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THE SCOTTISH GEOGRAPHICAL MAGAZINE

Yours very truly
Alex. L. Borneo.

THE SCOTTISH GEOGRAPHICAL MAGAZINE

PUBLISHED BY THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

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VOLUME X : 1894

EDINBURGH

PRINTED BY T. AND A. CONSTABLE, PRINTERS TO HER MAJESTY

AT THE UNIVERSITY PRESS

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CONTENTS.

VOL. X.: 1894.

No. I.—JANUARY.

No. II.—FEBRUARY.

No. III.—MARCH.

No. IV.—APRIL.

No. V.—MAY.

No. VI.—JUNE.

No. VII.—JULY.

No. VIII.—AUGUST.

No. IX.—SEPTEMBER.

No. X.—OCTOBER.

No. XI.—NOVEMBER.

No. XII.—DECEMBER.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

MY EXPERIENCES IN TIBET.

By Annie R. Taylor.

(*Read at Meetings of the Society in Edinburgh and Glasgow, December* 1893.)

In addressing the members of a learned Society, as I have the honour and pleasure of doing this afternoon, I feel much regret that, owing to my lack of scientific knowledge and the want of instruments, I was unable, during my late journey through Tibet, to make any of those observations which I know are valued by such a body. Tibet is, however, so little known, and information so scarce regarding its accessibility by travellers, that I feel that a short relation of my experiences, and a statement of facts, the knowledge of which I reaped in my late journey in that country and during my residence at various times on its frontiers, will not be uninteresting. I will deal especially with Eastern Tibet, of which I have the most experience.

There are three highroads from the Chinese borders to the Tibetan capital, Lhassa. Two start at the south-east of Tibet, from Ta-chien-lu, the border-town in the Chinese province of Sze-chuen. Of these one is the official, or Ba-li-tang-Lam (*lam* is Tibetan for road), and is used by the Mandarins, and by official couriers; the other is the Tea Road or Ga-Lam, the route of the tea caravans. The third highroad starts from Si-ning (north-east of Tibet) in the Chinese province of Kan-su, and is called the Si-ning Lam. In the centre of the Nag-chu-ka district of Tibet proper, and but a few days' journey from Lhassa, the Si-ning Road converges into the Tea Road.

Of these three routes the official is the shortest. Another advantage it has consists in the rest-houses at intervals by the roadside, where travellers can stay, and fresh horses be hired. It is, however, the most mountainous of the roads, and consequently, the most expensive to travel by. Nor is it freer from marauders and robbers than any other road.

The Tea Road traverses a country dotted over with numerous villages, and has rest-houses at intervals of long stages, as far as the town of Ke-gu, the centre of the tea trade, and the half-way halting-place between the Chinese frontier and the Tibetan capital. From Ke-gu onwards there are on either side of the Tea Road numerous black tent encampments, at which meat can be bought and tired-out horses exchanged for fresh ones. In the early part of the year mules can be hired for travelling by this route, but they are generally only taken as far as Ke-gu, at a hire of ten to twelve rupees each for the journey. Thence to Lhassa, the Tibetan ox, or yâk, the *Bos gruniens*, is employed, at the hire of four bricks of tea the animal. The conditions upon hiring yâk are: that if they die on the road, or are carried off by brigands other than the Golok tribes, the hirer bears the loss. With regard to the formidable Golok tribes just referred to, their attacks are so irresistible, that if they are the marauders, the hirer of the yâk need not make good the loss—the merchant loses his merchandise, the *drog-pa* his yâk. Should, however, the *drog-pa* (or cattle-owner) accompany the travellers, he has to be kept during the journey, but, on the other hand, no compensation is made for animals dying or lost on the road. The Tea Road is not difficult to travel along, comparatively speaking. Although the mountains are high, their ascent and descent are mostly gradual. The water supply is plentiful, but the grass is in some places very scarce, by reason of the large herds of cattle, belonging to the black tent settlements before referred to, which graze by the roadside.

The Si-ning Road, the direction of which, as you see, is south-west, passes for the most part through uninhabited country. The pasturage is good, but water at times is scarce. This is the least mountainous of all the roads.

From every town on the Chinese borders a road starts to Lhassa, but they all eventually merge into one of the three highroads above mentioned. I set out in my late journey from the town of Tao-chow, known to the Tibetans as Wa-tze, on the Chinese borders of the province of Kan-su, by a road which, after a few days' journey, joins the road running between the huge monastery La-ber-long (Tibetan name, Am-do Ta-shi gumpa)—to which are attached five thousand lamas—and the important town of Ke-gu.

Tao-chow lies some little distance from the river Tao, and the old city, at which I lived, is the centre of trade with Tibet and that part of Kan-su. This district is separated from Tibet by a range of hills, traversable by three passes, at which there are gates guarded by Chinese soldiers, where custom dues are levied.

Between the years 1887-1892 I had made sojourns of some length on the Tibetan borders, two on the Indian frontier, two on the Chinese. My last stay on the Indian side had been especially fruitful, for I had learnt the language as spoken at Lhassa. And it was on this border, when living in a hut among the Tibetans of Sikkim, that I came across my faithful little Tibetan man-servant, Puntso, now with me. A native of Lhassa, he had run away from a cruel master to take refuge in India, where he arrived in a pitiable condition. He was sent by some Tibetan neighbours to me to doctor him, and, with the blessing of God, I brought him back to health and strength. Becoming attached to me on this account, he entered my service, to accompany me, in 1891, *viâ* Calcutta to Shanghai, and thence for many long miles through China, till we again reached the Tibetan frontier. Here I settled in the old city of Tao-chow (there is a modern Tao-chow a few miles off) to await an opportunity of penetrating into the interior of Tibet. This opportunity came at last.

Among my acquaintances in the old Chinese town I counted a Chinese Mohammedan, Noga by name, married to a Lhassa woman called Erminie. Noga had been to Lhassa several times, and on his last expedition had brought away Erminie, who was given him to wife by her mother for the term of three years. That time was now fully up, and Erminie was anxious to return home. They were accordingly thinking over ways and means of making the journey, and, knowing my desires, proposed that I should engage Noga as guide and head-servant, and accompany them on the expedition. My idea was to make some stay at the capital, and thence to travel on across the Himalayan passes to Darjiling, thus traversing the country and getting a general knowledge of the people, with a view to prepare the way for mission-work. Noga agreed to conduct me the whole way; and we finally concluded a bargain by which he was to make all necessary preparations, receiving money from me for the expenses.

It was on the 2nd of September 1892 that I set out on my long-wished-for journey. My party consisted of myself and five Asiatics: Noga, the Chinese Mohammedan guide and my head-servant; Erminie, the Tibetan woman, Noga's wife, who was to travel with us as far as Lhassa; Leucotze, a young Chinese Mohammedan servant; Puntso, my faithful Tibetan, who had become a Christian; and Nobgey, a fellow-traveller, a Tibetan borderman bound for Lhassa. Our cavalcade numbered sixteen horses; Nobgey and Erminie rode their own; the others were mine, and consisted of mounts for myself and three servants, and of six pack-horses laden with our two tents, bedding, cloths for barter, presents for chiefs, and food for two months. The brigands relieved me of a good part of this luggage, together with two of my horses, a few days after crossing the border; while poor Nobgey was bereft of nearly all his belongings, and took a sad leave of us, to retrace his steps to the Chinese border.

Our road lay at first through the district inhabited by the agricultural tribes on the frontier. Fertile fields, populous villages, temples surrounded by trees met our eyes, while the picturesque natives in their bright cotton jackets and sheepskin gowns bordered with cloths of various colours, with their smiling faces and animated looks, singing or chatting while working in the fields, struck me by the vivid contrast to the sober looks and apathetic appearance of the Chinese on the other side.

But the country inhabited by the Drog-pa, or black-tent people, is soon reached, and here the aspect of the country changes. At first shrubs are to be seen, but these gradually disappear, and the country becomes a cheerless waste. These Drog-pa are divided into various tribes, and the tribes into numerous encampments. A head chief is acknowledged by the tribe, while a minor one rules over each encampment. The Mongol tribes who have settled in this district, namely, the Koko-Nor, between whom and their Tibetan neighbours there is continual strife, speak the Mongolian as well as the Tibetan languages. On account of their pillaging propensities, they are forbidden to cross the Chinese border, but Chinese merchants come to them. They prefer, however, to trade with the lamas of the monastery of La-ber-long. The Mongol women embroider artistically with gold thread and coloured silks. They also make eye-protectors of horse-hair, worn by the natives as a protection against snow-blindness, and manufacture large quantities of felt. This they use for tents, as also for rain-cloaks and other coverings. Their tents are different from those of the Tibetans. Their dress and mode of life are very similar. The women milk, churn, and tend the young cattle. The boys and old men watch the flocks and herds. The young men spend their time in practising the arts of warfare, in waylaying and attacking travellers, and in fighting other tribes in the surrounding country. The Upper Yellow River, or Ma-chu, forms the boundary of the district inhabited by this people. This river we crossed on a pontoon, made by four inflated bullock-skins, one at each corner of a hurdle-like raft of interwoven branches. This was pulled across the river by two horses swimming, guided by two men, who floated on the water with a foot on the hurdle.

The Golok people on the other side of the river are very different from the Mongols in appearance, but much the same in their love of plunder and pillage. Gold is to be found in this district, both in the mountains and in the sands of the rivers, but brigandage is the chief occupation. Nevertheless, I was hospitably entertained in their settlements, notably by a Golok chieftainess, who, upon my leaving their country, gave me an escort of two men to accompany me into a safer region.

We next came into the Sa-chu-ka country, which is rocky and stony. The tribes here also live by brigandage, though they are so far civilised as to pay taxes to China. Then we reached the monastery Sha-e-gumpa, and traversed a more smiling landscape, past monasteries, villages, and fertile crops of barley, peas, and turnips. The Tibetan monasteries that I saw did not consist, like the European, of one or more huge blocks of buildings, but, on the contrary, of many small gaily-painted houses of various shapes, grouped round the big square temple. Sha-e-gumpa, situated high on a hill, was a most fantastic conglomeration of odd shapes and many bright colours. The next day we crossed the Di-chu (the Yang-tse-Kiang of China) and came to the picturesque little town of Gala, built, like most Tibetan towns, into the side of the hill. In the summer time the Chinese find their way here to buy the gold washed by the Tibetans from the sand of the river. These latter exchange it for fifteen times its weight of not very pure silver, while the buyers get eighteen times its weight on Chinese soil. The rocks at Gala are of a peculiar green shade, indicating the presence of copper. In appearance the inhabitants of Gala bear a strong resemblance to portraits of the time of Charles the First. They have long narrow faces, aquiline noses, pointed chins, and big lips; cut their hair in a fringe over the forehead, and wear it in long locks, men and women alike. Their gowns are of red, blue, or white cloth, woven at Lhassa. They drink freely of a spirit distilled from barley, love singing and dancing, and, like most Tibetans, are full of fun. Our Tibetan host, by name Pategn, with whose wife and little children I became very intimate, consented to join my little train, to replace Leucotze, my young Chinese Mohammedan servant, who had died from exposure as we were leaving the Golok country.

We next 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, the half-way halting-place on the Tea Road, and the centre of the tea trade. This town is the residence of numerous tea-merchants, whose interests are guarded by a mandarin from Si-ning and another from Lan-chow. It is the Chinese who chiefly bring the tea here, to sell it to the Tibetan merchants, who forward it to Lhassa. The currency in this trade is the Indian rupee, which, however, is often dispensed with, and then the tea is bartered by the Chinese for wool, hides and furs, gold dust, mercury, and other Tibetan products, for importation into China. The tea, branches as well as leaves, is packed in compressed bricks about fourteen inches long, ten wide, and four thick. This tea is literally the sweepings of the plantations, and the dried leaves and branches of other plants are mixed with it. Eight of these bricks are sewed in a skin, and a yâk carries two skins. All Tibetans drink tea. They boil it, branches and all, in water with a little soda and salt, and before drinking add butter, barley flour (which is called *tsampa*), and dried native cheese. The solid part of this mixture, when merely moistened with a little liquid tea and made into hard balls, is called *ba*, and forms the staple food of Tibet. The chief meat consumed is mutton, upon which the black-tent people almost live. Sheep are cheap. In the interior of the country they cost from one rupee to two rupees. For winter consumption they are killed early in the cold season, and are frozen.

Turning our backs on Ke-gu, we followed the Tea Road through the midst of numerous nomad tribes. These do not follow the free-booting profession, but are adepts at the less honourable one of petty thieving (these are Tibetan sentiments !). Mercury is found in this district. It is called by the Tibetans white earth poison, and is one of the exports to China. Salt and mineral soda are also to be obtained, and find ready sale at Lhassa and other parts of Tibet, being important items in Tibetan tea-making.

We left the high or Tea Road at the Pan-gan monastery for a mountainous route which brought us to Tash-e-gumpa (*gumpa*=monastery) which is situated on the river Tsa-chu, and is the half-way halt between Ke-gu and Lhassa. We then continued our way along the valley of the river Tsa-chu. Here volcanic energy had evidently been at work. The variegated soil—red, pink, grey, brown, and white—was a novel sight. I especially admired the red earth, which cast a pretty pink glow on the sheep and horses grazing by the roadside. We passed a mineral spring, which threw a jet a foot above the ground. Our horses, though very thirsty, the rivers being frozen over, would not touch the waters from this spring, for they were bitter.

Upon crossing the Dam-jan-er-la, one of the most dreaded passes (though its ascent is gradual), we reached a greater elevation than any we had yet surmounted. The cold here is generally so intense that travellers often freeze by the wayside. Stopping to attend frost-bitten men would only mean destruction to the rest of the party. Breathing was very difficult, and I awoke in the night gasping for breath. I also suffered much from palpitation of the heart. It is probably known to you that the average elevation of Great Tibet is some 15,000 feet (the greatest altitude in the world, Mount Everest, is 29,000 feet). I was unable to make any scientific observations beyond noticing that on this pass our water boiled at so low a point that it was little more than tepid. We had to drink our tea very quickly to prevent a crust of ice forming on the top. And we took good care to touch no steel or iron for the sake of our epidermis. We came unscathed through this redoubtable pass, and crossed the Long-er-tsa-ke-la. On our descent we found the valleys thickly populated with the black-tent tribes, rich in large herds of cattle and horses.

We still marched on with slow pace and sorry exterior along the Tea Road, which took us on over the So-ba-ner-la, and on the 28th of December across the Sok-chu, the river followed by Captain Bower on his late expedition, till we came at last within sight of the boundary of our promised land, the waters of the Bo-chu, which here separate the province of Amdo from the sacred province of Ü. We were prepared for this, for we had been meeting large caravans returning from the capital. On the last day of the old year (1892) we crossed the river, and found ourselves within the Lhassa district.

Had I been strong enough, it would have been wise to have left our horses here and continued the journey on foot, following up the course of the frozen river as it winds in and out among the mountains, until we had reached a point near Lhassa. The natives say that this is sometimes done. But the road is long, and the tribes dwelling on the banks of the river share the freebooting propensities of the eastern tribes; I therefore resolved to follow the usual route. After twice crossing the river, and passing a small lake called Ang-nga, our horses picked their way over a very stony course and down a steep descent till we came to the Da-chu, flowing through a deep gorge. Two days after crossing this river I was taken prisoner, to be conducted later on by military escort a very long day's journey nearer to Lhassa, within an hour or so of Nag-chu-ko-kang. I was then within three stages of Lhassa, and at the junction of the Si-ning and the Tea Roads.

After much palavering with the Lhassa chiefs who came to interview me, I finally had to give up Lhassa for this time, and, with my Tibetan servants, Puntso and Pategn, set out on my return journey to Ke-gu, varying the route by not always keeping to the highroad.

After a long stay at Ke-gu, where I mixed much with the natives, we started for China in a south-easterly direction, with some mule-drivers returning to Oganze, which is on the Tea Road, half-way to Ta-chien-lu. We soon entered the province of Kham, which with Amdo are the two principal Tibetan provinces that pay tribute to China. The taxes and customs levied in Ü are paid to the royal lama at Lhassa. But it were a difficult task to detail the relation of the various parts of Tibet, either to the Tibetan or to the Chinese Government; still more to define exactly the nature of this relationship. We passed numerous small towns and villages, and the country, though mountainous, is—unlike the other mountainous districts we had traversed—well wooded and with occasional fertile districts. Hot sulphur springs abound as well as other springs of mineral waters, much valued by the Tibetans for their medicinal properties. I saw rocks of slate; and coal is found in abundance. It is used by the natives as fuel, but is not in great demand until the Chinese border is reached.

My Tibetan trip was now drawing to a close, and on the 12th of April 1893 I arrived at the town of Ta-chien-lu, in the Chinese province of Sze-chuen.

This journey, which lasted seven months and ten days from the date I left Tao-chow in Kan-su to my arrival in Ta-chien-lu, cost me about £100, including the value of everything—horses, luggage, and provisions—stolen on the way. The vicissitudes of my property, owing to the attack of the brigands, and the brigand-like propensities of my ostensible guide and guardian, the Chinaman Noga, are too many to be enumerated. Suffice it to say, my cavalcade and luggage diminished visibly and grew beautifully less day by day. Noga, after several attempts upon my life, abandoned me (to my great relief) at Tash-e-gumpa, taking with him his wife Erminie and the greater part of my belongings.

Hurrying after us by double stages, and passing us when out of sight behind some hills, he carried information to the Lhassa chiefs about the foreign lady-traveller, and it is to him I owe my failure in reaching Lhassa and carrying out my idea of journeying thence over the Himalayan passes to Darjiling. I was, when arrested in the Lhassa district, so destitute of money, and even of the necessities of life, that the Lhassa chiefs gave me the wherewithal to retrace my steps to the half-way town Ke-gu, where I had to leave my tents; and then for many a night I slept in the open air. My bed was either on the ground in the lee of a pile of luggage, or, if I chanced to find one, a hole, the sides of which protected me from the fierce icy blasts which blow over these great altitudes. A piece of felt to cover the ice at the bottom of the hole made my couch, and a warm sleeping bag into which I crept formed my sleeping clothes. Caves now and then proved a welcome luxury. I was in Tibetan dress, but this was only to avoid the gaze of too curious eyes. With regard to my servants, Noga, as you have heard, proved faithless; Leucotze, the other Chinaman, died; the two Tibetans—my faithful Puntso, and Pategn, who entered my service at Gala—alone stuck to me through thick and thin. The latter, Pategn, took leave of me upon our return to Ke-gu, and wended his way northwards to his home and wife and children at Gala. Puntso has never left me.

I have nothing but praise to give the Tibetans for their chivalry and kindness. Setting aside their raiding proclivities (of which, after all, in earlier times, we have had lively examples on our own borders), they are hospitable, friendly, trustworthy, and by no means averse to intercourse with Europeans. In simplicity and naïveness, more especially, these people form a striking contrast to most Asiatic races. Although the lamas, for political reasons, do not wish to see us in their country, it is the Chinese who force Tibet, though this country is only partly tributary to them, to so jealously guard her frontiers; and this principally for their own trade interests; nor do they hesitate to do all they can to impede any intercourse between the Tibetans and Europeans and to raise bad blood.

Should I be asked my opinion as to what is of most importance to Tibetan travellers, I should emphasise the necessity of the Tibetan language being mastered by all intending explorers; one is so peculiarly liable to be misled and deceived by Eastern interpreters. As this tongue is much easier to acquire than most Oriental languages, as for instance, Arabic or Chinese, it is not too formidable a task.

I shall trespass on your time for a little longer in order to reply to a frequent question regarding what I saw of the fauna and flora of Tibet. The following animals actually came under my personal observation :—

The yâk (*Bos gruniens*), both tame and in herds of wild ones. This curious black-coated and maned animal, in some points like a buffalo, in others like a horse, but which, clumsy as it looks, climbs precipitous ascents with a truly astonishing ease and celerity, and which grunts like a pig, has often been described. Not so an animal of the horse tribe, herds of which I came across on the lofty mountain ranges. This animal strongly resembles the quagga of South Africa. It is shaped like a zebra, but with a stripeless fawn-coloured coat, of a paler shade on the belly, and is, so the natives told me, untameable. One whole day's journey through snow-drifts and over snow-covered holes my little party safely followed in the wake of a herd of these animals, so unerring was their instinct in finding a safe footpath. Herds of deer were countless. We also came across flocks of wild sheep and goats, wolves, foxes, hares, marmots, and rats devastating whole acres. Among birds, the black and white eagles and the beautiful golden eagle were conspicuous. Vultures were innumerable, and play an economic part in the consumption of dead bodies, which are cut up in small pieces for their repast, the Tibetans objecting, from a feeling of sentiment, to the bodies of their friends being torn to pieces by the birds. Huge, impertinent, thievish crows would attack our provisions on the very backs of our pack-horses. Teal, and a little bird called *Tit* in Tibetan, were common.

When speaking of the flora I must remind you that a snow-covered ground does not offer much temptation to botanise. Except in Kham and on the borders, trees were conspicuous by their absence. A few fir stumps, juniper bushes, briars overhung with snow, and a sweet edible root given me by some natives claimed my attention in the interior. Edelweiss and other Alpine flowers grew on the borders.

THE HAWAIIAN ISLANDS.

By Adolf Marcuse.[1]

(*Translated by Helen H. Smith.*)

The task of investigating an important problem in astronomical-geodetical science,[2] which I undertook in the spring of 1891, caused me to spend thirteen months on the Hawaiian Islands, the Paradise of the Pacific Ocean. With a short account of this expedition, which developed into a tour of the world, this paper will be mainly devoted to a description of the island realm of Hawaii.

The outward journey was from Hamburg to New York, Washington, and San Francisco, where a few days' stay afforded me a welcome opportunity of accepting the invitation of Professor Holden to visit the celebrated Lick Observatory. One goes first by rail to the little town of San José, in the beautiful valley of Santa Clara. Thence one proceeds in the early morning by carriage to ascend Mount Hamilton (4600 feet), and, after a six hours' journey by an easy road, the Lick Observatory on the summit is reached. The ascent by the beautifully made hill-road affords charming and constantly changing views of the fruitful plain, the boundless sea, and the towering mountain ranges of the Sierra Nevada.

The excellently appointed Observatory, which stands in imposing solitude on the lonely summit, offers unusual interest to astronomers. Without going into a description of the apparatus, I shall here only mention briefly the great, at present the greatest, telescope in the world. The mechanical structure of this powerful instrument, and all the arrangements of the place, must be described as excellent. Unfortunately the condition of the atmosphere during the night of our visit was not particularly favourable, so that in viewing Saturn, Uranus, the adjoining double stars, and a few nebulæ, we had to use almost exclusively weak powers. Only for a short time could the 3000 power be used. The optical qualities of this gigantic telescope, with its 36-inch aperture, are very satisfactory; astronomical science owes many and important discoveries to the diligent and judicious use that has been made of it.

Singularly touching is the inscription on the tablet affixed to the granite support of the telescope: "Here lies buried James Lick, the founder of the Observatory." The coffin of the eccentric American millionaire, who generously supplied the means for building the Observatory, is built into the granite. It is said that James Lick originally intended to erect, as a monument to himself, an immense pyramid in Egypt, overtopping all the others. Yielding, however, to the persuasion of influential friends, and to the consideration that such an erection might be destroyed in case of war, he caused to be constructed the greatest telescope in the world, which at the same time was to form his mausoleum.

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[1] *Deutsche Rundschau*, Berlin, August 1893, and *Verh. der Gesell. für Erdkunde*, 1892, p. 492.

[2] The investigation of the variation of latitude. See *S. G. M.*, vol. viii. p. 103.

The voyage from San Francisco to the Hawaiian Islands is somewhat monotonous. There is so little shipping traffic that it is not surprising that we saw during seven days but one vessel, and that only a sailing boat. Here and there one catches a glimpse of a flying fish, and occasionally even of a whale. The Pacific Ocean here, as in nearly all parts of it, does no honour to its name, for we experienced for the first four days very bad weather and a heavy sea, with waves nearly 17 feet high. Only shortly before our arrival at the tropical zone did the weather become settled and fine. There the warm trade-winds blow, and sky and sea rival one another in their deep blue colour.

On the night of the sixth day there was a beautiful zodiacal light seen in the west, and just on the southern horizon the Southern Cross was visible for the first time. I hailed it as an old acquaintance whom I had not seen since I left the South American continent five years before. This constellation, though so much praised, cannot be compared for beauty with the northern constellation of Orion.

Land was sighted on the morning of the seventh day. It was the northern coast of the island Molokai, upon which is situated the leper establishment founded by the Hawaiian Government. Here the unfortunate victims of that terrible and incurable disease are isolated and faithfully tended until their death. The first cases of this contagious disease, introduced from China, were observed in the Hawaiian Islands about forty years ago, and now there are over eighty cases sent to the leper station annually. The peninsula Kalaupapa, on which this settlement is established, is accessible from the sea from one point only, and a single narrow pass leads to it over the surrounding mountains, nearly 3000 feet high.

The disease is said to have spread somewhat rapidly among the natives after the vaccination for small-pox, of which there was an epidemic in the Hawaiian Islands in 1853. The lepers were at first allowed to associate freely with the other natives, almost without the application of any special measures of precaution, until, in 1864, the evil had grown to an alarming magnitude. Thereupon the Hawaiian Government, in January 1865, resolved to carry out a strict isolation of the lepers; the station on Molokai was established with a hospital and numerous dwelling-houses. Then there began a regular hunt for lepers on all the islands of the Hawaiian kingdom; for those who had been seized by the disease fled to the mountains, and only with great difficulty could they be captured and conveyed to Molokai by the agents of the Government.

Horrible as such a measure of isolation seems, it is yet the sole means of checking the contagion, which is ever spreading with more alarming violence. During the first years the leper station on Molokai was in a somewhat neglected condition. Fortunately, in 1873, a young priest came forward, Father Damien, who undertook the post of pastor at the leper station, and devoted himself to his sad duty with truly noble humanity and undaunted bravery. It is mainly owing to Father Damien's exertions that ample funds have been sent to the station, from the Government and from private institutions, which have rendered it possible to have a physician and some sisters of charity to tend the poor incurably stricken sufferers. After eleven years of unwearying and self-sacrificing activity Father Damien himself fell a victim to leprosy, and in 1889 this benefactor of suffering humanity and martyr to duty died.

While we were still dwelling on such sad reflections, the north-eastern coast of the chief island, Oahu, rose before us, on the southern shore of which stands Honolulu, our destination. On the nearer side of the south-eastern promontory, Koko Head, the landscape wore a volcanic, wasted, and desert character; but, no sooner had the ship doubled the point and brought us in sight of the south coast, than the aspect of the country was completely altered. Rich meadows and thick clusters of coco palms refreshed our eyes, and the mountains were clothed to a considerable height with most beautiful vegetation.

We sailed into the harbour formed by the surf-beaten coral reefs. The entrance is by a single narrow channel. On the wharf at Honolulu the brown natives mingled with white men and half-castes; pretty, mostly one-storied, houses surrounded by palm gardens clustered round the bay, and in the background rose the high picturesque hills, the whole forming an harmonious, thoroughly tropical picture.

The Hawaiian Islands lie in a continuous chain running from north-west to south-east, between 18° 55′ and 22° 16′ north latitude, and between 154° 50′ and 160° 30′ west longitude. There are eight inhabited islands, viz., Niihau, Kauai, Oahu, Molokai, Lanai, Maui, Kahulaui, and Hawaii; also three quite small uninhabited islands. Situated in the midst of the Pacific Ocean, and within the northern torrid zone, they form the meeting-point for almost all steamers plying from the west coast of North America to Asia and Australia. The harbour of the capital, Honolulu, on the island Oahu, is distant 2100 nautical miles south-west from San Francisco, and 3400 south-east from Yokohama. The shipping traffic, even now considerable, will increase greatly as soon as the Nicaragua Canal is completed, when ships bound for Asia, both from the east coast of America and from Europe, will follow the new route.

The local sea traffic between the Hawaiian Islands is already considerably developed. Nineteen steamers and numerous sailing vessels maintain communication between the chief harbours of the islands, Kauai, Oahu, Molokai, Maui, and Hawaii. Lighthouses erected in well-chosen positions greatly aid the navigation of the coast, which is, as a rule, dangerous.

On the extinct crater, Diamond Head, on the south coast of Oahu, a signal-station stands at a height of about 300 feet, from which approaching vessels are observed at a great distance from the coast. As soon as the name can be ascertained, the ship in question is announced by telephone to Honolulu. In this way it is known at least one or two hours beforehand when a vessel will arrive. Sailing vessels which touch at Honolulu are towed into the harbour by tugs.

The population of the islands, principally domiciled on the coasts, is at present 90,100 persons, of whom about 40,000 are natives and the rest Americans, English, Germans, Portuguese, Chinese, and Japanese.

The islands are of volcanic formation, with many extinct craters. Only on the largest, Hawaii, are there still two active volcanoes; the one, Mauna Loa, nearly as high as Mont Blanc, and almost constantly smoking; the other, Kilauea, about 4400 feet high, contains a vast fiery sea of lava, continually fluctuating.

From the crater of Mauna Loa numerous devastating lava-streams have issued at various times, frequently overrunning the land down to the sea. The most recent of these immense eruptions on Hawaii took place in January 1887, and continued almost a week. The north-western island, Kauai, forms a striking contrast to Hawaii, overcharged with volcanic forces. For thousands of years all volcanic activity seems to have been extinct in Kauai, and this island, luxuriantly clothed with vegetation, deserves the name given to it by the natives, viz., the "Garden Island."

The area of all the islands amounts approximately to the same as that of the kingdom of Saxony. On this comparatively small area there is to be found a great variety of climates, according as the district lies to windward or to leeward. In general the climate is genial and warm, but cooler than that of other countries on the same latitude. This arises not only from the trade-winds, which blow constantly over a large area of the ocean, but is due also to the fact that, by reason of a stream which takes a turn in this direction from the neighbourhood of Bering Straits, the temperature of the sea-water in the vicinity of these islands is about 5° cooler than it would otherwise be in that latitude.

The trade-winds, blowing almost all the year from the north with varying strength, contribute very greatly to render a residence in these islands agreeable and healthy for Europeans. As soon as this great natural fan suspends its activity, and gives place to the warm wind from the south called "Konas," health suffers in a sensible degree. Then arises a moist and enervating heat, which causes most persons to suffer from headache and lassitude. The highest temperature which I observed on the islands, at the sea-level and in the shade, was 90° F.; the lowest, 55°.

The soil of the islands is on the whole poor; only in the valleys and wherever rain falls abundantly does the vegetation assume a luxuriant and charmingly beautiful aspect. The only animals living in the islands, previous to their re-discovery by Cook, were dogs, swine, and mice, along with the breeds of poultry indigenous to the whole of Polynesia. The sea abounded with fish, to which fact large ponds here and there on the coast, constructed of massive stonework by the ancient Hawaiians, still witness. Of vegetables the chief was the taro plant (*Colocasia antiquorum*), which still forms the main nourishment of all the South Sea Islanders. By roasting the mealy root and adding water, a pap called *poi* is produced, which is of a bluish-white colour, slightly sour, highly nourishing, and easily digested. The natives help themselves to *poi* out of great wooden dishes with their fingers. Fish, fowl, and flesh are laid in aromatic leaves and cooked on red-hot stones in a hole in the ground. It must be admitted that viands cooked in this way are uncommonly juicy and palatable.

As a reminiscence of olden times the custom of the Hawaiian feast called *luau* is still kept up by the natives. These banquets, to which even foreigners are admitted, are given on every festive occasion. In some shady spot mats are spread, on which the company seat themselves, and aromatic leaves laid down between them serve for table-cloths. The *poi* is contained in wooden vessels, various preparations of meat are rolled in leaves, and, as great delicacies, crabs and other raw fish are produced. A sea grass called *limu* is considered a choice dish. For drink, water is used, or, by the less temperate, *awa*, that intoxicating beverage of the Polynesians, which is prepared by fermentation from the root of the *awa* plant, and has a strong narcotic effect. Knives and forks are not used at these feasts, and he who has received a veneer of European manners will do best to remain a spectator only of such entertainments.

Sweet potatoes, the bread-fruit tree, the coco-nut, and banana, many fruit-bearing shrubs, and the sugar-cane, are indigenous on these islands. Magnificent timber, especially sandalwood, was to be found in abundance in ancient times. With the advance of civilisation all kinds of useful animals and plants, but unfortunately along with them many pests, such as mosquitoes and scorpions, have been introduced into the Paradise of the Pacific.

At present the chief branches of industry are the cultivation of the sugar-cane and the manufacture of sugar, then rice-growing, coffee-planting, the cultivation of tropical fruits of all kinds, especially of bananas, and, finally, the breeding of cattle.

Latterly, Chinese principally have been employed in agricultural work, and on the sugar plantations the workers are almost exclusively Japanese. The immigration from Asia is therefore very considerable, and is steadily increasing. The Chinese and Japanese population already amounts to over 18,000. Unfortunately the native population is undoubtedly in course of dying out. About 120 years ago it numbered 400,000, whereas at the present time it has dwindled to a tenth part of that figure.

Such an unusually high rate of mortality was, in earlier times, owing mainly to the frequent sanguinary wars which raged amongst the inhabitants of these islands, and which have ceased only in this century. Another cause is to be found in the frivolous and indolent character of the Hawaiian women, who shrunk from the burdens of the nourishment and tendance of children. It was even the practice to check births by artificial means. The magicians too, or *kahunas*, to whom I shall presently refer, with their great influence as "medicine-men," are greatly answerable for the high mortality of the natives. Finally, we must take into account the numerous infectious diseases which have been brought into Hawaii with civilisation, of which the before-mentioned leprosy is especially destructive.

The inhabitants are of the Polynesian race, which ramifies over all the island groups of the eastern Pacific, from New Zealand to Hawaii and even to the East Indies. We find everywhere among the branches of this race a similar bodily structure, analogous dialects, the same customs, usages, and religious views. It is fairly certain that Hawaii, the largest of the Hawaiian islands, has been the chief centre for the propagation of the Polynesian race.

It is believed that the Hawaiian Islands were inhabited as long ago as the sixth century of the Christian era, this assumption being founded on the discovery of human skeletons under very ancient coral or lava beds. The first discovery of the islands seems to have been made by Spanish mariners in the year 1527. At that time a fleet of three ships, under the command of Don Alvarado de Saavedra, was sailing from Mexico to the Molucca Islands. About 1000 nautical miles from Mexico a great storm from the south-west drove two of the ships out of their course in the direction of the Hawaiian Islands. Old Hawaiian traditions tell of the stranding of a ship on the coast of South Kona, from which only the captain and his sister were rescued. They were kindly received, and married natives, and the descendants of these intermarriages were raised to the rank of chiefs.[1]

In 1555 the Spanish mariner, Juan Gaetano, also discovered the islands, the largest of which, Hawaii, was called by him "La Mesa," and four more were also recorded by him. Although the determinations of latitude seem fairly accurate, the old maps of the Spanish archives make an error of 1000 nautical miles in the longitude. This mistake in the estimate of the longitude of Hawaii is not surprising when we consider that at that time there were no chronometers, and that the Spanish mariners with their single determination could not take into account the equatorial currents running from east to west.

It was not until more than two centuries later, after their re-discovery by Cook in 1778, that the Hawaiian or Sandwich Islands—as they were named by Cook, in honour of the First Lord of the Admiralty at that time, the Earl of Sandwich—became generally known. Unfortunately, the celebrated discoverer, on landing a second time at Hawaii, in February 1779, was killed by the inhabitants, who were highly incensed by the indiscreet behaviour of himself and his people. A simple but beautiful monument in the bay of Kealakekua on Hawaii denotes the spot where Cook was murdered.

At that time the islands were in a thoroughly disorganised state. Not only did the inhabitants of the different islands wage war against one another, but on one and the same island there were chiefs at feud with one another. Only twenty years later, however, all the islands were united into one kingdom by the strong hand of the first king, Kamehameha, and under his successor idolatry was abolished and entrance permitted to the first American missionaries. Up to the year 1874 there had reigned five kings of the house of Kamehameha. On the extinction of this line in 1874 the dominion was given by a plebiscitum to Kalakua, under whose rule the country attained to an unlooked-for height of prosperity. From the beginning of 1891 Queen Liliuokalani (*Anglicé*, The Lily of Heaven), governed strictly after the English model, appointing her Ministers after the members of the Upper and Lower House had been elected by the people. However, in January of last year a revolution broke out in Honolulu, which resulted in the dethronement of Queen Liliuokalani, and the establishment of a provisional government, prac-

[1] *Cf.* W. D. Alexander's *History of the Hawaiian People*, New York, 891.

tically under American influence. What turn political affairs on these islands will take in consequence of this arrangement cannot at present be foretold with certainty.[1]

Civilisation and modern culture have so rapidly developed the modes of life on the Hawaiian Islands that the capital, Honolulu, situated on Oahu, already wears an entirely European aspect. On the other islands, however, the life still retains many traces of olden times.

Honolulu contains upwards of 23,000 inhabitants, of whom 6000 are white, and the remainder aborigines, Chinese, and Japanese. The main streets of the town are broad and well made; they are lighted by electric arc-lights, and are provided with tramways. There are many public buildings of stately architecture, and numerous tastefully built private houses. Among the former the royal palace and the Government offices are especially prominent. The palace was completed in 1883, and contains about forty apartments, some of which are furnished in a very luxurious style. In the great throne-room and in the adjoining reception-rooms hang portraits of European monarchs which have been presented to the Hawaiian royal house. Of especial interest to foreigners is the valuable collection of Hawaiian feather mantles and head-dresses, which is the property of the royal family. They are made of small yellow feathers sewed close together on hempen or cloth fabrics. One can form some idea of the great value of these ornaments, reserved, according to ancient Hawaiian custom, exclusively for the use of members of the royal family, on learning the origin of these rare yellow feathers. They are obtained from two species of birds, the *Acrulocercus nobilis*, of the honey-sucker family, which is almost entirely black, having only one yellow feather under each wing, and the still rarer *Drepanis pacifica*, which has only two yellow feathers in its tail, and is now almost extinct.

The surroundings of Honolulu afford abundant opportunities for enjoyable excursions. There is, in the first place, the sea-bathing place, Waikiki (*wai* means water in Polynesian), about 3½ miles to the south, where a splendid bath can be enjoyed in the tepid waters of the Pacific. The average temperature of the sea-water is about 68° F., and at flood-tide there is a heavy surge. North of the town lie several beautiful mountain valleys, of which Nuuanu and Manoa deserve particular mention. The mountains through which they run are high but easy of ascent, as, for instance, Tantalus (2000 feet), the summit of which commands an exquisite view of the shores of the island Oahu. What a contrast between the charming, densely wooded Manoa valley and the wildly romantic mountain pass of Nuuanu, which, with rocks 3000 feet high towering on either side, rises to a height of 1200 feet, and then suddenly falls by a steep descent to the "Pali"! From this spot a magnificent view is obtained of the north side of Oahu, where luxuriant fields of sugar-cane and bright green rice and taro plantations, surrounded by coco palms, stretch nearly to the edge of the deep blue sea. The "Pali" is also historically interesting. Here, about 100 years ago, the last battle

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[1] Cf. *Deutsche Rundschau*, March 1893, *Ueber die politischen Zustände auf den hawaiischen Inseln.*

was fought between the chief of Oahu, Kalanikupule, and King Kamehameha I. The men of Oahu fought with great valour, but were overpowered by Kamehameha's army and driven over the "Pali" down the precipice. The whitened bones of those warriors who fell in the heroic struggle for the independence of their island are still to be found at the foot.

We cannot leave Honolulu without mentioning the interesting and important ethnographical and ethnological museum for Hawaii and the other islands of the Pacific, which contains amongst other things the largest and most valuable collection of Hawaiian antiquities. It was built and appointed in the most liberal manner by the American banker, Bishop, for many years resident in Honolulu, as a memorial to his wife, Bernice Pauahi Bishop, a member of an ancient Hawaiian royal family, who died early. The contents have now been arranged under the direction of the experienced American scholar, Mr. Brigham, and it is to be hoped that the exhaustive catalogue, provided with numerous photographic illustrations, which Mr. Brigham has already begun to compile, will soon be made public.[1] It would take me beyond the limits of this article to attempt even a glance at the treasures of the Pauahi Bishop Museum, which would certainly delight any one interested in important ethnographical objects. I may just mention that among the Hawaiian weapons is the stone dagger with which Captain Cook was killed; further, that the collection of Hawaiian calabashes (wooden vessels for containing food, etc.) is considered the most copious in the world; and finally, that the muster of old Hawaiian idols may be described as perfect.[2]

The life of the Hawaiian people is rich in original characteristics. They are genuine islanders, and love the sea above all else. There are hardly anywhere to be found more expert swimmers and fearless divers, and the length of time the latter can remain under water is certainly unsurpassed. Armed with only a knife, they plunge in and combat the sharks, so dangerous in that locality. Whenever a high surf approaches the coast they swim out into the sea, taking with them a plank fashioned expressly for the purpose, on which they ride in again on the crests of the waves. Their sharp and experienced eyes detect a shoal of fish between the shore and the coral reefs before a stranger could see it with a field-glass. As soon as the shoal has come near enough to the beach, the men spring into the sea, some to stretch out a great net, and others to drive the fish into it by loud cries and beating of the water. In this way they often take a copious haul in a few hours, which they divide honourably; and in this division even the stranger who has been curiously watching the proceedings is not forgotten.

Poetry and music play a great part in the life of the Hawaiian people. Their poems, called *mele*, have no particular metre in our acceptation of the term, but consist of short sentences or phrases, which are declaimed

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[1] An introductory catalogue was published last August.

[2] In the Kgl. Museum für Völkerkunde in Berlin there is also a very copious collection of Hawaiian antiquities.

in a sing-song tone, with accentuation of the last word. Numerous legends and romances many centuries old have been preserved by oral tradition. Mr. Dagett, formerly American ambassador in Honolulu, has rendered a great service by collecting and translating them into English. Many of these poems, especially those which celebrate heroic feats, recall to mind our northern sagas; others, such as the tale of the Princess Manoa, who is transformed into a rainbow to protect her from a persecutor, are analogous to the myths of ancient Greece.

The musical compositions of the Hawaiians are almost all in a melancholy strain. Even in the love-songs, one does not detect the sanguine character otherwise prominent in these cheerful and innocent children of nature. So long as the full moon reigns in the skies the Hawaiians cannot sleep. They sit in groups before their huts and sing songs, the melodious tones of which are heard afar through the silent warm tropical night, blending sweetly with the harmonies of the accompanying stringed instruments.

But the life of the Hawaiians exhibits also many dark shadows. One of the darkest is the influence which the magicians, or *kahunas*, exert even to the present day. There is a superstitious belief that these charlatans, who are employed by many of the natives as physicians, have the power to "pray" a man to death. All that is necessary is that the *kahuna* should acquire the possession of some trifle, such as a piece of a nail, a hair, etc., from the person of his allotted victim. These objects are secretly buried with incantations, and the *kahuna* then hovers about in the vicinity of his prey in order to watch his movements. The moral power of this ceremony on the superstitious souls of the natives is so great that the unfortunate victims lose all vital energy and gradually languish away. I have little doubt that poison may have been frequently used in former times by these unscrupulous *kahunas* for the more rapid attainment of their atrocious purposes.

With this superstition is closely connected the circumstance that in olden times the Hawaiian princes and chiefs were careful to arrange that after death their bodies should not be buried, but secretly placed by a faithful friend in some solitary rock-cave. For if an enemy should get possession of any portion of the skeleton, the soul of the dead man could find no rest. The ancient Hawaiians believed that every man had two souls, one of which quitted the body only at death, the other often during lifetime—in sleep or in ecstasy,—returning to it when the sleep passed off. In the bay of Kealakekua, shut in by a high wall of rock, numerous cavities are visible, which still contain human remains. One can scarcely conceive how the ancient Hawaiians contrived to convey the bodies of their friends to these apparently inaccessible caves.

The primitive natives reckoned time, like all the Polynesian races, by the course of the moon. The months had alternately 29 and 30 days. That twelve such months fall short of the true year by 11 days they had already discovered, and therefore interpolated occasionally a whole month. The Polynesian year began about 20th November, at the time when the Pleiades stand at sunset on the eastern horizon. The knowledge necessary for the regulation of the calendar was in the exclusive possession of a class of priests called *kilohoku*, *i.e.* star-gazers. These men observed the phenomena of the heavens, and had an intimate knowledge of the most important constellations which were utilised in the art of navigation.

The volcano Kilauea, on the island Hawaii, is considered the greatest marvel of the Pacific Ocean. I had an opportunity of visiting it at the end of 1891.

As we sailed out of the harbour of Honolulu, in lovely weather, three swarthy missionaries were engaged in preaching in the Polynesian language with the view of converting the natives on board our vessel to a better course of life. The power and rhetorical talent of these native preachers are much to be admired.

Our vessel sailed along the southern coast of Oahu, and gradually the islands Lanai and Molokai came in sight on the right and left respectively. Towards evening we approached the island Maui, where the enormous extinct volcano Haleakala presents an imposing spectacle. It is over 9800 feet high, and the crater measures nearly 30 miles in circumference. By next morning we were already near the island Hawaii, on which the three mighty, partly extinct volcanoes, Hualalai, Mauna Kea, and Mauna Loa, came first into sight. The last two, as high as Mont Blanc, showed no traces of snow, and, in the then cloudless sky, were visible to their summits. We sailed along the west and south coasts of Hawaii, our vessel putting in at several points to load or unload cargo. As we turned the most southerly point, Cape Ka-Lae, and were steering for our destination, Punaluu, situated on the east coast, the sea became very rough, and a heavy surf swept towards the land. We decided therefore to keep out from the land during the night.

About 2 o'clock in the morning we saw, at a distance of 60 nautical miles, the huge fire of the volcano Kilauea (about 4400 feet high). In the complete darkness of the night it presented a spectacle at once terrific and beautiful. Every minute the height and form of the pillars of fire and smoke altered; the crater often illuminated all the surrounding mountains with an intense red light, like a lighthouse erected by the powers of nature to facilitate navigation.

Shortly after sunrise we were landed in Punaluu. Our boats, rowed by strong and skilful natives, shot like arrows through the raging surf, about 13 feet high. After a very short rest we left Punaluu by a small railway car, which, being generally used for the carriage of sugar-canes, was but scantily furnished with seats.

This took us by an up-hill road through luxuriant fields of sugar-cane and over desert lava beds to the sugar plantation, Pahala, 5 miles distant. There I mounted on horseback and rode nearly 26 English miles to the top of Kilauea, which I reached in 6 hours. The road leads at first through charming valleys and over wooded hills. Then the country becomes gradually more barren, and finally one rides for hours in the midst of enormous masses of lava which have been deposited by eruptions of Mauna Loa. There are two quite distinct kinds of lava; one with a smooth, evenly polished surface, and the other of a rough, scoriaceous form, which lies piled up in great heaps. Wide stretches of the first kind give the impression of quiet solidification; while fields of the other description inspire one with a feeling almost of terror at the powerful and unbridled powers of nature to which they owe their formation.

Suddenly the summit of the crater comes in sight, with its volumes of smoke, and very soon the ground, cracked in all directions, begins to feel warm. From its clefts sulphurous gas constantly rises in great quantity.

No surveys had been taken for five years of the dimensions and height of this active volcano, and since the last survey the entire configuration had so very much altered that the map issued in 1886 seemed almost to be that of another district. Fresh measurements of the elevations and subsidences of the cold and the burning lava masses were therefore peculiarly interesting; and one could draw conclusions from such measurements as to the geological future of the volcano. For this purpose I had provided myself with a specially good aneroid barometer.

Then came the descent into the crater, with two guides, from the north-east side of the edge in order that the sulphurous gas might be carried away from us by the trade-wind blowing from the north-east. We were provided with lanterns for the return journey, water-bottles, and stout sticks. Five natives attached themselves to our party, who had travelled more than 50 miles on horseback to pray in the crater, and to offer sacrifices to Pele, the fire-goddess. First one descends a mound of 460 feet, covered with luxuriant vegetation. Then the cold lava-bed is reached, which stretches, a congealed mass, over the entire basin of the crater Kilauea (3 miles broad). The way lies over this field of lava for 2 miles in a south-west direction to the active lava sea Halemaumau, *i.e.* the home of eternal fire. Deep clefts, from which sulphurous gas arises, intersect the surface. The road is exceedingly difficult, over boulders and slippery stones. The lava-bed rises perhaps 210 feet towards the active part of the crater. After nearly an hour's march over this bed, formed by earlier eruptions, but which is almost every year the scene of fresh outbreaks and has risen some 65 feet nearer to the level of the lava sea during the last five years, we arrived at the margin of the real inner crater, which presents an approximately elliptical form with a major axis of nearly 3000 feet. Here lies the great sea of fire, to see which was the special object of our long toil since daybreak. The spectacle of the expanse of fiery lava in the interior of the crater defies all description. About 280 feet below us lay a liquid sea of fire, the melted lava rolling towards the sides like waves of water. Then suddenly a violent current set in towards the centre, and from two mighty conduits, evidently connected with the bowels of the earth, the glowing lava shot up in fountains, to a height of 50 feet, I should suppose. Innumerable smaller fire fountains played at the same time. We heard a roaring like that made by the sea surf. The colour of the glowing lava was intense red; that of the overhanging clouds of smoke and vapour blue. The display varied every minute.

On our side of the fiery sea lay a broad stratum of freshly cooled lava, through the cracks of which we saw the lurid fire far below; and yet this lava had to be crossed. It was a difficult and dangerous descent, and we had to turn back immediately on reaching the level of the red-hot lava, as the sulphurous gas became unbearable. I ascertained the depth of this level expanse below the edge of the crater to be 280 ft. When we had climbed to the upper rim again the darkness of night had fallen. The view of the fiery lake was now far more imposing than when seen by daylight. The colour of the lava had changed from red to gold, the fountains of fire spouted up higher, and the surface of the sea rose and became more agitated. Reddish-coloured smoke hung over the mouth of the crater, and the evening star glimmered through it with a yellow hue.

A few steps from us stood the natives, whose swarthy faces looked still browner in the lurid light from the crater. Suddenly the eldest began to pray and to throw into the crater the offerings they had brought, consisting of sacred berries and live fowls. A monotonous chant accompanied this rite, which, in such marvellous surroundings, made a most powerful impression even on minds free from superstition.

Not far from Kilauea there is an extinct crater which, it seems, was formerly connected with the hot lava sea, the small Kilauea, or Kilauea Iki, as the natives call it. Its lofty walls are already clothed with vegetation, and wild goats browse confidently among evergreen shrubs. The bottom of the crater is, however, still covered with slippery black lava, and one cannot help thinking that some day the underground fire may burst forth again and destroy the young life at the edge of the abyss.

To the north of Kilauea are seen the high peaks of the gigantic volcanoes, Mauna Loa and Mauna Kea. On these craters (over 13,000 feet high) an interesting series of pendulum observations has been carried out in the last few years for the purpose of determining their total density and the specific gravity of the masses at various heights. The results of these measurements show that both volcanoes are much heavier than would have been supposed from their structure, and that in the case of Mauna Kea, the channels or cracks on which are completely filled up with cooled lava, the lower part is denser than the upper.

The Hawaiian Survey Department deserves great praise for its detailed investigation of this interesting group of islands, which owes its origin to the powerful effects of volcanic energy. The survey was organised by the Government in 1870, on the proposal of Professor Alexander, who is now Director, and, thanks to its untiring activity, we have for the past ten years possessed excellent special maps of all the Hawaiian islands. The triangulation and geodetical connections have been effected by the Survey officials themselves. On the other hand, the astronomical co-ordinates of the fundamental points are borrowed partly from the observations of the English Venus expedition of the year 1874, which erected several stations on the islands, and partly from a series of special observations carried out in the years 1886 aud 1889 by Mr. Preston of the American Survey. The determinations of longitude are however somewhat imperfect, being, indeed, based solely on the English observations at the time of the transit of Venus.

As soon as the projected cable between California and Honolulu is completed, the establishment of the longitude by telegraph will be of the greatest interest. During my visit to Honolulu deep-sea soundings preparatory to the laying of a cable were being carried on by two American warships,[1] and, according to the opinion of persons qualified to judge, the undertaking should be completed in about two years.

Regular meteorological observations also have for years past been taken at several stations on the Hawaiian Islands, under the supervision of the Survey Commission. Special importance attaches to these observations in view of the advantageous position of the islands. Also in the harbour of Honolulu and in Hilo, on Hawaii, regular records of the water-level are regularly kept by means of new mareographs furnished by the Hydrographic Department of the United States Government. These measurements have already furnished data for important and interesting inquiries into the regular tide phenomena, and also respecting the recently discovered annual fluctuations of the mean level of the Pacific Ocean.

Our expedition left Honolulu in the summer of 1892, and set out on its homeward journey amid the farewell strains of the Hawaiian military band, which is directed by a Prussian bandmaster. From the beautiful and hospitable shores of the Hawaii our course lay southwards among the numerous islands of the Pacific. After an eight days' voyage the lofty mountains of the Samoan island, Upolo, came in sight in the moonlight. We landed in the harbour of Apia, which is notorious for the occurrence of devastating hurricanes. On the coast there still lies a sad testimony to their violence—the wreck of the German warship *Adler* stranded in 1887. Under the guidance of the German physician resident in Apia, who also superintended a fully equipped meteorological station in commission from the German Seewarte, I set out upon an excursion into the interior of the island. On all sides the most luxuriant vegetation and the most stately, shady forests meet the eye. Coco-nuts, rice, coffee, and excellent cotton are cultivated. About nine-tenths of the entire trade is in the hands of Germans; it has however declined very much since Samoa was declared neutral. At the present time there are no fewer than four post-offices in Apia, viz., German, Samoan, English, and American. In studying the interests concerned, one cannot refrain from a feeling of genuine regret that those fruitful and healthy islands, which have been opened up to civilisation and trade by German pioneers, do not also belong to Germany.

From Samoa the expedition proceeded by New Zealand to Australia. The excellently equipped observatories and meteorological stations in Sydney, Melbourne, and even in Adelaide, are already well known. From Albany, on King George's Sound, we took a north-west course through the Indian Ocean to Ceylon, where we were enabled to make some beautiful, ever memorable excursions into the interior of that 'pearl of islands.' Thence we continued our voyage by Aden, the Red Sea, and Suez Canal, through which we passed in the very hottest month. Notwithstanding the extreme heat, the passage of the canal is highly

[1] See *S.G.M.*, vol. ix. p. 600.

interesting; the work of a genius is everywhere apparent. In many places the canal is not broader than 25 mètres (82 feet), so that, when steamers of 7000 tons pass through, the water visibly rises up the banks.

The homeward voyage through the Mediterranean, past the Ionian Islands and the coasts of Greece, is a relief after the discomforts of the Red Sea and Suez Canal. On passing the island of Crete we hailed with peculiar satisfaction the high mountain Ida, famous in the legends of ancient Greece, and the blissful feeling that we were approaching our native soil, furnished with material for the study of new scientific problems, had a soothing effect on our minds after such a long and fatiguing voyage. But all the impressions received on the Hawaiian islands, that Paradise of the Pacific, will ever remain with undimmed lustre in our recollection. I hope my readers may not regret having been carried in imagination to a country which has been favoured in the highest degree by nature, which has played an important part in the history of geographical discoveries, and which now may claim also a by no means unimportant place in the history of geodetical investigation.

ALEXANDER LOW BRUCE.

ONLY a few days ago, many like myself boasted that in Alexander Bruce we possessed "the best friend in the world," and yet on Thursday last some hundreds of his friends from London, Manchester, Glasgow, Edinburgh, and other parts mustered around his grave, and saw his remains consigned to the ground in Morningside Cemetery. The members of the Royal Scottish Geographical Society need not to be informed that by this lamented death the country has been deprived of the services of a strong man, and of one who, for his healthful moral influence, deserved to be called a great man. They will feel, that had he lived a few years longer, few public men would have excelled him in public love and esteem. But, unfortunately, before the people at large could know what a rare and charming personality was amongst them, and have the opportunity to pay their homage to his worth, he has been suddenly snatched away, leaving those who had come in contact with him sincerely grieving. As we saw no cause for anxiety on his account, we flattered ourselves that, wide and noble as had been his influence of late years, the future would only exhibit it in a magnified sphere, and always wholesomely useful. For, to our minds, he appeared wonderfully free from all symptoms of approaching elderliness or declining vitality. His industry continued to be amazing, his energy in business unabated, his appetite for work uncloyed; he was a picture of health and of vigorous and enduring manhood. We were, therefore, rejoicing that such a man as our friend lived, and that the world was more and more sharing our esteem for him, when we were startled by the news of his serious illness, from an attack of influenza and pneumonia, to which three days later he succumbed.

This painful event, as is natural, considering his exceeding lovable-ness, is mourned as a great misfortune in many cities and lands. From Caledonia to many remote parts of Central Africa the telegraph has flashed the sad news with its usual brevity, and many men will doubt that they understand it aright. They will ask, "Can it be our Mr. Bruce, who appeared so blooming and youthful-looking, that is dead?"

We at home can best appreciate what this loss means when we look around the various circles where his familiar figure was always welcome, and where he was known as so eminent for sound judgment, attention to affairs, and earnestness of purpose. Where can we now find a person so capable and so devoted to the cause of unifying, strengthening, and expanding the empire as he was? I know of none living so richly endowed with those gifts of head and heart which made him so powerful for influencing others. He was at once so good-natured, cheerful, high-principled, zealous, persuasive, forbearing, self-sacrificing, and tirelessly industrious. There are many in whom a few of these qualities are conspicuous, but those who unite them all are most rare, and therefore the world can ill afford to lose so valuable a factor in its interests.

The several commercial businesses which Mr. Bruce upheld and animated will miss him also greatly. The various societies of which he was an honoured fellow, and for whose benefit he was never sparing of his services, will most keenly feel his absence. Religious missions in Africa have lost in him a strong advocate and strenuous supporter. Exploring and trading companies are deprived of a helpful and hopeful element, where his level-headedness and strong controlling spirit were felt to be essential for the success of their enterprises; and social life, which he used to kindle with his honest and genial presence, warm by his glance, and flavour with his conversation, is bereft of one of its most kindly characters. It would be superfluous to add that to his family, to whom he was unvaryingly affectionate and protective, and all that a Christian husband and father should be, his removal will have caused a void which can never be filled again.

That which was one great charm of Mr. Bruce was an endowment of nature. He was blessed with such an unceasing flow of geniality, that he could not help comforting and befriending wherever he went. His company was a tonic against depression, and dispelled gloom. He stimulated the faint-hearted and roused the lukewarm. Being without a trace of narrowness and self-interest, he was able to warm others into taking a more generous aspect of personal or public affairs. His native humour, assisted by a pair of speaking eyes, ever sparkling brightly and radiating hope, penetrated the frigid reserve and thawed the temper of those who, a few minutes before, were hugging their discontent and exaggerating dismal trifles. He appeared so insensible to despondency in his own person, that the face darkening from low spirits quickly brightened at the comic, humorous glance, which seemed to ask, "Well, what has come over you that you look so grieved?" The manner was irresistible, and, encouraged by the sympathy which was always ready and sincere, the questioned would unfold his tale of private misery, to be lightened and consoled. If such a cheerful spirit was a physic to dolefulness, it was no less useful in strengthening the sense of happiness. In its effects it was as sunshine. Distress was solaced, despondency was comforted, and the measure of content became overflowing.

Though I had known Mr. Bruce for nearly twenty years, I obtained a profounder knowledge of his character while staying with him and his family last year at Dunnolly Castle, which he had rented for the season. At his hospitable house, No. 10 Regent Terrace, I had often lodged and feasted, remarking meanwhile his cordial reception of his guests and generous manner of entertainment; but at Dunnolly, relieved as I was from the flurry of former visits, I became a witness of the domestic felicity and the beautiful customs of his household. I then understood whence sprang much of that perennial cheerfulness, and the inspiration of the countless good deeds for which he was distinguished. Each day was regularly ushered in by prayer for grace, and closed by heartfelt thankfulness. The efficacy of this custom cannot be questioned, for with him every working hour showed his rectitude and uncorrupted heart. In his conversation and dealings with all sorts of persons, as well as by every act, he proved his motives to be pure and his principles upright.

Those who have been favoured with his intimacy were no doubt struck by this or that prominent and distinguishing quality, but I think we shall all agree that he was insatiable for work. Perhaps some will go so far as to say that the absorbing zeal, variety, and quantity of the duties he voluntarily undertook, eventually proved harmful to his health. This may be doubted, for up to the day of his illness his physique bore no signs of overstrain. His death was due to an accidental exposure to a cruel blast, which during the ill-condition of the atmosphere this season has proved so pernicious in several parts of Great Britain. It may be that he postponed too long taking a holiday in sunnier regions for rest and relaxation, but he was not a man to fly away until compelled by necessity. A week previous to his death he was as well and hearty, seemingly, as could be wished, and one would need to be a prophet to foretell danger for one of his vitality. Therefore, to within six days of that fatal Monday, the 27th of November, he continued to be engrossed in various subjects, labouring strenuously and devotedly for the promotion of human well-being, politically, commercially, socially, by religion and civilisation.

However numerous his public or business engagements had become through increase of popularity, he never neglected what was due to private friendship. His letters appeared at regular intervals, excellently written in free, bold characters, cogently and lucidly expressed, each line stamped with his energising individuality, and revealing his sound common-sense and acute mind.

He was so well adapted by his talents to aspire to a commanding public position, that many marvelled why a man of his intellect and judgment, and at his mature age, had not been brought forward to represent some influential constituency in Parliament; but the truth is that, in spite of undoubted fitness and repeated solicitations, he was so retiring and modest that he preferred to assist in the elevation of others rather than to be forward in his own behalf.

When he became son-in-law to David Livingstone, it may have stimulated him to be worthier of the connection with the Apostle of Africa, and to equip himself fully for the career just closed; but the lady who became his wife must have discerned those noble qualities which to-day—in Canada, the United States, the Cape, Central and East Africa, no less than in several parts of these British Islands—are linked inseparably with his name.

I must leave to other pens the writing of the formal obituary which should find a place in the *Magazine* of the Geographical Society which he was instrumental in establishing. I have but availed myself of your kind permission to record my personal knowledge of a dear and valued friend, who was as remarkable for the fidelity of his friendship as he was unsurpassed for activity in business, good judgment, modesty of manner, and kindness of heart. HENRY M. STANLEY.

RICHMOND TERRACE, WHITEHALL,
LONDON, *Dec.* 5, 1893.

"*In every work that he began . . . he did it with all his heart, and prospered.*"
—2 CHRON. XXXI. 21.

THE Scottish Geographical Society has great cause to honour the memory of Mr. A. L. Bruce. It is indebted to him for inestimable work as one of its founders, for constant support as one of its most active office-bearers, and for the energetic development of one of its greatest objects as the indefatigable promoter of exploration and civilisation in Africa.

In the preceding personal sketch, Mr. Stanley gives us such a telling picture of the kindly and enthusiastic worker, that to make it complete, I need only supply some facts more directly relating to his connection with this Society.

Mr. Bruce was born in Edinburgh in 1839, and educated at the High School. After some years of training in an office in Leith, he, in 1858, entered the brewery of Messrs. William Younger and Co., in Edinburgh, but was soon promoted to their London office.

In London he spent the next fifteen years of his life. Marrying his first wife in 1864, he subsequently became manager of the London office, where he was respected as an able man of business associated with many good works. Returning to Edinburgh in 1874, he became a partner in the brewery, and by his energy and enterprise greatly contributed to the development of this and other large commercial undertakings with which he was associated.

As a churchman and a politician, Mr. Bruce was a most zealous worker. He was one of the chief supporters of his church, and in politics a recognised leader of the Liberal Unionist party in Scotland. As an advocate of the "Cape to Cairo" programme in Africa, he was a strong Imperialist, and had great belief in the extension of British power. His association with the "British East Africa," the "African Lakes," and the "British South Africa" Chartered Companies is well known. To these companies he gave his money and time freely, with no motive of gain, but for the honour of his country and the advancement of civilisation.

His special interest in Africa may be said to date from his friendship with Dr. Moffat, which ultimately led to his meeting, and subsequent marriage with, Miss Livingstone in 1875. Thenceforward all his wife's enthusiasm in her father's work became his also, and under the inspiration of Livingstone he seemed to give his heart and soul to the cause of Africa. Everything that contributed to realise his aims in this direction secured his ready support, and no doubt it was this object that prompted him to lend his energies towards the establishment of a Geographical Society for Scotland. As soon as the project was mentioned to him, he took to it with such eagerness that immediate action towards its realisation was determined upon. To Mr. Bruce's public spirit and enthusiasm all seemed possible. Where others brought forward only difficulties and objections, he was encouraging and sanguine; not because he did not see the difficulties, but because his keen insight saw success beyond, and he set to work with such determination that success seemed a foregone conclusion. We commenced work at the end of July 1884, and by the end of October, the Society, with 400 members, was formally constituted at a meeting in the Edinburgh Chamber of Commerce. Then Mr. Bruce persuaded Mr. Stanley to give the opening address, and our success was assured. At this time Mr. and Mrs. Bruce gave the greater part of their time and thought to the promotion of the Society; members were secured, money was raised, lecturers were engaged, and the general organisation was set in motion. To such vigorous work at the early stages of the Society's existence its after-success and strength are largely due; and, indeed, it may be said that but for Mr. Bruce we should not have had our Scottish Geographical Society of to-day. As its treasurer, Mr. Bruce made sure that all was on a sound financial basis, and it was often with difficulty that he was persuaded to agree to even necessary annual expenditure unless he also had a good sum to add to his reserve fund.

The loss of such an ardent worker and leading spirit is a direct calamity, not only to the Society, but to all his colleagues individually. They will long feel the want of that energy and good counsel which pulled the Society through many difficulties, while his hearty and sanguine nature was a source of stimulus and encouragement endearing him to many friends.

J. G. Bartholomew,
Hon. Secy., R.S.G.S.

OBITUARY: 1893.

By J. W. M'Crindle, M.A., M.R.A.S.

Alexander Low Bruce.—Towards the end of the year that has just closed our Society sustained a most grievous loss by the unexpected death of its Treasurer, Mr. A. L. Bruce, who had taken a leading part in founding it, and afterwards spared no exertions in endeavouring to secure its success. In another part of this number of the *Magazine* will be found a record of his noble life, and a copy of the resolution adopted by the Council deploring his loss, and acknowledging the invaluable services which he rendered to the Society.

Captain Nelson.—About the middle of January last tidings reached this country of the death of Captain Nelson, one of the ablest and hardiest officers of the Stanley Expedition. He was cut off on the 26th of the preceding month by an attack of dysentery in Africa, whither he had returned in 1892, in the service of the Imperial East Africa Company. He was born in Leeds, and educated first at Harrow, and afterwards in Germany, at Weimar. He went to Africa for the first time in 1878 with a view to engage in ostrich-farming. He exchanged, however, this industry for the pursuit of arms, when our contest with the Zulus began, and, having joined Baker's horse, distinguished himself in numerous encounters with the enemy. He was next engaged in the campaign to suppress the Basuto rebellion, and here, as Captain and Adjutant of a troop of native cavalry, he had again his own full share of hard fighting. Having thus established his reputation as an officer of signal energy and capacity, he offered his services to Stanley when he was organising the expedition for the relief of Emin. Stanley, who had an unerring judgment in the selection of his men, being struck with his manly bearing, his martial tread, and the intellectual strength visible in his face, had no hesitation in giving him an appointment on his staff, and had in the issue good reason to congratulate himself on the wisdom of his choice. In the thrilling narrative in which he has recorded the incidents of his perilous enterprise he repeatedly acknowledges the priceless services rendered by Captain Nelson. Dr. Parke also, the surgeon of the expedition, makes, in his reminiscences, frequent mention of Nelson, who suffered far more during the march than any of his brother officers. He was indeed so utterly prostrated with ulcers, fever and ague, and other maladies, that he was left behind in the horrible starvation camp. He bore, however, the most dreadful extremes of pain with a degree of heroic fortitude which could scarcely be surpassed. He is the fourth of the intrepid officers on Stanley's staff whom death has claimed since 1887, when they left England to dare all hazards in the attempt to relieve Emin. The other three are Major Barttelot, Mr. Jamieson and Lieutenant Stairs. They died, all four, in Africa.

Henry F. Blanford, F.R.S.—A tribute in these pages is due to the memory of Henry F. Blanford, who won for himself a great name in two departments of science closely connected with geography—those of Geology and Meteorology. He was born in the city of London in 1834, and in his seventeenth year entered the Royal School of Mines, which had then just been opened. He was an apt scholar, and having gained a scholarship proceeded to Freiberg in Saxony, where he studied for a year. In 1855, having obtained an appointment in the Geological Survey under the Indian Government, he left this country for Calcutta, which he reached about the end of September in that year. His most important work during the seven years for which he held this appointment was the examination and the classification (afterwards shown to be correct) of the cretaceous deposits in the neighbourhood of Trichinopoly. Mr. Blanford's health having been impaired by his exposure to the weather while prosecuting his researches, his services were transferred from the Imperial to the Bengal Government, which appointed him to a Professorship in the Presidency College, Calcutta, an office which he held from 1862 to 1874. He had not long entered on its duties when he began to turn his attention to questions of Meteorology, and this led to his being appointed, in 1867, Meteorological Reporter to the Government of Bengal, with an office placed under his charge which should give storm-warnings for the protection of shipping, and at the same time record and reduce to system meteorological observations collected from all parts of the Presidency. "One most important result," says a writer in *Nature*, "was within a short time obtained; the meteorological conditions under which cyclones originated in the Bay of Bengal were definitely ascertained, and it became practicable to say when a storm was a probable event, and in what part of the Bay it might be expected, and when a cyclone was impossible, although high winds might prevail." In 1874 the Indian Government, having established a central office in Calcutta to collect meteorological observations from all parts of India, transferred Mr. Blanford from the educational staff, and made him chief of the new Meteorological Department. The forecasts of weather issued from this office have proved remarkably correct, as well as useful in warning the Government in what parts of the country a deficient rainfall may be expected. Mr. Blanford retired from service in 1888, and died at Folkestone on the 23rd of January last. He has left works and papers on a great variety of scientific subjects, among which may be mentioned his *Physical Geography of India*, a work largely used in Indian schools, and his *Elementary Geography of India, Burma, and Ceylon*, an excellent manual included in Macmillan's Geographical Series.

Dr. John Rae, one of the great heroes of Arctic exploration, and popularly known as the discoverer of the remains of the Franklin Expedition, died in London on the 22nd of August last, after a few months' illness, at the good old age of eighty years. He was a native of the Orkney Islands, and, when a youth of sixteen, entered on a course of medical study in the University of Edinburgh, and in four years obtained the diploma of surgeon. He soon afterwards received the appointment of Surgeon to the Hudson Bay Company's ship which annually visited Morse Factory, a station situated at the southern extremity of Hudson Bay. Here he had resided for ten years, engaged in the Company's service, when (in 1846) he set out on his first exploring expedition. On this occasion he laid down 700 miles of new coast, thereby uniting the surveys of Ross in Boothia with those of Parry in Fury and Hecla Strait. In 1848 he joined the expedition which, under the command of Sir John Richardson, sailed down the Mackenzie River and along the coast to eastward of its mouth, in search of the Franklin Expedition. The quest proved fruitless, but in the spring of 1849 was resumed by a party commanded by Rae, who, in the course of that year and the next, searched, but in vain, the whole coast of the Arctic Sea between the Mackenzie and the Coppermine

Rivers. In 1851 he was sent out by our Government on another search expedition, and between that year and 1854 he explored the whole of Wollaston Land, all the coast east of the Coppermine River, Victoria Land and Victoria Strait, in which, as was afterwards ascertained, Franklin's ships, *Erebus* and *Terror*, had been abandoned. From the coast he led his party southward to Fort Garry, now the city of Winnipeg, and thence into United States territory. The party travelled in all 5380 miles, in which were included 700 miles of newly-discovered territory. On his return to London Dr. Rae was presented by Sir Roderick Murchison with the gold medal of the Royal Geographical Society. In 1853 he engaged once more in Arctic exploration at the head of an expedition fitted out by the Hudson Bay Company for the purpose of tracing the west coast of Boothia. His surveys proved that King William's Land was an island, but, above all, information was obtained from the Eskimo which placed almost beyond doubt the fact that Franklin and his men had been forced to desert their ships, and had died, one after another, from exposure and starvation. Many relics of the unfortunate men were at the same time purchased from the natives, and these were brought home to this country. On returning to London in 1855 Dr. Rae received from the Admiralty the reward of £10,000 which had been offered by our Government for the first authentic news of the missing expedition. In 1860 he took the land part in surveying a telegraph line from England to America by way of the Färoes, Iceland, and Greenland, and in 1864 conducted another telegraph survey from Winnipeg across the Rocky Mountains. Subsequently he accomplished successfully a voyage of some hundreds of miles made in small dug-out canoes down the most dangerous parts of the Fraser River.

Dr. Rae has left but scanty contributions to the literature of travel. In 1850 he published a work entitled *Narrative of an Expedition to the Shores of the Arctic Sea in* 1846 *and* 1847. His reports of his journeys, published in the journals of the Royal Geographical Society, may be described as brief and unadorned. He wrote also several papers about the Eskimo, a people in whom he took a lively interest. During the latter years of his life he frequently attended the meetings of the Royal Geographical Society, the Royal Colonial Institute, and several other public bodies, taking at the same time special interest in schemes for developing the resources of the more western parts of our possessions in Canada. He was a Fellow of the Royal Society, and his merits were recognised by several foreign scientific bodies.

Dr. Crozat.—News of the death of this distinguished African traveller was received at the beginning of last year by the French Colonial Office. He was a member of Captain Binger's Delimitation Commission engaged in surveying certain tracts situated between the river Niger and the Gulf of Guinea. It was on the 11th of June 1892, and at Kong, that he parted from his companions. They proceeded to the coast, while he was directed to make his way to Sakhala and Seguéla to find, if possible, the papers of Captain Ménard, who had been killed in February 1891. Before leaving Kong he had been supplied by its sovereign with letters of recommendation, which permitted him to reach, without accident, the territories of Tiéba, a chief who had once entertained him for some months with great hospitality, and held him in high esteem. The Doctor had left Kong in the best of health, but the African climate is treacherous, and he succumbed at Tengréla to some one or other of its fatal maladies. It thus devolved upon Tiéba to make known the fact of his death. In the pages of the *Bulletin du Comité de L'Afrique Française* Captain Binger pays a warm tribute to the worth of his friend. He was brave, he tells us, and circumspect, and, as he possessed a thorough knowledge of the natives, could extricate himself with honour from the most difficult situations. Of this he gave proof in the journey which he accomplished in 1890 to the Mossi, in circumstances of peculiar difficulty. He was deeply versed in questions of language and ethnography, and familiarly acquainted with the flora and fauna of the Sudan. All those who approached him, Captain Binger adds, were able to appreciate how elevated were his sentiments, and how much he was dominated by the qualities of the heart.

William Cotton Oswell, well known as an African traveller and as one of Dr. Livingstone's best and most faithful friends, died, after a short illness, near Tunbridge Wells, on the 1st of May last. He was born in 1818, and was educated at Rugby School in the days when it was under the rule of Dr. Arnold. He distinguished himself in his college career, and succeeded also in passing the difficult examination which gives admission to the Indian Civil Service. His health, however, broke down, and he was in consequence ordered to the Cape. He travelled in the southern parts of Africa, and penetrated 200 miles farther into the interior than had been done by any European before him. The country at that time abounded with big game, and he distinguished himself, as Mr. Selous has done subsequently, by the number of victims that fell to his sure and deadly aim. He made several discoveries, and the Paris Geographical Society, to mark its sense of their importance, awarded him its silver medal. He accompanied the expedition led by Dr. Livingstone in the regions to the south of the Zambesi, when Lake Ngami was discovered. The great traveller, both in his published works and in his private letters, acknowledges in warm terms his gratitude to Mr. Oswell for contributions which greatly helped him in his early African enterprises ere yet his name had become widely known.

Dr. Heinrich Lange, a distinguished German cartographer and Chief of the Map-room of the Royal Statistical Bureau in Berlin, died in that city on the 30th of August last. He was born at Stettin in 1821, and along with A. Petermann received his training as a map-drawer under Professor H. Berghaus in Potsdam. He worked thereafter with Messrs. Keith Johnston and Co., here in Edinburgh, while they were preparing their well-known Physical Atlas. On returning to Germany Lange became head of the Brockhaus Geographical Institute in Leipsic, and here he published his *Atlas von Sachsen*, which he enriched by the addition of physical maps, and also a *Railway Atlas*. His name is, however, most widely known through the *Lichtenstein School Atlas,* which he prepared with no ordinary skill and care, and also through the *Volksschule Atlas,* which has run through upwards of a hundred editions. Lange was a strenuous advocate of the cause of German colonisation in Rio Grande do Sul, the most southern province of Brazil.

General Sir ALEXANDER CUNNINGHAM, K.C.I.E.—This celebrated Indian archæologist died at South Kensington on the 29th of November last, in the eightieth year of his age. He was the second son of Allan Cunningham, the Nithsdale poet, who wrote a *Life of Burns* and composed a number of our popular Scottish songs. Born in London, he was educated at Christ's Hospital and at Addiscombe, which he left in 1831 as Second Lieutenant in the Bengal Engineers. During his term of professional service in India, which extended to thirty years, he filled a succession of high and responsible posts. In 1834 he was appointed Aide-de-camp to the Governor-General Lord Bentinck; in 1839 was sent on a special mission to Kashmîr; in 1840 was appointed Engineer to the King of Oudh; in 1846 was deputed as Commissioner to determine the boundary line between Kashmîr and Tibet; and in 1858 was transferred from Burma, where he had conducted the Engineering Department with eminent success, to occupy the difficult position of Chief Engineer of the North-Western Provinces, which were just then emerging from the confusion entailed by the Mutiny. The services, however, which he rendered during the thirty years referred to were not all of an administrative character. On the contrary, he took part in several campaigns—first, in the Gwalior War of 1843, when in the battle of Punniar he gave unmistakable proof of his military capacity, and afterwards in both the Sikh campaigns, in which he won high distinction as a Field Engineer and the rank of Brevet-Major. The discharge of his arduous public duties did not absorb all Cunningham's interest and activity. Inspired by the noble example of Prinseps, he set himself soon after his arrival in India to collect and study coins, to search for old sites, to dig up ruined topes, temples, and cities, and prosecute other researches which might redeem from the oblivion of ages the India of the Brahmans, the Buddhists, and the Greeks. The results of his investigations were published from time to time in the Journal of the Bengal Branch of the Royal Asiatic Society, as well as in separate works, such as *The Temples of Kashmir,* and *Ladakh: Physical, Statistical, and Historical.* The Indian Government, impressed with the value of such investigations, in 1861 intrusted Cunningham, who had completed his term of service and was about to retire into private life, with a General Archæological Survey of India. This appointment he held (with the exception of four years spent at home during a temporary suppression of his office) till his final retirement in 1885. His explorations, which extended from the Hindu-Kush to the plains of Bengal, were fruitful of discoveries of capital importance, especially to scholars attempting to construct Indian history for the ages anterior to the Mohammedan invasion, since from the paucity or utter absence of written records they depend mainly for their materials on the researches of the antiquarian. In successive years he submitted twenty-three reports of the work done in his department. In 1871 appeared his great work *The Ancient Geography of India*, in which "he marshalled, in a systematic plan, the whole cycle of modern discovery bearing on the Buddhist and Greek period." His zeal for work did not flag after his retirement, and, as lately as 1892, he published his magnificent work *Mahabodhi*, descriptive of his excavations at Gaya. It is said of him that he was one of the most instructive and entertaining of companions, and he leaves behind him a large circle of devoted disciples and friends.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The late Mr. A. L. Bruce.

At a special meeting of the Council of the Royal Scottish Geographical Society, held on Monday, December 4th, Professor James Geikie presiding, the following minute was moved from the Chair :—

"The Council of the Royal Scottish Geographical Society desire to record their deep sense of the irreparable loss which the Society has sustained in the death of its Honorary Treasurer, Mr. A. L. Bruce. From its foundation, in which he played a conspicuous part, he devoted himself with characteristic energy to its welfare. In days of difficulty and anxiety no one could have been a more sagacious adviser—a more courageous pilot. A man of many interests, he yet always found time to further the work of the Society, while his wide influence was ever ready to be used to its advantage. The Council recall with gratitude the generous zeal with which he supported all the Society's schemes and undertakings, and are well aware that the success attending these has been in large measure due to his unselfish devotion. It is with sincere sorrow that they now record their loss of so highly valued a colleague—one in whom they recognised not only a trustworthy counsellor, but a faithful friend. They request the Secretary to send a copy of this resolution to Mrs. Bruce, and to express at the same time their deep sympathy with that lady in her bereavement."

The Chairman, in submitting the resolution, said it had met with the approval of the Recommendations Committee. Mr. Bruce had been one of the founders of the Society, and, first and last, it owed to his generous devotion to its interests more than could be expressed. The success of the Society was in a large measure due to his boldness of initiative, that sent it forward on new and expansive lines which the more timid among them might have been disposed to hold back from ; and this courage of his had been thoroughly justified by events. To his sagacity and his business experience, also, they were deeply indebted ; for these enabled him to take broader and clearer views of the functions to be fulfilled and the work to be done by the Society than might have suggested themselves to the minds of others.

Mr. John George Bartholomew, in seconding the motion, spoke of the encouraging manner in which Mr. Bruce received the proposal for a Scottish Geographical Society. While others brought forward difficulties and objections, he took up the scheme with a confidence and energy that could not fail to ensure success. Without his assistance the Scottish Geographical Society would not be in existence to-day. During its early days both Mr. and Mrs. Bruce devoted a large part of their time to its furtherance and development, and worked zealously on its behalf.

After a few words from Dr. George Smith, the resolution was carried unanimously.

Presentations to the Library.

A Meeting of Council was held on December 12th, when it was announced that the following works had been presented to the Library during the quarter ending September 30th, 1893:—

	Presented by
Meteorological Observations made at the Madras Observatory	Prof. Michie Smith.
82 Photographs of views near Nice	Jas. Jackson.
Von Lendenfeld's Australische Reise	Baron F. von Mueller.
The Northmen in New England, by J. Toulmin Smith	Capt. M. J. Butcher.
Blue Books and Reports	T. R. Buchanan, M.P.
Statistical Data on the Population of Transcaucasia (In Russian)	Nicolas de Seidlitz.
Notes on Some of the more Common Diseases of Queensland in relation to atmospheric conditions, by D. Hardie, M.D.	Clement W. Wragge.
An Account of an Embassy to the Kingdom of Ava in 1795, by Lt.-Col. M. Symes	Dr. Cleghorn.
English Pictures, by Rev. S. Manning	J. Gunn.
Paterson's Guide to Switzerland	J. Gunn.

The Council expressed its acknowledgments to the donors of these books and of a number of pamphlets.

The first Ordinary Meeting of the Session was held in the Society's Hall, Edinburgh, on December 21st, at 4.30 p.m., the chair being taken by Dr. George Smith.

Amendments of Laws.

The following amendments of Laws XVIII., XXVI., and XXXVI., proposed by the Council, were submitted to the Meeting and unanimously approved:—

Law XVIII.—*Add the words*, "Every Member has the privilege of introducing one visitor to each Meeting."

Law XXVI.—*Delete the words*, "but Members may, if so inclined, give a larger subscription."

Insert the following after the words "November in each year":—Members joining this Society at any period of a Session are required to pay the Annual Subscription for that Session. A Member who may desire to withdraw from the Society is required to pay his Annual Subscription for the Session in which he intimates such desire.

Law XXXVI.—*The following to be substituted for clause "b":*—

(*b*) *On payment of a Diploma Fee of one guinea*, on Ordinary Members who have paid a Composition for Life Membership, or who have paid the Annual Subscriptions for at least three years preceding, or an equivalent amount, and who apply for the Diploma in writing. But the Council are empowered to remit the Diploma Fee when it may be found desirable to confer the Diploma on a Member who has rendered special services to the Society.

Election of Hon. Treasurer and Trustee.

Mr. John Cockburn was elected Hon. Treasurer, and Mr. James A. Wenley Trustee, in the room of the late Mr. Bruce.

Lecture in December.

Miss Annie Taylor delivered a lecture entitled "My Experiences in Tibet," at the above Meeting.

The Glasgow Branch assembled on Friday, 22nd December, to hear Miss Taylor lecture on Tibet. Sir J. N. Cuthbertson took the Chair.

Educational Lectures on Surveying were delivered by Mr. W. B. Blaikie in the months of November and December.

A Christmas Lecture to young people was delivered in the Society's Hall on December 27th. Mr. A. J. Copplestone was the lecturer, and numerous lantern slides were exhibited.

Meetings in January.

On January 4 a Meeting for the discussion of Antarctic Exploration will be held in the Queen Street Hall, at 8.30 p.m. Dr. John Murray will take the Chair, and Dr. C. W. Donald, Messrs. W. A. Bruce and W. G. Burn-Murdoch, who have lately returned from the Antarctic, Professor Geikie, and Dr. Buchan will address the meeting. Mr. Burn-Murdoch will exhibit a selection of his Antarctic views, and numerous limelight slides will be shown. A resolution in support of Antarctic Research will be submitted to the Meeting.

On January 8, at 8 p.m., Mr. W. L. Calderwood, F.R.S.E., will deliver a lecture to the Glasgow Branch in the Hall of the Philosophical Society, 207 Bath Street, on "British Sea Fisheries and Fishing Areas, in view of recent National Advance."

A Joint Meeting of this Society and the Philosophical Society of Glasgow will be held on January 10th, when Mr. Gilbert Thomson, C.E., will read a paper entitled "Above the Snow-line in Scotland," illustrated with limelight views.

On January 18th Mr. Calderwood will repeat his lecture in the Society's Hall, Edinburgh.

Mr. Calderwood will also address the Dundee Branch on January 23rd, and the Aberdeen Branch on January 24th.

A course of six educational lectures on Historical Geography, by Mr. W. L. Carrie, M.A., will commence on Tuesday, January 9th, at 8 p.m.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The English Lakes.—Mr. Heawood, assisted by Mr. R. Shields, has been continuing Dr. Mill's work by sounding some of the smaller lakes. Ennerdale was first visited, which consists of a broad shallow basin at the lower end, and an extremely irregular deep trough occupying the remaining two-thirds. Crummock-water was found to have steep shores and a nearly level bottom. At only one point does the 100-foot contour diverge to any marked extent from the bank, the greatest depth sounded being 140 feet. This occurs at the lower and broader end of the lake. Buttermere, which should be regarded as part of the same basin, nowhere reaches a depth of 100 feet, the maximum occurring quite at the upper end where the two feeders enter.—*Geographical Journal*, vol. ii. No. 6.

Herr Thoroddsen in Iceland.—In *Globus*, Bd. lxiv. No. 19, Herr Thoroddsen gives an outline of his work last year in Iceland, the results of which surpassed his expectations. His object was to explore geographically and geologically the little-known districts of the Vestur-Skaptafellssysla. The sources of the large rivers Skapta and Hverfisfljot had not been visited by explorers, and much of the adjacent country had never been trodden by the foot of man. Two weeks Herr Thoroddsen spent in the geological investigation of the Myrdalsjökull, a glacier field of about 425 square miles, where rises the notorious volcano Katla, from which within historic times twelve violent eruptions have taken place, melting the ice which covers the summit, and laying waste extensive tracts of occupied lands by floods and torrents of ice blocks. The study of the changes caused in the surface of the country by these catastrophes is of great scientific interest. The highlands above Skaptartunga to the west of Skapta were also explored. Their southern part is used as a summer pasture for sheep, and hence is to some extent known by the peasants of the vicinity, but most of the northern portion, being bare and consisting only of naked rock and sandy desert, was unknown before. The whole stretch from the Myrdalsjökull to the Vatnajökull was surveyed and examined geologically. The lake Langifjör was also visited, and an immense fissure was discovered, 400 to 600 feet deep, cleaving the mountains and valleys for a distance of about 19 miles; from it great lava streams have issued, pouring down in steep cascades. Such another cleft, Herr Thoroddsen affirms, is not to found in the whole world. One of the streams of lava can be traced for some 30 miles down to the sea at Alptaver. An important question in the geology of Iceland was solved by the investigation of this district. The numerous serrated ridges and steep summits are all composed of tuff and breccia, and are among the most recent formations in the island. It was found that they were for the most part formed after the Ice Age, and rest on older breccia impregnated with iron. This is the first clear proof that large rocks of tuff have come into existence in Iceland since the Ice Age.

Behind the row of craters running from south-west to north-east, between Skapta and Hverfisfljot, the scene of the disastrous eruption of 1783 (*S. G. M.*, vol. ix. p. 416), Herr Thoroddsen entered a barren region hitherto unvisited, where masses of piled-up lava seemed to prevent further progress. With great difficulty and danger he succeeded in reaching the source of the Skapta river, which is formed by several small glacier streams descending from the skirts of the Vatnajökull, and separated from the Langifjör lake only by a long and narrow ridge. Returning to Varmardalur and then travelling eastwards, he discovered two new lakes at the north-west of the crater-line of 1783, and reached the source of the Hverfisfljot. On the western side of Vatnajökull a mighty glacier extends from the Bonaskard pass to Fljotshversi, terminating in cliffs of ice 400 to 500 feet high. From the edge thousands of muddy rivulets fall to join the Hverfisfljot at its feet. The line of craters runs up to join the Vatnajökull, and forms the watershed between the Hverfisfljot and the Skapta. Before the volcanic fissure was formed, far more glacier streamlets joined the Skapta, and the Hverfisfljot was only a small brook called the Raptalœkur.

The Draining of the Lammefjord.—The draining of this sheet of water, which lies in the island of Zealand, Denmark, was commenced in April 1873. The first work was to construct a dam 7400 feet long, to cut off the area to be drained from the Isefjord. This dam has been raised to a height of nearly 11 feet above the mean water-level without. In January 1875 the process of pumping out the water was commenced, and has been continued to a depth of 10 feet below the original level, the capital being insufficient to complete the work down to 15 feet, as intended. The enclosed area is about 22 square miles, of which about a fourth is occupied by an inland lake, while one-tenth is dry only in summer. The remainder is excellent land for pasturage and gardens, but a railway is needed to carry off the products to Copenhagen. A canal encircles the recovered land, and drains the water through sluices into the Isefjord, and another 4000 yards long runs through the narrow ridge to the Nexelö bay. The total length of canals is fully 25 miles.—*Globus*, Bd. lxiv. No. 22.

ASIA.

A Chinese Map of Northern Tibet and the Lob-Nor Region.—The Emperor Kan-si, who reigned sixty-one years from 1661, employed the Jesuit missionaries residing at his Court to construct a map of the whole empire. This map was completed in 1718, and was engraved on copper plates. Since then it has been considerably improved by additional data obtained during the Tibetan explorations under Kan-Si himself, and the later journeys of the fathers D'Espinha, D'Arocha, and Hallerstein in the reign of Kien-lung. Another map based on this was produced at Wu-chang-fu, the capital of the province of Hu-pe, in 1863, on the scale 1 : 1,000,000. It embraces the whole of Asia and Europe as far as the Baltic and Ægean seas, and is printed from wood in thirty-two sheets. The projection is that known as the Sanson-Flamsteed, the central meridian being that of Pekin ; consequently the western meridians are very oblique, and the distortion at the extreme west enormous. In 1869 Baron von Richthofen found the blocks for this map, and procured some prints, from which Dr. Georg Wegener, assisted by Herr Karl Himly, has edited a map of Northern Tibet and the Lob-Nor region, and published it in the *Zeitschrift der Gesell. für Erdkunde zu Berlin*, No. 3, 1893. In the transliteration of the names great difficulties had to be overcome. The foreign names were written in Chinese characters representing as nearly as possible the same sounds. Some sounds are, however, wanting in Chinese, as for instance, the soft labial, guttural, and dental (*b*, *g*, *d*,) ; and in these cases it required long study to find out what sounds had been substituted, It must also be remembered that Chinese characters represent syllables, and that, therefore, the required combination of consonantal and vowel sounds would not always be represented by any Chinese character ; and, lastly, that the foreign sound would not always be correctly acquired by the compilers of the map.

The Uriankhai Country.—In 1892 M. P. N. Kriloff, Curator of the Botanical Museum in the University of Tomsk, travelled in this corner of Mongolia, setting out from Minnusinsk. Travelling south-eastwards towards the river Ulu-kem, he crossed four ranges in succession, ascending some of the mountains, and attaining, on the summit of the Oukziam, to an elevation of 7602 feet. After crossing the river near the mouth of its tributary the Ja-kul, M. Kriloff made an excursion to the Ubsa lake, passing over the Tannu-ola range and climbing some of its summits, one of which was as much as 8880 feet above the sea-level. He then descended into the basin of the Ak-kem and reached the Ubsa lake, which he found to be 2658 feet above sea-level. On his return to the Ulu-kem he took a more easterly route, passing over the Tannu-ola from the basin of the Irbittei, which flows into the lake, to that of the Elegess, a tributary of the Ulu-kem. Arrived at the river, he followed it upwards to where it divides into two branches, the Kha-kem and the Bei-kem, and, crossing the former, passed into the little-known country between these rivers. It is intersected by lofty parallel chains running from east to west. These chains extend westwards to the Bei-kem, where they turn to the north-west, and run up to the Saian Mountains. M. Kriloff's route lay, on the whole, in a north-easterly direction, passing from the basin of the river Tansa to that of the Pitche-O or Ulu-O, across the above-mentioned chains, here called Tomat-tagh, and then descending to the Upper Bei-kem. One of the summits of the Otygh-tagh, to the north of the route, was ascended, and found to be 8475 feet high. Before reaching the river, a small lake, the Doro-kul, was passed.

Not many miles down the river from the point where M. Kriloff struck it, a tributary, the Doro-kem, enters it, flowing from the east-north-east out of the lake Toju-kul. To this lake M. Kriloff made his way from the south over a pass 3845 feet high, and, skirting its shore, came to the river Azass, which flows slowly through a somewhat narrow, wooded, and swampy valley. Its bed has a sinuous course, and deserted channels are frequent. The river receives only unimportant tributaries, some of them draining lakes in the surrounding low mountains. In its upper course it is more rapid, the inclination of the ground being greater. To the south extends a lofty range, and on the north a broad wooded plain studded with lakes, of which the most important is the Noinoff-kul, which gives birth to the river Ii-suk. Near it on the east flow the upper tributaries of the Khamsara river, and from the summit of the Oiba-tagh, 6788 feet high, situated in this basin, the traveller could see a large portion of the upper course of the river, which issues from defiles in the mountains and then passes through a chain of lakes. Descending for a short distance this important tributary of the Bei-kem, M. Kriloff then passed over to the Noinoff-kul, a lake over 13 miles long and one to four broad, surrounded for the most part by mountains sinking abruptly to the shore. The Ii-suk flows slowly between marshy banks, forming a succession of lakes, of which thirteen have a length of $1\frac{1}{4}$ to $3\frac{1}{4}$ miles. It has no important tributaries. On arriving at the Bei-kem, the traveller embarked on a raft and descended the river, here 120 to 180 yards broad, to the mouth of the Sistygh-kem, passing the mouth of the Khamsara, which affluent considerably increases the volume of water. He then ascended the Sistygh-kem in a north-westerly direction. Its valley is $\frac{3}{4}$-mile to two miles broad, and its stream swift but smooth. Near the source of its western tributaries lie the Russian gold-mines discovered about fifty years ago. The pass over the watershed was 4186 feet high, and the descent leading to the valley of the Amyl more rapid than the ascent. Passing through Kuzhebar, M. Kriloff soon reached Minnusinsk, and proceeded to Tomsk, having spent $4\frac{1}{2}$ months on his journey. He drew numerous traverses and recorded over 400 altitudes with the help of two aneroids, which have been reduced by General Tillo, and are given in tabular form with numbers corresponding to those on the accompanying map.

The greater part of the country traversed lies in the region of forest. The Minnusinsk steppe is bounded by a forest, chiefly of birch, which forms a broad belt along the foot of the Saiansk Mountains. On the flanks of the mountains, except on the higher peaks and ridges, where an alpine flora prevails, varieties of the fir tribe grow, as cedars and spruce, which still farther south give place to larches. In the eastern part of the country cedars and spruce predominate, and on the Tannu-ola larches are less numerous and cedars are found only at the upper limit of forest growth. Steppe lands lie beyond the Ulu-kem, on the slopes of the Saian Mountains and Tannu-ola, and in the plain of the Ubsa lake. They are found also on the right bank of the Kha-kem, though of small extent. Small patches of steppe cover the spurs of the mountains between this river and the

Bei-kem, and occur in the valleys of the Tansa, Ii-suk, and Azass.—*Izvestiya* of the Russ. Geogr. Soc., Tom. xxix. Part iv.

AFRICA.

Anglo-German Frontier in West Africa.—The frontier running from the mouth of the Rio del Rey to the falls on the Cross river, and thence to Yola, has been further defined up to Lake Tsad by an agreement concluded in November last. With the town of Yola as centre, and a radius extending to a point on the southern bank of the Benue five kilomètres (a little over three miles) below the principal mouth of the Faro, a circle will be described, and will form the boundary from the line drawn from the Cross river to the Benue, so that the British territory will extend about 25 miles to the south of Yola. From the Benue the line will run to the intersection of the 13th meridian of east longitude with the sixth parallel of north latitude, and thence in a straight line to a point on the southern shore of Lake Tsad situated on the 14th meridian, or 35 minutes east of the town of Kuka. It is further agreed that Germany shall not extend its influence beyond the basin of the Shari, and that Darfur, Kordofan, and the Bahr-el-Ghazal, as they are drawn on Perthes' map, published in October 1891, shall remain in the British sphere, even if it should be shown that affluents of the Shari flow within the limits of those countries.

The Juma-Kwilu.—Major Parminter has ascended this tributary of the Kasaï in the steamer *Archiduchesse Stephanie* as far as 7° S. lat. It is a magnificent river, as important as the Sankuru, and is navigable for a distance of 435 miles ; and where further progress is barred by rapids, called the Stephanie by Major Parminter, the stream is still nearly 90 yards in diameter. The country through which the river flows is flat, and presents a long succession of savannahs, with forests scattered over it. At lat. 7° it becomes slightly rocky, and a few elevations are visible. The population is extremely dense, especially on the upper reaches. At one place the explorer found settlements that might contain 10,000 inhabitants. On the right bank dwells the tribe of the Bayaka, and on the left the Kinkanga. They are traders, hunters, and fishermen. The only affluent of any importance is the Kwenge, which enters the Juma at about 6° 20′ S. lat. The steamer ascended it for a distance of 16 miles.—*Mouvement Géogr.* No. 23, 1893.

Lake Leopold II.—Monsieur de Meuse, who has lately returned to Europe after a sojourn of three years on the Upper Congo, has communicated to the *Mouvement Géogr.*, No. 22, 1893, some information about this lake, which he has explored on several different occasions. It pours its surplus waters into the Lukenye-Mfini by a narrow channel issuing from the lake at 18° 5′ E. long. and 2° 45′ S. lat. Its most northern extremity lies at 1° 5′ S. lat. The depth of the lake is small, and the navigation dangerous at all seasons. The highest elevations on the shores are only about 30 feet, and the north-western banks are bordered by immense swamps. The largest affluent of the lake, the Kelenge, which is, however, insignificant, meanders through these swamps, and has its source near a village called Bosango, on the watershed between the lake and the Congo, not far from the Manga, which flows to the river. The population of the basin of the lake is very dense. No villages are built on the banks, the natives living in the interior and hiding their dwellings in the bush. On the west live the Tomba, and on the east the Gundu. The tribes which compose these nations are constantly at war with one another, and their flotillas are seen in every bay and creek ready to set forth and hunt slaves or pillage

AUSTRALASIA.

The Melanesian Plateau.—Mr. J. P. Thomson, F.R.S.G.S., etc., of Brisbane, has forwarded an interesting note on an article by Mr. Charles Hedley, F.L.S., of the Australian Museum. The extensive plateau, probably bounded by the 1300 fathom contour line, which includes the New Hebrides, Fiji, Solomon, and Loyalty groups, New Zealand, New Caledonia, Norfolk, and Lord Howe islands, Mr. Hedley regards as the remnants of a disintegrated continent, basing his theory on the distribution of the land mollusca, and especially of the genus *Placostylus.* To this area he gives the name of the Melanesian Plateau. Soundings of 2600 fathoms have been obtained between the Fiji and Samoa groups, and while the molluscan fauna of the latter is of an oceanic character, that of the Fiji Islands is distinctly continental. On the western side of the plateau, about the 20th parallel, a bank, nowhere lower than 1300 fathoms, was reported by the *Challenger* expedition. Its existence was not ascertained by actual soundings, but, the temperature in the coral sea increasing down to 1300 fathoms and remaining stationary at lower depths, it was inferred that the inrush at these lower depths of the cold water from the Antarctic was prevented by some such obstacle. Mr. Hedley suggests that this bank may lie between the Loyalty Islands and the New Hebrides instead of between New Caledonia and the Great Barrier Reef. The theory of a former connection between New Zealand and Australia, propounded by botanists, and on surer grounds by geologists, is, in Mr. Hedley's opinion, incompatible with the distribution of the Melanesian molluscan fauna in general, and of *Placostylus* in particular. Had the stream of life come from the north-west instead of from the north-east, Lord Howe Island would be tenanted by forms bearing some resemblance to Queensland mollusca. Mr. Hedley, therefore, concludes that the Melanesian Plateau was insulated early in the history of the existing fauna, and has never since been united to the adjacent lands. If, however, the distribution of land in earlier geological times is to be determined by the range of Placostylus, some theory is needed to account for the presence of the moa in Queensland, bones of which curious wingless bird were discovered on the Darling Downs by Mr. C. W. de Vis, Curator of the Queensland Museum. Remains of the kiwi (*Metapteryx bifrons*) also, another New Zealand form, have been found in the post-pliocene deposits of Queensland. Mr. Hedley holds that New Guinea was the source of the genera common to Australia and New Zealand.

Fossils in Lake Mulligan.—In vol. ix. p. 484 mention was made of the discovery of fossils in the bed of Lake Mulligan, South Australia. *The Colonies and India*, October 28th, 1893, states that the locality is a series of shallow claypans in the vast desert north-east of Farina. It is a lake only in flood-times, and in its ordinary state is an arid waterless region of sand and salt pools, where mirage deceives the eyes of the traveller. The yearly rainfall has of late been less than $1\frac{1}{2}$ inches, and the average is only 4 inches. It is in one of the salt claypans that the fossils have been found ; some that just appear above the surface of the mud are soft as chalk, while those below, where the salt water has percolated, are in better preservation but still very brittle. The most remarkable bones are those of the *Diprotodon*, so called from a pair of long curved front teeth. It probably resembled an enormous wombat. Some idea of its size may be formed when it is mentioned that, while the thigh-bone of a bullock measures about $2\frac{1}{4}$ inches in diameter, that of the *Diprotodon* measures 5 inches. These animals must have died by hundreds in this spot, for their bones lie close together, covered by a few feet of mud. The officials of the Museum are encamped at Lake Mulligan, at a distance of six days' journey from Adelaide.

ANTARCTIC REGIONS.

Antarctic Exploration.—On November 27th the Royal Geographical Society of London held a meeting, the object of which was to initiate a movement for the purpose of inducing the Government to aid in the equipment of an Antarctic expedition. A committee of representatives of scientific societies for the furtherance of this object is being formed.

At the meeting of the London Society, presided over by Mr. Clements R. Markham, Dr. John Murray read a paper on "The Renewal of Antarctic Exploration," in which he first sketched the history of Antarctic exploration and the development of the notions which prevailed regarding the South Polar regions, and then pointed out there probably exists round the South Pole a land area of about 4,000,000 square miles of which very little is known, and that the solution of many important scientific problems depends on the investigation of the meteorology, geology, biology, and oceanography of this distant region. Such an undertaking, the lecturer continued, was beyond the power of those who ventured into the Polar regions with slender resources, though they deserved great credit for the contributions they made to science. What was needed was a continuous and systematic exploration of the whole region with the aid of all modern appliances; and this exploration could best be undertaken by the Royal Navy. Two vessels, not exceeding 1000 tons each, should be fitted out for a cruise extending over three summers and two winters. Early in the season a wintering party should be landed somewhere to the south of Cape Horn—perhaps about Bismarck Strait, Graham's Land; and a second should be put on shore on Victoria Land—perhaps in Macmurdo Bay, near Mount Erebus. Then the ships should return northwards, conducting observations of various kinds towards the outer margin of the ice. In the early spring the position of the ice and the temperature of the ocean should be carefully noted, and later in the season the wintering parties should be communicated with, and furnished with reinforcements of men and supplies for another winter. During the second winter the deep-sea observations should be continued farther to the north, and in the third season the land parties should be picked up, and the whole expedition should return home. The advantages to trade and commerce of such an expedition were not likely to be great, as far as could be judged from our present knowledge, but of the importance of the results to British science there could be no doubt. It was often said that foreign governments did more for science than our own, and that foreigners were outstripping us in almost all departments of scientific work, but in the practical study of the ocean we had no superiors, and it was to be hoped that we should continue to take the lead in this direction. Expeditions, such as those of Cook, Ross, and the *Challenger*, had been sent forth with the primary object of acquiring fresh knowledge, and the nation had always approved of such action, though it yielded no immediate return. The Navy had made many glorious conquests in the region of science, and it was asked that the officers and men of the present generation should be given the same opportunities as their predecessors. It rested with the geographers and representatives of science to show clearly what was wanted, and to sketch a good workable scheme, and then, no doubt, a minister would be found sufficiently imbued with the spirit of the times to add a few thousand pounds to the navy vote for three years, in order to carry out an undertaking worthy of the maritime position and scientific reputation of the Empire.

In the discussion which followed, the Duke of Argyll, speaking as President of the Royal Scottish Geographical Society, said that it was a reproach to the enterprise and civilisation of the nineteenth century that so little had been done in the way of Antarctic exploration, and agreed that the work ought to be undertaken by the British Government.

COMMERCIAL AND INDUSTRIAL.

The Ismailia and Port Said Railway was opened on December 2nd.

A telegraph cable has been laid connecting **Mauritius, the Seychelles** and Zanzibar.

A telegraph cable has been laid between **New Caledonia and Queensland.** It is nearly 1000 miles long, and comes to shore at Bundaberg in Queensland.—*Revue Française et Exploration*, December 1st, 1893.

At present the **telegraph** line from Quilimane is carried as far as Chiromo and Tete. From Chiromo a new line is to be laid to Zomba, and this place will also be connected with Tete. It is estimated that fifteen months will be required to complete the work. Eventually the line will be prolonged from Zomba to the Nyassa and Tanganika lakes.

Cotton-Spinning in China.—The Chinese are making vigorous efforts to establish the industry of cotton-spinning and weaving in their country. The Governor of Canton has petitioned the Emperor to erect spinning factories in the town to improve its commerce, and prevent the exportation of specie, observing that India and Ceylon have ruined the trade in Chinese tea, and that trade in silk is passing through a crisis. Measures have already been taken to establish the cotton industry in the province of Kwang-tung, and a large quantity of plant has been purchased. Chinese cotton is adapted only for three kinds of fabrics, and to produce all the articles in demand an admixture of foreign cotton to the amount of 30 per cent. will be necessary. The low wages current in China will probably guarantee the success of the enterprise, and should the experiment prove profitable, other factories will be erected in Shanghai, Tien-tsin, and other towns. In consequence the importation of cotton goods into China will fall off considerably.—*Geografia per Tutti*, September 20th, 1893.

The Manchester Ship Canal.—After many difficulties this great engineering work has been brought to completion. In the early part of the year 1888 the work of construction was fairly commenced, and the course of the canal was shaped towards Ellesmere port. One of the great feats connected with the undertaking was the erection of an embankment, over a mile long, from Ellesmere port to Runcorn, across the bay of the Mersey. A jetty was first made in which 150,000 logs of timber, each 10 inches square and 35 feet long were used, and which, after the completion of the embankment, it was found necessary to leave buried. Another troublesome task was the construction of a syphon, composed of tubes 12 feet in diameter, to carry the waters of the Gowy river underneath the canal. Ten miles up stands Saltport, close to the mouth of the Weaver, which, since the opening of this section in October 1891, has attracted a large number of timber vessels, and is likely to become a shipping port for salt. The coal trade is provided for at Partington, which is 20 miles nearer the South Yorkshire coalfields than their present port, Hull. The quays at Partington have a length of half a mile and an area of 20 acres, the water basins covering $5\frac{1}{2}$ acres.

The Nautical Magazine, November 1893, from which this note is taken, gives also some general details of the dimensions, etc., of the canal. Its total length from Eastham to Manchester is $35\frac{1}{2}$ miles ; the average width at water-level is 172 feet, while at the bottom it is 120 feet, which is considerably in excess of that of the Amsterdam or Suez Canals. There are eleven principal locks, three being at Eastham and two at each of the places, Lachford, Irlam, Barton, and Mode Wheel. The depth of the lower sill at the Eastham docks is 23 feet below the Liverpool old dock sill, and the depth of water on the upper sills of all the docks is 28 feet; so that the depth of the canal, now 26 feet, may be increased to 28 feet if required. The fall from the level in the Manchester docks to the level of the tide rising 14 feet 2 inches above Liverpool old dock sill is $60\frac{1}{2}$ feet. The high-level bridges which cross the canal are high enough to leave a clear headway of 75 feet.

At Warrington the quays will be two-thirds of a mile in length, with an area of 7 acres and a water space of $22\frac{3}{4}$ acres. It is, however, at the terminus of the canal that the most extensive docks are situated. The largest are at Salford, and have quays $3\frac{5}{8}$ miles in length, with an area of 129 acres, and water basins of 71 acres, while the Manchester docks have quays covering 23 acres and $1\frac{3}{4}$ miles in length, with a water space of $33\frac{1}{2}$ acres. The latter will be open to vessels engaged in the coasting trades, and the Salford docks will receive ships coming from abroad. The railway communication with these docks will be very complete, and they will be connected with all the systems running into Manchester. Already arrangements have been made to ship cotton direct to Manchester, and there seems little doubt that, if Liverpool is to retain any considerable portion of the traffic with the manufacturing districts of Lancashire, the Mersey Dock Board and the railway companies will have to make reductions in their rates. It is expected, however, that the town will benefit by the increase of trade attracted to the district by the canal.

MISCELLANEOUS.

Mr. Theodore Bent has set out for **Hadramaut**, the least-known district of South-eastern Arabia.

Mr. G. F. Scott-Elliot has started on a scientific journey to **Central Africa.** He is to be absent for two years, and he will devote special attention to the Ruwenzori district.

The North Pole expedition under the conduct of **Captain Ekroll** (see vol. vii. p. 672) has probably by this time left Cape Mohn in Spitzbergen, and commenced its journey towards the unknown regions.—*Mitt. der k. k. Geogr. Gesell., in Wien*, Bd. xxxvi. Nos. 8 and 9.

Dr. W. Wolkenhauer has sent us a reprint of an article in the *Deutsche Geographische Blätter*, entitled "Zeittafel zur Geschichte der Kartographie," etc. It is a useful chronological record of the advance of **cartography** and the principal cartographical works from Thales to the present time.

Mr. Robert De C. Ward, of Harvard College, has collected observations on **Thunderstorms in New England** during the years 1886 and 1887, and published the results in the *Annals of the Astronomical Observatory of Harvard College*. A reprint has been presented to the Society by the author.

At the rocks of Pucho, about half a mile from the town of Pucho in **Hungary**, Baron Hönning-O'Carrol has dug out a kitchen-midden containing **reindeer** antlers in large quantities. This is the first proof, according to the director of the Hungarian National Museum, that the reindeer once lived in the country.—*Globus*, Bd. lxiv. No. 19.

Dr. Drygalski returned to Copenhagen on October 15th, after a thorough examination of the inland ice of Greenland, in the course of which he travelled by sledge from a point south of Jakobshaven to beyond Upernivik, a distance of about 2100 miles, measured along the sinuosities of the coast line.—*Deutsche Geographische Blätter*, Bd. xvi. Heft 4.

NEW BOOKS.

The Rise of our East African Empire. By Captain F. D. Lugard, D.S.O. Two vols. Maps and Illustrations. London and Edinburgh: William Blackwood and Sons, 1893. *Price* £2, 2*s*.

The name of Captain Lugard is inseparably associated with the vexed question of the retention of Uganda. Upon this subject he writes with indisputable authority; and in the two portly volumes before us he supplies a mass of information, the intrinsic value of which is so great that it is difficult to understand the pretext under which Her Majesty's Government imperilled the peace of Uganda by the procrastinating policy of obtaining "further information." With such evidence as Captain Lugard is able to lead, quite apart from the ample information which for years past has been at the disposal of every competent inquirer, the additional testimony of a Government servant was quite unnecessary. The despatch of Sir Gerald Portal to Uganda was, in fact, a mere subterfuge to escape prompt and decisive action. As things have turned out, however, it is as well that the public have before them, before it is too late, the straightforward evidence of one whom they can trust. After reading Captain Lugard's narrative, no unprejudiced critic can doubt in his mind what the action of Her Majesty's Government should be, though whether such action should be strictly followed may, it is true, be open to question as a matter of State policy. It is almost impossible to apportion responsibility as between the Government and the Chartered Company; but Captain Lugard makes out a strong case in favour of the maintenance of British rule over the source-region of the Nile.

Captain Lugard is, however, a man of action. He was the hero of Karonga's and the Dictator of Uganda. As such he rendered noble service to his country, and showed himself to be a man of exceptional integrity, of courage, and resource. In the rough work of administration, too, he was equal to the occasion, as officers trained in our Indian Empire are apt to be. But as a man of letters he is open to criticism. His narrative is very slip-shod in style, and he evinces but slight ability in marshalling his facts. The material has, in fact, been flung together, evidently in haste; and it requires the most painstaking efforts on the part of the reader to quarry out the essential facts and arguments. Only in the concluding chapters of the second volume does Captain Lugard make any apparent effort at close and connected reasoning; and it is upon these chapters that the value of his literary achievement must mainly depend.

We commend the frank and independent attitude of the author, which carries our convictions at the point of the bayonet, so to speak. But, as students of geography, we are disposed to rebut many of the comparisons which he draws in favour of those spheres of influence in Africa in which he is chiefly interested. In spite of some study given to the subjects, he is inclined to disparage what has been accomplished by British enterprise in other parts of Africa, and to magnify the results in Nyasaland and British East Africa. Thus, he scarcely does justice to the far more difficult and successful work of the Royal Niger Company, or even to that of the British South Africa Company.

The same attitude of mind is shown in his criticism of the commercial resources of East Africa. Undoubtedly great as these are, he is apt to underrate the cost to the nation of their profitable development, and the political responsibilities that must inevitably ensue, should Great Britain take over the administration of British East Africa. The retention of Uganda in that case means the ultimate re-conquest or pacification of the Sudan—that and no less. But no caution of such enormous responsibilities is to be found in the pages of Captain Lugard's volumes. Unless, therefore, Her Majesty's Government have very clearly defined views as regards Egypt, they may well hesitate before taking up a definite position at the head-waters of the Nile. Indeed, the whole problem turns on this one point, as regards the consolidation of an "East African Empire." The alternatives of absorption into the sphere of the British South Africa Company—an "open secret" —which he justly condemns as absurd, or of government "through Zanzibar," the inadequacy of which he clearly shows, are discussed at length and dismissed in favour of direct British Governmental control. Unhappily, the Chartered Company has proved itself incompetent to deal with the situation, and, failing another and stronger company, the responsibility of retaining or evacuating Uganda thus rests on Her Majesty's Government.

In the course of his work, Captain Lugard discusses most of the problems with which the development of Africa is invested. In particular he gives attention to the Slave-trade. His remarks in this respect deserve attention, not because of their originality,—for he adopts the opinions of the leading writers on this subject,— but because they are conspicuous for their common-sense and practical views, and are based upon experience. He advocates the adoption of the short *Indian Act*, of which he says: "The advantages of this method are, that its operation is gradual and permissive, and causes neither the social dislocation nor the friction of emancipation. It has the merit of having been proved efficacious by actual trial" (p. 183). It is a monstrous anachronism that the legal status of slavery should be acknowledged in Zanzibar, and in flat contradiction to our ostensible action against the Slave-trade. But this is in accordance with the Janus-like character of European administration in Africa.

Captain Lugard speaks with exceptional authority on the important subject of transport. He very wisely suggests that, should it be found undesirable or too costly to build the projected railway to the Victoria Nyanza, then the first section (about 200 miles) from the coast to the inland plateau might be undertaken. "Beyond this area there is no reason at all why animal transport should not succeed well—at least that is the opinion I have formed after some experience" (p. 457). His plan is thus summarised: "I advocate the construction of a railway for 208 miles over an area especially adapted for it, and unadapted to other forms of transport. . . . The second section, I think, should be of wheeled transport over roughly prepared roads. Its length would be 268 miles. The third section would at present be served by pack-animals. Its length would be 290 miles. . . . I also insist on the necessity of an adequate veterinary establishment" (pp. 464-5). "By such a system not only would the cost of transport be very greatly reduced, but by the establishment of such stations and depôts, the construction of rough roads, and the institution of regular convoys at stated periods, an organised administration worthy of the name would be facilitated throughout the country. These stations would work in harmony with the general scheme, affording a nucleus alike for colonies and settlements, for military posts, for heliograph stations, or for trade" (p. 469). This moderate view deserves public attention, and might with advantage replace the more ambitious scheme of connecting Uganda with the coast by a direct line of rails. Moreover, he wisely suggests heliograph stations instead of telegraphs, because the iron poles (wood being unsuitable, on account of the white ants) would rouse the cupidity of natives whose currency happened to be iron.

The closing chapters are, as we have said, of the highest possible value. Captain Lugard therein treats the subject of the retention and administration of Uganda with an elaboration of detail and an intelligence of reasoning which deserve the attention of our responsible statesmen. He proves, if proof were necessary, that no more competent man than himself could be found for the onerous post of Governor of British East Africa.

The book is furnished with a large number of illustrations, which are not conspicuous for their artistic merit, and with a most valuable series of maps, specially prepared by Mr. E. G. Ravenstein. The volumes themselves, though somewhat bulky, are handsomely printed and bound.

The Rival Powers in Central Asia. By JOSEF POPOWSKI. Translated from the German by A. BARING BRABANT, and edited by CHAS. E. D. BLACK. Westminster : Archibald Constable and Co., 1893. Pp. xxii + 235. *Price* 12*s.* 6*d.*

Much has been written in books, magazines, and newspapers, in the course of the last twenty years on the what is usually called the Central Asian Question. Now, however, that Central Asia, properly so called, has passed from a state of barbaric independence into the hands of Russia, the question, from a British point of view, may be more aptly termed that of the Defence of India. Mr. Popowski's volume is an important addition to its numerous predecessors on this subject,—none the less so that the author, who is neither Russian nor English, discusses the struggle between Russia and England in the East from a purely neutral standpoint.

In the preface, after giving reasons for his opinion that a war between Russia and Austria with her allies in Europe, and between Russia and England in Asia, is a mere question of time, the author sums up the general scope of his work as follows : "As the conflicting interests of Austria and Russia in Europe, and of England and Russia in Asia form the dominant element in the political situation, we make it the subject of our study in the following treatise. We commence our task with the conflict of English and Russian interests in Asia, as Russia's action in Asia is not so well known, and her need for disguise and restraint is less. Her movements in Asia being less guarded can be observed with greater accuracy, and from them we can learn the meaning of her *modus operandi* in Europe. Russia menaces by her advance England's Possessions in Asia, whilst England's extension in India is a matter of perfect indifference to Russia. Consequently, in the following study, we shall devote our attention primarily to Russia. In the first chapter we narrate the history of her advance in Asia since the fifteenth century. In the second chapter we prove that Russia aspires to the possession of India. In the third chapter we examine the political relations of Russia and England in regard to Asia since the commencement of the present century, and arrive at the conclusion that England is powerless to arrest Russia in Asia by means of diplomacy. In the fourth chapter we review the strategical relations of Russia and England. In the fifth and last chapter we discuss England's value to the Central European Alliance; and the reader having now acquired from the foregoing a thorough knowledge of the subject, we conclude by considering what it behoves England to do under the present circumstances."

The author takes a somewhat pessimistic view of our position, though it must be confessed that he furnishes many closely reasoned considerations in proof of the correctness of his opinions, chief among which are the invulnerability of Russia to naval attack, the inconclusiveness of a merely defensive attitude on our part on the Indian frontier, and the impossibility of striking a decisive blow by any forward movement in Central Asia. After showing that the Caucasus is the vital point of Russia's position in any attack which she may ever contemplate upon India, the author concludes that the only course by which England can permanently secure India is to join the Triple Alliance, and when the war in Europe, which he considers inevitable, breaks out, to carry Turkey with her and wrest the Caucasus from Russia. If the operations of the coalition should be successful, the new frontier along the northern base of the Caucasian Mountains would be held by the Turkish army, whose presence, owing to the success of the allies, would no longer be required in the Balkan Peninsula. England would fortify the line thus garrisoned by Turkey, and herself hold strong positions at each of its extremities, at the same time establishing a naval force on the Caspian. Most of our readers will no doubt consider that less heroic measures will suffice for the defence of India. There is no doubt, however, that by the advance of Russia to the borders of Afghanistan, and by the presence of France near the frontier of Burma, India has entered on a new phase of her history. Instead of the happy isolation, which, through our naval supremacy, she has so long enjoyed, her defence, like that of other continental states, must henceforth be intimately affected by the general political situation in Europe. The greater efforts, risks, and responsibilities, which this transition from an insular to a continental *status* involve, are clearly shown in Mr. Popowski's work, which may be profitably studied even by those who do not accept his somewhat pessimistic conclusions.

We may add that the work of the editor and translator is well done, and that the volume is provided with an ample index and an excellent map.

Rulers of India: The Marquess Wellesley, K.G. By the Rev. W. H. HUTTON, M.A., Fellow and Tutor of St. John's College, Oxford, and Examiner in the Honour School of Modern History. Oxford: At the Clarendon Press, 1893. Pp. 208. *Price 2s. 6d.*

Mr. Hutton has produced an admirably clear and spirited sketch of the career of Marquess Wellesley as a ruler of India. He has a great subject, but, as far as his limits permitted, he has done full justice to it. Wellesley's term of office formed a momentous epoch in the history of English settlements in India. For, as Mr. Hutton says, if Clive won and Hastings preserved the English foothold, it was Wellesley who founded the British Empire in the East. It marks the greatness of the man that very soon after he landed in India he showed that he had thoroughly grasped the situation, and seen, as it were intuitively, the true solution of the perplexing problems it then presented. He was not allowed to remain in India to see the complete realisation of his schemes, but he laid the foundation which necessarily governed the policy of his successors, and he once for all transformed the East India Company from a trading corporation into an Imperial Power. Mr. Hutton has given a clear and interesting narrative of the various steps of peaceful negotiation or open war with rival Powers by which Wellesley prosecuted his aim, but it is a valuable feature of his work that he has given even fuller details of other branches of his work as ruler, and has, by judicious use of the abundant materials, been able to convey a distinct impression of his great ability. In every department Wellesley is shown to have left his mark as a man of clear insight, bold origination, prompt vigorous action, and skill in the choice of agents, and to have combined with a strong grasp of principle and statesmanlike aims great mastery of detail. Mr. Hutton's warmly expressed admiration of his hero has not blinded him to the existence of flaws in character which may explain the comparative failure of his career at home, but it has given uncalled-for asperity to his criticism of those who differed from Wellesley, or did not at once see their way to countenance or support his schemes. This is rather to be regretted, as it seems inconsistent with the unimpassioned impartiality which befits a historian, and to detract somewhat from the value of what is otherwise a most excellent work. In this volume the great Sindhia always appears as "Mahadájí," but in Mr. Keene's work on him in this series his name is "Madhava Rao, or Madhoji." The editor might have preserved uniformity or explained the change, which is rather perplexing.

The Empire of the Tsars and the Russians. By ANATOLE LEROY-BEAULIEU. Translated with Annotations by Zénaïde A. Ragozin. Part I.—The Country and its Inhabitants. New York: G. P. Putnam's Sons, 1893. Pp. xx + 588.

The chief characteristics of this work are width and intensity of interest. Merely a section of the original is here presented to English readers, but the standpoint throughout is broad and liberal, and can be only partially indicated by the following heads of treatment:—nature, climate, and soil; races and nationality; the national character and nihilism; history and the elements of civilisation; the social classes; the peasantry and the emancipation; the *mir*.

From this topical summary the fact may be surmised that M. Leroy-Beaulieu allows sufficiently for the two dominant factors in the development and present bearings of Russian civilisation—geography and history: dominant factors, but difficult of due estimate by reason of their well-nigh incalculable extent. The author, thus almost universal in his survey, prudently views his main problems in the light of what we take to be the determining test: by what process, to what extent, to what probable issue has Russia become European? "Unity in immensity" marks Russia physically; in respect, however, of elements and agencies of civilisation not unity, but a fateful dualism. The critical epoch in this important aspect of his theme is rightly placed by M. Leroy-Beaulieu at Peter the Great: "To Peter's reforms are traceable many of the oppositions, or rather anomalies, which in Russia caused contrast to become law." Joseph de Maistre wrote to Prince Kozlòfsky: "Peter has placed you in a false position towards the other countries:—*nec tecum possum vivere, nec sine te*—that is your motto." To-day in the seat of authority the inclination is towards Russian individuality: the Russian with borrowed plumage, ill at ease with himself, has neither enjoyed his dual existence, nor can he associate himself with the unwonted symptoms and the dubious ends of late and present European unrest. Still, whether it be or not that from Ivan III. and Ivan IV. to Peter, and from Catherine to the three Alexanders, the mission of autocratic rule has attained to its fulfilment, political reforms demand settlement, be it only that the national life may be brought into line with the social and economic and (in a measure) administrative advances witnessed during two centuries.

Despite a few catchpenny expressions and some Americanisms, the translator's work has been well done. There is in the style much of French freshness and clearness. But the translator has done more than translate. Many valuable notes and supplemental discussions are added, often quite necessary in view of researches and criticisms more recent, in part at least, than the appearance of M. Leroy-Beaulieu's volumes. That absorbing *quæstio vexata*, the *mir*, is expounded at great length and with much acumen, but against expectation the translator has not here seized the ready opportunity of adding, modifying, and suggesting. Four maps, three of them ethnographical, complete a volume which even in their absence might be designated complete.

Politische Geographie der Vereinigten Staaten von Amerika, unter besonderer Berücksichtigung der natürlichen Bedingungen und wirthschaftlichen Verhältnisse. Von Dr. Friedrich Ratzel, Professor der Geographie an der Universität zu Leipzig. Zweite Auflage. Mit einer Kulturkarte and 16 Kärtchen und Plänen im Text. München: Druck und Verlag von R. Oldenbourg, 1893. Pp. xvi + 763. *Price* 15*m*.

The present reviewer has not had the pleasure of seeing the first volume of Dr. Ratzel's work, of which the above is the title to the second volume. But if vol. i. is the same compass as vol. ii., the book will assuredly bear comparison with its subjects in—at all events—point of size. After an introduction, treating of "The Properties and Effects of the Actual Continent:" its situation, boundaries, spaciousness, soil, climate, fauna, flora, and nature generally, there follow four principal sections, which deal respectively with (1) Races and families; (2) Population: its distribution and growth; (3) Natural products and means of communication; (4) Political relations of the States, religion and education, society and culture. A very short course of reading in this voluminous tome is sufficient to demonstrate that the author knows what he is writing about. Not only is he completely master of his facts, but he has thoroughly digested them and assimilated them to the permanent acquisitions of his knowledge. And in this thorough mastery of his subject are to be discerned both the chief merits and the chief demerits of his performance. Amongst the former rank the comprehensiveness of his knowledge, the accuracy and completeness of his information, and the profusion of concrete illustration and example, which are perceptible everywhere throughout the book. But over against these outstanding features on the one part must be set, in our opinion, the diffusiveness, not to say discursiveness, of the treatment, and the lack of elegance in the style. Dr. Ratzel elaborates too much; if he would be content to dwell less upon details, and restrain his scientific fancy from uncalled-for excursions after parallels and comparisons, the general course of his narrative would gain in clearness as well as logical co-ordination, and the reader would be enabled to grasp and arrange in his mind with greater readiness the salient features of the work. All the same, we do not for a moment wish to be understood to assert that there is any confusion of thought or want of lucidity in expression; our criticism simply amounts to this, that the main threads are frequently not so obvious as they should be, and the reason is that they are crossed and recrossed by, and blended with, too many threads of minor importance. With respect to the method and manner of treatment there is little to be said that is adverse; after it has been pointed out that Dr. Ratzel's tendency to dwell at too great length upon individual details leads him very frequently to anticipate what he is obliged to repeat more fully in a subsequent and more appropriate place, we have only the warmest congratulations to offer to the author. His book then, taking it all in all, is a most useful compendium to the geography of the United States, and it has all the merits of an honest, impartial, and thoroughly comprehensive study. There are some few points of detail upon which we should like to have offered qualification or expressed reasonable doubt, *e.g.*, the comparison between the mercantile marine of the United States and Norway, the relative growth of the negro population, the derivation of the word "cowboy" from the Spanish *corral* (p. 318, note), and one or two others; but we must forbear, from considerations of space. The book is well printed, and, considering its bulk, certainly not dear.

The Discovery of Australia. By ALBERT F. CALVERT, F.R.G.S., etc. With Maps and Illustrated Appendix. London and Liverpool: George Philip and Son, 1893. Pp. vi + 91. *Price* 10*s.* 6*d.*

A useful task has been undertaken, and very successfully carried out, by Mr. Calvert in arranging and discussing the claims to the discovery of Australia put forth by various voyagers, from Marco Polo, who is stated to have heard of the great southern land from the Chinese, down to Captain Cook. The value of the work has been much enhanced by the reproduction of a number of most interesting old charts. In this connection we doubt if the author is acquainted with the very fine series of such maps published in the *Proceedings of the Royal Geographical Society of Australasia* (*Sydney*) in 1892. At any rate, he does not notice certain of them which, we think, deserved mention in a work of this kind.

The appendix is full of interest. Here is described the finding of a forgotten part of the collections made by Sir Joseph Banks when naturalist with Captain Cook, and gives letters, never before published, of the great circumnavigator. It has long been known that the accounts of the voyages were cooked before publication, and in these letters we find the writer, evidently fearful of his own skill as an author, giving Canon Douglas leave to turn fine periods, insert sounding phrases, and even to make expurgations. The publishers have done their part of the work well. The printing, if rather small, is quite distinct. The addition of an index would have been an improvement.

La Hongrie Économique. Par GUILLAUME VAUTIER. Paris: Berger-Levrault et Cie, 1893. Pp. 486. *Prix*, 10*fr.*

M. Vautier considers his subject under three chief heads: Les Moyens, La Production, and Le Commerce. The first of these covers such topics as physical features, population, the political system, public finance, education. Production is considered as agricultural and industrial, each with sub-divisions. Commerce is treated of first generally, then definitely in connection with exports and imports and the particular relations of Hungary towards Austria and towards Eastern and Western Europe. Specially commendable are the sections dealing with the political system (a concise and lucid treatment), and with the commercial relations between Austria and Hungary,—relations the vital nature of which to both is here amply recognised, and becomes full of pressing significance in view of the expiry, three years hence, of the existing commercial arrangements between the two States. The section on public finance is mainly statistical, and might well have been vivified with principles, but the defect is largely compensated for by a valuable exposition of the economic legislation of the country. The book is a careful piece of work, abounding in statistics, orderly in arrangement, lucid, and, so far as our test has been applied, accurate. There is not within our knowledge any book in English—there are no two or three English works taken together—which will supply the student of contemporary Hungary with what he requires so readily as does M. Vautier's.

The Letter of Columbus on the Discovery of America. A Facsimile of the Pictorial Edition, with a New and Literal Translation, and a Complete Reprint of the Oldest Four Editions in Latin. New York: Printed by Order of the Trustees of the Lenox Library, 1892. Pp. xiii + 61.

The Lenox Library is rich in original copies of the Latin version of Columbus' letter, which was sent to Rome for publication immediately after the return of the discoverer to Spain. Of the Pictorial Edition, which is reproduced in this little volume, no other perfect copy is known. The woodcuts it contains are supposed to have been made from drawings of Columbus himself, and are therefore interesting as well as curious. The book is well printed, and is a suitable memento of the fourth centenary of the discovery of America. We should have expected, however, to find a reprint of the original folio edition in Spanish, which, as stated in the introduction, is probably the oldest extant, and of which also the Lenox Library contains the only known copy.

Der Völkergeist in den Geographischen Namen. Von Dr. J. J. EGLI (Sonder-Abdruck aus dem *Ausland*). Leipzig: Friedrich Brandstetter, 1894. Pp. 107.

During his work in connection with his *Nomina Geographica*, Professor Egli observed that place-names differed in kind with the conditions in which the people who gave them lived, and in this very interesting pamphlet he lays down certain principles of nomenclature, and illustrates them by numerous instances. Primitive peoples choose names more frequently from natural objects, while civilised nations show in general their higher culture in the designations they employ. The particular direction of their development and their special mode of life are also exhibited in this manner. In this connection rather an amusing example is given. The Spaniards used the names of saints very freely to denote the geographical features they discovered, and, accordingly, the Spanish navigators gave the name of the "Evangelists" to four rocky islets at the western entrance of the Straits of Magellan. But when Sir Richard Hawkins sighted these rocks in 1594, the practical Englishman christened them the "Sugarloaves." Again, the Dutch, having lately passed through a war of independence, scattered the names of the founders and upholders of their freedom over the Malay Archipelago. In the interior of South Africa, however, their nomenclature was dictated by their surroundings, and, accordingly, here, where water is scarce and therefore of great importance, while game is very plentiful, we find such names as *Bloemfontein*, *Wonderfontein*, and *Olifant*, *Rhinoster*, *Gazelle*, *Gnu*, etc., made frequent use of.

Eliseo Reclus: Colombia. Traducida y anotada con Autorizacion del Autor. Por F. J. VERGARAY VELASCO. Bogota: Papeleria de Samper Matiz, 1893.

This volume is a translation into Spanish of the chapters relating to Colombia in the *Géographie Universelle* of M. Reclus. The translator, who assisted in the compilation of the original, has added an interesting sketch of M. Reclus' eventful life, and has supplied in notes some useful emendations and amplifications. The work is published at the expense of the Colombian Government.

Das Karstphänomen. Von DR. JOVAN CVIJIC. (*Geographische Abhandlungen.*) Wien: Ed. Holzel, 1893.

This is a lengthy treatise, extending to 114 pages imp. octavo, dealing with the varied phenomena resulting from the chemical action of carbon dioxide upon calcareous rocks of all kinds and of all ages in various parts of the world. The author gives minute and detailed descriptions of swallow-holes, caves, underground watercourses, and various forms of depression of the earth's surface, due directly or indirectly to the chemical erosion of limestone, etc., by the action of surface waters. He devotes some attention also to the residual deposits (such as the well-known clay-with-flints of the chalk areas of the South of England) and others of similar origin. He also discusses the relation of these phenomena to the rainfall of the regions where they occur.

Although there is not much in the essay but what has been known to British geologists for many years, yet, as a collection of facts such as has never before been brought together, it will doubtless prove of considerable interest to many.

Mineral Resources of Western Australia. By ALBERT F. CALVERT, M.E., F.R.G.S., etc. London and Liverpool: George Philip and Son, 1893. Pp. xii + 179. *Price* 2*s.*

Mr. Calvert writes with authority, as he has made the subject peculiarly his own, and it should be remembered that, if his forecast of the future of the colony should be deemed inflated and exaggerated, the other divisions of Australia were, at one time, far less likely to yield the valuable minerals with which their names are now associated. Gold is the author's principal theme, as out of 179 pages 146 are devoted to descriptions of the auriferous regions, with their mines and diggings. The volume is freshly written, and figures, although sparingly employed, are used with considerable effect. A perusal of Mr. Calvert's pages may be recommended to all who are interested in Western Australia.

The Year-Book of Australia for 1893. Edited by the Hon. EDWARD GREVILLE, M.L.C., J.P. Twelfth Year of Publication. European and American Edition. London: E. A. Petherick and Co. Pp. 864. *Price* 10*s.* 6*d.*

It would be difficult to suggest any subject connected with the government, trade, life, and resources of the Australian Colonies which does not find intelligent description or remark in this substantial volume. It is a perfect mine of statistics and other matter likely to be useful to the merchant, speculator, emigrant, and geographer. So far as we have been able to test the innumerable figures, they appear to be remarkably accurate, and the mass of other information is succinctly, but luminously, treated. The various colonial gazetteers are likely to prove more useful to the traveller and resident than to the stay-at-home reader, as no descriptions of places are given, but only information on such points as routes, modes of conveyance, mails, telegraphs, etc. Most useful features are the reviews of the progress of art, literature, the stage, music, and science. The maps are large and treated in a bold and clear manner, but most of them could have contained more names. We notice that the Agent-General for New South Wales furnishes a number of copies for the use of public libraries and other institutions in England, but no volume appears to reach Scotland or Ireland in this way.

Rosneath: Past and Present. By WILLIAM CHARLES MAUGHAN, Author of *The Alps of Arabia*, etc. With an Original Poem by the Marquis of Lorne, K.T., and Illustrations by Alexander M'Gibbon, Esq. Paisley: Alexander Gardner, 1893. Pp. xvi + 269.

This book on Rosneath is published as "a modest contribution to those local, secular, and ecclesiastical records of interesting places in our land which are a little removed from the stirring domains of Scottish history." A residence of twenty years in the parish has given the author opportunities of collecting material for his work. He has evidently been very diligent in his task, and also very observant; and he has put before the reader a large amount of information about "the island," as the picturesque peninsula is familiarly called, much of which is of considerable interest. The author has naturally found it easier to gather material relating to the recent past than that bearing on remote times: and he has perhaps not sufficiently resisted the temptation thence arising to dwell at too great length on recent events and persons. That, however, will not make his book less acceptable to those who are familiar with the district, the varied beauties and attractions of which cannot fail to arouse enthusiasm, and are in truth well deserving of this loving and loyal description of them with pen and pencil, and in verse and prose. There are two *desiderata* which it may be hoped the author will have an opportunity of supplying—a map and an index.

Historical Guide to Edzell and Glenesk Districts, their Picturesque Scenery, Antiquities, Curious Traditions, and Remarkable Places. By D. H. EDWARDS, F.R.H.S. Brechin: D. H. Edwards. Edinburgh: John Menzies and Co., 1893. Pp. viii + 135.

Tourists to these districts will undoubtedly find this a useful and entertaining companion, as is proved by its having reached a third edition. The author knows his subject, and has done full justice to the available materials, although his style smacks rather too much of the Scots local newspaper. The illustrations are generally very rough, and we cannot help thinking that the book would be improved by their absence. The volume also lacks what no guide-book, however small, should be without, viz., a good map and a detailed and easily consulted index.

History of the Parish of West or Old Kilpatrick, and of the Church and certain Lands of East or New Kilpatrick. By JOHN BRUCE, F.S.A.Scot. Glasgow: John Smith and Son. Pp. 80. *Price* 1s. 6d. *net.*

Until Mr. Bruce's history is completed it would be unfair to pronounce judgment upon it. The first part of the work is full of promise, scholarly yet simple, excellently illustrated, and printed clearly on good paper. When the second and concluding part is issued we shall notice the whole work at length. Meantime, the suggestion may be made that the finished work ought to be accompanied with a good map of the district.

Jenkinson's Practical Guide to the English Lake District. Ninth Edition. Revised and Edited by the REV. H. D. RAWNSLEY, M.A., and THOS. BAKEWELL. London: Edward Stanford, 1893. Pp. 407.

Jenkinson's *Guide to the Lakes* has now been tested by so many thousands of visitors to the Lake District that its claim to practical utility may be regarded as beyond question. A new edition having lately been called for, the publishers have taken the opportunity of introducing a few modifications into the plan of the book. Chief of these are the sectional maps, which are now printed in different colours between each successive 500 feet contour lines, instead of the combination of contour lines and hill-shading employed in the maps of the older editions. On the whole, the present plan may be better for tourists in general. Much that was of general interest in the old editions has been omitted in this edition to make room for other matter whose practical utility in many cases may well be doubted.

In a book intended as a guide to the Lakes at least a few paragraphs might have been devoted to the relation between the geological structure of the district and its scenery. The labours of the late Mr. Clifton Ward and his colleagues on the Geological Survey are almost entirely ignored. Surely this is a mistake that ought to be remedied.

Brown's South Africa: A Practical and Complete Guide for the Use of Tourists, Sportsmen, Invalids, and Settlers. With Six Coloured Maps and Two Diagrams. London: Sampson Low, Marston, and Co., Limited. Cape Town: J. C. Juta and Co., 1893. Pp. 245. *Price* 2s. 6d.

Geography of South Africa: For the Use of Higher Classes in Schools. By A. WILMOT, F.R.G.S. Sixth Edition. Cape Town: J. C. Juta and Co., 1891. Pp. 139.

A New Geography of South Africa. By Rev. J. WHITESIDE. Third and Revised Edition. Cape Town: J. C. Juta and Co., 1893. Pp. 73.

The Story of South Africa: An Outline of South African History. By HENRY B. SIDWELL, B.A. Fifth Edition. Cape Town: J. C. Juta and Co., 1893. Pp. 138.

These books afford substantial proof that South Africa is keenly and reasonably alive to its own interests, and also that it is conscious of the importance it is assuming in the estimation of the world. The truth of this is not lessened by the fact that the books are intended to serve different purposes. Three of them are school-books, while the fourth is a guide-book for the use of tourists, sportsmen, invalids, and settlers. The first of these—Brown's *South Africa*—is a very complete and compact guide-book, arranged on the lines of the best European guide-books, but differing from most of them in being printed in a large and clear type and on excellent paper. The book is a storehouse of information on nearly every subject in which the traveller, to whichever of the classes specified he may belong, is likely to be interested. There are special sections on clothing, coinage, weights and measures, postal and telegraph rates, languages, railways, coaches, coasting steamers, climate, immigration, wild animals, the history of the Cape and of Natal, and other subjects. The journeys through South Africa are arranged in eighteen different routes, in connection with which there is given all the information—topographical, historical, and social—that any one can desire. The sectional maps are excellent. The sixth edition of Wilmot's *Geography of South Africa* is brought as nearly as possible up to date. An excellent feature of the book is its descriptive notes, which are well written and contain many interesting facts. Whiteside's *New Geography of South Africa*, which has reached a third edition, is a text-book for schools, of the same character as the preceding book. It is more formally arranged in lessons, and it bristles with facts and names. Sidwell's *Story of South Africa* is a brief outline of the history of the colonies, written in a bright and graphic style. All these books have the advantage of being prepared by residents in the country, who bring local knowledge to their task, and add to their work touches of local colouring which give it vividness and interest. They all give prominence to the recent opening up of Mashonaland. One of them calls it "the land of promise," and predicts for it a great future.

The Picturesque Geographical Readers. By CHARLES F. KING. Third Book: *The Land we live in*, Part I. Fourth Book: *The Land we live in*, Part II. Boston: Lee and Shepherd, 1892.

These books are specially written for American boys and girls, and their purpose is to give young Americans a general view of their country—of its great cities, its people, and its chief industries. A father and mother with their sons and daughters make a journey over the States, and much of the information imparted in the lessons is contained in their conversations The charm of a slight story makes the books lively and interesting, in spite of the obtrusively didactic tone of the father's utterances, which was perhaps unavoidable. The books are profusely illustrated with excellent pictures reproduced from photographs.

Commercial Geography of the World. By Dr. CARL ZEHDEN. Translated by FINDLAY MUIRHEAD, M.A. With a Map of the Chief Trade Routes. New Edition, revised and corrected to date. London: Blackie and Son, Limited. 1893.

The great merits of Zehden's *Commercial Geography* are universally recognised, and Mr. Muirhead's translation of it is without doubt the best book on the subject in the English language. All that need be said of this new edition is that it has been revised throughout, and brought down to date in the matter of statistical and other information. We observe, however, that one or two doubtful statements are retained, that the opening of the Panama Canal is still spoken of as a thing that may be looked for soon, and that there is no mention of the recent French acquisitions in Siam. The statement regarding Holland that "the income from excise and taxes is £335,000" also requires correction. The revenue from excise alone is £3,700,000. Probably customs duties are intended; and they amount to £480,000.

The Geography of North America: A Brief Handbook for Students. London: Blackie and Son, 1894. Pp. 38. *Price* 6*d*.

This pamphlet contains text, synopsis, and maps.

The text gives a fair account of North America; but a book dated 1894 should not say that the Behring Sea Question "is at present in the hands of a court of arbitrators."

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. With numerous Illustrations by the same. London: Swan Sonnenschein and Co., 1893. Pp. xvi. and 440. *Price*, 18*s*.

The author's principal object in writing this volume is a defence of the "Polynesian" Labour Traffic, in which he was so long engaged. He maintains not only that it was of vital importance to the sugar interest in Queensland, but of great moral and material benefit to the labourers and to the islanders generally. The evils, which he hardly admits, were greatly outweighed by the advantages, and the wave of philanthropy which swept the traffic away, was composed, as he explains, of very mixed materials. His defence is ingenious, and we are far from impugning the honesty of the writer, but most of our readers will feel that, from the nature of the case, a large amount of violence and other abuses were inseparable from such a traffic. His narrative, however, deserves to be read, and is full of adventures and incidents of an unfamiliar kind. The author writes easily, and from his constant intercourse with the natives he has much to tell about their customs, superstitions, and ways of looking at things: much, too, of the intricate and dangerous navigation among the islands, with their coral reefs and cyclones and uncertain weather. He describes very graphically more than one critical occasion where all his seamanship and long experience only just availed to save his ship. Nor does he neglect to observe natural phenomena and other objects of interest; his account, for instance, of the fortified islands in the Solomon group is very curious. But, indeed, throughout, this record of the writer's daily life in that remote region, and intercourse, by turns friendly and the reverse, with natives, missionaries, and man-of-war captains, is both varied and amusing.

The illustrations, from the author's drawings, are clever, and there are some good clear maps of the island groups visited.

NEW MAPS.

WORLD.

PROSPECT OF GEOGRAPHICAL POSITIONS. Five Sheets. Constructed by Captain Axel Staggemeier, 1892. *Copenhagen: Lehmann and Stage's Bokhandel. London: Ed. Stanford.*

These maps are specially designed by the author for the use of geographers and students in laying down the results of their investigations in geography and its allied sciences. To facilitate this work the maps are divided by lines of latitude and longitude for every degree. Two different projections are used; for the higher latitudes the Polar or Central Projection has been adopted, and for lower latitudes Mercator's Projection. The maps are very clear and nicely printed. Another series of twenty maps on double the scale is promised by the author, of which eight will represent the Polar Regions, and twelve the Middle Zones.

WELTKARTE zur Übersicht der Meerestiefen, mit Angabe der unterseeischen Telegraphen-Kabel, und Überland-Telegraphen sowie der Kohlen-Stationen und Docks. Herausgegeben von dem Reichs-Marine-Amt, Nautische Abtheilung. Ausgabe mit Meerestiefen und Höhenschichten, 1893. *Berlin: Dietrich Reimer.*

This is an admirable Map of the World on Mercator's Projection, published by the German Navy Department, showing the heights of land and the depths of sea. The contours are drawn at 300, 1000, and 2000 mètres, and printed in different tints of brown, while the lines of depths are given at 200, 2000, and 4000 mètres, in different shades of blue. The most important railways, the sub-marine cables, the overland telegraphs, the coaling stations, with signs showing the number of tons of coal stapled there, as well as all the docks, excluding those of Europe without the Mediterranean, are marked on the map. A few more railways in Africa and South America might have been added. The map is issued in three large sheets, and is in every respect well executed.

PHYSICAL PHENOMENA, Pictorial Illustrations of ——. These six sheets, representing a glacier, an earthquake, a volcano, a waterfall, an iceberg, and a rainbow, are brightly coloured and very distinct. They will interest children in the subjects illustrated, and thus ought to be useful in the schoolroom.

Edinburgh: W. and A. K. Johnston.

AFRICA.

NYASSA-SEES, Originalkarte des Nordost-Ufers des——. Nach eigenen Aufnahmen gezeichnet von Major H. von Wissmann, Januar und Februar 1893. Massstab 1 : 600,000. Nebenkarten: Dr. Bumiller's Route, 30 Jan. bis 23 Febr. 1893. 1 : 1,200,000.—Busse-Hafen—Kayser-Bucht—Langen-Hafen.—Wied-Hafen. Ansicht nördlich des Busse-Hafens. Ansicht von Station Langenburg.
Petermann's Geogr. Mitteilungen, Jahrgang 1893, *Tafel* 14. *Gotha: Justus Perthes.*

THE SHIRE HIGHLANDS, Sketch Maps of——, showing the routes of B. L. Sclater, R.E., F.R.G.S. Scale 1 : 500,000. *The Geographical Journal, Nov.* 1893.

TRANSVAAL, Troye's Map of the —— or South African Republic. Scale 1 : 500,000. Engraved and Printed by the Geographical and Topographical Establishment, Wuster, Randegger and Co. (J. Schlumpf) of Winterthur, Switzerland. *Published for Messrs. Fehr and Du Bois, Pretoria.*

Three years ago we welcomed Jeppe's admirable map of the Transvaal and adjacent Districts, in four sheets on the large scale 1 : 1,000,000; to-day we have to notice a New Map of the Transvaal on double the scale (1 : 500,000). Considerable differences from Jeppe's map and other older publications are noticeable, especially in the Northern and North-Eastern parts of the Republic, where Government Commissioners have recently re-surveyed the ground. As the North-Eastern portion of the Lydenburg District is still based on older surveys, the author, of course, was not able to lay down correctly the projected Salatie Railway, which has lately been done by Fr. Jeppe on a map published in the *Geographical Journal.* An important feature of the map is the first attempt to show the landed estates of the Republic; but, owing to the want of reliable information, it was impossible to complete this task. In a note the author gives the data used for his compilation, and the names of those gentlemen who supplied him with valuable information. In the north-west corner of sheet 1, a general map of South Africa, showing the political divisions, has been added. The map is neatly drawn, and, with the exception of the hills, well printed.

POLAR REGIONS.

NORTH GREENLAND EXPEDITION, Map showing Route of the ——, 1891-92. R. E. Peary, U.S. Navy. Scale, 1 : 3,000,000.

The Geographical Journal, Oct. 1893.

PETSHORA BAY AND KARA SEA (Norway and Lapland, Supplementary Sheet A), Gulf of Obi and River Yenisei (Norway and Lapland, Supplementary Sheet B), compiled by H. D. Jenkins, F.R.G.S. *London: James Imray and Son*, 1893.

These charts are compiled from Russian and Swedish Surveys. Much remains to be done, by sounding and accurately determining positions, to render the navigation of these seas less dangerous.

ATLASES.

WORLD, Bryce's Pearl Atlas of the ——. Edited by L. W. Lyde.

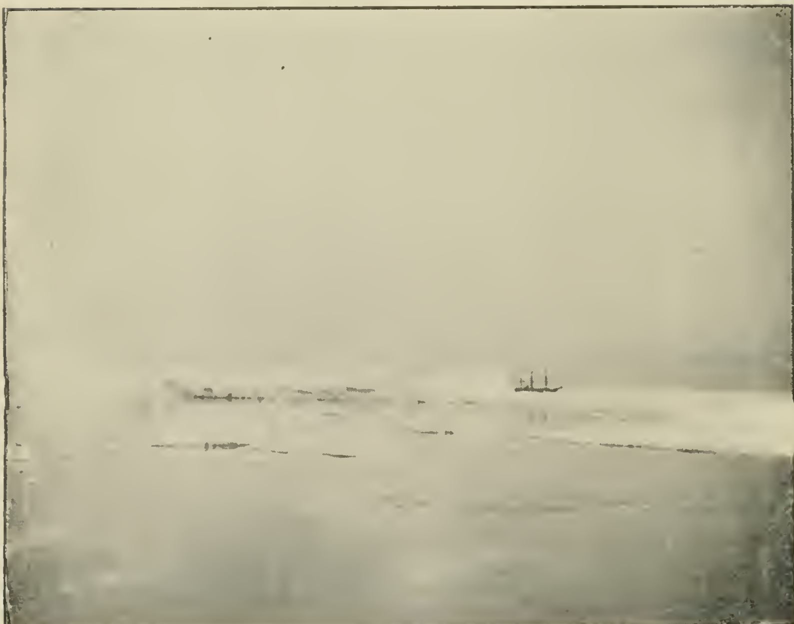
Glasgow: David Bryce and Son, 1893.

Not much can be shown in an atlas measuring some 3½ inches by 2½. What is given seems correct, except the political divisions on the map of Central Africa, which are by no means up to date.

NEUER HAND-ATLAS, E. Debes' —— über alle Teile der Erde in 59 Haupt- und weit über 100 Nebenkarten mit alphabetischen Namenverzeichnissen. Ausgeführt in der Geographischen Anstalt der Verlagshandlung. Lieferung 1 : Elsass-Lothringen und Nordost-Frankreich 1 : 1,000,000; West-Russland 1 : 2,750,000; Südost-Asien 1 : 10,000,000 mit 5 Nebenkarten. Lieferung 2 : Nordost-Deutschland (Provinzen West- und Ostpreussen) 1 : 1,000,000; Italien 1 : 2,750,000, mit 2 Nebenkarten; Griechenland 1 : 1.500,000, mit 4 Nebenkarten. *Price, M.* 1.80 *each Part.* *Leipzig: H. Wagner and E. Debes.*

E. Debes, of the well-known firm of Wagner and Debes, in Leipzig, has just published the first two parts of an entirely new Hand-Atlas of the World. These show at a glance the style and character of the maps, and give at the same time a clear idea of the whole work. The Atlas, when completed, will be undoubtedly one of the best at present published in any country of the world. Stieler's Hand-Atlas is engraved on, and printed from, copper, while in E. Debes' new atlas lithography has been brought to a perfection never attained before. Every care has been taken to incorporate the latest and best information. The maps are carefully drawn and artistically executed. A light grey is used for the hills to improve the clearness of the maps, but unfortunately this tint fails to represent the exact character of the ranges. The railways, on the other hand, are shown to advantage by double red lines.

VOLCANIC ISLAND IN THE NORTH OF EREBUS AND TERROR GULF.



SHIP AND ICE, MIDNIGHT, 1892. *Photographed by Dr. Donald.*

LAT. 64° 23′ S., LONG. 56° 14′ W.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

ANTARCTIC EXPLORATION.

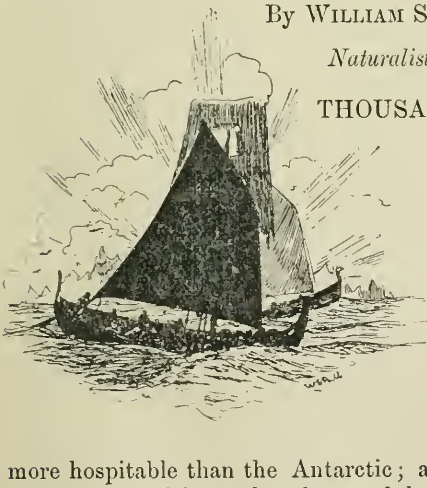
(*Papers read at a Meeting of the Society in Edinburgh, Jan.* 1894.)

(*With Illustrations by Mr. W. G. Burn-Murdoch, and a Map.*)

THE STORY OF THE ANTARCTIC.

By WILLIAM S. BRUCE,

Naturalist to S.S. Balæna.



A THOUSAND years ago Norsemen founded Arctic colonies in Greenland, and still they push to the North. Nor have they been alone, for Holland, Russia, Britain, and in recent years America, have all vied with one another for Arctic fame. Scores of expeditions, hundreds of crafts, thousands of men have sought to reveal the mysteries of the North; but few have ventured to the South. The Arctic is, perhaps, more hospitable than the Antarctic; as far north as man has penetrated he has found rich floral realms, and has seen reindeer and hares basking in the summer sun. There, too, can be tracked the stealthy footsteps of the fox, while endless flocks of puffins, looms, gulls, terns, and ptarmigans seek sacred nooks to hatch their young. The snowy raiment of winter is cast aside, and the deep fiords are green and warm. Not so in the South: there eternal winter reigns and the snow never melts; no plant is known to live within the Southern Circle, no living thing roams the snow-clad land, except a few strange birds that build in some comparatively sheltered spots. To the florist the South has few attractions, and no Castrèn need seek his life-work there.

Moreover, the winter of the South is very generally believed to be more severe than that of the North, though I believe the contrary may possibly be the case; but no man has ever wintered within the Antarctic circle. Look, also, how much more distant from the great exploring nations of the world the South Polar regions are, compared to the North Polar regions. But none of these circumstances appears to me to account for the great amount of work done in the North compared to that done in the South. Not Russia mapping out the northern coasts of Europe and Asia in order that she might know the extent of her empire, nor Britain doing the same for her American dominions, accounts for so considerable an amount of Arctic work,—but India. India's fragrant wealth has stimulated so much Arctic exploration, so much heroism in Arctic lands. Lives and ships have been sacrificed in the Arctic, not so much in the attempt to reach the Pole as to discover the NW. and NE. passages. Everything has been done to assure success; fleets laden with cargo have sailed from Holland and Britain seeking for a route to India by the North; time after time they have been repulsed, and, the greater the repulse, the greater the outburst of renewed energy for another trial. At last both the NE. and NW. passages have been forced; and to what avail, it is said, since the cutting through of a sandbank has given us a shorter and less perilous route? To what avail! See the fleets of whalers and sealers that leave Scotland, Norway, and America year after year, bringing home the richest cargoes in the world. Look also at the rich treasures which science has gained. But more than this is the romance, is the heroism, these adventures have called forth. For this reason alone, let us advance: Nansen, God speed thee!

The history of the North Polar regions fills volumes, but it is easy to give a brief outline of the history of the South Polar regions. To Peru belongs the honour of sending out the first Antarctic expedition, more than three centuries ago. In 1567 the Governor sent out an expedition under the command of his nephew, Alvaro Mendaña, to discover "Terra Australis Incognita;" and a second Peruvian expedition was sent out in 1605, and discovered an island of the New Hebrides group in 1606.

Dirk Gerrits in the meantime, in 1598, had set sail from Amsterdam accompanied by a small fleet, and, being separated from his companions by heavy weather, near the Straits of Magellan, discovered some high land now known as the South Shetlands. Gerrits and his crew were eventually captured by the Spaniards. France was next in the field, La Roche discovering the island of South Georgia in 1675, and Kerguelen in 1772 what he at first believed to be the Antarctic continent, but returning in the following year found to be only a small island. This island now bears his name. Britain, however, was the first nation to do any real work in the Antarctic, and that work is associated with the name of Captain Cook. He was the first to cross the Antarctic Circle, in 1773, and, crossing it again in 1774, he attained as high a latitude as 71° 15′ S. In a second voyage he circumnavigated the globe in high southern latitudes, twice crossing the Circle, and was thus the first to confine the Southern continent within the Antarctic Circle. Cook described the terrors and inhospitality of these regions, and firmly believed that no higher southern latitude would ever be attained. In 1819 William Smith of Blyth rediscovered the South Shetlands, the discovery being confirmed by Bransfield in the following year, who also sighted Bransfield Land. In 1820 the Russian Bellingshausen crossed the Antarctic Circle, and crossed the latitude of 70° S. in 1° 30′ W.; he also discovered the Peter and Alexander Islands, then the most southerly land known. In the following year Powell discovered the South Orkneys. In 1823 our brave and distinguished countryman, Captain James Weddell, beat all former records, sailing as far south as 74° 15′ S. in 34° 17′ W. Here, on the 20th of February, he found a sea clear of field-ice, with only three icebergs in view. Two days previously, two degrees farther north, Weddell says, "In the evening we had many whales about the ship, and the sea was literally covered with birds of the blue petrel kind; NOT A PARTICLE OF ICE OF ANY DESCRIPTION WAS TO BE SEEN."

John Biscoë, in the service of Messrs. Enderby, twice effected a landing: he was the first to put foot on land within the Antarctic Circle; this was on Adelaide Island in 1831. It was he who discovered the western coast of Graham's Land, the Norwegians and ourselves first seeing, last year, what in all probability was the eastern coast. Several other masters sailing under Messrs. Enderby made discoveries, notably Balleny, who discovered the Balleny Islands and Sabrina Land. After these, D'Urville the Frenchman, Wilkes the American, and Ross, our own countryman, during the years 1839-43, can alone be classed as Antarctic explorers. The *Challenger* paid a flying visit in 1874, and in 1892-3 Norway and Scotland despatched a whaling-fleet to which was attached a scientific staff, and Norway is again to the fore this year.

But of all the expeditions to the Antarctic, that of the *Erebus* and *Terror*, under the command of Sir James Clark Ross, during the years 1839-43, is by far the most important. With the most indomitable courage and perseverance, Ross crossed the Antarctic Circle in three successive years. On two of these occasions he attained far higher latitudes than any of his predecessors. He discovered Victoria Land, the vast mountainous tract extending away to 78° S. in the longitude of New Zealand, and terminating with Mount Erebus, which, from a height of over 12,000 feet, lights up the winter darkness of the snowy desert. From this point, in about 78° S., he sailed along an icy barrier running westward for 300 miles, the termination of the ice-cap of the great Antarctic continent. In 1842-43 he visited the region of Erebus and Terror Bay, lying to the south of Cape Horn, and became entangled in impenetrable pack; pushing farther eastward, he again crossed the Circle, attaining a latitude of 71° 30′ S., between Bellingshausen's and Weddell's tracks. Ross believed he could have landed and travelled over the continent.

"To the north-westward," he says, "we observed a low point of land, with a small islet off it which we hoped might afford us a place of refuge during the winter, and accordingly endeavoured to struggle through the ice towards it until 4 P.M., when the utter hopelessness of being able to approach it was manifest to all, the space of fifteen or sixteen miles between it and the ships being now filled up by a solid mass of land ice. . . . Had it been possible to have found a place of security upon any part of this coast, where we might have wintered in sight of the brilliant burning mountain, and at 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. . . . It was nevertheless painfully vexatious to behold at an easily accessible distance under other circumstances the range of mountains in which the pole was placed, and to feel how nearly that chief object of our undertaking had been accomplished; and few can understand the deep feelings of regret with which I felt myself compelled to abandon the perhaps too ambitious hope I had so long cherished of being permitted to plant the flag of my country on both the magnetic poles of our globe."

Had Ross had steam he would undoubtedly have accomplished what, with a sailing-vessel, was quite impossible.

D'Urville and Wilkes both did good work, and discovered land south of Cape Horn and south of Australia in high latitudes. I shall leave Dr. Donald and Mr. Burn-Murdoch to narrate our experiences in these regions during the past year, but perhaps I may detain you a few minutes longer to tell you something of the climatic conditions one meets with in the ice.

All the observations that have been made in the Antarctic have been in the height of summer—that is, during the months of December, January, and February; and an account of our experiences during these months will give you a very fair idea of what Cook, Weddell, D'Urville, Wilkes, and Ross experienced before us.

Like our predecessors, we found it to be a region of gales and calms—gales from the north, with wet fog; gales from the south, with blinding snow; calms with fog, and calms with brilliant sunshine. Towards the middle of December, when we were approaching the icy regions, we lay-to in squally weather and thick fogs. Gradually we pushed southward, and soon entered latitudes where flat-topped icebergs surrounded us on every side, and where pack-ice floated on the water. Squally weather continued till the 24th of December, when, in the vicinity of the Danger Islets, we met with a great number of bergs. From the deck I counted as many as sixty-five at one time, many being 1 to 4 miles in length and about 150 feet in height. Long shall I remember this Christmas Eve, when we were fast anchored to a floe. There was a perfect calm; the sky, except at the horizon, had a dense canopy of cumulus clouds, which rested on the summits of the western hills; and when the sun was just below the horizon, the soft greys and blues of the clouds and the spotless whiteness of the ice as it floated in the black and glassy sea were tinted with the most delicate of colours—rich purples and rosy hues, blues, and greens, passing into translucent yellows. At midnight the solitude was grand and impressive, perhaps the more so since we had for well-nigh a week been drifting among bergs, with dense fog and very squally weather. No sound disturbed the silence ; at times a flock of the beautiful sheath-bills would hover round the vessel, fanning the limpid air with their soundless wings of creamy whiteness. All was in such unison, all in such perfect harmony ; but it was a passing charm. Soon we had to think of more prosaic things, and reluctantly we turned our thoughts to the cargo we were to seek.

This is the picture of a calm midnight in mid-summer, different, indeed, from the heavy weather we experienced at other times, when for days we sheltered behind bergs and streams of pack during black nights thick with fog or snow. One of the gales we encountered the skipper described as the hardest that ever blew in the Arctic or Antarctic ; and, indeed, it was stiff. For ten hours we steamed as hard as we could against it, and at the end had only made one knot. Picture to yourselves a sailing-vessel : what a different agency we have now ! Where Cook, Ross, Weddell, and others would have been in the greatest peril, we with steam were comparatively safe.

The records of air temperature are very remarkable ; our lowest temperature was 20·8° Fahr., our highest 37·6° Fahr.—only a difference of 16·8° Fahr. in the total range for a period extending slightly over two months. Compare this with our climate, where in a single day and night you may get a variation of more than twice that amount.

During the last five months, in London, I have experienced temperatures ten degrees higher than on either of our crossings of the Equator, and five degrees lower than our lowest recorded temperature in the Antarctic.

The average temperatures show a still more remarkable uniformity. December averaged 31·14° Fahr. for one hundred and fifteen readings ; January, 31·10° Fahr. for one hundred and ninety-eight readings ; February, 29·65° for one hundred and sixteen readings—a range of less than 1½° Fahr. This seems worthy of the special attention of future Antarctic explorers, for may it not indicate a similar uniformity of temperature throughout the year ? Antarctic cold has been much dreaded by some ; the four hundred and twenty-nine readings I took during December, January, and February show an average temperature of only 30·76° Fahr. ; and this was in the very height of summer, in latitudes corresponding to that of the Faröe Islands in the North, but I believe the temperature of winter does not vary so much from that of the summer as in the North.

The greatest enemy in the South is the heavy swell which arises with and after gales. Listen to Weddell : "The rolling motion of several of these pieces was so great, that had one of them taken the side of the ship fairly in the descent, her destruction must have been inevitable.

"I was much rejoiced at having one vessel out of the ice, considering all the dangers of an open sea as of no moment compared with those we were subject to in such weak vessels.

"As I have been in Greenland seas, and am well acquainted with the nature and danger of that navigation, I may remark that sailing among ice in these southern latitudes is attended with much greater risk. This is occasioned by a heavy westerly swell, which keeps the ice in motion, and seldom entirely subsides." Ross also had similar experiences; but we never met with any very great swell amongst the ice.

I have told you somewhat of the Antarctic in summer; what the winter is no one knows. You will see that in the South we have a very different country to deal with as compared with the North. The conformation of land and water is exactly the reverse. In the North we have water surrounded by land—a polar basin; in the South, land surrounded by water—a polar continent.

It is of the utmost importance to science and romance, and perhaps also to commerce, that further exploration should be undertaken in the Antarctic; and it is to be hoped that this distinguished meeting will heartily support the resolution which will be submitted to it.

THE LATE EXPEDITION TO THE ANTARCTIC.

By Dr. C. W. Donald.

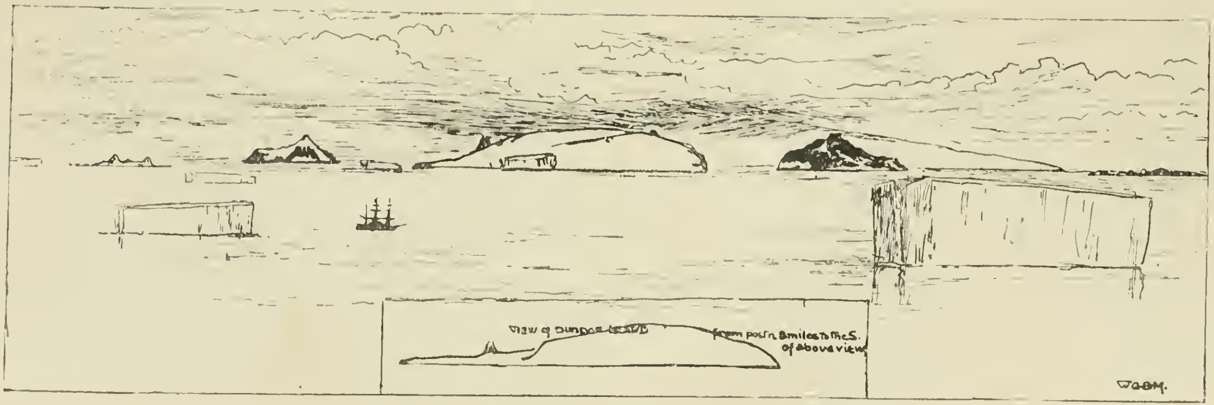
In view of the proposed expedition, the Antarctic has become a subject of general interest, and the experiences of our Antarctic explorers have again been studied with renewed zest. We see Cook with his small and totally unprotected ships crossing the 70th parallel; Weddell, with similar disadvantages, reaching 74° 15′ S.; while, in ships but little better, Bellingshausen, D'Urville, Wilkes, and others discover land to the south of the Antarctic circle. To Sir James Ross, however, we are indebted for most of our knowledge of this ice-bound region, where he spent three seasons, overcoming the many difficulties and dangers in a way that calls forth our heartiest admiration.

It is not my intention to deal with the Antarctic as a whole, but to consider in greater detail a small portion of it, in order, if possible, to give a picture which, with certain modifications, may be applied to Antarctic life generally. I turn to the neighbourhood of the Erebus and Terror Gulf, lying some 600 miles to the south and east of Cape Horn, where I spent the season of 1892-93.

This portion of the Antarctic was explored by Ross during his third voyage in 1842-43, and his careful and accurate survey left but little new geographical work to be done. However, I do not think I can give a better idea of Antarctic life and scenery than by describing our experience of this region.

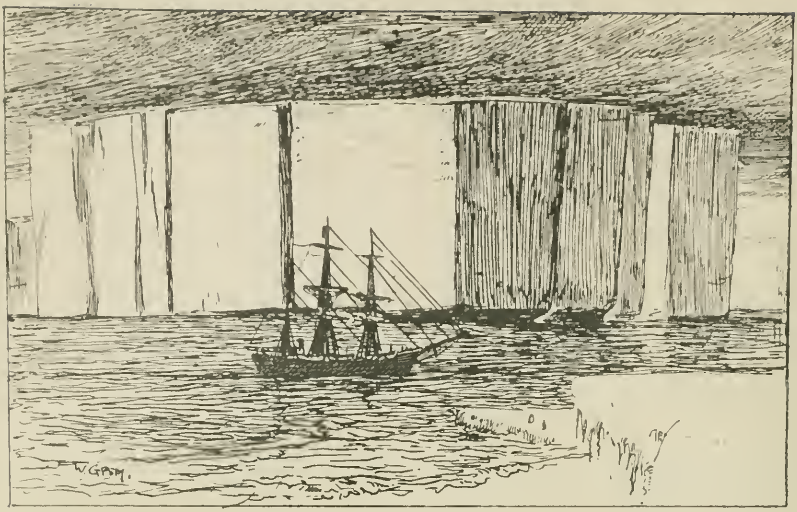
You may be inclined to say that I am giving the sunny side of the picture. You have probably read of terrible gales and heavy sea encountered in the pack, the ship being helplessly dashed about among the heavy ice, being severely strained, losing her rudder, and the commander and crew in the last stage of anxiety; of a collision to windward of a chain of icebergs, and of a ship being forced to make a sternboard along a berg, every roll of the heavy sea making the yard-arms jar

VIEW TO SW., EREBUS AND TERROR GULF.

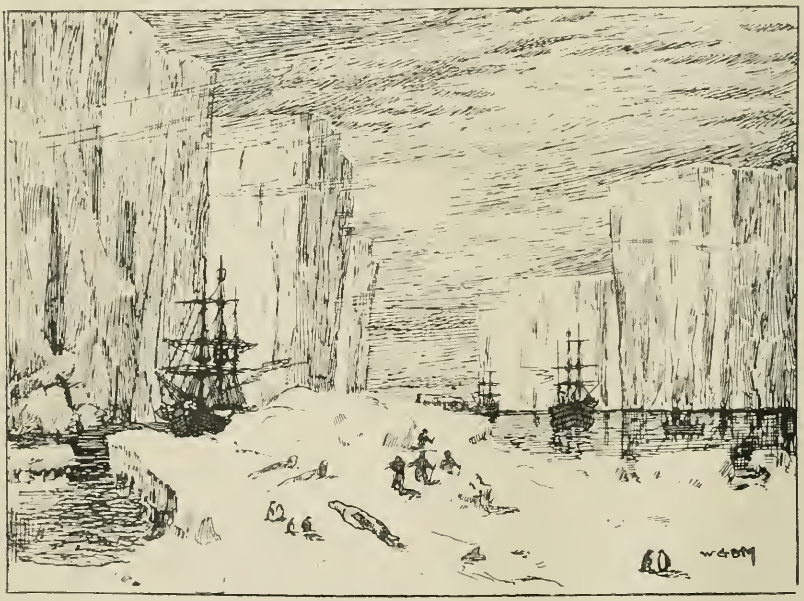


Paulet Island. Danger Islands.

VIEW NW. BY W. OF DUNDEE ISLAND, WITH JOINVILLE'S LAND IN THE DISTANCE.



AN ICEBERG.



THE THREE WHALERS AMONG ICEBERGS.

and scrape against the perpendicular face. You cannot read Ross's voyage without coming across many such incidents, sufficient to bring tears to the eyes of the strongest. But the introduction of steam into ice navigation has changed all that. Now, with the gale at its height, the spume drift flying, a heavy sea breaking on the outside edge of the pack, the ship lies a mile or two inside as safely as in a duck-pond, the sea being quite unable to penetrate so far, while a few revolutions of the propeller enable her to retain the friendly shelter of an ice-stream or berg.

I shall never forget our Christmas Eve a year ago. We were lying anchored to an ice-floe in lat. 64° 23′ S., long. 56° 14′ W. From here we had a magnificent view of the mountains of Palmer's Land, lying to the south of the Erebus and Terror Gulf. These form a small chain culminating in the peak of Mount Haddington, which rises in successive volcanic terraces to a height of 7050 feet. Completely snow-clad, except here and there where the black face of a steep cliff stood out in deep contrast to the surrounding whiteness, their slopes were thrown into various shades of light and dark by the slanting rays of the sun. To the south, the ice-floe, studded with numerous small bergs and hummocks, stretched as far as the eye could reach. Out to the eastward lay a long chain of bergs, their perpendicular faces tinged bright red by the sun's rays. Between these bergs and the floe lay a dark expanse of open water. To the north was the loose scattered ice, small bergs, and dark water-channels through which we had just steamed. Throw over this the lilac glamour, so frequently seen in the Antarctic, which, combined with the absolute stillness and quiet, broken only occasionally by the splash or harsh "quangk" of a penguin, or the soft tweet of the snow-petrel, made up a magnificent and imposing spectacle. By daylight on Christmas Day this scene seemed somewhat harsher in outline; but in the twilight, with the sea like a mirror, and slight ice forming on the surface, the effect was if possible enhanced, and acted on one like a spell.

Scenes such as these are of by no means infrequent occurrence, and well repay the adventurer for his tedious voyage.

Early in January we found ourselves in the north of the Erebus and Terror Gulf. One bright and sunny afternoon we had a memorable view of mountain and glacier, extending from Mount Percy in the north, with its remarkable double peak rising to a height of 3700 feet, the whole southern slope of which forms a single glacier; round by the west, along a chain of those grand deserted snow-clad mountains, to Mount Haddington in the south. These Southern glaciers differ in many important aspects from those in the North, and many problems in regard to them still require solution. I merely wish to state, however, that none of those we saw could have produced a berg of over 60 to 70 feet in height, so that all the larger bergs, running up to 200 feet or more, must have come from some tract of land to the south.

On the 6th of January we effected a landing on a beach in the NW. of the Erebus and Terror Gulf. Here the snow had almost entirely melted, enabling me to collect a few specimens of moss and seaweed. The surface was formed of small angular stones, which made walking pleasant and easy. At the head of the beach, which ran out as a long, low point, and within a short distance of the snow-line, I found a small rookery occupied by a somewhat rare variety of penguin—the white-headed or "Johnney" penguin (*Pygosculis Papua*). Here I obtained specimens of the eggs and young birds. Our authorities on board were all agreed that a party could spend a very comfortable winter in such a spot as this. As we lay off this beach on the following day, I had an excellent opportunity of viewing the surrounding country. I ascertained that it would be comparatively easy to reach the surface of the ice-cap from many of the landing-places in sight, on Louis Philippe Land as well as on Joinville Island. There is reason to believe that this also holds good with regard to the land much farther south in this meridian. The ice-cap for some distance from its edge was deeply indented by broad cracks or crevasses. Stretching eastwards was what appeared to be a long inlet or arm of the sea running through Joinville Island. This during the next few days we proved to be a sound, completely cutting off the southern portion of Joinville Island. To the portion thus cut off our captain gave the name of "Dundee Island," while the sound he called "Active Sound," after the name of our ship. Here we spent several truly Antarctic days of brilliant sunshine and perfect calm. The floating ice around us and the ice cliffs on either side showed every imaginable shade of green and blue. Frequently loud reports are heard, as a small avalanche descends into the sea, or a baby-berg is split from the ice-foot to commence its long journey to the north.

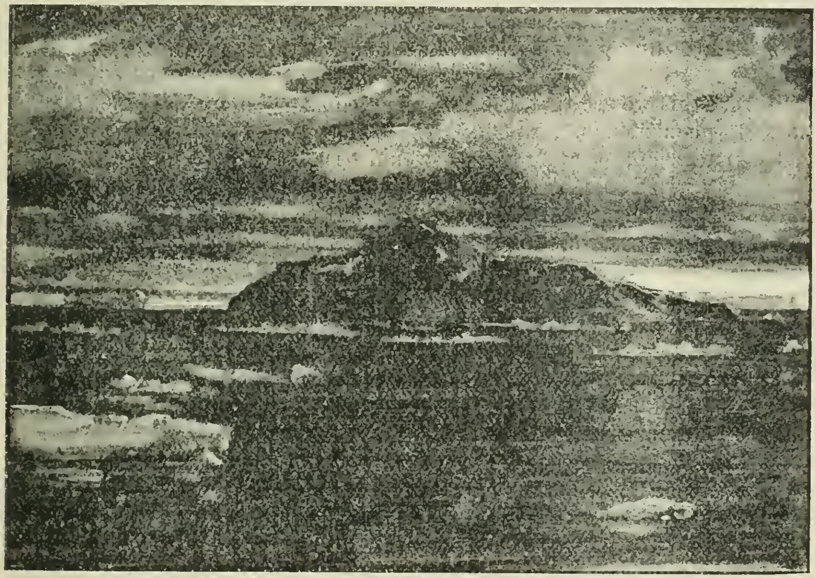
The shores bounding the western part of this sound are nearly parallel, about two miles apart, and completely lined by an ice-foot from about 25 to 60 or 70 feet in height. The shores open out in the middle of the sound, which at one point is nearly five miles across, and approach each other again near the eastern entrance. The southern shore is regular, while the north shore is broken to the west by a conspicuous hill, rising abruptly to 600 feet in height, and near the middle by a bay, bounded on the east by a prominent headland, to the east of which is a deep geo or bight. Nearly south of this "Gibson Bay," as it has been called, and within half a mile of the opposite shore, lies a reef which also, unfortunately, bears the name of our vessel. On the "Active Reef" we lay for six hours during a gale of wind, and were forced to disgorge ton after ton of our hard-won sealskins. Happily, we got off little the worse for the accident.

A large rookery on the north shore was visited. It was occupied by countless numbers of the common black-throated penguin (*Dasyrhamphus Adeliæ*), the nests being crowded together in square blocks formed by paths intersecting one another nearly at right angles. There was a constant stream of penguins going up and down the path leading from the rookery to the sea. Such a rookery, viewed through the telescope, has the appearance of a hair-brush, the penguins representing the bristles.

The new island forms a long, narrow, snow-covered plain, its highest point being not more than 150 feet above sea-level. Its total length from east to west is 29 miles, and its average breadth four miles.

The smaller islands and rocks scattered about this region are all volcanic and mostly basaltic. They seem to rise from the sea almost as perpendicularly as the icebergs, and present little or no surface on which snow can rest. Paulet Island differs from these in being cone-shaped, and having an easily accessible beach.

Lying in the south of the Erebus and Terror Gulf is Seymour Island, of some importance as being the depository of the only fossils as yet discovered in the Antarctic. For specimens of these I am indebted to Captain Larsen, of the Norwegian sealer *Jason*. Seymour Island forms the eastern boundary of Admiralty Inlet. It is long and low, and separated from the mainland by a narrow channel. Its surface, looked at from a distance, has a peculiar ribbed appearance, which Ross



PAULET ISLAND.
(Drawn from a photograph by Dr. Donald.)

describes as resembling the machine-turning on the back of a watch. Captain Larsen landed on the east side, where I have no doubt his marks will be found by the next expedition. The fossils he describes as lying loose on the surface in considerable numbers.

Cockburn Island, lying in Admiralty Inlet, is also important, as being the most southerly point on which Ross found traces of vegetable life. It is a small precipitous island, the elevation of which, according to Sir James Ross, is 2760 feet. Sir Joseph Hooker, in describing the vegetation, says: "The flora of Cockburn Island contains nineteen species, all belonging to the orders Mosses, *Algæ*, and Lichens." And then, after an account of these, continues: "On approaching Cockburn Island, the cliffs above were seen to be belted with yellow, which, as it were, streams down to the ocean among the rocky *débris*. The colour was too pale to be caused by iron ochre, which it otherwise resembles;

and the appearance was found to be entirely owing to the abundance of a species of lichen (*Lecanora miniata*) that prevails in the vicinity of the sea throughout the Antarctic islands and in other parts of the globe. It grows nowhere else in such profusion—a circumstance which may arise from its preference for animal matter, the penguin rookery of Cockburn Island, which taints the air by its effluvium, being perhaps peculiarly congenial to this lichen. Immediately on landing, one plant, and only one, is easily discernible—the *Ulva crispa*. It consists of pale green membraneous fronds barely one-fourth of an inch high, and crowded together in great numbers. The mosses grow in the soil which is harboured in the fissures of rocks; they are exceedingly minute, the closest scrutiny being requisite to detect them. All were confined to spots having a northern exposure, and even then they were so hard frozen into the ground that they could not be removed without a hammer."

From this we see that the vegetation of the Antarctic is not a very striking phenomenon.

A sketch of the Antarctic would scarcely be complete without mentioning its fogs. These are frequent enough and dense enough to be very troublesome. Yet they have a peculiar beauty of their own. In the morning, as a bright sun begins to dispel the fog, there first appears a "fog-bow," or, as the sailors call it, a "fog-schaffer," or "scavenger," their belief being that this bow eats up or removes the fog. It is in the form of a perfect circle, the two ends appearing to meet beneath one's feet. Soon after this, luminous points appear in the fog, and gradually extend into patches; I have counted as many as twenty of these. As the fog lifts a little more, each of these patches is seen to be suspended immediately above an iceberg. Then the fog finally disperses with a rush, leaving a bright sun and a cloudless sky, and every promise of a magnificent Antarctic day. Many of the fogs, however, do not disperse in this accommodating way, and may last for days.

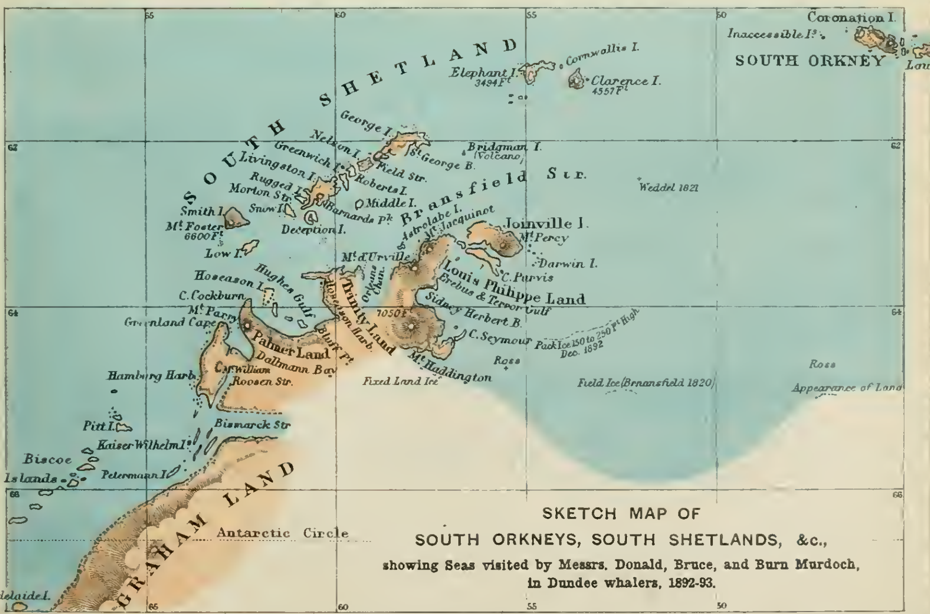
Let me turn for a moment to the mammals and birds which are daily seen, and are sufficiently characteristic of the Antarctic. As you are probably aware, great hopes had been centred on the finding of a true whalebone whale in the Antarctic. Such a whale Sir James Ross believed he saw. We, however, saw none; nor were any sperm whales seen among the ice.

Of the Southern Finner (*Balænoptera australis*) we saw great numbers, and so tame were they, that on one or two occasions the ship actually struck them before they would get out of the way. On a favourable day I have seen as many as twenty lying lazily on the surface, or coming up now and then to blow a high, thin blast. On one occasion (January 6th) one of these enormous creatures, probably not less than 80 feet in length, was seen to jump like a salmon, every portion of its body being clear of the water.

Another whale of which we had some experience was the Hunchback. There seemed nothing in particular to distinguish it from the ordinary northern Hunchback, the *Megaptera longimana*. It is a small whale, about 40 feet long, whose chief characteristic is the extreme length of the

SKETCH MAP OF SOUTH POLAR REGIONS,

according to most recent research.



SKETCH MAP OF SOUTH ORKNEYS, SOUTH SHETLANDS, &c., showing Seas visited by Messrs. Donald, Bruce, and Burn Murdoch, in Dundee whalers, 1892-93.

The Edinburgh Geographical Institute — J. G. Bartholomew.

pectoral fins. We attempted to catch one, and a most exciting chase it led us. I have fished salmon and trout, and confidently affirm that neither can equal whale-fishing for sport. On being struck, the whale ran the five lines in the first boat straight out and got free. It was again struck, four additional harpoons and six rockets being fired into it. In spite of all this it escaped after a thirteen hours' battle, taking with it a considerable quantity of line, two of the harpoons, and all the rockets.

Three other species of whale were seen: the Bottlenose, or *Hyperoodon*, of the North, two of which were captured by the Norwegian vessel; a species of grampus, perhaps *Orca Capensis*, was also common; several schools of another cetacean were seen, which may possibly have been a species of *Globiocephalus*.

Four species of seals were observed, apparently identical with those described from Sir James Ross's expedition. The largest of these—the sea-leopard—attained in some cases a length of nearly 14 feet. Their habits as regards food differ somewhat from those of the Northern seal. They spend the whole day basking on the ice, from nine o'clock in the morning till seven or eight in the evening, when they return to the water to feed. Their diet consists largely of penguins, and in part of a crustacean of the genus *Euphausia*, resembling a large red shrimp, with occasionally a small fish or cuttlefish. The sea-elephant—*Morunga elephantia*—was not seen by us.

Of birds we met with 20 species in all. Of these the penguins are by far the most numerous and characteristic representatives of this region. From an ornithologist's point of view the penguin for many reasons is one of the most interesting of living birds. To an ordinary observer it is one of the most ludicrous. Its peculiar methods of progression, its actions and gait, which may well be called "old-fashioned," and its senile expression, all serve to excite one's risibility. Of these we saw five species.

On one occasion, in the north of the Erebus and Terror Gulf, we saw large schools, numbering 200 to 300, of the common black-throated variety swimming together, the movements of each school being controlled by a single individual of larger size, which followed in the rear. When first seen, at a distance of about 200 yards, the school nearest the ship was leaping and diving noisily. On a croak from the leader this noisy sport instantly ceased, and the whole school swam quietly along for several minutes. In response to another and slightly altered croak, the leaping and diving recommenced. On a third croak the whole school disappeared in a prolonged dive.

In Mr. Spry's notes on the voyage of the *Challenger*, he states that a penguin perished on being held under water for a space of $1\frac{1}{2}$ minutes. To test this statement I repeated the experiment, and found that, if it were carefully and scientifically performed, the bird recovered after immersion for six minutes. Care is required in such an experiment to absolutely exclude all water from the lungs, either by plugging the larynx or compressing the trachea.

The white-throated variety, formerly described as a separate species under the name of *Dasyrhamphus Herculis*, I have good reason for believing to be merely the young of the black-throated variety, the *Dasyrhamphus Adeliæ.* No rookeries of the Emperor penguin were found, the egg being as yet absolutely unknown.

Of the other birds the most characteristic are the petrels, seven varieties of which are found in this region. They range from the great Giant Petrel down to the familiar little Mother Carey's Chicken. The Giant Petrel occurs in various shades of brown, and also in an almost pure white plumage, the latter form being very scarce—only about a dozen individuals being seen.

The beautiful *Chionis alba,* two gulls, two terns, a skua, the common hooded crow, and a handsome black-and-white duck complete the list.

I have tried to give a picture of Antarctic life which, though necessarily somewhat meagre, is nevertheless accurate. I hope I have impressed you with the fact that ice navigation and exploration is not all difficulty and danger, and that in sending out another and fully equipped expedition you are not sending the crew to certain destruction any more than you are committing the observers on Ben Nevis to such a fate.

After the above papers had been read, a series of limelight views was thrown on the screen, and the scenes were described by Mr. Burn-Murdoch, from whose drawings many of the slides had been produced.

Dr. Buchan then spoke on the meteorological problems awaiting solution in the Arctic regions. South of lat. 40° a belt of low pressure encircled the globe, the barometer sinking to 29 in. at lat. 60° S.—a condition which had no parallel elsewhere. In the northern hemisphere there was a region of high pressure round the Pole, and two areas of low pressure over the Atlantic and Pacific respectively. It was owing to this zone of low pressure in southern latitudes that vessels sailing to Australia were helped on their way by constant westerly winds, and found it to their advantage to return by Cape Horn. Some had maintained that this area of low pressure extended over the South Pole, but the experience of Mr. Bruce and Dr. Donald, who found south, south-east, and east winds prevailing in these regions, seemed to indicate that the South, like the North, Pole was situated in the midst of an anticyclonic area.

Professor Cargill G. Knott referred to the magnetic observations that should be made in the Antarctic regions. The distribution of magnetism was in general imperfectly known, and the science would be greatly forwarded if the south magnetic pole, which Ross longed to seek for, were discovered, and the magnetic conditions of the neighbourhood ascertained.

Professor Geikie urged the necessity of Antarctic exploration in the interests of geology. The only fossils discovered in these southern regions were those brought back by Dr. Donald, and it was an interesting fact that they indicated a comparatively genial climate, such as had at various periods prevailed in the Arctic regions. It was, then, desirable to learn something more about the climate of the Antarctic in remote times, as also to investigate the nature of the rocks and examine the ice-sheet, to ascertain the extent of the Antarctic lands and take observations of the depth and temperature of the ocean. In conclusion, Professor Geikie, as chairman of the meeting, moved the following resolution, which had been approved by the Council of the Society :—

"That at this meeting, held for the discussion of Antarctic research, the Royal Scottish Geographical Society resolves to give its hearty support to the promotion of further exploration in the Antarctic. The Society's Council is of opinion that at the present time a properly equipped Government expedition would, with the increased advantages of steam and modern appliances, have every prospect of successful exploration in the South Polar regions. The Council is also convinced that the additions which might be made to our knowledge of climatology, terrestrial magnetism, geology, and natural history would be of such practical scientific value as to fully justify the equipment of such an expedition at national expense. Towards the promotion of this object the Council considers it desirable to submit a memorial on the subject to Her Majesty's Government, and in this action they invite the co-operation of all the leading scientific societies of Scotland. To this end the Society appoints an Antarctic Committee, consisting of Dr. John Murray, Professor James Geikie, Dr. Buchan, and Mr. J. G. Bartholomew, together with the delegates of the other scientific societies, with instructions to draft such a memorial and take such steps towards the promotion of Antarctic exploration as may be deemed desirable."

The resolution was seconded by Professor Copeland, and unanimously adopted.

BRITISH SEA FISHERIES AND FISHING AREAS, IN VIEW OF RECENT NATIONAL ADVANCE.

By W. L. Calderwood, F.R.S.E.

(*With a Map.*)

It is gratifying to our national pride to be told that the sea fisheries of the United Kingdom are of greater value than those of any other country where fishery records are kept, and that they are worth, annually, about six million pounds sterling.

In a recent Report of the Fisheries Department of the Board of Trade this statement is made, and at the same time we are informed as to the proportion of fishermen to the total populations of a few countries.

A perusal of the latter statement is of special interest to Scotchmen, since it shows that we, most of all in the British Isles, should pay attention to the proper conduct and regulation of our fisheries; because we have a much greater number of fishermen than either England or Ireland.

In England and Wales there is	1	fisherman	in every	612	of the	population.
In Scotland	,,	1	,,	,,	76	,,	,,
In Ireland	,,	1	,,	,,	216	,,	,,
In U.S.A.	,,	1	,,	,,	381	,,	,,
In France	,,	1	,,	,,	278	,,	,,
In Norway	,,	1	,,	,,	16	,,	,,

Arranging the countries in descending order of the proportional numbers of fishermen, we have: Norway, Scotland, Ireland, France, U.S.A., and finally England.

With regard to our own fisheries we are certainly able to say that in the last few years we have gained a very considerable amount of information. The more careful collection of statistics enables us to estimate our present condition, and compare it with the results of previous years. The scientific study of the life-histories and habits of fish, and of the animals upon which fish prey, has given us a mass of invaluable information, which enables us to regard fishery legislation from a much more intelligent standpoint. And it is certainly true that the keen rivalry which now exists between different classes of fishermen has done much to open the eyes of the general public to the conflicting statements of the fishermen themselves, as it has made the application of accurate scientific information of paramount importance.

Our fisheries, like our agricultural efforts, are liable to great fluctuation, and are much influenced by the tricks of a fickle climate. Yet a certain balance of food-supply is often maintained by one land-crop or section of the fishing industry yielding an abundant harvest in certain districts, while poor results are obtained elsewhere.

In Scotland, our staple fisheries are the drift-net fishing for herring, and the line-fishing for haddocks, cod, and other white fish. We now possess a considerable amount of knowledge as to the spawning and development of the herring, but our information as to the movements of shoals is still very limited, the subject being beset with peculiar difficulty. Herring have been known to disappear suddenly from certain localities where their capture had long been looked upon as an established industry. In a single night the large shoals of herring which regularly frequented Cromarty Firth in the summer months forsook their haunts, and although many years have since passed, they have never been seen again. Lochfyne, the home of our most famous herring, now seldom contains a shoal in its upper reaches. This disappearance has, however, been gradual, and the fishery is still a good one in the neighbourhood of Skipness Point and Kilbrannan Sound. The experienced fisherman, however, knows when to expect the shoals of herring or mackerel in any one locality, and knows also the direction in which to look for them first of all. The approach of the shoals to shallow water occurs with wonderful regularity, although their movements when near to the land are more or less erratic.[1]

[1] For information as to the movements of the mackerel, see *auctor*, *Jour. Mar. Biol. Assoc.*, N.S., vol. ii. p. 4.

Certain fishes which do not move in shoals in the same compact way as herrings or mackerel appear to be subject to sudden fluctuations in like manner. About twenty years ago the haddock fishery of Dublin began to decline. Trawling had been carried on in this locality since 1818, *i.e.* ten years before the commencement of the great North Sea industry, concerning which I shall speak presently. The Dublin line-fishermen had long been loud in their outcry against the trawlers, and, believing that now they had full proof of the evil effects of beam-trawl fishing, they made great capital out of the circumstance, and, so far as I can find, did influence public opinion to a decided extent. But in spite of the loss of haddocks, trawl-fishing prospered, and the number of boats increased. After four or five years haddocks suddenly re-appeared, and the strong circumstantial evidence of the long-liners fell to the ground. It may be said that these were *Irish* fishermen, but we must remember that the same hostile attitude has been taken up by our fishermen of the East Coast, and often with much less reason. Fluctuations in the haddock fishery have also occurred in Scotland, and at a time when trawling in this country was unknown. The trawler may have committed many sins in Scotland, but this cannot clearly be laid to his charge.

At the present day a similar disappearance of haddocks has taken place in Devon and Cornwall, but in all probability this fishery may revive as those already mentioned have done.

It may be gathered, then, from the instances quoted, that the causes of fluctuations in our fisheries which are so readily advanced by many, especially by fishermen, should be adopted with great caution. Still more is this the case when such large questions as the destruction of immature fish, the spawning habits and life-histories of fish, the proper methods of oyster and mussel culture, and such kindred subjects as require an accurate knowledge of marine natural history, come under consideration. The large problems connected with our fisheries must now be looked at in no hap-hazard manner. What chemistry is to manufacture, the science of applied natural history must be to our fisheries; for it is clear that no truly beneficial legislation can be instituted which does not have for its keynote a proper understanding of the laws which govern the lives of the animals affected, and of the relation which these laws bear to the influence of man.

Turning now to the white-fish fisheries of the British Isles, and leaving out of count the drift-net fishing for herrings and mackerel, I think we are safe in regarding beam-trawling as decidedly the most important method of fishing.

Trawling has placed the common sole in the market, and is certainly the most effective method of catching all other flat fishes.

In the eyes of the long-line fisherman of Scotland, the trawler has appeared in recent years as a species of lawful poacher—if such an Irishism can be excused—as a person who has gradually insinuated his hated craft amongst a peaceful and prosperous people, to the detriment of the natural preserves of the time-honoured long-liners. Trawling in Scotland is a distinctly modern method of fishing, a "new-fangled" innovation. Moreover, it is usually associated with the clank and rattle of steam-engines and other modern abominations, which, in the eyes of our fishermen, place the beam-trawl in much the same category as the torpedo, submarine mine, or other fatal destructor.

The rivalry which exists so strongly between the old and the new methods of white-fish fishing in Scotland comes to be a repetition of the rivalry between the old hand-loom weavers and the mills, between the Clyde watermen of 1812 and Henry Bell's first steamboat. In fact, when we recollect some of the scenes which have taken place at one or two of our ports, where trawlers entering the harbours have been stoned and their fish left unsold in the market, we are forcibly reminded of the manner in which the French watermen broke up and hacked to pieces, in their jealous rage, one of the earliest of European steamboats—that constructed by Papin in 1690.

Trawling is an English method of fishing, and appears to have originated first of all at Brixham, on the south coast of Devon, about the time of the French war. Working eastwards along the English Channel, the Devonshire men fished off Ramsgate, Dover, and at the mouth of the Thames; then, finding that the North Sea yielded most remunerative results, they established a colony at Harwich in 1828.

In 1818, as already stated, trawling commenced in Irish waters, and it is of interest to note that the boats then employed were purchased at Brixham and manned by Devonshire men. When the Dublin men, who were the first adventurers in the art of trawling, had learnt the new craft, the Brixham men appear to have returned home and severed their connection with Ireland; but the fact remains that first Ireland, then England, and in recent years Scotland, indirectly through England, owe their knowledge of beam-trawling to the old town of Brixham.

On the east coast of England, soon after the establishment of the colony at Harwich, men began to practise the new art, boats increased rapidly in numbers, and a steady exploration of the unknown banks of the North Sea was commenced. Gradually boats worked further and further afield, till nine years afterwards—in 1837—the famous "Silver Pits" were discovered (*vide* Map). They were discovered by accident, and yielded enormous takes of large soles. Boats flocked to the grounds, but there seemed to be plenty of fish for all, and the name "Silver Pits" was given to indicate the mine of wealth which had been found.

Trawling grew and prospered, boats increased in number and size, the trawling centres of Hull, Lowestoft, Great Yarmouth, Grimsby, etc., sprung into life—Grimsby, indeed, entirely owes its origin and present thriving position, as the most important fishing-port on the east coast of England, to trawling. Boats began to seek such distant grounds that days, and even weeks, were spent at sea. The "Sylt" grounds were first worked over in 1860, and many years before this date the Dogger and Great Fisher Banks, in the centre of the North Sea, had become regularly established as important fishing-areas. Just as a deer-forest has, as a rule, no trees, so a fishing-bank is very frequently of the same depth as the surrounding sea bottom, or is a depression or valley of greater depth. The leading fishing-areas of the North Sea, however, are in reality banks, since they are no doubt the remains of the early land-surface which united our country with the rest of Europe, and which gradually became submerged before the southward advance of the Pliocene North Sea. A great river, flowing northwards, which we may perhaps describe as the ancestor of the Rhine, having as one of its leading tributaries the Thames, had then its estuary abreast of what is now the coast of Norfolk. This great river, in all probability, scooped out channels and heaped up banks of deposit around its mouth or mouths. Those higher parts, during the last subsidence of this area, must at one time have appeared as islands, and must have been covered only when the North Sea and English Channel were well advanced towards the condition in which we now know them.

When trawling was first commenced on these banks, large, well-conditioned fish were caught in great numbers. It is of importance now to attempt an estimate of the *present* condition of the banks, so as to note, if possible, the consequences of the great advance in this branch of the fishing industry.

First of all, we must fully grasp the changed condition of the fishing-boats and the gear they carry.

The early trawling-smacks were, from a modern point of view, small and poorly found. Many of them were not entirely decked, and for years the largest did not exceed a burden of 20 tons. At the present day, from English North Sea fishing-ports alone, there are about 2300 trawlers, besides a fleet of large line-boats. Hundreds of the trawlers are propelled by steam power, and are of 60 to 100 tons register. They are, therefore, capable of dragging gear in proportion. The early Brixham trawl fishermen, on returning from their toil, could beach their boats and carry their gear home on their backs.

The modern Grimsby trawler carries a couple of large beam-trawls ready for use, one over each quarter. Each beam is 55 feet in length, and the massive trawl-heads are shackled on to a steel-wire warp, working from the drum of a powerful steam winch. When one net has been fishing and the "take" is tumbled on board, the other net is shot and set to work before the fish are sorted out and the first net overhauled.

Nor do the present day North Sea trawlers go out, each independent of the others, to trawl for a night and then come into port with their fish for market. The trawlers sailing out of Brixham and Plymouth still do this, but the North Sea men work on what is termed the "fleeting system." By this method, a fleet of boats goes out to some distant ground and remains at work, it may be two or three weeks, it may be a month. All the fish caught are transferred daily to a fast steam carrier, which, having collected a full cargo from a number of trawlers, loses no time in laying the various lots of fish before the hammer of the auctioneer. The progress of years, however, has brought a change in the character of the fish sold.

By degrees, smaller and smaller fish have been accepted as marketable, so that now a box of small plaice or haddocks can find a ready sale, where previously the same class of fish would never have been brought on shore.

Fishermen and salesmen alike cry out against this market for small fish; but money is not too plentiful, and competition is keen. If one man can get well paid for a few boxes of baby fishes, his neighbour naturally thinks that he too will make money in this way. The market term "small" includes all sorts and conditions of fishes, but the species mostly found are plaice, dabs, soles, haddock, and codling. Experiments were instituted in January 1892, with a view to ascertain the actual condition of things in the North Sea, and devise means, if possible, to avoid the great destruction of small fishes which was said to take place. Various fishing conferences had been held, both at the fishing centres and in London, and several remedial measures had been proposed. The general opinion of those present at the conferences seemed to favour the establishment of a size limit for certain species of fish; and to prohibit, if possible, the sale of fish under that limit. This system had been adopted by the Belgian Government, and was recommended as a workable proposal. It was strongly urged that the limit should be so placed as to enable the fishes to spawn at least once before they could be lawfully captured. Unfortunately, no one then knew at what sizes the various fishes first spawned, either in the North Sea or in other localities.

It therefore became necessary not only to get an idea as to the number of immature fish annually destroyed, but also to ascertain the sizes at which the various food fishes spawned for the first time in different localities. As to the number of fishes of immature growth killed in the North Sea, it is impossible here to take up the whole question; but we may take a statement of my colleague, Mr. Holt, with regard to plaice, prefacing the statement by calling to your notice the fact that the majority of small plaice landed on our eastern coast come from the grounds on the opposite, or Dutch side, of the North Sea, and that the hauls made in this locality during the summer months consist almost entirely of plaice.

Mr. Holt says:[1]—'There were landed at Grimsby in

April,	1836	boxes of	small plaice.
May,	830	,,	,,
June,	3470	,,	,,
July,	2059	,,	,,
August,	1924	,,	,,

making a total for five months of 10,119 boxes.'

The boxes referred to are only those which came directly under the notice of Mr. Holt, and were from the port of Grimsby alone. Taking a low average of 250 fish per box, we have the startling total of two million, five hundred and twenty-nine thousand, seven hundred and fifty (2,529,750), or in round numbers two and a half millions of fish, all immature. Again, taking turbot from the same grounds (Dutch, German, and Danish), we find that out of 4623 fish landed there were 786 fish mature and 3837 immature: 82°/ₒ immature.

Add on all the figures concerning the capture of small fish which might be collected at Lowestoft, Great Yarmouth, Hull, Scarborough,

[1] Holt, E. W. L.—*Jour. Mar. Biol. Assoc.*, N.S., vol. ii. No. 4, p. 381.

Boston, etc., and the result will be sufficient to make any one wonder how long this condition of things can last. It is the most obvious "killing the goose which lays the golden eggs" that probably ever occurred. It has been going on now for many years, and has made such an impression on the North Sea banks that fishermen are crying out in despair that the methods which they themselves are practising are ruining the fisheries, but that they dare not stop because others won't.

We have noticed the early condition of the Silver Pits and the Dogger Banks. At certain seasons these grounds are now little frequented, and the name Silver Pits is at all times a term of irony. Still, we occasionally hear the dogmatic statement that "there are as many fish in the sea as ever came out of it." It is true that with an ever-increasing population we have a greater demand for fish, and therefore a more frequent appearance of scarcity; but with an increase of population we also have an increase of fishermen, as well as a steady capture of fish which have never had time to propagate their species.

To scoff at the possibility of destroying the balance of Nature by human intervention, even in such a vast area as the North Sea, is therefore, I consider, to take up a position which cannot be maintained in view of our knowledge of the present condition of our fisheries.

The other point of this question which has been so prominent of late is the one which deals with the sizes at which fish spawn for the first time in different localities. It is a purely zoological question, which has a direct bearing on certain proposed legislative measures which I shall mention later.

In treating thus the results of trawling in the North Sea, I have made an effort at the same time to place before you both the benefits and the drawbacks of the system. With the Commissioners appointed in 1883 to inquire into the results of trawling, I would say that "it has not been proved that the use of the beam-trawl is the sole cause of the diminution of fishes in territorial waters." At the same time, I would add that, while trawling has immensely benefited our food-supply, it is without doubt the method of fishing which more steadily than any other does influence the actual stock of fish on any given ground, especially the stock of flat fish.

Off the Fife coast, between St. Monans and Pittenweem, there is a circular patch of sandy ground partly surrounded by rocks, locally known as the "Fluke Hole." This patch has long been famous for its flat fish, especially plaice and lemon soles. Before the byelaws of the Fishery Board for Scotland were introduced, which now debar all but those trawling in the service of the Board, this ground was visited at intervals by Granton and Leith trawlers. The area is so limited that, in the old days, if a trawling skipper approaching the ground noticed a boat working the Fluke Hole, he generally allowed a tide or two to come and go, so that a fresh stock of fish might have an opportunity of moving on to the ground, before he considered it worth his while to drop his gear. In fact, a trawler working this limited area for an hour or two pretty well cleared the fish out. Situated as it is, however, with rocky ground in the immediate vicinity, where trawlers dare not work for fear of tearing their nets, it was kept constantly re-supplied with fish. It must be evident that any prescribed area, if steadily worked upon, will be, sooner or later, influenced in like manner, provided the implements used in the fishing are sufficiently effective, and the fishing-boats sufficiently numerous to more than cope with the natural supply of fish at any given time.

When constant trawling has reduced the productiveness of a bank till work on that bank has become unprofitable, the boats must go elsewhere and open up new ground, or try areas which have been allowed to rest for some time.

We have already seen that all the North Sea has been practically explored in this way; boats go now even as far north as Iceland, packing their fish in ice and bringing back cargoes to Grimsby and other English ports. Last year a small fleet of steam trawlers sailed from Grimsby to Vigo Bay, off the coast of Spain, landing their fish at Plymouth. The ground was found to be extremely rich in soles, but the expense of forty-three hours' steaming to and from the locality proved to be too much for the profits.

The Plymouth fishermen, who, as already mentioned, still work on the old "single-boating" system, found it necessary about three years ago to open up some new fishing-grounds. The Bristol Channel suggested itself, and was found to yield good results. Every one flocked to the Bristol Channel, and an impetus was for a time given to the industry; although in calm weather, owing to the absence of steam power, many cargoes of fish were unfit for market when landed at Plymouth. Now the Bristol Channel has been reduced to the condition of the other unprofitable banks referred to, and the boats are back fishing on the home grounds, or off Mount's Bay on the south coast of Cornwall, where a good "spot" for large turbot has been discovered.

So things go on, and it should be readily seen that, in the absence of any attempt at the proper regulation of extra-territorial waters by international agreement, our trawling industry is now working towards the end of its possibilities under existing conditions. The trawling companies of the east coast have large capital to keep them going for many years to come, but in localities where single-boating exists, where the fishermen are entirely dependent on their "takes," and have to maintain their boats and gear out of their own pockets, receiving no regular wages as men do who work for companies, "times are very hard."

This brief sketch of the trawling industry is sufficient, I think, to show that through its whole history there has been a gradual extension of the fishing-areas; that this extension has not been so much the result of pure exploration as of the absolute necessity to find more remunerative grounds.

It is impossible, in the short time at my disposal, to go into the subject at greater detail, and to produce proofs of individual cases of fishing-grounds where continuous trawling has materially affected the stock of flat fish; but I may be allowed to mention that the arguments here adduced from a history of the industry are in accord with the opinions of other naturalists who have given attention to the subject, as well as with the opinion of the Royal Commission of 1883, to which I have referred, in the Summary of the Report of which body we find that "the number of fishes on particular grounds, especially in narrow waters, may be diminished by the use of the beam-trawl."

It has been pointed out that the fisherman's only method of improving his returns is by opening up new fishing-grounds. The light area of the accompanying map shows what may practically be considered the possible fishing region for this country—*i.e.* the water which is not deeper than 50 fathoms. Trawling cannot be carried on where the sea bottom is rocky, and the large extent of water already worked upon leaves only a definite and distinctly limited region available.

In Ireland, owing to the energy of the Rev. W. Spottswood Green, one of the Fishery Inspectors, two survey expeditions have recently been conducted with a view to ascertain the productiveness of much unknown ground along the west coast. These expeditions have resulted in the discovery of several localities which are most favourably reported upon as likely to yield good returns either to the line-fisherman or the trawler.

With the light railways now either completed or in course of construction, by means of which fish can be forwarded to market, it is hoped that the Irish fishermen themselves may be greatly benefited, and that many may be induced to take to fishing as a livelihood who are at present in a state of semi-starvation, living upon the products of their very indifferent crofts. This exploration of the fishing-grounds will also be found of great value to the ever-increasing stream of Scotch and English fishermen who annually visit the coast of Ireland. From the official report of the expeditions it appears that, in almost every locality where stretches of clean sandy ground bounded by rock exist, good fishing can be had at some season of the year. A great number of the bays and estuaries form excellent trawling and long-line fishing-grounds, such as Galway Bay, Donegal Bay, and Kenmare River; and around, and especially outside of, most of the islands, the trials made during the expeditions yielded excellent results. In other localities, however, the sea seemed to be infested with a plague of dogfish, which consumed the baits on the long lines, and even the fish on the baits.

Thus Mr. Green[1] has attempted to benefit the Irish fisheries by the usual method of the fishermen—viz., by exploring new and unknown grounds.

These survey expeditions have also yielded results of considerable scientific value in extending our knowledge of British fauna. A study has been made of the range or distribution both of fishes and invertebrate forms; and since observations were made at considerable depths, beyond the limits of the Continental Plateau, several new species have been added to the list of our British marine animals.

With regard, now, to other methods which have been recently suggested in order to benefit the fisheries, over and above the mere opening up of new ground, I cannot, I think, do better than call your attention

[1] *Report of the Inspectors of Irish Fisheries for* 1891, or *Proc. R. Dublin Soc.*, 1892.

to the inquiries made by a Select Committee of the House of Commons which sat during last May and June.

Passing over all the evidence of a statistical order, I may say briefly that the members of the committee satisfied themselves that there was a serious depletion going on in the North Sea. The remedial measures which were discussed may fairly, I think, be classified under three heads, as follows :—

A. The protection of immature and undersized fish—
  1. By closing large sea-areas by international agreement.
  2. By prohibiting the landing and sale of fish under certain specified sizes.
  3. By prohibiting certain methods of fishing.

B. The protection of adult fishes—
  By instituting close-times.

C. The augmentation of our fisheries—
  By artificial hatching of fish.

The Committee, in their Report, dated 17th August last, advocate action on the lines of section 2 of head A, viz., the prohibition of the landing and sale of fish under certain specified sizes. They do not recommend any restrictions as to the landing and sale of round fish, such as cod and haddock, but intend that their recommendations should apply to flat fish alone. Further, the sizes which were proposed by witnesses, representing both the fish trade itself and the class described in the report as scientific experts, were rejected, and a special set of sizes drawn up. The reason given for this course is that Belgium, Denmark, and France have already adopted sizes which are smaller than those proposed by witnesses, and that any sizes adopted by this country should approximate to those in force already amongst the other nations interested in the fisheries of the North Sea. Further, that the adoption of larger sizes than those recommended would bring great hardship upon many of the poorer fishermen who fish near the shore in the smaller class of boat. The sizes recommended are eight inches in extreme length for soles and plaice, and ten inches for turbot and brill.

Having had the honour of giving evidence before this Committee, and having said that the Committee rejected the proposals of all witnesses as regards the size-limit of flat fish, I have already implied that I disagree with the Committee's position. At the risk, therefore, of being considered somewhat dogmatic, I would venture to say that my argument may be briefly cited thus :—Fishes spawn in different localities at different sizes. In no locality round the British coast do any of the fishes specified by the Committee spawn at the sizes given. It therefore follows that the prohibition of the landing and sale of fishes under these sizes cannot have any great effect upon the actual numbers of the fishes—will do little towards increasing the food supply. The benefit derived will merely be that fishermen will necessarily sell only the fish of a higher price than those prohibited, and that minute fish will have a slightly better chance of growing larger. The effect will be an insignificant one on the market; the fisheries will practically remain as before.

I do not propose to go into the vexed question of sizes; but to any one regarding the subject from the scientific point of view, which I have tried to show is the only rational one in this case, I think it should be evident that the thorough preservation of the immature examples of even a very few species, such as soles and turbot, is of far greater value than the regulation of the destruction of a number of species.

I now desire to call your attention to an entirely different class of fishery—one which is receiving marked attention at the present day, and should have received much greater attention in years gone by. I refer to the shell-fish fisheries of our foreshores and shallows.

Every one must be familiar with the fact that the oyster and mussel fisheries of the British Islands have for many years been undergoing a steady decline.

The oyster-beds of the country may, indeed, be spoken of as having reached a state of absolute unproductiveness, with the exception only of a few isolated fisheries which have been entirely under the care of companies or individuals.

To illustrate the change which has taken place, I cannot do better than give you a story I heard the other day, in which a gentleman, recalling the days of his boyhood, said that in Lanark, in 1835 or 1836, he saw two carts filled with "Pandore" oysters unyoked in front of the Auld Kirk at the foot of the High Street, where the two fishermen sold their "caller oysters" at from 15d. to 18d. the hundred. The very poorest oysters now sell at 18d. the dozen; Whitstable natives at 5s. the dozen in the best London *cafés*.

Mussels, through being more plentiful in their distribution round our coast, and probably also because they are looked upon as bait rather than food, still remain with us, although greatly reduced in numbers.

By an international agreement, which took place early in the present century, the Government of this country has a legal right over the sea-bottom for a distance of three miles from the coast-line; in other words, the sea-bottom within the territorial limit is part of the land of this country covered by sea. This tract of land is held by the Crown. In certain instances, however, portions of it have been handed over to individuals or companies, and are now held by right of title or Royal Charter; in other cases there may be a certain control exercised over beds by reason of prescription, or by ancient practice of more or less valid authority.

The Crown itself has never controlled the fishing of the beds, and in the absence of any Government regulations the public have had free dredging over all non-chartered scalps. An analogous situation might be found by imagining that the British public had free shooting over the length and breadth of the land, provided they did not disturb the preserves of private parks. The natural result has been that our mussel-scalps are overfished, and our oyster-beds rendered of little or no value.

If we want to see what can be done by a careful management of foreshores and sea-shores, we have only to look towards France (where the once depleted oyster-beds have been largely re-stocked by Scotch oysters), or to Belgium, Italy, or the United States.

The systems of oyster-culture adopted in these countries are well known, and need not be dwelt upon here. The point which I would rather indicate is the contrast between the wise organisations of foreign Governments and the lack of any facilities for oyster-farming in our own land.

If we study the arrangements of France, we find that the Government *keeps full control over the foreshores*, and not only retains oyster-grounds as its own property, but prohibits indiscriminate dredging; and recognises the fact that *the system of renting the sea-bottom and foreshores to individual culturists is productive of the best results both to the fisheries and to the general public.*

This, in my opinion, is the great secret of France's success. It is the system adopted everywhere between landowners and farmers, and, it seems to me, it is the natural system to adopt with regard to the farming of shell-fish in the sea.

In England, where Sea Fishery Districts have already been created, the various committees have power to close beds to dredging, to make close-times, and to specify the particular modes of fishing to be employed on the beds under their jurisdiction.

The exercise of such powers is very valuable in retarding the process of depletion and preventing the extinction of the oysters or mussels; but if the scalps have become absolutely barren, if the enemies of the shell-fish have gained entire possession of the beds, mere protection and regulation will do nothing to restore prosperity. Actual cultivation alone can do this.

To the regret of some of the English committees, such cultivation requires the expenditure of money, and in this particular they have little power. They cannot spend money in any speculation of a commercial sort, nor can they procure from the Board of Trade a right of Several Fishery, which would place them in the position of proprietors. Moreover, the Board of Trade, unlike the supporters of the Sea Fisheries (Scotland) Bill, of which so much has recently been heard, appear to be unwilling that the District Committees should have more power in this respect.

With regard to the bill just mentioned, whatever the general opinion may be with reference to local representation and assessment, the clauses which deal with our bait-fisheries should interest all those who care for the welfare of our fishermen and fisheries; and I think we should rejoice if the proposals at present engaging the attention of both Houses of Parliament take some definite shape likely to lead to the proper care and cultivation of our shell-fish scalps.

Some present may not be aware of the enormous importance of an ample supply of suitable mussels for the 12,000 short-line fishermen of Scotland. This may, perhaps, be most readily appreciated when I say that it has been estimated[1] that 50,000 *tons* of bait are necessary to supply the annual need of the fishermen of the east coast, from Berwick to Inverness, and that great quantities of mussels are regularly imported from Holland and elsewhere to supply the deficiency in this country.

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[1] Fullerton, J. H., *Eleventh Report S.F.B.*, App. F., p. 53.

58
56
54
52
50
10
ATLANTIC OCEAN
Rockall Depression
1000
500
Slyne Hd
R. Shannon
Kerry Hd
Blasket Is
Dingle Bay
Kenmare R.
Bantry Bay
Mizen Hd

SKETCH MAP OF BRITISH SEA FISHERIES,

ILLUSTRATING MR. W. L. CALDERWOOD'S PAPER.

The Edinburgh Geographical Institute

J. G. Bartholomew

Even when mussels are not brought from abroad, they have to be carried great distances in our own country, and are an increasing source of expense to our fishermen, who can ill afford to spend much in this way, but who *must* have bait for their hooks.

When we reflect that there is no reason why such a state of things should exist, that there are numerous natural mussel-beds all along our coast, and that mussel-culture presents no very serious difficulties, we are bound to feel that our fishermen are suffering an unnecessary hardship, and that we should take the part of an intelligent people, and fully appreciate what is required in order to cope with the circumstances which result from our advanced nineteenth century competition and our former negligence.

In reviewing our sea fisheries in relation to advance in modern times, I have endeavoured to show the wide range—geographically—over which the industry now exercises influence, and to bring to your notice the questions which, at the present day, are of special interest and importance. I have looked at these questions mostly from a biological point of view, in the firm belief that fishery problems must be worked out with the aid of this science.

In closing, however, I shall venture to express an opinion with regard to the combination of science and fisheries which is justified, I consider, by the experience of past years. In the marine laboratories and hatcheries which have sprung up of late, it has very naturally become the custom to combine the investigation of fishery problems with the study of pure science in the departments of zoology, botany, and physics. A marine laboratory gives facilities for both applied and unapplied science; but the results which accrue do not, I think, represent the benefit which might arise if each branch was kept separate from the other. Fishery investigations are directly for the public good, and, therefore, according to our modern views, should be, and are, carried on at public expense. With purely scientific research this is not so, and, moreover, the publication of purely scientific papers amongst the more commonplace reports of fishery investigations is not to the advantage either of science or fisheries.

As Britain has spread her fishing-nets over the length and breadth of the surrounding seas, so she must acquire a knowledge of all that makes for the protection and increase of her power and prosperity. While our neighbours on the Continent and our cousins beyond the Atlantic keep abreast of the times in zealous care of their fisheries, we, with our enormous floating population, should see to it that the reproach which it has been possible for some to cast at us in the past should be wiped out of mind by what we achieve in the future.

THE TEACHING OF GEOGRAPHY AND SOCIAL SCIENCE.

By Paul de Rousiers.

I.

The teaching of Geography has been considerably modified during the last few years. I still remember the dry lists of names that were placed before me in my childhood, and constituted what were supposed to be lessons in geography. They were a curious jumble of proper names, in which all the straits, capes, and gulfs of a part of the world were passed successively under review: the Skagerack, Gibraltar, the Bosporus jostled themselves together in the memory of the pupil, who knew not where to locate them, for geography was taught chiefly from books. Atlases were only consulted by the curious; the pupil knew his lesson well if he could declaim, without any show of interest, the enumerations of the book—for instance, recite in one breath all the capes of Europe from the North Cape to Matapan.

This method has wisely been abandoned. Now school-children work with atlases, they have large wall-maps in their class-rooms, and are asked to identify the names they learn with the points to which they refer. Moreover, it is sought to render the study of geography interesting, and for that object all that is necessary is not to remove the interest that the study naturally possesses. The pupils are shown something of real geographical science, that is, the description of the Earth; they are initiated into the history of the formation of continents and of the upheaval of mountains; they are told why a large river exists in one place, a dry and sandy desert in another; and thus the geographical details stored in the memory are connected together by a rational method. They perceive that the snowy peaks and large streams have not been distributed at hap-hazard over the surface of the globe, but recognise in their situations a consistent plan and the effects of general laws.

By this method progress is made in two directions at once: in the direction of science, in the first place, for a knowledge of some of the laws which produce order in the universe is substituted for a mere exercise of the memory; and also in the system of tuition, because the instruction is better and more easily conveyed. But on entering on this new and more efficient course, the teaching of geography has met with a difficulty which was unknown to the old method, and is a consequence of the very progress that has been made—namely, risk of confusion.

Formerly physical geography comprised only the position of the country under consideration, its limits, latitude and longitude, its orography and hydrography, and its outline—capes, gulfs, and straits. To this was added, under the name of political geography, an account of the administrative divisions; and this was all.

But now a very different view is taken. It has been thought—and, indeed, justly—that the description of the Earth should not be confined within such narrow limits, and accordingly details relating to a number of other subjects have been gradually introduced into geographical works, and even into atlases.

First of all, we will notice geology. The external form of the Earth, the quality of the surface soil, and the nature of its composition are so closely connected with the subsoil and geological changes that the latter cannot be entirely ignored by geography. And, again, is it not in the subsoil that are found coal-mines, mines of metallic ores, and petroleum pits, the presence of which is the cause of important modifications of the surface, and has a direct interest for the inhabitants of the globe? A certain knowledge of geology seems, therefore, necessary for a thorough investigation of the Earth.

Meteorology also claims a place. We cannot be said to know the Earth and how it is constructed, if we are ignorant of the phenomena of heat and cold, their intensity and duration, their influence on mankind, and the reciprocal actions of the domain of the winds and the domain of the waters—in one word, all the atmospherical conditions to which the inhabitants of the world are exposed. According as you go to the Antilles or Canada, to India or Siberia, you have to protect yourself from extreme heat or extreme cold, so that your mode of life is thereby completely changed. The persistence of certain winds produces arid desert, while the beneficent influence of others contributes to the fertility of the soil. Certain parts of the globe are devastated at frequent intervals by fearful hurricanes. How can such important facts be passed over in silence? And, without carrying the inquiry too far, we may ask what is the influence of climate on the products of the soil, on the physical constitution of the human race and of animals. For all these reasons it is indispensable that geography properly so called should be furnished with information regarding the atmospheric envelope.

Similarly, it must give an account of the vegetable and animal productions of each country. It must not be forgotten that the Central Asian plateau is a vast grassy steppe where graze, according to the nature of the herbage, herds of horses or of goats; that the reindeer alone can make its home on the *tundras* of Siberia; that the forests of equatorial America harbour only birds. These are not merely curious details, but are the essential features of the physiognomy of each of these countries, which differentiate them completely from neighbouring lands; and it is through them that the pupil is enabled to grasp their character and distinguish between them. Unless the professor gives due prominence to each of these features, the attention of the pupil will soon flag, crushed by the monotony of a lifeless and colourless enumeration. Should the pupil surmount this obstacle, should his memory be able to treasure up a series of encyclopædic data, he will have no notion of the realities that underlie the proper names. To him an Arab, a Laplander, a Chinaman, a Fuegian, a Maori, a Belgian, a Dahomian, and an Englishman will differ from one another only by the vagaries of individual wills; he will have no conception of the different physical surroundings in which they move. He should, therefore, be shown by pictures taken from life how the activity of man is reduced to fishing and the keeping of herds of reindeer on the shores of the Arctic Ocean, to the chase of small game in the valley of the Amazons, and to pastoral pursuits on the steppes; how, on the contrary, countries which yield a variety of products are the field of progressive civilisation and unlimited modifications.

In this way geography has summoned to its aid geology, meteorology, botany, and zoology in succession. Each of these sciences has, indeed, furnished contributions to the knowledge of physical nature.

Though the introduction of these four new factors is perfectly legitimate, it is bound to bring with it a certain degree of complication, especially in the study of geography; and yet nothing has so far been mentioned which goes beyond the range of the physical knowledge of the Earth—of descriptive geography.

But the Earth is more particularly interesting in its relations to mankind, and the elements that nature contributes to the activity of man are not generally apparent except when brought into the service of that activity. Not content, then, with considering the Earth as a planet to be described like any other, geographers have described it as a planet inhabited by man, and the great work on universal geography published during the last few years by Elisée Reclus bears the secondary title, *La Terre et les Hommes.*

It is curious to notice how, little by little, all social facts, to whatsoever class they may belong, have succeeded, according as they harmonise with the personal inclinations or special studies of one or other geographer, in finding their way into geographical works by this wide-open door. From the moment that man was introduced on to the stage, the whole social system entered with him.

Let us consider, for example, what that rather vague term, economical geography, which now appears in every book and atlas, includes: firstly, the resources of all kinds presented by nature—that is to say, a detailed description of mineral, vegetable, and animal products; then the ways in which man makes use of them—grazing, fishing, hunting, harvesting, agriculture, sylviculture, mining; the innumerable industries which transform the material supplied by the initial labour; the means of transport, such as roads, canals, and railways, which facilitate the distribution of the products of different forms of labour; the commercial establishments which effect their exchange. And in each of these branches we find mention made of the precise object of the work, the machinery employed, a description of the workshop in which the work is carried on, of the manner in which it is conducted, of the staff by which it is executed, and of the ties that connect the labouring element with the managing element, which entail a review of the question of wages, hours of labour, etc. Nor is this all. The term economical geography extends beyond the labour of man to the results of that labour—that is, property, its possession, transmission, nature, and various forms. Open any book of geography compiled according to the new methods, and you will find references to all these subjects. Every one of these books does not, of course, contain exact and complete information on all these points—far from it; but they all touch on these subjects, and pronounce a general opinion, accompanied by a few details taken pretty much at random, thus giving the studious pupil the impression that he has gained some information, that he knows things of which in reality he has been able to acquire no idea whatever.

This mass of facts, added to the former, produces a very remarkable medley. It is, again, quite a different thing when we come to the inevitable chapter on manners and customs, languages, religions, etc. There the geographers allow themselves full freedom, and, according to their fancy, heap up together notices, short or detailed, sensible or puerile, on family organisation, food, dwellings, costumes, local amusements, primary instruction, universities, academies, fine arts, religious, political, military, and judicial organisation, history, language, and ethnography; it is a fortunate chance if palæontology, demography, statistics, and anthropology are not invited to the feast.

It should be remarked that this encyclopædic chaos is not restricted to large quarto volumes intended for consultation; it is found also in so-called elementary treatises of geography, in those which are drawn up in accordance with the syllabuses of examinations. In both cases the great fault of confusion is the same, the chaos is equally complete. Except in geographical dictionaries, where the alphabetical arrangement introduces an order, artificial but convenient for the seekers, works of universal geography are very difficult to consult. One never knows whether one will find the information required, nor where to find it, and, on the other hand, details are sometimes met with which have no evident connection with the science of geography. This is a great inconvenience for workers. As for pupils, the difficulty proceeds from the necessity of getting into their heads isolated facts by a great exertion of pure memory, and, consequently, without any advantage to themselves, knowledge being useful only when it can be arranged in the mind, when the fact can be grasped, understood, conceived, when its cause can be recognised.

In this state of chaos the question presents itself: Is there really a science of geography extending beyond the form of continents, hydrography, orography, and other purely physical facts? Is it an unwarrantable development to add to the old enumerations of capes and gulfs fresh enumerations relating to productions, language, the origin of races, etc.? In other words, can the study of geography legitimately concern itself with subjects of this kind?

If the present confusion were inevitable, if the new method of learning geography necessarily involved the undigested compilations and encyclopædic *résumés* that we are familiar with, the answer would not be difficult; but there is a remedy for the state of things I have noticed, and this remedy will give to the science of geography its own peculiar value, its true function, and at the same time will render the study easier and more attractive. It consists simply in introducing an element which is still absent, though so many others have been added; this element is the natural order which connects the facts studied to one another.

II.

There is no occasion to invent this link; all that is necessary is to find it, for it exists already. We have already some notion of it; we have some perception that certain climates, certain physical conditions, the abundance, scarcity, or total absence of certain productions, have an influence on various phenomena of the social system, and for this reason we insert in our geographies all kinds of details on the manners and customs of the inhabitants of each country described. It only remains to determine clearly the relations of cause and effect connecting the physical and social systems.

A similar progress has already been accomplished as regards the facts strictly relating to the description of the material world. We are not now told straight out that Africa has so many capes, so many rivers, so many peaks, but a general idea is first conveyed of the form of the continent: its massive outlines are indicated, the slight development of its coast-lines, and the consequent scarcity of bays and gulfs; then the main lines of its relief are laid down, and the existence of a vast central plateau is noticed, and the distribution of water over the surface is explained as determined by the relief. In other words, the various physical features are grouped together instead of being enumerated, and this is done, not in an arbitrary, conventional manner, but with reference to the relations actually uniting them.

Such is the true geographical method. It now remains to apply it, not only to physical facts which constitute the basis of geography, but also to social facts, which depend on and supplement the former, whether they be economical facts, political, military, historical, or others. We have emerged from chaos as regards physical facts; we must attain the same standard as regards social facts.

And, first of all, we must decide what social facts really fall within the scope of geography. At present anything and everything is inserted in chapters on manners and customs, religions, etc.—too much or too little, and sometimes both at the same time. It is essential that we should know where geography begins and ends, however universal and detailed it may be. This science must have limits like all other sciences.

To find them, all that is needed is to call to mind the reasons for giving a place to new subjects in the programmes of geography. Their admission was due to a conviction that these new branches of investigation were not unconnected with local physical conditions. These relations, then, are the origin of their presence; it is by virtue of them that they have gained recognition. This being the case, nothing is easier than to choose out of the sum-total of social facts those which have definite relations to physical conditions. All these facts have their geographical side. If the relation connecting them with physical conditions be simple, easy to grasp, and direct, they may legitimately be admitted into elementary geographical works; if, on the contrary, they are connected with these conditions by a complicated relationship, difficult to trace out or indirect, they should be reserved for more abstruse treatises.

The whole question, then, depends on a knowledge of the exact relations which obtain between physical and social facts. This knowledge has been supplied by social science since the method of observation was applied to this science, first by Le Play, and afterwards by M. de Tourville. I do not claim that social science, in its present state, gives the key to all the relations of cause and effect between all physical and all social phenomena; I mean simply that it has determined certain of them, and that it furnishes the sole means of discovering others. Like the other sciences based on observation, it is always in a state of development; but, like them also, it has succeeded in registering some interesting results. By the aid of these it is possible to select social facts and group them together as they may be required, just as with the results of physical science the selection and grouping of physical facts concerning geography may be effected.

Suppose, for example, that I have to give an elementary lesson on the Central Plateau of Asia. Let us see how I should proceed to draw out the scheme with the aid of social science. Passing over, be it understood, the physical description of the region—which refers only to the Earth—I come to what concerns man.

In the first place, I must speak of labour, for here it is in direct dependence on the physical conditions, which only allow herbage to spring up spontaneously and prohibit cultivation. Grazing only is possible; and that only with a nomad mode of life and an absence of all restrictions to free movement—that is, under a system of proprietorship in which the land is common to all. I should point out by some examples how domestic industry of a simple kind produces clothing, carpets, and other useful articles from the raw material furnished by the herd; I should describe this workshop in which the patriarchal form and traditional methods are dictated by the circumstances; I should discourse on the sovereign and indispensable authority of the patriarch, the assemblage of the young households round the same hearth, and the habits of respect and docility resulting from this arrangement. I should also give some details concerning the food, of which milk is the sole basis; on the movable tent, so different from our houses of stone and brick; on the style of dress; on amusements; on instruction; on the absence of any higher authority than that of the family; on the historical *rôle* of these pastoral peoples, able in consequence of their nomadic habits to transport themselves *en masse* wherever grass is to be found by the way, indifferent to cold or heat owing to the extremes of temperature that occur on the Great Steppe. In short, I should give a lesson in which social facts would occupy a prominent place, because, on this soil, unchanged by human activity, they are most intimately connected with local conditions.

I should proceed differently had I to deliver a lecture on, say, England, a country where the soil has been thoroughly transformed by the labour of man. Here the part played by nature shrinks into the background, and human action is much more important. Nature determines primarily the sphere of action in which man moves, but man, gradually extending his power over nature, enlarges this sphere artificially. He not only modifies the surface soil by cultivation, but he descends into the bowels of the earth in search of coal, a new material for his activity. He elaborates natural products by costly and complicated processes; he creates means of rapid communication which change the physiognomy of the country and annihilate distance. He orders his life in a thousand different ways according as he is a cultivator, a manufacturer, a sailor, trader, etc. The variety of conditions proceeds from a complicated state of society, and the exertions of man tend to break down the opposing barriers of nature, so that the social state is both less easy to describe and less intimately connected with local conditions.

We see, then, that the number of social facts which properly fall within the geographical scheme is more restricted. All that remains is to point out what assistance man has derived from nature to second his victorious efforts, and what modifications he has forced on nature in order to obtain his ends. I should remark, for example, how the presence of coal has favoured the development of industry, and how an insular position has stimulated maritime commerce, navigation, and the divers modes of transport, because the results have a geographical interest in that they bring together countries separated from one another by situation; but the details of the progress have little to do with the physical conditions, and the ties that unite them are too loose, too complicated, or too indirect to be mentioned in an elementary lesson. I should not, therefore, explain to pupils the social organisations of England as I should the social constitution of the shepherds of the Great Steppe. I should content myself with alluding to this complicated system, the fruit of the long-continued efforts of man, and hence lying without the bounds of geographical study.

It must not be supposed that complicated social systems owe nothing to geography. Even in those manifestations of human energy which are least dependent on nature, the latter leaves its trace; but, instead of exerting a decisive and preponderating influence, it appears only as an occasional and subordinate force. For instance, commercial and financial combinations, the inspirations of literature and the fine arts, seem to be personal aptitudes capable of transportation to any part of the world; and yet it is recognised that the great routes of commerce are dependent on geographical facts, and that the centres of exchange are favourable to the development, and indispensable to the exercise, of the special faculties which evolve these combinations. It is equally certain that pastoral peoples are more disposed to reflection and to intellectual work than the agricultural; that music develops itself more easily in societies where the families live together in groups, than where they are isolated, etc. Commerce, literature, and the fine arts may find a place in geography as far as they are subject to the influences just stated.

Well, then, according as the society is in a primitive state, confining itself to the gathering in of the spontaneous products of the soil, or a complicated organisation transforming the soil and its products, the geographer should modify his method of exposition. In the first case, he can define the effect of the physical conditions, because it is direct and uniform, and consequently is complete in itself. In the second, he should, on the contrary, proceed by the help of subordinate reflections, laying before his readers or pupils the influence of such and such a local circumstance, wherever it manifests itself, and with regard to the facts on which it acts. Thus a perfect harmony will exist between the fact itself and the manner in which it is presented.

We understand sufficiently, by the example of the Great Steppe cited above, how countries with a simple form of society may be depicted. It will also be at once admitted that social facts have a place in a more complete and detailed study of geography. It may not, however, be so clearly understood how they can be admitted into an elementary lesson without overburdening the memory and exhausting the attention of young pupils. Nevertheless, I am convinced that they are, on the contrary, an aid to memory, and can rivet the attention of a child ten years old of average intelligence.

I have made the experiment personally, on a limited scale certainly, but I have found the method successful. I teach geography to my children, and I always notice that they retain much more accurately those geographical facts of which I have pointed out the interest from a social point of view. I am not speaking only of such as act uniformly and immediately on simple societies, as the aridness of the deserts, the herbage of the steppes, the warm moisture of the equatorial forests, or the glacial temperature of the Siberian *tundras.* I allude also to small details, which exhibit a perceptible influence on one or other of the phenomena of life in highly organised communities.

For instance, the geographical position of certain towns or countries easily explains their commercial development. The peculiarity of their geographical position, which appears to have the greatest influence and which is the most easily comprehended, should always be thrown into relief. Thus, if you explain to a pupil that Bremen and Hamburg are placed at the mouths of the Elbe and the Weser respectively, in front of the peninsula of Jutland, which intercepts the entrance into the Baltic, and that consequently they stand at the natural point for the unloading of merchandise coming from England, France, Spain, the Mediterranean, India, China, and the New World and consigned to German markets; if you endeavour to show him the natural advantages of these circumstances; if you make him thoroughly understand them by varying your explanation in all imaginable ways, until you perceive that the idea is thoroughly fixed in the child's head, you may be sure that he will not easily forget the exact position of Bremen and Hamburg, their commercial importance, the points where the Elbe and the Weser enter the sea, their curvature towards the east, the form and position of Jutland, and all the other purely geographical facts that your explanation has grouped together, and of which he has been shown the connection. In this way the indications of the map are inspired with life, and become interesting to the pupils. Similarly, you can make them perceive that Portugal, the most commercial part of the Iberian peninsula, commences on the east exactly at the points where the Spanish rivers become navigable; that Montreal, the commercial capital of Canada, has been built below the rapids of Lachine, at the place where the St. Lawrence presents an almost impassable obstacle to vessels ascending the river; that Venice at the period of its splendour, when land carriage was difficult and navigation in its infancy, constituted a convenient emporium for commerce between the Orient and Occident, thanks to the deep indenture of the Adriatic.

Neither are you precluded from giving political sketches. You can very well explain to children of fifteen years of age that the neutrality of Switzerland is to a great extent due to its physical configuration and to its situation, just as its democratical constitution has its origin in the equality of conditions produced by the poverty of its soil.

And, when you come to new countries, why not cite the advantages or obstacles which their various physical characters present? It is a simple matter to show that the continental climate of Australia, a land compact in form, is unfavourable to the colonisation of its inland tracts, while the narrow islands of New Zealand offer at all points the conditions of humidity favourable to cultivation. You can point out the part played in colonisation by the mines of California, which gave so much notoriety to that state, and attracted workmen who afterwards became cultivators. What singular reflections can also be made on the immense valley of the Mississippi, formerly only a hunting-ground for the Indians, but now become one of the granaries of the modern world! The vast tracts without forest, sometimes even without stones, would have been difficult to turn to account if rapid steam transport had not been introduced to connect them with the forests of the north and the industrial districts of the east. There is no end, indeed, to the examples that might be given, but I wish only to show that the method of procedure is easily applicable.

But that is not its only advantage. The substitution of a rationalised method for one purely mnemonic has, besides, the invaluable merit of showing the pupil the interest of what he learns, of educating his mind at the same time that it furnishes his memory with useful knowledge. Geography then would not only profit by a method which perfects it and systematises it; children who are obliged to study it would also find an excellent opportunity of developing their intelligence and strengthening their reasoning faculty.

It is worth noticing that by becoming more scientific the study of geography becomes also easier and more attractive.

OBITUARY.

The last of the noted African explorers of the previous generation has passed away, and we much regret to chronicle the death of Sir Samuel White Baker, which took place at Orleigh, Newton Abbot, on the 30th of December 1893. He was born in London in 1821, and thus was 73 years of age.

Baker was a Gloucestershire man, but was principally educated in Germany. Throughout his life he was an energetic traveller. A man of fine physique, he was not only a noted sportsman, an engineer, an explorer, and an administrator of no mean ability, but he possessed great literary ability, and his books have been, and still are, widely read. We may notice here a few of them: *The Rifle and Hound in Ceylon* was published in 1854, followed in the next year by *Eight Years' Wanderings in*

Ceylon. The next book to make its appearance was *The Nile Tributaries of Abyssinia and the Hamran Arabs.* Then followed the account of the discovery of the second great lake of the Nile, Albert Nyanza, and afterwards *Ismailia.* His last work was one on *Wild Beasts and their Ways*, published three years ago. Baker had a decided bent to science, chiefly to natural history, and his works abound in proofs of keen observation and touches of graphic description, so much so, indeed, as to render them classics.

When only twenty-six years of age, Baker founded a settlement in Ceylon, among the mountains at an elevation of 6200 feet, and took out a considerable number of emigrants from England. He sought out and conveyed to the settlers the breeds of cattle and sheep most likely to thrive in the mountains. The new colony, named Nuwara Eliya, made considerable progress, and, though it perhaps did not fulfil all the expectations of its founder, it has not proved a failure. For eight years Baker resided in his new colony, and then in 1855 found scope for his abilities in the organization of the first Turkish railway.

But the chief interest of his life naturally attaches to Baker's African explorations.

Accompanied by his second wife, a Hungarian lady, he started on his adventurous exploration of the Nile in the spring of 1861. By the time he had reached Berber he came to the wise conclusion that it was advisable to learn Arabic before attempting the further ascent of the river, and consequently he spent a year in exploring the Atbara, Settit, Royan, Salaam, Angrab, Rahad, and Dinder. Then, after overcoming with matchless tact and energy the obstacles set in his path by Egyptian officials, he ascended the Nile to Gondokoro, meeting Speke and Grant, on the 15th of February 1863, on their return home from their discovery of the Victoria Nyanza; and being told by them that they had not been able to see the little Luta Nzige Lake, nor to follow the western bend of the Nile, he determined to go and complete their exploration, which he did after suffering unspeakable hardships which taxed both him and his courageous wife to the very uttermost. He went as far south as Mruli, crossed Unyoro to Vacovia, skirted the eastern shores of the lake, which he named the Albert Nyanza, discovered the Murchison Falls, and returned to England in 1865, when he received the gold medal of the Royal Geographical Society and a well-earned knighthood. Many of the difficulties and dangers which beset his path were caused by the slave-dealers at Gondokoro and its neighbourhood, and it was principally his exposure of the horrors of the slave-trade that led to his being appointed Governor of the Sudan, and sent in 1869 with absolute power to annex the country which is now so well known as the late Equatorial Province of Egypt. Again he was accompanied by Lady Baker, and also by 1500 troops. By the end of 1873 he had accomplished his mission, and had, nominally at least, annexed the country as far as Unyoro, and founded fortified stations, the most important of which were Gondokoro and Fatiko. This expedition was very costly, and the loss of life it entailed was considerable, but there is no doubt that it laid a firm basis upon which Gordon Pasha, and later on Emin Pasha, built.

Baker's personality, his prowess as a hunter and his inflexible will, made a deep impression upon the natives. A traveller, who recently returned from Uganda, told us that his memory was still green there, and the writer of this notice, when travelling through the districts where Baker's name may be said to be a household word, was greatly struck by the way in which "Mlidju," or the big-bearded one, and "Njinyeri," or star, as Sir Samuel and Lady Baker were called, were reverenced and almost raised to the rank of deities. Probably of all the travellers in that region, they will live the longest in the memory of the people, and in his own country he will ever be remembered as one of the most noted explorers of the nineteenth century.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings held in January.

On Jan. 4th a meeting of the Society was held in the Queen Street Hall to draw attention to the necessity for further exploration in the Antarctic regions. Dr. C. W. Donald, Mr. W. S. Bruce, and Mr. W. G. Burn-Murdoch gave accounts of their experiences last winter on board the Dundee whalers; and Dr. Buchan, Professor Cargill G. Knott, and Professor Geikie pointed out some of the advantages to be looked for from an expedition to the South Pole. Professor Geikie, as Chairman, then proposed the resolution published on page 68, which was unanimously carried.

Mr. W. L. Calderwood, F.R.S.E., gave a lecture on "British Sea Fisheries and Fishing Areas, in view of recent National Advance," at Glasgow on Jan. 8th, at Edinburgh on Jan. 18th, Aberdeen Jan. 24th, and Dundee Jan. 25th.

The Edinburgh Chamber of Commerce courteously invited the members of this Society to two of their meetings. One was held on Jan. 19th, when Mr. R. A. Lockhart, Chairman of the Chamber, delivered an address on "The Cape: its Colonies and Commerce." The other took place on Jan. 25th; on this occasion Mr. A. R. Colquhoun, late Administrator of Mashonaland, lectured on "Matabeleland."

Meeting in February.

On Feb. 8th, at 4.30 p.m., Mrs. Grove will deliver a lecture in Edinburgh on the "Southern Regions of Chile," which she will repeat in the hall of the Philosophical Society, Glasgow, at 8 p.m. on the following evening.

GEOGRAPHICAL NOTES.

By The Acting Editor.

ASIA.

Rainfall in Persia.—In *Symons's Monthly Meteor. Magazine*, No. 334, are given the rainfall measurements of Mr. A. Hontum Schwindler at Teheran. These were commenced in 1891, and are complete only for the year 1892, when the total fall was 9·45 inches. On receiving those records the editor was under the impression that they were the first made in Teheran, but he subsequently discovered a series of observations made by Dr. Tcherepin between 1883 and 1888, and published by the Russian Government. The average fall of four of these years, for which the records are complete, is 11·64 inches. The fall during June, July, August, and September is very small : in two of the above years there was no rain at all during these months. At Bushire observations have been regularly conducted from 1878 onwards, and published in the volumes on the meteorology of India. The annual mean from 1878 to 1890 was 12·96 inches. The table shows great variations, the amount recorded in 1885 being 23·65 inches, while it was only 4·86 in 1878 ; 1889 was also a dry year, with only 6·59 inches. During all these years no rain fell from May to October inclusive, except in May 1889 ; and then the depth was only ·12 inches. At Urumiah, 7334 feet above the sea, observations continued during one year gave, according to Loomis, a fall of 21·51 inches. Lenkoran, on the Russian shore of the Caspian, and Muscat are outside the Persian territory, but are near enough to make their records useful. At the former station observations for the nine years, 1848-56, gave an annual mean of 47·40 inches, and those for the six years, 1874-78 and 1880, a mean of 45 inches. At Muscat the fall in the season 1883-84 was 7·24 inches, and 4·98 inches in 1884-85, scarcely any rain falling except between November and March, both inclusive. From the above the editor concludes that the mean fall at Teheran is probably between 11 and 12 inches ; that nearly all of it falls in the winter half of the year ; that north of the great mountain range between Teheran and the Caspian the fall is nearly four times as great ; that the amount and distribution at Bushire is much the same as at Teheran ; that at Muscat the fall is very small, and analogous to that of Karachi. He expresses his regret that no records are to be found for Ispahan.

Meteorological Observations in North Borneo.—In the *British North Borneo Herald*, August 1893, Dr. J. H. Walker publishes his report for the year 1892. He obtained records more or less complete from nineteen stations—a larger number than in any previous year. Daily maximum and minimum temperatures were recorded at eight stations, and show that the mean daily maximum was below the average of the preceding three years at all the stations, and also the minimum, except at Kudat. The highest mean annual temperature, 81·56° F., was recorded at Labuan, and the lowest, 78·75°, at Limbuak, while the mean of all the stations was 80·55°. At Sandakan and Kudat south-easterly winds were the most prevalent, next to which the most frequent were south-westerly at Sandakan and north-easterly at Kudat, though south-westerly were very nearly as common here as the north-easterly. The temperature of evaporation at Sandakan was slightly below the average of the previous three years at 9 A.M., and slightly above it at 3 and 9 P.M., while the vapour tension was a little above the average and the relative humidity 3° higher. The rainfall was decidedly above the average. As regards distribution, the most notable points were an exceptionally dry February and rather heavy falls in April (usually the driest month in the year) and in August. The annual fall varied from 162·83 inches in Labuan to 73·79 at Lahad Datu. The heaviest fall in one month was 39·96 inches at Labuan, while 8·46 inches fell in a single day at Papar, in August.

The Origin of Celebes.—Dr. Arthur Wichmann is the author of an article on the lakes of Celebes in *Petermann's Mitt.*, Bd. xxxix. Nos. 10-12. Professor A. R. Wallace, in the *Jour. of the R. Geog. Soc.*, 1863, compared Celebes to Borneo, affirming that a subsidence of a few hundred feet would reduce the latter to a shape very similar to that of Celebes, and that this island, by the filling up of the deep gulfs between its radiating lines of mountains, was advancing towards the present condition of Borneo. Peschel, on the other hand, considers that the contrary process has been going on, that the singular peninsulas of Celebes are but the skeleton of an island which once exhibited the compact form of Borneo. Dr. Wichmann rejects both these views. On the one hand, an elevation of 600 or 700 feet would not essentially alter the form of Celebes, while, on the other, Tertiary deposits, though of less extent than in Borneo, are yet present, and preclude us from speaking of the existing elevation as a skeleton. Nor is the orography similar in the two islands. Though the mountains of Borneo are represented on maps as forming a regular radiating system of ranges, in reality they consist of a number of larger or smaller groups surrounded and connected by hilly country, whereas in Celebes continuous ranges rise immediately behind the narrow strip of coast land. While the mountains of the former are of ancient origin, those of Celebes are evidently of recent date, and are composed of folded and uplifted strata ; they owe their existence to eruptions in the Tertiary and Post-Tertiary periods.

Starting from Mindanao, two lines of volcanic action run southwards, at first parallel to each other and then diverging. The one, commencing at the Bertulan, near the south extremity of Mindanao, passes through the Sarangani and Sangir islands to Minahassa ; then turns south-westwards to Bolaäng-Mongondou, and proceeds westwards to Boliohutu ; thence it apparently crosses the Gulf of Tomini to the Togian islands, some of which are certainly of volcanic origin. The further course of this line is unknown. The other cleft passes from Cape San Augustin, in Mindanao, through the Nanusa islands and Kabruang, the most south-westerly of the Talaut islands, to Halmaheira, and is continued in the Moluccas—Hiri, Ternate, Tidore, etc. The similarity which, in general, obtains between the formation of Celebes and Halmaheira is due to the parallelism of the fissures which run, some in a meridional, and others in an equatorial direction. These lines of fissure not only affect the outward form of Celebes, but are intimately connected with its construction. The enormous displacements have given rise to depressions, the study of which may throw a light on the history of the development of this remarkable island. In many of these depressions lakes have been formed, and Dr. Wichmann has collected the observations of numerous travellers with a view to determining their origin. The chief of all the known lakes is that of Tondano, which lies in the northern peninsula at a height of 2270 feet above the sea and has an area of nearly 18 square miles and a maximum depth of 67 feet. It contains a very poor fauna of purely fresh-water types. Dr. Wichmann, after passing in review all the information that has been acquired, concludes that it has arisen from the damming up of its basin at a date not earlier than the Pleistocene age. To the north-east lies the circular lake of Linou, 765 yards in diameter, where solfataras still exist, and which is undoubtedly a crater lake. Again, the lake of Limbotto, near the southern coast of the peninsula, is the remains of a gulf which was formed by the bursting of the sea through the low coast range. It is nearly rectangular in shape, covers an area of 27 square miles, and has an average depth of not more than $6\frac{1}{2}$ feet. The largest known reservoir of Celebes is the Posso lake, 433 square miles in area, and lying at an elevation of 1000 feet. Its origin is uncertain, for, while A. B. Meyer has found in the Kromposo river, which drains the lake, stones of augite-andesite and basalt, Van Hoëvell asserts that the northern shore certainly belongs to the Tertiary formation. Of many others of the lakes of the island so little is known that no definite opinion of their origin can be expressed. Dr. Wichmann gives full particulars of each lake, its position, the nature of the surrounding rocks, area of the drainage area, etc., as far as these data have been ascertained, and his article is accompanied by maps showing many new features.

AMERICA.

The Okefenokee Swamp in Georgia.—By the draining of this swamp, which lies on the south-eastern boundary of the state, bordering on Florida, 220,000 acres of arable soil will be won and the sanitary condition of the neighbourhood will be much improved. The construction of a canal to carry off the water into the St. Mary's river has already been commenced ; it will be fed by a system of secondary canals. Numerous remains of primitive Indian dwellings have been found, as well as several tumuli and fragments of crockery.—*Deutsche Rundschau*, Jahrg. xvi. Heft 1.

Southern Chile.—Dr. Steffen has lately made known the results of a journey by Robert Christie, accomplished as long ago as 1884. Christie succeeded in crossing the Cordilleras to the south of the volcano Tronador (10,000 feet high). It stands at about 41° S. lat., to the north-east of Puerto Montt. He then followed the valley of the Rio Concha, which flows into the lake Cayutue, to a point called Las Juntas, where a tributary enters the river from the south-east. Following the tributary, he came to a pass 2900 feet high, by which he gained the valley of the Rio Cochamo. This river guided him eastwards to a pass 2635 feet high, beyond which lay a series of lagoons connected with the river-system of Argentina.

Another more important exploration was accomplished last year by Dr. P. Stange, who from Osorno, a railway station to the south of Valdivida, over a pass never before scientifically explored, reached the lake Nahuel-Huapi. Thence he proceeded eastwards to the lake Puyehue, and followed its southern bank to the eastern extremity, where the river Gogol enters. Up the Gogol and Rio Colorado valleys he gradually ascended to the watershed, 5000 feet high, descending the steeper Patagonian side by the Rio Hondo and Rio Correntoso, the latter of which flows into the Nahuel-Huapi lake. Returning to the Puyehue lake, Dr. Stange travelled ten miles southwards to the Rupanco lake, crossed it, and passing round the Laguna del Estanque, reached the Coihueco, a tributary of the Rahue. The region traversed had been only superficially explored by Döll and Señoret. Dr. Stange has drawn a correct map with compass and chronometer, and has made observations on the geology of the country and the upper limits of vegetation.—*Globus*, Bd. lxiv. No. 23.

AUSTRALASIA.

D'Entrecasteaux.—On November 17th the Paris Geographical Society held a meeting to commemorate the centenary of the death of this famous navigator. Baron Hulot gave a sketch of his life. Antoine Raymond Joseph de Bruni d'Entrecasteaux was born in November 1737. Entering the navy in 1754, he distinguished himself at the battle of Minorca, when Admiral Byng was defeated, and in 1785 set out from Brest on a diplomatic mission to China, which he reached after an adventurous voyage in February 1787. In the autumn of the same year he arrived at Port Louis as Governor-General of the Iles de France and Bourbon (Mauritius and Réunion), in which post he showed great impartiality, foresight, and capability.

His fame, however, rests chiefly on his achievements in Australasia, whither he was despatched in 1791 in search of Lapérouse, of whom no news had been received for three years. With two vessels under his command, the *Recherche* and *Espérance*, he set sail on September 29th, and, passing the Cape, determined the position of the Isle of Amsterdam on March 29th in the following year. He came to the south coast of Tasmania at Storm Bay, and discovered Recherche Bay, D'Entrecasteaux Channel, and the island of Bruni. From observations of the currents he concluded that Van Diemen's Land was an island, which was proved to be a fact by Bass, a few years later. In June he reconnoitred New Caledonia, discovered the island of Huon, named after Huon de Kermadec, commander of the *Espérance*, and reached by St. George's Channel the Admiralty Islands, where he hoped to find the shipwrecked crews of the *Boussole* and the *Astrolabe.* The search proving fruitless, D'Entrecasteaux conducted his expedition to Amboina, where he gave his crews five weeks' rest. In October 1792 he reached the southern shore of New Holland at Cape Leeuwin, and gave names to D'Entrecasteaux Point, the Recherche Islands, and Espérance Bay, and skirted the coast to about 132° E. Returning thence to Tasmania, he sailed on February 27th, 1793, to New Zealand, doubled the North Cape, and discovered Raoul (Sunday) Island, cast anchor on March 23rd in the port of Tongatabu, and once more visited New Caledonia, where Huon de Kermadec died. On the 19th May a small island was sighted on the east, and its position determined. It was Vanikoro, the very place where Lapérouse perished, as was proved by Dumont d'Urville in 1828. Sailing between New Guinea and New Britain, D'Entrecasteaux passed the Admiralty Islands again, and shortly after died of dysentery and scurvy on July 20th, 1793. Captain Auribeau, succeeding to the command, sailed to Surabaya in Java, where his vessels were seized by the Dutch. After his death, which took place in 1795, Lieut. de Rossel tried to reach his native country, but was taken prisoner by the British, and all the maps and collections belonging to the expedition fell into the hands of the enemy.—*Comptes Rendus*, No. 16, 1893.

New Zealand.—The *Report of the Survey Department for the Year* 1892 of the work executed during the twelve months has reached us. The triangulation and topographical surveys covered an area of 799,246 acres, most of it lying in the Auckland, Wellington, and Otago districts. Much of the work was connected with the exploration of the Copland and other rivers in Westland, with the object of ascertaining whether a practicable route existed across the Southern Alps to the Hermitage, near Mount Cook. Mr. C. E. Douglas undertook the task, and his report is published in this volume. Above the Lower Forks, where the Karangarua joins the Copland, the river rises some 300 feet in the first three miles, and is bordered by high flat terraces. Then, near the mouth of Architect creek, a flat-bottomed gorge commences, and the river-bed, encumbered with gigantic boulders, rises 600 feet in about three miles, forming cataracts here and there. At length, after a weary scramble through the gorge, Mr. Douglas and his party reached Welcome Flats, an old glacier basin, now covered partly with patches of grass and partly with scrub of ribbon-wood, black-scrub, and akeake. The surrounding scenery is magnificent; to the north Lyttle's Peak rises up in solitary grandeur, and to the south one of the wonders of Copland, "The Sierra," is visible. For a short distance above Welcome Flats the course of the river is fairly level, but then it emerges from a narrow gorge where the water falls 200 feet in a few chains. The river descends from the Strauchon glacier, having cut its way through the moraine down to the Middle Forks, the junction of the Douglas Water. The Strauchon glacier is of great extent, and descends from the slopes of Stokes' and Banks' peaks. It is so covered with detritus that the climber is hardly aware that he is marching over hundreds of feet of solid ice. It is enclosed by towering precipices along the lower part of its course, and widens out above, presenting a clear slope of *sérac* ice up to Baker's Saddle. It is probably possible to ascend this saddle, though at certain seasons the enterprise would be dangerous, owing to avalanches and falling stones; but it would hardly be practicable to make a mule or horse track over such a slope. This is much to be regretted, as the route to the Hermitage would be very short, and would open up some of the most splendid scenery in the neighbourhood. The views given in the *Report* fully confirm Mr. Douglas's estimate of its beauty

Tiger Island, near New Guinea.—Captain Dallman, writing from Friedrich-Wilhelms Hafen, reports his discovery of Tiger Island, placed on maps about eighty nautical miles to the north of Berlin Hafen. On previous occasions Captain Dallman was unable to find the island owing to its position being incorrectly given. It lies approximately in lat. 1° 45′ S. and 142° 47′ E. long. It is nearly six miles square, and is thickly peopled with a fine race of light colour. They seem unacquainted with the use of iron, and they do not chew betel. The island is low and appears to be densely wooded; on the coast, and perhaps in the interior, are plantations of *taro*, yams, and bananas. The island Matty, placed on the same parallel but in long. 142° 55′ E., could not be found, and Captain Dallman believes it to be identical with Tiger Island.—*Deutsche Geographische Blätter*, Bd. xvi. Heft 4.

COMMERCIAL AND INDUSTRIAL.

On December 14th the first section of the **Congo Railway** was opened. It is 25 miles long, and runs from Matadi to Nkenge.

The Canal of the Two Seas.—The plan of a canal to connect the Bay of Biscay with the Mediterranean has been laid before the French Chamber. Starting from Bordeaux, it is intended to follow for a considerable distance the left bank of the Garonne; then crossing the river, it will remain on the right bank as far as the neighbourhood of Toulouse, where it will pass again to the other side. To the south of the town it will traverse the river a third time, and terminate in the Gulf of Lyons near Narbonne. Its length will be 327 nautical miles, its breadth 48 yards, and its depth 27 feet. 22 locks will be required.—*Deutsche Rundschau*, Jahrg. 2, Heft 16.

The Siberian Railway.—As the cost of a line from Irkutsk to the Transbaikal round the lake would cost about £2,500,000, and its construction would take a long time, it has been decided to build a line 53 miles long from Irkutsk to Listvinichnoie on Lake Baikal, and to maintain communication with the opposite shore by steamers during eight months in the year, and by a temporary railway over the ice when the lake is frozen. The section Achinsk-Krasnoiarsk, 113 miles long, will also be constructed with rails brought by steamers up the Yenisei. On the Cheliabinsk and Omsk section eighty per cent. of the earthworks are completed, and the rails are laid over 160 miles out of 495. Work is also being carried on over the second division, Omsk to the Ob (326 miles), and the third, Ob-Krasnoiarsk. Of the Ussuri line the first 67 miles, between Vladivostok and Nikolskoie, are opened for traffic.—*Geographical Journal*, vol. iii. No. 1.

Petroleum.—About 36 miles to the north of Payta in Peru, in the district of Talara, petroleum is found over an area of about 1000 square miles, and for some time the extraction of the oil has been systematically carried on. Its quality is said to be as good as that of North America, and it possesses the advantage of lying nearer the surface, the deepest perforation being 400 feet, whereas, in the United States, shafts have to be sunk to a depth of 2000 feet and more. In Ecuador, also, numerous petroleum beds are known to exist, and a syndicate has recently been formed to obtain a concession of these sources. In Cachenta and in the department of Lujan, Argentina, the industry has made great progress during the last two years. In British Burma there are now 602 wells ; but there are signs of exhaustion, and since 1891 the production has shown no extension.—*Globus*, Bd. lxv. No. 3, and *The South American Journal*, Sept. 30th, 1893.

Reservoirs in the Nile Valley.—Mr. Cope Whitehouse contributed an article to the *Fortnightly Review* for November last on the question of storing water from the Nile, of which he has presented a reprint to the Society. In vol. ix. p. 187, Colonel Justin Ross reviewed the schemes for retaining the surplus water during the annual flood, by means of dams across the Nile valley, one of which involves the destruction of the beautiful temple of Philæ. But apart from this æsthetic consideration, Mr. Cope Whitehouse has many objections to urge against such plans, as the danger attending the suspension of a large volume of water above the country to the north, and the probability of germs of disease being developed in the stagnant water. The object of his pamphlet is chiefly to draw attention again to the project he has for many years advocated, and in 1887 laid before Lord Salisbury, who fully recognised the importance of his discovery. This is the formation of a reservoir in the depression of Wadi Raiyan. Major Brown (*The Fayûm and Lake Mœris*, p. 107) asserts that the waters from this reservoir might be so regulated as to "prevent the Nile minimum discharge ever falling below the 50,000,000 cubic mètres a day, in the very lowest years of summer Nile." The great obstacle to the acceptance of this project has been the cost. In February, it is expected that all the surveys relating to the possible reservoir sites at Kalabshah, Asswân, and Silsileh, will be completed, and, with those relating to the Raiyan project, will be submitted to an International Commission of Engineers at Cairo.

Haifa-Damascus Railway.—The recent opening of the Joppa-Jerusalem Railway and the Sultan's sanction for English and French lines of railway to Damascus seems to point to the fact that the Turkish Government is more wideawake than we are generally led to believe. The construction of the English line, engineered by Sir Douglas Fox, is mainly due to the enterprise and energy of Mr. Pilling, who has every confidence in its financial success.

Starting from the Bay of Acre, it is connected with the commercial port of Haifa, on the Carmel side of the bay, and Akka, the Turkish military depôt, on the north side of the bay. Proceeding along the Plain of Esdraelon to the south of Nazareth, and down the valley of Jezreel, it enters the Jordan valley. After running along the right bank of the Jordan to near the Sea of Galilee, it crosses the river, skirts the south end of the lake, and ascends the plateau of Hauran, the biblical "Land of Bashan."

Then it passes through the rich wheat-growing plains of Bashan and Damascus, which, it is expected, will soon be contributing their supplies to the English markets, at prices competing favourably with those of American produce. Crossing the plain to the east of Mount Hermon, it arrives at Damascus from the south, after a traverse of 149 miles.

Although Damascus is its present terminus, some prophetic minds already see the line crossing the Euphrates valley and passing through Persia, to form a new route to India. Be this as it may, there seems a most reasonable prospect that the new railway will be a powerful factor in developing the riches of Syria to the advantage of British commerce. In connection with the railway, the harbours at Haifa and Akka, which are about the same distance from London as New York, are to be deepened and improved to provide accommodation for large ocean steamers.

The French line, which is also in progress, starts from Beyrout; but, although the route is shorter, the engineering difficulties are much greater, as the two ranges of Lebanon have to be crossed.

MISCELLANEOUS.

A narrative of the recent voyage of the Dundee whalers to the **Antarctic**, by Mr. W. G. Burn-Murdoch, will shortly be published by Messrs. Longmans and Co.

The *Revue Française et Exploration*, Dec. 15th, contains a useful chronological *résumé* of **Arctic Explorations** from 1497, when John Cabot discovered Labrador, to the present day.

By an agreement published in November last, the Persian district of **Firuzeh**, in Khorasan, has been exchanged for the Russian districts of Hissar and Abbasabad.—*Deutsche Rundschau*, Jahrg. 16, Heft 4.

The Hydrographic Office, Washington, has forwarded a **Pilot Chart of the North Pacific Ocean.** It is intended to issue this sheet monthly, if the necessary funds are granted by Congress; and the co-operation of mariners and others is invited.

In the *Mitt. aus den Deutschen Schutzgebieten*, Bd. vi. Heft 4, tables of corrections for **astronomical refraction** are given. In those already existing, the ranges of temperature and atmospheric pressure are too small for Africa, and therefore Dr. L. Ambronn, of Göttingen, has been invited to make the necessary calculations for the use of those travellers who wish to reduce their observations on the spot.

Five Germans have organised an expedition to explore the interior of **Brazil**, the Amazons, and, perhaps, the Orinoco. The party, consisting of Dr. H. J. Fladt, J. Gall, A. Hawlischka, F. W. Rupp, and Mathias Schleimer, set out from Santos in São Paulo, on August 26th, with the intention of proceeding through the province of Goyaz and the plateau of Matto Grosso to the Upper Amazons.—*Deutsche Rundschau*, Jahrg. 16, Heft 2.

The Bensbach river, which has been taken as the starting-point of the new **Anglo-Dutch boundary** in New Guinea, lies in 9° 7′ 35″ S. lat. and 141° 1′ 48″ E. long. The boundary will follow the meridian northwards until it meets the Fly river, then keep to the course of the river until it turns back to the meridian of 141°, and along this line will reach the point at 5° S. lat. where the British, Dutch, and German territories meet.—*The Colonies and India*, Dec. 30th.

Mr. Warburton Pike left Victoria, British Columbia, in July 1892, and has since accomplished a journey of over 4000 miles in a small canoe. From Fort Wrangel he ascended the Stikine river, followed the Dease river to its junction with the Liard, travelled by sleigh to Frances lake, and, passing over to the Pelly lakes, descended the Pelly river to the Lewis river, and paddled down it to the Yukon. From the Yukon he crossed to the Kuskoquim, along which he found his way to the coast near Fort Alexander.—*The Canadian Gazette*, Dec. 14th.

Dr. Frederick A. Cook, who accompanied Lieut. Peary on his first expedition, has submitted to the American Geographical Society a proposal for an **Antarctic Expedition.** Having bought a whaler of 300 tons, and furnished it with provisions for three years, he would leave New York about Sept. 1st, fill up with coal and provisions at the Falkland Islands, and then steam for Louis Philippe Land. He would search for an opening in the ice and endeavour to land and explore with dog-sledges. Astrup, Peary's Norwegian companion, is to accompany Dr. Cook.—*Geographical Journal*, Jan. 1894.

Captain A. C. Yate, Corr. Mem., sends us the following note, contained in a letter from Colonel C. E. Yate, on the **earthquake** which occurred in **Persia** on Dec. 1st:—"The earthquake did no damage here (Meshed). It sounded like nothing more than an underground train, as we sat at dinner; but it has laid Kuchan (90 miles north-east of Meshed) level with the ground. The shock threw every house down instantaneously, and buried almost all the inmates who chanced to be within at the time. The survivors have, for the most part, left the place, and the town is now like a city of the dead."

NEW BOOKS.

Eskimo Life. By FRIDTJOF NANSEN. Translated by WILLIAM ARCHER. London: Longmans, Green, and Co., 1893. Pp. 350. *Price* 16*s*.

Few books have ever appeared containing more curious details regarding a race of mankind than this masterly survey of the Eskimos. A superficial observer might think the Eskimos occupied a low grade of civilisation, but Dr. Nansen (the renowned Arctic explorer) assures us that such is not the case. "The Eskimo not only manages to live, but lives in contentment and happiness, while intercourse with the rest of the world has to him meant nothing but ruin." They are extremely ingenious, as is shown in the construction of their bladder-darts, throwing-sticks, and kaiaks (or canoes). "The Greenlander is of all God's creatures gifted with the best disposition. Good humour, peaceableness, and evenness of temper are the most prominent features in his character."

At the same time, the habits of the Eskimos are very peculiar. On the east coast of Greenland men, women, and children, whilst indoors, go about entirely naked. One of their greatest delicacies is the contents of a reindeer's stomach, or the entrails of ptarmigans. The Christian Greenlanders are so addicted to coffee, that the indulgence in it has on the west coast become almost a vice. Greenlanders are passionately fond of brandy—women as well as men—not because they like the taste of it, but because it is so delightful to be drunk.

Marriage by capture is the only kind in vogue. An Eskimo girl thinks it shameful for a European girl to answer "Yes," when a man asks her to marry him. The Eskimo young lady considers it her duty to be carried off and to struggle against her captor. Her husband would then "scratch her a little on the soles of the feet, so that she could not walk; and, before the sores were healed, she was generally a contented housewife."

Eskimos learn to read and write with comparative ease, and they master all our ordinary branches of education with more or less readiness. They are, however, full of superstition, "Every stone, mountain, glacier, river, lake, has its *inua* (or owner); the very air has one." They are also very much afraid of mentioning the names of the dead—indeed, the East Greenlanders are afraid to speak their own names.

"The Eskimos have no hell." Most think that, even if the soul is not quite immortal, it yet continues to live after leaving the body, and goes either to a place under the earth and sea, or to a place between the earth and sky. The former place is regarded as the better of the two, and is a very good land where there is lovely sunshine, excellent water, and animals and birds in abundance. *Thunder* is believed to be produced by two old women fighting for a dry and stiff skin and tugging at each end of it. In the heat of the contest they upset their lamps, and thus produce *lightning.*

Dr. Nansen severely censures the Europeans for disturbing and overturning the whole social order of the Eskimos. Attempting to give the latter a new character and religion, they have broken down their regard for their old customs and traditions without being able to give them new ones in their place. Thus the Greenlanders have declined from their former well-being and prosperity towards almost hopeless poverty and weakness.

Beautiful illustrations are interspersed throughout this most interesting volume, but an index is wanting, and a map showing the distribution of the Eskimos might have been given.

A Narrative of Further Excavations at Zimbabye (Mashonaland). By Major Sir JOHN C. WILLOUGHBY. 43 and xiii pp., with Two Illustrations and Five Plans of the Ruins. London and Liverpool : George Philip and Son, 1893. *Price* 3*s.* 6*d.*

Sir John C. Willoughby, of the British South Africa Company's Service, who published *East Africa and its Big Game* in 1889, spent five weeks in the end of 1892 in further diggings amidst the ruins partly explored by Mr. Bent in 1891, and may be regarded as a continuator of Mr. Bent's work. Of the 113 objects found, including bits of pottery, glass and soapstone, phalli and metal objects, the most important was a flat bit of copper some six inches long, covered with green enamel, paint, or lacquer, and bearing a triangular pattern. Sir J. Willoughby makes a number of corrections on some of the measurements reported by Mr. Bent and Mr. Swan, and differs from them on a few minor details ; but, without expressly committing himself to his predecessor's conviction that the builders had high culture and mathematical attainments, and made the curves of the walls with elaborate astronomical references, he abides by the theory that the builders were civilised foreigners come to secure the gold of the country, and that they were swept away utterly, and that there is no indication of the gold industry having been revived till the British occupation. Mr. Selous, on the other hand, holds that the builders, Arabian or other, were a very rude people, that they mingled completely with the aborigines, and that the building of stone strongholds and gold-workings too were carried on by the Mashonas till the irruptions of the Matebele about 1840.

The Discovery of the Ancient City of Norumbega. By EBEN NORTON HORSFORD. Cambridge, Mass.: Privately Printed. Pp. 63.

The Landfall of Leif Erikson, A.D. 1000, *and the Site of the Houses in Vincland.* By EBEN NORTON HORSFORD. Boston : Damrell and Upham, 1892. Pp. 148.

Leif's House in Vineland. By EBEN NORTON HORSFORD. *Graves of the Northmen.* By CORNELIA HORSFORD. Boston : Damrell and Upham, 1893. Pp. 40.

The site of Norumbega—the first Norse settlement in the New World—was until a few years ago one of the unsolved problems of geography, like the site of Atlantis or of El Dorado. Probably most English readers have become familiar with the name from Whittier's well-known poem, though few may remember Milton's reference to "icy blasts from north of Norumbega." When Whittier wrote his poem, he adopted the general belief that "the lost city of New England" had stood on the Penobscot river in the state of Maine. Yet, as Professor Horsford states, every rood of the Penobscot basin, from its mouth to its source, was scoured in search of its remains, and no traces of such remains were found. Not only was the quest regarded as hopeless, but the belief in the existence of the "barbaric city" was practically abandoned.

That was the state of the case when Professor Horsford took up the problem. He examined minutely the literature of geography bearing on the subject, and he studied carefully the references to the place in the Vineland Saga. He found, as the result of his researches, that Norumbega was the name of a river, a city, a fort, and a district of country. The conclusion was forced on him that the river was the Charles, in Massachusetts, at the mouth of which Boston stands, and that the site of the fort was at the mouth of Stony Brook, a tributary of that river. Being satisfied on that point, he says with amiable and even amazing self-confidence: "I drove directly there, and found it on my first visit." Pursuing his inquiries, he was able to fix, to his own satisfaction, the site of the city of Norumbega at Watertown, a short distance lower down on the Charles river, where he discovered the remains of dams and wharves, built with boulders, of an ancient date. A very interesting point is the author's explanation of the origin of the name Norumbega. Among the older names of Norway he finds Norbegia and Norobega, which, on Grimm's law, are readily converted into Norvega, Noruega, Norwega, and Norway. To account for the intrusion of the letter *m*, he points to a peculiarity of the speech of the Algonquin Indians, which was that they could not pronounce a syllable beginning with the letter *b* without the help of an initial *m*. They were not singular in this peculiarity, for Mr. Horsford points to the fact that Greek sailors coming to Boston call it *mBoston*, and he adduces other illustrations of the same phonetic law.

Professor Horsford's conclusions were accepted by the American Geographical Society at a special session held at Watertown in 1889, and he was then congratulated on his discovery. On that occasion he was able to announce, not only the discovery of the site of the ancient city, but also that of the Landfall, or landing-place, of Leif Erikson, the first Norse explorer, and of the site of his houses in Vineland, which is the same as the region of Norumbega, and which extended from Massachusetts Bay to the mouth of the St. Lawrence. On the site of the ancient fort, Professor Horsford erected a lofty and rugged tower, built with boulders found in the neighbourhood. A tablet inserted in the tower tells in brief the whole story of the city, the country, the fort, and the river. It tells of the discovery of the country by Leif Erikson in 1000 A.D., of its exploration by his brother Thorwald in 1003, of its colonisation by Thorfinn Karlsefni from 1007 onwards, and of the settlement of the first bishop, Erik Gnupson, in 1121. It also mentions the industries carried on there for nearly three centuries and a half—in māsur wood (burrs), fish, furs, and agriculture—and it records the departure of the last Norse ship for Iceland in 1347.

Professor Horsford tells the story of his discoveries in a very interesting manner, with great minuteness and abundance of detail, and with touches of self-complacency that are characteristic of an American and are by no means offensive. The most exhaustive account is that contained in the second work on the list at the head of this notice. The elaboration is justified on the ground that objections had to be met, for there are still antiquaries who hold with Professor Storm of Christiania that Newfoundland was Markland and that Nova Scotia was Vine-and; while there are others who maintain the older tradition that Leif's Landfall must have been somewhere on the coast of Labrador. It must be said, however, that no such evidence has been adduced in favour of these sites as has been presented by Professor Horsford in support of his view.

The third volume on our list describes the excavation of the foundations of the house supposed, on his theory, to have been that of Leif Erikson, and also that of the supposed house of Thorfinn, and of the graves of the Norsemen, at the instance of his daughter, who seems to have inherited a good deal of her father's enthusiasm. Her most interesting "find" was an implement about four inches long and four broad, made of obsidian, and dug up in the neighbourhood of Wayland. Now obsidian, vulgarly called Iceland agate, is a vitreous product of volcanoes. It is abundant in Iceland and in other volcanic regions, but it is not found in any part of the United States east of the Rocky Mountains. On comparing this implement with one of the relics she herself had found, between two and three feet below the surface of the ground, close to the north wall of Thorfinn's supposed long house, she found that the latter also was undoubtedly obsidian—a conclusion confirmed by the mineralogical authorities of the Harvard University Museum. The inference is that it had been brought there from Iceland by the Norsemen.

These volumes are sumptuously got up. The numerous illustrations, in photogravure, are beautifully executed, and the maps and plans are both abundant and admirable.

A Journey the through Yemen, and some General Remarks upon that Country. By WALTER B. HARRIS, F.R.G.S., Author of *The Land of an African Sultan: Travels in Morocco.* Illustrated from sketches and photographs taken by the Author. Edinburgh and London: William Blackwood and Sons, 1893. Pp. xii + 385.

This is a most attractive and interesting account of an adventurous journey through the south-western region of Arabia. The low lands which border on the Red Sea have been subject to the Turkish Government for a considerable time, but it was only in 1872 that the Turks succeeded in extending their sway over the elevated inland tract, which is the larger and more valuable part of the territory. The rule of the Turkish Pashas, oppressive and corrupt as usual, awakened great discontent, which broke out in open insurrection in 1891. The Arabs, while successful in other quarters, failed for want of artillery to take Sanaa, the capital of the Yemen, and an expedition, energetically led by Ahmed Feizi Pasha, not only relieved the capital, but gradually re-established the rule of the Turks over the whole country. The war was hardly over, and the country was still in great disorder, when Mr. Harris undertook his expedition. Starting from Aden, he managed to cross the Turkish frontier by passing himself off as a Greek merchant; and after some exciting adventures, and enduring no little hardship, he at length reached the capital. Immediately on arrival he waited upon the Governor, who, indignant that a foreigner had penetrated into the country, at once put him under arrest, kept him a close prisoner, and then, when he became seriously ill of fever, sent him by the direct route to the port of Hodeidah, on the Red Sea, whence he found his way by sea to Aden. Under the circumstances, as Mr. Harris says, his journey was devoid of great results, but he can boast of having brought back a story of travel and adventure, and numerous photographs and notes which throw light upon the present condition of the Yemen, especially on what has taken place in that country since the Turkish occupation of the highlands. This claim is amply justified. The narrative of his travels is simply and happily told. The scenery, the local colour, and the incidental circumstances are characterised by slight touches which testify to the keenness of his observation, and make it easy for the reader to realise them, and keep him deeply interested from first to last. The numerous illustrations are of quite exceptional power and beauty; we have rarely seen pictures of Arabian landscape and people which represent them with so much truth and power. Had the book contained nothing but the travels and the illustrations we could have expressed only unqualified admiration, but Mr. Harris seems to have thought he was bound to make it complete and exhaustive. He has, therefore, prefixed chapters on the history of the Yemen and on Muhammedanism and its relations to Christianity which are of very mediocre merit. Even his style, bright and happy when describing what he has seen and felt, becomes cumbrous and confused when he gives in condensed form information drawn from previous writers, or tries to express his rather crude speculations on subjects which call for profounder study and more power of thought than he can command. With this exception, however, the work can be strongly recommended.

Peru. Beobachtungen und Studien über das Land und seine Bewohner. Von E. W. MIDDENDORF. 1 Band: Lima. Berlin: Robert Oppenheim, 1893. Pp. xxxii + 638. *Price, paper,* 16 *M.; cloth,* 20 *M.*

The author of this large and important work, as we learn from his very interesting preface, spent altogether five-and-twenty years in Peru, which he entered for the first time in 1855, and left for good in 1888. His profession, that of medicine, he practised first at Arica, a small seaport in the most southern province of Peru, and afterwards, for eighteen years, in Lima, the capital of the country.

His professional duties fortunately did not occupy all his time, but left him intervals of leisure which he occupied in perambulations through different districts of the country, as well as in studying its antiquities and in mastering the old language spoken in the days of the Incas. These facts speak of themselves in favour of the work, and its perusal has only tended to confirm the good augury we ventured to draw from them. It is altogether an authoritative work, and, if completed in other two volumes of about equal magnitude, will be a complete repertory of information regarding Peru. It is written, we may add, in an easy, clear, and agreeable style, free from those awkward and involved constructions which sometimes mar one's pleasure in reading compositions in German. The present volume, though devoted more especially to Lima, contains many observations which relate to the country at large. It presents us, after some introductory remarks, with a sketch of Peruvian history during the time the country was a dependency of Spain. We are told of its conquest by Pizarro, who founded Lima, and made it the capital, of its government by viceroys sent out from Spain, who ultimately drained it of its vast wealth to meet the inexorable and insatiable demands of the Spanish Court; how its inhabitants lived under the Spanish *régime*, how churches and religious foundations multiplied among them, and how effectually the Inquisition prevented them from swerving from the true faith. This historical section closes with notices of the numerous earthquakes by which the western parts of Peru have been afflicted. The section which follows describes Lima as it exists at the present day. It is situated in a beautiful and fertile valley, on a small river called the Rimac, and is about 6 miles distant from its seaport, Callao, with which it is connected by a railroad. Though its streets are ill paved, and its dwelling-houses seldom more than one story in height, on account of the frequency of earthquakes, it is, nevertheless, on the whole a fine city, and is adorned with some noble edifices, the cathedral being the most striking. The population in 1876 amounted to 100,156, of whom 42,694 were whites. The account given by our author of the various races which by birth belong to the country is extremely interesting. He shows how they differ in personal appearance, in dress, in their occupations, and their habits both within their homes and when they appear in public. The next section brings under cognizance the churches, the monasteries, the religious orders, and the whole ecclesiastical organisation. The nature is then examined of the republican constitution under which Peru has been governed since 1824, the year in which her revolt from Spain was consummated and her independence proclaimed. The remaining sections treat of such subjects as the administration of justice, public instruction, charitable institutions, the mint, post office, railways and other means of communication, and places of public recreation and amusement. The work is copiously illustrated, and we trust it will ere long be reproduced in the form of a translation for English readers.

Chez nos Indiens: Quatre Années dans la Guyane française. Par HENRI COUDREAU. Paris: Hachette et Cie., 1893.

In this large and handsome volume, M. Coudreau tells us of his recent journeys in French Guiana during the years 1887-1891. The two expeditions treated of were undertaken by M. Coudreau at the instance of the Ministry of Public Instruction, and had for their object—the first expedition to study the Tumuc-humac mountain region, and the district between the upper waters of the Maroni and the Oyapok; and the second the exploration of the upper waters of these rivers and of the Yari, a tributary of the Amazon, also taking its origin in the Tumuc-humac region, as well as the country lying between the Maroni and the Oyapok. To the first of these expeditions the greater part of this work is devoted, while the second, and in some respects more interesting, is dismissed in a few chapters.

The book is beautifully printed, and copiously illustrated with numerous, and on the whole very good, wood engravings. It, however, pains us to see on p. 413 a picture of the exploring party apparently protecting themselves from the inclemency of the tropical shower by means of *umbrellas!* Nearly the entire volume is taken up by a narrative of the author's journeys—varied only once or twice by a historical or ethnological interlude. These are very interesting; for example, the historical account of the missionary enterprise in Guiana, or the description of life and manners amongst the Roucouyenne Indians. The latter is very graphic, and includes a not very flattering testimony to the condition of morals amongst these Indians. To the ethnologist is also of interest the account of the ceremony of "maraké" amongst the Ouayana—an ordeal which the young men have to pass through on attaining manhood, before they are regarded as full members of the tribe. The trial is of the most severe character, consisting of submitting to the bites and stings of peculiarly savage species of ants and wasps, which are pressed against the skin of the probationer. Though, however, some information may be gleaned by the ethnologist and the geographer from M. Coudreau's work, it is scientifically disappointing, and can only take its place in the library along with the most "popular" books of travel. There is an utter want of scientific precision in the statements; while animals or plants, when referred to at all, are mentioned only under uncouth *local* Indian names, which are quite unintelligible to any one not having a knowledge of the particular local dialect in question.

The general relations between M. Coudreau and his Indians appear to have been of the usual character; in other words, he did not gain their confidence. Almost his only word of praise is that "ils ont cette vertu grande: ils ne se querellent guère et agissent sans parler." He complains of their laziness, and says that after a journey of six to eight days they wish to rest fifteen days or a month. But, after all, upon leaving the Indians he admits that "l'habitude de vivre avec l'homme primitif dégoûte de l'homme perfectionné et de tout: l'âme se fond dans une tristesse infinie." The purely narrative part of the book is on the whole interesting, although it contains comparatively little that is new, and in the matter of wit is scarcely what one would expect in a book whose table of contents contains such tit-bits as "Le capitaine françois n'est pas un *struggleforlifer*," and "Hospitalité écossaise—Vertus sauvages."

Voyages of the Elizabethan Seamen to America. Select Narratives from the "Principal Navigations" of Hakluyt. Edited by EDWARD JOHN PAYNE, M.A. First Series—Hawkins, Frobisher, Drake. 2nd Edition. Oxford: At the Clarendon Press, 1893. Pp. lvi + 272.

Mr. Froude has happily characterised the "Principal Navigations" of Hakluyt as "the prose epic of the modern English nation." In full sympathy with this pronouncement of the Oxford Professor of History, and in fact inspired by it, Mr. Payne has reproduced from this venerable, but to the general reader practically inaccessible, edition the voyages of the three famous navigators abovementioned. To any reader of intelligence it need not be said that they are full of quaint and curious interest, personal, historical, and maritime, and the editor has made the reading easier and more attractive by modernising the obsolete spelling, while retaining the terse, archaic diction. Mr. Payne has also greatly added to the value and interest of the volume by a general survey of the conditions of the time, especially as affecting navigation, and by adding personal accounts of each of the three great navigators. Obscure or technical words and expressions are, besides, explained in notes, which are never superfluous. A desire for brevity probably causes the confusion in the note on p. 17, making out the albatross to be a tropical bird.

We observe that this volume is entitled the "first series," and we hope the success which it appears to have obtained will lead to the speedy appearance of another volume.

Old and New Paris: Its History, its People, and its Places. By H. SUTHERLAND EDWARDS. Vol. I. London: Cassell and Co., 1893. Pp. 376.

The first volume of what promises to be an interesting and important work, this description of Paris differs from most in conveying by means of sprightly narrative and graphic illustrations something of the sparkle which invests the brilliant city on the Seine. The author takes us rapidly through the history and sights of Paris, and enables us to enjoy, by means of illustrations of much artistic merit, unusual advantages. For example, we peep into the Green Room of the Théâtre Français, and go behind the scenes, or we witness Alexandre Dumas *fils* reading a play before the Theatre Committee. Then, for graver subjects, we may see the interior of the Mont de Piété, or be present at a duel in the Bois de Boulogne. The publishers have enlisted the services of numerous Parisian artists of ability, whose illustrations are, from an artistic point of view, much superior to those given in ordinary books of this class. We trust that a good index and a map, in page-size sections, of Paris and its environs will crown this promising edifice.

The Buccaneers of America: A True Account of the most Remarkable Assaults committed of late Years upon the Coasts of the West Indies by the Buccaneers of Jamaica and Tortuga (both English and French); wherein are contained more especially the Unparalleled Exploits of Sir Henry Morgan, our English Jamaica Hero, who sacked Portobello, burnt Panama, etc. By JOHN ESQUEMELING, one of the Buccaneers who was present at these tragedies. Now faithfully rendered into English. With Facsimiles of all the Original Engravings, etc. London and New York: Swan Sonnenschein and Co., 1893. Pp. xxxv + 508. *Price* 15s.

Mistaken notions regarding commerce, and the high-handed manner in which the Spaniards endeavoured to carry out these ideas, led to the buccaneering expeditions which had so marked an influence on the history of the West Indies, and have given so many romantic pictures of battle and tales of treasure to the story of these colonies. Then, as now, England was determined to push her foreign trade; but the merchants, planters, and traffickers of the West Indies found that little or no support was given them at home against the restrictions and impositions of the Spaniards. Hence arose that remarkable war, carried on by private persons, which latterly degenerated into downright piracy and murder, both on the high seas and on the coasts of the islands and neighbouring continent. Esquemeling joined the brotherhood at a period when decadence had set in, but before matters reached their worst, and his narrative may thus be taken as a fair account of many of the exploits of the buccaneers. He shows clearly enough that they were heroic in battle and wonderfully patient under privation, but cruel, covetous, and careless. He writes with the air of one who has repented of all his wicked ways, but it is not difficult to read between the lines a certain affection for, and delight in, his past career, which are often decidedly amusing. The value of the volume as a contribution to the history of our colonisation of the West Indies is considerable; while many of the pages, such as those devoted to the description of Hispaniola, have a distinct geographical interest. The worth of the book is further enhanced by the scholarly introduction by Mr. Henry Powell, and by the addition of the rare journal of Basil Ringrove, chief pilot to a piratical expedition round the coasts of South America, with reproductions of his charts and views of landfalls. In conclusion, the publishers deserve praise for the handsome manner in which the book has been produced.

Das Moderne Ägypten. Mit besonderer Rücksicht auf Handel und Volkswirthschaft. Von THEODOR NEUMANN. Leipzig: Duncker and Humblot, 1893. Pp. 340 and Appendix.

The author of this book resided for eight years as consul in Egypt, and he has produced in all probability the best account which has appeared in recent years of modern Egypt looked at from the historical, political, and commercial standpoint.

He professes in the preface to have written an unbiassed account of the country, and we believe with justice, as at any rate no prejudices are apparent. The first two chapters, dealing with the country and its inhabitants, are brief but accurate, whilst the descriptions of the commerce, method of government, finance and natural productions are more detailed. As far as we have been able to test it, the text is accurate. Herr Neumann believes that the presence of British influence in the Valley of the Nile has been of great benefit to the country, and will be an advantage in the future unless the protectorate should change into permanent occupation, in which case not only the peace of the world but also the well-being of Europe would be in the highest degree endangered. No one interested in

Egypt can afford to ignore this book, which is written by a man who is thoroughly acquainted with his subject, and has had the opportunity of obtaining all his data from official sources. It is by no means a tourist's manual, but can be strongly recommended to the politician.

Fishing Incidents and Adventures; with a Description of all the Principal Lochs in Perthshire; also a Day on Loch Doon and Lochindorb, the Dee, Tweed, Findhorn, etc. By MALCOLM FERGUSON. Dundee: John Leng and Co.; Edinburgh: Macniven and Wallace, 1893. Pp. viii. + 291.

Mr. Ferguson is a veteran angler, and in these varied sketches, mostly reprinted from local newspapers, he draws upon a large fund of piscatorial anecdote, all of which is credible, and therefore offers a pleasing contrast to the ordinary run of "fish stories." But the author has done more than this, as he has collected a large amount of general, topographical, and legendary matter regarding the places he has visited, and lays these materials before his readers in a manner that, if not perfect, is pleasant enough. On the whole, the volume is a useful addition to Scottish local literature.

Brehm's Tierleben. Herausgegeben von Dr. PECHUEL-LOESCHE. *Kriechtiere und Lurche*, von Dr. A. E. BREHM, vol. vii. Pp. xiv + 825.—*Fische*, von Dr. A. E. BREHM, vol. viii. Pp. xviii + 517.—*Insekten*, von Prof. E. L. TASCHENBERG, vol. ix. Pp. xxxii + 764.—*Niedere Tiere*, von Prof. Dr. W. MARSHALL, vol. x. Pp. xxviii + 716. Leipzig und Wien: Bibliographisches Institut, 1892 and 1893.

The publishers, editors, and artists, who have co-operated to bring this magnificent series of volumes to a conclusion within a reasonably short time, deserve much congratulation. The public may also congratulate themselves that the grandest book on natural history has in its re-edition been brought up to date and brought within their reach. It will have a formidable English rival in the *Royal Natural History*, as it already has its analogues in *Cassell's* and in the *Riverside* (both in six volumes); but it must be remembered that these works do in a certain sense stand on the shoulders of Brehm's *Tierleben*. The first six volumes, which we have already noticed, were given up to Mammals and Birds; of the remaining four, one is devoted to Reptiles and Amphibians, one to Fishes, one to Insects and the like, and the last to all lower creatures. This implies that the last volume is somewhat crowded—more so, in fact, than a zoologist would wish; but the excuse for this is, that a single mammal is in popular estimation of more value than many polypes or protozoa. Moreover, there is much less to tell about the habits of the lower animals, and Brehm's *Tierleben* is pre-eminently a book of habits. Criticism is out of the question, and praise is superfluous; what can we say but this, that to see these handsome volumes is to covet them, and that to read them adds a fresh pleasure to life?

Jahrbuch der Astronomie und Geophysik. (III. Jahrgang, 1892.) Herausgegeben von Dr. HERMANN J. KLEIN. Leipzig: Eduard Heinrich Mayer, 1893. Pp. x + 349.

This is a valuable annual compilation of scientific discovery in cosmical and terrestrial physics. It is the latter which more particularly concern the members of a geographical society. Most of the notices are brief, but sufficient to indicate what has been done. A few of the epitomes run to several pages, of which we may mention the abstracts of Dr. Penck's memoir on Land Contours; Dr. Wolff's description of the Andes of Ecuador; Dr. Langenbeck's discussion of the earthquake phenomena in the regions of the Upper Rhine; Dr. Schott's paper on the surface temperatures and currents of the East Asiatic waters; Dr. Murray and M. Renard's *Challenger* Report on Deep-sea Deposits; Dr. Andries' paper on Stellar Scintillation, etc. The matter is admirably arranged, so that there is no difficulty in finding where any special subject is treated. An index of authors' names would have added to the value of the book as a work of reference, the necessity for such an index being increased by the fact that not a few of the abstracts refer to papers published earlier than 1892. The volume is enriched by a number of maps and photographs.

Stanford's Compendium of Geography and Travel. (New issue.) *Australasia, Vol. I. Australia and New Zealand.* By ALFRED R. WALLACE, LL.D., D.C.L., etc., etc. Maps and Illustrations. London: Edward Stanford, 1893. Pp. xiv + 505.

This second edition of Mr. Wallace's well-known account of Australasia is to consist of two volumes, the one before us being confined to Australia and New Zealand, while the second is to embrace the Malay and other island groups contained in "Australasia." The present volume is practically reprinted from the former edition: only the statistics of population, trade, and material resources have been brought up to date, or approximately so, and certain additions have been made to the chapters dealing with the physical geography, natural history, and native inhabitants of the region. We notice several passages copied verbatim from the edition of 1879, which would seem to require some modification now. Thus, it was sufficient at the former date to say that "rabbits have increased in some of the scrubs to such an extent as to be a nuisance;" but this is hardly an adequate description of the rabbit plague of to-day. Again, of the northern territory of South Australia we are told in 1879 that "the most recent reports state that trade is springing up with Java, mining is improving," etc.; and this "most recent" statement is repeated verbatim in 1893! The "noble iron bridge" across the river at Brisbane is described again, but we are not told of its recent destruction in the great floods.

We should have liked some explanation of the reported decline in population of such flourishing towns as, *e.g.*, Ballarat and Geelong. In the edition of 1879 these are given respectively as 47,156 and 23,200; in the new edition Ballarat is said to have fallen in 1881, *i.e.* in two years, to 38,469, and Geelong is given at 21,157. Much later statistics than those of 1881 might have been taken from the *Colonial Year-Books.* It seems strange, too, that Queensland should have remained nearly stationary for fourteen years with its "10,000 miles of roads."

The present edition contains four or five new maps, and several new and interesting illustrations.

Wright's Australia, India, China, and Japan Trade Directory and Gazetteer, including Canada, South and Central America, Mexico, West Indies, and South Africa. A Handbook of Trades, Professions, Commerce, and Manufactures in the Australian Colonies, India, China and Japan, Canada, South America, Central America, West Indies, Mexico, and South Africa. Fourth Edition. New York: Geo. Wright. London: Thos. Cook and Son, 1893-94. Pp. cxxiv + 3035.

We have quoted the long title of this work in full, as it gives in a concise form an idea of the contents, which may save the necessity for any long description. A volume of the kind must go through several editions before full utility is attained, and in some respects the present issue requires expansion: this, however, may confidently be looked for in the future. To those having commercial relations and interests in any of the countries treated of the book must be invaluable, while the various gazetteers have very satisfactory rubrics, and contain a mass of useful matter conveyed in succinct form. Each division has an index to itself, and is printed on paper coloured differently from the parts going before and following after it, so that, with the help of the lettering on the edges of the pages, any country can be referred to at once. The buyers' guides to Great Britain and America, which conclude the volume, appear to be made up of advertisements. There is a distinct map of the world, showing the Pacific Mail Company's steamer routes. The printing is good and clear, and the binding substantial.

Artaria's Orts-Lexikon der osterreichisch-ungarischen Monarchie nach der Zählung von 1890. Bearbeitet von Dr. K. GRISSINGER. Wien: Verlag von Artaria und Co., 1893. Pp. viii + 79. *Price* 60 *kr.*

A useful list of inhabited places in the Austrian Empire, with their elevations, districts, and populations, to which are appended tables of towns containing over 10,000 inhabitants, of the Alpine, and of the Karpathian, passes. Health resorts and tourist centres are also indicated.

Oliver and Boyd's Edinburgh Almanac and National Repository for the Year 1894. Edinburgh: Oliver and Boyd. Pp. 1165. *Price* 6*s.* 6*d.*

No more familiar and well-known handbook is published in Scotland than the ever-welcome "Oliver and Boyd." Year after year it continues to provide all the varied and authentic information for which it is famous, and each year's issue bears evidence of great editorial care in increased scope, or in improvement in arrangement. The manner in which the information afforded is kept up to date is worthy of all praise, and the present issue fully attains the high standard expected and never looked for in vain, and which has, for so long a time, made it the familiar desk companion of so many Scotsmen. In a previous review we called the work "the Scotsman's oracle," and we can think of no better phrase to use in describing the volume for 1894.

An Almanack for the Year of Our Lord 1894. By JOSEPH WHITAKER, F.S.A. London: 12 Warwick Lane. Pp. 744.

The editor claims that this is the best almanack in the world, and we certainly are not disposed to dispute the assertion. Every year something is added to the information, or improvements are made in arrangement. As the compiler invites suggestions, we may remark that the value of a square kilomètre in decimals of a square mile is frequently required in geographical work.

Hazell's Annual for 1894: *A Cyclopædic Record of Men and Topics of the Day.* London: Hazell, Watson, and Viney. Pp. 676.

As we have often noticed the *Annual* in former years, we need say little to recommend this valuable book of reference to our readers. As a whole the subjects treated of are much the same, though of course there is much new matter under many of the headings. Among the new articles, those on Arctic Exploration, East Africa, the Niger Territories, Matabeleland, Mashonaland, and Uganda are of geographical interest. The insertion of sketch-maps is a new and welcome departure.

Bryce's Thumb Gazetteer of the World. Glasgow: David Bryce and Son, 1893.

A gazetteer of this size is, no doubt, published as a curiosity. Nevertheless, this minute volume contains much useful information. An improvement might be made by omitting several unimportant towns in the United States and elsewhere, to make room for some better-known places.

ATLASES.

WORLD, The Graphic Atlas and Gazetteer of the ——. Edited by J. G. Bartholomew. *London: John Walker and Co., Limited.*

This Atlas, which is a medium quarto convenient to handle, is in size and form an ideal book of reference for the library. It contains 128 plates, of which the principal features are the large-scale sectional maps of the British Isles. England and Scotland are subdivided into twenty-four sections, and Ireland into three. Large-scale maps of the principal cities of the world and their environs are also given, and form a very useful and convenient series. The workmanship of the Atlas is admirable—clear and well printed. It is not overloaded with names, though most of the important places are shown even on the small-scale maps. The weak point in the Atlas is the spelling of the Indian names, which do not agree with the Gazetteer, and in which the old spelling and the new are most incongruously mixed up. We are glad to see that in his new *Atlas of India* Mr. Bartholomew has consistently followed the new method, and we trust that in a future edition of the *Graphic Atlas* new maps of India will replace the present ones. The Gazetteer, which contains upwards of 50,000 names, is clear and complete, and an appendix gives the population of the counties, towns, and many of the villages of the British Isles, compiled from the Census of 1891.

INDIA, Constable's Hand-Atlas of ——. A New 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.E. *Westminster: A. Constable and Co.*, 1893. *Price* 14*s*.

This very neat and handy Atlas, dedicated to her Majesty the Queen, is a marvel of condensed information—the result of laborious and painstaking work, and will be invaluable on the desk and with the tourist. In four pages we are presented with a brief outline of the Census of 1891, arranged according to British and native territories, according to race, to language, and to religions; together with the separate populations of 230 of the principal cities. The first sixteen maps form a distinguishing feature of the work, and supply at a glance a great mass of carefully digested information on such subjects as the features of the land surface—elevation, geology, etc.; temperature and rainfall; relative density of population; prevailing races; languages; animal, vegetable, and mineral products; Christian mission stations; the distribution and stations of the Presidency armies, etc. Then we have a general and three sectional maps showing the railways, telegraphs, and navigable canals.

The next group presents the whole Indian Empire in fifteen sectional maps, with an index sheet. These are drawn to a scale of sixty geographical miles to an inch, and show the collectorates, railways, roads, and physical features. To them belongs the very full index, extending to 86 pages, and containing nearly 11,000 names, with the district and province also in which each is found. This indication is specially useful for maps where there may be several places of the same name. These maps include all the places either described or mentioned in the thirteen volumes of Sir W. W. Hunter's *Imperial Gazetteer of India*, and make the Atlas an indispensable accompaniment to that great work. In no other are nearly all these names to be found. The labour of seeking out so many places from the Survey sheets must have been enormous, and reflects credit on Mr. Bartholomew's care.

Next we have the speciality of the work in plans of twenty of the most notable cities and sanataria, with the environs also of Calcutta and Bombay—all carefully reduced from the best surveys, and further specially revised on the spot. This is the first time that most of these twenty-two plans of the cities and health resorts have been made available to the public, and their minute accuracy renders them doubly interesting and valuable. Lastly, we have good maps of Farther India or Siam and Anam, and of the Straits Settlements. It need hardly be added that all the maps are engraved and printed in the publishers' well-known style of excellence and clearness. All this in a volume 7½ by 5½ inches and 1¼ inch thick, neatly bound in half-morocco, gilt top, with 30 pages of blank paper for memoranda, presents at once the most complete and handy Atlas of India ever published.

INDIA, Atlas of ——. Containing Sixteen Maps and Complete Index, with an Introduction by Sir W. W. Hunter, K.C.S.I., etc. Imperial 8vo.
Edinburgh and London: W. and A. K. Johnston, 1894. *Price* 7*s*. 6*d*.

This *Atlas of India* reminds us of a remark made in this *Magazine* (vol. vii. p. 369, footnote) on the need of a work similar to Walker's *Atlas of India*, published by Stanford about 1860; can that suggestion have prompted this publication?

In the present work fourteen sectional maps, 9 inches by 12 within the borders, are arranged to cover, singly or in pairs, the ten provincial or governmental divisions of the country; and one sheet of plans of Calcutta, Bombay, Madras, and Aden is added. The arrangement by governments has a certain advantage, but it reduces the necessary scale, as it often necessitates the covering of much of the same area by more than one map; thus, about a third of Map 5 is covered by Maps 3 and 4, about an equal area of it also by Map 6, and a larger portion by Map 9. The scale adopted in these maps is 1⅝ inch to a degree of latitude, or 50·03 English miles to an inch;[1] and Messrs. W. and A. K. Johnston's system of printing coasts, rivers, and their names in blue, and rarely crowding the names, renders their maps distinct and open, and easily legible.

The letterpress, by Sir W. W. Hunter, gives sketches of the areas embraced in each map, but these are of a character hardly such as is much needed in an atlas. Nor are the maps specially adapted to accompany his *Gazetteer of India*, for we find many places marked that are not mentioned there, and at the same time many names wanting that are in the *Gazetteer*, and the latter are not always spelt as in that work; yet there is a professed connection. The maps contain about 9500 names, and 300 more are on the sheet of city plans. It is hard to say how many of these are found in the *Gazetteer*: counting down a column we found 55 per cent. alike in both works; but this may be under the average. Even 70 per cent., however, would indicate the absence of fully a fourth of the places named in the *Gazetteer*. Apart from this, however, it is a really good Atlas of India, and is engraved in the beautiful style characteristic of all the publishers' atlases and works of the kind.

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[1] This is a natural scale of 1 : 3,169,800; but the maps are all marked as being to the "natural scale of 1 : 3,225,000, or 50·9 English miles to the inch," which would make the degree of latitude 69·94 English miles, whereas the average degree in India, or about 20° N., is only 68·8 miles. This is, however, a trifling oversight.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE ISLANDS OF CHILOE AND THE SOUTH OF CHILI.

By Mrs. Lilly Grove.

(*Read at Meetings of the Society in Edinburgh and Glasgow, February* 1894.)

The traveller from the continent desirous of visiting the Chiloë Islands and the southern regions must disembark at Ancud, on the main island. Thence the journey to Castro and the intermediate ports can be made on horseback during summer, or else by the steamer, which once a week takes passengers to the following ports: Huite, Quemchi, Quicavi, Achao, Dalcahué, Pregueldon, Chonchi, and Castro; and once a month goes on to Palena, where the Chilian Government has established a little colony. To reach the various points of the continent, such as Hualayhen, Comau, Reñihue, or the islands San Pedro, Santo Domingo, Guaitecas, etc., a special steamer must be chartered, or else the passage must be made in the native sailing-vessels or canoes.

These small sailing-vessels, called *balandras*, pass frequently to and fro between Ancud, Castro, and the Guaiteca Islands, by way of the Channel of Chacao; but the navigation is so dangerous that no company will take the risk of insuring them for this voyage. The entrance of the river Maullin, too, to the north of the Channel of Chacao, offers much difficulty on account of a dangerous bar. But the Chilotes, or inhabitants of Chiloë, are excellent seamen, and manage their vessels with much courage and dexterity. They build their canoes themselves, often out of a single tree: they can row from seven to eight hours without resting, and they will brave the worst seas, though—strange to say—they cannot swim. They are fatalists, and, when they judge death to be inevitable, they tie themselves to the boat, so that their bodies may have more chance of being thrown ashore, when the priests are expected to bury them with due religious rights. Their canoes are called *piraguas* by the Chilians; but the Chilotes call their large canoes *gampu*, and their small ones *dalca*.

The Archipelago of Chiloë consists of sixty islands lying between 41° 40′ and 43° 42′ S. lat. The ocean has here, as it were, broken through the outer range of the Andes and converted valleys and ravines into straits and bays, the high land forming the islands of Chiloë and its neighbouring groups. Towards the north and east the archipelago approaches the continent, and is separated from it only by the narrow channel of Chacao to the north, and to the east by the gulfs of Ancud and Corcovado. The mean distance from the main island to the continent is between 30 and 50 miles. Towards the south, from the main island to the most northerly of the Guaitecas, the distance is about 25 miles. The principal island—Chiloë—contains about 3000 acres: it is well wooded and hilly, but the greatest height is not more than 2600 feet.

The climate is healthy, cholera having never reached these islands, and many of the inhabitants live to a great age. Rain is abundant throughout the year, snow is very rare, and the heat is great during the day in summer: November is, on the whole, the best month to explore the islands. The prevailing winds are south and west in summer, and north and west in winter. In the south of Chiloë, the easterly winds coming from the mountains cause terrible storms and waterspouts, which are very dangerous to the shipping at anchor in the creeks.

The inhabitants, mostly Indian or of recent Indian extraction, are gentle, humble, and hospitable: crime is rare, especially since the pirates of the Guaiteca Islands, who pillaged vessels and massacred their crews, have been captured and put to death. According to the census of 1889, the population of the islands numbers 75,500. Long accustomed to national administration, and converted to Christianity under the influence of an energetic and influential clergy, they carry on their various occupations in peace and prosperity.

The towns are thriving, and education is in a very satisfactory condition: in 1874 there were about 100 primary schools, forty of them being supported by the State. At present, in the department of Castro, in an area of 60 Chilian square miles, there are twenty-seven State schools and forty-six private ones, and 80 per cent. of a population of 36,000 can read. The merit of the educationalists is great, for they had to overcome the most formidable obstacles, the chief being the prejudices of the people. When, in 1811, they wished to open a drawing-school, no pencils could be found in all Chili, and it was considered a public scandal when, in 1812, a school for girls was opened. The ignorance of women was regarded almost as a religious dogma, and the Spanish writer Campomanes was quite an innovator when he maintained that a woman might reasonably learn to read. Vancouver says that in the beginning of this century many beautiful ladies of the Chilian "upper ten," descended from noble Castilians, could not sign their names, and those who could made pothooks and hangers like children just initiated into the principles of caligraphy.

To-day, however, the Chilian woman is not only an object of education, but also an agent of instruction; and those who have brought about this result deserve much credit from their country.

Chiloë is the most favourable province of Chili for employers of labour: workmen are plentiful, and wages consequently low. At Huite excellent woodcutters are paid 50 centavos—at the present rate of exchange, 6d.—per day, with food, *i.e.* rations of potatoes and parched flour, to the value of 15 centavos—equivalent to about 2½d. At Curaco, on the island of Quinchao, which is celebrated for the beauty of its women, labour is still cheaper, wages being about 25 centavos, or 3d. per day, with very simple food.

The inhabitants are principally employed in agriculture and woodcutting. Every Chilote is a landowner, if only of a few acres; but from early spring to late summer large numbers of them (from four to five thousand) migrate northwards into the province of Valdivia, to work on the railways, or at the harvest, or in the woods, returning afterwards to their own lands. They are a hardy race, possessing great muscular strength, and fearing neither cold nor rain. Always barefoot, both men and women cut wood in the forests even in midwinter, and they journey as far as the Guaitecas for this purpose. They carry the logs on their backs, unless they are very heavy, in which case bullocks drag them to the nearest creek, where a merchant usually buys the lumber. Generally they get paid in kind, and there is a great difference between the appraised value and that of the goods given in exchange. There as elsewhere, alas, the poor natives are victims of the cupidity of speculators, who offer in barter unrectified alcohols, made from corn and potatoes, which poison both mind and body. Otherwise life is easy for the Chilotes, who have few wants: their fields furnish the potato, *their main food*; the sea gives abundance of fish and shellfish, and wood grows almost everywhere. To collect shellfish the women go down to the beach armed with hooked sticks, like French *chiffoniers.* Pigs are also trained to hunt for the bivalves, just as they do in Perigord for truffles. The principal agricultural centres are Lemuy, which, strange to say, has no woods; and Lincura, a bay little known, where wheat is grown and the potato cultivated. The Chilotes are very superstitious and frightened of the witches supposed to inhabit the island of Huafo at the south.

The potato (*Solanum tuberosum* Lin.), known as *Patata*, and more generally in South America as *Papa*, is undoubtedly of Chilian origin. This precious tuber, without which humanity could hardly exist nowadays, grows in the wildest parts of Chili, in the deserts, in the islands; in the Cordillera it is found in such abundance that the Indians have named a whole region after it "Cordillera des ponis." In times of famine and of insurrection they have often resorted to the wild potatoes. When the virgin forests of Llanquihue were burnt down for the benefit of the German settlements, the potato was the most common of all the natural plants which reappeared spontaneously. We find it growing at the summit of the highest and steepest saddles of the Cordilleras, which man seldom visits. Don Pedro Valdivia, the Spanish conqueror of Chili, says in his letters to his Government that the Indians of Chili live on potatoes which they gather on the hills.

The starchy farina extracted from the potato is known as *Chuño,* and is specially well prepared in the southern parts of Chili, and used as a light digestible aliment for convalescents and children.

In speaking of the plants of Chili we must mention the *Latué* (*Latua venenosa*). Having heard that the Indian wizards of Southern Chili knew a plant which produces madness, Sr. Philippi was most anxious to discover it, but it was very difficult, as the Indians keep their secrets well. From the missionary, Father Doglipulli, he learnt that the name of the plant was *Latué,* that it grew on the Cordillera of the coast, and that it was a shrub; but he knew no more. However, Sr. Philippi gathered from Jean Renous that it was a prickly shrub resembling the *Flotovia diacanthoides.* Jean Renous added that a woodcutter, being wounded, took by mistake an infusion of *Latué* instead of *Flotovia,* and that he was mad for three days, hiding in the wood, where his comrades eventually found him, and that for many months he suffered from severe headaches. Again, some Chilotes who, being famished, had eaten of the fruit of the *Latué* on a voyage from Osorno to Maullin, were mad on arriving at their destination. Near Ancud, Philippi found at length the shrub bearing flowers and fruit; it is called there *Arbol de los brujos* (tree of the sorcerers). The precise physiological action and the therapeutic use of this active plant, the effects of which are similar to those of Belladonna, are as yet unknown. The antidotes are the juice of the mulberry given as a drink, and compresses of iced water laid on the patient's head till he recovers.

On the hills near, an everlasting shrub, the *Pangne,* is found, valuable medicinally as an astringent. The leaves of the *Pangne* are so large that they can be used as parasols. It grows especially in marshy places; the root is used as a black dye, and for the tanning of hides; in a decoction it is a most useful and widely spread remedy.

It would be interesting, if possible, to describe the many plants and trees of Southern Chili; but we cannot pass without mention the *Piñon* (*Araucaria imbricata*), a grand tree, the height which is over 90 feet. It is very straight and bare at its base; the branches, which are horizontal, sometimes droop so as to form a kind of cupola. The Araucanians call it *Pehuen* and the fruit *Piñon*: the latter is edible, farinaceous, and very pleasant, tasting somewhat like the chestnut. This magnificent tree is found in the cordilleras of Santa Barbara up to Villa Rica. From its trunk oozes a white resin, having the scent of incense; the natives employ this to make plasters for contusions and ulcers, and also as a preventive against headaches. At Castro, where agriculture is largely carried on, there are magnificent woods of *Araucarias.*

We must mention one more tree found in abundance in Chiloë, *i.e.* the *Canelo* (*Drimys Chilensis*), about 30 to 40 feet high, pyramidal in shape, with a shining leaf, green above and grey underneath; its flower is pure white, and its berries black and oval.

This is a celebrated tree. The Indians call it *Coighe,* and the Spaniards

Canelo—because it is rather like the Winter's Bark which grows at Quito. The natives employ it as a safe-conduct to pass from one province to another, and also as a flag of truce. It plays the same part among the Indians that the olive and the laurel did among the Romans. It is specially dedicated to demons; it forms the altar of their sacrifices and the tripod whereon their oracles prophesy. There are three species of *Canelo*: the first is used by the *machis* (doctors) and also by the sorcerers and wizards (*dugales*), for their cures and their invocations of demons. These wretched men dye the trunk of the *Canelo* with the blood of the animals killed, and then offer to the "bad spirit" the hearts and heads. This species of *Canelo* has a wide and very green leaf, whitish underneath.

The second species of *Canelo* is the symbol of peace. It figures in all the meetings or *parlamentos* presided over by the Caçiques; it also is used as a passport or safe-conduct in going from place to place. This kind has a smaller leaf, long in form, green on one side and greyish on the other.

The third species is similar to the two former, except that it has a curly leaf; it does not act as a safe-conduct, but the Indians employ it to deceive and to betray all those who do not know the various kinds of *Canelo*, as happened in the revolt of 1655 at the Fort of Arauco. The Indians (Araucanians) had revolted, and had made several attempts to take the fort. The Spaniards defended themselves with much courage, braving hunger and fatigue. When the Indians saw that they could not gain their end by force of arms, they resorted to their habitual cunning. Presenting themselves before the fort without arms and carrying branches of *Canelo*, they asked humbly to be allowed to enter for the purpose of negotiation, for that they repented of their fault, and were punished sufficiently by losing the friendship (so precious to them) of the Spaniards, whose pardon they now meekly craved. But the *Canelo* they displayed was the curly-leafed species, and therefore meant nothing.

The former kind grows in damp localities, and flowers in September. In the shade of its elegant foliage take place the solemn meetings at which the fate of an individual, of a family, or of a whole tribe is frequently decided. As a symbol of peace or justice it figures in all religious and political ceremonies.

Just as in Virgil we read of the inhabitants of Latium before Æneas carrying branches as symbols of peace, so we see the Araucanians carrying a branch of *Canelo* whenever a merciless war threatens to decimate a territory. The magic and powerful influence of this branch calms all irritation and disarms the bitterest foes.

The sorcerers and wizards worship the *Canelo*, and always take care to have a part of this tree in their houses, and often plant one in front of their huts.

When the wizards are consulted by some mourning family about the death of one of its members, they circle round this tree, climb up its trunk with convulsive movements, and seek inspiration in repeated draughts of a beverage made of a decoction of the bark; they then fall into a sort of delirious frenzy, like an ancient pythoness, during which they reveal to the family the supposed author of the crime which has bereaved them of their relative.

From a report made last century to the King of Spain by Moreluda, we learn that flax and tobacco were then cultivated in the islands. Probably a change of climate has stopped the cultivation of the latter. The extract alluded to runs as follows:—"The flax produced at Chiloë is so excellent, that if the islanders only had a love of industry, they would soon better their condition by means of this source of profit. Tobacco is also grown abundantly, and is similar in growth to the tobacco of Cuba, and superior in quality to the plant of Guayaquil, Lima, etc."

Fishing is also a great industry; the inhabitants smoke quantities of fish by simply hanging them over their cottage fires: the *Robalo* is excellent, and can compete with the best English stock-fish. Besides these pursuits, charcoal for domestic purposes is made near Huite: seal-skins, which come for the most part from the Guaitecas, are dressed at Dalcahué. Salt springs are worked at Chochahin, which are, no doubt, due to infiltrations into the porous ground at certain high tides; while at Chonche, in the department of Castro, salt lakes have been found from which an excellent salt has been extracted, when that article was scarce. There is a good breed of ponies in the islands; they are about the size of a Shetland, a little over three feet high, and are probably descendants of a breed which is seen to this day at the fairs of Northern Spain. In the Cousiño stables near Santiago, they are crossed with Pampeluna ponies.

The ports of Chiloë are Ancud, Castro, Huite, and Dalcahué. Ancud (41° 51′ S. lat.), the capital of the province as well as the principal port, is situated on a superb bay, the mouth of the river Pudeto. There is no shelter from the north winds, but it is protected to the south by the chain of Bellavista. It has a good mole or pier, which is, however, only accessible to canoes or lighters. Steamers have to anchor about a mile outside, and the landing from them in winter is not devoid of danger. The river Pudeto can only be navigated by very small vessels, and that only at high tide. The town of Ancud is very old and the seat of a bishopric. Nearly all the buildings are of wood, and are primitive in plan. The town is defended by the fort of San Antonio. The ground is hilly and little suited for large factories, so the inhabitants are chiefly employed in agriculture, which is somewhat meagre. From the constant rains, the roads are in such a condition that they can only be used by very narrow and primitive bullock-carts. Castro, the capital of an important department of the same name, has a well-sheltered port and a good pier, which allows vessels of all draughts to disembark their passengers at all states of the tide. The town is picturesquely built, on a height overlooking the bay, the river Gamboa (at one time celebrated for its golden sand), and the forests. The population is about 2000. Huite, facing the island of Concahué, has a fine harbour, where the remains of a dry dock for lighters are still visible.

The forests which have been mentioned near Castro and Ancud are largely composed of a most important tree, the *Alerce*, the botanical name of which is *Fitzroya Patagonica*. It reaches a height of 100 to 130 feet; its wood, reddish in colour, with regular dark veins, is light and soft, with few knots; when used green, it warps and contracts a little, but once dried it is not injured by damp. It can be split with the greatest ease and regularity, and if always kept in water will last for an indefinite time.

It is most useful for all building purposes: at present it is mostly made into small planks for roofing and railway sleepers, and is employed for making bridges, tubs, and barrels. It is believed that this tree could be used for every purpose to which the American pine is applied, for it has the same solidity, and lasts quite as long. The bark is fibrous and imperishable, and is very useful for caulking boats. Unfortunately, the forests at Castro are not near the coast, and cannot be worked for want of economical means of transport. The river Gamboa, although bringing down a large volume of water, is too tortuous and full of rocks to allow rafts (*balsas*) to carry down the timber. The Government ought to make new roads, railways, etc., to assist the timber trade.

It would take too long to describe all the numerous islands of the archipelago, or the Guaitecas Islands, south of Chiloë and close to the mainland. One or two, however, deserve notice. Quinchao is important as an agricultural centre: it is the residence of a governor, and has a telegraph-station. It comprises the *Capillas*, Achao, Palqui, Hullar, San Javier and Curaco. In all these islands a chapel (*Capilla*), generally very ancient and built by missionaries, indicates (and determines) the position of a village, and indeed gives it its name: for the natives do not speak of such and such a "village," but of such and such a *Capilla*; these chapels are often very beautiful. In the small island of Quilquico, near Castro, indications of the existence of petroleum have been found. San Pedro, at the southern extremity of the large island, is uninhabited, but traces of the encampments of fishermen and sailors, probably seeking a refuge on their way from the Guaitecas, are found on it. A stream, coloured red by the *Tepus* wood, comes out of the forest and runs into the sea. There are no paths except those made by animals, and they are so narrow that to penetrate into the interior a way must be cleared by the axe. The trees found are *Canelo*, beech, *Tiaca*, and *Tepus*, but no cypresses: wild celery, mosses and lichens of every description, are very abundant. The rocks are mostly white quartz, and may contain auriferous veins. In all probability this will become an important island. The Guaiteca Islands are much frequented by the Chilotes, especially in summer. They are covered with forests where cypress timber is obtained. They afford good sport to the seal hunter, and their fisheries are on a vast scale, immense quantities of shell-fish being carried thence to the preserving factories of Calbuco and Huite. None of the islands has a settled population except one, Melinka.

The Chilian Government ought to take stronger measures as to the regulations about timber-cutting and the colonisation of this interesting part. The islands ought to be connected by telegraph with the main island, and be put in communication with it by means of regular steamers. Fishing and shooting laws should be established, otherwise seals and fish will disappear, as whales have done already.

THE LAND OF VITI.[1]

By J. P. Thomson, F.R.S.G.S., etc.,

Hon. Secretary to the Royal Geographical Society of Australasia, Brisbane, etc. etc.

Before entering on my subject, I wish to assure my readers how highly I appreciate the privilege conceded to me of contributing a paper to the *Magazine* of the Royal Scottish Geographical Society.

It will be remembered by readers of the *Magazine* that the last paper I had the honour of contributing to the literary archives of the Society was upon our youngest colonial possession—British New Guinea. The subject of the present contribution is also upon one of our youngest British colonies—an archipelago of islands endowed with great wealth of natural resources and rapidly rising in commercial prosperity. Intimately associated with the establishment of British government in this colony were two famous Scotchmen, Sir Arthur Gordon and Sir William MacGregor, and for that reason, but more especially in view of the commercial importance of the islands, the contents of this paper, which records some of the experience acquired during several years of professional life in the group will, it is hoped, prove of special interest to the members and fellows of the Royal Scottish Geographical Society.

The position of the archipelago of the crown colony of Fiji is no doubt known to most of my readers, but, nevertheless, it may not be amiss to make some slight allusion to its remarkable geographical position.

Entirely encircled by the great equatorial drift-current and its offshoots, the Fiji Islands lie 1172 miles almost due north from Auckland in New Zealand, and due east from Halifax Bay on the coast of Queensland. North-east of them are situated the Samoa or Navigator Islands; to the south-east the Friendly or Tonga Islands; to the south-west the Loyalty Islands and New Caledonia; and west of them lie the New Hebrides. The whole group extends from about 15½° to 21½° south latitude: on the east it is bounded by the 178th meridian of west longitude, and on the west by the meridian of 176° 50′ east longitude; thus the anti-prime meridian passes right through the colony. From Sydney the distance to Suva, the capital of the group, is about 1800 miles, and from Melbourne the same place is separated by some 2222 miles of ocean highway. Although scattered over 139,000 square miles[2] of the South Pacific, within the great Polynesian division of Oceania, the actual land area of Fiji is probably little more than 7451 square miles.

Regarding the early history of this prosperous British colony little definite information can be gathered from our modern literature. Since about the middle of this century several interesting narratives of the

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[1] Read at the Adelaide Meeting of the Australasian Association for the Advancement of cience, September 1893.

[2] An error has obviously been committed by the Rev. Thomas Williams, who states that he group extends "over about 40,000 square miles of the South Pacific."—*Fiji and the Fijians*, 2nd ed., revised, p. 1.

group and its people have emanated from the pens of various estimable writers, including the admirable work published in 1858 by the Rev. Thomas Williams of Adelaide, who for many years laboured in Fiji as a Wesleyan missionary, and who was, moreover, a careful and intelligent observer. In none of these works, however, are we able to find anything more than a passing allusion to the prehistoric age of the land of Viti and its interesting race. To this fascinating subject our attention has recently been invited by Mr. Charles Hedley, F.L.S., of the Australian Museum. In a paper contributed to the Linnean Society of New South Wales,[1] Mr. Hedley, dealing with the geographical distribution of the molluscan fauna of the South Pacific, points out that the range of the genus *Placostylus* unmistakably denotes the early continental character of Fiji and other neighbouring groups—that in fact New Zealand, New Caledonia, Samoa, and Fiji are fragments of what was formerly a continent.

In a few notes upon Mr. Hedley's paper, contributed to the Queensland Branch of the Royal Geographical Society of Australasia,[2] I pointed out that to this extensive area designated the "Melanesian Plateau," and which was probably united during the Mesozoic era, should be added, at least, Australia and New Guinea. This opinion is in harmony with the views expressed by Professor Geikie, Wallace, De Vis, Maitland, and other well-known authorities.

If it be admitted that these views are borne out by the broad geological and palæontological features of these regions, then our investigations concerning the origin of the Fijians and other peoples of Polynesia will, I submit, be greatly simplified, and all doubt concerning the early movements of these island-dwellers set at rest.

That an enormous area of Oceania was formerly occupied by an extensive continental region, of which the numerous islets and groups of islands now separated and scattered about in all directions formed prominent and conspicuous features, seems unquestionable. Still less reason is there to suppose that the now extinct faunas of these regions were at any period of the world's history separated by such clearly-defined lines of demarcation as would adequately and effectually create an insuperable barrier and form distinct zoological provinces corresponding with the positions these widely-scattered fragments now occupy.

Concerning the causes that combined to insulate these regions we can only indulge in vague conjecture, probably of the most extravagant kind. Even now there are abundant signs that subterranean convulsions have not yet ceased in many isolated parts; but whether these are simply traces or after-effects of the forces that brought about the apparent changes in the physical features of this oceanic division we cannot definitely decide.

Date of Discovery.—Fiji was discovered in 1643 by the celebrated

[1] *The Range of Placostylus: A Study in Ancient Geography.* By C. Hedley, F.L.S. Vol. vii. (2nd series) of the *Proceedings of the Linnean Society of New South Wales*, p. 335.

[2] *The Melanesian Plateau: Notes on Mr. C. Hedley's paper.* By J. P. Thomson, F.R.S.G.S. *Proceedings and Transactions of the Queensland Branch of the Royal Geographical Society of Australasia*, vol. viii.

Dutch navigator, Abel Jansen Tasman, and was subsequently sighted by Captain Cook, in 1776; by Capt. Bligh, in 1789 and 1792; and by Captain Wilson in the *Duff*, in 1796; the two latter having passed through the group. There is little doubt, however, that in much earlier times this archipelago was not unknown to the Phœnician sailors who voyaged across the Indian and South Pacific Oceans to the shores of the great American continent. But it was not till the beginning of this century that the natural productions, *bêche-de-mer* and sandalwood, attracted adventurous traders to the coral-girt islands of Viti. About the same time the group was visited by a batch of notorious convicts who, having escaped from the penal establishment in New South Wales, settled among the Fijians. From the year 1804 till 1840, when only one out of the original number of 27 was left, their demoralising influence produced most baneful effects upon the natives of Bau and Rewa. The social habits of these refugees were low and brutal, and in tribal warfare they incited the natives to wanton acts of barbarism and cruelty. This, indeed, was the deplorable condition of the Fijians when the Wesleyan Church missionaries commenced their christianising work in 1835, the Revs. W. Cross and D. Cargill being the first to preach the gospel to this savage and cannibal people. Since that date the noble work of evangelisation has been carried on with vigour and success by the Wesleyan and Roman Catholic Churches. Rapine and plunder, savagery and cannibalism, and all the immorality of heathen life have disappeared before the civilising agency of the British Government and modern Christianity; consequently, we find the Fijians of to-day a useful and law-abiding people, living, moreover, in the full enjoyment of their ancient rights and usages, and participating, also, in all the privileges granted to British subjects throughout the Empire.

With pioneering settlement the work of survey and exploration went hand in hand. For the preliminary part of this important undertaking we are mainly indebted to the accomplished officers of the British navy and that of the United States of America, who conducted the marine survey of the archipelago. It was not, however, till after the group was annexed to the British crown, in 1874, that the actual land survey of the islands was undertaken and carried out in detail, being commenced by a small detachment of the Royal Engineers under the direction of Col. Pratt. Shortly afterwards that officer and most of his assistants were withdrawn from the colony, and the work of the survey was taken up by a staff of government surveyors, including myself, and one or two of the Royal Engineers who elected to remain behind. The earlier labours of these officers were chiefly directed to the coast survey and the exploration of the island colony, undertaken mainly for the purpose of assisting the Royal Commission appointed to investigate the European land claims. This was followed up by the permanent cadastral survey, which included all claims to land allowed or confirmed by the Commission, the rivers and creeks, the mountains and other physical features. The whole work, based strictly upon the true meridian, which is undoubtedly the best method for Australasia, was carried out with a degree of accuracy and completeness that reflects the greatest credit upon the Survey Department of the colony, of which the Honourable John Berry is head.[1] This will readily be admitted by all who know the exceptionally difficult character of the country. Apart from the enervating influence of a tropical climate, the dense jungle, the intricate forest belts, the surface vegetation and the exceedingly rugged nature of the islands combined to form impediments requiring great skill and physical strength to overcome. The daily task of climbing mountains, swimming rivers and channels, and wallowing in mud flats and among dense mangroves must sooner or later produce a very marked effect even on the strongest constitutions.

GEOGRAPHICAL DIVISIONS.[2]—The archipelago of Fiji comprises some 225 islands,[3] of which about 80 are inhabited, while several are mere barren rocky pinnacles shot up, as it were, from the floor of the ocean. The total land area of the group is probably about 7451 square miles. Of this Vitilevu occupies some 4112 miles, Vanualevu about 2432, Taviuni about 217, Kadavu 131, and the residue is distributed among the other smaller islands of the archipelago. The area of Kadavu was very carefully determined by myself, and I contributed a paper on the physiography of the island to the *Scottish Geographical Magazine*.[4]

For easy and ready reference the colony may be geographically divided into four groups. These comprise the Eastern Division, known to modern geographers and to the natives as Lau, and including the Windward and Ono clusters; the Southern Division, embracing Kadavu, Moala, Totoya, Matuku, and neighbouring islets; the Western Division, comprising Vitilevu, Ovalau, Gau, Wakaya, Nairai, Makogai, the Yasawa cluster, and surrounding islets; and, lastly, the Northern Division, including Vanualevu, Taviuni, Rabi, Coro, Qamia, Cikobia, Yadua, and others of less importance. These partitions which, besides coinciding with climatic zones of different peculiarities, are sufficiently marked in themselves to establish their claims to recognition as distinctly separate divisions, are partly based upon the bathymetrical data determined by the marine survey of the British navy. In Kadavu Passage, between the Southern and Western groups, there exists an abyss of some 1020 fathoms in depth ; on the east of the Southern Division there is a dip of 1200 fathoms ; in Nanuku Passage, separating the Northern and Eastern sections, the soundings show a depth of 543 fathoms. In some parts of the group the bathymetrical lines are not so pronounced as those I have noted ; in others, soundings have not yet been taken. Still, the other existing geographical features are, in themselves, sufficient reasons for adhering to the natural divisions here indicated.

Commodore Wilkes, in his narrative of the United States Exploring Expedition, divides the group into seven districts ;[5] while Rev. Thomas

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[1] The Departmental Staff is now reduced to two officers.

[2] For Map of Fiji see vol. vii. p. 440.

[3] *Macuata.* By J. P. Thomson, F.R.S.G.S. *Proceedings and Transactions of the Queensland Branch of the Royal Geographical Society of Australasia*, vol. i. p. 27.

[4] *The Island of Kadavu.* (With map.) By J. P. Thomson, F.R.S.G.S. *Scottish Geographical Magazine*, vol. v. p. 638.

[5] *Wilkes's Narrative of the U.S. Exploring Expedition*, 1838-1842, New York.

Williams counts eight divisions;[1] and the natives, when speaking of different parts of the archipelago, refer to five provinces, namely, Vitilevu, Vanualevu, Upper Fiji, Lower Fiji, and Central Fiji. None of these divisions appears to me to quite correspond to geographical characteristics of the group; the parts are, moreover, too fragmentary. The Yasawa Group is simply a chain of islets scattered over the northerly extension of the Great Sea Reef that encroaches upon the shores of the Nadi District on the west coast of Vitilevu. The whole base of this extensive northerly prolongation has been carefully plumbed by the sounding line, and nowhere does the depth of water much exceed 40 fathoms, while in some places it diminishes to about a fourth of that depth. And yet this group is classified by the writers just mentioned as one of the divisions of the colony.

Northern Division.—The Island of Vanualevu, the second largest of the group, occupies the greater portion of this division. From its most westerly point, called Nai Cobocobo, in longitude 178° 28′ east, it stretches north-eastwards for about 100 miles, and, crossing the 180th or anti-prime meridian, terminates in Cape Udu, in longitude 179° 56′ west. From Savusavu Bay to the northern coast it measures about 21 miles across, but as the island contracts considerably in some places, and in others greatly expands, it is scarcely possible to form an adequate conception of its shape or extent from a written description. To the south of Cape Udu lies the entrance to Natewa Bay, or the "Dead Sea" as it is called by the natives, an enormous indentation of some 40 miles in length, and, on a small scale, somewhat resembling the Gulf of Carpentaria, Queensland. Near the middle of the island, and on its southern aspect, is situated Savusavu Bay, a broad haven, wherein are to be found water and capital anchorage for trading vessels of every description. This and the Bays of Nadi and Sandalwood, to the westward, are the most useful indentations on the southern shores of the island, while, on the north side, snug harbours are to be found along the whole coast line. In a large island, such as Vanualevu, one would naturally expect to find a variety of physical features, nor are we disappointed in this respect. Along the entire seaboard extends a coast range, at some places rugged and precipitous, at others easily accessible. On the north coast the elevations are from 1200 to 2000 feet, the continuity of the range being broken in several parts by extensive fertile valleys, through which flow the waters of the Dreketi, Wailevu, Labasa, Dogatuki, and other rivers and creeks that carry most of the rainfall of the interior to the sea, while, overlooking the southern shores of the island, huge pyramidal masses, towering high above the neighbouring country to altitudes of some 4000 to 5700 feet or more, terminate abruptly near the water's edge. The topographical features of the interior are mainly composed of rugged and steep lateral spurs of the main coast ranges, with numerous precipitous hills, intervening valleys, limited areas of slightly undulating and moderately flat land, and patches

[1] *Fiji and the Fijians.* By Thomas Williams, late missionary in Fiji. Edited by George Stringer Rowe. Second Edition. London, Alex. Heylen, 1860, p. 15.

of swampy country. Running water is everywhere abundant, and, although free from loose stones and rocky boulders, the inland region is not by any means easy to traverse, whether for the professional surveyor or the natural history collector. The physical features of the smaller islands of this Northern Division are for the most part similar to those just described, except that along the whole coast line of Taviuni no deep bays or sheltered inlets indent the shores of the beautiful and fertile island. Separated from the south-eastern coast of Vanualevu by Somosomo Strait, Taviuni extends about 25 miles longitudinally from north-east to south-west, with a perimeter of some 60 miles. The island is almost entirely occupied by a high mountain range, extending along its whole length and culminating in lofty peaks over 4000 feet above sea-level. On the crest of this range, near the middle of the island, a beautiful placid lake of fresh water spreads itself over a deep depression, which probably is all that now remains of an extinct crater of a bygone age, when the group shook and trembled with the violent convulsions of volcanic activity that shattered the Great Melanesian Plateau into insulated fragments. On the eastern side of the island the spurs and outliers of this range spread themselves out to the seashore, and present a strange contrast to the general appearance of the western coast, where extensive patches of flat and gently undulating lands are met with. The island of Koro to the south, and that of Rabi, east of Vanualevu, are both rugged and mountainous; as in the case of Taviuni, the former possesses no sheltered inlets of any consequence in which vessels may ride in safety during stormy weather. The most northerly outpost of this division, and therefore of the whole group, is the remote island of Cikobia, situated some 26 miles due north of Cape Udu. It is of an elongated tongue-shaped form, extending eastwards and westwards. Owing to its exposed position and the absence of safe and sheltered havens, this island is rarely visited, except by small trading vessels that call for *copra* and the beautifully-manufactured floor-mats, for which the place is noted.

EASTERN DIVISION.—Of the numerous small isolated islands and clusters of islets that lie in close proximity to each other within this division, Vanua Balavu, Lakeba, Cicia, Mago, Nayau, Tuvuca, and Kabara merit priority of place; not that they are remarkable in size, for the largest is only some 24 square miles in extent, but because they are the largest of this section. Except the first, which is long and narrow, and is indented by several bays and inlets, these islands are nearly round, with elevations that culminate in their centres. The island of Mago is the property of some Europeans, who formerly utilised it for the cultivation of sugar-cane. The other islands of which we are writing are occupied by the natives, who cultivate many varieties of food products, for which the rich soil is eminently adapted. Apart from the romantic aspect of the coral-girt gems that stud these eastern waters of the group, the early association of the Tongans with this division, upon the shores of which they first landed, will always render it especially interesting to students of ethnology.

SOUTHERN DIVISION.—Within this division are some very prominent and remarkably interesting features. Of the five islands of which it is mainly composed, Kadavu is the most important. Extending in a north-east and south-west direction, the whole island is traversed by an irregular, rugged, and strangely contorted mountainous range, culminating in several high peaks of some 1140 to 2750 feet above the sea-level, of which Washington, Challenger, Korolevu, and Korotusara are the most noteworthy.

These and others of somewhat less elevation throw off steep and broken ridges that, radiating in various directions from the central peaks, terminate abruptly on the adjacent shores of the island, where their bases plunge deep into the waters of the ocean. Although its length is only some 33 miles, and the greatest breadth about 7 miles, the total length of coast line of this island is very considerable, owing to its irregularity and the succession of deep bays and intricate inlets, which run far into the land, and, in one or two places, almost cut the island in two. At Tavuki Isthmus, indeed, the continuity of the mountain range is broken, and the land is so low, that canoes and boats are frequently dragged across from one side of the island to the other. Where so many bays and inlets exist it is only natural to expect that many snug and sheltered anchorages will be found. Chief among these is the excellent harbour of Galoa, where, in the earlier days of British settlement on the shores of these islands, the American mail steamers were wont to cast anchor in the smooth and limpid waters of a sheltered bay. These days of pristine vigour, alas! have gone, and we sigh o'er the memories of the past.[1]

Mount Washington, or Bukelevu as it is called by the natives, which occupies the south-west end of Kadavu, is the landfall of vessels entering the group from the south. It is a very prominent landmark, but, except in very clear weather, the summit of the mountain is usually enveloped in dense vapour. Close to the north end of Kadavu lies the island of Ono, within the great Astrolabe Reef. It is small and somewhat roundish, indented by two or three convenient bays, and occupied almost wholly by a cone of volcanic origin; on its shores are scattered a few native villages.

The eastern limit of this division is marked by the picturesque islands of Moala, Matuku, and Totoya, all of which are composed of high broken ridges from 1184 to 1535 feet above sea-level. The former is an irregularly-shaped island, indented by sheltered bays, and the latter has the curved outline of a horse-shoe, with the opening to the south; it is probably a raised atoll, with a lagoon in the centre.

Western Division.—The land area of this division is larger than that of any of the preceding, and, by reason of its social and political history, this part of the group is undoubtedly of exceptional interest and importance. Great Fiji, or Vitilevu, is a large island, measuring 93 statute miles across its greatest breadth from east to west, and 68 from north to south. Among the numerous commodious bays on the

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[1] *The Island of Kadavu.* By J. P. Thomson, F.R.S.G.S., etc. *The Scottish Geographical Magazine*, vol. v. p. 641.

coast, the magnificent and picturesque harbour of Suva is pre-eminent. Situated on the south coast, it is flanked on the west by densely-wooded hills, while at its head and on the eastern shores nestles the European capital of the group. Here Government House occupies a picturesque spot on a gently sloping knoll near the southern end of the town, and the private dwellings of the government officials and other inhabitants are scattered over the hill-sides, commanding an unobstructed view of the harbour and surrounding country, with its green and variegated mantle of rich luxuriant vegetation. Along the beach are the business houses and main thoroughfare, where busy people, dressed in helmets and light shirts and trousers, hurry along both early and late; the whole aspect of the place bears the impress of prosperity.

The northern, and part of the eastern, coast of Vitilevu is traversed by a range of high hills. In some places the spurs of this range encroach upon the seashore, but there are parts where the base of the hills is bordered by wide strips of flat fertile land. Owing to the physical configuration of the country there are no navigable watercourses by which the interior can be reached, the rainfall being carried off by numerous creeks. On the southern coast, however, the physical conditions are entirely different; here are to be found tracts of flat land, many thousands of acres in extent, spread out over the coastal districts, and extending far back to the high and rugged mountain regions. Here, too, are located the two largest rivers in Fiji, the Rewa and Sigatoka; the former disemboguing into Laucala Bay, some 8 miles east of Suva,[1] traverses a beautiful and fertile basin of great extent and richness. Including tributary streams, its navigable length is over 70 miles, and it drains an area of some 1360 square miles, or about a third of the area of the island; its principal affluents are the Wainibuka, the Waidina, and the Wainimala. The first drains the western and southern watershed of the northern and eastern coast range, and the latter receive the waters of a high range that traverses the middle of the island from north to south, culminating in Muani Vatu, about 4000 feet above sea-level.

It is in the western face of this range that the source of the Sigatoka River is located, separated from the head-waters of the Wainimala by the high and narrow crest of the mountain; the distance across the mountain between the head-waters of the rivers is very short indeed. In point of magnitude the Sigatoka is scarcely inferior to the Rewa. From its head-waters, in the remote interior of the island, it drains the districts of Navosa, Nadroga, and Serua, and, meandering through wild broken country of exceptional loveliness, foaming and tossing through deep narrow gorges, over and around huge boulders, reaches the sea at the south-west corner of the island.

On the north-west coast lies the Ba River, a large and important stream, with two principal affluents, that originate in the high and rugged mountain ranges of the interior. The lower basin of this river

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[1] *The Rewa River, Fiji.* By J. P. Thomson, F.R.S.G.S. *Proceedings and Transactions of the Royal Geographical Society of Australasia, Queensland Branch,* vol. ii. p. 32.

is composed of rich alluvial flats of considerable extent, mostly owned and cultivated by Europeans.

Concerning the physical features of the numerous small islands forming the remainder of this division little need be said. Except in extent they very closely resemble those of which a description has been given. Bau, the seat of the late King Cakobau, and the native capital of the group, is a small and insignificant island, connected with the east coast of Vitilevu by a long coral reef, a few miles north of the mouth of the Rewa River. The early associations of this historical capital are full of wanton cruelty, savagery, and cannibalism, to which the rising generation is happily strange. Some distance north of Bau lies the island of Ovalau, upon the eastern side of which is situated Levuka, formerly the European capital, amid verdant hills and precipitous rocky cliffs. It is truly a charming spot of unsurpassed beauty, and, as it welcomes the morning sun, the hues and tints spread over the luxuriantly mantled hills and valleys present a picture of inimitable loveliness, nor can we deny this meed of praise to many other parts of this gem-like isle. It was on the shores of Levuka Harbour that I first touched Fijian soil, and it was at Nasova, the charming seat of government, at the south end of the town, where my professional duties in the colony commenced.

Reefs.—In order to avoid repetition and to economise space, I shall deal with the reefs of the whole group together, instead of describing the coral areas of each division separately. The islands of Fiji are either wholly surrounded, or partially fringed, by coral reefs of three classes, usually distinguished as atolls, barrier reefs, and fringing reefs. Of these we find a barrier reef, practically the only one of its kind in the whole group, extending north-easterly from the south-west corner of Vitilevu to Cape Udu, the Land's End of Vanualevu. Along the entire length of this enormous barrier are numerous associated lateral fringing reefs, that skirt the shores of the small and moderately large islands scattered over the whole western side of the archipelago. At several places the barrier reef is cleft by roomy or narrow passages, and the numerous openings in the shore, or fringing, reefs afford a safe approach to the land. In the southern and eastern part of the colony the coral areas appear in the form of atolls with the usual enclosed lagoons. The form and character of these reefs are exceedingly interesting, and their general aspect exquisitely beautiful.

The origin, character, and permanency of the coral reefs of the great Pacific Ocean are subjects upon which many diverse opinions have been expressed. Recent investigations throw a doubt on the accuracy of the data upon which some of the earlier conclusions were established, and it is now certain that many of the premises upon which Professor Darwin based his theory of subsidence are not supported by fact. In a very able and exhaustive paper contributed to the *Scottish Geographical Magazine*, Dr. Guppy points out that in placing the Fiji Archipelago in an area of subsidence, Darwin was guided by defective and even erroneous evidence; that, as a matter of fact, the Lau Group "possesses elevated reefs sometimes removed 600 feet above the sea," and that the character of the *foraminifera* of the soapstone deposit at Suva, recently investigated by Mr. H. M. Brady, affords evidence of an upheaval in post-Tertiary times of from 1000 to 1200 feet.[1] This view of the question is entirely borne out by the writer's own observations in many parts of the group, and nowhere is the evidence stronger than in the interior of some of the larger islands, where the old coral beds occur in the mountainous districts. There can be no doubt, however, that the defective points in Darwin's conclusions are to be attributed entirely to the scanty and imperfect data with which he had to deal, and not to faulty judgment on the part of that eminent authority.

It is mainly to the investigations of Wichmann and Weinicke that we are indebted for our knowledge of the geology of the Fiji Islands, although others have contributed much useful information upon this interesting subject. From the information these authorities supply, which there is no reason to distrust, the geological character of the group is chiefly marked by the presence of plutonic rocks, with which are associated crystalline schists, and over these lie accumulations of organic and volcanic deposits. While this general description holds good for most parts of the colony, there are several places in the larger islands where sedimentary rocks occur, and these have yielded fossiliferous deposits of Tertiary age. It must, however, be understood that, within the limited scope of this paper, little more than a general sketch of the geological features can be given.

The soils of Fiji are rich and various: river valleys and flat lands are covered with a deep alluvial soil of wonderful fertility, and deltaic areas are composed of highly fertile alluvial and diluvial deposits that are being constantly added to. On hilly country, and low undulating areas, the surface soil is a free and stiff loam, rich in humus. Extensive areas of rich *débris*, highly charged with phosphates, fringe the bases of the mountainous country, while the mountain slopes are covered with fertile soils, mainly composed of organic matter. The highly productive qualities of all of these are everywhere apparent in the density and luxuriance of the forest vegetation.

A word may be said on the scenery of Fiji. To state that the scenic beauties of the archipelago are charming conveys no adequate conception to the mind. Beauty that defies description is here to be seen, on the hills and mountain flanks, in the narrow glens and gorges, along the winding rivers, in the rapid foaming streams, by the silent lakes and marshes, and on the wide-spread plains and valleys. The forest with its richly coloured foliage, and the ocean with its submarine structures, sometimes a scene of quiet beauty, and sometimes of awful grandeur, have each its peculiar charm. In the different countries through which I have wandered I have seen nothing to surpass the natural loveliness of the coral-girt isles of Viti. There is some mysterious attraction in the place—a kind of preternatural power that completely enthrals those who live any length of time in the colony.

Products.—The natural products of this flourishing young colony

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[1] *A Criticism of the Theory of Subsidence as affecting Coral Reefs.* By H. B. Guppy, M.B. *S.G.M.*, 1888, p. 128.

are very considerable. From *bêche-de-mer* alone a sum of over £4812 was derived in the year 1887; and this sea-slug is scattered over the surface of the coral reefs of the archipelago. There are several varieties of wild fruit, including oranges, mangoes, shaddocks, and guavas. There are also wild bread-fruit, yams and other edible tubers. In the forests are gums and several varieties of very valuable timbers, including sandalwood. At one time there was a very considerable and remunerative trade done in the latter, but now it is scarce, and for several years has not been exported from the colony. To gums very little attention has been given, the energy of the colonists being directed to enterprises of greater magnitude; it is, in consequence, an industry awaiting development at the hands of some enterprising trader who may here find the means of profitable employment. Of pearlshell and tortoiseshell the export is at present small, but there is probably room for developing this very profitable industry. At the present time sugar, *copra*, and green fruit constitute the staple products of Fiji: the cultivation of the former has for many years been restricted to the earlier settled districts of the Rewa, Ba, Mago, Navua, and Serua; now the Colonial Sugar Refining Company has extended its ramifications to the Labasa and Wailevu, on the north-west coast of Vanualevu, and in other suitable parts of the group the cultivation of the sugar-cane is receiving attention. Exclusive of local consumption, the total value of the sugar exported from the colony in the year 1891 was £327,526.[1]

Copra comes next in importance, and although the market for this article is at present low, the cultivation of the coconut industry is developing rapidly. After the palms are planted they require little care or attention, and at from five to seven years of age they bear fruit, and continue to do so during man's allotted span of life. For the year 1892 the value of *copra* and dried coconuts exported from Fiji was over £65,300. Notwithstanding competition, the value of the green fruit exported has increased from £22,623 in 1886 to £61,501 in 1891. Nearly the whole of this amount represents the value of bananas shipped for Australian and New Zealand ports, chiefly to New South Wales, Victoria, and Auckland. The intercolonial steamers carry some 40,000 bunches monthly to Sydney. For perfect development and richness of flavour the Fijian banana is pre-eminently superior to any other in the market. It requires no microscopic analysis to detect the delicious qualities of this luscious fruit; the marked contrast between it and the insipid local varieties may be detected at a glance. The bananas grow and flourish in most parts of the colony of Fiji, the soil and climate being eminently suited for the development of this most valuable and remunerative industry. There are, besides, abundance of pines of several varieties; these, too, are exported in considerable quantities; they grow to perfection, are deliciously flavoured, and consequently fetch a high price in the Australian market. Formerly the cotton industry of Fiji was a very flourishing one: in recent years it has received but little

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[1] Statement of the Trade and Navigation of the Colony of Fiji.—*Legislative Council Paper*, No. 12, April 1893.

attention, owing to the low prices prevailing. Experience has, however, abundantly shown that the group can produce cotton of a quality better than can be obtained in any other country. On the black loamy soils of the elevated slopes, and in the rich sandy flats, the sea island variety grows to perfection. •That a valuable and highly remunerative industry in the cultivation of tobacco could be established in the colony there is no doubt whatever in my own mind. Cultivated almost exclusively by the natives, the plant flourishes luxuriantly in all parts of the group. For some unaccountable reason, most probably owing to inexperience in curing the leaf. this crop has, until quite recently, been almost entirely neglected in Fiji. In a colony where there is a large consumption of tobacco by both Europeans and natives, it is astonishing that such a paying enterprise should yet await development. At one time coffee-growing promised to take a prominent place among the highly remunerative industries of the colony. A large area of land at Bua, on the island of Vanualevu, was cultivated and planted with coffee, and the prospects of success were most encouraging when, in an evil hour, the plants were smitten with the disease well known in Ceylon, *Hemileia vastatrix*, and thus a prospective source of wealth was destroyed. Owing to the introduction of coolies for plantation work, the amount of rice consumed locally is over 1000 tons annually. This at first was imported, but now its successful cultivation within the group will supply the demand. Experience has amply demonstrated the suitableness of the Fijian soil and climate for the profitable cultivation of this esculent grain, and the necessary machinery for hulling and polishing has been imported by the Government. Cinchona cultivation is, as yet, very much neglected in Fiji. It is much to be regretted that the necessary capital is not available for the cultivation of this tree, which in Fiji flourishes more vigorously than in any of the Asiatic regions. Fifty bushels to the acre is the average yield of maize, and in many localities the rich alluvial soils yield as much as 80 or 100 bushels—two, and sometimes three, crops being harvested annually. To tea-drinkers it will no doubt be interesting to know that in Fiji the average yield of this herb is about 600 lbs. per acre. The industry is yet in its infancy, and consequently there is more consumed locally than the planters can supply ; it meets with a ready market at from 1s. 9d. a pound, and its delicious quality and flavour are much appreciated. Vanilla and ginger are also produced in the colony : the quality of the former is pronounced by experts equal to that grown in Mauritius, and it is believed that in Fiji the yield will be a very large one. A comparative analysis of samples of ginger from Cochin-China, Africa, Jamaica, and Fiji conclusively shows that the Fiji article is much richer in active constituents than the others. Peanuts also flourish in Fiji ; they are gathered by the natives, and contribute from £4000 to £5000 annually to the revenue of the colony. In addition to what may be termed the main products of Fiji there are many others imperfectly developed, which could be rendered more profitable by cultivation, or only need enterprise and capital to render them remunerative. There is abundance of arrowroot, an excellent opening for the cultivation of sisal hemp, for which there is plenty of suitable land, and a highly remunerative industry in castor and other varieties of oil-producing seeds and nuts, that grow wild and luxuriantly in almost every part of the group, might be established. To these may be added the West African kola nut (*Kola acuminata*), the Peruvian coca (*Erythroxylon coca*), and cinnamon, which have been recently introduced to the colony by his Excellency the Governor, Sir J. B. Thurston, who, in his interesting inaugural address to the Agricultural and Industrial Association of Fiji, earnestly invited attention to the commercial value of these plants, and their profitable cultivation elsewhere.[1] Oranges, and occasionally limes, grow wild in the virgin soils of the colony, the surface of the ground in many places being covered with a layer of the decayed fruit that annually falls off the trees. A few oranges are used by the natives as a substitute for soap, but otherwise there is no effort to utilise them, nor to cultivate them systematically, although the Chief Justice of Fiji, Hon. A. S. Berkley, pointed out the advantages of their cultivation,[2] drawing attention to the profits derived from the lime and orange industry in the West India Islands, where the concentrated lime juice and essential oil of limes are extracted, and a brisk trade has long been carried on in oranges.

Besides the products cultivated by Europeans it must not be forgotten that a considerable revenue is annually derived from exclusively native produce. The Fijians are an agricultural race, and, in addition to large quantities of food for their own consumption, plant cotton, sugarcane, tobacco, bananas, and maize, as well as other profitable articles of commerce, which are sold on the spot to European traders or taken to the most convenient market. It is usually from the surplus produce that their annual tax is paid to the Government. The commercial prosperity of Fiji mainly depends upon the successful development of the extensive agricultural resources of the colony, viewed from a broad and comprehensive standpoint. In the sugar industry a large amount of European capital is invested and employment found for a great number of people. Formerly, Polynesian labourers and Fijians were more generally employed to work the sugar plantations and in other industrial pursuits, but it was soon found that competition in the recruiting field from neighbouring colonies interfered with the island labour traffic to such an extent that it became impossible to meet the demands of the local labour market, and consequently arrangements were made in 1879 for the introduction of Indian immigrants. Of these there was in the year 1892 a population of some 10,000 souls in the colony. They are recruited in India and brought to Fiji, on the requisition of employers, at an average cost of from £16, 15s. to £23, 6s. for each adult. When on time-work men are paid a daily wage of 1s., and women receive 9d. per day. They provide their own food, but the employer finds them quarters and medical attendance. These coolies are brought to the colony for ten years; five of these they pass in the employ of the original requisitioner; during the remainder they work as free men, and at the end of that term are carried back to India at the expense of the State. The number of Polynesians at present in Fiji is about 2400, obtained

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[1] *Handbook to Fiji*, 1892 (by authority), p. 50.

[2] *Ibid.* p. 66.

chiefly from the Solomon and New Hebrides archipelagoes, the initial cost of introduction amounting to about £16 per head, besides £5 to £7 a head for the return passage paid by the employer. Unlike the former class of labourers, the Polynesian is indentured for a period of only three years; during this time his wages are from £3 to £6 per annum, in addition to food, clothes, house accommodation, and medical attendance. At the expiration of his term of service he is free to return to his home or to re-engage by the year, at a wage of from £10 to £12 per annum. Besides these, there is a large complement of Line Islanders (Gilbert Islands), known in Fiji as *Tokelaus*, employed at one of the *copra* and fibre manufacturing stations at Cape Udu; these are imported by the station-owners themselves. Fijians may be employed within prescribed districts, under certain regulations enacted by the Legislature, at a wage of about 8d. per day and rations.

Of the different classes of labourers the Polynesians are generally preferred. When properly treated they are kind, affectionate, and willing, and are excellent and intelligent workers; upon this point the writer can speak from experience. For general plantation work, where the clearing of scrubs and felling of timber are required, Fijians are very capable workers; they are good in performing allotted tasks and for river traffic service, but, to give satisfaction, they require to be away from the immediate influence of their own people.

FAUNA.—Fiji is perhaps not remarkably rich in reptiles and other forms of animal life; its avifauna is limited to several varieties of wild duck, parrots, pigeons, and hawks; to snipe, sandpipers, the golden dove, and swamp hen; to the white and gray cranes, the cat bird, and other minute forms of the feathered family that dwell in forest solitudes. Lizards are numerous. Land and water snakes are luckily few in number and variety; the former lurk among the lower branches of trees, while the latter are sometimes found along the sea-shore; both kinds are apparently innocuous. Beetles, butterflies, and moths are plentifully represented in all parts of the group, and so are numerous other forms of insect life, from the tiny sand-fly to the venomous scorpion and stinging wasps. Worms there are, too, and ants of various kinds, nor must the scintillating little fireflies, the mosquitoes, and the common house flies be forgotten. The latter are somewhat troublesome, but they do a great deal of good as scavengers. To the entomologist Fiji offers many attractions that are by no means common. The marine fauna is extensive in variety and unsurpassed in beauty. A marvellous number of fish of all shapes, sizes, and colours haunt the intricacies of the coral areas of the group. In preserving these fishes some difficulty was formerly experienced in retaining their colours, and it was not until some one succeeded in preparing a mixture of glycerine and some other chemical substance that this obstacle was overcome. Sharks are numerous, but alligators are not present in the rivers and creeks. The molluscan fauna is amazingly rich in beautiful types; they range in size from the large clam shells down to the minutest forms. Land and fresh-water shells are also fairly numerous; the former are often found in the hilly ranges of the islands, and the latter abound in the rivers and creeks. There are a few oyster-beds in some parts of the group, but these bivalves are very large here and the quality inferior to the Australian cultivated oysters. Crabs and fresh-water prawns are plentiful: they are captured and eaten by the natives. There are turtles in abundance, and lobsters also exist, though they are the least common kind of shellfish. The tree-climbing crab is also to be found in the northern part of Fiji. Cattle, pigs, and poultry thrive well in the colony: of the latter a very great number are owned by the natives, and are to them a source of wealth. A small rat and a flying fox are generally supposed to be the only mammals really indigenous to the group.

FLORA.—Within the narrow limits of a paper it is scarcely possible to do more than briefly summarise the leading features of the flora of a tropical region so densely clothed with a mantle of various forms of vegetation as Fiji. Generally speaking, the south-eastern side of the islands is covered with forest: on the opposite side forested areas occur in patches only, where the vegetation is more diversified and less vigorous. There is really no satisfactory reason why this should be so, considering the comparatively narrow areas of some of the islands. Very probably the vegetation of this group, as with that of other parts of the world, is largely influenced by the conditions of soil, and, possibly, the prevailing south-east winds contribute to its luxuriant growth. It is popularly believed that the air of the windward side of the land of Viti is more highly charged with moisture than that of the opposite side, but in this opinion I have always refused to concur, especially as there are really no lofty mountain ranges to interfere with an equal distribution of humidity. To the surveyor and the explorer the scrubs and other forms of vegetation are most exasperatingly dense. I was told when I went to Fiji that in some places the scrub was so thick that a party of seven or eight men could only cut a track of some seven or eight chains long in a day, and subsequent experience amply confirmed this statement. Dense and extensive areas of mangroves are usually associated with the salt-water swamps and mud flats along the seashore. The wood of this tree is very flexible and tough; the natives use it, with other sorts, for house-building and fencing purposes. In the forests are many kinds of really excellent and valuable timber trees; of these the *vesi* (*Afzelia bijuga*) and *dilo* (*Calophyllum inophyllum*) are especially well adapted for cabinet work, their grain being very beautiful and taking a fine polish. For durableness the former is little inferior to English oak. For building boats and other larger vessels the local shipwrights use the *dakua* (*Dammara vitiensis*), *vivi* (*Serianthes myriandenia*), and *damanu* (*Calophyllum Burmanni*). The *buabua*, or Fijian box-wood, is probably the most durable wood to be found in the group; it is used for a variety of useful purposes. There is a timber, light as cork, known to the natives as the *rara*; and the *viriviri* is but little heavier. There are also the excellent timber tree *dakua salusalu* (*Podocarpis vitiensis*) and other noted highland-dwellers. The weird-sounding *nokonoko* ironwood (*Casuarina*) also flourishes, the economic *ivi* tree, or Polynesian chestnut (*Inocarpus edulis*), and the lowland-loving *Pandanus* palms. On the authority of Mr. John Horne, Director of the Mauritius Botanic

Gardens, who spent a year in the colony,[1] the indigenous flora of Fiji numbers some 1086 species of flowering plants and 245 species of ferns and allied plants: of these 635 species have been met with in Fiji only. The most numerous orders are *Leguminosæ*, represented by 36 genera and 62 species; *Rubiaceæ*, by 23 genera and 122 species; Orchids, by 25 genera and 49 species; *Euphorbiaceæ*, and *Urticaceæ*, each with 20 genera and 131 species. In addition to these there are doubtless new forms that await discovery. Of economic plants Fiji possesses many representative forms, to some of which reference has already been made. The *yaqona* plant (*Piper methysticum*) grows luxuriantly, and combines the qualities of utility and ornament. I cannot agree with the Rev. Thomas Williams and others who speak of the "narcotic" qualities of the beverage manufactured from it. The candle-nut tree (*Aleurites triloba*), or *lauci* as it is called by the natives, grows in abundance in most of the islands of the group. There is also a plentiful supply of delicious fruits, of which are the *wi* (*Spondias dulcis*) and *kavika* (*Eugenia Malaccensis*). Flowering plants are numerous and, with variegated shrubs, lend beauty and brightness to the landscape. Of these the hibiscus is most conspicuous. Nowhere else do I remember having seen such a copious variety of these remarkable flowers.

NATIVES.—To the ethnologist the origin of the Fijians, and other neighbouring peoples who occupy the widely scattered Pacific Islands, is a subject pregnant with interest and one upon which there is no doubt room for diversity of opinion. Philological data led to the belief that at some remote period the peoples of Polynesia were more closely associated than their present position would seem to indicate, and it is upon this aspect of the subject that I will now say a few words. How were the islands of Fiji and other parts of Polynesia peopled? Whence did their inhabitants derive their origin? If we were able to supply a satisfactory answer to these questions nothing further would be required. But in the absence of some historical record we can do nothing but speculate. However, in the case of the Fijians, I am disposed to support the opinion of the Rev. Thomas Williams[2] and other contemporaries, who believe in the Asiatic origin of these island-dwellers. In his excellent paper, contributed to the Geographical Society of California, Mr. Crawford Johnston furnishes what appears to me abundant evidence of the early connection of the Phœnicians with America, that in fine "the Aztec was the product of Phœnician adventure and civilisation."[3] It was the preternaturally adventurous spirit of these people that impelled them to undertake long voyages from the shores of Asia to the west coast of South America, and Mr. Johnston points out that their track, across the South Pacific, lay through Torres Straits eastwards, and, after skirting the shores of the Islands of Fiji, Tonga, Samoa, and other eastern groups, terminated on the American coast at Mexico and Peru. Along this great ocean highway Asiatic commercial enterprise and civilisation ran

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[1] *A year in Fiji*, by John Horne, F.L.S., etc. p. 58.
[2] *Fiji and the Fijians*, p. 18.
[3] *Did the Phœnicians discover America?* by Crawford Johnston, Geographical Society of California: *Special Bulletin*, 1892

hand in hand, for how long none can tell. But we are justified in conjecturing that it was along this highway that the scattered groups of Polynesia were peopled.

In colour and physique the Fijians, Samoans, Tongans, and Maoris are much alike, while between them and the natives of British New Guinea many dialectic affinities and similarities are known to exist. Attention has recently been invited to these by Mr. S. W. Brooks, in an interesting paper contributed to the Queensland Branch of the Royal Geographical Society of Australasia, in which the author points to the remarkable similarity between the causative prefix *Vaka* of the Fijian language and the Hiphil and Hophal conjugations of the Hebrew verb.[1] Taking these philological fragments in conjunction with the evidence adduced in support of our theory of the great "Melanesian Plateau," to which attention was drawn in an earlier part of this paper, we may conclude (1st) that the peoples of New Guinea, New Zealand, and Polynesia are sprung from an Asiatic stock; (2nd) that their physical and dialectic dissimilarities are due to tribal distinctions and not to racial differences; and (3rd) that these regions were peopled contemporaneously with the continent of America.

Class distinctions are generally recognised by the Fijians, and by no other race of people are they more rigidly respected. There are kings and queens, provincial chiefs, chiefs of villages; the low born who have gained distinction on the field of battle; the masses and the slaves. The king is designated *Tui; Roko* is the official title of a provincial chief, and a village chief is called *Turaga ni Koro*. The king is the head of the native State, and the provincial chiefs are his ministers. The native Parliament is held annually in each province in succession, and is usually opened by Her Majesty's representative. The session is short, and it is customary for the European Secretary for Native Affairs to be present during the sitting. The programme is arranged beforehand, and the occasion is one of unusual activity and feasting. New houses are built to accommodate visitors from neighbouring provinces; turtles are brought from all parts of the group; pigs are slaughtered wholesale; tons of vegetable food are consumed *ad nauseam*, and European delicacies find a place at the festive board. There is no lack of food while the season lasts, but extravagance is too often followed by dearth, and it not infrequently happens that for several months the majority of the people live upon wild vegetable food. Formerly the Fijians were divided into numerous septs, and these were constantly involved in warfare. There were the Kai Colos, who lived in the mountain regions of the interior, and the Kai Wais, dwellers on the sea-shore; the former wild and incorrigible, the latter cunning and voluble. Since the establishment of civil government and the development of missionary work, tribal distinctions in many districts have been almost altogether effaced, while in remote places the old order is very greatly modified. The process of transition, in some

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[1] *Grammarial and Glossarial Similarities of the Languages of New Guinea and Fiji*, by S. W. Brooks. *Proc. and Trans. of the Queensland Branch of the Royal Geog. Society of Aust.* vol. viii.

cases, has no doubt been slow and gradual, but the fact remains that the entire native population of Fiji now acknowledge Christianity and the authority of the British Government, and appreciate the beneficial influences of these powerful civilising agents.

Throughout the group the Fijians live in coastal towns, in villages located along the rivers, and in the remote districts of the interior. Some of these centres are large, clean, and healthy, and decidedly attractive. The larger towns are usually built round roomy squares, and it is within this public space that the usual village amusements take place, when it is not being used for more important public purposes. Unlike the native houses of New Guinea, the Fijian dwellings are not raised on piles, but usually on foundations, often several feet in height, composed of coral and gravel. The houses are substantially built of hard and durable timber; the ground plan is usually rectangular, and the ridge-pole rests on long end and intermediate posts; the sides are supported by upright studs, that, like the posts, are sunk in the ground, and between these are reeds, fastened by strong cords of fibre sinnet and wild vines. The roof is thatched sometimes with the leaf of the sugarcane, but more frequently with grass and the leaves of wild plants. In most cases the sides are also thatched. The interior, of chiefs' houses and of those belonging to the better classes, is beautifully ornamented with plaited cords of dyed coconut fibre, called *magimagi*. The outer ends of the ridge-poles are usually ornamented with white cowrie shells, or with some other distinctive object, and the doorways are often elaborately finished off with coloured sinnet. In the chief provincial towns there are churches, school-houses, native court-houses, and jails. There are large club-houses, where the men meet to discuss social subjects and the affairs of the State. A house is provided for each family, and the girls sleep in separate quarters. Formerly many of the towns were fortified by deep ditches and palisades: in many places traces of these are still to be found, notably in the interior of Vitilevu, where a typical example of a Fijian stronghold exists in "Fort Carnarvon." At this post a European officer has been stationed for years, but the Fijian style of the fort is preserved. In their days of heathenism, polygamy was a recognised institution among the natives of Fiji. As a rule the custom was restricted almost exclusively to the chiefs, the common people being usually unable to keep more than one wife. To the number of wives belonging to a chief there was practically no limit, and the lot of these poor creatures, the favourites excepted, was not always enviable. Happily the old order of things has now completely passed away, and the full privileges of English marriage law are enjoyed throughout the group. These seem to commend themselves to all, and the divorce court is rarely resorted to. As a rule the Fijians have very small families, usually not more than two or three children each; there are strong reasons for believing that in most cases the number of children is regulated by the mother; but the domestic habits are not favourable to a rapid increase of population. The children are well nourished and cared for; they have abundance of out-door exercise; they are trained in sports, in industrial pursuits, and receive religious and secular instruction. The village schools are conducted by native teachers attached to the Wesleyan and Roman Catholic bodies. Besides these, there are native State schools and the Wesleyan Training Colleges, where the native teachers are prepared. The whole educational organisation is very complete, and reflects great credit upon the promoters. The children are bright and intelligent; they learn to read well and to write well; they are fairly good at figures, and they sing agreeably. In the Roman Catholic schools they read music, and their songs are accompanied by the organ. Their religious instruction is carefully attended to, and, in most villages, morning and evening prayers are conducted, preceded by a hymn, in which old and young join. The Sabbath is a day of rest, and all take part in devotional exercises. Outwardly these people are Christians, but that they are so at heart I cannot affirm after my long experience in their midst. Their domestic relations are, in many respects, most admirable, and not unworthy of emulation by a much higher order of civilisation. The cares and worry of life are matters of little consequence to them; they are happy and contented and take little thought for the morrow. They are affectionate and hospitable to a fault, giving strangers a cordial welcome and supplying the hungry with abundance of food. As in times of old, the women still occupy an inferior position and do a large share of household and out-door work. But they do so without complaining, even when their lords and masters are enjoying ease and comfort. The domestic implements of this people are few and simple; the ground is dug with long-pointed digging-sticks and broken up and weeded by hand. Before American axes and other steel tools were introduced the natives used stone axes; for knives they used shells and split bamboos; plaited cords of fibre and wild vines were substitutes for nails, and, even now, these home-made articles have not been entirely superseded. The cooking utensils consist of earthenware pots, with occasionally vessels of European manufacture, but the earth and stone oven is used when much cooking has to be done. Wooden troughs and baskets lined with banana and bread-fruit leaves are used for serving up food, and fingers take the place of forks. Their weapons consisted of the spear, the club, the battle-axe, the bow, a large sling, and the European musket. Of clubs a great variety was formerly used by the Fijians, and with these effective weapons the condemned were usually despatched. The canoes are sharp at both ends, and have outriggers. Some large war and trading canoes are built double, with long raking masts and mat sails; they are steered by an oar, and can lie very close to the wind. The smaller reef and river canoes are single, hollowed-out logs of wood, but the larger kind are built of several dug-out pieces. They are very strongly and skilfully made, and they sail very fast, but I never felt comfortable and easy in them, although they often accomplish long sea journeys. Although naturally lovers of ease, the Fijians are often occupied in useful industrial pursuits; the women are expert mat-makers, and they manufacture a very fine native cloth called *masi*, from the bark of the *malo*, while pottery is also turned out by their skilful hands. The men build houses, fashion canoes and weapons, manufacture sinnet, and cultivate the ground. They are all expert swimmers, and instances are numerous of shipwrecked crews having reached land after spending over a day and a night in the water without support. To Europeans this may seem an extraordinary feat, but the Fijians make no boast of it. It has always been a matter of surprise to me how insensible these people apparently are to physical pain. They cut and bruise themselves and burn themselves with fagots of wood, but the pain is borne in silence.

The Fijians certainly have many excellent and noble traits of character, and it is unjust to call them a weak and cowardly race. They were undoubtedly anthropophagous, and many horrible and revolting cruelties stigmatise their early history, but now they are civilised and useful British subjects, living in peace and enjoying prosperity. Generally speaking, they are strong and healthy; sufferers from ringworm and ophthalmia are sometimes met with, but phthisis is not a common disease; it is, indeed, from elephantiasis they suffer most, and this disfiguring and insidious affection constantly presents itself in every part of the group, the legs, feet, hands, arms and scrotum being the parts generally affected. The peculiar initiation ceremony of the Australian blacks and of other coloured races was formerly practised by the Fijians, especially by the tribal communities of Vitilevu, where certain districts were dedicated to the rite. In Fiji it is called the *Naga*. The veterans are very reticent upon this subject, and only those intimately acquainted with native life and character can obtain particulars of this interesting ceremony, which is now a thing of the past and rapidly sinking into oblivion.

There are several dialects spoken, but they differ so slightly that people of one province have no difficulty in communicating with their neighbours of another district, especially since the adoption of the Bau tongue as the written language of the country. Of this there is a grammar and a dictionary, the product of missionary labour. The English alphabet is used with the omission of the letters H, X, and Z.

In the beginning of April 1891, the native population of the group numbered 105,800, made up of 56,445 males and 49,355 females. It is, however, believed that there are about 3,700 more than the number actually recorded.

Climate.—Although lying within the tropics, the Fiji Islands are exceptionally healthy. During about eight months of the year the tropical heat is greatly modified by the south-east trade winds, when the temperature is agreeably warm without being oppressive. At the approach of night these winds gradually die away and are superseded by the cool, refreshing land breeze; but, when the sun brightens the eastern sky, there is usually a calm of a few hours' duration till the trade winds set in about ten o'clock. Generally speaking, these are the ruling climatic features from April till November, when dull, wet, and stormy weather prevails. There is generally some anxiety felt during this unsettled period, to which the name of "Hurricane Season" has not inappropriately been given. It is between December and the end of March that the

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[1] *Twelfth Annual Report of the Vital Statistics of the Native Population.—Years* 1890-1891.

devastating hurricanes, of which so much is heard, sometimes sweep across the Southern and Western Pacific with terrific force, uprooting trees, overthrowing houses, dashing vessels upon the coral-bound shores, and destroying the European and native crops. But crops grow rapidly in the rich soils of Fiji, and after the lapse of a few weeks the face of the country again smiles with an abundant harvest, and people in their happiness forget the fury of the elements amid increasing prosperity. European children thrive well in Fiji, and so do women who are thoroughly acclimatised; but I am constrained to concur with those who maintain that a tropical climate does not contribute to the general health of European females for prolonged periods. Indeed, to some female constitutions the enervating influence of a tropical climate is positively inimical. But, as already remarked, most of the European lady residents of Fiji enjoy good health, epidemics being very rare and malarial fevers unknown. It is during the wet season that the greatest discomfort is felt, when the excessive humidity permeates everything and renders life a burden.

Of the four divisions of the group, the southern is undoubtedly the coolest: the eastern is dry and cool; the north-west half of Vanualevu is dry and moderately cool, but the mass of land being greater than in the preceding divisions, the rainfall is less regular and the climate less uniform. Over the western division a greater precipitation occurs, and the climatological conditions are, perhaps, more irregularly distributed than in other parts of the archipelago, where the land areas are smaller. The barometric pressure ranges from 29·90 to 30·10 inches. The maximum shade temperature averages 84 degrees, and the minimum 72 degrees Fahr. The highest reading, 92 degrees in the shade, was recorded on four days in April and in December 1891, and on the 16th September of the same year the lowest reading of the thermometer was 61 degrees.

A Governor and an Executive Council administer the affairs of the Crown Colony of Fiji; a Legislative Council is also constituted, consisting of the Governor, as President, the Chief Justice and departmental heads, with whom are associated an equal number of unofficial members, nominated by the Governor and appointed by the Queen. The present Governor and Colonial Secretary is Sir J. B. Thurston, K.C.M.G., a warm supporter of science. For administrative purposes the group is partitioned into fifteen provinces named as follows:—Rewa, Tailevu, Naitasiri, Namosi, Serua, Colo, Nadroga, Ba and Yasawa Ra, Lomaiviti, Bua, Macuata, Cakaudrove, Lau and Kadavu. At the head of each of these there is a native official, paid by the State.

If an excuse be necessary for the rather inordinate length of this paper, it is hoped an adequate one will be found in the wide scope and vast importance of the subject. Nothing has been included which could have been omitted without impairing its value as a conscientious and trustworthy contribution on the broad geographical and physiographical aspects of the subject.

My cordial thanks are due to the Honourable the Colonial Secretary and to the Assistant Colonial Secretary, Mr. James Stewart of Fiji, for much valuable statistical information.

OBITUARY.

Many African travellers whose work was finished have of late passed away, and have been commemorated in these pages. Now we have the still sadder task of recording the death of one who has been cut off in the midst of a useful career—Sir Gerald Herbert Portal. After an attack of malarial fever, a complaint from which he had suffered during his mission to Uganda, symptoms of typhoid fever developed themselves, and Sir Gerald Portal succumbed to this disease, dying in London on January 25th. Born in 1858, Gerald Portal was educated at Eton, and entered the Diplomatic Service in 1879. His first appointment was in Rome, where he was promoted in 1881 to the rank of Third Secretary. In 1882 he was attached to the staff of Sir Evelyn Baring in Egypt, where he arrived just before the outbreak of the Arabi movement. He was present at the bombardment of Alexandria, and received a medal, with clasp, and the Khedive's star. Being transferred to Cairo in 1884, he there displayed great ability and tact, and impressed his chief with a high opinion of his capacity and character. But he longed for some means of indulging his love of adventure, and in 1887 eagerly seized the opportunity afforded by a mission to Abyssinia for the object of bringing about a reconciliation between King John and the Italians. As the favourable season for warlike operations was commencing at the time (October), the Italian Government could not undertake to delay hostilities for more than five weeks, and therefore Gerald Portal saw no prospect of a successful issue to his enterprise. The event turned out as he expected, but his reputation was in no wise diminished by a failure due to circumstances beyond his control. To traverse Abyssinia at a time when the Negus and his chiefs were hostile to foreigners was a task requiring great coolness and intrepidity, and Mr. Gerald Portal acquitted himself with great credit, and on his return to Cairo was made a C.B. The narrative of his journey was given to the public in *My Mission in Abyssinia*, published in 1892.

In this year he was made a K.C.M.G., being then Commissioner and Consul-General in East Africa. On December 10th he set out on his mission to Uganda to report fully on the state of the country in connection with the negotiations between the British East Africa Company and the British Government. The fatigues and hardships of the journey, together with the loss of his elder brother, who accompanied the expedition as chief military officer, no doubt told upon his health, and led to his untimely death at the age of 36 years.

Sir Gerald Portal's report on Uganda is finished, and will be of the greatest interest to all who have watched the progress of events in that unfortunate country. It is much to be regretted that one who has shown such fitness for the work of administration in Africa has not survived to carry out whatever scheme he may have recommended, or may be decided on by the Government.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings in February.—On February 8th, Mrs. Lilly Grove delivered an address on "The Southern Regions of Chili," in the Society's Hall, Queen Street, Edinburgh. The chair was taken by Sir Thomas Clark.

On the following evening, Mrs. Grove repeated her lecture in the hall of the Philosophical Society, Glasgow, the chair being taken by Dr. G. A. Turner. A vote of thanks was awarded to Mrs. Grove on the motion of Mr. R. A. Robertson.

At a Meeting of the Society, held in Edinburgh on February 22nd, Miss Flora L. Shaw delivered a lecture on Australia. Mr. Coutts Trotter presided.

Mr. Carrie's course of lectures on Historical Geography was brought to a close on February 13th. The lectures were well attended and thoroughly appreciated.

Meeting in March.—A Meeting will be held on March 22nd in Edinburgh, when Mr. George R. Parkin will speak on "The Geographical Unity of the British Empire."

He will also address the Branches of the Society at Dundee and Aberdeen.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Census of Bulgaria.—The last quinquennial census was taken on January 1st, 1893. The population proved to be 3,305,458, which number, distributed over an area of 38,330 sq. miles, gives a density of 86 to the square mile. Since 1888 the population has increased by 151,083, or ·96 per cent. yearly. The men numbered 1,688,458 and the women 1,616,770, the former increasing about one per cent. annually and the latter only ·92 per cent. The proportion is now 958 women to 1000 men, which is singular for the south-east of Europe. Sofia, the capital, had in 1893 a population of 49,593, the increase being 10 per cent. annually.—*Deutsche Rundschau*, Jahrg. xvi. Heft 4.

Northern Greece.—Dr. Philippson, well known for his cartographical work in the Peloponnese, has spent three and a half months in Northern Greece, travelling more than 1200 miles. His explorations extended over Thessaly, Epirus, and the intervening Pindus mountains. After visiting Lake Copais, now drained, he continued his way in March through Lamia, Karditsa, Trikala to Kalampaka, near the northern frontier. He found that the Kambuni (?) Mountains do not run east and west, as usually represented, but from north-west to south-east, and should be grouped with Olympus. Khasia is a flat country between Thessaly and Macedonia, and not a mountain-range : its inhabitants are poor, indolent, and uncivilised, and suffer from the exactions of the large land-proprietors. Dr. Philippson next turned westwards, and crossing the Zygos Pass, 5080 feet high, reached the Turkish town of Janina, in Epirus, standing beside a large shallow lake. From this point Dr. Philippson commenced his exploration of the Pindus, which he found to consist of a number of groups separated by deep, pathless ravines, the channels of mountain torrents, instead of two parallel chains parted by the broad valley of the Aspropotamos, as hitherto represented on maps. The forests are rapidly disappearing, and no attempt is made to keep up the supply of timber. In the Oxia Mountains, to the south of Karpenisi, is found the most southern beech forest in the Balkan peninsula.—*Globus*, Bd. lxv., No. 7.

ASIA.

The Eastern Mediterranean.—It has already been announced that the *Pola* was despatched last summer for another cruise in the Eastern Mediterranean. According to the *Geographical Journal*, Feb., another deep depression (2110 fathoms) has been discovered to the east of Rhodes in lat. 36° 5′ 30″ N., and long. 28° 36′ E. Though shallower than the "Pola Deep" (vol. vii. p. 672), it is deeper in relation to the adjacent land, being fully 3828 fathoms below the summit of Ak-Dagh in Anatolia. On the south-east the depression is closed by a ridge rising to within 1050 fathoms of the surface. Dr. Natterer, as on former occasions, investigated the chemical properties of the water, and was again unable to detect the presence of free carbonic acid. Since this gas must be formed in considerable quantities from the oxidation of animal and vegetable remains at the sea bottom, it seems probable that ammonia is also formed, and combines with the carbonic acid to form carbonate of ammonium. Dr. Natterer inclines to the belief that not only the clayey and stony deposits of the sea-bottoms, but also the calcareous and siliceous structures in living organisms, are principally due to precipitates caused by dissolved carbonate of ammonium, having found the water, except near the mouths of rivers, free from suspended matter. Samples of water collected at the Tanitic mouth of the Nile, and near Port Said, towards which the Nile water is carried by the easterly current, contained surprisingly little suspended matter. Natterer holds that the fine sand brought down by rivers is only to a slight extent deposited directly, but is for the most part dissolved and carried into parts of the sea where the conditions cause precipitation. This process assists in the formation of dunes and coral reefs.

Where the sinking of decaying organisms is prevented by strong currents, a strong crust is formed on the bottom instead of the usual muddy deposits. It consists of carbonate of lime, siliceous clay, and free silica, and it may perhaps be caused by the action of the ammonia on the sea water.

Dr. Natterer has also applied a special chemical method, based on local variations in the amounts of bromine, iodine, and nitrous acid contained in the water, to the detection of currents too feeble to be otherwise observed. As far as chemical conditions are concerned, Dr. Natterer holds the waters of the Mediterranean to be favourable to animal life, and believes that the poverty of the fauna is due to the want of circulation—an opinion opposed to that of Dr. Carpenter, who attributed this poverty to an excess of suspended matter.

The Lake of Tiberias.—In 1890 M. Th. Barrois made an exploration of this lake. Its maximum depth was given by MacGregor (*The Rob Roy on the Jordan*) at 936 feet, and by M. T. Lortet (*Poissons et Reptiles du Lac de Tibériade*) at 820 feet. M. Barrois carried out six series of soundings across the lake without finding depths at all approaching these. He affirms that the lake is nowhere deeper than 130 to 148 feet, according to the season, the greatest depth occurring in the line of direction of the Jordan near the meridional axis of the lake. The temperature of the surface, under the burning sun of Syria, is subject to great variations. Thus, on May 2nd, it was $73\frac{1}{2}$° F. at 8.45 in the morning, 79° at 2.30 p.m., and 69° at 9 p.m., the fall being caused by a fresh north-westerly breeze. The depth of the layer of water subject to diurnal variations is only about 50 feet, or not greater than in the Lake of Geneva, where the mean temperature of the surrounding air is much lower. In the Lake of Tiberias the temperature is 68° or 69° at a depth of 30 feet, and falls to 62° or 63° at 50 feet. The water between 65 and 130 feet has a uniform temperature of 59°, a slight diminution of not quite one degree being observable at the latter depth. This is a much higher temperature than is observed in the Swiss lakes at the same depth. The lake of Morat, which most nearly approaches that of Tiberias in maximum depth, has a temperature of only 46° at 130 feet, the lake of Zürich 41°, and the lake of Geneva 45½°. The difference may be explained by the lower latitude of the Lake of Tiberias; the lower elevation, the Lake of Geneva lying 1230 feet above the sea-level and the Lake of Tiberias 682 feet below it; and by the hot springs which pour their waters into the lake, besides others which no doubt rise from its bottom.

Hadramaut.—Herr L. Hirsch has just returned from a journey in Hadramaut. He had the greatest difficulty in penetrating into the interior from the Arabian ports, and it was only with the assistance of the British Governor of Aden that the opposition was overcome. From Makalla he followed the course of the Wadi Howaire to its source, lying on the extensive plateau which, dominated by the steep peaks of Kar Saiban, forms the watershed between the wadis flowing north and south. Then Herr Hirsch descended to the populous and fruitful Wadi Doan, which, gradually increased by the tribute of other important wadis, traverses under different names the whole length of Hadramaut.

The traveller came first to the town of Sif, where, fifty years ago, Wrede's expedition came to grief; the other towns extend towards the north and north-east, and follow in the order Hajaren, Meshed Ali, Qate, where the Jemadur Selab holds his court, and Shibam, the most important town of Hadramaut. After visiting these towns he passed into the territory of the Kathiri, but being badly received in Terim, one of their chief towns, he returned to Shibam, and found his way back to Makalla by the unexplored wadis Bin Ali and Odym, over the difficult Figra Mountains, and through the town of Ghail-ba-Yezir, which is situated at about a day and a half's journey from Makalla, in the midst of a fertile oasis producing dates, durra, etc., and the Hamumi tobacco, so much prized in all Arabian lands. Though the journey occupied only fourteen days, the results are of no slight value.—*Verh. der Gesell. für Erdkunde zu Berlin*, Bd. xx., Nos. 8 and 9.

The Natives of Borneo.—In a paper published in the *Journal of the Anthropological Institute*, vol. xxxii. No. 2, Mr. C. Hose gives an account of the natives of the Baram district (lat. 4° 30′ N., long. 113° 52′), situated in the northern portion of Sarawak. They may be divided into four sections—the people of the coast and lowlands; the Kayans and Kenniahs, dwelling round the headwaters of the Baram river and its tributaries; the Kalabits, inhabiting the hills and plains of the interior; and the Punans, nomadic tribes found at the headwaters of all the large rivers of central Borneo. It is to the Punans, Kayans, and Kenniahs that Mr. Hose's remarks chiefly refer. The first he holds to be the aborigines of the country. They are a fine, strong race, with fair skins, never disfigured by skin disease. They build no houses, and live on game shot with the blowpipe and fruits, keeping within the shadow of the forest and shunning the sun. Of all the races of Borneo the Punans alone do not regard the taking of human heads an act of laudable prowess. Honest and unselfish, they are probably superior in disposition to the other natives of Borneo. They collect indiarubber, and are the only people in the island who systematically work the camphor tree, exchanging the camphor with the Kayans and Kenniahs for tools, tobacco, etc. Occasionally they live in caves, but these, being chiefly in limestone, and therefore damp and cold, are unhealthy. Punans who have not mixed with the Kayans use no boats.

The other tribes, unless they live at a distance from a river, all use boats. The Kayans and Kenniahs make boats out of trunks 38 yards in length, which, propelled by a hundred men sitting two abreast, can travel fifty or sixty miles a day. Smaller boats, propelled by twenty paddles, are also used, besides various small canoes. The hunters are armed with a long spear and a kind of chopper, and employ dogs, except among the Punans. In fishing the juice of a root called *Tuba* is used to stupify the fish. The casting-net and—on the coast—the seine net are the implements most commonly made use of, besides traps, and a fish spear so arranged that the head comes out of the socket when a fish is struck, remaining attached by a string to the bamboo shaft which floats on the surface of the water. The houses are built on huge posts 20 feet above the ground, are sometimes 400 yards in length, and contain over a hundred families each. The rooms open on to a verandah running the whole length of the building. A fireplace, a few rude stools, chairs carved out of a single block of wood, and neat mats of rattan constitute the furniture. The tribes of the interior cultivate only sufficient land to satisfy their own wants, growing rice, sweet potatoes, bananas, tobacco, sugar, and maize ; on the coast a quantity of sago is produced. The Kayans are very good blacksmiths, and in former days smelted their own iron. They manufacture neat and serviceable articles, and adorn them with well-finished and artistic engraving. In wood-carving also they are proficient, turning out pretty designs in fruits, leaves, and human figures. Spinning and weaving are but little practised by this people, though almost all the other tribes of Borneo manufacture some kind of cloth. They make, however, coats and waistcloths from bark, dyeing them in patterns with the juice of the fruit of the rattan and the sap of certain trees. The Kayans are particularly fond of tattooing, the women being most adorned. The Kenniahs also and the Kalabits adopt this style of ornament. The teeth are always filed, and sometimes pierced with a brass wire : the women wear very heavy weights in their ears. The Kayan and Kenniah men shave their heads with the exception of a single tuft which hangs down the back. This is no doubt the last remnant of the Chinese pigtail, and Mr. Hose believes that these tribes and the Punans are descended from a Chinese stock.

The Kayans measure the shadow of a post at noon, and by some means, which is kept a secret, are able to determine dates, times of planting corn, etc., with considerable accuracy. They measure articles with the fingers (four fingers being equivalent to the breadth of the hand), the wrist, the thigh, the span, etc. Omens are derived from the cries of birds, and auguries are drawn from the inspection of a pig's liver. In former times several forms of ordeal were in vogue, such as thrusting the arm into boiling water and picking up a pebble from the bottom of the vessel containing it. Now the only custom of this description retained is diving, by which small disputes are often settled. The ownership of a fruit tree, for instance, may be decided by the claimants plunging into the river, where they lay hold of sticks placed there for the purpose, and keep down as long as they can. The one who keeps under longest is declared the owner ; or, should both lose consciousness, the one who, after they have been pulled out, recovers first.

AMERICA.

Greenland.—The expedition of Dr. Erich von Drygalski to West Greenland has already been referred to in vol. ix. p. 483. Now a fuller account of his experiences has been given by the explorer in the *Verh. der Gesell. für Erdkunde zu*

Berlin, Bd. xx. No. 8 and 9. Accompanied by Dr. Stade and Dr. E. Vanhoffen, he arrived on June 27th, 1892, at the Danish colony of Umanak, and on July 16th landed at the spot chosen the previous year for the erection of a station (vol. viii. p. 49). By the end of the month Dr. Stade was able to commence his meteorological observations, and in August Dr. von Drygalski and Dr. Vanhoffen made a long journey by boat along the coast of the Nugsuak peninsula, examining the Asakak, Sermiarsuit, Kome, and Sarfarfik glaciers. They are fed from the plateau ice above, and not from the snow that falls on their surface. The surface is annually melted to a depth of 6½ feet, and the loss is in most cases hardly compensated for by the advance of the ice from above. The Asakak, however, has advanced nearly a mile since Steenstrup's visit, thirteen years ago.

Early in September an ascent was made to the inland ice, and the bamboo poles for ascertaining the movement of the ice were set up. The shade temperature by day was from 14° to 5° F., while in the night a minimum of 2° was recorded. Dr. Drygalski remained on the edge of the ice in a wooden hut until December, and thus acquired a thorough knowledge of the great Karayak glacier. It is about 4½ miles broad and fissured in the most extraordinary manner, presenting a wild chaos of ice blocks, pinnacles, and columns, which is continually changing its form. From the falling pinnacles clouds of ice-dust rise, hanging for a long time between the peaks and glittering with various colours, or gradually spreading over a considerable area. Near the edge of the land ice pools had formed themselves during the summer, but in autumn the surface burst in numberless new clefts and fissures, and the water finding an outlet left the pools dry. Through these newly made channels it was possible to crawl underneath the inland ice, though the enterprise was attended with great toil and difficulty. The cold was not great; in November, when the temperature outside ranged from 14° to 4° F., at a distance of a hundred paces from the entrance of the grotto the ice was at the melting point, and the walls were damp.

At the beginning of December Dr. Drygalski retired to his winter quarters, and occupied himself with the examination of the structure of the glacier ice, which he found to be essentially similar to that formed on lakes. The ice on the fiords, on the other hand, possesses a different structure. In February traffic commenced between the colonies scattered along the coast, and Dr. Drygalski set out on his long journeys by sledge, during which he explored the coast from Jakobshavn in the south to Upernivik in the north, and beyond. The most compact and longest of the ice streams descending to the sea is that at Jakobshavn. The edge is remarkably indented, and in the pack-ice lay many large fragments just in the same state as when they had fallen from the glacier, while the icebergs were particularly numerous, and many of them far loftier than the edge of the glacier. Round Umiamako is some of the finest scenery in Greenland. In place of the monotonous rounded gneiss rocks of Mysuak and Jakobshavn are fiords lying in deep clefts between lofty walls, and the white inland ice forces its way through every gap between the dark rocks. At Söndre Upernivik the basalt formation of the peninsula of Svartenhuk suddenly breaks off, and gneiss again makes its appearance, forming a labyrinth of small islands among which currents frequently run, which in the early part of May had made many openings in the ice, rendering travelling by sledge very troublesome. The Upernivik glacier can hardly be called an ice stream, for it is not dammed up by land elevations; it is, in fact, the edge of the inland ice in direct contact with the sea.

Of the results of his investigations Dr. Drygalski says little in this article, making only a few remarks on the part water plays in the movements of the ice. The ice streams, he says, do not float but lie in the water. They are saturated with water not only as far as the fiords extend, but also far up on the land, and this condition must facilitate the movements of the ice. Only in the presence of water is motion possible, taking place at the melting point. The temperature is kept up in the lower strata by the water that pours down in summer through the holes and clefts, and the winter cold penetrates but slowly into the depths of the ice. Accordingly, the progress of the ice is dependent on the state of its lower strata. A comparison cannot, then, in Dr. Drygalski's opinion be made between the movement of a glacier and the flow of a stream of water. Both Dr. Drygalski and Dr. Vanhoffen were struck with the similarity in appearance between the gneiss rocks along the coast and the ice. Many peculiarities of its structure and formation might be explained by the supposition that at one time the former also had been a stream with its motion dependent on its melting point.

Chiapas.—Dr. Carl Sapper narrates in *Petermann's Mitt.*, Bd. 39, No. 12, the results of a journey to this Mexican state. On descending from the Chuy pass, 11,060 feet high, in the Sierra Madre of Guatemala, the traveller first obtains a view of Mexican territory, and is struck with the great change in the landscape. In the Altos, the highlands of Western Guatemala, a tendency to the form of horizontal plateaus is perceptible, but the plains are crossed by mountain chains of considerable altitude, while on the Mexican side horizontal or slightly inclined plains rise one beyond another, hemmed in by insignificant mountain chains of unbroken outline. The only relief is the singular mountain of San Bartolo, which with its steep rocky pinnacles dominates the nearest plain. This plain is reached at the Rio de Santa Catarina (2520 feet), here running in a deep gorge, and has a mean elevation of 2750 feet. A few miles to the north lies Nenton, the last place in Guatemala. On Sept. 14th, 1889, the Yalisjao was reached, and the next day the *hacienda* San Vicente (3655 feet) in Chiapas. At first the route passed through a thick oak forest, which afterwards became a savannah thinly strewn with oak, mimosa, *Brumelia*, and *Opuntia*. When the range is reached which forms the southern boundary of the plateau of Comitan, the woods become more frequent, and near the pass, 5492 feet high, fine old oaks, sometimes mixed with firs, bear evidence to a heavier rainfall than occurs on the adjoining plateaus. The plateau of Comitan has a deltoid form : it is begirt on all sides by ranges, except where it gently slopes south-eastwards to the plain of San Vincente. The river Iveletic, fed by numerous tributary brooks, traverses its entire length in a deep channel, and near Jotola at its eastern corner enters the three connected lakes of San Lino Miramar, San Lorenzo (4747 feet above the sea-level), and Arco San José, which have no visible outlet. Numerous other lakes and pools occur on the plateau, but in the dry season are, like the Iveletic, almost waterless. There is no doubt that at one time the plain of Comitan was a lake ; horizontal layers of calcareous tufa, containing in one spot remains of *Glossophoræ*, occur, and quartz pebbles border the plain, becoming finer towards the centre, and then giving place to sand. The surface is clothed with clumps of *Opuntia*, mimosa, etc., and wide grassy tracts afford excellent pasturage for cattle and sheep ; horse-breeding is a flourishing industry. The town of Comitan, 5300 feet above the sea-level, contains some fine buildings. Here Dr. Sapper replenished his stores, and then turned westwards, reaching in the afternoon a small plateau, 6200 feet high, and descended on September 19th to Sayatitan, a small Indian village. The view from this spot resembles that of the northern slope of the Suabian Alb. Long lines of hills with rounded summits run in front of the step-like plateaus, and still more prominent are some steep conical peaks, the so-called volcanoes of San José. San Bartolo, Mispilla, and La Lanza, which, however, are undoubtedly of sedimentary formation. At their feet extends to the west the plain of the Chiapas river, connected to the south-east with the plain of Nenton. On reaching it, Dr. Sapper was surprised to find himself among the rich vegetation of the *Terra caliente*, but it soon appeared that this was a local phenomenon due to the presence of brooks and pools, for elsewhere the vegetation is very similar to that of the more elevated plains. The Rio Blanco (2130 feet) is divided into several arms, and therefore is not deep; but being at the time swollen with rain and rapid, it was difficult to cross. On September 22nd the pretty little town of San Bartolomeo was reached. The streams on the way to La Concordia being impassable, Dr. Sapper was obliged to return to Comitan after ascending the mountain San Bartolo, 3898 feet high. Firs, cypresses, and oaks are the prevailing trees in the extensive forests. The few inhabitants of the country live by cattle-feeding and the cultivation of maize. Apples grow in the highlands, and corn would no doubt thrive as well as in the neighbouring Sierra Madre of Guatemala.

ANTARCTIC.

The Antarctic Question.—It is encouraging to find that in Germany also the necessity for exploration in the South Polar Regions is being urged by scientific men. At the meeting of the Society of German naturalists and medical men, held at Nuremberg in September last, Dr. Neumayer insisted on the absolute impossibility of definitely solving various problems of terrestrial physics in the absence of observations in the Antarctic regions (*Annalen der Hydrographie*, Heft xii. 1893). In particular, he referred to the theory of magnetism. Having undertaken since 1886 the calculation of the 24 constants of Gauss, and the determination of the magnetic elements therefrom, he found their agreement with actual observation by no means satisfactory. Dr. Adolf Schmidt sought to extend Gauss' theory, and published a very valuable treatise in the collection of the Deutsche Seewarte, but he also came to the conclusion that without a knowledge of the magnetic conditions of the Antarctic regions it was lost labour to devote further attention to the elaboration of a universal theory of terrestrial magnetism.

The figure of the earth is another subject which awaits further investigation. Observations of the lengths of the seconds' pendulum seem to show that the variations of gravity are very similar in both Polar zones, but it must be remembered that no observation has been made within the Antarctic Circle, and that even in the Arctic regions few observations are available of sufficient reliability to serve as a basis for the calculation of gravity co-efficients. Now these observations may be made with much greater ease and certainty by the pendulum apparatus designed by Lieut.-Colonel von Sterneck, with which excellent work has been done on the continent of Europe, and by Lieut. Gratzl in Spitbergen during the summer of 1892. In the southern hemisphere also active interest is now shown in this branch of science, and the Royal Society of Victoria is engaged in the planning out of a complete gravity survey, which, if carried out, will serve as a solid basis for a gravity survey of the Antarctic regions.

The plan for the exploration of the southern regions proposed by Dr. Neumayer is essentially the same as that of Dr. Murray (vol. x. p. 40). He advocates, in addition, the formation of a depôt, especially for coal, on some island lying immediately to the north of the point chosen for an observing station. As a British expedition would probably sail to the south of Cape Horn, Dr. Neumayer proposes that the Germans should at the same time descend on the unknown regions from the opposite side, erecting a depot on Kerguelen or the Macdonald Islands, and landing the scientific staff on Kemp's or Enderby Land. He recommends that the vessels, two in number, should be of about 450 tons each, and be manned by 50 men each, including 5 officers and 6 scientists.

In a letter to Dr. Murray, Professor Wild of Melbourne, after referring to the unsuccessful scheme of an expedition from Australia, already recorded in these pages, continues:—"You may therefore readily appreciate the great delight and gratification with which all lovers of scientific progress dwelling at the Antipodes learned from the public prints of your personal endeavours and exertions to revive the interest of the British nation in favour of a thoroughly scientific exploration of the vast and unknown Antarctic regions, and how ardently we desire that your efforts may be successful. A more complete exploration of the South Polar regions is the necessary corollary of our doings on board the *Challenger* during our Antarctic trip in February 1874—just twenty years ago. Here, in Australia, we are living, so to speak, next door to the Antarctic Victoria Land. From our ports we command the entire South Polar region, and nothing can be done effectually and permanently without the co-operation of Australia. A ten days' journey by steam would land an expeditionary corps at North Cape in Victoria Land, and a strongly built craft of about 200 tons would steam round the Antarctic lands in one or two seasons, and perform exploring work which it took our predecessors years to accomplish. Sydney, Melbourne, Hobart, Adelaide, and the Falkland Islands would afford admirable points of departure for exploring vessels, and would supply all that is required for establishing and maintaining permanent observing stations at the more important localities in the Antarctic. I deny that we must wait upon trade and commerce to attain so great an object. History shows that the courageous traveller, the bold explorer, has always been the first; the trader follows his steps later on, sometimes hundreds of years after. I need not tell you, who have studied the subject and beheld the wonders of the Antarctic with your own eyes, what interest and importance attach to this enterprise. If but the scientific men of the old world would join hands with those of the new for the promotion of a common object!"

COMMERCIAL AND INDUSTRIAL.

Cameroons.—The official report on this colony for the year ending July 1893 gives a favourable account of the progress accomplished during the German occupation. The European settlers number 215, of whom 145 are Germans. The sanitary state of the inhabitants was not so good as usual, owing to the excessive rainfall and the abnormally high temperature. The exploitation of the riches of the country is pursued with ever-increasing energy, and palm oil and nuts, *copra*, caoutchouc, kola nuts, ivory, cocoa, coffee, and tobacco are exported in considerable quantities. The botanical garden, laid out at Victoria, has, under the superintendence of Dr. Preuss, done good service in testing the adaptability of various plants for cultivation in Cameroons, and distributing seeds, grafts, and cuttings among both Blacks and Whites. The cultivation of cocoa is extending on all sides with excellent results. Attempts have been made to acclimatise a liana very similar to the *Landolphia florida*, so common in the forests of the Congo, and the Brazilian rubber-tree and manioc have been introduced into the nurseries of the botanical garden. The latter grows as rapidly as the banana, and affords shade for the young indiarubber and cocoa plants. The *Ficus elastica* of the East Indies has also been planted, and the experimental plantations of *Hevea Brasiliensis*, which yields the celebrated caoutchouc of the Para, give good results. Coffee also thrives, but is less widely cultivated than cocoa. The Liberian variety and Arabian coffee promise well, and the *Coffea marogopipe* and the Blue Mountain coffee of

Jamaica are planted. The volcanic soil of the Cameroons mountains appears to be peculiarly suited for this plant. Tobacco also commences to yield crops, and vanilla flourishes in the botanical gardens. Among other imported plants are the *Erythroxylon coca*, Jamaica ginger, cardamoms, ipecacuanha, mangoes, and lemons. Cattle thrive only on the high plateaus, and fowls, singularly enough, are very small. The imports for the twelve months were valued at £235,000, and the exports £206,250. Oak, mahogany, and redwoods are exported in Swedish sailing-vessels.—*Le Mouvement Géogr.*, November 12th, 1893.

The Railway across the Isthmus of Tehuantepec was noticed in vol. vi. p. 497. Its length, when completed, will be 200 miles, and it will connect Coatzacoalcos on the Gulf of Mexico with Salina Cruz on the Pacific coast. About 30 miles of railway in the centre of the isthmus remain to be constructed, and it is still uncertain whether the Mexican Government will be able to procure the necessary money. On completion, harbour works and jetties will have to be constructed on the Mexican Gulf and a large breakwater will be needed at Salina Cruz.—*Commerce*, Dec. 13th, 1893.

The introduction to **Australia** of the **camel** as a transport animal appears to have met with a considerable amount of success. Advices from the Queensland border, of date 10th November 1893, inform us that in the town of Bourke alone there are now upwards of eleven hundred camels with their Afghan drivers. The animals eat almost anything, and are therefore very cheaply maintained, while the Afghans are found willing to give their own services for sums ranging from 4s. to 5s. per week. Against such cheap labour the teamsters, who make up a considerable proportion of the population of Bourke, are unable to compete, and considerable discontent has consequently been excited amongst them.

MISCELLANEOUS.

M. Emile Gautier has arrived at Morondava after a difficult journey through **Madagascar**, bringing with him much fresh information concerning the topography and geology of the country. He has spent nearly two years exploring in the west of Madagascar, travelling to Ankavandra, on the Manambolo, and thence southward across the Tsiribi, and discovering a spring of mineral oil.—*Annales de Géographie*, January 15th.

Mr. Clement Wragge has established two **meteorological stations** in New Caledonia, at opposite ends of the island. The one is at the Military Hospital, in Noumea, the other at Gomen, the starting-point of the new cable. From these points Mr. Wragge will receive records twice daily at Brisbane, and he expects to be able to forecast at least 95 per cent. of the storms that visit Australia, instead of 85 per cent. as at present. In return for the courtesy of the French authorities, Mr. Wragge will daily telegraph forecasts to New Caledonia.—The *Colonies and India*, Jan. 27th.

The Geographical Society of Lisbon has presented to the Society a copy of *Caminho de Ferro da Beira a Manica: Excursões e Estudos effectuados em* 1891 *sob a Direccão do Capitão de Engenheira J Renato Baptista.* The author, who was commissioned to survey the country for the railway from **Beira to Massi Kessi**, gives a very detailed account of the country traversed, and the positions determined, as well as much information relating to the past history of the region, and notes the necessary equipment for a journey through it, hints for the preservation of health, etc. A map, founded on the observations of former travellers, as well as the author's own investigations, is appended.

On 11th January Wilhelm J. A. von Freeden, founder of the German Seewarte, died at Bonn, in his 72d year. He was born at Nordon in East Friesland, on May 22d, 1822. Having filled the posts of schoolmaster in the *gymnasium* of Jever and rector of the School of Navigation at Elsfleth, he moved in 1867 to Hamburg, and, with the assistance of the Chambers of Commerce of that town and Bremen, founded the North German, afterwards the German, Seewarte. When the institution passed in 1876 into the hands of the German Admiralty, Herr von Freeden retired to Bonn. He edited *Hansa, Zeitschrift für Seewesen* from 1871 to 1891, and was the author of a *Handbuch der Nautik*.

We have received vol. iii. of the *Transactions* of the Inverness Scientific Society and Field Club, covering the period 1883-88, and containing much valuable and often exceedingly interesting matter relating to the geology, botany, natural history, customs, antiquities, and industries of the Highlands, as well as a few papers dealing with matters without that area. A very interesting paper is that by Mr. Alexander Mackenzie on "The Gaelic Origin of Local Names," in which he strongly, and rightly, insists on the necessity of a knowledge of local topography to enable the student to attempt translations of place-names. A meaning may be found for a name taken from a printed or written page which agrees perfectly with the sound, but, if the locality be visited, the supposed meaning may, as likely as not, be found quite inapplicable, and an entirely new derivation present itself. Mr. Mackenzie says that he has approached the subject in neither a scientific nor dogmatic spirit, and merely gives what, in his opinion, are likely translations of local Gaelic names. He does not agree with the generally accepted derivation of Inverness. He believes it to mean "the *land* at the confluence of the river Ness," and that Ness is derived from the Gaelic "Eas," a waterfall; thus Loch Ness was originally Loch-an-Eas, the loch of the waterfall, referring to the Falls of Foyers, which he translates as the fall underground, a meaning easily associated with the cataract at a time before boats were common on the loch, and previous to the opening of the lower Dores Road, as it is invisible from below. As regards Tomnahurich, Mr. Mackenzie again disagrees with general opinion, believing the name to mean the wooded hill, and from the evidence adduced this rendering strikes us as being decidedly preferable to the commonly accepted "Tom-na-h-iughrach," the boat-hill, so called from its shape, resembling that of an overturned boat. In noticing the name of Bona, the author expresses his inability to give any opinion upon it, as in old documents it appears in such varied forms as "Baneth," "Bonacht," "Bonoch," "Bonnache," "Bannache," and "Bonath." Altogether sixty-six local place-names are dealt with in the article. Other papers of interest are those on a visit to St. Kilda, by Mr. Alexander Ross; Prison Life in Inverness between 1700 and 1720, by Mr. William Mackay, who is perhaps not aware that a bridge-dungeon, similar to that described, existed at Halkirk, Caithness, down to the last few years, and was employed as a small lunatic asylum as late as the closing years of the eighteenth century; the Sutors of Cromarty, by Mr. Hugh Miller; notice of a "Pieta" at Banff, by Dr. Grigor; notes on the ancient iron industry of Scotland, by Mr. W. Ivison Macadam; a paper on the study of Celtic place-names, by Mr. James Macdonald, and many others which we are unable to notice through want of space. The Society promise another volume at an early date.

NEW BOOKS.

The Discovery of North America: A Critical, Documentary, and Historical Investigation, with an Essay on the early Cartography of the New World, including descriptions of 250 maps or globes, existing or lost, constructed before the year 1536. By HENRY HARRISSE. London: Henry Stevens and Son, 1892. Pp. xii + 802.

This splendid volume is by the learned author of the *Bibliotheca Americana Vetustissima*, M. Harrisse, and it is impossible to speak too highly of the immense research, prolonged investigation, and accuracy which it displays. In the first part we have an authentic account of the work and opinions of the first explorers of American waters—the Cabots, Columbus, the Cortereals, Vespucci—all resting on the most careful examination of original documents. In the second part there is a detailed account of early cartography; some of the maps are reproduced in facsimile, with descriptions, and there is a critical examination of the names on this large assemblage of maps and globes. In the third, fourth, and fifth parts there follow a chronology of over one hundred voyages to the West, which were either attempted, projected, or accomplished; biographical accounts of the three hundred pilots who first crossed the Atlantic; and lists of original American names, together with much other interesting information concerning the North American continent.

This is not a volume for ordinary reading but for reference, and it exhibits in every page the faculty for taking pains. The author hints that the time is not yet come for synthetic labours in the sphere of history, and states his aim to have been to smooth the way for another generation of not less loyal searchers after truth, to whom he leaves "the more difficult task and the higher honour of erecting the definite fabric." M. Harrisse questions if the historical works of ancients or moderns are likely to possess for our successors any lasting value beyond the bare facts which they will have been found to afford. Viewed in this light, M. Harrisse's grand collection of facts is undoubtedly a model for all historians of the present age, destined to out-last all the other literary productions called into existence by the fourth centenary of Columbus's great discovery.

In looking over the hard but not dry facts in this volume, one is reminded of the recent works of Fiske and Payne, which to most minds appear more satisfactory and interesting. These authors evidently take a different view of history, and Payne goes so far as to say that the mind revolts from a mere recital of facts, however undeniable may be their truth. It is, then, interesting to find these different types of historical writers taking different lines with reference to some fundamental points in the history of the discovery of America. Payne and Fiske say that Columbus died in the belief that he had simply discovered the best and straightest route to the eastern shores of Asia; while Harrisse argues from documentary evidence that Columbus thought otherwise, but that to acknowledge his doubts would mean a discontinuance of all further exploration by the Spanish Government. Harrisse holds that as early as 1501 the notion prevailed in Europe that a regular continent barred the way to the eastern Asiatic coasts. It must be remembered that the discovery of America was not a single event, but a gradual development, the most decisive incident being the voyage of 1492.

The first voyage of Vespucci has always been a difficulty: it would appear, however, that the matter has been cleared up by the investigations of Varnhagen and Fiske, and that the voyage actually took place, as stated, in 1497. In a former publication Harrisse saw formidable difficulties in the way of accepting this view, but now admits that this expedition of Vespucci is not improbable.

In the *Fortnightly Review* of January of the present year there is an extraordinary article on the discovery of America by Jean Cousin of Dieppe, who was caught in a storm, and blown across to Brazil, in 1488. There is nothing altogether improbable in the story, for we know that Cabral was thus carried to America in 1500. Harrisse thinks this story will not bear critical examination, for he says, "Quant aux voyages du Dieppois Jean Cousin en 1488, de João Ramalho en 1490, et de João Vaz Cortereal en 1464, le lecteur nous pardonnera de les passer sous silence."

All the works of M. Harrisse, and this one no less than its predecessors, are classical and standard works for the student of history. No reader can carry away with him the infinite details which M. Harrisse furnishes concerning the cartography and bibliography of North America. Nor is this necessary or intended. The book itself must be on the shelves of the student and historian ready for reference.

The Sacred City of the Ethiopians, being a Record of Travel and Research in Abyssinia in 1893. By J. THEODORE BENT, F.S.A., F.R.G.S. With Map and Illustrations. London : Longmans and Co., 1893. Pp. ix + 309. *Price* 18*s*.

Abyssinia is not a *terra incognita* ; the aim of Mr. Bent and his wife in their expedition was, as he tells us, primarily archæological : and they did not penetrate as far into the country as Captain Harrison Smith (1890), or the lamented Sir Gerald Portal (1891), each of whom has left a record of his mission from Queen Victoria to the King of Kings. But Mr. Bent's book combines many interests for all who wish to know about this realm of most Christian savages, of Africanised Asiatics. Mr. Bent's keen eye and swift and graphic pen have left unnoted very little that fell beneath his eyes, from Massowah to Asmara and the seldom-visited monastery of Debra Sina, to Adowa, and to Aksum (as he insists on spelling the familiar and venerable Axum). The nature of the country, the badness of the roads, the vexatiousness of servants, the unamiablenesses of the nefarious Ras Alula, the anthropological types, the religious and social customs, the architecture, the artistic efforts, the tools, weapons, garments, ornaments, and musical instruments of that line of country, are entertainingly described by pen and pencil, as well as the ancient monuments and inscriptions of Yeha, Axum, Adulis, and Kohaito. Mr. Bent is chiefly pleased to think that "the impressions of inscriptions we took, and the photographs of the ruins, now place the Sabæans of Arabia, by incontrovertible documentary evidence, in the heart of Abyssinia as early as the 7th or 8th century B.C., whilst they show that paganism continued as the national religion down to a much later epoch than is supposed." The inscriptions and their significance have been thoroughly analysed and expounded by Dr. H. Müller of Vienna in one of the chapters of the work, and an appendix by Dr. Garson discusses the anthropology of the Abyssinian races.

It is to be regretted that native political conjunctions limited Mr. Bent's researches in Axum to a period of ten days ; and signs of hasty writing are visible also in the book. The arrangement and relation to one another of the several monuments at Axum are not made clear—one is not always quite sure which of several monuments is being discussed. Does the picture at p. 182 give the back view of the "tall standing monolith," a few pages further on ? They don't seem quite to tally. Mr. Bent occasionally repeats himself—as about Dr. Johnson and Father Lobo and the £5, on pp. 9 and 112, and the Persian look of the saddlery, at pp. 69 and 123. He descants on the horrors of the *zinc* roof of the cathedral at Adowa, on p. 99, and at p. 126 it is an equally horrible *tin* one. The Tacazzeh river of p. 153 appears elsewhere in the book as Tacazzy (p. 144), Takaze (p. 265), and Takazze (p. 270) ; Mordtmann occurs as Mordman (p. 232) ; the eminent Semitic scholar Rödiger is disguised as Roedige (p. 256 and index); the statement on p. 279 about Ethiopic being written like Greek from right to left is surprising; and not a few sentences (*e.g.* that at foot of p. 180) might with advantage be re-arranged. The spellings in the map (apparently from Italian sources, with some of the names unaltered) and in the text differ as much as usual, even in such important names as Massaua and Adua. But these are all but trifling defects, easily removable from an interesting and excellent book.

Mission Binger: France Noire (Côte d'Ivoire et Soudan). Par MARCEL MONNIER. Illustré d'après les photographies de l'auteur. Paris: Plon, Nourrit et Cie., 1894. Pp. xii + 299.

This work is an interesting supplement to Captain Binger's valuable account of his journey *Du Niger au Golfe de Guinée* (see this *Magazine*, vol. vi. p. 205, and vol. vii. p. 108). The most important feature of that journey was the visit to the State of Kong, with its simple but effective civilisation, its commercial enterprise, and the individual dignity and self-respect of the leading race, due apparently to their reception of Islam. Captain Binger, as will be remembered, approached Kong from the north, and made treaties all along his route, providing exclusive favours for French trade. On the occasion before us, he and his companions marched up from the opposite direction, *i.e.* from the Guinea coast. When the *Hinterland* theory is worked from two opposite lines, it can become very comprehensive. The party was sent out from France with the view of meeting a British Commissioner, and thus forming a joint commission to determine the frontier, from the coast northwards, of the respective spheres of influence. The Commission came to nothing, for the British officer, apparently dissatisfied with the French interpretation of the basis laid down, decided, before proceeding further, to refer the matter home—getting, however, so M. Monnier tells us in his appendix, no satisfaction. Meanwhile, the French party marched northward from Assinie, traversing with much labour the dense belt of malarious forest, here some 150 to 180 miles in width, and emerging at length on the plain country beyond, where they visited first Bondoukou, a place which, if less advanced in various respects than Kong, is of some commercial importance. Thence they proceeded north-west, over a very sparsely inhabited country, to Kong, where they strengthened the favourable impression made four years before by Captain Binger, and here, as in other places, treaties giving exclusive trade rights to the French were made or renewed. M. Monnier, who writes with much humour, describes the kind of negotiations which took place on these occasions.

Although there is considerable difference between the tribes, they seem as a rule to be a singularly easy-going, goodnatured, inoffensive race, and easy to deal with. On one occasion only, viz. in trying to reach the Isi river, the party was turned back, and, instead of thus discovering a new route to the coast, had to return thither by the Comoe river. Of 2000 kilomètres traversed, 500, however, were, we are told, over new ground; and many curious details are given of the usual drawbacks to African travel—the abounding superstitions, interfering with every movement; the chiefs and their exactions; the runaway bearers; the food and the climate. The illustrations, being from photographs, are both reliable and interesting.

Studies of Travel. By EDWARD A. FREEMAN. Greece—Pp. viii + 286. Italy—Pp. iv + 321. New York and London: G. P. Putnam's Sons, N.D. *Price 5s. the two vols.*

These dainty volumes contain the characteristic studies of places visited by Mr. Freeman on three tours in Greece and Italy, which were contributed by him at the time to the *Saturday Review* and other papers, and which, had he lived longer, would undoubtedly have been recast by him and republished, as others of a similar kind were. Though they have not had the benefit of his final revision, they are well worth preserving in a permanent and handy form; and as issued they will be indispensable companions to every traveller going over the same ground, who has any interest in the historical associations of the places he visits. They are masterly studies in political geography, in which incisive appreciation of natural characters and intimate acquaintance with history, both local and general, combine to the production of a luminous commentary, which brings out their relations in the most impressive manner. The permanent physical features, the buildings of architectural and historical interest, and the bearing of both on historical events, are so forcibly described that any reader can follow the writer intelligently and with real pleasure. The points taken are, as a rule, few, but they are elaborated and enforced in great detail, and with a wealth of illustration by parallel or contrast drawn from many lands, and the impression is inevitably produced of their importance and interest. The form and size of the volumes make them most convenient to carry in the traveller's pocket or bag, and assuredly he will not find a more delightful and instructive guide. We have noted rather more errors of the press than, considering the beauty of the volumes and the care bestowed on their production, we should have expected; and we are at a loss to understand why *Agora* of the common and Attic Greek always appears in the Ionic form of *Agorê*.

Impressions Coloniales (1868-1892): *Étude comparative de Colonisation.* Par CHARLES CERISIER, ancien Officier de Commissariat de la Marine, Directeur de l'Intérieur au Congo Français. Paris et Nancy: Berger-Lévrault et Cie. Pp. viii + 357.

The intention of this book (of which some chapters have appeared before in different forms) is to impress on the French reader the extreme importance, in the author's view, of the possession of colonies, to break through what he considers the prevailing indifference on the subject, and to suggest and discuss the methods by which the results of past indifference may be repaired. It must be admitted that to the British, though probably not to the French reader, some of his recommendations savour of the fantastic. Ships, each freighted with "exhibits" from a special colony, are to be sent into the different French ports, and exhibitions held and lectures delivered. Again, bands of carefully selected young men are to be conducted to the various French colonies, and, having looked about them, are to return and write reports dealing exhaustively with all matters commercial, moral, scientific, and economic. The author is very candid in his criticisms, pointing out the contrast between the comparative failure of such a colony as French Guiana side by side with the prosperous British colony. He exhorts his countrymen to imitate the "egoistic and selfish policy" of the British; but there is all the difference in the world between this so-called British policy—which is little more than the unconscious workings of individual effort, with a minimum of official encouragement—and the elaborate and artificial administrative fostering which he recommends.

The book contains a mass of useful statistics, relating chiefly to the colonies with which M. Cerisier is personally acquainted, viz., French Guiana and the French Congo and other West African territories. He urges the necessity and duty of the French colonists to deal with the mother-country, and *vice versâ*; but the small relative amounts of French exports and imports and French shipping, even aided by preferential tariffs, would suggest that this might be difficult to carry out.

Cochin China, he says, is the most flourishing French colony, and may be made the basis of a great Oriental empire, rivalling that of the British in India. The basis could hardly as yet be commercial, seeing that, as the writer tells us, of the export trade 70 out of 75 millions of francs, and of the import trade 76 out of 87 millions, is with the foreigner; while as to the carrying trade, out of 4110 ships only 253 are French, and 185 of these are trading with foreign countries.

We note that the writer is in favour of developing such possessions as those above referred to by means of great companies, to whom he would grant very extensive powers, reserving, in fact, only such matters as the concession of public works and the right of establishing credit institutions. We may also note his common-sense protest against the decision of colonial questions by the Colonial Office staff without reference to local colonial experience.

Exploration de la Région du Grand Lac des Ours. (Fin des Quinze Ans sous le Cercle Polaire). Par ÉMILE PETITOT, ancien Missionnaire Arctique, Lauréat des Sociétés de Géographie de Londres et de Paris, etc. Paris: Téqui, 1893. Pp. vi + 470. *Price 4 francs.*

The scope and gist of the present volume cannot, perhaps, be better indicated than by quoting the author's own words: "This book is based upon my journals of eight expeditions made, between 1866 and 1879, to the Great Bear Lake, and my residences there, eight in number, and each of three to six months' duration. I had the honour to be the first Frenchman and the first missionary to visit, travel over, explore, and dwell beside that Caspian Sea of the Arctic Circle and the desolate regions that environ it. I claim the right of discovery of all the large lakes, streams, prairies, and mountains, which I have been the first to visit, and which I have inscribed on the maps that accompany this volume, although I must acknowledge that I made use of certain data supplied by the Arctic Expedition of 1825-27, conducted by the immortal Sir John Franklin." As the reader will perceive, M. le Prêtre-curé Petitot, ancien missionnaire arctique, has laboured in a distant and difficult portion of the world, during years to which we look back over a considerable interval of time, and he estimates the importance of his discoveries at their full worth—and something above it. The narrative reads, indeed, like a journal or diary of occurrences, the contents of which are reproduced in much the same fulness of detail with which they were originally set down. The author does indeed make useful additions to the geographical knowledge of the region of which he writes, adding to the facts gathered and recorded by the Franklin Expedition, and correcting points of detail with regard to the topography. The student will find a great fund of information respecting the Indians of those high latitudes; the author's account of them makes a series of sombre and depressing pictures. The book is illustrated with some poor woodcuts and a couple of useful maps.

The Conversion of India, from Pantænus to the Present Time: A.D. 193-1893. By GEORGE SMITH, C.I.E., LL.D., etc. With Illustrations. London: John Murray, 1893. 8vo, pp. xx + 258.

Dr. G. Smith was selected to deliver the fifth course of Graves Lectures in the Theological Seminary of New Brunswick, N.J., and chose for his subject "The Conversion of India." This volume contains a more expanded and detailed treatment "of the question, historically and practically, than was possible in the six lectures which he was appointed to deliver in the first fortnight of October 1893." The work is eminently instructive to all interested in missions and in the recent history of social movements and amelioration in India. On such subjects, and on the men who have initiated them, there is here brought within moderate compass a wealth of important information. Of geography we had little to look for—nothing that is new. Following Yule's opinion in 1863, Dr. Smith (p. 39) identifies the Supera of Friar Jordanus, *cir.* 1330, with Surat; since 1872, Yule and all scholars have accepted Supârâ, close to Bassein, as the Supara of Ptolemy and later writers. The Kalliena of Cosmas Indicopleustes, and the seat of an early Nestorian bishopric (p. 157), Dr. Burnell was inclined to identify, not with Kalyân, near Thânâ, but with another place of the name, 32 miles north of Mangalûr. But these trifling oversights in no way detract from the real interest and permanent value of this volume.

Rulers of India. Haidar Alí and Tipú Sultán, and the Struggle with the Musalmán Powers of the South. By Lewin B. Bowring, C.S.I., formerly Chief Commissioner of Mysore. Oxford: At the Clarendon Press, 1893. Pp. 233. *Price* 2s. 6d.

Haidar Ali and his son Tipú played an important part in the great struggle which ended in the establishment of the English Power in Southern India, and this justifies their being made the subject of one of the series of monographs on Rulers of India. Mr. Bowring has given a graphic sketch of Haidar Ali's career, and shows how, starting as a mere soldier of fortune, he, by his force of character and ability, gradually won for himself an extensive and powerful kingdom, which passed to his son on his death. He has taken pains to indicate vividly what manner of men they both were, and his narrative is replete with interesting details which will be very welcome to all students of Indian history, though possibly somewhat disproportionate to the object of the series. They present, however, a valuable picture of the state of confusion and misrule which the English Government superseded, and keep alive the remembrance of what it is important should never be overlooked or forgotten.

Spain: Being a Summary of Spanish History, from the Moorish Conquest to the Fall of Granada. (711-1492 A.D.) By Henry Edward Watts. London: T. Fisher Unwin, 1893. *Story of the Nations* Series. Pp. 315. *Price* 5s.

Mr. Lane-Poole's *The Moors in Spain* formed an early volume of this excellent series. Mr. Watts now narrates the long duel between Spaniard and Moor, which lasted for 781 years, and was at length brought to an end on the 2nd January 1492, when Abu Abdallah rode forth from his stately palace-fortress of the Alhambra, and the banners of Castile and Aragon waved over the last Spanish possession of the Moor.

From his preface we perceive how erudite a Spanish scholar and historian Mr. Watts is, and how carefully native Spanish histories must be sifted. There is in this volume a map of Spain as at A.D. 910, but we look in vain upon it for Mr. Watts' "mountains of Asturias." Otherwise, the illustrations are good. We note that Mr. Watts says nothing about the Gypsies (a large and troublesome portion of the Spanish people), although they reached Spain in 1447, which is within the period embraced by his history.

My Arctic Journal: A Year among Ice-fields and Eskimos. By Josephine D. Peary. London: Longmans, Green, and Co., 1893. Pp. 240. *Price* 12s.

Mrs. Peary here relates her adventures and experiences whilst accompanying her husband, Lieutenant Peary, U.S. Navy, on his celebrated Arctic voyage. The volume is prettily illustrated after photographs taken in the Arctic regions. Mrs. Peary writes in a lively and graphic manner, and the volume is interesting, and perhaps unique, as containing a "plain and simple narrative of a year spent by a refined woman in the realm of the dreaded Frost King."

From Island to Island in the South Seas; or, the Work of a Missionary Ship. Compiled by George Cousins, Editorial Secretary of the London Missionary Society. With Route Map and numerous Illustrations. London: L.M.S., 1893. Pp. 128.

This little shilling volume has a distinct geographical value. All that the islands of the Pacific Ocean are, the missionaries—London, Wesleyan, and Presbyterian chiefly—have made them, in a style which has won the public commendation of Mr. Robert Louis Stevenson. The history of each group is here given from the day—nearly a hundred years ago—when the good ship *Duff*, under Captain Wilson, landed the first London Society's missionaries at Tahiti, to the present time, when the same Society, under Mr. Lawes, is opening up British New Guinea. In the century thirteen ships have been employed in civilising and evangelising work in the South Pacific alone, and now the Samoans and other islanders send out missionaries on their own account. This number is exclusive of the three *Dayspring* ships of the Presbyterian Mission, and those of Bishops Selwyn and Patteson. The London Missionary Society has ordered a new steamer from Messrs. R. Napier and Sons of Glasgow, for combined New Guinea and South Sea Island work, at a cost of £17,000, and it is ready for launching on its voyage of benevolence.

Forty-two Years amongst the Indians and Eskimo: Pictures from the Life of the Right Reverend John Horden, First Bishop of Moosonee. By Beatrice Batty. London: Religious Tract Society, 1893. Pp. 223.

John Horden began life as David Livingstone did, and died at sixty-five, after forty-three years' missionary and episcopal service in the diocese nearest to the North Pole. The story is here skilfully told, chiefly from his correspondence. Moosonee is the division of the Hudson Bay territory to the south of the Bay. In 1851 Horden reached it in an ice-ship from Stromness, and found the Cree Indians and Eskimo hunting and bartering their furs exactly as their fathers did in 1670, when Charles II. gave a charter to the ten merchants who formed the Hudson Bay Company. How he evangelised and civilised them this little book tells. We note that Churchill is "the last house in the world," for there is no other between it and the North Pole.

Social Life among the Assyrians and Babylonians. By A. H. Sayce, LL.D., Deputy Professor of Philology, Oxford. "By-Paths of Bible Knowledge." London: Religious Tract Society, 1893. Pp. 128. *Price 2s. 6d.*

Himself the chief expert in Assyriology, Dr. Sayce here popularises the latest results of scholarship. His first chapter on "the People" is a model of lucid geographical and ethnological description, distinguishing the Accadians or Sumerians (Shinar) from the Kassi of Elam and the Semites of Babylonia from whose midst Abraham migrated; these formed the people of muddy Babylonia, mixed as the English are to-day, as the Sumerians and Semites originated the military caste of rocky Assyria. Hence the importance of always, in reading the Old Testament, discriminating between the Chaldæan-Babylonians of the south and the Assyrians of the north. In eight short and clear chapters Dr. Sayce characterises the customs, beliefs, economic condition, and religion of the two races. Incidentally he derives the modern "dragoman" or interpreter from the *targumannu*, whom the King of Aram Naharaim sent to Egypt as far back as the 15th century before Christ. *Sab-athu* or *Sabatuv*, in the cuneiform inscriptions on the monuments, the Jewish "Sabbath," was derived by the Babylonian grammarians from the Accadian *sa*= the heart, and *bat*=to end, "the day of rest for the heart." The book wants only an outline map and illustrations to make it perfect. The whole "By-Path Series" is invaluable for students of Holy Scripture and recent scholarship.

In Sugar-Cane Land. By EDEN PHILLPOTTS. London : M'Clure and Co., N.D. Pp. xii + 297.

This is a very amusing account of a trip to the West Indies, concerning which, the author remarks, "great ignorance still prevails at home." Whether the account here given helps to dispel that ignorance the reader may judge for himself, and we think he will agree with the writer when he says, "Much that I shall say is sure to be new to everybody, even the West Indians themselves." The work is very entertaining, although it cannot be taken seriously as a contribution to geographical knowledge.

How I Shot my Bears; or, Two Years' Tent Life in Kullu and Lahoul. By Mrs. R. H. TYACKE. With Illustrations and a Map. London : Sampson Low, Marston, and Co., 1893. Pp. 318. *Price 7s. 6d.*

The book is brightly written, and contains an interesting account of the Kullu valley, which is noted for its beauty, and in which for many years past a small number of European settlers have established themselves ; also of Lahoul, a bleak and inhospitable region, reached from Kullu by crossing the Rohtang Pass, and in which the only European residents are the devoted Moravian missionaries, Mr. Haide and his wife.

The reader marvels at the physical strength of the woman who could endure so much fatigue and so many hardships in the pursuit of a sport usually indulged in only by the stronger sex.

If the authoress brings out a new edition, she should revise the spelling of names and vernacular words. The pheasant she calls the "argus" is a species of *Ceratornis*, and is, of course, not the true argus. Kullu and Lahoul are not, as she seems to suppose, beyond the limits of India, but form a part of the Kangra District of the Jalandhar Division of the Punjab.

Adventures in Mashonaland. By Two Hospital Nurses, ROSE BLENNERHASSETT and LUCY SLEEMAN. London : Macmillan and Co., 1893. Pp. 340. A Map.

Interest in South Africa is now so great, that probably the two hospital nurses will gain many readers for their chatty book. There is nothing new in it from the geographical point of view, but it gives a good idea of life on the fringe of civilisation.

Among Boers and Basutos. By Mrs. BARKLY. London : Remington and Co., Ld., 1893. Pp. 270. *Price 3s. 6d.*

This little book is the story of life on the frontier pleasantly told. Mrs. Barkly is evidently an observant woman, and gives some interesting notes as to Basuto customs and administration difficulties. She was in Basutoland from 1877 to 1881, so that the incidents she mentions are rather ancient history.

L'Algérie et la Tunisie à travers les âges. Deux conférences, accompagnées de deux cartes. Par ALEXANDRE BOUTROUE. Paris : Leroux, 1893. Pp. 62.

In this brochure M. Boutroue prints a couple of addresses which he delivered before the Geographical Society of Paris in December 1892. He communicates the results of an archæological mission to Algeria and Tunis, under the auspices of the Minister of Public Instruction and the Fine Arts. He treats of the monuments of Roman and Arab civilisation, and briefly describes their salient features. One of the maps illustrates the Roman times ; the other gives M. Boutroue's itinerary, and indicates the localities and sites of the monuments which he visited. Not only students of history, but visitors to the country, will meet with an instructive guide in M. Boutroue.

Portuguese Discoveries, Dependencies, and Missions in Asia and Africa. Compiled by the Rev. ALEX. J. D. D'ORSEY, B.D. London: W. H. Allen and Co., 1893. Pp. xvi + 434.

This work calls for little comment. Mr. D'Orsey divides his work into five books. In the first he gives an account of the geographical position and early history of Portugal introductory to the narrative of maritime discoveries of the Portuguese in the fifteenth century, and their conquests in the East in the sixteenth. Sketches of Portuguese and South India lead us to the second book, where the Portuguese missions are traced, and the Jesuit rise and settlement traversed. Syrian Christianity under Portuguese missionary influence is the main theme of Book III., and the next leads us from the subjugation of the Syrian Church under Menezes to modern missionary enterprise in Southern India. The fifth book is concerned with these recent efforts, and finds in the present condition of the Syrian Church proof of the existing operation of Portuguese influence and the revival of Romish missions in Madura. In the conclusion Mr. D'Orsey suggests how the Malabar Church, contaminated by the Portuguese, may be purified in doctrine and ritual.

The book brings together in small compass a mass of material not readily accessible. It will be useful to the average reader, and helpful even to the well-read. The writer has not, indeed, made allowance enough for the existence of many mansions in the Christian Kingdom, but it is fair to state that he provides data for his conclusions. He is uniformly guilty of the elementary practice of italicising for emphasis. The maps are rather rough and the lettering indistinct.

Rund um die Adria. Ein Skizzenbuch von JOSEF STRADNER. Mit 34 Illustrationen von FRANZ SCHLEGEL. Graz: Druck und Verlag "Leykam," N.D. Pp. 168. *Price* 1 *fl.* 20 *kr.*

Herr Stradner has produced a very readable description of some of the unfrequented corners at the upper end of the Adriatic. He notices the vegetation, animal life, and the inhabitants, with their manners, habits of thought, and origin, dwelling at greater length on the mysterious Morlacchi or Cici. Readers in this country will perhaps regret that the plan did not permit of a sketch of Abbazia being included, but the little book will be useful to visitors to the new resort who may wish to extend their wanderings. The illustrations, though small, are well executed and attractive.

The Burmese Empire a Hundred Years Ago. As described by FATHER SANGERMANO. With an Introduction and Notes by JOHN JARDINE, Judge of Her Majesty's High Court of Judicature at Bombay, etc. Westminster: A. Constable and Co., 1893. 8vo. Pp. xxxix + 311. *Price* 10*s.* 6*d.*

Vincentio Sangermano was a Barnabite father, sent out as a missioner to Burma in 1782, who lived in Rangoon in charge of the Roman Catholic mission there till 1808, when he returned to Italy. Before his death in 1819 he had prepared for the press and left in manuscript an interesting *History of the Birman Empire*, which was translated by Dr. W. Tandy about 1833, and published, with a short prefatory note from the pen of Dr. N. Wiseman, by the Oriental Translation Fund. Mr. Jardine, when Judicial Commissioner in British Burma, reprinted the work at Rangoon in 1884, with some notes; and the present reprint, which may be called the third edition, has prefixed to it an interesting introduction and many illustrative notes by the same accomplished editor. The work is in handy form and excellent type, with an index and a map of Burma and Siam.

Meteorology. By H. N. Dickson, F.R.S.E., F.R.Met.Soc. London: Methuen and Co., 1893. Pp. viii+192. *Price 2s. 6d.*

The author may be congratulated on this acceptable work, in which in a concise, although thorough, manner he has traversed the wide field of modern meteorology. The book is not altogether without its drawbacks, which, however, are more than balanced by the comparative fulness with which even recent advances in meteorological science are summarised.

In the opening chapters, dealing with the broad facts and principles underlying the science, sufficient "permanent way" is laid down to enable the reader to grasp the theories of cyclonic and anti-cyclonic circulation dealt with in succeeding sections. Among the other matters treated of in connection with weather-forecasting, the practical utility of the Ben Nevis observations is more than once alluded to.

The chapter on "Meteorological Instruments" (in which, by the way, the subject of clouds is disposed of) suffers from the lack of a sufficient number of woodcuts. Illustrations of the more important instruments might have been given with considerable advantage. A special feature of the work is the explanation of a large number of "weather saws" current among our agricultural and seafaring communities.

There are few errors, the only ones worth noticing being the transposition of the international "symbols" for solar and lunar halos and coronæ (p. 14), and the absence of the one for dew.

The metric system and centigrade scale have been frequently used throughout the book, the English equivalents being given in very few cases. Exception must be taken to the use of these Continental forms of measurement, chiefly on the ground that very few persons in the British Islands are practically familiar with them. In this connection it may be noted that there are no tables appended to the work for the conversion of the observations from one scale to that of the other.

British Commerce and Colonies from Elizabeth to Victoria. By H. de B. Gibbins, M.A., Author of *The Industrial History of England*, *The History of Commerce in Europe*, etc. London: Methuen and Co., 1893. Pp. viii+136. *Price 2s.*

Mr. Gibbins has added a very useful volume to "Methuen's Commercial Series," the chief aim of which is to furnish handbooks suitable for young men preparing for a commercial career. Mr. Gibbins's book, as its title indicates, is a review of the progress of British commerce and colonisation from the reign of Elizabeth to the present time. Starting with an account of the "mercantile system" introduced by Elizabeth's ministers, the author shows how great an impetus it immediately gave to British commerce. That system, in accordance with modern ideas, must now be condemned as one of rank protection; but Mr. Gibbins seems to be of the opinion that it was well adapted to the circumstances of the time; and it cannot be denied that, under it, British commerce flourished, and that the power of the country increased. The author makes it his object to show that, in the expansion of Britain, commerce and colonisation have always gone hand in hand, not merely as cause and effect, but as influences that have both acted and reacted on each other. He calls attention in his closing chapter to the part which chartered companies are playing in the work of extending British trade and influence now, as in the days of Elizabeth and James, referring especially to the British South Africa Company and the Imperial British East Africa Company. The book closes with a full list of the British possessions and colonies, in which we find Cyprus assigned to Europe instead of to Asia. There is an index, but no map.

Katechismus der Völkerkunde. Von Dr. HEINRICH SCHURTZ. Leipzig: J. J. Weber, 1893. Pp. 358. Index and 67 Illustrations.

This book gives a brief outline of ethnology. It is written in a popular style, but it is accurate, and gives the general reader sufficient information regarding ethnology to enable him to take an intelligent interest in the subject. The illustrations are good, and the subject-matter well balanced.

Earth Knowledge: A Text-Book of Physiography. By W. JEROME HARRISON, F.G.S., and H. ROWLAND WAKEFIELD. London: Blackie and Son, Limited, 1893. Pp. 166 + 176. *Price* 3s.

In this volume, the two sections of the work, the elementary and the advanced, are bound together. Though the double index is inconvenient, there are, no doubt, advantages in having the work in a complete form, especially in the case of schools and colleges that desire to use it as an introductory text-book of science. The method and plan of the book are excellent. The statements are characterised by accuracy and clearness. Homely illustrations are freely introduced. A special word of praise must be given to the woodcut diagrams, which are remarkably clear and delicate. The questions set by the Science and Art Department for the last ten years in the May examination are given in the appendix to each section of the work.

Elementary Palæontology for Geological Students. By HENRY WOODS, B.A., F.G.S. ("Cambridge Natural Science Manuals.") Cambridge: University Press, 1893. Pp. vi + 222, 56 figs.

This little volume seems to be intended as a handbook for students of geology who wish to master a typical collection of invertebrate fossils. It gives a terse statement of the general characters of the classes, and diagnoses of the most important genera which occur as fossils. But the title does not indicate so restricted an aim, and this is not as it should be. The book deals with invertebrates only, and with but one aspect of palæontology. We are quite willing, however, to judge a book in reference to its precise purpose, and as a museum-guide this will be found handy and trustworthy. But it lacks life, the salt of suggestiveness and vividness of treatment. One cannot help noticing also certain idiosyncrasies of grammar which are not beautiful. Most, however, we wish that the author had given us what he could have given us—a living picture of the past history of animals.

A Short Account of England's Foreign Trade in the Nineteenth Century: Its Economical and Social Results. By ARTHUR L. BOWLEY, B.A. London: Swan Sonnenschein and Co., 1893. Pp viii + 132.

This is the Cobden Prize Essay of Cambridge University for 1892, recast and completed, and is published as one of Messrs. Swan Sonnenschein's Social Science Series.

It gives a well-thought-out account of its subject, dealing among other topics with the history of Free Trade; and its graphic diagrams bring out clearly and with emphasis the necessary statistics.

The author uses the term "England" as though it included all the United Kingdom, and speaks of the Clyde shipbuilding firms as "English."

A Concise History of Ireland from the Earliest Times to 1837. By P. W. JOYCE, M.A., LL.D., etc. Dublin : M. H. Gill and Son, 1893. Pp. viii + 312.

While the political events that have taken place in other countries are after a comparatively short lapse of time regarded impartially as subjects of purely historical inquiry, whatever relates to Ireland even centuries ago cannot be referred to without exciting party spirit, and therefore the task of writing the history of that unfortunate country is one that needs much caution. Dr. Joyce has in this short work confined himself almost entirely to a plain and moderate statement of facts, neither giving undue prominence to the bitter feuds and violent deeds that originated from differences of race and religion, nor seeking to gloss them over. At the same time, the main obstacles to the material progress of Ireland, such as the interference with its wool-trade, and the excessive flow of emigration due to this and other causes, are fully set forth. The book may be thoroughly recommended to all readers who wish to gain an accurate knowledge of the outlines of Irish history.

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 F. W. PENNEFATHER, LL.D. With numerous Maps and Plans. London : John Murray, 1893. Pp. [64] + 172.

That this time-honoured series has extended to the Antipodes and embraced New Zealand is an interesting and convincing proof not merely of the degree to which the resources of the Colony have developed—for of this we had evidence in the *Handbooks* of Sir J. Vogel and Sir J. Hector—but of the multiplication of the means of communication both by land and sea, and of British and other tourists. This volume does not profess to give an exhaustive description of the country, of which great districts still remain unexplored, but all the principal routes are described, with their respective facilities in the matter of railways, coaches, horses, and hotels. Especial attention is given to the more famous and attractive regions, such as the hot lakes district in the North, the cold lakes in the South Island, and the great Alpine region ; so that the intending traveller can easily decide for himself, according to his time, strength, and inclination, how much he should do or leave undone. The principal centres, the capitals of the old provinces, are all described, with plans of the towns. We could have wished that the historical sketch had been a little fuller, though many historical incidents are given in describing the localities where they took place ; a few words more perhaps on the flora (under which heading only the trees and the ferns are dealt with) and on the industries and trade of the colony might also have been acceptable, for the volume is far from bulky ; but we must defer to Mr. Murray's superior knowledge of the needs of the British tourist.

Ordnance Gazetteer of Scotland: A Survey of Scottish Topography, Statistical Biographical, and Historical. New Edition. Edited by FRANCIS H. GROOME. Vol. III.: Fad—Hyndford. London, Edinburgh, and Glasgow : William Mackenzie, N.D. Pp. 280.

The present volume exhibits all the excellent features, wide scope, and care in preparation that characterised the former edition and the first two volumes of the new issue as previously noticed (vol. ix. p. 432). The principal article in this volume is, of course, that on Glasgow, and it is an admirable specimen of gazetteer work of the highest class, occupying nearly seventy-nine pages, with a special and well-compiled index running to nearly three additional pages. This article is not only an accurate and detailed descriptive account of the city as it now is and as it was, with full notices of its streets, churches, public buildings, institutions, trade, and manufactures, but a readable and valuable history of the city, its rise and progress, with abundant biographical details of those who helped to make it what it is at the present day. In our former notice want of space compelled us to leave out any reference to the plates and maps. The former are beautifully produced on excellent paper, the subjects being judiciously chosen, and add much to the value and sightliness of the whole work. The maps are sufficiently clear, with all the names one can reasonably be expected to look for in them, and give effect to the various changes in marches ordered by the Boundary Commissioners; they might, however, we venture to think, have been more pleasingly tinted. The town plans are very good and clear. In a word, the work is indispensable to any one wishing to have an accurate knowledge of Scotland as it was and, especially, as it is.

The Northern Counties Red-Book and Chronicle Almanack for 1894. Inverness: *Northern Chronicle* Office. Pp. 84. *Price* 3*d.*

The present issue of this annual maintains its past reputation in every way. The manner in which the information has been brought up to date deserves all commendation, while the accuracy of the varied lists is vouched for by the fact that they are contributed or revised by local correspondents. There is a large mass of unpaged matter.

"*The*" *Practical Guide to Algiers.* By GEORGE A. HARRIS. Fourth Edition. London: George Philip and Son, 1894. Pp. 176. *Price* 3*s.* 6*d.*

There is ample room for a Practical Guide to Algiers, but Mr. Harris's volume does not meet the requirements. The author's notions of what is "practical" are not ours. Parts I. and II., dealing with Algiers and its environs, fill only 88 pages, including 20 pages of introduction. Part III. takes in "The Interior" of Algeria, which, properly speaking, is beyond the scope of the book.

Mr. Harris is apparently ignorant of the value of climatic phenomena. Moreover, it is not true, as a general statement, that the climate of Algiers is "bracing," or "good for asthma," though asthmatic patients requiring a warm and humid climate might find it so in the winter.

The author's description of Hammam R'hira is evidently based on the plans of what that establishment (the Grand Hotel) was intended to be. Last winter, at least, the building was only half-finished, with no prospect of its being completed; the accommodation was indifferent, and the fare of the most primitive description. But the charm of the place is such that few tourists should be frightened away on that account. We merely mention these facts to show how "practical" the *Guide* is. Another fact is worth noting: the book is ante-dated, having appeared last year.

The maps (French) are poor, and far too bulky. Indeed, the size of the book is to a great extent made up of them and the advertisements. The illustrations are, however, very good.

"*Devia Hibernia*": *The Road and Route Guide for Ireland of the Royal Irish Constabulary.* Compiled and edited by GEORGE A. DE M. DAGG, D.I., etc. Dublin: Hodges, Figgis and Co., Limited, 1893. Pp. xi + 344.

To the tourist in Ireland who leaves the railways for walking, driving, riding, or cycling excursions, this volume is simply indispensable, and, although it will not supersede the ordinary guide-book, ought to prove a supplement to it of the greatest utility. The accuracy of the information is vouched for when it is stated that the description of each place is from the pen of a resident member of the Royal Irish Constabulary. By a cleverly arranged use of contractions, letters, figures, and symbols, a mass of matter is put into half-a-dozen lines which, if extended, would cover more than a couple of pages. As an example of the contents of the volume we open it at random, and find the following facts about Ballingarry, a village of 250 inhabitants. First, its geographical position in barony, parliamentary division, county, riding, and province are given, followed by postal data, such as hours of collection and despatch of letters, and the hours during which the telegraph office is open. Fairs come next; then the nearest station, with the railway system to which it belongs, and facilities for hiring. The three nearest villages, or roadside places where police are stationed, follow, with the distances and the character of the roads (a most important matter) leading to each of them, the entry ending with miscellaneous details. Many of the entries are much fuller than that quoted. The map, by the Messrs. Johnston, contains an almost bewildering amount of information. The railway lines, however, could have been much more easily followed had they been printed in black. Altogether, the volume is an excellent one in every way.

About Holland: A Practical Guide for Visitors. By GREVILLE E. MATHESON. Pp. 188. *Price* 1s.

Mr. Matheson gives us interesting descriptions of the chief towns of Holland, detailed enough for most tourists. In the last two chapters those who wish to travel about the country by boat or cycle will find instructions. Hardly any hotels are mentioned, and more information might have been given about steamers running to Holland. The book contains a large number of illustrations, most of them being very good.

Ferguson's Ceylon Handbook and Directory, 1893. Colombo: A. M. and J. Ferguson; London: J. Haddon and Co. 8vo, 1320 pages.

This work is more fully described as a "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." This gives a good idea of the contents of the work, which seem to cover every kind of statistical information relative to the colony and the population area and products of the island—"the Eden of the Eastern Wave." Being an annual publication, there are various insertions of extra pages, amounting to about 100, in different parts of the volume. One of the co-editors is the author of the interesting volume *Ceylon in* 1893, noticed *ante*, vol. ix. p. 602.

Orotava as a Health Resort. By GEORGE VICTOR PEREZ, M.B. Lond., M.R.C.S. London: Chas. J. Clark, 1893. Pp. 40.

In this little pamphlet the author has republished, with additional matter, an article which appeared in the *British Medical Journal.* A slight sketch only is given of the island of Teneriffe and its scenery, with a notice of its former inhabitants, the Guanches. The chief subject is the climate, which Dr. Perez shows is remarkably equable and sunny, the record showing 142 hours in the most cloudy month, November, and therefore particularly suitable for invalids, especially those suffering from bronchial affections and pulmonary consumption.

Western Australian Year-Book for 1892-93. By MALCOLM A. C. FRASER, Registrar-General. Perth: By Authority, Richard Pether, Government Printer, 1893. Pp. viii + 275.

The value and utility of this handbook, and the scope and general reliability of its statistical and other contents, have so frequently been noticed in these pages that it is unnecessary, on the present occasion, to do more than announce and welcome its appearance. A good map accompanies the volume.

A Statistical Account of the Seven Colonies of Australasia. By T. A. COGHLAN, Government Statistician for New South Wales. With Map and Diagrams. Sydney: Charles Potter, Government Printer, 1893. Pp. 469.

It is distinctly an advantage to have the principal statistics of the several Australasian colonies brought together and methodically arranged in a single volume, and this Mr. Coghlan has done in a very able and satisfactory manner. Not only are figures given for Australia and New Zealand, but those for the nations with which the chief part of their trade is connected have frequently been added, thus giving the work a greater interest than it would otherwise have possessed. The diagrams are very clear, and, where tinted, tastefully coloured. The map, on too small a scale, shows the rainfall. The index appears to be exhaustive, and has been very well compiled and arranged. Altogether, the volume is an excellent one, and ought to be in the libraries of all interested in these colonies, and in all the larger public collections of books in this country, as it is certain to prove a useful work of reference to intending emigrants of most classes.

Amerika. Eine allgemeine Landeskunde. In Gemeinschaft mit Dr. E. DECKERT und Prof. Dr. W. KÜKENTHAL herausgegeben von Prof. Dr. WILHELM SIEVERS. Leipzig und Wien: Bibliographisches Institut, 1894. Pp. 687 *Price* 15 M.

Splendidly illustrated and most carefully compiled, Prof. Sievers' *Amerika* will take rank with his previous volumes on Asia and Africa. He commences with an account of the discovery and early explorations of the American continent. Then he describes South America, its physical geography, its climate, its flora, its fauna, its population, its political divisions, its European colonies, and its commerce. North America is then treated in the same thorough and systematic manner, and finally Greenland and the Arctic Archipelago are submitted to the same searching analysis. Illustrations abundantly interspersed make the volume one of the most attractive geographical treatises ever published. Some of the illustrations are printed in colours, and are very beautiful, the picture representing the Tyndall Glacier in Whale Sound, North-west Greenland, being, for example, a masterpiece of book-illustration. The coloured illustration of "Chicago und sein Weltausstellungspark von 1893" shows that the work is up to date.

A "Politische Uebersicht" map of South America does perhaps sufficient justice to that country's political divisions; but the same cannot be said of the corresponding map of North America, in which the various States forming the United States, and the various divisions of Canada, are not marked. In fact, considering the enormous importance, wealth, and progress of the United States, more space might have been allotted them, and less to the struggling republics of Central and South America. As for Canada, it comes off with only a few pages, which is not much for half a continent, and a people which has transformed a vast wilderness into a magnificent wheatfield.

NEW MAPS.

NORTH AMERICA.

UNITED STATES, Geological Survey of the ——. J. Powell, Director.

GENERAL MAPS. Scale 1 : 62,500.

Maryland : El Cajon, Escondido, Oceanside.
Illinois : Hennepin, Lacon, Lasalle.
Louisiana : Cat Island, East Delta, Fort Livingstone, Forts, La Fortuna, Shell Beach.
Louisiana—Mississippi : Rigolets.
Maine : Casco Bay, Sharpes Island, Small Point, Wiscasset.
Maryland : Gunpowder, North Point.
Mississippi—Louisiana : Toulme.
New Hampshire : Mt. Washington.
New York : Troy.
New York—Connecticut : Carmel, Clove.
Pennsylvania : Harvey Lake.
Vermont : Rutland, Wallingford.
Virginia—North Carolina : Virginia Beach.

Scale 1 : 125,000.

Alabama : Jasper.
Arkansas : Yellville.
California : Sonora.
Colorado : Platte Canyon.
Kansas : Smith Center, Washington.
Montana : Huntley.
Tennessee : Briceville.
Virginia—North Carolina : Norfolk.
West Virginia : Buckhannon, Sutton.
Wyoming : Fort Steele.

SPECIAL MAPS.

Grass Valley, Scale 1 : 14,400.
Indian Valley, Scale 1 : 65,500.
Nevada City, Scale 1 : 14,400.

AUSTRALIA.

WESTERN AUSTRALIA, Map of——. 1893.

Department of Lands and Surveys, Hon. W. E. Marmion, M.L.A., Commissioner of Crown Lands.

This is a very useful map, showing the larger divisions of the Colony, the railways open to traffic, under construction, and proposed, as well as the gold-fields in a yellow tint. The map is up to date, giving all the travellers' routes, including that of D. Lindsay, of Sir Thomas Elder's Scientific Expedition.

WEST- UND SÜD-AUSTRALIEN, Sir Thomas Elder's wissenschaftliche Forschungs Expedition in ——. 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. Massstab 1 : 3,000,000.

Petermann's Geogr. Mitteilungen, Jahrgang 1893, *Tafel* 18.

ATLASES.

ATLANTE SCOLASTICO per la Geografia Fisica e Politica, di Giuseppe Pennesi. 1894. *Roma: Istituto Cartografico Italiano.*

This new Atlas is principally designed for use in Italian schools, and contains 24 pages of maps and a sheet of the usual astronomical diagrams. The first page gives the world in hemispheres, while the next four show the meteorology, vegetation, ethnology, religion, densities of population, and the continents. Each continent is represented by an orographical and a political map, facing each other, which greatly facilitates comparison. Special prominence, of course, is given to Italy, no less than four maps being devoted to that country. One is a general map on the scale 1:4,500,000, while the others show Northern, Central, and Southern Italy, on double the scale, with numerous insets. The maps are drawn by G. E. Fritzsche of the Istituto Cartografico Italiano, and are on the whole worthy of special commendation.

L'ANNEE CARTOGRAPHIQUE. Supplément annuel à toutes les publications de Géographie et Cartographie, dressé et rédigé sous la direction de F. Schrader, Directeur des travaux cartographiques de la Librairie Hachette et Cie. Troisième Supplement, contenant les Modifications Géographiques et Politiques de l'Année. 1893. *Paris: Librairie Hachette et Cie.*

This third annual supplement to Hachette's geographical publications contains three sheets of maps with letterpress. Though on the whole a most useful publication, it contains a few errors. Thus in India we find Haidarabad (Nizam's dominions), like the North-western Provinces and Lower Bengal, coloured as though it had been surveyed in detail. Again, on the second sheet, which deals with Africa, there is a general map showing the topographical and approximate surveys, the reconnaissances and itineraries, the untraversed regions being left white. But when we draw rivers, wadis, and hills, although in a sketchy way, we know from reports at least that they exist. The map gives the impression that we know very little of that continent. Eight insets are given, showing explorations on the Ivory Coast, between the Ubangi and Shari in the Upper Congo basin, the Somali Peninsula, among the great lakes, and in Mashona and Matabele Land. The third sheet is devoted to America, and, besides a general map of North and South America, gives a reduction of Wolf's admirable map of Ecuador.

SCHWEIZ. Topographischer Atlas der ——, im Massstab der Original-Aufnahmen durch das eidg. topogr. Büreau gemäss den Direktionen von Oberst Siegfried veröffentlicht. LIEFERUNG xlii. :—

No. 248. Vorder Wäggithal	No. 379. Stanserhorn.
„ 260. Schwiz.	„ 433. Gimel.
„ 288. La Muratte.	„ 435. Bussigny.
„ 290. Lignerolles.	„ 441. La Dôle.
„ 291. Vallorbe.	„ 468. Lécherette.
„ 378. Sarnen.	„ 470. Les Ormonts.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

AUSTRALIA.

By Miss Flora L. Shaw,

Special Correspondent of *The Times* in Australia.

(*Read at a Meeting of the Society in Edinburgh, February* 1894.)

In speaking a few weeks ago in another place of the future of Australia, I laid myself open to the criticism that I was inclined to dwell too exclusively upon the rosy possibilities of the outlook, and not to give full prominence to the "seamy side" of present and prospective Australian history. I should be sorry to seem to ignore the extreme gravity of the crisis through which Australia has passed. The steps which brought her to this crisis have been often catalogued. Australians themselves do not deny the unhappy sequence of reckless borrowing, extravagant expenditure, inflated values, unsound speculation, and exorbitant rates of labour. To these causes of disaster I should be inclined to add a fiscal system which rendered it possible that such a state of things should exist for some years without detection, and I have little doubt that many of you would be inclined to add a banking system which included commercial and speculative enterprise within the sphere of its legitimate business. But besides all other causes, there was one the operation of which has never, I think, been fully admitted, and I hope I shall not be misunderstood if, in speaking to so distinguished and well informed an audience as I have now the honour to address, I venture to say that that one, more potent perhaps than all the rest, was simply the ignorance which prevailed at home of the conditions of Australian life and business. Ignorance, in the first instance, caused Scotch and English money to be freely lent for unsound speculation, while opportunities of remunerative investment were neglected. Ignorance, at a later stage, caused a depreciation of Australian stocks which was totally unwarranted by the circumstances, and I think I am not saying too much when I affirm that ignorance was directly responsible for the creation of the panic that led to the downfall of the banks.

I was in Melbourne in the early part of last year, just before the acute stage of the crisis. At that time there were 17,000 houses standing empty, most of them having been lately built and never occupied, except by caretakers. This is a sufficient comment upon the nature of the land and building boom. At the same time, nothing could have been less justified by the facts than the opinion which was apparently entertained in England and Scotland of the general condition of the public finances. I am indebted to the kindness and patience of some of the leading bankers and financial authorities of Melbourne and Sydney for such grasp as I was enabled to acquire of the position; and without laying claim to anything approaching to a full acquaintance with detail, I think I may perhaps claim to speak with all the reinforcement of their knowledge, when I say that there never was in all the anxiety of the situation one moment in which the possibility of failing to meet their public engagements to the full was entertained in any Australian colony.

I discussed the subject freely in all the eastern colonies, in the capitals, in remote bush town-ships, in producing centres, in manufacturing centres, on the decks of coasting steamers, at the bottom of mining shafts, with every sort of man in every sort of place, and, with the solitary exception of one workman in South Australia, who had theories of his own about the iniquity of paying interest, I found from Queensland to New Zealand an absolute unanimity of opinion. Briefly summarised into its most businesslike expression, this opinion was: "Our future is too good; we cannot afford to damage it by any public action which would discredit our financial reputation." This view was so strongly held, and the solidarity of interests between the different Australian colonies was so fully appreciated, that in the event of one colony of the group ever being brought face to face with a serious difficulty in meeting its public engagements, I am convinced the other colonies would make every effort to come to its assistance rather than allow it by any failure to tarnish the Australian name. Were the continent federated, this security would, of course, be absolute. Without federation the sentiment is still operative, that the honour of Australia is the concern of every Australian.

I wish to be practical, and I am putting before you the business reasons why this should be so; but I should like, while I am on this subject, to be allowed to add that no one could travel through Australia, as I did, in the enjoyment of somewhat exceptional opportunities for frank and intimate observation, without recognising that the sterling honesty which has made the British nation what it is at home is at the backbone of Australian society. In a new country, where everything has been to make, and that almost within the span of one long lifetime, there is necessarily a spice more of adventure than we are accustomed to associate with prudence. This must be allowed for; but it is not only the British tradition that honesty is the best policy in trade which keeps, and will keep, the main current of Australian business straight;

there is in Australia the same good old inalienable honesty in the blood which, with all our shortcomings, is what most of us cherish as the best birthright of our race. It is no more possible, of course, to give a complete character of a nation than it is to draw up the indictment of a nation ; and what I have said is true of Australia with the same exceptions that it might be true of us. Australians are just ourselves with our own qualities and our own defects. Nothing can hinder Australia, whatever it may become, from being an extended Britain. If Australians wished to undo their breeding, which I doubt, they are powerless to effect their will. For good or for evil, we are one people, and they can no more drain their veins of British blood than they can teach their tongues to wander from the language learned in generations long gone by from Chaucer and Shakespeare, Milton and Burns. In all our dealings with them we have the guarantee of a race that we know, and that history has given us the right to respect.

If at the beginning of the late crisis we had realised this, and understood, what I believe to be the case, that the majority of Australians would have sold their last possessions rather than permit the smallest repudiation of their public debt, the credit of the colonies would not have been depreciated as it was; and though the collapse of the building boom, the fall in the price of silver, and other well-known causes would necessarily have had their own deplorable effects, the field of financial disaster would have been much restricted, and the public, not only of Australia but of England and Scotland, would have been spared an immense amount of totally needless suffering. A comparison of the prices at which the Victorian and New South Wales loans were taken up in the months of September and October last with the prices of the principal Australian stocks in the spring of the same year will sufficiently support the statement that the distrust of the public credit of Australia, which did so much to precipitate the crisis, was totally unjustified by facts. On the 16th of May of last year, New South Wales $3\frac{1}{2}$ per cent. stock was selling at $83\frac{1}{8}$; Victorian $3\frac{1}{2}$ per cents. were at 79. In the end of September Victoria issued a fresh loan, which was entirely taken up in a few hours at a fixed price of 96. The following week New South Wales issued a fresh loan, which was subscribed three times over at a minimum price of $98\frac{1}{2}$, and rose within the week of issue to $103\frac{3}{16}$. To-day, New South Wales $3\frac{1}{2}$ per cent. stand at $98\frac{1}{2}$, and Victorian at 94. The rise in price from the figures which I have just quoted of both stocks on the 16th of May is 15 per cent. Nothing has happened between the two dates except that a crisis of unparalleled severity has passed over the colonies in question, and both of them have added to their public indebtedness. It is impossible to say that the security is better. The only difference is that it is better known, and we now realise that the fall from the average prices of January 1893 to the low May prices which I have quoted need never have taken place.

If this appreciation of last year's position is correct, we get some conception of the magnitude of the mischief done by that dissemination of false news which Lord Rosebery stigmatised the other day as nothing short of an imperial crime. We owe some reparation both to Australia and to ourselves for an injury which, however unwittingly, has been none the less surely inflicted. The only reparation that is possible lies in an enlargement of knowledge which will encourage closer relations, and minimise the danger of any future repetition of the mistake. The security which Australia offers not only for the investment of Scotch and English money, but for the much more important investment of Scotch and English brains and blood and muscle, is so good that, while I speak with the assumption that we have all of us the knowledge in our minds of the failure and the crisis through which Australia has passed, I shall, I hope, be interpreting your wishes rightly if I persist in dwelling rather upon what I believe to be the causes of her astonishing revival and the reassuring symptoms of her future development than if I linger upon a past that is already fully known. The Australia of the crisis is the Australia of yesterday. The Australia with which we are practically concerned is the Australia of to-day.

It may be quite fairly asked whether, taking for granted the accuracy of all that has been said about the willingness of Australia to pay her way, she has the power. Her present position in the markets of the world, combined with the statistics of revenue published at the beginning of the year by the various colonies, is, I think, a sufficient general answer. The most interesting details of Australian development are, however, involved in the more specialised inquiry of how she has maintained that position in the teeth of the storm which has beaten upon her. I do not wish to tax your attention with lists of figures, but when we think of the depreciation of value which has taken place in bank shares, mining shares, real estate, and other securities in Australia during the last three years, and remember that the principal burden of this loss has fallen upon a population of $3\frac{1}{2}$ millions, considerably less than that of London alone, we cannot but feel that the mere fact of having weathered such a hurricane and being alive to tell the tale is an extraordinary testimony to the natural wealth and recuperative power of so young a continent.

The fact that Australia is the youngest of the continents is the main fact which lies at the bottom of it all. She has all the qualities of healthy youth. Reckless, vigorous, full of enterprise, rich in unexhausted possibilities, careless of comfort, sanguine of success, she approaches the problems that confront her with a confident courage that brings its own reward. Australia, taken as a whole, is successful, has been successful, means to be successful. There is no other Australian scheme of life. Resignation has been described by a witty French writer as the worst of virtues. Australia will have none of it. There is not an ounce of resignation in the whole composition of the continent. Let the old world keep all it needs. The creed of the Australian is to remedy, not to endure; and the immediate effect of misfortune is only to bring into play the invincible hopefulness of the national character.

And the more the conditions of the continent are examined the more justifiable does this general hopefulness appear. The possibilities of prosperity are within the reach of every one. Individuals may fail to attain it, because circumstances or character have overpowered them at a critical moment, or they have declined, in one of the thousand and one ways in which it is possible to decline, to pay the necessary price. But there is no man born in Australia who does not feel that, if he chooses to make his own way, there is nothing to prevent him from making it to a very comfortable degree of prosperity and independence. The dense crowd of the old world, through which only the strongest and the ablest can hope to shoulder his slow way, is dispersed in Australia over sunny acres of fertile earth. The average individual is free to move, and he can move, without exciting envy, to secure for himself advantages that, as his neighbours know, they too can secure if they choose. It is not upon the big fortunes of Australia that the wealth of the colonies is based, but upon the multiplied possibilities of competence which are within the reach of the average man.

The soil and the people contain the germ of everything that is most interesting. In these two elements, acting and re-acting upon each other as they do, we have the material and the artist of future Australian history. Which is material, and which is artist, it would, in many instances, be difficult to say. But from whichever side we approach the subject, whether we consider what the soil of Australia is doing for the man, or what the man is doing with the soil, it is a feature of the youth of the Australian continent that the soil and the man are still visibly the main factors of every sum, and that in the whole repertory of Australian questions there are none which can be compared in importance to the fundamental questions of land and labour.

These questions have always been interesting, but the crisis of last year has rendered Australia the great service of making the interest of them vividly apparent to every one who is concerned in her future welfare. Through all her late troubles Australia found in her land a widow's cruse which did not fail. While prices were falling, while speculations were collapsing, while public credit was depreciated, while banks were closing their doors, the sun did not cease to shine upon her fields, her corn did not cease to grow. Indifferent to the state of Melbourne securities, her flocks and herds increased in number. Her cows gave milk, her sheep gave wool, her grapes gave wine. The more that labour was driven from the towns the more it went upon the land. Instead of diminishing, the bulk of her production increased. The debts which she had made in coin she paid in kind. Wealth flowed out from her soil until, like the farmer's sons of the fable who dug in vain for a bag of gold but found a fortune in the fruits of the land on which they had laboured, she became aware that all unconsciously she had achieved her purpose, and had assured the prosperity of her towns by the still greater prosperity of her country.

The supreme lesson of the crisis has been that the wealth of Australia lies in her primary production. This lesson, I venture to think, is worth all that it has cost to learn. If for a couple of generations Australia would abandon the idea of protected manufactures, and would set herself to add to the wealth of the world by the immense production of which her soil is capable, the gain to her, and to the Empire, would pass the limits of our computation. A glance at the map will show that Australia falls very nearly into two halves. One is tropical, the other is temperate. Of the two it is difficult to say which is the richer. At present more than 3,000,000 of people are working in the temperate half, and less than 300,000 are working in the tropical half. But imagine both halves filled, as they some day will be, by a population suited to their requirements, intent upon reaping from the soil the harvests which wait now only to be sown, and you imagine an increase in our actual possessions of which the amount is almost fabulous.

For land and labour, when they are brought together, are creative. The corn, the cotton and the wool, the meat and wine, the fruit and spices, the beauty and the wealth which are not now, wait to be called into existence. The plough and the pruning-knife are the magician's tools, the steam-engine is the chariot upon which he rides. The secrets which he must learn, in order to make sure of ultimate success, are the daily unfolding secrets of science. In a new continent like Australia, teeming with undeveloped resources, the man who knows is master of the situation. He brings silver out of the rock. He brings gold out of the mine. He brings corn and fruit out of the earth. Here, in Scotland, you have that which is the first need of Australia. You have knowledge, intelligence, and industry. In Australia there sleeps within the soil everything which high-class labour, such as yours, can claim for its material reward. And the benefit which is to be reaped is mutual. You have everything to gain by knowing where the vital forces of your young generations can find scope; Australia has everything to gain by the employment of such forces upon her land.

There is nothing that will not flourish in Australian soil. From the English apple of Tasmania to the shaddock and the mango of Queensland, every fruit of the known world is produced. From the sugar, the cotton, and the rice of the tropical coast to the wheat lands of the temperate interior, there is no common necessary of food or commerce that cannot be cultivated. Australia is simply a storehouse of raw material. The already great value of her external trade has caused a development in the facilities of transport which is practically abolishing distance; and all that is needed to make her the great country that she ought to be is that the Australian people should take the full measure of their possible future and be content now to lay the foundations broad and deep, instead of hurrying to build upon unworthy and inadequate designs.

The day for complicated manufactures has not yet come in Australia. The fact is proved by the necessity for protection under which her manufactures exist; and there are one or two other salient points in connection with the question which are worth notice. In the first place, the average rates of labour are so much higher in Australia than in the great manufacturing centres that competition in price would be impossible. When cost of transport to distant markets is added, it is evident that Australian manufacture for export is economically out of the question. Local manufactures must therefore be for local consumption, and the quantity manufactured in Australia, in comparison with the quantity manufactured elsewhere, will, for many years to come, be small. But while manufactures are designed strictly for local consumption, and demand a protection which runs up in some instances to very high percentages, primary production is, on the contrary, intended largely for export. As soon as the local market has been overtaken the producer has to sell at the prices of the world. These prices are ruled in London, and assuming the protection of Australian manufactures to average twenty per cent., the position of the Australian producer is that every £100 earned abroad has only £80 spending power at home. In other words, primary production is taxed twenty per cent. in a country of which it is the breath of life.

The duration of this state of things can only be a question of the strength of the producing party in the country as compared with that of other parties which find their interest in the maintenance of a protective tariff, and this in turn depends on the extent of the general perception that to divert intelligence and energy from a field of primary production, which offers such remarkable special advantages, to a field of secondary production weighted with so many disadvantages, is a distinct deviation from the path of progress. That manufactures will some day flourish in Australia can hardly be doubted. There are many industries, such as those involved in mining processes, fruit-preserving, the freezing and preserving of meat, the preparation of hides and tallow, the manufacture of wine, the making of butter and cheese, which enjoy already the natural advantages that ensure success. All of these are sources of profit, and add constantly increasing quantities to the wealth of the community; but the manufacture of which the natural disadvantage has to be counterbalanced by protection has, I think, been clearly shown by the developments of the crisis which culminated last year to be simply a source of impoverishment.

The Australian who contemplates a speedy separation from the Empire is of course justified in saying that, as no independent national existence can be carried on without manufactures, it is essential to establish them at any cost. Arsenals, dockyards, and the whole paraphernalia of modern defence would, in such an event, also be essential. But, assuming the greater conception of our mutual history to prevail—and I am only speaking now of what I believe to be the greatest possibilities of the Australian future—there can be little to gain by substituting a financially unsound competition for a mutually profitable co-operation. In textile industries alone I believe that Great Britain employs something over five million hands, or one and a half times the entire population of Australia. For Australia in the present stage of her growth to set up manufactures in competition with these is, economically speaking, as idle as if every village of the Highlands were to insist upon smelting the iron which it uses in its household implements. We have everything to gain by supplying Australia with manufactured goods the cheapest and the best that can be produced. Australia has everything to gain by supplying us with raw material, also of the cheapest and the best. There is nothing we want which in time she could not give us. There is nothing she wants which we cannot return to her. And we are not two countries, we are one. As one people we have our manufactures, we have our arsenals, we have our dockyards, and we have besides a veritable Garden of Eden in which all that our children can want for countless generations can be produced. Then why quarrel with a situation such as no people has enjoyed since history began, and allow ourselves to make mincemeat of it through ignorance, or indifference, or jealousy?

This is the question which the experiences of the late crisis defined more clearly than it had ever been defined before. The result is supremely interesting, not only to Australia, but to us. A first step in the sequence of new thought, which will, I think, be found hereafter to date from the turning-point of 1893, is to be noted in the prominence given in the late sessions of all the Australian parliaments to questions of land-settlement. Land-settlement has become the most practical question in Australia. This, of course, is the logical result of a keener realisation of the immense importance of encouraging primary production. It is also the indirect outcome of the great labour struggle which preceded the financial crisis. In that struggle the four principal bodies of Australian labour tried their strength on fields of their own choosing with the main body of the united employers. All four were beaten, so badly beaten, that the general decision of the Australian labour party is understood to be that no more progress towards the better material condition which it seeks is to be made by the old methods of industrial revolt. The old trade-unionism has been abandoned for what is known as new unionism, and first among the theories of the new unionism stands the principle of the substitution of co-operative for competitive production. Men who have hitherto crowded the labour market and lowered the prices of labour by seeking employment in competition with each other, now propose to co-operate, and by putting their labour together upon land of their own, look forward to securing for themselves the whole profit of their exertions. The theory is so evidently to be encouraged in a country which has just learnt from other sources to appreciate the phenomenal value of its unoccupied land, that it is not surprising to find the Australian Governments eager to use the aspirations of the labour party for the now commonly desired end.

The position that has been created is most remarkable. Out of a financial crisis, severe enough to have swamped almost any community of equal size that can be imagined, has come a realisation of enormous wealth, and out of a labour struggle that threatened to dislocate the entire industry of the continent, has come a conciliation of the interests of all parties seriously concerned, which bids fair to render practicable one of the most useful movements of the day. Capital and labour, each taught by different processes, each working toward what it conceived to be its separate interest, have come to join forces side by side in the attainment of their common end. Every financial authority in Australia to whom you may speak of the crisis will tell you: "The land saved us; we must devote ourselves to the development of the land." Every labour leader with whom you may discuss the social situation will tell you: "Strikes are useless; we must take up the land on our own account, and enjoy the fruit of our own labour." The two great bodies of the nation stand asking for the same thing, and between these two bodies the Governments who depend upon their votes find their task simplified.

In all the colonies the State is the great landlord. In all the colonies public finance depends more upon revenue derived from land, and from public services of which the effect is to increase the value of land, than upon revenue derived from taxation. In New South Wales where, besides the unalienated land which it holds still for sale, the Government leases 150,000,000 of acres, the sources of public revenue may be described in round numbers as one-fourth taxation, one-fourth land, and two-fourths the public services. Three-fourths, therefore, of the income of the colony comes from the property of the colony. If this property were so administered as to increase by one-third in value, while public expenditure remained at its present figure, the whole revenue would be supplied from public property, and taxation in the colony would be abolished. This possibility, which is a very real one, opens a new vista in the aims which are in this country associated with good government. The interests of the taxpayer present themselves in Australia in a new light. The object of every Government is to serve them by increasing the revenue derived from the public estate. In other words, the value of the public estate is a matter of direct interest to every Australian taxpayer. We all know, with regard to private estates, how value is effected by a general demand for land. Consequently, when we note that throughout Australia the effect of the industrial and financial crisis has been to create a general demand for agricultural holdings, and to bring to the attention of the highest authorities the supreme importance of developing the natural wealth of the soil, it is, I think, justifiable to look with some confidence towards the future.

Speculation in land has had its day. Cultivation of land is now entering upon a new era. To enter into the details of the provisions made by the new Land Acts would be tedious. The general principle which underlies them all is a recognition of the crucial difficulty created by the want of capital, and an endeavour to minimise or to remove it. It is impossible that virgin land can be brought into cultivation without the expenditure of money, but money wisely expended upon good land is simply money planted, which brings its own harvest in due time. If Australian land were bad, there would be no justification for the late procedure of the Australian Governments. But the land is good. The authorities living on the spot, and knowing all the resources of the country, have practically determined, with the general consent of the public, that the interest of the taxpayer is better consulted by improving the property of the country and increasing the public income, than by any direct attempt to decrease taxation. That will decrease of itself as the increase of revenue makes the necessity for it less and less. Therefore, under the new Acts, the workman who desires to take up Government land can also, subject to certain restrictions, borrow Government funds, for which he gives a mortgage upon the land; and the wealth which, in the application of the one to the other he is thus enabled to create, will, it is believed, suffice, not only to pay back his actual debt in due course, but to swell the volume of the general revenue. The object of most of the restrictions is to ensure his own residence upon the land, and also, of course, to limit the amount of his debt. From Queensland to South Australia measures of this description, providing for the possible creation of village homesteads, co-operative communities, and other forms of labour-settlement, have within the last year been introduced. The Sugar Works Guarantee Act of Queensland enables capital to be advanced for the purpose of assisting the erection of sugar-mills. You will have noticed only a few days ago a cablegram announcing that the Victorian Government had taken power to utilise portions of the money deposited in the Savings Banks for the purpose of making small agricultural loans. It has hardly been realised in this country what the whole of this new movement means. It means, if it is successful, that the personal possession of capital will no longer be necessary in order to enable competent and steady workmen to take up land. The great question which will arise will necessarily be how these small Government loans are likely to be used?

There already exist forms of private enterprise in Australia which serve, I think, to throw some valuable light upon this question, and it seems not unlikely that the experience of private capitalists, of which the results are of course very well known on the spot, has had a considerable share in determining the action of the Governments. I will take one instance from tropical and one instance from temperate Australia.

In Queensland, where the belt of sugar cultivation runs north of Brisbane towards Cooktown for a distance of about 1000 miles, the only continuous attempt which has yet been made to develop tropical production may be studied. The natural features of the country, where dense jungle clothes the river banks, and cedars and other massive timber crown the hills, show the soil to be fitted for the cultivation of heavy crops. Words cannot easily picture the rank luxuriance of the crop of timber, fruit, and flowers which it produces by spontaneous effort. The creepers alone which mat and weave its forests into walls of impenetrable foliage would seem to need all the sustenance that the earth can give. The trunks of some of them are as large as the trunk of an average larch. They climb to the tops of the highest trees, flinging their branches from one tree to another, and drop again in long, trailing ropes, so stout that some of them will, I was told, bear a weight of five or six tons without snapping. And these are a mere extra of no account. The trees among which they grow are scarcely less gigantic in proportion. Single specimens of cedar, when cut for timber, have been known to yield as much as 20,000 superficial feet. The silky oak, the bean tree, and many kinds of pine, are extremely valuable for cutting, and the measurements which are given of individual trees almost pass credibility. Wild fruits and spices grow on the edges of the woods; in the deeper gloom of their warm shade orchids abound. The earth, if one stoops to examine it, is rich and black, and there are districts on the slopes approaching to the highly-mineralised plateau of the Herberton district, where the soil round the roots of the palms and wild bananas is enriched with nothing less than gold-dust.

It is enough, without going into further detail, to say that the profuse natural growth of the favoured plains and valleys of the coast is such as to stagger the imagination. A thought of the little strip of cultivated Egypt and its six millions of inhabitants causes the mind to recoil before an endeavour to picture the possible future of tropical Australia. In the Cairns district alone, which makes a mere spot upon the map, there are 2500 square miles of just such jungle as I have described, waiting only to be cleared and cultivated. The patient Chinaman is slowly carrying on a sort of single combat with the scrub, and he has established patches of fruit and grain in which the primeval vigour of the jungle growth is disciplined to the uses of civilisation. Fields of rice, and pineapple and banana lie in bright openings here and there, breaking the darkness of the woods. Coffee, cotton, tobacco, spice, have been grown experimentally with success. But all this is a mere suggestion of what might be done if tropical Australia were ever to be fairly developed according to her own requirements. No tropical crops can be grown commercially without an assured supply of labour which is accustomed to work under tropical conditions, and at present there is only one crop in Queensland to which this condition has been even partially applied.

This crop, with which the attempt has been made, I need hardly say, is sugar. At Bundaberg and Maryborough and Isis, at Mackay and Rockhampton, on the Burdekin delta, on the Herbert and the Johnstone rivers, across the foot of the hills at Cairns, green fields of waving cane lie in ever-widening areas between the palms. The sugar industry, as you know, used to be carried on upon the principle of big plantations and private mills. The growing of the cane and the making of the sugar were in the same hands, and formed a part of the same enterprise. The system was extremely extravagant, and, after a period of booming prices, the sugar industry of Queensland fell into a condition of over-capitalisation, as a result of which it was forced to go practically through the bankruptcy court. The causes of its past failure are known to every one who is interested in the matter. Very briefly, the expense of production, under the conditions which prevailed, was found to be greater than could be recouped in competition with bounty-fed sugar and sugar manufactured by cheap labour. What was necessary in order to enable sugar-growing in Queensland to be successfully carried on, was to reduce this expense to a point at which Queensland could compete again in the markets of the world.

This has been done, and it has been done in two ways—first, by economy in the methods of agriculture; secondly, by efficiency in the methods of manufacture. It is with the first that we are for the moment concerned. It was found that the system of large plantations held by the manufacturers was an extremely costly way of growing cane. There was waste both of labour and supervision, and the extent to which this was carried is easily divined from the fact that even now, with all the awakened sense of the necessity for economical production which prevails, the average number of *Kanakas* employed upon large plantations is one to five acres, while on small holdings the average is one *Kanaka* for ten acres.

To halve your labour bill in an industry which demands so much labour is an economy of which the importance does not need to be insisted upon. Throughout the sugar belt the system of large plantations has been abandoned, and small farmers are encouraged to take up holdings having an average size of 100 to 160 acres. I cannot, without trespassing far too much upon your time, enter into the conditions under which this new system has been made to pay. I will only say that it has paid so well as to induce the owners of mills and large plantations everywhere to cut up their plantations and offer them for settlement to small farmers who will undertake to come and grow for them all the cane that is required by the mills. Every mill is now rapidly becoming a central mill served by numbers of small farms, and, in order to turn over larger profits by keeping the mills employed to their full working power, millowners find it to their interest to advance all the capital which a man requires for the purpose of taking up a sugar farm, and to pay themselves gradually back out of crop. As an example of how this system works, from the point of view of the small farmer, I may mention that in the neighbourhood of the Herbert River I met with numbers of men, who had been ploughmen, gardeners, and grooms, who had begun with borrowed capital, and were at the time of my visit independent owners of farms which brought them in a gross income of about £1000 a year and cost about £500 to cultivate. The same openings are, of course, open to young gentlemen farmers. All that is required is that a man wishing to take up land should satisfy the owners of his respectability, capacity, and intention to remain steadily on his farm. In order to do this, it is advisable, to whatever station he may belong, that he should do as all our sons are willing to do if they desire in this country to become civil engineers, namely, that he should serve an apprenticeship, working three years as a labourer. During those three years he may hope to receive his rations and £1 a week. When he has thus earned his local character, the owners have their own advantage to serve in providing him with the money which he requires for the enterprise. One gentleman farmer at Mackay was good enough to give me his financial experience of seven years. He had begun with a borrowed capital of £700. At the end of the seven years, during which he experienced two years of drought, he had paid off his debt, he had a good house, a farm of which the crop gave him a gross average income of £1000 a year, and he had £2000 in the bank.

How the system pays from the point of view of the millowner, is to be estimated from the fact that the sugar output of this year is expected, if I have been correctly informed, to exceed by something like one-third the output of the year in which my visit was paid. As more farmers take up land, additional mills are required, and they are this year being erected in the principal sugar centres.

Here, then, is one instance in which private enterprise has found its advantage in doing what the Governments of Australia are proposing to attempt upon a more general scale.

Another, and scarcely less striking, instance of success may be found in the Mallee country of Victoria. The larger portion of this immense tract of country is still directly in Government hands, but a few private owners, who have been instrumental in acting as the pioneers of cultivation, have retained large leaseholds, with powers of subdivision and transfer, and it is of course to their advantage to raise the value of land in which they are interested.

Mallee, I should perhaps explain, is an evergreen gum of low-growing habit and of great vitality, which spreads over eleven millions of acres of the north-western portion of Victoria. Until three or four years ago this was regarded as a waste quarter of the colony; for though the soil was known to be suitable for wheat, the mallee scrub was so difficult to clear that the initial expense was too great to give any prospect of profitable farming. Now, by the simple invention of two agricultural implements known as the "mallee roller" and the "stump-jumping plough," one of which rolls down the mallee and snaps the slight trunks off at the roots, and the other ploughs without the necessity of removing the stumps from the ground, cultivation has been rendered so cheap that the vast area, amounting in extent to a fifth part of the colony, is being rapidly converted from useless, vermin-infested scrub to farm-land of the highest value. The district is formed from the estuaries of ancient rivers. There is therefore a great quantity of sand, but the portion which is estimated as fit for cultivation is reckoned at about 8,000,000 acres.

Nothing can be imagined more unlike the tropical growth and surroundings of the Queensland coast than this inland district of temperate Australia. It is the more interesting to find an experiment in agricultural life which is yielding results that are almost identical in profits to the agriculturist. Here are no hills, no palms, no orchids, no rank luxuriance of blossom, no black earth mixed with gold. All is plain green and russet, and the landscape swells in gentle undulations to north and south and east and west, without a landmark of note enough to be carried in the memory. Where there is no mallee there is corn, where there is no corn there is mallee scrub. The shadows thrown by the clouds as they drift across the sunny sky are the first variations of the scenery that you remark. A low, dark line on the horizon usually defines the mallee edge. Against it rows of homesteads, strung together by a straight red road, shine in the morning or the evening sun. In the dip of a hollow a team of twelve or sixteen oxen may be straining against the massive roller that increases the area of civilisation every day. The mallee goes down beneath it in even rows, and if you are near enough an aromatic scent from the bruised eucalyptus leaves will reach you with a half-strange, half-familiar suggestion of hay in the summer fields at home.

Unconsciously the imagination sets itself in a quiet and more homely key. On an upland of yellow stubble a farmer in a soft felt hat is guiding the horses of his stump-jumping plough. You rejoice that no pigtail hangs below his waist, and that the face which he turns presently to greet you is a face of the British type. Here there is no coloured labour. Every man is his own master, and the machine he drives replaces the *Kanaka* of the north. The homesteads, when you reach them, confirm the familiar impression as of something which you have known before. They are only log-huts—some of them still quite rough, some of them papered inside and finished with a certain care for the amenities of life. Few are more than three years old, but almost all have already their gardens, with a patch of vineyard and an orchard just about to come into bearing. Some are inhabited by educated men, some by uneducated. All are, in the primitive stage of the community, about equally wealthy, and all tell you cheerfully that they are more than content with the prospect that lies before them. In entering the country by a grain line which leaves the main railway at Murtoa, you have already gained some conception of the returns that the soil gives them for their labours. Store-sheds, and elevators all along the line are filled to overflowing with wheat; and if your visit chances to be at harvest-time. little wayside platforms are piled high with yellow sacks.

The system upon which the settlement in the particular district which I visited is carried out is almost identical in principle with the system under which the sugar lands of Queensland are being taken up. The half a million of acres belonging to Mr. Lascelles of Hopetoun is surveyed, irrigated, and divided into blocks of 480 acres each. Settlers may take one or more of these blocks as they please, and two are generally found to constitute the best-sized farms. Mr. Lascelles' rights in them are transferred at a cost of 10s. an acre, of which one-third is payable immediately, and the rest in the course of two years after a crop has been harvested. It is to his interest that the land should be taken up, and in order to render this possible to men who have no personal command of capital, individuals of good character are allowed to take up farms without purchase, are helped with the capital which they require for the first outlay, and give in lieu of money a fixed proportion of their crop for three, four, or five years. At the end of this time they have acquired all the rights which Mr. Lascelles possesses in the land, and have become independent owners of their crop. Whether they obtain their working capital in this way. or have the good fortune to start in the first instance with money of their own, the annual expense and profit, if strictly calculated, is the same. Including interest upon capital at 5 per cent., the average annual expenses of a farm of a thousand acres after the first year are about £700, and the average returns, with wheat at 2s. 6d. a bushel, are £1500, leaving a net profit of £800. I may add that, though these figures were compiled for me with the greatest care, every working farmer to whom I took them for examination commented in equivalent terms: "Well, the figures are about right, but it works out better than that." At present the working population of the Mallee country is almost entirely a community of men. There seems no reason why women should not take part in settlements of this kind, and their presence would no doubt be found, as it is, I believe, found on the farms of France, to add considerably to the profits. Dairying, poultry-rearing, and fruit-growing would fall naturally into their department.

Time forbids me to dwell on other instances of the profitable development of Australian land; but such instances might be multiplied. The extraordinary development of the butter industry, which was only started four years ago, and has risen in that time to a value of more than one and a half millions sterling, will be within your knowledge. The wine and fruit industries have still to some extent their market to make, but there can be little doubt of the excellent prospect which lies before them. Nor have I touched on sources of pastoral and mining wealth, which demand the employment of more considerable capital for their development.

It may very justly be objected, that such a thing has never been heard of since the world began as a continent filled from shore to shore with one great rustic population employed in the production of raw material, and it may be asked whether it can be seriously proposed to introduce such a dead level into Australian life? To such an objection there are many answers that may be made. In the first place, I have only desired to show that the soil of Australia can and does yield an ample return for capital and labour invested in it, and that the demand in agricultural districts is for the multiplication of small holdings rather than for the maintenance of large estates. In the second place, bearing in mind the opinion current amongst the most cultivated people that we have known in history, the ancient Greeks, who held that the basis of a nation's greatness is its agriculture, and thinking of the Australia that may be, I am inclined to see in all that is now being done in the new continent the mere laying of the foundations of the future. Beyond this I would suggest that Australia already possesses towns which show no sign of declining from the position which they hold, and that the wealth of the country at their back will tend to a constant demand for their expansion. Wealth of primary production must always result in an increase of secondary wants, and the town populations of Australia will find full occupation in providing for these.

But in addition to these answers to the objection there is another, which is possibly more interesting than them all. It is, that if no continent has ever yet been heard of filled from shore to shore with a rustic population, no rustic population has ever yet been heard of which possessed the characteristics of the population now settling itself upon Australian soil. Landed labour is a new element of cultivated society. We have had it before in the peasant proprietary of old and thickly populated countries, where the returns of such labour have been too small to encourage hope of doing more than provide for the bare needs of the body. We have never before had it under conditions which make the occupations of a rustic life attractive to large classes of educated men and women. That is what Australia offers now. What is known as the "intense culture" of land under modern conditions demands a high average of intelligence. It is to be remarked that among English and Scotch families who propose to send some members to the colonies, it is no longer the worst but the best of our young men who are ready to go and risk their chances, with fair hope of the reward they have a right to ask. This, among other causes, has made it possible that they should be followed before long by some of the best of our young women. There is no reason why in a great number of cases their sisters should not go with them. What applies to us applies with still greater force to the youth of the colonies themselves, and we have yet to learn what a rustic population may be of which the social intercourse is based on the conception that manual labour need not exclude the exercise and cultivation of the mind. Science has annihilated time and distance, and the rustic who, in the heart of Australia, gets his news of last night's play from Paris, and inquires the price of butter, wine, or wheat in the London market this afternoon, who has to keep ahead of the latest inventions in America, to follow the political developments of Europe, and even likes occasionally to give his wife a diamond or himself a rare edition, is a different being from the rustic whom La Bruyère describes as bending black-faced over the furrows of France, or from our own Hodge chawing his bacon on a gate.

I do not want to be assumed to entertain unqualified expectations of the success of the Government measures for encouraging the settlement of the land. The employment of public funds is too often wastefully or unwisely carried out to permit of such an attitude. The system of State interference is opposed to many of our most cherished convictions, and all that I have said with regard to the conditions under which sugar and wheat are being cultivated might be used as a argument in favour of leaving the movement to the development of private enterprise. It is perfectly possible that experience may prove this to be the wiser course. The real interest which attaches to the Government measures is, I think, to be found in the indication which they give of a general public recognition that the supreme necessity of Australia is to put labour on the land. It has been shown that it is at least possible to do this on a sound financial basis; and it is only necessary to look at the map and note the fractional importance of cultivated to uncultivated Australia, in order to appreciate the development which may be given to the movement.

The possibilities which are thus opened to the peaceful increase of wealth appear to me to carry with them the solution of so many of the bitterest and most pressing problems of the day, that it seems difficult to exaggerate their importance. Much that we have yet to do in the realisation of our Imperial position rests upon the material basis. The fact is becoming every day more clear that within our enlarged boundaries we possess every resource that a great people can require. Australia is but one province of the Empire. To speak of it, or to think of it, only as it is, is to confine our interest within limits too narrow for our general growth. Nothing which is taking place can be considered fairly, unless it is considered in relation to what Australia may become. We may have to stretch our minds to views differing widely from those in which we have been trained. We may have to accept methods repugnant to our taste and irreconcilable with our personal opinions. We may have to learn where we have been wont to teach, and live to find that under rapidly changing conditions our old rules have grown insufficient. Never, perhaps, in all the course of history has the compulsion been stronger upon us to enlarge our mental and moral horizon; but also, I think, it may be said that never has it been better worth our while to lift up our hearts to a conception of the great destinies with which we have to deal.

THE SITUATION IN ALGERIA.

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(*With Maps.*)

Introduction.—Algeria is the premier colony of France. It faces the mother-country, though 500 miles distant, on the southern shores of the Mediterranean. On the west, it has an unprogressive Mohammedan State, Morocco, for a neighbour; on the east, a prosperous French Protectorate, Tunis; and in the south, a desert which, more effectively than any other barrier to migration, sets a limit to European colonisation.

Physically, Algeria is the ideal type of an African colony: from the ocean to the interior limits of its natural *Hinterland*, we find the typical gradation of (1) fertile Littoral, (2) healthy and productive uplands, and (3) desert. But, east and west, there are no natural divisions. Politically, it has cost France four milliards of francs and the lives of many thousands of her soldiers and colonists to establish her domination over a country essentially Mohammedan and still maintaining intimate relations with the scattered forces of Islam. The native populations are unprogressive and hostile: conquered, but not pacified, nor content to wear the chafing yoke of European civilisation.

It is not my intention to give a general description of Algeria. My purpose is, rather, to investigate the conditions and results of the French administration, with the object of discovering general principles—principles that regulate the European colonisation of all Tropical or semi-Tropical lands peopled by primitive races. It is in directions such as this that Geography, to my mind, holds out the best prospects of being recognised by the public at large as a fruitful and practical science.

In 1830, when the French captured Algiers, the *Hinterland* was an unknown country. Now, in 1894, it is a Department of France—beyond the seas, it is true, but still a slice of the mother-country, in which the ordinary tourist may observe very much the same landmarks and machinery of government as are found in the country he leaves behind him at Marseilles. In the larger towns, on the railway, and along the great highways of traffic, the conservative French colonist has reproduced the features of his own land and of his well-beloved *administration*. There is, however, this striking contrast: the obverse of *France d'outre-mer*: Islam. One is everywhere confronted by the unchangeable face of Islam: stern, dignified, and repellent. "There is but one God, and Mohammed is His Prophet." There is but one race, and the Infidel is its enemy. The Korán, in fact, is the Alpha and Omega of the Faithful.

It is not, therefore, surprising that it took twenty-seven years for France to conquer Algeria; nor is to be expected that the indigenous populations will be pacified before a century has elapsed. France laid Europe under a lasting obligation when she overturned the government of the Dey and destroyed the power of the Algerine pirates. The Arabs and Kabyles, though hereditary enemies, joined in their opposition against the European intruder: for the nonce they were united by the bond of a common religion. A Holy War was preached; a Mahdi, Abd-el-Kader, appeared; a host of marabouts and other fanatics fanned the flames of the conflagration. It took three campaigns (1854, 1856, 1857) to subdue the hardy mountaineers of the Jujura: Kabylia was conquered for the first time in history.

The French conquest may be divided into four periods:—

1. The occupation of the Mediterranean ports (Algiers, 1830; Oran, 1830; Bône, 1832; Bougie, 1833).

2. The conquest of the Arab country, except that to the west (between Oran and Algiers), ceded to Abd-el-Kader (1835-37).

3. The submission of Abd-el-Kader and of the Kabyle tribes of the Sahara (1847-70).

4. The establishment of French posts in the Sahara and the expansion of political influence southwards (1870-94).

It will thus be seen that the progress of French conquest and colonisation was from north to south; that of the Romans, on the other hand, was from east to west, following the lines of least resistance. Had France first conquered Tunis, the submission of Algeria would have been achieved more rapidly; but she had no such choice.

At the time of the Roman Occupation, the colonies of North Africa were among the richest provinces of the Empire. There were probably at that time 8 to 10 million indigenous inhabitants. The Romans, who founded important cities, vestiges of which may be seen to this day, had a fixed policy of grafting what was best of native institutions on the higher civilisation they implanted in their colonies. The process of assimilation was thereby rendered practicable. The Kabyles, however, retreated into their mountain-fastnesses, and there retained their independence. The high degree of cultivation that must have existed in Roman times was, doubtless, due in great measure to the more favourable climatic conditions of North Africa. It had disappeared centuries before the French Conquest: desiccation and disforestment had done their work. Wheat was, it is true, raised on the fertile Littoral—the *Tell* lands, where the olive grew wild; but the land had been neglected, and in many parts was submerged.

The earliest form of government introduced by France into Algeria was of the nature of a Protectorate. But divided counsels existed then, as they exist now, at Paris. No settled policy has been followed, though many experiments have been tried. In the earlier days there was a "forward" party and a party addicted to "scuttle." The discovery has only lately been made that the policy of assimilation, as applied to Algeria, was from the first, in the nature of things, unpractical and visionary. It has been reserved for the Special Commission, under M. Jules Ferry, to vindicate the policy that has built up the British Empire, and which may be simply defined as: (1) conciliation, or identity of interests, as between the conqueror and the conquered, and (2) self-help and local self-government on the part of the colonists and colony. This, like honesty, is the best colonial policy, and the only one worthy of a great Power towards a subject and inferior race: in the end, too, it is best for the European colonist. It is surprising that France should have persisted so long in endeavouring to govern Algeria from Paris direct, at a cost of 85 million francs per annum. By the Decree of 1881, the Governor-General was divested of all real power and initiative. Nine Ministers at Paris are now responsible for the government and welfare of Algeria: the chief local functionaries are amenable to their respective Ministers; the colonists themselves vie with one another in their attempts to extract money from the mother-country, which they lavish too often on unproductive public works; and as for the natives, their land has been sequestrated and their rights ignored. That the laws of France should be held as applicable to a Mohammedan country, with the slight modifications that obtain in that country, is not a question upon which a geographer would hesitate to express a condemnatory opinion.

Algeria is not a colony of settlement, in the sense that Australia is; nor is it a colony of exploitation, like all Tropical colonies. It is a compromise between the two. But to properly understand this aspect of our subject, upon which our conclusions must depend, it will be necessary to glance briefly at the characteristic physical features and conditions of the colony. That it is a colony, and not a Department of France, has at last dawned upon the collective mind of the nine Ministers at Paris. Further legislation is pending.

Physical Characteristics.—The Atlas Mountains may be regarded as the only true mountain-range in Africa, running, as a backbone, across this north-west corner of the continent, and forming a complete physical system in itself, surrounded by the sea on the one side and by the desert on the other. The Arabs have very correctly designated this region *Djezirat-el-Maghreb*, or "The Western Isle." Physically and politically, we may regard it as, in fact, an island, belonging to Europe rather than to Africa. In area it is about equal to that of France, Italy, and the Iberian Peninsula combined, the greater half being occupied by Morocco, and the lesser by Algeria and Tunis.

The climate and vegetation of Algeria approximate to those of Southern Europe, but are more sub-Tropical in character. Of a country so diversified in its physical features as that of Algeria, I cannot, in the space at my disposal, attempt an accurate description: I must trust to my maps to convey this. Only in regard to rainfall may I be permitted to offer a few general remarks, because of its direct effect on agriculture; and Algeria is essentially an agricultural region. The average annual rainfall of Algeria is sometimes taken at 29 *in.* The highest rainfall (over 31 *in.*) is recorded in the Jujura mountains, to the east of Algiers; the lowest, of course, in the Desert. The intervening regions receive, roughly, from 23 to 31 *in.* on the northern slopes of the Atlas, and from 15 to 23 *in.* on the southern slopes. On the borderland of the Desert there is an annual rainfall of from 7 to 15 inches. Algeria suffers very much by the absence of important rivers, and the prolonged drought in the summer; but extensive irrigation-works (costing nearly five millions of francs) have been undertaken to remedy these defects, whilst in the south, especially at the base of the mountains, there are inexhaustible supplies of subterranean waters.

Coinciding with the systems of climate, we find well-marked and diversified characteristics of soil. Broadly speaking, there are three distinctive regions: the *Tell* lands of the Littoral, the High Plateau, and the Saharan or Desert tracts. The vine, cereals, olives, and oranges are cultivated in the *Tell*; cereals and *alfa* are raised on the High Plateau; and in the Desert regions, date-palms and fruit-trees bear fruit in the summer, whilst in the winter flocks and herds occupy the attention of the inhabitants.

The natives of Algeria devote themselves almost exclusively to cereals and cattle, and the European colonists to viticulture. Enough cereals are raised to feed the entire population, and to leave over considerable quantities for export. All the Europeans have rushed into viticulture, upon which the prosperity of Algeria now chiefly depends; but the danger of relying upon an exclusive culture is not altogether lost sight of. Agriculture is as yet almost restricted to the *Tell*, where about 3,304,000 acres of land are under cultivation: almost the entire European population is to be found there. The soil in parts of the High Plateau is, however, very fertile; but the regulation of the water-supply and the restoration of the forests are essentially costly. In the Sahara, too, large fortunes may be made by cultivating the date-palm. Olives require ten years, oranges from five to eight years, to give results. Mineral wealth the country certainly has, but, in the absence of capital, it has not been sufficiently exploited. The forest-lands cover an area of 8,025,040 acres, and, though much of it is very thinly wooded, there is some valuable timber. The most common trees are the Aleppo pine (*Pinus halepensis*), the *chêne vert* (*Q. ilex*), and the *chêne-liège* (*Q. suber*). Cedars and the *chêne zéen* (*Q. mirbeckii*) are also found.

Although only about a quarter of the soil capable of production is actually laid under contribution, it more than repays the working expenses.

Analysis of the Populations.—The following table exhibits the increase of the civil populations of Algeria, according to the last three Census reports:—

Nationalities.	1881.	1886.	1891.
French,	195,418	219,071	260,362
Algerian Jews,	35,663	42,595	47,677
Mohammedans,	2,842,497	3,264,879	3,567,223
Morocco-Tunisians.	...	22,338	18,501
Spanish,	112,047	144,530	151,859
Italians,	31,865	44,315	39,161
Anglo-Maltese.	15,149	15,533	15,675
Germans,	3,738	4,863	3,189
Various,	18,555	8,145	10,036
Totals,	3,254,932	3,766,269	4,113,683

*** The Army of Occupation and the foreign element, not included in the above, number about 68,000 persons, or less.

One-third, or at least one-fourth, of the native population of Algeria are Arabs of pure race; the remainder belong to the Berber family and other races. At the time of the French Conquest there were about two million natives. The native population has, in fact, increased during the last fifteen years at the rate of 13·9 per cent.: at the same rate of increase it would be doubled in forty-six years. The Arabs and the Arabised Berbers show a greater relative increase, if we may trust the Census reports, than the Grand Kabyles or pure Berbers.

As regards the European population, in the earlier days of the colony its increase was due solely to immigration. After 1856 the births were stated to be in excess of the deaths, which would point to a natural increase. It is only since the year 1876 that the French population itself shows a greater numerical increase over that of other Europeans, though at all times it would appear to have formed the most wealthy section of the foreign community. In 1876 there were 155,363 French, as against 155,072 other Europeans. This slight superiority in numbers was increased, in 1881, to 14,064; in 1886, to 15,917; and in 1891, to 40,442. The increase on the part of the French over other Europeans was, however, partly due to the naturalisation of the latter: of at least 8000 individuals.

The following table exhibits the relative natural increase of the French and other European colonists:—

Triennial Periods, 1873-1890.	Percentage of Excess of Births over Deaths.	
	French.	Other Europeans.
1873-75, . . .	3·7	5·5
1876-78, . . .	3·1	1·9
1879-81, . . .	4·5	3·4
1882-84, . . .	4·8	5·8
1885-87, . . .	4·5	6·0
1888-90, . . .	5·4	1·1

The French in Algeria do not increase at the same rate as their compatriots in the mother-country. It is, of course, all a question of acclimatisation. The people of southern France are, very naturally, more easily acclimatised in Algeria than the people of northern France. Also, the Spaniards and other Southern peoples show a much greater relative increase. Still, it is satisfactory to state that the European colonists of Algeria may now be said to have become acclimatised, and that after a period of only sixty years.[1]

As regards mixed marriages, from 1881 to 1890 there were recorded 5544 among the French and other European nationalities (chiefly Spaniards, Italians, and Maltese). The mixed marriages between French-

[1] Accepting these figures, I am tempted to advance the axiom, that, for every ten miles' difference in latitude, it requires at least one year for Europeans to become acclimatised, under the most favourable circumstances, in sub-Tropical countries.

men and foreign women are much more frequent than between foreign men and Frenchwomen, as is natural in a young colony. Marriages between French colonists and natives are very rare: thirty-four were recorded within nine years (1882-90).

The Arabs represent a floating population of nomads: aristocratic and idle. The Kabyles, on the other hand, are sedentary, industrious, independent, and entirely democratic. The two races do not readily fuse, in spite of the domination of the Arabs having been supplanted by that of Europeans. Of the 260,000 Frenchmen in Algeria, 60,000 are functionaries. The remaining 200,000 French colonists are, therefore, numerically weaker than the 220,000 colonists of other European nationalities. (The Army of Occupation is not included in this estimate.)

The French Administration.—Prior to the insurrection of 1871, Algeria was placed under a military administration, which accomplished much in the pacification of the country and in the institution of public works. Subsequently, the military and civil offices were separated, although, even to this day, a certain portion of territory remains under the military dispensation. In general terms it may be said that Algeria is governed on the same lines as the mother-country, and returns three senators and six representatives to the National Assembly. Each of the three provinces has a General Council; and the Governor-General has a Superior and a General Council to aid him. Native affairs are dealt with specially by the *Service des Affaires Indigènes.* The Army of Occupation comprises the 19th *Corps d'Armée* of France, and consists of about fifty-three battalions of infantry, fifty-two squadrons of cavalry, and sixteen batteries of artillery. Compulsory service is for one year only. The Turcos and Spahis are native levies.

There are three kinds of commune: (1) European centres (*communes de plein exercise*), (2) mixed communes, and (3) native communes. The first have very much the same organisation as in France, and allow certain privileges to the natives. The second are chiefly centres of colonisation. The third are governed by officers, or, what were formerly called the *bureaux arabes.* There is thus, theoretically, a natural transition from the third to the first, providing for the assimilation of the native elements into the civil life of the European. The native "*douars*," or group of Arab families, have their *sheikh*, and the tribe its *kaid*; whilst occasionally groups of tribes constitute an *aghalik* under the order of an *agha.* The office of *khalifa* has been abolished.

Mohammedan law is administered as well as French law; but the latter is too slow and costly for the natives to benefit by it. There are native schools and French schools: the former teach the Korán; the latter are not willingly attended, but when they are, they teach the natives to be discontented with their lot. Theirs, however, is not "a divine discontent."

Public works have been undertaken on a vast scale; but much remains to be desired. Water is wanted at many places; several important centres are still insalubrious; new ports are required in the Departments of Oran and Constantine; above all, more railways are needed to develop the natural resources of inaccessible districts. The railways and roads have been built for strategic purposes, and do not sufficiently provide for the economic wants of the colony. About 1860 miles have been constructed, the money for which has come from the mother-country. The railways themselves do not pay, but without them the country could not have been conquered and pacified. That the metropolis has still some faith in the colony may be judged from the fact that of recent years the project of a trans-Saharan railway has been seriously and sedulously discussed : it is proposed to continue the line, which now stops at Biskra, to Tuggurt and Wargla. If it were intended to stop there, the project would deserve influential support, because of its commercial as well as strategic value. But the wild scheme of making Wargla the terminus of a railway across the Sahara to Senegambia appears to me both unnecessary and unpractical: to my mind, there can never be intimate overland relations between the two colonies. This conclusion is, I think, proved beyond dispute by the paper and map which I published in Volume VII. of this *Magazine* on "The Comparative Value of African Lands." The natural regions are therein sharply defined.

Colonisation.—In the earlier history of Algeria, the French Government made three abortive attempts at colonisation by the aid of commercial companies. No less unsuccessful have been their schemes of State-aided colonisation. In the latter respect alone, the Government expended, between 1830 and 1891, no less than 151,700,882 francs, exclusive of the value of the lands upon which the colonists were planted. It is estimated that, in the ten years ending 1881, it cost the Treasury no less than 7705 francs to instal a single family.

Political exigencies in Europe and the unsettled state of Algeria itself were partly responsible for this failure. The agricultural classes of the mother-country, whom it was specially desired to benefit, were not made sufficiently acquainted with the benefits and advantages of colonial life in Africa, nor was this favourably regarded by them. The selected colonists were for the most part unfitted for the hardships and shifts incidental to pioneer-life in a new country, nor were they provided with adequate capital.

In the colonisation of Algeria, the Home Government appear to have been influenced by theoretical, political, and strategic reasons rather than by the special needs of the colony. Nothing has been left to individual enterprise. The colonists have been spoilt by being taught to rely upon the metropolis to get them out of their difficulties and to support their various undertakings.

But the days of the *colon officiel* are, happily, now over. The colonist has at last been convinced that any further progress must depend on his individual exertions. Of the European population, in 1891—namely, 480,282—only 185,969 were located in the rural districts. This figure represents about 45,000 families. There is ample room for more colonists; but, before creating new centres, it were desirable to strengthen some of the old and feeble ones. Above all, private enterprise should be better supported, when some of the results achieved in Tunis by this means may be repeated in the older colony.

The Native Question.—There are nearly four million natives in Algeria; in thirty or forty years more, at the present rate of increase, there may be seven or eight millions. Compare these figures with the European population: the half-million Europeans of the present day will be augmented, probably, by another 100,000 towards the close of the century; and they may reach one million in 1920 or 1930. The relative disproportion in numbers between the Europeans and natives is therefore likely to be maintained: it is important to remember this fact. Neither assimilation nor autonomy is possible. All that is required is the institution of a policy of conciliation and the treatment of Algeria as a colony and not as a Department of France.

During the Conquest, which dragged on for about twenty-eight years, the natives were treated with severity and injustice: their land was sequestrated; whole tribes were moved about like pawns on a chess-board; and rebellions were fomented. In 1888 the Administration adopted a more reasonable policy.

The pacification of the country was supposed to have been accomplished in 1854. The Arab chiefs, though divested of their feudal authority, were not then outwardly hostile to the French; but with the Berbers it was different. Absurd attempts were made to "Arabise" the Berbers, especially in their stronghold—Kabylia; and race-prejudices were brushed aside with a rough hand. In the regulation of forest-lands and the administration of justice, the French evinced profound ignorance of the ideas and customs of the Mohammedan population: measures were introduced that were diametrically opposed to their stereotyped habits of life. For instance, in 1870 all the Jews were naturalised. Now, the Arabs and Berbers, though mutually hostile, unite in their hatred of the Jews, who, moreover, are not in sympathy with the French themselves. This ill-considered measure practically led to the insurrection of 1871.

A profound gulf separates the natives from the Europeans. Neither the character nor the essential mode of life of the former has undergone any fundamental change: they still hate the European intruder as much as they dare. In the chief centres of European colonisation, and especially in the large towns, the public life is essentially French in character; the natives have no part in it. The younger generation do not, unless compelled or bribed, attend the French schools: they go to the local *zaouïa*, kept by a *taleb*, where they study the Korán. Their sacred book inculcates hostility to the Infidel; and Mohammedans, for the most part, practise what they preach. Their religious orders have not been suppressed, but have grown and flourished since the French Conquest. The Senussi are still powerful in the country, and their strong outside organisation constitutes, to my mind, a standing menace which at any moment may lead to disastrous consequences: they are specially embittered against the French, and have stirred up at least one insurrection.

The natives are neither so contented nor so prosperous as they were before the Conquest, though their peace is more assured. They are better off in the High Plateau countries, where European colonists are scarce. The Berbers have prospered more than the Arabs, though their best lands have been sequestrated. Much hope, in fact, has been placed in the Kabyle: he is thrifty even to a fault, industrious, clever with his hands, and is rooted to the soil. But, fundamentally, he is a semi-barbarian: the natural man may be easily seen through the thin veneer of Gallic civilisation. His code of morality is of the most primitive description. The position of the woman is inferior: she is merely a chattel, though monogamy is general among the Berbers.

Religious liberty has been respected, and no organised attempt has been made to convert the natives to Christianity.

Uniformity of administration is practically impossible. The Arabs of the *Tell*, and those of the High Plateau and the Sahara, the "Arabised" Berbers, the pure Arabs, and the Kabyles, differ so widely in their personal and social characteristics, that they cannot be made amenable to the same laws. Adaptation of means and flexibility of ends are urgently required in the French Administration; in short, the solution of the Native Question is—fusion of interests.

The natives are unfairly handicapped in all material respects. They are overtaxed,[1] the benefits they receive for taxation are less, and their profits on production are infinitely smaller. Too many exemptions are made in favour of Europeans, and at the cost of the natives. At the same time, the latter escape compulsory service in the army, which sets free 17,000 men; and their land is becoming more valuable. The forest-laws weigh very heavily on the indigenous populations. In many regions these laws have brought ruin to them. Their flocks and herds, upon the profits of which they subsist, have been driven from the old pasture-grounds, though, in full-grown forests, these perform a useful function in cropping the light undergrowth, and thus diminishing the chances of fire. Between 1883 and 1890 no less than 96,570 *procès-verbaux* were served by the Forest Department on the natives for petty offences against the Act. This is the result of applying to Algeria the same code as obtains in France, as if the conditions of life were the same in both countries. No wonder there are constant fires, by which enormous damage is done to the young forests.

The space at my disposal does not admit of my entering into closer particulars. The *Dépositions* before the Special Commission, to which I have alluded, afford valuable material from which the French Administration may learn its shortcomings; and these are amplified by the exhaustive reports to the Senate supplied by various members of the Commission. It is from these reports, and from M. Vignon's admirable work, *La France en Algérie*, that I have derived my chief information, my own activities in Algeria having been largely confined to the study of bronchial asthma in my own person.

[1] The dual fiscal system raises about 33 million francs from Europeans, and about 36 or 37 millions from the natives; the European pays about 62 fr. 30 c., and the native about 11 fr. 30 c., per head of population. The European should properly pay 79 fr., judged by his superior resources.

FINANCE.—Algeria is a rich colony. In the last twenty-five years the European population, landed property, commerce, and navigation, have been doubled. The mother-country has been too tolerant: the communes and departments of Algeria enjoy much greater privileges than those of France in the raising and disposition of the communal budget. For instance, the State gives up one-half of the receipts from the native taxes; and the money thus obtained is too frequently lavished on imposing public buildings, and in other less legitimate directions.

Reforms in the financial administration of Algeria are, perhaps, the chief requirements of the colony; and it is, therefore, satisfactory to state that it is precisely in this direction the Home Government are now turning their attention. The Colonial Budget should be independent of that of the metropolis; Algeria is certainly as much a colony as Martinique or Guadeloupe. Separation of their budgets need not weaken their political ties, as is feared in Paris. But this consideration appears to have weighed with the Chambers, and to have inspired the adoption by them of a middle course. The colony has been warned that the time has come for a radical change in their financial arrangements, and that the mother-country has reached the limit of self-sacrifice. Nevertheless, a handsome annual grant is still to be handed over to the colony for expenditure on public works. This is either too much or too little: too much, if, indeed, as many consider, the colony should be made more self-dependent; and too little to meet its growing needs. It would be quite possible for Algeria, with an independent budget, to raise a large capital sum—in France, of course—to meet all its requirements, the interest on which might be guaranteed by the Government. The money would be spent on the colony itself, which is quite rich enough to secure any reasonable loans. And in this way the colony would become more and more self-reliant and self-supporting.

It is estimated that, by the expenditure of some 350 million francs, spread over a period of ten years, Algeria might realise its limits and hopes of productiveness. Capital is most urgently needed—the leading industries are stagnating for the want of it; but the time is past for the mother-country to accede to fresh demands. It must and could be raised by Algeria itself, but not so long as the colony occupies an anomalous position.

A few words in CONCLUSION. I have given a very imperfect impression of Algeria as a French colony. I have said nothing of its foreign commerce or of many important subjects dear to the colonial mind. Faults of the Administration rather than its many notable achievements have chiefly occupied my attention, because my object has been to discover why it is that Algeria has not made greater progress as a colony, and why it should be so costly an appanage of the Republic. Criticisms have been freely scattered throughout this paper; but they may be summed up in a few words.

Judged by the principles that have governed the consolidation of the British Empire, I should say that the fundamental reasons of the arrested development of Algeria are the following:—(1) The natives

SKETCH MAPS ILLUS

DESI

SKETCH MAPS ILLUSTRATING THE PHYSICAL AND POLITICAL GEOGRAPHY OF ALGERIA.

DESIGNED TO ACCOMPANY MR. SILVA WHITE'S ARTICLE ON "THE SITUATION IN ALGERIA."

have been unfairly treated, and the colonists have been "coddled"; (2) division of responsibility has led to the practical irresponsibility of the active agents of the Government; (3) the colony has been treated as a Department of France, whereas, in fact, it is a colony pure and simple, in which the European colonists form the mere fraction of a hostile population, incapable of assimilation; and (4) not sufficient care has been taken to introduce the right kind of colonist or qualified administrators. The reforms most urgently needed are (1) that the administration and finances of the colony should be entirely separated from, although under the supervision and control of, the mother-country; (2) that the Governor-General should be invested with more power, and have under his exclusive control the entire civil staff of the colony; (3) that the local functionaries and administrators should be more carefully selected and specially trained—above all, that they should be conversant with the Arabic and Kabyle dialects of the districts under their command; and (4) that a policy of conciliation towards the natives should be followed.

Events are shaping towards the fulfilment of these ends; and all Africanists should consequently welcome the dawn of better days for Algeria.

NOTES ON AN IMPORTANT GEOGRAPHICAL DISCOVERY IN THE ANTARCTIC REGIONS.

By John Murray, LL.D., Ph.D.,

Of the *Challenger* Expedition.

(*With a Map.*)

The most interesting discovery made by the whalers who, last season, visited the Antarctic Seas to the south of Cape Horn, was that of the Norwegian schooner *Jason*, under the command of Captain Larsen. During a short visit to the shores of Seymour Island, Captain Larsen picked up a good many fossils which had fallen from a decomposing cliff.[1] Some of these fossils were procured by Dr. Donald, and on critical examination they turned out to be specimens of *Cucullæa*, *Cytherea*, and *Natæa*, together with some pieces of a coniferous tree. These fossils are probably of lower Tertiary age, and they indicate a warmer climate than now prevails in these high southern latitudes.

During the present season the Dundee whalers did not return to the Antarctic; but Captain Larsen has again made a voyage in the *Jason* to the same waters as last year, and has made some highly important geographical discoveries—the most important in the Antarctic regions since the time of Ross. M. Christensen of Sandefjord has received the log of the *Jason* up to January last, and has sent me some abstracts

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[1] See "Renewal of Antarctic Exploration," by John Murray, *Geo. Journal*, January 1894, p. 11.

which are printed below. The annexed sketch-map shows the probable course of this sealing voyage, and at once makes apparent the additions which Captain Larsen has made to our knowledge of these little-known regions. On the 17th January Captain Larsen again sailed from the Falkland Islands for another trip to the south, and on his return to Europe it is to be hoped that he will give a full account of this interesting voyage.

In 1843 Ross spent nearly the whole season in attempts to penetrate the ice to the south and east of Louis Philippe and Joinville Land; and last year the Scotch and Norwegian whalers found the sea blocked in the same position. This year, however, Captain Larsen has found a comparatively open sea, and has been able to proceed a considerable distance within the Antarctic Circle to the south of Louis Philippe Land.

After looking for seals where they were found last year, Captain Larsen landed on the middle of Seymour Island on the 18th November, and walked a good distance over the land, which he describes as rocky, with deep valleys. There was no ice from Seymour Island to the north of the Danger Islands. On some days a great deal of whale's food was observed in the water, with many whales, birds, and some seals. On the 29th November the *Jason* proceeded to the south. On the 1st December, in lat. 66° 4′ S. and 59° 49′ W., land was seen to the east, and is described as rocky, with a very high peak in the SSW. This land stretched from NW. to SE., and the ice-barrier appears to be pushed out five miles into the sea. On the 4th December, in lat. 67° 00′ S. and 60° 00′ E., high land, covered with snow, was seen to the south. The ice was continually dropping down from the icebergs with a great noise. On the 6th December the ship reached the most southerly point in 68° 10′ S., and here the ice is said to be low bay ice, with few cracks, and the weather nice and warm, with less fog than further north.

In returning to the north, new land was discovered somewhere about 65° 7′ S. and 58° 22′ W., consisting of islands, two of which were active volcanoes. The captain went ashore with three boats, and, with his mate, went on snow-shoes (*skier*) over the ice for seven miles to the land. On the ice there were many seals. Both the volcanoes smoked very much, and the ice around them was strewn with volcanic stones. These islands were not covered with snow.

The statements with reference to currents show that they come from the south. Although the barometer is relatively low, as in the case of all the observations in these latitudes, still there is often fine bright weather, especially when the wind is from the south. So far as they go, these observations of Captain Larsen confirm the view that there is a large anti-cyclonic region overlying the Antarctic continent.[1]

The excursion of this small sealing schooner shows what large additions might in a short time be made to our geographical knowledge

[1] See "Renewal of Antarctic Exploration," by John Murray, *Geo. Journal*, January 1894, p. 17.

by a properly equipped expedition, provided with steam power. If our Government would send forth a British expedition, as is now being proposed, almost every branch of natural science would be enriched. Such an expedition must be accompanied by scientific men, and be fitted with all the apparatus of scientific investigation, or otherwise the expenditure and risk would hardly be justified. To determine the extent and the nature of the land making up the Antarctic continent, to penetrate into the interior of this continent, to ascertain the depth and condition of the ice-cap, to take magnetic and meteorological observations on sea and land, to sound the ocean, to ascertain the temperature of ocean waters at all depths, to trawl up the animals on the sea-floor, and to study the nature of the marine deposits,—all this would be the work of a modern British Antarctic Expedition. It is earnestly demanded by the science of our day, and should be undertaken by the Royal Navy in the same way as the expeditions of Cook, of Ross, and of the *Challenger*.

It is to be hoped that the scientific societies and the general public will soon urge this matter on the attention of our Government. It is evidently our duty to undertake this kind of work as in the past. If we do not do so, then it is good evidence that the present generation takes little interest in conquests over the powers of nature, and is little concerned in maintaining the maritime position and scientific reputation of this great empire.

Extract from the "Jason's" Journal.

Nov. 15th, 1893.—Calm and sunshine. Commenced 4 o'clock in the morning to steam past a small point. Took some seals, and saw others on the pack-ice. Saw Graham's Land to-night in WNW., 64° 30′, 53° 44′ L.; Bar. 75 (29·5 in.).

16th.—Nearly calm. Wind from north in the morning, and rather fresh in the afternoon. Steamed all day along the coast of Graham's Land westwards. Many icebergs. Cape Seymour to W. Fine weather. Bar. 75, to-night 74·9 (29·52 and 29·48 in.).

17th.—Storm from NW. and W. In the afternoon high rough sea. No ice to be seen where we found seals last year. Open water all the way to Graham's Land. 64° 24′, 53° 14′; Bar. 73·3 (28·85 in.).

18th.—Gale from NW., with clear weather. Steamed from 6 morning WNW. Took some seals. Stood from noon ESE. from Seymour Point. Went ashore 5 o'clock on the middle of Seymour, and walked a good distance over the land, although it is difficult to walk, as there are deep valleys and high rocks. In the interior of the island we found several dead seals, and a great number of penguins had their nests there. Went out 11 o'clock NNE., to find some ice with seals. Bar. 74·4 (29·27 in.).

19th.—Heavy wind, WNW., and some fog last night before 12. Steamed N. by E. to 10 A.M., and then fell off to E. by N., with a speed of 8 knots. Fresh breeze. No ice from Seymour to the north of Danger Islands, but several icebergs.

20th.—Gale from WNW. Steered E. by N. till 10 o'clock, and then S. by E. 64° 7′, 51° 5′; Bar. stood at stormy.

21st.—Wind WSW. Pretty clear weather. Started 4 o'clock in morning, going southward till 9, then NNE. and NE. till evening. Saw whale blasts now and then, and some seals. 64° 21′, 50° 29′. Bar. 74·5 (29·33 in.).

22nd.—Fresh wind from WSW.; in the evening storm from SSW., with snow and cold. Some seals in a bay, and many blue whales, and a few grampus. 63° 41′, 48° 52′; Bar. 75·1 (29·57 in.).

23rd.—SW. wind, with snow and foggy air. 63° 22′, 47° 32′; Bar. 75·3 (29·65 in.).

24th.—Gale from WNW., later WSW., with fog and snow. Sailed west. 63° 29′, 49° 37′; Bar. 75·3.

25th.—Steamed SW. In the afternoon wind from N., some fog. 63° 35′, 49° 20′; Bar. 75·1.

26th.—Gale from W. and WNW. Many icebergs seen; some whales and birds. 63° 32′, 51° 18′; Bar. 75.

27th.—Wind NW. and N. Fog, nearly calm from noon. Great number of whales and birds; took some seals; plenty of food (*aate*) for the whales. 63° 59′, 52° 32′; Bar. 75·3.

28th.—Wind N. Fresh breeze and thick fog. Saw some blue whales. 63° 56′, 53° 8′; Bar. 75·1.

29th.—Wind W. Have passed through lots of icebergs but scarcely any small ice. Some whales and seals. Have seen Graham's Land all afternoon. 64° 50′, 55° 33′; Bar. 75. Fine weather and fresh breeze. Will go south.

30th.—Wind NW. to N. and E. Fine weather; warm in sunshine. In the evening nearly free of ice; only a little floating ice. Saw land 10 o'clock. 66° 58°; Bar. 74·1 (29·17 in.).

Dec. 1st.—Wind S., fresh, with some snow. Heard whale-blasts in the fog; took some seals. 66° 4′, 59° 49′; Bar. 74·3 (29·25 in.). Ice-barrier along the shore. The land is rocky, and stretches from NW. to SE. To WSW. there is a very high peak, much of which is bare of snow. The ice-barrier runs about 5 miles out to sea. We saw five or six different kinds of birds. The current runs NNE. with a speed of 1 knot. Fine weather.

2nd.—Nearly calm. Have steamed along the ice northwards to see if possible how far it is from land, but as far as could be seen from the masthead there was fast ice. Took an emperor penguin, and saw some small fishes with large eyes.

3rd.—Light breeze from NE., foggy. 66° 42′, 59° 59′; Bar. 74·9 (29·49 in.).

4th.—Breeze from NE. Can see high land to the south, covered with snow. 67° 0′, 60° 0′; Bar. 74·9. The ice is constantly falling down from the icebergs with great noise.

5th.—Gale from NE., with fog; later, calm, with snow. Some whales. 67° 13′, 60° 16′; Bar. 74·6 (29·36 in.).

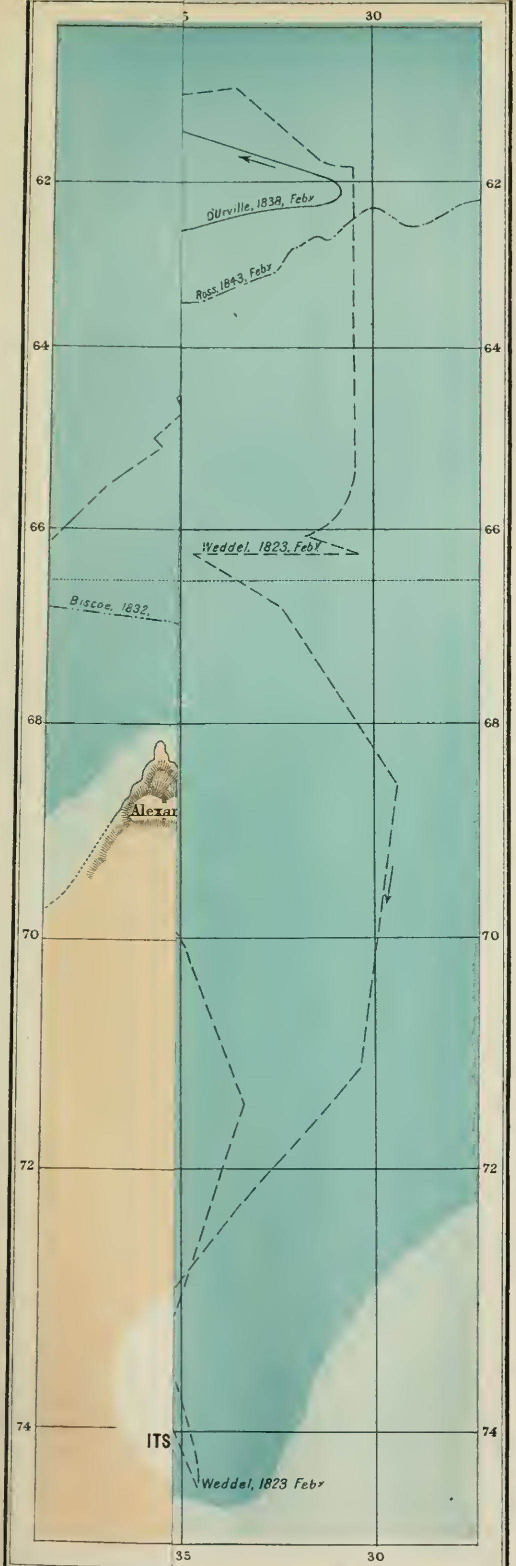
6th.—Slight wind from W. Sailed SSE. Fine day. 67° 50′, 59° 59′. At 6 o'clock the ship was 68° 10′ south; Bar. 74·8 (29·45 in.). The low ice here is fast bay ice, with few cracks. The weather has been nice and warm down here, with less fog than further north.

7th.—Wind fresh from NE. Have steamed along the ice NNE. without seeing any life. 67° 45′, 58° 56′; Bar. 74·9.

8th.—Slight wind from NE., with fog. Saw some seals. 66° 12′, 58° 46′; Bar. 73·8 (29·05 in.).

9th.—Observed some new land and a small island. The land, to SW., we saw well, as the air was clear. Steamed N. till noon. The weather fine and warm, with sunshine. Many birds and seals; found a sealskin floating, probably since we were here last. 65° 57′, 58° 53′. This afternoon we saw an island, stretching from S. to N., high and snow-covered, except the north end, which was bare. Open water near to land; some blue whales. Bar. 73·7 (29·02 in.).

10th.—Gale of wind from NW. The current ran to shore, so we had to steam out. The water runs NE. at 2 knots an hour.



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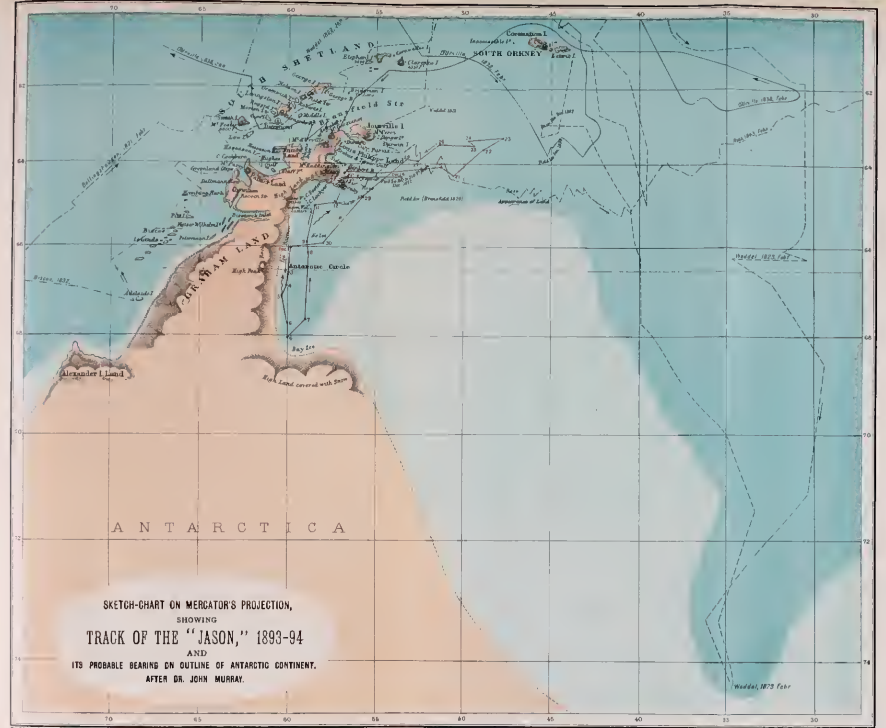
SKETCH-CHART ON MERCATOR'S PROJECTION,
SHOWING
TRACK OF THE "JASON," 1893-94
AND
ITS PROBABLE BEARING ON OUTLINE OF ANTARCTIC CONTINENT.
AFTER DR. JOHN MURRAY.
ANTARCTICA
GRAHAM LAND
SOUTH SHETLAND
SOUTH ORKNEY
Coronation I.
Joinville I.
Bransfield Str
Alexander I. Land
Antarctic Circle
High Land covered with Snow
Bay Ice
Waddel, 1823 Febr

11*th*.—Wind NE., S., and SW. Snow and clear weather. Found a small active volcanic island. Went ashore with 3 boats; captain and mate went on snow-shoes (*skicr*) over the ice to the land, a distance of 7 miles from the edge. Seals numerous on the ice. To NW. we saw another volcano. Both islands smoked very much, and the ice around the volcano was bestrewed with ejected stones. W. to N. in straight line we saw 5 islands. These islands are not covered with snow. The ice is lying fast between the islands. 65° 7′, 58° 22′; Bar. 74·4.

12*th*.—Wind E., fresh. Great number of icebergs. Saw snow-covered land E. of Cape Forster. 65° 4′, 57° 18′; Bar. 74·9.

13*th*.—Wind E. 64° 28′, 56° 40′; Bar. 74·9. Some grampus; took some seals.

14*th*.—Light breeze SE. Numbers of blue whales and some grampus. Great number of icebergs, but little ice round Cape Seymour. 64° 23′, 53° 20′; Bar. 73·8 (29·06 in.).

MACHICO AND THE DISCOVERY OF MADEIRA.

By Professor Carlos de Mello,

Corr. Member, R.S.G.S.

During the recent festival held at Oporto in honour of the fifth centenary of the birth of the Infante, Dom Henrique, some very interesting facts were brought to light. Among these are some details relating to the discovery of Madeira, and the much-disputed origin of the name Machico, questions which were solved by the Portuguese writer, Professor Alvaro Rodrigues de Azevedo, in his edition, published in 1873, of the *Saudades da Terra*,[1] by Gaspar Fructuoso (1590). Having demonstrated that the voyage of Machan, or Machin, and Anne d'Arfet was a pure fiction, he puts forth some theories of his own, suggesting that the name *Machico* was a corruption of *Monchique*, the well-known sierra of the Algarve. That this is incorrect we shall presently show.

The principal authors who have referred to the story of Machin are here given in chronological order :—

1421.—*Relation historique de la Découverte de l'Isle de Madère*, traduit du portugais de François Alcaforado, Escuyer de l'Infant de Portugal, D. Henri. Paris, 1671.[2] Pp. 1-20 (MS. of 1421).

1508.—*Descripção das Ilhas do Atlantico*, pelo allemão Valentim Fernandes, or Valentim de Moravia. (MS. preserved in the Library of Munich.)

1563.—*Tratado que compoz o nobre & notavel capitão Antonio Galvão dos diversos & desvairados Caminhos, por onde nos tempos passados a pimenta & especcaria veio da India ás nossas partes, & assim de todos os Descobrimentos antigos*

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[1] This work was printed at Funchal. See pp. 348-429.

[2] Quoted as a manuscript by Conrad Malte-Brun in his well-known *Géographie Universelle*, 1809, and by Huot in his edition of this book (1845), p. 245, note. Translated into English, and published in London, 1675, *in folio*, with the title, *The First Discovery of the Island of Madeira.* Sr. Azevedo proved, at page 353 of *Saudades da Terra*, that this manuscript is a clumsy fraud, being merely a French translation of the *Epanaphoras* of D. Francisco Manuel de Mello, printed in 1660.

& modernos, que são feitos até á era de mil & quinhentos & cincoenta. Lisbon. Fol. 15.[1]

1590 (probably some years earlier).—*Historia do Descobrimento da Ilha da Madeira, a da descendencia nobelissima de seus valerosos Capitães.* Anonymous manuscript, supposed to have been written by the Canon Jeronymo Dias Leite.[2]

? ——.—Another history of the same discovery, written in Latin, attributed to the Doctor Manuel Clemente, and referred to by D. Francisco Manuel de Mello in the dedication of his *Epanaphoras III.*

1628.—*Epitome de las Historias Portuguesas*, by Manoel de Faria y Sousa. Madrid. Part iii. ch. xi.

1660.—*Epanaphoras* (the third), by Dom Francisco Manoel de Mello. Lisbon. P. 313.

1678.—*Europa Portugueza*, by Manoel de Faria y Sousa. Lisbon. Tom. ii. part iii. ch. iii.

1679.—*Castrioto Lusitano*, by Fr. Raphael de Jesus. Lisbon. Pp. 2-4.

1717.—*Historia insulana das Ilhas a Portugal sugeytas no Oceano Occidental*, by Father Antonio Cordeyro. Lisbon. Liv. iii. ch. iv.

? ——.—*Memorias sobre a creação e augmento do Estado Ecclesiastico na Ilha da Madeira.* Anonymous manuscript, attributed to Henrique Henriques de Nogueira. Pp. 277-373.

1730.—*Memorias para a Historia . . . del rey D. João I.*, by José Soares da Silva. Lisbon. Liv. i. cap. lxxvi.-lxxx.

1758.—*Vida do Infante D. Henrique*, by Candido Lusitano (Father Francisco José Freire). Lisbon. Pp. 147-176.

*1809-12.—*Géographie Universelle*, by C. Malte-Brun, tome i. (He cites Alcaforado.)[3]

1812.—*Account of the Island of Madeira*, by Dr. N. C. Pitta. London. P. 11.

182-.—*Apontamentos historicos e geographicos sobre a Ilha da Madeira*, by Dr. João Pedro de Freitas Drummond (MS.), fol. 3.

*1823.—*Excursions in Madeira and Porto Santo in* 1823, by T. Edward Bowdich.

1841.—*Breve Noticia sobre a Ilha da Madeira*, por Paulo Perestrello da Camara. Lisbon. Ch. i. and v.

1841.—*Africa Occidental*, by Francisco Travassos Valdez. Lisbon. Tom. i. pp. 44, 45.

*1841.—*Chronica de Descobrimento e Conquista de Guiné*, pelo chronista Gomes Eannes de Azurara (1448). Paris. P. 388, note.

*1842.—*Dictionnaire Universel d'Histoire et de Géographie*, by M. N. Bouillet. Paris. Art. "Madère," giving only the date 1344.

*1845.—*Précis de la Géographie Universelle*, par Malte-Brun, revu par J. J. N. Huot,[4] vol. i. p. 252.

*1846.—*Portugal*, by Ferdinand Denis. Paris. Pp. 64, 65.

*1859.—*Die Entdeckung Amerikas*, by Kunstmann. Munich. Pp. 4, 82.

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[1] Written in 1555, printed at Lisbon in 1563, published at London in 1601 by Richard Hakluyt, and reprinted for the Hakluyt Society, with the original Portuguese text, in 1862. See pp. 58-64.

[2] In the possession of Professor Azevedo.

[3] Works marked with a star are not to be found in the bibliography published by Professor Azevedo on pp. 349, 350 of his book.

[4] He quotes Alcaforado (the manuscript), Cordeyro, and Candido Lusitano, and says that Madeira had been *probably visited* previously to the Portuguese discovery.

*1863.—*Die preussische Expedition nach China, Japan und Siam.* Leipzig. Vol. i. p. 3.

*1866.—*Archivo Pittoresco.* Lisbon. Vol. ix. p. 172, Art. by Rebello da Silva.

1868.—*Iles d'Afrique* (Collection l'Univers), by M. d'Avezac. Paris. P. 116 of part ii. sect. iii.

1868.—*The Life of Prince Henry of Portugal*, by Richard Henry Major. London. Ch. v., viii.[1]

*1875 (?).—*Historia de Portugal escripta segundo o plano de F. Diniz*, vol. ii. p. 234.

*1877.—*Geschichte der Erdkunde*, by O. Peschel. Second edition, by Professor Ruge. Munich. P. 193, note.

*1877.—*Diario Illustrado*, Lisbon, 2nd May. Letter by Camillo Castello Branco.

*1877.—*Athenæum*, No. 2592. Article by R. Major, p. 833.

*1878.—*Boletin de la Sociedad Geográfica de Madrid*, tom. v. p. 66. Art. by D. Cesareo Fernandez Duro.

*1879.—Do., tom. vi. p. 245. Art. by Carlos de Mello e Fernandez Duro.

*1879.—*Sentimentalismo e Historia*, by Camillo Castello Branco. Lisbon. Last part.

*1888 (?).—*Historia de Portugal*, by M. Pinheiro Chagas. Lisbon. Vol. iii. p. 128.

I do not pretend to have exhausted the bibliography of the Machin question, but only to have mentioned some of the most important works.

The reader has seen that the first document, that of Alcaforado, dates from 1421. In note 5 (p. 348) of the edition of *Saudades da Terra*, by Professor Azevedo, he will find convincing proofs of the fraud committed by the unhappy translator of the *Epanaphoras*, and the refutation of the arguments advanced by R. Major, certainly the best defender of the Machin legend.[2]

Recently the name of Machico has been found in a document bearing the date of 12th April 1379, among the papers of King D. Fernando I. The discoverer and publisher of this paper is Sr. Jacintho Ignacio de Brito Rebello, a son, and a noble one, of the Azores, and the able and well-known palæographist whose name occurs in the valuable works of Henry Harrisse.

The document referred to runs in Portuguese, with the original orthography, as follows :—

"Carta porque o dito Senhor deu umas casas que stam na rua noua de Lisboa, que partem com casas do capitam moor e cum joham pirez canellas a *machico* mestre da sua barcha em que morase em quanto fosse sua mercee &. em alanquer xij dabril de mil iiij^{c}xbij anos." (*Torre do Tombo*, Book II. of D. Fernando, fs. 42.)

The following is a translation :—

"Deed by which the said Lord gives the houses standing in the New Street of

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[1] Published in 1877 under the new title, *The Discoveries of Prince Henry the Navigator, and their Results, being the narrative of the discovery by sea, within one century, of more than half the world*, etc. (London), with omission of controverted matters. The edition of 1868 was translated into Portuguese by Sr. José Antonio Ferreira Brandão in 1874, under the supervision and at the expense of the Duke of Palmella, who did good service to Portugal by publishing this work in 1876.

[2] *Life of Prince Henry*, chap. v.

Lisbon, between the houses of the chief-captain (*capitão-mór*) and of John Pires Canellas, to *Machico*, master of his bark, for his abode as long as he chooses to reside there, etc. Alemquer, 12 April 1379."

This is evidently a grant of a lodging (in Portuguese *moradia*) given by the King D. Fernando, deceased in 1383, to a sailor or discoverer who had done him great service. This grant, taken in connection with the occurrence of the name *Machico* in the island of Madeira at the date of its re-discovery in 1419-20, induces Sr. Brito Rebello to think—and many others will certainly agree with him—*that Machico or his father was really the true discoverer of Madeira*,[1] and not Gonçalves Zarco and Perestrello, his successors.

Thus the story of the elopement of Machin with Anne d'Arfet is shown to be a myth, and the origin of Machico is now decided. Dying on or near the coast of Madeira, the navigator was buried in the island, and his grave gave the name to the now important village of Machico.

The earliest map on which the name Machin occurs is that drawn up in 1519 by Vesconte de Maiollo, and referred to by Harrisse (*The Discovery of North America*, p. 501), where Aldea de machin appears as the name of a village in the New World!

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings of the Society.—On February 23rd, Mr. Herbert Giles of H.B.M. Consular Service, delivered a lecture to the Aberdeen Branch on "The Language and Literature of China." The Chair was taken by Professor Pirie.

A Meeting was held in Edinburgh on March 8th, when Mr. J. S. Stuart-Glennie, M.A., Barrister-at-Law, gave an address entitled "Dodona, Olympos, and Samothrace: a Narrative of Personal Explorations." Mr. Coutts Trotter presided.

On March 26th, Mr. Geo. R. Parkin, M.A., lectured in Edinburgh on "The Geographical Unity of the British Empire." Professor Butcher presided. The Lord Provost, Professor Geddes, and Dr. Scott Dalgleish also addressed the Meeting.

Mr. Parkin addressed the Aberdeen Branch on March 27th, on which occasion the Chair was taken by Sir William Henderson; and repeated his lecture at Dundee on March 29th, the Rev. Colin Campbell, D.D., presiding.

Meetings in April.—A Meeting will be held on April 12th, in the Society's Hall, Edinburgh, when M. Joël le Savoureux will speak on Montenegro.

On April 26th, Mr. E. Delmar Morgan will lecture in Edinburgh on "The Mountain Systems of Central Asia."

Mr. Delmar Morgan will also address the Glasgow Branch.

The International Congress of Orientalists.—At a Meeting of Council, Dr. Burgess and the Hon. John Abercromby were appointed delegates to the Congress which will be held in September at Geneva.

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[1] Supplement to the *Diario de Noticias* of Lisbon, a single sheet, published 4th March 1894.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Prince Henry the Navigator.—In March, Portugal celebrated the birth of this illustrious leader of exploration. He was born in Oporto on March 4th, 1394, the fourth son of King João First and his Queen Philippa, daughter of John of Gaunt. When only twenty-four years of age, he abandoned the Court, and took up his residence on the desolate peninsula of Sagres, near Cape St. Vincent, and from this spot directed the explorations which eventually led to the doubling of the Cape of Good Hope and the discovery of a new route to India.

When Prince Henry began his work, Cape Nun was the farthest point on the African coast known to Europeans. Between 1418 and 1460 expeditions were sent out in rapid succession, and Cape Bojador was rounded by Gil Eannes in 1434; nine years later Antonio Gonsalvez doubled Cape Blanco; in 1446 Diniz Dias discovered Cape Verd; and in 1445-6 Cadamosto explored the Cape Verd Islands, and obtained a mass of information about the interior as far as Timbuktu. Under the Prince's auspices 1500 miles of the west coast of Africa from Cape Nun southwards were made known, and on his death in 1460, at the age of sixty-six, a great stimulus had been given to exploration, and the work was vigorously carried on under Affonso v. and João ii. So much has been published of late on the discoveries of the fifteenth century, in the *Magazine* and elsewhere, that it is unnecessary here to do more than allude to the great services rendered to geography by Prince Henry, and his initiation of those voyages which prepared the way for the great discoveries of Vasco da Gama and Columbus.

Lake Copaïs.—Dr. A. Philippson states that this lake occupies a depression formed in late Tertiary times, which subsequently expanded to a greater area. At the dawn of history the lake was much in the same state as in the present century. The periodical disappearance of its waters must have suggested in very early times the possibility of obtaining a large area of fertile land by permanent drainage. This was said to have been actually accomplished by the mythical Minyans, and the system of dykes and canals lately discovered at the bottom of the lake proves the correctness of the tradition. The canals of the Minyans carried the water to natural funnels (*katavothroi*), through which it escaped. These openings stopped up by natural causes or the work of enemies, the lake came again into existence. Another attempt was made to drain it by means of channels cut through the edge of its basin. The undertaking is ascribed to Alexander the Great, and traces of the unfinished works are still to be seen. In recent years a French, and afterwards an English, company have successfully carried out the undertaking, so that in 1887 the lake ceased to exist. The plan adopted has turned out to be a combination of those of the Minyans and Alexander. The feeders of the lake have been diverted along canals to the eastern bank, where some of the water is allowed to flow into large *katavothroi*, while the greater part is conducted by cuttings and tunnels to the sea. Two small lakes, the Likeri and Paralimni, lie between Lake Copaïs and the coast, separated only by narrow and low ridges, which have been cut or tunnelled through. In this manner more than 90 acres of exceedingly fertile land in the basin of Lake Copaïs have been reclaimed. Very little, however, has been done to render it profitable, for the population of the neighbourhood is sparse, and labour consequently scarce.—*Mitt. der k. k. Geogr. Gesell. in Wien*, Bd. xxxvi. Nos. 11 and 12.

Variations of Gravity in Central Europe.—It has long been known that there is a deficiency of mass under or near to elevations. Such a deficiency was discovered by Colonel Clarke during his pendulum experiments at Arthur's Seat, the deviation of the pendulum being too great to be accounted for by the basin of the Forth ; and a similar condition was shown to exist under the Himalayas, where the deficiency is equivalent to a mass 13,000 feet in depth at sea-level. Of late years Colonel von Sterneck has conducted a series of experiments in Austria with the pendulum apparatus he has designed, and the results are given in the *Deutsche Rundschau*, Jahrg. xvi. No. 5. Under the Tyrolese Alps he discovered a deficiency equivalent to a stratum at sea-level 3900 feet in thickness, with a density of – 2·4. How this volume of low density is distributed is, of course, unknown ; but it probably lies in the upper strata within 60 miles of the surface, or its effect would be perceptible to a greater distance than it actually is. The discovery explains a fact which had been already noticed by geodetic surveyors. In the neighbourhood of mountains there is, or should be, a deviation of the plumb-line owing to the attraction of the elevations ; but yet in Munich no such disturbance is perceptible, while at Nice, near an area of low density beneath the Maritime Alps, it amounts to only 20′ instead of the calculated 53′. The observations by Colonel von Sterneck in Bohemia in 1890 revealed a connection between the force of gravity and the geological formation, the attraction being less over primary than sedimentary rocks. And to this is due the greater attraction of gravity in oceanic islands, the formations covering the bottom of the sea being of high density.

In consequence of these observations, Colonel von Sterneck was invited by the International Geodetic Commission, which met at Freiburg in 1890, to extend his pendulum measurements northwards to Munich and southwards to Padua. From these investigations it appears that from Munich southwards a deficiency of mass occurs under the greater part of the Alps. It increases to the southward nearly constantly from 1000 to 3200 feet. From Wörgl to Franzensfeste it remains nearly constant, with a thickness of 3200 to 3900 feet, and then suddenly decreases to 2600 feet. It then remains constant as far as S. Michele, where it commences to diminish rapidly, ceasing entirely at Matarello. Between Trent and Mori an excess of matter, equivalent to a depth of 2300 to 2600 feet, becomes perceptible, which extends over the plain of the Po to Mozzecane. Near Mantua a deficiency becomes once more apparent, and increases rapidly up to the last station on the Po, at Borgoforte, where it is equivalent to a depth of 2300 feet. The deficiency has the same extent as the mountains, and the excess of mass the same as the plain between the Alps and the Apennines ; but both areas seem to be displaced about 30 miles to the north. The limit of low density is marked in the south by the swamp of Mantua, and to the north by the moors of Erding and Dachau.

In the spring of 1892 observations were made along a line from Graz to Vienna, and also from the Schöpfl to the lake of Neusiedl. A deficiency of 650 to 980 feet was found to commence to the north of Graz and extend to the southern slope of the Semmering pass ; it may be considered to be an offshoot of the Alpine area of low density. An excess of mass occurs between the Semmering and Vienna, which gradually increases between the Schöpfl and the lake of Neusiedl, here attaining a thickness of about 3200 feet. The Steinfeld and the Vienna Tertiary basin lie in a subsidence region to which also the mountains of the Wienerwald belong. These results, as well as those obtained by Colonel von Sterneck in Hungary and Galicia, tend to prove that it is rather the geological formation than the elevation which affects the conditions of gravity, and the sudden transition from deficiency to excess of mass seems to indicate that the disturbing causes are situated at no great depth.

In 1892 Lieutenant Grazl of the Austrian navy visited Edinburgh, Tromsö, Spitzbergen, and Jan Mayen for the purpose of making gravity observations, and in 1893 work was carried on in Dalmatia. Lieutenant von Müller has used Sterneck's pendulum apparatus in the East Asiatic waters.—*Deutsche Rundschau*, Jahrg. xvi. No. 5.

ASIA.

India.—The *Investigator* has been sent to examine Palk's Strait, with the object of ascertaining whether it be possible to construct a railway between India and Ceylon, and to make a canal for large vessels through the numerous coral islands, reefs and sandbanks. The breadth of the strait is about sixty miles, of which thirty are occupied by the islands of Adam's Bridge. The bridges required would have an aggregate length of forty miles, but would be of no great span, nor need they be high, since the flood-tide attains a height of only about 1-2 feet.—*Petermanns Mitt.*, Bd. xl. No. 1.

The Sources of the Irrawaddy.—The *Geographical Journal* for March contains further particulars of the journey of Mr. Errol Gray, noticed in vol. ix. p. 541. His intention was to travel from Assam into Western China through the country explored by Lieut. Wilcox in 1827, and afterwards by Col. Woodthorpe and Major MacGregor in 1884-5. On reaching the Nam-kiu river, the western branch of the Irrawaddy, the limit of their explorations, he was to push on eastward across the unknown mountains which give birth to the eastern affluents of the Irrawaddy, the Salwin, and the Mekong. Had Mr. Gray succeeded, he would have determined the question whether the Lu river is the upper course of the Irrawaddy. He did, in fact, penetrate further eastward than his predecessors, crossing from the valley of the Nam-kiu into that of the Tisang, another affluent of the Irrawaddy as large as the Nam-kiu; but here he was prevented from continuing his journey by the refusal of the Khaku Singphos, who live in the vicinity, to allow him to pass through their territory.

On November 24th, 1892, Mr. Gray started from Saikwa, on the Lohit Brahmaputra in Upper Assam, and passed through several Singpho villages in the valley of the Dihing. The country is covered with dense forest, and is very difficult to traverse. There is no road practicable for baggage animals, and therefore all supplies must be carried by men. Numerous rivers intersect the route, and when in flood often stop all communication for days together. The Singphos are great opium-eaters, and every village cultivates the plant. The men are of fine physique but not handsome, and the women age rapidly, having to do almost all the work. The men wear a piece of cloth arranged as a kilt, and a short jacket; they tie their hair in a knot on the top of the head, round which they wind a small turban. The women wear a piece of cloth descending from the breasts to the knees, and those of the better classes are tattooed from the knees downwards in parallel bars. The Singphos have little of the Mongolian type, and in this respect differ from the Khamtis and the Burmese; their language is also quite distinct. Leaving Khomang, the last village in the Dihing valley, on January 6th, Mr. Gray crossed the Chaukang pass, 8300 feet above sea-level, on the 12th, and after marching for three days through a highland region, where snow falls to a considerable depth, descended into the Phangma valley, and came to the two Langnu villages a few miles to the west of the Nam-kiu river. He was well received by the rajah, who advised him not to attempt to cross the country of the Khakus, of whom the Khamtis themselves were afraid, though he consented to communicate on Mr. Gray's behalf with Alang Chowtong, a powerful Khaku chief living four days' journey to the south.

Mr. Gray spent the time while waiting for an answer in a visit to the village of Putu (Woodthorp's Padao), the residence of the chief rajah of Khamti. The whole country is covered with hills, the only open country being the valley of the Nam-kiu to the south. All these hills are covered, up to an elevation of 4000 feet, with the cultivations of the hill tribes—the Khunongs to the west, north, and north-east, and the Tureng or Duleng Singphos to the east and south-east. Alang Chowtong returned the presents sent to him, and intimated that Mr. Gray was not wanted in his country, and thus the primary object of the journey could not be accomplished. Mr. Gray spent, however, two months in the Khamti country, exploring in various directions, and obtaining information about the neighbouring districts.

He met with some people of the Maru tribe, which dwells on the borders of China, twenty-one days' march from Putu. During eight marches the route thither follows the right bank of the Nam-kiu, and seven marches further reaches the Phungmai-kha, the eastern branch of the Irrawaddy. Three marches further is situated the Lashi country, from which the Chinese frontier is distant three days' march to the east, and the Maru country as many to the north. The Khaku country is said to be fairly well populated, seven or eight villages being sometimes met with in a day's march, each with twelve, or twenty, and occasionally as many as a hundred houses.

In the Nam-kiu valley Mr. Gray noticed that on the eastern side the creepers twined round the trees from right to left, and on the west in the opposite direction. He crossed the river, and made his way into the valley of the Tisang, which rises, like the Nam-kiu, in the mountains of Tibet forming the southern boundary of the valley of the Lohit Brahmaputra. Wandering about with his surveyors, and ascending the summits of the mountains, he obtained good views of the surrounding country, and has made many valuable additions to our knowledge of its topography. On April 23rd Mr. Gray reached Sadiya, having accomplished the return journey much more rapidly than the outward journey. His party of fifty men were all in good health, in spite of the many privations they had endured.

Siberia.—Last year the Imperial Russian Academy sent out an expedition under Baron E. Toll, with the primary object of ascertaining the truth of a reported discovery of mammoth remains. The leader, however, reserved the right to employ the time, after his task was accomplished, in the way that might seem most advisable to himself, and consequently he has obtained much valuable topographical and geological data. Visiting the New Siberian Islands for the purpose of forming depôts of provisions for the Nansen expedition, he was able to complete his former surveys by the determination of positions worked out by Lieut. Shileiko. He then wandered through the unknown country between the Lena and Khatanga, striking Middendorf's route (1843) at Khatangskoie. Baron Toll satisfied himself that there was no truth in the discovery of mammoth bones on the river Sanga-yrach, 73° N. lat., as reported, and then with dog-sledges passed across the Liakhoff Islands to 75° 37′ N. lat. on the west coast of Kotelnyi. On this island two depôts were formed in case the *Fram* should encounter the same fate as the *Jeannette*, and Lieut. Shileiko carried out some astronomical and magnetic observations. On the mainland reindeer were used, and the party crossed the *tundras* from Sviatoi Noss to the Lena, and then they descended the river by boat to its delta, and skirted the coast to Olokhon Krest, a cape about 65 miles from the mouth of the Olenek. Mounting again on reindeer, Baron Toll travelled through Bolkalak at the mouth of the Olenek to Anabar Bay, and ascended the Anabar for 265 miles to the border of the forest region. Returning again to the Olenek mouth, he found that Nansen had not called for the dogs he had sent there, and therefore concluded that, finding open sea beyond Cape Chelyuskin, Dr. Nansen had steered straight to the north-east. This was the more probable as at lat. 72° the temperature on the coast was 93° F. (!), and the constant south-east wind would be very favourable for the Arctic explorer. Baron Toll returned from the Olenek to the Anabar, and continued his way to the Khatanga. On December 4th he arrived at Yeniseisk.—*Petermanns Mitt.*, Bd. xl. No. 2.

AFRICA.

The Rif.—*Deutsche Rundschau*, Jahrg. xvi. No. 5, contains a sketch of this country by G. Rohlfs, which is of interest at the present time, when the Spaniards have been at war with its inhabitants. The district, which derives its name from the Latin *ripa*, stretches from Ceuta on the west to the mouth of the Muluya, or, if the territory of the Beni Snasen be included, to the French town of Nemours. Its length is about 125 miles, while its breadth is very variable, being determined by the courses of the Wed Kus, the Wergha, and some of the tributaries of the Muluya. Continuous mountains fill the country, with summits attaining to a height of 6500 feet, and are intersected by precipitous ravines running north and south. The rocks are probably sand and limestone. Along the coast the mountains sink suddenly to the sea, forming numerous recesses, some of which might be converted into good harbours. There is a deep and roomy bay at Peñon de Alhucemas, and near Melilla an excellent harbour might be formed by moles, as also opposite the Zafarin Islands. In the small inlets of the Rif, pirates lie in wait with their feluccas for European vessels, and many a ship supposed to have foundered has fallen a prey to these barbarians, and its crew been slain or sold as slaves. Bonsal (*Morocco as it is*) saw in 1892 a Spanish slave at Fez, and procured his liberation. In this rugged mountain land there is no open ground for agriculture, but fruit-trees thrive, and horticulture is to some extent pursued by the natives. They grow excellent olives, figs, and grapes, and from the last manufacture a kind of wine—for all the Rif-Berbers, though professedly Mohammedans, are addicted to wine and spirits. Apricots, peaches, and almonds are also cultivated, and, in sheltered spots, lemons and oranges. These fruits the Berbers barter in Anjera, El Gharb, and Angad for barley; but they are unwelcome guests in these provinces, and the inhabitants are glad to get rid of them as soon as possible. A native of Morocco hardly ever ventures into the Rif, where he is nearly certain to be robbed of all his possessions, even if nothing worse befall him.

The only person the Rif people respect is the Grand Sherif of Wazan. Sherifs visit the country every year to collect contributions, but they are not treated with the same reverence as in other Mohammedan lands.

The Berbers live in small villages, usually on the summits of hills or mountains, from which they take their names. Around the villages grow olives and other fruit-trees of the Mediterranean zone, while below extends the forest characteristic of the country, composed of *Thuja*, *Lentiscus*, pines and oaks, especially the scarlet oak (*Quercus ilex*), ashes, etc. Wild animals are plentiful; the lion has, indeed, disappeared, but panthers, jackals, and hyenas are still to be found. Wild boars are frequently killed by the Berbers, who do not hesitate to consume the flesh. The wooded hills are also peopled with pigeons, francolins, partridges, and singing birds, among which nightingales are very common in spring; while the brooks swarm with fish, especially at their mouths.

A village contains usually about forty or fifty houses. These houses are 16 to 20 feet long by 10 feet broad, and are built of stone, and have no windows. The pointed roof is formed of rafters of aloe wood, and is thatched with barley or wheat straw. Furniture there is none, except, perhaps, a few mats whereon the occupants of the house sleep at night. If visitors come to a village, they find shelter in the mosque, for, unless a Berber be very rich, his sheep and goats share his house. These mosques are of the most simple description, and contain no furniture ; only the Kibla (the direction of Mekka) is indicated. The Berber of the Rif, like all others of his race, has only one wife, who takes her share in all important affairs ; but, as the women always eat alone, there is no real family life.

In appearance the people of the Rif are not exactly ugly. They are usually of high stature, slim and thin, with an arched nose, high forehead, and small hands and feet. Their eyes are black, and also their hair, which grows to a considerable length. Some travellers have spoken of Berbers with light hair and eyes, and have attributed to them a descent from Goths, Vandals, or other Europeans (see vol. v. p. 41) ; but Dr. Rohlfs never met such a Berber but once, and that was in Wazan. Though very ignorant and neglectful of some of the principal rules of the Koran, the Berbers of the Rif yield to no Mussulman tribe in religious fanaticism.

German South-West Africa.—In the *Mitth. aus den Deutschen Schutzgebieten*, Bd. vi. Heft 4, Capt. von François gives a short notice of the journey he made in 1892 to the Kalahari district. Though the soil is sandy, showing here and there a substratum of limestone, vegetation is by no means scarce, and to the east of Nosob trees become numerous, and to the north and west of Lehutitang form dense forests. Acacias of different varieties are the most common forms. The luxuriance of the grass also is a sign of sufficient rainfall. In the Kalahari district about 370 acres are under cultivation, of which about one-third are planted with water-melons, which are used in the dry season as a substitute for water. There are few pools that contain water all the year round, and in some of these the water during extreme drought becomes bitter and poisonous. But a small part of the arid country lies within the German sphere, and here, in Captain von François' opinion, a constant supply of water might be obtained by the sinking of wells. The inhabitants of this part of the German territory are composed of Bakalahari (6000), Bechuana (400), Geikaus-Hottentots (300), Haiumga and Gabe Bushmen (500). The last are the original dwellers in the land, and were joined in the seventeenth century by Bakalahari from the northern districts of the Transvaal, and about twenty years ago by the Bechuana. The huts are of grass in the form of a beehive, and the groups of huts are surrounded by a fence. The huts of the Bechuanas are far more neatly built than those of the Bakalahari. The language of the latter resembles that of the Bechuana, and the Bushmen speak a dialect similar to that of the Namas. The skin of the hartebeeste is used for clothing, and straw or felt hats are worn on the head. The women bedeck themselves with chains of beans, grass roots, and rings made from ostrich eggshells. The Bakalahari are armed with percussion guns imported through Kuruman, while the Bechuanas and Hottentots generally carry breechloaders. The Bushmen and a few of the Bakalahari use bows and arrows, poisoning the latter with the juice of the *goa* root. For the chase small sandals are worn, the points of which are turned back under the ball of the foot. The spring-like action of these sandals enables the hunter to overtake the swiftest-footed animal. The Bakalahari possess about 5000 head of cattle and some 50,000 sheep and goats, and the numbers increase yearly. The customs of this people, their dances and songs, have much resemblance to those of the mountain Damaras, and the headman informed Captain von François that his forefather had left the Transvaal with a tribe which had gone further westwards. The mystery, therefore, which has hung over the history of this people, who more than fifty years ago lost their original dialect, seems to be now cleared up. Game, formerly so numerous, is now comparatively scarce. Giraffes are almost extinct, and the ostrich is seldom seen. Gnus, hartebeestes, and springboks are still numerous. Snakes are particularly common, especially puff-adders and cobras.

Unfortunately, the dromedary post between Walvisch Bay and Windhoek has not been a success, probably through improper management of the animals.

AMERICA.

Boundaries in the United States.—In the *Bulletin of the American Geogr. Soc.*, vol. xxv. No. 4, part 1, it is remarked that the boundary lines of the Yellowstone Park are as yet unmarked, though twenty years have elapsed since the region was set apart for public use. The position of certain portions of the northern and western boundaries are as yet undetermined. The limits of the Sequoia Park, a tract about twenty-four miles long by six to twelve broad lying to the south-east of Fresno, California, have never been laid down. The country is, moreover, inaccessible owing to the absence of roads or even trails. The great feature of this park is a splendid forest occupying an area of some three miles square on an elevated plateau east of the Marble Fork. Most of the trees exceed 300 feet in height, and here the giant *Sequoia*, with its huge trunks 15 to 25 feet in diameter, attains its finest growth.

The boundary line between north and south Dakota has been surveyed and distinctly marked. The preliminary surveys for the determination of the north-western boundary between the United States and Canada and between Alaska and British Columbia have been almost completed by the Coast Survey. The same department has also commenced the surveys for laying down the boundary between California and Nevada from Lake Tahoe to the Colorado river, and for the adjustment of the line between Pennsylvania and Delaware.

It is suggested that the petrified forest, near Holbrook in the eastern part of Arizona, be set aside as a national park. It occupies 10,000 acres, and the ground is nearly all covered with trunks and limbs of petrified trees of every size and colour.

The Highest Meteorological Station in the World.—Mr. Lawrence Rotch gave an account of the new meteorological station in Peru in the October number of *The American Meteorological Journal.* In 1887 Mr. Uriah A. Boyden left a sum of money to the Harvard College Observatory to aid in the establishment of an observatory at such an elevation as to be free from disturbing atmospheric influences. Preliminary experiments in Colorado and California proved that the selection of a proper site did not depend on elevation alone, and it was thought desirable to try a tropical land. Finally a site was chosen overlooking the city of Arequipa in Peru. The observatory was erected in 1891 on the crest of a hill about 400 feet above the city, and 8500 feet above sea-level. It stands approximately in 16° 22′ S. lat. and 71° 22′ W. long. Twelve miles to the north rises Chachani, 20,000 feet high, and it is on this mountain, just below the permanent snow-line and on the south-eastern flank, that the new meteorological station is erected. Its elevation is 16,650 feet above sea-level. Direct observations have been made three times a day, at 8 A.M., 2 and 8 P.M., for the past two years; but they have not yet been reduced. At Arequipa the atmospheric pressure and air temperature were very uniform throughout the year 1891-92. The highest barometer reading was 22·676 inches on August 17th, and the lowest 22·472 on Jan. 19th. The maximum temperature, which was unusually high, was 79° on June 3rd, and the lowest 38·5°, eight days afterwards. The temperature never descended to freezing point, but there were occasional frosts. Most of the rain, amounting to two or three inches, fell in January and February. The diurnal range of temperature and pressure is small. At Mollendo, the sea-level station, the chief minimum and maximum pressures occur about 5 P.M. and 11 P.M. respectively, with secondaries at 4 A.M. and 9 A.M.; at Arequipa the chief minimum occurs about 5 A.M., and the secondary about 4 P.M. The night maximum occurs at about the same hour as at Mollendo, but the secondary day maximum is retarded to 1 P.M. The records at Chachani are at present too few to determine the pressure period, but there appear to be double daily maxima and minima about the same hours as at Arequipa. This is an interesting fact, because some preliminary observations of M. Vallot on the summit of Mont Blanc showed a single maximum about 1 P.M., and a single minimum about 4 A.M. In March the plateau on which the station is placed was covered with snow to a depth of two feet, and ice formed at night as low as 11,500 feet. The range of temperature from January to March was from 13° to 46° F. The decrease of temperature in the 8600 feet of air between the station and the observatory on March 9th and 10th was one degree for 284 feet in the morning, and one degree for 309 feet in the evening.

All the meteorological observations would be much more valuable if obtained in the free air on the summit of Chachani. It will, however, be a difficult matter to establish a station 3400 feet higher. Should it be impossible to place instruments on the summit, a lower and more accessible peak to the west of Chachani may be utilised.

MISCELLANEOUS.

Montego Bay, Jamaica, is now connected by railway with Kingston.

The *Mouvement Géographique* of January 21st contains a chart of the section of the Congo Railway from Matadi to Kenge, now open for traffic.

A line of railway laid last January on the ice of the Volga from Saratof to the Pokrofski suburb has proved a successful means of communication.—*Deutsche Rundschau*, Jahrg. xvi. No. 6.

Mr. H. M. Becher has lost his life by a sudden flood, while attempting to scale the Gunung Tahan in the province of Trengganu, Malay Peninsula. He estimated the height of the mountain at 8000 to 9000 feet.—*Petermanns Mitt.*, Bd. xl. No. 1.

A twin-screw steamer of 540 tons and 170 feet in length, built at Dumbarton, has been carried out to Peru and placed on Lake Titicaca. It is now plying regularly on the highest navigable water in the world.—*South American Journal*, February 17th.

Mr. N. B. Conger of the U.S. Weather Bureau, has launched 2000 bottles on the great lakes. Of those comparatively few have been picked up; in Lake Superior only 34 out of 800. The result of this work is to be given in a special bulletin.—*Monthly Weather Review*, November 1893.

According to the *Bulletin of the American Geographical Society*, the tale of a whaler, the *Newport*, steaming as far north as 84° N. lat. (see vol. ix. p. 655) is an invention of a newspaper reporter. The captain reports that he reached 73°, and, seeing no ice-blink to the north, concluded that there was open water for probably forty or fifty miles.

In the *Transactions of the Northern Association of Literary and Scientific Societies*, vol. xi. part 1, Mr. Richardson, Hon. Secretary of this Society, has published a paper on **Physiographical Geology**, in which he treats of the connection between geology and surface features, chiefly as exhibited in the neighbourhood of Callander, and discusses the inland-ice theory and the views of its opponents.

Captain Roborofski, leader of the Russian Geographical Society's expedition to **Central Asia**, has sent a letter from Luntshun dated November 14th, 1893. The expedition crossed the Great Yuldus valley to Kara-shar, passing over the mountains on the north to the source of the river Algo, which descends to the Lunshun depression. The latter Captain Roborofski asserts to lie 1000 feet below sea-level (?). Having established a meteorological station here, the party went on to Sa-chu. During four months more than 1300 miles had been surveyed, eight positions had been fixed astronomically, and various observations had been taken. A large collection of animals and plants had been made.—*Petermanns Mitt.*, Bd. xl. No. 1.

Herr Elis Nilson has kindly sent us the following communication on the object of the journey to **Ellesmere Land** on which he has just started :—"The Swedish naturalist, Björling, having received the 'Vega Grant' for scientific exploration from the Anthropological Society of Stockholm, left St. John's, with Kallstenius, on board the *Ripple*, at the end of June 1892, with the object of exploring Ellesmere Land and tracing out its western coast. He hoped to return to Europe the same year. The other members of the expedition were the captain, Karl Kann, a Dane ; the mate, Gilbert Dunn, an Englishman ; and a Scotch steward, named Herbert M'Donald. In spite of heavy gales and the unfavourable condition of the ice, the schooner reached the Carey Islands in the month of August, but there it was driven ashore by the ice. The shipwrecked men made an attempt to reach the Eskimo living at Foulke Fjord, but for some reason or other they changed their plans on arriving at Northumberland Island, and returned to the Carey Islands. There one of them died—probably the Dane. From a letter that has been found it seems that it was the intention of the party to leave the islands again on October 12th, and to proceed this time to Clarence Head, and thence, if possible, to reach the Eskimo said to be living on the west coast of Ellesmere Land. Further information was to be deposited in a cairn at Clarence Head.

"Since then nothing has been heard of them. No one has been to Clarence Head, nor have all the letters said to have been left on the Carey Islands been recovered. There is little hope that the explorers are still alive, but it would be some consolation to their relatives if their fate were ascertained. The Anthropological and Geographical Society has, therefore, through Professor Nordenskiöld, commissioned me to try and reach the Carey Islands and Clarence Head on a whaler, and obtain all the information possible. About March 20th I sail in the Dundee whaler *Eclipse*, and hope to be back again in October. Should I meet with anything of interest, I shall be happy to give an account of it to the Royal Scottish Geographical Society."

NEW BOOKS.

China and her Neighbours. By R. S. Gundry. London : Chapman and Hall, 1893. Pp. xxiv + 408. *Price* 9s.

Under this heading Mr. Gundry has collected a number of essays which had previously appeared in various newspapers and magazines. The first seven treat of France in Indo-China, the next four of Russia and China, and the last four of India and Thibet. As was to be expected from the manner of their first production, each essay is complete in itself, and occasionally the same information is given in different essays. This inevitable overlapping in no way detracts from the value of the collection as a whole, and has indeed a distinct value in emphasising important aspects and elucidating the connection of events. To most readers, the chapters on France in Indo-China will probably prove the most fascinating; first, because less is known in this country of the movements of the French in Saigon, Cambodia, and Tongking; and second, because of the strong light Mr. Gundry throws upon the motives which have all along inspired France in her colonial policy. The recent Siamese difficulty has brought forward prominently the fact that, in the near future, we may have to reckon with France in Asia as well as with Russia in Asia; and, to take an intelligent view of the situation, we should all become acquainted with, at any rate, the broad outlines of the historic developments which have brought matters to the present pass. And this it is which Mr. Gundry has supplied us with. His narrative is well worth the study of all who have any interest in the East—and who amongst us has not some? As an indication of the historic importance of these essays, we cannot do better than quote from the Introduction, in which Mr. Gundry says:—

"The series of papers, for example, on French operations in Indo-China, written to elucidate the several events as they took place, will, it is believed, be found to furnish a fairly complete narrative of the whole course of that remarkable enterprise, which cannot fail to interest the political moralist at the moment when it has culminated in the most cynical aggression of modern times.. The dual motive of hostility to England and the glorification of France, which has animated French policy in Asia, has undergone no variation whatever since France had a policy in Asia at all. Monarchies, republics, and empires succeed each other, but the spirit remains the same through all these superficial changes. It is candidly avowed, and there need be no delicacy in putting the truth in plain language."

The first of the four essays, devoted to the relations between Russia and China, gives a graphic sketch of the political incidents which group round the Kuldja difficulty of 1880. A broad outline is next given of the history of Corea, which, from its position, must necessarily play a growingly important part in the political development of the far East; while the third essay treats of the occupation of the island of Port Hamilton at the time of the Anglo-Russian crisis in the spring of 1885. In the last of the four chapters we find a general sketch of the history of Russian encroachments on the Celestial Empire, followed by a clear-cut picture of present-day relations, with hints as to probable futurities.

Finally, in the last four chapters under the heading of India and Thibet, Mr. Gundry writes an instructive account of the hitherto futile endeavours made to gain an entrance into the mysterious Lhassa. These have a most direct interest for us; and all should be familiar with the succession of events which have made Sikkim such an important factor in our Indian Empire. Taken along with Miss Taylor's recent paper, these cannot fail to be of great interest to the members of the Scottish Geographical Society.

The geographical references are rendered the more intelligible by two maps of China and the neighbouring States and territories.

Australian Commonwealth. (*New South Wales, Tasmania, Victoria, Western Australia, South Australia, Queensland, New Zealand.*) By GREVILLE TREGARTHEN. "Story of the Nations" Series. London: T. Fisher Unwin, 1893. Pp. xxi + 444. *Price* 5s.

If the desirability of including the story of the Australian Commonwealth in this series, and at so early a period after its partial consolidation, be doubted, there can be no question as to the skill and ability with which Mr. Tregarthen has performed his task. His plan is nowhere too ambitious for the space at his disposal, and he has thus produced a most readable and instructive sketch rather than a history proper, recording all facts of importance without speculation regarding their origin, or trying to dig too deeply after motive. He has also recognised that the early history of the colony is, for his purpose, best sought for in the careers of the early governors, and has devoted adequate space to the manner and effects of each administration, showing how, in those days, the character of each individual governor went far to mark the success or failure of his rule. In later times, the narrative more particularly concerns itself with the broader features of colonial life, trade, policy, and politics, when individual character no longer markedly influenced the course of events ; and if this part of the record is not always pleasant reading, that is no fault of the author. There can be no doubt that, since young Australia received the power of self-government, the tendency has always been to advance too far and too rapidly, with the natural result of a crisis—from which she is at present still suffering—at longer or shorter periods.

This volume amply attains the standard of the series to which it belongs. There are numerous illustrations, including interesting portraits of Cook, Phillip, Hunter, Bligh, and Banks, with some rough maps, and an index that might have been a little fuller with advantage.

Rio-Hacha et les Indiens Goajires. Par M. Candelier. Paris : Firmin-Didot et Cie., 1893.

The Goajires described in this admirable little volume are a race of nomadic Indians, who occupy the peninsula which projects into the Caribbean Sea, and forms the north-east extremity of Colombia, one of the republican States of S. America. This peninsula, which is comprised between 11° 5′ and 12° 30′ of north latitude, has for its eastern boundary the Gulf of Venezuela, and for its southern the mountains of Oca and the river Rancheria, which at its mouth, where it is about half a mile wide, is called the Calacala. Its northern portion is traversed by three ranges of hills nowhere higher than 1500 feet, and produced, as their structure shows, by volcanic eruptions. As they attract the rain-clouds wafted from the ocean on the wings of the trade-winds, which prevail for about three-fourths of the year, their sides are clothed with verdure and cultivated to a considerable elevation. They absorb, however, all the moisture distilled from the clouds, and hence the spacious sun-scorched plains which lie between them are, from want of rain, reduced to wastes of unmitigated sterility. The southern portion, again, is almost entirely level, and consists of pasture-lands, which are here and there diversified with thickets of prickly shrubs or with swamps and lagoons. M. Candelier has much to say in praise of the natives, among whom he lived for about two years and a half, for the purpose of gaining a close insight into their ways of thought and action, as well as of exploring their country. Physically, the Goajires are a fine race of men ; their frames are strong and robust, their features handsome, and their bearing proud and dignified. At the same time, they are distinguished for their love of independence. Their territory is, no doubt, included within the dominions of the Colombian Republic, but their subjection is nominal and altogether illusory. The most striking fact regarding them is that they have preserved in unimpaired integrity the laws and usages characteristic of the primitive stages of human society. They are still the children of nature—innocent of all civilisation. Of religion they know nothing, and they are the despair of the Christian missionary. Among their virtues, hospitality of the type practised in Arabia is conspicuous; and among their vices are specified drunkenness and a readiness to resent and revenge an injury, however unintentionally it may have been inflicted. Polygamy is practised, and the wives do all the drudgery work. They are faithful to their husbands, but the children are nevertheless, according to primitive custom, considered to belong to their mother's caste, and the rights of the father devolve upon the maternal uncles. The Goajires consist of thirty castes, each distinguished by the name of some animal or bird. Their number is in all above 30,000. The nominal capital of the peninsula was formerly San Antonio, a village of some thirty huts, built on the right bank of the Calacala; but the effective capital is now, and always was, Rio-Hacha, which stands at a short distance from the left or southern bank of that river, and has a population of upwards of 4000. It draws to it all the products of the peninsula available for commerce, and forwards them either by land or by sea to their proper markets. It is a town of mean appearance and without sanitary appliances. Our author has little good to say of its inhabitants, who are either of Spanish or mixed descent. They are indolent, dirty in their habits, and grossly superstitious. M. Candelier returned to France towards the end of 1892. He paid dearly for the knowledge he brought home with him, for in the course of the expedition he lost his son, a promising youth of nineteen, and he himself was brought to the verge of the grave by a violent fever, by which he was prostrated for several months. The work he has produced is as charming as it is instructive; it is very racily written, and adorned with numerous illustrations taken from photographs.

Selections from Strabo. With an Introduction on Strabo's Life and Works. By the Rev. H. F. Tozer, M.A., F.R.G.S. With Maps and Plans. Oxford: Clarendon Press, 1893. Pp. 376.

In the belief that Strabo is an author to whom not only geographers and historians but also naturalists and folk-lorists are much indebted, Mr. Tozer has here made a copious and judicious selection, from the *Geography*, of the more interesting passages, which are rendered more valuable by useful notes. In the Introduction the date of Strabo's birth, generally placed between 68-54 B.C., by an ingenious process of reasoning is more definitely fixed at 63 B.C. His philosophical, religious, and political opinions are then dealt with. As a traveller he was personally acquainted with a large part of Asia Minor, with Egypt as far as the first cataract, perhaps with Rhodes and Samos, with Corinth, Rome, and a good many other places in Italy. But, nevertheless, in Mr. Tozer's opinion, his journeys were not made with the object of research or to verify the statements of former writers. It is often supposed, from internal evidence, that the *Geography* was written at Rome; but two good reasons can be brought against this view. A war in Africa between 17-24 A.D.—Strabo was certainly still alive in A.D. 21—is not mentioned, a circumstance which could hardly have happened had he been living in Rome. Again, his work met with very scanty recognition in Antiquity, and is not even named by Pliny. From this it may be inferred that the *Geography* was published in the provinces, perhaps at his native town of Amasia in Pontus. It aimed at instructing an intelligent public about other parts of the world, and its greatness consists in its encyclopædic character. It is such a storehouse of facts, and contains such a mass of geographical, ethnological, mythological, and other information, that it never can fall into complete oblivion. It will ever retain a permanent place on the book-shelves of successive generations.

Travels in India a Hundred Years Ago, with a Visit to the United States: being Notes and Reminiscences of Thomas Twining, a Civil Servant of the Honourable East India Company. Edited by the Rev. WILLIAM H. G. TWINING. With Portrait and Map. London: James R. Osgood, M'Ilvaine and Co., 1893. Pp. xii. + 537. *Price* 16s.

Except in the map of the Ganges and its tributaries and towns from the Bay of Bengal towards their sources, this volume is a valuable and, indeed, charming addition to Anglo-Indian literature. Like the wine which the East Indiamen used to take to and from India, Mr. Thomas Twining's journal has received additional value from the century's delay in its publication. The reader can now contrast the India of 1894 with what the young civilian records of it in 1794. The present writer, in 1854, made a boat voyage up the Hoogli rivers to the Ganges and on towards Delhi, exactly similar to that here described, and touched at the same towns. Santipore, from which Thomas Twining sailed, long ago ceased to be a factory; Moorshidabad is half deserted; Rajmahal and its ruins are nearly covered over by vegetation; and so on. The people, the country, the general aspect are the same. But missionaries and planters—all too few—dot the banks; railways and telegraph wires course along them; steamers carry the traffic; magnificent bridges span the streams; the Mutiny has come and gone; the old East India Company has given place to the Empress and her Viceroy; and a new spirit of progress, of unrest, of seeking after God, and even of finding Him, is working out remarkable results. Thomas Twining describes the land of William Carey's first efforts, and his journal sounds like the voice of a buried century. This illusion is even deepened when we are introduced to George Washington, and see the first Congress of the United States in Philadelphia. Truly an invaluable and delightful book, from which we may extract this anecdote of Plassey, which seems to us new. Mr. Twining visited the battle-field, or what was left of it, along with the Commander-in-Chief of that day, the brother of our Sir Ralph Abercromby, and his staff. These experts represented the engagement as almost a drawn battle till Jaffier Khan deserted the young Nawab. After his victory, Clive returned to the hunting pavilion from which he had directed the conflict, and, while apparently in deep thought, he cut with his penknife his own name "Clive" on the arm of the chair. Was he thinking of his personal fame, or did he realise that Great Britain had now virtually been made ruler of Southern Asia?

A Mission to Gelele, King of Dahome. With Notices of the so-called "Amazons," the Grand Customs, the Yearly Customs, the Human Sacrifices, the Present State of the Slave-trade, and the Negro's Place in Nature. By Captain Sir RICHARD F. BURTON, K.C.M.G., etc. etc. Edited by his Wife, ISABELLA BURTON. Memorial Edition in 2 Vols. London: Tylston and Edwards, 1893. Pp. xxi + 256 and viii + 305.

This is the second of Sir R. Burton's works that has appeared in the present series, and one of the best known. It is not the less valuable in that it describes a state of affairs very different from the present; the French power, that is advancing so rapidly over West Africa, has for some time been preponderant in Dahomey, and since its recent conquests that once important kingdom has become a thing of the past, and goodly detachments of the famous "Amazons" have performed their evolutions in Paris and Edinburgh theatres. The book is very characteristic of the author. While not free from occasional confusion, and garnished with the strange words which it amused him to coin, the style is unfailingly vigorous and lively, and the narrative rich in illustrations or digressions drawn from the author's copious store of anthropological gleanings. As usual, when certain subjects come up they are treated with an unconventional directness. He has very definite opinions as to the essential inferiority of the Negro race, and gives free play to a cynical satire in dealing with the absurdities of various Negrophile writers;—but further notice of so well known a work is unnecessary.

L'Égypte et les Égyptiens. Par LE DUC D'HARCOURT. Paris: Plon, Nourrit et Cie., 1893. Pp. xi + 305. *Price* 3 *fr.* 50.

This is an interesting book. The writer of it, in the course of three successive visits to Egypt, has made it his aim to study the people mainly from the point of view of race, and has gone to history to account for the facts and tendencies of the present time. He divides the contents of his book into two parts. In the first three chapters of the first part, he treats of the people of Egypt generally, and their social condition. In the fourth he treats of the Copts, and in the fifth of the Turks, according to the sense in which this word is used in Egypt. In the sixth he treats of the position and condition of the women, of their life in the harem and their education; in the seventh, of slavery and the conventions for its abolition. This last is one of the most instructive. In these chapters there is not a page but is full of suggestions for thought and study. In handling, however, the estimate of the different races and their characteristics, the writer is apt to forget that one and the same scale cannot be used. Hence, he has not quite done justice to the Copts in judging them mainly by a military standard. His estimate in this case has been challenged, and he has a note with reference to the point.

Is it possible for the "habitants" of Egypt to constitute a "people" in a political sense, within a reasonable time? This is a question of great interest at the present moment. In the second part, which is a moiety of the book, the Duc d'Harcourt discusses the intellectual and moral state of Egypt, and the prospects of civilisation. In the course of it he has had to make a critical and historical study of Arab civilisation, and has put the gist of it into one of his appendices, since he cannot recognise the high merits which some ascribe to the historic *rôle* of the Arabs in the middle ages. But the Duc d'Harcourt writes more as a statesman than as a savant. His thoughts and views, therefore, are of practical importance with regard to the duty of England in Egypt. He is remarkably free from the jealousy which is apt to distort the view of facts where the interests of England and France are concerned. The writer's style, and the print of the book, make it easy and agreeable to read.

The Memoirs and Travels of Mauritius Augustus Count de Benyowsky in Siberia, Kamchatka, Japan, the Liukiu Islands and Formosa. From the translation of his original manuscript (1741-1771), by William Nicholson, F.R.S., 1790. Edited by Captain PASFIELD OLIVER. London: T. Fisher Unwin, 1893. Pp. 399.

The European colony at Macao, in the month of September 1771, was perturbed, and its curiosity raised to the highest pitch, by the arrival of a dilapidated vessel flying the Hungarian colours, and commanded by a certain Baron Benyowsky, who gave himself out to be a personage of high importance. In 1783 he came to England, where he managed to impose upon two members of the Royal Society by means of his plausible manners and the romantic nature of his adventures, alleging that he had visited various islands off the American coast beyond Bering Strait. Before leaving England on a freebooting expedition to Madagascar, where he lost his life, he left his written memoirs with Mr. de Magellan of the Royal Society, who had advanced money to the Count. These memoirs pretend to set forth his life from the time he entered the army till his arrival in China. From a geographical and ethnological point of view they are absolutely valueless. But as fiction, as a human document, as a portrait of what an adventurer of the last century wished to be thought like, this volume may well find a place in 'The Adventure Series,' of which it forms the latest representative. The interest of the narrative—almost entirely fictitious—is well kept up and entirely centred round the person of the Count, who is the *deus ex machinâ* that sets everything right when everything seems to be going most wrong.

At p. 100 the editor in a note, through an oversight, makes the Angara flow in a north-easterly direction from the sea of Baikal into the Yenisei. The book is accompanied by several illustrations and a map. Though the Kurile islands are often mentioned in the text, and their positions and individual names are marked on the map, yet the engraver has omitted the general name of the group.

La Nation Canadienne. Étude historique sur les Populations Français du Nord de l'Amérique. Par CH. GAILLY DE TAURINES. Paris: E. Plon, Nourrit et Cie., 1894. Pp. xii+338. *Price* 3 *fr.* 50.

In singular contrast to the French population of the mother-country, which is retrograde rather than progressive in numbers, the French population of Canada is rapidly increasing, and, according to the writer of this work, most meritoriously increasing, at a rate which surpasses that of their Anglo-Irish fellow-colonists. That a Frenchman, turning his regards to the banks of the St. Lawrence, should look back upon the past with fond regret, and permit his imagination to sport with the possibilities of the future, is only natural; such reflections as the contemplation awakens in his mind are very creditable to his patriotism, whilst in the eyes of the successful rival they are, to say the least, excusable and not unjust. M. Ch. Gailly de Taurines cherishes an exceedingly tender sympathy for his compatriots across the Atlantic, who were lost to *la belle France* through *la belle France's* own culpable indifference and thoughtlessness; and he cannot suppress the keen regret he feels at the fact. In spite of that, however, the little monograph he here gives us is brightly written, adorned with no inconsiderable store of literary graces, and altogether makes uncommonly pleasant reading—especially if you scan its pages through the author's golden spectacles! Of the "Canadian nation" he entertains a very high opinion, and invests them with the task which France discharges in Europe—to act as the centre whence culture and civilisation are diffused throughout the adjacent continent. His information appears to be fairly accurate and not too old; indeed, he seems nearly everywhere to have availed himself of the latest statistical reports. The subjoined brief extract gives a favourable specimen of his manner:—"Sir John A. Macdonald, who was Premier for an almost uninterrupted period of thirty years, is a curious type, and easily occupies the first place amongst the statesmen of Canada. Possessed of that ductility of conscience that works round difficulties, and the steely firmness of will that breaks them; perceiving clearly the ends he desires to attain, and pursuing them either directly or by such detours as the difficulties of his path render necessary; sufficiently clever and ingratiating not only to keep under his flag the most irreconcilable enemies, but to compel them to fight for his own peculiar objects; the idol of the anti-French, anti-Catholic Orangeists, to whom he always accorded his efficient protection; courted also by the Catholics, to whom he was never sparing either of words or promises; hiding an iron will under a smiling and ingenuous countenance, Sir John had in him the stuff of a thorough politician. His work was worthy of his ability: a state as extensive as Europe, bathed by two oceans, and crossed by the longest railway in the world—is not that indeed a creation to be proud of?" A commendable compilation, a creditable study, M. Gailly de Taurines' book may be read with both entertainment and profit.

American Big-Game Hunting: The Book of the Boone and Crockett Club. Editors THEODORE ROOSEVELT, GEORGE BIRD GRINNELL. 8vo. Edinburgh: David Douglas, 1893. Pp. 345. 16 pls.

We hail this beautifully printed and illustrated volume with enthusiasm, for it is the book of the Boone and Crockett Club. This is a club of sportsmen who have among their objects that of working for the preservation of the large game of North America. We wish that similar clubs would spring up everywhere. For while biologists are busy with theories of evolution and zoologists ply the microtome, many of the earth's finest animals are disappearing for ever. But in this club and in its book we have a practical recognition of the rights of the creature which makes us glad. The book is by many authors, who write vigorously, as sportsmen usually do, about the buffalo, the elk, the white goat, the prongbuck, the grizzly, and other big game, about "fair chase," and about the Yellowstone Park as a reservation land. It is not only an interesting book for sportsmen, but it gives vivid pictures of the North American fauna, and contains not a few items of precise zoological information. To us it is most interesting as a proof that the human conscience is not hopelessly degenerate as regards the rights of animals.

Matabeleland: The War, and our Position in South Africa. With Sketch Map of the Country. By ARCHIBALD R. COLQUHOUN, First Administrator of Mashonaland. London: The Leadenhall Press, Limited, N.D. Pp. vii+167. *Price 2s. 6d.*

This is a short but clear *résumé* of the principal events, now more or less familiar to our readers, leading up to the present position of affairs in the Matabele country. Mr. Colquhoun is a practised writer, and from his personal connection with the country—having gone up with the first pioneers, and acted for some little time as Administrator of the settlement—he necessarily speaks with knowledge and authority. The book cannot, however, be called an exhaustive or adequate account of "our position in South Africa," which is a very much bigger subject.

Mr. Colquhoun considers that South Africa is "assured of a brilliant future," his assumption resting mainly on the effects of the enormous wealth of the country in gold and diamonds. We should like some definite estimate, if that were possible, of the increase of prosperity in the colony due to the export, in the last twenty years, of diamonds estimated at £70,000,000. As regards the gold, it is perhaps too early as yet for the effect to be visible, seeing that the export began practically only six years ago: it was then 34,000 ounces; it has since then risen to 1,056,000 ounces for the first nine months of 1893.

The writer points out that the Matabele are not entitled to any special consideration on the score of long possession, as they only occupied the country 50 years ago, and have since maintained themselves chiefly by raids on their weaker neighbours. This practice has reacted on the race, for while they slaughter the men, they adopt the young women and children, and the admixture of local blood has thus weakened the pure Zulu element. As regards the future development of the country, however, this is, he considers, an advantage, as the mixed race will adapt itself more readily to peaceful habits, agricultural or pastoral. The notion of "driving the Matabele across the Zambesi" is, as he observes, quite unpractical—not merely would it create difficulties for us in the north, but the depopulation of the newly acquired territory would seriously diminish its value.

Letters of Travel. By PHILLIPS BROOKS, late Bishop of Massachusetts. London: Macmillan and Co., 1893. Pp. 386. *Price* 8*s*. 6*d*. *net.*

Bishop Brooks was so charming a preacher that these *Letters* seem to the present critic to fall below his reputation. They are too private, too colloquial and careless, too sketchy and full of repetitions of such epithets as "queer" and "funny," to be worthy of publication. They appear in anticipation of the *Life* of the good Rector of Trinity Church, Boston. It would have been better to have incorporated in that memoir those which reflect the private life of such public men of England as Tennyson and Browning, Mr. Gladstone and Dean Stanley. The letters descriptive of foreign travel, especially in India, are meagre. But all are genial, loving, and frequently quietly humorous.

Obock. Exploration du Golfe de Tadjoura, du Gubbet-Kharab et de Bahr Assal. Par L. DE SALMA. Paris: A. Faivre, 1893. Pp. 153.

The purpose M. de Salma had in view in visiting the French colony of Obock lying on the Somali coast a little south of the Straits of Bab-el-Mandeb, was not scientific but commercial. He hoped to get a concession to allow him to exploit the rich salt deposits on the shore of Bahr Assal. Indeed, he pours forth the vials of his indignation on the numerous scientific missions sent to distant lands at the expense of the State to collect mere shells or insects.

The first cession of territory at Obock was made to France in 1862, though no use was made of it till 1884, when the infamy of England in refusing to furnish coal during the Tonquin affair forced the Government to establish a coaling station at Obock. A French firm has been granted the monopoly of supplying the French navy with coals at the rate of from 73-75 frs. a ton, though these can be obtained in Aden for from 38 to 42 frs. The caravans that ought to reach Obock or Djiboutil, on the south side of the Gulf of Tadjoura, are diverted to Zeila, a little further south and under British protection, because from it there is weekly communication with Europe and other ports, instead of monthly, as in the French region. All this is due to the perfidious energy of the English, who do their best to thwart on all occasions the legitimate aspirations of France.

Though M. de Salma has the greatest horror of Great Britain, he has quite an Englishman's love of grumbling. To him the smallest State-paid official is an insupportable and odious being; and the service of the Messageries Maritimes between Marseilles and Alexandria is so detestable that he is tempted to forswear the line for ever.

The Mohammedan Dynasties. Chronological and Genealogical Tables, with Historical Introductions. By STANLEY LANE-POOLE. Westminster: Archibald Constable and Co., 1894. Pp. xviii + 381.

This manual will be of the greatest assistance—nay, we may confidently say, will be indispensable—to all students of the history of the various Mohammedan States. Those who have been aided in finding their way amid the perplexing revolutions and dynastic changes in Mohammedan Asia by the tables appended to Prinsep's *Indian Antiquities*, will be the first to welcome an exhaustive manual which includes Europe and Africa as well as Asia, and to appreciate the corrections which Mr. Lane-Poole's prolonged study of the original authorities has enabled him to make. The principles by which he has been guided in selecting the name by which a ruler is to be indicated, in determining orthography, and in fixing dates, commend themselves as reasonable and scholarly; and, as far as we have been able to test the tables, they have been consistently applied. Accuracy has been aimed at, and evidently no pains have been spared to attain it. To each table there is prefixed a short but admirably clear historical introduction. The manual thus contains not merely dry tables of names, but also a brief universal history of Mohammedan Powers and dynasties which any student of history, however little of a specialist he be, will read with pleasure and interest, and which gives in short compass an admirably comprehensive sketch of the rise and progress of Mohammedan dominion.

History of Trinidad (*First Period*) *from* 1781 *to* 1813. By LIONEL M. FRASER. Vol. I. Trinidad Government Printing Office, Port of Spain, N.D. Pp. 365.

"It was on the 31st July 1498, when on his third voyage of discovery, that Columbus first sighted the island to which, in pursuance of a vow, he gave the name of Trinidad." Yet we are assured by Mr. Fraser that Trinidad sank into oblivion until, in 1868, a new era commenced for the colony under the firm and able government of Sir Arthur Gordon, and until Charles Kingsley wrote, during his stay in the island at Christmas 1869, his charming *At Last*, to which Trinidad is mainly indebted for that constant stream of visitors who yearly visit its shores.

Mr. Fraser's *History* is rather a storehouse of facts than a work of literary pretensions. The first volume brings us down to 1813, when Sir Ralph Woodford became Governor, and inaugurated nearly every work of public utility which now exists in Trinidad. The book has been well printed at the Government Printing Office, and the production of this *History* does much credit to the island. We trust that a good map of Trinidad and an index will complete the work.

A Commercial Geography of the British Empire. By LIONEL W. LYDE, M.A. London: Methuen and Co., 1894. Pp. ix + 156. *Price* 2s.

This book is in two sections: an Introduction, dealing with general principles, mainly of physical geography; and an account of the commercial geography of the chief regions of the British Empire.

In the Introduction clearness and even accuracy have to a considerable extent been sacrificed to brevity. The student is referred to some text-book of physical geography should he find himself in difficulties, but even with this proviso such statements as the following should not occur: that the earth presents "four sides to the sun in the course of one complete revolution, and thus we have four seasons," and "as warm air rises, cooler air gravitates in to take the vacant place."

The commercial geography is on the whole well done. There is a freshness and directness about the statements that stamp them as the work of one well in touch with the recent progress and present condition of the parts treated of. But the irrigation colonies of Messrs. Chaffey in Australia might have been mentioned, and a book dated 1894 should not say that "Manchester is in process of being provided with a ship canal to the Mersey."

Hilfsbücher zur Belebung des geographischen Unterrichts. Von Dr. PAUL BUCHHOLZ. II.: *Tier-Geographie.* Zweite, verbesserte Auflage, pp. 134. IX.: *Charakterbilder aus Australien, Polynesien, und den Polarländern.* Zweite, verbesserte Auflage, pp. 95. Leipzig: J. C. Hinrich'sche Buchhandlung, 1893.

These two little books form part of a well-known series intended to give freshness and life to the teaching of geography. They seem to us very successful, and, if judiciously used, cannot but be helpful. For while the educational result must ever be mainly determined by the degree of art which the teacher possesses, he must be dull indeed who cannot utilise these books—packed with information of broad scientific and human interest—so as to make the geography lesson, as it ought to be, a pleasure to the pupils. Happily, we have now no lack of rational English guides to the right teaching of geography, with *Charakterbilder* such as No. IX. presents; but we do not, so far as we know, possess in English a primer on the geographical distribution of animals. That by Dr. Buchholz pleases us very much; it is simple, terse, and lively. It is not, of course, free from faults, such as the entirely unnecessary mistake of calling reptiles amphibians all through the book, and the remarks on the zoological position of the duckmole. But most of the facts are accurate, and the tone of the book is excellent.

The Romance of Navigation: A Brief Record of Maritime Discovery from the Earliest Times to the 18th Century. By HENRY FRITH. With Numerous Illustrations. London: Ward, Lock, and Bowden, Limited, 1893. Pp. xii + 312. *Price* 3*s.* 6*d.*

Although this book is mostly a compilation, it has been well done, and the author has completed his task in a very satisfactory and satisfying manner. The narrative is lively and instructive, and the numerous illustrations, though mostly old friends, are generally useful. There is a good index, and the volume is brightly bound. It will make a welcome present for boys.

The Royal Natural History. Edited by RICHARD LYDEKKER, B.A., F.G.S., F.Z.S. With Preface by P. L. SCLATER, M.A., Ph.D., F.R.S., Secretary of the Zoological Society of London. Illustrated with 72 Coloured Plates and 1600 Engravings by W. Kuhnert, F. Specht, F. J. Smit, G. Mützel, A. T. Elwes, J. Wolf, Gambier Bolton, and many others. Vol. i., Section i., pp. xii + 288: 3 coloured plates, 6 page plates, and 112 figs. London: Frederick Warne and Co., 1894.

This delightful book gives promise of being a worthy British analogue of Brehm's *Tierleben*, and one cannot but admire the enterprise of the publishers and the energy of the editor in undertaking so large a task. The section published is half of the first volume, and deals with apes, monkeys, lemurs, and bats; and we are told in Mr. Sclater's commendatory preface that two and a half volumes out of six are to be devoted to mammals. This ratio—confessedly adapted to a supposed or real popular appetite—makes us apprehensive on behalf of the simple forms of life. Who are the people who wish to know about so many monkeys? The editor's reputation is enough to assure us of the book's accuracy and intelligibility; among its less obvious virtues is the skilful and discriminating appreciation of the tales of the naturalist-travellers. The numerous illustrations are very beautiful; many are old friends from Brehm's *Tierleben*.

An Elementary Text-Book of Agricultural Botany. By M. C. POTTER, M.A., F.L.S., Professor of Botany in the Durham College of Science, Newcastle-upon-Tyne, etc. With 99 Illustrations. London: Methuen and Co., 1893. Pp. vii + 250, including an Index. *Price* 3*s.* 6*d.*

A useful little book, which aims at explaining in simple language the structure and physiology of plants, with special reference to those which occupy the attention of the farmer. The several members of the plant are treated of in successive chapters; and the author then proceeds to enumerate the constituents of plant-food, to explain the various methods of reproduction, and to deal briefly with some of the most important diseases, including finger-and-toe, potatoe disease, rust of wheat, and others. There are chapters on grasses and *Leguminosæ*, and on the botanical classification of agricultural plants.

The work, in which the author does not claim to set forth any new facts, is well arranged, and will prove valuable to agricultural students, for whose use it has been compiled.

A Handbook to Western Australia and its Goldfields. By HAROLD G. PARSONS, Barrister-at-Law. London: Swan Sonnenschein and Co., 1894. Pp. 134.

This handbook differs from that by Mr. Calvert, reviewed on p. 51, in so far as the scope is wider, such subjects as the agricultural and miscellaneous resources of the country, its geographical features, industries, etc., being treated of in a fairly full manner, in addition to information regarding minerals. Mr. Parsons writes in a fresh and frequently amusing style, and appears to treat the various subjects in a very impartial manner. His hints to intending immigrants are to the purpose, and ought to prove useful. Altogether, the work is a handy production, accompanied by a rough map, and wanting an index.

Western Australia in 1893. By FRANCIS HART. By Authority of the Government of Western Australia. London: Burton and Co., 1893. Pp. x + 276. *Price* 2s.

Western Australia appears to be determined to keep herself before the eyes of the world, if the issue of books on her potentialities and resources can do so; and the present work, published by Government authority, leaves little to be desired in extent of information upon most points likely to interest prospective settlers and investors. It is an excellent work of reference, and the manner in which the various subjects are treated is in every way satisfying. There are several good maps, and many full-page illustrations, which frequently want something in the way of better artistic reproduction. The want of both table of contents and index is much to be regretted, and ought to be remedied in future editions.

About Perak. By FRANK ATHELSTANE SWETTENHAM. Singapore: *Straits Times* Press, 1893. Pp. 78. *Price One Half-Crown, One Dollar, or Two Rupees.*

We lately noticed (vol. ix. p. 597) some of the more important facts connected with Perak, as set forth in the last issue of *The Perak Handbook*, and we would now draw the attention of our readers to this small volume, in which a good deal of supplementary and useful matter will be found. The printing is very clear and distinct, and the publisher's note, to the effect that the author had no opportunity of revising or correcting the proof-sheets, disarms the only hostile criticism we might feel inclined to indulge in.

De Tunis à Alger. Par MARIUS BERNARD. Paris: Librairie Renouard, N.D. Pp. 364.

This volume is one of a series, *Autour de la Méditerranée.* The author, M Bernard, visited most places of interest in Algeria and Tunis, and travelled as far south as Tuggurt. The most useful portions of the book are those dealing with the southern oases, which are less visited by the tourist—except Biskra, of course.

The style is very abrupt, and the itinerary is wanting in continuity. The author simply gives what amounts to "literary jottings": for the most part, these appeal to the student and artist rather than to the tourist.

The illustrations are good.

The Tangut-Tibetan Frontier of China and Central Mongolia. Journey of M. N. Potanin, 1884-1886. 2 vols. (in Russian). St. Petersburg: A. S. Suvorin, 1873. Pp. 557. Pp. xviii + 568 + xviii, and xii + 437 + xix.

During the last thirty years, the Imperial Russian Geographical Society has been exceedingly active in the promotion of exploration in Central Asia. The expeditions of M. Przhevalski are well known to all students of geography, and have been noticed in the *Magazine.* Nor is the name of the author of the present work, who is now travelling in China, by any means unfamiliar to our readers. The journey here narrated was undertaken at the instance of the Society, with the pecuniary assistance of M. V. P. Sukacheff. M. Potanin, accompanied by a geologist, A. I. Skassi, and a zoologist, M. M. Berezofski, both, like himself, experienced in Asiatic exploration, were conveyed to China in the frigate *Minin*, and, having made preparations for the journey in Tien-tsin and Pekin, made their way westward to the Whang-ho, and crossed it into Ordos. Here M. Potanin was able to examine the sandy dunes gradually moved across the country by the winds. An old Chinese traveller speaks of the district in his time as being called Sha-ho or "River of sand," and now there seems to be a constant movement commencing near Ling-chow, and taking a north-easterly course.

The winter of 1884-5 was spent by the expedition in the village of Ni-che, on the Upper Whang-ho, 6066 feet above sea-level, where the mean temperature in the coldest month, January, was 24° F., and the lowest reading observed, in December, was 6°. In the following summer the Kan-su frontier was explored as far south as Lun-an-fu, and then the party turned again northwards to the Si-nin river, or Shi-ho, which was followed to the Kuku Nor. In this country M. Potanin arrived in April 1886, and halted beside the small Dere Nor, which, as well as the larger lake, was covered with ice. The water is salt and bitter, but sweet water can be procured from wells dug on the very bank of the Dere Nor.

But it is useless to follow the expedition further in its journey northwards to Lake Baikal, or to attempt to give an abstract of the information contained in these bulky volumes. One chief object of the expedition being to observe the transition from the sub-tropical flora of the Chinese plains to that of the palæarctic region of the Central Asiatic highlands, we find numerous references to the vegetation. The various races met with on the route are defined, and their manners and customs described. In fact, the travellers collected information on all kinds of subjects, which, with the incidents of their journey, are here recorded in detail. The volumes are well printed on good paper, and illustrated by portraits of the explorers and natives, and excellent phototypes of views of landscapes, towns, and monasteries. A good map of the country and a route-map are also given.

Australia as it is; or, Facts and Features, Sketches and Incidents of Australia and Australian Life. With Notices of New Zealand. By A Clergyman. Third Edition. London: Longmans, Green, and Co., 1894. Pp. xi + 257. *Price* 5*s*.

Nowhere scientific, and often rambling, in his style of treating his subject, the author expresses himself with a homely energy and directness that carries with it the conviction that he writes of his own knowledge, gathered from a lengthened experience of Australian life and customs, as these are exhibited outside the towns. That the volume has shown its value as a work to be consulted by the intending emigrant, and by those having interests of any kind in these colonies, is proved by its having reached a third edition. In its present form it is neatly bound and clearly printed, but lacks both map and index.

NEW MAPS.

EUROPE.

WARWICKSHIRE, with Plans.

SHEFFIELD, Plan of ——, with Environs.

W. H. Smith and Son's series of Reduced Ordnance Maps for Tourists. By J. Bartholomew, F.R.G.S.

In the former of these maps the county of Warwick is given in the usual style of this series, and plans of the towns of Warwick and Leamington. The plan of Sheffield is accompanied by a map showing the environs for a distance of some twenty miles around.

ASIA.

CELEBES, Die Binnenseen von ——. Von Professor Dr. A. Wichmann. Das Stromgebiet des Tjenrana, Süd-Celebes. 1 : 200,000. Der See von Tondano und seine Umgebung. 1 : 300,000. Geologisches Profil des Sees von Tondano und seiner Umgebung. Geologische Skizze der Umgebung des Sees von Limbotto. 1 : 800,000. Geologisches Profil der Umgebung des Sees von Tondano. Der See A-Opa. 1 : 1,500,000.

Petermann's Geogr. Mitteilungen, Jahrgang 1893, *Tafel* 16. *Gotha: Justus Perthes.*

AFRICA.

HAUT-NIGER AU GOLFE DE GUINÉE, Carte du ——, 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. Échelle de 1,000,000[e].

Maison Andriveau-Goujon, Paris.

There are considerable additions in this new map derived in particular from the explorations of Dr. Crozat, Captain Marchand, Commander Monteil, and the Commission for the delimitation of the boundary between the English and French territories, of which Captain Binger was chief. The head-waters of the Niger have been inserted, many new localities in the Mossi country are indicated, the tributaries of the Mayel Balevel or Bani river are more exactly laid down, and many details are shown of the country west of the Comoe through which MM. Binger and Monnier travelled in 1892. The work has, like the former, been produced under the direction of the Service Géographique des Colonies, by which it has been presented to the Society. The execution is better than that of the first edition.

ZOUTPANSBERG GOLDFIELDS, Map of the ——. Compiled from latest information by Fred. Jeppe, F.R.G.S., Surveyor-General's Department, Pretoria, S.A.R., 1893. The Geological Formations are given by J. Klimke, State Mining Engineer. Scale 1 : 600,000. *The Geographical Journal. Sept.* 1893.

OCEANIA.

MARSHALL INSELN. Beiträge zur Kenntnis der Deutschen Schutzgebiete. Von P. Langhans. Dschalut-Gruppe, 1 : 500,000. Dschalut, auf Grundlage einer Vermessung des Ingenieurs B. Linnemann, 1 : 10,000. Einfahrt in den Hafen von Dschalut, 1 : 50,000. Hauptstation der Jaluik- (Dschalut-) Gesellschaft, 1 : 5000.
Petermann's Geogr. Mitteilungen, Jahrgang 1893, *Tafel* 17. *Gotha: Justus Perthes.*

STILLEN OCEAN, Die Deutschen Besitzungen im ——. Gezeichnet von Richard Kiepert. *Nachrichten über Kaiser Wilhelms-Land und den Bismarck-Archipel*, 1893.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE GEOGRAPHICAL UNITY OF THE BRITISH EMPIRE.

By Geo. R. Parkin, M.A.

(*Read at a Meeting of the Society in Edinburgh, March* 1894.)

(*With Maps.*)

In placing before you the large map of the World which Mr. Bartholomew has prepared for me to especially illustrate the position of the British Empire, it might seem as if I had furnished you with an ocular refutation of the very name which I have given to this address. In this map you at once see geographical diversity and separation apparently carried to their utmost extent. Parts of the Empire are found on every continent; they are in the extreme north and the extreme south; they are in the Frigid, the Temperate, and the Torrid Zones. The portion we examine may cover a continent, or half a continent; it may be a lonely island or an isolated promontory; it may be coloured deeply to indicate full possession, or it may have the subdued tint which points only to pervading influence. There are vast areas which are practically incapable of settlement or commercial development; there are others which already feel the full rush of human life and industry; and there are others still which lie only waiting for the presence of civilised man and the appliances of civilisation, to deal with their boundless resources, and transform them into happy homes and prosperous spheres of activity. There are prairies large enough to absorb the population of European kingdoms with ease; there are deserts in whose almost boundless wastes armies might be swallowed up and lost. Every ocean washes the shores of the Empire; ships are constantly making the full circuit of 25,000 miles around the globe without touching at anything but widely separated British ports.

Population is as diversified as position and climate. While the backbone of national strength is white, Caucasian, and English-speaking, beyond this all is diversity; every colour—black, brown, red, yellow; all races—Negro, Indian, Mongolian, Malay, Papuan, Kanaka, Maori: all religions—Christian, Mohammedan, Buddhist, Parsee, and Pagan. Language is even more various than race, creed, or colour. Diffusion, separation, isolation, variety, every expression which contrasts with the term unity is what naturally suggests itself to one who merely looks at a map of the Empire, without studying the great facts which underlie its history, its progress, its aims, its manifest place and work in the world, the new conditions under which it exists to-day. I fear that this primary, superficial, and utterly misleading impression of national disconnection still dominates great numbers of minds; it is to modify such an impression that this paper is chiefly intended.

That I have begun by placing before you this map which so vividly represents the scattered state of the Empire, with its dividing spaces of continent, and ocean, and zone, will be, I trust, some guarantee that I wish to face my text fairly.

What I wish to prove is, that in spite of all this apparent diversity, the territorial growth of the Empire has been not abnormal, but strictly organic—the outcome of racial instincts and the fundamental necessities of national life; that each part is fitted to minister to the wants of the other parts, or of the whole, with singular felicity of adaptation; that this vast diffusion of territory is so linked together as to be fitted in a very special way for the performance of peculiarly high national functions; that dismemberment would mean for it what dismemberment means for any highly complicated and efficient organism; that, in short, to speak of the geographical unity of the Empire is no paradox, but a simple truth—a truth which it is of the utmost importance that all British people should vividly realise.

In entering upon the argument by which I hope to justify these conclusions, it seems necessary, in the first place, to briefly consider a few of the most salient features in the historic growth of the Empire.

If we take the coming of the Saxons as our point of departure in British history, then we may say roughly that eleven centuries were passed in the manifold processes of internal growth and change before our people began to get even a hint of the world-wide destiny that was in store for them.

First, in this period there was for some hundreds of years that fierce clash of people against which was to settle, by the survival of the strongest, the prevailing strain of race. At last there emerged a population in whose blood was curiously mingled Saxon force, and Celtic fire, and the Berserker energy of the Sea-Kings.

Then followed some further centuries spent in internal struggles, varied occasionally, but only incidentally, by continental wars, which gave temper and fibre and greater homogeneity to the race, and stability, with ordered liberty beyond that of other nations, to social and political institutions.

But from the very first the direction of the country's history was dominated by one geographical fact which differentiated its position from that of every other European State, and from that of every nation known to ancient history—the fact that it was an island; an island, too, penetrated on all sides by estuaries which suggested commerce, and hinted at the revival of the sea-roving spirit, which, during the long constructive period, had slumbered, but was by no means dead.

By the beginning of the sixteenth century signs of a renascent maritime energy began to show themselves, and soon developed with wonderful rapidity; as the century drew to a close, in "the spacious times of Great Elizabeth," English navigators—Drake, Hawkins, Frobisher, Cavendish, Sir Humphrey Gilbert, Raleigh, and others—had given ample proofs of those qualities which pointed with no doubtful finger to the sea as the scene of Britain's greatest glories and greatest gains.

They had circumnavigated the globe: they had made their name feared in the remotest seas: they had tracked the Spanish galleons to the places from which Spain drew her stores of wealth; they had vanquished in open fight the most imposing fleet that the pride and wealth and skill of man had ever put upon the sea.

But though the force of them and the fear of them prevailed everywhere, as yet there was little thought of territorial expansion. While Spaniard, Frenchman, Portuguese, and Dutchman were planting their feet in many lands, the sixteenth century closed while yet scarce an Englishman had found a fixed home beyond his own narrow seas. As yet only the pathways were being found for the flood of Anglo-Saxon life which was to follow.

The seventeenth century saw a change in this. The spirit of adventure, the desire for wealth, the wish to free the soul from old-world traditions and despotisms, conspired to kindle the colonising spirit. An outlet had to be found for forces which, if pent up at home, might well have wrecked the State. The first great expansive movement of British people was as natural and organic as the force which compels the bursting of a bud, or the transformation of a chrysalis. It is now possible to present a map of the Empire abroad, as it is here before you. At the end of the seventeenth century, as you see, there is a thin line of settlement along the eastern coast of North America; trading posts or points secured for the refreshment of navigators are scattered here and there. Trade and settlement are the two characteristics of the period; the movements are tentative, but in each lies the germ, on two distinct lines, of astonishing growth.

Let us here mark the philosophy of this growth, while we are at its very beginnings. That philosophy, in one of its main aspects, at least, has been admirably stated by Lieutenant Mahan, of the American navy, in his profound work upon *The Growth of Sea Power*, now everywhere accepted as the ablest study of the question yet written. He says:

"As a nation, with its armed and unarmed shipping, launches forth from its own shores, the need is soon felt of points upon which the ships can rely for peaceful trading, for refuge and supplies. In the present day friendly, though foreign, ports are to be found all over the world; and their shelter is enough while peace prevails. It was not always so, nor does peace always endure. . . . In earlier times the merchant seaman, seeking for trade in new and unexplored regions, made his gains at risk of life and liberty from suspicious or hostile nations, and was under great delays in collecting a full and profitable freight. He therefore intuitively sought at the far end of his trade route one or more stations, to be given to him by force or favour, where he could fix himself or his agents in reasonable security, where his ships could lie in safety, and where the merchantable products of the land could be continually collecting, awaiting the arrival of the home fleet, which should carry them to the mother-country. As there was immense gain, as well as much risk, in these early voyages, such establishments naturally multiplied and grew until they became colonies; whose ultimate development and success depended upon the genius and policy of the nation from which they sprang, and form a very great part of the history, and particularly of the sea history, of the world. . . .

"The needs of commerce, however, were not all provided for when safety had been secured at the far end of the road.

"The voyages were long and dangerous, the seas often beset with enemies. In the most active days of colonising there prevailed on the sea a lawlessness the very memory of which is now almost lost, and the days of settled peace between maritime nations were few and far between. Thus arose the demand for stations along the road, like the Cape of Good Hope, St. Helena, and Mauritius, not primarily for trade, but for defence and war; the demand for the possession of posts like Gibraltar, Malta, Louisburg at the entrance of the Gulf of St. Lawrence—posts whose value was chiefly strategic, though not necessarily wholly so."

The territorial expansion, then, of the seventeenth century was the natural result of forces working in the national life.

We pass on to the eighteenth century. All is now again changed. This is for Britain the period of storm and stress. The century opened in comparative quiet, save when broken by continental wars which we now know were but a mere prelude to what was to come. Its middle decade was marked by a contest of which the brilliant American historian, Parkman, has said:

"The Seven Years' War made England what she is. It crippled the commerce of her rival, ruined France in two continents, and blighted her as a colonial Power. It gave England the control of the seas and the mastery of North America and India, made her the first of commercial nations, and prepared that vast colonial system that has planted New Englands in every quarter of the globe. And while it made England what she is, it supplied to the United States the indispensable condition of their greatness, if not of their national existence."

The century closed in another Titanic struggle which shook the whole civilised world—a struggle for national life or death.

It was in this latter half of the eighteenth century that for the first time in her long history Britain learned the secret of her destiny; that she began to fully understand "the meaning of the riddle of her might." Against the most colossal military genius and the most tremendous military combination that the modern world has known she matched her sea-kings' blood; the might of the waves against the might of the land.

Have you ever reflected upon the tremendous odds against us when we entered upon our struggle with Napoleon—odds so overwhelming that without our ocean power nothing apparently could have saved us?

"In 1789" (I quote from that remarkable book on *Social Evolution*, lately written by Mr. Benjamin Kidd) "the population of Great Britain was only 9,600,000, the population of France was 26,700,000. The annual revenue of France was £24,000,000, that of Great Britain was only £15,650,000.

"At the beginning of the nineteenth century the French people numbered some 27,000,000, while the whole English-speaking peoples, including the Irish and the population of the North American States and Colonies, did not exceed 20,000,000." (The population of the United Kingdom at this period was only 14,000,000.)

Lieut. Mahan's statement upon this period of British history is also most effective.

"When war broke out with Spain in 1739, the navy of England was in numbers more than equal to the combined navies of Spain and France: and, during the quarter of a century of nearly uninterrupted war that followed, this numerical disproportion increased. In these wars England, at first instinctively, afterward with conscious purpose, under a Government that recognised her opportunity and the possibilities of her great sea power, rapidly built up that mighty colonial empire whose foundations were already securely laid in the characteristics of her colonists and the strength of her fleets. In strictly European affairs her wealth, the outcome of her sea power, made her play a conspicuous part during the same period. The system of subsidies, which began half a century before in the wars of Marlborough and received its most extensive development half a century later in the Napoleonic wars, maintained the efforts of her allies, which would have been crippled, if not paralysed, without them. Who can deny that the Government which with one hand strengthened its fainting allies on the Continent with the life-blood of money, and with the other drove its own enemies off the sea and out of their chief possessions, Canada, Martinique, Guadeloupe, Havana, Manilla, gave to its country the foremost *rôle* in European politics? and who can fail to see that the power which dwelt in that Government, with a land narrow in extent and poor in resources, sprang directly from the sea?"

This desperate struggle, long hanging in the suspense of doubtful issue, was decided at Trafalgar, for to Trafalgar Waterloo itself was but a sequel—a corollary.

We came out of the conflict bleeding at every pore; with one great fraction of the Empire wrenched from the parent stem; with a national debt such as had never weighed down a country before; with social and industrial dangers of the gravest kind. But it left Britain unquestioned mistress of the sea, and with the foundations of a new empire—the material for working out a new history—more wonderful than the old.

In this second map you may see where we stood in the early years of the nineteenth century.

Now, let me say that the vast growth of this period also—a period of dire struggle ending in victory and conquest—was once more inevitable and therefore organic; it was in a contest for very existence that the empire was so widened by accessions of territory in India, America, and at minor points.

If these vast territories, however, had remained as simple conquests, if they had not become grafted into the very life of the nation, they might easily have come in time to be looked on as mere excrescences, and so to be got rid of as opportunity offered.

But what are the facts? The work of conquest had barely ceased when the process of complete assimilation began. A new era now opens upon us. A few years were required to collect our shattered forces, to steady political institutions, to get our new bearings in the world, and then it might be truly said of our national life that "old things have passed away and all things have become new." Our history for the last half-century may for our purpose to-night be summed up in a few words. It is a national life expanding, and ever more and more expanding, abroad; intensifying, and ever more and more intensifying, at home.

The growth of population, with the astonishing organisation of industry and application of manufacturing power within; the steady flux of population from our shores to form new centres of national strength abroad: these are the characteristics of our time which chiefly concern us.

You have before you the map of the Empire at this last decade of the nineteenth century. It presents an entirely new set of problems, problems which we must face resolutely and study with what accuracy we can.

Observe that the comparatively small province of Quebec, which we won by conquest, has now, under the impulse of settlement, expanded into the great Dominion; a country covering half a continent, and an area well-nigh equal to Europe.

The two or three penal settlements of Australia have spread out into the vast provinces which cover a whole continent—again nearly as large as Europe.

New Zealand is comparatively small, and yet even it is nearly as large as the United Kingdom.

From the Cape of Good Hope our purchase from the Dutch has spread, and is spreading, over the most habitable parts of Africa.

The complete spontaneity of this expansion no man who studies the facts can question. It has taken place in the very teeth of Government opposition. The rulers of this country, for instance, long hesitated about laying any claim to New Zealand, but were driven to it unwillingly at last; they had no thought of taking possession of the whole of Australia; they interposed to prevent Australia occupying the islands around them; their hands are even now being constantly forced in Africa by a restless energy which resistance seems only to stimulate.

No impulse from our rulers led to the opening up of the vast Canadian North-West; it was simply the push of Canadian energy, pioneering the way for English, Scottish, Irish, and other emigrants. Taking the countries I have mentioned as a whole, the expansion of the Empire has consisted in the rush of a national life, powerful beyond all precedent, along the geographical lines of least resistance. This spontaneous rush has not even been confined to the Empire, but has contributed quite as much to building up the United States as well. The force of which we are speaking, so wonderfully penetrating in influence abroad, has its genesis in the homes of this country. I venture to say that there is not a person in this audience who has not found or will not find it in operation by his own fireside. A lady beside whom I sat a few evenings ago at a London dinner-table told me that she had seven brothers abroad in the Colonies, and, she added, all doing well. Multiply such a fact as that by what each of you knows of the circumstances of the homes with which he is familiar, and you can judge for yourselves whether the expansion of the Empire is or is not a vital process. One statistical fact will bring vividly before your minds the vastness of its operation during the last hundred years. I have mentioned that at the opening of the last decade of the eighteenth century the population of Great Britain was 9,600,000, as compared with the 26,700,000 of France. At the opening of the last decade of the nineteenth century, the English-speaking peoples, excluding subject races and the Negroes of the United States, number 101,000,000, while the French people number less than 40,000,000.

But besides this expansion by colonisation of which I have spoken, another well-nigh as wonderful has taken place.

The needs of commerce first carried us to our great Eastern Empire; they have combined with other forces to keep us there. The few trading ports of the seventeenth century, the fringe of dominion won in the eighteenth, have steadily spread during the nineteenth, until our possessions reach the Himalayas, and push out west and east far beyond the Indus and the Irrawaddy. Here we have come, not to colonise, but to trade and rule.

This, you may say, is not normal and spontaneous growth; it is the mere aggregation of conquered provinces, such as built up the Roman Empire. A study of history soon modifies this judgment.

One thing at least we can say with certainty: that this great growth was not intentional. Ruler after ruler was sent out to India with the strictest orders to avoid the annexation of territory, and one after another seems to have gone with the sincere purpose of carrying out these instructions, only to find himself in the grasp of a destiny which he could not control.

When once we had expelled our only European rivals, the French, from India, when once our hold on the sea-coast became essential to our commercial position, we found ourselves coming under the operation of a law which seems to hold whenever highly civilised man comes in contact with the less civilised races—he ends by ruling them whether he will or no. At any rate, under the impulse of some force which statesmen and people alike could not control, we rule to-day 286,000,000 of people in India; and so closely have its commercial interests become bound up in our own, so vital is the link of industrial connection, that in addressing the London Chamber of Commerce five years ago Lord Dufferin could with truth affirm that "it would not be too much to say that if any serious disaster ever overtook our Indian Empire, or if our political relations with the Peninsula of Hindostan were to be even partially disturbed, there is not a cottage in Great Britain, at all events in the manufacturing districts, which would not be made to feel the disastrous consequences of such an intolerable calamity."

The unity, then, even with our great dependencies, is vital. Every year brings out in more vivid relief some striking illustration of the close industrial dependence, based, you will observe, on geographical conditions—in other words, on geographical unity between different parts of the Empire. Let us take a few conspicuous examples.

Sixty or seventy years ago the woollen industry of this country, which had for centuries given employment to a considerable number of people, took a new start, through the application of machinery, and since that time its development has been prodigious. The manufacture of wool is not only the chief industry of the great Yorkshire towns, but is also found giving wide employment in the south of Scotland, in the Stroud valley, and in other parts of England. Altogether some millions of people depend upon it. Now, in this country, upon Scottish moors, Welsh mountains, and English pastures, wool is raised with much expense and difficulty. But at the very time when this woollen industry began to advance by leaps and bounds, we also began to occupy those milder climates to which our people have gone in New Zealand, Australia, and South Africa. In these countries the conditions for raising wool inexpensively are almost ideal. The mild climate, the wide extent of lands unsuited to anything but pasturage, the possibility of managing vast flocks with little labour, entirely changed the conditions of sheep-raising. The result is that the enormous demands made by the newly invented machinery and the growing industries of this workshop of the world have been met without difficulty.

Of the five countries from which woollen fibres are imported, four—New Zealand, Australia, India, and South Africa—are under the British flag; while the fifth, South America, has been chiefly exploited by British capital. But beyond all the natural advantages which these countries enjoy for raising wool, there remains the great fact that they border closely upon the sea; that nowhere do the wool-packs have to be carried any great distance by land before they come in contact with the great industrial uniter—the Ocean. Had these wool-growing areas been in the centre of Asia, or even in the centre of Europe, how different would have been the conditions of our woollen manufactures! To-day the cost of bringing a bale of wool from New Zealand or Australia to London, 11,000 or 12,000 miles, is little greater than it subsequently costs to carry it from London to Leeds, Bradford, or Galashiels, 200 or 300 miles.

Take cotton again, none of which can be grown on our own soil. Our greatest supply has come from the United States, that offshoot of our race which sprung from the first great period of national expansion. But it now comes in large volume from India and Egypt (from the latter far more freely since British influence has given security to capital and labour), and it could undoubtedly be produced abundantly in our Australasian and African possessions, so that exclusion from the American supply, as in 1865, could never again produce such disastrous consequences.

The geographical fact that jute is best produced in a single district of India, where under British rule capital and labour are free to operate successfully, and whence safe transit in peace or war is secured by the flag, means not a little to the greatest industry of Dundee.

And so the argument might be carried through an immense range of industry.

My next illustration will be found in the question of food supply. This country imports every year twenty million quarters of wheat out of the twenty-eight million quarters which are required to feed its people. In the past these vast supplies have been drawn largely from the Black Sea, the Baltic, and the United States of America. But the population of the United States is increasing so rapidly that the best statisticians estimate that consumption will soon press closely upon the food-producing capacity of the country. The area of wheat production has shifted steadily westward from New-York through Ohio, Illinois, and Kansas, and then northward to Wisconsin, Dakota, and Nebraska. Now the great North-West of Canada is admittedly the largest undeveloped wheat area of the world. There is also a vast extent of country suited for the rearing of cattle and for cattle products, such as cheese and butter. Now notice the geographical position of this enormous wheat and cattle area in North-Western Canada in relation to the consuming millions of this country. The greater part of them lie far beyond the centre of the continent. But here the uniting power of waterways again asserts itself. From the Straits of Belle Isle, where a steamship crossing the Atlantic first enters the inland water of Canada, to the head of Lake Superior is a distance of 2384 miles. For the greater part of this distance the gulf, rivers, and lakes present an almost unbroken system of navigation. Only seventy miles of canal were required to be constructed to make this system complete. This canal system is already finished for vessels drawing twelve feet of water. But with this the Canadian people are not satisfied. Just as Glasgow has spent an enormous sum in dredging the Clyde, and as Manchester has made such sacrifices to get into immediate touch with the ocean, so the Canadian people are resolved that their vast north-western granary and ranching country shall have the full advantage of the waterways with which nature has provided her so liberally. All the canals are being deepened, and a new lock is being constructed on the Canadian side of the Sault St. Marie, so that within two years a ship of 2000 tons can be loaded at the head of Lake Superior and make its way on British waters directly to London, Manchester, or Glasgow.

As with wheat, so with cattle. In a single year 400,000 live cattle are sometimes brought across the Atlantic. Of these 100,000 or more come from Canada, and the Canadian supply will from this time forward be the rapidly increasing factor in the trade, as every one knows who studies the American continent or watches the growth of the trade of English and Scottish ports. As with cattle, so with cattle products such as cheese and butter. Of the former, Canada last year sent this country no less than 113,000,000 pounds.

Look once more on the map, at the vast prairies and the land areas of Canada; let your eye follow along the line of the great lakes and the St. Lawrence to the sea, and you will see the most remarkable example of geographical unity in the world; conditions under which the greatest supply of human food can be produced at a minimum of expense, and then again transported at a minimum of expense along a vast waterway which leads directly to the greatest artisan and consuming population that the world has ever known. A late leader in the *Times* says:

"It is remarkable that mere mileage should tyrannise over the human imagination as it undoubtedly does, in days when science has done so much to annihilate space. A man can step out of Canada into the United States, while a broad ocean separates the Dominion from England. It is apparently almost impossible for many people to recognise the triviality of the circumstance. Neither country is concentrated on the frontier line. We have to deal with both as we deal with masses in physics—*i.e.* we have to reckon from their centres of gravity. The Canadian centre of gravity might be much nearer to that of England than to that of the United States, even if the nature of the attraction in both cases were the same. The sea unites far more than it divides, and the sea runs into the heart of the Dominion. If we measure by the scale of commercial dynamics, Liverpool is nearer to the St. Lawrence than to the Thames." And again:—"Freight, not mileage, is the true mercantile measure of distance, and it will soon not be always easy to say whether Toronto lies nearest to Manchester or to New York or Chicago."

To take a still more distant point, the same illustration may, in the matter of food supply, be extended to New Zealand, whence we last year got upwards of 1,500,000 frozen carcases of sheep, which, so far as cost of production and carriage is concerned, ought to be supplied to the consumer here at a little more than half the price of the home-grown mutton. Anything beyond this goes to the middlemen.

Turning now to another article of common consumption—once considered a luxury of the rich, but now become the luxury of cottage and palace alike—tea, we find some facts of a very surprising character.

In 1883 the United Kingdom imported from China 156,000,000 lbs. of tea; from British India 59,000,000 lbs., and from Ceylon only 2,005,000 lbs.

In 1892, only nine years later, China sent us but 57,050,708 lbs., while the supply from British India had risen to 111,711,261 lbs., and from Ceylon to 66,041,630 lbs.

That is, whereas in 1883 China supplied about 72 per cent. of our tea, and countries under the flag 28 per cent., in 1892 our dependencies supplied 76 per cent., and China only 24 per cent.

The proportions have still further changed within the last two years, but the precise figures are not at the moment available. It is to be observed, also, that the immensely increased consumption of this poor man's luxury has been due to a lowering of price traceable chiefly to the ease and security with which British capital and British industrial skill have been applied to production under the flag in India and Ceylon.

The reverse side of this illustration is equally striking. Of all Ceylon's exports of tea in 1893—amounting to 84,387,656 lbs.—more than 83,000,000 lbs. went to the United Kingdom, Australia, and other countries within the empire, and only about 1,000,000 lbs. to foreign countries.

The geographical fact that populations which consume tea and others which produce tea are under the same flag, manifestly produces a unity of commercial and industrial interest such as few people imagine.

If we follow this thought to its conclusion and study the facts with care, we shall find that nothing more astonishing has occurred in our industrial position than the degree to which the areas of production of raw material and food have shifted under the flag during the last few years, and the increasing tendency shown to still further do so. The geographical unity of the Empire is, in short, asserting itself in the most practical form. But before we can grasp the situation fully, we must turn from the extraordinary picture of expansion which we have studied to the equally wonderful process of contraction which has gone on during the last half-century. First, the world has, for most practical purposes, been recreated, and on a smaller scale, by the applications of steam.

The man is still alive in Canada who was stoker on the first engine George Stephenson built to run between Stockton and Darlington.

Since then—that is, well within a man's lifetime—£800,000,000 have been spent in the United Kingdom alone on railways: in all countries the amount is estimated at between 5000 and 6000 millions, or one quarter of all the invested capital of the world. All this has been spent to give contiguity to places once remote from each other. But railways are not all. If the ocean was a uniter before, how much more has it become so since steam has been applied to navigation! In measure of time weeks of separation have been changed into days. The facts that three-fourths of the world's commerce is carried on in steamships, and that the whole of the power used by all the nations of the world for the defence of commerce depends upon the use of coal, have become to British people primary facts which touch upon their very existence. The security of the seas has become a necessity, and the security of the seas depends upon the geographical distribution, or rather the geographical continuity, of coaling-stations and coal-supplies all around the world. It is a question of coal endurance.

We have lately had stated in precise terms, by one of the highest living authorities on the subject, what the conditions of coal endurance are for our ships of war. Speaking before the Royal Institution on March 9th last, Mr. W. H. White, the Director of Naval Construction and Assistant-Controller of the Navy, stated that a first-class battle-ship built in 1861 carried 750 tons of coal, and, with the engines then in use, could keep the sea for six days, steaming at the rate of ten knots an hour. The limits of such a ship's endurance at sea would therefore be only 1440 knots. Pointing out how great an advance had been made in this respect since 1861, he added that a first-class battle-ship of the new Naval Defence Fleet could leave port with nearly twice as much coal on board, and, partly on account of improved engines, could steam continuously at ten knots an hour for twenty or twenty-one days without exhausting her coal. That is to say, the limits of a battle-ship's coal endurance at sea still remain under 5000 miles at the very best. Observe that this is not sufficient to enable her to cross the Atlantic and return without renewing her supplies of coal; not enough to carry her from St. Helena to Australia; barely sufficient to carry her from St. Helena to Mauritius. For a nation whose very existence depends upon keeping open the pathways of the sea, what volumes of meaning are conveyed in the statement of a single fact like this! But you will easily understand that ten knots an hour, which gives this minimum of coal consumption, and the maximum of steaming distance, is not likely to be an ordinary steaming speed for either commerce preservers or commerce destroyers. The additional facts which Mr. White gave in connection with this further aspect of the question are very striking. A first-class battle-ship, for instance, is driven ten knots an hour by 2000 horse-power. At fourteen knots, 5500 is necessary; at eighteen knots, 13,500 horse-power. These more rapid rates, therefore, mean a greatly increased consumption of fuel, and therefore a lessening of coal endurance.

Keeping these conditions thus accurately stated in mind, look at the distribution of our national coaling-stations along the great trade routes: Gibraltar, Malta, Aden, Bombay, Trincomalee, Singapore, Hongkong; Sierra Leone, Ascension, St. Helena, Cape Town, Mauritius; the Australian and New Zealand ports; Halifax, Quebec, Bermuda, St. Lucia, Kingston; the Falkland Islands and Esquimalt. After that consider the deposits of coal on the east and west coasts of Canada, in South Africa, in India, and Australasia, and you will find that for a nation whose commerce is all round the world, little more could be done to make geographical unity complete; little more to give the fullest effect to the contraction of distance which is effected by steam.

But this is not the only contraction. That the whole world has become in our generation one great whispering gallery we all know. The same idea is expressed by a different but sufficiently exact metaphor when we say that a new nervous system has been given to the world. The land telegraph and submarine cable have changed the whole conditions of national life; above all, they have revolutionised the meaning of the terms geographical unity and geographical dispersion. Especially is this true of the British Empire. The circumstances of our national existence have brought it about that we have been compelled to take the chief part in creating this new nervous system for the world, from which, moreover, no other nation, nor indeed all nations put together, derive a tithe of the practical advantage that we do. Out of the 152,936 miles of submarine cable in existence, above 102,656 miles have been made in British workshops, laid by British vessels, and now pay their dividends to British shareholders. The amount of British capital invested in British lines is stated to be £26,530,589, as at present standing, and not including such debentures as have been redeemed. This also excludes the cost of the lines under Government administration. But this is the merest fraction of what they mean to us. The transactions of finance and commerce, the regulation of demand and supply, the direction of our commercial fleets and of the armed navy which defends them, all now depend in great measure upon the far-reaching influence of electric force. More important still is the unity of thought thus gained. It is no flight of imagination, but a simple fact, to say that by the agency of the telegraph, backed up by the diffusive power of the press, in a few short hours the heart of our nation through all its world-wide extent may be made to beat with one emotion—from Montreal to Melbourne, from London to the Zambesi, from the Ganges to the Saskatchewan.

Think of the single fact that more than £1000 per day is spent in telegraphic communication between the United Kingdom and Australasia alone, and in that fact we have some measure of the value put by our people upon this new link of unity which has been added in the latter half of the nineteenth century.

But this nervous system is not as complete as the geography of the Empire makes possible; one may say that it has defects which might prove fatal if not remedied in time, and at this present moment are fraught with no small dangers. The greatest gap consists in the lack of connection between Canada and Australia. Reflect upon what this means. There is, perhaps, no responsibility which statesmen feel more deeply than that connected with the maintenance of our position in India and the East. The financial and commercial interests which we have at stake there are simply enormous, and practically reach every home in this country. For purposes of trade, as well as for defence, both military and naval, instant communication with the East has become almost a necessity. But it would be almost certainly broken at once in the event of our being engaged in a great European war. There are at present many routes of telegraph by which we can reach India and Australia: across the Continent by way of the Mediterranean and the Red Sea, around Africa, and even across Siberia. But all these lines either pass through possibly hostile countries, or through shallow seas where they could easily be fished up or destroyed in time of war. A cable across the Pacific would be free from both these fundamental objections. That this cable should be laid has become a matter of imperial necessity. The Home Government has been asked to give it financial support. But even if no such aid is given, it now seems probable that the work will be carried out by the united efforts of Canada and Australia. A conference to deal with this and other questions of inter-colonial connection is to meet in Canada during the present season, and I think there can be little doubt about the result of its deliberations. The meeting of such a conference will furnish another striking illustration of the organic unity of the Empire.

The second important flaw to which I have referred in the cable communication of the Empire is in the lack of direct communication with the West Indies. At present our important colonies and naval stations there can only be reached by wires passing through the United States, and in some cases touching at islands belonging to foreign Powers. This missing link in our cable system could be supplied with comparatively little trouble and expense. Two years ago a line was laid from Halifax to

Bermuda, connecting those two important naval stations. The extension of this line for a few hundred miles would give us an independent means of communication with our West Indian possessions. The question of granting the line a moderate subsidy is now under consideration of the Imperial Government, and it is to be hoped that its construction will not be long delayed.

This new set of nerves will undoubtedly change the whole conditions under which the naval wars of the future will be carried on, quite as much as the change from wooden and wind-driven ships to those built of iron and impelled by steam. Once more we may say that, as with steam, this change has resulted in a reconstruction of the world, a reconstruction which creates a practical unity out of what was before separation.

One point is worthy of special illustration as showing what unity and concentration of action in defending commerce a widespread empire gives.

For our immense trade in Eastern and Southern waters we have a choice of route inward and outward; by the Cape of Good Hope; by Cape Horn; for passengers, troops, sailors, and even the less bulky kinds of expensive freight by the Pacific and trans-Canadian route. For our present purpose, it will be better to leave out of consideration the Suez Canal route.

Now, when our Pacific cable line of telegraph is completed, this variety of route gives us a wonderful means of attaining security for our trade. The method may be explained as follows:—Those responsible for the defence of the Empire fix long beforehand certain routes, to be known respectively as, say, the A, B, C, D routes. These may not only vary in passing around the different points I have mentioned, but also by a variation of the latitude and longitude of sailing a hundred miles more or less north or south, east or west, as the case may be. These routes, planned in secret but communicated in sealed orders to the authorities of the great outlying parts of the Empire, are thought out carefully beforehand. Then, on the outbreak of war, the whole machinery of our vast commerce may be directed over different routes, known to ourselves but unknown to the enemy, with perfect ease. One week, for instance, every ship which leaves Australia or New Zealand would be ordered to go by a special Cape Horn route; another week the B or C route might be selected according to the exigencies of the naval protecting force. Thus our own naval authorities would know precisely at what point and at what time to expect every ship of commerce which required convoy, while an enemy would be left to find out these facts as best he could, under circumstances of the utmost difficulty. Such a system would certainly mitigate greatly the terrors and dangers of the much talked-of commerce destroyer. It seems to me clear that in this way any serious risk to British commerce could be avoided until our ships had reached those narrow seas nearer our shores where the full protecting force of the navy could be put forth for their defence.

Nothing proves the reality of unity in any body more than the vigour of the living circulation which goes on throughout its various parts. And what a wonderful flow of circulating human life there is constantly passing between the centre and circumference of the Empire in spite of distance. Witness the lines of huge steamships crowded with passengers which are every day finding their way to or from Canada, or the Cape, India, Australia, and New Zealand. Witness the fact that scarcely a family in these islands has not one and often several members in the remotest parts of the Empire. Witness the large contingent of colonial and Indian students always attending our medical and other colleges, some remaining to practise in this country, more going back to carry with them what we have to give of professional skill and literary culture. Think over, again, the list of your acquaintances, and remark what numbers are people who have spent years abroad in Colonial or Indian work. Notice the increase which takes place year by year in the space given by your daily papers to the doings of British people abroad—space not so many years since almost exclusively devoted to the affairs of foreigners. Go to Sydney or Toronto, and you find much of the same world-news served up to you morning by morning that you get in Edinburgh or London; only in Toronto the difference of time makes it a little more up to date, while in Australia time is slightly in your favour.

You meet a friend in London; as he shakes hands with you in farewell, he hails a cab to catch a P. and O. boat for Singapore, or an Allan Liner for Vancouver. You see a familiar face, and you remember that you last saw it a few weeks ago in Montreal or Melbourne. These are not exaggerations, but the ordinary facts of daily life to men of business and travel—in these days a very numerous class. In the autumn of 1888 I was speaking at a large meeting in your Edinburgh Music Hall. About six months later, I found myself, quite casually, sitting at dinner in Melbourne with four people who had been at the same meeting, while our hostess mentioned that a fifth who had called during the afternoon had also referred to being there.

It is very curious and suggestive to watch the play of some of the forces which promote the circulation of our race throughout all parts of the Empire. Britain itself is cramped in size; it has a climate good for rearing men, but not favourable to the easy enjoyment of life; it is the centre of an advanced and, therefore, conventional civilisation. Men go abroad to get elbow-room: to find a sunny and exhilarating climate; to escape the shackles of conventionality. All this they can do on the open veldt of South Africa; in the lonely bush of Australia; on the wide prairies of Canada; or listening to the "long wash of Australasian seas" upon the lonely coasts of New Zealand. That the change is a healthy one no man can doubt; it gives free play to that Berserker energy of our Norse blood which still clings to us; it is what unlimited oxygen is to lungs long shut up in crowded rooms. But the impulse to movement is not from the centre outward alone. Sated with freedom, space, movement, action, the man who has gone abroad longs to keep in touch, at least, with the old home, and the good things which, more than any other land, it contains. He comes back as opportunity permits; he brings or sends back his children to come under the influence of art, taste, culture, refinement, historic surroundings; appreciation of all these things is quickened by long abstinence; a new value is put upon them from the comparative roughness of colonial life. Thus you have the steady pulsation of a healthy life; a reciprocal action good for both.

This movement—movement made more easy and natural by its common citizenship—will one day be recognised as being for our national life what the great currents are for the ocean, a preservative from stagnation: on the one hand, a safeguard against that enervation of wealth, luxury, power, and over-civilisation which has overthrown the greatest nations of the past; on the other, an influence, stimulating and refining, for rough energy. Thus the geographical diversity of the Empire makes for a higher unity and harmony of national development.

The material greatness of Britain has been built up on the trading instincts and trading habits of the British people. They are the basis on which other elements of greatness rest, or have furnished the best means for their development. It is very curious to observe how true this general statement is when we study the question in detail. We have had the fighting energy, almost equal to that of the Romans, of a great military race. Yet our military tendencies have been almost entirely employed for the preservation of our commercial position. We are a naval people, and have attained great naval skill and wide supremacy; but all this has been won by seeking pathways for our trade across the seas, or in the defence of that commerce. It has enabled us to reap the fullest advantage from our enormous national resources in coal, iron, temperate climate, maritime position, and physical vigour. The vast accumulations of wealth in this country which have come from trade do not go alone to the trader and manufacturer. The wealth of the aristocratic classes who own land is largely due to the increment of land values arising from the growth of the artisan and commercial population, and from the keen competition for the possession of land among men who have made their fortunes in trade and manufacture.

The prosperity and comfort of the professional classes—lawyers, doctors, etc.—depends upon the opportunities offered by an exceptionally rich community, made so by trade.

The leisure of our learned classes at the great universities, which gives to the nation a keen intellectual life, depends directly or indirectly upon trade and the industries which develop trade.

So we shall find, if we follow up the subject, the influence and benefit of trade extending through all the ramifications of our national life. But that trade depends on the fact of our being and continuing an ocean empire—an empire which is made by the sea a geographical unit.

Once more, without any touch of national vanity, we may truly say that our British people stand to-day in what one of our great poets has called the "foremost files of time." We are facing, as no other nation has faced before, the most difficult social and political problems: how to work out the highest good for the highest number; how to give the greatest measure of liberty to the individual while retaining the greatest security for the community.

Consider the remarkable circumstances under which we are doing this. Instead of working from one example and under one set of conditions, we are working under a hundred. We are trying every system of government, from the freedom of democracy to methods which can only be described as paternal despotism, and in each case with equal desire to secure the good of the governed. We are testing social systems in forms various beyond any previous experience.

In these points the Empire, in its wide extent, seems only commensurate with the greatness of our mission and our destiny. Complexity is the mark of a higher form of organism; of an organism fitted for the performance of exceptional functions. This is a great law of nature, well known to apply to the material world, vegetable, mineral, and animal. But nothing is more certain than that it applies to the life of nations as well. I know of no more interesting and fascinating study than that which deals with the geography of countries and continents in its relation to the growth of nations and the progress of civilisation. In the earlier stages of existence man spread out over the wide, monotonous plains of Mesopotamia, of Egypt, of Central and Southern Asia, where the conditions of life were easy but curiously equal. There immense communities arose; magnificent and imposing, but half-developed, civilisations were produced. The empires have passed away; the civilisations have, in many cases, remained, but have continued for centuries without change—struck, as it were, into apathy by the wide monotony, the want of variety in the surroundings and internal conditions under which they arose. These great inland plains could not develop man's higher powers. He moves westward; he comes in contact with the sea, with islands, peninsulas, countries of varied scenery and conditions, which stimulate his activities and open new vistas to his thought. There, around the borders of the great inland sea, we see springing up the wonderful civilisations of the ancient world; those of Palestine, of Phœnicia, of Asia Minor, of Greece, of Rome, of Carthage.

Here was an amazing advance. Under the influence of contrast, variety, manifold geographical conditions, and a sea furnishing an easy pathway for commerce and for the interchange of ideas, the human mind made a marvellous forward spring. Language, literature, art, philosophy, the science of government, all reached with a bound levels undreamed of before, and in some instances scarcely retained since. Even religion broke free from the shackles of slavish Eastern fear; it became etherealised and intellectual, if not moral. But Palestine, and Greece, and Rome, with all their astonishing achievements, were drawn into the meshes of the monotonous, apathetic, sensual, half-civilised East. The Jew, hanging up his harp upon the willows by the waters of Babylon; Alexander, the Greek, unnerved and overthrown amid the magnificent revels of the same great Eastern capital; Antony, the Roman, yielding to the seductions of Cleopatra and her Oriental luxury, are but types—types of a higher civilisation yielding to a lower from want of moral backbone. The ancient West, with all its noble gains, surrenders to the more ancient East.

Once more geography, with its subtle and mighty influence upon life, comes to the rescue of mankind. Down upon that demoralised Western civilisation sweep the German, the Goth, the Vandal, the Scythian, nurtured among the gloomy forests, the mountain ranges, the vast wind-swept plains of Northern Europe and Asia, amidst those hard conditions which give physical and mental and moral fibre.

The civilisation of the world, the garnered wisdom of ages, seems to be swept into a hopeless abyss; it is only that it may have a new and nobler birth. On the fierce Northern energy has now been engrafted the moral strength of Christianity; the capacity to win back and make use of the culture of Greece, the governing power of Rome. Then comes the Renaissance of national life on small, concentrated spheres of action—Italy, Spain, Portugal, France, Holland, Germany, Belgium, Britain. But while the geographical area of each European nation is circumscribed, the horizon of activity and effort expands. New worlds are discovered; new routes are found; instead of the inland sea, the mightiest oceans become the field of man's highest activities. Who is to take the lead in this new process of new World Growth? Who is to realise the idea of an Ocean Empire united in spite of distance? Long the decision hung in the balance; now it seems clear (and let us say it with all humility and sense of responsibility) that the Briton with his Teutonic basis of strength must take the leading place in this great sphere of world-activity. Two of the new continents, America and Australia, have fallen almost exclusively to our race. A third, Africa, seems, in its most habitable parts, well within our grasp by the compulsion of circumstances and almost without our conscious effort. Once more, again, as representing the civilisation of the West, we go back to the East: to Egypt, to India, to China. We go armed not merely with the intellectual gains of the Greek, the fighting and governing energy of the Roman, but with the moral energy of the Christian. We go again as masters; surely it is not again to become slaves.

Not if we know the greatness of our destiny and accept it. Not if we recognise that under this strange diversity and complexity of our national life there is the material for a wonderful unity of effort and organisation; that we have a marvellous opportunity to make our moral and political impact upon the world greater even than in the past, and greater for the highest and noblest aims.

A QUIET CORNER OF THE ALPS.

By V. Dingelstedt,

Corr. Member R.S.G.S.

The Swiss are on the whole a very progressive people; but among a number of communities making very valuable efforts for the diffusion of arts and science, there are some who are singularly averse to any change in the conception of life bequeathed to them by their forefathers, and remain obstinately conservative in their customs and manners. Such backward communities are to be found in the mountain districts of some of the Catholic cantons, among a pastoral population difficult of access, and leading during the long winter season an isolated existence.


Spitzbergen
ARCTIC OCEAN
New Siberia
GREENLAND
Iceland
Arctic Circle
SIBERIA
Shetland Is.
BRITISH ISLES
London
EUROPE
ASIA
Newfoundland
Nova Scotia
NORTH

POLITICAL, COMMERCIAL, AND HISTORICAL SKETCH-MAPS OF THE BRITISH EMPIRE.

DESIGNED TO ILLUSTRATE MR. G. R. PARKIN'S ADDRESS ON "THE GEOGRAPHICAL UNITY OF THE BRITISH EMPIRE."

In these communities the priesthood still maintains very considerable power. Their study presents particular interest, primarily, because they are slowly disappearing—railways and external influence constantly penetrating more into the farthest recesses of these beautiful districts; and, secondly, because such communities, notwithstanding their backward state of general culture, present a picture of contentment and peace which is truly gratifying amidst the turmoil and unrest which now agitates the civilised world at large. Besides making instructive observations on the simplicity and quaintness of manners and customs, visitors to these regions gain an unaccustomed serenity of mind. The effect is produced not only by the view of those imposing snow-clad mountains, which remain to all appearance unchanged through ages, but also by the apparent unchangeableness of the simple course of life which prevails amongst the robust population. Having had the good fortune to spend a whole summer in one of such backward and yet happy communities, situated at the foot of the well-known Dent du Midi, in the lateral valley of the Vièze, an affluent of the Rhone, in the canton of Valais, I am able to give in this paper some results of my personal observations on the life, customs, and usages of its inhabitants. I cherish the idea that these remarks, though of no particular value, may be not without some interest to those of the readers of this *Magazine* who have not yet had an opportunity of visiting this part of Switzerland.

As man is so much dependent upon his environment, I may first of all say some words about the physical features of the country, its fauna and flora. The Val d'Illiez, as the valley of the Vièze is called, is a transversal valley formed by the mountain torrent which follows its impetuous course between the Dent du Midi—considered as a prolongation of the Bernese Alps, cut off by the valley of the Rhone—and one of the spurs of the Pennine Alps, thrown out from the south-west. The valley is thus open to the north-east, where it enters into the Rhone valley, and closed on the south-west by some well-known ramparts rising around Champéry, such as the Dent du Midi, the Tour Sallières, the Dents Blanches, etc.

The Val d'Illiez divides first at Troistorrents, where branches off to the south-west the elevated vale of Morgins, watered by the Tine and remarkably beneficial to sufferers from anæmia. Higher up, about two miles above Champéry, the Val d'Illiez resolves itself into three high and very picturesque valleys, viz., the Sezanfe, Bormaz, and Creuses. The ridges that enclose the Val d'Illiez are highest on the eastern side, where the magnificent Dent du Midi (10,695 feet) uplifts its seven summits, constituting a point of attraction to a crowd of Alpinists every summer. On its western side the Val d'Illiez is bounded by l'Haut, a ridge with an average height of about 6500 feet, thickly covered with forest, which separates it from the vale of Morgins. Extending thus on the north-western slope of the Dent du Midi and on the south-eastern declivity of the Montagne de l'Haut, between the sources of the Vièze and its outlet into Rhone valley, the country we are speaking of may have an area of 35 square miles. The châlets are mostly on the mountain slopes at a distance from the easy route along the valley, where now runs a good new carriage-road from Monthey to Champéry. This circumstance has certainly some connection with the conservative habits of the people. Three communities share the Val d'Illiez between them : the village bearing the same name half-way up the valley, Champéry at its upper end, and Troistorrents lower down among the vines. The valley enjoys an abundant supply of water, for numerous tributaries enter the Vièze on both sides, many of them forming cascades, the roar of which can be heard everywhere. The principal torrents on the right side of the Vièze are the Sautlaz, Frâche, Crettex, and Tille, which are abundantly fed by the glaciers and snows of the Dent du Midi; on the left side are the Chavalet, Charnay, Fayot, and Tine, which swell up suddenly after rain and never dry up, though they have no glaciers at their sources. Rain and snow are abundant, though I cannot give precise figures of the average precipitation. The geological character of the country, studied by A. Favre, is rather complicated. The Dent du Midi and the Dents Blanches belong to the Lower Cretaceous system, corresponding to the Wealden beds, and known here as Neocomian. But the principal summit of the Dent du Midi may be of older formation. The valley itself has been produced by repeated cataclysms. The predominating rock is a clay schist or slate, of a more or less dark colour. No fossils have been found in it. The country has an eminently Alpine and rural character. It possesses all the elements of scenic beauty in a high mountainous region—green pasturage, with herds of cattle, dark forests of pine and fir, rocks of varied forms and colours, murmuring streams, roaring torrents, foaming cascades, rugged summits boldly rising into the clouds, blue glaciers and blinding snow-fields, neat, picturesque huts, châlets and country houses. All these elements of the picturesque are grouped together in the most striking manner, and, through the endless changes due to weather and the effects of light and shade in different hours of the day, always preserve their peculiar charm. The predominance of green gives to the landscape on a sunny day a very smiling character; but the background of naked rocks and lofty summits, clad with eternal snow, without at all detracting from this bright impression, lends to the scene a grandeur which elevates the mind. There is an intimate connection between the physical features of the country and the disposition of its inhabitants : as there are simplicity and grandeur in the one case, so also simplicity and grandeur are to be found in the other. It is a land of grazing and elevated pasturages at an altitude of between three thousand and nine or ten thousand feet. The valley, being open on the north, enjoys the benefit of refreshing north-east winds, accompanied by dry, fine weather. Champéry is sheltered from the direct force of this wind by a promontory, and is consequently an agreeable place of sojourn, even in winter. The south-west wind is pretty frequent, bringing rain and stormy weather; the south wind, accompanied by hot weather, occurs but seldom. The maximum heat averages 82° to 85° F., and the greatest cold in the village of Val d'Illiez is about 4° F. The winter lasts about six months; the early spring is particularly delightful. The Vièze is very seldom completely frozen, and rafts can float on it at all seasons. Rain is abundant in summer and snow in winter; the autumn is usually dry, and the spring, beginning in April, is often interrupted by cold blasts. A barometer and thermometer, as well as a clock, are seen in many cottages. The people have also a great number of sayings and omens foretelling the weather, many of which present very curious instances of popular wisdom. Many of these sayings are expressed in rhyme, as for instance :

> " S'il pleut le jour de Saint Médard,
> Il pleut trente jours sans retard."

Or :

> " Quand l'ours retourne en sa caverne,
> On a encore vu hiver."

Or, better, in local patois :

> " Quand l'eûs teurne in sa caverne
> Onco oun hivè on a."

The Fauna.—Trout live in the cold and pure waters of the Vièze, and heath-cock and hares abound in the mountains, but the chamois, formerly plentiful, has been exterminated. Shooting is not much indulged in, and, indeed, there is hardly any small game except foxes, blackbirds, and hazel-hen. Birds are scarce, as there is little corn. Besides the familiar kite, raven, daw, sparrows, bullfinches, tomtits, larks, swallows, and magpies, there are finches and wagtails to charm the ear in the day, and different kinds of owls and bats to frighten the rather superstitious peasant at night. Larks are to be found from May to October, but swallows appear only in October as birds of passage. Field-mice, moles, and snails are troublesome in the pastures and meadows. The field-mice live for three years, and it is during the last year that they do the most damage. There are no wolves, but the people complain much of badgers, of which, however, one kind is edible (*Meles vulgaris*). Among the insects, gadflies and wasps are numerous, but there are not many common flies. The peasants keep their windows and window-shutters jealously shut during the summer to keep out the flies, at the same time excluding the fresh air.

The Flora of the country is rich, and of considerable interest. Of arborescent forms, the pine predominates over all other trees, not only coniferous, but also nuciferous and bacciferous. Spruces, larches, and yews are comparatively few. Up to an altitude of 4000 feet the pines are intermingled with a number of deciduous trees, such as plane, ash, aspen, lime, birch, maple, elm, sorb, etc. A little higher up one may see, as the last representatives of deciduous trees, the willow and dwarf alder. Scattered over the meadows grow some fruit trees, such as the cherry, apple, pear, and hazel. Along the roads and on the edge of the forest grow raspberry, gooseberry, currant, juniper, etc. But extensive meadows and pasturages are left, the latter reaching up to the limits of eternal snow and to the foot of the naked precipitous rocks. They are thickly covered with an innumerable variety of herbaceous plants. The meadows in the lower part of the valley where the châlets are habitable in winter, up to 4500 feet of altitude, are mown once or twice a year, and are carefully manured. The pasture lands (*alpage*) lie between the meadows and the limits of vegetation. Each zone of pasture lands has its particular character and vegetation, and is in different seasons of the year bedecked with beautiful flowers, of which the most choice are: ranunculus, gentian, veronica, myosotis, orchis, *soldanella*, rhododendron, saxifrage.

The people may be considered from three points of view, viz., physical appearance, morality, and intelligence. It is not quite easy to pronounce summarily upon the first point. Some of our Swiss writers, as Dr. Schiner,[1] A. de Claparède,[2] Wolf, and A. Céresole have pronounced a highly favourable opinion upon the external appearance of the inhabitants of Val d'Illiez. The last-named authors say, among other things: "So kräftige Männer, so bildschöne Frauen—der Wiederschein moralischer und physischer Gesundheit, ideale Urtype eines thätigen und geistig begabten Volksschlages—das sind die glücklichen Bewohner dieses schönen, von Gott gesegneten Thales" (*Wallis und Chamonix*, Zurich, Band 2, p. 802). Whilst appreciating the moral and intellectual qualities of the inhabitants of the Val d'Illiez, I am obliged to demur to this estimate of their beauty. There are certainly pretty women and very fine-looking men among them, but they form rather the exception than the rule, and the average natives of the valley can certainly not be called handsome. They cannot compare favourably with the Scottish or Caucasian Highlanders, with the Russian population on the shores of the Volga or Terek, or with the sturdy people of North Germany. Though, perhaps, as vigorous as their Caucasian brethren, the mountaineers of Val d'Illiez are far inferior in gracefulness and suppleness, in harmony of form, regularity of features, and energy and vivacity of expression. Nor is it to be wondered at when we remember the difference of life and habits between the warlike Caucasians and the peaceful inhabitants of a Swiss valley. The peasant of Val d'Illiez is strongly built, but he is rather plain in features, and has a sanctimonious and rather lymphatic expression. Without apparent haste he traverses with long strides the great distances which separate his cottage from the church and the village market, along steep and craggy tracks, but his gait is heavy and does not resemble in any way the light and elastic tread of a Scotch Highlander or Caucasian climbing his native hills. The contrast is heightened by the differences in dress; whilst the Caucasian has still preserved a very picturesque garb which shows off his form to advantage, our Swiss mountaineer has long ago assumed an ordinary townsman's coat, black trousers, and a round broad-brimmed hat, which are dreadfully prosaic. The women are comely but not beautiful; small in stature, rather heavy and awkward in their movements in consequence of the sedentary life they lead. Their blue eyes often sparkle with intelligence and quiet humour, but their faces have often a palish hue, sometimes almost cadaverous, and bear the marks of lassitude, care, and resignation. The forehead is fairly high and large, the nose straight and of moderate size, rather large at the base, the mouth not large, the cheeks rather hollow, and the cheek-bones prominent. The chest is broad, and the feet and hands are very large; the speech is

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1 *Description du Département du Simplon*, Sion, p. 538.

2 *Champéry, le val d'Illiez et Morgins*, Genève, 1890, p. 22.

drawling and tuneful, and the gait, like that of the men, heavy. Most women, and even the girls, wear a chignon of artificial tresses. There are few bald men. White hair is to be met with only in very advanced age. The women's dress is black, of ordinary cut, and its prosaic character is relieved only by a bright scarlet handkerchief, which is coquettishly tied round the head in place of a hat. On the pastures, whilst tending the cattle, the women wear trousers, and dress like men but for the handkerchief. The children strike one by their precocious earnestness and almost ridiculous gravity of demeanour, when, accompanying their seniors to the church, they move along at a slow pace and with the greatest composure. They are dressed like adults, like them demurely carrying their breviary in the hand. But these are mere externals. We prefer to study the mental disposition of this truly excellent people. In this case, as in many others, a less superficial study will be profitable. The population is essentially pious, honest, peaceful, laborious, and docile. In our days, so full of anxiety and worry, it is scarcely possible not to admire this peaceful corner of God's world. Amidst advanced civilisation, simplicity of manners, peace, contentment, and resignation reign here supreme. Notwithstanding the fervour of their Catholic faith and the almost childish docility with which they follow the directions of their clergy, the people of the valley are hospitable to the strangers, mostly Protestant, that sojourn among them or pay them only a flying visit. In their bearing towards travellers the people are very polite and obliging; the children are very respectful, and, like their parents, always salute the strangers they meet. They behave with the dignity that well becomes the citizens of a free country, greeting strangers with respect, but with no shade of servility. They readily recognise the townspeople who come to visit them in the summer as their superiors in knowledge and ability, without, however, desiring to change their lot, or manifesting any false modesty. They are simple folks, ignorant of the great world, knowing only their business, profoundly attached to the creed, customs, and usages of their fathers, averse to change, laborious, honest and content. They do not seem to be disturbed in their amusements and social gatherings by the presence of a stranger, who may find a real pleasure in intercourse with them. These good people are certainly not exempt from imperfections, always inherent in human nature, but they have really good moral qualities which render them eminently sympathetic to those who approach them.

The total number of the inhabitants of the valley of the Vièze is estimated at 3166, divided between three communes, of which that of Troistorrents is the largest (1639), and that of Champéry the smallest (638). The young people marry among themselves, and the old men jealously preserve their country from the intrusion of strange settlers. The birth-rate is 28·7 per thousand, the rate of mortality 22·4 per thousand, and, consequently, the rate of increase of population is only 6·3 per thousand, which, considering the salubrity of the country, is rather small. This is sufficiently explained by the little desire for marriage. The mortality according to the different periods of life is as follows :—

On the average, out of 100 deaths,

31·29	per cent. take place at the age of	0— 2 years.
11·86	„ „ „	2—12 „
2·37	„ „ „	12—22 „
8·07	„ „ „	22—50 „
22·23	„ „ „	50—70 „
24·18	„ „ „	70—91 „
100·00		

The great mortality among young children is caused by early baptism (a few days after birth) and the want of care on the part of young women during pregnancy. The public health is very satisfactory; there is no cretinism and scarcely any goître. The prevalent diseases are rheumatism and pleurisy among adults and hooping-cough among children.

The people of the Vièze valley are almost as industrious as they are pious. Their principal occupations are the cultivation of the soil, breeding cattle, the exploitation of forests, the woollen industry, apiculture, and inn-keeping, so widely developed in Switzerland. A few words about each of these industries. There were formerly in the valley arable lands of considerable extent, but it was found more profitable to turn the greater part into meadows. Except in the vicinity of Troistorrents, where vines are grown, only small patches of tilled soil are found, close to the cottages, which are carefully worked as kitchen gardens. In these are raised with infinite pains the usual vegetables, and hemp and flax, so necessary for the household fabrics which a peasant family cannot afford to purchase. The greater part of the available land is laid out in meadows, which are carefully tended and manured. The hay is harvested twice a year, at the end of July and at the end of August and in September. The grassy patches above four thousand feet are not mown, but constitute what is called *alpage*. The latter differ in value, according to the richness of the soil, the exposure, and the altitude. Only some which are private property are manured. The châlets, serving as shelter for cattle, and built of large unhewn stones, under the protection of rocks, are occupied by herdsmen only in the grazing season and are abandoned in winter. The whole country is divided into grazing grounds, usually defined by some natural boundary or some ancient landmarks. Those grounds are called *montagnes*. A *montagne*, or a hill capable of supporting for the summer about forty cows, and measuring about a square kilomètre (250 acres), brings to its owner an annual rent of from £40 to £48. They are usually rented by some herdsman who feeds his own cattle and those confided to his care. The owner may either let his cattle out to the herdsman, or only intrust it to his care. A fixed rent (usually 50-60 francs with one hundredweight of good cheese) is given in the first case, but only good cows are accepted; in the other the owner gets at the end of the season the cheese which has been made from the milk of his cows, the milk of one day a week being reserved for the remuneration of the herdsman.

In either case the family who undertake this business are bound to return the cattle intrusted to their care in good condition. Disputes hardly ever arise, which speaks well for the honesty of the people. There are private and communal pasture grounds, the first being the better and fetching a higher rent. No festivities take place when the cattle go forth to the mountains or on their return, but sometimes it is deemed necessary to obtain the benediction of the *curé* on a particular mountain. On such occasions there are large gatherings; the milk obtained that day goes to the clergy. During the whole winter season, which lasts six to seven months, the cattle are kept closely confined in the cow-house, which is on the same level as their owner's room, and separated only by a thin partition. It is of course in summer that cows are most profitable, and consequently much speculation arises, graziers seeking to buy in the spring and sell in the autumn. There are two large cattle-markets a year. But even in winter a good cow is a source of considerable benefit. The hay she eats may be valued at £4, 15s. to £6, 10s., and may involve an expenditure of from 10s. to 16s. in cash, but the cow yields milk (10 to 15 quarts daily during six months), manure, and a calf, the whole worth about £10. Besides cattle, there are bred in this country a few sheep, goats, and pigs.

Sawmills are numerous, but the timber trade is on the decline owing to deforestation and the evident necessity for economy. There are no laws strictly regulating this important matter, and as yet no cadasters. A large supply of fuel is provided by the communities for their members, and there are some forests where wood is felled in winter. The timber is sawn into planks and exported, principally to Geneva. The bark is stripped for the tanner. The price of pine has risen considerably; some twenty years ago a big tree twenty inches in diameter was to be had for 16s. to £1, while now it costs more than double this price. The woollen industry occupies many women, but it has only local importance. Every woman can spin, and this work is the principal occupation of all old people; there is a wheel in every house, and almost all the woollen clothing for the family is spun at home. There are some small mills in which a good though rather coarse cloth is woven. Apiculture is no longer of much importance, the winters being, it is asserted, longer and the springs colder. The sole industry, after cattle-breeding, which is prospering and promises to increase, is hotel-keeping, for there is a marked increase of visitors, who come for a shorter or longer stay in the Val d'Illiez, and especially at Champéry. This situation is certainly highly picturesque, is sheltered from the north wind, and is an excellent starting-point for delightful excursions and mountain climbing.

Now let us turn to the manners and customs of the people. Religious rites certainly occupy a prominent place in the daily life of this very pious and bigoted people. As the dark pine reigns in these mountains almost to the exclusion of every other tree, so the Catholic faith dominates in the heart of these highlanders almost to the exclusion of every other sentiment which elsewhere agitates so powerfully poor human souls. Crucifixes, chapels, and oratories are to be seen in all directions. The *curé* is by far the most important personage in every village. He exercises full control over the whole conduct of the people, not only in religious, but also in private, family, and public affairs. The clergy alone are practically at liberty to exert their influence freely by means of daily sermons, exhortations, etc. There is no instruction of any other kind for adults, and secular instruction for the people would certainly not be welcomed. Indeed, their religion enters so largely into the daily life of the people, that it is quite impossible to form any adequate idea of their character and habits without some knowledge of its teaching and practices.

Every village is grouped round its church, with a turret or gable, from which three times every day, viz. at sunrise, at sunset, and at noon, the bell summons the faithful to prayer. Confirmations, funerals, baptisms, are also opportunities for drawing the people together and enforcing the dominion of the Church. Saints' days, which add considerably to the number of holidays, are kept as strictly as Sundays, all work being officially prohibited. They are also celebrated by great processions led by an old man bearing a bell in each hand. Crucifix and banners are carried behind him, and then follows the priest, the consecrated wafer in his hands, accompanied by a choir of boys and Capuchin monks. Next in order walk girls clad in white, belonging to the Sisterhood of the Rosary. and the flock of the faithful closes the procession, marching to the time of the bell. On seeing such processions and the gravity of the persons of every age who take part in them, one is no longer astonished to find these simple shepherds completely enthralled by religious mysticism. It would certainly be difficult to find even in Spain such a bigoted people as the inhabitants of the Vièze vale, living as they do in close vicinity to Protestant Switzerland, where the free investigation into religious questions has made such considerable progress in our time.

In speaking of the secular customs and usages, we must remember that this is an old conservative community, with the virtues and defects inherent to advanced age. It has lost the spontaneity, the elasticity, the illusions, and the faculty of accommodation to circumstances that constitute the appanage of youth, while it has cultivated and developed patience, contentment, and love of peace. A law has long been in force which prohibits children from being sent for education into Protestant towns. External regenerating influences have as yet been excluded, but it is clear that the struggle against new ideas cannot be maintained much longer. On the whole, however, respect for the customs of their ancestors still holds sway, and the people are as yet pretty unanimous in their hostility to change, and even in prosperous families there is not much difference in the simplicity of manners. Drinking is sometimes carried to excess, leading occasionally to quarrels, but crimes are almost unknown, and the office of magistrate is really a sinecure. The holidays, being numerous, might be occasions for mischief, but these, owing to their religious character, pass off quietly. The greater part of the day is spent in religious exercises, and is pretty far advanced when, after some official communications made by the mayor from the balcony of the town hall, the people disperse to take some rest and refreshments in the nearest tavern and wine-shop. In some villages the largest tavern is kept up by the local authorities for the public benefit. Before long, however, the Angelus reminds the consumers of the propriety of starting in order to get home before darkness, always dangerous in mountains, sets in. There are not many amusements; card-playing is pretty often resorted to, and the young people take walks, but social gatherings are not regarded with favour by the older people, and always take place in some remote cabin, far from the church and the ear of the *curé*. But little interest is taken in what is going on in the world. Only a small religious paper is found in the hands of the peasants, and a few religious tracts decorate their bookshelves. An echo of the world rarely breaks the monotony of existence, which nothing disturbs but some avalanche, landslip, tempest, or an awful accident that befalls a daring Alpinist. Of family events, only weddings are divested of an exclusively religious character, civil marriage having been made obligatory. The intercourse between the sexes is exceedingly reserved, and strangely free from passion. Before entering into matrimony there is much negotiation and calculation. There is scarcely any difference in the prudence of the sexes. Men hold that if it is necessary to be prudent in buying a cow, it is a thousand times more necessary to be prudent in choosing a wife. The girls on their side do not seem to be less cautious and reserved; they are not blind to the imperfections of men, and know that marriage leads only too often to increase of work and care, and that there is more merit before the Church, which has canonised holy virgins, in celibacy, than in matrimony. Both sexes seem to agree that wealth only—in other words, a respectable number of cows and landed property—is capable of guaranteeing in some degree the happiness of a married couple and their family. The desire to obtain property by marriage is very common, but many do not succeed, and remain single. Some reject marriage from religious motives, and others that they may not desert their aged parents. Very different are the Russian rural communities, where everybody marries at an early age. The courtship is carried on with much discretion, and a long time is allowed to pass before any overtures are made. And even then the engagement between young people is for long kept a profound secret, sometimes for years, during which the engagement may be broken off without occasioning ill-feeling. The announcement from the pulpit is usually the first public intimation. The wedding passes off very quietly, the invitations being limited to the nearest relations of the contracting parties. Wedding-cake and wine are provided, but there is no dancing and no honeymoon. On the very morrow after the ceremony the young couple take possession of the new cabin prepared for them, and enter on their daily prosaic duties.

The reluctance to marry naturally diminishes the number of marriages, and statistics show, indeed, that in some large communities of about a thousand inhabitants, such as the Val d'Illiez, there are years during which not a single marriage has been announced. In the ten years, 1880-90, in the above-named community, only thirty-seven marriages were contracted. The age of marriage ranges for men from 25 to 45, and for women from 20 to 50, but the average age is 31 years for men, and 29 for women. It is remarkable that in the Val d'Illiez, in about

80 per cent. of the marriages, the wife is some years older than her husband. Husband and wife generally live happily together, though the wife is inclined to pose as a martyr, and perhaps she really works harder than her partner. The latter, when not too old, has always some outdoor occupation, and finds sufficient time to visit his friends, whereas the woman is much occupied at home, and has not only the care of her children and of the house, but also of the cattle, besides spinning and sewing for the household. It is true, however, that she has also time to frequent the church, but that is hardly a relaxation. There may be some truth in the complaint of the men, that their wives are rather whimsical, but it is scarcely an excuse for their pretty general indulgence in alcoholic drinks, a weakness probably attributable to the long cold winters and the monotonous life. Servants are seldom engaged, even in rich families, all the work being performed by its own members. There are few large families, children being considered a blessing only in small numbers. The household expenses, even of well-to-do families, are very small and average only 4 or 5 francs a week. The meals are exceedingly frugal; very weak coffee and milk, with bread, is taken in the early morning, and sometimes porridge of maize flour, which is considered more wholesome for children than coffee; at eleven o'clock, the principal repast of the day is served, consisting of milk porridge, potatoes, cheese, and occasionally salt meat. The last meal takes place between four and five o'clock, and consists of weak coffee and cheese. A short prayer is always pronounced before the family begins its repast. Only on great occasions do ham, poultry, and cakes appear on the table. Wine, liqueurs, and sweet cakes for the girls are obtained only in taverns on holidays. Very early hours are kept in every orderly household. Young children are sufficiently cared for, but instead of fairy-tales the mothers relate to them the lives of Catholic saints, and teach them prayers and the catechism, in order to impress them betimes with a religious sentiment.

Notwithstanding the prevailing pietism and general seriousness, a few social gatherings are held, where the men drink, smoke, and play cards, while women organise some games or even dance, which is formally prohibited by the priests. Many curious games have been handed down, transmitted from generation to generation, full of fun and usually serving to show off a man's skill and dexterity, and to mortify those who fail. I was often struck by the really childish pleasure with which the apparently gravest men took part in them. As to primary education, so successful in most parts of Switzerland, little provision is made for it in this valley; as might be expected, the Church has little sympathy with the legal obligation on parents to send their children to primary schools. Consequently there are at present no buildings specially designed for schools. The whole system of instruction is anything but satisfactory. The school session lasts only six months, and is frequently interrupted by holidays. The girls are also often released from school attendance after confirmation, at the age of 13 to 17. The clergy have great influence in the management, and schools for girls are actually directed by nuns. Some boys' schools are also practically under the direction of the *curé*.

There are, besides, scarcely any sources of public instruction, and the only books found in the hands of the people are religious works.

The official language is French, which is pretty familiar to the inhabitants of the valley, but the popular dialect is a *patois* differing considerably from the French. It is an Alpine *patois*, of which there are two varieties, both very different from the *patois* spoken on the plains and those spoken in the Jura. It is distinguished by the frequent use of liquid consonants, as also by the pronunciation of the letters *s* and *z*, which have the sound of *th* in the words *teeth* and *leather* respectively. The other peculiarity of pronunciation is the use of the sound *w*, as, for instance, in the word *iwé*, water, in which it is pronounced like *w* in weapon. A great many words of this *patois* are only corrupted from the French. Many more interesting particulars might be given of the people of the Vièze valley, their popular sayings and folklore, their numerous superstitions, their omens and auguries, their ancient usages in selling and buying, their simple municipal administration, and so on, but these have no very direct connection with geography. I shall now conclude with the wish that many British tourists who come yearly to Switzerland would cast a glance at the calm and beautiful valley that extends along the foot of the Dent du Midi.

DODONA, OLYMPOS, AND SAMOTHRACE.

A NARRATIVE OF PERSONAL EXPLORATIONS.

By J. S. STUART-GLENNIE, M.A.

(*Abstract of a Paper read before the Society, March* 1894.)

DURING the eighteen months of my explorations in Albania and Epirus, Thessaly, Macedonia, and Thrace, these provinces were—as, with the exception of Thessaly, they still are—in a state of almost complete anarchy, overrun by brigands and the frequent scene of insurrectionary movements. It was confidently predicted, therefore, that my proposed explorations would be found altogether impossible. Dodona I should certainly be unable to reach; and I might think myself lucky if I got safely even to Ioannina by the direct highroad from its seaport, Prevesa. I accomplished the journey, however, and by the most interesting route—through the country of the Acherusian Plain, the groves of Persephone, the rivers Pyriphlegethon or Kokytos, and the Oracle of the Dead at the Gate of Hades. Still Dodona appeared as far off as ever. But, during my stay at Joannina, I made the acquaintance of an old Turk, Djemal ed-Din Agha, who was the chief landowner in the mountain-country round Dodona, and the Agha procured me an escort and assured me of hospitable entertainment in his castles and in the houses of his tenants.

Riding forth on a beautiful autumn morning, and leaving behind that rocky peninsula jutting out into the lake of Ioannina which Colonel Leake, British Consul here in the beginning of this century, regarded as the most probable site of the temple of Dodona, we travelled for two or three miles over the plain of Hellopia, the Ancient Hellas of Aristotle, and then ascended a ridge opposite the hill of Kastritza, and were fitly reminded by a clump of fine oaks that we were about to descend to the sanctuary of the Dodonæan Zeus, to whom the oak was sacred. By a long, steep, winding descent, ending in a rocky staircase of the most remote antiquity, we made our way down into a retired east-and-west-running glen, divided, by a hill jutting out from its northern side, into an upper and narrower, and a lower and wider, part. And it was on this eminence that we found the ruins which mark the site of the temple.

The glen is studded with oak copses still. To the north, the direction from which we came, the hills are low, but above them rise in the distance the summits of Pindus; while to the south the great mass of Olytsika, identified with the ancient Tomaros or Tmaros, towers up 4000 or 5000 feet above the level of the glen, which is itself some 1500 feet above the level of the sea. Along the lower slopes of this grand mountain are four or five villages. Above these is a belt of primeval oak forest, and still higher a long range of precipitous heights. The ancient lake, like the ancient forest of the Sanctuary, has left only traces of its existence.

The walls, at which we dismounted, form an irregular square; only a few courses of large stones, carefully fitted together without cement, are still standing. These may be the walls of a small town or, more probably, of an acropolis. At the south-west corner is the theatre, scooped out of the face of the hill and overlooking the glen. This is the finest of the ruins, and, indeed, is the best preserved of ancient Hellenic theatres. To the east of the theatre and acropolis are traces of the temple of Zeus, and of the cathedral of the Pantokrátor into which it was transformed. But it must be confessed that the ruins of Dodona, with the exception of the theatre, are wanting in grandeur, and are not to be compared with those of any of the ancient cities within a day's journey of, and apparently built with reference to, this Sanctuary, as their centre-point. Dodona impresses one very much less by its ruins than by the grandeur of its surroundings, and the associations connected with a spot which was a revered and awe-inspiring Sanctuary from remote ages down to, at least, the sixth century of the Christian era.

On recalling all that I had seen during my explorations in and around Dodona, I was struck with the fact that Dodona was no isolated temple and oracle, but the chief of a system of Holy Places. It was to be remarked also that in the history of Dodona, and in the discoveries recently made there, we find memorials of the whole history of Religion, from the simple worship of the Sacred Oak down to that of the Crucified Christ; and that probably the most characteristic and the longest lived was the Chthonian worship, or worship of the Powers of the Earth and of the Under-World. And lastly, one noted that around the Dodonæan system of Holy Places were built a number of cities, of which the Archæan or so-called Cyclopean ruins testify not only to a powerfully organised civilisation, but to a civilisation similar to that of Tiryns, Mycenæ, and Argos, which was probably non-Hellenic and pre-Hellenic.

These facts have not hitherto, I believe, been duly pointed out in their mutual relations. But it is only the recognition of these facts that will enable us in some degree truly to understand how it was that Dodona, or rather the Dodonæan region, became the scene of popular legends and poetic fictions so innumerable connected with the Heroic Age of Greece; and how it was, therefore, that this mere corner of the mainland came to be distinctively named Ἤπειρος.

With an escort of some thirty Turkish troopers—Albanians, Osmanlis, and Circassians—I had a glorious two days' ride from Trikkala, Trikka, the Homeric city of Asklepios, to the ford of the Peneiós, and shortly after to a rocky eminence from the summit of which, not only the snowy peaks, but the whole range of Olympos, with Ossa and Pelion, came into view, and under the pyramid of Ossa the many minareted capital of Thessaly, Larissa of the Pelasgians.

The western or upper plain of Thessaly is one vast, perfectly flat, unbroken expanse of corn and pasture land. But it derives a wonderful beauty and grandeur from the blue serrated mountains bounding it on the south. Still grander is the environment of the eastern Thessalian plains. To the north-east is the vast range of the Lower and Higher Olympos, the snows of the latter towering nearly 10,000 feet into the usually cloudless azure. From Olympos run north-westward the Kambunian hills; the range of Ossa and Pelion forms the eastern boundary of the plains; and on the southern side lie the mountains of Othrys.

In these Thessalian plains I had found myself riding through those Homeric kingdoms which we are generally, perhaps, too much inclined to regard as mere poetic fictions. When I began to re-study, with the new interest thus naturally excited, the mythical tales of the Heroic Age of Greece, I found that almost all were directly, and that those few which were not directly were indirectly, connected with these Thessalian plains, and especially with that eastward division of them in which Larissa is situated. And I found also that these mythical tales—the tales of that Ancient Hellas which both Homer and Aristotle localised in these northern provinces of Greece—presented, when put together in due sequence, a magnificent epic unity.

A conflict both of races and of religions seemed clearly to be indicated by these legends. But how were these races to be named, and what were their ethnological relations? It was at Larissa that the clew seemed put into my hand that might lead to a verifiable solution of this question, and hence to a verifiable solution of the problem of Greek Origins. For it was at Larissa that I remarked that not only is the Larissa of the Pelasgian Argos as closely connected with the Pelasgians as Dodona itself, but that this name, wherever it occurs, is always apparently connected with the same people; and that a broad band of Larissas connects this Larissa on the Peneiós (Larsa, as it appears in the Greek Folksongs) with a Larissa (or Larsa, as it appears in the cuneiform inscriptions) on the Tigris, near Ur of the Chaldees. But though scholars had long been well aware that there were other Larissas, or Larsas, besides those of Greece and Italy, yet, so far as I am aware, no serious attempt had hitherto been made to approach the problem of Greek Origins by a solution, first, of the problem of the ethnographical relations of the Pelasgians by following the line of thought and research indicated by the remarkable topographical facts just stated.

My exploration of Olympos itself was attended with a good deal of difficulty and danger, the district being only nominally under Turkish rule, and really in the power of the brigand-patriots called Klephts. The Lower Olympos, which rises above Tempe, I visited with a Turkish hunting-party attended by a strong escort, and narrowly escaped capture on returning through the gorge or ravine of Tempe. The Higher Olympos I was unable to explore until much later, when I accompanied a brigand-hunting expedition, which ended in our forces getting so much dispersed that three of us were very nearly captured.

Olympos is not so much a single mountain as a mountain region, with strongly marked divisions like the Caucasus; and it offers, like the Caucasus, a key to much of primitive history in its physical divisions and varied characteristics. For the physical differences between the Lower Olympos towards the Thessalian Peneios and the Higher Olympos towards the Macedonian Haliakmon, and between the seaward and landward plains of these districts respectively, must have contributed greatly to the differentiation of the inhabitants. Olympos is also, like Dodona, a region of Holy Places; and here, too, is found a river of Hades, with traces of an ancient Chthonian worship. Combining physical and ethnological with mythological facts, we see that in Olympos, moreover, there are shrines of other gods, of Apollo and Herakles; and in the Plain of the Muses and the Tomb of Orpheus are memorials of an order of semi-divine beings, unknown at Dodona. Olympos became imaginatively the seat of the mansions of a great variety of gods, because it was actually the scene of the primitive settlements of a great variety of tribes, both Aryan and non-Aryan—tribes with whom the Hellenic Aryans intermarried, and whose gods they adopted. In a word, the historical fact underlying the divine republic of the Olympian gods, and the peace ultimately established between them and the other Greek gods not formally admitted into the Olympian Pantheon, was the *modus vivendi* ultimately found by, or forced on, the warring Olympian tribes, their creators.

The last division of my subject is Samothrace. With difficulty approachable has, from of old, been the sacred island-mountain. Winds blowing right from off it, or sudden thunderous squalls, obliging us to run for shelter into some cove of the Thracian mainland; or, more provoking still, dead calms on a glittering sea of oil, prolonged my voyage from the *scala* of Kassaviti in the island of Thasos for more days than it should have taken hours. At length, however, we landed, under a blazing sun, on the beach of this sacred and divine sea-mountain. The herbage ran down to the edge of the translucent sea; but hardly visible was the green grass for the wonderful profusion of flowers, of which the delicious odours were intoxicating. A ravine opened above, running to the heart of the overtowering mountain; and nothing could exceed the wild grandeur of its precipices. And still as we advanced we breathed the flower perfumes; and the scene was altogether magical. From the summit of the mountain, which I ascended the next day, I had a magnificent view, with Mount Athos on the horizon on one side, and Rhodope on the other, while eastward were the plains of Troy and the islands of the Thracian Sea.

Like these, and especially Lemnos, Samothrace is a centre of volcanic energy, and earthquakes of more or less severity are of frequent occurrence. By their action the temples were reduced to their present ruinous condition, and fountains and deep rocky pools of hot yellow sulphurous water, famous for their healing virtues, testify to the existence still of volcanic conditions. Some way up the mountain-side, overlooking the open sea and the Thracian mainland, with woods and mountains below and precipitous cliffs above, stands a tank fifteen feet square and five feet deep, to which pilgrims still resort on the 22nd of the Greek July—the very season, probably, of the great festival of initiation into the mysteries of the Kabeiroi—to seek relief from disease and return thanks to the gods of the Greek Pantheon, though under new Christian names. And my suggestion that here was the Shrine of Hekáte has been confirmed by the observations of later travellers.

The temples are on the north-west side of the island, fronting the Thracian mainland, about an hour's walk from the modern—that is, mediæval—village. Three ravines here unite into one, and the ruined temples stand in, or overhanging, them, so deep that we do not even see their roofs until some minutes after we have left the gate of the Pelasgian city. As it issues from a narrow, precipitous gorge on the left, the central torrent is abruptly turned into a straight channel by archæan walls, which I believe to be the ruins of the primitive Pelasgian Sanctuary, for such a gorge we find everywhere associated in ancient belief with an entrance to Hades, and we know that the Kabeiroi—whether they were originally deified metallurgists or not—became Chthonian gods, or gods of the Under-World. Further, it may be suggested that the three gorges are symbolical of the trinitarian doctrine, characteristic of the religion of Samothrace as of the religion of Nature generally, and representing the three processes of Nature—Creation, Preservation, and Destruction.

It has been impossible here to do more than make slight allusions to the legends and ethnographical questions connected with the three Sacred Centres of Northern Greece, which will be fully discussed in a work entitled *Ancient Hellas*.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings held in April.—On April 4th, Captain M'Auslan, of the African Lakes Company, lectured on "Nyasaland" at a joint meeting of this Society and the Philosophical Society of Glasgow. Dr. Joseph Coats presided, and Dr. G. A. Turner proposed a vote of thanks to the lecturer.

A Meeting was held in Edinburgh on April 12th, when M. Joël le Savoureux, French Consul, lectured in French on "Montenegro." Sir Thomas Clark, Bart., took the chair, and Sir Alex. Christison, Bart., moved a vote of thanks to the lecturer.

On April 26th Mr. E. Delmar Morgan read a paper, "The Mountain Systems of Central Asia," before a Meeting of the Society in Edinburgh. Major-General Sir R. Murdoch Smith presided.

Mr. Delmar Morgan repeated his lecture at Glasgow on the following evening.

Meetings to be held in May.—Mr. Henry Seebohm, Sec. R.G.S., will give a lecture in Edinburgh on Siberia. The date is not yet fixed. Arrangements for other lectures during the month are in progress.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Daily Variations in the Temperature of Rivers.—We have been favoured by Dr. Guppy with a copy of his paper on the temperature of rivers, read before the Royal Physical Society in February last, in which he discusses the results obtained by various observers at home and abroad as well as his own observations on the Thames. The author found considerable difficulty in dealing with his subject from the fact that most observers have directed their attention more to seasonal than to diurnal changes of temperature, the experiments conducted by M. Renou in the Loire and Dr. Griffith in the Brahmaputra having alone been directed mainly with a view to working out the daily variations.

The observations on the Thames, made between Teddington and Walton Bridge, have resulted in establishing the following facts:—Between May and September the difference between the temperatures of the surface and bottom water, the latter at depths of from 7 to 12 feet, varied from 1° F. to 1·5° F., but when cloudy weather prevailed the variation was only 0·5°. These differences were most marked when the water had attained its greatest heat, and gradually grew less, until, at night, they had almost or wholly disappeared. In the morning the water gradually gets warmer, the surface most quickly; but as the day advances the bottom gradually rises in temperature, until by eight or nine P.M. the difference is very small. The under-current does not attain its maximum until some time after the surface has reached its highest point, but, during the night, the minima of both surface and bottom are about the same.

In winter little difference was observed in the temperature at various depths, the increased current having more thoroughly mixed the water.

In smaller rivers, where the current is less rapid than that of the Thames, the difference in temperature at various depths is more marked. Thus, in the Mole, between Hersham and Esher, where the flow of the stream was hardly noticeable, there were differences of 2·5° between the surface and the bottom where the depths were from 5 to 9 feet.

Turning to the diurnal ranges, Dr. Guppy found that the Thames reached its minimum temperature at sunrise or during the two succeeding hours. In summer the maximum is attained between four and six P.M., and continues to half-past seven and to half-past eight. In winter, again, the maximum was observed at two P.M., and in spring and autumn between three and four P.M. In smaller streams the minimum and maximum must, Dr. Guppy observes, be looked for an hour earlier than is the case in the Thames, and in larger rivers the maximum ought to be found about six P.M. in summer, between four and five P.M. in autumn and spring, and between two and three P.M. in winter. He also believes that the mean temperature of the Thames is reached between eleven A.M. and noon.

The daily ranges in temperature in smaller streams were found to be greater than in the case of the Thames. Thus, when, in September, the latter had a range of 1·5° F., the Hogmill showed a difference of 3·7° F. In August, when the Thames ranged 1·8° F., the range of the Mole was 3·2° F. and that of the Ember 15° F. In March the Thames ranged 1° F. and Beverly Brook 10° F. From a discussion of results obtained by observers on the Thurso, Dr. Guppy concludes that the mean diurnal range of that river must be 3·5°, or double that of the Thames.

The paper concludes with a useful bibliography, and is illustrated by a plate showing the results of Dr. Griffith's observations on the Brahmaputra.

The Lakes of France.—A few details of the investigations of M. Delebecque in the lakes of Central France were given in vol. viii. p. 656. In the *Nouvelles Géographiques* for March is published a more complete account from the soundings and observations of MM. Delebecque, Belloc, and Thoulet. The following is a list of the lakes exceeding 30 mètres (98 feet) in depth, with their areas and maximum depths, Geneva and the Lac des Brenets, already noticed in vol. ix. p. 481, being omitted :—

	Area in acres.	Maximum Depth in feet.
Bourget, ...	11,026	476
Bleu (Hautes-Pyrénées), . . .	121	381 approx.
Lesponne (Hautes-Pyrénées), . .	...	362 ,,
Issarlés (Ardèche), ...	225	354 ,,
Caillaouas (Hautes-Pyrénées), . .	...	331
Girotte (Savoy), ...	139	325
Pavin (Puy-de-Dôme), . . .	109	302
Annecy, ...	6,682	266
Aiguebelette (Savoy), ...	1,347	233
Cotepen (Isère), ...	74 (about)	230
Oo (Haute-Garonne)	74 ,,	220
Tazanat (Puy-de-Dôme) . . .	84	220
Chauvet ,, . . .	131	207
Lanoux (Pyrénées-Orientales), . .	...	180 approx.
Orédon (Hautes-Pyrénées), . .	...	177
Gaube ,, . .	...	174 approx.
Godivelle-d'en-Haut (Puy-de-Dôme), .	35	144
Nantua (Ain), ...	348	141
Cos (Isère), ...	49 (about)	138
Saint-Point (Doubs), ...	984	131
Laffrey (Isère), ...	311	128
Narlay (Jura), ...	101	128
Crozet (Isère), ...	27	121
Paladru ,, ...	964	118
Carré ,, ...	49 (about)	118
Gérardmer (Vosges), ...	301 ,,	118
Chalain (Jura), ...	571	112
Motte (Jura), ...	178	98
Longemer (Vosges), ...	173 (about)	98

The above list cannot be considered definite ; future investigations may result in the discovery of other deep lakes, especially in the Pyrenees, where M. Belloc has not yet brought his labours to an end. The form of the bottom varies considerably; while some, as the lake of Nantua, consist of a single basin, others have several—the lake of Saint-Point as many as eight. All the basins have remarkably flat bottoms, and sometimes one of them is much deeper than the others. The irregularities of the bed are due to sublacustrine ravines, torrential deltas, ancient moraines, to springs such as the Boubioz, which rises in the lake of Annecy from a funnel 266 feet below the surface of the water, and to subterranean emissaries.

Most of the French lakes are of the temperate type, according to M. Forel's definition, that is, the surface temperature is sometimes above and sometimes below 39° F. The lake of Geneva, on the other hand, belongs to the tropical type, its water, at any rate out in the open, being always above this temperature. Some of the small mountain lakes are of the Polar type, never rising in temperature above 39°. Thus, M. Delebecque found the temperature of the upper Lac du Doménon to be 38·5° on July 9th. Certain of the temperate lakes never freeze. The Lac du Bourget, for instance, has never been known to freeze—an anomaly due, perhaps, to the agitation caused on the surface by the winds. The temperature at great depths is as a rule 40°, but may be modified by the presence of springs, as in the case of the lake of Annecy. The Lac de la Girotte is also an interesting example. In the month of July 1892 the temperature in all parts of the lake was 62·5° at the surface, decreasing to a depth of 82 feet, where it attained the minimum of 40°, after which it rose to 44·5° between 300 and 330 feet.

As regards colour there is considerable difference, the lake of Geneva being blue, the Lac du Bourget green, and many of the lakes of the Jura, that of Saint-Point in particular, almost yellow. The cause of this difference is not well understood.

The transparency also varies considerably, not only in different lakes, but even in the same lake from one season to another. Lakes fed by glacier streams are naturally clearer in winter than in summer. In the lake of Geneva a white disc can be seen at a depth of 69 feet in winter, while in certain of the Jura lakes it disappears at 7 to 10 feet.

The chemistry of the water and of the bottoms of the lakes is also treated of in the article from which this note is taken.

The Iron Gates of the Danube.—At the beginning of March the last stone was laid on the slope of the canal, and thus the principal work connected with the regulation of the river is completed. Work was commenced on December 15th, 1890, but for some time little progress was made, until at length the method was changed. Some 9,180,000 cubic feet of stone were blasted in the rocks and reefs of the cataracts and carried away; and to protect the canal, 1¼ miles long, huge dams of stone were thrown up on either side, in which 21,400,000 cubic feet of material were used. Now, a man may walk dry-shod along the smooth bottom of the canal, 10 feet below the surface of the Danube. Between the Iron Gates and the town of Orsova another canal, 260 feet broad and 10 feet deep, has been cut out by blasting, and the canals at the upper cataracts of Izglas-Tachtalia, Kozla-Dojke, and Stenka are to be carried to greater lengths than were assigned to them in the earlier schemes.

ASIA.

Turkestan.—One of the most important results of an exploration by M. Nikitin of the Ust-Urt plateau and the Transuralian steppes, undertaken to ascertain the practicability of constructing a railway from Riazan through Uralsk to the Sea of Aral, is the compilation of a map of this little-known country, chiefly from the labours of M. Sergheyeff, who is now dead. A more correct survey of the relief of the ground has shown many deviations from the configuration as hitherto accepted. The whole depression formerly occupied by the Caspian Sea is impregnated with salt to such a degree that it is totally unfitted for agriculture; in some parts even grazing is impossible. The valley of the Emba is, for the most part, very sandy, and hence incapable of cultivation; only in its lower course does it produce grass, and here are some very fertile and densely populated spots. Near the sea, however, gnats are so troublesome that the country is uninhabitable. Fort Nijni Embinskoie is abandoned.—*Petermanns Mitt.*, Bd. xl. No. 1.

The South-East of Borneo.—On arriving at the mouth of the Barito river in Borneo, vessels have frequently to lie-to for some days before they can cross the bar. They then steam up for a distance of twelve or thirteen miles and turn into the Martapura, a tributary of the Barito, on which stands the capital of the Province of South and East Borneo, Banjermassin. The town contains 25,000 inhabitants, of whom 1600 are Chinese, 300 Arabs, and 200 Europeans. The houses are built on piles driven into the swampy soil, and the floor is some feet above the ground; the roof is generally composed of mats made of *atap*. The houses of the Europeans all have a balcony running along the front. The name Banjermassin signifies a place which is generally flooded, and indeed the Barito delta is flooded at every tide, while during the spring-tides it is hardly possible to cross the most elevated streets of the town dry-footed. The rise of the water in the rivers is perceptible for many miles up-stream, as the fall of level is scarcely noticeable. In general, these floods contribute to the healthiness of the country by washing away all infectious matter. The climate of Borneo is, indeed, not so unhealthy as would be supposed from the latitude. The humidity of the atmosphere modifies the heat, though the thermometer stands at 91° F. at midday, and at 73° at sunrise. The effects of the sudden change of temperature after sunset and heavy rain should be carefully guarded against. Even in the dry season there are few days when there are no showers, and heavy dew falling in the cool nights promotes the luxuriant growth of vegetation.

The number and size, also, of the rivers are evidence of heavy rainfall. The mightiest of all the streams of Borneo is the Barito, which, rising in the interior on the unknown mountain Gunong Tedong, has, according to Schwaner, a length of 560 miles. Steamers ply on this river and its tributary the Martapura, and by this means the traveller can soon reach the interior of the country. Rather more than forty miles from its mouth the Barito is connected by a canal with the Kapuas on the west. Of great importance to the communication with the interior is the military road, which connects the forts of the Martapura with those on the Negara, another tributary of the Barito, terminating at Tabalong. The Barito flows with a sluggish current through a luxuriant tropical landscape: its breadth at Bahan, about 280 miles from the mouth, is 150 yards; at Nuwara Teweh, 250 miles up, 210 yards; at Buntok, 160 miles up, 260 yards. At 79 miles from the coast it has widened to 596 yards, and at its mouth it is 3½ miles broad. The farthest Dutch post is at Nuwara Teweh, in the country of the Dyaks.

The Negara is more densely peopled than the lower course of the Barito, chiefly in consequence of the colonising efforts of the Dutch in this district. It is navigable not only by small boats, but also by river steamers of deeper draught. The first obstacles to navigation are some slate rocks near Tabalong, but it is expected that this difficulty may be easily overcome by a regulation of the bed.

On the east the valley of the Negara is bordered by a chain of lofty mountains which has long been renowned for its mineral wealth. The districts of Martapura, Tanah-Laut, Tanah-Kusan, the mountainous island of Pulo-Laut (about 700 square miles in area), Tanah-Bumbuh, and Pasir are the most interesting to the miner. No doubt the south-eastern division of Borneo would before now have acquired industrial importance, had it not been for certain unfavourable circumstances. The coast is in parts rocky, and possesses no first-rate harbour; the best is Pamukan Bay, which affords safe anchorage for vessels of no very great draught, and gives access to the district of Tanah-Bumbuh. A still greater hindrance to the development of the mining industry is the circumstance that the regulations of the Dutch Administration render it almost impossible for any European but a Dutchman to obtain concessions of land for mining or agricultural purposes.

The mineral wealth of Borneo consists of gold, platinum, coal, copper, antimony diamonds, etc. The first is found in the streams flowing into the sea between 1° and 4° S. lat., and no doubt the Meratus mountains running through the interior from north to south are rich in this metal. At many other places in the interior, also, there is reason to believe that gold may be found. Of special importance is Gunong Kaki, seventy miles west of Banjermassin, between the rivers Kahayan and Katingan, and only fifteen miles from the sea. Gold has here been washed from the streams by Chinamen and natives, but the mountain is considered uncanny by the natives, and none dares climb it. The coal found in Borneo is of Tertiary age. The mine near Pengaron, on the Martapura river, is so far from the sea that the carriage leaves no profit. Lately a mine has been discovered near Samarinda, on the Kutei river, which, owing to its accessible situation, promises a good return. A yellowish-brown lignite, probably of Miocene age, is also found in South-East Borneo.

The vegetable products of the country have likewise been neglected. Gutta-percha, camphor, and ironwood, which are widely distributed in Borneo, are obtained only by barter with the natives through the medium of Chinese. Rice, the chief food of the natives, is cultivated by them only in sufficient quantity to supply their actual needs, so that, when there is a partial failure of the crop, a large importation must take place to keep off famine. More attention is paid to pepper, which thrives well on the soil formed in many places by the weathering of plutonic and volcanic rocks. Tobacco cultivation has made most progress, and the product has been well spoken of by experts. The difficulty attending any industrial enterprise in Borneo is the scarcity of labour. The Chinese are the best workmen, but the Dutch Government has forbidden their immigration. The natives, especially the Banjerese, cannot, for various reasons, be employed. They are exceedingly lazy, and the Government has hitherto passed no regulations with regard to labour contracts, so that the workman can desert at a moment's notice.—From an article by Herr Gottfried Schneiders in *Petermanns Mitt.*, Bd. xl. No. 2.

AFRICA.

The Franco-German Boundary in West Africa.—By the convention of February 4th the meridian of 15° E. longitude is in general accepted as the limit of the Cameroons *Hinterland*. At the south-eastern extremity, however, the German territory is extended along the parallel of 2° N. from the Ngoko to the Sanga, and follows the latter river northwards for about 19 miles, returning to the meridian of 15° in the latitude of Bania. Kunde with the country around to a distance of 3 miles is left in French territory. At 8° 30′ N. lat. the boundary again leaves the meridian of 15°, this time in favour of the French, passes round Lame on the western side and strikes the Benue at Bifara, and, running northwards to 19° N. lat., follows this parallel to the Shari, which forms the eastern boundary of the German territory up to Lake Chad.—*Revue Française et Exploration*, April 1894.

The Mongalla.—Captain Schagestrom has crossed the country from Banzyville on the Mobangi to Mobeka near the Congo, by the basin of the Mongalla. This river was noticed by Mr. Stanley on his descent of the Congo in 1877, and at the end of 1884 Messrs. Grenville and Coquilhat ascended it for a distance of a few miles on board the *Peace*. It is to M. Hodister, however, that we are indebted for the most precise information on its course and tributaries. He explored the upper sources of the river in 1889 and 1890, and discovered the three streams, the Dua, Ebola, and Ikema (or Likema), which unite near Bocapo to form the Mongalla. M. Schagestrom, coming from the opposite direction, struck the head waters of the Ikema, and verified the supposition of Hodister that the Mongalla drains the whole district to the south of the great bend of the Mobangi, for its sources lie close to the latter river, which receives no tributary on its left bank below the confluence of the Welle and the Mbomu. The country M. Schagestrom describes as very beautiful; it is a forest region densely peopled.—*Mouvement Géogr.*, Feb. 18th.

Meteorological Observations in Madagascar.—The Hovas have established a meteorological observatory in Antananarivo, and have already published two volumes of observations recorded by P. Colin. From these we learn that the elevation of the station is 4593 feet. The mean temperature in 1891 was 63·9° F., with a maximum of 84° on Oct. 26th, and a minimum of 41° on August 11th. The three hottest months (December, January, and February) are said to have a mean temperature of 68°, and the coolest (June, July, and August) a mean of 57°. The annual mean atmospheric pressure was found to be 24·8 inches. In 1891 the rainfall was 50·8 inches, distributed over ninety days. The east was the prevailing wind.—*Mitt. der k. k. Geogr. Gesell. in Wien*, Bd. xxxvi. No. 10.

AMERICA.

The Origin of the Name Labrador.—Professor Carlos de Mello has kindly sent us the *Archivo dos Açores*, No. 70, in which is an article by Sr. Ernesto do Canto on the discovery of Labrador. This name occurs (1) on the map in the Biblioteca Oliveriana at Pesaro (1501), where are marked *Cavo Laboradore* and *Insula Laboradore*; (2) on the *portulano* of Vesconte Maggiolo (1511) appears a *Terra de Lavorador* of the King of Portugal, 10 degrees south of a *Terra de los Ingres*; (3) on an anonymous Portuguese map (before 1520) we find written *Do Lavrador: Terram istam portugalenses viderunt a tamen non intraverunt*; (4) on the planisphere of Diego Ribero (1529), in the College of the Propaganda at Rome, the *Tiera del Labrador* is said to have been discovered by Englishmen and to contain nothing of value; (5) the Atlas of Lazaro Luis (1563) ascribes the discovery of this country, here marked between 41° and 51° N. lat., to João Alvares Fagundes—an evident mistake, for Alvares did not make his voyages before 1521; (6) the map B (1534 ?), in the ducal library at Wolfenbüttel, bears after the name of the country a remarkable legend, stating that it was discovered by Englishmen of Bristol, and received its name from a *lavrador* (farmer) of the Azores, who gave information of its whereabouts. Farther south appears *Tiera nueva de los bacellaes*, with a legend stating the country to have been discovered by the Portuguese and that the Corte-Reales perished there.

The explanation given on this map of the origin of the name appears more probable than those generally accepted. Malte-Brun states that Gaspar Corte Real named the country Labrador because it appeared suitable for cultivation, and Humboldt says that Corte Real found there men of great endurance and capable of hard labour; whereas Labrador is stony and has a very severe climate, and is inhabited by savage tribes who live entirely by hunting and fishing.

The name João Fernandes frequently appears in the annals of Portuguese discovery. In the Torre do Tombo exists a grant given to a João Fernandes by Dom Manuel in 1499 of any island or islands he might discover; and in 1501, Henry VII. of England gave a patent to some Bristol merchants and their partners, João Fernandes, Francisco Fernandes, and João Gonçalves, esquires (*armigeri*), of the islands of the Azores, ensuring to them possession of the lands they might discover. It seems not improbable that the same João Fernandes is referred to in the grants. Such is the opinion of Harrisse (*Les Corte-Real*, p. 44). Moreover, the enterprise appears to have been successful, for in 1502 a sum of £5 given to 'the men of Bristol who discovered the island' is entered in the private account-book of Henry VII. Again, in 1506, we find a Pedro de Barcellos laying claim to a parcel of ground in Terceira. The claimant alleges that he received a commission from the king to go on a voyage of discovery with João Fernandes Lavrador, and that on his return, after an absence of fully three years, he found his property in the possession of some of the sons of João Valladam. From the circumstances connected with the case, it may be gathered that Pedro de Barcellos set out on his voyages not later than the early part of 1492. From all these notices it may be concluded as highly probable that a João Fernandes of the Azores, in company with Pedro de Barcellos, sighted Labrador between 1492 and 1495, that he obtained the grant from Dom Manuel in 1501, and, not being able to fit out a ship at his sole cost, associated himself with the Bristol merchants. The title of esquire in the English grant may have been given him by courtesy, or he may in a foreign country have himself pretended to higher rank. Though a farmer, he may have had some knowledge of navigation, for, as on the coast of Scotland, the inhabitants of the Azores often combine the occupations of fishing and agriculture.

AUSTRALASIA.

The Tasmanians a Palæolithic People.—Last year Dr. E. B. Tylor read a paper before the Anthropological Institute on the stone implements of the natives of Tasmania (*Journal*, vol. xxiii. No. 2). The kinds of rock principally used were a mudstone, indurated to some degree perhaps by contact with igneous rock, and a compressed and re-cemented grit, probably derived from the denudation of quartz felsite. It is singular that, while far better materials were at hand, the natives should have made such extensive use of the mudstone. The tools were made sharp simply by striking off flakes with another stone until the required edge was obtained; there is no record of small chips ever having been flaked off by pressure, and no implement of native manufacture appears to have been ground and polished. According to the statements of experienced observers the tools were always grasped in the hand, and were never mounted on handles. The Tasmanians were therefore in an earlier stone age than the Australian savages, not having even the hatchet of the latter, sharpened by rubbing its edge on a grit-stone and fitted to a handle by a withe or cement. Neither did they know of the bow, nor of the throwing-stick characteristic of Australia. They did not use the bark canoe, but a solid float of bundles of bark which they punted along with poles. Yet they made string and baskets, and were adepts in hunting, and drew on bark with the ordinary skill of savages. Their language also, as far as can be judged from the fragments that have been preserved, seems to have been an agglutinative language of simple structure, but not of an extraordinarily low type.

The Islands of Queensland.—In *The Colonies and India*, Feb. 10th, attention is drawn to the importance of the islands lying off the coast of Queensland. It is remarked that the whole sea-line of other Australian colonies is exposed to the unbroken surge of the ocean, whereas in Queensland are over 1000 miles of coast sheltered by the Great Barrier reef. If, then, Australia is to produce native seamen, they must be trained on this coast. The question then remains whether a fairly numerous population could find support by fishing or cultivation of the coastal lands. The writer affirms that from the Tweed river, the southern boundary of Queensland, as far north as the Proserpine river, near Whitsunday Island, he has not seen an acre of really fruitful land near the coast. But with the islands the case is different. They are clothed with thick grass, and the valleys and flats contain soil of fair quality and some moderately heavy timber, chiefly ironbark and bloodwood. From Keppel Bay to Port Bowen all the islands of 100 acres and upwards are capable of supporting two or three sheep to the acre, and from the Percy Isles northwards the islands could maintain a considerable population on the profits of fruit-growing. Mangoes, mangosteens, durians, guavas, bananas, cherimoyas, papayas, oranges, lemons, etc., might be successfully grown. Coconuts also might be cultivated for *copra*. Fish abound all along the Queensland coast; there are millions of kingfish and swarms of green turtle. But the hawk's-bill or shell-turtle is the most valuable sea product, its carapace being often worth £2. Its most southern limit is the Whitsunday group. At present a shell-turtle is obtained only occasionally from the natives. But it is unnecessary to dwell more at length on the marine sources of wealth, which have been fully set forth by Mr. Saville-Kent (vol. ix. p. 364). The writer in *The Colonies and India* maintains that on these islands any man with a capital of £50 to £100 could make a comfortable living without working half so hard as he would on the mainland.

POLAR REGIONS.

The Swedish Explorers in the Arctic Regions.—Through the courtesy of the Swedish Consul at Dundee, we have received another communication from Herr Nilson, giving a more detailed narrative of the adventures of the lost explorers and of his own plans. It was the intention of Björling and Kalstenius to land at some point in Ellesmere Land—Cape Sabine if possible—arriving there about midsummer 1892, and to spend two months and a half in exploring Ellesmere Land with sledges and boats. If the plan were thus far carried out successfully, the travellers were to cross Jones Sound and try to reach North Kent or the Victoria Islands, regions hitherto undescribed, and offering a rich field for botanical research. In order to return home the party were to make for Cape Warrender on North Devon, and there look out for a whaler. On arriving at St. John's, Newfoundland, Messrs. Björling and Kalstenius were unable to find a whaler to carry them to Ellesmere Land, and were therefore obliged to purchase a schooner, the *Ripple*, which made a quick passage of only ten days through the heavy ice which, for the first time during 100 years, filled up the southern part of Davis Strait, leaving only a narrow passage along Baffin Land. Farther north, in the vicinity of Cape Walsingham, there was no ice to be seen when Herr Björling sailed past, on July 4th. If he were unable to return home before winter, Herr Björling intended to seek refuge with the Danes on the west coast of Greenland, or with the Eskimo in the north. These particulars were given in a letter received in Sweden in the autumn of 1892, and as no more was heard of the expedition, great anxiety was felt in the country, and whalers were requested to assist in the search for the lost explorers, their attention being particularly invited to the Carey Islands, which Herr Björling had mentioned in his letter. In consequence, Captain Mackay of the Dundee whaler *Aurora* visited the islands in June 1893, and found the wreck of the *Ripple*, the corpse of one of the sailors, and several despatches deposited in a cairn. He was unable to get into the interior of the vessel, as the deck was covered with nine inches of ice. The despatches referred to give an account of the attempt to reach Foulke Fiord, as related on page 211, but assign no reason for the abandonment of the attempt, nor explain why the party did not make for Inglefield Gulf, where, as they well knew, they would have found the Peary expedition. Herr Björling, in a letter dated October 12th, announced his intention of returning, after spending the winter among the Eskimo on Ellesmere Land, to the islands before July 1st, and requested that a whaler might be sent to the rescue, and that, if no communication from him was found there, it should proceed to Clarence Head, where he would deposit letters in a cairn. Provisions had been obtained from Captain Nares' depôt sufficient to last until January 1st. The party then consisted of five men, one of whom was dying. It would seem that a more reasonable plan would have been to seek the Eskimo living at Wolstenholm Sound or Cape York, rather than to undertake the long and dangerous journey of more than 300 miles to Ellesmere Land, and therefore the friends of the explorers are inclined to believe that the four men were still in vigorous health, and had not given up the hope of attaining the object of their voyage.

The chances that any of the party still survive are certainly small. There are, however, several instances of shipwrecked crews in the Arctic regions having been able to support life in still more unfavourable circumstances. If once the expedition reached Clarence Head, it would not take them long to travel along the western and southern coast of Ellesmere Land until they fell in with the Eskimo who are said to frequent these parts. Reindeer, musk oxen, and other game are supposed to abound here, and the expedition was well supplied with guns and ammunition. Again, they may have been obliged to take a more southerly course, and have found refuge with the Eskimo of North Devon or Baffin Land. With the hope that the party may have reached safe quarters in one or other of those directions, Herr Nilson has set out in search of them, on the *Eclipse* of Dundee. His purpose is to make inquiries among the Eskimo of Cape York, land at the Carey Islands, and bring away all letters and relics that may be found there, land at Clarence Head and look for Herr Björling's despatches, if he does not meet with any members of the expedition, and, if the steamer can touch at North Devon or Baffin Land, seek information from the Eskimo there. He has no definite promise that the steamer will put to land at these points, but the owners and Captain Milne take the greatest interest in his enterprise, and will no doubt do all they can to assist him.

Antarctic Exploration in Australia.—Baron von Mueller has kindly sent us information of a scheme for establishing the whaling industry in Victoria. Mr. Bull, when in Melbourne during 1891, endeavoured to induce the capitalists of the city to embark their money in the venture, but without success. He then returned to Norway and obtained the co-operation of Captain Svend Foyns of Tönsberg, who placed the *Antarctic* and her crew at his disposal for an experimental voyage. This vessel, under the command of Captain L. Kristensen, left Tönsberg on September 20th, and during eight days caught 1500 seals in the vicinity of Kerguelen, which are expected to yield 95 tons of oil. She then made for Australia, and arrived at Melbourne at the end of January. It is hoped that the Victorian Government will remit the primage duties on the *Antarctic's* cargo, and will assign some place where the boiling-down may be finished. Next November the vessel will be again despatched southwards, and will attempt to enter the Antarctic Circle. Arrangements will be made to take scientific men on board, should any wish to make the voyage. If the expedition proves a commercial success, more Norwegian vessels will be sent to Australia.

MISCELLANEOUS.

Deutsche Rundschau, Jahrg. xvi. Heft 7, contains a list of the navigable waterways of the German Empire, with their lengths, accompanied by a map which shows at a glance the importance of these means of communication.

The tenth Congress of Americanists will be held at Stockholm, and will be opened on August 3rd. Those who intend to read papers at the meeting are requested to communicate with the secretary before July 1st.

The gunboat *Massie* has passed the Kemerat rapids on the Mekong, and has pursued its course northwards. It will probably during the high water reach Luang Prabang, the rapids at the second bend being insignificant.—*Revue Française et Exploration*, April.

According to *Globus*, Bd. lxv. No. 14, yet another Polar Expedition is projected. Walter Wellman, a newspaper correspondent of Washington, accompanied by Professor Frenon, late of the Coast Survey, proposes to enter the Arctic regions by way of Spitzbergen with an expedition of fourteen men.

An Austrian lady, Fräulein Hlawaczek, passed through Fort Salisbury last June, when she stated her intention of travelling alone and on foot to Cairo. Through Umtali, Massikessi, and Chilomo, she reached Mt. Milanji, and in a letter dated August 28th, 1893, expressed her intention of walking round Lake Shirwa, and then making for Mt. Zumbo and Blantyre. Later intelligence from Nyassaland contains the sad announcement of her death at Fort Anderson.

Professor de Mello wishes to make the following corrections to his paper on Machico. The date of the first work on p. 200 is 1579 (not 1590 or earlier), and the second work was published in 1599 with the title *De Insula Materiæ.* On p. 201 the date of *Iles d'Afrique* should have been 1848 (not 1868). The Prussian expedition of 1863 was under the leadership of Reinhold Werner. The Capuchin monkeys, so common in South America, are called Machim, and Professor de Mello suggests that they may have given its name to the Aldea de Machin of Maiollo's map.

NEW BOOKS.

Unter den Naturvölkern Zentral-Brasiliens. Reiseschilderung und Ergebnisse der zweiten Schingú-Expedition, 1887-1888. Von KARL VON DEN STEINEN. Berlin: Dietrich Reimer, 1894. Pp. xix+570. *Price* 12 *M.*

One is so accustomed to the usual books of travels that Professor von den Steinen's work comes as a pleasant surprise. Here we have none of the tedious, monotonous accounts of the ups and downs of the journey, no extracts from the almost inevitable diary, no ill-digested opinions on everything in general and nothing in particular, but a thorough and yet fascinating description of the people and country, of habits and customs, of language, of myths and superstitions, such as has hardly been seen before.

There are now few primitive peoples left to investigate, and certainly no one has hitherto made such a thorough study of children of nature as the author. Well equipped with the requisite knowledge as he was, he has surpassed expectation, and the result is a standard work which will serve as a model in anthropological research, but will almost defy competition. There is no slipshod work in this volume; every page shows signs of careful study and strict deductive reasoning, of keen insight and great powers of observation.

The geographical part of the work is of considerable value, as the sources of the Schingú were explored and a map of the district was drawn up by Professor Peter Vogel, who was responsible for the astronomical and topographical observations.

The chief importance of the work lies, however, in the anthropological and ethnographical description of the aborigines—people in a perfect state of nature, on whom civilisation has had no effect. Living with them for months on intimate terms, Von den Steinen has not only been able to give us information concerning their habits and customs, and the outward details of their daily life, but he has successfully endeavoured to obtain an insight into their thoughts and feelings—to get, as it were, behind the veil—and has presented to us a comprehensive account of the workings of their minds. After reading his work we seem to understand, as we, perhaps, never did before, the origin of the arts, the growth and development of the mental faculties, and those subtle and almost mysterious influences which contribute to form the intelligence of man and give him the necessary impulse to rise above the level of the beast. Von den Steinen does not confine himself to the mere narration of facts, but seeks the why and the wherefore, and traces back the customs and habits which obtain among the Indians to their causes. Most travellers are in the habit—probably unconsciously—of regarding natives from an external standpoint and a higher level, whereas our author seems to identify himself with the people he investigates, and to give us, as it were, a subjective view both of the influence of environment on man and his efforts to adapt himself to it or overcome it.

It would be a hopeless attempt to give a *résumé* of the book, for it is as full of matter as an egg is full of meat; but we can assure the reader, scientific or general, that its perusal is an intellectual treat.

The illustrations are not the least valuable part of the contents; the photographs taken by Dr. Paul Ehrenreich are excellent, and give a graphic idea of the country and people. The publishers also must be congratulated on the production of a well-printed and elegant volume.

Mit Emin Pascha ins Herz von Afrika. Eine Reiseberieht mit Beiträgen von Dr. Emin Pascha, in seinem Auftrage geschildert von Dr. FRANZ STUHLMANN. Berlin: Dietrich Reimer, 1894. Pp. xxii + 901. *Price* 25 *M.*

It is well known to our readers that, after his return to Bagamoyo from the Equatorial Province, Dr. Emin Pasha entered the German service, and, as soon as he had recovered from his serious accident and made the necessary preparations, set out on the journey from which he was never to return. Accompanied by the author of this work, than whom he could not have had a more sympathetic colleague, he made for the southern shore of Victoria Nyanza, and skirting the lake arrived at Bukoba on the western shore, where he founded a station. Then, after exploring the Kagera and its associated lakes, he marched to the Albert Edward Lake, and by its western shore came to the Isango and Mt. Ruwenzori; and, having received into his company some of the Sudanese, who with Selim Bey had retired from the Equatorial Province to the south-western shore of the Albert Lake, he advanced on to the Lendu plateau, where scarcity of provisions and an outbreak of smallpox among his men obliged him to retrace his steps to Undusuma, where he ordered Dr. Stuhlmann to leave him and hasten on to Bukoba with the men who were still free from disease. He himself, worn out with illness, was obliged to intrust himself and his men to the care of some Manyema, with whom he had travelled nearly to Nyangwe when he was murdered at the instigation of the Arabs then at war with the forces of the Congo State.

The book is a mine of scientific information on all that relates to the country traversed. Emin Pasha's great achievements in scientific research are known to every one, and Dr Stuhlmann was well fitted to assist in such work, and his zeal is shown by the large number of data he collected. Anthropology and ethnology are, perhaps, the branches of science which occupy the greatest space in the book, these being subjects to which Emin Pasha always paid particular attention ; but we find also abundant notices of the fauna and flora, etc., of the districts traversed. The dwarfs on the western side of the lakes were examined by Dr. Stuhlmann with especial care.

While the expedition stayed at Bukoba, Dr. Stuhlmann made an excursion to Uganda in search of boats, and was there when Captain Lugard arrived. He was, therefore, a witness of some of the events which took place in Uganda at that time, though he left the country before hostilities commenced. Of these he heard only from missionary refugees, and is therefore cautious in his judgment. It is evident that he has tried to form an impartial opinion on these unfortunate occurrences ; and he fully recognises the difficulty of Captain Lugard's position, with a small force, among three parties animated by the fierce animosity towards one another that only religious differences can inspire.

Some of the chapters were dictated to Dr. Stuhlmann by Emin Pasha. Among them is an account of the occurrences in the Equatorial Provinces after the Pasha's departure, gathered from Selim Bey and his brother officers. The details of the negotiations with the Sudanese are also given. Emin was very conscientious in refusing to make any promises which he could not perform without the consent of the German Government, and made the Sudanese clearly understand that, if they joined him, they must go wherever he chose to lead them.

The picture of life at the camp of Undusuma, on the return from Lendu, is a very sad one. The men were daily falling victims to the ravages of smallpox, and Emin Pasha himself was nearly blind and worn out with sleeplessness and loss of blood. For all that he never relaxed his efforts, carrying on negotiations with the natives, and distracting his own attention and that of his men from the wretchedness of their condition by scientific pursuits. To prevent the further spread of the disease, he decided that Dr. Stuhlmann should march on with the healthy men ; and when the latter showed great reluctance to leave him in such a plight, he peremptorily exacted obedience to his orders.

The character of Emin Pasha need not be discussed here, as it was sketched in these pages only a few months ago. It exerted a powerful attraction on Dr. Stuhlmann, and the warm friendship that sprang up between the two explorers during the two years of their acquaintance redounds to the credit of both. To the friends of Emin Pasha it must be a consolation that, during the last troublous days of an eventful career, he had beside him such an attached and sympathetic companion.

The volume is well printed and profusely adorned with illustrations, some of them of considerable merit, and is accompanied by two excellent maps. The great objection to it is that it is too heavy.

Discovery of Lakes Rudolf and Stefanie. By Lieut. LUDWIG VON HÖHNEL. Translated by NANCY BELL. With 179 Illustrations and 5 Coloured Maps. Two vols., pp. 435, 397 ; Appendices, etc. London : Longmans, Green, and Co., 1894. *Price £2, 2s.*

This is a popular narrative of Count Samuel Teleki's exploring and hunting expedition in Eastern Equatorial Africa during 1887-88 written by his companion, Lieut. von Höhnel. The object of the expedition was not, strictly speaking, scientific ; but incidentally it resulted in very considerable gain to science, and, above all, in the important discovery of Lakes Rudolf and Stefanie.

On setting out, the object of the expedition was to penetrate to the north of Lake Baringo, and to open up the dreaded Kikuyu country. This object was more than realised. The hardest experiences were those encountered during the passage of the southern portion of Kikuyu, in consequence of the hostility of the natives, and along the desert shores of Lake Rudolf. Breaking new ground, as it did, the expedition had to face all the uncertainty, all the hostility, and all the risks of pioneer exploration. It had to fight its way through at some points ; whilst at others, many died of famine, disease, and exhaustion. At Reshiat, on the north shore of Lake Rudolf, the expedition again entered a populous district ; but, after discovering Lake Stefanie, the hardy explorers were compelled by circumstances to retrace their footsteps instead of completing the circuit of the lake. A less conscientious leader than Count Teleki would have raided his host's cattle and pushed on.

The geographical results of the expedition have been given at length in the pages of this magazine, and with still greater completeness in a Supplement (No. 99) of Petermann's *Mitteilungen*, 1890. But the popular narrative before us adds useful and interesting information concerning the fortunes of the expedition, and the new tribes visited by it. Other scientific results are briefly referred to in the Appendices ; and Count Teleki himself publishes what is modestly called his "game-book." The volumes abound in hunting stories : few regions in Africa are better stocked with big game than those over which the Count hunted.

The expedition was a large one, and was most efficiently equipped. It was conducted with tact and forbearance, for which the leaders—not forgetting the natives, especially the Somali—deserve the highest credit. Undoubtedly, none but large expeditions should venture over the same ground ; but this fact does not sufficiently justify the statement by Lieut. Höhnel that, in all parts of Africa, large expeditions are better than small. The latter have the advantage in "eating their way" through the inhospitable regions, through which the former cannot pass unless supplied with large stores of provisions. In such districts large expeditions are too often tempted to pillage and brigandage.

A word of praise is due to the large map in two sheets accompanying the volumes, the physical colouring of which is admirable.

The work of the translator has been carefully and efficiently performed.

Sibirische Briefe. Von O. O. Leipzig : Duncker und Humblot, 1894. Pp. 327.

Paul v. Kügelgen, of St. Petersburg, in his preface to this volume remarks : "Most books on Siberia are unfortunately calculated, when serious and scientific, to weary their readers with too many statistics, without furnishing them with any relaxation. The exhaustive work on Siberia and its Railways, prepared for the Chicago World's Fair, is of this description. Other books on Siberia are certainly entertaining, but are unreliable and faulty, partly because the writer has not approached his task impartially but with a certain bias, partly because he was not in a position, although spending months and weeks in studying Siberia, to grasp its complicated character, and to express a fair judgment on its actual condition." These letters from Siberia, being written by a resident there of perfect impartiality and great scientific knowledge, are, in Herr v. Kügelgen's opinion, thoroughly trustworthy. They originally appeared in the *St. Petersburger Zeitung*, are nineteen in number, and are nearly all written from Irkutsk between October 1888 and May 1892. There is also an article on "The Gold-washing Industry of Eastern Siberia." The letters are written by the author to his mother, and are lively, interesting, and instructive. Winter at Irkutsk in February 1889 is described. There was little snow, the air was as clear as glass, the sky was of a splendid blue colour just as in Italy, and the frost-bound ground was as hard as iron. In November 1888 the thermometer fell below – 13° Fahrenheit, and on one occasion it was even below – 32° Fahrenheit. During December the cold ranged from about – 23° to – 60° Fahrenheit. At the New Year the cold was less intense, but every evening – 23° was registered.

In March 1891, the author comments on the strenuous efforts being made by English merchants to obtain in Siberia a market for their goods. At first these imports proved too costly and altogether unsuitable, so the British importers changed the character of their wares, and, having substituted cotton stuffs, agricultural implements, pottery, and ironware of a plainer variety, they obtained such a success that they begged for a prolongation of the duty-free privileges which they enjoyed. With noble indignation, the author contrasts the petty jealousy shown by his German fellow-countrymen towards these English traders, and their poor satire of the "nation of shopkeepers," with the indomitable energy displayed by the British merchant; and he declares that all good Russians should be, and are, thankful that the English have proved that the Arctic Ocean can be navigated not merely for scientific, but also for commercial purposes. The author, however, criticises severely the superficial accounts of Siberia published by some English-speaking travellers, specifying in particular *An Inquiry into Siberian Prisons*, by a well-known author. The volume ought to have had an index, and a map indicating the gold-fields of Siberia.

Recollections of a Tour made in Scotland A.D. 1803. By DOROTHY WORDSWORTH. Third Edition. Edinburgh: David Douglas, 1894. Pp. 316. *Price* 5s.

Written in 1803, this diary of Dorothy, sister of the poet Wordsworth, was not published till 1874, when it was issued in Edinburgh, and edited, with a preface, by Principal Shairp of St. Andrews University. It is now a classic which will be read and prized by every lover of Scottish scenery. William Wordsworth, Coleridge, and Dorothy left Keswick on 15th August 1803, the occupants of an Irish car, which Wordsworth drove. Entering Scotland, they made for Dumfries to see the burial-place of Robert Burns, and then, after passing up Nithsdale, they struck off to Leadhills. After visiting the Falls of Clyde and Glasgow, the party drove to Loch Lomond, and, sailing across from Tarbet, entered the then seldom-visited land of Loch Katrine and the Trossachs. Wordsworth, Coleridge, and "an Edinburgh drawing-master" slept there in a barn upon hay, whilst Dorothy slept in the room of a hut which the cottagers also occupied. There were no hotels there then. Returning to Loch Lomond, Coleridge (who was very unwell) left the Wordsworths and went to Edinburgh. Dorothy and her brother drove on to Inveraray, Loch Awe, and Ballachulish, and, whilst on the road to Glencoe, their horse and car went headlong into the loch. The Wordsworths had barely time to jump out and save their lives. After the districts of Breadalbane and Athole had been traversed and the Trossachs revisited, the Wordsworths drove by Stirling to Edinburgh, and visited Mr. and Mrs. Walter Scott at Lasswade. Then followed a charming Lowland tour, often in Scott's company; and on 25th September 1803 the Wordsworths arrived at their home at Grasmere. The volume contains the poems by Wordsworth inspired by the tour, whilst the tour itself is narrated by his sister in language which is always delightful and never commonplace. So valuable a book merited an index, and a sketch-map showing the itinerary would have been interesting.

Amid Greenland Snows; or, the Early History of Arctic Missions. By JESSE PAGE. London: S. W. Partridge and Co., N.D. Pp. 160.

This little volume, with too ambitious title, tells the story of the mission to Greenland of Hans Egede, the Norwegian pastor, and of the Moravians who immediately succeeded him at the central settlement of Godthaab. Brief descriptions of the Eskimos and their customs are given, and of the out-stations of Lichtenfels and Lichtenau. The whole is illustrated by an outline map of Greenland, and by pictures, one of which is of value—New Herrnhut, from the original in Crantz's *History of Greenland.*

Life in Tripoli. By G. E. THOMPSON. Thirty Illustrations. Liverpool: Edward Howell, 1894. Pp. 116.

To any one contemplating a visit to Tripoli, this pleasantly written travel-sketch will be of great service. It displays sunlit pictures of Arabs, camels, palms, and desert in a rich and tempting panorama of Eastern life and colour. The thirty illustrations are photographs from the author's camera.

A Historical Geography of the British Colonies. By C. P. LUCAS, B.A. Vol. iii.: *West Africa.* With Maps. Oxford: At the Clarendon Press, 1894. Pp. 283. *Price 7s. 6d.*

In this, as in the two preceding volumes of his work, Mr. Lucas shows that he has formed an admirable conception of the range and the aims of historical geography. His method is thoroughly sound. Physical features are carefully described for the purpose of showing their bearing on exploration and settlement, on the relations between the settlers and the natives, and on the subsequent development of the resources of the countries dealt with. The author notes with perfect accuracy that the early interest in Africa shown by the nations of Western Europe was due, not to what it was in itself, or to what it promised in the way of direct gain, but to the hope and expectation that it would afford a new way to the East, which was regarded as the great source of wealth and the main sphere of commercial activity. In short, Africa, in the first instance, was regarded not as a goal, but as a stepping-stone.

The volume comprises three sections. The first, which is introductory and general, enumerates the British colonies and dependencies in Africa, and devotes a special chapter to the history of early exploration down to the opening of the route to the East round the Cape of Good Hope. In this section, full justice is done to the enlightened scientific and philanthropic expeditions of Prince Henry the Navigator, who, by the way, was half an Englishman, his mother having been a daughter of John of Gaunt, and the fifth centenary of whose birth was lately celebrated at Oporto. Not without reason does the author claim for the Prince's efforts the proud distinction of having stimulated the beginnings of modern history in Western Europe, as the fall of Constantinople did in the East. In this section, Mr. Lucas refers to Perestrello, the Governor of Porto Santo, as having been the father-in-law of Columbus. If he will consult Mr.

Clements Markham's *Life of Columbus*, published a year ago, he will probably see reason to reconsider that statement, and also the explanations of his footnote.

The second section deals specially, and in detail, with the West African dependencies. It shows that these settlements had their origin in privileged and chartered trading companies—Portuguese, English, French, and Dutch—the first company having been founded by the Portuguese at Lagos in 1444, which was followed by English companies in 1588, 1592, and 1618. During that period, the two sources of wealth in West Africa were also the sources of misery to the natives, and of demoralisation to the settlers, namely, the slave-trade and gold-dust. The most interesting, as well as the most startling, chapter in this section is that which deals with the moral, social, and economical aspects of the slave-trade. Mr. Lucas seems to admit the force of the economic arguments with which the slave-trade was defended in early times. The chief of these was that slavery was the necessary outcome of time, and place, and circumstance. The fact must be recognised that black labour was necessary to the development of the West Indies and of tropical America. Without it, indeed, these regions could not have been cultivated. Moreover, the condition of the transported slaves was greatly improved. Slavery is indigenous to Africa, and the Negroes who were carried across the Atlantic exchanged black and uncivilised for white and humane masters. They exchanged useless and ruthless servitude for a comparatively comfortable plantation life. It must be remembered, moreover, that the Europeans who engaged in the slave-trade did so, in the first instance, not as raiders, but as traders. They bartered for slaves just as they bartered for gold-dust and palm-oil. Moreover, the slave-trade was sanctioned by the blessing of the Pope, who argued that the slavery of the body might lead to the eternal saving of the soul.

The English adventurers kept aloof from the slave-trade as long as they could. The chivalrous Sir John Hawkins was the first English slave-trader. In 1562 he carried off 300 Negroes from Sierra Leone, and sold them to the Spaniards of Hispaniola. But this was an exceptional case. Queen Elizabeth is said to have disapproved of the traffic; but she did not object to derive profit from it. Cromwell also disapproved of the slave-trade; but in his Navigation Act of 1651 he made it a part of his national commercial policy.

Mr. Lucas is careful to point out that his explanation of the slave-trade as an economic necessity does not involve approval of its hideous atrocities. On this subject he says :—

"It is impossible, then, to resist the conclusion that the slave-trade was inevitable, and that it provided the material by which tropical America was developed and was colonised, and without which development and colonisation would have been impossible. But such an admission involves no denial of its hideous atrocities, or of the evil which it brought on every country and every people which had part and lot in its wickedness and its shame. In America it produced conditions of life which were only partly remedied by nothing short of social revolution, which have left to this day a blight on the lands to which Africans were carried, which have created difficulties of race and colour, of political and social economy, which make the present anxious and the future all uncertain. In Africa it stereotyped savagery, it paralysed industry, it created such monstrosities as the negro power of Dahomey, it made the land which Europeans first visited in modern history the darkest and most degraded part of the world. But, worst of all, it tainted and lowered the peoples of Europe, it ran directly counter to freedom, to humanity, to every noble impulse of growing races and moving times, and it left a mark of infamy on English history which no chronicler can minimise and no apologist erase.'

Other trading companies were chartered by the English Government in the latter half of the seventeenth century—"The Company of Royal Adventurers" in 1662, and "The Royal African Company" in 1672. The monopoly of the latter company was abolished in 1697, and then the trade in slaves was thrown open to all British subjects. Nevertheless, in 1713, the Treaty of Utrecht confirmed the *Assiento*, or contract, with the Spanish Government for the right to supply slaves at the rate of 4800 every year. The last British African Company—"The Company of Merchants Trading to Africa"—was formed in 1750. It received a subsidy from Government for the maintenance of African forts for the public service; but in 1821 the forts were taken over by the Crown, and the company was dissolved.

It is interesting to note that the slave-trade, in which so much capital was embarked, was not profitable to the companies. For this two causes are assigned—the one, that the traffic was economically unsound, inasmuch as the slave-trade implied a constant state of war; the other, that no monopoly was allowed to the traders, monopoly being inconsistent with the condition of cheap labour, which the planters required. The case would have been different if the British Government had been eager to assume the responsibility of direct ownership; but the British policy has always preferred indirect to direct control—to encourage private companies and to declare protectorates, rather than to constitute new colonies.

It only remains to be said that the literary quality of Mr. Lucas's work must be rated high. He has command of a clear, exact, and pointed style, which is often fervid, and always arrests attention.

Introduction à l'Étude de la Géographie Physique. Par J. Thoulet. Paris: Soc. d'Éditions Scientifiques, 1893. Pp. 352.

This book is to be regarded as a series of thirteen essays upon various branches of physical geography, which have been developed from notes of a course of lectures delivered by the author as professor at the Faculty of Natural Sciences of Nancy. In his preface the author disclaims for his lectures and for this volume that they are in any way intended to enable students to pass examinations. That may help to explain why it is that the book offers to a thoughtful reader so much that is pleasant as well as instructive. His object in publishing the essays in their present form has been to arouse a genuine interest in the subjects of which he treats; and no one who reads the book can deny that the author has been successful in his aim. His discursive style rather adds, if possible, to the charm of the book, without at the same time detracting in the least from its value as a popular introduction to the study of physical geography. The reader, in perusing M. Thoulet's book, will probably feel disposed to express regret that physical geography, as it is there treated, has, in this country, been thrust aside to make room for the heterogeneous compound of astronomy, chemistry, and physics which, under the name of physiography, has latterly usurped its place.

M. Thoulet begins by giving a clear and concise account of the birth of the world, which is followed by chapters dealing with its youth, its maturity, and its old age, or, in other words, with geology. Some observations upon its future, so far as this can be predicted from the facts made known by the astronomer and the physicist, follow the chapters devoted to geology. He then gives us a short account of the rocks composing the earth's crust, which is, of course, treated in popular language, but which is, at the same time, correct in the main. This chapter is succeeded by one on the internal forces of the earth, in which the author treats of terrestrial movements, earthquakes, and volcanoes—subjects which, like nearly all the others treated of in the book, are made the texts for observations upon the relations between various races of men and their physical surroundings. Then follows a chapter upon the forces which act upon the world from without, including the geological action of wind, rain, and rivers. An interesting summary of the main facts of oceanography follows, and then another on ice. Chapter x. deals with the part played by organised beings in the life of the globe. Lastly, the concluding chapters are devoted to the subject of Man, Ancient and Modern.

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., etc. London: Charles Griffin and Co., 1894. Pp. xix + 156. *Price* 12*s.* 6*d.*

The announcement contained in the secondary title is a guarantee of the thoroughness of the work. The mean density of the earth may be determined either by the deviation of a plumb-line near some elevation or by pendulum observations above or below such elevation, or, secondly, by observations of the attraction of small masses in the laboratory. The author gives an account of all the principal experiments of both classes, among the former those of Maskelyne and Hutton at Schiehallion and of James and Clarke at Arthur's Seat being especially interesting. In these field experiments there is much uncertainty arising from the difficulty of ascertaining the mean density of the surrounding masses, and the author shows that in the investigations alluded to the calculation of the surrounding attracting masses was not carried far enough. It is interesting to note that contour lines were probably first used to indicate the configuration of the surface by the Rev. Nevil Maskelyne.

We come next to pendulum experiments, of which may be mentioned Professor Airy's in 1826 in the Harton coal-pit. As an error of 0·1 second per day in the observation of the pendulum vibrations would cause an error of more than one per cent. in the final result, while the personal equation of one observer amounted to ½ second in a four hours' swing, it is not to be wondered at if the result was not satisfactory. In 1883 and 1885 Major von Sterneck made some very interesting experiments at Pribram in Bohemia and Freiberg in Saxony, with the pendulum apparatus he has himself devised, the swings being observed at the surface by the same clock through the medium of an electric current. Corrections were made for temperature, pressure, humidity, etc., but there remains the difficulty of ascertaining the density of the surrounding crust, and the results cannot be considered very satisfactory; in the one case the calculated mean density of the earth was 5·77, and in the other about 7.

Laboratory experiments show a much closer agreement in the results, as might be expected, because the volume and density of the mass, the attraction of which is to be compared to that of the earth, can be ascertained to a high degree of exactness. On the other hand, the utmost accuracy is required, the masses and the distances between them being so small, and the greatest care is necessary to obviate errors arising from differences of temperature, convection currents, etc., or to make corrections for them. Of such experiments three kinds have been made; with the torsion balance by Cavendish, MM. Cornu and Baille, and others; with the pendulum balance; and lastly, with the common balance. The latter half of the book is occupied by a description of the author's own experiments with the common balance in the Mason College, Birmingham. The attracted masses were spheres of lead and antimony, and were capable of being raised equal known distances in order to eliminate by a second experiment the cross attractions. The attracting mass was supported on a platform movable round a central axis so as to bring it under either of the attracted masses. The balance was set in a case, and the observations were taken by a telescope in the room above. All the moving parts were supported independently of the balance and its case, and were operated by pulleys, etc., from the outside. The statements that it was necessary to leave the beam free for two or three days before making an experiment, that it might attain its position of stable equilibrium, and that the effects of entering the balance-room did not die away for some hours, give a notion of the extreme delicacy of these experiments. The result obtained was 5·493.

The work is a very complete and exceedingly interesting account of the whole question of the density of the earth.

Outline of the Geology and Physical Features of Maryland. By GEORGE H. WILLIAMS and WILLIAM B. CLARK. Baltimore, 1893. Pp. viii + 67.

This is a summary of the information at present available regarding the physical geography, the geology, and the mineral resources of the State of Maryland, originally contributed by certain members of the Faculty of the Johns Hopkins University for the World's-Fair Book. The two authors whose names appear on the title-page are well-known geologists ; and it therefore goes without saying that the matters treated of in this volume will fully repay attentive perusal.

The first chapter, occupying thirty pages, deals with the topography and climatology of Maryland, and is illustrated by several valuable maps and diagrams. In the second chapter we get a good general summary of the geological succession, which is illustrated by several full-page illustrations, printed from photo-process blocks, which bring before us the field aspect of the rocks referred to in the text. Lastly, the three last pages are devoted to a summary of the main facts relating to the mineral resources of the State, among which, as might be expected, coal occupies the first rank.

Hints to Travellers, Scientific and General. Edited for the Council of the Royal Geographical Society by DOUGLAS W. FRESHFIELD, Hon. Sec. R.G.S., and CAPTAIN W. J. L. WHARTON, R.N., F.R.S., Hydrographer to the Admiralty. Seventh Edition. London : Published by the Royal Geographical Society, 1893. *Price* 8*s.* ; to Fellows, at the Office of the Society, 5*s.*

After an interval of four years the Royal Geographical Society have issued a new edition of their invaluable little traveller's *vade mecum*. The new volume, though containing sixty-eight pages more than the last edition, does not apparently bulk more, and is quite as convenient to carry. There are some slight alterations in arrangement—all improvements. The Contents are better arranged. Each subsection is paginated in the table, making reference much easier. On the binding, too, the scale of inches and centimètres has been removed to the edge of the cover and has been duplicated. This apparently slight alteration is a vast increase of convenience.

In the book itself a new and exhaustive chapter on Medical and Surgical Hints, by the late Surgeon-Major Parke, replaces that of Mr. Dobson. Mr. Donkin's article on Photography has been revised and brought up to date by the Society's instructor, Mr. Thomson ; and Mr. Bates's on Natural History by Mr. Sclater. The article on the Orthography of Place-names has been rearranged and amplified ; and to the article on Geology a memorandum on Glacier Observations, by the Alpine Club Committee, has been added. The subject of Climate and Meteorology has received much attention. An important table of relative humidity, and four meteorological charts giving isothermal and isobaric lines for the whole globe, have been added ; and the chapter is further enriched by the hints and instructions to observers in Tropical Africa which were prepared by a committee of the British Association of 1891.

Altogether this new edition is a credit to the Society that has issued it, an indispensable companion to every traveller, and interesting reading for the armchair geographer.

Verhandlungen des zehnten Deutschen Geographentages zu Stuttgart, am 5, 6 *und* 7 *April*, 1893. Herausgegeben von GEORG KOLLM, Hauptmann, A.D. Berlin : Dietrich Reimer, 1893. Pp. lxiv + 221.

Among the papers printed in this volume are articles by Dr. Kuhlmann on the dwarfs on the Ituri, by Count Zeppelin on the configuration of the basin of the Lake of Constance (see vol. ix. p. 375), by Dr. Willi Ule on the temperature of the Baltic lakes (see vol. ix. p. 146), and by Dr. A. Schenk on the mountain structure and configuration of German South-West Africa. Dr. Theobald Fischer spoke at the meeting on the outlines of the land surface of Italy, Dr. J. Walther read a paper on the subject which he has studied so thoroughly—denudation in the desert, Dr. H. Schlichter gave an account of his photographic method of determining longitudes, and Professors Penck and Hartmann, Dr. A. Hettner, Dr. E. Brückner, and others made communications to the Congress.

Kartenkunde. Geschichtlich dargestellt von EUGEN GELCICH und FRIEDRICH SAUTER. Mit gegen 100 Abbildungen. (Sammlung Göschen.) Stuttgart : G. I. Göschen'sche Verlagshandlung, 1894. Pp. 160.

This little book may be described as a systematic sketch of the evolution of scientific cartography. The principal part of it is devoted to the study of map-projections, from the first attempts in ancient times down to the latest improvements of recent invention. Then follows an account of the different kinds of maps and the different methods employed in the delineation of topographical features. Had such a handbook been published in this country, where ignorance of map-making is characteristic of the people, it would have been a welcome addition to our geographical literature, but in Germany, where there are already so many such treatises, it is difficult to see where there is room for another.

The Statesman's Year-Book: Statistical and Historical Annual of the States of the World, 1894. Edited by J. SCOTT KELTIE. London and New York : Macmillan and Co. Pp. xxxiii + 1152.

Few words are required to welcome the thirty-first annual issue of this invaluable work of reference. As usual, no pains have been spared to render its contents accurate, and to bring them down to date : thus, the recent changes in the Cabinet are noted on a slip inserted after the volume went to press, while a few additions and corrections have been added to the introductory matter. It seems a pity, however, that the last-mentioned items could not have been included in the index, which, otherwise, appears to be exhaustive. The naval statistics are of the highest interest, and form a useful and admirable review of the state of all the navies of the world. The lists of works of reference appended to the notice of each State and colony are excellent, the works having been selected with care and judgment. Can we say more in praise of the volume than that it is as good as, and in some ways better than, those which went before it ?

The Australian Handbook (incorporating New Zealand, Fiji, and New Guinea) Shippers' and Importers' Directory and Business Guide for 1894. London, Melbourne, Sydney, Brisbane, and Cape Town: Gordon and Gotch, 1894. Pp. 624.

We have so frequently and favourably noticed this admirable year-book that it is rather difficult to say much that is new in its praise. The publishers must, however, be heartily congratulated on having reached the semi-jubilee issue, and on having expanded the publication from the modest 164 pages of the first volume to the substantial book now before us, with its clear illustrations and reliable and useful maps and charts. The gazetteers have undergone revision by local correspondents, and are fuller and better than before. The manner in which the information has been brought up to date is very satisfactory, separate slips showing colonial appointments since the work went to press and the recent changes in the British Cabinet. Another feature of great interest at the present time is the series of charts showing very clearly the prices of the Government securities of New South Wales, New Zealand, Queensland, South Australia, Tasmania, Victoria, and Western Australia, and of the prices of various bank stocks between the years 1883 and 1893. These charts form an excellent companion to Miss Shaw's paper on Australia (p. 169). Other new or important matter will be found in the exhaustive article on the Australasian colonies, in the description of the New South Wales railways, and in the land regulations of New Zealand. The book is indispensable to all interested in the colonies of Australia, and has been well got up in every way.

Helensburgh and the Gareloch: A Photographic Souvenir. Helensburgh: J. Lindsay Laidlaw. *Price* 6*d*.

A collection of views of the scenery of the Gareloch, with a few lines of explanatory letterpress to each. The photographs are on the whole well executed.

A. Hartleben's Statistische Tabelle über alle Staaten der Erde. Zweite Jahrg., 1894. Wien, etc.: A. Hartleben's Verlag.

A large amount of information is contained in this useful sheet—areas, population, trade, weights and measures, army and navy, etc. In some cases the figures are not quite accurate (we noticed last year the case of London), and we have certainly no yellow in our national flag.

The Famous Places of Scotland. By Rev. R. LAWSON. Paisley: J. and R. Parlane, 1893. Pp. 123. *Price* 1*s*.

A companion volume to the author's *Sacred Places of Scotland*, this pretty little book contains short descriptions of thirty-eight celebrated places in Scotland, including the Shetland Islands. Although the author writes from personal knowledge of each place, some details, such as the names of the rooms he describes at Abbotsford, require correction. The illustrations are pleasing.

Guide to Annan and Neighbourhood: Historical, Traditional, Descriptive. By D. WATT. Annan: D. Watt; Edinburgh and Glasgow: J. Menzies and Co.; Glasgow: Wm. Love, N.D. Pp. 26. *Price* 6*d*.

This is a neat, brightly written little guidebook, well calculated to be useful to those visiting Annan and neighbourhood, either on business or for pleasure. But it ought to have been provided with both index and map, the want of which is felt even in so small a book.

Le Sous-Sol des Causses. Par M. E. A. MARTEL. Rouen : Imprimerie de Espérance Cagniard, 1893. Pp. 39.

Sous Terre. Recherches dans le Lot en 1892 *et* 1893. Par E. A. MARTEL. Brive : Marcel Roche, 1893. Pp. 42.

The exploration of caves and underground channels is by no means new. From curiosity or in quest of beetles and other insects, men have penetrated considerable distances into the natural cavities of the earth ; but to M. Martel is certainly due the credit of initiating a systematic investigation, with portable boats, ropes, and other apparatus, of the curious and often beautiful vaults which rivers excavate deep down below the surface of the ground. He has made known a new world entered by the *avens* of the Causses, has descended into the *katavothroi* of Greece, and has examined the underground streams of Carniola, Bosnia, and Herzegovina. The pamphlets cited above give an account of some of his later work, and are lectures delivered before the Soc. Scientifique, etc., de la Corrèze, and the Soc. Normande de Géographie. As we have already reviewed M. Martel's *Les Cévennes et la Région des Causses* in vol. vi. p. 331, it is unnecessary to say much about the present publications. We will only allude to his adventurous journey for a distance of nearly two miles along the subterranean river of Padirac, through lofty halls and narrow tunnels, lakes and falls, and groups of stalagmites.

Last year the author, as we learn from the *Comptes Rendus* of the Paris Geographical Society, Nos. 17 and 18, 1893, added nearly a mile to the known length of the Adelsberg Grotto, thus showing it to be the longest cavern hitherto discovered in Europe, with a total length of more than six miles.

But M. Martel's work is not confined to merely scrambling among dark and tortuous passages ; he also investigates the temperature of the air and water and other physical conditions, as we have had occasion to notice in the case of the *Creux de Souci* (vol. ix. p. 656) ; and in September last he proved that the river Pivka, which flows through the Adelsberg Grotto, unites with an emissary of the Lake of Zirknitz in the grotto of Kleinhäusel.

Switzerland : Poetical and Pictorial. A Collection of Poems by English and American Poets. Compiled by HENRY EBERLI. With 87 Illustrations. Zurich : Art. Institut Orell Füssli, 1893. Pp. xvi + 537.

All who have experienced the charm of Alpine scenery will be delighted with this collection of views, accompanied by appropriate poetical extracts. The illustrations are well executed, and the paper and printing are excellent. This tasteful volume is an admirable gift-book.

British Columbia : its Present Resources and Future Possibilities. Victoria, B.C. : *The Colonist* Printing and Publishing Co., 1893. Pp. 109. *Price* 6*d*.

As the author remarks, British Columbia "is still to a very great number of intelligent people a mere name upon a map." Since the construction of the Canadian Pacific Railway and the discoveries of gold and silver in Kootenay and coal in Vancouver, the country has been growing in importance, but yet it is not easy to obtain information about it, except such scattered notices as are to be found in the *Canadian Gazette* and other periodicals. There is, therefore, much need for a work like the present, which gives an account of the resources, climate, etc., of the country, without exaggerating its attractions. It gives, as a Government publication should, the information which settlers of all descriptions may require, leaving each to find his own sphere of activity. The clear illustrations give charming glimpses of park-like valleys, picturesque rocks, and stately forests.

NEW MAPS.

AFRICA.

CENTRAL AND SOUTH AFRICA, Bartholomew's New Map of ——. By J. G. Bartholomew, F.R.G.S. *John Bartholomew and Co., Edinburgh*, 1894.

The above is a new edition of the map published in 1892. It is extended so as to include Abyssinia and the German and Niger territory up to Lake Chad. The alteration of the boundaries in this region in consequence of the late agreements between England and Germany and Germany and France at once strikes the eye. A closer inspection will show that the results of recent travels have been carefully collected, as those of Dr. Stuhlmann and Emin Pasha, the Chanler Expedition, M. Maistre, etc.

AMERICA.

UNITED STATES, General Map of ——, constructed from the best authorities, by W. and A. K. Johnston, Geographers to the Queen. Natural scale 1 : 3,984,000, or 62·88 miles to an inch. *Edinburgh and London*, 1894.

Though mounted as a wall-map, this is of the nature of an atlas map, the execution being fine and the names very numerous, though not overcrowded ; indeed, in the west there is room for a few more. Confusion is also avoided by printing the names of lakes and rivers in blue. The details, as far as can be judged from a comparatively short inspection, are correct and up to date. No information is given as to the choice of types for the names of towns. They seem to be arranged according to the population of the towns, and consequently many places of considerable importance in the sparsely populated Western States are not easy to find quickly, their names being printed in the type common to the general ruck of small towns. The map is well executed and excellently printed. A copious index is issued with it.

SOUTH AMERICA, Commercial Map of ——. By J. G. Bartholomew, F.R.G.S. Revised by John Samson, F.R.G.S., of the *South American Journal. Price, cloth*, 3*s*. *The Edinburgh Geographical Institute.*

A clear and useful map on which are marked all the railways and the navigable waterways which are in unbroken connection with the ocean. The routes of steamers plying regularly to South American ports are also given. The inset maps represent Trinidad, the isthmus of Panama, and the towns of Rio de Janeiro, Buenos Ayres, Valparaiso, and Lima.

SCHINGÚ-EXPEDITION, Karte des Weges der zweiten ——, vom 28 Juli bis 31 December, 1887, von Dr. P. Vogel. Massstab 1: 500,000.

CUYABÁ NACH COXIM, Karte des Weges von ——, über die Serra de São Jeronymo, aufgenommen von Dr. P. Vogel. Massstab 1: 500,000.
Zeitschrift der Gesell. für Erdkunde zu Berlin, Tafel 3 *und* 4, 1893.

ATLAS.

WORLD, Miniature Atlas and Gazetteer of the ——. By J. G. Bartholomew, F.R.G.S., F.R.S.E. *London : John Walker and Co., Ltd.*

There is far more information to be obtained from this atlas than would be expected from so small a volume. The most striking feature is the large number of maps of environs of towns and Continental tourist resorts. It is on this account a very useful companion to the guidebook.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

A REVIEW OF SWEDISH HYDROGRAPHIC RESEARCH IN THE BALTIC AND THE NORTH SEAS.

By Otto Pettersson.

I.

Introductory Remarks, Apparatus and Methods of Investigation.

(*With Plate.*)

The system adopted by the Swedish naturalists at the present time, in their exploration of the sea which surrounds the Scandinavian peninsula, is to despatch a number of ships simultaneously from different ports across that part of the sea which is to be explored, each ship being provided with a complete set of hydrographic instruments worked by assistants specially trained for their task in the laboratories of Stockholm's Högskola, the Polytechnic Institute, etc. The route of each ship, and the position of every sounding station, are determined beforehand, according to previous experience. In every successive expedition the same sounding-places are chosen, in order to ascertain the alterations which have occurred in the arrangement of the water-strata. The advantages of this method of research are obvious. All the observations being taken within a few days, the hydrographic state of a certain part of the sea at all points is exhibited practically simultaneously, unaffected by changes of wind and weather. In February 1890 we explored the Kattegat and the Skagerack with five steamers. In less than a week we collected at about seventy sounding-stations more than 1000 water samples, and took the same number of temperature observations, besides 200 samples for gas analysis.

The hydrographic condition of the Baltic was minutely investigated in July 1877 by a Swedish expedition, conducted by Professor F. L.

Ekman, who collected about 1800 records of temperature and salinity from different depths at sounding-stations in all parts of the Baltic.

In the winter 1878-1879, when herrings re-appeared on the west coast of Sweden after the usual 70-years' period of absence, Gustaf Ekman made some coasting expeditions in order to study the conditions of the sea at the fishing-grounds.

From 1890 began a more systematic investigation of the North Sea and adjacent waters, introduced by the winter expedition in February just mentioned. This and the following researches up to the present day have been conducted by G. Ekman and myself, with the assistance of a large number of chemists and physicists. All methods and instruments now in use are of my invention. The laboratory work, which in the hydrographic exploration of recent times is extremely extensive, has been executed in the laboratory of Stockholm's Högskola by G. Forsberg, R. Ekman, A. Smitt, and Miss A. Palmqvist, under my superintendence. For the past two years the same method of simultaneous hydrographic research has been adopted by the Danish Government for the Kattegat and parts of the Western Baltic and the Danish Sounds. Four times a year, on the 1st of February, May, August, and November, thirteen hydrographic sections in different parts of the Kattegat and the Sounds are made by Danish gunboats. We have proposed to the Swedish and Norwegian, as well as to the British, Governments a plan for a common international hydrographic exploration, according to which Swedish and Norwegian research should proceed in the Baltic, the Skagerack, and on the eastern side of the North Sea simultaneously with Danish soundings in the Kattegat and British observations in the northern parts of the North Sea. The Royal Academy of Sciences at Stockholm has appointed G. Ekman, Professor A. Wijkander, and myself to be directors of the Swedish researches during the twelve months, May 1893 to May 1894.

The Fishery Board for Scotland has most readily accepted the invitation to international collaboration in hydrographic research from our Government, and has despatched H.M.S. *Jackal* quarterly on deep-sounding expeditions, under the scientific direction of Mr. H. N. Dickson, to the northern part of the North Sea, Shetland, and the Faröe Islands.

In case the importance of an international hydrographic survey of the North Sea and the Baltic, according to a strictly regulated and systematically executed plan, should be more widely acknowledged, and the bearing of such researches upon the intricate economical problems of the fisheries should lead to further collaboration between scientists of different nations, it appears desirable that a description of the results already obtained, and of the efficiency of such methods and instruments as can be fully recommended from trial and long experience, should be published in a more generally known language than Swedish, and in one of the leading scientific journals of the world.

I therefore, at the request of my colleagues and collaborators, here

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[1] Professor O. Krümmel in Kiel has also executed a series of deep soundings in the Western Baltic from Kiel to Rügen, in August and December 1893 and February 1894, in connection with the British, Danish, and Swedish explorations.

give a summary of our proceedings. It must, however, be expressly understood that this paper only contains a review of the most salient facts discovered up to the end of 1893, and not the full particulars of our research. For all such particulars, as numbers, dates, tables of observations, etc., I must refer to the original papers, a list of which will be found at the end of this paper.

The Water-bottles.

The Swedish deep-sounding stations visited since 1890 are marked on the charts which will accompany the corresponding sections of my article. Every time the investigation is repeated at these stations, water samples are collected and the temperature determined at the following depths:—0, 5, 10, 20, 30, 40, 60, 80, 100, 150, 200, 300, 400, 500, 600 mètres, etc. Where the temperature series shows abrupt changes, water-samples are taken at short intervals of 5 or 10 mètres. The greatest depth of the Skagerack not exceeding 650 mètres,[1] and of the Baltic 420 mètres, we have found it advantageous to construct insulated water-bottles, by means of which the water-samples are brought on board the ship without any sensible alteration of temperature. Two water-bottles impervious to heat have been constructed on different principles, one by F. L. Ekman, the other by myself.

Ekman's water-bottle is minutely described in the narrative of the hydrographic expedition of 1877.[2] As insulating substance Ekman employed gutta-percha. In point of solidity and simplicity of construction this water-bottle is unrivalled, and the temperature readings are correct to within $\frac{1}{10}$ of a degree, if the instrument is properly used and the depth is not too great. With the aid of this instrument Ekman explored the depths of the Baltic in 1877, and discovered the great layer of minimum temperature existing at a certain depth in summer-time, which had escaped the attention of former investigators. The hydrographic investigation of the Kara and the Siberian Seas by the *Vega* Expedition was executed exclusively by means of the Ekman water-bottle. It is used in the researches of the present day only as a reserve instrument, and for lesser depths. We never employ it for greater depths than 150 mètres—not because the insulation is incomplete, but because such observations at greater depths must very often be repeated, since there is no absolute security that the bottle has not closed before it reached the appointed depth. The click, which indicates the closing of the lid, can very well be felt by the hand on the rope down to a certain depth (80 to 100 mètres), but not much further. Besides, the Ekman water-bottle cannot well be worked except with a hempen line, which is inconvenient and involves great loss of time as compared with the modern sounding apparatus, with its cord of phosphor-bronze, which will be described hereafter.

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[1] The depth of 820 mètres noted in the charts is, according to our investigations, an error.

[2] *Den Svenska hydrografiska Expeditionen år* 1877, af F. L. Ekman, *K. S. Vet. Ak. Handl.*, Bd. xxv. No. 1, Part i. p. 17.

Pettersson's insulated water-bottle, of which no description has hitherto been published,[1] has been in use since July 1890. The heat insulation is here effected by a series of concentric water layers, which envelop the central part of the instrument when closed, and thus protect the interior column of sea-water (see Figs. 1 and 4) from the influence of the surrounding sea-water. Fig. 1 represents the water-bottle open and ready to go down into the sea. The upper lid *A* and the cylindrical jacket *B* move with the weight *D*, and are kept in the position shown in the figure as long as the bottle is descending. *A* and *D* are connected by two cords of phosphor-bronze, and *A* hangs by means of two hooks upon the beam *a* which forms part of the metallic framework of the instrument. The hooks are released by the action of the propeller when the apparatus is hauled upwards. The construction of the propeller is shown on a larger scale in Fig. 3. The axle of the propeller ends below in a screw which is turned by the action of the water upon the blades of the propeller, when the apparatus begins to move upwards. The thicker part of the stem is thus raised a few millimètres and separates the hooks, so that *A* is set free and falls down, closing the water-bottle (see Fig. 2). The cylindrical jacket *B* is kept in its place (see Fig. 1), when the instrument is open, by two little hooks, *h*, with feeble springs, which fit into two small holes in the metal rods. When *A* falls down it first lets loose *B*, and then *A* and *B* fall together, propelled by the weight *D*, with some force upon the under lid or bottom, *C*, of the bottle. The water-bottle is then hermetically closed, every one of the cylindrical parts of *B* being pressed by the weight of *D* against india-rubber packings, which serve the double purpose of keeping the instrument water-tight and preventing the circulation of water in the interior compartments.

The inner cylindrical envelope of *B* (see Fig. 4) consists of three concentric cylinders of thin sheet-brass joined to each other and to the outer envelope by ebonite plates fixed with screws, care being taken to avoid direct metallic contact between the inner and outer parts. The upper lid, *A*, and the bottom piece, *C*, of the apparatus consist of solid metallic discs covered with india-rubber. Four little brass tubes are soldered to each disc, and support thin brass rings over which is stretched a thin sheet of india-rubber. The concentric cylinders are closed above and below by close contact with these elastic diaphragms without touching the brass rings.

This arrangement gives perfect protection against changes of temperature in the water without. A thermometer, which is inserted into the inner water column of the apparatus through a hole in the upper lid, *A*, and slits in the india-rubber sheets, gives the temperature of the water-layer from which the sample is taken with an accuracy hitherto never obtained in hydrographic research. We use normal thermometers from Geissler in Bonn, with scales which are divided to one-twentieth of a degree Celsius, and allow the hundredth part of a degree to be estimated. Such a thermometer requires several minutes to reach its permanent position, but the insulation is such—even if the water sample

[1] It was, however, exhibited to Section B of the Meeting of the British Association, in August 1892, in Edinburgh.

be hauled up from a depth of 600 mètres and the circumstances are the most unfavourable, as, for example, when great differences occur between the temperature of the water-layers, or between the air and the water contained in the bottle—that the temperature reading remains absolutely unchanged for one and a half to two minutes. By means of such temperature determinations it is easy to trace what I would call *secondary minima* or *maxima, i.e.* temperature-waves of very small amplitude on their way to the great depths of the sea. Wherever in the bottom of the sea there exist submarine depressions, there will, as a rule, be found such small oscillations in the temperature series.[1]

I here give, as an illustration to the statement above, three series of deep-sea soundings with the Pettersson insulated water-bottle, taken in July and August 1893, at widely different parts of the sea.

No. 1 is from the deepest part of the Gullmar fiord, situated on the west coast of Sweden. The deep basin of the fiord is separated from the Skagerack by a submarine ridge of 40 mètres. Date 2nd August 1893.

No. 2 is from the deepest depression of the Baltic SSE. from Landsort. Below about 200 mètres the communication is intercepted by the submarine banks of the Baltic. Lat. 58° 41′ 30″, long. E. 18° 25′ 0″. Date 7th July 1893.

No. 3 is from the deepest part of the Aaland Sea. Lat. 60° 8′ 20″, long. E. 19° 18′ 18″. Date 6th July 1893.

No. 1.		No. 2.		No. 3.	
Depth in Mètres.	C.	Depth in Mètres.	C.	Depth in Mètres.	C.
0	17°·50	0	13°·06	0	8°·05
5	17°·40	5	13°·06	5	7°·70
10	17°·35	10	13°·07	10	6°·95
20	13°·40	15	12°·05	15	4°·15
30	12°·65	20	7°·90	20	3°·05
40	8°·74	25	4°·95	30	1°·80 (min.)
50	6°·35	30	4°·05	40	2°·95 (max.)
55	4°·93	40	3°·30	50	2°·95
60	4°·60 (min.)	50	2°·40	60	2°·95
70	4°·72	60	2°·15 (min.)	70	2°·95
80	4°·82	80	3°·50	80	2°·70
100	4°·88	100	3°·85	90	2°·70
120	5°·04 (max.)	120	3°·80	100	2°·60
Bottom		140	3°·90	110	2°·50
		160	3°·90	120	2°·40
		180	3°·95	140	2°·10
		200	3°·95	160	2°·10
		220	3°·95	180	1°·85
		230	3°·95	200	1°·75
		240	3°·95	225	1°·75
		260	3°·95	250	1°·70
		280	4°·00 (max.)	255	1°·70
		300	4°·00	265	1°·65 (min.)
		320	4°·00	Bottom	
		340	4°·00		
		360	3°·95		
		380	3°·90		
		400	3°·95		
		Bottom			

[1] From numerous experiments on the insulating property of the water-bottle I here give a series of temperature readings of a water-sample taken from a depth of 400 mètres at the

I must here draw attention to one point which is very essential in the construction of insulated water-bottles. The instrument must have the least possible capacity for heat, so that it accommodates itself easily and immediately to the temperature of the water strata. The Pettersson water-bottle is constructed in accordance with this principle, the insulating parts of the instrument being made of thin sheets of brass and thin diaphragms of india-rubber. The heat capacity of the envelope is thus extremely small compared to that of the volume of water which it contains. The insulated central portion of this water has a volume of about 600 cc.[1] Immediately after the temperature of the water has been determined, samples for gas analysis are taken by means of exhausted glass tubes of about 150 cc. capacity.

Analysis of Gases dissolved in Sea-water.

The water-samples are taken in the manner shown in Fig. 4. The thin (but not capillary) stem of the exhausted tube is cautiously inserted into a channel bored obliquely through the inner cylindrical part of the brass instrument, *k*, which acts like a pair of scissors, breaking the lower end of the thin glass tube when the handles are turned asunder by the experimenter, who must carefully replace the thermometer by *k*, and then insert the glass tube through the orifice before using the scissors. After the tube is filled it must be sealed up either by the blow-pipe or by exposing the thin glass stem to the flame of an ordinary wax candle. This must be done in the cabin of the ship, and requires a little training.[2] The flame is at first applied cautiously to the narrowest part of the tube, which is filled with water. As soon as the water boils, the full heat of the flame is employed to melt the glass and seal up the tube at the part now filled with vapour. In this manner the intrusion of atmospheric air

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station S_{viii} on the 1st of Sept. 1893. Temperature of the upper water stratum 15° C.; temperature of the air 17°·5 C.; sunshine, soft breeze; time 2.40 P.M.

Time in Minutes.	Temperature Readings in °C.
0′	+17°· 0 C.
1′	+ 5°·52 ,,
1½′	+ 5°·35 ,,
2′	+ *5°·33* ,,
2½′	+ *5°·33* ,,
3′	+ 5°·34 ,,
3½′	+ 5°·36 ,,
4′	+ 5°·40 ,,
5′	+ 5°·44 ,,

[1] The Pettersson water-bottle is probably the lightest and smallest instrument hitherto used for this purpose. The entire sounding apparatus, as mounted on board Nansen's ship, the *Fram*, with meter-wheel, registering machinery, and 300 mètres of cord, composed of seven very thin strands of phosphor-bronze of extra strength, is manufactured by Mr. Lyth, instrument-maker to the Pilot Office in Stockholm, at a cost of about £22. The addition of a special mechanism for closing the water-bottle by means of a messenger (see Fig. 1), which I invented expressly in order to meet the demands of the Danish hydrographers, is, according to my own experience, a wholly superfluous encumbrance, the propeller acting infallibly even when the water-bottle has struck against the bottom. I never hesitate to let it go down directly to the bottom without previous sounding.

[2] The filled tube should be carried into the cabin with the stem *downwards.*

into the tube is completely obviated. Two tubes must be filled from each water-sample, one to test for nitrogen and oxygen, the other for carbonic acid.

The way in which a tube is exhausted is shown in Fig. 5. When it has been completely filled with mercury, even in its upper capillary part, it is sealed by means of a blow-pipe, and the reservoir is lowered. The air adhering to the glass collects in the Torricellian vacuum, and can be expelled from the interior of the tube when the reservoir is raised again by cutting off the point and sealing it up again with the blow-pipe. If the reservoir is then lowered cautiously, the emptied tube is free from air, and can be hermetically closed by applying the blow-pipe to the narrow part of the stem above the india-rubber tube. This must, of course, be very thick, of the best quality, and wound and fastened to the glass tube with copper wire. For transport the tubes are placed in a wooden box. Twelve such boxes, each containing twenty exhausted tubes, formed part of the equipment of the Swedish Expedition in February 1890. Not a single tube was broken in transport, but more than a dozen were broken during the operation of sealing up the water-samples, and a few more during the work of analysis. Each tube has a number etched upon it.

The analysis of the gases contained in the water of the sealed tubes involves two operations.

(A.) *Method of determining the quantities of oxygen and nitrogen present* (see Fig. 6).—By a short piece of india-rubber the tube *A* is connected with a narrow burette, *B*, of about 12 cc., graduated to $\frac{1}{20}$ cc., which is surrounded by a condenser, *E*, and by means of a forked glass tube fused to *B*, and india-rubber tubes, communicates with the reservoirs *C*, *F*, and *D*. The tube joining *F* and *D* is wound with copper wire to enable it to withstand the pressure of the mercury. All other arrangements are easily understood from the figure. The analytical operation consists in boiling the water in *A* in order to expel the gases, which are collected and measured in *B*. The latter tube, as well as all its ramifications, must be previously exhausted of air and filled with mercury. This is easily done in the following way :—Raise the reservoir *D*, keeping the stopcocks *y* and *z* open, and *x* shut. When the mercury has filled *B* to a little above *z*, shut it and lower *D*. A Torricellian vacuum is thus formed in *B*, wherein the air adhering to the glass tube, the india-rubber, and the stopcocks collects, and can easily be expelled by again raising *D* and opening *z*. This operation can be repeated several times until the air is entirely exhausted from *B*. Then, by a gentle pressure of the hand on the outside of the india-rubber tube at *m*, the upper point of the glass tube *A* is broken, and the boiling is commenced by cautiously applying the flame of a Bunsen burner to *A*. The sea-water boils under greatly reduced pressure, which can be regulated by lifting or lowering *D*. Gas and water now ascend into *B* instead of mercury, and even fill a part of the reservoir, *F*. The boiling is regulated so that *F* is never entirely void of mercury. Whenever the water in *A* begins to boil too violently, the flame is shifted and applied for an instant to the water which has collected above the mercury in *F*, and which likewise must be kept boiling. In this way the gaseous matter of the water-sample is, in the course of 20 to 30 minutes, entirely boiled out, and collected *in vacuo* in *B*. Then take away the burner, lift *D* until mercury rises into the forked glass tube above the stopcock *y*, shut *y*, open *x*, and keep up a rapid circulation of cold water from a jet through *E* until the thermometer shows a constant temperature. In the meantime, the carbonic acid in *B* is absorbed by a few cc. of alkali solution poured into the funnel, *t*, and admitted into *B* by opening the stopcock *z*. The absorption is almost instantaneous. The remaining volume, consisting of oxygen and nitrogen, is determined, and the oxygen is absorbed by means of an alkaline solution of pyrogallic acid.[1] This solution requires a certain time to act (about 5 to 7 minutes), and must be applied several times until the remaining gas shows no further diminution of volume. The liquid in *B* has then become dark brown and opaque. Pure water is therefore allowed to run from the funnel into the burette *B* before the volume of the nitrogen is read off. Theoretically, two corrections ought to be applied to these volume determinations. In the first place it is to be observed that the gaseous matter in *B* is liable to re-absorption by the sea-water while the volume is being read off. I have found, however, that the re-absorption of nitrogen and oxygen proceeds so slowly that it has no perceptible effect upon the volume readings.

Secondly, a certain difficulty arises from the fact that the columns of liquid in *B* and in *C*, which must be kept at an equal height when reading off the volumes, have not the same specific gravity and temperature. This error can easily be corrected if *C* is kept steadily in its position close to *E* after the determination of the volume of the nitrogen, and the slight difference of level is observed which arises in *B* when the stopcock *z* is opened. The error is, however, quite insignificant.

Lastly, the volume of the sea-water in *A* must be determined by measuring or weighing the glass tube, both when empty and when filled with pure water of known temperature. The volume must be ascertained with an accuracy of about 0·2 to 0·3 cc. If two glass tubes are filled from the same sample of sea-water and analysed by this method, the results never differ by more than 0·2 or 0·3 cc. per litre of sea-water.

Since the time of the second German Expedition in the *Pommern* in 1872, the determination of the gaseous matter held in solution by sea-water has become a work of the highest importance in hydrographic research.

Dr. O. Jacobsen,[2] the chemist of that expedition, proved by a number of exact analyses that the quantities of atmospheric gases, nitrogen and oxygen, absorbed in sea-water are by no means dependent upon the pressure to which the water is exposed *in situ*, but solely upon the circumstances, *i.e.* the temperature and barometric pressure, under which the

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[1] One volume of a 25°/₀ solution of pyrogallic acid in water and six volumes of a 60°/₀ solution of potassium hydrate (Hempel) are poured separately into the funnel *t*, and gradually admitted into *B*.

[2] *Über die Luft des Meerwassers*, v. O. Jacobsen, *Ann. d. Chemie und Pharmacie*, Bd. 157, p. 22.

water was saturated with air the last time it was at the surface in contact with the atmosphere. The nitrogen then absorbed remains unchanged, while the oxygen is liable to diminution in the course of time by the chemical action of the organic matter or of animal life in the sea.

The consequence of this—as was afterwards shown by Tornœ[1]—is that an analysis of the number of cc. nitrogen contained in one litre of sea-water from a certain depth enables us to calculate the temperature of absorption (τ°C.) of the water when it left the surface for the last time, while the deficiency in oxygen below the normal amount is a measure of the reducing action to which the water has been exposed since that time.

Dr. H. Tornœ,[2] of the Norwegian Expedition on the *Vöringen* in 1876-78, elucidated the circulation of the waters of the North Atlantic upon this principle. The cold deep stratum, for example, of the southern basin of the Norwegian sea was found to be of Atlantic origin on account of the relatively small quantity of nitrogen held in the water. In researches of this kind the urgent necessity of ascertaining the absorptive power of sea-water upon the atmospheric gases is fully apparent.

From experiments upon "sea-water of considerable specific gravity," Tornœ concluded that the volume of nitrogen absorbed by one litre of sea-water can be represented by the following formula :—

$$\text{Cc. } N_2 = 14{\cdot}4 - 0{\cdot}23\ \tau^\circ.$$

The absorption of nitrogen is, therefore, according to Tornœ, a linear function of the temperature.

From the tables and graphic representations of Dittmar's[3] experiments upon an artificial sea-water, we infer that the absorptive power of sea-water upon nitrogen does not diminish in a direct ratio to the increase of temperature. In this respect Dittmar's determinations are superior to Tornœ's.

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[1] *The Norwegian North-Atlantic Expedition*, 1876-1878. *Chemistry*, by H. Tornœ.

In order to show the position which Jacobsen and Tornœ took up regarding the question of atmospheric absorption by sea-water, I give the following quotations :—

Dr. Jacobsen writes :—"Ich glaube . . . über den Luftgehalt in der Tiefe den Satz aufstellen zu konnen, dass die Summe von Sauerstoff und Stickstoff nahezu gleich ist derjenigen Menge dieser Gase, welche das Wasser bei seiner wirklichen tiefen Temperatur an der Meeresoberfläche aus der Atmosphäre aufnehmen würde, weniger der etwa verbrauchten Sauerstoffmenge."

Dr. Tornœ writes :—"From the latest observations throwing light upon this question we may, therefore, reasonably infer that all sea-water below the surface retains undiminished the quantity of air, or rather of nitrogen, which it absorbed when last at the surface in direct contact with the atmosphere."

Regarding the experimental part of Jacobsen's and Tornœ's work upon the gases of sea water, I need only mention that they both employed the same method (Bunsen's) in order to separate the gases from the water. The gas samples were afterwards analysed by means of the Bunsen gasometric methods (Jacobsen), or with the apparatus of Frankland and Ward (Tornœ).

The large number of gas samples from the *Challenger* Expedition were treated by Mr. J. Y. Buchanan by the Bunsen-Jacobsen method, and analysed by Professor Dittmar with an apparatus specially invented for that purpose (*Challenger Reports, Physics and Chemistry*, part i. p. 173, plate iii.).

[2] Tornœ: *On the Air in Sea-water. The Norwegian North-Atlantic Expedition*, 1876-78. *Chemistry*, p. i. *sq.*

[3] *Challenger Reports, Phys. and Chem.*, part i. pp. 173-197.

Mr. A. Hamberg,[1] chemist of the Swedish Expedition to Greenland in 1883, thoroughly investigated the relationship between the temperature of sea-water, its salinity and absorptive capacity for nitrogen.

Hamberg worked with real sea-waters of the following degrees of salinity:—

No. 1 = 0‰ salt; No. 2 = 17·78‰ salt; No. 3 = 26·58‰ salt; No. 4 = 35·12‰ salt.

As the table of Hamberg is of the greatest importance for practical hydrographic work, I reproduce it here:—

A. Hamberg's Table

for the absorption of atmospheric nitrogen by one litre of sea-water.

Temperature τ°C.	Cc. N_2, abs. by 1 litre water of salinity =0‰	Δ	Cc. N_2, abs. by 1 litre water of salinity =10‰	Δ	Cc. N_2, abs. by 1 litre water of salinity =20‰	Δ	Cc. N_2, abs. by 1 litre water of salinity =30‰	Δ	Cc. N_2, abs. by 1 litre water of salinity =35‰	Temperature τ°C.
− 3°	20·69	1·63	19·06	1·40	17·66	1·21	16·45	0·52	15·93	− 3°
− 2°	20·15	1·55	18·60	1·36	17·24	1·17	16·07	0·52	15·55	− 2°
− 1°	19·64	1·49	18·15	1·31	16·84	1·14	15·70	0·51	15·19	− 1°
0°	19·14	1·43	17·71	1·26	16·45	1·11	15·34	0·49	14·85	0°
+ 1°	18·66	1·37	17·29	1·22	16·07	1·07	15·00	0·48	14·52	+ 1°
2°	18·20	1·31	16·89	1·18	15·71	1·04	14·67	0·47	14·20	2°
3°	17·76	1·26	16·50	1·14	15·36	1·01	14·35	0·46	13·89	3°
4°	17·34	1·22	16·12	1·10	15·02	0·98	14·04	0·44	13·60	4°
5°	16·93	1·17	15·76	1·06	14·70	0·95	13·75	0·43	13·32	5°
6°	16·54	1·13	15·41	1·02	14·39	0·92	13·47	0·43	13·04	6°
7°	16·17	1·09	15·08	0·99	14·09	0·90	13·19	0·41	12·78	7°
8°	15·81	1·05	14·76	0·96	13·80	0·87	12·93	0·40	12·53	8°
9°	15·47	1·01	14·46	0·93	13·53	0·85	12·68	0·39	12·29	9°
10°	15·14	0·98	14·16	0·90	13·26	0·82	12·44	0·38	12·06	10°
11°	14·83	0·95	13·88	0·87	13·01	0·80	12·21	0·38	11·83	11°
12°	14·53	0·92	13·61	0·85	12·76	0·77	11·99	0·37	11·62	12°
13°	14·25	0·89	13·36	0·83	12·53	0·76	11·77	0·35	11·42	13°
14°	13·98	0·87	13·11	0·80	12·31	0·74	11·57	0·34	11·23	14°
15°	13·73	0·85	12·88	0·78	12·10	0·72	11·38	0·34	11·04	15°
16°	13·48	0·82	12·66	0·77	11·89	0·70	11·19	0·32	10·87	16°
17°	13·25	0·81	12·44	0·74	11·70	0·68	11·02	0·32	10·70	17°
18°	13·03	0·79	12·24	0·73	11·51	0·66	10·85	0·31	10·54	18°
19°	12·82	0·77	12·05	0·71	11·34	0·65	10·69	0·30	10·39	19°
20°	12·63	0·76	11·87	0·70	11·17	0·63	10·54	0·29	10·25	20°
21°	12·44	0·75	11·69	0·68	11·01	0·62	10·39	0·28	10·11	21°
22°	12·27	0·74	11·53	0·67	10·86	0·61	10·25	0·27	9·98	22°
23°	12·10	0·73	11·37	0·65	10·72	0·60	10·12	0·27	9·85	23°
24°	11·95	0·72	11·23	0·65	10·58	0·58	10·00	0·27	9·73	24°
25°	11·81	0·72	11·09	0·64	10·45	0·57	9·88	0·26	9·62	25°

It must be observed that the numbers given in the 2nd, 4th, 6th, 8th, and 10th columns represent the volumes of nitrogen (reduced to 0°C. and 760 mm.) which saturate 1 litre of sea-water at τ°C. under a barometric

[1] *Hydrografisk-Kemiska iakttagelser, etc.* *Bih. till K. Svenska Vet. Akad. Handlingar*, Bd. x. No. 13 (*Meddelande från Stockholms Högskola*, No. 37), pp. 16-22.

pressure of 760 mm. (dry air). By substitution from this table, the temperature, $\tau°$, of absorption, can be calculated from the amount of nitrogen a sample contains.

Still more useful for practical calculation is a diagram which the author has published in the *Bihang till K. Vet. Akad. Handl.*, Bd. x. No. 13. Curves of salinity of 0, 10, 20, 30, and 35 *pro mille* are drawn with abscissæ representing temperatures, and ordinates representing cubic centimètres of nitrogen. The volumes of nitrogen corresponding to intermediate degrees of salinity can be obtained by the use of a scale appended to the diagram.

In calculating the temperature, $\tau°$C., which a sea-water had when it left the surface for the last time, it must be borne in mind that the result will be in some degree approximative, because we do not know the barometric pressure of dry air at the moment when the nitrogen was absorbed.

The following table gives the amount of absorbed nitrogen held in solution by oceanic water according to Tornœ's, Dittmar's, and Hamberg's experiments:—

Temperature C.	N_2, cc. in a Litre.		
	Tornœ.	Dittmar.	Hamberg.
0°	14·40	15·60	14·85
+ 5°	13·25	13·86	13·32
+ 10°	12·10	12·47	12·06
+ 15°	10·95	11·34	11·04
+ 20°	—	10·41	10·25
+ 25°	—	9·62	9·62

The amount of atmospheric oxygen dissolved in a sea-water is given in the following exposition, partly in the same units as the nitrogen, viz. in cc. of the gas absorbed by 1 litre of the water, partly in percentages of the total quantity of nitrogen and oxygen contained in 1 litre, that is,

$$\text{Percentage of oxygen} = 100\frac{O_2}{N_2+O_2}$$

The percentage of oxygen in sea-water saturated with atmospheric air is variable, sea-water being—as shown by Tornœ—liable to super-saturation with oxygen at low temperatures, especially in high latitudes. The normal value of the above expression $\left(100\frac{O_2}{N_2+O_2}\right)$ in the North Sea seems to be about 34%, but is usually found to be between 33% and 34% in waters from depths of 5 or 10 mètres.[1] At greater depths it is

[1] The value of $100\frac{O_2}{N_2+O_2}$ varies with the temperature, as first shown by Dittmar, who gives the following table (*l.c.* p. 227) :—

Temperature,	0°	5°	10°	15°	20°	25°	30°
$100\frac{O_2}{N_2+O_2}$	34·40	34·24	34·09	33·93	33·78	33·62	33·47
Cc. O_2 in 1 litre sea-water,	8·18	7·22	6·45	5·83	5·31	4·87	4·50

found to diminish, and the deficiency in oxygen is a property which I have found to be highly characteristic of the different kinds of water which enter into the deep channels and basins of the Skagerack and the Baltic.

Tornœ found that the ratio $100\frac{O_2}{N_2 \times O_2}$ diminished with the depth in the water layers of the North Atlantic as follows :—

Number of Observations.	Mean Depths in Mètres.	Mean Percentage of Oxygen in total gas dissolved.
28	0	35·31
6	126	33·93
14	384	32·84
16	768	32·50
11	1251	32·58
6	2180	32·78
10	3010	32·89

The lowest percentage of oxygen found by Hamberg, at a depth of 600 mètres, in Melville Bay (W. of Greenland), was 26·97%.

In the waters of the North Sea,[1] Jacobsen found the oxygen to diminish slightly in the deeper strata, the range of variations being from 34% to 30%. The German expedition on the *Drache*[2] found the percentage of oxygen in the bottom waters of the North Sea at some places reduced to 29·8% and 25·2%.

It will hereafter be shown that the Swedish hydrographers have found in some parts of the deep waters of the Skagerack and the Baltic a percentage of oxygen as low as 11%, and even 6% or 7%.[3] In the same waters the proportion of carbonic acid was found to attain *abnormally high values.*

I shall presently show the connection which I have found to exist between this phenomenon and the circulation of the waters and the development of animal life in those parts of the sea.

(B.) *Method of determining the total carbonic acid contained in a sample of sea-water.*—The total quantity of carbonic acid cannot be determined from the same sample as the nitrogen and oxygen. Of course, a great deal of the carbonic acid is given out in boiling, but a part is retained in chemical combination by the basic constituents of the sea-water (Jacobsen, Tornœ). In order to determine exactly the total

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[1] I scarcely need recall the important discovery of Mr. Buchanan that the percentage of oxygen in sea-water reaches a minimum in the tropical seas, at a depth of about 400 fathoms.

[2] *Ergebnisse der Untersuchungsfahrt des Kbt. "Drache" in der Nordsee*, Tafel D 2.

[3] The oxygen deficit in some parts of the Skagerack and Baltic may be compared with the exceptionally low values found in some cases by the hydrographers of the *Challenger*, mentioned by Dittmar (*l.c.* pp. 226-227).

amount of carbonic acid, I have found the following conditions to be necessary :—

1. Free acid must be present.
2. The boiling operation must be conducted under greatly reduced pressure.
3. A slight quantity of a neutral gas (hydrogen) must be generated within the boiling water in order to expel the last trace of carbonic acid.

The first condition forbids the employment of the apparatus already described (Fig. 6) for the determination of carbonic acid. If water containing free acid is boiled in contact with mercury, part of the oxygen absorbed in the water enters into combination with the mercury and the acid. Therefore, I have found it necessary always to take *two water-samples*, one to analyse for oxygen and nitrogen, the other for carbonic acid. For the latter purpose I have invented the following apparatus :—

Fig. 7 shows the measuring-tube, *D*, connected with *C* and *A* by means of india-rubber tubes carefully fastened with copper wire. The upper end of the sealed tube *A*, which contains the water sample, must be cut off immediately before the operation, and a few drops of concentrated sulphuric acid introduced into the water (by means of a small pipette), together with a bit of iron wire enclosed in a thin capillary tube of glass sealed at one end. This arrangement serves the purpose already mentioned, viz., to keep up a very slow development of hydrogen during the boiling of the water. The gas and the boiling water mount into the wider part of *C*, but the gas alone, not the water, is sucked into the measuring tube, *D*, through the capillary tube of *C* when the stopcock *b* is opened and the reservoir, *F*, is lowered. In this manner it is possible to boil the gases (N_2, O_2, H_2, CO_2) entirely out of the sea-water under very low pressure, without a single drop of liquid entering the measuring-tube. Every drop of water which shows itself in the capillary stem of *C* is brought back into *C* and *A* by lifting *F* and opening *b* for a moment. If the pressure in *D* is then suddenly diminished (by lowering *F*), the gas which has collected in *C* enters *D* without any water. As soon as water appears in the capillary, *b* is shut, and the boiling is continued a few minutes until a fresh quantity of gas is collected in *C*. Then the water-drops in the capillary are brought back into *C*, and the gas is drawn into *D* as just described. It is necessary that the stem of *C* should be really capillary. The only thing to observe during the operation is always to keep the pressure in *A* and *C* lower than that of the atmosphere. This is easily done by carefully heating *A* and frequently emptying *C* of its gaseous contents. By skilful management of the flame, the reservoir *F*, and the stopcock *b*, the greater part of the gas contained in the sea-water is collected in *D* within five minutes after the boiling has commenced. When *D* is filled (under low pressure) with gas, the flame is taken away, *b* is shut, *F* is raised until the level of the mercury is the same as in *D* (see Fig. 7). Then *d* is opened and the position of *F* regulated by means of the pulley, so that the alkaline solution in the Orsat tube *E* stands at a certain mark. I need not enter upon any description of the volume determination and the subsequent absorption of carbonic acid, because such operations must be familiar to every chemist. Suffice it to say that *D* must be emptied of the greater part (*not all*) of the remaining gas through the stopcock, after the absorption of CO_2, in order to obtain room for more gas, developed by the subsequent boiling of the water in *A*. Two or three such repeated boiling operations with volume-readings are necessary to expel the last trace of carbonic acid, which leaves the fluid with great reluctance.

It will be observed that this proceeding constitutes a general method for the determination of carbonic acid in any solid or liquid substance. It is extremely accurate—repeated analyses of the same kind of sea-water never differing by more than 0·1 to 0·2 cc. of CO_2 in 1 litre of water. It will be remembered that the sealed tube must be opened at its upper extremity immediately before it is joined to the gas-analysis apparatus. This, however, involves no risk of the escape of carbonic acid, provided that the tube has been kept cool, and not previously exposed to heat. For the alkalinity of sea-water generally is more than sufficient to hold the carbonic acid in combination in the form of carbonate and bicarbonate. Only in very exceptional cases, when the water was taken from stagnant bottom layers of deep fiords, where the oxygen was greatly diminished by the action of organic life, did we find an amount of carbonic acid (52 to 53 cc. in 1 litre) sufficient to convert the total alkali of sea-water into bicarbonate.[1]

Numerous determinations of the alkalinity of sea-water have been executed in the Stockholm Högskola laboratory according to the method described in the *Challenger* Reports. I have, however, been obliged to reject all these results, because I found that the alkalinity of samples of sea-water kept in glass bottles is within a short time altered by the chemical action of the water upon the alkali of the glass. Alkali determinations should be made either immediately on board the ship or upon water-samples collected in bottles of earthenware or porcelain.

The only reliable alkalinity determinations are the following, which were made with due precautions in the summer of 1890, at the biological station, Christineberg, from water of the Gullmar fiord (on the west coast of Sweden), by Miss A. Palmqvist, at my request. Miss Palmqvist[2] recommends the iodometric method of alkalinity titration, as described by Kjeldahl. I here reproduce a table containing the results of Miss Palmqvist's work, because they bear out a general rule which has, I find, once been mentioned by Dr. Gibson, viz., *that the alkalinity increases when the amount of chlorine or the salinity decreases.*[3] This rule is proved by the

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[1] The apparatus, Fig. 7, for the gas analysis of sea-water is made by F. Müller, Dr. Geissler's successor, in Bonn.

[2] *Hydrografiska Undersökningar i Gullmarfiorden*, af A. Palmqvist: *Bihang till K. Sv. Vet.-Akad. Handl.*, Band xvii. Afd. ii. No. 5, p. 15.

[3] The observation, that alkalinity varies inversely as salinity, was also made by Dr. H. R. Mill during his work on the Forth and the Spey. See *Fifth Annual Report of the Fishery Board for Scotland*, Appendix F, p. 353 (1887).—Ed.

numbers of the last column, which give the relation of the alkalinity (A) of one litre of the water to the number of grammes of chlorine (Cl) which it contains per litre.

The values of the expression $100 \frac{A}{Cl}$ are seen to steadily decrease as the salinity increases.

The waters of the Gullmar fiord are especially adapted for this study, because the fiord contains water strata with from 20°/₀₀ to 34°/₀₀ salt, of widely different origins, regularly superimposed one upon another, from a depth of 120 mètres to the surface.

A. Palmqvist's Table of Alkalinity of Sea-water.

Date, 1890.	Depth in Mètres.	Temperature of Water t°C.	Temperature of Saturation τ°C.	Grammes Cl in 1 litre.	Salinity °/₀₀	Nitrogen cc.	Oxygen cc.	$\frac{100\ O_2}{N_2+O_2}$	Carbonic Acid cc.	Alkalinity.		$\frac{CO_2}{A}$	$A.\frac{100}{Cl}$
										cc CO_2.	mgr. CO_2.		
Aug. 26	5	16·0	16·4	13·16	23·16	11·56	6·10	34·54	37·22				
July 10	5	15·4	12·0	13·81	24·31	12·40	5·92	32·30	38·51	23·46	46·13	1·64	0·334
,, 11	5	15·2	13·4	13·88	24·43	12·19	5·88	32·53	39·90				
,, 11	5	15·2	14·9	13·95	24·55	11·78	6·05	33·91	37·72	22·40	44·04	1·68	0·316
June 20	5	14·7	13·3	14·02	24·68	12·09	6·20	33·91					
July 11	5	15·0	14·7	14·05	24·73	11·79	6·00	33·75	38·83	22·73	44·68	1·71	0·318
,, 10	5	15·2	15·3	14·14	24·89	11·66	5·64	32·59	38·45	22·54	44·32	1·71	0·313
,, 1	5	15·4	15·1	14·35	25·26	11·66	5·99	33·92	41·56	22·69	44·60	1·83	0·311
,, 10	25	11·8	10·5	17·29	30·43	12·27	5·87	32·38	42·59	25·59	50·30	1·66	0·291
,, 10	25	11·9	11·4	17·49	30·78	12·05	5·73	32·20	42·20	25·55	50·23	1·65	0·287
,, 11	25	11·6	11·2	17·52	30·84	12·17	6·01	33·06	44·70	24·93	49·02	1·79	0·280
,, 1	25	11·3	10·1	17 62	31·02	12·33	6·10	33·11	43 19				
,, 11	35	10·2	8·5	17·74	31·22	12·68	6·11	32·60	42·73	24·89	48·94	1·72	0·276
,, 11	35	10·0	8·8	18·00	31·68	12·60	6·29	33·29					
,, 10	40	8·9	7·4	18·01	31·69	12·95	5·55	30·00	47·86	25·14	49·42	1·90	0·274
Aug. 26	25	13·3	12·8	18·20	32·04	11·66	5·25	31·05	46·15				
,, 26	50	9·5	9·3	18·75	33·00	12·35	5·16	29·47	47·37				
July 10	50	6·1	5·9	19·13	33·67	13·16	4·78	26·68	46·67	26·20	51·51	1·78	0·269
,, 1	50	5 7	5·5	19·16	33·73	13·27	4·56	25 57	48·77	25·87	50 87	1·88	0·265
,, 11	55	5·8	6·6	19·30	33·97	12·96	3·97	23·44	49·08	25·79	50·71	1·90	0·263
June 20	52	6·0	5·7	19·44	34·22	13·17	5·09	27·90	44·70	26·41	51·91	1·69	0·267
July 1	111	6·0	5 6	19·53	34·36	13·20	4·82	26·75	48·23	26·12	51·35	1·85	0·263
,, ,,	,,	,,	5·8	,,	,,	13·14	4·81	26·78		26·65	52·40	1·81	0 268
,, ,,	,,	,,	5 6	,,	,,	13·20	4·89	27·01		26·32	51·75	1·83	0·265
Aug. 12	75		5·7	19·54	34·40	13·18	4·13	23·85	49·69				
July 10	82	5·8	6·4	19·56	34·43	12·98	4·75	26·77	48·52	26·20	51·51	1·85	0·263
Aug. 12	100		5·2	19·57	34·44	13·32	4·76	26·34	48·31				
,, 12	100		4·5	19·59	34·48	13·50	4·84	26·42	49·54				
July 1	70	5·9	5·0	19·61	34·51	13·37	4·67	25·89	48·09	26·20	51·51	1·84	0·263
Aug. 26	70	5·8	5·6	19·68	34·64	13·20	4·77	26·54	49·35				
,, ,,	120	5·8	5·1	19·74	34·74	13·31	3·81	22·24	49·71				
,, ,,	,,	,,	5·1	,,	,,	13·29	3·88	22·40					
,, ,,	100	5·8	5·0	19·76	34·77	13·34	4·47	25·13	48·92				

On the other hand, we must be on our guard against drawing any premature conclusions from the last column but one which gives the ratios of the total amount of carbonic acid found in the water (by Pettersson's method) to that part of the carbonic acid which is neutralised by combination with the bases of the sea-salt, that is, the alkalinity. This relation is given in the fraction

$$\frac{CO_2}{A}$$

It appears from the table that this expression assumes very different values, while water from the upper strata of the fiord with 25·26°/$_{00}$ salt gives the same number, 1·83, as water of 34·36°/$_{00}$, from a depth of 111 mètres. Moreover, the numbers in the table seem to indicate that the salter water is relatively more saturated with carbonic acid than the fresher water. We know, from the classical investigations of Tornœ upon the carbonic acid in sea-water, that one part of the carbonic acid forms a monocarbonate, and another part a bicarbonate, with the surplus of basic ingredients of the sea-salt. Schlösing proved that the amount of carbonic acid which enters into the sea-water as bicarbonate is dependent upon external circumstances, such as pressure and temperature. We have found that still another cause exists which can affect the formation of the bicarbonate in sea-water, viz., the influence of organic life. I shall hereafter show that the Gullmar fiord presents the most remarkable example of periodic changes in the relation of oxygen to carbonic acid in its deep waters, changes which can only be caused by the respiratory process of animal life (*i.e.* Plankton and fishes). We have found the deep water of this fiord at times to be almost exhausted of oxygen, and supersaturated with carbonic acid, so as to be almost incapable of supporting animal life until a fresh influx of water from without displaces the foul stagnant stratum at the bottom of the fiord. The causes of this phenomenon are to be found in the periodic changes to which the eastern parts of the North Sea are exposed, and will be discussed in a subsequent part of this paper.

Meanwhile it will be granted that if the waters of the Gullmar fiord are exposed to disturbances of this kind, we are not justified in laying down any general rule for the relation of the percentage of salinity in the water to the value of $\frac{CO_2}{A}$ from the numbers contained in the table.

Chlorine Titrations and Determination of Specific Gravity and Salinity of Sea-water.

The most essential property to be ascertained in each sample of sea-water is its salinity, which in Swedish publications is always given in *promilles*, *i.e.* grammes of sea-salt in one kilogramme of water. The salinity of a sample can be calculated with accuracy to 0·02°/$_{00}$ from a determination of the amount of chlorine as found by titration, and from a determination of the specific gravity of the water by some method of weighing—for example, with the Sprengel pycnometer.

In titrating oceanic water-samples I employ a very carefully calibrated and cleansed pipette, on which the volume of 10 cc. at 15° C. is marked with two sharply engraved lines on the upper and lower part of the stem. A glass stopcock, of the best Geissler make, is fused to the pipette, so that the quantity of fluid which runs out of the instrument can be controlled exactly. The temperature of the water-samples, as well as that of the room, is kept as nearly as possible at 15° C. The bottles containing the water are cooled down to that temperature, if warmer, or heated to 15° C., if colder, before the titration. I never allow water-samples to be titrated on board the ship, because I find it impossible to keep the temperature constant in the cabins. Therefore the water is kept in well-corked[1] flasks of 100 cc. volume, labelled and packed into boxes, wherein each bottle occupies a separate compartment.[2] Of brackish sea-water, such as is obtained from the Baltic, for instance, 20 or 30 cc. are titrated. The silver solution is nearly $\frac{1}{5}$ normal. Burettes of 32 cc. volume, graduated to $\frac{1}{20}$ cc., with floats and very thin stems, specially manufactured by Geissler for this purpose, are employed. One drop of a solution of neutral chromate of potassium serves as indicator. As we are obliged after every expedition to titrate many hundred samples in the course of a week, I have found it advisable to control the titrations by quantitative analyses of the silver solution as well as of some of the samples chosen at random. In such controlling analyses only determinations by actual weighing are allowed. The silver solution is analysed by precipitation of the chlorine as Ag Cl. in a weighed quantity of the purest Na Cl. Of the water-samples 10 cc. are weighed in a glass flask with a glass stopper, and precipitated with silver nitrate. As the $\frac{1}{5}$ normal silver solution is always analysed and used for titration at 15° C., we know exactly how many milligrammes of chlorine are equivalent to a cubic centimètre of the solution, and may neglect the specific gravity, which, however, must be carefully taken into account in analysing the water. The numbers found by titration for the amount of chlorine and salt in 10 cc. or 1000 cc. water are divided by the specific gravity of the water ($\frac{15°}{4°}$), as determined with the Sprengel pycnometer, in order to obtain the *promilles* of chlorine and of salt.

The relation between the grammes of chlorine in 1 litre of sea-water at 15° C., the specific gravity at $\frac{15°}{15°}$ and $\frac{15°}{4°}$, and the grammes of (neutral) sea-salt contained in 1 kilogramme of the water (the $°/_{oo}$) is the following, as found by direct experiment in the Stockholm Högskola laboratory, without reduction to vacuum weights :—

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[1] India-rubber stoppers are not preferable to cork stoppers of the best quality properly secured. A cork stopper should never be used more than once.

[2] Immediately on arriving in harbour these boxes are sent to Stockholm, and kept in the cellar of the laboratory until the day before the analysis, when they are unpacked, and allowed gradually to acquire the temperature of the room, 15° C. As a rule we do not keep the water more than a week before analysis.

Table containing the relations between Chlorine, Salt, and Specific Gravity.

Sample from Station.	Depth in M.	Grammes of Cl_2 in 1 L.	Cl_2 in ‰	Salt in ‰	Sp. gr. $\frac{15°}{15°}$ Sprengel.	Sp. gr. $\frac{15°}{4°}$	Locality.
C_{II}	60	20·03	19·517	35·26	1·02715	1·02629	Skagerack.
C_{III}	300	19·92	19·415	35·07	1·02701	1·02614	,,
C_{II}	85	19·84	19·335	34·95	1·02698	1·02612	,,
C_{III}	40	19·67	19·171	34·64	1·02668	1·02582	,,
C_{III}	5	18·77	18·320	33·12	1·02554	1·02468	,,
G_{IX}	30	17·43	17·040	30·83	1·02377	1·02290	Kattegat.
C_{V}	20	17·39	17·005	30·76	1·02371	1·02285	Skagerack.
‡	20	16·63	16·277	29·46	1·02261	1·02175	Fehmern-Belt (Krümmel).[1]
C_{I}	5	15·74	15·421	27·93	1·02155	1·02068	Skagerack.
G_{IX}	20	14·49	14·220	25·77	1·01983	1·01897	Kattegat.
G_{IX}	10	13·15	12·928	23·46	1·01805	1·01719	,,
G_{X}	20	12·84	12·628	22·93	1·01761	1·01675	,,
‡‡	15	12·78	12·571	22·81	1·01750	1·01665	Fehmern-Belt (Krümmel).
G_{X}	25	11·43	11·263	20·45	1·01570	1·01484	Kattegat.
G_{XI}	0	9·59	9·473	17·25	1·01323	1·01237	,,
‡‡‡	0	7·13	7·067	12·86	1·00987	1·00903	Fehmern-Belt (Krümmel).

The relation between chlorine and salinity is, according to the best analyses I know, as follows :—

Table of Chlorine Ratios for Sea-waters of different Salinity.

Cl_2 in ‰	Salt in ‰	Chlorine Ratio.	Authority.	Sea-water from
19·56	35·32	1·806	Tornœ	N. Atlantic 73° Lat.
19·47	35·21	1·808	,,	,, 68° ,,
19·38	35·03	1·808	,,	,, 76° ,,
19·374	35·01	1·809	F. L. Ekman	Skagerack
16·460	29·850	1·813	G. Forsberg	,,
14·254	25·87	1·815	F. L. Ekman	,,
11·509	20·91	1·817	,,	,,
5·655	10·317	1·824	G. Forsberg	Baltic
3·766	6·905	1·829	,,	,,

The ratio of salt to chlorine for oceanic waters is, according to Dittmar,[2] = 1·8058.

By means of the numbers registered in these two tables,[3] the salinity of a water-sample can be determined exactly to 0·02 or 0·03‰ by a simple titrimetric analysis of the chlorine (or rather of the halogen) in the water. With nearly the same accuracy, the salinity can also be determined by means of these tables from a determination of the specific gravity of

[1] Samples taken by Professor O. Krümmel in August 1893, in Fehmern-Belt, and forwarded to me.

[2] *Challenger Reports, Phys. and Chem.*, vol. i. p. 39.

[3] If a great number of water-samples are to be analysed, I recommend the use of a diagram drawn from the given figures.

the water at $\frac{15^\circ}{15^\circ}$, provided that such determination is made with *the degree of accuracy required in modern hydrographic research.*

This degree of accuracy can only be obtained in determinations of specific gravity by actual *weighing* (by use of the Sprengel pycnometer, for instance). Hydrometers are never employed in Swedish hydrographic work, except where serial observations at some important station (*e.g.* at a lightship) are required in order to study the changes in the condition of the water during a certain period, when it is impossible to collect water samples for titration. After the criticism to which the hydrometric method has been subjected by the most prominent authorities, as Professor Dittmar[1] and O. Krümmel,[2] I need not dwell further upon the subject.

It seems to me that the time of hydrometric scientific work is nearly past. The general distribution of salinity in the oceans is now known, thanks to the extensive hydrometric work of the great expeditions in the *Challenger*, the *Gazelle*, and others. The problems of hydrography now pending are of a more detailed nature, viz., to investigate the circulation and sources of water, the stratification and the periodic changes in the position of water-layers, the physical and chemical conditions of organic life in the sea. Problems of this kind will require more and more refined methods and more delicate instruments of investigation.

Besides, I think it will be acknowledged, as a good guiding principle for hydrographic work, that the labour should be judiciously divided, so that no observation which it is not absolutely necessary to execute immediately should be made on board the ship, where the time should be devoted mainly to the collection of material for examination by trained specialists in the laboratories.

Pettersson's Plankton Apparatus.

This apparatus is invented for the special purpose of fishing Plankton simultaneously from several water-layers at different depths. The hydrographic condition of the Skagerack, the Kattegat, and the North Sea—where many water-layers of very different origin, containing in the same volume of sea-water different quantities of living organisms of various kinds, overlap each other—is such that the use of the vertical Plankton-nets, by means of which Professor Hensen has obtained such important results in the Atlantic, must here be abandoned. Our very first trial, on the 2nd August 1893, in the Gullmar fiord, convinced me that the waters of the Skagerack at different depths often contain different and characteristic forms of Plankton. On that day we could distinguish three strata of water in the fiord, which showed marked differences with regard to tem-

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1 See Dittmar "On the Hydrometer Error" in the *Chall. Rep.*, *l.c.*

2 See Krümmel, *Geophysikalische Beobachtungen der Plankton-Expedition*, Kiel, 1893, pp. 65, 66, 67. My own objections to the use of hydrometers for accurate determinations are shortly these:—We must carefully distinguish between the sensibility and the accuracy of a physical method. Hydrometers can be made as sensitive as can be desired. But in proportion as the sensibility increases, the inevitable and uncontrollable errors also increase. How, for example, can the experimenter ensure uniformity of temperature in all parts of the instrument, and at all depths of the water-column wherein it swims?

perature and salinity. We then invited the biologists, Professor Cleve, Dr. C. Aurivillius, and Mr. Wallgren, who accompanied us, to examine the Plankton in these water-layers. The result of this combined hydrographic and biological research will be seen from the following table [1] :—

THE GULLMAR FIORD, 2ND AUGUST 1893.

Depth M.	Temp. $\tau°$.	Salt ‰	Cc. N_2 in 1 L.	Cc. O_2 in 1 L.	$\frac{100.\ O_2}{N_2+O_2}$	Cc. CO_2 in 1 L.	Temp. of absorption $\tau°$.	General character of Plankton.
0	17°·30	22·90						Plankton abundant. Copepods, larvæ of Lamellibranchia, etc.
5	17°·40	22·90						
10	17°·35	23·09	11·86	5·60	32·08	38·55	15°...	
20	13°·30	31·18	12·37	6·11	33·06		10°...	
30	12°·78	32·45	12·38	5·47	30·65	45·10	10°...	
40	9°·05	33·05	13·19	5·69	30·13	46·71	6°...	Plankton less abundant. *Peredinia*, Copepods, etc. See the fig. in Plate viii.
40 bis [2]	8°·74	33·10						
45	7°·33	33·70	13·36	5·49	29·12		6°...	
50	6°·35	34·06						
55	4°·98	34·19						Plankton very scarce. At 60 M. *Sagittæ*, etc. At 90 ,, nil.
60	4°·60 (min)	34·29	13·99	5·03	26·47	47·94	3°...	
70	4°·72	34·40						
80	4°·82	34·56	13·78	4·77	25·71		3°...	
100	4°·90	34·50						
120	5°·04	34·55	13·86	4·02	22·49	50·11	3°...	

The experience from this deep sounding, which clearly bears out the fact that the waters of different origin, superimposed one on another in the Skagerack, may contain Plankton differing in quantity and species, showed the necessity of constructing an apparatus fitted for Plankton-fishing at different depths. I have tried, in the construction shown in Fig. 8, to combine a practical arrangement of the Plankton-nets with the highest possible degree of accuracy with regard to measurement of depths, the time, and the volume of the water which has, in a given time, passed through the silk gauze of the apparatus, and there deposited its living organisms.

Three wires, 1·5 mm. thick, of phosphor-bronze of extra strength, are wound upon three equal brass cylinders. Each cylinder is exactly 1 mètre in circumference. The first and third cylinders are rigidly fastened to the common axis, while the second can rotate around this axis independently of the others. By a little hook or clasp it can be fastened to the first cylinder, and then the entire system of three cylinders rotates as a whole. Each wire carries a heavy lead of at least 10 to 15 kilogrammes. This is necessary in order to keep the bronze wires straight, and prevent their being entangled or twisted by the force of under-currents.

[1] Being myself no specialist in biology, I must omit all detailed account of these results, and only mention the general character of the Plankton. Thus, in the Plankton from 30 m. there are five different forms of *Peridinia*, etc.

[2] The limit between two water-layers is just at 40 m. Therefore, the two consecutive soundings have given slightly different results.

On the wires of the first and the third cylinders brass frames can be fastened anywhere by means of screws with side-slits. To these frames measuring apparatus can be fastened, inside or outside. In the former case, the quantity of sea-water is measured which has actually passed through the frame and filtered through the silk gauze of the Plankton-net, which is attached with water-tight india-rubber packing to a separate brass frame fitted to the former by screws. In the second case, when the measuring apparatus is affixed outside the frame, it acts simply as a log. The principal frame has a lid, which covers an opening of $\frac{1}{20}$ square mètre, and is shut or opened by the movement of the second cylinder. The opening mechanism of the brass lid is fastened by means of a little screw with a side-slit to the bronze wire of the second cylinder. When the apparatus descends, the lids of all the frames are kept shut, and then all three cylinders rotate together. When each frame and net has reached the water-layer from which it is to collect Plankton, the second cylinder is unclasped. Then the lids of all the brass frames open simultaneously, and the water has free access to the nets and the measuring apparatus within the frames. The ship must steam against the wind with the slightest possible speed. If the leads are heavy enough, the bronze wires go down almost perpendicularly into the sea by the side of the ship. After ten or fifteen minutes the nets are shut simultaneously by manipulation of the second cylinder. After the hooks have been fastened, the apparatus is hauled up, and each net is in turn unfastened from its frame, and emptied into a measuring-glass filled with alcohol.

During our hydrographic expedition in November 1893, this Plankton apparatus was used successfully at three localities, viz., the mouth of the Gullmar fiord, the deepest station in that fiord, and at Station S_{vii}, in the centre of Skagerack.

On the 15th November, Dr. Aurivillius fished up Plankton in the Gullmar fiord at depths of 10, 30, 70, and 90 mètres simultaneously. After ten minutes the measuring apparatus of the Plankton-net No. 2 indicated 9920 turns of the propeller, and the apparatus No. 3, at 70 mètres, 10,333 turns.

The constant of No. 2 is : 9·710 turns = 1 mètre.
„ „ No. 3 is : 9·865 „ = 1 „

Consequently, a column of sea-water of 1021 mètres had passed through the silk gauze of the net at 30 mètres, and a column of 1047 mètres through the net at 70 mètres. The opening of each being exactly $\frac{1}{20}$ square mètre, we conclude that the Plankton obtained (in ten minutes) at 30 mètres depth represented the quantity of organic matter in 51·05 cubic mètres of that layer, and the Plankton from No. 3 the organisms contained in 52·35 cubic mètres of the water-layer at 70 mètres depth.[1] The Plankton obtained in November was very different from that which we found at the same place and depths six months before. Suffice it to say, that in quantity the winter Plankton was far in excess of that of the summer; that the vegetable matter seems to predominate in the colder

[1] Dr. Aurivillius is now engaged in the examination of this Plankton.

season; and that abundance of living organisms were brought up from a depth of 70 mètres in November, while no Plankton was found at the same depth in August. In the middle of the Skagerack the character of the Plankton at 30 and 40 mètres is different from that at 10 mètres, a fact which could be predicted from the hydrographic conditions of the central part of the Skagerack.

List of Original Papers.

(1.) *Den Svenska hydrografiska expeditionen år* 1887, *under ledning af F. L. Ekman. K. S. Vet. Ak. Handl.*, Bd. xxv. No. 1. Stockholm, 1893. Part i. by F. L. Ekman; Part ii. by O. Pettersson.

(2.) *Grunddragen af Skageracks och Kattegats hydrografi. K. S. Vet. Aks. Handl.*, Bd xxiv. No. 11. Stockholm, 1891. By O. Pettersson and G. Ekman.

(3.) *Om hafsvattnet utmed Bohuslänska Kusten. K. S. Vet. Aks. Handl.*, Bd. ix. No. 4. Stockholm, 1870. By F. L. Ekman.

(4.) *On the General Causes of the Ocean-Currents. Nova Acta Reg. Soc. Ups.*, Sec. iii. Upsala 1876. By F. L. Ekman.

(5.) *Hydrografiska undersökningar vid Bohus-Kusten. Bih. till Göteborgs och Bohusläns Hushålen. Sällskaps qvartalsskrift.* Göteborg, 1880. By Gustaf Ekman.

(6.) *Hydrografisk-Kemiska iakttagelser under den Svenska expeditionen till Grönland*, 1883. *Bih. K. S. Vet. Aks. Handl.*, Bd. ix. No. 16 and Bd. x. No. 13. (*Meddelanden från Stockholms Högskola*, No. 37.) By A. Hamberg.

(7.) *Hydrografiska undersökningar i Gullmarfjorden, sommaren* 1890. *Bih. K. S. Vet. Aks. Handl.*, Bd. xvii. No. 5. By A. Palmqvist.

(8.) *Hydrografiska observationer i Kattegat vid början af September månad*, 1891. *Öfvers. K. Vet. Aks. Förhandl.*, 1892, No. 7. By O. Pettersson and G. Ekman.

(9.) *Om det hydrografiska tillståndet i Bohusläns Skärgård vid tiden för vinter-sillfiskets upphörande* 1878, 1890, *och* 1891. *Öfvers. K. Vet. Aks. Förhandl.*, 1892, No. 7. By O. Pettersson and G. Ekman.

(10.) *On the Properties of Water and Ice. Vega-expeditionens vetenskapliga iakttagelser*, Bd. ii. Stockholm, 1883. By O. Pettersson.

(11.) *Contributions to the Hydrography of the Siberian Sea. Vega-expeditionens vetenskapliga iakttagelser*, Bd. ii. Stockholm, 1883. By O. Pettersson.

THE BOLIVIAN ALTIPLANICIE.

By D. R. Urquhart, C.E.

In the following article I propose to give a few notes descriptive of that part of the republic of Bolivia which is known as the Altiplanicie. This strip of country consists of high plains or pampas lying between the different mountain ranges and spurs of the great cordillera of the Andes at an average height of about 12,000 feet above the level of the sea; they are often of immense length, while their breadth varies con-

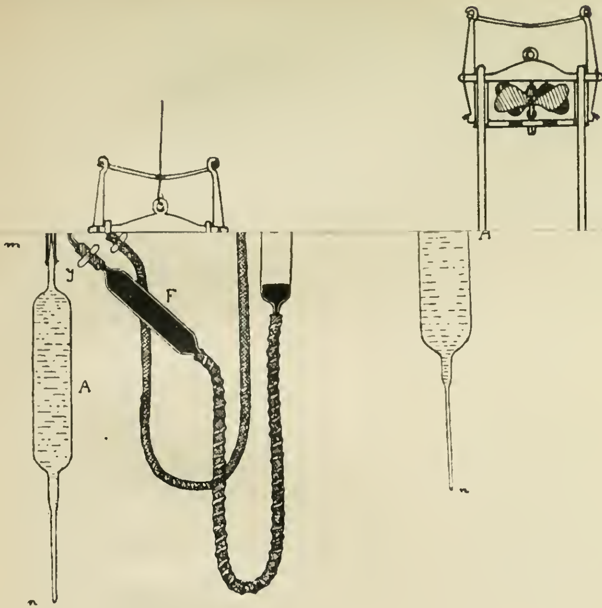
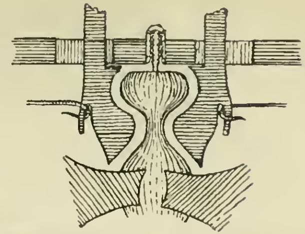


Fig. 6.



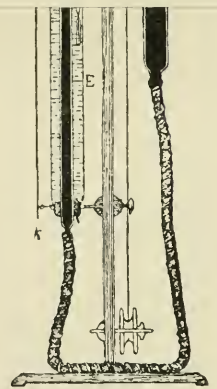


Fig. 7.

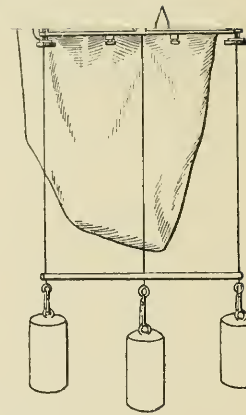


Fig. 8.

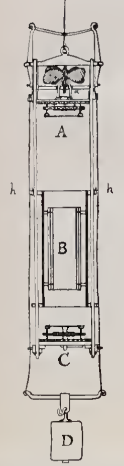


Fig. 1.

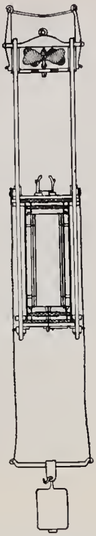


Fig. 2.

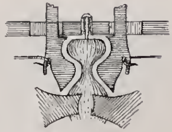


Fig. 3.

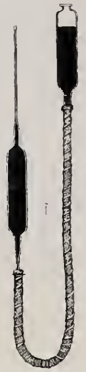


Fig. 5.

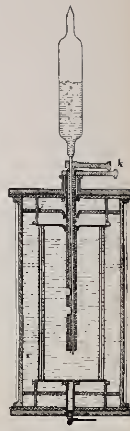


Fig. 4.

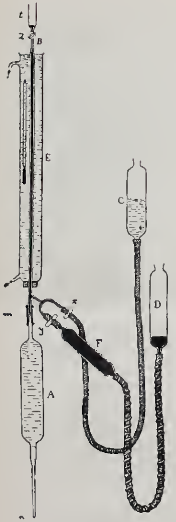


Fig. 6.

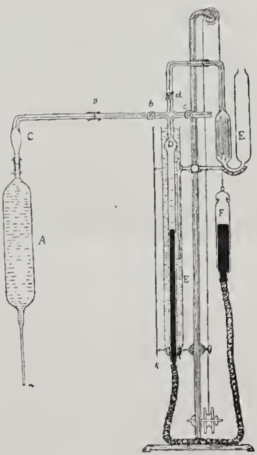


Fig. 7.

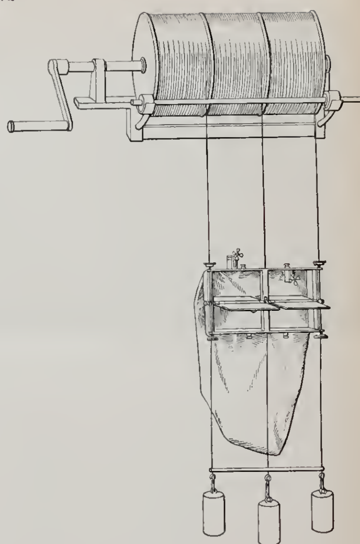


Fig. 8.

siderably. I shall follow, to some extent, the route taken by the Antofagasta railway, crossing the cordillera somewhat diagonally, though the notes will be applicable more or less to the whole of the Altiplanicie.

Economically, the district is interesting for the abundant mineral deposits of silver, tin, copper, lead, antimony, etc., in the hills; but the somewhat trying climate, the dearth of vegetation, and the difficulties of communication with the outside world render it a somewhat undesirable place of residence.

Proceeding from the Chilian port of Antofagasta by the only railway which at present traverses Bolivia, we travel nearly in a north-easterly direction. At a distance of some 220 miles Ascotan is reached, where there is a *portezuela*, or opening in the hills, at an altitude of 12,000 feet above sea-level. From this point onwards the changes of level are of small account, except where we have to find other *portezuelas* in the ranges we may wish to cross. We do not leave Chilian territory until we are some 50 miles beyond Ascotan, where an imaginary line joining the volcanoes Ollagua and Loa is crossed—the provisional boundary of Bolivia fixed by the Chilians after the late war. Before proceeding into Bolivia, it may not be out of place to make a few remarks on the country through which we are supposed to have passed. From the coast to within 40 miles of Ascotan we traverse the great desert of Atacama, which, excepting a few isolated spots, is entirely devoid of vegetation. The air is very dry, and during the day the rays of the sun beating down on the seemingly endless plains of burning sand are almost insupportable. The desert has, however, its oases, such as the old Indian village of Calama, through which the line passes (8000 feet above sea-level); and these, with their small corn patches, etc., present refreshing sights indeed. In the hills which encroach on and bound this desert there are mines of silver, etc.; and many strange and dismal stories are related of prospectors who have set out in search of them, for the traveller who loses his way here has little chance of returning.

A wagon-road from the Huanchaca silver mines in Bolivia to Antofagasta (now supplanted by the railway) can be easily traced by the bones of horses and mules that have perished by the way. The climate on the northern part of the coast of Chile is rather warm, but pleasant enough, except for the absence of rain. As one proceeds into the more elevated interior the heat continues during the day, but the nights are cold, as there are no great heat-storing bodies of water to equalise, to some extent, the temperatures of day and night. The air, indeed, is so dry that carcases of dead mules completely mummified are a common sight; and the hands and face of the traveller are cracked by hot wind and sand. Another effect of the dryness of the air is the electric sparks produced by merely stroking the neck of a horse or mule. One who has crossed this desert on horseback, or in a cart, or worse still on foot, can truly appreciate the advantages derived from the introduction of the locomotive.

Towards the hills there are ravines, wide and deep-cut, but now perfectly dry. The mountains are volcanoes, some still semi-active, others perpetually snow-tipped. On their sides may be seen the gorges, red and yellow-coloured, down which have poured streams of molten rock, and the foot-hills are strewn everywhere with masses of volcanic slag, rendering travelling difficult and tedious. There is no rain, and no life of any kind, vegetable or animal. The endless undulations of the sandy desert, the weird and dismal valleys through which no water flows, the verdureless foot-hills bestrewn with fantastically-shaped heaps of lava, the red-scarred, smoking mountains which seem but recently to have finished their work of destruction. and the eternal silence everywhere, combine to form a scene of the utmost desolation.

One bright streak in this dreary scene is the Loa, which, though really only a rivulet, ranks as a river in this country. One might ride over the flat lava-strewn plains through which it mostly flows without even suspecting its existence, as it runs in a gorge with steep, sometimes almost perpendicular, sides over 300 feet deep and only about 800 feet apart at the top. Its water is cold and pellucid up in the desert, and its grassy banks are lined with water-cresses. Farther up the stream are hot springs where the Indians have constructed a rude open-air bath. I am not aware what mineral ingredients these springs contain, but the Indians have a high opinion of their curative properties in cases of rheumatism and similar complaints. As the lungs are easily affected in this country, I should hesitate before taking a warm bath in the open air, which, in the cold air of this valley, and with the rapid evaporation consequent on the dryness of the air, must be a very chilly experience. Wild duck and geese frequent the river. Up in the rocks are caves where the Indians live to whom belong the sheep and cattle that graze by its waters, and who also own the numerous dogs that make for the unwary traveller.

These Indians are of the same race as those of the Bolivian sierra, whom I shall describe further on. Indian tribes seem to have existed on the outskirts and oases of this desert down to, or at least near to, the coast. In such villages as Calama, Chiu-Chiu, and others, remains of them may be seen in forts and other buildings; mummies, urns, arrowheads, and other relics are also found, some of which have been taken to Europe and elsewhere, and have probably been carefully studied. I have frequently seen what appeared to be remains of old Indian villages somewhat farther in the interior than the Loa, where there is rain and a very sparse Indian population still exists. In these places, however, I have also often come across human bones and skulls, so that it is possible I may occasionally have mistaken an ancient burying-place for a village. To attempt to seek information from the aborigines is simply to expose oneself to a useless trial of patience.

Nitrate deposits exist and are worked on the desert near Antofagasta, similar to the well-known ones of Tarapaca, but on a much smaller scale.

Conchi, the point where the railway bridges the river Loa, is situated at the foot of the semi-extinct San Pedro volcano, which stands beside its snow-clad brother, San Pablo. It is said to be impossible to ascend San Pedro, partly on account of its steepness, and partly on account of the fumes which emanate from its sides. Its crater still smokes, and I have had some rather unpleasant experience of the earthquakes produced from time to time by its efforts to resume operations. At its base there is a diminutive volcano (the Poruna), which, from the perfect appearance of its crater and lava-covered sides, might have been in full blast only yesterday. It is perhaps not much over 150 feet high.

From Conchi (10,000 feet high) onward to Ascotan, the climate gets distinctly colder, although it is rarely very cold for long after the sun is up, even during snow-storms. From May to September the nights are intensely cold, and everything capable of freezing is solidified. For about 50 miles beyond Ascotan we cross the first great chain of the Andes, and the scenery on every side is of a very grand character, but all too barren to be beautiful, and the eye soon wearies of the somewhat similar contours of the mountains. The climate, however, commences to be of a less trying character; there is less difference of temperature between night and day, and the air seems to be less keen—perhaps it contains more moisture, for we are coming into a country which has its regular rainy season from October to March. But a person whose skin is easily affected by cold and dryness, as mine unfortunately is, has to submit to rough cracked hands and face on any part of the Altiplanicie.

We now find springs and pools of water at no very distant intervals; and instead of one great desert we have pampas, sometimes bare, and sometimes (like the spurs of hills which divide them up) covered with a scanty vegetation of scrub. The pampas are perfectly flat, often almost horizontal, and, when bare, look like sheets of water, while the small, isolated hills which suddenly rise up from them might be taken for islands. This effect is further intensified by the well-known illusions of the mirage, so prevalent on hot deserts. This phenomenon is a source of great annoyance to a person who wishes to sight any distant object exactly, and the laying down of a long straight line is a difficult matter for the engineer. A surveying pole placed more than 500 yards off commences to wriggle about under the instrument, and, at a greater distance, disappears altogether, leaving only the pole-bearer visible as a shapeless mass. The engineer has, therefore, to get up very early in the morning, before the sun is out, if he wishes to get ahead at all, and this is not very easy when everything is frozen and the air is bitterly cold, especially as the previous day has been spent under a broiling sun. These extreme variations of temperature are perhaps the most trying difficulty one has to contend with. Many of the barren pampas are covered with a white saline efflorescence, which renders the use of coloured spectacles necessary during the bright sunshine; on a cold, clear, moonlight night it has all the appearance of snow.

These pampas are evidently dried-up lakes. On the surrounding hills are to be seen beach lines running round at various levels. The rocks at the bases of the hills are mostly limestone of the rough and rugged character produced by subaqueous chemical precipitation, of very curious shapes and abounding in cavities. In the larger ravines this stone may be quarried out in exceedingly hard blocks of compact structure, and very pure lime can be obtained by calcination, although some contains a good deal of sulphate (gypsum) and other foreign matter.

The same rock is also found in the clay composing the beds of the pampas in the form of *costras* (crusts), and, from its rough exterior, forms an excellent material for common masonry work.

The formation of this calcium carbonate may be seen in progress at Carcote, a lake on the Chilian side of the frontier. The precipitated incrustation is deposited at the banks, is pure white, and assumes a variety of pretty forms, growing in the water somewhat like vegetation. Of this "lake" only one corner contains water, the remainder being covered by a snow-white deposit of various salts which the railway traverses. No borax has been found in paying quantities on this lake; but on the lake of Ascotan, which the line also crosses, and which is of a similar character to Carcote, borax-works are in full operation. While we are back at Ascotan, I may draw attention to the Cerro de Azufre (Sulphur Hill), standing over 16,000 feet above sea-level, one of the many hills overlooking the lake. One side of it seems to have been blown out, leaving exposed a yellow sulphur-bed of vast extent but no great depth. The volcano of Ollagua, already mentioned, has also extensive sulphur deposits, probably of some value. Although only a small part of the lake of Ascotan is occupied by water, and this too saline to be potable, still there are several fresh springs and pools by its sides, such as Cepullo and Cebollar. Here may be seen wild duck and flocks of gaudy-coloured flamingoes. The flesh of the latter is said to afford good eating. The natives say that it should first be buried in earth for two or three days shortly after it is killed, but from my own experience of it as an article of diet I should recommend burying it permanently and at once. The graceful vicuña also comes down to these pools to drink. This animal here takes the place of the deer, which it resembles in colour. It has the long neck of the lama and alpaca, but is much more slender and has not the same thick coat of wool. Its wool, however, is of a much finer quality. Fine rugs are made by sewing together the skins of the necks, which is the finest and most valuable part; and caps, mittens, shawls, etc. made from vicuña wool are much used in Bolivia and in South America generally. The vicuña is readily tamed, but does not breed in captivity. A flock of them scudding over the pampas, followed by their little ones, is a common sight; and in the hills, perched on some high rock against the sky, these slender animals look like tall, ghostly phantoms. They have a jumping, jerky pace, and are by no means an easy mark for the rifle: unless struck in some vital spot, there is little chance of securing them, for if not wounded fatally they will make off with the greatest rapidity, probably to hide themselves and die. A vicuña steak broiled on embers makes a dinner not to be despised out on the pampas, or indeed anywhere.

The Pampa Pelada (*pelada* means hairless or bald), some 160 miles north-east from Ascotan, is of remarkable extent. It is a large stretch of nearly level red clay, in some directions extending to the horizon. There is a slight declivity to the westward, and one or two salt streams trickle slowly through it in that direction. The clay is 4 or 5 feet deep, and overlies dark-bluish fine sand, the two being separated by a thin layer of the *costra* before mentioned. At about its narrowest point, where the railway crosses it, the width is over 20 miles: at other places it widens out immensely. It is absolutely without a trace of vegetation, and during the rainy season is entirely submerged in water to a depth of 2 feet more or less, so that the railway presents the singular appearance of a small clay embankment running through a great lake. At the western extremity lies an immense salt lake having no outlet that I am aware of. The evaporation, however, in this country must be very great, considering the prevailing dryness. This lake is fed by several saline streams flowing down from the mountains, whence they bring their salt. As the dry season sets in, these streams diminish or dry up; and as the waters of the lake fall (by evaporation, probably) a thick crust of salt is formed round its edges. This, of course, being only a residue, does not present the peculiar formation of the lime precipitate before referred to. During the dry months Indians may be met, with flocks of numberless lamas, carrying salt to the different establishments where this article is used in the reduction of minerals. They probably take away some thousands of tons each year, but the rains annually obliterate all trace of excavation. The Indians cut it with axes in blocks about 18 inches square and 4 to 6 inches thick, and load two of these on each lama. The salt is said to be nearly chemically pure, and some of it is beautifully white. During the dry season the edge of the salt crust can only be attained by taking one of the roads used by the Indians, the ground being at other places too soft to be passable. The Pampa Pelada is therefore a dangerous place to get lost on at night, as a person may easily perish in the soft salt flats which surround the lake. One can see carcases of animals which have probably strayed there in search of water, stuck fast generally in an upright position, and completely covered by a thick coating of salt.

To the east of the pampa, above the horizon, may be discerned the tops of the silver-bearing, snow-tipped hills of Lipez, San Cristobal, Santa Isabel, etc.; also the great mountains of Chorolque and Ubina, containing silver, tin, antimony, and bismuth. These minerals are worked to some extent, but the intense cold and the conditions of life at such altitudes render the working of them a matter of great difficulty; while the transport of large pieces of machinery for pumping, hoisting, etc., is a very costly undertaking. Water in large quantities is soon encountered in these hills, a constant supply being kept up by the snow with which they are covered. This presents, perhaps, the most serious obstacle to the miner.

Near the railway are two or three rather pretty isolated hills standing up from the flat, which are known as the Enchanted Islands. A priest who left the Indian village of Colcha to cross the pampa to San Cristobal, taking with him a considerable sum of money belonging to the Church, is said to have disappeared mysteriously while passing these islands, and neither he nor his servant nor the specie was ever heard of more.

A flock of wild ostriches may occasionally be met on these plains. For swiftness they might almost compete with the locomotive.

On the north side of the Pampa Pelada, some 420 miles from Antofagasta, the line divides into two branches, one going to the Huanchaca silver-mines, and the other to the town of Oruro. At this junction, Uyuni, there has grown up quite a village of more or less modern fashion, consisting for the most part of stores and mineral agencies. A description of the Huanchaca mines would be beyond the limits of this article. The following notes refer mostly to the country between Uyuni and Oruro, which is more habitable and more thickly peopled than that through which we have passed. We now travel in an almost northerly direction. Although we descend but little from the level of 12,000 feet above the sea, there is now vegetation in the form of brushwood and rank grass both on the pampas and foot-hills. Cacti also abound on the otherwise almost barren hills, and little forests of them may be seen, their trunks shooting up from 20 to 30 feet high. Some of these cactus-plants bear pretty flowers, and others produce deliciously refreshing fruit, such as the prickly-pear. Many varieties are small, growing along the ground; and as all are plentifully supplied with long sharp thorns, it is advisable to look well before sitting down. At the different *ranchos* or clusters of huts and villages there are small enclosures of cultivated ground; we also pass an occasional *hacienda* or farm. The crops, such as they are, consist of barley, *quinua*, potatoes, beans and wheat, and good hay grass can also be grown. The barley is cut before it is quite ripe, and sold unthreshed along with its straw as fodder. *Quinua* (*Chenopodium quinoa*) is quite an Indian cereal: the seeds are washed to remove their bitter taste, and are afterwards cooked; it makes a fairly good substitute for rice or barley in soup. The potatoes grown here are as good as one could wish; these are frozen (*chuño*), but not so as to produce the saccharine matter we taste in the sweetish frost-bitten potatoes at home. The vegetable is simply turned as hard as stone, and, in my opinion, deprived of all flavour. It is usually cooked chopped up with cheese, and the dish is greatly relished by some. One species of brushwood also produces a kind of large tuber which the Indians eat. Of the brushwood there are several varieties, most of which have a medicinal value, according to the natives.

As we approach Oruro the welcome sight of occasional trees meets the eye—small and stunted they are, it is true, but still trees; and I have even seen roses blooming at the village of Huari, some 60 miles south of Oruro.

The villages have usually a pleasant enough appearance at a distance, with their church and white-washed tower, but it is no uncommon thing to find them entirely deserted. The houses have all owners, it is true, but they are away with their lamas or looking after their land. Or perhaps the whole population has adjourned to some neighbouring *fiesta*, or holiday-making, which, though usually connected in some way with the Church, practically means a few days of excessive indulgence. The village of Huari, for example, is only really inhabited once a year, for about a week, when there is a great cattle fair or *feria*; for the rest of the twelve months it contains only a few souls and the Indian travellers who happen to be passing through it. At the principal store, which is kept by a retired colonel of the Bolivian army, alcohol is sold by the bottle, candles, and sometimes bread.

If the villages do happen to be inhabited, they are often in a state of *fiesta*—somebody's birthday, perhaps. The chief attraction is a group of musicians, armed each with a drum and reeds, something like the punch-and-judy man at home, vigorously wielding the drumstick with one hand, and in the other holding the reeds, from which he elicits a few mournful notes. They are refreshed at very frequent intervals by their friends, who hand round tins of alcohol. The bystanders from time to time indulge in a sort of primitive dance, which, like the music, appears to have no particular beginning or end.

I have used the word alcohol, because that is the word the people use themselves, and because that is simply what they drink. What we know as unrefined spirits of wine (non-methylated), and use for commercial purposes, is imported into Bolivia in enormous quantities, in tins containing three or four gallons each, and is used by the Indians (and sometimes by the Whites also) as a beverage. They usually dilute it with water, as even an Indian cannot stand much of it as imported; but they drink large quantities of it whenever an opportunity occurs, and it says much for their constitutions and the general healthiness of the country that there are any old or even middle-aged people among them at all. Drunkenness is, indeed, a prevailing vice throughout all Bolivia.

The Indian house consists of four walls, a thatched roof, an opening for entrance, and sometimes a door. The buildings are composed mostly of unburned mud bricks, and the cactus supplies the necessary timber. They are fairly well squared and put together: the walls are not plumb, however, but slope slightly inwards from the ground to the top, which is scientifically reasonable enough, but exceedingly ugly. At one end of the apartment the floor is raised, so as to form a low bench, which is the bed. When the Indian goes off on business or holiday-making, his wife and family go with him; and if his house possesses a door he secures it with a tremendous wooden kind of padlock, the mechanism of which I have never been able to fathom. The impatient and weary traveller often opens it in his absence with a stone or a kick. Sometimes the aperture is merely filled up with loose stones. These people have no fear of anything being stolen when they are away, as either the squaw or a lama carries all the movables of the family. The stranger, however, will sleep under the open heavens, exposed to every wind that blows, more peacefully than under the shelter of these *ranchos*, unless indeed he be provided with a quantity of vermin-killer. By the way, it is a curious thing that the flea is quite unknown on the Altiplanicie. Every one who has had any experience in the matter knows that Antofagasta is one of the liveliest ports on the coast for fleas. No sooner, however, is a height of a few thousand feet attained than they entirely disappear.

There is nothing interesting in the Indian villages. When empty, everything is desolate; when inhabited, everything is filthy. There are not even windows to give light to the houses. The inside of the church is unswept and tawdry with cheap tinsel ornaments. It may, however, contain much valuable property, deposited in some safe place where thieves will find it a difficult matter to break through and steal. A host of yelping, snapping curs prowl the streets—a very popular breed resembling the black fox. The Indian trains his dog (which he values very highly) to bark and howl outside the door all night and keep away evil spirits and disease; so you can imagine what it is to try to sleep in one of these villages. This superstition I have also observed among the Indians of Central America.

Each small cluster of huts on the pampa has its *capilla* or chapel (the *templo* of the Indian), although they may be only a few yards apart. This *capilla* is a building about 12 feet long by 8 feet broad, with a door at one end. Outside, in front of the door, is a small pillar, which is sometimes adorned with brushwood decorations placed there years ago. In the middle of the ridge, or over the door, there is a small wooden cross, an ornament often seen also over the dwelling-houses. Inside, the chapel is white-washed, and a bench facing the door serves as an altar. On this is placed what looks like an old tea-box with folding doors, containing a little dressed-up figure surrounded by a wreath of dirty artificial flowers and leaves of tinfoil. In front of the figure flickers a lamp of lama tallow. The altar is usually—why, I cannot say—further adorned with a number of empty bottles. The Indians are very reverential in the chapel, and evince considerable pride in showing off the image, whose wooden expression bears a droll resemblance to their own. They are supposed to be Roman Catholics, but it is very certain that their ideas never rise above mere idolatry and gross superstition.

Shortly after leaving Uyuni and passing the Cuzco mountain (not to be confounded with the well-known Cuzco of Peru) there is a range of hills on the right called the Cordillera de los Frailes, perhaps on account of some fanciful resemblance to a string of hooded monks. The same range exists under different names up to and beyond Oruro. It contains mineral deposits of considerable value, as yet not much worked. Many claims are, however, being taken up towards Oruro, the two metals most sought for being tin and silver. The former is found in the usual form of oxide. This stannic oxide, being one of the heaviest of minerals, is easily separated from its accompanying dirt by washing; and as it then contains about 60 per cent. of tin, it may readily be sold even without having recourse to any further process of smelting, etc. Consequently, where the mineral is found as compact earth, which can be removed simply with a pick, no great expense for machinery is necessary to make a start. In these matters, however, money is much more easily lost than won, as I am aware from some experience. Indeed, capital, along with great patience and indomitable perseverance, may be said to be essential for the continued success of any mining enterprise. Copper, lead, and antimony all exist in this range of hills, but for the present no one is content with less than a silver mine, or, at least, a tin one.

Some of the *quebradas* (valleys or ravines) are very interesting; specimens of minerals of different kinds may be picked up everywhere, and veins may often be seen up on the bare, steep, inaccessible sides of the hills, from which water breaks out, leaving great stains of the metallic salts it contains. In some of these *quebradas* the water of the cold mountain stream is somewhat strongly flavoured with iron, and has a purgative effect for the first day or two, but after a time is found very refreshing. The turf on the bottom of the *quebradas* is often several feet thick. This is cut into square blocks and taken as fuel to the neighbouring mining establishments, there being no coal-mines on the Altiplanicie. These *quebradas* are not at all inviting, and during a snow-storm are very cold and dismal. Near the farmhouse of Pasña, some 120 miles from Uyuni, there are hot springs much frequented by the Indians, and somewhat similar to those already referred to on the Loa.

The rivers passed between Uyuni and Oruro are numerous, but not of great size, many not being worthy of the name of river, which is applied to all streams indiscriminately. During the rainy season, however, even the smallest runnels on the hillsides, usually dry, are changed into roaring torrents. These rivers mostly flow into the lake of Poopo, or Pampa Aullagas, as it is sometimes called, into which also pour the surplus waters of Lake Titacaca by a river called the Desaguadero (water-emptier). The presence of the great body of water of Lake Poopo has a marked effect in ameliorating the climatic conditions of the surrounding country. The railway passes a few miles to the eastward of it, where there are several Indian villages—Quillacas, Huari, Challapata, Poopo, Tolapalca, and others, and, at the northern extremity of the lake, Oruro. The outlet of Lake Poopo is at its southern end, Quillacas, and the water, after flowing in a regular channel for some miles, breaks up into branches, which ultimately get lost in great marshes. There are other streams on the Pacific slope of Bolivia which are also lost in the same way.

Now, where does all this water go to? It is said that shrubs which grow only up in Bolivia, and are not found near the coast (which is in fact all barren and waterless), have been found floating in the ocean, and it has been inferred from this that these lost rivers have underground passages to the sea. I have also been told that on the Tarapaca plains the sound of rushing water has been heard in certain places by persons placing their ears to the ground, but I am unable to substantiate any of these statements. However, should underground rivers actually exist here, it might be possible to irrigate and render fertile many large tracts of land at present barren and unproductive, nearer the coast, and at a much lower level than Lake Poopo, and therefore under more favourable conditions as to climate and transport than those farther in the interior. There are also large mineral deposits near the coast which at present cannot be worked profitably owing to the scarcity of water. These are questions which will probably be settled in time by the driller or Artesian well-borer. It must be remembered that these supposed subterranean rivers referred to do not necessarily, or probably, pass through the desert of Atacama, which we have now left to the south-west: Lake Poopo is in the same latitude as Iquique.

In the admirable report of Don Avelino Aramayo (published, if I remember rightly, in 1863) concerning a road of communication to the Pacific from Bolivia, he proposed to carry it across the cordillera in this neighbourhood. He would take advantage of the navigability of Lakes Titicaca and Poopo, canalise the Desaguadero and the drainage stream of Lake Poopo as far as practicable, and finally, from the south-western end of his waterway, construct a railway to join the present one from Iquique. This gentleman—a Bolivian—spent a large sum of money in patriotically endeavouring to solve this question, and thus bring his fellow-countrymen into touch with the outside world. He had experts brought to survey and study the technical features of the problem, and in his own report he reviews the customs, mining laws, conditions, and possibilities of development of his own country with great ability and fairness. He concludes, however, by complaining that the Congress, to whom the scheme was submitted, threw it on one side without consideration, on the miserable excuse of being occupied with some trifling question of alcohol duties.

It was in the same report, I think, that I read some statistics concerning the great quantities of silver which are annually taken to Potosí for Government assaying and taxing, and pointing out the fact that robberies were almost unknown on the way, as well as some reference to the general absence of crime in Bolivia. These last statements I can fully corroborate. During the four years I resided in Bolivia I was continually riding over the pampas and sierra by night and by day, and I do not remember ever having been molested, nor indeed having ever encountered anything that could be dignified by the name of an adventure. Acts of violence do occur, and I shall have occasion to refer to one or two for purposes of illustration, and because they happened to come under my own knowledge; but they are rare, much rarer I should say—even in proportion to the scanty population—than in any other country with which I am acquainted. They are usually connected with strangers, many of whom, when they come into a semi-civilised country such as this, imagine, because the people and customs do not correspond to their own stereotyped notions and conventionality, that they are at liberty to break all bounds of decent conduct. This remark does not apply to every one, by any means; but it is very often applicable to our own countrymen, and that, at least, is a matter which concerns us.

Dust-storms are frequent on the pampas between Uyuni and Oruro during the dry months. They commence with a slight breeze and what appears to be a fog, but is in reality fine dust. The wind gradually increases, and the flying dust is now seen and felt, soon becoming so dense that it is impossible to see even a few yards ahead. These storms very often last for three days, and are exceedingly disagreeable. Horses and mules are blinded for the time, and it is next to impossible to drive them. A very common phenomenon on the pampas is a moving pillar of sand. This, however, may be easily avoided, which the dust-storm cannot be.

(*To be continued.*)

THE PEOPLE OF INDIA AND THEIR MARRIAGE CUSTOMS.[1]

By Dr. George Smith, F.R.G.S., F.S.S.

At last the Secretary of State for India has been able to give to the world the complete Report and figures of the Census of India, by Mr. J. A. Baines, F.S.S., of the Indian Civil Service. More than three years have passed since the enumeration was made one moonlight night, the 26th of February 1891, three days after the multitudinous peoples were believed to have again settled down in their villages and towns after visiting their shrines on the auspicious occasion of full moon, as is their wont. The grand total of the population of India, on that date, was 289,187,316, including those in the small French and Portuguese districts. To that figure already three millions or more must be added, for our subjects in the East increase at the rate of a million a year under our prosperous and peaceful rule. One-fifth of the population of the world is, in India and Burma, intrusted to our care, and yet the peoples cover only 3 per cent. of the estimated area of the globe, with a density, in such a province as Bengal, unparalleled elsewhere. The mere counting of so many millions in so short a period, and with results which test the comparative accuracy of the process. is a marvel of administrative organisation. But it is also a triumph of economic and ethnographic science. For the Government of India, being a benevolent and, on the whole, a trusted dictator, collected facts impossible to be gathered in Europe in the same way, as to the distribution, the occupation, the mother-tongue, the religion, the caste. tribe, or race, the education, the sex, even the marriage and widowhood and the age, of 262½ millions out of the grand total, which make these three folios of reports and tables a treasure-house of information such as no other country, however civilised, can present. The whole, too, was accomplished without even a suspicion of riot or disloyalty on the part of the varied population, although not more than about six in the hundred can both read and write. Two great facts stand out from this enumeration: nearly three-fourths of the people belong to one or other of the many varieties of the one Hindu religion; and nearly three-fourths, wholly or partially, live by agriculture.

The revelations of greatest interest and novelty made by the Census of 1891, following that of 1881 and compared with it, refer to marriage and widowhood. More than once Mr. Baines relieves the sombre tint of scientific and statistical inquiry by facetious quotation and satirical remark. The enumerators were instructed to enter each person, whether infant, child, or grown-up, as either married, unmarried, or widowed, and were forbidden to leave the column blank for any one of whatever age, while warned to accept the statement made without exciting fear or suspicion by further investigation. Constituted as the social system in India is, this

[1] *Census of India*, 1891. General Report by J. A. Baines, F.S.S. General Tables, vol. i. Statistics of Caste, Tribe, and Race combined with Literacy and Infirmities: Territorial Sub-divisions, and Births and Deaths. 3 vols. London: Printed for the Indian Government, 1893.

policy was the very best to arrive at the whole truth and nothing but the truth. Still, difficulties arose, which, however, hardly affect the total result. In Assam there is no word for widower. In Burma divorce is common, but in India proper it is not recognised by either sex, except among Christians and Mohammedans of course. Permanent concubinage, in many cases, exists in order to avoid the marriage expenses ordered by rules of caste. Again, a comparatively large class of girls are, unhappily, dedicated to the idol in infancy, and become temple or nautch-women, formally wedded to a dagger, fig-tree, or bunch of flowers. Practically all these cases were treated as married from their own and their religion's point of view.

The first result which will cause greatest surprise to all but experts is that polygyny is rare. It is restricted to the richer Musalmans, and to certain hill tribes. In Brahmanic circles, of course, it is as legal as under Islam, but it is rare, save where the first wife is without a son. Omitting Buddhist Burma, in all India there are only seven in every thousand Benedicts who have more than one wife. The contrary popular impression as to zenanas and hareems has been partly derived from Turkey and countries where slavery is legal, but it is largely due to the system of the Hindus, who live in great joint-families and marry so as to create numerous widows. In India, also, there is much migration of married men for the season, while it is the custom of the young wife to return to her father's house for the birth of the first child. The other extreme of polyandry, or the plurality of husbands, on which and kindred subjects the late J. F. Maclennan wrote so skilfully, is equally restricted to the valleys of the Himalayas, where food is scarce, and to the Malabar coast in the south, where the ruling community, known as Nair, follow the matriarchal form, or succession through the female. Elsewhere, especially in the Panjab, it is pleasing to learn that the custom of the marriage of one woman to the whole family of brothers is on the wane, and is even growing to be regarded as disreputable.

All over the north and east of India, but less common in the centre and south, "Karewa," or the custom of the marriage, by the younger brother, of the widow of the elder, prevails "very widely." This is the Levirate of the ethnologists with which the Old Testament has made us familiar. The widows of near relatives also are thus married. In Assam the custom assumes a repulsive form, for there succession to a Miri estate involves the inheriting by a son of all his father's wives, with the exception of the actual mother. Among the Garos of the hills, whom the Welsh missionaries are civilising, the bridegroom, by his marriage, binds himself to the reversion of his mother-in-law—a custom which provokes the well-read Census Commissioner to appeal to the shade of Thackeray. In fact, the matrimonial bargain in our Indian Empire is found in every stage, from the buying of a wife, "which prevails to a great extent among the masses throughout India," to the more advanced transaction in which the husband is bought. The latter is common among the richer classes and those who thus aspire to social or caste distinction.

The extraordinary difference between the civil condition of the sexes in East and in West is seen if we contrast India in 1891 with Scotland in 1881. Of every 10,000 persons of each sex there were only 4873 unmarried males, and 3389 unmarried females in India (with Burma); while the corresponding figures in Scotland were 6628 and 6285. Nearly twice as many women are married in India, or 4851 per 10,000, as in Scotland, where the number is only 2896, or in Ireland, 2698. The only part of Europe which approaches the much-married condition of the people of India is the semi-Oriental country of Hungary, where 4050 of every 10,000 females are married. Burma, taken alone, has almost the same proportion of married and unmarried as Hungary. Among the Hindus the age of marriage accounts for much of the difference; of 10,000 of each sex 5715 males and 8059 females are married up to nine years of age, and 1946 males and 1373 females between ten and fourteen years. Infant or juvenile marriage has as its inevitable complement early widowhood. The Brahmanic influence is dead against widow marriage, though legalised, and entirely in favour of earlier marriage, so that the two evils react on each other, and woman is ever the victim. In Baroda and the Goojarati States north of Bombay it is the rule in a large local agricultural class to contract marriages only once in a period of about twelve years, at a certain conjunction of the stars. Every infant available at the lucky hour must be united to some other lest the next cycle should begin too late for caste propriety. The high ratio of married couples which results from all this is the principal cause of the increase of the population, unchecked by wars and commotions. We know nothing accurately of the fertility of the population of India, but the provincial superintendents of the Census estimate it variously at between 159 and 317 births per 1000 married women of the proper ages, against 286 births in the probably accurate returns of England and Wales.

There are 1760 widows in every 10,000 of the women of India. The proportion rises to 1915 in Madras, and 2063 in Bengal. In England it is only 758, and in Scotland 819. As Mr. Baines puts it, though he waxes humorous over what he calls Wellerism, where there are eight widows in the Temperate Zone there are not far from eighteen in the Tropics. What this evolves morally as well as socially it is not in his province to tell. On the other hand, all the sex figures point to a growing diminution of girl infanticide, against which those old Scotsmen, Jonathan Duncan and John Wilson, set their faces long ago, and Sir William Muir in more recent times. Girls of high caste are now allowed to live at birth and for a few years after; but when the time comes, in the higher and smaller castes, for finding a husband for her, the girl is at a discount. By mere neglect she is then allowed to perish in a way of which British penal legislation can take no cognisance. Mr. Baines suggests that, apart from the desire thus to get rid of daughters who must be married, the prevailing custom as regards dress is prejudicial to female vitality between five and ten or eleven years of age. The boy is protected by a jacket, but the girl wears only trousers or a petticoat, which leaves the vital organs unprotected. The whole Report, however, contains evidence, not only of the decrease of a crime once so prevalent as infanticide, but of a general rise in the standard of living, due to the peace and firm government of the last thirty years.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Meetings held in May.—On May 14th Mr Henry Seebohm, Sec.R.G.S., delivered a Lecture in Edinburgh, entitled "Adventures in Siberia." Professor Geikie presided, and Dr. John Murray proposed a vote of thanks to the Lecturer.

At the last Meeting of the Session, held in Edinburgh on May 29th, Captain A. E. J. Cavendish, Argyll and Sutherland Highlanders, gave an account of his journey in Corea in the year 1891. The Lord Provost presided.

Corresponding Societies.—The Tyneside and the Liverpool Geographical Societies have been made Corresponding Societies, and have conferred reciprocal privileges on members of this Society.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Haweswater.—This lake was sounded by Dr. H. R. Mill and Mr. Heawood in March last. It is the highest of the English lakes, its surface being 694 feet above Ordnance datum. The delta of the Measand Beck nearly cuts off the lower third of the lake, which is called Low Water, while the rest of the lake is called High Water, and the channel between them is named the Straits. Low Water is very shallow, only a small patch near the channel being over 25 feet in depth; here one sounding of 52 feet was taken. High Water is a narrow flat-bottomed trough, with steep sides. The deepest sounding was only 103 feet, and the depth exceeds 100 feet only over a small area near the centre. Haweswater is, therefore, one of the shallowest of the lakes, being surpassed only by Derwentwater, Bassenthwaite, and Buttermere.—*Geogr. Journal*, May.

The Area of France.—In February General Derrécagaix gave an account to the Geographical Society of Paris (*Comptes Rendus*, No. 3) of the new measurement of France executed by the Geographical Department of the Army. The copper-plates of the map of France on the scale 1 : 80,000 were used for the work, and it was assumed that the meridians and parallels at intervals of 10′ were traced on an ellipsoid. These form rectangular figures, some of which are full, while others are only partly occupied by French territory. The former were calculated, and in the latter the French territory was measured with a planimeter, then the sea or foreign soil, and, lastly, the whole square. By this means an idea could be obtained of the error. For the former squares, 7341 in number, the error was regarded as negligeable; for the frontier squares it was found to be ± 83 acres, and another trial gave $\pm 63\frac{3}{4}$ acres. As to the difference between the surveys and the actual surface of the ground, it was concluded that, until new surveys have been taken, the map on the scale 1 : 80,000 is the most exact representation obtainable. As a final result, it was calculated that, taking Clarke's ellipsoid for the form of the earth, the area of France is 207,288 square miles. The highest earlier estimate was about 3022 square miles less than this.

Italian Statistics.—Professor Luigi Bodio has sent us several publications of the Direzione Generale della Statistica, containing many interesting tables showing the comparative progress of Italian and other cities, emigration, mortality, etc. It would require considerable study to thoroughly grasp the import of the figures contained in these tables, and to gain some notion of the relation of the statistics to one another; and it is useless to attempt to give here more than a few prominent facts.

One of the publications referred to contains statistics of the population, buildings, public works, etc., in the cities of Rome, Naples, Turin, Palermo, Genoa, Florence, Venice, Bologna, and Catania, and also of the foreign cities of Paris, Bordeaux, Berlin, Hamburg, Breslau, Leipzig, Dresden, Vienna, Budapest, Trieste, and London. There is considerable difficulty in compiling statistics of towns so as to be exactly comparable. We have Greater London and Registration London, and we may expect the figures relating to increase of population, density, and mortality to vary according as we take the inner or outer limit. On the other hand, even within the walls of Rome there is a large area of ground laid out in market-gardens or lying waste. Professor Bodio has to some extent overcome this difficulty by dividing the area of each city among the buildings, streets, and public gardens respectively, and is thus able to state that in 1889 Rome had 8·87 inhabitants for every 100 square mètres (7·42 per 100 square yards) built upon. It is surpassed in density only by Genoa, which has 14·77 persons on the same unit of area, though Milan and Naples are not far behind. Of foreign cities Trieste comes first, with 10·9 persons; on the whole, they are less crowded than Italian cities. Genoa and Rome show a rapid extension, 50·86 out of every 1000 square mètres having been covered annually with buildings during the years 1888-91 in the former, and 48·19 during the years 1881-89 in the latter. For Breslau and Hamburg the figures are still larger, namely, 78·45 and 68·47 respectively. Paris comes last, with 1·09. Of all the towns, Italian and foreign, none has received such a large proportional addition to its population in recent years as Rome. In the nine years 1882-91 the annual increase was 45·16 per thousand of the total, or about double the rate for the preceding period; Berlin and Hamburg come next, with 40·67 and 38·80 respectively. The last in the list are Venice with 8·61 and Paris with 8·25. The tendency of population to gravitate to large towns is shown very conspicuously in Rome, the number 45·16 being made up of 35·96, representing the excess of immigration over emigration, with only 9·20 due to the excess of births over deaths. Thus the former is to the latter as 3·9 to 1. But even this is surpassed in the case of Milan, the ratio being 6·9 to 1. The birth-rate is highest in Catania, 40 per 1000; and lowest in Bordeaux, 22·84. In Budapest, Breslau, Palermo, and Hamburg it is also high. Leipzig has the lowest death-rate, only 17·24 annually for the period 1882-91. London holds the second place with 20·37. The comparison is, perhaps, not quite fair, for of the 291,374 persons given as the population of Leipzig more than 115,000 are located in villages added to the municipal area in 1889. Vienna and Dresden are also healthy towns, while Budapest, Venice, Catania, and Naples show a very bad record, the rate in all these cases being over 30. In Bordeaux and Venice the mortality exceeds the birth-rate.

In another volume comparative statistics are given of the mortality in the principal States of Europe. Austria heads the list, with a yearly mortality of 283·15 per 10,000 inhabitants during the period 1887-91; Italy follows, with 267·52; while Ireland and Sweden, with 180·45 and 163·63 respectively, bring up the rear. The last figures are especially remarkable when the large emigration from these two countries, draining Sweden and Ireland of their young and healthy inhabitants, is considered. On turning to the deaths from particular diseases, we find that Austria shows a high death-rate from small-pox, measles, scarlet fever, and typhoid fever; indeed, many diseases seem rife in this country. A very deadly disease in Italy is, as might be expected, malarial fever, the rate being 5·81 per 10,000, whereas in no other country does it exceed ·4 (Holland). Measles also shows the highest rate in Italy, 6·17, as well as enteric fever, cholera and dysentery, 33·43. In tuberculosis Austria again comes first with 37·2 per 10,000, followed by France with 33, England with 16·09 and Italy with 13·61 coming last. The rate in England and Scotland is relatively high for measles, scarlet fever, whooping-cough (especially in Scotland), consumption, malignant tumours, and apoplexy, and is the greatest for alcoholism. It is well known that suicide is very common in Germany. The proportion for German cities of over 15,000 inhabitants is 2·46 per 10,000, and 1·97 for the whole of Prussia. France has 2·18, and is closely followed by Switzerland with 2·16. Italy has but ·52, and yields only to Ireland, with ·24.

In 1892 the total number of emigrants from the United Kingdom was 210,012, being 133,815 from England and Wales, 23,325 from Scotland, and 52,902 from Ireland. There has been a gradual diminution in the total since 1887, and this is also apparent with some variations in the emigration from many other European States. Italy reached its maximum, 207,795, in 1888, and in 1892 sent out only 116,642. German emigration shows great fluctuations; it attained its maximum, 220,902, in 1881, and was 120,089 in 1891. Austria and Denmark show on the whole the most steady advance; the figures for 1892 are 31,359 and 10,422 respectively. The table of immigrants into America, Australia, and New Zealand shows naturally a corresponding diminution of late years. The United States have received a fair proportion—595,251 in 1891 and 547,060 in 1892; the maximum occurred in 1887, being 730,349. To Canada the immigration rose to 133,624 in 1883, and was 82,165 in 1891, a fair average for the years immediately preceding. The figures for Brazil and the Argentine Republic show the effects of the political and commercial disturbances in these countries. In the former the number fell from 191,151 in 1891 to 54,509 in 1892, while in the latter there is a partial recovery from 52,092 in the former year to 73,242 in 1892. The most steady influx has been into Australia and New Zealand, though there has been a falling-off in recent years. The numbers rose to over 230,000 in 1883, and attained a maximum of 252,631 in 1886; since then there has been a gradual falling-off to 206,533 in 1892.

The last table to which we shall refer is of particular interest; it gives the population, emigration, and excess of births over deaths. Of all the countries mentioned, Ireland is the one from which the emigration is largest. It was 12·15 per 1000 of the population in 1890, 12·42 in 1891, and 11·39 in 1892. On the other hand, the excess of births over deaths is smallest, except in France, where the deaths preponderate. The ratios for the three years are 4·11, 4·73, and 3·04. These figures, taken in connection with the low mortality, are very remarkable. In Austria emigration is small, the excess of births over deaths fairly high, and the mortality, as we have seen, very great. In Scotland there is an emigration about as large as in other northern countries, and somewhat larger than in England, averaging about 5·50 per 1000; the excess of births over deaths is high, being exceeded only in Germany and Norway, while the mortality is 192·03 per 10,000, or rather higher than in England. Italy occupies about a mean position as regards emigration and excess of births, and Norway takes the first place in both.

Northern Greece.—In the *Verhandl. der Gesell. für Erdkunde zu Berlin*, Bd. xxi. No. 1, Dr. Alfred Philippson describes his journey in Thessaly and Epirus, and in conclusion sums up the scientific results of his exploration. Epirus, as might be expected, is a branch of the Dinaric Alps, built up of parallel folded saddles of Mesozoic and Eocene limestone, the intervening hollows containing Eocene *Flysch*. The Pindus mountains consist of a number of close-lying chains through which the Aspropotamus winds its way diagonally in a narrow ravine. The whole group is composed of thin light-coloured strata of limestone and quartz-felsite, a continuation of the so-called Olonos limestones of the Peloponnese and Ætolia, which are probably for the most part of Eocene age. These limestone ranges are accompanied on both sides by belts of *Flysch*. To the north, round the Zygos pass, serpentine appears below the limestone over a considerable area. To the west of the Zygos, in the direction of Janina, the Pindus limestones give place to Eocene shales, which stretch some distance towards the north-west. The Kambuni mountains are a chain of crystalline rocks connected with the system of Olympus, and running in a north-north-westerly direction. Of great importance is the Khasia gap, separating the Kambuni from the Pindus ranges, and connecting the basins of Thessaly with those of Upper Macedonia. A formation which, from the fossils found by Dr. Philippson, seems to be of Oligocene age, passes through this gap from Western Thessaly into Macedonia, showing that these basins are older than the late Tertiary basins of Southern Greece. Perhaps the most important discovery is that the Othrys mountains, running east and west, do not abut suddenly on to the Pindus, but, turning to the north-west, accompany this range for a short distance as an eastern rampart. It appears, then, that the elevations of Eastern and Western Greece form part of the same system, which gradually diverges from its north-westerly direction towards Asia Minor. In other respects they present a striking contrast.

The Eastern Mediterranean.—*Globus*, Bd. lxv. No. 10, gives some details of the cruise of the *Pola* in 1893. The vessel arrived at Cerigo, the western extremity of the region of exploration, in July 21st, and, after sailing through the Cyclades, visited Rhodes and the Karamanian Sea. It then turned northwards past Samos, Chios, and Mitylene to Mount Athos, and thence to the Dardanelles. The Turks, in spite of the efforts of influential officials, would not allow the *Pola* to enter the Sea of Marmora; and therefore the expedition was obliged to return, passing by Lemnos and Skyro to Syra, and then striking homewards by Capes Malea and Matapan.

The Ægean Sea, bounded on the south by Candia, Karpathos, and Rhodes, is, like all land-locked seas, of no great depth. The deepest sounding obtained by the *Pola* was 1230 fathoms, a little to the north of the eastern point of Candia. The bottom of the sea consists of a series of basins of various sizes and depths, separated by islands or submarine barriers. An important fact is that the approaches to the basins are shallow, never reaching a depth of 438 fathoms. Consequently, just as the Mediterranean is shut off by the Straits of Gibraltar from the cold deep water of the Atlantic, these basins of the Ægean are in turn cut off from the Mediterranean. In the Dardanelles the depth never much exceeds 55 fathoms. The temperature and salinity of the middle layers gradually diminish from south to north, as was to be expected. In the open sea the water is somewhat cooler than near the coast. The low bottom temperature in the Ægean basins, 54° to 55° F., is remarkable, seeing that in the open Eastern Mediterranean 56° and over were found at much greater depths. From a table of observations at Sari-Siglar, in the Dardanelles, it appears that on September 8th the temperature on the surface was $39\frac{1}{2}$° F., and decreased to $29\frac{1}{2}$° at the bottom, 16 fathoms deep. The salinity was 23·1 *promille* on the surface, and 34·9 at the bottom. Experiments were also made to determine the transparency and colour of the water, and the effect of oil and soap on the waves.

ASIA.

Hadramaut.—Mr. and Mrs. Theodore Bent have returned from their journey to the Hadramaut Valley. They left the coast at Makalla, where Herr Leo Hirsch also commenced his march (p. 144), and reached Shibam early in January. With the assistance of the Sultan, Mr. Bent was able not only to explore the Hadramaut Valley, but also to make a flying excursion northwards to the confines of the great central desert of Arabia, where he found the ruins of an ancient city. The coast was reached again at Shehr, where with the help of the Sultan an excursion was made eastwards, which, however, did not lead to any important archæological discoveries. The Indian surveyor, Imam Sherif, selected for the work by Colonel Holdich, has made a very complete map of the country. About 200 botanical specimens and a fair collection of insects were obtained, but the country is not rich in animal and vegetable life. At one time Southern Arabia was a great centre of production of frankincense, myrrh, and other spices, but the inhabitants have carelessly allowed the trees to perish. The valleys descending to the coast are choked up with sand blown down from the central deserts, and the cultivated spots are irrigated by water obtained from borings. Mr. Bent believes that some of the deep valleys stretching from the coast up to the plateau were at one time inlets from the sea, and have been gradually filled up with sand. Mrs. Bent has taken a number of interesting photographs.—*The Times*, April 24th.

In the *Verhandl. der Gesell. für Erdkunde zu Berlin*, Bd. xxi. Nos. 2 and 3, Herr Hirsch gives some particulars of his journey. He describes the Wadi Howaire as a valley enclosed with bare sandstone walls through which a few small threads of water trickle. Huge blocks of stone that have fallen from the cliffs lie scattered over the bottom of the valley. Jebel Karmun, on the right, rises about 1200 feet above the valley, and on the west the Kor Saiban runs in the background, apparently in a northerly direction ; Jebel Howaire, on the edge of the valley, attains a height of 1800 feet. As the valley is ascended the scenery becomes grander. The district is known as Ghail-Halka, which is also the name of a village where numerous palms are cultivated on terraces and watered by artificial conduits. The ascent of the Ahaba of Howaire brought the travellers to the Jol or Meged, the great plateau between the wadis to the north and south. It is a dreary land without a stalk of vegetation, and is covered with small stones which have acquired a black tint from the chemical action of the elements. The rock is a crystalline limestone. On the north the plateau edge sinks precipitously to the Wadi Doan, 1500 feet below. The loamy ground of this valley is carefully tilled, and there are numerous plantations of palms and jujube-trees (*Zizyphus spina Christi*). Shortly before Mashhed Ali extensive ruins were seen, built of stones three feet long and one and a half high ; and Herr Hirsch also visited the so-called tombs of kings, mentioned by Von Wrede, in Wadi Ghaifun on the left. Systematic excavation would probably bring to light many valuable relics. Shibam, the capital of Hadramaut, lies on a sandy plain, and is begirt with large plantations of palms. A march of three and a half hours then brings the traveller to Saiun, a town of the Kathiri Sultans. The Kathiris (another prince governs Terim) are poor, and therefore weak. Saiun is noted for its mosques, said to be 300 in number. At Terim, the Sultan, an enlightened man, who had lived a long time in Java, gave Herr Hirsch a hospitable reception ; but his friends were so indignant at his receiving an infidel into his house that Herr Hirsch was obliged to leave.

Eastern Syria and Mesopotamia.—Baron von Oppenheim has just returned from a very successful journey in this region. Starting from Damascus, he first visited the Druses of Jebel Hauran, by whom he was hospitably received. By their mediation with the Rhiath tribes he was able to explore the Es-Safa mountains and the Er-Ruhebe oasis. He ascended the Jebel Ses, one of the many extinct volcanoes of the country, and travelling over the desert past Tadmor, crossed the Euphrates at Der-es-Sor. Having gained the friendship of the Shammar Beduin, he explored the courses of the Khabar, the Rad, and the Jurjur, and visited Sheikh Faris in his camp to the north of the Sinjar mountains, which is inhabited by Yezids. The Yezids are an interesting race who worship the Devil, though the utterance of his name is punished by death. At the time of the Baron's visit they were in open revolt, and a bloody struggle with the Turks had already begun. Thence Oppenheim wandered over the deserts of Mesopotamia until at length he reached Mosul, where he embarked on a raft and descended the Tigris to Bagdad. During his journey he traversed many parts never previously visited by Europeans, and came across unknown ruins of the times of the Assyrian Empire and the Khalifate. He also obtained a large collection of botanical specimens.—*Verhandl. der Gesell. für Erdkunde zu Berlin*, Bd. xxi. No. 1.

Prehistoric Man in the Lebanon.—A Jesuit, G. Zumoffen, has lately discovered relics of primitive man in the cave of Antelias, 5 miles to the north of Beirut. The ground is covered with a thick layer of broken bones, among which were found calcined bones, flint implements, and sherds of pottery. Under a huge stalagmitic block Zumoffen discovered several human bones and jawbones of *Sus scrofa* and of a stag. Only fragments of the bones of animals were found. Among those recognised were some of the bison, of a bear (*Ursus arctos*?), gazelles, deer. Egyptian hare, weasel, marmot, partridge, and pigeon. Several shells were mixed with the bones, one of them being the large *Helix pacheia* still living in the neighbourhood.—*Globus*, Bd. lxv. No. 16.

AFRICA.

Bizerta.—This town, the Roman Zarytus, stands at the northernmost point of Africa on a peninsula lying between the Mediterranean and the Bay of Bizerta. It contains 8000 inhabitants, of whom 500 are French, for the climate is healthy and the surrounding country pretty and fruitful. Its strategical position between the eastern and western basins of the Mediterranean has induced the French to dredge out the haven, which was entirely silted up, and protect it by two breakwaters, each 1100 yards in length. Between their extremities an entrance 460 yards long is left free. From the outer harbour thus formed a canal 660 yards broad and 23 to 26 feet deep leads to a haven in the Bay of Bizerta, where all the fleets of Europe could anchor. These works will soon be completed. This spring the line connecting Bizerta with Djedeida, and thus with the French system of railways, will be opened.—*Deutsche Rundschau*, Jahrg. xvi. Heft 7.

The Niger and Benue.—A letter from Dr. Passarge, of the Uechtritz expedition, published in the *Mitth. aus den Deutschen Schutzgebieten*, Bd. vii. Heft 1, contains much interesting information, chiefly relating to the geology of the country. The alluvial deposits of the Niger delta extend to Abuchi and Onitsha, where they give place to a red sandstone which forms the banks of the river up to the King William mountains. Here crystalline rocks first make their appearance, but at Lokoja they have again disappeared, the hills on which the town is built being of red sandstone, which extends far to the east and forms the cañon above the town through which the Niger flows. To the west of the mouth of the Katsena the scenery is relieved by rounded hills 300 to 650 feet high, probably of crystalline rock, but the plateau walls, which here retire to some distance from the river, show no change. A complete change takes place in the Nuori district. Here stand the Fumbina mountains, rising as high as 3300 feet, and from their appearance formed of crystalline rocks. On the north side of the valley stretches the long Muri chain, a huge fold divided by a longitudinal valley. What its composition is Dr. Passarge is unable to say, but to the east the rock diminishes rapidly in elevation, while sandstone, increasing in depth, maintains the average height of the range. Between these mountains the Benue flows as in a ditch, and on its bank rise two round grass-grown summits of dark-brown rock, probably of volcanic origin. Between the Fumbina mountains and the mountains of Yola extends a plain with low broad undulations, which is probably the surface of sandstone deposits. Kasa, where the expedition encamped near Yola, stands on a mass of sandstone rising from the bottom of the Benue valley. To the north of the river the Bagala chain runs south-south-west to north-north-east, and to the south of Yola is the Hosere Bere of Flegel.

On leaving Yola the party marched north-westwards to Gire, and then eastwards over the Digina pass between the Bagala and Manda mountains. The summits of these mountains attain a height of some 1600 feet. In the Benue valley stands an isolated hill of basalt with olivine, 100 to 130 feet high; the Zarita or Mount Blackstock, another isolated hill, is composed of phonolite. The formation of laterite by the weathering of sandstone was often observable. The residue is a sand with sharp pieces of iron oxide of all sizes. On the slope of the valleys a belt of sandy clay has been deposited, whereon are situated the villages and cultivated fields, while in the swampy valleys rice is grown. The laterite is clothed with grass and is seldom tilled, its productivity being very poor. On the west of Garua stretches a succession of sandstone ridges 60 to 130 feet high, with swampy valleys between. To the north and north-east are visible in the distance steep mountains 1300 to 2000 feet in height, formed partly of sandstone, partly of trachyte, granite, and limestone. Between Yola and Garua the valley of the Benue is probably a subsidence basin, in which volcanoes have here and there broken out. Dr. Passarge took a number of astronomical observations to determine the longitudes of various points. The longitude of Yola he gives as 12° 47′ E., and therefore it lies some distance to the east of the usually received position.

The Lukuga.—During his expedition to Katanga M. Delcommune explored this river (vol. ix. p. 316), which Cameron twenty years before discovered to be the drainage channel of Lake Tanganika. In the *Mouvement Géogr.*, No. 7, M. Wauters gives some precise details concerning it. M. Delcommune was unable to follow it from its outlet in the lake owing to the disturbed state of the country. He left the lake at Mpala, further to the south; and after crossing several branches of the Niemba, an affluent of the Lukuga, arrived at Kalumbi, 55 miles in a straight line from the lake, where Thomson turned aside from the river in 1880. The Lukuga flows in general from east to west, making a decided bend to the north. Leaving the lake at an altitude of 2684 feet (Stairs' measurement), it traverses the Kakazi mountains by the narrow gorge of Kilambi, shut in on both sides by rocks 1000 to 1200 feet high. The rapids commence immediately, and at Kalumbi the level of the river has fallen to 2293 feet. Rapids are numerous until Bulu is reached, at no great distance from the Lualaba, where the valley expands and the river divides into branches with no perceptible current, and is navigable by canoes. At the confluence the surface of the water is at an elevation of 1630 feet, the change of level being thus 1054 feet in a distance of 250 miles, or greater than that of the Congo between Matadi and Stanley Pool. There is very little water in the bed; at Kalumbi the breadth of the stream is only some 160 feet, and the discharge at the confluence in November was about 1060 cubic feet a second, the breadth of the river being 189 feet and the depth 5 feet. It should, however, be remembered that M. Delcommune saw it in the dry season.

At some remote period the Lukuga was simply an unimportant tributary of the Lualaba, separated from the basin of Lake Tanganika by the Kakazi chain; then the Niemba was probably its parent stream. The lake formed an isolated hydrographic system until at a certain moment its waters, raised to an unusual height by the rains, overflowed through the dip in the Kakazi mountains. The channel of the emissary, once formed, was considerably deepened by erosion; at certain places water-worn rocks rise to a height of 24 or 25 feet above the water. The discharge from the lake now varies in amount with the rains, and after a dry year the level of the water hardly rises above the bottom of the bed of its emissary.

The country is a succession of undulating plains, with scattered woods. It is well watered, and thickly populated by a fine and brave people of the Balaba race. Near the lower course of the river nine or ten villages were seen on a day's march. This people has successfully resisted the attacks of the Arab slave-traders.

AMERICA.

The Average Elevation of the United States.—Mr. Henry Gannett has written a paper on this subject for the *Annual Report* of the Director of the U.S. Geological Survey. The paper has also been issued in a separate form, accompanied by a map with contours at 100 and 500 feet and at every 500 feet up to 5000, then at 8000 and 11,000. Colorado is the most elevated State, having a considerable area above 10,000 feet and a mean altitude of 6800 feet. California has the widest range, from sea-level almost to 15,000 feet, but its mean altitude is only 2900 feet. The following States have a mean elevation exceeding 5000 feet:—Colorado, 6800; Wyoming, 6700; Utah, 6100; New Mexico, 5700; Nevada, 5500; and Idaho, 5000. States with a low elevation are Connecticut, Massachusetts, and Alabama, 500; Maryland and South Carolina, 350; Mississippi, 300; New Jersey, 250; Rhode Island, 200; District of Columbia, 150; Florida and Louisiania, 100; and Delaware, 60. The mean for the whole of the United States is 2500.

The Currents of the Great Lakes of America.—*Bulletin B* of the United States Weather Bureau contains an account by Mark W. Harrington of the experiments made with bottles during 1892 and 1893. Forms were prepared with blanks for the names of the persons who started the bottles on their voyages and picked them up, and containing a request that the finder would post them to the Chief of the Weather Bureau. These were enclosed in glass bottles made for the purpose, and distributed among captains of vessels and others. It is impossible to say what proportion of the bottles was recovered, for it cannot be ascertained how many are still in the hands of masters of vessels: probably it is more than 5 per cent., and does not surpass 10 per cent. The bottles could, of course, be thrown into the water only during the season of navigation, *i.e.* the summer months, and those that were floated in the autumn would become lodged in the ice, so that they cannot give any reliable indications concerning the currents. Nothing being known of the course of a bottle but its terminal points, it is only by combining a large number of observations that the direction of the current between these points can be ascertained. By such combinations it can be shown that the currents of the Great Lakes may be grouped under four heads, as follows:—

(*a*) Body currents. This is the slow and general drift of the mass of the water towards the outlet of the lake, which is very evident on the charts. It must be continuous throughout the year and affect most of the water.

(*b*) A surface current due to the prevailing wind. The great effect of winds on currents in large bodies of water is well known, and the currents of the oceans have been ascribed in a great measure to their agency in driving the water before them, or in causing a compensation movement (see *S.G.M.* vol. vii. p. 99). The tables of relative frequency at various stations given in the *Bulletin* show the great preponderance of westerly winds. In the case of those lakes which lie east and west these winds would produce a surface current in the same direction as the body current; while on those lakes which lie across the wind the surface drift would be from the west across the lake, the details of its direction depending on the positions of the outlet and inlet and the form of the lake. But though the prevailing direction of the winds is westerly, very variable weather is experienced in the region of the lakes, and the wind changes from day to day, and the courses of the bottles are undoubtedly affected to a considerable extent by these frequent changes. Other meteorological changes also interfere with their movements. For instance, a high atmospheric pressure over one part of the lake lowers the surface of the water and induces a movement of the water towards it from the other parts. The condition, however, is too transient to exert any marked effect on the currents, except in the immediate neighbourhood.

(*c*) Return currents. In the case of three of the lakes the main current hugs the shore. In Lake Superior it is the southern shore, in Lake Michigan the eastern, and in Lake Huron the western. In the case of Lake Erie and Lake Ontario this phenomenon is not so marked. In any case the drift of the water towards the outlet must, in the great lakes where the outlets are comparatively small and will not allow all the water to pass through, give rise to a return current. Such currents will combine with the direct ones to make a general whirl in the lake, if the surface be sufficiently broad, as in Lake Superior and Huron, or if the lake lies across the wind, as Huron and Michigan. When the longer axis is in the direction of the wind, as in Erie and Ontario, the return currents will break up into smaller whirls along the large indentures of the coast.

(*d*) Surf motion. When a wave breaks, its crest carries forward any body that happens to be floating in it. Outside the surf, then, bottles would be carried along with the general drift of the water, but in shallow water they have a tendency to seek the shore, being borne over the underlying water by the breakers. It is to surf motion also that is due the tendency of bottles to pass into deep bays and along their entire length.

The velocities of the currents are much less easily determined than their directions. The precise point where a bottle was floated is unknown, nor can it be said how long the bottle had been at its journey's end before it was picked up. The length of its course is affected not only by the curved direction of the currents, but also by changes of wind. The velocities of bottles which have traversed the longer paths in the shorter time may be taken as indicating the minimum for that particular current. On this assumption it has been found that the currents of the great lakes vary in general from 4 to 12 miles a day; but all that can be said of those results is that the velocities are at least as high as the figures mentioned. General Cutcheon, having to investigate the speed of a current off the coast of Manistee, Michigan, found that it varied from $1\frac{1}{2}$ to 4 miles per hour, or from 36 to 96 miles per day, whereas the bottles gave a velocity of only about 10 miles per day.

The steadiness and persistence of the currents cannot be decided from the facts collected. The one just mentioned was found to continue throughout the year, but with variations depending on the seasons. The predominance of westerly winds and the drift towards the outlets of the lakes are no doubt favourable to their persistence, while, on the other hand, a wind of brief duration would not check the motion far beneath the surface. These considerations do not apply so strongly to the return currents, which must be less constant, extend to lesser depths, and be more amenable to changes of wind.

The *Bulletin* concludes with accounts of the currents in the individual lakes, which are too detailed for notice here.

MISCELLANEOUS.

An expedition under Mr. Flint, Agent-General of the Royal Niger Company, has set out for **Sokoto**, its object being to draw up a map of the countries visited.

On September 24th to 30th the **Versammlung Deutscher Naturforscher und Aertze** will be held at Vienna. A section will be devoted to Physical Geography, under the direction of Professor Penck.

The **Shilka**, a tributary of the Amur, has till lately been navigated only up to Stretensk. Last summer, however, the steamer *Kiakhta*, with a draught of 5 feet, ascended 100 miles further, to the village Mitrofanofskaia.—*Globus*, Bd. lxv. No. 77.

An American, Dr. Donaldson Smith, who has just returned from a journey of 200 miles into the interior of Somaliland, is about to start for **Lake Rudolf**. He hopes to explore the country around the northern end of the lake and between the lake and a point 200 miles west of Berbera.

The **Congrès Géologique International** will meet this year at Zurich from August 29th to September 2nd. Three sections will be formed—General Geology, etc., Statigraphy and Palæontology, and Mineralogy and Petrography. Numerous excursions are organised. Professor H. Golliez of Lausanne is the secretary.

The construction of a line of **telegraph** along the **Congo** was decreed last year by the King of the Belgians. Following the river from Boma to Stanley Falls, it will then cross the Manyema country to Tanganika, where it will eventually be connected with a network constructed by other Powers.—*Bull. de la Soc. R. Belge de Géogr.* No. 1, 1894.

The Royal Commission on the draining of the **Zuider Zee** has concluded its labours, and by a large majority has declared in favour of the scheme. By means of a sea dyke from North Holland to Friesland, an area of about 450,000 acres will be enclosed. The cost of the work is estimated at $15\frac{3}{4}$ millions sterling, or, including defensive works and compensation to fishermen, $26\frac{1}{4}$ millions. A sketch of the various plans which have been suggested was given in vol. vi. p. 316.

The Duke of Sutherland has agreed with the County Council of Sutherlandshire to again open up the **Kildonan Gold Diggings** in 1895, or, if possible, sooner. A committee of the Council is to choose from twelve to twenty men who are to take up claims in the gold-yielding area. The work, under strict supervision, is to be carried on for a specified time, and the whole of the gold recovered handed over to an expert for examination and report; on the results thus obtained the future working of the gold is to depend. For the experiment the Duke is to receive no rent, nor make any claim for surface damage, but the Crown royalties must be met out of the findings. Members of the Council's committee residing at Helmsdale, in the neighbourhood of the auriferous area, have been for some time engaged in gathering statistics and other information regarding the results of the operations formerly carried on at Kildonan.

NEW BOOKS.

Rügen: eine Inselstudie. Von Dr. RUDOLF CREDNER, Professor der Erdkunde an der Universität, Greifswald. Stuttgart: J. Engelhorn, 1893.

Rügen, forming one of the eastern groups of the West Baltic Islands, is the largest and fairest of the islands belonging to Germany. It has an area of over 370 square miles, being some 32 miles in length and 25 miles in maximum width. Its coast line is very irregular, bays and straggling inlets penetrating the land in all directions, which has thus become largely broken up into a series of narrower and broader peninsulas. The island is fairly fertile, and can boast of fine forests of oak and beech. Like so many other islands of the West Baltic, it is composed mainly of chalk-with-flints, which is exposed in magnificent sections along the north-east coast. In the interior this rock is for the most part concealed under a covering of glacial and fluvio-glacial deposits. If we add to these occasional sheets of alluvium, dunes of blown sand, and peat-bogs, we exhaust the geological formations of Rügen. Along the steep coasts of Jasmund the chalk has been fractured and disturbed to an extraordinary degree, and it is remarkable that some of the glacial accumulations participate in these rock disturbances. Inland from the north-east coast the whole island, as already stated, is more or less deeply covered with superficial deposits, and it is impossible, therefore, to say whether the dislocations visible in the cliffs of Jasmund are continued into the interior beyond the immediate coast land. The appearances presented by the jumbled chalk masses and boulder-clay of Jasmund have been described and variously accounted for by several German geologists. Prof. Berendt, for example, is of opinion that the chalk and boulder-clay have been squeezed into folds and inverted by the action of the immense *mer de glace* which occupied the basin of the Baltic in glacial times. By others, however, the dislocations and disturbances have been attributed to earth-movements, similar in character to those which have given birth to true mountain-ranges. This latter is the view set forth with great skill by Prof. Credner. The reviewer, who has studied the phenomena so well described by Credner, could find no trace of any "normal faults," such as are shown in the diagrammatic sections by Messrs. Cohen and Deecke (*Mitteil. des naturw. Vereins für Neuvorpommern und Rügen*, 1889); nor could he assure himself that the boulder-clay had been actually inverted along with the chalk, as maintained by Berendt. Certain it is that the lower boulder-clay (for there are two deposits of that kind) everywhere agrees in its disposition with the chalk upon which it rests. When the latter is horizontal, the stony clay is horizontal likewise; when the beds of chalk are highly inclined, the overlying lower boulder-clay is similarly disposed. Again and again, however, we see this boulder-clay overlaid by a great thickness of chalk—the former has all the appearance of a deposit intercalated between two successive sheets of chalk. The line of junction between the boulder-clay and the overlying chalk is what geologists in Britain call a "thrust-plane." Obviously the chalk and overlying boulder-clay have yielded to tangential thrust; they have been thrown into folds which have cracked across, and one limb of the fold has been pushed in below the other. Although the phenomena thus described reproduce on a small scale the appearance visible in true mountain-chains, there is no evidence to show that they have originated in the same way. So far as is known, they are confined to the sea-cliffs of Jasmund and their immediate neighbourhood. In this respect they precisely recall the similar jumbled masses of chalk and boulder-clay which are exposed in the cliffs of the island of Möen, to which part they are confined. In the interior of that island the chalk and boulder-clay are quite undisturbed. There can be little doubt, indeed, that in the dislocated rocks of Jasmund we have only another example of the same kind. They bear witness to the powerful pressure and "drag" of the old "inland ice" of the Glacial Period. Professor Credner has brought out very clearly that the disturbed chalk and lower boulder-clay are covered by a second boulder-clay, which obviously belongs to another epoch of glaciation. The chalk and lower boulder-clay had been subjected to a long period of denudation, during which the irregularities of the surface had been reduced, before the upper sandy boulder-clay was laid down. Like the lower, it is also the ground-moraine of an ice-sheet ; but this latter does not appear to have produced rock disturbances on the same scale as those that accompanied the former *mer de glace*. Professor Credner, who, as we have seen, attributes the dislocations in question to tectonic movements of the earth's crust, is of opinion that these must have taken place in the long interglacial epoch which separated the one glacial epoch from the other. He gives a detailed account of the surface features of the island, which are in several respects most interesting. In the peninsula of Jasmund the ground is arranged in a series of long parallel banks with intervening depressions. In most cases these banks appear to be composed principally of chalk cloaked with glacial deposits. Now and again chalk merely forms the nucleus of a bank which otherwise seems to be made up of boulder-clay, etc. Again, chalk occurs at the one end of a bank, and boulder-clay, etc., is heaped up in its rear—recalling the phenomena of "crag-and-tail" in our own country. In the southern part of Jasmund those parallel banks trend south-west and north-east ; in the eastern section their direction is approximately east and west ; while in the north they run from east to west and south-east to north-west. The trend of all these banks, according to Credner, has been determined by the direction of the dislocations which are exposed in section on the sea-cliffs. To us they appeared merely to indicate the direction of the ice-sheet which overflowed Rügen. The banks constantly recalled not only the phenomena of "crag-and-tail" but the "drums" and "drumlins" of Scotland and Ireland. The whole surface of Jasmund has been moulded by glacial action—partly by erosion and partly by accumulation. Nor was rock-disturbance confined to the earlier glacial epoch. In many places the upper boulder-clay is seen jammed and rammed into the underlying chalk, while in other places the latter has been jumbled and has lost all trace of bedding. In the latter part of his work Professor Credner has traced the changes which the surface of the island has undergone in post-glacial times. He shows that Rügen is an island of erosion, having been cut off from the mainland by the action of the sea, and concludes with an interesting description of the changes which are in progress round the coasts. We can cordially recommend his work as a model geographical monograph. Although we do not agree with him in his explanation of the purely geological phenomena, we must bear testimony to the faithfulness of his descriptions, and to the clearness with which he has delineated the features of a most interesting region.

On the Original Inhabitants of Bharatavarsa or India. By GUSTAV OPPERT, Ph.D. Westminster : Archibald Constable and Co., 1893. Pp. xv + 711.

This work has for its main object to prove that the original inhabitants of India belong, with but few exceptions, to the Finnish-Ugrian or Turanian race, branches of which are spread over various parts of the continents of Asia and Europe. The branch domiciled in India, the author thinks, should be called *Bharatan*, because in old times the Bharatas were not only the most numerous and the most distinguished representatives of the pre-Aryan population, but even gave their name to the country in the form *Bharatavarsa*, the land of Bharata.

In support of his doctrine of this racial unity, Dr. Oppert turns for proofs to the domains of language, religion, and ethnology. He accordingly passes in review the multifarious tribes by which the northern and peninsular provinces of India are peopled, while taking but little notice of those tribes which belong to Bengal and Assam. The Bharatas, he tells us, were divided at an early period into two great sections known as Kauravas and Pândavas, and afterwards as Gaudians and Dravidians. Those tribes whose names he takes to be derived from *Ko*, a term for *mountain*, he calls Gaudians, and those whose names are derived from *Mala*, which also means *mountain*, he calls Dravidians. He believes that the Bharatas were essentially a race of mountaineers, and that their name is intimately connected with the Gaudo-Dravidian root *para*, *pârai*, mountain. He even ventures to say that the spots which men in primeval times preferred to select for their dwellings were hills and mountains, and that the foemen whom the Aryans first encountered were generally brave mountaineers. We imagine, however, that riverain lands were the first to be occupied, and that the Dasyus, with whom the Aryans had first to contend, were Dravidians who had been long settled in the plains of the Panjâb and elsewhere, and were probably emigrants from countries to the west of the Indus and from the valley of the Euphrates, between which and the western shores of India commercial relations had been established more than 4000 years B.C. But the Dravidians themselves do not appear to have been, as the author contends, the earliest known occupants of the country. This distinction rather belongs to certain tribes of the Mongolian stock, which, issuing from the regions beyond the lower course of the Brahmaputra, gradually spread themselves over Bengal and other tracts. In course of time these tribes, which have been classed together under the general name (not well chosen) of Kolarians, were driven from the plains into the jungles and mountains of the Deccan and of Central India, where their descendants, who form the most uncivilised and socially degraded portion of the Indian community, are still to be found. In their character, in their habits, and above all in their religion, they were sharply discriminated from the Dravidians. The latter were snake-worshippers, and were perhaps also addicted to the cult of the linga or phallus—a cult, however, to which our author would rather assign an Aryan origin. The Kolarians, on the other hand, were devotees of one of the grimmest forms in which religion, or rather superstition, has ever manifested itself—that of devil-worship, the rites of which are bloody, grotesque, and hideous in the extreme. Dr. Oppert, we think, has made a great mistake in refusing to recognise a difference of origin in two races between which such essential differences exist.

His work is divided into four parts, in the first of which, after some general remarks and others of a philological and historical nature, he describes the Southern Bharatas, called Dravidians, that is, the people by whom Tamil is spoken; and in the second part the Northern Bharatas, whom he calls Gaudians. These two parts form the most useful section of the work, as they supply copious information regarding a great number of more or less obscure tribes, derived chiefly from narratives written by missionaries and officers of the Indian Government, who had special opportunities of studying their modes of life and thought. In the third part our author discusses Indian theogony in its various aspects, while in the fourth he deals with the early history of the Bharatas, as it can be gathered from the Vedas and the national epics. He infers that the Bharatas there mentioned were warriors of non-Aryan origin who gained access into the Aryan pale, and by their prowess and influence became the representative tribe of the Aryan race, just as their relatives beyond the pale were the representatives of the aboriginal inhabitants. The work, we fear, will prove but little acceptable to the ordinary reader, it is so filled with uncertain solutions of philological problems, with absurd Indian legends, with long notes that frequently all but swamp the text, and sometimes also with irrelevant matter such as speculations about the Flood (pp. 313-328). This is the more to be regretted as it contains much interesting and valuable nformation not otherwise readily accessible.

A Japanese Interior. By ALICE MABEL BACON. London : Gay and Bird, 1893. Pp. xix + 267. *Price* 5s.

In this book the author of *Japanese Girls and Women* has reproduced, from letters written during her stay in Japan, some of her experiences in that most fascinating of Eastern lands. In intrinsic interest this work cannot, of course, compare with her earlier volume, but it is marked by the same calm judgment and freedom from all extreme sentiments. To much of pure description that is met with in most narratives of life in Japan, Miss Bacon adds not a little of what the mere tourist or ordinary sojourner could never have experienced. Japanese manners and customs crop up naturally as they affect her in her everyday life, whether in school or at home. They thus receive a personal flavour which enhances the interest. The letters cover an eventful year in Japanese history, and record at considerable length the events that cluster round the famous promulgation of the New Constitution, including the tragic end of Viscount Mori, certainly the ablest Minister of Education that Japan has ever had. There is little of the purely geographical in the book, but the interest is strongly human throughout, and the reader will rise from its perusal with a truer conception of the Japanese character than could be gained from many a more ambitious volume.

Le Japon Moderne. Par CH. LOONEN. Paris : Librairie Plon, 1894. Pp. viii + 326.

As we learn from the preface to this book, M. Loonen, dissatisfied with the incomplete and sometimes contradictory accounts which have been published concerning Japan and the Japanese, determined to make acquaintance with them at first-hand. One of the problems he sets himself to solve is not a little curious. In his opinion the old temples, and fantastic storks, and everything artistic which makes Japan interesting to French eyes, can hardly excite the enthusiasm of the Americans, the practical people of the earth *par excellence.* No ; there must be some weightier attraction for "l'utilitaire Jonathan, l'ami des dollars. . . . Il devait nécessairement exister dans le pays un côté positif que je me suis promis de découvrir et de décrire." This discovery has not yet been divulged ; and although M. Loonen went and came by way of New York and Vancouver, he seems to have failed to appreciate aright the "æsthetic side" of the American character, for in that obviously lies the simple solution of the imagined problem. Like many tourists, who spend a few months in the country, M. Loonen is not afflicted with much diffidence, and believes himself to have "presented to the public an abridged, but very complete, portrait of modern Japan." What he has given us is a clearly written and (so far as it goes) accurate sketch of the usual features that strike the visitor and of the facts that can be gleaned from historic and statistical records. The descriptions are necessarily brief, for little more than 200 pages of the book are devoted to Japan proper. When the author touches upon the broader and more fundamental aspects of Japanese life and development, he evinces a good faculty of observation and a calm judgment. He never loses himself in effusive panegyric, but displays, nevertheless, a true sympathy with the Japanese in their rapidly changing national life. The book is distinctly superior to the usual run of tourist impressions, especially in the attention it gives to the developing industries of Japan. One chapter treats of the World's Fair at Chicago, and has a *raison d'être* in so far as it touches upon the Japanese exhibits. There are some thirty-five illustrations, reproduced from Japanese photographs, which, for the most part, are well selected so as to bring out the varied aspects of Japanese life. An appendix contains a number of valuable hints to the intending tourist.

Races Berbères : Kabylie du Jurjura. Par JULES LIOREL. Préface de M. ÉMILE MASQUERAY. Paris : Ernest Leroux, N.D. Pp. 18 + 544.

This book, which M. Masqueray of Algiers introduces with a few pages of preface, is meant to provide the generality of people with a succinct but complete account of the Kabyles. M. Liorel divides his work into ten books. In the first he treats of the descriptive geography of Kabylia. In a sort of appendix to this chapter (pp. 24-88) he has compiled an alphabetically arranged list of the villages, etc., of the Kabyles of the Jurjura before the occupation of the French. Though it interferes with the proportions of his work, it will justify itself in the handy use which students of history and geography will make of it by way of reference. In books two, three, four, and five, M. Liorel treats of the history of Kabylia before 1830 and from 1830 to 1871, of the insurrection of 1871, and of the insurrection of 1881, respectively. These chapters comprise more than two hundred pages of conscientious work. At times M. Liorel has impeded his narrative with details which might have been assigned to a more suitable place in a note. This seems to us the main defect of his book. In his desire to make it scientific he has not availed himself of the methods—for which French writers are noted—of making it a work of literature as well as a work of science. In book six he treats of the administration of Kabylia. This is one of the most interesting and instructive to students of history and politics, since it gives an account of the organisation of the village communities among the Kabyles, and the introduction of the administrative system and methods of France. In books seven and eight M. Liorel treats of the manners and customs, domestic life, religion, literature, science, art, agriculture, industry, and commerce. Of each of these he presents the reader with the salient facts and features. In books nine and ten he discusses the different systems of colonisation as they have been applied to Algeria, and the political future. At the present time this is a very important question. With the results of the Jules Ferry Commission before them, it is to be hoped that the responsible rulers of France will be able to devise a system of administration that will ensure the prosperity of the Kabyles and their loyalty to France. M. Liorel's work shows a vast amount of reading and conscientious work, and we wish him speedy success with the work which he promises on the M'Zab.

Ludovico Nocentini : Nell' Asia Orientale, impressioni e note di viaggio. Firenze : Success. le Monnier, 1894. Pp. 312.

The author, who seems to be a Tuscan endowed with a well-balanced and judicial mind, describes in detail the impressions of a four years' residence in Shanghai, a trip up the Yangtse-Kiang, and a visit to Pekin. The voyage from Naples to China and the expedition to Corea and Japan are very lightly touched upon. He does not believe the Chinese, as a race, have any inborn dislike to foreigners, citing in proof various historical facts, but that the modern prejudice has arisen from the aggressive way in which first the Portuguese and Spaniards, then the Dutch and the East India Company, established themselves in the various seaports. He correctly assigns the origin of the pagoda to India, whence it was introduced by the Buddhists, and shows that it was originally destined to contain relics of the great saint. At Hankow he ascertained that Father Huc had enormously exaggerated the population of this and of two other adjoining towns, placing it at eight millions instead of only one million. Here a colony of Russian traders, mostly engaged in the tea-trade, have established themselves. It is generally believed that the flavour of caravan tea is superior to the ocean-borne article, from having been transported wholly by land. So far as it concerns the tea brought from Hankow this belief rests on a misconception, for, after finding its way to Shanghai, the brick-tea is shipped either to Tientsin, a distance of six days by sea, or more generally to Vladivostok, which is still farther, before entering upon the overland journey. At a great Italian missionary establishment, chiefly supported by French Catholics, the author found to his surprise that the feet of the little girls were compressed in bandages. On inquiry, he was told that unless that was done the girls would never get married. An instructive chapter is devoted to railways in China, and another on Pekin customs as they appear to a southern Chinaman, contains some amusing paragraphs. On his way home, the German Lloyd steamer that should have conveyed the traveller to Italy struck on a reef near Socotra and became a complete wreck. A British trading steamer arrived after many hours of most unpleasant suspense, saved all the passengers and crew, and brought them to Aden. As a sober account of China and the Chinese from an unprejudiced point of view, this book can certainly be recommended.

L'Europe Politique. Gouvernement—Parlement—Presse. Tome premier. Par LÉON SENTUPÉRY, ancien Chef du Cabinet du Sous-Secrétaire d'État au Ministère de la Justice et des Cultes, etc. Paris: Lecène, Oudin et Cie., 1894. Pp. vii + 882 + xxix.

The first volume of what promises to be a monumental and authoritative work upon the Governments of the various European States is before us, and deals with Germany, the Republic of Andorra, Austria-Hungary, Belgium, Bulgaria, Denmark, Spain, and Great Britain. The task undertaken by M. Sentupéry has been no easy one, and he is, upon the whole, to be very heartily congratulated upon the success with which he has accomplished it. Painstaking care is everywhere apparent, and the researches undertaken to bring such a mass of valuable and not always easily obtainable material together, and to properly digest and arrange the information, must have taken time, patience, and no ordinary degree of skill on the part of the author. Of course, any one writing upon the political state and constitution of foreign countries is always liable to make mistakes, and M. Sentupéry is no exception to the common lot. But these faults are seldom of much consequence, and the volume will be found full of reliable and well-arranged matter, making it a book of reference of the highest importance to the politician and political student. We have naturally devoted most attention to the part of the work treating of Great Britain, and particularly of Scotland. The author, like most Frenchmen, has found our titles too much for him, and we have the usual Sir William Gladstone, while the Duke of Devonshire is referred to as Hartington simply, with his title in brackets. The list of chief politicians has evidently been made up from a perusal of Parliamentary debates, and thus we have included in the catalogue several individuals whose only claim to distinction is their much speaking, while men of influence and weight, whose voices are seldom heard in the Chamber, pass without notice. We hardly know what is meant by "juge de paix" on p. 671—probably Justice of the Peace, although the words are undoubtedly used to designate the Sheriff elsewhere. Probably M. Sentupéry confuses the office of convener of the county with that of Justice of the Peace. In the press list, commendably full and accurate upon the whole, there is no mention of this journal, while the publications of some other societies receive notice: indeed, the plan upon which the author has worked in including and excluding the publications of societies is obscure, and this portion is the least satisfactory part of the list. Space does not permit us to go into further details or to offer more extended criticism, but we may say in conclusion that the volume deserves the welcome which, we feel sure, will be extended to it. The printing is good and clear, the indexes well compiled, and there are blank pages for notes and for adding additional information as such becomes available. There are no maps, however: perhaps the publishers intend to provide a large map of Europe with a future volume.

Die Hawaiischen Inseln. Von Dr. ADOLF MARCUSE. Berlin: Friedländer und Sohn, 1894. Pp. 186. *Price* 9 *M.*

Dr. Marcuse spent thirteen months in the Sandwich Islands, and gives in the present volume one of the most comprehensive and instructive accounts of the archipelago which has yet appeared. After describing each individual island of the group, he furnishes scientific details concerning the vulcanology, meteorology, ethnology, flora and fauna of the islands, concluding with their history and statistics and a list of the works which have been written on the Sandwich Islands. Among statistics of the islands, he points out that in 1890 there were 1928 American, 1344 British, 1034 German, 8602 Portuguese, 227 Norwegian, and 70 French inhabitants. 12,244 Japanese immigrants arrived between 1884 and 1890. North America had the chief commercial interest in the islands in 1890, its trade amounting to over eighteen million dollars, followed by over one million for Britain, and one hundred and forty-eight thousand for Germany. The Americans had over twenty-four million dollars invested in sugar plantations, followed by the British with six millions, and the Germans with two millions. As to shipping, 451 American, thirty-four British, and seventeen German ships entered during 1890. Excellent phototype illustrations are given, but a good index and a geological map would have rendered the book complete.

Eine Wallfahrt nach Dodona. Von ALEX. FREIHERR v. WARSBERG. Aus dem Nachlasse herausgegeben von JOHANNES FRISCHAUF. Mit zwei Karten. Graz: Leuschner und Lubensky, 1893. Pp. 149.

To reach the object of his pilgrimage, the late author—for his work is posthumous—took the route from Sajada, opposite Corfu, *viâ* Philiates, the Kalamas River, and Janina. But the easiest way for the ordinary tourist is to disembark at Prevesa and hire a landau, which will take him in fourteen hours to Janina; a ride of three hours will bring him to the site of the ancient oracle. Or, without going so far as Janina, he can stop at the Rovilasta Khan, and take a horse to the ruins of Dodona. These notes of travel are written by a man of a gushing, poetic nature, with a boundless admiration for a remote past, and well posted up in every classical reference to the region he travelled through. They abound with quotations from the classical authors, and with the subjective impressions left on his mind by the experiences of his tour. But his enthusiasm and his transports of ecstasy sometimes border on the puerile, and the book is more adapted for Germans than for us. Naturally he was a great admirer of Byron, whom he occasionally cites, while he speaks disparagingly of Leake. He gives credit to Christopher Wordsworth for being the first to suggest the true site of Dodona, and to Mr. Menejko, a Polish civil engineer resident at Janina, for being the first to prove the fact by actual excavation.

Gold, Sport, and Coffee-Planting in Mysore. With Chapters on Coffee-Planting in Coorg, the Mysore Representative Assembly, the Indian Congress, Caste, and the Indian Silver Question, being the 38 years' experiences of a Mysore Planter. By ROBERT H. ELLIOT. With Map in Colours. Westminster: Archibald Constable and Co., 1894. Pp. xxx + 480.

The author, who has spent the best part of his life in the Native State of Mysore, gives an interesting account of the progress made in that State under its present rulers, and shows the benefit that has accrued to its people, especially to the labouring classes and in seasons of scarcity or famine, by the introduction of British capital. The elected Representative Assembly of Mysore, which is a consultative body without legislative functions, appears to satisfy the political aspirations of the people, and might be found suitable to other States or Provinces. The author emphatically condemns the Congress. Though he is evidently an experienced and intrepid hunter, one cannot be surprised that he felt "generally commoved for a moment" in some of the awkward situations in which he found himself, especially when he had, unfortunately, forgotten to take his usual dose of digitalis before starting. In writing on the subject of caste, it is hardly correct to class the Dravidians with the Aryans in colour and appearance; and it is strange that so old a planter should continue to believe that the lower branches of a tree "rise with the rising stem."

The author is a vigorous opponent of the financial policy of the Government in connection with the fall in value of the rupee.

Pictured Palestine. By JAMES NEIL, M.A. With Eighty Illustrations by James Clark, Henry A. Harper, and other artists. London: James Nisbet and Co., 1891. Pp. viii + 322. *Price 7s. 6d.*

The author, who lived for some years in Palestine, being incumbent of Christ Church, Jerusalem, here describes many of the manners, customs, and incidents of daily life in the East. These illustrations are interesting, though, perhaps, none of them is new, and throw light on many expressions in the Bible not otherwise intelligible in their full significance. Many of these customs are of very ancient origin, and at one time prevailed even among our own forefathers. Thus, the division of the land for agricultural purposes is effected much in the same way as formerly among the Saxons and other Teutonic tribes, and at the present day in Russia. Several anecdotes serve to enliven the book, and to bring out more clearly the state of society described; and the sketches also contribute to the same end.

American Notes. By GEORGE COMBE. London, etc.: Cassell and Co., 1894. Pp. xii + 280.

The record of George Combe's visit to the United States in the years 1838-40 filled three volumes, and contained much that has now lost its interest. These notes have, therefore, been selected and published at the request of the Combe Trustees. Much useful information and food for thought may be gathered from them, provided they be read with discrimination. The author was a warm champion of American institutions, and seems to have held a very poor opinion of those of his own country. A comparison of the progress of the two countries during the past half-century is instructive, and will show how far the author's expectations have been realised.

Following the Flag. By W. H. LEVER. With Illustrations. Liverpool: Edward Howell, 1894. Pp. 132.

This is a collection of letters of travel, descriptive of a tour round the world by way of Canada, the United States, Sandwich Islands, New Zealand, Australia, and home by the Suez Canal. Although there is nothing of geographical novelty in them, yet they give the impressions of an intelligent tourist in a lively and gossipy style, and form interesting reading. Some of the numerous illustrations are from photographs by the writer, and are of original interest.

Léon Deschamps: Histoire sommaire de la Colonisation Française. Lettre-Préface de M. P. FONCIN. Ten Maps, thirteen Illustrations. Paris: F. Nathan, 1894. Pp. 156.

The aim the author has in view is purely practical. With great method and conciseness he passes in review the history of all French colonies from the sixteenth century to the present day, dividing that time into five periods. At the end of each period he gives a summary of the special legislation by which each colonial possession was or is governed; of its commerce and shipping; of its expense to the mother-country; and the general state of its finances. The last part of the book is devoted to pointing out the colonies best suited for French settlers or traders with or without capital; the class of workman or artisan that is most likely to be in request in each; and the hygienic rules to be observed in order to preserve health.

Though the author, like a good Frenchman, is proud at the thought that France has tripled the area of her external possessions since 1870, he is annoyed to find that the mother-country only supplies about 33 per cent. of the value of the goods imported into them, whereas from 80 to 90 per cent. of the imports into British colonies are exported from Great Britain. On the whole, her colonies are a costly affair. For the glory and self-satisfaction of seeing her flag flying so far and wide beyond her natural boundaries, France had to pay in 1869 the sum of 26½ million francs. Since the triple expansion of the colonial empire the outlay had increased in 1892 to no less than 67¼ million francs.

Resources and Development of Mexico. By HUBERT HOWE BANCROFT. San Francisco: The Bancroft Company, 1893. Pp. xii + 325. *Price* $4, 50 c.

Mr. Bancroft's survey of Mexico was undertaken under the auspices and with the active assistance of the President of the Republic; and thus, while his information may be generally regarded as authentic and official, the ease with which it was come by and the natural anxiety of the officials who supplied much of the matter to present the state of their country, her potentialities and resources, in the best possible light, have led to a general optimistic tone throughout the work that is, perhaps, hardly warranted by the present state of Mexico. But the volume is an authoritative one, containing much of interest and value, and cannot be neglected by those who wish to form a notion of the boundless wealth and resources of the country. The numerous illustrations are excellent, the maps are sufficiently good, and there is an exhaustive index; while paper, printing, and binding combine to make up a handsome and sightly volume.

Heroes of History: Sir John Franklin. By A. H. BEESLY, M.A. Two Maps. London: Marcus Ward and Co., 1894. Pp. 238.

It is a pity that the very first sentence should contain a distortion of real facts. It is a mistake to write: "The earliest venture of England in the Arctic Seas was made as far back as Alfred's reign." All that is known of Ohthere is to be found in the narrative of his voyage to the White Sea, as he related it to Alfred, who inserted it as an appendix to his translation of *Orosius.* Ohthere was a Norseman, as he says himself, who to all appearance and in all probability made his voyage of discovery entirely on his own account, before he had visited the shores of England and taken service with King Alfred. There is not a word in the narrative to suggest that England had anything to do with his expedition at all. Apart from this, the book gives a readable account of Sir John Franklin's two land journeys to the northern coast of Canada, of his work in Tasmania, where he was governor for some time, and of his final voyage which ended so disastrously for all concerned. Sir John's was such a noble, heroic nature, that any life of him is well worth reading, and this is a suitable book to put in the hands of boys.

The History of Australia and New Zealand from 1606 *to* 1890. By ALEXANDER SUTHERLAND, M.A., and GEORGE SUTHERLAND, M.A. London and New York: Longmans, Green and Co.; Melbourne, Sydney, Adelaide, and Brisbane: George Robertson and Co., 1894. Pp. iv + 248. *Price* 2*s.* 6*d.*

For its size and price, this is, without exception, the best history of our Australasian colonies which it has ever been our fortune to peruse, and will form an admirable class-book in schools. Narrative and illustrations are alike interesting, the former being frequently picturesque, and always impartial and trustworthy. The authors' faculty for plain and luminous description is everywhere apparent; we may cite their account of the Wakefield doctrine and its influence on South Australia as an example. There is a good index, but no map.

Geography of Victoria. By ALEXANDER SUTHERLAND, M.A. London and New York: Macmillan and Co., 1893. Pp. viii + 122.

Planned on excellent lines and successfully carried out, Mr. Sutherland's little volume is calculated to be of great service in Australian schools, and in those at home where time can be afforded for special study. It contains lessons suited for Standards II. to IV. inclusive, thus doing away with the necessity for the pupil providing a new book as each advance is made into a higher form. The maps are distinct, although small, and contain only such names as are mentioned in the text. The few other illustrations are helpful, the plans of a table and of a dining-room being, through their simplicity and the familiarity of the objects presented, well calculated to interest younger pupils, and to give them just notions regarding what a map really is, and what it is intended to represent. A second volume is promised for Standards V. and VI., which will complete a very interesting and useful work.

Introductory Text-Book of Physical Geography. By the late DAVID PAGE, LL.D., F.G.S. Revised and Enlarged by CHARLES LAPWORTH, LL.D., F.R.S., F.G.S. Thirteenth Edition. Edinburgh and London: William Blackwood and Sons, 1893.

So well known a text-book as Dr. Page's *Physical Geography* does not stand in need of recommendation. The fact that it has reached a thirteenth edition is sufficient evidence of the favour in which it is held. The present edition has been thoroughly revised by Professor Lapworth of Mason's College, and its information has been brought up to date. The chapter on geology has been, to a large extent, rewritten; and in other sections new matter has been added, relating to such subjects as astronomy, physics, and geographical discovery and research.

NEW MAPS.

EUROPE.

EAST LONDON, New Plan of ——. By John Bartholomew, F.R.G.S. *Cloth*, 2*s*.
London: W. H. Smith and Sons.

We have formerly noticed others of these maps. The present one, of East London, is in the same style, with railways marked in black, and tramway and omnibus routes in brown. The printing is very clear.

THE "BATH ROAD" MAP.

THE "HOLYHEAD ROAD" MAP. Compiled by H. R. G. Inglis. *Price* 1*s*. *Cloth*, 1*s*. 6*d*. *London and Edinburgh: Gall and Inglis.*

These maps are uniform with that of the "Great North Road," published by the same firm. The sheets are folded so that any part may be referred to with the aid of the index maps. For travelling by road, they are exceedingly useful. The execution is rather rough.

SCOTLAND, W. and A. K. Johnston's Map of the Railway Systems of ——.

On this large sheet the railways of the various companies are distinguished by colours. The lines round Edinburgh and Glasgow and the railway communication between these towns are shown on inset maps.

TONGUE AND CAPE WRATH. Bartholomew's Reduced Ordnance Survey. Sheet 26. *Cloth*, 2*s*. *Edinburgh: The Geographical Institute.*

With this sheet the series of maps of Scotland on the scale of two miles to one inch is completed. The style and colouring are now well known.

ALPES, Carte des Régions naturelles des ——.

ALPES, Carte des Variations de la Frontière Française des ——, depuis le xvi^e siècle. *Annales de Géographie, Jan.* 1894.

MONTENEGRO, Die Landschaftsformen von ——. Von Dr. K. Hassert. 1: 800,000.
Petermanns Mitt., Tafel 4, 1894.

ZELLER SEES IM PINZGAU, Tiefenkarte des ——. Nach eigenen Messungen entworfen und gezeichnet von Dr. W. Schjerning, 1892. Massstab 1: 15,000.
Zeitschrift der Gesell. für Erdkunde zu Berlin, Tafel 6, 1893.

AMERICA.

TUMUC-HUMAC GEBIRGE, Das ——, nach Henri Coudreau.
Deutsche Rundschau für Geogr. u Statistik, Jahrg. xvi., Heft 1.

ATLASES.

ALDERSGATE ATLAS OF MODERN AND ANCIENT GEOGRAPHY. *Price* 3*s*.
London: Relfe Brothers.

A handy collection of seventy-two maps well adapted for schools or private use. As a whole they are up to date. The new African boundaries were no doubt not fixed in time for insertion.

THE WORLD-WIDE ATLAS OF MODERN GEOGRAPHY, POLITICAL AND PHYSICAL. With Introduction by J. Scott Keltie. Second Edition.
W. and A. K. Johnston, Edinburgh and London, 1894.

We reviewed this atlas two years ago. The present edition consists of the same plates with corrections, and the index is four pages longer.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE MOUNTAIN SYSTEMS OF CENTRAL ASIA.

By E. Delmar Morgan.

(*With a Map.*)

(*Read at a Meeting of the Society in Edinburgh, April* 1894.)

The mountains of Inner Asia, though known from remote antiquity, are mentioned by early writers in a vague and legendary way: they were the abode of snow, the seat of the mighty god Indra; their crests were white as swans, their rivers of the purest crystal water in which the gods delighted to bathe; they shone like mirrors and glistened like the flowers of the lotus.[1] Such were some of the earliest notices in literature of the highlands bordering India on the north.

The Chinese, more practical, had accurate surveys made of all the regions brought under their control, and were at a very early date, about the commencement of the Christian era, well acquainted with the "Countries of the West." Orography, however, was never their strong point; and so ignorant were they of the relative heights of these regions, that they believed that the Tarim, or river of Kashgar, after losing itself in Lob-nor, re-appeared again at the sources of the Hwang-ho.[2]

In the accounts the Buddhist pilgrims of the sixth and seventh centuries have left of their travels, they speak of the mountains in a general way, applying to them the terms "black" and "white," according as the ranges were bare or covered with snow; and it is difficult to trace their routes with certainty.

Turning to the Greeks, we find in Herodotus[3] a fabulous tale of a

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[1] Carl Ritter, *Erdkunde von Asien.* Russ. ann., ed. by Semeonof, vol. i. p. 28.

[2] Georg Wegener, *Die Entschleierung der unbekanntesten Teile von Tibet*, p. 6.

[3] Canon Rawlinson's *Herodotus*, vol. ii. p. 505.

plain in Asia which is shut in on all sides by a mountain range, and in this mountain range are five openings. A mighty river called the Aces flows from the hills enclosing the plain, and formerly this stream, splitting into five channels, ran through the five openings in the hills and watered the lands of the five nations which dwelt around. The great king of the Persians came and conquered this region, and then it went ill with the people, for the great king blocked up all the passages between the hills with dykes and floodgates, and so prevented the water from flowing out. If the Aces may be identified with the Oxus, as some have conjectured, and the five channels with the five head-streams of this river, the story told by Herodotus, whether founded on fact or not, would serve to illustrate what might happen to the inhabitants of the plains of Turkistan in the event of their water-supply being stopped by the erection of dams at the mouths of the tributary streams of their river.

From Herodotus down to modern times no writer has approached the subject in a scientific spirit, and, with but few exceptions, little information of a precise nature concerning the mountains of Central Asia is to be found in ancient literature. One such exception, however, must be noted in the case of Mirza Haidar, a prince of Kashgaria and a connection of Sultan Baber. His description of the mountainous region round his native place shows, as the late Mr. Robert Shaw remarks,[1] that he was able to rise above details and conceive a general idea—a rare faculty among Orientals. Mirza Haidar's account, written three centuries ago, agrees very well with the explorations of the Forsyth Mission.

The first great impetus to the study of orography was due to Humboldt, who published in 1843 his classical work *Asie Centrale.* It was at his suggestion that the British Government sent the brothers Schlagintweit in 1856 to explore the region north of the Himalayas. In his anniversary address to the Royal Geographical Society,[2] Sir R. Murchison says of these travellers that they were the only geographers to visit those localities and sustain what Humboldt had affirmed, "that his Kuen Luen presents all the characteristics, relations, and attributes of an independent chain."

Humboldt, whose travels in the cordilleras of the Andes and many years of fruitful study had led him to very advanced views on physical geography, argued by analogy that Asia was filled with a whole system of distinct ranges, four of these—the Altai, the T'ian Shan, the Taurus, and the Himalaya—lying parallel to the Equator, and a fifth, the Bolor-tagh, parallel to the meridian; this last continuing the north to south direction of upheaval of the Suliman and Ural chains. Ritter and his school of geographers upheld the theory of great protuberances of the earth's crust, forming wide mountainous tracts in which short ranges held a subordinate place.

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[1] *Journal R.G.S.*, vol. xlvi. An English translation of Mirza Haidar's work is now in course of preparation.

[2] *Journal R.G.S.*, vol. xxviii.

These views, founded on an imperfect acquaintance with the physical geography of Central Asia, exercised a great influence on the books and maps of the first half of the present century, and it was not till actual exploration was taken in hand that they were corrected.

Before alluding to the advance in our knowledge of High Asia, mainly due to Russian explorers, let us say a few words on Baron von Richthofen's great work, *China*.

This was the first attempt since Humboldt's time to systematise the geography of Central Asia, and define in a clear and comprehensive way the directions of the principal chains. In the course of his travels in the central provinces of China the author had collected a large number of facts and observations. He found, however, that to explain satisfactorily the physical geography of China it was necessary to extend the scope of his inquiry so as to include Central Asia. Hence the first chapter of *China* is wholly devoted to a masterly treatise on the past and present physical conditions of the interior of the continent.

Richthofen defines the term "Central Asia" to mean that region where the waters collect in inland basins having no outlet to the ocean, and where the long continuation of such waterspreads has given rise to special phenomena. This continental region extends from the highlands of Tibet on the south to the Altai on the north, and from the Pamir watershed on the west to the Khingan range and the great rivers of China on the east. It is connected by the bridge of the Hindu Kush with the Aralo-Caspian basin on the west. But this last, as well as the separate lake basins in other parts of Asia and Asia Minor, are not included in his "Central Asia." Those parts of Asia where the drainage reaches the sea he styles the periphery, and, lastly, between the inner basin and the periphery he distinguishes an intermediate zone in the transitional stage, where in recent times the flow has changed from inwards to outwards, or *vice versâ*. The important difference between the central basin and the periphery consists in the fact that, while *there* all the products of the latest geological periods proceeding from chemical decomposition and mechanical disintegration of rocks have remained in the country, *here* they have been carried to the sea; and the deposition of solid matter, *there* sub-aërial, *here* took place with the aid of running water.[1]

Richthofen further shows that "Central Asia" formed the bed of an ancient sea in the Cretaceous or Tertiary period. This sea, occupying the whole of what is now known as Chinese Turkistan, part of Mongolia and the Gobi, is the Han-hai (or desiccated sea) of the Chinese, whose traditions speak of a sea having once existed here. Its area, within the limits assigned to it by Richthofen, may be compared with the Mediterranean. M. Mushketof, a Russian geologist, assigns to it an even wider expanse, and would include the so-called Turanian or Turkistan region in the Han-hai; for recent geological researches tend to show that the Aralo-Caspian plains were submerged in Tertiary times, and were connected with the Tarim basin on the one hand by the Straits of Dzungaria and with the Northern Ocean on the other, and that the gradual disappearance of

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[1] *China*, i. pp. 7, 8.

both seas and separation into distinct basins in all probability took place contemporaneously. In support of this argument he adduces, besides geological evidence, the similarity of their surface-deposits—loess, drift sands, and saline plains; and the fact that Turkistan is completely land-locked, for most of the rivers discharge into lakes—the Syr Daria and the Amu Daria into the Aral, the Ili into Balkhash, the Tchu into the Saumal-kul; while the rest lose themselves in the sand, *e.g.* the Talas, the Zarafshan, the Tejend, the Murghab, etc., precisely in the same way as the Tarim disappears in Lob-nor.[1]

Richthofen classifies the mountains into two principal systems[2]—those of Eastern Asia with a general north-east trend, and those of Western Asia lying approximately north-west. To the first of these he gives the name of *Sinian* or Chinese, a term originally suggested by Mr. Pampelly, an American geologist; the second he calls *Altai.* His Sinian system begins near the meridian of Lha'sa and stretches to Tokio. His Altai, with an almost constant WNW. to ESE. direction, is continued in the Tangnu-Khangai, Lesser Altai, Tarbagatai, and other chains. It is met with again in Armenia, in the Caucasus, and probably also in the Pyrenees. In the south-east the Altai system is represented by the Himalayas and the mountains of farther India; the last-mentioned, however, lying almost due north and south as far as their intersection with the Sinian system. To the Sinian system, again, belong the T'ian Shan and the Hindu Kush.

The Kuen Luen.

But the most remarkable of Richthofen's systems is the Kuen Luen, with its axis almost parallel to the Equator, the "backbone of the continent." Whether viewed in its continuity in one and the same direction for upwards of 2500 miles, or with reference to its average height, this is the most remarkable of the mountain ranges of the world.

To the physical geographer the Kuen Luen offers much that is of interest. It demarcates the low-lying Tarim basin on the north from the Tibetan highlands on the south. As regards its western and central parts it belongs to the drainage system of Central Asia as far as the 103rd meridian east of Greenwich. East of this, its southern slopes supply the headwaters of the great rivers of China, and therefore belong to the periphery of the continent. Though millions of years have disintegrated its rocks, it still rises throughout its whole length to the enormous altitude of 18,000 feet above sea-level, so that, though its summits are lower than those of the Himalayas, its crest is higher. It intercepts the passage of the north-east winds blowing across the plains of Mongolia and the Gobi, just as the Himalayas on the south stop the moisture-laden monsoons of the Indian Ocean. Its characteristics are an extremely scanty flora and an extraordinary abundance of animal life—two conditions at first sight apparently opposed to one another, and, as

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[1] Mushketof, *Turkistan*, p. 14.

[2] Six systems altogether.

regards the second, only to be explained by the absence of human beings. This immense desolate range, extending in almost unbroken continuity through 40 degrees of longitude, from the meridian of Yarkand on the west to that of Hwai-King-fu in the east, has remained almost unknown to Europeans till quite lately, and does not even appear on the maps with any approach to accuracy. In 1856 the brothers Schlagintweit, as already mentioned, first ascertained its independence of the Himalayas. From 1865 to 1873, Messrs. Johnson, Shaw, Hayward, the members of the Forsyth Expedition, and a few others crossed its north-western extremity. Among these Dr. Stoliczka first studied its geology, but was not spared to finish his labours.

Richthofen's travels in the provinces of Honan and Shensi drew attention to its extension eastwards, and many pages of that author's classical work are devoted to its importance in relation to the vertical configuration of the continent. As other ranges of Central Asia came to be better known, and their geology more studied, the interest attaching to the Kuen Luen increased, for it was important to define what connection there was, if any, between this range and the T'ian Shan on the one hand and the Karakoram on the other.

Richthofen places its limits at the meridians of 76° and 118° ; he divides it into three nearly equal parts—a *western*, composed of a single broad chain; a *central*, consisting of a system of parallel chains; and an *eastern*, where several chains are so closely compressed together as to form but one trunk. Later explorations have shown that the parallelism observed in the central parts extends much farther east and west than Richthofen conjectured; and Dr. Wegener, his pupil, in an admirable essay on the orography of this system, while adopting the method of his master, divides the system at the 82nd and 106th meridians; that is to say, he shows that west of 82° and east of 106° it consists of a single chain, while in the centre is developed the system of great parallel ranges.

The Western Kuen Luen.

One of the most interesting questions concerning the Western Kuen Luen is its relation to the Pamir tableland; and here we are again brought face to face with Humboldt's theory of a meridional range. It will doubtless be remembered how much learned controversy this subject called forth some years ago. The Russian geographers claimed to have discovered that there was no such meridional range, and the English geographers set themselves to show how Humboldt's mistake had arisen, in the first place by falsification of documents by Klaproth, and secondly by the turning of a Chinese map through an angle of 90°, so that east became north, north became west, and so on.[1] It was expected that actual exploration would decide the point. But, after all the researches of the past fifteen or twenty years, there yet remain doubts. Shaw, Hayward, and the officers of the Forsyth Expedition were confident that the magnificent snowy mountains they saw to the west of Kashgar, culminat-

[1] *Journal R.G.S.*, vol. xlii. p. 482.

ing in the massive group of Tagharma or Mustagh-ata with its twin-headed peak, 25,900 feet above sea-level, and rising as a long wall from the plain on the east, constituted a meridional chain. Fedchenko, Severtsof, Ivanof, Mushketof, and others, were of the contrary opinion. They attributed the statement of the English explorers to an optical illusion, produced by the appearance of the ends of the Pamir chains, which, when seen in the distance *en face*, gave the impression of a continuous range. This view, however, was not shared by the late Colonel Kostenko, who accompanied General Skobelef's march across the Alai in 1876. He saw these mountains in August from the summit of the Uzbel pass, about fifty miles off, and confirmed Humboldt's views of a meridional range.

Dr. Wegener, in discussing the question as to where the Kuen Luen begins, says that in the present state of Pamir research there is hardly room to doubt that the east margin of the highlands is defined by an approximately north and south upheaval of extraordinary height, having the appearance of a mighty range and producing the deepest impression on the beholder, be he even the impassive Chinese.

Eduard Suess in his *Antlitz der Erde* has lately formulated the idea—not his originally, but Stoliczka's—that the Kuen Luen itself, forming a curve towards the north, is continued as the Kizil-art range, and this view, founded on Stoliczka's geological researches, has been adopted by Neumayr and Geiger; the last-mentioned geographer has developed it still further by bringing the Kuen Luen, as the Kizil-art or Kashgar range, to 37½° north latitude as far as the Trans-Alai mountains belonging to the Pamir group.[1] Professor von Loczy, in his work lately published on the scientific results of the Szechenyi expedition, has put forward an entirely new theory, viz., that these marginal ranges of the Tarim basin on the south, as well as of the Pamir region on the east, are quite distinct, and have nothing to do with the Kuen Luen system. These views, however ingenious, are not based on sufficiently well-ascertained facts to be accepted as final, and they certainly do not agree with the latest Russian map of the Pamir region, where ranges running parallel to the Equator cross those having a meridional direction, and where the Tagharma or Mustagh-ata group appears to have an equatorial axis, and is placed at the end of the southern Rang-kul range.

The westernmost parts of the Kuen Luen are the narrowest, and at the same time the loftiest, of the whole system. Peaks of 21,000, 22,000 feet and upwards, though surpassed by many in the Karakoram, Mustagh, and Himalayas, are among the loftiest in the world; and if we consider the great age of their component rocks and the enormous denudation these have undergone through untold ages, it will be safe to conclude, as Wegener does, that they must at one time have been equal to their younger rivals in the Himalayas and Mustagh.

Till within the last few years the only geological observations in this western end of the Kuen Luen were those of Stoliczka and Bellew along the Chang Chenmo and Karakoram routes. Stoliczka found that the

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[1] Wegener, *l.c.* p. 19.

whole system of mountain ranges between the Indus and the borders of Turkistan were bounded on the north and south by syenitic rocks, enclosing between them Silurian, Carboniferous, and Triassic formations; and he remarked on the great contrast between these and the mountains south of the Indus, where all the principal sedimentary formations are represented, from the Silurian up to the Eocene, and most of the beds abound in fossils.

Bogdanovitch, the geologist of the Pevtsof Expedition, who crossed the Western Kuen Luen from the upper valley of the Tisnaf in 1890, also found the chains to be built up of granite and syenite, with clay and chloritic schists farther north; and these were followed by sand and limestones with a typical Carboniferous fauna; lastly, at the foot of the mountains opposite Karghalyk he found very recent Tertiary deposits, such as Stoliczka had observed in other parts of the Tarim basin.

The Central Kuen Luen.

Between 82° and 106° E. longitude, or from about the meridian of Keria to that of Sining, the Kuen Luen develops a system of parallel chains trending approximately from east to west or from east-south-east to west-north-west, and sweeping across Northern Tibet in gigantic parallel ridges. Prejevalsky was the first to cross them, on his third expedition, and place them on his map. They begin on the north with the Nan Shan, the Southern Mountains of the Chinese, and east of Shachow (Sand Town) the Altyn-tagh (properly Astyn-tagh or foremost mountains), west of that town the Anembar-ula, Tokus-dawan (or Nine Passes), and Russian range. These form the first line of ascent from the Gobi. Beyond lie five or six more principal chains, divided by broad level valleys, with occasional subsidiary ridges, mostly composed of detritus.

All these mountain groups, whether primary or subsidiary, have the same direction from east to west, and are, therefore, parallel; even the principal ranges, enormous though their absolute elevation, are of comparatively small apparent height; the snowy mountains occur generally in distinct groups, not in lines extending for great distances; the forms of the mountains are mostly rounded, their slopes gradual, and their summits dome-shaped; the ranges are easy of access, and the passes very gradual; there are generally few cliffs, these being replaced by detritus, the product of disintegration of the rocks, which are mostly clay schists, limestones, and sandstones.

The mean level of the snow-line in the Central Kuen Luen, as observed by Pevtsof, is 16,700 feet on the northern slopes, and 17,800 on the southern; perpetual snow is met with only on some of the highest ranges—the Tang-la, Marco Polo, and others; also at the sources of the Hwang-ho and in the Western Nan Shan.

Glaciers occur but seldom in the Kuen Luen, and are not extensive, probably not exceeding four miles in length; and the slopes leading up to them are so gradual that the horseman may ride up to the edge of them. Besides those of the Mustagh-ata group, Bogdanovitch only observed five glaciers (the principal of which he named Prejevalsky) between the meridian of Yanghi Hissar and Lob-nor, all of these being of the second rank.

The glaciers descend to about 15,000 feet of absolute height. There are no signs of former glaciers, the orographical conditions being unfavourable. If more detailed surveys should bring to light a greater development of glaciers,[1] Bogdanovitch is of opinion that this will not affect his statement that glaciers in the Kuen Luen, at all events as far east as the meridian of Lob-nor, are rare, insignificant in size, and wholly dependent on the accumulation of snow on the northern slopes. Turning to the geognostic character of the Kuen Luen, Bogdanovitch observes that the ranges of the Kuen Luen and the Eastern T'ian Shan are alike in their geognostic features, but that there are few formations of the period when the present gigantic snowy ranges were covered by the sea. The process of the development of the continent began in the earliest Palæozoic epoch.

The least-explored region of the Central Kuen Luen is from Keria to the north-west for 12 degrees westwards.

Pevtsof's Expedition, in 1890-91, supplied many details regarding the submontane region in the meridian of Cherchen, and the mountains rising immediately above it. Five parallel ranges were observed, mostly snow-capped. These, taking them in order from south to north, are: Akka-tagh, Ayalyk-tagh (also known as the Kizil-unguinin-tiure, a continuation of Prejevalsky's Moscow range), Diomnalyk-tagh (a continuation of Prejevalsky's Tsaidam range), Yusup-alyk-tagh (Prejevalsky's Tchamen-tagh), and Astyn-tagh (Prejevalsky's Altyn-tagh); and this wide system of ranges continues eastwards to Tsaidam and Kuku-nor. With regard to the first of these, the Akka-tagh, Pevtsof reports it to be the same range as that seen by the late General Prejevalsky from Unfreezing Lake, and named after him "Prejevalsky" range. To the north of it is a broad valley, gradually narrowing towards the west. Many of the peaks in this Akka-tagh are 20,000 feet high, and are covered with perpetual snow. Streams fall down its slopes, and join the Tchertchen-daria from the left.

According to hearsay, a lofty hilly region extends to the south of Akka-tagh, but the passes across the latter were blocked with snow, and Pevtsof's Expedition could go no farther. The region to the north is auriferous, and mines are worked here during the summer months by the natives of Keria.

The horizontal structure of the Kuen Luen is thus described by Bogdanovitch:—From the meridian of Polu or Keria to that of Tchertchen the constant direction of the ranges is west-south-west and east-north-east; the chains are all straight, and their ends overlap, and only one is capped with snow. East of the meridian of Tchertchen a succession of

[1] Mr. St. George Littledale saw a very high range of mountains in long. 96° 30′ E. (approx.) south of Humboldt range with snowy peaks and large ice-fields. Cf. *Geogr. Journ.* vol. iii. No. 6, p. 462.

distinct snowy chains trends east and west; farther east the direction changes to west-north-west and east-south-east, and finally becomes north-west and south-east. Here, too, the ranges are detached and their ends overlap. It is in this central part of the system that gigantic groups of mountains have been observed (Mt. Jing-ri, Shapka Monomakh, and Mt. Kremlin), and easy passes (Muzluk, Karachuk, leading from the valley of the Tchertchen to that of the Zaisan-saitu).

There are certain features of the Kuen Luen system, when viewed as a whole, that cannot fail to arrest our attention. First, the general straight line of the strike of the several chains, as opposed to the usual convexity or undulating course of most mountain ranges. It is the longest straight range in the world. Secondly, the very great vertical development, the more remarkable inasmuch as the chains for the most part rise from a base greatly elevated above the sea; the greatest heights occur in the west and south of the system. The southernmost chain has, according to Wegener, at its west end a height along the crest of more than 18,000 feet. It is unrivalled among the ranges of the world, and preserves a height of 16,400 to 19,600 feet as far as the Tang-la pass. Each of the more northerly chains is, as far as at present known, lower than the one behind it, and the west end of each is higher than the east end. Prejevalsky, however, gives the precedence to the central chain because of its great extent continuing uninterrupted through 40 degrees of longitude; while the southern snowy chain, which branches off near the gorge of the river of Keria, and is probably continued in the Tang-la or the mountains bordering Tengri-nor on the north, terminates much sooner, or loses its equatorial direction on merging with the meridional ranges of Indo-China.

Exploration in the Kuen Luen has made great strides of late years, but there still remain tracts in the north-west where no traveller has ever set foot. Between Bower's route and those of the Russian explorers lies an unvisited part; the sources of the Yangtse-Kiang have not yet been discovered, and there is much detail to fill in. Meanwhile every fresh step in advance brings to light new facts bearing, not only on the geography and geology, but also on the past history of these regions. For we know that what is now a wilderness was formerly the seat of cultivation, and that underneath the sands lie the remains of flourishing cities dating back to Bactrian times, or even earlier.

The T'ian Shan.

The second great mountain system of Inner Asia is the T'ian Shan or the Celestial Mountains (so called because they appeared to the Chinese to reach to heaven). The T'ian Shan rears its mountain masses on the Rubicon between two deserts—the Tarim desert on the east, the Turanian desert on the west. With its snowy crests and peaks, and its glacier-fed streams, it ensures life to the cultivated oases of the plains. Less lofty in elevation above sea-level and less extensive than the Kuen Luen, it is nevertheless one of the greatest mountain masses of the world. It belongs wholly to the interior of Asia, all its drainage finding its way into lakes, or evaporating before reaching them. Its area has been estimated to be twenty-five times that of the Swiss Alps and thirty-one times that of the Pyrenees.

Beginning about 100 miles east of the meridian of Barkul, the T'ian Shan soon throws out a series of parallel subsidiary chains, and to the west of the sacred peak of Bogdo-ula these rise to a great elevation, and continue in a more or less east and west direction, with a deflection towards the south-west, till they die away in the plains of Turkistan.

The orography is somewhat complicated, and Richthofen's division of the chains into NE. and NW. systems does not include all the several lines of upheaval of which the T'ian Shan is composed. A glance at the map, however, will show that the prevailing direction is north-east by south-west, and that the north-west and south-east strikes are of secondary importance, and serve to connect the principal chains. But besides the continuous parallel ranges of which the T'ian Shan is mainly composed, there are huge masses of mountains, such as Khan Tengri (24,000 feet), the groups of Kok-su, Ak-shirak, and others, where the peaks attain a height of 21,000 to 22,000 feet, and where there are vast accumulations of glaciers. It is near these masses that the principal rivers of Turkistan take their rise, and flow down wide, long valleys in a general north-western direction.

There have been several attempts to classify the T'ian Shan into "Eastern" and "Western," "Northern" and "Southern." Severtsof divides the range at Khan Tengri, and calls the part to the east of this group the T'ian Shan proper, characterised by a simpler relief and a series of longer parallel ranges; all to the west of it he calls the "Western" or "Turkistan" part, with its more complex relief and series of short upheavals with intersecting ranges; he would even make a "Central" division comprising the region between Khan Tengri and the sources of the Tchat-kul.

Mushketof adopts a different division, depending on the hydrography; thus the water-parting between the Amu and Syr-daria discharging into the Aral on the west, and the Chu emptying into marshes, and the Ili into Lake Balkash on the north-west, serves to divide his "Eastern" and "Western" T'ian Shan. All to the north-east of the watershed forms his "Eastern" T'ian Shan.

Mushketof again divides the T'ian Shan into a system of five folds or arcs, with their convexity turned towards the south. The northernmost of these begins on the west with some low hills at the south-western extremity of Lake Balkash, and, rising to a great height in the granite mass of Khan-tau (Royal Mountain), terminates on the east in the meridian of Turfan, with a total length of 1000 miles.

His second fold begins with the Kulja-Bassy hills, and is afterwards known as the Trans-Ili Alatau, a very fine range of mountains attaining a height of rather over 10,000 feet along the crest, and culminating in Mount Talgar (15,353 feet) on the meridian of the town of Verny. Soon after this the range becomes much lower, and, after dividing into a number of secondary ridges, disappears in some hillocks in the Ili valley. In length this range is equal to the Pyrenees, and has a most imposing appearance when seen from the plain, with its dark wall-like sides and snow-streaked ridge. The Trans-Ili Alatau is the first chain seen by the traveller on approaching the T'ian Shan from the north by the high road.

The third fold is formed by the Alexandrofsky mountains, beginning near the town of Auliye-ata with the lofty peak Mount Semeonof, so named after the first explorer of the T'ian Shan. This range is known farther east as the Kungei Alatau, and borders on the north the magnificent waterspread of the Issyk-kul (5300 feet), rising abruptly from its shore to a height of 10,000 feet of absolute elevation. There are several passes over this range, but the most interesting to the geologist is that known as the Buam gorge, down which the impetuous Tchu pours its stream between steep walls of conglomerate rock. The Kungei Alatau is closely associated with the Trans-Ili Alatau, so much so as to be called its "twin" range. In the meridian of Talgar the two are connected by a transverse granitic ridge known as Almata, and there is a pathway over the two ranges by which the pedestrian, if he be accustomed to mountain climbing, can reach Issyk-kul from Verny in a day. These mountains have delightful grassy valleys, such as the Great and Little Kebin, which are the favourite resort of the nomadising Kirghiz. East of the Almata or Almatinka the Kunge Alatau is much lower and divides into two ridges. These afterwards unite to form the Ak-buran-tau range, known farther east as the Ish-kilik, continuing beyond the Ili till it merges in the mountains of Dzungaria. The peaks of this fold are from 9000 to 10,000 feet of absolute elevation, and the easiest pass (Santas) 5850 feet. Tradition says that Timur, passing through it with a vast host, ordered all his warriors to place a stone on its summit; on his return march, in order to judge of his losses, he bade the men form a second similar heap in the same way. Hence, say the Kirghiz, the name *Santas*, "a million stones."

The fourth fold of Mushketof's system is the longest and most elevated of all, and is in fact the axis of the T'ian Shan. It begins on the west with two parallel ridges which afterwards form one not far from Khan Tengri. The first of these western ramifications is composed of the groups Karakol and Ulakol, uniting in the grand range of the Terskei Alatau aligning the southern shore of Lake Issik-kul; the position of this lake being approximately central in the system. The Terskei Alatau, running parallel with the Kungei Alatau on the north shore, but surpassing it in elevation, with its long serried crest covered with constant snow and glistening with glaciers, produces an impression not easily rendered in words. Its northern slopes, not exposed to the fierce rays of the sun in these latitudes, are here and there clothed with belts of forest, contrasting with the somewhat monotonous aspect of the mountains on the opposite side of the lake. East of Issyk-kul, near the sources of the Tekes, the range loses its regularity where it rises in the mighty group of Khan Tengri; beyond this again its sides are darkened by trees and whitened by snows as it continues along the Burkhan-tau [1] and Khalyk-bassy to the

[1] According to its petrographical peculiarities this is a distinct range.

Narat range, sending down numerous tributary streams to the Tekes and Kunges.

The scenery here is the finest in the T'ian Shan, especially between the east end of Issyk-kul and the lower valley of the Tekes, affording a variety of hill and dale and effects of colouring worthy to rank with the most beautiful parts of the Alps of Switzerland; while the gloomy recesses of the defiles, with their precipitous cliffs and the snow-clad peaks towering above them, might call to mind parts of the Austrian Tyrol and the Saint Gothard pass. The weather-worn limestones and marbles of its summits have a jagged appearance, and the outcrops of schistose rocks here and there complete a picture which is never wanting in variety.

Very different is the aspect of the southernmost of the two ramifications composing this fold to the west of Khan Tengri. Instead of a wall-like range we observe here, says M. Krasnof, groups of mountains divided by valleys and low passes, apparently so distinct that we are at a loss to know how to classify them. A closer survey, however, of these mountains, and the fact that they all have a granite core margined on north and south by sedimentary rocks with conformable stratification on either side, convinces us that this range belongs to the same fold as the last. It begins at Djitim-tau, continues to the eastward as the Ak-shirak and Kiuiliu, and unites at the Sari-djas with the Terskei Alatau at Khan Tengri.

The mean height of the range is between 9000 and 10,000 feet, and many of its peaks are between 15,000 and 18,000 feet; many of the passes[1] are above 11,000 feet, *i.e.* higher than any of the passes of the mountains of Europe and approaching those of the Himalayas. These passes are, however, in the summer months free from snow, and, with the exception of those over glaciers, not more difficult than any others.

The fifth and last fold limits the T'ian Shan system on the south. It begins on the south of the river Naryn (headwaters of the Syr-daria) with the Ferghana chain, which under various names borders the plain of Ferghana on the east. This chain has a mean altitude along its crest of 10,000 feet, and is crossed by several easy passes. On the extreme east it attains its greatest height of 12,740 feet at the Col of Suyuk; a range of the same name runs off from it in a direction east-south-east. Farther east are the Kara-teke-tau and Djagaimal, which unite in the great chain of Terek-tyn-tau, trending north-east and crossed by the Turong-art pass. About here are some very high mountains—Mount Nicholas, 17,000 to 19,000 feet, Mount Catherine, and Mount Peter, and the plateau of Ak-sai (about 11,000 feet), watered by a river of the same name, and separated by low rising ground from the alpine lake of Tchatyr-kul (11,050 feet).

South of these five folds or chains begins a succession of ranges

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[1] Kyz-art, 8090 feet; Barskoun, 11,810 feet; Turgen-Ak-su, 12,800 feet; Muz-art, 12,000 feet; Besh Mainak, 10,520 feet; Kiuiliu, 13,570 feet; Kashka-su, 10,918 feet; Narat, 10,200 feet.

known under the generic name of Alai, and belonging to the Pamir system with its higher valleys and different relief.

Summarising the foregoing remarks and comparing the heights of the valleys between the folds of the T'ian Shan, we find that, beginning on the north at the level of Lake Balkash (900 feet), the absolute elevation of the country increases in regular gradations as we proceed southward—the Ili valley (1300 feet), Issyk-kul (5300 feet), Son-kul and the so-called Syrts (9400), forming as it were a succession of three gigantic steps, or terraces, each being raised 4000 feet above the one next below it; and on the margin of each step rise two chains, so joined together as to form the letter x, with peaks at the points of junction rising high above the step. Above all towers the noble mass of Khan Tengri, with its white cap, affording a panorama, when viewed from Lake Boroga-bossun, which dwarfs into insignificance the views from the summit of the Rigi and Mount Pilatus, and may bear some resemblance to that of the Alps as seen from Milan.[1]

In order to understand the geography of the T'ian Shan we must learn how it has gradually been built up. When were these mountain ranges raised? Have they always been as they are at present, with their snowy peaks rising up to the vault of heaven? and when did this great mass of mountains dividing the interior of the continent into two basins come into existence? These questions can only be answered by studying the results of long-continued geological observation. In India, where the geological survey has been at work for a series of years, the whole of the peninsular area has been mapped out, and the knowledge of the geological structure is very extensive. In Central Asia geological observations have only been recently undertaken, and wide areas are comparatively unknown. The investigations of Professors Mushketof and Romanofsky during the last decade enable us, however, to form some idea of the changes that have taken place before the surface assumed its present aspect. Mushketof tells us that the core of the principal folds is composed of crystalline rocks, granites or diorites, and these are exposed along the crest of the ranges of the T'ian Shan group. The crystalline rocks are covered conformably by primordial shales, limestones, and sandstones of a white, grey, and red colour. At the point of contact of the shales with the granites the former lose their stratification and partake of a granitic character, with crystals of felspar imbedded in them. The sandstones and limestones belong to the Palæozoic formations, and have been so little disturbed that, even in those places where the topography is a chaos of peaks and defiles, it is easy to make out the orography. With these Palæozoic formations, continues Mushketof, are unconformably stratified later deposits, belonging mostly to the Jurassic series. The Tertiary deposits on both the northern and southern flanks of the T'ian Shan are so closely allied to each other that they may be traced in the passes leading from Ferghana into Kashgaria, and in the so-called Dzungarian strait between the T'ian Shan and Tarbagatai.

[1] Krasnof, *Zapiski, Imp. Geog. Soc. Gen. Geog.*, vol. xix. p. 34.

All these deposits have a marine character. This, and the fact that they stretch round all sides of the T'ian Shan, induces Mushketof to believe that in the Tertiary period the Central and Eastern T'ian Shan formed an archipelago of islands between two extensive seas, now represented by the Turanian depression and the Han-hai or Tarim region, and united by the Dzungarian and the Ferghano-Turkistan straits.

Relying on the unconformable stratification of the younger with the primary rocks, he is also of opinion that in pre-Tertiary times, while this sea was in existence, the summits of the mountain masses of the T'ian Shan, the Pamir, and probably also the Himalayas and Hindu Kush, reaching now to a height of 20,000 to 25,000 feet, had not more than one-third of their present elevation; for the Tertiary strata, as observed by Mushketof at Lake Tchatyr-kul and at Ish-kilik, are, according to Krasnof, not less than 10,000 to 11,000 feet above the actual sea-level. The great mountains were then low heights hardly appearing above the surface of the waters; and, as with the western Alps, so with these ranges of Asia, there were in their stead only groups of small islands.

At the end of the Tertiary period a general upheaval took place, probably extending over millions of years, for the deep-sea deposits are overlaid by shallow-water deposits, and these again by beach deposits, with remarkable regularity. While this change of the surface was in progress, both basins, the Han-hai on the east and the Turkistan basin on the west, gradually receded at the same time and equally, and, owing to the influence of new climatic conditions, lost by evaporation more and more of their waters, till they at length assumed their present condition, which is still one of desiccation.

This picture, drawn for us by the learned Russian geologist, may be compared with one by Mr. Oldham[1] of the geological changes that have taken place in India since Palæozoic times.

He shows that the distribution of land and sea was very different then from what it is now. All the land west of the Aravalli range, says Mr. Oldham, 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 series of great earth movements which took place in India, and which were 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—were probably contemporaneous with similar earth-movements in the interior of the continent. But the evidences of volcanic eruption in the T'ian Shan are not at present convincing. Stoliczka, indeed, found basaltic rocks and boulders in the mountains north of Kashgar, and passed through what appeared to be the centre of an extensive volcanic eruption. Mushketof discovered diabase, melaphyre, and more recent volcanic rocks, such as dolerites, in the Borohoro range north of Kulja, and tuffs in the valley of Badam in the Western T'ian Shan. But he is of

[1] *Journal R.G.S.*, vol. iii. No. 3, pp. 169.

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J. G. Bartholomew

THE MOUNTAIN SYSTEMS OF CENTRAL ASIA.

The Edinburgh Geographical Institute

J. G. Bartholomew

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opinion that there is no connection between the recession of the sea and the volcanic phenomena, and that volcanic rocks are by no means so widely distributed in Inner Asia as some have supposed, on the basis of Humboldt's theory of the existence of active volcanoes in the T'ian Shan.

It is impossible in this paper to deal with the intricate question of the origin and age of the mountain ranges of Central Asia. Moreover, there are not sufficient data to enable us to do more than speculate on the ancient relief or contour of the land. Actual observations have been limited to lines of route, leaving wide intermediate spaces unsurveyed. The filling-in of these, and the making of a detailed geological map on the same scale as that of India, would allow of a theoretical reconstruction of the primeval continent. For the present we must be content to leave the orography a little indefinite, and turn our attention rather to those other changes now moulding the face of this part of the world—changes due not so much to water or to subterranean forces as to air. Sub-aërial deposits are distributed widely over the whole of Inner Asia; they may be seen along the foot of the hills and all over the plains. Loess and drift-sands, the products of the disintegration of the rocks by violent winds, are deposited in every hollow and slope, and produce that monotony of landscape which is a special feature. The natives have a saying that where there is *turpak*, or loam, and *su*, water, there you will find a settler. And this is true in more senses than one, for all the buildings are of this material; the mosques, minarets, and tombs are all made of it.

This loess, or loam, mixed with water, and sometimes with a little straw, makes the most durable bricks, whether dried in the sun or in kilns, and resists admirably the action of time and weather.

Not less valuable are the loess deposits to the agriculturist. The fertilising properties of this argillaceous soil when deposited on the fields by plentiful irrigation have been shown by Richthofen in his great work in relation to China. In Central Asia, according to a recent writer, M. Moser, its adaptation to the wants of the inhabitants is equally remarkable, enabling them to cultivate land and produce good crops in localities where this would be otherwise impossible.

Central Asia, it has been said, is the land of contrasts, for side by side with the beneficent loess is the all-destroying sand. Taking its origin in the sandstone rocks of the mountains and the arenaceous deposits of the rivers, this sand is driven by the wind over the plains, invading the fertile oases and burying towns, villages, and fields in its march. Enormous areas are covered by this drift-sand, and its approach is dreaded as much as an earthquake or a flood.

We find, then, the T'ian Shan, the great mountain system of Central Asia, rising in the heart of the continent, united by the Pamirs with the Kuen Luen and the ranges bordering India and the Iranian plateaux, and connected by a system of north-western upheavals with the Altai and the mountains of Siberia. Dividing, as a gigantic wall, the plains to the east and west of it, the T'ian Shan plays an important part in the economy of this region. It is at the same time the source of prosperity and the cause of misery to the inhabitants, whose future must depend in a great measure on the development of all those undertakings which, under British rule, have assured to the people of India their present well-being.[1]

A REVIEW OF SWEDISH HYDROGRAPHIC RESEARCH IN THE BALTIC AND THE NORTH SEAS.

By Otto Pettersson.

(*With Plates.*)

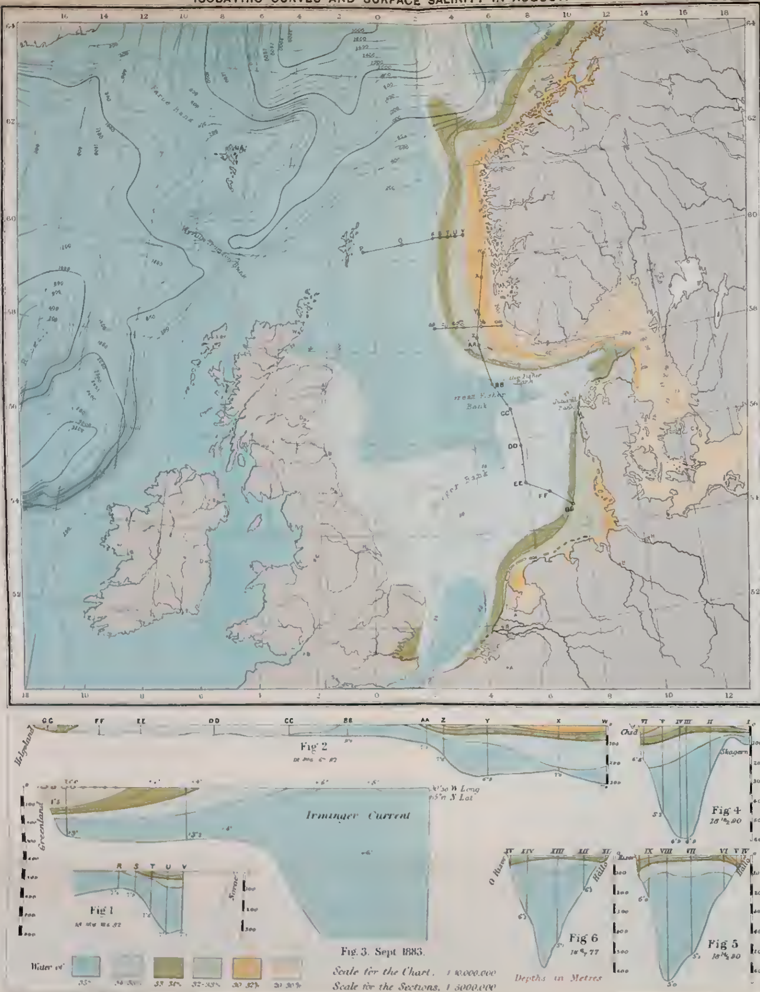
II.

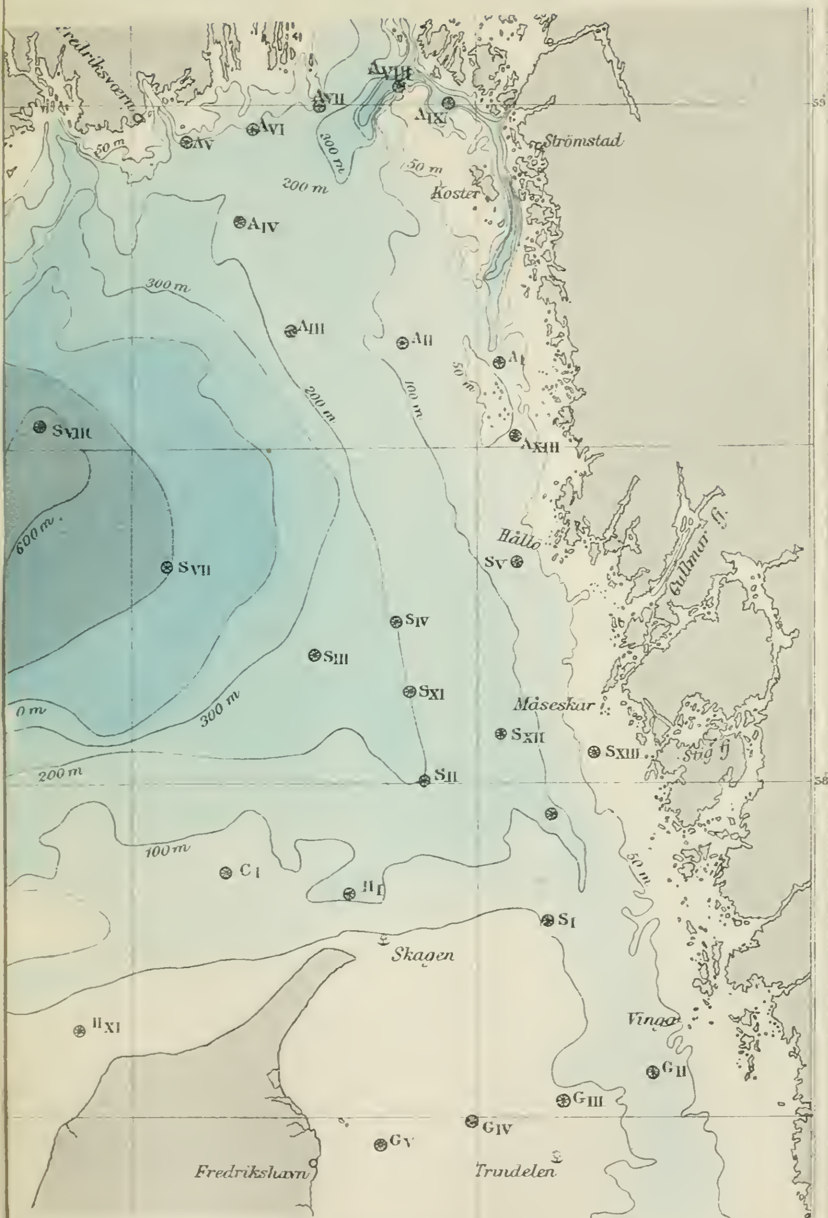
Explanatory Remarks—The Baltic Current in the Skagerack and North Sea—The Salinity of the inflowing and outflowing waters—Different Conditions of the Surface Water in winter and summer respectively, and the Meteorological Consequences.

A few explanatory remarks about the symbols, colours, etc., used in the following maps and diagrams may perhaps be useful to the reader. The configuration of the bottom of the North Sea and part of the Northern Atlantic will be seen from the isobathic curves (coloured black) in the maps, Plates II., III., and IV. The positions of the Swedish sounding-stations from February 1890 are denoted on Plates IV. and V. by letters with Roman ciphers. Thus, for example, C_i, C_{ii}, C_{iii}, . . . C_{vi} indicate the sounding-places on the section Christiansand—Skagen, etc. On subsequent

[1] In endeavouring to treat of so wide a subject as that covered by the title of my paper, I have been obliged to omit much that is interesting and suggestive in the reports of recent travellers. Among these, Professor Milne in his "Journey across Europe and Asia" (see *Geol. Mag.* 1877, Decade ii. vol. iv.) makes an observation here and there, touching on some of the points raised in the preceding remarks. Thus, at p. 565, he speaks of the Lake Baikal seal, a species of *Callocephalus*, and its similarity with that of the Caspian and Sea of Aral; also of a seal inhabiting Lake Kozo-gol farther south, evidencing the probable way in which these lakes were formed. All this tends to strengthen the theory of Von Richthofen, Mushketof, and others, of a *former large inland sea* in Central Asia; and my friend Dr. H. Woodward. President of the Geological Society, thinks it highly probable that such a sea once existed.

With reference to the immense thickness and extent of the loess, some interesting remarks are contained in Von Richthofen's original article (*Geol. Mag.* 1882, Decade ii. vol. ix. pp. 293-305), where the question of the origin of this deposit is fully discussed. Similar sub-aërial deposits are very well described by Israel C. Russell, of the U.S. Geol. Survey, in the Arid Region of N. America—Colorado, New Mexico, W. Texas, Arizona, S. California, Nevada, Utah, S. Oregon, etc., and he adopts the desiccated lake theory (see *Geol. Mag.* Decade iii. vol. vi. 1889, pp. 289, 342). The observations of Mr. St. George Littledale (see *Geogr. Journ.* June 1894), and of the Russian traveller, M. Potanin, in his journeys across the Gobi, are of special interest as showing the extraordinary accumulations of this fine dust or sand, in which mountains appear completely immersed, only the rocky crests emerging here and there above the level expanse.


Faroe Bank
Great Fisher Bank
Little Fisher Bank
Jutland Bank
Fig 1
Fig 2
Helgoland
Greenland
Irminger Current
Skagern
Fig. 3. Sept 1883.
Fig 4
Fig 5
Fig 6
Water of
Scale for the Chart. 1:10,000,000
Scale for the Sections. 1:5000,000
Depths in Metres


Fredriksværn
Strömstad
Koster
Hållö
Gullmar fj.
Måseskar
Stig fj.
Skagen
Vinga
Fredrikshavn
Trudelen
50 m
100 m
200 m
300 m
600 m
A I
A II
A III
A IV
A V
A VI
A VII
A VIII
A IX
A XIII
S I
S II
S III
S IV
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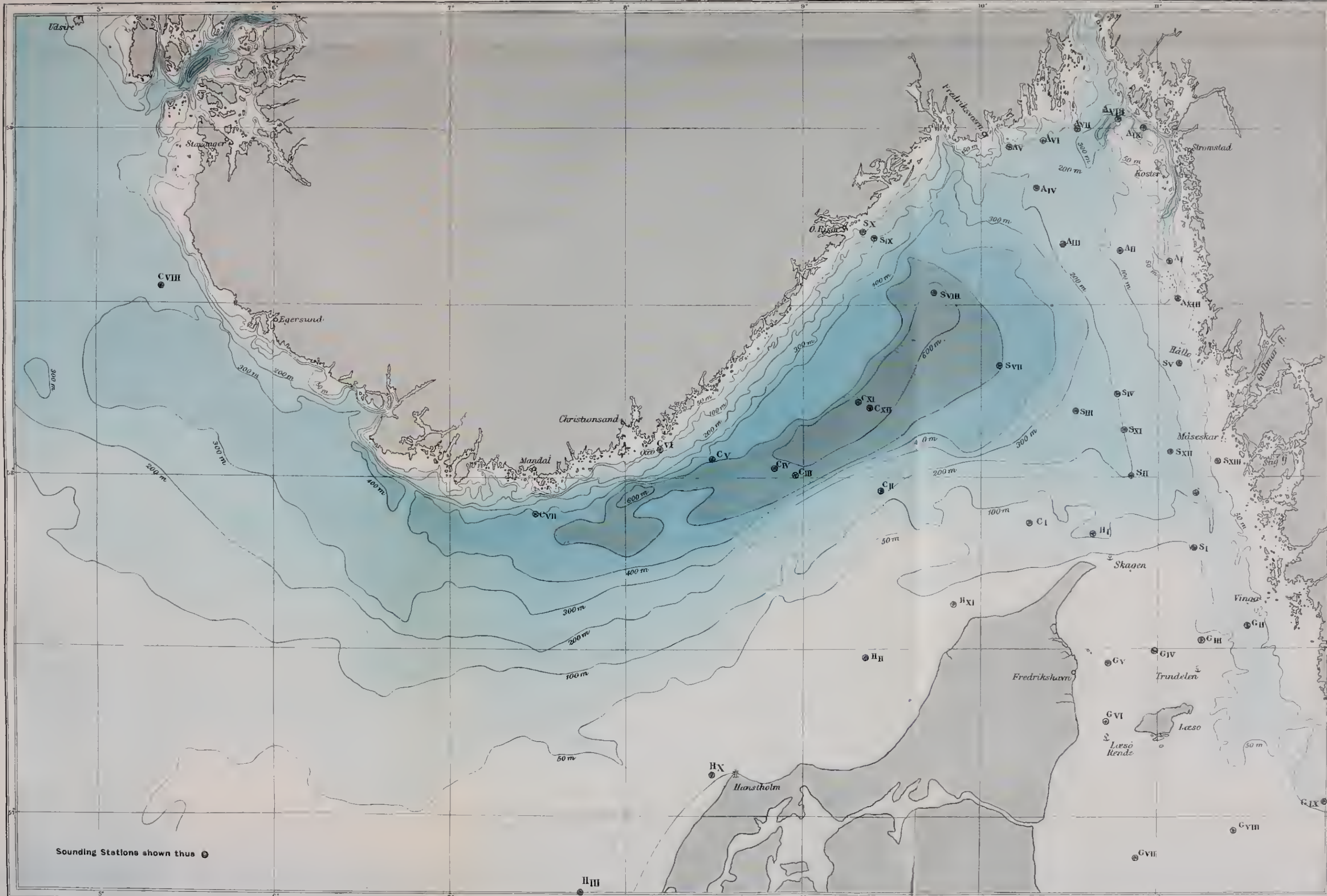
S VIII
S XI
S XII
S XIII
C I
G II
G III
G IV
G V
58

CHART OF DEPTHS.



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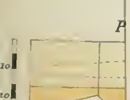
Bartholomew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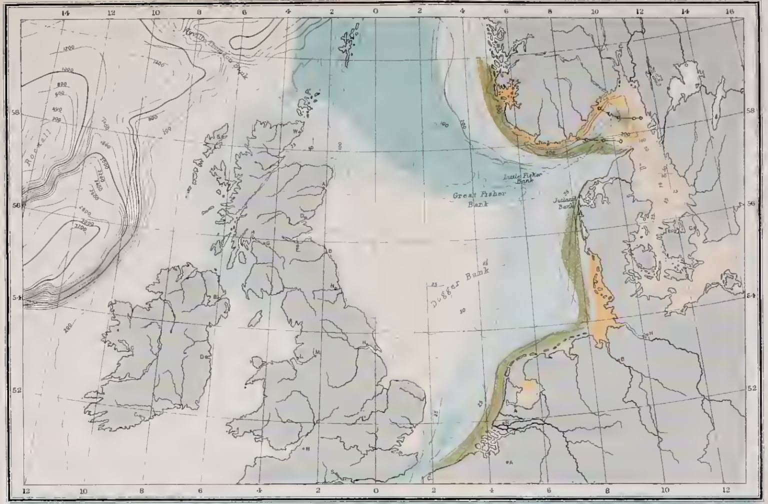


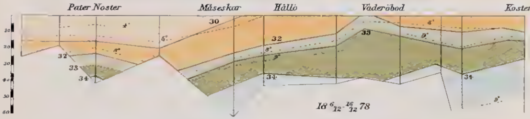


Fig. 1

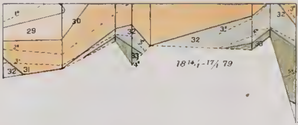


Fig 2

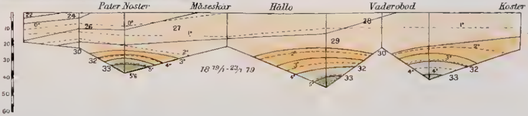


Fig 3

hydrographic expeditions we repeated the soundings at the same stations, and intend to do so in future, because this method of research enables us to detect the alterations taking place in the constitution of the sea. Plate XI.[1] contains a very minutely elaborated bathymetric chart of the Baltic, where the Swedish sounding-sections and stations from July 1877 are represented. In the sectional diagrams on Plates VI., etc., the same letters and ciphers are used as in the maps to denote the sounding-stations. These diagrams contain a graphic representation, by means of isohalines and isotherms, of the state of the sea along a certain sectional line. From the maps and the diagrams together the distribution of temperature and salinity in any part of the sea will easily be perceived. The temperature is given in Centigrade measurement and the saltness in *promilles* of the *weight* of the water.

The saltness of the surface-water is represented by certain colours on four maps, viz., on Plates II., III., V., and X. The map on Plate II., which represents the state of the surface of the North Sea and North Atlantic in summer (August), is compiled from the chart of the Norwegian North Atlantic Expedition by Tornœ, and from the charts of the German *Drache* expeditions. In Plate III. is represented the state of the sea-surface in February 1890, according to our own observations, and in Plate X. the state of the Baltic in July 1877, according to my calculation of Professor Ekman's records. This Plate also contains a sectional diagram along a line, drawn in black on the chart, from the Great Belt along the Baltic to its northern extremity. The longitudinal section and the map on Plate X. correspond to each other, the same colours which in the former denote the vertical distribution of halogen from the surface to the bottom, being used in the map to represent the horizontal extension of the water-layers of different salinity at the surface of the Baltic Sea. Another diagram representing a cross-section of the Baltic from the Swedish coast to the island Ösel is remarkable because it passes through the deepest pit in the whole Baltic. The deep-sounding of Ekman in July 1877 at this place was repeated in September 1891 by myself, with the result shown in the two diagrams on Plate X.

The bottom of the North Sea and the Baltic consists of a series of submarine plateaus, hollows, and channels, separated by shallow ridges. The circulation of the water in this offshoot of the ocean is a very intricate phenomenon, on account of the irregular formation of the bottom.

The guiding principle in the investigation of the oceanic circulation in the North Sea and the Baltic, considered as an entire hydrographic system, must be *to distinguish between the inflowing and the outflowing strata.* The latter we denote by a common name, the "Baltic Stream." The Baltic Sea, which serves as a drainage-basin to a great part of Northern and Eastern Europe, receives, by rainfall, the discharge of rivers, etc. much more water than it loses by evaporation. This surplus of water in the Baltic Sea gives birth to the Baltic Stream. From well-known physical principles it will be evident—

[1] No. IX. and the following Plates will be published with a subsequent section of the article.

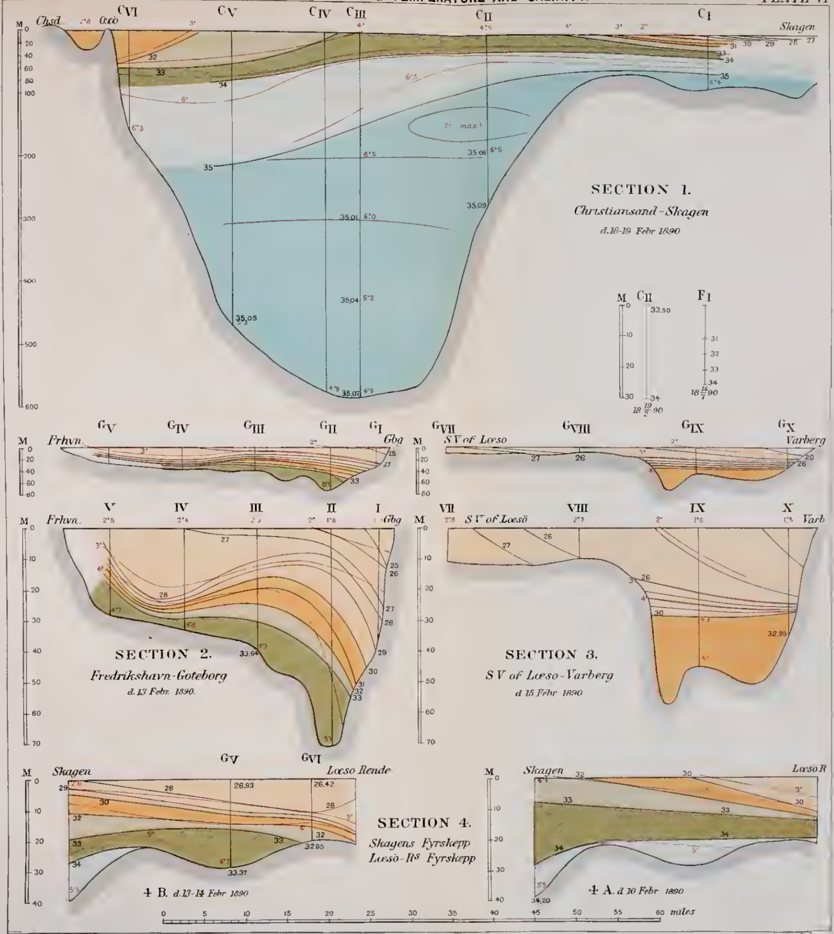
1. *That the Baltic Stream must be a surface-current, because it originates from a redundancy of fresh water.*

2. *That, on account of the Earth's rotation, the main part of the Baltic Stream must keep close to the coast of the Scandinavian peninsula.*

3. *That it must be a periodic stream, because the discharge of the rivers into the Baltic varies with the season of the year.*

It is very easy to verify these general laws by an inspection of the charts (see, for example, Plates II. and X.). The distribution of salinity in the water-layers of the Baltic is, as already mentioned, laid out with different colours in Plate X. The isohalines of the surface-chart all run from NE. to SW., indicating that the freshest water at all latitudes was always found along the Swedish coast. From every cross-section of the Baltic it can be proved that the uppermost layer, which contains the freshest water, increases in thickness at the west side of the Baltic, while the salter and denser bottom layers are found to be thickest, and attain their highest level, at the eastern side. Outside the Baltic, in the Skagerack and the North Sea, the isohalines of least salinity are found along the Swedish and the Norwegian coasts (see Plates II., III., and V.) until the parallel of 62° of latitude is passed, when they seem to diverge from the coast and form a tongue of water of peculiar shape, of which I shall have more to say hereafter. The coloured diagrams in Plate II. show that the Baltic Stream in the Skagerack and the North Sea is a broad, but relatively thin, strip of water, which gradually increases in saltness. It will be observed that the outflowing water increases very rapidly in saltness after its entrance into the western part of the Baltic (*i.e.* between the coast of Pomerania and the Danish island Falster) until it leaves the mouth of the Kattegat. The isohalines are here crowded closely together, while they are separated by long intervals in the larger, eastern, part of the Baltic, and also in the Skagerack (see Plate X.). From the northern end of the Gulf of Bothnia to the islands of Rügen and Falster the saltness of the surface-water increases only from 1 to 8°/$_{oo}$ (see Plate X.). In the short distance from Falster to the Skaw it increases from 8 to about 28 or 30°/$_{oo}$. Beyond that it again increases very slowly. The crowding of the isohalines denotes rapid intermingling of the fresher outflowing water and the underlying saline layers. The Kattegat, the Danish sounds, and the western part of the Baltic are thus evidently the region where the salt and fresh water are mixed together, forming water-strata of intermediate salinity, which constitute the innermost part of the Baltic Stream, *i.e.* of the coast-water along a great part of the Swedish and Norwegian shore. In the open and deep parts of the sea the fusion of waters proceeds with extreme slowness, especially at such depths where the orbital motion imparted to the water-particles by the waves is insignificant, and the molecular movement or diffusion is the sole acting power. On the other hand, water-layers, in passing over shallow ridges or submarine plateaus (as in the Southern Kattegat), rapidly mix with one another under the united action of friction and wave-motion.

The mingling of the surface-water of the Baltic Stream with the subjacent ocean-water is affected in a very remarkable manner by the



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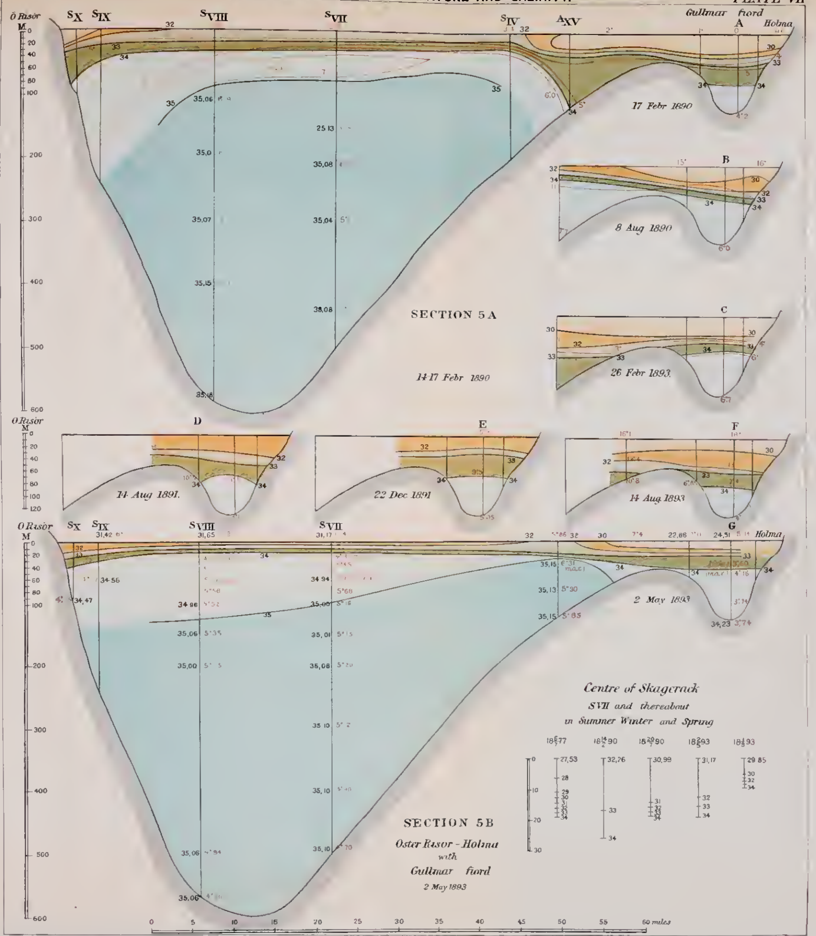
Salinity Lines in Black, Temperature Lines in Red.

Bartholomew

SECTIONS SHOWING TEMPERATURE AND SALINITY. PLATE VII



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Salinity Lines in Black, Temperature Lines in Red.

Bartholomew

outlines of the coast and of the submarine banks surrounding the coast. Wherever the coast-line changes its direction the Baltic current shows a tendency to separate into two branches, whereof one (the westerly or outward-bound branch) soon disappears in the open sea, while the other continues along the coast. We have found such points of divergence in the Baltic Stream :

(*a*) At its entrance from the Kattegat into the Skagerack, where a westerly branch of considerable area starts off whenever the direction of the winds is favourable. This was the case in the middle of February 1890, when, after two weeks of high atmospheric pressure over the Scandinavian peninsula and feeble easterly winds, the Baltic Stream assumed the form shown on the map in Plates III. and V.

(*b*) West of Hållö, on the Swedish coast.

(*c*) South of the Christiania fiord and Fredrikswœrn, where the contour of the coast obliges the stream to alter its direction.

(*d*) West of Mandal and the Naze.

(*e*) At the embouchure of the Norwegian channel, on the 62nd degree of latitude, where the coast of Norway to the north of Cape Stadt takes an easterly direction.

To the influence of this last great bifurcation of the Baltic current I attribute the peculiar arrangement of the isohalines of the sea-surface between the 62nd and 66th degrees on the west of Norway found by the Norwegian North Atlantic Expedition, and represented, after Tornœ's chart, on Plate II.

The system of isohalines found in summer at the mouth of the Norwegian channel, north of 62° of lat., shown in Plate II., bears a striking resemblance to the condition of the Baltic Stream as we observed it in February 1890 at the mouth of the Kattegat (see Plate V.). The analogy of the two cases will be still more evident later when the movement of the deeper strata is taken into consideration.

I do not mean to say that the Baltic Stream sends out side branches at *every* bend (*a, b, c, d, e*), although the tendency to do so reveals itself in the contour of the surface isohalines, which at these places generally assume an *irregular tongue-shaped form*. I think these points may be characterised as weak points, or *points of instability*, in the stream, where under favourable circumstances (as, for example, during easterly or northerly winds) the stream may split up into two branches or be totally deflected from its ordinary course along the coast.

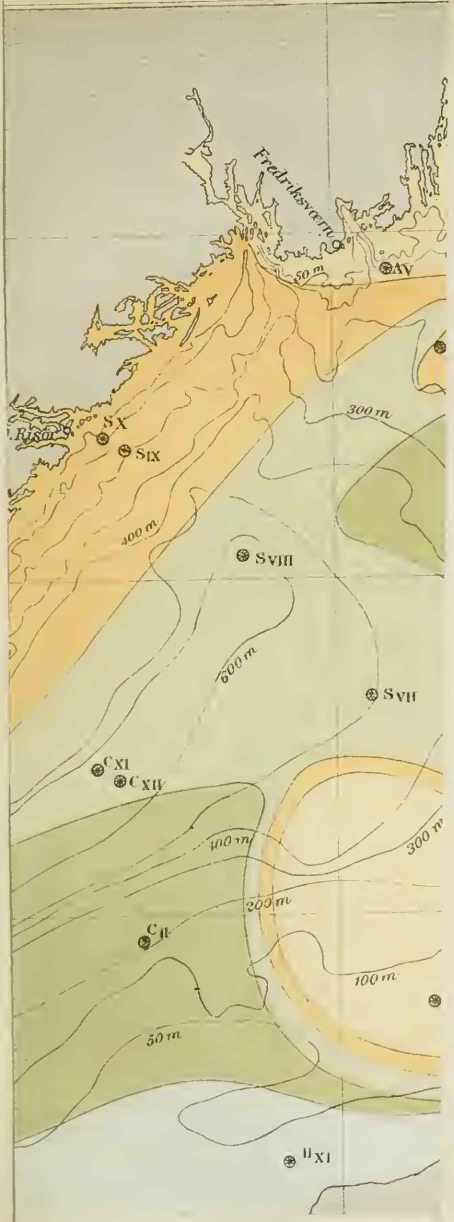
Contrary to what might be expected, we have found *that the stream augments in volume and increases in saltness at these points of cleavage.* The map in Plate V. gives a very conspicuous proof of this fact. South of the Christiania fiord the Baltic current changes its direction, and at the same time increases in salinity, which is shown clearly in this map by the contour of the isohalines of $30\,^{\circ}/_{\circ\circ}$ and 32° and the colours denoting the salinity at the surface. The Swedish part of the Baltic Stream is represented by a lighter colour, indicating less salinity than the Norwegian part. It is evident that the stream at such bifurcations as those situated near the stations A_{iv}, A_{v}, A_{vii} takes up and mixes with the adjacent sea-water. Thence the tongue-like form of the isohalines.

The periodic variations of the Baltic Stream with the seasons of the year are illustrated by the two coloured maps on Plates II. and III. From the former it will be seen that in summer the whole surface of the Skagerack, except the south-western part along the Danish coast, is covered with a sheet of Baltic water (light yellow colour in Plate II.), which is thinner in the centre (about 10 mètres) and becomes deeper at the coasts. The yellow colour in the map denotes the water of the Baltic Stream. Fig. 6 in Plate II. shows the depth of the surface-water in the Skagerack, as measured by Swedish observers in 1877. Figs. 1 and 2 show the thickness of the coast-water belonging to the Baltic current on the western side of the coast of Norway, as found by the *Drache* expeditions of 1882 and 1884. It is obvious that the outflowing water from the Baltic and the Kattegat in summer is sufficiently abundant to inundate the greater part of Skagerack and half the surface of the Norwegian channel with relatively fresh water of about 28-30°/$_{oo}$ salinity. In winter the sources of the Baltic current for the most part dry up. The result is shown on Plate III. Here the Baltic current appears as a coast stream along the Swedish and Norwegian shores (see also Plate V.), which occasionally sends off branches or is deflected altogether in a westerly direction across the Skagerack, but does not suffice either to cover the surface of the Skagerack, or to reach the high latitudes on the west Norwegian coast which it attains in summer. Figs. 4 and 5 in Plate II. represent our sections across the Skagerack from Skagen to Christiansand (fig. 4), and from Hållö to Öster Risör (fig. 5) in February 1890. The Baltic Stream appears in the sectional diagrams and on the chart as thin superficial strips (yellow) at the coasts, the central part of the Skagerack being occupied by water of higher salinity (green and blue).

Winter is the most appropriate time for studying the Baltic Stream. The Skagerack, considered as a whole, is a whirlpool with still water in the centre and a movement gradually accelerating towards its circumference. In summer, when the same kind of water covers its entire area, it is next to impossible to discern the outer limit of the moving water, *i.e.* of the Baltic Stream, because the salinity is almost uniform over the whole surface of the Skagerack. But in February we found it comparatively easy to draw the line of demarcation between the water in the centre and the Baltic Stream from the difference of salinity at the surface (see Plate V.).

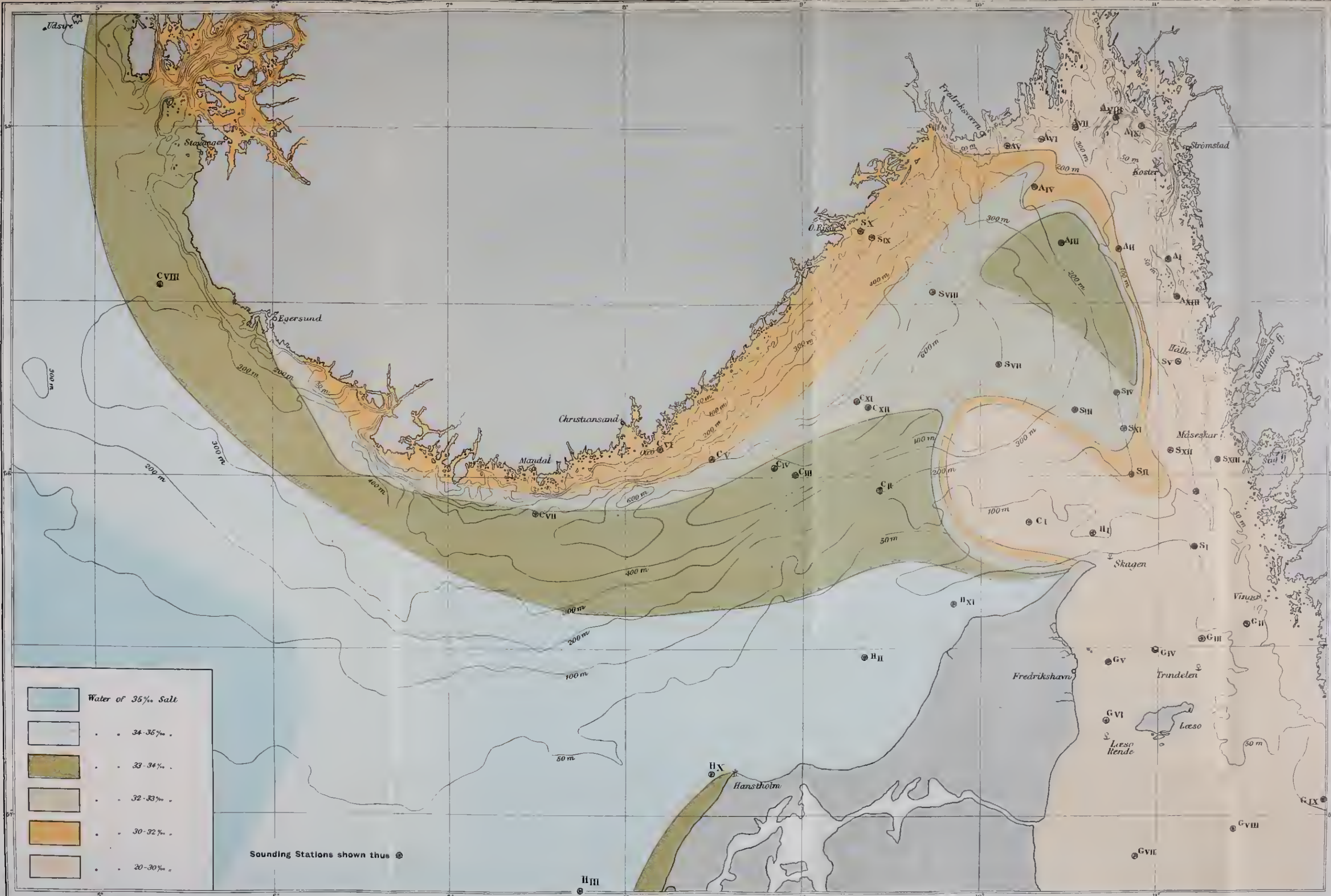
The question to be solved was simply this:—What degrees of salinity characterise the outflowing and the inflowing waters respectively? Certain points within the limits respectively of the Skagerack and Kattegat are specially adapted for observations of the movement of the surface current. The Danish lightships at the Skaw, Trindelen, Læsö Rende, and Anholt hold the first rank among such marine stations. The Director of the Meteorological Institute at Copenhagen, Dr. A. Poulsen, very kindly sent me the records of the salinity and temperature of the water and of the direction and velocity of the current at these stations for every day in February 1890.

The lightship at the Skaw lies alternately in the inflowing water of the Danish current, which sets in from the North Sea along the coast of Jutland accompanied by west and south-west winds, and in the westerly branch of the Baltic Stream, which is directed westward by southerly or



Fredriksværn
Risør
50 m
AV
SX
SIX
300 m
400 m
SVIII
600 m
SVII
CXI
CXII
100 m
300 m
200 m
CII
100 m
50 m
IIXI

CHART OF SURFACE SALINITY IN FEBRUARY.



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easterly winds. From the end of January 1890 until the 12th of February an *ingoing* current (from W. or SW.) or dead water was reported from this lightship, and from the 12th to the 28th of February an *outgoing* current (from E. to SSW.). The change which occurred on the 12th of the month at the Skaw was very sudden. The salinity of the surface-water on that day sank suddenly from 32·7°/oo to 27·6°/oo.

During the earlier period (ingoing current) the minimum salinity was 32·2°/oo; the maximum 33·6°/oo.

During the latter period the minimum salinity of the outgoing current was 21°/oo; the maximum 28·9°/oo.

It will be seen from this that the Baltic current, when, propelled by easterly winds, it sends off a westerly branch at the Skaw, is very well defined and easily recognisable from the underlying and adjacent waters which originate from the North Sea or the Atlantic.

The outflowing Baltic water thus contains less than 30°/oo of salt.

The inflowing water contains more than 32°/oo of salt.

In the northern part of the Skagerack we also found the Baltic coast current very clearly defined.

On the 13th February our expedition cut the Swedish branch of the Baltic Stream to the north of the Wäderö islands (see stations A_i and A_{ii} in the map on Plate V.), and on the 14th February we intersected the Norwegian stream to the east of Öster Risör (stations S_{ix} and S_x on Plate V.). The current ran so strongly in the former place to the north, and in the latter to the south-west, that we had some trouble in keeping the ship stationary during the sounding operations. The depth of the moving stratum may be judged from the following observations:—

THE BALTIC STREAM (see Plate V.).

Depth, M.	On the Norwegian Coast. 14th Feb. 1890.				On the Swedish Coast. 13th Feb. 1890.			
	Station S_x. Long. 9° 20′ E. Lat. 58° 42′.		Station S_{ix}. Long. 9° 24′. Lat. 58° 41′.		Station A_{ii}. Long. 10° 46′ 30″. Lat. 58° 38′ 50″.		Station A_i. N. of Wäderö.	
	Temperature C.	Salt °/oo	Temperature C.	Salt °/oo	Temperature C.	Salt °/oo	Temperature C.	Salt °/oo
0	...	30·58	3·3°	31·61	2·1°	29·15	3·0°	28·65
10	3·0°	30·80	3·8°	32·25	3·8°	32·90	3·7°	29·30
20	3·8°	32·11	4·1°	33·03	4·4°	33·48	3·7°	30·10
30	4·4°	33·02	4·2°	33·44	4·6°	33.64	4·2°	32·22
40	5·1°	33·48	5·0°	33·66	4·6°	33·87	...	...
50	5·2°	33·77	5·5°	34·05	...	...	5·4°	33·74

The limit between the outflowing Baltic Stream and the underlying water appears very sharply defined by the sudden increase in temperature and salinity. It must be borne in mind that a great dividing point of the Baltic Stream is situated midway between the stations A_{ii}, A_i and S_{ix}, S_x, off the entrance to the Christiania fiord, where the stream increases in salinity. The Norwegian part of the stream consequently is always, on the average, of higher salinity than the Swedish stream.

The maximum salinity of the outflowing water (the Baltic current) at the Swedish and Danish coasts is about 29 ‰ or 30 ‰; at the Norwegian side of the Skagerack, 32 ‰. The area covered by the Baltic Stream in the Kattegat and Skagerack, in the latter part of February 1890, is coloured with light yellow (water up to 30 ‰) and darker yellow (water from 30 to 32 ‰) in the maps on Plates III. and V.

From the tables given above it will be seen that the Baltic current consists of a broad but very thin sheet of water. At the stations A_i and S_x, next to the coasts, it is about twenty mètres deep; at the outer edges it becomes thinner; at S_x it has thinned out to a little more than 10 and at A_{ii} to less than 10 mètres. (See the foregoing table.)

Under the direction of the Bureau of Marine Meteorology at Stockholm, regular observations are taken at one of the Wäderö islands, a few miles south of our station A_i and about seven miles from the coast, and from these I have compiled the following table, giving the mean salinity observed at different depths during the last eleven years:—

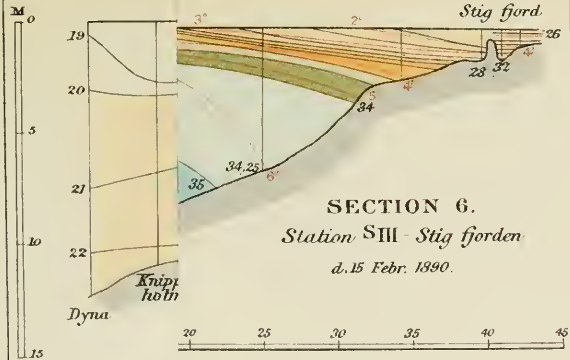
The Baltic Stream off Wäderö (near Station A_i).

Year.	Depth, 0 M.	Depth, 10 M.	Depth, 20 M.	Depth, 40 M.
1880	27·3 ‰	28·9 ‰	31·2 ‰	33·0 ‰
1881	27·3 ,,	29·2 ,,	31·3 ,,	33·1 ,,
1882	27·2 ,,	28·4 ,,	31·5 ,,	33·3 ,,
1883	28·8 ,,	30·1 ,,	31·9 ,,	33·1 ,,
1884	26·8 ,,	28·5 ,,	31·3 ,,	33·0 ,,
1885	27·5 ,,	28·9 ,,	31·3 ,,	33·2 ,,
1886	27·2 ,,	28·8 ,,	31·5 ,,	33·3 ,,
1887	29·2 ,,	30·4 ,,	32·0 ,,	33·2 ,,
1888	27·3 ,,	28·8 ,,	31·8 ,,	32·6 ,,
1889	26·1 ,,	26·8 ,,	30·2 ,,	32·6 ,,
1890	27·2 ,,	26·9 ,,	29·9 ,,	31·8 ,,
Mean of 11 years.	27·44 ‰	28·70 ‰	31·26 ‰	32·94 ‰

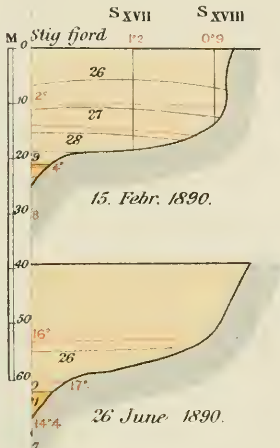
The depth of the stream about seven miles from the Swedish coast, at the Wäderö, is, on the average, less than twenty mètres, and has shown a tendency to increase during the period of 1888-90.

Contrary to what might be expected, it appears from the original tables of observation (which cannot be reproduced here on account of their extent) that the Baltic water is *thinner* in the vicinity of the coast in summer than in winter. This corroborates a general rule, which will hereafter be proved, viz., that *all isohalines in the Skagerack lie more closely together near the coasts in winter than in summer.* Thus at Wäderö the fresher water attains its maximum depth in the month of February. In summer it is thinner, but, instead, spreads out further over the Skagerack.

The thickness of the tongue-shaped western branch of the Baltic

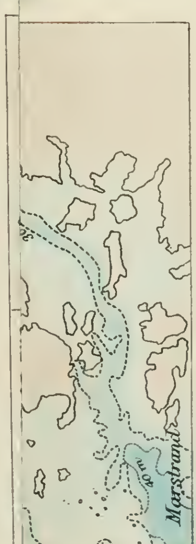


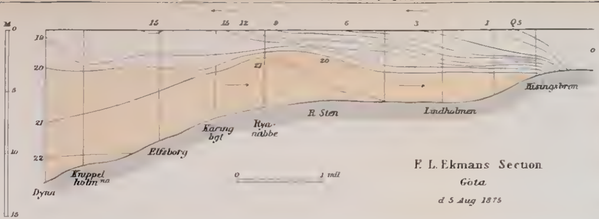
SECTION 6.
Station SIII - Stig fjorden
d. 15 Febr. 1890.

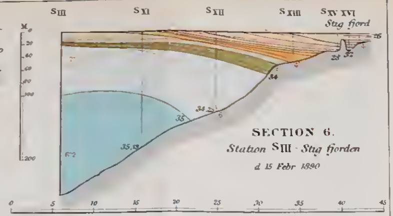


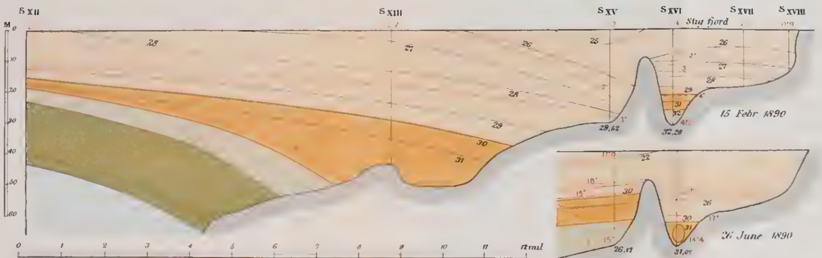
15. Febr. 1890.

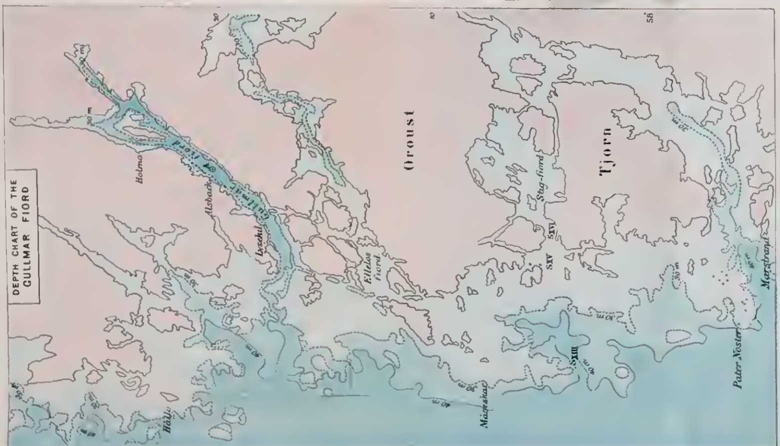
26 June 1890.











Salinity Lines in Black, Temperature Lines in Red.

Stream, marked light yellow on Plate V., wherein are situated stations H_i and C_i, S_i and S_{ii}, can be seen from section 1 on Plate VI. and section 4 on Plate II. The thin cuneiform strata at the right side of the figures about the stations C_i, S_{ii}, and S_i, where the isohalines of 27 to 31 °/₀₀ crowd closely upon each other, overlapping the warmer and salter water of 32 to 33 °/₀₀, show the vertical dimensions of this branch of the Baltic Stream.

Another section of the Baltic Stream, to the east of Christiansand, just at the point where it emerges from the Skagerack, is given in the same figure 1 on Plate VI. at the opposite (left) end of the diagram. Here the isohaline of 32 °/₀₀ (closely followed by the isotherm of 3° C.) shows the dimensions of the stream in the vicinity of station C_{vi}.

The Baltic Stream is distinguished, not only by its salinity but also by its temperature, from the surrounding sea-water. The Baltic water is liable to greater changes of temperature than the North Sea water, being warmer in summer and colder in winter. In February, which is the coldest season, the temperature of the coast water is ordinarily a little above 1°, but may, under certain circumstances—of which I shall presently have to speak more fully—sink below 0° to $-1{\cdot}4°$ and $-1{\cdot}6°$ C. Outside the rocks and shoals of the Swedish coast the temperature gradually increases to the westward up to $+2°$ and $+3°$ C. The mean temperature of the air is below zero on the Scandinavian coast in mid-winter. *The temperature of the coast water is accordingly higher than that of the land.* Still higher is the temperature of the broad central part of the Skagerack, coloured green in Plate V., which is covered by water containing 33 °/₀₀ and 34 °/₀₀ of salt, at a temperature of $+4°$ C. and more. This singular distribution of temperature in winter has an important effect on the climate of the Scandinavian peninsula, as may be seen from the lines of equal temperature on meteorological charts. *Another effect is to promote cyclonic disturbances.* The air over the central part of the Skagerack, which is in contact with water of a temperature ranging up to 5° C., forms a warm central column surrounded by cold concentric envelopes, which is the proper condition of the air for *producing or attracting cyclones.* The rough and stormy weather in the Skagerack during the winter months is very probably caused, to a great extent, by the peculiar hydrographic arrangement of water-layers of different origin at its surface, whereof the charts in Plates III. and V. give a striking illustration. Early in spring the condition changes. The Baltic Stream begins to inundate the salt and warm surface-water of the central Skagerack with a thin superficial sheet of fresh water, which is, at that season of the year, *as cold as the temperature of the air and the coast,* but becomes gradually warmer in May, June, July, and August. It is clear that only the water at the surface in direct contact with the atmosphere can exert any influence upon the weather and modify the climate. In spring, when the cold outflow from the Baltic begins to spread over the warm and salt water which in winter occupies the surface of the central Skagerack, and the sea as well as the continent acquires a uniform low temperature, the Skagerack ceases to be a centre of attraction for cyclones. Consequently, in spring, the weather in Sweden is comparatively cold and dry.

THE BOLIVIAN ALTIPLANICIE.

By D. R. Urquhart, C.E.

(*Continued from page* 312.)

I will not trouble my readers with any detailed description of the town of Oruro, which, indeed, calls for no special remark. It contains some eight thousand inhabitants, and is very regularly divided up into squares, but the meanest Indian *rancho* may be found side by side with the best building in the town. The town itself owes its existence to the many important silver-mines by which it is surrounded; and the *trapichero*, or buyer and smelter of stolen minerals, does a roaring trade here, as in fact he does in all the mining districts of Bolivia. The Orurenses are very fond of dress; and to be in anything like proper "form" here, it is necessary to wear a silk hat. It seems to be the height of the Cholo's ambition to don a pot-hat and black coat and dub himself "Doctor." Every one, from his Excellency the President downwards—lawyers, medical men, priests, prefects, and politicians—in fact, any one who is anybody at all—is a "doctor" of some kind or other, excepting, of course, the generals and colonels, who are also very numerous—more so than the privates, I should say.

As an instance of the enlightenment of these worthy burghers, I may mention that when the railway reached Oruro, and the town council had to arrange certain questions as to the location of the station and the appropriation of the necessary ground previous to obtaining the approval of Congress, the then legal representative of the company, a Bolivian and a highly intelligent, educated gentleman, who was also a councillor, was occupied for several weeks trying to get together a meeting, extracting promises of attendance and of, at least, appearing in a condition befitting the dignity of the occasion. The council being finally assembled, and the representatives of the railway present, an honourable member rose and charged another with having accused him of stealing a sack of potatoes, and the evening was spent in discussing this question. The matters of the station, etc., were not settled until the road was well advanced in construction.

Oruro, Potosí, and Colquechaca are the three great mining centres in Bolivia; the first-mentioned, however, has now a great advantage over the others, and has assumed greater importance in every way since the railway reached it.

Proceeding in an easterly direction from Oruro, we come to the lower-lying rich agricultural district of Cochabamba, with its genial climate, pretty women, and men whose sharp practice in business is proverbial over the Republic; or, going north through the cultivated pampas, we reach La Paz, the capital, where modern elegance is imitated to extravagance. From Cochabamba we may proceed to the province of Santa Cruz, where it is too hot for the European to stay long, and where the estates are so vast and the cattle so numerous and valueless that one has often *carte blanche* to shoot them, on the condition of delivering the hide to the proprietor, who will pay a small sum for it; or we may go to the fever-stricken-regions of El Beni, with its immense forests and tropical luxuriance; and so to the Brazilian frontier and into quite unexplored regions. To the north of La Paz lie the fertile valleys of the Yungas, whence come abundance of quinine, coffee of most excellent quality, sugar, coca, and other produce. Most of these districts are inhabited by Indian tribes possessing very different characteristics from those we have to do with; but we are now quite out of the Altiplanicie, to which these notes refer.

The coca just mentioned, however, calls for a few remarks, used as it is in such quantities up in the sierra. Cocaine, the extract used in medicine, is, of course, well known. The coca plant in appearance is not unlike the Scotch blaeberry, but the foliage is not so thick, and the leaves are somewhat larger. The leaves are picked and dried with great care, for they are very perishable. The plant grows in great abundance without any special cultivation in the north of Bolivia, and I have also seen it growing wild in the interior of Peru. The Indian and Cholo chew the leaves and swallow the juice. They also burn certain herbs and bake the ashes into a kind of stone (*yuta*). This, or lime, they use along with the coca to heighten its flavour. *Yuta* tastes as if it were red-hot. I cannot say whether the effect of coca is that of a narcotic or a stimulant, but I do not think that when used in moderation it is at all injurious to the system, but rather the contrary. It allays, to a great extent, the pangs of hunger and thirst, and removes the faintness caused by want of food, and is, therefore, most useful in travelling through such a country as this. The Indians, though capable of consuming enormous quantities of food, are very sparing in their use of it when they provide it themselves, and often go for days without eating; but they continually chew coca. As their digestive functions seem in no wise to suffer by these eccentricities, and as they are a very hardy, healthy race, with great powers of endurance, I take it that coca-chewing is not physically detrimental. Some say, however, that it has a *brutalising* effect on these people, which may be true. Coca may be used as a substitute for tea, and, prepared in this way, is very efficacious in curing stomachic complaints.

Of the animals which inhabit the Altiplanicie three burrowing rodents are very abundant—the chinchilla, found towards the hills and ravines; the *cuyo*, like a small rabbit with short ears; and the *curruro* or *chululo* (*Ctenomys*), of the rat species. The last is the pest of the pampas, a source of untold annoyance to the mounted traveller. The ground is often honey-combed for miles by these animals, and the horse or mule has to stumble along as he best can, for one moment on firm ground and the next sunk up to the belly in the treacherous soil. The *curruros* themselves are very rarely seen.

An animal which inhabits the rocks is the viscacha, which combines the characteristics of the rabbit, squirrel, and cat. He is herbiferous, and makes a stew, although the fastidious object to him on account of his feline appearance. On some of the hills there are deer; very fine specimens of the fox may also be seen; while the presence of the odoriferous skunk is often easily detected on the pampas. I have already referred to the vicuña; the same remarks apply to the guanaco, which is very similar, being a little larger and darker coloured. The alpaca and lama, so closely resembling each other, belong to the same family. The lama, however, is too important an animal on the pampas and sierra to be passed by without a word or two, providing as it does for all the necessities of the Indian. His clothes and cap are made from its wool, which is coarse and is not shorn, but simply detached in handfuls as it gets long; from its hide he makes his sandals, straps, etc.; its flesh he eats, although sparingly; its tallow provides him with lights; and its very bones he fashions into household implements. If he has any money it has been won for him by the toil of the lama. The male only is used as a beast of burden, and can carry about one *quintal* (100 lbs.), which, however, is an excessive load. The lama is met absolutely everywhere on the Altiplanicie, and the Indian, slowly driving along his laden flock, is encountered on every road. Only an Indian, in fact, can do anything with these beasts, which he threatens with words and gestures, but never strikes. Sometimes the leader of a flock will deliberately squat down, and his example will be followed by all the rest; but the Indian does not lose his temper and resort to violence like the white man. He simply sits down also, and, taking a handful of small pebbles, begins leisurely to pop them at the noses of the foremost lamas, which conduct soon so disgusts these animals that they rise and resume their journey. The Indian is never in a hurry; he will reach his destination some day or other. The lama is of especial utility in such a country as this, as he can exist on the scantiest herbage, and will often select a comparatively barren spot to graze upon. The alpaca is very similar, but has more wool; his legs are shorter, and he is more knock-kneed, while his snub nose gives him an air of being rather disdainful of his surroundings. The Indians rarely use him as a beast of burden, nor do they value and care for him as they do the lama. A lama is worth from ten to fifteen shillings; the Indian will not sell him to the white man, but this is the compensation demanded from a person who accidentally kills one.

The gigantic condor and the ill-omened vulture describing great circles in the sky denote the proximity of some dead or dying animal. Partridges of a very fine kind, growing to about the size of a hen and affording excellent food, are found on the hills. They seem to be easily affected by the thin air, and only fly for a short distance, when they lose their wind and can only run along the ground. The Indians, therefore, kill them with sticks; but it requires an experienced eye to follow them, even though the brushwood be scant. There are several other kinds of edible birds—wild duck, geese, and various water-fowl. The only kind of fish that is found in the rivers, that I know of, with the exception of minnows, is a small cat-fish. They were much prized by us, to whom this kind of diet was somewhat of a luxury, but their appearance is not inviting. Other kinds of fish are said to exist in Lake Poopo.

I cannot omit some mention of the mule, which is much used in Bolivia, as in all South America. He is rarely found with the Indian, but usually with the Cholo. I would recommend the mule in preference to the horse for travelling over these plains and hills, from his hardier and altogether tougher constitution, and it is well known that a mule is much more sure-footed and better able to take care of himself on perilous tracks. If one is lost on the plains it is usually safe to slacken rein and leave the matter to the mule, even although that animal may be a comparative stranger to the locality. As for his stupidity, it may be said that, out on the pampas at least, what the mule does not know is scarcely worth taking the trouble to learn. Of course, all mules do not exhibit the same degree of intelligence. A first-class riding mule may cost forty pounds and more, the average price being about fifteen pounds; pack-mules are smaller and of less value.

The conditions of existence at such altitudes as 10,000 feet and upwards are, of course, somewhat different from those at sea-level, and vary a good deal with the locality. On first ascending, most persons experience difficulty in getting enough air, and often suffer from violent headache: this is called the *soroche* or *puna*. Sometimes bleeding at the nose and ears also takes place. For the first few days, in fact, one feels exceedingly unwell; but that sensation soon wears off, although in some cases the symptoms are so serious that an immediate return to the coast is imperative. Others, again, scarcely experience any inconvenience by the ascent. If heights of 15,000 feet and upwards are climbed, however, it should be done by degrees. Although the difficulty of obtaining air soon passes off, still one is never able to sustain any violent exertion, such as running or walking quickly up a hill, for any length of time without great panting, accompanied by violent beating of the heart. I think, from what I have noticed, that healthy, powerful individuals suffer more in the ascent than those of a less robust constitution. These altitudes are said to be very beneficial to weak lungs; and I know of at least one instance where an apparently radical and rather remarkable cure was effected. Those who bear in their systems the poisons of the miasmic fevers, so general all over South America, and which have proved so fatal on the Isthmus of Panama, do well to repair for a while to these cold regions, where their former health is soon recovered. It is necessary to bear in mind, however, that digestion is to many an exceedingly difficult operation at these heights. Those persons, therefore, whose digestive organs are not of the best, or who suffer from any organic disease, had better remain at a lower level, as these infirmities in most cases become very much aggravated up here.

The Altiplanicie generally is very healthy, and epidemic diseases are little known, although small-pox has occasionally broken out with some violence; nor did it altogether escape the recent influenza.

It is expedient to avoid sudden chills, because here it is very easy to contract what is known as *puntado*, or *pulmonia fulminante*. It is a violent inflammation of the lungs, which does its work with fearful rapidity, for the sufferer does not last more than two, or at most three, days. If the coast be reached in time, however, the *puntado* invariably disappears as quickly as it came. A good many Chilians died of this complaint while we were in their territory; but on crossing the frontier, Bolivians were chiefly employed, and these were not attacked, as they are more acclimatised. The disease is usually brought on by sleeping outside uncovered, or by such acts of carelessness as rising from a warm bed and going into the cold air half clad or unshod; but it is often impossible to tell from what cause it arises. Among the Indians, the most fatal, and almost only epidemic that I know of, is called *membrana*, one of the symptoms being a mucous growth in the throat, which I take to be similar to diphtheria or croup. It sometimes clears out whole villages. In some parts they suffer also from sore eyes, resulting probably from exposure to the glare of the sun on the salt-covered plains. It is no uncommon thing to meet Indian men and women claiming to be over one hundred years of age, and looking considerably over five hundred.

The inhabitants of Bolivia may be divided roughly into three classes, which, for convenience, I shall call simply the Bolivian, the Cholo, and the Indian.

The Bolivians are, of course, of Spanish descent, and speak the language of that country. They are usually dark-complexioned, although some are fair, as the northern Spaniard often is. The Bolivian gentleman is generally quiet and reserved, being often well read in general literature and the antiquarian lore of his country, but knowing little that is of much practical utility. He possesses considerable humour and great natural shrewdness, but is by no means the man of the world that the Chilian is; nor is he given to the absurd bombastic talk so often heard from the Peruvian. His opportunities of communication with the outside world have always been scarce. The small coast he once possessed, to arrive at which was always a difficult and expensive journey, has been taken by Chile since the war, and to leave his own country now he must pass through foreign territory. He is usually courteous to strangers, and, I think, has hardly learned as yet to hate the *Gringo* or fair-complexioned race. His hatred is all concentrated on the Chilian, perhaps. The Bolivian is very patriotic: and, although not generally boastful, he has a very high opinion of the future of his country.

The Cholo, a mixture of Bolivian and Indian, combines to some extent the characteristics of the two. He forms a very important element in the population, and is to be met with in every sphere of life. Possessed of a great reserve of dogged resolution, he does all the hard work that has to be done. He is a much quieter and more submissive subject than his social representative in Chile, the Roto, who owes much of his insubordinate nature and impudence, and undoubted pluck, to a mixture with the fierce Araucanian Indians. There are many persons in Bolivia, occupying high positions and undoubtedly possessing a good deal of Indian blood, who would, nevertheless, be very much shocked and insulted by being called Cholos; because, although there are distinct types, the three classes are naturally not divided by any sharp line, but gradually merge into one another. This class talk Spanish to outsiders, but among themselves Quechua or Aymará. I was a good deal surprised to find that most of them read and write Spanish also, because, in most South American republics, this amount of education is not found among a class of similar status. The Cholo has, of course, a great contempt for the Indian—for the same reason, perhaps, that the mule hates the donkey.

About the 6th of August, the anniversary of the day—*tan glorioso y inolvidable*—when Bolivia was delivered from the yoke of Spain, the Cholo is in a state of abnormal excitement, and is drunk for a week or ten days. He celebrates his patriotism by fireworks, speechifying, bell-ringing, processions, and amateur bull-fighting; and the last-mentioned popular entertainment is usually accompanied by one or more accidents of a fatal nature, owing to the universal abuse of alcoholic beverages.

Of the three classes of Bolivian inhabitants mentioned, the Cholo is the most useful; his most objectionable quality I can only describe by the Scotch word "dourness."

From what has been said, some idea may already have been formed of the Indian of the Bolivian Altiplanicie or Sierra. It is not possible to arrive at any very definite conclusions regarding his ideas or sentiments, because, as I have hinted in a former paper, the characteristics he presents are so negative.[1] In stature, this Indian is not much over five feet high, and lean; some of them may be short and stumpy, but I have never seen a fat or even a stout one. Their features are coarse and somewhat flat, the mouth large and ugly, but the teeth as a rule beautifully white and regular. Their hair is straight and black, and they have no beard. Their expression is one of intense melancholy, and, although they sometimes grin, they are rarely seen to laugh. The sierra Indian is a mirthless, abject, spiritless creature, whose only idea of recreation or pleasure is in drunken orgies of the most disgusting nature, and whose sense of duty is shown only by grovelling before a painted doll and handing over the greater part of his scanty earnings, so tediously scraped together, to a being often little better than himself in any respect.

These people invariably carry a bundle strapped to their back, the mysterious contents of which I have never discovered. They never wash their bodies or their clothes, considering it a most unhealthy practice and productive of disease. They are of a very reticent nature, and it is impossible to elicit from them any information whatever. They will neither give nor sell anything, as a rule, to the stranger; but this may arise partly from their treatment by a large portion of the Bolivians and sojourners in their country, who often pay, indeed, but, on receiving the article, forcibly take back the money. The Indian, in fact, is often robbed and beaten into the bargain, especially by the passing soldiery. Everything that it is possible to hide he hides; and one has often to take by force such sheep, fowls, etc., as may be required, paying afterwards, of course. When they got in some degree accustomed to the railway camps, and found that they were actually paid, they gained confidence, and even brought such articles of food as eggs and potatoes for sale. They are all exceedingly drunken; but I think this may be one of the results of their "civilisation," for they have no knowledge of the manufacture of spirits; they only prepare *chicha*, a kind of cider made from maize, *Chicha de maiz* is a pleasant enough drink when made in a proper manner; but the Indian method is to start fermentation by masticating the grain.

[1] *Among the Campa Indians of Peru*, vol. ix. p. 348.

The Indians maintain an obstinate silence regarding mines and minerals, of which many of them have, doubtless, considerable knowledge. Probably they entertain some similar superstition to that which I have found among the Indians of Central America, namely, that they will die shortly after disclosing such facts. Undoubtedly, however, much of their aversion to assisting a white man—*Dago* or *Gringo*—is the result of their treatment years ago by the conquering Spaniard. Some old Indian mines which have been discovered are said to have been very carefully concealed: even the *desmontes*, or rubbish-heaps, having been removed and carried to a distance. I have remarked that the Indian hides his money; and so tenacious is he of his secret, that it is said he often dies without having mustered up resolution to disclose it even to his family. Hidden treasures do exist, and have often been found and are still being looked for in Bolivia—not only the small sums put away by the Indians of to-day, but considerable quantities of bullion concealed by them during the Spanish conquest. Other persons besides Indians have also undoubtedly preferred to place their money where it would not be affected by the political upheavals which have been so frequent in this country. These remarks apply also to Peru and other Spanish republics.

In all matters relating to money the Indian is most miserly and avaricious. Being on a journey, and having a number of mules with me, I halted one morning for breakfast and bargained with an Indian for some barley for the animals. This he brought, and its price was some twenty cents less than a dollar, which was the smallest change I happened to have. The Indian vowed he had not a cent in the world to give me change with, and I stuck to my dollar. All during breakfast, when he devoured everything offered him, he kept up a continual begging for his money. He even actually went down on his knees and wept for it. I should, of course, have eventually given him the entire dollar before leaving; but on making a pretence of proceeding on my way, the Indian produced a small bag full of twenty-cent pieces, from which he took the required change. He said he was keeping the money for the *ta-ta cura*. Everything one may wish to purchase is being kept for the *ta-ta cura*. As I have remarked, they very often feign not to understand Spanish, and in reply to inquiries invariably reply *mana cancha* (which means in Quechua "there is none," or "I have not any"), or they simply reiterate *mana! mana!* (no! no!) in a way which is very provoking. They have also an irritating habit of repeating your questions in broken Spanish and assuming an expression of helpless, vacant, idiotic stupidity. The poor wretches are beaten often enough, in all truth; but, considering their conduct, it is a wonder they are not assaulted even oftener. Whenever money is produced you may at once detect their quick, furtive side-glances, which are, however, immediately suppressed.

They very seldom do anything of the nature of hard work, but as they walk along with the lamas are continually spinning threads of its wool. Occasionally they offered themselves as labourers on the railway, but those of the pure race never stayed long. We were a good deal troubled by their placing sleepers and other obstacles on the rails in order to upset the train. In this they were probably acting by the advice of persons whose duty it was to have taught them very differently, as they themselves could scarcely have had any idea of what the consequences of such acts might have been.

The Indian can endure great fatigue: the length of the journeys he performs on foot (for he never rides), and the rapidity with which he travels, are astonishing. If you are starting on a journey on horseback, and give an Indian your parcels to carry, you will probably lose him very soon, but he will invariably be at the destination, waiting for his wages, when you arrive. Of course he can take roads which a horse could not, and he always keeps up a quick, long trot. The Indian postman running along is a common sight in Bolivia.

The Indians are taxed according to their position and the land they occupy, simply for existing in what is their rightful country, for they receive no benefit from these taxes. They have no voice in the election of any of the authorities or rulers, and they take no part or interest in the political changes and revolutionary upheavals which have always played so sadly prominent a part in the history of Bolivia, as in most other South American republics. They did, indeed, join in the movement for independence against the Spaniards, influenced, perhaps, by some illusionary idea that thus they might regain their lost freedom. They are exempt from military service, but during the war of Peru and Bolivia against Chile they were often seized on the road and forced to bear arms. They certainly would never run the risk of discharging rifles, and they deserted on every opportunity.

Precious stones of different kinds are said to be found on the mountains, but I have no certain knowledge of their existence. The Indians often possess pearls of some value, which they rarely show, and will on no account part with. They probably are from some of the existing or dried-up lakes.

The language of these people in the southern parts of the Republic is Quechua, and towards the north Aymará. I have no knowledge of these languages, but I am told by Bolivians that Quechua is very expressive, being rich in terms of endearment, and that delicate affairs of the heart may be most efficiently conducted through its medium; while Aymará is the language of command—of soldiers and heroes.

There formerly existed among these people small communities in which all property was common. They conducted transactions by barter, and did not use the metals as a regular means of exchange. This state of things is said still to prevail to some extent among the Indians of Colcha, a village not far from the Chilian frontier.

Of the social habits or customs of these Indians I have little to say. What ceremonies are observed at births, marriages, or deaths I am ignorant; I know only from one experience that at the last-mentioned occurrence they have something resembling a wake. Before Uyuni had grown to be even a village I had on one occasion to remain there on business for a day or two, and occupied an unfurnished shanty composed of galvanised iron sheets. It happened that small-pox was raging somewhat badly at the time, and an Indian family, stricken with the disease, had put up their temporary *ranchos* against one side of this building.

One individual had died, and another was apparently groaning his last. A number of old Indian hags had gathered together to celebrate the occasion, and I was kept awake all night by their howling and wailing, shrieks of laughter, and drunken tumbling against the sheets of iron. Occasionally one of them would break out into song.

It is difficult to estimate how far the Indian's wretched character is innate, and to what extent it is the result of "civilisation." I have not been able to detect in him any intellectual qualities worthy of the name. By what process of mental or bodily hammering he can have been induced to become a Christian is a marvel: however, we know pretty well the kind of arguments the earlier Spanish proselytisers used. As this Indian is really incapable of improvement, he will probably shortly disappear and leave but little trace of his existence, except, it may be, in the Cholo.

I shall conclude this article with a few illustrations of the types of character which may be encountered on the Altiplanicie.

While camping on the pampas I observed one morning a considerable group of Indians approaching, accompanying two persons, male and female, on horseback. It turned out to be a priest and his escort passing from one village to another. As they pulled up I invited him to enter and rest, which, after some hesitation, he did, ordering the rest of the party to proceed. He was a big, burly, bull-necked man, perhaps about forty years of age, with a good-humoured expression, a heavy square jaw, and a round bullet head covered with thick, short cropped black hair, shaven but bristly on the crown, as was also his face. He wore the long black coat peculiar to his class, rather stained and dusty; but otherwise his get-up was in the usual rough style of the traveller on the pampas. In his hand he carried a formidable cudgel. After his apparent restraint, or perhaps shyness natural to a person who has lived long out of the world, had worn off, he conversed freely on such subjects as happened to turn up—almost more freely than the colour of his cloth seemed to warrant—and exhibited some humour in his remarks. The lady whom I had seen arrive with him he explained was his niece; and here I may remark that the charity of the priests of Bolivia in supporting their nieces is somewhat singular.

My visitor was a man of considerable reading and intelligence. In the course of our conversation it cropped up that he contributed extensively to the newspaper literature of his country. As might be expected, some of his ideas of the outside world were very ludicrous; but he was most interesting in his talk of the Indians, who, he assured me with a significant glance at the club he carried, were a very perverse race and often required corporal correction. He was especially indignant at their having charged us more than two dollars for a sheep, which, he said, was all he ever paid. "You do not know these people yet, my friend; I must look into this matter. If ever they ask such outrageous prices again, break their heads; it is the only effectual method. You have my full authority." This he said with the air of an emperor.

He became afterwards a pretty frequent visitor to the camps, where he was quite a favourite, with his guitar-playing and rather unclerical songs and jokes. Occasionally he received instructions to repair to headquarters and give an account of his stewardship, but these orders he appeared to treat with little respect. On one occasion, however (not entirely unconnected with a lady and an irate husband), a picket of soldiers arrived and promptly marched him off to the bishop. I have not space to indulge in further reminiscences of this Bolivian Friar Tuck. He is a fair specimen of his class, as is also the "lean and hungry man who thinks too much," and who usually hides his irregularities in part under a very thin cloak of hypocrisy. I am by no means endeavouring to run down a class of men among whom there are many most cultivated gentlemen in South America, or trying to criticise any special form of religion, for that is quite out of my province; but, taken as a whole, and their profession considered, very little is to be said to the credit of the priests of the Altiplanicie.

The strolling Gaucho from the Argentine and the Chilian Roto are frequently to be met on the pampas. The latter is usually ready for whatever hard work may turn up, but is sometimes a character to be avoided. One day a young Bolivian came galloping into camp in a very excited state. He and a companion having captured two Chilian Rotos who had stolen some mules, ordered them to march to Cuzco, and on penalty of death to keep their hands from their pockets. After a time one of the prisoners begged hard to be allowed to eat some bread he had with him, and, permission being granted, immediately produced a revolver and shot his armed captor dead. He fired also at the other, who being unarmed fled, and was then on his way to Uyuni to seek assistance from the authorities there.

Another disturbance, but with a different ending, occurred at the posting-house of Parañave, which is kept by an old Indian. Two Chilians arrived there one night and forcibly demanded and obtained food, and one of them replied to the proprietor's request for payment by a slash of his *corva*, the national weapon of the Roto. This is a sharp-pointed knife, curving inwards, which makes an ugly wound. The Chilians continued on their journey the same night, but had not proceeded far when, on passing through a small ravine, they were assailed by Indians and slain by showers of stones. The victors carried the bodies back to Parañave, where they buried them, and, according to their custom, placed small wooden crosses at their heads. Although a race by no means to be trusted, this was the only actual deed of violence perpetrated by the Indians of the sierra proper (I do not include Santa Cruz) that came to my knowledge during my stay in Bolivia.

The Argentines who have wandered over here are usually tall, powerful, well-built men, more at home on horseback than on foot. They are quiet and unobtrusive, but dangerous when molested, and they usually carry a long straight knife at the back of their belt. From their skill in the management of animals and general knowledge of everything appertaining to camp life, they are most valuable on the pampas. One of them, by name Angel, accompanied me for some time, and was a most excellent servant. He was, however, credited with having committed several very desperate acts. When in liquor (which rarely happened) he would defy the whole town of Oruro, marching through the streets and up to the chief of police's quarters defiantly shouting the name of some revolutionary general. Once while in such a state he fell asleep on a doorstep, and was found in the morning dead, his head being literally battered into a pulp. The act was attributed to the soldiery or police, who revenged themselves in this dastardly manner on a foe they dared not face openly.

The *arriero*, or driver of pack-mules, is a well-known character. In all this dusty country he is the dustiest person. His black whiskers and beard, broad-brimmed *sombrero*, thick muffler, short jacket, red sash, long riding boots, enormous spurs, and even the very mule he rides, all seem to have been powdered over with a substance not unlike oatmeal. This dustiness may extend internally also, and perhaps accounts for the gusto with which he swallows down a stiff glass of brandy at the posting-house. What innumerable packages he piles up on the mules, and with what skill, so that the cargo be evenly balanced and so secured that no parcel may get unshipped even in struggling across the muddiest river! His own saddle also is a high and wonderful structure—a complete repository of blankets, wraps, lassoes, belts, and inexhaustible bags.

Disbanded soldiers, usually of some revolutionary party, are a dangerous class, as they are often armed, and are always ready for plunder. Two young Americans, out gold-prospecting, were recently shot down by a party of them without a word of warning. This desire for plunder may be said to be common to all Bolivian soldiers. Conscription is here seen in its worst aspect. The soldier is seldom or never paid even the miserable pittance he is supposed to earn. He is badly treated, badly fed, badly clothed, and often goes barefooted. His habits are dirty and slovenly. The quiet and peaceful Cholo, who, if his own will were consulted, would probably be engaged at some honest trade, is changed into a shameless thief and an importunate beggar with vicious habits that cling to him for life. On one occasion two Englishmen got into trouble with some soldiers (who also act as police) in one of the Altiplanician towns, and in the scuffle were robbed of a small sum of money. They complained to the *intendente*, or head of police, next morning, and simply on the word of these strangers two soldiers, although loudly protesting their innocence, were sentenced to twenty lashes each; and their punishment was inflicted, very probably by their companions of the previous night, with the greatest vigour and goodwill. The soldiers could not be fined (for want of funds, most likely), but the Englishmen could—and were, too; and I half expected to see some unsuspicious bystanders seized and fined also, as this course is always resorted to where practicable.

The village of Challapata, by Lake Poopo, is a centre of Indian commerce. A large part of the sugar, coffee, coca, and other produce, which comes up from the valleys of Yungas, Santa Cruz, etc., to be distributed over the Altiplanicie, passes through this town. Many of the Indians, therefore, are persons of considerable worldly means, and the *curato* (living) consequently produces a very comfortable income. The incumbent also picks up gleanings of considerable magnitude at the various *ferias*, or fairs, which are held there throughout the year. Some time ago two individuals presented themselves to the *cura* with a tale of hidden treasure. One was a Mexican, a short, thick-set man, with bushy beard and whiskers, active and determined; the other, a Spaniard, was one of those quiet, ungainly rustics who come from Galicia and are full of cunning. They represented to the priest that they had just come from Panama, where they had heard from a dying Bolivian of a treasure in bars of gold hidden near Challapata. Being poor men without even food to eat, they could not carry off the gold themselves, and therefore begged the assistance of the reverend father. A bargain was struck, and the Mexican privately suggested to the priest that when the treasure was found they might divide the Spaniard's share between them and send him about his business. These arrangements met with the approval of the *cura*, though, legally, notice should have been given to the Government, which claims a third of all treasure-trove. After living with the priest for more than a month, eating and drinking of the best, these two rascals found some bars of metal that looked like gold, which they had themselves concealed, and received from the priest 6200 dollars. Moreover, they undertook to transact some business for the priest in another town, and borrowed his horses for the purpose of travelling thither. Of course, they made for the frontier with all speed, and then by train to the coast. The Mexican spent his ill-gotten gains in less than a week at Antofagasta, but the Spaniard returned to his native country, probably to settle down as a respectable farmer.

With the introduction of the railway, and a consequently increased influx of mining prospectors into his country, the Bolivian is awakening to the fact that he cannot much longer remain stationary amid the universal progress by which he is surrounded. The go-ahead Chilian is ever ready and watching to annex more country; and the Argentine may wish to add to his already immense territories. Perhaps only by encouraging the immigration of foreigners, and thus giving to other Powers some pecuniary interest in his country, can he hope to obtain the outside protection and internal strength necessary to maintain Bolivia in an independent position.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Meteorological Observations at Edinburgh.—Mr. R. C. Mossman has kindly forwarded us a copy of a paper on this subject read before the Royal Physical Society in April last. He remarks upon the general meteorological phenomena observed during each month in 1893, and discusses the spring and summer of that year, the warmth of which the author characterises as unprecedented. Dr. Buchan having given him access to memoranda extending over 130 years, Mr. Mossman has been able to compare the figures for the past spring and summer with those for the long period just mentioned, and brings out some very interesting results. Much labour was spent in computing and verifying the old observations, and in their reduction to the mean of maximum and minimum thermometers, and to a height of 250 feet above sea-level. Having thus made them comparable, Mr. Mossman states that in 1893 March was 3·7° above the average, and was the warmest March since 1882, when the temperature was 4·2° above the average; only on eleven occasions since 1764 was a warmer temperature experienced during this month. April was 3·1° above the average, being the hottest April since 1870, when the temperature was 4·1° above the average: in eleven years since 1764 has this height above the average been attained. May showed an increase of 4·0° above the average, and was the warmest since 1848, when the excess above the average was 5·5°; only on five occasions was there so hot a May since 1764. June showed 2·9° above the average, being the hottest June since 1858, when the excess over average was 3·3°: ten Junes since 1764 were warmer. August gave a figure of 3·8° above the average, the warmest since 1819, when the month was 4·9° above the average: this height was only recorded three times since 1764. December was 3·9° above the average, the warmest since 1865, when 5·1° was the figure: eleven Decembers were warmer since 1764. The mean temperature for the three spring months of March, April, and May was thus 3·6° in excess of the average, and this spring was absolutely the warmest experienced since 1764. The rainfall, however, was not remarkably small, the precipitation amounting to 3·83 inches, spread over 27 days. The mean barometric pressure for the three months was 30·086 inches, or the highest since 1854. July 1893 was 0·9 below the average, notwithstanding which the summer was the hottest since 1868, and the mean temperature for the six months ending in August was the highest since 1826. The mean temperature for the whole year was 2·0° over the average since 1764, the only higher records being for 1857, 1846, and 1779. During the year the highest barometric reading, 30·653 inches, was observed on 8th April at 8 A.M., and the lowest, 28·510 inches, on 17th November at 11 A.M. The highest temperature in shade, 85·9°, was noted on 18th June at 3 P.M., and the lowest, 15·0°, on 6th January at 2 A.M. The greatest range of temperature, 28·5°, occurred on 18th June, and the smallest range, 3·2°, on 2nd January. The highest temperature in the sun's rays (black bulb thermometer *in vacuo*), 136·3°, was observed on 18th June. The greatest excess of sun maximum over that of shade was 60·0° on 30th May. The lowest temperature on grass was noted on 6th January, when it was 7·5°, and the greatest difference between the minimum on grass and in shade was 12·2° on 25th March. The sunniest day was 18th June, when 15 hours 9 minutes were recorded, or 87 per cent. of the possible. The stormiest day was the 8th December, when the velocity of the wind was 30 miles per hour. The greatest daily rainfall occurred on 22nd June, when 1·00 inch was registered. The paper concludes with a number of useful and interesting tables, and is illustrated by a well-produced plate showing the principal results by the graphic method.

Andorra and the French Pyrenees.—Mr. Eagle Clarke has sent us a pamphlet in which he describes a visit he and Mr. Basil Carter made some time ago to the Pyrenees and the Republic of Andorra with a view to the study of the avi-fauna. They first established their headquarters at Ax, a pleasant little town in the very heart of the French Pyrenees, where the confluence of the Ariège, Upper Ariège, and La Lauze takes place. In the neighbourhood are several underground caldrons, the waters in which vary considerably in their chemical constituents, and range in temperature from 76° to 113° Fr. The fine scenery and the health-giving properties of the hot springs make the place a locally popular resort. The valley, here attaining a height of 2300 feet above the sea, is narrow and shut in by high mountains, the lower slopes of which are covered with forests of oak and other deciduous trees, and with coppice and brushwood, succeeded higher up by beech woods, followed again, at a height of 4500 feet, by grand forests of pine, the sombre foliage of which contrasts pleasingly with the perpetual snow above and with the bright green of the beeches below. Pasture-lands, on a limestone formation, stretch eastwards from the woods. At Tarascon the valley was found to be well cultivated, rich meadows, orchards, and vineyards covering the ground. Above Ax the valley becomes narrower, until at Merens the mountains close in, leaving a narrow gorge with rocky and precipitous sides, only wide enough to contain the road and the bed of the Ariège. Farther up trees almost entirely disappear, and the scenery becomes bare and rocky. Hospitalet, the last village in France, is a miserable little place, situated at a height of over 4600 feet above sea-level, and begirt on three sides by peaks and ridges covered by perpetual snow. The village streets are narrow and winding, full of filth and garbage cast from the doors and windows of the houses. Two passes, the Port de Framiquel and the Port de Saldeu, both at an elevation of about 8200 feet, lead from Hospitalet into Andorra. With considerable difficulty from the amount of snow which the travellers found, even in May, a hindrance to their advance, a passage was made through the Port de Saldeu. At heights above 6000 feet snow covered the ground and river, only an isolated rock showing here and there above the white sheet of winter. At the top of the pass a scene of great grandeur was presented; numerous peaks rising to heights of 10,000 feet, and connected by snow-clad ridges, were on all sides, completely hemming in the little Republic of Andorra, which can only be approached by mule-paths. Andorra is physically part of Spain, being included in the drainage area of the Ebro; its people are Catalans, and therefore of the Iberian race; yet French influence predominates and is desired, while the ecclesiastical government is in the hands of the Prince-Bishop of Urgel. The people are below the middle height, and are not distinguished for good looks. They are very industrious, pushing the area under cultivation well up the mountain slopes, and have constructed efficient and excellently planned irrigation-works in the neighbourhood of the town of Andorra. Their flocks comprise sheep, cattle, goats, and mules. The chief part of the agricultural work falls to the share of the women, the men being mostly occupied in smuggling, at which they are adepts, and for which the physical features of the country present many advantages. Matches and embroidered scarfs form the largest items in this contraband trade with France. Saldeu was found to be a wretched little hamlet, situated at a height of 6000 feet, and in the end of May still surrounded with all the appearance of winter. Some pasturage and a few pine-trees alone afforded some relief to the eye. At Canillo the appearance of the country changes for the better. Arable land and pasturage are both rich, there are considerable wooded areas, and the scenery is fine. The village stands at a height of between 4000 and 5000 feet above the sea. Lower down the valley of the Valira becomes narrower, but opens out a little at Encamp, only to again close in above Escaldas. The town of Andorra stands at a height of 3400 feet, and has a population of about one thousand. The houses are mostly hovels, built with no regard to order, and standing at all angles to the narrow, dingy, evil-smelling passages which do duty for streets. The Casa del Valle, or Parliament-house, is the chief building, and the meeting-place of the Council-General. The surroundings of the town are very pleasant, the land being well cultivated, hundreds of acres being under white narcissus, and the scenery of an enchanting description. Below the town the valley again contracts, and still farther down is the hamlet of San Julia, on the lowest land in the Republic, only 3000 feet above sea-level; it stands close to the south-western frontier of the territory.

Ornithologists will find much of interest in Mr. Clarke's pamphlet. He catalogues the birds observed, with their range in regard to altitude, and records not a few discoveries of importance.

AFRICA.

Great Britain and the Congo Free State in Central Africa.—On May 12th a convention was signed at Brussels giving to the Congo State the Bahr-el-Ghazal, under certain restrictions, and regulating the boundary between that State and the British possessions. · From Cape Akalunga on Lake Tanganika, at about 8° 15′ S. lat., the line will run to the point where the Luapala flows out of Lake Moero, and will pass on to the mouth of the Luapala at the southern end of the lake, leaving the island of Kilwa to Great Britain. It will then follow the river to Lake Bangweolo, and thence run due south to the crest of the watershed of the Congo and Zambesi, which will form the boundary as far as the Portuguese frontier.

To the north of the German sphere of influence in East Africa the frontier is to follow the 30th meridian of E. longitude up to the watershed of the Congo and the Nile, which is the limit fixed to the north and north-west. The Bahr-el-Ghazal, however, and the western part of the Equatorial Province are to be granted on lease to the Congo State. This territory will be limited by a line starting from a point on Lake Albert immediately to the south of Mahagi, and running to the nearest point of the watershed before-mentioned. It will then follow the watershed up to the meridian of 25° E. long., and this meridian to the parallel of 10° N. lat. This parallel will mark the northern boundary as far as the Nile, somewhere to the north of Fashoda. The eastern boundary follows the Nile and the western shore of Lake Albert. This lease is to remain in force during the reign of King Leopold II., but at his death the territory will be limited on the east by the 30th parallel; the Congo State, however, retaining a belt 15½ miles broad (25 kilomètres) to be determined by agreement, stretching from the watershed to the lake, and including Mahagi. With this modification the lease is to continue in force as long as the Congo basin remains an independent State or a Belgian colony under the sovereignty of the King and his successors.

On the same terms as the territory to the west of the 30th meridian is granted to the Congo State, Great Britain obtains a lease of a belt of country 15½ miles broad, extending from the most northern port on Lake Tanganika to the most southern point of Lake Albert Edward. In the territories granted on lease, the subjects of each of the contracting Powers shall enjoy all the rights granted to the subjects of the other Power.

The Congo State authorises the construction, by the British Government, or a company duly empowered to carry out the work, of a telegraph line connecting the British possessions in South Africa with its territory on the Nile, the Congo State having the right to connect this line with its own system.

The Congo State and Portugal.—The boundary between the Congo State and the Portuguese territory in West Africa, which was roughly fixed by the convention of May 25th, 1891 (see *S.G.M.* vol. viii. p. 443), has been delimitated by the Rev. G. Grenfell and Captain Gorin on behalf of the State, and Lieut. Sarmento representing the Portuguese Government. The rivers Wambi, Kwilu, and Loangwe were crossed by the commissioners at altitudes of 3000 to 3600 feet. Great suffering has been caused among the natives by the raids of the Kiokos, and it will be necessary for the State to establish a service of steamboats on the Kwango, in order to reach this part of its territory and protect its people. The oil-palm flourishes everywhere up to an altitude of 2300 feet as far south as the 7th parallel, where its place is taken by the *Raphia vinifera*. Along the Kwango caoutchouc, *Pandanus* and papyrus are found in abundance. The borassus palm and the tree that yields copal gum, as well as the wild coffee so common along the Congo, do not grow here ; but there are pine-apples in the woods, and sugar-cane, cotton, tobacco and hemp flourish in the Lunda valley with little attention. The fauna calls for no special remark.

The *Mouvement Géogr.*, No. 8, contains a map of the new boundary. It will be seen that the modifications have been in favour of the Congo State.

Scientific Work on the Congo.—As announced in vol. vi., Captain Delporte was, in 1890, commissioned to undertake a series of scientific observations along the Congo river. On July 3rd of that year he embarked with Captain Gillis at Antwerp, and arrived on August 5th at Matadi. Unfortunately, at the end of February both officers were attacked by dysentery, and on May 26, 1891, the leader of the expedition expired at Mpozo, not far from Matadi. A report of the results of these observations has been drawn up by Captain Gillis, and has lately been published in the *Mémoires de l'Académie royale de Belgique.* The objects of the expedition were (1) to determine the latitude and longitude of a large number of points on the river Congo and in the heart of the country, so as to cover the territory with a network which might hereafter serve as a foundation for triangulation ; (2) to study the magnetic declination, dip, and intensity. Captain Delporte gave a detailed account of his programme in a pamphlet entitled *Exploration du Congo*, published at Brussels in 1890. The *Mouvement Géogr.*, No. 5, contains a table of the astronomical observations taken at various points between Matadi and Stanley Falls. The geodetic operations actually accomplished comprise only three small triangulations, one connecting Matadi with Ango-Ango, the others relating to Stanley Pool and the island of Bamu. Magnetic data were obtained from twelve stations along the Congo, and altitudes were determined with the barometer and boiling-point thermometer.

Meteorological Observations at Equatorville.—In the *Bulletin de la Soc. Roy. Belge de Géographie*, No. 1, Lieut. Ch. Lemaire publishes the records of observations made at this station on the Congo from April 1891 to December 1892. Equatorville is situated in lat. 2′ 30″ N. and long. 18° 15′ E., at an elevation of 1050 feet above the sea-level. Diagrams of the temperature for each month are given, and then M. Lemaire summarises the results. The greatest heat experienced was 94° F., on April 3rd, 1892 ; on March 25th the thermometer rose to 93°, and to 92° on March 23rd. On these three days the heat was most oppressive, and the temperature in the sun reached 122°. During the whole period of 21 months a higher temperature than 89½° was, however, recorded only on ten days. The lowest daily maximum was 71°, on February 15th, 1892. The lowest minimum, 64°, was registered on June 2nd and 14th, 1892 ; these nights seemed remarkably cold. On 20 days in all the thermometer sank to 66° or below. The highest minimum was 77°, on April 29th, 1891. Taking the highest maximum and lowest minimum, we find that the range of temperature was 30°. The greatest range in 24 hours was from April 4th, 1892, to the minimum of the following night, and amounted to nearly 25°. The cold nights cause colds and bronchitis among the natives, but do not affect the health of Europeans. M. Lemaire divides the year as follows : from the end of January to April—hot season ; May—the season of least storms ; June to August—season of fresh breezes ; September and October—temperate season ; November to early part of January—season of rains and storms. The mornings he speaks of as fresh and pleasant, and the evenings are also remarkable for their agreeable air and bright moonshine. He maintains that the climate is well adapted for Europeans, and that a white man can work all day at Equatorville. As a proof of the healthiness of the country he mentions that Mr. and Mrs. Blair Banks have lived at a mission station $3\frac{1}{2}$ miles below Equatorville for seven years, and that their three children, all born on the Line, are in robust health. This instance would be more convincing if the children were three or four years older. Of the agricultural value of the country M. Lemaire speaks with enthusiasm. Maize yields three crops a year without irrigation, and cocoa produces fruit only two and a half years after it is planted. Coffee also, kola, and a large variety of fruits grow luxuriantly. Pine-apples thrive with extraordinary vigour.

AMERICA.

A National Park of Canada.—A rectangular area surrounding the village of Banff, 51° 10′ N. lat. and 117° 53′ W. long., has been set apart by the Canadian Government for a national park. Its length, from east to west, is 25 miles, and it measures 10 miles from north to south. It is traversed by the Pacific Railway at an altitude of 4500 feet. The railway company has done much to render the country accessible to visitors by making good carriage-roads to the warm springs on Sulphur Mountain through the grand pine-forest; the Bow and the Spray are crossed by iron bridges, and paths to the cañon of the Sundance, a small affluent of the Bow, and to the foot of Cascade Mountain. The highest summits in this district attain a height of 10,000 feet, and are clothed with forests to an altitude of 7000 feet.—*Annales de Géographie*, April 15th.

Newfoundland.—The railway from Placentia Junction to Port au Basque will be about 500 miles in length. Two hundred and thirty-seven miles have been constructed, and it is expected that the whole line will be completed by the end of next year. After leaving the peninsula of Avalon the railway runs northward past Random and Clode sounds, and crosses the Gander river near the lake of the same name, and then passes on to Exploits Bay, 257 miles from St. John's. The route then runs north-west to Lake Bond, crosses the Great Barrens, the bare stony ridge between the basins of the Exploits and Humber rivers, and comes to the Grand Lake and its charming scenery. Then the Deer Lake is reached and the Humber is followed to its mouth. After this the railway will run south-westwards to St. George Bay, the Codroy river, and Port au Basque. There is some good pasture-land along the route, especially in the Humber and Exploits valleys, fine scenery and good sport. Seals are very numerous on the west coast, ascending the rivers and destroying the salmon.—*The Colonies and India*, April 7th.

AUSTRALASIA.

The Railways of New Zealand.—The construction of railways in this colony was commenced in 1861 with a line, 8 miles long, from Lyttelton on the east coast of Middle Island to Christchurch. Owing to the difficulty of making a tunnel $1\frac{3}{4}$ miles in length through the intervening mountain range, the work was not completed until the end of 1867. In 1870 the lines opened for traffic were only 45 miles in length, while in 1893 the total length had reached 1897 miles, the cost of construction being on the average £7812 per mile. The gauge is 3 ft. 6 in. Besides these State railways there are lines of the aggregate length of 150 miles belonging to private companies, of which the most important is that running from Wellington to the Manawatu river on the west coast of North Island, a distance of 84 miles.—*Deutsche Rundschau*, Jahrg. xvi. Heft 7.

Neu-Mecklenburg.—This island, formerly called New Ireland, stretches from north-west to south-east, and has a bend in its southern part which gives it the form of the butt of a revolver. It is narrow, and gives the impression of being a lofty mountain chain which has subsided beneath the waters, leaving only its highest peaks still visible. In consequence of this configuration the coast is but little indented ; the whole south-west coast, extending for a length of nearly 250 miles, has scarcely any opening deserving the name of a harbour. At the southern extremity there are some roadsteads, and at the northern end the numerous small islets and coral reefs form sheltered anchorages. Geologically the island falls into three divisions. No one has yet ventured into the ravines of the northern portion, but its formation may be learnt from an inspection of the islets which in former times were probably connected with the main island. They consist of clastic rocks resembling granite in colour. The extreme north-western end of the island is a long plain of laterite sloping to the sea. The middle part, in which a sudden dip occurs, appears to be composed of alternate strata of limestone and sandstone, lying on volcanic rocks of various kinds. The brooks have in some places cut deep into this formation, and carry down fragments of porphyry, basalt, diabase, and granite ; nor is anhydrite wanting. The southern part of the island seems to be entirely of volcanic origin ; at this end the land spreads out, and the mountains attain a greater elevation, several summits being, perhaps, 6500 feet high. The surface is covered with forest, except in a few small patches, where ferns and grasses, chiefly *alang-alang*, take its place. Except in the southern part, however, the trunks are not large enough to yield useful timber.

Neu-Mecklenburg seems to be inhabited by three different types of men. It may be shown that not so very long ago an immigration took place from the Gazelle peninsula. The intruders settled in the middle part of the island, cutting off communication between the original inhabitants at the northern and southern extremities, who in course of time developed into distinct types. The physical difference of the people of Neu-Pommern (New Britain) and the aborigines of Neu-Mecklenburg is striking, and especially, according to Count Pfeil (*Petermanns Mitt.* Bd. xlviii. No. 4), in the smell, the native of Neu-Pommern being a very unpleasant neighbour except when he has been chewing betel. The aborigines at the extremities of the island have more elegant figures than the later settlers, broader foreheads, better-shaped noses, and thinner lips. They are more intelligent and less opposed to innovations, and will give the stranger food, though they are quite ready to eat him up when they get an opportunity. The people of Neu-Mecklenburg also distinguish themselves by greater cleanliness in their houses and persons, and are braver, not fearing occasionally to attack their enemy openly. They make spears with points of hard wood, and axes of shell, porphyry, and greenstone ; but now the latter have almost entirely given place to cheap axes of English make, to which the natives fix wooden handles 3 or 4 feet long. Drums are made, some of them very large, and a code of signals is used. The wood-carving is remarkable for the drawing and originality. One specimen seen by Count Pfeil deserved notice both on account of its fine work and because it represented a bird of paradise and a monkey, creatures not found on the island. Shell ornaments are much in vogue. A very elegant one is made of a piece of *Tridacna* shell varying in size from that of a half-crown to a saucer, on which is laid a piece of tortoise-shell of the same size with a pattern cut through it.

The only domestic animals are thin, long-legged black pigs. *Taro* and yams are cultivated, the work being done by the women, and also another root, which Count Pfeil found only on the mountains of the middle part of the island : it is like a new potato, with a sweetish taste ; but as the plant was not in flower, Count Pfeil could not determine its family. Sago, fish, banana, and human flesh are also used as food, the last being eagerly sought for. In some districts they burn the dead, and in others throw them into the sea. The men of Neu-Mecklenburg are enterprising traders, and extend their operations to distant islands. In the south and east very good canoes are made of planks fastened together with *Pandanus* fibres, and caulked with a resinous substance. Shell-money of different kinds and values serves to facilitate exchange.

Count Pfeil succeeded in crossing the island twice at the narrow part to the north-east of Neu-Lauenburg, attaining a height of 5900 feet. He found no cockatoos or parrots on the island. Wallabies and cassowaries, which live on the Gazelle peninsula, are not found here, but the whitish-yellow pigeon of the Torres Straits is common. Butterflies are not numerous ; beetles are better represented. Of large game there is none.

GENERAL.

The Crust of the Earth.—At a meeting of the Royal Society of Edinburgh, Dr. John Murray, of the *Challenger* Expedition, read a paper on the *rôle* of quartz in the evolution of the larger surface-features of the earth's crust. The careful examination of all the samples of deep-sea deposits collected during the last quarter of a century showed that the sedimentary materials now being laid down on the floor of the ocean in deep water far from land contained only the merest traces of free quartz. It might, indeed, be said that free quartz particles were practically absent from the deposits covering that half of the Earth's surface known as the abysmal regions. The average level of the plane of the abysmal regions lay at about three miles beneath the plane representing the average height of the continents. Free quartz particles, however, were abundant in all the shallow and deep-sea deposits laid down near the land. Occasionally these particles of quartz made up eighty per cent. of the whole deposit in the terrigenous areas. Free quartz particles were also so abundant in continental rocks that they probably made up a third of the mineral particles in the series of geological formations.

The average chemical composition of the abysmal deposits showed only about 36°/₀ of silica, while the terrigenous deposits and continental rocks showed about 68°/₀ of free and combined silica. Lime, iron, manganese, magnesia, and the alkalies had accumulated in the ocean and in the abysmal deposits at the expense of the rocks of the continents. The bases were being continually leached out of the rocks of the continents and carried away in solution, the grand result of all the denuding and disintegrating agencies now at work being the ultimate deposition of the greater part of the heavier materials in the abysmal regions, and the accumulation of the lighter quartz on or near the continents. Continental rocks had an average specific gravity of about 2·5 ; the abysmal deposits would form rocks with a specific gravity of over 3·1. In the original crust all the silica was probably combined with bases, the rocks being much less acid than granite. Although the isothermal lines might rise under the continents, the line of fusion would sink, acid rocks being less fusible than basic.

If this process had been going on since the original formation of the crust, a heterogeneous arrangement of the superficial layers would be the result. Many considerations indicated that the continental masses were lighter portions of the Earth's crust. Pendulum observations indicated a deficiency of mass beneath the continents. The plumb-line along continental coasts tended towards the ocean basins. If the figure of the earth be due to its rotation and the mutual gravitation of its own parts, why is it not an exact oblate spheroid? How have the inequalities of continental protuberances and ocean basins arisen? The materials of the Earth's crust are not rigid enough to maintain the continents in their elevated position against gravitation ; but these continental bulges might be maintained in a state of equilibrium without strain if composed of lighter material, such as an accumulation of quartz on these areas would produce. From experimental evidence it was held that rock-masses were formed of those substances which became denser in consolidation, and hence at a given temperature would tend to melt or become viscous with increased pressure, and become solid with removal of pressure. Deposition along continental margins would increase pressure, denudation from continents would relieve pressure, with the result that a flow of rock material largely composed of an excess of silica would take place towards the continental areas in order to restore the equilibrium disturbed by the process of denudation from the continents and deposition along the continental margins.

These suggestions might assist towards the solution of some difficult problems of geology and physical geography. The continental masses appeared to have commenced as low ridges of no great extent, and with time they had grown in extent, had united and become more elevated. The oceanic areas, on the contrary, had less extension than in early times, but the ocean had become deeper. The abysmal areas and the continental areas seemed never to have changed places on the surface of the earth, although a deep sea might often have existed on what are now the continental areas.

Thunderstorms.—*La Geografia per Tutti*, April 30th, states that thunder is most frequently heard in Java, where there are thunderstorms on 97 days in the year. After Java comes Sumatra, with 86 days; India, with 56; Borneo, with 54; the Gold Coast, with 52; and Rio de Janeiro, with 51. In Europe, Italy takes the first place, with 28 days; Austria, Baden, Würtemberg, Hungary, Silesia, Bavaria, and Belgium have storms on more than 20 days; Holland, Saxony, and Brandenburg on 17 or 18; France and South Russia on 16; Great Britain and Switzerland on 7; Norway on 4 days. Cairo has storms only on 3 days in the year, and in Eastern Turkistan these phenomena are of very rare occurrence. The northern limit of thunderstorms passes by Ogle Point, Iceland, Novaia Zemlia, and the coast of Siberia.

Chart of Equal Annual Ranges of Temperature.—Mr. J. L. S. Conolly has drawn up a chart on the basis of Dr. Buchan's. Dr. Supan drew a map of the temperature differences of the warmest and coldest months, but he had not the advantage of the use of the *Challenger* material. The chart of Mr. Conolly shows that the Torrid Zone is on the whole a region of moderate annual range of temperature, while the North Temperate Zone has greater variations than the South Temperate, and, in general, the Northern Hemisphere greater ranges than the Southern, the large water area in the latter rendering the temperature more uniform. The effect of insolation and radiation over large areas of land is shown by a range of 120° in part of Northern Asia, and one of 80° in North America. In the Southern Hemisphere the greatest range is 30°. The eastern coasts of continents in the North Temperate Zone have as a rule greater ranges than the western, owing to the winds prevailing over the latter coming from the ocean.—*The American Meteorological Journal*, April.

MISCELLANEOUS.

The *Comptes Rendus* of the Paris Geographical Society, No. 6. contains a list of positions determined by **M. Monteil** on his journey from the Senegal to Tripoli.

Mr. Thomas Scott, of the Fishery Board for Scotland, has contributed an important paper to the *Proceedings of the Royal Physical Society*, showing the **geographical distribution** of the **Entomostraca** in the **island of Mull**.

In the *Zeitschrift der Gesell. für Erdkunde zu Berlin*, Bd. xxix. No. 1, Dr. Philippson describes in detail **Lake Copaïs** and its neighbourhood. This article, accompanied by maps and sections, is of great interest to geologists.

On February 1st a railway, 100 miles long, was opened, connecting Valencia and Caracas, the two chief towns of **Venezuela.** In 1893 the total length of Venezuelan railways was 287 miles.—*Mitth. der k.k. Geogr. Gesell. in Wien*, Bd. xxxvii. Nos. 3 and 4.

A biography of the late **Dr. John Rae, F.R.S.**, the Arctic traveller, being in course of preparation, Mrs. Rae will be obliged by the loan of any correspondence or other documents likely to be of use. Her address is: Mrs. John Rae, 10 Royal Terrace, Warrior Square, St. Leonards-on-Sea.

Mr. H. A. Bryden, author of *Gun and Camera in South Africa*, says, in a letter to *The Field*, that the bontebok is now only preserved on one farm in Cape Colony; that of the white-tailed gnu, or black wildebeest, only a few hundreds are now to be found grazing on one or two farms in the Orange Free State; the blesbok exists in small and ever decreasing numbers in the same State and in the Transvaal; and the mountain zebra (*Equus Zebra*) is to be seen only on a few of the less accessible ranges of South Africa, and is rapidly approaching extinction. All these animals were plentiful not very many years ago.

The *Revue Française et Exploration*, May, reports that the Swedish captain, Hans Johannessen, having heard of land of considerable extent lying about 15 miles to the north of the New Siberia islands, set out to visit it. Being enclosed among the ice, he had to winter at these islands, where he suffered from cold and hunger. Taking advantage of a break-up of the floes, he succeeded in casting anchor on the shore of this new land, which he called **Hansenland.** It is desolate and without vegetation, and covered with high mountains and deep valleys in which numerous glaciers descend to the ocean.

From two pamphlets sent to us by Mr. F. H. Worsley-Benison we learn that the height of the **tidal-wave in the Wye and Severn** has hitherto been greatly exaggerated. It has been sometimes given as 70 feet or over at Chepstow, and 60 is a very common estimate. It now appears from careful measurements, made by Mr. J. G. Wood, that the highest known tide at Chepstow, in 1799, could not have been as much as 50 feet above the level of the water at the ebb. The height reached by the water in January 1768 was probably due to heavy floods. In the Bay of Fundy the tide is said to reach a height of 70 feet, and this is probably the only place in the world where it exceeds that of the Severn.

The Summer School of Art and Science, which we have noticed several times in previous years, will be opened from August 6th to the 31st. A course of lectures on Applied Ethics and Sociology will be delivered by Professor Geddes, assisted by Dr. Dyer, Mr. J. S. Stuart-Glennie, and M. Desmolins; Mr. V. Branford, Mr. Stuart-Glennie, and Mr. Cecil Wyld will have charge of the History, Literature, and Language Class; Mrs. Boole and Professor Lloyd Morgan will give instruction in Education and Psychology; Dr. Stephens on Hygiene; Dr. Irvine, Miss Newbigin, and Messrs. J. A. Thomson and R. Turnbull on Biology; and Messrs. Herbertson and Goodchild will both deliver lectures and conduct geographical and geological excursions. As usual, there will be an Art School, conducted by Miss Johnston, Miss Helen Hay, Messrs. W. G. Burn-Murdoch and John Duncan, and also a Sloyd course. All communications should be addressed to Dr. Riccardo Stephens, University Hall, 4 Ramsay Gardens.

The Colonies and India contains particulars of the expedition about to be undertaken by Mr. W. A. Horn of Adelaide to the MacDonnell Ranges. Mr. Horn will have charge of the expedition, and, along with Professor Spencer, will make numerous photographs. Professor Ralph Tate is to conduct the palæontological and botanical researches, while Dr. E. C. Spencer, C.M.G., will attend to ethnological matters. Other members of the expedition will be Mr. Charles Winnecke, surveyor and explorer; Mr. Watt, field geologist; and Mr. F. W. Bell and Mr. G. A. Keartland, ornithologists and collectors. Four camel-drivers will accompany the party. Leaving the railway at Oodnadatta, the party is to follow the Fincke River to its confluence with the Palmer, then to Petermann Creek, where fossils have been already found, afterwards pushing on to Gill's Range, Glen Edith, Glen Helen, and Hermansburg, where there is a Lutheran mission station. The explorers then propose to visit the Glen of Palms and the Alice river, and return to the railway somewhere near the overland telegraph line. Three months will probably be passed in the interior.

NEW BOOKS.

The Rhind Lectures in Archæology. Scottish Land-Names: their Origin and Meaning. By Sir HERBERT MAXWELL, Bart., M.P., Rhind Lecturer in 1893; Author of *Studies in the Topography of Galloway, Meridiana, Life and Times of the Right Hon. W. H. Smith,* etc. etc. Edinburgh and London: William Blackwood and Sons, 1894.

In the title of this handsome volume of 219 pages the author discards the word "Topography," used by him in his previous work on the Place-Names of Galloway. He has acted rightly, for Topography has a province of its own, distinct from the origins and meanings of names. It may, however, be doubted whether "Land-Names" (including references to the sea) is any improvement on Place-Names. There seems to be room for some new word of scientific precision for the science of proper names, in their two divisions of local and personal, on both of which Sir Herbert Maxwell has written pleasantly. But there can be no doubt as to the scientific spirit in which the author sets about his task. He devotes the first of the six lectures to the general principles that regulate the study of place-names. All these, as he points out, have a real meaning, though even the physical features that so frequently suggested the names may have long ceased to be recognisable, as in the case of "London," from *lon dyn*, "the marsh fort." Sir Herbert insists on the rule that in attempting to arrive at the true meaning of a place-name we must pay special attention to stress. Names are often combinations of words constituting a description, and the law of accentuation for these compounds or quasi-compounds makes the emphasis fall on the *describing* word. Thus in both the Gaelic and the English form of the name of the Scottish capital, Dunedin and Edinburgh, the accented word is *Edin*, the meaning being given as "Edwin's stronghold." By noticing the stress we should be able to say, not necessarily what the meaning is, but very often what it cannot be. It is also always desirable to hear the local pronunciation of a name; but corruption of sounds, arising from various causes, makes recourse to the original orthography of the first importance. We are not, for all that, to be slaves to letters. Sir Herbert gives a list of no fewer than twenty-five ways of spelling the name of his native province of Galloway, "all these renderings pretty well concealing the original name." In discussing the languages of old Scottish place-names the author, after noting the slender contribution made by Latin, reviews what has been ascertained about the pre-Celtic inhabitants of Scotland; but that, at least as regards their language, is very little. Nor can much more be said of the Picts; still, a sufficient number of their place-words has survived to furnish ground for controversy, in which Sir Herbert mildly joins. Most of the Scottish names are in Old-Norse, Anglo-Saxon, Welsh, or Gaelic, especially in the last. Inflexion plays an essentially important part in Gaelic place-names, and for the assistance of those who would elucidate them some grammatical information is here supplied; but it might perhaps have been as well if, in its stead, a simple statement had been made to the effect that the lowest qualification for interpreting Gaelic names should include ability to decline the article, orally and in writing, with nouns and adjectives of either gender. Numerous words in the various languages are discussed, and the concluding lectures treat of the lessons that the study of the subject conveys. Not much, in Sir Herbert's opinion, is thus added to our knowledge of history, but a great deal may be learned about the appearance of the country in ancient times, and something also about the occupations and social circumstances of our ancestors. A detailed and interesting account is given of the names of plants, animals, trades, etc., that are preserved in the topographical nomenclature of the country. Throughout the work many collateral topics are introduced; and full exemplification, apt analogies, humorous touches, and amusing instances of mistakes illustrate and enliven its pages. The names discussed are reduced to alphabetical order, analysed, and explained in an index containing about a thousand entries. This will prove one of the most useful features of the book.

In a work that modestly does not claim to be even tolerably exhaustive we may not complain of omissions, but surely such characteristic words as *Aber* and *Inver* are worthy of more than casual mention. Occasionally, it may be remarked, Sir Herbert transgresses his own rules, as for instance when, in explaining "Pitlochry," he takes neither the Gaelic form nor the vulgar local English "Pitclochry," but the genteel rendering, and calls the place "rushy" instead of "stony." With another word, also involving *stone*, he makes a double mistake. The Gaelic place-word *clachan* has its termination ("a common topographical affix," as it has been called) broad and open, and is not the plural of *clach*, where the ending is obscurely sounded like *en* in *oxen*. Then it does not mean a hamlet. It originally meant an enclosure within a stone-wall, a churchyard. Then it came to mean a church, and its use in this sense is hardly yet obsolete in the Highlands. In some parishes "Bail' *a' chlachain*" has as its exact equivalent in English "*The Kirk*town." The spontaneous use of "clachan" in any sense has probably ceased in the Lowlands; but "kirktown," and not "an ordinary hamlet," is the meaning that gives point to the line of Burns locating Jock Hornbook. Slips like these, however, do not detract much from the value of an industriously compiled, sensible, and learned yet thoroughly readable book.

Urquhart and Glenmoriston: Olden Times in a Highland Parish. By WILLIAM MACKAY. Inverness: The Northern Newspaper and Printing and Publishing Company, Limited, 1893. Pp. xxi + 594.

Few, if any, such limited districts as the parish of Urquhart and Glenmoriston have been treated of in a volume like that before us. Loving and painstaking care, intimate local knowledge, scholarly research, and unbiassed judgment mark every page, and render the work as complete, accurate, and pleasing a piece of historical investigation regarding a limited area as we have ever seen. A work so thoroughly carried out must form instructive and interesting reading to those who know little or nothing of the district described, while to natives and those having any kind of interest in the locality the perusal of the author's pages will be a delightful and profitable task. One drawback the southern reader will soon detect: the "asperous names," so dreaded by one well-known Highland historian, have no terrors for Mr. Mackay, who deals them out with a lavish and unsparing pen. The early semi-mythical or legendary history of the parish is lightly passed over, and then the author begins a minute and searching inquiry into all the many subjects which concern him and his readers, in a manner that calls forth admiration. The frequent references and explanatory notes are a most excellent feature, while the style is easy, luminous, and distinct. Space will not allow us to quote, or even to follow the course of events discussed, much as we should like to do so; all we can add is, that besides the history proper we have chapters on the ecclesiastical, educational, literary, and industrial history of the district, with a dissertation upon its folklore. The first of these chapters is especially graphic and entertaining, and brings out in a manner we have never before seen the seemingly common practice of the celebration of irregular marriages by the Highland clergy. In this connection we have a narrative, in quaint but forcible language, of the notorious marriage of Simon, Lord Lovat, in which dirks and bagpipes played an uncomfortable and unusual part. The appendices are of great value, and include a description of Urquhart Castle as it was, by Provost Ross; details of spuilzie taken in 1545 and 1746; ancient documents made public for the first time; specimens of Gaelic poetry; lists of persons connected with the '45; stipends at various periods; local place-names, etc. As will be seen, the volume is a mine of wealth to all interested in the Highlands, and a better book on the various subjects treated of must be hard to find. We congratulate both the author and the parish on the result of what must have been years of labour, and the publishers upon the manner in which they have produced a volume pleasant both to read and to handle. There are pleasing illustrations and a good index. When the next edition is called for, may we venture to suggest the addition of a large map of the parish, containing, at least, the principal names mentioned in the text?

Korea and the Sacred White Mountain: being a brief Account of a Journey in Korea in 1891. By Captain A. E. J. CAVENDISH, F.R.G.S. Together with an Account of an Ascent of the White Mountain, by Captain H. E. GOOLD ADAMS, R.A. London: George Philip and Son, 1894. Pp. 224.

Although Captain Cavendish was unlucky, his kodak pictures turning out bad, his tiger-shooting proving a failure, and his ascent of the White Mountain being accomplished only by his comrade, he has written an interesting book, illustrated by native sketches executed by a Korean gentleman, and by two good maps of Korea by W. and A. K. Johnston. Landing at Chemulpho, the port of Soul, the capital of Korea, on 28th August 1891, Captains Cavendish and Adams pushed on to Soul, then crossed to Wön San by a road hitherto untravelled by Europeans, then struck north to Chang-Jin and Kapsin, and finally reached Pochön, from whence Captain Adams ascended the White Mountain (8900 feet high). Captain Cavendish returned alone *viâ* Pukchong to Wön San, and sailed on 23rd October 1891 for Japan.

Captain Cavendish gives some instructive details regarding the rivalry between China, Japan, and possibly Russia, which is going on at present in Korea. He says: "Strictly speaking, Korea has no army; she does not want one, nor has she pecuniary resources wherewith to provide one in a modern and Western sense.

For centuries a bone of contention between China and Japan, Korea finds her safety in the jealousy between these two countries. Though conquered by the former and now nominally her vassal, she is practically independent as far as her internal affairs are concerned ; the Japanese have long coveted the country, and indeed, after several invasions, held it tributary for many years, but Korea, with the aid of China, long since emancipated herself from that yoke. . . . Any real danger there may be lies in the proximity of Russia ; but even here her safety is assured by the necessity for Japan and China to unite against the annexation by Russia of a country so situated as, in the hands of a hostile Power, to command their main trade-routes."

A considerable quantity of gold is obtained from washings in the Yeung-heung district of Korea. In 1889 Korea exported from its three treaty ports about £157,135 worth of gold. In 1891 the total export was worth about £110,400, but it is considered that nearly as much again left Korea without being declared, or was smuggled across her borders to China or Russian Siberia. A large trade is carried on between Korea and Vladivostok, the Russian port (which in Korean cattle alone takes annually 10,000 head) ; and it is because the harbour at Vladivostok is icebound during four or five months of the year that Russia is said to have desired a port in Korea which would be open throughout all the year.

A Manual of the Geology of India, etc. Second Edition, revised and largely rewritten. By R. D. OLDHAM, A.R.S.M., Superintendent, Geological Survey of India. Calcutta : Geological Survey Office, 1893. Pp. 543.

The first edition of this work, written by Messrs. Medlicott and Blanford (chiefly by the latter), and published in 1879, was extremely welcome to geologists. It gave an admirable summary of what was known up to that time of our great dependency, the information being, of course, derived mainly from the Geological Survey. Since the appearance of that work it is needless to say that the geological structure of India and the stratigraphical succession of its rock-masses have been more and more developed as the Survey has continued its labours. It is with much pleasure, therefore, that we hail this new edition of an admirable work. Here the geologist finds a clear and authoritative statement of the present position of knowledge, with copious references to original sources of information, where the subjects treated of can be studied in greater detail. No one was better fitted for the task of revising his predecessors' work than Mr. R. D. Oldham, and he can be complimented upon the result of his labour. The original work was in two volumes, one of which treated of the stratigraphy and structure of India, while the other dealt with its economic geology. The present edition is restricted to one volume, devoted exclusively to stratigraphical and structural geology, the economic aspects of the subjects having been already sufficiently discussed in other authoritative works. A comparison of the present book with the earlier issue shows that the work has undergone a thorough revision, and that a large part consists of new matter. To review a work of this importance as fully as it deserves would demand a much larger space than we can devote to the subject. But reference may be made to Mr. Oldham's extremely interesting account of the Gondwána system and the discussion of its homotaxis. He visited Australia that he might be able to compare the Indian rocks with the corresponding strata in New South Wales, and has been able to show that the two series occur on the same geological horizon. The remarkable boulder-beds of India are paralleled by the similarly striated boulders in the Bacchus Marsh beds of New South Wales, the glacial origin of which was long ago recognised by Daintree and Selwyn. Nor is there much doubt that the Ecca boulder-bed of South Africa is an accumulation of the same age. The stratigraphical and palæontological evidence alike seem to show conclusively that all these remarkable glacial beds appertain to Permo-Carboniferous times. It is not at all improbable, in fact, that they occupy the same horizon as the Permian breccias of Europe. The occurrence of glacial beds in Central India is a hard nut for geologists to crack. Since the publication of the present volume, Australian geologists have greatly increased our knowledge of the "Permo-Carboniferous" boulder-beds. It has now been proved that these boulder-beds are not only charged with ice-worn and scratched stones, but that a large proportion of the boulders do not belong to Australia. They are true *erratics*, and the question is, Where did they come from, and how did they travel? The Silurian rocks upon which they rest are scored and glaciated, the grooves and striæ indicating a movement from the south. It is the belief of those who have been lately studying the deposits that these indicate the invasion of Southern Australia by an ice-sheet. Whence that ice-sheet came no one can say. So long a time has elapsed since the Permo-Carboniferous period that almost any amount of change may have taken place in the relative levels of land and sea. It may be that a wide and elevated land-surface formerly extended south of Australia and Tasmania, and that, as some have conjectured, a continuous sheet of ice may have existed between New South Wales and the South Polar lands. Others, again, have supposed it possible that the glaciated boulders of Bacchus Marsh may have been carried northwards by floating ice. Take any explanation we choose, we cannot escape from the conviction that at a certain period in Palæozoic times a true ice-age reigned in regions which are now farther removed from the South Polar circle than our own lands are from the Arctic latitudes.

The Canadian Ice Age, etc. By SIR J. WILLIAM DAWSON, C.M.G., LL.D., F.R.S., etc. Montreal: Dawson, 1894.

In this volume Sir William Dawson gives a useful summary of the evidence obtained in Canada as to the physical condition which obtained in that region during the Glacial Period. He has thus done a distinct service to students of glacial geology in this country who are desirous of comparing the phenomena seen here with those that are met with in North America. His work commences with some account of the progress of geological opinion in matters glacial. Sir William's long and continuous acquaintance with the subject is evinced by the fact that the earliest results of his glacial studies were published so far back as 1855, while his latest paper bears the date of 1890. Chapters iii. and iv. discuss the physical and climatic conditions of the Ice Age, while Chapter v. supplies us with local details as shown in the several geographical regions of Canada. In Chapter vi. the author is peculiarly at home in the account he gives of the organic remains met with in the Pleistocene accumulations. The last chapter briefly sums up the general conclusions to which Sir William's studies have led him. With these, geologists are already familiar. While freely admitting that wide snow-fields and large glaciers existed during the Ice Age, he yet maintains that the "boulder-drifts" which have so extensive a distribution in Canada have been deposited by floating ice. The Ice Age, according to him, set in with a depression of the land, during which the lower boulder-clay, etc. were accumulated. As this subsidence continued the intensity of cold conditions diminished. The gathering ground of local glaciers was lessened, the area over which floating ice was distributed was greatly widened, and the climate improved. While these improved climatic conditions continued, re-elevation set in, and the land-flora was thus enabled to extend to lower levels. This was the Canadian interglacial epoch. Thereafter a second subsidence ensued which succeeded in drowning the Canadian uplands to 1200 feet and more below their present level. The "boulder-drifts" belonging to this stage are wholly marine, and give little evidence of colder climatic conditions than now obtain in those regions. That final submergence was in its turn followed by "a paroxysmal elevation in successive stages, till the land attained even more than its present height, as subsidence is known to have been proceeding in modern times." Sir William protests against the views of those who maintain that the boulder-clays of Canada and the States are the bottom-moraines of an extensive ice-sheet; and he denies that the great terminal moraines which have been traced by geologists from the east coasts of New England to the far north-west are what almost every observer who has studied them declares them to be. But into these and other allied questions we need not enter. Our author, it will be seen, is more or less conservative of the views which were prevalent some twenty years ago. We fear that "the current school of glacialists" will not be shaken in their opinions by any of the arguments which have convinced Sir William Dawson that he is right and they are wrong.

Rhodes in Ancient Times. With Six Plates. *Rhodes in Modern Times.* With Three Plates. By Cecil Torr, M.A. Cambridge: University Press, 1885 and 1887. Pp. xi + 156; vi + 106.

Mr. Torr's work is a very happy blend of the scholarly with the popular. Although during the last thirty or forty years several writers have added to our meagre and chaotic store of knowledge of ancient Rhodes, Mr. Torr is the first to make systematic use of the material which has been rendered accessible by recent research. The result is a work reliable in its authorities and of considerable comparative interest—not only useful as a record, but entertaining also as a description of political and social life.

Mr. Torr touches with a light hand, but confidently, on the part played by Rhodes in ancient times both before and after the city of the name was founded (408 B.C.) and became the seat of government in the island. In its own scale, that part is an illustration (to use Captain Mahan's expressive and already classical phrase) of the "influence of sea power upon history"—in its own scale, for there is real risk of mistaking the proper perspective when writing (and reading) at length on the place and power of a community, like that of the Rhodians, comparatively insignificant. And yet we may say that from about the time of the Confederacy of Delos till the civil broils which followed the death of Cæsar, the island and its people (enterprising on occasion) were a force to be reckoned with. A rhetorician talked once of their fleets of one hundred ships: that, indeed, is rhetorical; still, in 190 B.C. they had more than seventy ships seaworthy. "Ten Rhodians, ten ships" is a proverbial exaggeration, but it points to a flourishing maritime and domestic condition; and Aristotle mentions that once the democracy was overthrown for failing to hand over the customary seamen's pay to the trierarchs. Does the maritime spirit engender independence beyond wont? The Rhodians alone are said to have refused Cæsar's offer of a general remission of debts after the civil war; and the same vigorous trait is discernible in their civil life, where the son's liability for the father's debts was more stringent than at Rome.

In mediæval times (Mr. Torr's "modern times" end where, for most of us, they begin) the historical interest of Rhodes is fragmentary and, in general, petty. The Crusades, Knights Hospitallers, and Turks do, however, invest it with some significance. For more than three centuries and a half the Turks have now held it. But, says Mr. Torr, "the future of the island will be determined by its strategic value to a Mediterranean Power with interests in Egypt against a hostile Power in Asia Minor."

In both volumes are chapters dealing with religion, art, learning, social life. They are well written, and contain much information, curious and valuable.

Le Sahara. Par Henri Schirmer. Paris : Hachette, 1893. Pp. 440. Illustrated.

Monographs of this description are of the greatest possible value to geographers and students. They combine under one purview a well-proportioned and carefully reasoned analysis of all that has been written on the subject of a distinctive natural region, and include much that might escape the notice of those who are not themselves specialists. The Sahara is, in fact, an ideal subject for such treatment, in spite of the scanty and unreliable material at the disposal of the investigator. In the performance of his task Dr. Schirmer evinces marked ability, and a capacity for dealing with details that is more commonly encountered in German than in French geographical literature. He appears to have read all the literature on the subject, and to have made a judicious selection of facts. His generalisations are those which have come to be adopted by the majority of scientists, and therefore do not require restatement in this place.

After a very careful and exhaustive examination of the physical aspects of the great desert, its origin and its phenomena, as compared with other desert tracts, the author takes up and reviews the outstanding political and commercial conditions. In the latter respect the opinions which he advances are thoroughly sound and trustworthy, and should be read by those enthusiasts in France who support the wild scheme of a trans-Saharan railway.

The book has a large number of illustrations, etc., but has no good map. A large coloured physical map would have greatly enhanced its value.

Besuch bei den Kannibalen Sumatras. Erste Durchquerung der unabhängigen Batak-Lande. Von Joachim von Brenner. Würzburg : Verlag von Leo Woerl, 1894. Pp. iv + 388.

In the northern parts of the large island of Sumatra there exists what was for many years a mysterious lake. It lies in the heart of the country occupied by independent Batak tribes, who, like the Tibetans, have always offered the most strenuous and jealous opposition to the visits of Europeans. It was not until the year 1866, so far as is authentically known, that any European ever set eyes on the wonderful lake, known as Toba. The region in which it is situated is, like Tibet, a plateau region, girdled by lofty mountains. In area it is comparatively small—some 2300 square miles—and it has a population of somewhat over a quarter of a million. But the people are open and avowed cannibals, their hostility to Europeans is fierce and unrelenting, and their watchful and jealous exclusiveness has always run to a high pitch. To have crossed this perilous region is therefore no mean feat. It was first accomplished by the author of this book in the year 1887. The Second Section, in which he relates the incidents of his adventurous journey, is full of interest. Baron von Brenner and Herr Mechel, who accompanied him, were detained as prisoners by the Batak, and were more than once on the very verge of assassination. The narrative is as thrilling as the tone of the writer is modest. But the most valuable part of the book, from the geographer's point of view, is the Third Section, in which are gathered up the scientific results of the expedition. In this division there is much solid information and not a little that is curious. The Baron devotes considerable space to the social habits, customs, and institutions of the Batak; for, contrary to what might be expected from their being addicted to the horrible practices of cannibalism, they have made appreciable progress in the arts and sciences of civilised life. Numerous illustrations make the text more graphic, and convey a vivid impression of the country and the people, and afford a good deal of information as to their mode of life. Various addenda—*e.g.*, tables of estimated population, panoramic charts of the orography of the Batak Lands, a couple of useful maps, a serviceable bibliography, and an index—all help to increase the value of this excellent book, and render it an almost complete epitome of the subject of which it treats. But the proofs ought to have been read more carefully than they have been : we have noticed several misprints and an unusual number of "turned" letters.

Through Turkish Arabia : A Journey from the Mediterranean to Bombay by the Euphrates and Tigris Valleys and the Persian Gulf. By H. Swainson Cowper, F.S.A. Two Maps and twenty-six Illustrations. London : W. H. Allen and Co., 1894. Pp. 490.

The author should have condensed his manuscript by fully a half before sending it to the printer. From Alexandretta he drove in a close carriage to Aleppo, and thence was transported, in a covered litter on account of his health, to Bagdad, following the right bank of the Euphrates as far as Feluja. From Bagdad he made an excursion on horseback to Birs Nimrud and to the sacred town of Kerbera. On his return to Musul he proceeded by steamer to Bombay, and so back to England. On the whole, we gather that a tour along the route followed by Mr. Cowper is one to be avoided by the ordinary tourist, as it seems to be remarkably dull.

Journal of the Elder Scientific Exploring Expedition, 1891-2, *under command of D. Lindsay.* With Maps. Adelaide : C. E. Bristow, 1893. Pp. 207.

The progress and fate of this expedition, solely equipped at the charges of Sir Thomas Elder, have been so closely followed in the pages of our *Magazine*, that it is now only necessary to call the attention of our readers to the publication, *in extenso*, of the official journal of the leader. The diary form in which it appears may not be the best for general purposes, but the geographer will find it well suited for careful study. The want of an index is much felt : with such an appendix it would have made a most excellent work of reference for a large tract of newly discovered territory. As it is, the reader wanting to refer to any particular place has much trouble in finding what he requires, although the dates on one of the maps give some help in this direction. The two large and distinct maps, which are accommodated in a too fragile case, will be found most useful. To those interested in the latest phase of Australian exploration the small volume may be confidently recommended.

Nigh on Sixty Years at Sea. By Robert Woolward ("Old Woolward"). With Portrait. London : Digby, Long, and Co., n.d. Pp. x + 304. *Price* 6s.

A lengthened experience of life on the ocean, such as possessed by Mr. Woolward, makes one naturally expect a stirring narrative of shipwreck and adventures on the deep. The author, however, for all his years and experience, has been wonderfully lucky in escaping or avoiding disasters ; and if his narrative is not so full of adventure as one might look for, it is told in a bluff, sailor-like manner, very much to the purpose, and impressing upon us that in it we have an honest, unexaggerated account of an arduous and well-spent life. Mr. Woolward made most of his voyages to the West Indies—of which he is always eager to speak enthusiastically as a health-resort—and to Brazil, in command of vessels belonging to the Royal Mail Line, varied with transport duties during the Crimean and Chinese wars and during the Canadian rebellion in 1861-62. He had thus opportunities of coming in contact with a number of curious characters; and as, above all things, he appears to love a joke, even when it tells against himself, his pages are full of racy anecdotes and amusing recollections. Although the volume presents few features of geographical value or interest, we welcome it as a bright and faithful account of a mariner's life, well told and well arranged. There is no index. The printing is beautifully distinct and clear, but the proof-reader appears to have done his work in rather a careless manner.

Hamburgische Festschrift zur Erinnerung an die Entdeckung Amerika's. Herausgegeben vom wissenschaftlichen Ausschuss des Komités für die Amerika-Feier. Hamburg: L. Friedrichsen und Co., 1892. 2 vols.

A copy of the above work has lately been presented to the Society by the Hamburg Society of Geography. The first volume will be the more interesting to most readers. After an introduction by Dr. G. Neumayer, the story of the discovery of the New World is told by Dr. S. Ruge, and Prof. Gelcich describes the instruments in use on ships at the time of the great discovery. The rest of the work deals with Hamburg's connection with the New World, its trans-Atlantic trade, the enterprises of the Welser, etc.

The work is well got up and tastefully bound.

A Mound of Many Cities: or, Tell el Hesy Excavated. By FREDERICK JONES BLISS, M.A. London: A. P. Watt and Son, 1894. Pp. 201, with Illustrations.

This is one of the valuable publications of the Palestine Exploration Fund. In scholarly fashion, with plans and photographs, the author and excavator tells the story of his "anatomy" of the Mound, identified with Lachish, sixteen miles east of Gaza and twenty-three miles north of Hebron. Following Dr. Flinders Petrie, Mr. Bliss has revealed the sites of eight successive cities or strongholds, dating from at least about 1700 B.C. to 400 B.C., as Dr. Schliemann described the seven superimposed cities of Troy.

Dumfriesshire Illustrated. I. Nithsdale: A Series of Descriptive and Historical Sketches of Stra'nith. By PETER GRAY. Illustrated with Thirty-two Pen-and-Ink Drawings on stone, from old prints, and from photographs taken specially for the work, by J. Rutherford. Dumfries: J. Maxwell and Sons, 1894. Pp. 110, with 21 Lithograph Plates. *7s. 6d.*

This is a local work of special interest to natives of Nithsdale: we do not know the authority for "Stra'nith" on the title-page. The letterpress is appropriate, and written with some care, though there are perhaps differing accounts of some of the historical narratives, and one would have liked the references in such cases as that, for instance, given under Amisfield Tower. The pen-and-ink sketches are fairly well executed in lithography, and the book deserves a place among the memorial volumes of those who love one of the prettiest valleys in the Lowlands, rich in historical reminiscences.

Honours Physiography. By R. A. Gregory and H. G. Wells. London: Joseph Hughes and Co. Pp. 188. *Price* 4s. 6d.

This book is written to meet the examination requirements of the Honours Examination of the Science and Art Department, and is supplementary to Mr. Gregory's former volumes on Elementary and Advanced Physiography. The adjustments and use of astronomical instruments; the most recent developments of stellar photography and chemistry; an excellent chapter entitled "Concerning Members of the Solar System," describing the photography of the sun's spots and prominences, and the latest remarks on the planets, etc.; chapters on atmosphere, climate, terrestrial waters, and geology, make up this little volume on that mixture of astronomy, geography, chemistry, and geology which in modern phraseology is called Physiography. The book is well adapted for its purpose, written with great condensation, and fully up to date. Each chapter is followed by testing questions, and two good indexes of references and of authorities complete the work.

The Intermediate Geography: Physical, Industrial, and Commercial. By the Rev. A. Mackay, LL.D., F.R.G.S. Edinburgh: Blackwood and Sons, 1894. Pp. 283.

This is the eighteenth edition of this well-known work, and has been "thoroughly revised." Its very rough and inaccurate map of the two hemispheres should not, therefore, bear "Antartica" (*sic*) nor omit the British Islands. The account given of our importation of cotton confuses it with wool. No mention is made of the British trade in chemicals. Though the book is published in Edinburgh, Portobello is described as "a fashionable watering-place." It is not easy to see how the deep indentations of the sea cause Scottish lakes to be of small dimensions. There is no discussion of the general geographical problems of the British Empire. Though the book contains a very large amount of good geographical pemmican, it seems to need still further revision to secure accuracy.

The Economics of Commerce. By H. de B. Gibbins, M.A. London: Methuen and Co., 1894. Pp. 94. *Price* 1s. 6d.

In this little book, which is the latest of Methuen's Commercial Series, Mr. Gibbins, the editor of the series, has handled with considerable skill the main economic principles that underlie modern commerce. He has managed to do it in a way as little technical as possible. Here and there his own position with regard to moot points is a little obtrusive. In the suggestions for further study we are surprised to see that Mr. Gibbins has omitted Professor Bastable's *International Trade* and *Public Finance.* When a new edition is called for, Mr. Gibbins might modify his view of the Atlantic (p. 34) in respect of the natural restrictions to trade. Since a bale of sea-island cotton can be put down at Liverpool or Manchester at little more cost than at New York, the United States can be regarded as economically nearer to Great Britain by sea than Glasgow, say, is to London by rail. The Atlantic, therefore, is not now a barrier to trade. A chapter, too, might be given to freights in their economical aspects. In fact, a little book on freights contributed to this series would be likely to meet with acceptance.

Géographie Générale Illustrée: Asie, Afrique, Amérique, Océanie. Par W. Rosier, Professeur de Géographie. Lausanne: F. Payot, 1893. Pp. viii + 340. *Price* 5 *fr.*

Having devoted the first volume of his admirable *Illustrated General Geography* to Europe, Professor Rosier has compressed his description of the other continents into the second volume of the work. Consequently, the countries in these continents are treated with greater brevity and with less attention to details. Yet no one can complain that the treatment is not adequate for all practical purposes. The author tells us in his prefatory note that his constant aim has been to increase as little as possible "the baggage of proper names" with which the scholars in the upper classes of secondary schools are already burdened. The book is, in the strictest sense, a descriptive geography, and the descriptions are aided and illustrated by some hundreds of excellent diagrams, sketch-maps, and pictures. It is worthy of note that this publication is issued under the auspices of the Swiss Geographical Societies, and that its author received subventions from the Swiss Confederation, and from several cantons, in order that the book might be published at a moderate price.

The Countries of the World. By ROBERT BROWN, M.A., Ph.D., etc. Part I. London, Paris, and Melbourne: Cassell and Co., N.D.

We have to announce the commencement of a new issue of this publication. No doubt Dr. Robert Brown will revise it up to date. The map issued with the first part is good on the whole, but contains one or two slight errors. For instance, St. Paul and Amsterdam are French, not British.

London Past and Present: A Reading-Book for Schools. London: Blackie and Son, 1894. Pp. 274. *Price* 1s. 6*d.*

This book contains chapters upon the aspects of London at various periods in its history, its great buildings, its markets and water-supply, its parks and bridges, its constitution and officials, its commerce and relations to the Empire. It is bright and readable, and the numerous illustrations are of very fair quality. It should help our school children to realise the greatness of the Empire of which they are citizens, and develop their patriotism in a practical way.

Guide to Craigmillar and its Environs. By TOM SPEEDY. Selkirk: George Lewis and Son, N.D. Pp. 82. *Price* 6*d.*

In December 1892 we noticed the larger work on Craigmillar by the same author. In the present small volume are reprinted those portions of that work which are of interest to the tourist. The illustrations are also included.

Cromarty and its Neighbourhood: A Guide for Visitors. Second Edition. Dingwall: Lewis Munro, 1894. Pp. 28. *Price* 3d.

A neatly got up, well-printed little book, likely to be of some use to visitors who are unacquainted with the town and its surroundings. In future editions, greater scope in treatment, more precision in statement, and the addition of a map would be improvements. A portrait of Hugh Miller makes a very appropriate frontispiece.

Illustrated Europe. Nos. 159, 160, 161: *Carlsbad. Nos.* 162, 163: *Toggenburg and Wil.* By J. HARDMEYER. Zurich: Art. Institut Orell Füssli. *Price* 6*d. a number.*

We have so often noticed this useful and elegant series that little need be said of these numbers. Carlsbad is well known, by name at least, to English readers. Toggenburg is a pretty valley to the north-west of St. Gall, and can be approached from Wil on the railway between St. Gall and Winterthur. The illustrations are as good and numerous as in the other guides of the series.

Jersey, Guernsey, Herm, Sark, Alderney, and Western Normandy. By C. B. Black. Sixth Edition. London: A. and C. Black, 1894. Pp. xiv + 134. *Price* 1s.

Every information that the tourist can desire is given in this volume. Maps of each of the principal islands on a large scale are given, and numerous notes on the history of the islands. As this is the sixth edition, the guide-book must now be well known.

The Land of the Vikings: A Popular Guide to Norway. By C. Jurgenson. London: Walter Scott, n.d. Pp. 12 + 221 + 10.

This *Guide*, first issued in 1884, was republished in 1888, when it was reviewed in this *Magazine*. The present edition is not essentially different from the preceding; the only additions refer to the new roads from Marak to Skeaker and through the Bratlands valley, and the improved accommodation between the Nord and Sond fiords.

Holland, its Rail, Tram, and Waterways. By C. B. Black. London: Adam and Charles Black, 1894. Pp. xxxvi + 225 to 373. *Price* 2s. 6*d.*

Messrs. Black's Guides can confidently be recommended to tourists, and this one seems to be very complete in all points. The picture galleries are fully described, and the maps are numerous and well executed.

A Text-Book of Field Geology. By W. H. Penning, F.G.S. London; Baillière, Tindall, and Cox, 1894. Second Edition.

This is a reissue of the second edition, which was published in 1879—the only additions being a new preface and a short appendix on Pioneer Surveying. Long residence in South Africa, the author tells us, has shown him that surveying the geology of new regions must proceed by other than the minute methods applicable at home. Accordingly, he gives us here in his appendix the outcome of his own experience. What he writes is quite to the point, and will doubtless be serviceable to those who are about to begin geological surveying in a new or little-known region. His remarks, however, might have been extended with advantage. They seem to us to be hardly sufficient for a beginner's purpose; while to one who has already acquired a reasonable acquaintance with surveying work at home they are more or less superfluous.

Reports on Governmental Maps for Use in Schools. Prepared by a Committee of the Conference on Geography held in Chicago, Ill., December 1892. New York: Henry Holt and Co., 1894. Pp. 65.

The Committee referred to was appointed to prepare a selected list of topographical maps issued by the Government departments, making special mention of those sheets which best illustrate the physical features of the country. Accordingly, they examined the maps of the U.S. Geological Surveys, the U.S. Coast and Geodetic Survey, the Lake Survey, the Mississippi River Commission, and the Missouri River Commission. In this pamphlet they give information about the maps published, and state how they may be obtained. Then follows a list of maps specially illustrating geographical features, such as plains and plateaus of different kinds, mountain ridges, volcanoes, etc. The pamphlet is published for distribution among school superintendents and teachers who, it is hoped, will procure the maps for their schools —especially that of their own district—and introduce them in the teaching of geography. The Geological Survey supplies its maps gratis for purposes of instruction, and the other departments charge a very moderate sum. This example should be followed by other Governments.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ALASKA: ITS PHYSICAL GEOGRAPHY.

By Israel C. Russell.

(*With Map.*)

The following account of the geography of Alaska is based to a considerable extent on personal observations, but includes also information obtained from books of travel, and from conversations with explorers, miners, navigators, traders, and missionaries in various parts of the country.

It has been my fortune to make three journeys in Alaska, each of which revealed something of the geography of that most interesting land. The first of these journeys was made in 1889, in connection with an expedition sent out by the U.S. Coast and Geodetic Survey for the purpose of determining the localities where the Alaskan-Canadian boundary crosses the Yukon and Porcupine rivers, respectively. We first touched the Alaskan shore at Unalaska, the principal commercial station on the Aleutian Islands, and from there crossed Bering Sea to St. Michael; we then ascended the Yukon by steamer to Selkirk House, in the North-west Territory of Canada, a distance of, approximately, 1500 miles, making on the way a trip up Porcupine river to near the 141st meridian. After reaching Selkirk House, I continued on up the Yukon in an open boat with a party of miners for about 500 miles, to Lake Lebarge, and, crossing the mountains on the south to the head of Lynn Canal, proceeded thence by canoe with a single Indian to Juneau.

The second and third journeys, in 1890 and 1891, comprised two expeditions to Mount St. Elias, which were put under my direction by the U.S. Geological Survey and the National Geographic Society. These expeditions were made for the purpose of climbing Mount St. Elias, of studying the geology and geography of that instructive region, and, especially, of obtaining a better knowledge of the vast glaciers which cover it.

The more thoroughly one becomes acquainted with Alaska the more pronounced appear the contrasts in its physical features and in its plant and animal life. Owing to its high latitude, the summers are short and the winters long. In the northern portion, in summer, there are many weeks during which the sun does not set; and again, in winter, there are many weeks during which it does not rise. The climate of the south coast is mild and equable, while in the interior the winters are severe and the summers hot. The mountains on the south coast are the loftiest on the continent; but low moss-covered plains, featureless as a prairie, fringe the borders of Bering Sea and the Arctic Ocean. The central and southern portions are covered with dense forests, while the Alaskan peninsula, the Aleutian Islands, and the broad tundras at the north are treeless. In summer the lower slopes of the mountains are brilliant with fields of flowers; while the peaks towering above these smiling gardens are covered with snow and ice throughout the year, and form desolate, frozen solitudes in which not a trace of life can be seen. In places along the south coast great glaciers break off in the sea and send thousands of bergs afloat; while on the adjacent shore vegetation of tropical luxuriance overhangs the water. The south coast is fringed with thousands of islands, and its shore-line is one of the most intricate in the world; but the coast of Bering Sea and the Arctic Ocean is nearly free of islands, and is without inlets and harbours. The animals of this great northern land are clothed with warm furs which are among the most valuable that man has adapted to his use; but the birds are largely summer migrants from more sunny lands. Its native people are Eskimos and Indians. The white men who have wandered there are from every land and form a cosmopolitan band, in eager search for gold, silver, copper, coal, furs, fish, oil, whalebone, ivory, lumber, and other products of the land and sea. Missions have been established by many Churches, and the natives are being taught many religions. Portions of the land have been inhabited by Europeans for more than a century, while other portions have never been trodden by man, either civilised or savage. The south-eastern coast is visited every year by hundreds of tourists in quest of pleasure or of health; but in the interior there are tribes, speaking unknown tongues, who probably have never seen a white man.

Enough is not yet known of this remote corner of the world to enable one to thoroughly discuss the origin and history of its physical features, which is the aim of a geographer; but we can group together a limited number of facts bearing on various geographical questions, and reach certain general conclusions, and, perhaps, point the way for future study and exploration.

Area.—In the absence of a survey of Alaska its area cannot be accurately stated, but is believed to be somewhere about 578,000 square miles, or approximately one-fifth as large as all the other States and Territories of the United States combined, and over eighteen times the area of Scotland. The general coast line is 4000 miles long, and, including the shores of the bays and islands, is estimated to measure between 11,000 and 12,000 miles. These figures are so great that they will perhaps fail to convey any definite meaning. The vast extent of the territory belonging to the United States north of latitude 50° 40′ may best be realised by comparing a map of Alaska with a map of Europe, both drawn on the same scale.

Boundaries.—The boundaries of Alaska were stated in a convention between Great Britain and Russia in 1825,[1] but have thus far been marked on the ground at only three points; these are where the 141st meridian crosses Forty Mile creek, the Yukon and Porcupine rivers respectively. In the treaty referred to it is stated that the eastern boundary, commencing at the southern point of Prince of Wales Island, in latitude 54° 40′, shall ascend Portland Channel to a point on the continent where it meets the 56th degree of north latitude. From there the line of demarcation shall follow the summit of the mountains situated parallel to the coast as far as the point of intersection with the 141st meridian; the said meridian shall then be the boundary to the Arctic Ocean. It is further stated that, whenever the summit of the mountains which extend in a direction parallel to the coast between latitude 56° and the intersection of the 141st meridian shall prove to be at a distance of more than ten marine leagues from the ocean, the limit between the British possessions and the strip of coast now belonging to the United States shall be formed by a line following the windings of the shore and not more than ten marine leagues therefrom.

The interpretation of this treaty is now a matter of international consideration, and need not be discussed here. But it is proper to direct the attention of both Canadian and American geographers to the fact that our knowledge of the region through which the boundary passes is exceedingly meagre. Before the questions in dispute can be settled, both of the "high contracting parties" must acquire more definite knowledge than they now have of the geography, mineral wealth, timber, and other resources of the region, as well as of the character and the rights of its native inhabitants. This can only be done by a systematic and comprehensive survey. In the absence of such a survey, not only will it be impossible to establish the boundary line designated in the treaty, but no modification of the treaty can be made which will be both practicable and just.

The western boundary traverses the waters of Bering Sea and the Arctic Ocean, and its determination does not involve the partitioning of valuable territory.

Drainage.—Alaska is drained principally by one great river, the Yukon, which rises in the north-western part of Canada, flows westward across the Territory, and empties itself into Bering Sea. Alaska is divided by this noble river into two approximately equal portions.

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[1] The text of this treaty may be found in a report of the Boundary Line between Alaska and British Columbia, Fiftieth Congress, second session, *Ex. Doc.* No. 146, Washington, 1889.

The Yukon ranks with the great rivers of the world. Among those of this continent it is second in drainage area. Its length is about 2000 miles, and its hydrographic basin, half of which lies in Alaska, is approximately 440,000 square miles in extent.

The valley of the Yukon is bordered by gently rolling uplands with a well-developed secondary drainage, showing that it has a long history, during which a large part of its appointed task of reducing its drainage basin to a plain surface has been accomplished. During its life, however, changes have occurred which have modified its action and greatly increased the amount of excavation and transportation that it has to do. Mountains have been upraised across its course, as at the Lower Ramparts, which have changed the grade of the stream and caused it to spread out a vast sheet of sediment above the obstruction, and form a plain through which the river now flows in many intersecting passages. Lakes were also formed by the warping of the river valley, but these are now drained, and stream channels have been excavated through the thick horizontally stratified sediment that they left. In these deposits of clay and sand the bones of many large animals, now extinct, were entombed. In some places, as at the mouth of Pelly river and again at Miles Cañon, lava streams have descended into the previously excavated channel, and formed level-floored valleys, bordered by the walls of the ancient stream. These sheets of hard basalt, in one instance several hundred feet thick, have been cut through by the river, forming cañons, the walls of which are still vertical. These obstructions of volcanic rock also led to the formation of lakes above them, in which thick sheets of fine, light-coloured, evenly stratified sediment were deposited, as may be seen along the beautifully terraced banks of the various branches of the main river to the east of the Alaskan boundary. The country drained by many of the southern feeders of the main stream was at a recent date covered by a northward-flowing ice-sheet, and its history still further modified.

These accidents, as they may be called, affected especially the upper portion of the drainage system, and left its lower course comparatively free to broaden its channel and cut away the land between its many branches. The lower Yukon valley is so broad in many places that to an observer standing on its northern margin the uplands bordering it on the south are beyond the reach of vision. In this ancient valley, owing to a moderate change of level, sediment has been laid down, forming vast swamps through which the stream now winds, and which are overflowed during spring freshets. A vast delta has been formed where the mighty river empties itself into Bering Sea, comparable in extent and in character with the alluvial lands near the mouth of the Mississippi. Near the head of its delta, and more than a hundred miles from the sea, the Yukon divides, and its diverging branches again subdivide, so that its brown waters are discharged through many mouths. The distance between the extremities of the channels into which the river separates is over seventy miles. Seaward from where the mouths of the river are now located the water is shallow, owing to the vast amount of fine silt that is dropped when the currents of fresh water meet the saline water into which they flow. It sometimes happens that a vessel in approaching the delta finds itself aground so far from land that no shore is in sight. Large quantities of drift-wood are carried down by the river from the forested region drained by it, and cast ashore on distant islands and along barren beaches, hundreds of miles from the delta, and furnish the only wood supply for many Eskimo villages.

On the Yukon, as on many rivers flowing northward, the changes of the seasons are first felt on its head waters. Vast floods, accompanying the breaking-up of the ice in the spring and early summer, inundate broad areas of the valley bottom and frequently form ice-dams, thus still further increasing the height of the annual floods. The spectacle presented by the swollen river when crowded with broken ice is said to be among the most striking of natural phenomena.

Among the many tributaries of the Yukon the most important is the Tennah, which rises on the northern ice-covered slopes of the Alaskan mountains, and, flowing north-west through a broad forest-covered valley, joins the main stream over six hundred miles from its mouth.

Another important tributary, known as Porcupine river, rises far to the north-east, near the lower course of the Mackenzie, flows south-west, and joins the Yukon below the site of Fort Yukon, or nearly a thousand miles from Bering Sea. The land drained by the Porcupine is north of the Arctic Circle, but in general character differs but little from many regions in more favoured latitudes. During my first trip to Alaska I ascended the Porcupine for about 150 miles. The river is swift, and flows with many windings through a forested land, which has a history inscribed in its hills and valleys that tells of many changes. Its lower course is through flat bottom land, which has been filled in with sand and gravel by its own waters; but about seventy-five miles from its mouth the uplands on each side come close together, and above that point the stream flows through a well-defined valley, separating grass-covered hills. Sand and gravel deposits, seen in a few places on the uplands, suggest that the general plateau surface is an old river valley of great width or an ancient base-line of erosion, in which the present stream has sunk its bed to a depth of, perhaps, two hundred feet.

In July, the month in which I saw the Porcupine, the country presented a charming picture of rounded hills, covered with a luxuriant growth of grasses and flowers, overlooking flat bottom lands densely covered with spruce trees and aspens. The swift-flowing river in places gleamed brightly in the sunlight, and again was lost in the shadows of the over-hanging forest. The hills were just changing from green to brown, and a dash of yellow here and there amid the foliage of the river-bank told that the short, hot, dry summer, during which the sun did not set, was drawing to a close. The fair landscape gave no suggestion of Arctic severity, but was so mild and peaceful, so rich in colour and pastoral in character, that it lacked but a farmhouse here and there to make one fancy that a part of New England was spread out before him.

The most distant sources of the Yukon are in numerous lakes on the northern slope of the mountains bordering the southern coast, among which the scenery is unsurpassed in picturesqueness and variety. The lakes on its head-waters are in a region formerly ice-covered, and many of them owe their origin to the scooping-out of basins by glacial action, and to the obstruction of drainage by glacial deposits. Some of the broad sheets of placid waters are clear and blue, and surrounded with dense vegetation, while others, situated in a desolate area above the timber-line, receive the drainage of glaciers, and the transparency of their waters is changed to yellowish-green by fine sediments. The presence of glaciers on its head-waters accounts in a great measure for the muddiness of the stream throughout. In all its lower course it is as heavily charged with sediment as is the lower Mississippi or the Missouri. In voyaging up the great river one is struck with the fact that nearly all the tributaries from the south are heavily loaded with silt, while those from the north are clear and limpid. This is because all of the larger streams emptying into it from the south have their sources in the immediate proximity of existing glaciers, the drainage of which is always turbid; while the streams from the north drain a forested and moss-covered region in which there are no glaciers, and the water, having to filter through dense vegetation before reaching the drainage ways, is exceptionally clear, although frequently of an amber hue on account of the vegetable products in solution. The muddiness of the tributaries from the south, however, is not due entirely to the presence of rock-flour ground fine by glaciers, but is owing in part to a widely spread layer of volcanic dust, which has been recently deposited over thousands of square miles of territory, and is so easily eroded that it is washed into the general drainage by the rains. As has been shown by Dr. C. Willard Hayes, this is the principal cause of the extreme turbidity of White river, which, as its name suggests, is of a whitish colour, and owes its muddiness to the immense amount of volcanic ash and glacial mud that it carries.

The great divide of the Alaskan region is along the crest of the mountains close to the south coast. In many places the rain falling on the southern side of this sharp crest-line reaches the ocean within less than a score of miles, while that falling on the north side finds its way to the Yukon, and has to travel more than two thousand miles before reaching the sea.

The Yukon has been ascended by stern-wheel steamboats of light draught as far as Selkirk House, a distance of about 1500 miles from Bering Sea, and is known to be navigable to a still greater distance. The current towards its head-waters, however, is so swift in places, that steamboats more powerful than those now used would be needed for its navigation. With the exception of the rapids at Miles Cañon, where for a mile the stream rushes through a narrow gorge in basaltic rocks, the river is navigable as far as Lake Tagish, on the Pelly, and to Lake Ahklen near the source of the main stream. Many of the tributaries are also known to be navigable, although only a few have been systematically examined. Thousands of miles of inland waters there await the coming of explorers and traders, but owing to the severity of the winter climate they can only be traversed during a few months each year. In summer these rivers are the highways for the native inhabitants in their birch-bark canoes; and in winter they are no less favourable lines of communication, as they can then be traversed with facility by means of sledges drawn by dog-teams. Should reindeer be introduced into Alaska, as is now hoped, the rivers may be followed with even greater facility in winter than in summer. The importance of the streams to the traveller is enhanced by the fact that there is not a road in the country, and scarcely a trail, that can be followed when the dense vegetation is not deeply snow-covered.

The drainage of the southern coast, from Dixon's Entrance to the end of the Alaskan peninsula, is mostly performed by high-grade streams issuing from beneath glaciers; but there are a few rivers which cross the mountain barrier near the coast, and afford means of communication with the interior. These are the Stikine, Taku, Alsek, and Copper. The Stikine has been ascended by steamboats for a distance of about two hundred miles, but the others have never been navigated, except by canoes. It is known that steamboats could ascend the Taku for a distance of about forty miles, but the Alsek and the Copper are too swift for this purpose. These streams are without broad valleys, but are bordered by exceedingly rugged mountains, and are surrounded by some of the most magnificent scenery in the world. Their present channels have many of the characteristics of young rivers, but the deep fiords at their mouths and their glaciated walls show that they have undergone a recent change, which has removed to a great extent the records of the tasks they have already accomplished.

North of the Alaskan peninsula, and emptying into Bering Sea, there are several important streams, although appearing insignificant when compared with the great Yukon. Of these the Kuskoquim is the largest. It rises among the ice-filled valleys on the west slope of the Alaskan mountains, and drains an area of about 800,000 square miles. To the north of the Yukon there are several small rivers as yet only partially explored; the largest of these, the Kowak and the Noatak, as shown by the explorations of Lieutenants Cantwell and Allen, are navigable. The Arctic coast of Alaska is but little known, and no streams of importance have been discovered there. Their supposed absence may be due to lack of information, or possibly to the fact that the country for a long distance inland is a low, moss-covered, swampy area, in which even important streams may spread out and lose their individuality.

Mountains.—The vast cordilleran system which follows the west coast of both South and North America traverses southern Alaska, and, bending westward, follows the coast to the end of the Alaskan peninsula. The partially submerged continuation of the same system forms the Aleutian islands, more than a thousand miles in length. The culminating points of this great system in North America are two rival peaks, Mt. Logan, 19,500 feet high, and Mt. St. Elias, 18,010 feet high. A host of neighbouring peaks, several of which exceed 14,000 feet in elevation, make this region one of the most rugged and impassable in the world. For fully three hundred miles from Cross Sound westward the mountains rise precipitously from the sea to great heights, and above an elevation of about 2500 feet are always snow-covered. In vast *névé* fields, filling the valleys and depressions among the higher peaks, thousands of glaciers have their birth, and flow both north and south. Among those on the southern slope of the mountains there are hundreds which practically reach sea-level, and scores that discharge into the waters of the Pacific. These mountains are portions of a great system, but many independent ranges are known, and it is probable that future explorations will show that they have an extremely varied and, perhaps, a very long history. In the neighbourhood of Mt. St. Elias the ranges are monoclinal, and agree in general structure with the Great Basin system more closely than with any other mountain type now known. In common with all lofty mountains, St. Elias is young. The foot-hills near the ocean have been elevated at least 5000 feet during the existence of species of marine molluscs now living in the adjacent waters, and it is probable that the main uplift received an important increment at the time the foot-hills were raised above the sea. Since the mountains were uplifted, ordinary stream erosion seems to have had but little to do with their sculpturing; glaciers took possession of the depressions as soon as they were raised above the ocean, and the subsequent modifications of their forms have been largely due to ice-action. A novel feature in their history is the fact that the ice-drainage is consequent upon the prevailing geological structure. Too little is known, however, of this exceedingly rugged region to allow us to speak with much confidence concerning its geological history. North of Mt. St. Elias there is an extremely rugged country where man has never penetrated. This region bristles with lofty peaks overlooking ice-filled valleys, from which many magnificent glaciers flow. A lofty peak, in about latitude 63° 30′ north and longitude 147° west, has been seen from a distance by a few trappers and traders, and is thought to rival even Mt. St. Elias in height and magnificence. Problems of great geographical and geological interest there await the explorer, and in no other portion of our country can one expect to obtain a greater return for hardship and exposure than in this wild, ice-bound land.

The mountains on the Alaskan peninsula and the principal peaks of the great Aleutian chain are many of them surprisingly rugged, and rise to great heights; but as yet little definite knowledge is available concerning them. Many of the mountains are known to be of volcanic origin, and some are still active volcanoes. As seen from the ocean, the land appears wonderfully rugged and magnificent.

To the north of the great system of mountains fringing the Pacific coast there are many minor uplifts reaching elevations of probably 4000 or 5000 feet, the summits of which are above the timber-line and add variety and beauty to the great inland region. But none of these peaks has been climbed, and but few intelligent white men have ever seen them. Their outlines and distribution have never been mapped, and their heights are known only by estimate. They are bare of snow in summer, and no glaciers exist upon them. They do not possess the graceful double curves typical of volcanoes, but frequently present the outlines of uplifts that have been long exposed to atmospheric erosion. When they become known it will probably be found that they are composed of older rocks than the higher mountains in the south, and belong to a more ancient chapter in the earth's history.

Volcanoes and Hot Springs.—The only active volcanoes in the United States are in Alaska. In the Alexander archipelago, on the Alaskan peninsula, on the Aleutian and neighbouring islands in Bering Sea, there is a large number of mountains of volcanic origin, about ten of which are now active; those that now show no signs of activity are proved by their symmetrical and uneroded contours to be of very recent date.

In the Alexander archipelago volcanic energy is now dormant, and the mountains are silent and cold; but some of them are reported to have been in eruption during historic times. The mountains from which lava and volcanic ashes have been ejected within the past few years are situated west of Cook's Inlet on the Alaska peninsula, and on the Aleutian islands. Frequent eruptions in this region are reported to have occurred within the past hundred years, some of which would have been very destructive had they occurred in more thickly settled regions. Fragmentary accounts of these catastrophes, obtained principally from the Russians, have been summarised by Dall; and observations made since the country came into the possession of the United States show that the subterranean energies have by no means been exhausted. Within the past few months a volcanic eruption of marked violence has occurred in Shumagin island, where similar phenomena were previously unknown. The most beautiful of volcanic mountains now known is Mount Shishaldin, on the island of Unimak. This mountain is about 8000 feet high, and is a symmetrical cone with gracefully curving sides of the same type as Fusiyama. The wreath of steam emerging from the crater at the summit can be seen for scores of miles out to sea, and, like the light in the sky above Stromboli, is a beacon eagerly looked for by mariners. Another volcano, known as Pogrumnoi, on the same island, is also reported to have been in action in recent years, and has been the centre of severe earthquakes. Mount Makushin, on the Unalaska islands, is the only volcano in the region which has been climbed. It is known to have been mildly active for many years. The greatest eruption in modern times has been from a small volcano known as Bogoslof, some 60 miles west of Unalaska. Remarkable changes in this island have been noted from time to time by officers of the U.S. Revenue Marine, and showers of ashes erupted from it have darkened the sky over hundreds of square miles in its vicinity, and in a few instances have fallen to a depth of several inches at Iluiluik, and on the decks of vessels still more distant.

The greatest eruption of volcanic dust which has occurred in the Alaskan region in recent geological times took place from an unknown crater supposed to be located about 75 miles north of Mount St. Elias, and was carried north-eastwards by the prevailing air-currents to a distance of fully 100 miles, covering an area of not less than 20,000 square miles to a depth varying from a few inches to 50 feet.

In the volcanic belt extending from the Alexander archipelago to the end of the Aleutian Islands there are many hot springs, some of which are highly charged with mineral matter, and are used as medical baths by both Indians and white men. This great belt, over 2000 miles long, has also been visited by several earthquakes from time to time, and in certain instances these disturbances are known to have been directly connected with volcanic eruptions. The history of these various phenomena has been but imperfectly noted, and their geological records have not been studied; but enough is known to show that important changes are in progress which are well worthy of the attention of the geographer and geologist.

TUNDRAS.—In contrast with the lofty mountains on the south coast, and illustrating the diversity so characteristic of Alaska, are the low, nearly level, moss-covered plains from 70 to 100 miles broad, forming the shores of Bering Sea and the Arctic Ocean. Possibly a comparatively recent and very moderate elevation of the gently sloping shores has taken place, forming plains, broken in some places by low volcanic mountains. On these desolate moorlands there grows a low, dense vegetation peculiar to high latitudes.

The word *tundra* is used in Siberia to designate the vast, treeless, moss-covered plains bordering the Arctic Ocean, and has been adopted for similar regions on the northern shores of America. During the summer the tundra is a swampy, moderately level country covered with mosses, lichens, and a great number of small and exceedingly beautiful flowering plants, together with rushes and ferns. The most conspicuous plants are dwarf willows, which attain a height of, perhaps, two feet. The soil beneath the luxuriant carpet of vegetation is a black humus, and at a depth in general exceeding a foot or thereabouts is always frozen. On the surface of the tundra there are many lakelets and ponds, surrounded by banks of moss, which grows even more luxuriantly than on the adjacent areas. The dense tundra vegetation extends up the sides of the hills that occasionally break the monotony of the plain, and is very similar to the deep mat of living plants decked with Alpine flowers which add such an indescribable charm to the mountains of southern Alaska at the upper limit of timber growth. The dense vegetation forming the tundra changes by imperceptible gradations to dead and decaying matter a few inches below the surface, and finally becomes a black, peaty humus, which retains but few indications of its vegetable origin. In many instances, observed near St. Michael and on the delta of the Yukon, the depth of the peaty layer was from 2 to more than 15 feet. In other localities a depth of 150 to 300 feet has been reported. The accumulation of this highly carbonaceous layer depends on the fact that vegetation grows luxuriantly at the surface, while it dies and partially decays below, but is frozen before complete decomposition takes place. This process is similar to that which occurs in the formation of peat bogs, except that a great variety of plants take the place of *Sphagnum*, and the subsoil is always frozen.

Over hundreds of thousands of square miles on the bleak Arctic coast, both of America and Europe, deposits of vegetable matter are accumulating in the manner just described, which rival in extent and thickness the greatest coal-fields in the world. The suggestion naturally follows that coal may in some instances have originated under conditions similar to those now admitting of the formation of tundras.

Islands.—Should a deeply dissected mountain range adjacent to the ocean be depressed a few hundred feet, the valleys would become flooded and form bays, straits, and sounds, surrounding bold islands and headlands. It is generally true that the submergence of a coast tends to the formation of islands, and that, conversely, emergence tends to unite previously outstanding areas with the mainland. This proposition, to which there may be many exceptions, is illustrated on our north-west coast. From Puget Sound to Glacier Bay and Lynn Canal the coast is fringed by hundreds of islands forming an archipelago more than a thousand miles long. Mount Tacoma and Mount Fairweather are monuments marking the extremities of a vast system of land-locked ocean waters through which the largest ships can sail for a thousand miles in one general direction without entering the open sea. The magnificence of this celebrated "inland passage" is already well known to thousands of tourists, and has been amply described by writers who are better able than myself to give graphic pictures of its many attractions. This vast archipelago owes its origin to a recent subsidence of the coast, which has changed glaciated river valleys into placid waterways. West of Mount Fairweather to beyond Mount St. Elias, the coast for a distance of more than 300 miles is practically free of islands, and the mountains on the border of the continent rise boldly from the ocean. There is evidence of a recent rise in the land of this region which may account for the unbroken character of its shore line. West of Mount St. Elias the island-fringed coast again begins, and extends to the end of the Alaskan peninsula, beyond which lie the Aleutian Islands, forming a narrow chain over a thousand miles long, where only the summits of the higher mountains rise above the ocean's surface. Terraces in this region at elevations of a few hundred feet above the sea show that a reverse movement has been initiated, and that future changes will be in the direction of uniting the various detached land areas.

The continental plateau to the north of the Aleutian Islands is submerged to a depth of from 200 to 500 feet, and is occupied by the waters of Bering Sea. On this plateau there are a few volcanic mountains of recent date which rise above the ocean surface, but no remnants of true mountain uplifts. A more detailed survey of Bering Sea may show that its bottom is traversed by stream channels, and may thus, perhaps, furnish physical evidence of a recent land connection between America and Asia.

All of the west and north coast of Alaska is remarkably free from islands, which suggests, as do many other facts, that the land has there experienced but moderate changes of level. The contrast between the island-fringed shores of Southern Alaska, together with the extension of the same system of archipelagoes to the westward, where the continental plateau is below sea-level, and the comparatively unbroken coast-line forming the shores of Bering Sea and the Arctic Ocean, where there is scarcely a harbour in which a ship may take refuge, suggests many lines of inquiry.

Climate.—The climate of Alaska, like its physical features, presents marked contrasts. On the south coast the rainfall is excessive, amounting in some observed instances to more than 100 inches in a year. A series of observations made at Sitka by Russian observers for twenty years gave a mean annual precipitation of over 83 inches. A belt of extreme humidity extends westward along the coast, probably increasing in breadth until Mount St. Elias is reached, and then diminishing in the vicinity of the Aleutian Islands. In the interior it is much drier, as is known from the experience of travellers, and also from a limited number of observations. At Camp Davidson, where the Yukon crosses the 141st meridian, as observed by Mr. M'Grath, of the U.S. Coast and Geodetic Survey, the precipitation from September 14, 1889, to June 22, 1891, was but 19·05 inches; for the year 1890 it was 13·55 inches. On the northern coast, in common with other portions of the Arctic zone, the annual precipitation is small; at Point Barrow, as observed by the International Polar Expedition in charge of Lieutenant Ray, the rainfall for 1882 was a little over 8 inches.

The aridness of the interior and northern portion of Alaska may thus be compared with that of the arid region between the Rocky Mountains and the Sierra Nevada. The humid region along the south coast is a continuation of the rainy belt of Oregon and Washington. The excessive rainfall on the southern coast is accompanied by cool summers and by remarkably mild winters. The mean annual temperature at Juneau and Sitka is about 50° F. The temperature seldom falls below zero (F.). The winters are milder than at Chicago or Boston, and are not marked by the extremes experienced in New York or Washington. In the interior the summers are warm, and occasionally the temperature rises to between 90° and 100° in the shade; but in winter the cold is excessive, and a temperature 40° or 50° below freezing-point is frequently experienced for many days in succession. The difference in climate between the coast and the interior is, perhaps, most strongly indicated by the character of the vegetation. On the coast east of Mount St. Elias the forests are dense, the trees are large, and the undergrowth nearly as impenetrable as in the Tropics. In the interior the forests are almost entirely of spruce trees of small growth, which are confined to the river valleys, while the hill-tops and mountain-sides are bare of trees and covered with luxuriant grasses.

The marked climatic differences between the coast and the interior also find expression in the distribution of the glaciers, which are of great extent among the mountains on the coast, but are entirely wanting on elevations 4000 or 5000 feet high, situated near and even north of the Arctic Circle.

Ocean Currents.—The principal cause of the great contrast between the climate of Southern Alaska and of the interior is to be found in the currents of the Pacific. A great current of warm water comparable with the Gulf Stream is described by hydrographers as starting in the neighbourhood of Japan, and flowing eastward and northward across the Pacific to within 800 or 900 miles of the American coast, where it divides, one portion turning north and bathing the southern coast of Alaska. The mean temperature in the path of this river in the ocean near the Alaskan coast is about 50° F. The effect of such a vast perennial supply of warm water impinging upon the land is to warm the atmosphere and charge it with moisture. The prevailing winds, at least in summer, are from the south, and are warm and moist. Blowing against lofty ice-covered mountains, they are forced upward, and become cooled, part with their moisture, and envelop the land in mists and clouds. Descending to the lower region in the interior, they become dry winds, which instead of giving out moisture promote evaporation. A more complete knowledge of the ocean and atmospheric currents in this region would throw much light on the origin of glaciers and the conditions which initiate glacial epochs.

GLACIERS.—The ice-fields of Alaska are a portion of a great system which begins at the south in detached masses of ice on the summit of the High Sierra in California in about latitude 37°, and extends northward along the cordilleran system through British Columbia and Southern Alaska to the end of the Alaskan peninsula, embracing also some of the islands of the Aleutian chain. This belt reaches its maximum development in the St. Elias region, where the mountains for fully 80 miles inland from the coast are literally buried beneath vast *névés* from which great glaciers flow both north and south. This ice-covering diminishes in breadth towards the west, and on the Alaskan peninsula and the Aleutian Islands becomes broken into detached glaciers of the Alpine type. In the High Sierra the lower limit of the glaciers is from 12,000 to 13,000 feet above the sea, but they descend lower and lower as one follows them northward, until, in Southern Alaska in about latitude 57°, they flow into the ocean and become "tide-water glaciers." In the St. Elias region there are hundreds of magnificent ice-streams which come down practically to sea-level, while many enter the ocean, and, breaking off, form cliffs of clear ice from 200 to 300 feet high. Farther westward the lower limit of the ice again rises, and glaciers are found only on the mountains.

The glaciers of Alaska are, with the exception of those of Greenland, the largest and most instructive in the Northern Hemisphere. The snow falls in vast quantities, and accumulates year after year and century after century, and would build up the mountains to vast heights were it not for the fact that it is drained away in ice-streams which play the same part in relieving the mountains from snow as rivers do where the mean annual temperature is higher. The snow, becoming compacted into ice, acquires a motion along lines of depression principally on account of its own weight, and flows like a plastic body through the valleys to lower regions, where it melts away. The glaciers formed among the mountains are of the Alpine type, and are much larger on the southern than on the northern sides of the highlands. Many of the ice-streams, on leaving the mountains and emerging on to the flat lands at their base, where they have room to expand, spread out in all directions and form delta-like masses of ice of the type illustrated on a small scale by the Rhone glacier in Switzerland. The best-known example of this phenomenon in Alaska is Davidson glacier, near the head of Lynn Canal, which expands into a broad, semi-circular plateau of ice at sea-level. Many of the neighbouring glaciers, as already stated, enter the ocean, usually at the head of wild fiords, and, breaking off, form magnificent ice-cliffs which are among the strangest and most picturesque features of the wild coast where they occur. The most widely known tide-water glaciers are the Taku glacier, at the head of Taku Inlet, and the Muir glacier, at the head of Glacier Bay. Splendid ice-cliffs are also formed by the glaciers which flow into Disenchantment Bay; but the most magnificent example of all occurs where the Malaspina glacier enters the open ocean and forms what is known as Ice Cape, just south of Mount St. Elias.

The largest and, from a geological point of view, the most instructive glacier yet discovered in Alaska is the Malaspina ice-sheet, situated on the coast south of Mount St. Elias. The glaciers of the Alpine type, draining the ice-fields on the lofty mountains to the north for a distance of fully 75 miles, contribute to the formation of this great ice-sheet in much the same manner as mountain streams unite to form a lake. The glaciers on leaving the mountains expand and unite on the flat lands adjacent to the sea, and form a nearly level plateau of ice about 1500 square miles in extent. This is the type of a class of ice-masses termed "Piedmont glaciers," which has not been recognised elsewhere. The general elevation of its surface is about 1500 feet. In the central portion it is free from moraines and dirt, and presents the appearance of a vast snow-covered prairie without surface streams and destitute of all traces of life. At its borders it is covered with a belt of boulders and stones, forming a fringing moraine some 10 or 15 miles broad, the outer margin of which is overgrown with dense vegetation consisting principally of spruce trees, in many instances 3 feet or more in diameter. This striking example of a forest growing on a glacier, although novel before the study of the glaciers of the west coast began, is not confined to the example cited, as many of the smaller glaciers in the same region on both sides of the mountains are similarly buried beneath forest-covered *débris*.

The Malaspina glacier is drained by sub-glacial or englacial streams, flowing in tunnels and emerging at the margin of the ice from beneath low archways, or rising under great pressure as immense springs just at the base of the escarpment formed by the border of the glacier. The streams on issuing from the ice bring out vast quantities of gravel and sand from the tunnels through which they flow, and deposit it in alluvial fans, some of which are many square miles in area. These deposits consist of stratified and waterworn material, which in several instances is being deposited over a forest-covered region, and is burying the vegetation in such a way as to form what in formerly glaciated regions is sometimes designated as a "forest bed." The stratified material spread out about the borders of the glacier is more extensive and of greater geological interest than the *débris* carried upon its surface. Connected with the alluvial fans about the margin of the glacier there are deposits of gravel forming in the tunnels beneath the ice that have many of the characteristics of the "osars" (known in Scotland as "kames," and in Ireland as "eskers"), which have been such a puzzling feature in ancient glacial records both of Europe and America.

Another interesting fact connected with the great ice-belt which has its greatest development in Southern Alaska is, that from one end of the series to the other, a distance of fully 3000 miles, the glaciers are slowly retreating, and probably have been receding for the past one hundred or one hundred and fifty years. The amount of this recession in the case of the glaciers at the head of Yakutat Bay is known to be four or five miles; and at the head of Glacier Bay the retreat is thought to have been not less than fifteen miles during the past century.

Space will not admit of a more extended account of the wonderful glaciers to which attention has been directed; but any one who visits Alaska even as a summer tourist cannot fail to be charmed with the variety and beauty, both of form and colour, which they impart to the stern scenery.

SUBSOIL ICE.—In describing the tundras it was mentioned that at a depth exceeding a foot beneath the surface the soil is always frozen. This condition prevails also in many places in the interior of the country where other characteristics of tundras are absent. In many places along the Yukon for 1500 miles from its mouth the banks are formed of horizontal sheets of ice many feet thick, which is covered with moss and supports a dense forest of spruce trees. The thickness of the frozen stratum beneath the moss-covered flat lands of the interior has never been determined, but in a few localities a depth of more than 25 feet has been penetrated without reaching the bottom. In some instances the frozen layers seem to have been preserved by the deposition of silt and mud over them during spring freshets, thus sealing them up and preserving them until additional layers are formed above, and ensuring their preservation for ages. But many observations, both in the northern part of North America and in Siberia, show that a great depth of subsoil ice frequently occurs in situations where it is not probable that it could have been formed by the freezing of the surface waters during the winter. In such instances it seems that the frozen layer represents the excess of winter freezing over summer thawing for a long period.

A frozen subsoil is a novel feature to most people, and frequently forcibly attracts the attention of travellers in Alaska. Many times during the hot summers, while the temperature is from 90° to 100° F. in the shade, and there is no night to bring relief and rest, one may brush away the moss at his feet and find solid ice beneath. These conditions occur also, as already stated, in the tundras along the shore of Bering Sea and the Arctic Ocean, and probably exist in the flat lands bordering many of the rivers of the interior. On the Kowak river, as described by Lieut. Cantwell, there are bold ice-cliffs from 125 to 150 feet high; these are the most striking examples of frozen subsoil that have been reported.

Forests.—The summer traveller to Sitka, Juneau, and Lynn Canal is usually deeply impressed with the extent and value of the forests clothing the shores along which he sails. The most important trees in this region are two species of spruce, but there is in addition the yellow cedar, concerning the value of which much has been written. The yellow cedar is found sparingly throughout South-eastern Alaska, and reaches as far westward as Yakutat Bay. The trees are often fine and large, and reach a height of 150 to 200 feet. The wood is fragrant, light yellow in colour, and very durable. It is said to be especially valuable for ship-building. Unfortunately, the supply is not so great as has frequently been stated, and should the forests of Alaska be thrown open to lumbermen the tree will soon be exterminated. The two species of spruce which make up 99 per cent. of the forests are the Menzies, or Sitka spruce, which is very abundant, and the Marten spruce, or hemlock, which grows luxuriantly, especially in the sheltered valleys among the foot-hills, and forms one of the most beautiful forests of any of the *Coniferæ*. Besides the trees already mentioned, there are birches, maples, alders, and wild apples, which grow sparingly and have no commercial importance.

Beneath the dense shades of the sombre, moss-draped forests there is a great variety of shrubs, ferns, and lichens, and many bushes which produce edible berries. Of these the huckleberry and salmonberry are in greatest profusion and of greatest value. In open places near the coast strawberries of fine flavour grow luxuriantly. In a grassy meadow bordering the coast south of Mount St. Elias I found luscious strawberries growing in the greatest profusion. The ground was literally white with blossoms in June and pink with ripe fruit in August. Everywhere in the shade of the evergreens the ground is thickly covered with moss and lichens, growing so closely that they form a continuous carpet into which one sinks knee-deep at every step. This brown-green mantle not only covers the ground and conceals fallen tree-trunks, but grows on the trunks and branches of the trees still standing, so that it is one of the most prominent features in the sombre woodlands.

The dense forests to which attention has been directed are confined to South-eastern Alaska, where the air is humid and the temperature remarkably uniform. It is in this region that by far the most valuable trees grow, and it is here only that timber available for building purposes is likely to be found. To the west, along the coast, the forests come to an end at Kadiak island, and all the land to the westward, including the Alaskan peninsula and the Aleutian Islands, is treeless.

Nearly all the region drained by the Yukon and the neighbouring streams is forest-covered, but the trees have an Arctic character, and except along some of the river bottoms do not usually attain the size necessary for lumbering purposes. The most common—indeed the only tree of importance—in the interior is the white spruce, which furnishes an inferior wood for commercial purposes, and is seldom of large size. It is frequently stated that Alaska is a great timber reservation; but, so far as my own information goes, this term should be applied only to the coasts and islands of South-eastern Alaska, and even then with limitations.

ANIMAL LIFE.—The large game of Alaska consists of moose and cariboo, formerly abundant throughout the interior; bears of at least two species, the black and the brown, roam over nearly every portion of the mainland; deer live on the islands in the south-east; flocks of mountain sheep and mountain goats graze on the highlands both near the coast and in the interior. Of fur-bearing animals the most important are the sea-otter and fur-seal, land-otters, martens, beavers, minx, ermine, black, silver-crossed and red foxes, besides the bears already mentioned. The commercial value of the furs of these various animals is too well known to call for remark in an article of the present character. Hair-seals occur in abundance along the entire coast-line, and are a most important article of food for a large part of the native inhabitants. When the value of their skins for leather and other purposes becomes more widely known, they will no doubt form an important article of commerce. The Beluga or white whale is a common article of food with the Eskimos, and is taken many miles up the Yukon. Bird life is abundant and varied, and many migrating birds have their summer breeding-ground there. In the autumn immense flocks of geese and crane may be seen high in the air flying southward. Swans are not rare, and ducks of various species abound. Ptarmigan are common both near the coast and in the interior.

Nearly all of the streams emptying themselves into the Pacific and into Bering Sea abound in food fishes. Salmon and sea-trout are to be seen in myriads at certain seasons, and halibut, cod, herring and other fishes may be taken in quantities off the coast. The value of the fisheries of this region is already very great, and in the future will no doubt be the basis of the largest industries of the north-west coast.

MAN.—Alaska, like other portions of America, was peopled by many tribes before the coming of Europeans. The diversity in customs and language, arts and traditions, among these peoples is even greater than among the native tribes of the central and southern parts of the continent; thus indicating that they have been separated into families and tribes for a period sufficiently long for diverse languages and arts to arise. Their tribal life has been in many instances of such long duration that its origin is lost in the obscurity which preceded tradition. Their myths and folklore give but slight, if any, indication whence they came or from what older stock they sprang.

Those who have studied Alaskan ethnology most thoroughly are of the opinion that the north-western portion of this continent was not peopled from Asia, as is popularly supposed, but consider that all of the tribes of Alaska, including even the Eskimos, are descendants from aboriginal stocks in the more central part of the continent.

The natives of Alaska form two main groups or stocks known in popular language as Eskimos and Indians. The natives of the north and west coasts and the Aleutian Islands have been designated as Orarians by

Dall, and have two divisions, Innuit and Aleutians. The Indians are also divided into two principal stocks; those in the interior being known as Tinneh or Athabaskans, and those of the south-eastern portion as Thlinkets [Tlingit].

The hardy Eskimos have chosen their homes on the bleak, inhospitable north and west coasts facing the Arctic Ocean and Bering Sea, where frozen tundras extend for scores of miles inland, and not a tree breaks the monotony of the sombre moorland. Winter there reigns for eight or nine months, and the summers are rainy and foggy. These people are confined to a narrow strip along the shore, which widens to perhaps one hundred miles where the Yukon and Kuskoquim enter the sea. As is well known, this same great stock extends around the Arctic shores of the continent to Labrador and Greenland. Strange as it may appear to the inhabitants of more favoured lands, these people shun the forests, preferring the open tundras and low bleak coasts, where the only wood for fuel or for shelter is such as is cast ashore by the waves. They are fed and clothed by the products of the sea. The hair-seal is to them what the coconut palm is to many tribes in the Tropics.

Skin boats or kayaks are the most characteristic and typical of the many products of their skill, and compare favourably with, if they do not excel, any similar crafts used by other peoples. These remarkable boats are made of parchment-like seal-skin stretched tightly over a light frame of driftwood, so as to leave only a round hole through which the body of the occupant projects as he sits flat on the bottom. Some of the larger kayaks have two or three openings, and in this respect differ from the similar crafts of the Labrador coast, which, as I understand, are made for a single occupant. These strong, light boats are models of grace and buoyancy. The paddler, clothed in a thin waterproof shirt or *kamleka*, which is tightly lashed about the opening in which he sits, is secure against rain and spray and safe among waves that would swamp many a larger vessel. Kayaks are not made by other races, and are typical, and we might almost say a part, of the Eskimo. To one seeing a native for the first time riding the waves swiftly and safely in his kayak far out on the stormy sea, it seems as if boat and man were one; in the same way that horse and rider were considered as one animal when Spanish horsemen were first beheld by the simple natives of Mexico. These hardy navigators might with propriety be called "kayakers," or the people of the kayak.

The Eskimos live in well-built winter houses and practise many arts and industries which indicate a stage of advancement not attained by many races in more favoured lands. They are separated into many subordinate divisions, speaking somewhat diverse dialects; but in the present sketch we can only direct attention to their more general characteristics and to their peculiar geographical distribution.

The minor division of the Orarian people, the Aleuts, have their homes on the Alaskan peninsula and the Aleutian Islands, and now number about 2000. Their intercourse with Europeans has been longer and more intimate than is the case with any other natives of Alaska, and the change wrought in their lives and character by this contact has been great. The harsh treatment of the Russians for more than a century stamped out many of their customs and characteristics, greatly reduced their numbers, and contaminated their blood. In more recent years the labours of missionaries, the establishment of schools, and other changed conditions have continued the modification of the race. Many of their arts have been neglected or forgotten owing to the fact that the rewards received for sea-otter hunting, and for killing seals on the Pribilof Islands, have enabled them to supply their wants with articles manufactured by white men. Changes in environment, produced in different ways under Russian and American rule, have conspired to modify this people, so that to-day they seem a different race from that described by early visitors to the wild and strangely magnificent shores on which they live.

In the interior of Alaska, and confined to the forest-covered region, there are several tribes of Indians which are markedly distinct from the Eskimos. These peoples belong to a stock which extends southward throughout the Rocky Mountain region for many hundreds of miles, and include some of the tribes with which white people coming from the east have been long in contact. The stock to which the Indians of Central Alaska belong is designated by some as the Tinneh and by others as the Athabaskan. These Indians probably number three or four thousand. They live on the banks of the numerous rivers and lakes of the interior, and only reach the coast near Cook's Inlet. In all other portions of the shore-line of Alaska they have been held back and kept from direct commerce with distant peoples by the more intelligent and more progressive Eskimos, and by the still more warlike and agressive Thlinkets.

The Athabaskans live by fishing and hunting, and it is from them that many of the rich furs so highly prized in Europe and America are obtained. They are river Indians, and do all their summer travelling in birch-bark canoes.

Their canoes are not curved upward at either end as are the more familiar crafts built of the same material in the region of the Laurentian lakes, but are low, sharp-pointed, and have a deck of bark from twelve to sixteen inches long at either end. Occasionally they are tastefully decorated with beads and porcupine quills. These crafts are so light that a man can easily carry one in a single hand, but are strong and serviceable, and seem as well adapted to the requirements of the river travellers as are the kayaks to the needs of the more venturesome Eskimos. The Athabaskans do not yield themselves readily to the advances of civilisation, and are now in a great measure in practically the same condition as when the first white man ventured into the vast wilderness where they have their homes.

Among the numerous islands and along the deeply indented coast of South-eastern Alaska there lives a people second to none of the native tribes of America in general intelligence and progressiveness. These are the Thlinkets. They now number about 4500 souls. They are closely related to tribes in British Columbia which extend up the great rivers, and are associated with, and in some instances merge into, other tribes which have the commonly recognised characteristics of the Indian strongly pronounced.

The Thlinkets are the only natives of Alaska that tourists by the ordinary steamship routes to Sitka are likely to meet. They have been studied more thoroughly than any other of the tribes of Alaska, and much interesting and valuable information bearing on their customs and traditions, arts and languages, is now available in our libraries.

The placid waters separating the thousands of islands of South-eastern Alaska are to the Thlinkets what the rivers of the interior are to the Athabaskans. The convenience of these widely branching water-ways, in a land where the vegetation is so dense as to be almost impenetrable, has led the native inhabitants to acquire great skill in the construction of canoes. Their boats are of an entirely different type from those used on the ice-bound shores at the north, or on the Yukon, but are none the less well adapted to the wants of the brave and venturesome navigators who build them. The canoes are hewn from a single log, and are sometimes 50 or 60 feet in length, and 5 or 6 feet in breadth, while others intended for a single paddler are almost as light as birch canoes of similar size. These boats are not only remarkable for the beauty of their curving lines, but are sometimes richly decorated with totemic designs in colour. They are high at the prow and stern, which gives them something of the appearance of gondolas. When gliding over the placid waters separating shaggy mountains, they add a charm to the wonderful scenery of the Alexandrian archipelago which will never be forgotten by those who have once beheld it.

The houses of the Thlinkets are large, well built, and often richly carved and painted with grotesque designs. In front of some of the older houses carved and painted totem-poles still stand, which record the ancestry of their owners. The totemic system in vogue among this people renders them of peculiar interest, especially as it has led to a development of a truly artistic taste which finds expression in carving on wood, stone, and ivory. Many of the products of this art, apart from their mythical meaning, are attractive by reason of their design and finish. Many other peculiar and interesting characteristics of this race might be enumerated, but a glimpse is all that space will allow.

Brief and imperfect as this essay is, of necessity, yet I trust enough has been said to show that, to the geographer, Alaska is a fascinating land. It holds out inducements to the explorer to tread new soil and behold vast regions on which the eye of civilised man has never rested; to the geologist it offers the keys which will unlock many enigmas in the ancient history of other lands; its living glaciers are now making records which are in every way similar to those left by ancient ice-sheets both in America and Europe; to the ethnologist it presents tribes of men as yet but imperfectly studied or entirely unknown; it is here that the New most nearly approaches the Old World, and thus affords facilities for studying the vexed question of whence came the native tribes of America.

The future of Alaska, and its direct response to the wants of man, do not fall within the scope of this article; but it must not be forgotten that

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PHYSICAL SKETCH MAP OF ALASKA

in the far north-west there is a vast region which is more favourable as an abode for man than many lands now inhabited. When less remote countries are peopled to overflowing, Alaska will cease to be neglected, and its fisheries and mines will be developed, and many of the wants of the people engaged in these and kindred industries will be supplied by flocks and herds that can be pastured all the year round in the luxuriant meadows here and there along the southern shores and on many neighbouring islands.

A REVIEW OF SWEDISH HYDROGRAPHIC RESEARCH IN THE BALTIC AND THE NORTH SEAS.

By OTTO PETTERSSON.

III.

Changes in the direction of the Baltic Current in the Skagerack caused by the winds —Effect of the outflowing waters upon the deeper strata—"Reaction currents" in the Kattegat—Comparison of the Baltic Current and the Polar Ice Stream.

As I have already mentioned, the outflow from the Baltic in spring and summer is sufficient to inundate the entire surface of the Kattegat and Skagerack with water of less than 30°/₀₀ salinity. This condition is represented in the map on Plate III. The only exception to this rule is the south-western part of the Skagerack from Hanstholm to the Skaw, where the Danish current sets in from the North Sea, following the coast of Jutland.[1] The North Sea water, on account of its higher density here, generally dips under the Baltic water, and enters the Kattegat as an undercurrent. But during westerly winds the Danish current passes the Skaw as a surface-stream, and fills the shallow western part of the Kattegat with salter water than that of Baltic origin. This salt water penetrates like a wedge into the midst of the Baltic current in the Kattegat, and occasionally divides it into two parts to the south of Vinga, where a narrow strip of fresher water along the Swedish coast forms a link between the large, superficial layers of Baltic water in the middle part of the Kattegat and the main northern part of the Skagerack. The condition is then the reverse of that represented in Plate III. Instead of a broad flake of yellow (Baltic water) to the west of the Skaw, we ought to have a similar area coloured brownish-green (representing salter water from the North Sea) extending to the east and south-east of Skagen. This state of things is especially common in autumn, when the westerly gales are strongest. This season is remarkable,

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[1] On the coloured maps this part of the sea is marked with blue or green colour (see Plates II., III., and V.), indicating that the highest salinity is always found here in summer as in winter. Hence the North Sea may be said to extend as far eastward as to the Skaw.

because the herring fishery then begins in the Kattegat, and is generally ushered in by strong westerly gales. The following observations exhibit the typical state of this part of the sea in autumn : [1]—In September 1891 Mr. G. Ekman and I made a deep-sounding about six miles west of Vinga, in the vicinity of station G_{ii} (see Plate V. and section 2, Plate VI.), and another near G_{i}, a few miles nearer to the Swedish coast. The strong gale prevented us from proceeding farther westward to station G_{iii} at the other side of the deep channel of the Kattegat. As our sounding-place, G_{ii}, is situated at the deepest part of this channel, and the second station, G_{i}, on the eastward slope of the coast, the following table of observations is sufficiently representative of the condition of the east part of the Kattegat, from the surface to the bottom, in the autumn fishery-season:—

East Side of Kattegat in September 1891.

Depth M.	Station G_{ii}. Long. 11° 29′ E. Lat. 57° 35′.		Second Station, G_{i}. Long. 11° 32·5′ E. Lat. 57° 36·5′.	
	Temp. °C.	Salt °/₀₀	Temp. °C.	Salt °/₀₀
0	15·2°	27·56	15·1°	21·19
10	15°	28·70	...	...
20	14·9°	30·79	15·0°	26·02[2]
30	14·9°	32·11	14·6°	32·99
35	12·7°	...	...	...
40	...	32·94	13·6°	...
45	...	...	13·3°	...
50	12·2°	33·47	11·7° bottom.	...
60	10·9°	33·76		
75	10·0°	...		
80 bottom.	9·9°	33·86		

A few miles eastward, in the vicinity of the cliffs, the salinity was found to be 20·50°/₀₀. The rapid increase in saltness from the coast to station G_{ii} shows the influence of the invading salt water from the North Sea. The Baltic Stream seems, under such circumstances, to be restricted at the latitude of Vinga and Gothenburg to little more than a third part of the Kattegat. We did not, however, reach its western limit at station G_{ii}, where we found it a little more than ten mètres in depth. The Baltic water thus overlaps the intruding salt water from without, which holds from 30 to 33°/₀₀ of salt, and has a temperature of from 13° to 15° (at a depth of 50 mètres it is about 10° to 12°). Exactly the same conditions prevailed in the Kattegat in September 1888, according to Dr. Trybom's

[1] In the collection of charts accompanying this paper there is no representation of the state of the Skagerack and Kattegat after a period of westerly winds. We have studied the question very attentively, but I do not possess a sufficient number of simultaneous observations from all parts of the Skagerack to draw such a chart.

[2] The dotted line marks the limit between the waters of the Baltic and the Danish currents. The Baltic water floats upon the salt undercurrent in the vicinity of the Swedish coast. A few miles westward of Station G_{ii} it is supposed to thin out altogether.

observations. Under the superficial layer of Baltic water with low salinity he found salter water, from 31·5 to 33·5 °/₀₀, with a temperature of 11° to 14° C. Another proof we have from September 26th in the same year, when the Scottish expedition under Dr. Gibson in the *Jackal* made a deep-sounding at a more southerly point in the Kattegat, 8½ miles N. 72° W. of Anholt, with the following result:—

Depth.	Temp. °C.	°/₀₀ Salt.
0 M.	13·90°	19·82
9 „	13·90°	...
18 „	13·45°	...
27 „	13·05°	...
36 „	11·20°	32·39

The deep water in the Kattegat attains its maximum temperature in autumn. The warm salt water, which probably has its origin in the southern part of the North Sea, can, during westerly winds, be traced on the surface for many miles to the east and south-east of Skagen in the middle of the Kattegat, but finally dips under the Baltic water and continues its course, as an undercurrent, to the Baltic, following the deeper channels of the bottom of the Kattegat. Dr. Trybom states that an opposite movement of the upper and lower water-layers has often been observed by the herring-fishers, who generally endeavour to keep their nets floating at the boundary between the two layers.

The influx of relatively warm water in autumn through the deep channel of the Great Belt was observed as long ago as 1869 by Dr. Meyer. I shall hereafter try to show the connection between this phenomenon and the presence of certain migratory fishes foreign to the fauna of the Western Baltic observed by German naturalists.

The typical condition of the Skagerack in summer is seen from Plate II., and in winter from Plates III. and V. In the hope of accounting in some measure for the transition from the summer to the winter condition of the Skagerack, G. Ekman and I instituted regular monthly observations of the temperature and salinity of the surface-water, with the aid of the officers of the steamer *Nornan*, along the line Gothenburg—Skagen—Christiansand. The water samples were taken once every month from October 1891 to June 1892 at eight stations, situated on the above line across the entrances to the Kattegat and the Skagerack, where the sounding-places of the winter expedition in 1890, H_i, C_i . . .C_{vi}, are marked in Plates IV. and V.

No. 8 (=C_v). 72 m. W. of the Skaw.			No. 7 (=C_{iii}). 59 m. W. of the Skaw.			No. 6. 45 m. W. of the Skaw.			No. 5. 32 m. W. of the Skaw.		
Long. 8° 28′ E. Lat. 58° 4′.			Long. 8° 54′ E. Lat. 58° 1′.			Long. 9° 18′ E. Lat. 57° 57′.			Long. 9° 42′ E. Lat. 57° 54′.		
Date.	Temp.	Salt ‰	Date.	Temp.	Salt ‰	Date.	Temp.	Salt ‰	Date.	Temp.	Salt ‰
1891 Oct. 21	11·8°	29·73	1891 Oct. 21	11·8°	29·49	1891 Oct. 21	11·8°	32·13	1891 Oct. 21	12·2°	33·24
Nov. 11	9·4°	30·04	Nov. 11	8·8°	30·66	Nov. 11	9·6°	33·73	Nov. 11	9·8°	34·29
Dec. 2	7·6°	33·03	Dec. 2	8·0°	33·86	Dec. 2	...	...	Dec. 2	9·2°	34·77
1892 Jan. 6	4·8°	33·50	1892 Jan. 6	5·6°	33·55	1892 Jan. 6	6·8°	33·50	1892 Jan. 6	7·0°	34·44
Feb. 6	3·2°	33·42	Feb. 6	3·6°	33·97	Feb. 6	3·2°	33·79	Feb. 6	3·8°	34·02
Mar. 10	0·0°	27·30	Mar. 10	2·2°	33·55	Mar. 10	1·0°	30·35	Mar. 10	2·0°	33·28
Mar. 30	2·8°	30·70	Mar. 30	2·2°	30·55	Mar. 30	2·8°	30·60	Mar. 30	3·2°	31·46
April 20	4·2°	27·92	April 20	4·9°	33·86	April 20	4·8°	32·61	April 20	4·0°	32·20
May 11	6·8°	29·33	May 11	6·8°	29·00	May 11	6·8°	29·37	May 11	6·8°	29·76
June 29	14·1°	28·30	June 29	14·2°	27·27	June 29	14·0°	29·57	June 29	13·0°	30·60

No. 4 (=C_i). 13 m. W. of the Skaw.			No. 3. 6 m. W. of the Skaw.			No. 2. 10 m. E. of the Skaw.			No. 1. 27 m. E. of the Skaw.		
Long. 10° 17′ E. Lat. 57° 51′.			Long. 10° 30′ E. Lat. 57° 48′.			Long. 10° 58′ E. Lat. 57° 44′.			Long. 11° 27½′ E. Lat. 57° 38½′.		
Date.	Temp.	Salt ‰	Date.	Temp.	Salt ‰	Date.	Temp.	Salt ‰	Date.	Temp.	Salt ‰
1891 Oct. 21	12·4°	33·00	1891 Oct. 20	12·45°	31·24	1891 Oct. 20	13·0	32·01	1891 Oct. 20	12·4°	30·60
Nov. 11	10·2°	34·07	Nov. 10	9·0°	29·30	Nov. 10	10·6	29·68	Nov. 10	8·4°	24·76
Dec. 1	8·6°	34·13	Dec. 1	7·8°	33·45	Dec. 1	...	25·15	Dec. 1	5·4°	23·43
1892 Jan. 5	6·6°	34·20	1892 Jan. 5	5·0°	33·94	1892 Jan. 5	4·8°	32·54	1892 Jan. 5	4·8°	33·58
Feb. 6	4·2°	34·71	Feb. 6	2·2°	33·61	Feb. 6	1·0°	30·38	Feb. 6	1·0°	30·66
Mar. 9	2·4°	32·94	Mar. 9	−0·4°	22·18	Mar. 9	0·0°	19·90	Mar. 9	0·0°	20·66
Mar. 29	2·6°	28·03	Mar. 29	2·6°	28·41	Mar. 29	2·1	25·94	Mar. 29	1·8°	20·62
April 19	3·6°	30·24	April 19	5·0°	27·10	April 19	5·2	27·17	April 19	5·0°	20·45
May 11	7·0°	30·56	May 11	7·0°	30·60	May 10	7·0	28·18	May 10	7·8°	23·16
June 29	10·8°	31·00	June 29	13·0°	30·64	June 28	13·2°	31·88	June 28	13·6°	31·68

These stations can be divided into four groups. No. 1, which is only five miles distant from Vinga, is situated in the midst of that part of the

Baltic current which may be denoted as the Swedish coast-stream; Nos. 7 and 8 are situated in the corresponding Norwegian coast-stream; Nos. 2, 3, and 4 in the immediate vicinity of the Skaw; Nos. 5 and 6, from their situation midway between the Skaw and the Norwegian coast, are exposed to the direct influence of the North Sea. It appears from the table that as late in the year as October and November Baltic water stored up since the summer was found at the Norwegian side of the Skagerack more than thirty miles from the coast (station 7). Its temperature had been reduced by the cold of the season, but its salinity was as low as in summer. It is startling to find that the *Nornan*, on her way from Gothenburg to Christiansand, on the 20th and 21st October, met with fresher and colder water on the *west* side of the Skagerack than on the *east* side of the Kattegat, a few miles from Vinga (see the table, stations 1, 2, 7, and 8). The explanation is this: the westerly gales had at the beginning of autumn swept a great mass of salt water from the south part of the North Sea into the Kattegat, thereby nearly cutting off the Baltic current to the west of Gothenburg, as we found to be the case in September of the same year. The great superficial stratum of Baltic water in the middle, western, and northern parts of the Skagerack had remained there since the summer, while the southern part was filled with salter water from without, which passed round the Skaw into the centre of the Kattegat, propelled by the prevailing winds.

A very important fact which has hitherto not been satisfactorily explained is, that the water attains its maximum level along the Swedish coast in autumn (October). This rise of level is especially marked at the northern stations off the coast of Bohuslän. It seems evident that this phenomenon must be connected with the arrangement of the water strata in autumn just described.

In December 1891 no trace of Baltic water was found on the whole line, except in the Kattegat (stations 1 and 2). Even at so short a distance from Christiansand as station 8, which is situated eight miles from the coast, the salinity was found to be as high as 33°/₀₀, which indicates that the outflow of Baltic water has at this season of the year dwindled into a mere coast-stream along the south-east shore of Norway. The entire space between Skagen and Christiansand was occupied by inflowing waters of high salinity, 33 to 34°/₀₀, and higher temperature (7·6° to 9·2° C.) than that of the Baltic water, which at station 1 showed only 5·4° C. Therewith the Skagerack assumed its winter state, exhibited in the map on Plate V.[1] The maximum of temperature

[1] The map on Plate V. is, however, as already remarked, strictly typical for the winter state of the Skagerack only during easterly winds. After a spell of westerly winds the condition is so far changed that, instead of the yellow flake on the chart extending to the west of Skagen, there ought to be figured a broad area of greenish colour, extending on the east of Skagen into the middle of the Kattegat. Such would also be the typical state of the Kattegat in autumn.

Thus the variability in the distribution of the surface waters chiefly depends upon whether the Baltic current sends off a western branch at the Skaw (during easterly winds, with a barometric maximum over the Scandinavian peninsula), or whether the Danish current prevails over the Baltic Stream, and invades the central part of the Kattegat (westerly winds, minimum pressure in the North Sea).

and salinity was henceforth to be found at stations 4 and 5, which are exposed to the influence of the North Sea, while the temperature sank at the western, and still more at the eastern, shore of the Skagerack. The Baltic Stream, which in summer covers the entire surface of the Skagerack and Kattegat, was then ebbing, so that isohalines which in August were found prominent at the 64th degree of latitude in the Atlantic (see Plate II.) were restricted to the vicinity of the coast in the Skagerack. This state of things lasted during December 1891 and January and February 1892.

In March an alteration took place. The difference between the numbers given in the table for February 6th and March 29th-30th is striking, and indicates that the hydrographic transformation of the Skagerack from its winter into its summer state had then begun. In February inflowing water of high salinity and a temperature of 3° to 4° C. was found at all stations in the Skagerack (3—8). At the end of March the surface of the sea was covered by relatively fresh (Baltic) water, which then began to spread over the Skagerack, occasioning a uniform low temperature over the whole area. The atmospheric conditions were thereby changed, because the air over the central part of the Skagerack was no longer in contact with sea-water 3° to 4° C. warmer than the coast-stream and the coast itself, but with cold Baltic water. The table shows how the sheet of Baltic water which begins early in March to inundate the Skagerack increases in temperature during the succeeding months, April, May, June. In the middle of May the outflow from the Baltic through the Kattegat seems to be very abundant. A multitude of indications, such as observations of the direction and velocity of currents at the Swedish and Danish lightships all over the Kattegat and the Sounds, testify to this fact, which is further corroborated by the very low degree of salinity, not exceeding 30 to 31°/₀₀ (shown by the numbers of our table), at all stations. In short, the Skagerack has then assumed its summer condition, as depicted in Plate II.

Such are the general outlines of the great periodic changes which the Baltic Stream undergoes with the seasons of the year. It remains to discuss the effect of these changes in the direction and velocity of the outflowing surface-current upon the movement of the deeper strata.

The first actual proof of the influence which a surface-current of outflowing fresher water exerts upon the underlying deeper strata was given by Professor F. L. Ekman in his treatise upon the hydrographic conditions of the estuary of the Göta Elf in August 1875. We repeated those observations fifteen years afterwards at another season (February 1890). On Plate VIII. is a diagram representing a section along the estuary of that river, from the town of Gothenburg to the outer part of Dana fiord. On both occasions there was found to be an undercurrent of salt water from the open sea entering the river below the outflowing fresh water. The most startling circumstance is, *that this undercurrent rises to a higher level in the river than in the sea outside the estuary*, as is shown by the rise of the isohalines of 20 and 21°/₀₀ in the diagram from August 1875 in Plate VIII. It is evident from this that the outflowing river water has power not only to draw in salt water from the sea far into the bed of the river as an undercurrent of opposite direction to its own, but also *to lift it to a higher level* within the river than it had outside of it. Ekman justly ascribed this effect to the kinetic energy of the river water. The lower side of the outflowing body of fresh water compels by friction the adjacent layer of sea water to partake of its motion; and in order to replace those particles which are carried away and mixed up with the superincumbent fresh water, a new supply of salt water rises from the depths and moves *inwards and upwards in the opposite direction to that of the upper current.* Ekman has shown that this will always be the case where fresher water flows out into a part of the ocean. Such undercurrents Ekman named "reaction-streams." The *vis movendi* of such a current is the kinetic energy stored up in the waters of the upper layers, which gradually disappears as they proceed farther out into the open sea, and is transformed into work, namely, the impulsion of the deeper water-strata in the opposite direction.

Ekman applied this principle to explain the entire circulation of the water in the Baltic, the Skagerack, and the Kattegat.

THE SKAW LIGHTSHIP, 1*st*—28*th February* 1890.

Feb. 1890. 8 a.m.	Current.		Temperature and Salinity of the Water.									
	Direction.	Velocity in knots per hour.	0 Mètre.		7·5 Mètre.		15·1 Mètre.		22·6 Mètre.		37·7 Mètre.	
			t.° C.	Salt ‰	t.° C.	Salt ‰	t.° C.	Salt ‰	t.° C.	Salt ‰	t.° C.	Salt ‰
1	W.	1·5	2·9°	32·2	3·7°	33·0	3·9°	33·2	4·0°	33·6	4·0°	33·7
2	SW.	0·5	3·6°	33·0	3·8°	33·0	4·2°	33·2	4·6°	33·7	5·2°	34·4
3	WSW.	1·0	3·6°	33·1	3·7°	33·2	3·8°	33·5	4·0°	33·6	4·1°	33·8
4	Calm.	0	4·3°	33·0	4·2°	33·0	4·1°	37·5	4·3°	33·7	4·4°	34·0
5	WSW.	0·3	4·1°	33·1	4·0°	33·2	4·3°	33·5	4·6°	33·8	4·7°	34·1
6	Calm.	0	3·5°	33·5	4·2°	33·6	4·4°	33·7	4·7°	34·0	4·7°	34·3
7	W.	0·5	4·4°	33·5	4·8°	33·6	4·5°	33·8	4·8°	34·3	5·2°	34·5
8	W.	0·4	4·1°	33·4	4·2°	33·5	4·5°	33·6	4·8°	34·1	5·2°	34·4
9	Calm.	0	4·4°	33·6	4·7°	33·7	4·7°	34·0	5·1°	34·1	5·4°	34·4
10	NW.	0·3	4·1°	32·7	4·3°	33·0	4·5°	33·2	4·6°	33·8	5·5°	32·2
11	Calm.	0	3·9°	32·7	4·3°	33·1	4·7°	33·5	5·2°	34·0	5·6°	34·1
12	SSW.	0·7	2·3°	27·6	4·5°	32·6	4·9°	33·9	5·5°	34·4	5·7°	34·5
13	S.	1·0	2·6°	28·1	3·9°	31·7	4·6°	32·5	4·7°	33·7	5·5°	34·8
14	SSE.	0·5	3·0°	29·9	3·7°	31·7	4·1°	32·4	4·6°	33·0	5·4°	34·4
15	SSE.	1·3	2·4°	29·4	3·1°	29·6	3·3°	30·7	4·4°	33·0	5·5°	34·8
16	S.	1·5	2·1°	28·1	2·7°	28·4	2·8°	29·1	3·6°	33·2	5·3°	34·4
17	SSE.	1·7	1·9°	28·3	2·5°	28·6	2·6°	29·1	3·9°	32·4	4·1°	33·8
18	SSE.	1·5	1·9°	28·1	2·3°	28·4	2·4°	29·1	3·9°	30·4	5·6°	34·4
19	S.	1·3	1·3°	28·0	2·0°	28·9	3·5°	29·9	4·8°	32·7	5·8°	34·7
20	SSE.	1·5	1·6°	27·0	2·1°	27·5	2·6°	30·1	4·0°	33·0	6·1°	34·5
21	SSE.	1·7	1·0°	23·5	1·7°	26·2	2·5°	29·6	3·3°	30·9	5·5°	34·1
22	SSE.	1·3	0·8°	22·3	1·7°	25·0	2·4°	27·6	4·3°	31·2	6·2°	34·4
23	S.	1·5	0·5°	21·1	1·5°	25·0	4·5°	31·2	6·4°	34·5	6·5°	34·8
24	SSW.	2·0	0·6°	21·0	4·4°	31·6	5·8°	34·3	5·9°	34 5	6·0°	34·8
25	SSW.	2·3	1·2°	24·3	4·3°	31·5	5·7°	33·9	6·0°	34·4	6·0°	34·6
26	Calm.	0	2·5°	28·4	3·5°	30·4	5·2°	34·1	5·6°	34·7	5·6°	34·9
27	S.	2·0	0·1°	23·3	1·4°	24·3	5·7°	32·0	6·0°	34·7	6·0°	35·0
28	S.	1·7	0·3°	24·3	1·3°	24·5	1·3°	24·8	3·6°	29·1	5·9°	34·2

We had the opportunity of studying the effect of the western branch of the Baltic Stream north of the Skaw in producing reaction-currents from the depths of the Skagerack. In order to explain this we must dwell a little upon the atmospheric conditions which prevailed at the beginning of February 1890.[1] After a stormy period of westerly winds at the close of January and in the first days of February, an anticyclonic maximum was established over the Scandinavian peninsula about the 8th of February, accompanied by fair weather and gentle winds from the east. The previous westerly winds had compelled the Baltic Stream to keep close to the Swedish coast, and had filled the western part of the Kattegat with inflowing water of 32 and 33°/₀₀ salinity from the Skagerack. But now the Baltic Stream, under the influence of the easterly wind and of the pressure of the water stored up in the Baltic and the southern part of the Kattegat, began to spread rapidly westward beyond the Skaw, overlapping the salter water in the Skagerack, thus producing the formation of a thin superficial layer stretching far to the west, which we have represented in yellow on the map in Plate V.

Day by day, almost from hour to hour, we studied the progress of this branch of the Baltic Stream by comparing our own observations with those of the Danish lightships at the Skaw, Læsö Rende, and Trindelen.

Until the 9th of February salt water of 32 to 33°/₀₀ at the surface and 34°/₀₀ at the bottom had streamed from W. and WSW., *i.e.* from the North Sea, past the Skaw into the Kattegat. This was an effect of the previous westerly winds, which had been very violent, especially on the 28th and 29th January. From the 8th February the anticyclonic maximum begins to develop itself over the Scandinavian peninsula, bringing calm weather or light easterly winds, and, in consequence, the current at the lightship changes on the 12th of the month, and the Baltic water stored up in the Kattegat begins to spread itself in a westerly direction from the Skaw, and continues to do so during the remaining part of February. The outgoing water-layer is at first extremely thin; by the 15th it has increased to 7·5 mètres, by the 16th to 15·1 mètres, and on the 18th it has attained its greatest thickness, about 23 mètres (see the table). Fig. 1 on Plate VI. gives a section of these water-layers from the lightship of the Skaw along the line Skagen—Christiansand. The thin cuneiform layers extending from the Skaw to beyond station C_1, with a salinity 26 to 30°/₀₀ and a temperature below 3° C., belong to this sheet of Baltic water, which at the surface extends over an area represented by the great yellow branch of the Baltic Stream in the map on Plate V.

It is important to observe that the new arrangement of the surface waters dates only from the 12th February. During the earlier part of the month the condition is totally different. If the map on Plate V. had been drawn in order to represent the state of the surface of the Skagerack and Kattegat during the earlier instead of the later part of February, a great patch of green or brownish-green colour would, as I have already

[1] I have already in the foregoing chapter mentioned the sudden change in the direction of the current and the quality of the water which occurred on February 12th at the Skaw. I now wish to complete the description of the phenomenon by showing the effect of this change in the Baltic current upon the deep waters.

mentioned, be seen extending to the south-east of the Skaw into the Kattegat instead of the yellow area lying to the west and north-west of the Skaw. The map in Plate III., therefore, refers exclusively to the interval 18th-28th February.

This will suffice to give an idea of the extreme changeableness of the hydrographic state in the vicinity of the Skaw and its reef.

It is very remarkable that, while the salinity of the outflowing water at the surface *decreases* from the 12th to the 28th February, the bottom water, at a depth of 37·7 mètres, *increases* in salinity and temperature, as will be seen from the table. This indicates that the salt and warm water, which, according to section 1 on Plate VI., is found on the slope of the Danish coast off Skagen at a depth of 100 to 200 mètres in the vicinity of station C_{ii}, rises to a higher level, and finally at the close of the month, on the 23rd and 27th, appears above the reef of the Skaw at a depth of 37·7 mètres, beneath the lightship, where on those days a temperature of 6° to 6·5° C. and a salinity up to 35°/₀₀ were observed in the bottom layer. This is about the highest temperature and salinity which existed at any depth in any part of the Skagerack in February 1890, and proves that deep water of oceanic origin had been *lifted to this level* from its ordinary place outside of the Danish bank, by some mechanic force, which—as I shall show later—is no other than the reaction of the outflowing Baltic water upon the deep water-layers. It must be remembered that the development of the western branch of the Baltic Stream from the 12th February is contemporaneous with the gradual increase of temperature and saltness in the bottom water. The observations at the lightship do not go to a greater depth than about 40 mètres. But, independent of these, we have proofs of an alteration in the same direction going on in the deep layers north of the Skaw from the 8th to the 16th February. One of our ships passed the Skaw on the 8th February on its way to Hamburg, and on the 16th on its return to Gothenburg. On both days a deep sounding was made at the station denoted by the sign H_i in Plate V. The observations are as follows:—

St. H_i, Feb. 8.—100 M. . .	temperature = 5·4° C.	salinity = 34·75°/₀₀
„ „ 16.—100 „ . .	„ = 6·2° C.	„ = 34·92 „

Thus, even at so great a depth, the influence of the thin surface-current, which on the 16th February was not thicker than fifteen mètres (see the table), had produced an increase in temperature and saltness which can only be ascribed to an undercurrent of opposite direction in the deep layers.

Nothing will better aid the reader to realise the meaning of this than a close inspection of section 1 on Plate VI. The waters of the superficial current are graphically represented by the crowded isohalines 27, 28, 29, 30°/₀₀. The effect of this upon the deep water exhibits itself in the rise of the isohalines of 34 and 35°/₀₀ at the Danish side.

The only objection to applying the theory of reaction-currents to this singular arrangement of water-layers is that the effect upon the deep waters, if judged by the form of the isohaline for 35°/₀₀, seems to be disproportionally great in comparison to the cause which has produced it.

But an easy calculation will show that these thin superficial layers of fresher water contain a great amount of kinetic energy. The energy stored up in the mass of water which on the 13th February, at 8 A.M., passed in one hour by the lightship through a section of one square mètre was equivalent to about 25,000 kilogrammètres. This energy must in the course of a few days be transformed into work, because the water of the western branch of the Baltic Stream, to which it belongs, soon comes to a standstill and loses itself in the surrounding sea, as may be seen from the map. The part of the energy which is converted into heat by friction is probably insignificant. Now, on the other hand, consider what effect a certain amount of energy may produce upon water in the depths of the sea. It must be remembered (1) that the friction between two bodies of water is relatively small; (2) that to raise water through water of nearly the same specific gravity to a higher level does not require any great expenditure of work.

Bearing this in mind, we shall hardly be apt to underrate the effect of the thin superficial currents crossing or encircling the Skagerack upon the motion of its deeper layers.

We possess observations from two other Danish lightships, the Trindelen and the Læsö Rende, which enable us to follow the same change in the Baltic current at places situated further within the Kattegat.

LIGHTSHIP OF TRINDELEN, *February* 1890.

Date.	Current.		Temperature and Salinity of the Water.					
			0 M.		7·5 M.		11 M.	
February, 8 A.M.	Direction.	Velocity in knots.	t.° C.	Salt °/oo	t.° C.	Salt °/oo	t.° C.	Salt °/oo
1	WNW.	0·3	3·5°	31·8	3·7°	31·8	3·6°	31·8
2	NE.	0·3	3·4°	32·0	3·7°	32·1	3·7°	32·1
3	W.	0·2	3·3°	31·7	3·5°	31·7	3·5°	31·8
4	ENE.	0·2	3·4°	31·2	3·6°	31·2	3·5°	31·3
5	*SSW.*	*0·3*	*3·3°*	*29·5*	4·7°	30·7	4·8°	32·5
6	SW.	0·7	2·4°	29·6	2·9°	30·8	3·6°	31·3
7	SW.	1·0	2·6°	29·2	*3·7°*	*29·2*	4·0°	30·8
8	WSW.	0·7	2·4°	28·9	3·2°	29·2	*3·4°*	*29·6*
9	SSW.	0·2	2·3°	28·4	3·2°	28·7	4·2°	28·9
10	ESE.	0·2	2·3°	26·0	3·0°	26·6	3·6°	28·4

It is evident that, after the Baltic Stream has for a time been blocked in the Kattegat by an influx of salt water driven by westerly winds, it will, when the wind changes, begin to flow again with renewed vigour.

From this table it will be seen that the salt water had invaded the Kattegat beyond Trindelen. During the first four days of February an inflowing current with 31 to 32°/oo of salinity was observed. On the morning of the 5th the current changed its direction at the surface, and simultaneously the salinity sank from 31·2°/oo to 29·5°/oo. The same decrease of salinity occurred at the depth of 7·8 mètres two days later, and at 11 mètres on the 8th February. After that day until the end of the month the Baltic Stream predominated at Trindelen without interruption at all depths. During this time its temperature sank gradually to 0·2° C. and its salinity to 17°/₀₀ at the surface.

The same change of current which took place on the 5th February at Trindelen was observed at the Skaw lightship on the 12th of that month. We possess complete observations of the velocity of the current taken at intervals of four hours at the lightship of Trindelen for every day in February. They are omitted in the table. From these observations I have calculated the mean velocity of the outflowing Baltic water between the 5th and the 12th February to be 0·5 knots an hour. With this velocity the Baltic water ought to have travelled from Trindelen as far as the Naze by the 19th February if it took a westerly direction, or to the Koster Islands by the 13th February if bound for the north. Instead of this we found the most advanced traces of Baltic water only 27 miles W. of the Skaw, on the 19th February, which shows that its velocity and energy had been very much reduced on the way. At 27 miles W. of the Skaw it seems to have been almost bereft of its original motion, for, on the 25th February, one of our ships, on its return from Christiansand, met with Baltic water about 35 miles west of the Skaw. During a whole week, therefore, the western branch of the Baltic current had only advanced about 8 to 10 miles, although the same wind and weather had prevailed all the time. This circumstance will explain why the change of the current was felt so late as the 12th at the Skaw.

In the channel called Læsö Rende, between Jutland and the island Læsö, is stationed a lightship at which the following observations have been taken:—

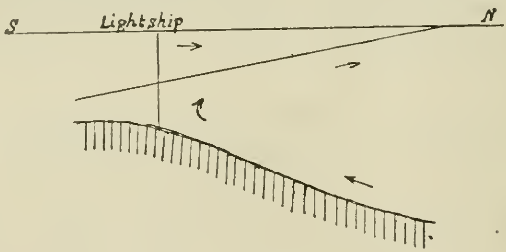
LIGHTSHIP OF LÆSÖ RENDE, 1*st*—15*th February*, 1890.

Date.	Current.		Temperature and Salinity of the Water.							
			0 M.		7·5 M.		15·1 M.		20 M.	
February, 8 A.M.	Direction.	Velocity in knots.	t.°	Salt °/₀₀	t.°	Salt °/₀₀	t.°	Salt °/₀₀	t.°	Salt °/₀₀
1	NNE.	0·2	3·2°	31·1	3·4°	30·9	3·4°	31·3	3·5°	31·3
2	SSW.	0·5	3·3°	29·8	3·5°	30·5	4·2°	32·1	4·4°	32·8
3	Calm.	0	3·5°	31·3	4·0°	31·7	4·2°	32·8	4·4°	33·4
4	*Calm.*	*0*	*3·1°*	*28·7*	3·8°	30·8	4·2°	32·8	4·4°	33·0
5	SSW.	0·2	2·6°	27·4	*3·3°*	*29·8*	4·2°	32·5	4·4°	32·8
6	SSW.	0·5	2·6°	27·4	3·2°	27·6	4·3°	32·6	4·5°	33·2
7	SSW.	0·3	2·9°	27·5	3·1°	27·5	4·3°	32·9	4·6°	33·4
8	Calm.	0	2·7°	27·5	4·2°	30·0	4·7°	33·9	4·7°	34·0
9	SSW.	0·3	2·6°	27·6	3·3°	29·0	4·7°	33·8	4·9°	34·1
10	SSW.	1·0	2·6°	28·3	3·0°	28·4	4·7°	33·6	4·8°	34·0
11	S.	0·3	2·6°	28·4	3·4°	28·4	4·6°	33·2	4·8°	34·1
12	SSW.	1·0	2·1°	27·0	3·3°	28·3	4·7°	33·1	4·7°	33·9
13	SSW.	1·5	2·3°	27·9	2·7°	28·1	*2·6°*	*28·6*	4·5°	32·6
14	SSW.	2·0	2·5°	27·5	2·8°	27·5	2·4°	28·1	*2·5°*	*28·5*
15	SSW.	1·5	2·2°	27·9	2·5°	27·9	2·3°	28·3	3·0°	28·9

The influx of salt water caused by the strong westerly winds at the end of January had reached farther to the south than the Læsö Channel, as appears from the observations at the lightship on the 1st February. But the lightship is situated so far to the south of the entrance to the Kattegat (more than 35 miles from the Skaw) that the change in the direction of the current was felt there sooner than at Trindelen. As early as the 2nd February the current becomes unsteady, but the actual change from the inward to the outward direction takes place on the 4th of the month at the surface, and twenty-four hours later at a depth of 7·5 mètres (see the table). From this day forth we must concentrate our attention chiefly on the state of the deep water. It seems at first quite inexplicable that the Baltic water does not daily increase in thickness there as at Trindelen and the Skaw. We should expect to find Baltic water of low salinity at 15·7 and 20 mètres on the 6th or 7th; but instead of *decrease* of salinity and temperature the table gives the following numbers:—

Feb. 5, at 20 mètres, ...	32·8°/₀₀	t. = 4·4°
„ 6, „	33·2 „	„ = 4·5°
„ 7, „	33·4 „	„ = 4·6°
„ 8, „	34·0 „	„ = 4·7°
„ 9, „	34·1 „	„ = 4·9°

This fact is due to the reaction of the upper outflowing sheet of water upon the lower water to the north of Læsö channel in the vicinity of the Skaw. This deep salt water is drawn into the channel as an under-



current of opposite direction (Ekman's "reaction-current") by the friction of the upper layer upon the adjacent underlying water particles which are swept away northwards with the surface water, while water from the bottom layers to the north of the channel is drawn inwards and upwards to fill their place, as is shown by the arrows in our diagram. Thus—and only thus—can it be explained how the salinity and the temperature, 15 and 20 mètres below the lightship, steadily *increase* from the 5th to the 9th February. Then a new complication arises.

According to the table the velocity of the outflowing water at the surface increased considerably from the 9th to the 15th. At the same time the salinity and temperature at a depth of 20 mètres began to *decrease* as follows:—

Feb. 10, at 20 mètres, ...	34·0°/₀₀	t. 4·8°
„ 11, „	34·1 „	„ 4·8°
„ 12, „	33·9 „	„ 4·7°

Feb. 13, at 20 metres,	. . . . .	32·6‰	t. 4·5°
" *14*, "	. . . . .	*28·5* "	" *2·5°*
" 15, "	. . . . .	28·9 "	" 3·0°

The reason is this: the Baltic current in Læsö channel has now increased in bulk so much that *there is no room left for the inflowing salt water at the bottom.* Consequently it is swept out of the channel again *by the same current which formerly drew it thither.* The diagram shows clearly that if the upper cuneiform layer moves onwards from south to north it will entirely fill from top to bottom the space where the lightship is anchored. Then naturally a great and sudden change in the nature of the bottom-water at 20 mètres must take place. This is exactly what happened on February 13th and 14th.

By combining the observations at the Skaw lightship with those of Læsö Rende and of our own stations G_v and G_{vi} from the 13th and 14th February, on the line Vinga—Fredrikshavn (see section 2 on Plate VI.), we can obtain a clear view of the alteration in the arrangement of the water-layers which took place between the Læsö channel and the Skaw along the Danish coast from the 10th to the 13th February. Section 4A on Plate VI. gives the hydrographic condition on the 10th, and section 4B on the 13th February. The isohaline of 30‰ may be considered as the line of demarcation between the outflowing Baltic water and the inflowing water. Section 4A shows that the Baltic water has advanced about half-way from Læsö Rende to the Skaw, and by its kinetic energy has caused an upheaval and indraught of relatively very salt and warm water (34‰ and 5° C.) from the outside of the Skagen reef into the channel. Section 4B shows that the Baltic water has spread beyond the Skaw at the surface, and at the same time has increased sufficiently in bulk to force the salter layers of 33‰ and 34‰ downwards and outwards. The isotherms follow very closely the changes of the isohalines, which gives us the final proof—if any such be needed—that we have here studied the contest between two different kinds of water of widely different origins.

It is interesting to follow the ramification of the Baltic Stream inside and outside the Kattegat.

At the surface the actual cleavage of the Baltic current is observed at 58° lat., where a tongue of salt water appears between the eastern and western branch of the Baltic water (see stations S_{iii}, S_{iv}, S_{xi}, S_{ii} on Plate V.). But a tendency to bifurcate appears long before in the deeper strata between Frederikshavn and Gothenburg (see section 2 on Plate VI.). On this plate the sections 2 and 3 are drawn on two different scales of depth in order to make the singular formation of the water-layers in the Kattegat more conspicuous. South of Læsö the Baltic Stream flows as a broad current, with its deepest furrow and its freshest and coldest water on the Swedish side of the Kattegat (see section 3). North of Læsö, in section 2, between Frederikshavn and Gothenburg, the Baltic current is seen to plough *two* furrows in the underlying water, which rises to higher level in the stations G_{iii} and G_{ii}, thus forming a wall between the eastern and western branch of the Baltic water, which here shows the tendency to bifurcate at a depth of about

10 mètres, and divides at the surface 30 miles farther northwards in the vicinity of station S_{II} (see Plate V.). Here also the eastern part contains the coldest and freshest water. A closer inspection of section 2, Plate VI., reveals the fact that the undercurrent, like the surface-current, consists of two parts separated (or nearly separated) from each other at station G_{IV}. The eastern part of these undercurrents enters the Kattegat through the deep channel (see station G_{II}). The westerly undercurrent is that which I have already described in the foregoing pages, when discussing the observations in Læsö channel, and exhibited graphically in sections 4A and 4B on Plate VI. It is important to observe that the western, shallower, part of the Kattegat is under certain circumstances exposed to a special influx of water from the deep basin to the west of the Skaw independently of the usual undercurrent of the deep channel.

After this study of the alterations in the constitution of the sea, which occurred in February 1890 at the embouchure of the Kattegat, there can be no doubt of the capability of the surface-currents to produce great disturbances in the deeper strata of the ocean. It would, however, be very difficult to put the theory of reaction-currents to the test by investigations in the open ocean, because the water-strata which have opposite motions in the ocean are not characterised by any particular difference in temperature and salinity. The Baltic, the Kattegat, and Skagerack are well adapted for this branch of research, especially in winter, when the inflowing waters are not entirely covered by Baltic water, but can be traced at the surface over large areas before they dip under the outflowing current.

Lastly, I wish to call attention to the marked analogy between the Baltic current, especially in winter, and the Polar ice-current which passes along the east coast of Greenland and through the Denmark Strait.

Like the Baltic current, the Polar ice-stream is subject to periodical variations with the seasons of the year. From Danish observations, made during 17 years at the mouth of the Arsuk fiord, regarding the time of appearance and the frequency of ice in the sea, A. Hamberg concludes that the Polar current begins to increase in January and February, and reaches its maximum in spring, after which it decreases in the course of the summer months and sinks to its minimum volume in autumn and the early part of the winter.

As the water of the Baltic current on its way to the ocean increases gradually in salinity, and in winter also in temperature, so Hamberg found the waters of the Polar current to increase in temperature and salinity from north to south. The mean values calculated by Hamberg are :—

Latitude.	Temperature.	Salinity.
65°—66°	−0·5° C.	29·37‰
62°—63°	−0·2° C.	30·66‰
59°—60°	+0·4° C.	31·64‰

The salinity of the water of the Polar current thus seems to be almost equal to that of the Baltic Stream on the Swedish and Norwegian coast.

Like the Baltic current, the Polar stream shows a tendency to divide whenever it changes its direction or is deflected from its course by the contour of the coast. The most remarkable branching points in the Polar current are Bear Island, to the north of Iceland, and Cape Farewell. At each of these points the Arctic current splits up into two parts, and sends off a separate branch in a southerly or south-easterly direction (which is, however, soon lost in the surrounding warmer water), just as the Baltic current tends to split up at the mouth of the Kattegat, at Lindesnæs, at Cape Stadt, etc.

From fig. 3 on Plate II., which represents a section across the Polar current in a south-easterly direction from the Greenland coast at 67° lat., to lat. 65°, long. 30° W., according to Hamberg's observations,[1] we infer that the waters of the Arctic current float upon a layer of warmer and salter sea-water, like the waters of the Baltic current in winter at the Swedish coast (see figs. 2 and 3 on Plate III.). Beside the Polar current to the south of Iceland and in the Denmark Strait is found a large mass of warm (6° to 8° C.) and salt (35·2 to 35·0°/₀₀) oceanic water, the Irminger stream. This corresponds to the broad tongue of ocean water in the northern part of the North Sea (see the charts in Plates II. and III.), which in winter has a temperature of 6° or 7° C. and 35°/₀₀ of salt, and dips under the Baltic water off the Scandinavian coast just as the water of the Irminger stream[2] dips under the Polar current off the coast of Greenland.

I have shown that a great part of the *vis movendi* of the deep water in the Skagerack is due to the kinetic energy of the Baltic current, and it seems also probable that no theory of the circulation of water in the North Atlantic can be complete which does not take into account the important effect of the kinetic energy stored up in the waters of the Polar ice-current.

(To be continued.)

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

Dr. Felkin has been appointed to represent the Society at the Meeting of the German Congress of Naturalists and Physicians to be held in Vienna during the month of September.

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[1] See A. Hamberg : *Hydrografisk Kemiska Iakttagelser*, etc.

[2] The isohalines of 34°/₀₀ and 35°/₀₀ water in fig. 3 on Plate II. are drawn from an approximate reduction of Hamberg's observations, and have no claim to represent the exact limits of these waters on the Greenland coast.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The Fauna of West Ross.—Messrs. W. Eagle Clarke and Lionel W. Hinxman have kindly sent us their interesting paper on this subject read before the Royal Physical Society in April last. The area treated of includes Dundonnell, Gairloch, Applecross, Strathcarron and Lochalsh. Although the paper is mostly devoted to the subject of natural history, the geography, geology, and meteorology of the district receive some welcome attention. The region is mountainous, fifty-six mountain peaks attaining heights of between 2500 and 3500 feet, and twenty-seven are over 3000 feet in altitude. In fact, only around the Gair Loch and on North Point is any considerable area of land found under 500 feet above the level of the sea. Between the mountains are narrow valleys, down which flow the principal streams, continued under the ocean level, and numerous sea-lochs, along the shores of which, and at the mouths of several of the glens, terraces of gravel, ancient sea-beaches, prove the presence of the sea at a considerable distance inland in past times. The eastern boundary of the region, following the watershed of Scotland, is nowhere farther than 15 miles from the coast, whence it follows that the streams have short courses, and, with the exception of the Ewe draining Loch Maree, have a small discharge except after rains. Salmon and sea-trout frequent all the rivers, and sea-trout and grilse may be taken in most of the large burns. The lochs are numerous, and vary greatly in size: they contain salmon, pike, char, brown and sea trout. Woods do not cover much ground, although there are some large plantations at Braemore, Leckmelm, and Achnashellach, with some natural wood, especially around Loch Maree. The climate is mild and humid, the mean annual temperature ranging from 46·4° to 46·6°. The mean annual rainfall may be stated as nearly 68 inches per annum. The prevailing winds are from the south and south-west, and are accompanied with mists and rain: easterly winds are dry, and in summer generally bring hot weather. The rocks are mostly confined to three well-marked zones, and consist of Pre-Cambrian and Cambrian rocks and schists. The mountainous character of the area is not favourable to a varied fauna, yet the authors have compiled an interesting and valuable catalogue of the animal life observed both by themselves and others. Although the wild cat, polecat, marten, and badger are now on the eve of extinction, the golden eagle, buzzard, peregrine falcon, and merlin are still rather common, thanks to the conserving influences of the deer-forests, while the black and red-throated divers still visit the mountain tarns in summer. The remarkable absence of bird life over wide stretches of the area, especially of species making their nests on the ground, is accounted for by the heavy rainfall, while the nature and dip of the rocks are, in many places, unfavourable to natural drainage. Thus the young broods are frequently entirely or partially drowned, and the increase of many species is effectually stopped. Indeed, the numbers of black and red grouse are said to be on the decline. Where the woods grow, however, bird life is more common and flourishing. Yet the magpie and the great titmouse do not appear to be present, while the starling, rook, and sparrow are comparatively new settlers and do not yet occur in any great numbers. Of mammalia, the bank-vole has only lately been discovered at Braemore, the farthest northern point of which there is at present any record. The rabbit, now fairly common, was first introduced at Shieldaig in 1867-70 and at Applecross in 1878; the date of its introduction at

Dundonnell is unknown. In all, the authors catalogue 27 species of mammalia and 132 species of aves, of which 91 are breeding ones. Useful notes are appended to each entry.

The Lakes of Denmark.—M. Feddersen describes the Danish lakes in the *Geografisk Tidskrift* of Copenhagen. He distinguishes the lakes on the coast from those of the interior. The former are gulfs now cut off from the sea by small banks; they are particularly numerous on the coasts of Jutland and Zealand. The deepest lakes of the country are the following:—

	Depth in feet.	Altitude.
Fure	122	62
Gleenstrup	108	46
Mos	108	72
Fusing	102	49
Viborg	81	27
Hold	81	27

The depth at which Forel's bars are visible varies from 6 ft. 1 in. in the Bavelse lake (maximum depth 66 feet) to 15 ft. 3 in. in lake Esrom (maximum depth 51 feet). The observations were made in June, in the morning, when the temperature of the water was 59° F.—*Nouvelles Géogr.* May 5th.

The Observatory on Mont Blanc.—The first volume of the *Annales de l'Observatoire Météorologique du Mont Blanc* has been published under the direction of M. Vallot. The observatory was erected in 1890 at the Rocher des Bosses (14,350 feet) and provided with instruments at the expense of M. Vallot, who generously places them at the service of any scientist who may wish to work there. Observations have also been made at the summit of Mont Blanc (15,780 feet), at the Grands Mulets (9875 feet), and Chamonix (3395 feet) with self-recording instruments, and at Geneva.

It is shown that the influence of the ground in raising the air temperature diminishes with the altitude, so that the air on the summit of Mont Blanc is probably colder than free air. The decrease of temperature with altitude is dependent on the hour of the day up to about 10,000 feet; in July and August it averaged 1° C. for 164 mètres (1° F. for 299 feet). The variation of relative humidity is quite different from what it is in the valley. At Chamonix the maximum occurs at about 4 A.M. and the minimum at 2 P.M., whereas at the Grands Mulets the maximum is at 7 P.M. and the minimum at 10 A.M., and on Mont Blanc they probably change hours. The reason probably is that the sun produces an ascending current from the valleys, carrying the vapour to higher regions, which thus become damper as the day advances. The diurnal period of the barometer has been studied at five stations, ranging from Geneva to the summit of Mont Blanc, and it is found that, though the maxima and minima occur at about the same hours, their relative intensities vary. The difference between the morning maximum and the evening minimum diminishes with the altitude, and at the summit the curve is reduced to one morning minimum and a long afternoon maximum, with a slight minimum between 7 and 8 P.M. Dr. Hann has shown that the barometer on Mont Blanc should closely follow the temperature.

M. Vallot also discusses the storms on Mont Blanc, and refers to the movement of snow and glaciers. He made some interesting researches in the tunnel cut out in the ice on the summit in search of a foundation for M. Janssen's observatory. Among these is a determination of the mean annual temperature on the summit, which M. Vallot places at slightly above 1·9° F.—*The American Meteor. Journal*, May.

ASIA.

The Valleys of the Himalayas.—In December last Mr. R. D. Oldham, of the Geological Survey of India, addressed the Manchester Geographical Society on the subject of the drainage of the Himalayas (*Journal*, vol. ix. Nos. 7-9). An important point he noticed was that the watershed does not coincide with the line of greatest elevation. Various theories have been suggested to account for this. Richthofen supposed that the whole region north of the high peaks was once still higher than they are now, and that the present elevation of the peaks is due to their greater power of resisting denudation ; there does not, however, seem to be sufficient difference in the hardness of the rocks to warrant such a conclusion, and it is hard to believe that the Himalayas were once overshadowed by a still higher range to the north. Another explanation, propounded by the authors of the first edition of *The Manual of the Geology of India*, was that the hydrographical features were marked out before the Himalayas attained anything like their present elevation, and the comparatively small drainage areas to the north of the snowy range were attributed to the encroachment of the longitudinal valleys of the Sutlej and Sanpo ; but the gradient of the valleys is less owing to their greater length, nor does there appear to be along their course a general preponderance of softer rocks, which would compensate for this loss of erosive power. Mr. Oldham's suggestion is that the line of maximum elevation did originally coincide with the watershed, and that the high gradient of the rivers flowing direct to the plains has enabled them to cut back through it. The facts are well established that at the commencement of the Tertiary era the Himalayas did not exist in their present form and proportions ; that they grew in elevation during the first half of the period ; and that, when the conglomerates of the upper Siwalik series were deposited—a time corresponding to the Pliocene age in Europe—the Himalayas existed as a mountain range with the main features of its hydrography already marked out. The large size of the boulders and the great thickness and coarse texture of the conglomerates show that the rivers were rapid torrents draining from lofty mountains, but yield no evidence as to the position of the watershed.

The question, then, is whether the headwaters of the Sutlej and Sanpo have cut their way back and encroached on the drainage areas of the transverse river valleys. No observations have yet been made of these headwaters with a view to settling the question. The only specific observation bearing on the subject is that of Colonel Strachey, that the sub-recent gravels of the Sutlej valley extend right up to the Niti pass, and that a detached portion is to be found some two miles south of the watershed, whence it may be concluded that there has been a northward displacement of the divide, and that the Dhauli river has robbed the Sutlej of a part of its drainage. The general features of the surface contour point to the same conclusion ; on the south the approaches to the passes are through deeply cut valleys between precipitous mountains ; whereas on the north the descent is much less, and the size and gradient of the valleys show that they must at one time have been occupied by much larger streams than at present. This state of the watershed Mr. Oldham illustrated by reference to the Zoji La pass and the passes north of Kumaon and Garwhal.

When the Himalayas had still but a moderate elevation there was probably no marked difference between the rainfall on their northern and southern slopes, but as the crest rose the moisture was gradually cut off, and the power of the southern streams thereby much increased at the expense of those on the north. Thus over the greater part of Tibet the streams were no longer able to maintain their course to the sea. The struggle that went on is strikingly illustrated in the Sutlej valley.

At one time the upheaval of the mountains gained the mastery over the erosive action of the river, and the upper Sutlej valley is occupied by an accumulation of sub-recent deposits 2000 feet in depth; later on the river cut down its gorge through the Himalayas and began to sink its bed into these earlier deposits. Mr. Oldham does not extend his theory to those rivers which have very large drainage areas in the high lands to the north, as the Indus and Sanpo; these are probably older than the mountain range.

AFRICA.

The Sahara.—M. Foureau has reported to the Paris Geographical Society the results of his last journey (*Comptes Rendus*, Nos. 7, 8, and 9). He travelled 2800 miles, and mapped his route on the scale 1 : 100,000; he took 138 astronomical observations with a theodolite, and recorded several magnetical and meteorological data. After a rapid excursion through El Golea and across or along numerous wadis and down the gorges of Ain-el-Guettara to Hassi-el-Mongar, he returned northwards across the Baten region, by the ravines of the Wadi Abkhokhen to the west of Guettara, and reached his camp at El-Haj-Mussa on December 3rd, having traversed 400 miles in fourteen days. He then started on his journey to the south-east, his object being to pass through the territory of the Azjer Tuareg and gain Aïr. By the southern edge of the Erg through El-Biodh he came to Temassinin, and procuring a guide he followed the Wadi Jua towards Ohanet, and then, crossing the Erg of Issauan, reached the well of Tajenturt on the road from Ghadames to Ghat. Then the plateau of Eghele was crossed, a great bare desert of sandstone intersected by numerous water-courses, the chief of them being the Wadi Assekifaf; and a little beyond Saghen the expedition encamped in the Wadi Tikhamalt. Here the guide was sent to advise the Azjer of M. Foureau's arrival. The wadi was filled with large pools of water left by the floods of the previous month, and its bed was covered with fine vegetation; here the serfs of the Azjer were encamped with their flocks.

On January 11th the Azjer notables arrived, to the number of eighteen, and, after long negotiations, consented to allow M. Foureau to pass through their country, but only as far as the Anahef mountains, at about 23° N. latitude. Having paid £20 for the right of passage, M. Foureau ascended the Wadi Tikhamalt to Afara-n-Wesherane, where he sojourned three days among the tents of the chiefs. Men and animals find life hard in this country; the former live three-parts of their time on milk food, and very often on herbs. The only routes are the water-courses, the rest of the country being composed of rocky plateaus. The expedition continued to ascend the wadi, and at length reached the Wadi Mihero, the Tuareg chiefs trying all the time on various pretences to prevent its further progress. Here a certain Sheikh ben Mohammed, abetted by a sherif of Adrar, vehemently opposed their passage, and finally M. Foureau was obliged to give up his visit to the Aïr and return to Algiers. He believes, however, that he has gained the friendship of the Azjer chiefs, and hopes to be more successful next season.

M. Attanoux has also been in the Tuareg country as far as Lake Menkhugh, and on his return surveyed a new route across the Erg, by which a caravan could travel in seven days from Bel-Heïrane to Hassi Tanesruft, a well only two days' journey from Temassinin, avoiding the district of El-Biodh, which is not always safe.

Meteorological Observations in East Africa.—The *Mitth. aus den Deutsch. Schutzgebieten*, Bd. vii. Heft 1, contains tables of meteorological records, taken at

Bismarckburg, for the five years 1888-93, and for the year 1892 at Baliburg. The elevation of Bismarckburg is 2329 feet above sea-level. The absolute extremes of atmospheric pressure were 27·74 and 27·30 inches; the lowest monthly mean for the five years, 27·48, occurred in February, and the highest, 27·59, in July. The maximum air temperature was 99·7°, and the minimum 52·7° F.; the monthly mean maximum was 92·5°, in March, and the lowest 79·2, in July; the highest and lowest minima were 68·7° and 66·2°, in February and August. The annual rainfall was 57¼ inches, and the number of rainy days 160½. September is the rainiest month, with 10·7 inches; the rain is considerable from April to October inclusive, August, however, being much drier than the other months in this period. Some of the above figures may not, however, be as accurate as might be wished, certain anomalies having shown that the barometer and thermometers were not always read with sufficient care. Other observations in Togoland were given in vol. vi. p. 379.

At Baliburg Lieut. Hutter continued in 1892 the observations he had conducted in the previous year. He found the annual mean temperature to be 64·6° F., or much the same as in 1891. Two maxima were clearly apparent: the principal in April, followed by a principal minimum in July, the secondary maximum and minimum occurring in November and January respectively. The mean annual range was 5° in 1892, and only 2·9° in 1891. The mean minimum was 55·2° in 1892 and 56·8° in 1891, while the absolute extremes in 1892 were 90·5° and 11·2°, giving a range of 79·3° as against 73·6° in 1891. The rainfall was 104 inches, and there were 236 rainy days. The greatest amount which fell on one day was 3·2 inches, in March, which was also the rainiest month.

GENERAL.

Astronomical Models in the Edinburgh Museum of Science and Art.—Students not uncommonly experience much difficulty in forming an adequate conception of the long intervals of time constantly referred to by the geologist. Quite as often, also, they fail to comprehend the true proportions of the vast intervals of space dealt with by the astronomer. From time to time many scientific men have attempted to lessen this difficulty by representing the various members of the solar system, for example, on a large scale in true proportion to certain distances chosen as units. Sir John Herschel, many years ago, selected for this purpose a large open space wherein a globe 2 feet in diameter was placed to represent the Sun, and a small sphere the size of a pea, placed at a distance of 215 feet, was employed to represent the Earth. This distance being taken as his astronomical unit, Mercury was represented by a mustard seed at the distance of 82 feet from the model of the Sun; Venus by a pea at 142 feet; Mars by a small peppercorn at 327 feet; Jupiter by an orange at the distance of a quarter of a mile, and so on. The same idea has been worked out, in a different manner and on a smaller scale, at the Museum of Practical Geology in Jermyn Street, London.

Dr. Croll, in dealing with geological time, recommended the employment of a strip of paper an inch in width and 83 feet 4 inches in length, with the first inch subdivided into tenths. If each tenth of an inch, then, stands for one hundred years, the width of the band will represent one thousand years, and the total length of the paper one million. The writer of this note has for some years employed for field-demonstrations in both geology and physiography a cord one-tenth of an inch in diameter and 83 feet 4 inches in length for the same purpose. This cord has been taken to represent 1,000,000 miles, and has been used out of doors to enable Edinburgh students to realise the distance between the Earth and the Sun, which on that scale (1000 miles to the inch) is about equal to the distance between

Edinburgh Castle Rock and the summit of Arthur's Seat. The proportional diameters of the Earth (nearly 8 inches) and the Sun (about 74 feet), etc., were, of course, graphically represented by the same means. The observed rates of denudation, or of deposition, of rock material can be graphically shown by the same means.

The obvious disadvantage of the first and of most of these methods is that they are on too large a scale to be at all times easy of application. To be of use for general purposes they should, if possible, be set forth in some public building of a size adapted to the purpose.

A space suitable for such graphic representations exists in the Geological Gallery in the Edinburgh Museum of Science and Art ; and, therefore, with Sir Murdoch Smith's approval, advantage has been taken of the opportunity, and a set of models of the inner members of the Solar System has been constructed to scale by the Museum staff, and placed in that gallery for the use of visitors.

The upper floor of the west wing of the Museum, where the geological collections are accommodated, consists of a large quadrangular hall at the north or Chambers Street end, adjoining two corridors extending respectively along the east and the west sides of the gallery. At the south end the two corridors are connected by the summit of an arch, which rises from the basement floor of the Museum.

From the summit of this arch to the southern edge of the quadrangle above referred to is a distance of 125 feet. If this distance be taken to represent the mean distance of the Earth from the Sun (92,890,000 miles) a scale of 61,925 miles to an inch is obtained, and then the Sun will be represented by a sphere 13 inches in diameter, which, accordingly, is that of the gilded ball fixed on the top of the arch referred to. On the same scale the Earth is represented by a small steel ball, about one-seventh of an inch in diameter, which is fastened to the top of the railing at the south side of the quadrangle. On the same scale the Earth's mean orbital traverse in 24 hours is represented by a line $25\frac{3}{4}$ inches in length, painted vermilion so as to attract attention. The Moon is shown by a small pin's-head at a distance of $3\frac{3}{4}$ inches from the Earth. Its position is shown in quadrature. The relative distance traversed by the Earth and the Moon in revolving about their common centre of mass, during one lunation, is represented by the distance between the front of the cases containing the Fifeshire rocks, at the north-east end of the corridors, and that of the opposite cases devoted to the geology of Stirling.

This arrangement enables the student to understand how it is that the Moon's path is always concave towards the Sun, even during the new moon quarter—a fact that can never be satisfactorily exhibited in the pages of a book. The full import of many facts relating to the tides, and other manifestations of gravitational force, can also be readily apprehended by a study of the same models.

Between the Sun and the Earth, Venus is represented by a small sphere placed on the railing nearly opposite the northern or chief entrance to the gallery, and at a distance of 89 feet from the Sun ; while Mercury again is shown by a small pin's-head nearly opposite the southern entrance, at a distance of 48 feet from the model of the Sun. Mars in the same scale would be placed a few feet outside the northern face of the quadrangle ; but for convenience it is denoted by a pin's-head on one of the window-sills, in a line with the Sun and the Earth.

On the same scale the mero-planets would find a place on the building opposite the Museum ; Jupiter would be represented by a four-shilling piece on the south face of the Signet Library ; Neptune on the same scale would be of the size of a threepenny piece placed on the Free Church College ; and Donati's Comet in aphelion would be between Inchkeith and Burntisland. Lastly, *a Centauri*, the nearest fixed star, would, on the scale adopted, actually be as far off as the West Indies.

Adjoining the model of the Earth is an engraved plate showing the curvature of a segment of a circle of 43 feet radius, which is the distance from that line to the basement floor below. These 43 feet being taken to represent the radius of the Earth, the altitude of the highest mountain and the depth of the deepest ocean-sounding are respectively shown by engraved lines about half an inch in length extending respectively above and below the curved line representing the Earth's surface.

A pendulum arranged so as to demonstrate the rotation of the Earth has lately been suspended in the same gallery ; but its small size renders it unreliable, and it will, therefore, be replaced ere long by one of larger dimensions.

It may not be generally known that the original model of Arthur's Seat, constructed by the Royal Engineers in 1832, on a true scale of 5 feet to the mile, for the plumb-line experiments upon the density of the Earth, is also at present located in the same gallery. J. G. Goodchild, F.G.S., etc.

MISCELLANEOUS.

Lord Dunmore, it is reported, is about to undertake a journey from **New York** to **Europe** by a new route. Passing through the United States, Canada, and Alaska, Behring's Strait will be crossed on the ice, and the journey continued through Siberia.

The Chinese have opened a line of **telegraph** from **Pekin** to **Kashgar**, a distance of about 2500 miles. It is only necessary to construct a line 190 miles in length from Kashgar to Osh in order to complete a new telegraph route across Asia.—*Comptes Rendus*, No. 12.

In the *Bull. de la Soc. de Géographie*, 3e trim., 1893, M. Alfred Grandidier publishes an important article on French travellers in **Madagascar** during the past thirty years, accompanied by a series of maps showing the progress made in the exploration of the island.

Houses are being rapidly built in **Buluwayo**, where a hospital is to be erected as a memorial to those who fell in the late war. A brewery is about to be started. A gold reef has been found running across the market square, which has, accordingly, been pegged off.—*The Colonies and India.*

A fresh emigration on a large scale of Negroes from the United States, particularly Georgia, to **Liberia** has commenced. 100,000 blacks are said to be eager to return to their original abode, finding that they cannot obtain equal rights with their white neighbours in America.—*Globus*, Bd. lxv. No. 19.

The officers of the Geological Survey, Canada, have discovered indications of **petroleum deposits** near **Athabasca Landing**, 150 miles north of Edmonton in the North-west Territory. Skilled oil-miners have been sent by the Government to make the necessary investigations by boring.—*The Colonies and India.*

A serious **flood** has taken place in the **Kulu Valley**, Punjab, caused by a landslip in the Chark Kupri Hills on the head-waters of the Mandalghur Khud. The flood came down the khud very suddenly, the wall of water being said to be 40 feet high. The loss of life is estimated to have been from 100 to 300.—*The Colonies and India.*

Knowledge announces the foundation of a twin **observatory** on the **Gaisberg**, by the town of Heidelberg, at a height of 1000 feet above the university buildings. The instruments from the Karlsruhe observatory are to be removed to one of the buildings, where the meridional department will be superintended by Professor Valentine, while in the other erection the astro-physical investigations will be under the direction of Dr. Max Wolf, who is to be provided with a new photographic apparatus.

The great African telegraph line is being extended along two sections, from Fort Salisbury to Tete on the Zambesi, and from Tete to Blantyre and Zomba. The former section, 200 miles in length, runs through the gold-mining district of Manzoe, and will cross the Zambesi at Tete by posts erected on the islands in the river. The second section is also 200 miles long, and between Tete and Chekwawa on the Shire, a distance of 80 miles, passes along a tunnel cut through dense forests.—*Globus*, Bd. lxv. No. 19.

In the *Chamber of Commerce Journal* for May, Mr. J. Emerson Dowson shows how the change to the decimal system of weights and measures was brought about in Germany. To all who are engaged in scientific work the difference between British and foreign measures is a continual source of annoyance ; indeed, the metrical system is very commonly used in this country for scientific purposes, being also much easier to work with. The introduction of this system would be a much less formidable matter than, say, the adoption of a gold coinage in Germany was ; and if the New Decimal Association succeeds in its aims, it will, we believe, confer a benefit on all classes of the community.

We have received Vol. xviii. of the *Transactions* of the Gaelic Society of Inverness, which, as usual, contains much of interest and value connected with the Highlands. Mr. Norman Matheson writes on apparitions and ghosts in the Isle of Skye ; Mr. Charles Fraser-Mackintosh on minor Highland families, the Frasers of Foyers and of Guisachan ; Mr. A. Polson on the superstitions of fishermen ; Mr. Hector Maclean on the Iberians ; Rev. John Macrury on stray notes on Gaelic, devoting a little space to some sensible remarks on Gaelic place-names ; Mr. William Mackay on General Monk's Highland campaign in 1654, with despatches from that general to Cromwell and Lambert, never before published, and throwing light on a forgotten piece of history ; Mr. Alexander Macbain on the dialect of Badenoch and on Ptolemy's Geography of Scotland ; Mr. W. Mackenzie on Gaelic charms and incantations in the Hebrides ; Mr. John Mackay, C.E., on Sutherlandshire place-names ; Mr. A. Mackintosh Shaw on some Clan Chattan MSS. genealogies and histories ; Mr. Charles Ferguson on the early history, legends, and traditions of Strathardle ; Mr. A. Maclean Sinclair on the Macintyres of Glennoe ; and Mr. Paul Cameron on the Gaelic songs of Perthshire and their composers. The book is illustrated by two maps, and is in every way a well-produced and handsome volume, the variety of its contents and the ability of most of the writers making it the most important serial work published either in or concerning the Highlands.

NEW BOOKS.

The British Mission to Uganda in 1893. By the late Sir Gerald Portal, K.C.M.G., C.B., the British Commissioner. Edited, with a Memoir, by Rennell Rodd, C.M.G. With the Diary of the late Captain Raymond Portal, and an Introduction by Lord Cromer, G.C.M.G. Illustrated from photographs by Colonel Rhodes. London : Edward Arnold, 1894. Pp. 351 and map. *Price* 21*s*.

The sad death of Sir Gerald Portal almost immediately after his return home from his adventurous journey to Uganda, and the death of his elder brother, Captain

Raymond Portal, in Uganda, will be fresh in the memory of all our readers. This volume will serve as a memorial of the two brothers, the two latest victims to the attempts of Great Britain to civilise Africa. The editor, Mr. Rennell Rodd, has published the first eight chapters of the volume as the author left them. The remaining portion consists of extracts from Sir Gerald Portal's diary and his letters to his relations.

Sir Gerald Portal and his companions made a remarkably rapid march from Mombasa to Kampala, traversing 820 miles at an average speed of $12\frac{1}{2}$ miles a day. They had no adventures on the route, but the description of the journey is brightly written and is not overburdened with unnecessary details. Sir Gerald Portal has a good deal to say on the difficulties of transport, condemning *in toto* the present system of porterage and advocating the employment of the zebra. He is careful to avoid the mention of a railway, thinking that it would be improper for him to discuss the *pros* and *cons* of that scheme ; but the following sentence seems to give a clew to his opinion on the subject : "If a railway is ever built the whole way to the Lake, that would, of course, in itself settle all the questions which have been raised above. The suggestion which I have just ventured to make can only have any application in the event of no such railway being made, or of a line being constructed only over a part of the whole distance."

On the journey the travellers visited the Scottish Industrial Mission at Kibwezi. They were received with every possible kindness and hospitality, and Sir Gerald speaks well of the success which the Mission has already had in gaining the affections of the people ; and he thinks that it bids fair, if well supported, to rival in well-doing its elder sister, the Lovedale Mission of Southern Africa. One or two sentences may be quoted here:—"This establishment affords another proof, if such were needed, of introducing the true benefits of civilisation among natives, not in the time-honoured English fashion, with a bible in one hand and a bottle of gin or a Tower musket in the other, but by teaching simple, useful arts, or by inculcating an improved system of agriculture, the benefits of which, and the additional comforts thus acquired, are quickly noticed and appreciated by the imitative African. The ordinary African, by the way, is not half such a fool as he looks. He appreciates, as much as any one, the advantages of a warm blanket on chilly nights, or of an iron hoe to replace his wooden spud in digging his little field ; and the man who can teach him how to earn these luxuries will obtain a proportionate influence over him. . . . Africa, certainly, cannot complain of having received insufficient attention during the past few years, and yet it must be confessed that but little progress has been made except in a few isolated instances. It is to be feared that the shortcoming is to be found in the practice, the *mise en exécution*, of all the carefully devised plans for the improvement in the lot of the negro. It is true that the long hide-whip and the chains of the white overseer are things of the past, and that slave caravans are now scarce ; but it is to be greatly feared that the breechloader and the repeating rifles of the European officer and his half-disciplined troops are still emptied far too often in the cause of civilisation, and that the fire in which the African now finds himself is not much more comfortable than his former passive position in the frying-pan. All the theories, rules for guidance, and plans which have been evolved on this subject are useless if the first principles be forgotten. The ordinary African native is a curious compound of suspicion, superstition, childlike simplicity, and mulish obstinacy ; if he knows and trusts his leader, he may be guided gently towards civilisation, may be made a useful member of society, and even a Christian ; but he will resist with the whole force of his nature any attempts to kick him from behind into comfort or into heaven."

Like all other travellers, Sir Gerald Portal was greatly struck by the appearance of the Waganda on first entering the country. "When at sunset I received the visit of the half-dozen chief men of the place, I was rather surprised to find that they were all dressed in ample robes of the cleanest and most snowy cotton cloth of very fine quality, and that each man was followed by a slave bearing his master's chair or camp-stool! Verily the wearied traveller entering Uganda for the first time, across the eastern frontier, contemplates with unconscious relief the most ornamented, polished, and whitened side of the sepulchre, and at first, at all events, neither sees nor suspects anything of the festering bones, the foulness of iniquity, and the hideous decay which lie behind that pleasing surface."

It is exceedingly to be regretted that the author did not live to finish his book, as we should have been glad to hear from him his view of the reason why Uganda has so deteriorated during the last few years. Can it be due to the influence of Europeans breaking down native customs and laws before the natives were ready to appreciate and to calmly adopt those of the white man?

The chapter on the kingdom of Uganda, its climate and population, is somewhat sketchy and disappointing, but doubtless the author would have elaborated it had he lived. He complains of the contradictory evidence furnished by writers on Uganda; but he does not seem to realise that the authors he refers to wrote at different times about a country that was undergoing a series of constant changes, and Sir Gerald was certainly not in Uganda long enough to form any thorough estimate either of the country or the people.

Sir Gerald Portal's stay in Uganda, his negotiations with the king, with the Protestants and Catholics, are only given in form of brief extracts from his diary strung together by the editor, and therefore, although interesting, do not give a very connected or comprehensive account of what occurred. He had, evidently, great difficulties to contend with, and he seems to have overcome them with much diplomacy.

In the diary of the return journey there are many geographical notes of importance.

Captain Raymond Portal died of fever on the 27th of May 1893, at Kampala. He seems to have been a bright, energetic man, and the editor describes him thus: "He was still the glorious type of physical manhood we remembered on the Iffley path. He still had all the old commanding charm, his honest, kindly nature beaming through the eyes. Grave on occasion, reserved, almost shy with strangers, he was full of a light-hearted humour among his intimates, and his smile went straight to the heart—a man whom men would follow anywhere, and who only needed opportunity to lead. He was the type and pattern of an Englishman at the best—calm, sensible and just, generous, simple and sincere, and his head was as good as his heart." His brief diary is added to the book, which thus perpetuates the memory of the two brothers who devoted their lives to their country and their Queen.

The illustrations are good, and Lord Cromer writes a very appreciative introduction. None can fail to feel a deep interest in this book. The omission of an index is unfortunate.

Durch Massailand zur Nilquelle. Reisen und Forschungen der Massai-Expedition des Deutschen Antisklavereikomite in den Jahren 1891-1893. Von Dr. Oscar Baumann. Berlin: Geographische Verlagshandlung, Dietrich Reimer, 1894. Pp. 377, Index, Map, and 27 Plates. 140 Illustrations in text.

This richly illustrated volume is dedicated to the memory of John Hanning Speke—a courteous act on the part of the author. Quite a new departure seems to have been taken in Germany in the publication of books on Africa, for the number of the illustrations, and the artistic manner in which they are now produced, are far beyond what one is accustomed to in books of travel.

Dr. Oscar Baumann is a well-known African explorer; and as he has spent years in East Africa, it was only to be expected that his book would be well worth perusal, and we are not disappointed. Dr. Baumann was commissioned by the German Anti-Slavery Society and the German East African Railway Company to explore the unknown country in the northern part of the German sphere of influence. He avoided all known routes, and has by his journey added greatly to our knowledge of the Masai country, the south and south-east of the Victoria Nyanza, and the country between the Victoria Nyanza and Tanganika.

The book is divided into three parts. The first, containing six chapters, deals with the journey, and is well written and of considerable interest. The second part deals with the physical geography of the country passed through, followed by two chapters on the anthropology of the various tribes met with, and a most useful chapter on the commercial value of the district.

Eight appendices are given dealing with geology, fauna, flora, insects, cattle, crania and languages. Various authorities, amongst whom are Dr. Hans Lenk, Dr. F. Körnicke, Dr. Rudolf Sturany, Dr. L. Adametz, and Dr. Zuckerkandl, have come to the author's assistance in these matters, and a rich store of very valuable information is given.

Dr. Baumann strongly urges the importance of railways in opening up Africa. He does not advise a railway from either Bagamoyo or Dar-es-Salaam to Tabora, but prefers the route Tanga—Korogwe—Mgera—Irangi—Umbugwe—Meatu to Speke Gulf on the Victoria Lake: he thinks it is shorter and better in all respects, although such a railway would be more difficult to construct than one through Ugogo. He is inclined to think that it would be wise for the English and Germans to combine in making *one* railway. He does not think that ivory will ever pay the cost of the railway, but that it must be supported by agriculture. We can recommend Dr. Baumann's views to the consideration of the authorities. He is also of the opinion that a railway could be constructed at a more moderate cost through German territory than through English, because, he says, the Germans have plenty of labour (the Wanyamwezi), whereas the English would have to import coolies from India. He evidently does not think that any engineering difficulties of importance are likely to occur.

Dr. Baumann has been most successful in his ethnographical researches, and gives a graphic account of the native tribes, their habits and customs.

The population seems to be more sparse than we should have expected—two to the square kilomètre in some parts, Dr. Baumann thinks; and he holds that the country could support a hundred or a thousand times the number.

The illustrations, after photographs or drawings by the author, are excellent; and the book is a credit to the publisher.

Dr. Baumann has rendered a distinct service to our knowledge of Africa by the publication of this volume. His training has rendered him an acute and accurate observer; and his opinions on men and things may, we think, be regarded as perfectly trustworthy.

Die Liparischen Inseln. Erstes Heft, *Vulcano*: Zweites Heft, *Salina.* Prag: Heinrich Mercy, 1893.

The Lipari Islands, a volcanic group off the north coast of Sicily, have been geologically celebrated from remote antiquity, the ancients believing them to be the chosen residence of Vulcan himself. Hence their old name *Vulcaniæ Insulæ*. Lipari is the largest island, followed by Vulcano, Stromboli, Salina, Filicudi, Alicudi, and Panaria. Vulcano and Salina are the subjects of the two princely monographs before us—the work, we believe, of the Archduke Louis Salvator, brother of the ex-Grand Duke of Tuscany. We never remember seeing geological treatises more beautifully printed and illustrated. The illustrations are from sketches from nature made by the Archduke himself, and display all the skill of the artist combined with the science of the geologist. We may instance the view of the Faragghiuni picciulu as exhibiting this combination of geology and picturesqueness in no ordinary degree. Excellent maps of Vulcano and Salina are appended, indicating the land contours, the depths round the shores, and also the covering of the sea-bottom, whether seaweed, mud, rocks, or sand.

The islands are subjected to a very minute analysis, in which again geology and scenery form the leading points. Whilst indicating the rocks he traverses, the author never fails to point out any "schöner Ueberblick" which seizes his artistic eye. Take such a sentence as the following: "From the height of the Faragghiuni 'ranni we enjoy a fine view of the Puortu di Livanti, and observe the greenish-yellow colour of the sea, not merely under the Faragghiuni, but strongest of all at the foot of the first declivity of the Fossa, where the sea is absolutely yellow. Upon the Faragghiuni 'ranni are found a number of little whitish gypsum crystals, as well as in the pumice-like deposits of yellow and red lustre. Halfway up the Faragghiuni 'ranni there is a lovely view of the Faragghiuni picciulu." This view forms one of the illustrations, all drawn on wood by Friedrich Hawránek, who superintended their engraving by skilled artists belonging to Prague. Altogether the printing and illustration of these magnificent volumes does much honour to the ancient capital of Bohemia, as well as to the illustrious artist-geologist who modestly conceals his name.

Polar Gleams: An Account of a Voyage on the Yacht "Blencathra." By Helen Peel. With a Preface by the Marquis of Dufferin, and Contributions by Captain Joseph Wiggins and Frederick G. Jackson. London: Edward Arnold, 1894. Pp. 211. *Price* 15*s*.

The daughter of Sir Robert Peel, Miss Peel showed a love of adventure which, Lord Dufferin in his playful preface declares, "exhibits the untamable audacity of our modern maidens." The *Blencathra* left Appledore, near Bideford, on 25th July 1893. She was a three-masted rigged steam schooner of 424 tons, and built entirely of wood and with an ice-ram. Anchor was not dropped till Tromsoe was reached on 5th August, and two days afterwards the *Blencathra* was joined by the *Orestes*, commanded by Captain Wiggins, Mr. Seebohm's hero. On 29th August the two ships entered the Kara Sea, and Miss Peel records with pardonable pride that she was the first lady who had navigated its waters. She found navigation through it "perfectly delightful. . . . The sun shone brightly, not a cloud intercepted our view of the great vault of heaven, and so mild was the atmosphere that we slept all night with open port-holes, feeling all the better for it." Yet the Kara Sea lies between Nova Zembla and Siberia. On 1st September the vessels reached their most northerly point, latitude 74°, when, "sparkling under a blue sky and brilliant sunshine, the ice formed a *coup d'œil* as striking as it was beautiful." Next day the *Blencathra* entered the mouth of the Yenesei River, and for three weeks anchored off Golchika. In these three weeks, says Miss Peel, "my mind had certainly grown richer by a thousand new impressions never likely to fade." The yacht left Golchika, homeward bound, on 20th September, and, rounding the

North Cape, dropped anchor at last at Dundee on 7th November, the termination of Miss Peel's first voyage at sea, a trip which had occupied nearly four months.

The book is prettily illustrated, and Miss Peel's narrative is both instructive and fascinating. As a specimen of what a London "last year's *débutante*" (as Lord Dufferin styles her) can do, Miss Peel's plucky trip is unique.

Die Reise S.M. Schiffes "Zrinyi" nach Ost-Asien. (Yang-tse-kiang und Gelbes Meer) 1890-91. Verfasst im Auftrage des k. und k. Reichs-Kriegsministeriums Marine-Section, unter Zugrundelegung der Berichte des k. und k. Schiffscommandos, und ergänzt nach Consularberichten und anderen authentischen Quellen. Von JEROLIM, Freiherrn VON BENKO, k. und k. Fregatten-Capitän d. R. Mit einer Reiseskizze und acht lithographirten Tafeln. Wien: Carl Gerold's Sohn, 1894. Pp. xi + 439.

The present volume contains a detailed history of the voyage of the Austria-Hungarian war-corvette *Zrinyi* to China and back in the years 1890-91. The dual empire has trade relations with the Celestial Empire and with certain East Indian ports, which make it desirable from time to time to show the Austrian flag in the seas of Eastern Asia. Accordingly, it is deemed expedient to despatch a war-vessel every few years. At the same time the voyage serves a second useful purpose, in that a body of Austrian naval cadets are taken on board and given a prolonged course of instruction in seamanship. The book before us is an official account of one of these combined diplomatic and training voyages. Its wealth of detail, and the evident care with which the narrative has been written, should make it interesting reading for the officers of our navy and mercantile marine. The vessel's itinerary, it may be useful to know, was through the Suez Canal, *viâ* Colombo, Singapore, Shanghai, up the Yang-tse-kiang as far as Hankow, then through the Yellow Sea, touching at Chefoo, Port Arthur, and Chemulpo, and back by way of Foochow, Hongkong, Singapore, and so on.

Andalusien. Eine Winterreise durch Südspanien und ein Ausflug nach Tanger. Von ERNST VON HESSE-WARTEGG. Leipzig: Verlag von Carl Reissner, 1894. Pp. viii + 443.

Andalusia, which comprises the southern provinces of Spain, is supposed by some to owe its name to the Vandals, by whom it was overrun early in the fifth century of our era; but it is perhaps an Oriental word signifying the Land of the West. It is a country rich in all those materials which best subserve the art of picturesque description. It is overarched with sunny skies, while its surface is diversified with mountain chains, the summits of which soar snow-clad far into the ethereal blue. It has valleys, some of wildest grandeur, others of softest beauty, permeated by fair-flowing streams and luxuriant with a vegetation of quite a tropical character. It is, at the same time, a land rich in historic memories which carry the mind far back into antiquity—rich, also, in treasures of art and in remains of past grandeur. The Andalusians themselves are in many respects an interesting people. In their veins runs the cold Northern blood of the Goth commingled with the warm Southern blood of the Saracen. Their disposition is towards gaiety, but with some taint in it also of ferocity—for while they delight in dance and song, their joy of joys is to witness the horrors of the sanguinary bull-fight. The population also, among its other constituents, presents conspicuously to notice characters dear to romance—the gypsy, the smuggler, and the bandit. All these and other characteristics of the country and its people are vividly depicted by the author of this work—a man evidently of varied accomplishments, and the master, at the same time, of a felicitous literary style. From the preface, we learn that he has travelled in many countries both of the Old and New World. When visiting Mexico, the West Indies, and South America, he found in the manners and customs of the people, as well as in their utensils and in their apparel, much that strongly reminded him of what he had learned in the Mohammedan Orient. Articles, such as thousands of years ago were in use amid the scenes of Biblical history, he found in form but little altered in the hands of the Indians on the coasts of the Pacific Ocean. This Eastern culture had reached the New World by way of Andalusia, into which it had in turn been imported by its Saracen conquerors. In that congenial region it flourished for centuries, and even continued to exist long after the Moors had been driven from the last bulwark of their power in Spain. It was this culture which Columbus and his followers transplanted to America, and it was in 1892, the year in which the fourth centenary of their great discovery fell to be celebrated, that our author, to whom Orient and Occident were both well known, had his wish gratified of visiting Andalusia, the link by which the two are connected. He landed at Gibraltar accompanied by his wife, to whose pen we owe two chapters of the work—one regarding the women employed in the great cigar manufactory at Seville, and the other a description of harem life as witnessed at Tangier. He visited all the great cities of Andalusia—such as Cadiz, Seville, Cordova, Granada, Malaga, as well as others to which travellers rarely direct their steps. In the course of his wanderings he had an opportunity of inspecting a great cork forest belonging to the ducal family of Sidonia-Medina, the famous vineyards of Xeres also, and the deserted seaport of Palos, memorable as that from which Columbus sailed to discover the New World. His observations show that wherever he went he kept his eyes open, and carefully scrutinized all that fell under his notice. His book is therefore, from beginning to end, as full of instruction as it is of interest. It has not a single dull page, and we trust it will soon be translated for the benefit of English readers.

Some Salient Points in the Science of the Earth. By Sir J. WILLIAM DAWSON, C.M.G., LL.D., etc. With Forty-six Illustrations. London: Hodder and Stoughton, 1893. Pp. x + 499. *Price 7s. 6d.*

Those who are given to geological studies will find a good deal to interest them in this work by Sir J. W. Dawson, which consists of thirteen chapters, each dealing with a special subject, though the whole forms a progressive series from the "Starting-point" to "Man in Nature." Of especial interest, from a scientific point of view, may be mentioned Chapter ii., "On World-making;" Chapter iv., the "History of the North Atlantic;" and Chapter xiii., the "Great Ice Age."

The great object of the book, however, seems to be to "have a dig" at the doctrine of Evolution, and we are sorry to be obliged to confess that the way in which he fights his battle does not seem to us to be very straightforward. He nowhere says directly that he believes in what naturalists understand as "special creation," yet he occupies himself all through the book with throwing stones at the doctrine of descent. He dishes up to us all the old fallacious arguments about the high organisation of the Trilobites, Lingulæ, and Pteropods found in "primordial" rocks, but is strangely silent regarding the morphological evidences of evolution as shown, for example, in the progressive abolition of the lateral digits in the series of horses, or the relationship of the homocercal to the heterocercal form of tail in the series of fishes. He does not conceal that he is aware of the imperfection of the geological record, yet he carefully tries to escape from the overwhelming importance of this unavoidable admission. He points to the Cambrian fossils—"highly organised crustaceans, worms, molluscs, and other creatures"—and then tells us how that "to a Darwinian evolutionist this means that these creatures must have existed through countless ages of development from their imagined simple ancestral form or forms—how long it is impossible to guess, since, unless change was more speedy in the infancy of the earth, the term of ages required must have far exceeded that from the Cambrian to the Modern. Yet to represent all this we have absolutely nothing except Eozoon in its solitary grandeur, and a few other forms, possibly of Protozoa and worms."

Alas for poor *Eozoon*, whose supreme function with Sir J. W. Dawson is evidently to show not only that organisms might be preserved in such highly metamorphic rocks as the old Laurentians, but that in its "solitary grandeur" it was the immediate and only predecessor of the Cambrian Trilobites and other highly organised creatures! Indeed, alas!—for the ranks of the defenders of the organic theory of Eozoon are waxing thin. Who are they now, it may almost be asked, except Sir William Dawson himself? And he, too, may as well give it up as a lost cause.

In dealing with Man in his concluding chapter, our author, though admitting the human organism to the *class* Mammalia, enters into a heroic protest against his being placed with the monkeys in the *order* Primates. We wonder, indeed, what our comparative anatomists and osteologists will say to a statement like this: "If he were an extinct animal, the study of the bones of his hand or of his head would suffice to convince any competent palæontologist that he represents a distinct order, as apart from the highest apes as they are from the Carnivora."

Well, after all, what is the great point gained by denying man a place in the same "order" with a monkey, if we at the same time allow him to be put in the same "class" with a donkey?

Life of General Sir Hope Grant, with Selections from his Correspondence. Edited by HENRY KNOLLYS, Colonel (H.P.) Royal Artillery, his former A.D.C. William Blackwood and Sons, 1894. Two volumes, pp. 359 and 362, with Index and Illustrations.

This book, which consists for the most part of extracts from the voluminous journal written by Sir Hope Grant during the many years he spent on active service in India and China, will have a special interest for Scotchmen. The distinguished officer whose life is here chronicled was a Highlander—a Grant of Kilgraston—and a brother of Sir Francis Grant, the distinguished President of the Royal Academy. When he first went to Hongkong, in 1842, the voyage occupied 164 days, and China was practically unknown to civilised nations. In perusing the book, the reader wishes that the extracts containing the remarks of so shrewd an observer on the countries he served in could have been fuller; for instance, that it had not been necessary to omit his description of the "large and wonderful city (Shanghai), with its neighbourhood, population, and cultivation." But at that time stirring events were occurring, and Sir Hope played so conspicuous a part in them that space could not be found for such comparatively tame records.

The journals are absorbingly interesting, bringing before the reader the occurrences they describe in the most vivid manner; but what strikes one most is the extreme modesty of the man—always extolling the exploits of others, and making little of the important part played by himself, or of the dangers, hairbreadth escapes, and hardships to which he was constantly exposed. He never imputed an unworthy motive to those with whom it was his misfortune to disagree. He was an earnest Christian, a true gentleman, and a brave soldier; and no one can rise from the perusal of this record of his life without feeling improved and elevated by it.

It may be doubted whether the editor has exercised a wise discretion in printing such a document as the letter from the Vicar (pp. 332-3), which was written after the incident it relates to had been officially closed, and in reprinting the animadversions passed by the Field-Marshal Commanding-in-Chief on the Commander-in-Chief in India in connection with the once celebrated Jervis court-martial, with which Sir Hope Grant had nothing whatever to do. These throw no light on the General's character or achievements, and it would have been better to omit them.

It should be noted that on the map illustrating the battle of Sobraon the arrow indicating the direction of the current of the river Chenab is drawn pointing in the wrong direction ; and this seems to have led to the erroneous inference conveyed on p. 123, that Ramnuggur is on the left bank of the river.

Rulers of India: Sir Thomas Munro and the British Settlement of the Madras Presidency. By John Bradshaw, M.A., LL.D., Inspector of Schools, Madras. Oxford : At the Clarendon Press, 1894. Pp. 233. *Price* 2*s.* 6*d.*

The backbone of the Indian revenue is, as is well known, the land revenue ; and nothing has a greater influence on the well-being of a community generally than the principles regulating the tenure of land and the assessment and collection of the revenue imposed upon it. In the Madras Presidency the land is generally held by peasant proprietors, who pay the revenue assessed directly to Government, without the intervention of any superior owner. That this is the case is the result mainly of the exertions of Sir Thomas Munro, who has thereby left an ineffaceable impression on the administration of the Presidency, for which, as for what more he contributed to the British settlement of Southern India, he well deserves a conspicuous place in the roll of Rulers of India. Apart from his political importance, he was also a man of singularly attractive character—one of the best specimens of a type of man of which Scotland has given to India not a few ; one of "the trio of illustrious politicals"—Munro, Elphinstone, Malcolm, all of them Scotsmen, who played the chief part in the introduction of British administration into Southern India. No British ruler in India has ever evoked, in all classes of the community, a warmer feeling of affectionate regard, nor is the memory of any cherished with deeper reverence.

Dr. Bradshaw has contributed to the series of Rulers of India a sketch of Munro's career, which so portrays the man as to render intelligible the profound impression he made on the popular mind and the feeling yet excited by his name. The selections from Munro's letters, diaries, and State papers are judiciously made, and are such as to illustrate the character of the man and indicate the principles by which he was guided in his administration, both as a district officer and in the wider sphere of the Governorship of Madras. But, considering the character of the series, we are not satisfied that the account of Munro's work as ruler is so adequate as it might have been made even in this necessarily short memoir. Room might have been found for a more detailed account of the genesis and development of his characteristic theories and methods—especially of the important principle of revenue administration with which his name is identified. Dr. Bradshaw, writing in Madras where all this is very generally known, thought probably that it was superfluous, forgetting that for Western readers a more minute picture of the ruler might be useful, and that not only Munro's character but also his work needed ampler treatment. Still, the short memoir can be confidently recommended to all who wish to make acquaintance with a lovable and noble-minded man.

Japan ("*The Story of the Nations*" *Series*). By DAVID MURRAY, Ph.D., LL.D. London: T. Fisher Unwin, 1894. Pp. v + 420. *Price* 5s.

Among the many books that have been written on Japan and the Japanese this volume will take an important and unique place. With the exception of the first chapter, which gives a concise description of the physiographical features of the Japanese archipelago, the book is an historic epitome of the development of Japan as a nation. The Ainu is treated incidentally as the remnant of what was almost certainly the original race inhabiting these islands, the Japanese being as truly an immigrant as was the Angle in our own island. Not till centuries after the Japanese had taken possession was there anything of the nature of a written record; but in the myths and legends, of which Dr. Murray gives some characteristic specimens, there is ample evidence that the settlement of the country was a stormy one. Out of the conflict of rude barbarous tribes a central power gradually emerged, and was fairly well consolidated in the early centuries of our era when writing and the arts were introduced from Korea. Dr. Murray retails the outstanding features of the reigns of the early emperors, though it may be questioned whether the term emperor is at all a fit one as so used. The "empire" ruled over by Jimmu Tenno and his immediate successors included a few provinces in the south. From these, by a method very familiar in the history of nations, Japan gradually expanded. Dr. Murray follows the best authorities in rejecting as historically untrustworthy most of the tales of prowess previous to 500 A.D. These could have come down only in the form of tradition. The modern Japanese, who bases his loyalty on the sentiment that his dynasty is the oldest continuous dynasty extant, is slow to admit this obvious axiom. From the sixth century of our era, when through the influence of China Japan took the first great strides in civilisation, a genuine history can be compiled. It divides itself naturally into certain well-marked epochs, to each of which Dr. Murray assigns a chapter. The broad lines of historic development are well drawn through the fierce internecine struggles of the eleventh and twelfth centuries, and the hopeless anarchy that prevailed during the Ashikaga Shogunate until Nobunaga appeared. His work of consolidation, continued by Hideyoshi and completed by Ieyasu, made Japan such as it continued to be down to the "Restoration" of 1868. A great deal regarding the Japanese feudal system has still to be made out; but its main features are sufficiently well understood and are clearly described by Dr. Murray, who has escaped alike the confusion of over-detail and the meagreness of superficiality. The history is brought down to the promulgation of the New Constitution in 1889 and the tragic end of Mori Arinori, the Minister of State for Education. To the reader who desires to get an intelligent view of the life-history of the Japanese nation this volume will be eminently serviceable. The author has read widely and to good purpose, and gives full references to his authorities; while his personal familiarity with Japan of to-day is a further guarantee for the general accuracy of his views. Well-selected illustrations, two maps, and a good index enhance the value of a work which is fascinating and yet sound.

Elementary Meteorology. By WILLIAM MORRIS DAVIS, Professor of Physical Geography in Harvard College. Boston, U.S.A.: Ginn and Company, 1894. Pp. xii + 355. *Price* 10s. 6d.

Professor Davis summarises the plan of his book in the following sentences: "The origin and uses of the atmosphere are first considered, with its extent and arrangement around the earth. Then, as the winds depend on differences of temperature over the world, the control of the temperature of the atmosphere by the sun is discussed, and the actual distribution and variations of temperature are examined. Next follows an account of the motions of the atmosphere in the general and local winds, in the steady trades of the torrid zone, and in the variable westerly winds of our latitudes. The moisture of the atmosphere is then studied with regard to its origin, its distribution, and its condensation into dew, frost, and clouds. After this, we are led to the discussion of those more or less frequent disturbances which we place together under the name of storms: some of them being large, like the great cyclones, or areas of low pressure on our weather maps; some of them very small, like the destructive tornadoes. The effect of these storms and other processes in the precipitation of moisture as rain, snow, and hail is next considered. Closing chapters are then given to the succession of atmospheric phenomena that ordinarily follow one another, on which our local variations of weather depend, together with some account of weather prediction; and another on the recurrent weather conditions that we may expect in successive seasons, repeated year after year, which we call climate."

The author admirably carries out this programme, the treatment throughout being thoroughly scientific. The English student who has long wished for a satisfactory text-book of meteorology in his own language will find this work the best for his purpose. The main defect is that the references to the literature of the subject are so scanty. This is the more to be regretted because Professor Davis's wide knowledge of the subject and experience in teaching it especially fit him to guide the advanced student to the more important papers, which are too often buried between pages of observational details or discussions of local records.

Only a few of many original and excellent features of this book can be noticed. On page 21 is a striking diagram of the amounts of insolation (radiant energy emitted by the sun) received in one day at different latitudes and seasons; that reaching the Equator on the day of the vernal equinox being taken as unit. Throughout the book vertical sections of temperature and pressure are inserted, and greatly add to the elucidation of the various questions considered. The discussion of gradients is exceptionally good.

The *Challenger* maps of January and July isotherms and isobars have been reproduced. The isanomalous[1] temperature lines for January and July based on these maps, as well as the lines of equal range of annual temperature, have been charted by Professor Davis's pupils, and are here reproduced.

The discussion of the general circulation of the atmosphere is based on Ferrel's theory. This required a low-pressure area to exist over the poles; but the facts are not so convincingly in favour of this as Professor Davis imagines, even in the case of the South Pole. Dr. John Murray has pointed out that all wind observations in latitudes higher than 60° S. are southerly or south-easterly, and point to an anticyclonic area of relative, if not absolute, high pressure round the South Pole. (See *Geographical Journal* for January 1894, p. 17, and *Scottish Geographical Magazine*, April 1894, p. 196.)

Land Systems of Australasia. By WILLIAM EPPS, author of *The People and the Land.* London: Swan Sonnenschein and Co.; New York: Charles Scribner's Sons, 1894. Pp. 184.

This interesting little volume is well worth a perusal by our readers. The various land Acts which have been in force from time to time are described in

[1] Thermal anomaly = difference between the mean temperature of any place and the mean temperature of its latitude.

divisions treating of the different colonies; and the historical retrospect, which has been ably executed, forms, perhaps, one of the most extraordinary object-lessons in experimental land legislation that could possibly be imagined. Almost every conceivable method has been tried to encourage, and at times discourage, settlement; but it may be said that, in spite of land legislation, the development of the Australian Colonies, up to the financial crisis of a few months ago, was unparalleled. Statistics are given to illustrate the slow rate at which population in rural districts is increasing as compared with the growth of that of large cities—more particularly the capital cities of the different colonies. While we appreciate the matters of fact treated of, and the concise and interesting method adopted in stating them, we are not so confident as our author that coming land legislation is the great means by which the steady flow of population into large centres is to be checked. Crown lands are subject to the control of the voice of the people through their parliamentary representatives. It will be interesting to those agriculturists in this country who sympathise with the movement for the nationalisation of land to learn that in New South Wales (the oldest colony and the one with the most varied experience in the matter of land legislation) all "improvements on the land, at the expiry of the lease, become the property of the Crown, without compensation, and the land may then be dealt with as desired." The executive power in this colony has, by recent legislation, been somewhat decentralised by the appointment of local land boards, having control over one or more land districts. Existing legislation in connection with land is of such recent date that neither its success nor its failure can be said to be assured. The experiments now being tried with the object of discovering some method of procuring from the land "the greatest benefit for the greatest number," irrespective of class interests, and even irrespective of what till recently have been held sacred as class rights, are not without interest to those who are connected with land management in this country. We trust that the volume before us will have such a reception that the author may, for the public benefit, be induced to keep the information on this interesting problem up to date by the issue from time to time of extended editions.

Special Report on the Agricultural Resources of Canada. By ROBERT WALLACE, F.L.S., F.R.S.E.

Scotch Tenant-Farmers on the Agricultural Resources of Canada. The Reports of Mr. JOHN STEVEN and Mr. ALEXANDER FRASER on their visit to Canada in 1893.

Canadian Agriculture. A Report of a Visit to the Dominion in 1893. By Professor JAMES LONG. London: 1894.

Intending emigrants, and those who are interested in agriculture or in the progress of the Dominion, will gain much instruction from the perusal of the above pamphlets, which may be obtained on application to the High Commissioner for Canada. All the writers speak well of the country and of the quality of its agricultural produce. Wheat now fetches such a low price that they recommend the adoption of mixed farming. Cattle-breeding is being developed, hay is now imported to this country, dairy produce may be successfully disposed of, and fruit is remunerative. As to the immigrants, the authors state what has often been said before but cannot be repeated too often, that a settler in Canada must be prepared to work hard and not be too easily upset by difficulties. Capital is, no doubt, an advantage, when a man knows how to make use of it, though many have done very well without it, while other have lost what they had to start with. To become really prosperous, even steadiness and hard work are not sufficient; a man must also possess energy and enterprise. The Icelandic settlers overcome the initial difficulties with ease, but never advance beyond a certain level of well-being, from want of these qualities. As everywhere else, it is the few who acquire large fortunes ; but a man of ordinary capacity may, with hard work and perseverance, make a comfortable living. The crofter emigrants from Scotland, in spite of the efforts of agitators to excite discontent, are on the whole satisfied with their position and prospects.

Le Père Huc et ses Critiques. Par Henri-Ph. d'Orléans. Paris : Calman Lévy, 1893. Pp. 65.

In this pamphlet Prince Henry of Orleans defends the reputation of Père Huc against the attacks of Przhevalsky, who threw doubts even on the fact of the well-known traveller's journey. Changes take place even in the East, and it not infrequently happens that two writers are unconsciously describing different localities, and hence discrepancies may easily arise between the accounts of a country published at an interval of forty years. Huc, no doubt, made mistakes occasionally, but will always be famous as the first European traveller in Tibet, and on the whole his descriptions may, according to the testimony of Mr. Rockhill, be relied on.

Anson's Voyage round the World in the Years 1740, 1741, 1742, 1743, 1744. By Richard Walker, M.A., Chaplain of the Flag-ship *Centurion.* London, Glasgow, and Dublin : Blackie and Son, Limited, 1894. Pp. 220. *Price* 1s. 4*d.*

This neatly got-up, well-printed volume forms one of a series now being published by the Messrs. Blackie under the name of "Blackie's School and Home Library." The series is intended for the benefit of young people, and boys ought to enjoy the perusal of the present work, which, as it is now a classic, needs no further mention in this place. But the publishers may be congratulated on preparing such books, so cheap and yet so excellently produced.

The County Directory of Scotland (for 1893-1896), *containing the Postal Addresses of Mansions and other Rural Residences in Scotland; their Occupants; nearest Telegraph Office and Distance;—also, the Postal and Telegraph Addresses of all Towns, Villages, etc.; and various Information appertaining thereto.* Postally edited by George Massie, General Post Office, Edinburgh. Proprietor and General Editor, Arthur Giles, F.R.S.G.S. Edinburgh : R. Grant and Son, 1894. Pp. xxx + 1048.

The jubilee issue of this important work exhibits, so far as we have been able to test it, traces of great care and ability in preparation, while the variety of its information makes it an indispensable companion to business men and to officials whose correspondents live in Scotland. We have only observed one or two errors in the inclusion, as occupants of residences, of persons who are now dead ; but, looking to the time which must necessarily elapse before such a volume is ready for the press, it is surprising how unimportant these slips are. The work is divided into three parts. The first contains residences in alphabetical order, followed by the names of the occupiers, with their location and the nearest post and telegraph offices. The second portion is a directory of persons, also arranged alphabetically, followed by the residence of each, its location, and postal information, as in the first part. The concluding division consists of a gazetteer of all towns and the principal villages in the country, with their populations, clergy, officials, telegraph and postal information, and other useful matter. This edition was exhausted on publication, and cannot be reprinted. The volume is a very handsome one, well and clearly printed, and accompanied by an excellent map of Scotland showing railways and principal roads.

NEW MAPS.

EUROPE.

SCOTLAND: The "Safety" Cycling Map of ——. Edited by H. R. G. Inglis.
Edinburgh and London: Gall and Inglis.

The chief feature of this map is the colouring of the various roads so as to show at a glance whether they are superior main roads, superior main roads but hilly, ordinary, hilly, or rough, bad or very bad roads. Brightly coloured symbols mark steep and dangerous hills. Such a map ought to prove useful to cyclists. We have tested it, so far as we could, and found it accurate, except where a single hill ought, we think, to have been marked by a red triangle. The tinting might have been more pleasing, and we hope that a mounted edition can be had; otherwise the map will not wear well if consulted, as cyclists' maps so often are, in high wind or during rain.

EDINBURGH AND PORTIONS OF THE ADJOINING COUNTIES: W. and A. K. Johnston's Cyclists' Road Map of the County of ——.

In this map the different counties are distinguished by colours, the main roads are marked by strong red lines, and the cross-roads are shown in black, with railways in blue. Thin red lines mark mile circles from the Register House—a very useful feature. The area represented stretches from Beath Kirk in the north to Hallyards in the south, and from Gifford in the east to Shotts in the west. A few pages of letterpress give particulars regarding routes, etc. The printing is distinct, the size handy, and the mounting substantial.

NETHERLANDS AND BELGIUM.
Edinburgh and London: W. and A. K. Johnston.

This is a very clear, well-printed, and tastefully tinted wall chart. The names are not crowded, and the towns are distinguished by different types and symbols according to their population. Lakes and rivers, with their names, are printed in blue, still further preventing confusion. The map is accompanied by a good little handbook.

KOPAÏS-SEE, Der ——, und seine Umgebung. Von Dr. Alfred Philippson.
Zeitschrift der Gesell. für Erdkunde zu Berlin, No. 1, 1894.

ASIA.

KURDISTAN. By Captain F. R. Maunsell, R.A., F.R.G.S., 1892. Scale 1: 3,000,000 or 47·5 miles = 1 inch. *The Geographical Journal, February.*

BORNEO, Der Südosten von ——. Nach den neuesten Gouvernements-Aufnahmen und eigenem Journal entworfen und gezeichnet von Gottfr. Schneiders. Massstab 1: 2,000,000. *Petermanns Mitt., Tafel* 3, 1894.

TIBET and the Surrounding Regions. Compiled from the latest information.
The Geographical Journal, July 1894.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

A REVIEW OF SWEDISH HYDROGRAPHIC RESEARCH IN THE BALTIC AND THE NORTH SEAS.

By Otto Pettersson.

IV.

The Inflowing Waters.

All the inflowing waters which enter into the Skagerack or Kattegat as undercurrents can be found at the surface in some part of the North Sea. If the hydrography of the North Sea were more fully investigated than it is at present it would be easy to account for the origin of all kinds of water which are found in the Skagerack at any season of the year.

It appears from the sectional diagrams, figs. 1 and 2 on Plate II., which I have constructed [1] from the observations of the German expeditions in the *Drache* to the North Sea, 1882 and 1884, that a large mass of oceanic water of over $35^{\circ}/_{00}$ salinity fills the centre of the northern part of the North Sea as far as the Dogger Bank. It stretches as a broad band obliquely over the great northern submarine plateau of the North Sea from the Shetlands and Orkneys to the entrance of the Skagerack, where it dips under lighter water-layers (see Plate II., map and sectional diagrams).

We ascertained by observations in February and March 1890 and during the whole winter 1891-92, that at every season [2] of the year

[1] In the publications of the *Drache* Expedition the sectional diagrams represent only the distribution of temperature, not of salinity.

[2] *N.B.*—In every season (not every month or week) of the year.

Our observations were taken (under the direction of Dr. J. Grieg) on the route from Bergen to S. Shields during the winter 1891-1892. We endeavoured by means of these there exists such a broad area of oceanic water (35°/$_{oo}$) at the surface of the central part of the North Sea, although its limits are variable and seem to be more restricted in winter than in summer. Plate III. shows the configuration of the surface of the North Sea in February and March 1890. There can be no doubt that the tongue-shaped area of dark blue colour on the maps in Plates II. and III. represents an influx of water from the North Atlantic into the Skagerack. Figs. 1 and 2 in Plate II. show *that this great body of oceanic water flows into the Norwegian deep channel along its western side, and thence into the deep basin of the Skagerack* (figs. 4, 5, 6—dark blue), filling a considerable part of it. At the Norwegian side of the North Sea, and at the entrance to the Skagerack, it is overlapped by waters of lesser density and saltness. The peculiar manner in which these water-layers overlap each other is understood by comparing the coloured map in Plate II. with the sectional diagrams in the figures beneath, in which the same colours denote the vertical arrangement of those water-layers in the diagrams, and the horizontal distribution in the map above. The letters on the map and the sections correspond to one another.

These water-layers, which are denoted in the maps with special colours, are the following:—

1. *Ocean-water of* 35°/$_{oo}$ *salinity* or more, represented by dark blue.

2. *Water of from* 34 *to* 35°/$_{oo}$ *salinity.* A broad light blue area encircling the dark blue tongue on the chart represents the distribution of this kind of water, which, on account of its predominance over a great part of the North Sea, we have called *North Sea water*, and in the following denote shortly as 34 water, because its salinity is above 34°/$_{oo}$.

3. *Water from* 33 *to* 34°/$_{oo}$ *salinity*, marked on the maps in olive green; and

4. *Water from* 32 *to* 33°/$_{oo}$ *salinity*, indicated by a lighter shade. These kinds of water are seen on the charts to form a broad edging or band along the continental coast, covering the coast banks of Holland, Germany, Denmark, and Norway. Therefore we denote them as *bank-water*, or 32 and 33 water.

5. *Water from* 30 *to* 32°/$_{oo}$ and

6. *Water of less than* 30°/$_{oo}$ *salinity* are represented by yellow colours, and belong to the Baltic Stream, when found at the surface of the sea outside the Kattegat. This reservation is necessary because, as I have

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surface observations to draw *synoptic charts* of the North Sea and Skagerack, after the patterns shown in Plates II. and III. These charts bear out the following facts :—

1. The tongue of oceanic water (35°/$_{oo}$), laid out in deep blue colour in the maps II. and III., where it stretches obliquely across the northern North Sea from the Shetlands to the Dogger Bank and the entrance of the Skagerack, is *much broader* in summer and autumn than in winter, as can be seen from the Plates.

2. From January this band of 35°/$_{oo}$ water began to diminish in extent. At the close of March or in the early days of April it had disappeared altogether from the North Sea, which at that time was filled entirely with 34°/$_{oo}$ water. At that time the temperature *reached its minimum* in the surface water of the northern North Sea, where it varied between the limits 4·8° and 6·5° C.

3. In the last week of April the broad band of 35°/$_{oo}$ water appeared again in our charts at its usual place.

already observed, the Baltic Stream increases in salinity during its course. Thus, we found it change from 30°/₀₀ to about 31-32°/₀₀ after having turned its direction through a sharp angle south of the Christiania fiord. To the west of the Naze it probably increases still more. Consequently the salinity is not a necessary attribute but only a *local accident of the Baltic Stream.* Outside the Naze, water of a certain saltness may form an integral part of the Baltic Stream, while in the Skagerack, east of the Naze, water of the same saltness is found always to move in the opposite direction to that of the Stream. We know very little of the condition of the Baltic Stream off the west coast of Norway, because the hydrographic state of the Norwegian channel has not been sufficiently explored, though the circulation in that part of the North Sea is of extreme importance. We must therefore necessarily restrict the scope of our conclusions to the circulation of water in the Skagerack. And there we have found the rule to hold, that water of higher salinity than 32°/₀₀, viz.,

Ocean-water,	. .	35°/₀₀ (dark blue in the maps),
North Sea water,	. .	34°/₀₀ (light blue „ „),
Bank-water,	. .	32-34°/₀₀ (olive green, etc.),

always belongs to the *inflowing* layers, and that water of salinity below 29 or 30°/₀₀ belongs to the *outflowing* Baltic Stream, to which also the water of 30-32°/₀₀, which in winter is found off the SE. coast of Norway, must be counted, although water of such high salinity in the east part of the Skagerack generally belongs to the ingoing current.

It will be seen from section 1 on Plate VI., which follows a line crossing the entrance to the Skagerack from the Skaw to Christiansand, that the water-strata of different saltness, which are represented by six different colours in Maps II., III., and V., are superposed upon each other in the basin of the Skagerack. A closer inspection of section 1 shows that the limits of temperature represented by the isothermal (red) lines almost coincide with the limits of saltness (isohalines or black lines).

The chief part of the water of 35°/₀₀ saltness, excepting the bottom-layers, has a temperature above 6° C.

The isohaline 34°/₀₀ is enclosed between the isotherms 6° and 5° in February.
„ 33°/₀₀ follows the isotherm of 4° in February.
„ 32°/₀₀ „ „ 3° „

This, with very little modification, will also be found to hold good for the following sections. Thus a certain amount of saltness in every stratum of water corresponds to a certain temperature in winter (February). This suggests the idea that the waters which meet and overlap each other in the Skagerack, and which we have represented by blue, green, etc., may have their origin in different parts of the sea. Such is really the case, as we have proved by a number of facts.

I will now proceed to discuss the properties of each of these water-layers separately.

1. The deepest water-stratum in the Skagerack has more than 35°/₀₀ of salt, which is an infallible proof of its oceanic origin. It flows into

the deep Norwegian channel, across the northern plateau of the North Sea, and arrives almost unaltered as an undercurrent in the basin of the Skagerack. The distribution of this water at the surface of the North Sea in summer and winter I have already discussed in the foregoing pages. It is represented graphically on Plates II., III., and V. The limits of the 35 water in the North Sea and the Atlantic are naturally variable. Thus we found in March 1890 and in February 1891 water of not more than 34 around the north and west coasts of Scotland (see Plate III.). But in March 1891 the salinity of the water in the Minch and between the Orkneys and Scotland was nowhere less than 35°/₀₀. From both sides of the Shetland Islands a tongue of 35 water stretches in a south-easterly direction across the North Sea towards the entrance of the Skagerack, where it dips under other waters, and enters into the Skagerack as an undercurrent, as is seen from section 1 on Plate VI., and figs. 4, 5, 6 on Plate II. *Its level has in all deep soundings made hitherto been found to lie considerably higher at the outer (i.e., western and southern) than at the inner end of the Norwegian channel.* In the Skagerack it has generally two maximum heights, as shown by the peculiar undulating contour of the isohaline of 35°/₀₀ in the two sections 5 and 6 on Plate II.

Ocean water of 35°/₀₀ and more seems to be restricted to the above-mentioned part of the North Sea, north of the Dogger Bank,[1] the west side and bottom of the Norwegian channel, and the deep basin of the Skagerack. Although the isohaline of 35°/₀₀ rises to within 60 mètres or less of the surface at the slope of the Danish and Swedish banks, we found no trace of this water at the entrance to the Christiania fiord, or in the deep ponds and channels off the Swedish coast. Neither has it been observed at the bottom of the 120 mètres deep Gullmar fiord on the Swedish coast (see Plates VII. and VIII.), nor in the deep channel of the Kattegat, where the salt in the bottom samples was found to be little more than 33°/₀₀ in February (see section 2 on Plate VI). We have, however, proofs that formerly, sixteen years ago, the bottom water of 35°/₀₀ reached farther to the north and south in the Skagerack than it does at present.

It was believed that the circulation of water in the deepest layers of the Skagerack was extremely slow, and that the salinity and temperature at the bottom did not alter sensibly from one year to another. Our investigations, from 1890 to 1893, if compared with the results of previous deep-soundings in 1872, 1877, and 1880, tend to modify this opinion.

The oceanic water at the bottom and in the deepest parts of the Skagerack thus seems to be liable to changes of long period, and is probably not always derived from the same part or the same depth of the North Atlantic.

Of later years its temperature and salinity have gradually decreased.

Besides, there are other proofs of the fact that the deep water present in the Skagerack is from another origin than in 1877.

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1 From the maps, Plates II. and III., it will be seen that another tongue of 35°/₀₀ water also enters into the North Sea through the English Channel.

TABLE OF TEMPERATURES AND SALINITY FOUND IN THE BOTTOM-WATER OF SKAGERACK.

Time.	Expedition.	Locality.		Depth in M.	Temperature t°C.	Salinity $^{\circ}/_{\circ\circ}$.
1872, Summer	*Pommerania*[1]	Skagerack.		About 600	5·0°	...
1877, 6 July	F. L. Ekman	58° 31′ 41″ lat.	10° 11′ 15″ E. long.	440	5·1°	35·43
,, 9 ,,	,, ,,	58° 13′ 58″ ,,	9° 19′ 20″ ,,	450	5·0°	...
,, 9 ,,	,, ,,	,, ,, ,,	,, ,,	420	. .	35·56
1877, 4 Sept.	*Hansteen* Ex.[1]	58° 14′ 0″ ,,	9° 12′ 0″ ,,	622	5·2°	...
1880, 20 May	,,	58° 5′ 0″ ,,	9° 0′ 0″ ,,	549	5·0°	...
,, ,,	,,	,, ,,	,, ,,	631	5·0°	...
1890, 13-19 Feb.	Swedish Ex.	58° 28′ 50″ ,,	9° 43′ 35″ ,,	630	5·1°	35·18
,, ,,	,,	58° 0′ 25″ ,,	8° 57′ 0″ ,,	570	4·9°	35·09
,, ,,	,,	58° 12′ 15″ ,,	9° 22′ 15″ ,,	625	4·9°	35·09
,, ,,	,,	,, ,, ,,	,, ,,	645	4·9°	—
1893, 2 May	,,	58° 19′ 0″ ,,	10° 4′ 45″ ,,	500	4·70°	35·15
,, ,,	,,	58° 28′ 50″ ,,	9° 43′ 35″ ,,	500	4·94°	35·10
,, ,,	,,	,, ,, ,,	,, ,,	550	4·87°	35·10
1893, 2 Sept.	,,	58° 19′ 0″ ,,	10° 4′ 45″ ,,	500	4·80°	35·15
,, ,,	,,	58° 28′ 50″ ,,	9° 43′ 35″ ,,	650	4·69°	35·15

In the Skagerack the oceanic water ($35^{\circ}/_{\circ\circ}$) never appears at the surface. Consequently, it is exposed to loss of oxygen without any possibility of restitution by absorption from the air. This accounts for the low percentage of oxygen in the gases obtained in our analyses of all samples of 35 water.

The percentage of oxygen in such water-samples, obtained in February 1890, was on the average 29·6%, and occasionally as low as 27·5 and 28·3%, of the total volume of nitrogen and oxygen.

In May, August, and September 1893 the average amount of oxygen was 30·4%, the normal percentage for sea-water of this kind being about 33·6%. As these numbers are means obtained from seventeen samples of $35^{\circ}/_{\circ\circ}$ water taken from various depths in 1890, and from eighteen samples of the same kind collected in 1893, we may infer *that the oceanic deep water which fills the greater part of the basin of the Skagerack is, as a rule, deficient in oxygen.*

The total amount of carbonic acid in 1890, calculated in cc. per litre of water, was 48·14 cc., and 47·95 cc. in the summer 1893.

From the amount of nitrogen dissolved in one litre of sea-water we can, with the aid of Hamberg's table, which is given in a preceding chapter, calculate the temperature of absorption, τ° C., of the air in the water. This, as I have already mentioned, can give us important information as to the origin of the sea-water.

The mean number from all water-samples (17) of $35^{\circ}/_{\circ\circ}$ water ("ocean-water") collected from various depths in the Skagerack was in February 1890

[1] See Mohn, *The Northern Ocean, Depths, Temperature, and Circulation*, p. 81.

12·86 cc. N_2, corresponding to a temperature of absorption, τ, of 6·6° C., and in spring (2nd May), 1893 (18 samples),

13·80 cc. N_2; temperature of absorption $\tau = 3{\cdot}2$ C.

This bears out the following conclusion :—*The oceanic water which was found in the Skagerack in spring and summer*, 1893, *seems to have originated from a colder part of the North Atlantic than the water collected in February* 1890, *for it had absorbed air at a considerably lower temperature* (3° *to* 4° *C., instead of* 6° *to* 7° *C.*).

Here are analyses of samples of bottom-water taken at exactly the same places in the Skagerack, and from nearly the same depths, in both years.

Date.	Station.	Depth.	t° C.	Salt °/₀₀.	Cc. N_2.	Cc. O_2.	$\frac{100\ O_2}{N_2 + O_2}$	τ° C.	
Feb. 25th, 1890	C_{XII}	645 M.	4·9°	35·09	12·98	5·35	29·18	+ 6·2°	1890
,, 19th, ,,	C_{III}	570 ,,	4·9°	35·09	13·29	5·48	29·28	+ 5·4°	
Aug. 6th, 1893	C_{III}	560 ,,	4·55°	35·06	13·82	6·08	30·56	+ 3·2°	1893
May 10th, ,,	C_{III}	550 ,,	5·00°	35·06	13·82	6·08	30·56	+ 3·2°	
Feb. 17th, 1890	S_{VIII}	600 ,,	5·10°	35·18	12·54	5·20	29·31	+ 7·9°	1890
Aug. 2nd, 1893	S_{VIII}	550 ,,	4·87°	35·10	13·88	6·54	32·02	+ 3·1°	1893
,, ,,	S_{VIII}	660 ,,	4·69°	35·15	13·80	6·52	32·08	+ 3·2°	
,, ,,	S_{VII}	500 ,,	4·80°	35·15	13·77	5·41	28·20	+ 3·3°	

τ° represents the temperature of the water when it was for the last time at the surface in contact with the atmosphere; t° is the actual temperature, or temperature *in situ,* of the water.

In the deep waters of 1890 we find $\tau° > t°$, consequently the water had been *cooled* on its way from the surface to the depths ; in the bottom-waters of 1893, $\tau° < t°$, consequently the water had *increased* in temperature since it left the surface. The former was *deficient in nitrogen*, the latter was *supersaturated with nitrogen.*

It is possible to determine approximately, not the precise part of the North Atlantic these waters actually came from, but the nearest place from which they could possibly have been derived.

In the last chapter of this paper I shall give a scheme for regular monthly surface-observations across the North Sea and the North Atlantic to furnish data for synoptic maps of the distribution of salinity and temperature in the water at different seasons of the year. From a number of such observations which G. Ekman and I arranged, with the assistance of Dr. Grieg of Bergen, it appears that the oceanic water of 35°/₀₀ salinity in the North Sea never acquires a lower temperature than +5°, or +6° C., even in the coldest months of the year (February and March). This result agrees well with the isothermal chart of Mohn,[1] where the isotherms of 5° and 6° in March cross the North Sea to the north of the Dogger Bank.

[1] See Mohn's chart, Plate xxviii., in the *Reports of the Norw. North Atlantic Expedition.*

The *nearest* place where the bottom-water of the Skagerack in 1890 can have been in contact with the atmospheric air is the northern part of the North Sea. This water may have passed in winter as a surface layer across the North Sea plateau (as indicated by the dark blue stripe which stretches from the Shetlands to the entrance of the Skagerack on the map in Plate III.) before it sank to the bottom of the Skagerack basin.

On the other hand, it can be proved that the bottom-water of the Skagerack in 1893 cannot have come from the North Sea or from any part of the Atlantic south of 64° N. lat. According to Mohn's[1] chart of surface-temperatures in March, the positions of the isotherms of +3° and +4° are as follows:—

At 10° W. long.	water of +3° to +4° C. is found between			63°	and 64°	lat.
„ 5° „	„	„	„	63°	„ 65°	„
„ 0°	„	„	„	68½°	„ 70°	„
„ 5° E.	„	„	„	70°	„ 71°	„
„ 10° „	„	„	„	64°	„ 74°	„ [2]

Thus the nearest place where the deep water which then filled the Skagerack basin could have been at the surface is not the North Sea, but either 70 or 80 miles to the north of the Färöes, or the sea west of the Norwegian coast from above Lofoten to below the Throndhjem fiord. But it *may* have had a still more distant source.

2. The next kind of water, of 34°/₀₀ to 35°/₀₀ salinity, I have called North Sea water, because it is constantly found in the North Sea south, east, and west of the Dogger Bank. But this designation is incorrect in so far as water of this kind has a far wider distribution. It is found at the surface of the North Atlantic as a broad belt encircling the warmer Atlantic water of more than 35°/₀₀ salinity, both on the European and the American sides of the ocean.[3] On Plate IX. is represented a series of surface observations taken on a northerly line across the Atlantic in October 1892.[4] Between the 30th and 35th degrees of longitude the salinity suddenly sank from 35·23°/₀₀ to 34·93°/₀₀. Here was situated at that time of the year the limit between the Atlantic drift current and the 34°/₀₀ water, as we may conclude from the considerable fall of temperature, from 12° C. to 9° and 10° C., which accompanied the change in salinity. Between the longitudes of 50° and 55° W. was found the limit between the 34°/₀₀ water and the cold coast-water of the Labrador stream.

In the Skagerack water of 34°/₀₀ is never found at the surface, except as a broad strip or tongue along the coast of Jutland from Hanstholm to Hirtshals, or thereabouts (see the surface-chart, Plate V.).[5]

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[1] See Mohn, *The N. Ocean, l.c.*, Chart xxviii.

[2] *i.e.* along the Norwegian coast from N. of Lofoten to S. of the Throndhjem fiord.

[3] See Tornœ's Chart No. 1, in the *Reports of the Norweg. North Atlantic Expedition: Chemistry.*

[4] Plate IX. will appear with a later section of the article.

[5] This part of the Skagerack always has the saltest surface-water. The salinity is not always 34°/₀₀, but often 33 or 32°/₀₀. This seems to depend upon the winds and the direction of the Baltic current. The situation shown in Plate V. is evidently a result of the reactive force of the Baltic current, which causes an indraught of 34°/₀₀ water from the North Sea. After westerly winds the salinity is generally 33 or 32°/₀₀.

As an under-current it is always found in the Skagerack overlying oceanic water of $35°/_{oo}$, as is shown in the diagrams of Plates II. and VI. It enters into all the deep coast channels and into the Christiania fiord, but is not always found in the deep channel of the Kattegat. Generally, it does not reach up to the level of the Swedish coast-bank, and is consequently excluded from our fiords, except the Gullmar fiord, into which it has *periodical access,* as I shall prove in the next chapter.

The limit between the 35 and the $34°/_{oo}$ water is not very well defined, but the *upper* limit of the 34 water towards the bank-water and the Baltic waters is extremely well marked. This will be clearly perceived from a fuller discussion of the state of the waters in the centre of the Skagerack near stations S_{vii} or S_{viii}. The isohaline of $34°/_{oo}$ is, like the others, a curved line with branches sloping down to the coasts, and its apex in the centre of the Skagerack, about S_{vii} and S_{viii} (see the charts). The Skagerack is a water-whirl with its centre at this place. The stratification of the water here is the most remarkable I am acquainted with. Mr. Ekman and I have studied it at various seasons—in summer, spring, and winter. I give our observations in full, because no station is more representative.

A preliminary view of the conformation of the waters may be obtained from the diagram in Plate VII. (Centre of Skagerack). In winter (Feb. 14, 1890) we found the level of the 34 water to stand at its *lowest.* It is then covered by a thick layer of bank-water (33 and $32°/_{oo}$). There is no trace of Baltic water at the surface of the Central Skagerack at this season. In the spring (May) the level of the 34 water begins to rise, and in summer it is at its highest. Then it is overlapped by extremely thin layers of bank-water (32 to $33°/_{oo}$), and, over all, by a thicker stratum of Baltic water, which at that time of the year inundates the entire area of the Skagerack, and in July attains at its centre a thickness of 10-20 mètres. This proves the following rules :—

The water-layers of the Skagerack are liable to a yearly periodic change.

The water of $34°/_{oo}$ *salinity has its principal time of inflow in spring and during the warm season.*

The bank-water of 33 *and* $32°/_{oo}$ *salinity flows most abundantly into the Skagerack in autumn and in the cold season, when it reaches a considerable thickness and predominates at the surface in the central part of the Skagerack. In summer time this water is extremely reduced in volume (to* 2-3 *mètres at Stations* S_{VII} *and* S_{VIII}*). It is then displaced by Baltic water.*

Thus the deep waters of over $34°/_{oo}$ salinity and the bank-water of 33 and $32°/_{oo}$ have *distinct periods of influx* into the Skagerack. The cause cannot be any other than the periodic variation of the outflow from the Baltic. When the Baltic current decreases, bank-water flows into the Skagerack, where it is found as a thick and relatively warm surface-layer in the coldest months of the year. Such is the situation sketched in Plate V. When the outflow of Baltic water increases in spring and summer, the bank-water is swept out of the Skagerack again. Simultaneously with this outflow of the bank-water, the deep waters begin to flow in and swell in volume. It is probable that this phenomenon is due to an effect of *reaction* upon the deep-water strata in the North Sea and North Atlantic due to the energy stored up in the waters of the Baltic current. The immediate effect upon the conformation of the water-strata, as represented in our sectional diagrams, is, that the deep-water isohalines attain a higher level and assume a more flattened shape in spring and summer, as can be seen from sections 5 on Plate VII., which represent a hydrographic section from the Norwegian to the Swedish coast in February and in May. The different curve of the $34^{\circ}/_{\circ\circ}$ isohaline is especially worthy of attention. It will be seen from the sections on Plate VII. that deep water of $34^{\circ}/_{\circ\circ}$, which in the coldest season is excluded from access to the Swedish shore and the Gullmar fiord, can in spring rise sufficiently high to surmount the ridge which separates the fiord from the open sea. The bottom-water of such a fiord will thus periodically be shut off from communication with the corresponding water-layers in the Skagerack, as can be seen from Section 5A (February).

Tables

SHOWING THE YEARLY PERIODIC VARIATION OF THE UPPER LAYERS IN THE CENTRE OF THE SKAGERACK.

1. Salinity (Plate VI.).

Depth in Metres.	6th July 1877. Salinity $^{\circ}/_{\circ\circ}$.	14th Feb. 1890. Salinity $^{\circ}/_{\circ\circ}$.	20th July 1890. Salinity $^{\circ}/_{\circ\circ}$.	2nd May 1893. Salinity $^{\circ}/_{\circ\circ}$.	2nd Sept. 1893. Salinity $^{\circ}/_{\circ\circ}$.
0	27·53	32·26	...	31·17	29·85
5	27·79	...	...	31·17	29·85
10	28·52	32·35	30·99	31·66	*34·27*
15	31·63	...	31·61	...	...
20	*34·49*	33·28	*34·56*	*34·07*	34·79
30	34·69	*34·48*	34·78	34·58	34·93
40	...	34·77	...	34·81	35·13
60	...	34·95	34·83	34·94	35·06
80	...	35·00	...	34·94	35·15
100	35·07	34·98	34·99	35·00	35·17

2. Temperature.

Depth in M.	t° C.	t° C.	t° C.	t° C.	t° C.
0	14·9°	3·3°	...	6·40°	15·22°
5	14·5°	...	...	5·95°	14·56°
10	14·4°	3·4°	13·2°	5·41°	10·36° ($34^{\circ}/_{\circ\circ}$)
15	11·9°	...	$\left\{\begin{matrix}12·6° \\ 13·5°\end{matrix}\right\}$	...	...
20	9·0° ($34^{\circ}/_{\circ\circ}$)	4·9°	7·4° ($34^{\circ}/_{\circ\circ}$)	*4·30°* $\left\{\begin{matrix}(\textit{min.}) \\ (34^{\circ}/_{\circ\circ})\end{matrix}\right\}$	7·25°
30	7·1°	6·9° ($34^{\circ}/_{\circ\circ}$)	6·9°	4·65°	7·00°
40	...	7·1°	*6·3° (min.)*	5·45°	6·92° ($35^{\circ}/_{\circ\circ}$)
50	*4·7° (min.)*	...	6·3°	...	6·55°
60	...	*7·2° (max.)*	6·4°	5·60°	*6·07° (min.)*
80	...	6·9° ($35^{\circ}/_{\circ\circ}$)	6·6°	*5·68° (max.)*	6·50°
100	5·2° ($35^{\circ}/_{\circ\circ}$)	6·8°	... ($35^{\circ}/_{\circ\circ}$)	5·16° ($35^{\circ}/_{\circ\circ}$)	6·30°

The yearly period of variation in the Skagerack affects the water to a depth of about 100 mètres. Beyond that depth its effect is combined with that of another variation with a longer period, the causes of which have not yet been investigated.

The North Sea water of 34°/₀₀ thus presents at all seasons a sharp contrast to the overlying waters as regards both salinity and temperature. In all our observations we have found a sudden break of continuity in the temperature series as we approached this water-layer. In summer the temperature suddenly sank 3 to 5 degrees, while in the winter it rose 2 to 3 degrees in the space of a few mètres.[1]

The temperature of the 34°/₀₀ water changes inversely to that of the season: it is the coldest water of the Skagerack in the warm season, and the warmest water in the cold season. The maximum temperature of this water in February we found to be 7·1° C.; the minimum temperature, 4·7° C. in July 1877 and 4·30° C. in May 1893, was likewise found in samples of this water. In May 1893 we found both the vanishing winter maximum at 80 mètres, and the new summer minimum at 20 mètres, in the 34°/₀₀ water.

The temperature of the bank-water, and still more of the Baltic water, changes with that of the seasons.

The 34°/₀₀ water evidently originates from another part of the ocean than the overlying waters. This is confirmed by the analysis of the atmospheric gases dissolved in the water. On the 20th July 1890 I found the upper limit of the 34°/₀₀ water between 15 and 20 mètres in the centre of the Skagerack (see the table above). The gas analysis of water-samples from 15 and from 20 mètres was as follows:—

Gas Analyses from 20th July 1890 ($S_{vii.}$).

Depth in Mètres.	Temperature t° C.	Salt °/₀₀.	Cc. N_2 in 1 lit.	Cc. O_2 in 1 lit.	$\frac{100\ O_2}{N_2+O_2}$	Temp. of abs. τ° C.
15	13·15°	31·61	11·84	5·85	33·06	12·4°
20	7·40°	34·56	13·23	4·87	26·93	5·4°

Gas Analyses from 2nd May 1893 (S_{vii}).

Depth in Mètres.	Temperature t° C.	Salt °/₀₀.	Cc. N_2 in 1 lit.	Cc. O_2. in 1 lit.	$\frac{100\ O_2}{N_2+O_2}$	Cc. CO_2 in 1 lit.	Temp. of abs. τ° C.
10	5·41°	31·66	14·46	7·02	32·69	...	2·2°
20	4·30°	34·07	14·43	7·25	33·44	47·16	1·6°

[1] The upper surface of the 34°/₀₀ water may be compared to a shelf in the sea upon which the shore-water floats. Beneath the level of this floor we meet with a water of entirely different properties (temperature, quantity of dissolved gases, etc.). The transition is so abrupt that in two consecutive soundings at 15 mètres my water-bottle brought up water of 12·6° and 13·5° C. The tossing of the ship had on the first occasion caused the water-bottle to dip into a deeper layer.

GAS ANALYSES FROM 2ND SEPT. 1893 (S_{vii}).

Depth in Metres.	Temperature t° C.	Salt °/₀₀.	Cc. N_2 in 1 lit.	Cc. O_2 in 1 lit.	$\frac{100\ O_2}{N_2+O_2}$	Cc. CO_2 in 1 lit.	Temp. of abs. τ° C.
5	14·56°	29·85	11·79	5·96	33·58	42·02	13°
10	10·36°	34·27	13·47	7·57	35·98	45·39	4·7°
20	7·25°	34·79	13·52	8·03	37·27	...	4·3°
,, (bis)	7·25°	34·79	13·48	8·07	37·46	...	4·3°

The difference in the quantity of absorbed gaseous matter in water-layers which are only 5 or 10 mètres distant from each other is really astounding. Thus the water at 5 mètres in Station S_{vii} on the 2nd Sept. 1893 contained 4·42°/₀₀ less salt, 1·68 cc. less nitrogen, 1·61 cc. less oxygen, and 3·37 cc. less carbonic acid than the adjacent layer of 34°/₀₀ water at 10 mètres. The former (Baltic) water had absorbed its air in summer at a temperature of about 13° C, the latter in winter at 4·7° C.

The 34°/₀₀ water is also remarkable in another respect. In no other kind of water do we find greater variations in the amount of dissolved oxygen. In July 1890 it was very deficient in oxygen (26·93%). In September 1893 we found it *supersaturated with oxygen* (35·98 to 37·46%). There is no possibility of a mistake, because analyses of two different water-samples of 34 water from 20 mètres gave identical results (see the table). Moreover, I have other proofs. The Station S_{vii} is situated in the central part of the Skagerack. Station C_{iii} is a corresponding point on the section Skagen—Christiansand. It is probable that the waters in S_{vii} pass through the vicinity of C_{iii}. Three weeks before we took the deep-soundings at S_{vii} a deep-sounding was made at C_{iii}, with the following results :—

GAS ANALYSES FROM 6TH AUG. 1893 (STAT. C_{iii}).

Depth in Metres.	Temperature t° C.	Salt °/₀₀.	Cc. N_2 in 1 lit.	Cc. O_2 in 1 lit.	$\frac{100\ O_2}{N_2+O_2}$	Cc. CO_2 in 1 lit.	Temp. of abs. τ° C.
10	9·15°	34·19	13·69	7·97	36·78	45·74	4·1°
20	6·80°	34·59	13·67	8·14	37·31	46·86	4·1°

Thus, already in the commencement of August, there was 34 water 35 to 40 miles south-west of Station S_{vii}, at the same depth (10 mètres), which exhibited exactly the same properties with regard to the dissolved air, viz., supersaturation with oxygen, as the corresponding water in S_{vii}. Consequently we may infer that a large body of North Sea water supersaturated with oxygen was flowing as an undercurrent into the Skagerack in August and September 1893.[1]

[1] In November of that year the oxygen was again reduced to about 32°/₀.

Supersaturation with oxygen is a phenomenon which has hitherto been found to exist only in surface-waters from high latitudes. Tornœ found 35 to 36% of oxygen only in certain waters which were collected north of the 70th parallel. Buchanan found the percentage of dissolved oxygen to be about 33 in Equatorial and about 35 in Antarctic waters.[1]

3. The bank-water, or water of from 32 to 34°/₀₀ salinity, is found along the continental coast of the North Sea and North Atlantic (see the charts in Plates II. and III.). It may flow into the Skagerack from *two* directions—either from the southern part of the North Sea or from the north along the Norwegian coast. This is worthy of remark, because there are certain reasons for believing that the bank-water has *two periods of influx.* The seasons are autumn and winter, as already mentioned in the preceding pages. The first influx, which occurs in August-September, is due to the influence of the westerly gales. Warm water of up to 15 to 16° C. and 32 to 33°/₀₀ salinity then sets in with the Danish current along the north-west coast of Jutland. It fills the central part of the Kattegat from top to bottom as far to the south as between Trindelen and Anholt, and then dips under the Baltic water, with which it mingles during its further progress southwards through the broad and shallow parts of the Kattegat, the Belts, and the western part of the Baltic.

In early autumn the herring-fishery with floating nets in the Kattegat and South Skagerack coincides with this inflow of bank-water, as I have already mentioned.

From September to December and January I have no hydrographic observations of recent date to rely on, and must therefore pass over the changes which probably occur in the early part of the winter, and discuss the situation in the coldest months, January, February, and March, which is well known from the winter expedition in 1890 and researches continued during the two following years. The situation, then, is as represented in the maps on Plate III. and V. and sections 1-6 on Plates VI., VII., and VIII. The broad greenish area in the map represents an indraught of water of 32 to 33°/₀₀ or bank-water of 4° to 5° C., which, however, has little or no connection with the bank-water on the southern coast of the North Sea, but is evidently an inflow from the north along the Norwegian coast.[2] This bank-water is a surface-layer in the centre of the Skagerack, and is overlapped at the coasts by Baltic waters of lower salinity and temperature. Nevertheless, it attains a sufficiently high level to flow into the Swedish coast channels and inundate the deeper parts of our banks. Consequently, there exists on the Swedish coast a layer of relatively warmer and salter bottom-water

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[1] The section 5B on Plate VII. (2nd May 1893) is typical for the time of influx of 34°/₀₀ water into the Skagerack. In the figure a tongue of this water is seen to stretch as an under-current towards the Swedish coast.

Simultaneously with the inflow of 34°/₀₀ *water in May the mackerel fishing begins on our coast.* There seems to be a certain connection between the expansion of the 34 water and the appearance of the mackerel and the garfish.

[2] There seems to exist a certain connection between the winter herring fishery off the Norwegian west coast (about Bergen and Stavanger) and the coast of Bohuslän. These fisheries seem, *on the whole*, to be of alternating or opposite periodicity.

(bank-water) covered by a colder and fresher surface-water (Baltic water). Occasionally these waters displace each other. The bank-water may, under favourable conditions (easterly winds, etc.), approach the coast in the northern parts of Bohuslän (see the figures 1 and 2 on Plate III.), in which case the Baltic current is intercepted and deflected to the westward. Or the Baltic current may keep close to the Swedish coast (winds from the S. or SE.), and, increasing in thickness, there force the underlying bank-water to flow out from the banks through the deep channels (see fig. 3 on Plate III.).

This bank-water was found in November 1893 to contain a very characteristic Plankton entirely different from that of the adjacent water of the Baltic current, which chiefly consisted of vegetable organisms, such as diatoms, *Cilioflagellates*, etc., intermixed with certain copepods, such as *Centropages hamatus*,[o] occurring also in the Kattegat and the Baltic from the Sound up to the Åland Islands.

In the bank-water, on the contrary, vegetable Plankton was scarce. The predominating animal Plankton consisted of organisms of Arctic or North Atlantic origin, which never appear in the Skagerack during the summer, such as—

Euphausia inermis [Kröyer] (schizopod).
Hyperoche Kröyeri [Bovallius] (amphipod).
Parathemisto obliria [Kröyer] (amphipod).
Diphyes truncata [M. Sars] (siphonophore).

There can be no doubt that these animalcula, whereof the first mentioned is known to be the principal food of the great whale, *Balenoptera Sibbaldii*, and is most abundant between the Varanger fiord and the Lofoten Islands, have followed the inflowing bank-water from the north and north-west coasts of Norway into the Skagerack, where they were caught by means of the Plankton apparatus described in Part I. at Station A_{xv} (surface $33{\cdot}15°/_{oo}$; $t = 7°{\cdot}95$ C.).

S_{vii} (10 mètres deep $33{\cdot}35°/_{oo}$; $t = 7°{\cdot}70$ C.).

S_{x} (surface $32{\cdot}12°/_{oo}$; $t = 8°{\cdot}31$ C.).

The boundary between the Baltic stream and the bank-water was marked not only by the change in the contents of the dredging-net, but also by a sudden break in the series of temperature and salinity records of the surface water, whereof the following observations on the 13th November 1893 from Lysekil to Station A_{xv} is a striking example:—

	4 m. NW. of Lysekil.	7 m. from Lysekil.	10 m. from Lysekil.	13 m. from Lysekil.	A_{xv} (16 m. from Lysekil).
Salinity	$26{\cdot}01°/_{oo}$	$25{\cdot}66°/_{oo}$	$27{\cdot}67°/_{oo}$	$25{\cdot}73°/_{oo}$	$33{\cdot}18°/_{oo}$
Temperature	$6°{\cdot}36$ C.	$6°{\cdot}65$ C.	$6°{\cdot}17$ C.	$5°{\cdot}88$ C.	$7°{\cdot}95$ C.

Baltic stream Plankton: diatoms, *Peridinia*; copepods, *Centropages hamatus*, etc.

Bank-water Plankton: *Euphausia*, *Hyperoche*, *Parathemisto*, *Noctiluca*, *Diphyes*, and others.

[1] *Planktonundersökningar*, by C. Aurivillius. *Bih. K.V.A. Handl.*, Bd. 20. Afd. iv. No. 3 [1894].

The herring-fishery was then going on in the neighbourhood of Lysekil. Only 33°/₀ of the fishes had any food in their stomachs. The food consisted of fifteen forms of animal Plankton, of which the remains of *Limacina balea* was the most remarkable. This pteropod frequents chiefly the North Atlantic and the Arctic Ocean, and occasionally appears on the west coast of Norway, where it is greedily devoured by the herrings. As not a single specimen of this pteropod was found in the waters of the Skagerack in November, the shells of the *Limacina* in the stomachs of the herring must be a remnant of the food swallowed by the fishes *outside* the Skagerack. This throws light upon the question of the origin and wanderings of the winter herring.

The winter herring is fished (*as far as all observations go*) *in water of that kind here denoted as bank-water, and disappears with it,* as will be shown in the next chapter.

Among facts which indicate a close connection between hydrographic and biological phenomena I must call attention to the observation of Professors Möbius and Heincke [1] regarding the time of appearance in the Western Baltic of certain migratory fishes which, though not appertaining to the fish fauna of the Baltic, have occasionally been found there.

Of thirty-two species of such foreign fishes ten are known to come from the northern parts of the Atlantic, for they have never been caught south of the Bay of Biscay. Eighteen species come from the south (for instance, the Mediterranean), and are never caught within the Polar Circle.

The southern fishes always come into the Baltic during the latter half of the year, usually in September and October. From February to April no southern fish has ever been caught in the Baltic—an observation which, according to Danish biologists, also holds for the Kattegat and the Sounds. Once only a fish of this kind, the *Conger vulgaris*, was caught at Eckenförde.

The northern fishes, on the contrary, appear early in the year. They are :—*Liparis Montagui, Anarrhichus lupus, Stichæus islandicus, Gadus pollachius, Hippoglottis vulgaris, Pleuronectes microcephalus, Pleuronectes cynoglossus, Gadus virens, Lota molva, Raia radiata.*

The authors conclude :

"Aus den mitgetheilten Thatsachen lässt sich der wichtige Schluss ziehen, dass die gelegentlichen Besuche fremder Fische in der westlichen Ostsee *keine ganz zufälligen* Verirrungen sind sondern durch periodische Veränderungen in der physikalischen Verhältnissen des Wassers und in der Belebung desselben veranlasst werden."

I hope the preceding may serve to throw some light upon the nature of the "periodical changes" mentioned by Möbius and Heincke.

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[1] See Möbius and Heincke, *Die Fische der Ostsee* in the *Berichte d. Comm. z. Unters. d. Deutschen Meere* (1877-1881, ii. p. 278).

(*To be continued.*)

GEOGRAPHY AT THE BRITISH ASSOCIATION, OXFORD, *August* 1894.

By W. Scott Dalgleish, M.A., LL.D.

Though the Oxford meeting of the British Association was scarcely a "record" meeting, it must rank, as regards attendance, among the most successful of recent years. It derived a certain *éclat* from the presence of the Marquis of Salisbury in the double capacity of Chancellor of the University and President of the Association—a complex position which, as his Lordship humorously said in his inaugural address, imposed on him the double duty of welcoming the Association to Oxford and of acknowledging the University's welcome. The meeting in the Sheldonian Theatre, at which the inaugural address was delivered, was one of the most brilliant functions ever witnessed in the long history of the Association. No one who had the good fortune to be present is likely to forget the impression produced by the appearance of the grand old theatre, all the grimness of which disappeared in presence of the electric light, and the galaxy of fashion that filled it from floor to ceiling. The arrangements for entrance and exit were far from perfect; but they were perhaps as good as the nature of the building made possible.

We are mainly concerned, however, with Section E—Geography. The room assigned to the Section in the new Examination Schools was all that could have been desired—large, lofty, comfortable, well lighted, and easily darkened. The attendance was from first to last exceptionally good, and the audiences held together with quite remarkable constancy. That, however, was evidently due to the popular rather than to the strictly scientific character of the papers and discussions. It must always be remembered that in the British Association two audiences have to be catered for—the scientists and the amateurs—and that the financial success of the meeting depends much more on the latter than on the former. Complaints are often made—they have been made this year—that the treatment of the subjects in some sections is so technical that it repels the lay members, who form the bulk of the membership of the Association. The objection may or may not be deserving of notice; but it certainly does not apply to the Geographical Section. That Section is the happy hunting-ground of the unattached and amateur Associate. Thanks to the profuse and promiscuous use of the magic lantern, it has become the most attractive show-room of the Association. But geography as a science, or the scientific aspect of geography, does not gain much by this ephemeral popularity. The audience is panting for sensations; the ubiquitous and irrepressible globe-trotter is the ideal of the hour, and the sensation is all the greater if the globe-trotter happens to be a woman. The paper which attracts a crowded audience may be a tedious narrative of a holiday spent in Armenia, or in Mexico, or in the desert of Libya, or in Montenegro, or in Arabia; but all its sins are forgiven if it is illustrated by what the official programme calls "optical projections," which means, in common parlance, "lantern slides."

Now, no geographer will question the benefit which geography has derived from photography and the lime light in combination; but the lantern is not everything; and it will certainly fail when its results are used merely for pictorial and not for scientific purposes. Mr. John Thomson, in his paper on "Geographical Landscape Photography," insisted strongly on the use that might be made of the camera in illustrating points of science; and Dr. H. R. Mill, in connection with his paper on "The English Lakes," showed some admirable examples of that kind of work—pictures such as an artist would probably see no beauty in, but which to the eye of science were really beautiful as illustrations of the structure of lake basins and deltas. Dr. Mill's paper was noteworthy in other respects. It was a strictly geographical paper; it was a record of original work; and it showed how genuine science may be made thoroughly interesting and popular. There were a few other papers of the same character, such as Mr. E. G. Ravenstein's on "The Climatology of Tropical Africa," and Mr. H. N. Dickson's on "The Currents of the Faeröe-Shetland Channel and the North Sea." But these were the exceptions. Most of the papers were of the topographical and descriptive character already referred to, and gave the impression that Section E is becoming a medium for the dissemination of travellers' tales, which, however interesting, are of no great value to geographical science. If geography is to hold its place worthily in the British Association it will be necessary to enforce a much higher standard in the admission of papers than that which seems to prevail at present.

These strictures do not apply to the presidential address of CAPTAIN WHARTON, R.N., which, as coming from an experienced hydrographer, was quite appropriately devoted to a survey of our knowledge of the sea—its depth, its temperature, and its movements. Though in no sense popular in treatment, and though it bristled with facts and figures, it proved interesting enough to hold the attention of a large audience for the better part of an hour. Perhaps its most valuable passage was that in which the President summarised our knowledge of the depth of the great oceans; and while Dr. John Murray referred to its omission of the results of some of the most recent soundings, he acknowledged its value and its fairness as a summary of our present knowledge. The following is the passage referred to:—

It is very remarkable, and from a geological point of view significant that the very deepest parts of the ocean are not in or near their centres, but in all cases are very near land. 110 miles outside the Kurile Islands, which stretch from the northern point of Japan to the north-east, the deepest sounding has been obtained—4655 fathoms, or 27,930 feet. This appears to be in a deep depression, which runs parallel to the Kurile Islands and Japan; but its extent is unknown, and may be very large. 70 miles north of Porto Rico, in the West Indies, is the next deepest cast known, viz., 4551 fathoms, or 27,306 feet, not far inferior to the Pacific depth; but here the deep area must be comparatively small, as shallower soundings have been made at distances 60 miles north and east of it. A similar depression has been sounded during the last few years west of the great range of the Andes, at a distance of 50 miles from the coast of Peru, where the greatest depth is 4175 fathoms. Other isolated depths of over 4000 fathoms have been sounded in the Pacific—one between the Tonga or Friendly Islands of 4500 fathoms, one of 4478 fathoms near the Ladrones, and another of 4428 fathoms near Pylstaart Island, all in the Western Pacific. They all require further investigation to determine their extent. With these few exceptions, the depth of the oceans, so far as yet known, nowhere comes up to 4000 fathoms, or four sea miles ; but there can be little doubt that other similar hollows are yet to be found. The sea with the greatest mean depth appears to be the vast Pacific, which covers 67 of the 188 millions of square miles contained in the Earth's surface. Of these 188 millions, 137 millions are sea, so that the Pacific comprises just one-half of the water of the globe, and more than one-third of its whole area. The Northern Pacific has been estimated by Dr. John Murray to have a mean depth of over 2500 fathoms, while the Southern Pacific is credited with a little under 2400 fathoms. These figures are based on a number of soundings which cannot be designated otherwise than as very sparse. To give an idea of what remains to be done, I will mention that in the eastern part of the Central Pacific there is an area of 10,500,000 square miles in which only seven soundings have been taken, whilst in a long strip crossing the whole North Pacific, which has an area of 2,800,000 square miles, no sounding has been made at all. Nevertheless, while the approximate mean depth I have mentioned may be considerably altered as knowledge increases, we know enough to say that the Pacific is generally deeper than the other oceans. The immensity, both in bulk and area, of this great mass of water, is difficult to realise ; but to know that the whole of the land on the globe above water level, if shovelled into the Pacific, would only fill one-seventh of it, may assist our imagination. The Indian Ocean, with an area of 25,000,000 square miles, has a mean depth, according to Dr. Murray, of a little over 2000 fathoms. This also is estimated from a very insufficient number of soundings. The Atlantic, by far the best sounded ocean, has an area of 31,000,000 square miles, with a mean depth of about 2200 fathoms.

Colonel H. W. Feilden's paper on "Current Polar Exploration" attracted a large audience, and was listened to with intense interest, which was probably stimulated by the circumstance that he had recently returned from a cruise in Polar waters north of Spitzbergen, in search of the ill-fated Wellman expedition. The paper did not, perhaps, fulfil the expectations of those who eagerly expected new lights; but it was a well-informed summary of current facts. It is gratifying to know that, since the paper was read, the arrival of Wellman and his crew at Tromsö has been announced. That fact does not impair the force of the warning given by Colonel Feilden and others against the rash intrusion of inexperienced enthusiasts into Polar Seas. The following were the most interesting points in Colonel Feilden's paper :—

There were now four important expeditions exploring the realms of the Ice King. In the front rank stood Nansen. There was nothing in the entire history of Arctic adventure that surpassed the boldness and audacity of that explorer's conception. The risk he had calmly and voluntarily undertaken was tremendous. In whatever particular part of the Polar area the *Fram* might now be was a matter of hypothesis. After Nansen got beset in the Polar pack his vessel must be entirely under the influence of the ice-drift. Neither steam nor wind could help her in any appreciable manner. There was every reason to believe that there was a steady circulation of water around the Pole, independent of the surface movements of the ice caused by winds. An examination of drift timber indicated that there might be some hope of Nansen's audacious and magnificent project being safely accomplished ; but even if the *Fram* were lost, he had such confidence in the boldness and resource of the leader that he believed Nansen and his companions would return to civilisation. During the last few days we had received authentic accounts of the loss of the ship which took the young American journalist, Mr. Wellman and his party, to Spitzbergen, and the abandonment of his projected attempt to follow in the footsteps of Sir Edward Parry. He respectfully ventured to offer his humble opinion that inexperienced men should not be encouraged by the great thinking public to rush into Polar and Arctic enterprise. Having described the recovery by his own party and conveyance south of the Wellman despatches, Colonel Feilden referred to the magnificent work of Peary and his Norwegian friend Astrup in North Greenland. From a geographical point of view it was of the highest importance. Whether Peary had been able to connect the East Greenland coast-line from Cape Bismarck with Independence Bay, or whether he had been exploring the frozen archipelago which apparently constituted the northern apex of Greenland, the result would be a splendid addition to our knowledge. From the highlands of Grinnell Land on the opposite shore of Smith's Sound, and nearly in the same parallel as the northern shores of Greenland, he (Colonel Feilden) had looked forth month after month on the great frozen sea. Sir George Nares and he, with the late Lieutenant Lockwood (of Greely's expedition) and Brainard, were the four men who had seen furthest Polewards. He was afraid they might think he was not very sanguine about our reaching the North Pole. With our present resources he was not, but still the most feasible route for making a high northern latitude was by following in Peary's footsteps.

We subjoin summaries of the most important of the other papers read in the section.

Dr. Hugh Robert Mill *On a Bathymetrical Survey of the English Lakes.*

Ten of the largest English lakes were sounded by the author, assisted by Mr. E. Heawood, Mr. Shields, and others, and the final discussion of the work enables the following tabular statement to be drawn up :—

Name.	Length, miles.	Breadth, yards.		Depth, feet.		Area, square miles.	Volume, million cubic feet.
		Max.	Average.	Max.	Average.		
Windermere .	10·50	1,610	950	219	78½	5·69	12,250
Ullswater . .	7·35	1,100	827	205	83	3·44	7,870
Wastwater .	3·00	880	650	258	134½	1·12	4,128
Coniston . .	5·41	870	600	184	79	1·89	4,000
Crummock .	2·50	1,000	700	144	87½	0·97	2,343
Ennerdale . .	2·40	1,000	800	148	62	1·12	1,978
Bassenthwaite .	3·83	1,300	950	70	18	2·06	1,023
Derwentwater .	2·87	2,131	1,270	72	18	2·06	1,010
Haweswater .	2·33	600 .	405	103	39½	0·54	589
Buttermere .	1·26	670	620	94	54½	0·36	537

There are two main types amongst these lakes, the shallow and the deep. The former, including only Derwentwater and Bassenthwaite, are the broadest of all the lakes, and they only average 18 feet in depth. The bed of these lakes may be roughly described as an undulating plain, grooved and ridged into shallow hollows and low shoals running parallel to the long axis of the lake. The second, or deep, type comprises all the other lakes, the shallowest of which has an average depth of 40 feet. Ennerdale combines the characteristics of both types, conforming to the deep type in its upper, to the shallow in its lower reach. They are long, narrow, sometimes winding like Ullswater, or slightly curved in outline like Wastwater and Haweswater. The most characteristic lie in long narrow valleys with steeply sloping sides, and the slopes are continued under water with almost equal steepness, in some cases with greater steepness, and terminate in an almost flat floor. The typical form of this class of lake is thus a steep-sided flat-bottomed trough, diversified along the slopes by the still steeper conical mounds of *débris* thrown down at the mouths of the streams.

M. E. Delebecque *On the Bathymetrical Survey of the French Lakes.*

As the result of the author's soundings in most of the French lakes, he has produced a series of sheets, published in 1892 and 1893 by the Ministère des Travaux Publics, under the title "Atlas des Lacs Français." The soundings were in every case made by means of a steel wire mounted on a graduated drum, the revolutions of which indicated the amount of wire paid out. The form of apparatus at first used was that of the Swiss Bureau Topographique ; subsequently that of Belloc was employed, but finally one designed by the author and weighing only 4 kilogrammes was adopted. The position of each sounding was determined, either from angular measurements of the graduated mast of the boat taken from the shore, or by sextant bearings of objects on shore taken from the boat. A number of lakes have been sounded more roughly than those laid down in the atlas, and many observations of temperature and of the chemical composition of the water have been made. The atlas, which will be completed by the addition of maps of several lakes in the Jura and the Pyrenees, is only a part of a comprehensive work about to be published by the author. In all cases the configuration of the lakes is expressed by contour lines at intervals of 5 or 10 metres, and the position of each sounding is shown by a dot. It was impossible to add the land contours on the same scale, as the French Staff maps do not show them with sufficient exactness.

Mr. H. N. Dickson *On the Currents of the Faeröe-Shetland Channel and the North Sea.*

The physical observations made by the author on board H.M.S. *Jackal*, on behalf of the Fishery Board for Scotland, during August 1893, were continued in November 1893, and in February and May 1894. The discussions of the observations lead to the following provisional conclusions :—(1) While the Atlantic current flowing over the Wyville-Thomson ridge attains its maximum velocity in winter, its speed is maintained during summer by the greater warmth of the upper layers of water in the Atlantic, and consequent higher level of the surface of that ocean compared with the Norwegian Sea. Passing over the ridge, the Atlantic current is cooled by mixture with the cold water of the Norwegian Sea lying at the bottom of the Faeröe-Shetland Channel, and loses its horizontal motion. The warmer the Atlantic current, the more rapidly does this mixture take place. Hence in a hot, windless summer a mass of Atlantic water, extending to a great depth, tends to collect on the northern and north-western edge of the North Sea bank. (2) At all seasons Atlantic water is drawn from the Faeröe-Shetland Channel and forced into the North Sea by the tides between Orkney and Shetland. The tidal streams run NW. and SE., and an eddy is formed to the north-west of the Orkneys, into which North Sea water is drawn, and perhaps also water from below. (3) As the season advances the surface water of the North Sea becomes warmer, the upper layers probably receive smaller supplies of fresh water, but they become specifically lighter than the under layers, which they protect from the warming influences of the atmosphere. The upper layers becoming ultimately warmer than the Atlantic current, the surface of the North Sea becomes higher, and the surface water spreads outwards into the Faeröe Shetland Channel, checking the surface supply of Atlantic water. Meanwhile, the mass of Atlantic water, collecting at the edge of the North Sea bank, seeks entrance into the North Sea. Mixing with the cold bottom water already there, it increases its salinity, but reduces its specific gravity by warming it, and, at a certain stage of the process, the temperatures and salinities of the two waters combine to form a ridge or axis of maximum specific gravity. This axis, which probably runs NE. from Shetland in the end of May or in June, turns slowly toward a N. to S. direction, and moves eastward. As it retreats, Atlantic water is gradually admitted round the north end of the Shetlands, passes down the east side of the groups, joins the tidal stream at the south end, and, guided by the axis of heavy water, is distributed along the east coast of Scotland, probably during July and August. Later in the summer, as the axis retreats still further, the Atlantic water is probably distributed more towards the eastward, perhaps until the latter part of September, when the diminishing supply from the Faeröe Channel, and the increasing outflow from the eastern side of the North Sea, bring about a gradual return to the conditions with which we started.

Mr. E. G. Ravenstein *On the Climatology of Tropical Africa.*

This paper was illustrated by an elaborate series of maps and diagrams. The author said that, by ascending a mountain we might, even in tropical Africa, enter a region the mean temperature of which coincided with that of England, but if we at the same time considered the annual and daily ranges of temperature, we should find that a tropical climate differed exceedingly from that of the temperate regions. In the latter, the annual range was considerable, the daily range small. The character of a tropical climate was the very reverse, for there the difference between the coldest and warmest months of the year was small, while the difference between the temperature of day and night was very great. Nor could we escape these features even though we ascended the loftiest mountains to be met with there. These conditions inevitably led to anæmia and racial degeneracy. Malaria prevailed throughout, even on the plateaus, and some of those explorers who had been loudest in praising the climate as thoroughly well adapted to European constitutions had fallen victims to its deleterious influences. Europeans might certainly 'live' in Africa, with occasional holidays in Europe, and they could superintend native labour, but no locality had been discovered as yet where it would be advisable for European agriculturists and colonists to settle down. The districts most favourable to European settlers appeared to him to be some of the hill stations and the steppe-like plateaus which occupied so large an area in Eastern Africa, and extended southward into Cape Colony. Speaking of the rainfall, Mr. Ravenstein said that it was sufficient in most parts, but very irregular, so that works of irrigation would be required wherever agriculture on an extensive scale was to be carried on. The humidity, which in combination with great heat produced a climate very trying to the strongest constitutions, was, fortunately, not excessive over a considerable portion of Africa, including all the steppe-lands.

Dr. A. Markoff *On Russian Armenia.*

In 1892 the lecturer was sent by the Russian Government to report to the central officials on the administration of Armenia. He obtained his information by freely mixing with the people, and, as he knew all the languages of the people, he gained access to places and sources of knowledge which would otherwise have been closed to him. In June 1892 he started on his own horse from Tiflis to Armenia, and he was not molested either by Kurds or Tartars. He reached Akstafa, situated in a plain on a river of the same name. Nine miles from the town the mountains begin, commanding beautiful views, with rich Tartar villages in the distance. Thence he reached the beautiful pass of Delijan, where luxurious vegetation covers the steep mountain sides. Passing Tars-chai, he crossed the ridge near the village Ryédkin, famous for its ancient tombs, whence he descended into a picturesque valley, into the richest forests of Transcaucasia, and reached Delijan, a most important strategic point, used also as a sanatorium. The road to Erivan rose to 7127 feet above the sea-level. In the village of Seminovka he found people who had been sent to Armenia because they belonged to a sect prohibited by the Russian Church. This was the border of Armenia, and he soon reached the lovely Gotcha Lake, twice as large as that of Geneva, and 6370 feet above the sea level. It is 135 miles round, 40 miles long, and 20 broad. Then, passing the high peak of Achmangan, more than 10,000 feet high, he came to Novobayazet, the capital of the district of the same name, with 97,000 inhabitants, consisting of Armenians, Tartars, Kurds, and a few Greeks. Agriculture and cattle-breeding are the main industries. Here and in the neighbourhood are many old tombs and cuneiform inscriptions. Crossing a ridge of 11,711 feet he reached Eranos, famed for its vegetables. The air is clear and the scenery lovely, affording ample material for the painter.

Mr. G. G. Chisholm *On the best Method of Aiming at Uniformity in the Spelling of Place-names.*

The purpose of this paper was to show in the first place that the preliminary requirement indispensable for the attainment of the end stated is to have an adequate scheme of orthography—not adequate in the sense of providing separate signs for all articulate sounds, but making up for the deficiency of such signs by clear rules to be followed with respect to the sounds for which signs are lacking. To leave it to the individual judgment to decide what is the nearest sound represented in the scheme to one for which no express provision is made was bound to lead to confusion. The inadequacy of the latest version of the Royal Geographical Society's scheme from this point of view was then pointed out, and remedies were suggested. The addition of some subordinate rules likely to promote the efficiency of the scheme was next recommended. Attention was drawn to special difficulties in connection with Russian and Greek names, and reasons were given for entertaining the hope that, with the aid of Oriental scholars, special rules might usefully be framed with regard to the spelling of Chinese and Indo-Chinese names. Finally, it was urged that, once an adequate and clearly expounded scheme was adopted, it would be of great importance to make special arrangements to secure the co-operation of all contributors to the *Geographical Journal* and other geographical periodicals, of publishers and authors, and, above all, of the newspaper Press, towards getting the scheme carried out.

Mr. W. H. Cozens Hardy *On Montenegro.*

Montenegro, since the Berlin treaty, has nearly doubled in area. The old Montenegro, which lies near the sea, is made up of bare limestone mountains enclosing fertile basins, the average height of the country above the sea being 2000 to 3000 feet. The Zeta, flowing into the Lake of Scutari, is the chief river, but this part of the country is almost destitute of water, and the inhabitants are compelled to store snow for drinking. The small village of Cetinje, which forms the capital, lies in one of the mountain basins. In July 1893 the Montenegrins celebrated there the 400th anniversary of the establishment of the earliest Slavonic printing-press, set up not far from Cetinje in 1493. In the new Montenegro, to the north and west, the geographical characteristics are quite distinct. Grassy downs, dense forests, and innumerable mountain streams are found, and there is excellent pasture for sheep. The two highest mountains are Kom and Durmitor, which are slightly under 9000 feet high. The Montenegrins are divided into clans and communes, and possess an elaborate system of local government. At present Montenegro is emerging from an Homeric state of society, and its future depends on the ability of its people to adapt themselves to less warlike pursuits.

Mr. Osbert H. Howarth *On the Sierra Madre of Mexico.*

A comparison was made of physical features common to the whole western range of North America from Oregon to Guatemala, illustrated by slides, and by notes from other ranges of great extent—*e.g.*, the Great Atlas and the Caucasus. The means and incidents of travel in the Mexican ranges were described and compared with those of the Rocky Mountains and Sierra Nevada. The probable source of origin of the Sierra Madre races—viz., North American, South American and Asiatic—was discussed and illustrated by a description of various antiquities, including villages, tombs, cave fortifications, and gardens, discovered or visited by the author. Instances were given showing the gradual fusion of these races into the existing Mexican nation of to-day, and the extent to which a few families still remain unabsorbed ; as in the case of the Apaches in Sonora, the Cota Indians in Durango, and the Zapotecas of the Tehuantepec Isthmus. Certain peculiarities in the geological structure, vegetable productions, and fauna of the Sierra Madre were noticed, together with legends and traditions amongst the primitive inhabitants arising out of known facts connected with them.

Mr. Somers Clarke *On the Geography of Lower Nubia.*

The paper was chiefly confined to that part of Lower Nubia which will be flooded by the proposed Nile reservoir. The differences in size and colour-effect of the scenery in the valley of the Nile above and below Assuan were noticed. The Wadi Kenus, the abode of the Beni Kensi tribe, is nearly coincident with the projected Nile reservoir, and if the proposed scheme is carried out, a population numbering about 30,000 and inhabiting a cultivated area of some 10,000 square acres (?) will be displaced. Population in the Ptolemaic times must have been greater, as there are tracts about Korti and Dakkeh, once under cultivation but now abandoned. In the Dodeka-Schoenus there is a number of temples and remains of antiquity, a further proof of considerable population ; and the district is protected by a line of forts, some of very high antiquity, some of later date. The existence of Egyptian civilisation side by side with the ruder customs of the natives is especially to be observed in the method of burial. The present inhabitants on the course of the Nile valley from Assuan to Wadi Halfa exhibit very slight variations in modes of dress, particularly among the women. Men go to Cairo, women stop in the villages, so that the men adopt the ordinary dress of fellaheen in Egypt. In the discussion on this paper, Professor Norman Lockyer observed that the temples of Philæ were founded about 6000 years B.C. It had been suggested that a careful topographical and engineering survey should be made of all the temples, and that all the inscriptions should be transcribed and translated. Time and money were required for such a work, but the archæological and historical results would be invaluable. Mr. F. C. Penrose desired to express his full concurrence in what Professor Lockyer had said.

MR. YULE OLDHAM *On a New Light on the Discovery of America.*

A glance at the map of the Atlantic Ocean will show the three easiest points of access:—(1) North America by means of the convenient stepping-stones, Iceland and Greenland. (2) Central America, with the help of the steady NE. trade-winds. (3) Brazil, in South America, which is not only the nearest point to the Old World, but has the additional advantage of winds and currents tending in its direction. There can be little doubt that America was visited by Norsemen about A.D. 1000 by the first route. Tradition and the records of some early maps, which show large land masses as far west of the Azores as these are west of Europe, seem to indicate that the second route had been possibly utilised early in the fifteenth century, but the third and easiest was not available till the West African coast as far as Cape Verd had been discovered. It was in A.D. 1445 that Cape Verd was for the first time rounded by one of the exploring expeditions despatched from Portugal by the indefatigable Prince Henry. There is good reason to believe that only two years later Brazil was reached. There is at Milan a remarkable manuscript map, dated A.D. 1448, drawn by Andrea Bianco of Venice. On this map are shown for the first time the results of the Portuguese discoveries as far as Cape Verd, but in addition there is drawn at the edge of the map, south-west from that cape, in the direction of Brazil, a long stretch of coast-line labelled 'Authentic Island,' with a further inscription to the effect that it stretches '1500 miles westwards.' Antonio Galvano in *The Discoveries of the World*, published in the middle of the sixteenth century, says that in A.D. 1447 a Portuguese ship was carried by a great tempest far westwards until an island was discovered, from which gold was brought back to Portugal. As Bianco's map of A.D. 1448 was made in London, it is likely that it represents information about this voyage obtained in Portugal, where Bianco probably called on a voyage from Venice to England. The conclusion to be drawn is that South America was first seen, in the very year in which Columbus is believed to have been born, by one of the Portuguese explorers despatched by Prince Henry the Navigator. In the discussion on this paper, the author's conclusion was challenged by Dr. John Murray and Mr. Ravenstein, on the ground that its argument was purely conjectural, and that, if such a discovery had been made, it would have been known to Columbus and other geographers of the day.

MR. J. T. BUCHANAN *On Researches of the Prince of Monaco in the North Atlantic and the Mediterranean in* 1894.

The paper described the scientific researches of the Prince in his yachting excursions in the *Princess Alice.* Careful soundings were taken in the course of the voyage, and it was found that for a considerable distance eastwards from Gibraltar and Ceuta the surface water comes mainly from the Atlantic. The surface temperature varied from 15° C. to 17·4° C.; but under the influence of hot winds the thermometer rose in the water to 28° C. and 29° C. The Prince introduced several improvements in sounding and dredging operations, and the dredge was successfully employed at great depths. From a depth of 2230 mètres were brought up 89 black ground sharks of a species until now considered to be exceedingly rare. The greatest depth at which the dredge was used was 3610 mètres, on July 8, 1894, when some fishes were brought up which have still to be identified. Life was shown to be abundant where it has hitherto been supposed to be scarce.

Mr. Theodore Bent, *On the Exploration of the Hadramaut in South Arabia.*

Having spoken of the narrow and arid coast-line fringing the Indian Ocean and its peculiar volcanic features, the author proceeded to describe his journey up to the high plateau over 5000 feet above the sea-level, and the geological features of this extensive elevated area. After that he descended into the Hadramaut valley and the collateral valleys running into it, going as far north as the confines of the great central desert of Arabia. He described the great sand rivers of these valleys. There is no running water in the district, but plenty is to be found by digging in the sand, and all the cultivation is therefore carried on by irrigation. He gave some account of this cultivation and the nature of the produce, the commerce, and the present conditions of the inhabitants. Finally, he described his somewhat adventurous return to the coast by another series of valleys, and an expedition he undertook along the coast to ascertain the exact point at which the long Hadramaut valley falls into the Indian Ocean.

Dr. John Murray *On the Geographical and Bathymetrical Distribution of Marine Organisations.*

The question was, in effect, why similar species were found at the North and South Poles, separated by entirely different species in Equatorial waters. His opinion was that this fact was an argument for the view that at one time a uniform climate prevailed all over the globe, and that the universal ocean was peopled by a universal fauna. When the cooling process began, those forms which could not adapt themselves to the cold migrated to tropical regions. Dr. Murray explained that this uniform climate might have been in existence when the sun was much larger than it is at present, and when, in consequence, the darkest night would be only a strong twilight. The paper gave rise to a lively discussion, in which Dr. Günther, Canon Norman, Mr. H. O. Forbes, and others took part.

Lieut.-Col. H. H. Godwin-Austen *On Bhutan and the Himalayas East of Darjiling.*

This paper described the country traversed by the last mission to Bhutan, under the late Sir Ashley Eden, in 1863-64, to which the author was attached. As no European traveller had visited Western Bhutan since, the paper contained the latest information on the subject. A fuller abstract than we have space for here will hereafter appear in the *Magazine.*

Mr. Herbert Weld-Blundell *On the Oases of the Libyan Desert.*

The paper described the author's visit to the oasis of Khargeh, Um-ed-Abadeb (now Abbas), Dakhel, Farafrah, Baharieh, and Siwah. Dakhel was an oasis separated from Khargeh by a peninsula of high land, forming part of the Libyan desert plateau, in which the oases were depressions containing the now shrunken tracts of vegetation that rose like green islands from a petrified ocean. Muth was a village of some importance and was built on a mound of bright golden ochre, the streets and people being covered with a bright yellow dust, a relief to the usual dull mud colour of an ordinary Egyptian village. Kasr, a town ten miles to the north, was principally interesting from the vicinity of an Egyptian temple of the second century of our era. The walls inside and the chambers were thickly inscribed with hieroglyphs, but the work was late and inferior in artistic quality. Siwah was described as a sort of ruinous honeycomb of houses piled up on a natural rock in the marshy plain, and surrounded by groves of palms, which were here of an exceptionally fine quality and were almost the only wealth of the population. This numbered about 20,000 souls. The Egyptian Government was only feebly supported by five soldiers, and was represented by a *mamur*, or prefect, a *cadi*, or judge of ecclesiastical law, and an official correspondent. The temple of Jupiter Ammon was shown, though not much remained of this the oldest oracle in the world to enable archæologists to give much idea of its plan and appearance. The return to Alexandria was over the back of the great Libyan plateau and the road followed by Alexander the Great. The whole journey from beginning to end covered a distance of about 1200 miles.

Miss Frances Baildon *On New Guinea.*

The author and her brother visited British New Guinea in 1891 as guests of the Rev. J. Chalmers, the well-known missionary. They reached Port Moresby in a Queensland Government schooner of 68 tons register on August 15, and after a short stay continued their journey westward for 150 miles to Motu-motu, where the native villages were visited. A canoe voyage was then undertaken to the inland village of Movi-avi, where the natives were suspicious and dangerous. After returning to Port Moresby by the same route, a visit was paid to Kerepuna, and on September 2nd Hood Bay was left for Cooktown in Queensland.

Report on Antarctic Exploration.

The report of the Committee on Antarctic Exploration was read by Dr. H. R. Mill, the recorder of the Section. A committee had been appointed at Nottingham for the purpose of assisting Mr. Bruce to go on another voyage of exploration to the South Polar seas, but the difficulty was that while the Norwegian sealers and whalers might take out the explorer, there was a risk that they might not be able to bring him back in the following year. The Committee in the circumstances could not take the risk of causing the death of an eminent scientist. There was, however, it was stated, a strong movement in favour of Antarctic exploration, and the Committee pressed upon the Council of the Association the desirableness of memorialising the Government to take the matter up. This view was strongly supported by Sir Edward Ommaney, who said that a great naval country like this should always have some of its ships engaged in scientific research. Such work was always popular with the men and gave prestige to the service.

At the concluding meeting of the General Committee it was announced that the number of members and associates enrolled at Oxford was 2321, a number in excess by several hundreds of last year's meeting. The following proposals of the Committee of Recommendations were adopted, namely, that Section D be called zoology instead of biology; that a separate section be constituted for botany; that Section I should include physiology, with experimental pathology and experimental psychology. It was also proposed that Section I be separately formed for the first time at the Liverpool meeting in 1896.

At the General Meeting, the following grants were made to the Section of Geography:—Mr. E. G. Ravenstein—Climatology of Tropical Africa, £5; Mr. H. Seebohm—Exploration of Hadramaut, £50.

"SOCIETY IN CHINA."[1]

As decade by decade, with a slowness and gravity proper to an empire of such high antiquity and vast extent, China is emerging from the obscurity in which it has been for ages enshrouded, and is year by year coming more and more into contact and possible conflict with the great nations of the West, so on the part of these latter there is a growing necessity for more and more definite information as to the characteristics of the political and social life of the Chinese people and as to the material and moral resources of the Chinese Empire. This necessity, in its present stage, Professor Douglas in his work on *Society in China*, lately published, has endeavoured to meet. To this end he has confined himself to such matters as are of special interest to Western peoples, and more particularly to the British, and has supplemented the more general and scattered information given in the various works on China and the Chinese, which have from time to time appeared, by carefully arranged and co-ordinated details as to the Constitution of the State and the character of the Court, the nature and administration of the Laws and the political and social condition of the people, the foreign relations of the Empire and its commercial position in regard to Great Britain.

In the task which Professor Douglas has set himself, and within the limits imposed, it may be said at once that he has succeeded. His book teems with facts from cover to cover, expressed in clear, concise language without padding. His object, so he says in his preface, is "to picture the Chinese as they are, and not, necessarily, as they profess to be. . . . At the present time when affairs appear to be drifting towards a condition of danger, when the attitude of the Pekin Government towards foreigners is becoming well nigh intolerable, it is well to take to heart the lessons which the last sixty years should have taught us. . . . If our trade is to be maintained and our treaty-rights observed, it will soon become necessary for us to take a far stronger line than we have lately adopted in our relations with the Celestial Empire."

Professor Douglas' task, however, like that of every Western writer on Chinese history and polity, presents extraordinary difficulties. To the Chinese straight lines are abhorrent. Their thoughts find outward expression in zigzags, as it were, and their actions can be only understood when worked out on a principle like that of the parallelogram of forces. Superficial opportunism hides deep and settled policy. Then, again, the nation is not homogeneous. Under the influences of climate and of geographical position, of internal divisions and of successive waves of external invasion, the people in different parts of the empire show wide differences in physical and psychical characteristics, in customs and in habits. The Imperial Government, too, is not native, but Tartar and foreign. A European, therefore, in attempting to explain the state of Society in China must necessarily and not infrequently find himself placed

[1] *Society in China.* By Robert K. Douglas, Keeper of the Oriental Books and Manuscripts in the British Museum, Professor of Chinese at King's College, London. A. D. Innes and Co., 1894. Pp. xvi + 415. *Price* 16s.

on the horns of a dilemma, or faced by paradoxes and contradictions. Professor Douglas is no exception. Thus, for example, in his preface he says:—"The Empire is pre-eminently one of make-believe. From the Emperor to the meanest of his subjects a system of high-sounding pretension to lofty principles of morality holds sway. And yet few courts are more devoid of truth and uprightness, and no magistracy is more corrupt." Such a description could, properly speaking, only be given of a nation which has outlived itself and is falling into the decay of death. Yet in his opening words in Chapter I. Professor Douglas says that "with the exception of fashions in trivial matters nothing has changed in China for centuries. Dynasties come and go, and even foreign powers take possession of the throne, but the national life in all its characteristics goes on unmoved by political change and revolutionary violence." And he proceeds further to remark in Chapter IX.: "For forty centuries the Empire has stood, resisting both disintegrating influences from within and the attacks of foes from without. While all the great empires of antiquity—Babylonian, Egyptian, Grecian, and Roman—have flourished and decayed, China alone has gained force and power, and now, rich with the spoils of time, stands firmer and more enduring than at any period during the long course of her history." Professor Douglas has not drawn attention to the fact that the Chinese really do believe in the lofty principles of morality which they profess. These principles are taught them in their infancy, are made almost their sole study in their schools, and are taken as the subjects of the examinations through which alone for the great majority place and influence can be obtained. Engraved on stones and tablets these principles are ever before them, along the streets and roads and in every public building, confront them from the door-posts as they enter their houses, and surround them on the walls of their homes. Nor do the Chinese, like the Pharisees, explain them away. With the Chinese, however, the end is apt to justify the means, especially in their dealings with foreigners, and expediency too frequently usurps the place of morality. In explanation of such contradiction, Professor Douglas has omitted to take more than casual notice of a principle which is the very cement, so to say, of the social fabric, a principle to which an extra chapter might well have been devoted—the principle, namely, of Mutual Responsibility. Professor Douglas indeed speaks of the responsibility of the officials one to the other from the lowest to the highest, but he leaves the people without help in the hands of a corrupt magistracy. Later on he describes very truly each individual as "a cog in the social machine," but he does not draw attention to the fact that each individual cog is not only consciously driven by other cogs but consciously drives in turn, and that, too, in a closed circuit of wheels within wheels perpetually revolving one upon another. The author also takes only comparatively slight notice of the fundamental idea of Chinese society, the pivot of the whole social and political engine, namely, Filial Piety.

Professor Douglas in his preface states that it is from the pages of the *Pekin Gazette*, "the oldest journal in the world," and from the novels and plays of the people, supplemented by a residence of some years in the country, "that much of the present work has received its inspiration."

From these sources he quotes numerous cases in illustration of various abuses. It is an open question, however, whether such cases really represent the normal and not the abnormal conditions of society. The *Pekin Gazette* is the official record of such matters of unusual importance as are referred for the consideration of the Emperor himself in council, of special reports and petitions to the throne, and of imperial edicts and proclamations. Professor Douglas describes how even these official statements are rendered unreliable by concurrent private memorials or secret orders. In popular novels and plays, too, whether historical or farcical, realism is by no means aimed at. Professor Douglas says: "In the vast majority of cases the object of the play is to elevate virtue and to hold up tyranny and wrong to just execration." Hence the examples of virtue and vice are equally exaggerated and abnormal. To take for granted that the reports in the *Pekin Gazette* or the representations on the stage reflect the normal, everyday social life would be to run the risk of serious error. At the same time, of course, a strong side-light is thrown upon many institutions and customs which, strange or irregular or inverted as they may appear to Europeans, are taken by the Chinese as essential to social stability. Professor Douglas has not shown very clearly how abuses and corruption in China, like everything else in that country, are organised and systematised within recognised limits, and within those limits regularly allowed for.

Two other omissions must be alluded to. Beyond an outline of the training of military graduates no description at all is given of the Military and Naval Services. These, unlike all other things in China, have during the last twenty years undergone much change and development, and are indeed almost the only Departments of State which for centuries have varied. To these some space might well have been allotted. For no other Western ideas or inventions, save military training and war *matériel* have the Chinese as a nation shown any desire. Secondly, no index beyond a list of contents is appended. In such a carefully compiled work, really a text-book of facts and details, the absence of an index is a very serious oversight.

On the other hand, the book shows on every page the wide and minute acquaintance of the author with things Chinese. First comes a detailed sketch of the daily private and public life of the Emperor. He is pictured as the vicegerent of Heaven, and the supreme ruler of Earth, the representative of Man in the Trinity, of which the powers of Heaven and Earth form the other two persons, superior not only to the kings of the Earth but to all who are called gods, "taking upon himself to grant titles of honour to deities and to promote them in the sacred hierarchy," "the Buddha of the present day," with power to stay even the transmigration of the soul. The duties falling to him from his early years, and the ceremonies attending his accession, marriage, and funeral are given in detail. Next are described *seriatim* the Court, practically without hereditary nobility; the various orders of civil and military Officials (who "by the essentially democratic system in vogue in China are taken from the people, and sometimes from the poorest ranks in life"), the Cabinet, the Council of State, the Six Boards of Civil Office, of Revenue, of Rites, of

War, of Punishment, and of Works; the Foreign Office, the Colonial Office, and the Bureau of Censors. The descriptions of the Board of Rites and of the Bureau of Censors, institutions particularly strange from a European point of view, are specially interesting. Of the former "the ministrations enter into every act of the life of the people, and supply all ranks with the knowledge necessary to enable each man to play with assurance his social part." Of the latter the duties are :—"The care of manners and customs, the investigation of all public offices within and without the capital (including the conduct of the Emperor himself), the discrimination between the good and bad performance of the business transacted in them, and between the depravity and uprightness of the officers employed, the duty of urging its members to utter each his sentiments and reproofs in order to cause officers to be diligent in attention to their daily duties, and to render the government of the Empire stable." An admirable outline of the Penal Code follows, in which, as the author says, "there is much to admire. Unlike many of the legal systems of the East and West, it avoids all useless redundancies, and represents in a concise form the laws which are intended to govern the courts of justice. Its provisions are mainly directed to keeping the people quiet and loyal." The administration of the Laws is next dealt with, perhaps from too depreciatory a point of view. Several cases of gross miscarriage of justice are quoted at length from the *Pekin Gazette*. The fact, however, that these cases were exposed and the culprits duly punished must to some extent militate against the conclusion at which the author, from a review of such cases, is inclined to arrive in regard to the general gross corruption amongst the officials. The author acknowledges that "sometimes a mandarin may be found who is impervious to bribes," and he quotes one or two instances in point.

More space might well have been given to that most interesting feature of Chinese life, the Village Community. Under the operation of the unwritten laws of such communities—laws which, as Professor Douglas states, "stand entirely apart from the legal code, and are the outcome of centuries of custom"—the vast majority of Chinamen live and die. Typically social-democratic in nature, these communities are self-governed. In them every man has a voice and a vote. Each "must work with the rest or the whole machine will get out of gear." "No Chinaman ever stands alone. He forms one of a general body, and to the opinion of this body (his fellow-villagers) he is compelled to yield obedience. He would no more venture to refuse to submit even the concerns which we should consider the most private to the intervention of his neighbour than an Englishman would dream of flouting the decision of a judge and jury." Hence comes doubtless—though Professor Douglas does not allude to it—the independence of character and the power of irresistible combination which are so characteristic of the Chinese as compared with other Oriental nations. In these communities the people, under the direction of the village elders, not only carry out public works, but adjust disputes of a civil nature, and adjudicate on a large proportion of criminal business.

The four descending grades of Literati, of Farmers, of Mechanics, and of Merchants, into which the whole nation, exclusive of the officials, is divided, are ably dealt with at length, and their guilds and trades-unions described. No mention is made, however, of the literary guilds, which in most parts of China wield power superior to that of the officials. One of the best chapters in the book is devoted to the subject of the Competitive Examinations, which form the one avenue to public employment and emolument, "absorbing the best years in the life of the many thousands who annually present themselves before the examiners." The author's assertion, however, that by the system of examination adopted "the memory becomes abnormally developed, and is trained at the expense of all the higher mental faculties," is somewhat difficult to reconcile with the admirable example of an examination paper given at length in the text, with the well-known great love of, and ability for, logical argument on the part of the educated Chinese, and with their marked success, and sometimes, perhaps, superiority, in matters of intellect, whether in diplomacy or commerce, wherever they have come into contact or competition with Europeans. Professor Douglas says indeed that "the merchants and traders of China have gained the respect and won the admiration of all those who have been brought into contact with them. . . . For honesty and integrity they have earned universal praise, and their intelligence gains them a position of respect." Yet these men, especially the best of them, have gone through identically the same system of education as the professional Literati. Professor Douglas might, perhaps, have drawn attention to the fact that the educational system of the country not only trains the memory, but involves a vast amount of steady perseverance, unremitting diligence, close application, and ready and facile grasp of details in association, qualities which in themselves go far toward success in every walk of life. As to professional classes other than that of the Literati Professor Douglas says: "It may be asked in surprise why no mention has been made of the doctors, the lawyers, and others, and the answer may be given in the words of the celebrated chapter on the 'Snakes in Iceland,' 'There are none.'" He interpolates, however, an essay on medicine, the practice of which he rightly describes as in the hands of "itinerant quacks, the merest empirics," and he goes on to show how utterly helpless the people are in the face of disease. As to legal assistance, he describes how the people are even worse off than in the matter of medical advice.

Articles at some length on the Position of Women, and the ceremonies connected with Marriage and Death, conclude the first part of the volume.

A very admirable, as it is a most interesting, part of the work, comprising a full quarter of its contents, deals in detail with the history of the commercial and foreign relations of China, more particularly with Great Britain, brought right down to date from the time of Queen Elizabeth, when the first flotilla left the British shores for China. The whole section is at the present time worthy of very careful study. Professor Douglas leads the reader irresistibly to the same conclusions as those at which he has himself arrived—conclusions fully shared in by all British residents in China, namely: "For the effective transaction of international affairs a certain modicum of good faith on both sides is essential. That modicum has never been shown by the Chinese Government. . . .

Only two years ago the foreign ministers at Pekin declared in conclave that 'no faith could be put in the assurances of the Chinese Government.' In face of such disingenuous statements as those of the Tsungli Yamen (Chinese Foreign Office) our true policy is to demand the execution of our treaty rights to the full letter of the law, and to ignore the excuses and evasions with which they invariably attempt to avoid carrying out their engagements." "Forms, which in the eyes of Chinamen are of vital importance, are regarded by the Foreign Offices of Europe as insignificant details, and they (the Foreign Offices of Europe) are apt to consider as trivial and ceremonious that which really involves the weighty matter of national honour."

Short supplementary chapters are added on Architecture, Food and Dress, Amusements, Gardens and Travel, Slavery, Infanticide, Coins, and Art, with a final short essay on Religion.

From this summary it will be seen that Professor Douglas has presented in a concise form a very admirable *résumé* of the leading features of Chinese society, more particularly of such as have a direct influence and practical bearing upon the relations of the Chinese Empire with Great Britain. The book is one which should be carefully read and thought over by all who have at heart the maintenance of the British power in the East.

W. P. MEARS, M.A., M.D.

BRITISH PROTECTORATES AND JURISDICTION.

By D. P. HEATLEY.

ANOTHER *Expansion of England* may soon be in demand. The old forces are still at work, with the addition of some new ones. The Empire lives and flourishes, and it would seem to be almost an inevitable accompaniment of its healthy vigour that it must yet grow, although it has already (we may suppose) reached the prime of life. Commercial companies and their administrative authority may or may not deserve the harsh judgment passed on them by Adam Smith: that depends on circumstances, and Adam Smith wrote when commissions were being appointed and bills drafted to cope with the anomalies of the longest-lived and most fruitful of such companies of which history has the record; (and, we may remark, the anomaly and the fruit were detected almost concurrently). Possibly our Indian empire was not, after all, such a haphazard growth as has been widely and on high authority believed. Else, what do we make of this suggestive resolution of the East India Company, when it had barely as yet passed beyond an infancy at once precocious and precarious? "The increase of our revenue is the subject of our care as much as our trade; 'tis that must maintain our force when twenty accidents may interrupt our trade; *'tis that must make us a nation in India.* Without that, we are but a great number of interlopers; and upon this account it is that the wise Dutch, in all their general advices that we have seen, write ten paragraphs concerning their government, their civil and military policy, warfare, and the increase of their revenue, for one paragraph they write concerning trade." We can only say, perhaps, that it is our British fashion to do things (things even of high administrative and imperial import) with a stout heart and will for the day, so that to-morrow, with excellent effect indeed, may look after itself. Racial advantages, national character, favouring institutions, enterprise and pluck—and, with it all, mere rash adventure—by land and on sea, casual encounters and planned policy, unique maritime opportunity and a half-conscious perception for some centuries of the value of "sea power" (an "abridgment of a monarchy," wrote Bacon), commercial necessity and commercial ambition, imperial entanglements and imperial capacity (the parent of "destiny,"—if we may use the word and still be historical) —these have founded, strengthened, and are like to make relatively endurable our "oceanic empire." The *pax Britannica* may not carry with it the *suprema majestas Romanae pacis*: it has more effective competitors to contend with. But the establishment of it and its triumphs are not less certain than were those of old, and, we may affirm and anticipate, the issues are no less vital.

"The system of protectorates," writes Sir Alfred Lyall in the judicious chapter which forms the last of his lucid and able work, *The Rise and Expansion of the British Dominion in India*, "has been practised from time immemorial as a method whereby the great conquering and commercial peoples masked, so to speak, their irresistible advance, and have regulated the centripetal attraction of greater over larger masses of territory. It was much used by the Romans, whose earlier relations with Asia and Africa were not unlike our own. The motives have been different—sometimes political, sometimes military, sometimes commercial—the consequences have been invariably the same. It is used politically as a convenient method of extending various degrees of power, of appropriating certain attributes of sovereignty, without affirming full jurisdiction. It has become the particular device whereby one powerful State forestalls another in the occupation of some position, or scientific frontier line, or intermediate tract that has a strategical and particularly a defensive value. It is employed to secure command of routes, coaling stations, or trading posts, whenever one nation desires to be beforehand with an enterprising competitor. Under this system, applied in these various manners, the extra-territorial liabilities of England all over the world are rapidly increasing, and our frontiers are rapidly expanding." Hence the true frontier of the British dominion in Asia is determined by the "outmost political boundary projected, as one might say, beyond the administrative border": within that boundary we do not admit rival foreign influence.

It is a policy of would-be limited liability and an illustration of our caution, though of such caution as may lead to far-reaching complications in the future, just because the consequences are obscured and shunned for the time. Individual enterprise we applaud; to companies we may grant a charter; a protectorate we will even declare; but responsibility and greatness must not be sought, only endured. Hardly thirty years ago, a Parliamentary Committee, appointed to deal with our position in West Africa, reported that it was inexpedient to extend our territory there, or assume government, or enter into treaties offering protection to native tribes: the object of our policy was to be the encouragement in the natives of the exercise of those qualities which might render it possible to transfer to them the administration of all the governments, "with a view to an ultimate withdrawal from all, except, probably, Sierra Leone." The same policy may be seen earlier, as in the conventions with the Transvaal Government in 1852, and with the Free State in 1854. We have, indeed, of necessity, moved away from this impossible position. Still, to quote from a despatch of Lord Salisbury, dated May 30, 1892: "The colonial policy of Great Britain and France in West Africa has been widely different. France, from her basis on the Senegal coast, has pursued steadily the aim of establishing herself on the Upper Niger and its affluents. This object she has attained by a large and constant expenditure and by a succession of military expeditions. . . . Great Britain, on the other hand, has adopted a policy of advance by commercial enterprise. She has not attempted to compete with the military operations of her neighbour." Even more directly and faithfully does the imperial sovereignty of Germany attend on the companies and the subjects of the fatherland. "It is not at present the intention of the Imperial Government," said Prince Bismarck in June 1884, "to establish colonies with official machinery on the French or the English pattern, but wherever private German subjects acquire possessions hitherto without owners, the Government will consider itself under the obligation to give them full protection."

The diverse nature of British and, say, German jurisdiction in protectorates is part of the general characteristics of administration and government. We are fortunate in procuring an exposition of the subject —at least on its British side—from the able hands of Mr. W. E. Hall, the author of the best English work on international law. In his *Treatise on the Foreign Powers and Jurisdiction of the British Crown*, Mr. Hall has a chapter on Protectorates, Spheres of Influence and Barbarous Countries, which is of special importance in view of recent developments and probable contingencies in Africa.

Premising that the term "protectorate" is somewhat indefinite, that in all cases, however, a State or community under the protection of a European State has yielded up its freedom of action in foreign affairs, and that the native States of India do not possess the amount of independence retained by the ordinary protected State, and so form a class apart, Mr. Hall is chiefly concerned with (1) the true nature of the relations existing between the protecting and the protected State, (2) these relations as they are found in British protectorates, and (3) the future of these relations.

Since the protecting Power represents, or rather supersedes, the protected in dealings with foreign Powers, these Powers cannot exact redress for themselves for wrongs inflicted on their subjects by the natives. It is, accordingly, the duty of the protecting authority to safeguard the person and property of a foreigner, and to invest itself with the powers requisite for securing this end. The necessary equipment will not, need not, be uniform throughout all protectorates. But it must be adequate. It follows that the foreigner, thus protected, must consent to the protection of others against himself: jurisdiction may not be partial in its application. The foreigner who sues may also be sued.

Do the British Protectorates stand the test? Owing to diverse conditions and a corresponding diversity of arrangements, no single answer can be given. In the agreement concluded in 1888 with the Sultan of Brunei, jurisdiction was reserved to British consular officers over British subjects and "protected subjects," but no authority was assigned to the British courts to exercise jurisdiction, either civil or criminal, over the subjects of foreign States. The test, therefore, fails here in its twofold aspect: British subjects receive no protection against foreigners whose governments do not cede jurisdiction, and foreigners are denied a like protection against natives or the subjects of a third Power. It is provided that in a mixed civil case (one, that is, between British or British protected subjects and the Sultan's subjects) the trial shall be conducted in the courts of the defendant's nationality, although an officer nominated by the government of the plaintiff's nationality may take part in the proceedings, without, however, having a voice in the decision. By an Order in Council issued in 1890—subsequently, that is, to the establishment of the protectorate—it is laid down that a foreigner, instituting proceedings against a British subject, or willing to appear as defendant in a British court, must first file his consent to the jurisdiction, and may even be required to produce the consent of a competent authority of his government; and in Zanzibar there is no escape from this latter condition. Similarly, by the Somali Order in Council (1889), causes affecting a foreign European subject can come under British jurisdiction only by consent. The originating ground of this imperfect authority is, says Mr. Hall, "the somewhat pedantic, and certainly erroneous, notion that sovereignty is indivisible:" Zanzibar, Brunei, and the Somali Coast are not completely under British suzerainty; hence for no purpose (the notion implies) can they own that sovereignty in its full force; the powers exercised by Great Britain are delegated powers; and an Eastern State cannot grant jurisdiction over subjects who are neither its own subjects nor those of the State in whose favour the delegation takes place.

The Africa, South Africa, and Pacific Orders in Council, of dates 1889, 1891, and 1893 respectively, provide for the assumption of wider jurisdiction. Through consular instruction, or on the notification of a Secretary of State, the first may be applied to any existing or future African protectorate, where no other Order in Council is already in force. It is thus of prospective importance greater than usual. By it, jurisdiction is made to extend to all persons "with respect to whom any State, king, chief, or government, whose subjects, or under whose protection they are, has by any treaty or otherwise agreed with Her Majesty for, or consented to, the exercise of power or authority by Her Majesty," —extends then, in effect, to natives and to subjects of European States. This definition tallies with the undertaking entered into by Great Britain at the Berlin Conference of 1884-85, "to protect foreign merchants and all the trading nationalities in all those portions of the Niger which are or may be under her sovereignty or protection, as if they were her own subjects;" and tallies also with the first Article of the General Act of the Brussels Conference, July 1890, whereby the Powers, including Great Britain, enjoined, as the most effective means of counteracting the slave-trade in the interior of Africa, the "progressive organisation of the administrative, judicial, religious, and military services in the African territories placed under the sovereignty or protectorate of civilised nations." Mr. Hall remarks that "it would be impossible for the signatories of agreements pointing so clearly to the establishment of whatever jurisdiction may be found necessary or advisable by a protecting State for the attainment of prescribed objects, and pointing moreover to a development of organisation as an end in itself, to deny the grant of implied consent to the exercise by Great Britain of civil and criminal jurisdiction over their subjects in British protectorates duly set up upon the coasts of Africa; and as the conditions under which protectorates can exist upon the coast and in the interior parts of the continent, to which the agreements do not extend, differ only in the greater difficulty of maintaining effective jurisdiction in inland places, the signatory governments are morally precluded from objecting to the assumption of equal powers in the one case to those which they have given in the others."

The Pacific Order (applying to the following groups of islands: the Union, the Phœnix, the Cook, the Gilbert, and the Southern Solomons), in "an indirect and confused, but sufficient manner," asserts jurisdiction over natives and over foreign subjects independently—herein differing from the African Order—of the consent of European States. Under an Order in Council of December 29, 1887, the Legislative Council of the Gold Coast Colony would seem to be empowered to extend the operation of the principle of the Pacific Order throughout the Gold Coast. Foreigners, as well as natives, are also brought under the jurisdiction of the protecting courts by the South Africa Order, establishing the South Africa Protectorate, and by the Charter of the Royal Niger Company, which exercises protectorate authority in the Niger Territories.

It will appear that, though there is a definition of the jurisdiction in all cases, there is an absence of that uniformity, that systematic directness and comprehensiveness, which we are wont to associate with the law as a machine. That system and uniformity will be found rather in the protectorates of Germany and France. All persons, irrespective of nationality, come under German jurisdiction; the protectorate assumes a distinctly territorial character, and foreigners settling within the jurisdiction may even be naturalised, and rank as German subjects. As Germany, so France, wherever she finds it practicable, as in Annam and Cambodia, but not Madagascar (where prior treaties with Great Britain and the United States preclude the French from exercising jurisdiction over all foreigners), and not in Tunis. As a rule, France and Germany but give effect to the general enunciations accepted by all the Powers, except Britain, at the Berlin Conference, that a protectorate carries with it the right of administering justice over the subjects of other civilised States.

There is no need of a rigid uniformity. The British are not as logical as the French (and fare not worse). The nature and amount of the jurisdiction are properly determinable by reference to the circumstances of each case. But (1) there are cases—*e.g.*, that of the Somali Coast—where the jurisdiction assumed is not adequate to meet the requirements of foreign subjects, and where, accordingly, foreign extra-territorial jurisdiction may intervene, and, intervening, may clash with the nominal protecting authority; (2) have we municipally legalised and safeguarded such protectorate jurisdiction as has been assumed by the Crown and recognised by international arrangement? Would a foreigner bent on conducting an appeal find the protectorate jurisdiction confirmed by the English courts?

Dependence would be placed on the Foreign Jurisdiction Act of 1890, which, however, according to Mr. Hall, does not afford the required security; it is a mere consolidating statute, and, as such, cognisant only of the extra-territorial jurisdiction over British subjects to which the successive consolidated Acts had referred. Still, other sources are available. The Powers signing the Berlin and Brussels Acts might have their attention directed to the extent of the jurisdiction claimed and controlled by this country over foreigners in protectorates. Or, that jurisdiction might be affirmed by legislation. Or, it may meanwhile be possible to maintain that jurisdiction without statutory enactment. In this way argues Mr. Hall: The doctrine of the indivisibility of sovereignty is exploded; the British Crown, in the exercise of its prerogative, can acquire a portion only of the *territorial* sovereignty of a state, just as, through conquest and cession, it can acquire the whole; the powers exercised in a protectorate are really territorial, and it may accordingly be concluded that the English courts will decide that the Crown in assuming a protectorate is invested with powers which resemble in kind those exercised by it in a conquered territory. It follows, from the same general reasoning, that when natives of protectorates are in foreign countries they are not (as usually regarded) foreigners, but fall, of right, under the same category as persons habitually protected by Great Britain; subjects of foreign Powers entering British protectorates have security guaranteed to them; the same amount of security must be accorded persons of a protected community when they are in a foreign State.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

Place-Names of Sutherlandshire.—Mr. John Mackay, C.E., Hereford, contributes a couple of papers on this subject to Vol. xviii. of the *Transactions* of the Gaelic Society of Inverness, in which he discusses the names of localities in the parishes of Reay, Kildonan, Loth, and Clyne. Mr. Mackay appears to have overlooked the fact that the Sutherlandshire portion of the parish of Reay has been included by the Boundary Commissioners in the parish of Farr, and that Reay is now entirely confined to Caithness. Mr. Mackay thinks that the proper meaning of Cnoc-an-eireanaich means "the hill of the gelded goats," and not "the hill of the Irishman" as generally supposed ; yet the Rev. Mr. Sage, in his *Memorabilia*, has given the latter meaning as correct, and speaks of the circumstance which brought about the adoption of the name in a way that leads one to believe that it took place during his own boyhood, or, at earliest, very shortly before his birth. The translation, too, of Loch Leam-a-chlamhan as "the loch of the leap of the vulture" seems to us to be rather far-fetched : vultures do not usually leap, and, if they did, why should the loch be so called ? Duible, or Diobal, Mr. Mackay believes to mean "the township of the bog," and gives the following forms as occurring in old charters : Daypull, Dowebull, and Dwebul. As to Loth Mr. Mackay does not commit himself, but suggests several translations or derivations, all likely enough : he also gives ancient variants of the name as Lothe, Lothkirk, and Logh. Portgower we believe to have received its name from the Gower family, and to have nothing to do with the neighbouring Culgower, "the goats' corner." Does Cnoc-coir-an-oir, "the hill of the hollow of gold," point to an early knowledge of the presence of gold in Sutherlandshire ? Achrimisdal is, no doubt, the same as the Caithness Rumsdale and the Norse Raumsdalr, both the Scots forms coming with the Vikings from Scandinavia. Old forms of Sciberscross are given as Shiberscage, Schibriskeig, Scheb, and Serirscraig. Altogether the author deals with over two hundred and twenty place-names, the articles being characterised by scholarly care and wide local knowledge.

ASIA.

The Marine Survey of India.—Commander Oldham has sent us his annual *Administration Report of the Marine Survey of India* for the official year 1893-94. As formerly noticed (vol. ix. p. 538) the survey of the Coromandel coast was last year completed up to Pennair, after which the *Investigator* proceeded down the coast towards the Armeghon Shoal, and then ran northward as far as Chapalmundi, taking soundings to fill up gaps left in previous surveys, and making observations to be afterwards utilised in future editions of the Sailing Directories. After a visit to Madras, Kistnapatam was reached, and a line of soundings completed up to Shallinger Shoal, when it was ascertained that the beacon at Kistna, like that of Pennair, had disappeared. A temporary substitute was fixed up. The coast here, composed of sand and fronted by sandhills, is subject to considerable changes during the monsoons. Off the shore the bottom is uneven and rocky, making the trawlings, which were conducted in depths up to 600 fathoms, not so successful as might have been expected, though some interesting corals were obtained—one, from 80 fathoms, being an Oculinoid, a family not previously found in the Indian seas. After again calling at Madras, the *Investigator* made a rapid passage to Bombay, where Lieutenant C. V. Smith was sent on board H.M.S. *Marathon* in order to survey the Seychelles Bank, while the remainder of the staff proceeded to Poona to work out the results of the new investigations. The deep-sea sounding machine, with the necessary accompaniments, was transferred to the *Marathon*, which proceeded to the Seychelles, where Lieutenant Smith made successful sectional lines of soundings, and marked by buoys the position over the edge of the bank for the proposed telegraph cable between the Seychelles and Zanzibar, on the one hand, and Mauritius on the other. Lieutenant Smith then joined the staff at Poona where the following charts were prepared, viz. : Shallinger Shoal to False Point Divi ; the Port of Bombay ; Bombay Island to Manori Creek (tracing) ; Kardamat Island ; Betra-Par and Peremul-Par. When the party rejoined the vessel the *Investigator* left Bombay for the Laccadive Islands, sounding and trawling on the way, until the Aukutta Islands were reached, when a sketch survey was made of the two northern islands of the group, and the work among them completed. After Kavaratti Island had been surveyed and its position fixed, soundings being made off each side of the island, Calicut was visited, a haul of the trawl being taken on the hundred-fathom line. Suheli-Par, the southernmost of the Laccadives, was afterwards surveyed, and its position accurately fixed, its reef being nearest to the usual track of vessels. Tidal observations were made here for a week. Towards the end of November 1893 the weather became unfavourable for survey work, indicating a cyclonic disturbance in the Arabian Sea; and, accordingly, the vessel ran for Minikoi, making frequent soundings by the way, in course of which a new bank, covered by 119 fathoms of water, was discovered about 25 miles north-east of Minikoi, near where a reef was reported in 1889 by the master of the *Noord Braband*. This bank causes violent tide rips which, in Commander Oldham's opinion, may have been mistaken for surf, and thus a reef was reported no trace of which has since been found. From soundings made at every twenty miles, all under 1100 fathoms, between Minikoi and the Maldive Islands, it appears that the latter are connected with the Laccadive Islands by a submarine bank. Here the lagoon of one of the atolls was sounded and explored by Surgeon Anderson; deep soundings were made off the eastern side of the atoll, where the trawl was successfully employed, and a depth of 601 fathoms was found in the entrance-channel to the lagoon. Soundings made to ascertain the slope and the nature of the foundation on which the atoll rests gave the following results:—

Fathoms.	Slope with the Horizon about
5 to 45	22°
45 ,, 100	42°
100 ,, 250	22°
250 ,, 440	40°
440 ,, 670	7°

Another section, carried to a depth of 250 fathoms, gave a similar slope. Off the south-east of Ceylon a very strong four-knot current, setting to the southward, was observed. The *Nancowry* joined the *Investigator* in February, in which month the survey was completed up to Madras. Here the bottom was found to be rocky and unsuited for trawling, one trawl being lost and others damaged. Both vessels then proceeded to Palk Strait, calling at Negapatam on the way, and the survey of this area was begun at Point Pedro. As there is no triangulation of the north coast of Ceylon, that work had to be undertaken by the Marine Survey, and was carried out, although somewhat hindered by the theft of marks by natives. Commander Oldham concludes his report by announcing that he has completed a revised and condensed list of all the lighthouses and lightships in British India, and that the duty of keeping this list corrected and revised is, in future, to be undertaken by the officer commanding the Marine Survey.

Lieutenant Gunn reports upon the work performed by the boat party under his command. The survey of Bombay harbour having been completed, the party proceeded to Vesava, in the Thana District, and commenced the survey of the coast-line on a scale of one inch to the nautical mile. After the recess at Poona, the same survey was continued from the mouth of the Bassein Creek, the interior of which was afterwards carefully examined, the party camping at Ghodbandar, and completed to within five miles of its junction with the Thana Creek.

Surgeon Anderson, as naturalist to the survey, has prepared a most interesting report; but before noticing it we may mention that the results of the examination, at the Calcutta Museum, of the marine deposits supposed to contain pumice, the absence of which we regretted when reviewing last year's *Report*, are now given. The examination proves that the oozes contained less pumice than had been supposed, and there is, therefore, no reason to believe that its presence is due to a submarine volcanic convulsion, the outbreak at Krakatoa being its probable origin.

The following table gives the soundings and some other details contained in Surgeon Anderson's report:—

Station.	Position.	Fathoms.	Bottom Temperature.	Deposit.
139	14° 29′ 55″ N., 80° 19′ 45″ E.	31	...	Soft brown, terrigenous mud.
141	15° 25′ 6″ N., 80° 25′ 7″ E.	599	...	Green Ooze.
142	14° 18′ 8″ N., 80° 24′ 2″ E.	573	43·8	Soft brown mud.
143	14° 11′ 6″ N., 80° 24′ 0″ E.	88	60·0	Coral.
	Between Bombay and the Laccadive Islands	172 696	... ...	
147	Off Calicut	28	...	Sand and shells.
148	Lagoon, Northern Maldive Atoll	15 to 30	... ...	Sand, broken shells, and corals.
149-50	7° 05′ 45″ N., 75° 04′ 0″ E.	719	...	Fine coral sand.
151	Off Colombo Lighthouse	142 to 400	... ...	Brown mud.
	14° 18′ 0′ N., 13° 01′ 0″ N.	8-475	...	
172	8° 40′ 10″ N., 81° 17′ 45″ E.	200-347	49·5 to 53[1]	Green mud.
173	4½ miles NNW. of Foul Point	609	...	Soft brown mud.

At station 139, numerous specimens of *Raninoides personatus*, a very rare though characteristic crab of the Indo-Malayan region, were obtained. At station 142 a new turbinolid coral, named by Dr. Alcock *Rhizotrochus crateriformis*, was got, as well as a new fish, described and named *Odontostomus atratus*. At station 143 "large numbers of a small, very delicate, and friable Ophiuroid, hitherto undescribed, but now named *Astroschema flosculus* by Dr. Alcock," were found. On being taken out of the water this animal was of a brilliant red colour, but on immersion in spirit it shortly became a dull grey, the pigment passing out into the spirit. The same occurred in the case of another crustacean, *Parthenope spinosissima*, from the same station. On Bingaroo Island, Surgeon Anderson found *Ocypoda ceratophthalma*, an Ocypode crab, inhabiting burrows near high-water mark, and notable for the peculiar sound (produced by the stridulating apparatus on the inner surface of its hand) which he mistook at first for the croaking of frogs.

Off Uleganu Island, station 150, a fine *Terebratula* was taken, the first known to have been fished up in Indian waters. All the animals captured in this haul, although from a depth to which light is not supposed to penetrate, were remarkable for their divers tints; all colours, especially red, being presented, with the exception green. At station 151 many *Crustacea*, several new to science, were obtained. The reporter mentions many other new species, and is to be congratulated on the success of his season's work. Of Palk Straits he remarks that the southern shore between Point Pedro and Delft Island is largely formed of coral sand, generally

[1] Surface temperature, 85·0° F.

fronted by a fringing reef at a distance of about a hundred yards from high-water mark, with, in many instances, breaches opposite the mouths of streams, as was to be expected. The lagoon is shallow, deficient in fauna, and dry in places at low water. A coral cliff, from one to twelve feet high, runs along part of the beach, which Surgeon Anderson at first was inclined to look upon as due to upheaval, but after examination he came to the conclusion that Professor Agassiz's theory regarding the coral coasts of Florida, facing the keys, applies here also, and, therefore, he believes it to be of sub-aërial origin. The soil near the beach is red, porous, and very light, probably of the same kind as that of the Bermudas, overlying a hard, partially crystalline limestone of coral origin, and valuable as building material. The outside edge of the fringing reef is composed of living coral, slopes sharply down into deepish water, and is remarkably free from outlying coral patches. The reef rock has been much drilled by boring animals.

The Akas.—In the autumn of 1883, Colonel R. G. Woodthorpe, C.B., R.E., accompanied an expedition into the Aka country sent for the purpose of recovering two natives who had been kidnapped by this people. He has kindly lent us a copy of a lecture in which he described his experiences, and from this we have gathered the following particulars concerning the tribe and their territory.

The Aka country is a small portion of the Himalayan range lying immediately to the north of the British station of Tezpur. It consists of a series of ranges, more or less parallel, steep and high and clothed with forests, long grass, cane and scrub. The Bhoreli river flows southward between snowy peaks rising to as much as 23,000 feet above sea-level, and receives many important tributaries from the Bhutan and Daphla hills. The outer ranges are uninhabited, and the Aka villages are reached only at the third. The people, who call themselves Hrussos, are divided into two clans—the Kapaschors (lurkers among the cotton plants), and the Hazari Khoas (eaters at a thousand hearths). These are Assamese nicknames, the former indicating the predatory habits of the tribe, and the latter alluding to the villages or houses in the plains which in former times were chosen by the Assamese Rajah to furnish blackmail to the Khoas. The villages of the Kapaschors, against whom the expedition referred to was directed, are seven in number, and each consists of only a few houses, surrounded by scanty patches of cultivated land, where rice, millet, Indian corn and vegetables are grown. Small axes and a kind of broad chopper, with which they both cut wood and dig the soil, are their only agricultural implements. The houses are long buildings of bamboo and planks, thatched with grass or palm-leaves, and raised on piles some four or five feet above the ground. They vary in length from 60 to 150 feet, and are about 25 feet wide. Inside, hearths of clay are constructed at intervals, each representing a family; as sons marry and the families increase, the houses are lengthened. The villages have no permanent defences, but at suitable points stockades are erected and traps constructed to protect the territory.

The people are short in stature, but broad and well built, and capable of great exertion. In type they closely resemble the Bhutias, having high cheek-bones and eyes obliquely set. As a rule they are fair-skinned. Their dress consists of a petticoat and a jacket of coarse red material with broad blue stripes. Some of these jackets are sleeveless, and others are of white calico obtained from Assam. Shawls of Tibetan cloth or coarse silk from Assam are also worn. Strings of beads are worn round the neck, and also serve as garters to keep up loose gaiters of cloth, which are neccessary to protect the legs from the bites of a troublesome little fly that abounds in these hills. The head-covering is a cylinder of cane, wood, or leather, like a tall hat without a brim, covered with cloth or skin and ornamented with leaves. The weapons are bows and arrows and swords. The arrows are poisoned with a preparation of aconite, the root of which is obtained from the tribes farther up the country, near the snows; the head is barbed and so fashioned that it remains in the wound if the arrow be drawn out. The sword is three to four feet long, and is left unsharpened for about a third of its length from the handle, so that it may be grasped there and used as a two-handed sword.

The river can be ascended by boat as far as Diju Mukh, the confluence of the Diju with the Bhoreli, but the journey occupies three or four days owing to the strength of the current and rapids; the distance by road is only seventeen miles. From Diju Mukh two paths run into the Aka hills. One runs northward nearly to the source of the Diju, crosses the first range of hills, and descends again to the Bhoreli, here called Maj (Middle) Bhoreli, which is deep and wide, and is crossed by rafts and a cane bridge; it then crosses another range to the small Tenga river, and finally ascends to the villages of Labi, Mehdi, etc. The other path follows the right bank of the Bhoreli, and the crossing of the river is thus avoided.

AFRICA.

Anglo-Italian Convention.—On May 5th an agreement for the delimitation of the spheres of influence of Great Britain and Italy was signed at Rome. The territory of Berbera is to be bounded by a line drawn from Gildessa (Jaldessa) to the 8th parallel of north latitude, skirting on the north-eastern side the territories of the Girri, Bertiri, and Rer-Ali tribes, and leaving the villages of Gildessa, Darmi, Giggigœ, and Milmil on the right. The frontier will then follow the parallel to its intersection with the parallel of 48° E. long., and then run to the intersection of the parallel of 9° to the meridian of 49°, which latter it will follow to the coast.

Obok.—This territory has a coast-line of more than 100 miles, from Lawadda near Zeila to Ras Dumeirah to the north of Perim, and extends inland to a distance of some 300 miles. Thermometric observations have been made regularly at the town of Obok only, and show that the maximum temperature is 107°, the minimum 73° and the annual mean 84° F. During the months of July and August a northerly wind blows from the arid plains of the Afar, and at certain hours of the day increases in force, bringing with it thick clouds of sand and an enormous rise of temperature. This wind the Arabs call *Khamsin* (fifty), because it blows during fifty days of the year. The population of the territory numbers about twelve thousand, consisting of autochthonous Gallas, Arabs, Somalis, Sudanese, and Abyssinians. The flora of the country is poor, but the fauna is abundant; at a short distance from the town are seen wild asses, buffaloes, large and small gazelles, a small grey antelope, and rabbits. Ostriches, bustards, herons, pelicans, partridges, teal, snipe, and curlews are the most common birds; and insects, especially *Coleoptera*, are found in swarms. The commerce of the port is almost *nil*; it is situated to the north-east of the deep gulf of Tajura, and caravans from Shoa would have to make a march of seven days through a desolate, sterile country without water, in order to round the Ghubet-Karab, the deep bay at the extremity of the gulf, and reach Obok. Hence the necessity of moving the seat of government to Jebuti on the other side of the gulf, in the Issa country. The orographical system consists of a chain of mountains running from north-west to south-east, of which the plateau of Jebuti forms the first stage. The highest mountain on the route to Harar is the Biacaboba, 3600 feet high. In Issa the elevations do not exceed 500 feet; they are furrowed by numerous torrents, and the river Ambuli, near Jebuti, is seldom dry.

Jebuti, situated on four flats, connected by dunes of sand which are partly covered even at low water, is composed of 800 houses built of stone and straw. Its population is 1800 to 2000 Arabs, Danakil, a few Hindus, and Issas. Pasture-land is scarce, and the sheep feed chiefly on mimosa leaves. Pearls and mother-of-pearl are obtained in the gulf of Tajura, and are often carried to Zeila. The Issas, of Somali race, are warlike, and are constantly at feud with the Danakil and the Gadabursi. They are sober and have few wants; they rear a large number of goats, sheep, cattle, and camels, which they sell at Obok and Zeila for rice, *durra*, dates, and woven materials.

Most of the trade with the interior takes the route to Zeila, though the anchorage at that town is bad and at a distance from the coast, while Jebuti possesses an excellent roadstead and a jetty 650 yards long. The route to Harar presents no difficulty to caravans, and is provided with water at intervals of about five miles. Harar, situated 6483 feet above sea-level, enjoys a temperate climate. Rains are frequent and the vegetation luxuriant. The population is 35,000. Coffee grows in abundance, and the crops of Harar as well as those from Kaffa are shipped at Berbera for Aden. The other products are hides, ostrich feathers, musk (a coarse kind of civet), and gold. The routes to Jebuti and Zeila diverge at Biacaboba, at a distance of 170 miles from the ports. That to Zeila is rather more level, but it wants water, and it traverses the country of the Gadibursi, who are always at war with the Issas, so that caravans are often attacked.—*Bull. de la Soc. de Géogr. de Marseille*, Tome xviii. No. 2.

POLAR REGIONS.

Arctic Expeditions.—On June 20th the members of the Peary Auxiliary Expedition left Brooklyn for Newfoundland, where they would embark on the *Falcon*, about July 4th, for Godhavn. The expedition was planned by Lieut. Peary, and intrusted to Professor Heilprin; but as the latter is unable to leave the country, Mr. Henry G. Bryant has taken the command. The *Falcon* is to be at Bowdoin Bay on September 1st, to take Mr. Peary and his party on board, who are expected to return to the west coast of Greenland about the end of August. The intervening time will be spent by the Auxiliary Expedition, if the circumstances be favourable, in searching for the lost Swedish explorers, Björling and Kallstenius.

In a paper published in the August number of the *Geographical Journal*, Mr. Jackson describes his plans and equipment. As is well known, he has set off to Franz Josef Land, having chosen this route towards the Pole, because the land is accessible late in the summer, and extends a considerable distance northwards, Cape Fligely lying in 82·5° N. lat., while Cape Sherard Osborn was believed by Payer to be continuous with the portion of the country he called Kronprinz Rudolf's Land. From Cape Fligely, also, Payer saw an ice-covered land of apparently large extent, which he called Petermann Land. Another advantage of this route is the abundance of animal life which, according to Payer and Mr. Leigh Smith, is found on the southern shores of Franz Josef Land, in winter as well as in summer. Mr. Jackson has secured for his expedition the well-known Peterhead whaler, the *Windward*, and is well supplied with boats, tents, and all other articles necessary for Arctic travelling. The boats are of several different kinds, one being of copper and another of aluminium, the latter weighing only 150 lbs. The *Windward* sailed from Greenhithe on July 11th, and on August 6th it left Archangel.

Mr. Walter Wellman's expedition left Tromsö on May 1st, in the steamer *Ragnvald Jarl*, with the intention of following in Parry's track to the north of Spitzbergen. The vessel left Danes Island—where it landed Professor Oyer, the geologist of the expedition, and part of the stores—on May 10th, for the Seven

Islands, and on the 24th was crushed by the ice near Walden Island, in 80° 37′ N. lat. and 19° 17′ E. long. Mr. Wellman, with fifteen companions, was on board, of whom six, after travelling a long distance over the ice, fell in with a vessel and were carried to Tromsö. One of these was the captain of the *Ragnvald Jarl*, and he immediately set to work to equip a ship for the rescue of Mr. Wellman and his companions, who on June 17th were at a point six miles east of Cape Platen, and of Professor Oyer, at Danes Island. On August 16th the members of the expedition landed at Tromsö.

Herr Ekroll set out from Skroven in the beginning of July for Spitzbergen, in the *Willem Barents*, with the intention of passing the winter in the Stor Fiord. He will erect a branch station in Helis Sound, for the purpose of observing the movements of the ice. This expedition is preparatory to the attempt Herr Ekroll is to make to reach the North Pole, if the necessary funds come in.

The Danish Government intend to send out a deep-sea expedition to the seas of Greenland and Iceland, to continue the work commenced in 1878 and 1879 by the vessels *Fylla* and *Ingolf*. Commander Wandel, Director of the Chart Department, will take the command, and will sail on the first voyage in May 1895.

The newly-discovered Land in the Antarctic.—In *Petermann's Mitt.*, No. 6, are given the names adopted by Captain Larsen for the points of land he discovered, which were not contained in the extract from the *Jason's* log forwarded to Dr. Murray (see p. 197 of this volume). As the expedition was fitted out by German capital, Captain Larsen's report came into the hands of a Hamburg firm, HH. Woltereck and Robertson, by whom it was communicated to Herr A. Shück. The positions, according to Herr Shück, are: Veir Island, 66·4° S., 60° W.; Cape Framnaes, 66·3° S., 59·9° W.; South Peak, 66·1° S., 60·8° W.; Jason Mountain, 65·9° S., 60·6° W.; Robertson Island, between 65·7° S., 59·1° W. and 65·5°, 58·6° W.; Christensen Island (the Jason volcano of the map facing p. 198), 65·2° S., 58·9° W.; Lindenberg's Sugarpot, 65·13° S., 58·95° W.; the Sea-Lion Islands (Sarsee volcano of the map referred to), 65·1° S., 59·1° to 59·6° W.—that is, if the bearing be given from Christensen Island, but if from the vessel during the voyage, the islands may lie between 65·1° S., 59° W., and 65° S., 59·3° W.

MISCELLANEOUS.

The **East Coast Railway of India**, from Calcutta to Madras, has at length been commenced, but it is feared that the work may be postponed from motives of economy.

It is proposed to found a **palæographic society** in Australasia for the collection, preservation, and study of all kinds of ancient writing symbols and pictograms. Dr. A. Carroll, of Kogarah, Sydney, and Mr. Elsdon Best, of Wellington, N.Z., are the promoters.

Dr. Sauer, Captain Sampson, and Mr. Bradley have discovered more **ruins in Matabeleland**. Near Fort Maduro (Dhlodhlo) they have found a ruined fortification of oval shape, similar in construction to the Zimbabye ruins. It has been named Fort Regina.—*South Africa*, June 14.

The number of hours of bright **sunshine** recorded at Greenwich during **1893** was 1454, the highest number recorded in any year since 1877, when the registration commenced. It is also 171 hours above the average for the sixteen years, and is 32·6 per cent. of the possible.—*Symons's Monthly Meteor. Mag.*, July.

The expedition of Prince Ruspoli has returned to Berbera. It had crossed the Upper Juba and reached Lake Stefanie, discovering a new lake 20 miles long. There was every prospect of success, when Prince Ruspoli was killed by an elephant. Colonel Piana is about to travel in the same direction.—*Comptes Rendus*, No. 13.

The French ports on the Mobangi have been separated from the French Congo and placed under the command of M. Monteil. It will be his task to extend French influence towards the north and north-west, and, accordingly, he has already despatched one of his lieutenants, M. Julien, towards Lake Tsad.—*Mouvement Géogr.*, July 22nd.

A sounding taken by the Italians in the Red Sea, lat. 23° 11′ 30″ N. and long. 37° 3′ 40″ E., has given a depth of 886 fathoms. At lat. 21° 14′ 15″ N. and long. 37° 57′ E., a depth of 674 fathoms was found. At about 85 fathoms the temperature of the water was in general lower than on the surface, while at 820 fathoms it was higher.—*Mouvement Géogr.*, July 8th.

Baron von Mueller has often impressed on the Government that there are whales in Australian waters, and on June 17th his affirmation was proved correct, two large humpbacks entering Port Phillip and ascending as far as the Gellibrand lightship. A few sailors came out of Williamstown and gave chase. One of the whales was harpooned, but, after an exciting chase, the rope broke and the fish escaped.—*Melbourne Argus*, June 18th.

The lake of Joux, which lies at an altitude of more than 3000 feet in the Jura Mountains, canton Vaud, has no visible outlet. It has long been suspected that its waters, by some subaqueous channels, find their way into the Orbe, which rises about three miles from its northern shore, and this has lately been proved to be a fact, both by the use of colouring matter poured into the lake, and by the rise of the water in the river when certain sluices in the lake are opened.—*Mouvement Géogr.*, July 22nd.

The *Annalen der Hydrographie*, Heft vi., report a singular case of two bottles floating across the Atlantic in opposite directions. With eight others, they were thrown out of the schooner *Doña Evelina*, on February 24th, 1893, to the north-east of St. Paul's Rocks, in lat. 1° 44′ N. and 27° 16′ W. long., the vessel then being in the domain of the south-east trade-wind, but near its northern limit. One of the bottles was found on March 8th, 1894, on the coast of Nicaragua, 11° 59′ N. lat., 83° 46′ W. long, and must have travelled about 3420 nautical miles in 377 days, or 9·1 miles per day. The other was driven eastward to the coast of Sierra Leone, and was found in lat. 7° 3′ N. and long. 11° 43′ W., on September 8th, 1893. It must therefore have drifted 984 nautical miles in 196 days, or five miles a day.

NEW BOOKS.

The Historical Geography of the Holy Land, especially in relation to the History of Israel and of the Early Church. By George Adam Smith, D.D., Professor of Hebrew and Old Testament Exegesis, Free Church College, Glasgow. With 6 Maps. London: Hodder and Stoughton, 1894. Pp. xxi + 692. *Price* 15s.

To the already extensive literature on the geography of the Holy Land Dr. Smith has given us a substantial addition. Of his valuable work the author says very modestly in his preface, "It is as a provisional attempt to collect old and new material . . . that I offer the following pages. I have not aimed at exhausting the details of the subject, but I have tried to lay down what seem to me the best lines both for the arrangement of what has already been acquired, and for the fitting on to it of what may still be discovered." In this Dr. Smith undertook a much-needed work, and has done a great service. For his task he has had exceptional preparation. He has diligently and candidly searched the wide literature of the subject and acquired an extensive and most accurate acquaintance with it. He has visited the land twice. His special study of Old Testament literature, his familiarity with the original Scriptures of the Hebrew historians, poets, and prophets, and his own quiet observation and open-mindedness fit him well for the task he has undertaken. Every page bears evidence of his conscientious use of earlier workers, and his fairness in estimating their work. Though his book is closely packed with information, the style is bright and interesting, and Dr. Smith carries lightly the equipment of exact scholarship which his volume displays.

The book is welcome as a soundly based attempt to deal with geography historically. It is to be hoped that the time is not far distant when the too familiar method of "teaching geography" will be a thing of the past. A list of the names of towns, rivers, and mountains is not geography ; and the juvenile mind which revolts against the imposture is guided by a scientific instinct.

In this *Historical Geography of the Holy Land* we are shown the connection between the position, configuration, and climate of the land, and its history, its literature, its moral condition, its faith. Every one can understand how the position, climate, and fertility of the land of Palestine must have determined its early colonisation and cultivation ; but where did the first colonists of the land come from ? What race did they belong to ? What was their language and their faith ? These are supremely important questions. We are hardly prepared to agree altogether with the author in his answers, and must wait fuller archæological discovery. Dr. Smith thinks they came from Arabia ; but was it not more natural for those pressing westwards to feel their way by river banks than to cross deserts or even fertile mainlands ? Movements on continents are rather the swaying of masses than the adventures of pioneers. Geography seems to teach here what history must have been. But the labour of tracing the early migrations and conquests of "prehistoric times" is only being effectively taken in hand now as material is coming to light. According to Dr. Flinders Petrie "we now know from the objects found in Egypt that these peoples (from Greece, Asia Minor, and Italy) were dwelling there as settlers so far back as 1400 B.C., if not, indeed, before 2000 B.C. ; that Europe had an indigenous civilisation as independent of Egypt and Babylonia as was the indigenous Aryan civilisation of India . . . and that Europe has given to the East as much as it borrowed from there." This has an immediate bearing, for example, on the question where the Philistines originally came from—a question which Dr. Smith discusses at length. Though they came up out of Egypt into Philistia they *may* have come there from Crete. It is however too soon to settle this question. Whatever other peoples may have contributed to the population of Canaan, the bulk of its inhabitants were, when we have any history of the land, Semitic tribes. Philistines and Hittites were late incomers ; and even the Philistine King Abimelech had a Semitic name, which may, however, have been official, as there were, at least, two so named. Dr. Smith might have given his readers a fuller statement of the light which the Tell-el-Amarna letters and other ancient monuments have thrown on the early history of Canaan—reserving his decision on disputed points. Few have yet realised the extent of the civilisation of Canaan in the times of the patriarchs and its close relation with surrounding countries, or how entirely the representation of the country given in the Book of Genesis accords with knowledge recently acquired from contemporary sources. Here, as throughout his book, Dr. Smith has reserved his strength. We would have gladly exchanged some of the discussions, as on the Israelitish invasion and on Sychar—valuable as they are—for fuller information as to this early history. Throughout the volume we recognise the caution of the author in accepting proposed identification—a caution which, however, it is gratifying to note, only affects very few sites of importance. The survey of Palestine has been so well done, and its results so carefully sifted by the officers of the Exploration Fund Committee, that each new student has to pay such a tribute to it as is generously done throughout this volume. There may be temptation, as Dr. Smith hints, " to *make* identifications," but that is rather the temptation of quick-witted and interested scholars than of "committees interested in subscriptions." To Dr. Smith himself we are indebted for some both new and good identifications; as of Mizar (Ps. xlii. 6). The work of identification, it is to be remembered, is much aided by the very limited area within which lost sites must be sought. Here geographical considerations come in, as Dr. Smith shows very interestingly, *e.g.* in the case of Banias (Cæsarea Philippi) and as Major Conder before showed in the case of Lachish, where his identification has been pretty surely confirmed. All the principal towns had their positions fixed by trade routes by which caravans and armies passed and repassed. A market town must be on a highway, a fortress must hold the key of the position, and these, as well as the battlefields, nature fixed. So that although towns in later times shifted their sites and took their names with them, the position of the original town is not usually difficult to determine.

This book has many distinctive features of great excellence. The chapters on " the scenery of the land, with its reflection in the poetry of the Old Testament" is delightful reading, and as profitable as it is delightful. The chapter on the Jordan Valley is admirable, and the discussion of the term "the Pride of Jordan" is conclusive as to the original meaning of it. But is it not reasonable to suppose that it became in later times a phrase suggestive of the perils of wild beasts and of malarial fevers—a combination of all deadly terrors none could survive? Does not Jeremiah's use of the expression imply this? The part of the volume treating of Eastern Palestine will be read with most interest by many. We wish *all* who have travelled on the east of Jordan had given us their observations in like form.

We agree with Dr. Smith that " the exploration of Western Palestine, at least, is almost exhausted on the surface, but there is a great future for it underground. We have run most of the questions to earth : it only remains to dig them up." It is satisfactory to know that the exploration of Jerusalem is resumed, and is in the skilful hands of Mr. Bliss. Mr. Bliss has been excavating also at the site of ancient Jericho, where he traced a wall of mud brick, of which he writes, "I confess this wall sent a thrill through me. If Tell-es-Sultan is a mass of *débris* caused by the ruins of several mud-brick towns over the first Jericho, then there is good reason to suppose that this wall, uncovered near the base of the mound, at its edge, is the very wall which fell before the eyes of Captain Joshua" (P. E. F., Quarterly Statement, July 1894). Had any one else so written, scholars would only too likely have passed it over with a smile. We hope, on the contrary, it will stimulate those interested in the story of the Land of Israel to see that such investigations are prosecuted till conjecture gives place to knowledge.

We cannot close a review of this important book without notice of the admirable maps which so efficiently aid the readers to follow and understand the history. They, as well as the book itself, must contribute largely to a better method of teaching the geography of Palestine. We must also say that acquaintance with this volume would be a fresh light on "the Book" as well as "the Land" for Bible students, and we most earnestly commend it to them as worthy of a first place among the books on this subject.

Man-hunting in the Desert, being a Narrative of the Palmer Search-Expedition (1882-1883). By ALFRED E. HAYNES, Captain R.E. With an Introduction by WALTER BESANT, and Appendices by SIR CHARLES WARREN. London: Horace Cox, 1894; xxii+305 pp. With Portraits, 2 Maps, and many Illustrations.

This work is really, as Mr. Besant says, a sequel to his *Life and Achievements of Edward Henry Palmer* (1883)—a melancholy sequel to a melancholy tale; and would have been published ten years ago but for the absence of its author on foreign service. It gives a full—perhaps over-full—account of the travellings and encampings, and the investigations and questionings by which Sir Charles Warren and his party obtained final evidence as to the place and manner of the death of Palmer, Gill, and Charrington in the gnawed skull and bones and blood-stained socks and drawers found in the Wadi Sadr, and as to how the party identified the murderers and brought them to trial and condemnation in Egypt. There is incidentally a good deal of light on the conditions of life on and near the Sinaitic peninsula, the number and dispositions of its Bedouin inhabitants, with reasons for identifying the Mount Sinai of the Old Testament with Jebel Yeleg on the Tîh plateau. The story is lucidly and graphically told; but unlike the *Life* of Palmer, it is obviously not the work of an accomplished author. There are many signs also of carelessness in composing and in revising. In spite of the numerous accents, many of the Arabic words have a very odd appearance. A gentleman called Sard (p. 63) becomes Saad at p. 91; and the patronymic of M'dackle (sometimes (M'duckle) suggests doubts as to the nationality of another; Marbruk is so spelt at 53, Marbrook at 288. Kashgoria (5) catches the eye at once. The "disabilities of war" (60) is a curious expression for the hardships of war; "were obliged to be left behind" is inelegant, to say the least. A few slips like *coveluous*, *pretentions*, and *slop* (for *slope*) might be passed over; but what are we to say to "camel *traets*" (for *tracks*, p. 136), "under their *lea*" (174), "is much *drank*" (194), and "*Pharoah*" (! 209). The author must also bear the blame of "The level Tîh is the *par excellence* of country for a railway" (185), "brought into such *extremis*" (author's italics, 220), and "*laiser faire* style" (267). And at p. 177 he goes out of his way to append a footnote to tell us that Sir Richard Burton (who died in 1890) died in 1892. These occasional blemishes, though they should not have occurred, do not seriously mar the interest of the story, which is presented in a handsome and beautifully printed volume, with illustrations of various degrees of merit and interest.

The Yosemite, Alaska, and the Yellowstone. By WILLIAM H. WILEY and SARA KING WILEY. London: Offices of *Engineering*, Strand, W.C.; and New York: John Wiley and Sons, East Tenth Street. Pp. xix + 230.

This handsome quarto volume of 230 pages is a reprint of a series of articles in *Engineering*, with an introduction by James Dredge, containing an account of an excursion to some of the sights of the Far West. The authors travelled with a party over a great area in a very short time; and, as there was much to see, the account of each place is necessarily superficial and of no special geographical interest. The authors are Americans, and the expedition was conducted in the American style, in corridor trains, with all the resources of Western locomotion. The introduction gives interesting statistics as to the growth and development of the Western States of Colorado, Montana, California, Washington, and Alaska Territory. All these regions are advancing by prodigious strides, except Alaska, whose population, we are told, has diminished from 33,000 in 1880 to 30,000 in 1890. The places visited include Niagara, Chicago, Pike's Peak, Manitou, Denver, Salt Lake City, Sacramento, San Francisco, the Yosemite, Alaska, and the Yellowstone, about each of which the authors have something interesting to say. The volume partakes of the guidebook genus, and might with advantage be perused by those who wish to visit these most fascinating regions, as yet only beginning to be discovered by European tourists, but well known to Americans. The excellent photographic illustrations, with which it is richly garnished, add greatly to its attractiveness, although the pictures of the Yellowstone district convey but a poor idea of the splendour of that wonderful region. The style is not brilliant, and the authors might have compared notes before inflicting on the reader the same story at pages 42 and 53. There is a good deal of padding throughout the book which might have given place to more interesting information, and several inaccuracies are to be noted which ought to be corrected should a second edition be called for—among these, at p. 211, fig. 142 is described as *Asidian* Cliffs, instead of *Obsidian*. The book is, however, very readable and handsomely got up, and can be recommended to tourists "on this side of the pond" who can afford to cross it and spend a couple of months on the Rocky Mountains and the magnificent Pacific Slope.

Notes de Voyage en Sibérie. Le Chemin-de-Fer Trans-Sibérien et La Chine. Par EDGAR BOULANGIER. Paris: Société d'Éditions Scientifiques, 1891. Pp. 397.

The author admits that his pages form very desultory reading, but pleads that at the end of the century people have no time for anything else. He begins with a political chapter about the coming struggle between the Elephant (Russia) and the Whale (Britain), and then plunges into a description of the Ural Mountains, followed by a chapter on exiles to Siberia, with curious illustrations. The most interesting part of the volume is devoted to what, for briefness, is called "Le Trans-Sibérien," just as Canadians speak of the "C.P.R.," a similarly vast undertaking. The railway line destined to cross Siberia will run *viâ* Zlatoust, Omsk, Krasnoiarsk, Irkutsk, Tchita, and Blagovetchensk to Vladivostok. According to a map appended, we see that the Chinese Government propose that a railroad shall run north-eastwards to San Sin Tchen, whence there is a carriage-road along the Sungari river to the Russian frontier and the Trans-Siberian railway. It may be remarked that just as the Russians made their Trans-Caspian Railway run along the Persian frontier, so they propose that their Trans-Siberian Railway shall closely follow the river Amur, the north-eastern frontier of the Chinese Empire.

The World's Highway: With some First Impressions whilst Journeying along it. By MRS. ARCHIBALD DUNN. London: Gay and Bird; Newcastle-on-Tyne: Mawson, Swan, and Morgan, 1894. Pp. 376.

In a bright and interesting volume Mrs. Archibald Dunn gives an account of a trip round the world which she took with her husband, embarking at Port Said in February 1892, and landing at Liverpool in the end of August of the same year. Their journeyings included Ceylon, China, and Japan; and from Japan they crossed to Vancouver Island, and thence to New York, visiting the World's Fair at Chicago on their way. Though Mrs. Dunn tells us much that we knew before, as any one writing an account of the World's Highway must necessarily do, there are many happy touches of description, and occasional serio-comic moralisings, which make the book fresh and interesting. Her experiences in Japan are related in a racy, albeit rather slipshod, style ; and we are much impressed with her outspoken admiration for the gentle-mannered Japs. Indeed, America suffers at her hands by comparison with the æsthetic land of temples and of flowers, and she criticises the customs, buildings, and scenery of the States and Canada with a measure of justice not altogether free from prejudice. Like many other persons who have passed rapidly through America, she is apt to accept the surface for the whole, and speaks as if she knew a great deal more than she possibly can. The few illustrations are very prettily reproduced, and it is only to be regretted that they are not more numerous.

A la Côte occidentale d'Afrique. Par E. M. LAUMANN. Paris : Librairie de Firmin-Didot, 1894. Pp. 266. Illustrations.

The author carried out a petty mission to the *Rivières du Sud*, and visited a few spots on the littoral between Boffa and Boké. He devotes the first three chapters to the voyage out, and a considerable space to a description of the resources and value of Konakry. He also refers to the Los Islands (belonging to Great Britain), and to the adventures of that notorious pirate, Edward Wood. But his information, such as it is, is summarised in the last sixty pages. The book is pleasingly written, but it might quite as easily have been compiled at Paris.

Les Sociétés Africaines. Par A. DE PRÉVILLE. Paris : Librairie de Firmin-Didot et Cie, 1894. Pp. 345. With Maps.

This is an anthropological study of some interest. The object of the author is to define and describe the salient characteristics of the native races and tribes in Africa, with reference to their physical environment and the conditions of their social life. The manner of his treatment is thoroughly scientific, and is not lacking in insight, but it fails to satisfy a student whose knowledge of Africa is more exact and complete than that which the author assumes his readers to possess. For the general reader, the book might be made to pass muster, subject to one or two qualifications, to which effect might be given in a subsequent edition ; but for the geographer it is of no particular value. M. de Préville does not, in fact, appear to be abreast of modern research in Africa ; in particular, he has neglected the rich stores of information emanating from Germany. His views are therefore subject to qualification or correction at almost every point, and too often are erroneous and antiquated ; nor are his maps quite accurate. But, in spite of this inadequacy, we cordially welcome any attempt, though imperfect, to treat scientifically and in broad lines, the physical and political phenomena of Africa.

L'Irrigation en Asie Centrale. Étude géographique et économique. Par HENRI MOSER. Paris : Soc. d'Éditions Scientifiques, 1894. Pp. 379.

M. Henri Moser, writing from Schaffhausen, declares that in this work he has nothing to say to his Russian compatriots, and speaks (somewhat sadly, if not bitterly) of lack of encouragement and defeated hopes. Turkestan, in which he has lived and laboured for years, will likely see him no more. He writes this book, the result of much patient research into past history and extensive investigation into present conditions, in the hope of attracting attention to regions where European intelligence, enterprise, and capital may find a great opportunity when the administration drops its exclusivism. The Aralo-Caspian basin, the bottom of an ancient

Mediterranean, has a climate hot but regular, and extremely favourable to culture under irrigation: there is no desert, but unwatered steppe, clayey, sandy or saline, as the case may be; and the *loess* only requires water to produce vast quantities of cotton, cotton-seed oil, walnut wood, wine, raisins, brandy, and fruits of all sorts, as well as pasture for sheep bearing excellent wool, and the conditions for unlimited silk culture. The orography, soil, climate, vegetation, and agricultural methods of the Zerafshan province and the Emirate of Bokhara are specially discussed; the hindrances heretofore in the way dealt with; and engineering, and legislation, and administrative plans examined for introducing irrigation on a grand scale. The disastrous results of charcoal-burning (by disforesting the country) are insisted on, and remedial measures proposed. Examples are given of plants which, unwatered, grow 93 centimètres in a year, but have grown over 3 mètres with sufficient irrigation; and care is taken to distinguish the special kinds of cotton, vines and fruit most suitable for growth here. The work is doubtless of interest, not merely to the (comparatively few) persons who may think of investing their money in the steppes or neglected oases of Turkestan, but to irrigation-culturists in India, the United States, and Australia, as well as to men of science. The map is based on Justus Perthes'.

Erdbebenkunde: Die Erscheinungen und Ursachen der Erdbeben, die Methoden ihrer Beobachtung. Von Dr. Rudolf Hoernes. Leipzig: Weit and Comp., 1893. Pp. vi + 452.

The secondary title of this book, *Die Erscheinungen und Ursachen der Erdbeben, die Methoden ihrer Beobachtung*, completely describes its character. After an introduction, which is mainly historical and bibliographical, the author begins with a general discussion of earthquake phenomena, including, for example, a description of the several kinds of wave motions which may pass through an elastic solid, their reflection and refraction at the surfaces separating different materials, the rate of propagation of disturbances through rocks, the various effects of shocks and tremors, and so on. The second chapter is devoted to an account of the numerous instruments which have been devised for recording and measuring earthquakes. Here very full extracts are given from the transactions of the now extinct Seismological Society of Japan,—the inventions of Ewing, Gray, Milne claiming a large share of attention. One of the plates at the end of the book is a reproduction of an earthquake record taken at Tokyo University by one of Ewing's instruments. It was from this record that Sekiya constructed, point by point, his instructive model of the motion of an earth particle during an earthquake. Sketches of this model are also given by Dr. Hoernes, and a very complicated model it is. Earthquake problems are taken up in Chapter III., such as the question of distribution in space and time, frequency and periodicity. This chapter does not seem to be so full or satisfactory as it might be. But in the succeeding chapters we have Dr. Hoernes, who is primarily a geologist, at his best. To each of the categories into which the author classifies earthquakes, a separate chapter is given. Thus, there are earthquakes of distinctly volcanic origin, earthquakes which result from internal landslips, earthquakes accompanying the formation of faults, and so on. The book ends with a scientific discussion of the probable cause of the Deluge, which, according to Suess, is to be referred to an earthquake in the vicinity of the Persian Gulf in conjunction with a cyclone from the south. These in combination would suffice to cause a considerable flooding of the low-lying districts of Mesopotamia. A thoroughly sound exposition of nearly all that is known concerning earthquakes and their origins, Dr. Hoerne's *Erdbebenkunde* is further to be commended for its full and systematic references to the rapidly growing literature of the subject.

Ancient Ships. By CECIL TORR, M.A. Cambridge: University Press, 1894. *Price* 10*s.* 6*d.*

This book is meant to form a portion of a larger work on which Mr. Torr has been for some time engaged, namely, *A History of Ancient Shipping*, by which he means shipping in the Mediterranean between 1000 B.C. and 1000 A.D. The instalment before us is devoted almost exclusively to an examination of the structure and character of the ships of which we read in the Classics. The subject, it is well known, is one which presents to the investigator many obscure points—many problems of which no satisfactory solution has as yet been found. This is mainly due to the insufficiency of the evidence on which conclusions can be safely based as to the structure of biremes, triremes, and other ancient warships with a still greater number of banks of oars, even to the incredible number of forty. The works of the classical writers throw much less light on this subject than might have been reasonably expected. Their statements are, with very few exceptions, nothing more than passing allusions, and Athenæus, who alone enters into details, is open to suspicion in the account which he gives, from two other writers, of some great ships that were built about 400 years before his time. The Scholiasts, again, and lexicographers our author holds of no account, having found such of their statements as relate to matters admitting of proof oftener wrong than right. The best of the written evidence is that which comes from some inscriptions containing inventories of the Athenian dockyards, which were found underground at the Piræus in 1834, engraved on marble slabs which lined a drain. In addition to these written sources of information, there are some material sources—the ruins of the docks at Athens, which give some idea of the size of warships; some rams, figure-heads, and anchors; a few models, too rough to be instructive; pictures of ships on painted vases and figures of them on reliefs; and various other works of art. Mr. Torr acknowledges his obligations to modern writers for much information on his subject which he says he was not likely to have discovered for himself. At the same time, he points out that caution is necessary in accepting their evidence. They are too much the exponents of traditional views which they adopt and transmit without adequate inquiry. Against himself no charge can be laid on this score. He accepts nothing at second-hand, but subjects all the ancient authorities to a most thoroughgoing scrutiny. His pages, indeed, overflow from beginning to end with citations, Greek and Latin, by which he either substantiates his own conclusions or controverts those which he takes to be erroneous. The work, though very learned and scientific, is fitted to interest not a few different classes of readers; and it will be of especial—we may say of invaluable—service to students of the Classics, not excluding even the greatest proficients. The illustrations, which are numerous and well executed, are of great service to the understanding of the text.

The Natural History of Plants: Their Forms, Growth, Reproduction, and Distribution. From the German of ANTON KERNER VON MARILAUN, Professor of Botany in the University of Vienna. By F. W. OLIVER, M.A., D.Sc., Quain Professor of Botany in University College, London, with the assistance of MARIAN BUSK, B.Sc. and MARY EWART, B.Sc. With about 1000 original woodcut illustrations and 16 plates in colour. Parts I.-IV. Pp. 448.

This well-known work is appearing in fitting English dress, and it deserves a hearty welcome. It is in some ways the best book on botany ever written, in this especially that the plant never dies in the author's hands, but remains a living, growing, striving creature with complex relations in the web of life. Here, indeed, we have biology, and not, as is too often the case, necrology. But it is too late in the day to praise Kerner's *Pflanzenleben.* It is said that the author devoted a quarter of a century to the preparation of this work, and from personal experience of its ability and suggestive value we humbly put on record our impression that it is worth it. It would be easy to pick holes in it, as in every human achievement, for Professor Kerner has made mistakes (and the editor has not corrected them) and there are recent advances in accuracy of which he has taken no account (and the editor has not added them, as yet at least), but the spirit of the book, its livingness, its recognition of plants as organisms with multiple relations in the struggle for existence—these are the pre-eminent qualities which raise it above its fellows. At the same time, we think that the distinguished editor might do more to warrant the inclusion of his name on the outside of these parts where we read "Kerner and Oliver." We wish to see more of Oliver. The translators and publishers have done their work well, and our admiration of the book is so great that we might call their work a privilege. Professor Kerner's aim was to provide "a book not only for specialists and scholars, but also for the many," and his success is such that we have confidence as well as pleasure in recommending this edition of his work to all who love plants and flowers.

Eine Botanische Tropenreise: Indo-Malayische Vegetationsbilder und Reiseskizzen. Von PROFESSOR DR. G. HABERLANDT. Mit 51 Abbildungen. Leipzig: Engelmann, 1893. Pp. viii. + 300.

This is a refreshing book, and of no little general interest. For here we have an expert botanist, whom we had hitherto associated with ingenious interpretations of tissues, giving us pictures of tropical vegetation, interpreting instead of cataloguing, telling us of perched plants and parasites, mangrove-swamps, and primitive forest, insectivorous plants, and those which keep a body-guard of pismires, and all from the standpoint of an evolutionary physiologist. We had known Professor Haberlandt as a thoughtful botanist, we now know him as a naturalist. And as he speaks of temperatures and climates as well as of leaves and fruits, of the animal life of Java, and the coffee disease in Ceylon, we hail him as one of the true traveller-naturalists who know that, if organisms are to be understood, they must be studied in their inter-relations. It should be added that the nucleus of the book is the Botanic Garden at Buitenzorg, a treasure-house whence Dr. Treub has made not a few botanists rich.

England and India: being Impressions of Persons and Things, English and Indian, and brief Notes of Visits to France, Switzerland, Italy, and Ceylon. By LALA BAIJNATH, B.A., of the N.W.P. Judicial Service. Bombay: Jehangir B. Karani and Co., 1893. Pp. 234.

The author visited England during the Jubilee festivities, and no doubt his description of London and English life will be read with great interest by his fellow-countrymen. On the whole, his criticism of the English character and customs is very favourable. He also appreciates English scenery and parks and English society. Some statements are rather astonishing, such as that three-quarters of the meat sold in London is unsound, and that the Speaker has to keep his seat when every one else is gone, unless some member takes compassion on him and proposes a motion of adjournment. In Indian affairs he naturally takes the side of Lord Ripon, but he speaks on questions relating to Indian administration with great moderation. The language is much superior to what we are accustomed to find among Indian writers. There are mistakes occasionally: as, for instance, in the use of "will" and "shall"—a stumbling-block to many in these islands as well as foreigners.

Lehrbuch der Kosmischen Physik. Von Dr. JOH. MÜLLER. Fünfte umgearbeitete und vermehrte Auflage von Dr. C. F. W. PETERS, Ordentlichem Professor und Direktor der Sternwarte zu Königsberg i. P. Braunschweig: Friederich Vieweg und Sohn, 1894.

The late Professor Müller of Freiburg wrote the first edition of this well-known book in 1856. Dr. Peters has revised and enlarged the fifth edition, which is now published. The text is divided into four sections:—(1) Astronomy, (2) Optical Phenomena of Sky and Air, (3) Meteorology, and (4) Atmospheric Electricity and Magnetism. It is very fully illustrated; the tinting of the glaciers a pale blue in some of the figures greatly adds to their effectiveness. Accompanying the text is a small quarto atlas of 60 plates, some of which evidently were published in the earlier editions of the book, while a few of them are new—for instance, the reproduction of two photographs of the moon taken at Mount Hamilton in 1890. The meteorological maps seemed based on those in Berghaus, and the rainfall map on the earlier, and not the later one, published by Loomis.

Sussex. By AUGUSTUS J. C. HARE. Author of *Walks in London*, *Walks in Rome*, etc. London: George Allen, 1894. Pp. xxi + 240.

The practised hand of the experienced guide and local antiquary is manifest in every page of this admirable guide to Sussex. No doubt the history of the shire lends itself in a peculiar manner to the art of the chronicler; but it must be admitted that the abundant material has been well used. The account of the battle of Senlac (Hastings) is well done, and is very interesting from the amount of local colour thrown in. The illustrations, also, are very delicate and dainty, and there is an excellent folding-in map of the county.

The Year-Book of the Imperial Institute of the United Kingdom, the Colonies and India. Compiled chiefly from official sources. Third Issue. London, 1894. Pp. xviii + 888.

The first issue of this publication appeared in 1892, when it was noticed in the *Magazine*, vol. viii., p. 559. The present volume, compiled by Mr. Hebb, is on the same plan, but contains about sixty more pages. Much of the information relating to the early history, etc., of the colonies, is simply reprinted from the earlier editions, to which we think the inquirer might have been referred. The heading "Miscellaneous," as remarked in our former review, is unsatisfactory, and it is difficult to understand why it should be restricted to the particular islands treated of in that chapter. Who, again, would look for the Somaliland Protectorate under "Asia"?

The information concerning exports, imports, railways, mining, and other industries, prices, etc., seems to have been carefully brought up to date, and some chapters, as those relating to British Zambesia and New Guinea, are practically new. Maps are given of the Australian Colonies and Canada, and a chart of the British Empire. Money and discount rates, and the prices of silver, are shown in diagrams drawn up by Messrs. Page & Gwyther, and a historical chart, based on a compilation by Mr A. C. Price, M.A., shows the growth of the British Empire. An appendix contains full particulars about the Imperial Institute, the lectures which have been delivered in the Institute during the past season, and lists of officials, chambers of commerce, etc.

Gazetteer of the Amritsar District, 1892-93. Revised Edition. Compiled and published under the authority of the Punjab Government. Pp. viii + 172 + xlvi.

The Amritsar District in the Punjab contains no old city of historical importance, nor any famous architectural remains; for its only city, Amritsar, is comparatively modern, and has grown in note and size only since it became the sacred centre of the Sikh religious community; nor has it ever had a prominent place in the general history of India. But, none the less, this statistical memoir will be found to be replete with interest for every student of Indian social questions who desires to have accurate information on the condition of the people.

The first edition of the *Gazetteer*, which appeared in 1883, was hastily prepared and was largely based on old materials, much of which had ceased to be in accord with existing facts. In this new edition the work has not only been broughtup to date, but has been so thoroughly revised, and in part re-written, as to be in a great measure a new work. The revision has been performed with great care and good judgment. In nothing is this more conspicuous than in the due apportioning of the space given to each of the many subjects treated, and in the selection of matter for admission. The result is a work from which no attentive reader can fail to carry away a very distinct impression of this typical, purely agricultural district, with its dense and laborious population, and of the conditions of life generally. For most readers the work would have been rendered still more useful if there had been given with it a good map of the district on a large scale (it is rather surprising that the volume contains no map), and if there had been appended a glossary of all vernacular and local technical words. The scientific equivalents are given for a few of the principal vegetable productions ; but there are many other terms, more or less peculiar to the district, which, even to one acquainted with the neighbouring provinces, are strange and obscure.

The Handbook of Jamaica for 1894. *Published by Authority. Comprising Historical, Statistical, and General Information concerning the Island.* By S. P. Musson and T. Laurence Roxburgh. London : Edward Stanford ; Jamaica : Government Printing Office, Kingston, 1894. Pp. vii + 555 + ix.

We are indebted to Mr. Nash for a copy of this clear, well-equipped, and excellent handbook, which is now in its fourteenth year of publication, and contains all the varied information that one is accustomed to look for in its well-printed pages. The statistics are useful and excellently arranged, while there are most interesting chapters on the general and chronological history of the colony. The notice of the meteorology of the island, by Mr. Maxwell Hall, is an excellent feature. From his tables we learn that for the ten years 1880-90 the mean barometric pressure was 29·999 ; the mean temperature, 78·1° ; the maximum temperature, 87·8° ; the minimum temperature, 70·7° ; the mean range, 17·1° : dew point, 70·3, and humidity, 78 ; cloud, per cent., 75 ; total rainfall at Kingston, 32·64 inches, and for the whole island 66·30 inches ; average mortality from infantile diseases 19, lung diseases 15, fever 9, dysentery and diarrhœa 9, and various diseases 56 per 1000. These mortality statistics show considerable range, yet, on the whole, go to prove an advance in health, no doubt due to improved sanitation and the more general adoption of precautions. Another useful table exhibits the decrease of temperature with elevation. As the authors invite suggestions for improvement, we may say that were the description of the island put into gazetteer form it would be more convenient for consultation, and a good map would be an addition of considerable value. The index is full and reliable.

NEW MAPS.

EUROPE.

LONDON, The Up-to-Date Pocket Atlas and Guide to ——. *Price* 1s.
London: G. W. Bacon and Co., Ltd., 1894.

LONDON, Extended Tape Indicator Map of ——, and Visitors' Guide.
London: C. Smith and Son. N.D.

In the first-named Atlas, London is divided into sixteen sectional maps, which make reference to any locality easy. Distances are given in half-mile circles from Charing Cross, and each map is ruled in half-mile squares. The maps, however, would be greatly improved by the colours being modified, and the buildings indicated by a different tint from the print. The present scheme gives a confused impression, which should be avoided, especially in what is meant to be a handy reference book for visitors to the metropolis.

The second publication consists of a map of London ruled in quarter-inch squares, having a numbered tape, which aids in the discovery of the 7500 streets mentioned in the full index. "Terminus" is printed on each of the great stations, but its special name is omitted on the map.

BRIGHTON, Plan of ——. By J. Bartholomew, F.R.G.S.
London: W. H. Smith and Son.

THE EXETER ROAD MAP.

THE LAND'S END TO JOHN O' GROAT'S MAP. Sections 1 and 2. Compiled by H. R. G. Inglis. Scale: half-an-inch to a mile.
London and Edinburgh: Gall and Inglis.

These maps are uniform with the Bath Road, Holyhead Road, and Great North Road Maps, already noticed. Certain arrows and other signs seem to require explanation. The last section of the latter map, Edinburgh and Glasgow to John o' Groat's, has yet to appear.

AFRICA.

POSSESSÕES PORTUGUEZAS, Carta das ——, da Africa Meridional, segundo as convenções celebradas em 1891. Escala, 1: 6,000,000.

MOÇAMBIQUE, Provincia de ——. Carta dos Districtos de Lourenço Marques e de Inhambane. Escala, 1: 1,000,000. 1893.

PRINCIPE, Carta da Ilha do ——. 2ª Edição. Escala, 1: 100,000. 1893.
Presented by the Commissão de Cartographia, Lisbon.

ATLASES.

THE ROYAL ATLAS OF MODERN GEOGRAPHY. By the late Alexander Keith Johnston, Geographer to the Queen, LL.D., F.R.G.S., F.R.S.E., etc. With additions and corrections to the present date by T. B. Johnston, Geographer to the Queen, F.R.G.S., F.R.S.E., etc. A new edition.
Edinburgh and London: W. and A. K. Johnston. N.D.

It is now ten years since the last edition of this well-known atlas was published, and therefore a new edition was urgently needed. The present volume contains fifty-six maps, some of which, such as the United States, Central Canada, North-West Africa and Australia, are entirely new, while others have been thoroughly revised. A large number of inset maps—plans of towns, etc.—have been added, and the maps of the basins of the North Atlantic, Mediterranean and Baltic have been coloured to show depths.

The new maps have been compiled with great care; and those of the United States and Australia in particular are excellent productions, exhibiting the results of the latest surveys and explorations; and in many of the other maps it is evident that the most reliable authorities have been consulted. A work of such magnitude can hardly be expected to be entirely free from faults. There are, indeed, one or two errors and omissions to which attention should be drawn. We are surprised to see that the currents in the North Atlantic have been drawn as in the old edition, no use having been made of the Prince of Monaco's chart. In Sicily the railway along the south-east coast was completed from Nolo to Terranova at least as early as 1891. In South America we notice that the territory in dispute between Colombia and Venezuela is still marked as claimed by the latter, though the arbitrator gave his decision in 1891. In the same year also, the new boundary of Missiones was fixed.

On the whole, however, this is an excellent atlas, and is well executed. The maps are well printed on good paper, and the colouring is pleasing to the eye. The names, too, are numerous, without being overcrowded.

PHILIP'S SYSTEMATIC ATLAS: PHYSICAL AND POLITICAL. Specially designed for the use of Higher Schools and Private Students. By E. G. Ravenstein, F.R.G.S. *London: George Philip and Son*, 1894.

The object of this atlas is "to meet the requirements of pupils in Higher Schools, of teachers, and of other students of geography, for whom neither the ordinary school atlas nor the general reference atlas is entirely adequate," and, in order to attain this object, every department of geography has its place in the carefully considered system upon which the atlas has been constructed. The plan of the work is ambitious, three eminent geographers subscribe the preface, and no fault can be found in the scheme of the work. When, however, we come to examine the maps themselves, we are bound to confess that the limits of space have very much interfered with the usefulness of the scheme of the authors. It is true that no department of geography is absent from the maps: mathematical geography, astronomy, botany, climatology, geology, zoology, anthropology, languages, religions, temperature, currents, railways, ocean routes, and many other subjects are here, in addition to the usual political and physical maps; but they are on a scale that, we fear, will make the atlas of less use than its projectors had hoped for, and will even tend to confuse the student.

The volume contains 52 quarto plates, in which are packed 250 maps. No atlas could be distinct on this scale. The Introduction is well arranged, and is an outline guide to the study of geography in its largest sense. The articles on Projection and Scale are well timed and well written. No book we know of gives so distinct and thorough a grasp of the intricate principles of depicting a spherical surface on a flat sheet. The scheme of the maps' scales is a distinct benefit. When not identical, the scales are proportional—multiples of each other—so that the student can compare the information collected on the different sections, even when the scales are not the same. The workmanship of the atlas is fairly good, though there are a few slips in the spelling—Beteigeuze in the map of the Heavens; Oussent for Ouessant, etc. The political maps are distinctly printed, and are not overcrowded with names; and if the projectors had been content to follow this principle throughout and not to overcrowd a school atlas with more information than it can conveniently hold, the result would, we think, have better repaid the research, the thought, and the labour that have been bestowed on this work.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

CORSICA.

Notes on a Recent Visit.

By Ralph Richardson, F.R.S.E.; Hon. Sec. R.S.G.S.

(*With a Map.*)

There are two methods of describing Corsica and the Corsicans. The usual mode has been to follow the lines so exquisitely traced by Prosper Merimée in his classic novel *Colomba,* and to present to the reader a *melange* of history and romance in which brigandage, the vendetta, love, jealousy, and crime form a piquant flavouring to the drier details of the book. A much rarer method has been followed by the learned Corsican Abbé F. Girolami-Cortona, who in his *Géographie générale de la Corse,* published at Ajaccio in 1893, describes his native island, her physical and political geography, her natural and political history, her agriculture and commerce, her meteorology and antiquities—in a word, everything connected with Corsica—in a systematic, practical, and exhaustive manner worthy of a German philosopher.

Bibliography.—In the wonderfully complete "Corsican Library" of M. Louis Campi, 54 Cours Napoleon, Ajaccio, I had last April an opportunity of seeing the 1500 books and pamphlets which have been already written on Corsica. Unfortunately, owing to his official duties, M. Campi has been as yet unable to find time to prepare a catalogue; but I noticed several early accounts of Corsica by British travellers, such as that of James Boswell's visit to the island in 1765, the Rev. Dr. A. Burnaby's visit in 1766, and Boswell's collection of *British Essays in favour of the brave Corsicans,* published at London in 1769.

It is generally conceded that the two greatest books yet written on

Corsica are Prosper Merimée's *Colomba*, which gives with inimitable truth, grace, and humour the salient details of Corsican life in 1840, and the ponderous, diffuse, yet exceedingly comprehensive and attractive work on Corsica by the German, Ferdinand Gregorovius, the result of his tour through the island in the summer of 1852. These no doubt are old works, and describe old Corsica; but a country's manners and customs change as slowly as its geological features, and, if we except their tales of the lawlessness which once undoubtedly permeated Corsica, both works contain information which should be consulted by the student of to-day.

Fortunately for the intending tourist, Corsica attracted the attention of two landscape-painters, one English, the other French, who each published a charmingly illustrated work upon the island. In 1870 Edward Lear published in London his *Journal of a Landscape-Painter in Corsica*, the illustrations in which seemed to me to represent such extraordinarily grand scenery that I would not believe that they were correct until I had seen that scenery with my own eyes, and found that the artist had not exaggerated its magnificence. Mr. Lear finds his French counterpart in M. Gaston Vuillier, who adds to an exquisite pencil a literary style of exceptional beauty. His description and illustrations of Corsica appeared at Paris in 1891, in the first *semestre* of *Le Tour du Monde*, one of the most attractive geographical journals in the world.

With regard to large and expensively printed works on Corsica, I ought to mention Prince Roland Bonaparte's *Excursion en Corse*, a quarto volume printed for the author at Paris in 1891, and containing four fine heliogravures.

For breezy, vigorous, fascinating writing on Corsica, nothing is better than the papers of the Rev. W. H. Hawker, Douglas W. Freshfield, and F. F. Tuckett in the *Alpine Journal*, published at London in 1870, 1882, and 1884. Members of the Alpine Club, these writers describe their ascents of the mountain peaks of Corsica in language as fresh and bracing as the snow-clad summits which they scaled.

I append a list of the works I consulted before and after going to Corsica, but I need hardly say that they represent only a tithe of the literature regarding the island which time has accumulated. As Gregorovius truly observes: "Even here the usual experience is verified, that any subject, however insulated it be, draws a continent of literature after it." The 1500 books and pamphlets in M. Campi's "Corsican Library" prove the justness of Gregorovius' remark.

In describing a country, it is customary to deal first with its physical features and geology, to pass on next to its natural history and flora, to touch on its meteorology, to glance at its archæology, history, and the customs of its inhabitants, to detail its political divisions and commerce, and to add any general observations which a visit may occasion. After this method let us approach Corsica and the Corsicans.

Physical Features.—The island of Corsica (lat. 42° N., long. 9° E.) is the fourth largest island in the Mediterranean, being only exceeded by Sicily, Sardinia, and Cyprus. It is 116 miles long, 52 miles broad, and contains an area of 3376 square miles, or about that of the counties of Argyll and Bute. Less than 60 miles separate it from Italy, less than 100 from France. Its highest mountains are Monte Cinto (8892 feet), Rotondo (8613 feet), Pagliorba (8278 feet), Padro (7846 feet), and d'Oro (7841 feet). The limit of perpetual snow is 7500 or 8000 feet high. Whilst the greater part of the island is mountainous and healthy, the eastern seaboard is often low-lying and unhealthy. Here the river Golo, the longest in Corsica (46 miles in length), and other rivers form marshes and alluvial tracts from which the population has to remove in summer to escape malaria.

The GEOLOGY of Corsica will not be authoritatively known until the sheet of the Geological Survey of France relating to Corsica is published. As yet it is only in preparation. Failing this, we may fall back upon the map accompanying the admirable paper of M. Hollande, Professeur de Physique au Lycée de Chambéry, which was published at Paris in 1877, in the ninth volume of the *Annales des Sciences Géologiques.* This geological survey of Corsica occupied M. Hollande four years, and he remarks that, even after that time, he found the stratigraphical order very difficult to establish, the stratification of Corsica being so complicated and the fossils so rare. From M. Hollande's map we perceive that the western and greater part of Corsica consists of granitic rocks, with a large area of quartziferous porphyries forming Monte Cinto and its vicinity; and, whilst the north-eastern and smaller portion of Corsica chiefly consists of primary rocks (Carboniferous), with serpentine and euphotide, secondary, tertiary, and recent rocks fringe the eastern sea-coast of the island. Concessions for working mines of copper, antimony, iron, lead, silver lead, and anthracite have been granted in the northern half of Corsica; but only four out of these fourteen concessions have been taken advantage of, the remaining ten mining areas remaining still untouched.

I have indicated on the accompanying map the localities of these mining areas, which are as follows:—

Mines.	Area in Eng. acres.	Locality.	Date of Mining Concession.
Anthracite, ...	980	Osani, ...	1889
Copper and other metals,	640	Cardo, a hamlet of Bastia, ...	1868
Do.,	4160	Ponte Leccia railway-junction.* . .	1861
Do.,	1142	Frangone, in Olmeta de Tenda, . .	1873
Do.,	3800	Santo Agostino, in Castifao and Moltifao,	1857-63
Do.,	1680	Linguizetta, ...	1855
Iron, ...	2687	Farinole and Olmeta, in Cap Corse, .	1849
Lead, ...	335	Prato, in Barbaggio, ...	1849
Do., ...	1880	Monticello, ...	1865
Do., ...	2655	Tartagine, in Castifao, ...	1852
Silver Lead, . . .	6300	Argentella, in Calenzana and Galeria,*	1856-74†
Sulphurous Antimony, .	1630	Luri-Castello,*	1863
Do., .	555	Ersa (36 % of metallic mercury), . .	1861
Do., .	742	Meria,*	1858

* Mines opened. The other mining areas unopened.

† Concession to an English company.

It may be asked whether I observed anything relating to Glacial geology in Corsica. Whilst crossing the Col de Sevi (3300 feet high) between Vico and Evisa, it seemed to me that the granite rocks there had often a rounded and polished appearance suggesting glaciation; whilst near the Col de Vizzavona (3809 feet high) a mound (on which the fort is situated) stretches for more than an English mile, covered with perched blocks of various kinds of rock, some of enormous size, the mound itself being composed apparently of moraine-like detritus. This mound (by aneroid) was 150 feet in height in front of the Hôtel du Monte d'Oro, and gradually descended from a height of about 4000 feet above the sea-level to about 3700 feet. I may add that the Abbé Girolami-Cortona is inclined to attribute the rocks in Corsica styled *in cavaletto* (literally, "riding on each other"), not to human agency, but to the action of glaciers, and he accordingly considers them erratic blocks, often carried from afar by ice.

Whether or not real *roches moutonnées* met my view, there is no doubt that the weathering of granite forms one of the most curious geological phenomena of Corsica. At the celebrated Calanches rocks near Piana, the red granite is weathered into such fantastic shapes that one seems to approach a sculptor's yard full of rough-hewn birds, beasts, and idols. Near Parata point, in the vicinity of Ajaccio, white granite is also weathered in a singular manner. The granite mountains near Vico seem crowned with ruined castles. The granite precipices near Porto are, for abruptness, unequalled in the world. Now, all this adds immensely to the picturesqueness and grandeur of Corsican scenery, for the mountains rise in jagged outline, their peaks and pinnacles fret the sky, whilst their precipices are awful in their suddenness and depth. Add to this extraordinary rocky grandeur forests of superb Corsican pines and a dense and fragrant jungle of *maquis*, whilst snowy peaks glitter in a sky of cloudless blue reflected in the lovely bays forming the Corsican coast, and one understands the reason why every writer who has visited Corsica bursts into ecstasy as he describes its scenery.

NATURAL HISTORY.—With regard to the natural history of Corsica, that which will chiefly interest the tourist relates to Sport. In his excellent *Guide*, M. Paul Joanne devotes more than twenty pages to Sport in Corsica; whilst an anonymous English author wrote in 1866 *Paul Pendril, or Sport and Adventure in Corsica*, and Emile Bergerat's *La Chasse au Mouflon* has appeared in various forms. The mouflon is the wild sheep of the mountains of Corsica, Sardinia, and Greece. It is extremely difficult to find, but two had been killed not long before our visit to Vizzavona, amid the recesses of Monte d'Oro. The mouflon has long, curving horns, and is covered with short wool, with an outer clothing of long and nearly straight hair. The wild boar is another attraction for the sportsman to Corsica, and is found chiefly in the southern part of the island. Partridges and woodcock are common, and hares also are found; but, strangely enough, the wild rabbit is not a native of Corsica, occurring, according to the Abbé Girolami-Cortona, only in the islets of Giraglia and Spano off the north coast of the island.

Looking to the abundant cover for game all over Corsica, to the mountainous, undisturbed, and unproductive character of the greater part of the island, to the poverty of the people, and to the immense attraction sport has for thousands who would be willing to spend large sums in order to obtain it, it often occurred to me when in Corsica that, if the greater portion of it were turned into a game-preserve, much good would accrue to the islanders. Coming as I did from a mountainous country like Scotland, where the largest and most certain rents are now obtained from what are known as "sporting tenants," it seemed to me that if the Conseil Général de la Corse were to turn its attention to this subject instead of wrangling with the unfortunate French Préfet over financial problems which, in so poor a country, perhaps neither he nor they could ever satisfactorily solve, the Conseil would confer a boon upon Corsica, and money would at last flow into its impoverished exchequer.

At present very little is done to preserve game in Corsica, and for 28 francs a licence may be obtained to shoot over all the island with the exception of two "*chasses reservées.*" Guns are frequently carried by peasants, who shoot without any licence at all. The consequence is that hardly any game is visible. To make Corsica a game-preserve would, of course, involve its being stocked and the game being protected. The large hawks one sees hovering in every direction would have to be kept down. Deer (which I believe are common in Sardinia) would flourish if protected.

Whilst the Mediterranean supplies Corsica with a great variety of fish, eels people her marshes and trout her streams. A dish of small trout is one of the few good things placed before the tourist in country inns. We never saw any anglers, however. Mr. C. B. Black, in his admirable *Guide*, describes "a small inn called Le Repos des Voyageurs (near the Col St. Sebastien), where bread and wine and capital sea-urchins can be had. They are eaten raw, and taken out of the shell by cutting it in two horizontally." I did not alight at this attractive hostelry; but in a high-class hotel which I stayed at, the *menu* of the table-d'hôte contained star-fish one day and sea-slugs another.

I must devote a few words to the goats and horses of Corsica. There, owing to the absence of meadows, the goat takes the place of the cow. Wherever we went we only got goats' milk, butter, and cheese. This absence of meadows distinguishes Corsica from Switzerland, and lends, as a rule, to the scenery of Corsica a much sterner and grander aspect. As for the Corsican horses, they are small, wiry, willing, and fleet. Wretchedly thin, they accomplish with ease long journeys over mountain roads. I was glad to see that their drivers were usually merciful men, attached to their horses—and, I may add, to their dogs, which almost invariably accompanied them. This trait, affection for the lower animals, distinguishes the Corsicans from the Italians and Spaniards.

Flora.—Next, with regard to the flora of Corsica, Gregorovius, Dr. J. H. Bennet in his well-known work on the Mediterranean, and Mr. Douglas Freshfield in the *Alpine Journal*, have all divided the island into distinct "forest zones," each zone depending upon a particular temperature. Above the plains on the coast, covered with cereals and Indian corn, we find the mulberry and the vine; above them the olive-tree; and, higher still, the chestnut-tree; above that the maritime pine; above that the Corsican pine; higher still the beech; and, highest of all, the birch; after which come the confines of eternal snow. According to Freshfield, there are three forest zones: the *first*, that of Mediterranean forests, composed of evergreen oaks and cork-trees; the *second* composed of beeches and chestnuts; and the *third* of pines and firs. Taking the Forest dell' Ospedale as an example, we find cork-oaks occupying the low ground, and ascend to evergreen oaks, and higher still to pines.

The most characteristic forest tree of Corsica is the Corsican pine (*Pinus laricio*), which grows to an immense height, and is distinguished by its long, mast-like trunk, which has been known to attain 160 feet in height. In the forest of Aïtone I took the height of some Corsican pines with the hypsometer, and found it to range from 92 to 110 feet. I also measured their girths four feet from the ground, and found them to range from six to eight feet. In connection with the forests of Corsica, I may mention seeing the curious white, woolly pouches of the "army-worm" hanging from the pine-trees' branches. This army-worm is a name given to the grubs of a small black fly (*Sciara militaris*), which form caterpillars that move forward in single file, and are hence called "processional caterpillars."

Among Corsica's chief glories are her forests, which covered in 1890 an area of 305,960 English acres, and yielded half a million feet of timber. They are controlled by a special Government department, numbering 167 officials of various grades. It is calculated that one-half of Corsica is afforested, if woods of chestnuts and olives are included. But the forests proper of Corsica consist of Corsican and maritime pines, beeches, firs, and evergreen- and cork-oaks. The principal forests are those of Aïtone (3400 English acres), Valdo Niello (2500 acres), Vizzavona (60,000 trees), and Bocognano (13,000 beech-trees). Near Porto Vecchio, on the south-east coast, occurs a fine wood of cork-oak trees, the bark of which is exported to England for tanning and dyeing purposes. On the accompanying map I have indicated the localities of the various forests of Corsica.

With regard to the Spanish chestnut, I measured it repeatedly in the chestnut-woods around Bastelica. There I found the height of the chestnut-trees to range from 50 to 60 feet, and their girths, four feet from the ground, to vary from 20 to 30 feet. The Spanish chestnut provides the inhabitants of Corsica with wood for building, with bark for tanning, with nuts for food. Chestnuts form the food of the Corsican poor, and are made into flour and bread.

Whilst the "Castagniccia" in the north-east of Corsica is the chosen country of the chestnut, the "Balagna" in the north-west is the special region of the *Olive*. This Balagna is called the Garden of Corsica; and although the granitic soil elsewhere throughout Corsica is not considered very fertile, it is peculiarly suited to the olive here. The tree seems to flourish on a hill-side with its roots grasping a heap of rocks. Indeed, it was rare to see an olive which did not spring forth from one or more boulders.

Nor must we forget the importance of the *Vine* to Corsica. Whatever else the tourist may lack in the country inns of Corsica (and he will lack many things there), he is always sure of a bottle of good red wine. The "*meilleurs crus*" of Corsica are those of Sari, Cargese, Piana, and Tallano; but every innkeeper seems to have his own vineyard and to make his own wine. The Vin de Cauro is also a red wine of good body and pleasant flavour, whilst the cognac made there is quite white and also good. The red wines of Corsica reminded me of those of Spain, and like them are put on the table as *vin ordinaire*, for which no extra charge is made. Corsican wines are not so thin or sour as many French clarets; and so much did the great Napoleon's mother prefer the former to the latter, that a supply of Corsican wine was regularly sent to the Tuileries for her use.

Corsican *Oranges* also are excellent. Our Scottish countryman, the late Lieut.-Colonel Hagart, C.B., grew the best oranges at his lovely residence, "La Barbicaja," near Ajaccio, where I visited him. He came there twelve years ago, and built the house and laid out the grounds. His oranges were in great demand, and were sold for one franc the dozen. I was told by another orange-grower near Ajaccio that the granitic soil there is not very favourable for their culture, and certainly they do not attain the perfection of the oranges I obtained in Spain.

I come now, in the last place, to the leading feature of the vegetation in Corsica, the enormously developed *maquis*, or Bush, which, especially in the south, covers almost the entire country beyond the limits of towns and forests. This omnipresent bush is not peculiar to Corsica, being common along the shores of the Mediterranean; but nowhere does it attain the dimensions, nor has it acquired the celebrity, of the *maquis* of Corsica. This *maquis*, or Corsican bush, is mainly composed of five plants, viz., arbutus, cistus, lentiscus, myrtle, and heath; or, in Corsican Italian, *albatro*, *mucchio*, *stincolo*, *murta*, and *scopa*. Growing together in one dense jungle, these plants cover the wilder parts of Corsica with a lovely mantle, sometimes gay with flowers, always rich in perfume. It was to this perfume of his native island that Napoleon referred at St. Helena when he exclaimed: "A l'odeur seule, je devinerais la Corse les yeux fermés." But the *maquis* has other uses than to perfume the air of Corsica. It has furnished her bandits or outlaws with a safe hiding-place from time immemorial. To this day, if a Corsican deals another "*un mauvais coup*," he takes to the *maquis* and lives there, as in a boundless "sanctuary," hidden by the bush, which often attains dimensions far exceeding the height of any man. Again, Mr. Barry, in his recent work, *Studies in Corsica, Sylvan and Social*, has shown the valuable economical uses to which the *maquis* is put. It furnishes the poor with firewood, the inflammable twigs of the heath being universally used for kindling fires. The same heath (in French termed *bruyère*) supplies us with the wood from which are made the hence-called "briar-wood" pipes—"briar" being an English corruption of *bruyère*. Barry says that a single French merchant in Corsica has fourteen mills in which the arborescent heath's stems are rough-hewn into blocks of convenient size for pipes. From these commonplace details we see that the *maquis* is not merely an aromatic and romantic retreat for bandits, or the most picturesque mantle which Nature could have cast over Corsica, but that it is capable of economic uses from which the Corsicans derive comfort and employment.

METEOROLOGY.—I pass on next to the meteorology of Corsica, a subject authoritatively treated in a pamphlet entitled *Ajaccio, Station d'Hiver*, by M. Charles Guérin, Ancien Directeur de l'Observatoire Météorologique d'Ajaccio, published at Zurich in 1883. M. Guérin makes the somewhat remarkable statement that, after numerous observations in years which were reported rainy, only fifty days on an average per annum were recorded at Ajaccio during which the sun did not shine. He adds that most rain falls during the autumnal equinox, towards the close of September, less rain falling during the vernal equinox. As to winds, the worst are the Libeccio (south-west) and the Mistral (north-west), whilst the east wind and south-east wind (Sirocco) are extremely hot. M. Guérin declares, after a long experience, that there are really only two seasons at Ajaccio, one warm and dry, from May to September; the other genial and temperate, from October to the end of April. The temperature in winter is more constant than on the Riviera, where the icy wind from the Alps makes more victims than is generally supposed. Again, the air of Ajaccio is more salubrious for invalids than that of Algiers, where summer is scorching, and winter, owing to the vicinity of the Atlas range, more trying than some towns in the centre of France.

The fact is that we must remember, in comparing Corsica with the Riviera or Algeria, that Corsica is an island, and therefore much more exposed than they are to marine influences. Whilst these marine influences temper heat, they also prevent cold winds from having that icy character which a passage in winter over land alone is apt to entail. I am indebted to Dr. Alex. Buchan for the tables, which I annex, showing the mean temperature and average rainfall for every month in the year at Ajaccio and other places in France and Great Britain. Dr. Buchan very kindly allowed me to obtain these returns from MS. records in his possession, the returns for Mentone, however, being taken from Dr. Bennet's well-known book.

As a rule the climate of Corsica is healthy, except on the east coast and near marshes at the mouths of rivers. To overcome the malarial atmosphere at such places, eucalyptus-trees have been planted along the roads traversing them. Both Dr. Bennet and Miss Gertrude Forde agree that the best time to visit Corsica is during spring. "The climate," says the latter, "is delicious in early spring, and the flowers and trees are in their glory in April and May. The lowland towns become hot and unhealthy for visitors in June, if not before. . . . The east coast of the island is to be avoided by travellers, being rife with malarious fever."

When I visited Ajaccio last April, the shade temperature was, in early morning, always 60° and upwards, rising to 70° as the day advanced. In the country, as at Evisa (2740 feet above the sea), the shade temperature was, during April, somewhat lower, whilst in other mountainous regions, like Bastelica and Vizzavona, the mornings and evenings were distinctly cold.

ARCHÆOLOGY.—Seneca, whilst exiled in Corsica, wrote:

"Corsica Phocaïco tellus habitata colono,
Corsica quæ patrio nomine Cyrnus eras."

In this he alludes to the Phocæans, who founded Marseilles about 600 B.C., also colonising Corsica, and states that the old name of the island was Cyrnus. Gregorovius, however, considers that Corsica is the more ancient name, although Cyrnus was in use among the Greeks. The Romans, under the consul L. Cornelius Scipio, crossed over to Corsica in 260 B.C. and destroyed the town of Aleria on the east coast.. By 162 B.C. they had completely subjugated the island. In 713 A.D. the first swarms of Saracens appeared in Corsica, and from thence they harried the Mediterranean seaports, such as Nice, San Remo, and Genoa. The Tuscan marquis, Boniface, however, annihilated them in 833, and built a fortress in the extreme south of Corsica, hence called Bonifacio. Corsica has for its armorial bearings a Moor's head. Originally the Moor was represented as having his eyes bandaged, but ultimately the bandage was placed only round his forehead. These armorial bearings date from 1296, when Pope Boniface VIII. gave James II. of Aragon the crown of Corsica, whereupon this Spanish prince added to his coat-of-arms a Moor's head in token of his suzerainty over Corsica.

Neither Greeks, Romans, nor Saracens have left many vestiges of their occupation; but the succeeding masters of Corsica—first the Pisans, and subsequently the Genoese—are still much in evidence. All round the island are towers built principally by the Genoese during their long and difficult tenure of Corsica, which lasted from 1133 to 1768. These towers had, generally, subterranean means of escape, as may be seen from the "*trou*" adjoining the road passing beneath the Tower of Sagona. They were entered by a doorway which could be reached only by a long ladder; and as this had to be placed on a most exposed rock, the garrison had every means of punishing intruders. The Genoese tower of Parata, near Ajaccio, is still entered in this way. Genoese ruined castles and old Genoese roads and bridges form picturesque objects throughout Corsica.

Whilst driving through the upper Balagna, near Aregno, I came upon an interesting old chapel which I do not see noticed in the guide-books. It is the ancient Chapel of the Trinity, and is situated about 1000 feet above the sea-level. This chapel is constructed of white and black stones, and its interior consists of a nave and choir, with well-executed frescoes adorning the roof of the choir. These frescoes bear the date 1458. The chapel has a roof of red tiles. Some strange figures are carved on the outside of the chapel, such as that of a man holding his toe, etc. An outside stone is marked 777.

HISTORY.—In this slight allusion to the archæology of Corsica, I have necessarily touched upon the earlier stages of the history of the island. Except when completely conquered by the Romans or thoroughly pacified by the French, Corsica and the Corsicans seem to have known no rest. For 635 years the Genoese struggled to retain possession of an island whose inhabitants abhorred them. In this opinion the Corsicans were not singular, for did not Dante exclaim :

> "Ahi ! Genovesi, uomini diversi
> D'ogni costume, e pien d'ogni magnagna,
> Perchè non siete voi dal mondo spersi !" [1]

Our Horace Walpole expressed a similar antipathy: "I hate the Genoese," he said ; "they make a commonwealth the most devilish of all tyrannies."

The more salient events in the modern history of Corsica may be made to pass before our eyes like the five acts of a great historic drama, each act having a leading personage and a number of subsidiary actors.

I. During the tenth century A.D., Corsica was the prey of contending barons, who, in their struggles for territory, ravaged the island and despoiled the people. At last, in the first year of the eleventh century, the Lord of the Cinarca (to the north-east of Ajaccio), a baron more powerful than the rest, sought to make himself ruler of the island, under the title of Count of Corsica. He had triumphed over his brother barons, but he had not reckoned with the democracy of the island. That long-suffering body arose, with Sambucuccio d'Alando at its head, and in one decisive battle swept away the Lord of the Cinarca, and proclaimed that the land of Corsica belonged to the people of Corsica. SAMBUCUCCIO and the island assembly founded in 1007 what is known as "La Terra di Commune," and gave it a popular constitution, which has ever since been held sacred. Under this constitution the various hamlets of a valley were formed into a *pieve* or parish, presided over by a *podesta* or mayor and two or more "communal fathers," who nominated a *caporale*, a sort of tribune of the people. The various podestas or mayors of different parishes assembled and elected a supreme council consisting of twelve men.

II. The Pisans ruled the island well during their first hundred years of supremacy; but the Genoese occupation of Corsica is one long tale of oppression on the part of the rulers of the island, and of heroic resistance on that of the Corsicans. Foremost among the heroes of Corsica—the Sir William Wallace of the island—stands SAMPIERO, a native of Bastelica, where the site of his house is still shown, and where a statue has lately been erected in his honour. Having become in 1553 colonel of the Corsican Guards of Henry II., King of France, Sampiero induced that monarch to send an expedition to Corsica to rescue the island from the hands of its Genoese oppressors. Corsica was attacked by the French both by land and by sea, and ultimately Calvi alone remained in the hands of the Genoese. But in 1559 Genoa again acquired possession of the island, and Sampiero was left to continue alone the war of liberty. So furious was he against the Genoese, that, when he heard that his

[1] Which may be translated : "Ah ! Genoese, at war with every virtue, and stained with every vice, why are you not banished from the universe?" Dante visited the Genoese Riviera early in the fourteenth century.

wife, Vanina d'Ornano, had made terms with them, he strangled her. For five years he continued the struggle against Genoa, and at last, in 1567, he fell, assassinated by his servant (bribed by the Genoese) Vittolo, whose name is accursed in Corsica, like that of Menteith, the betrayer of Wallace, in Scotland.

III. I link the third period with a name held in high veneration in Corsica—that of PASQUALE PAOLI. The son of a hero, Paoli showed himself a hero also. Landing at Aleria in 1755, he was, although only twenty-nine years of age, unanimously appointed general by the Corsican Assembly, and took the supreme direction of the island. He found the island in great disorder, without laws, without agriculture, whilst the Corsicans, torn by family feuds, decimated their number with the insane vendetta. Paoli stringently forbade the latter, and gave to Corsica a constitution founded upon that of Sambucuccio. Every citizen of twenty-five was to have a vote, and every thousand of the population sent one representative to the *consulta*, or national council. A system of justice was also established, and a university was founded at Corte, all the professors of which were Corsicans. Whilst Corsica thus breathed a new life, that of independence, the life of its ancient tyrant, Genoa, was ebbing fast. In 1764 the Genoese made a treaty at Compiègne with Louis XV., King of France, whereby it was agreed that the French should garrison the coast towns. On 15th May 1768, Genoa ceded to France the island it had so long misgoverned. But Paoli and his Corsican republic refused to ratify either of these treaties. Hating the Genoese, they had no wish to become French subjects. So they fought with all their might against the French troops, and at Borgo won a decisive victory on 1st October 1768. Next year, however, on 8th May, the island militia under Paoli was completely defeated by an overwhelming French force at Ponte Nuovo, and on 12th July 1769 Corsica became a French province.

Paoli fled to England when his Corsican republic was overthrown. In 1789 the French monarchy fell, and Corsica was made a French department. Next year Paoli was invited by the French National Assembly to reassume the command of Corsica, and on passing through Paris was fêted as a hero deserved to be. He returned to Corsica, but the atrocities following the execution of Louis XVI. in January 1793, and the uncalled-for interference by the French Convention in the government of Corsica, so alienated the patriot and his fellow-countrymen, that they resolved to place the island under British rule—a striking testimony to the high opinion which (like Voltaire) Paoli had formed of the free institutions of Britain during his twenty years of residence there. Assisted by the British fleet, the Corsicans shut up the French in the three towns of Bastia, St. Florent, and Calvi, from whence they were ultimately expelled; and on 21st June 1794 the National Assembly met at Corte, and formally tendered the crown of Corsica to George III., represented by a Scottish baronet, Sir Gilbert Elliot of Minto, His Majesty's Plenipotentiary, who accepted it in the King's name. I may add that the brochure, *La Révolution Française en Corse*, by M. Maurice Jollivet, published in 1892, is very unjust to Paoli in condemning his advocacy of the transference of Corsica from the Red Terror of France to the mild rule of Britain, for Paoli had at heart the happiness of his fellow-countrymen.

IV. Sir Gilbert Elliot was forty-three years of age when Corsica thus became a British possession by the will of her National Assembly. Gifted with every attribute likely to win the respect and affection of those with whom he came in contact,[1] Elliot was placed in a false position when the British Government nominated him Viceroy of Corsica. The Government should have imitated the French Republic, and given Paoli the chief command in Corsica, the more so as he expected it, and was chagrined when he did not get it. Thus the undoubtedly great talents of Elliot were neutralised from the very beginning; and, as is shown by the letters which he wrote home to his Government, and which were published in a French translation by the Société des Sciences Historiques et Naturelles de la Corse, at Bastia in 1893, Elliot had, during the whole of his viceroyalty, to endure the jealousy of Paoli, who, as the Corsican editor of these letters justly remarks, was the only man able to consolidate British rule in Corsica. It was to Paoli that Britain was indebted for the crown of Corsica; he possessed, as few Corsicans have ever done, the confidence of his fellow-countrymen; he knew, as few ever did, *how* to govern them; he had, in fact, governed them for years —yet a stranger was preferred. From being virtual ruler of Corsica, Paoli suddenly found himself fall to the position merely of an adviser of its new Scottish viceroy, and his proud spirit rebelled. No doubt, the admirable tact and temper of Elliot postponed the inevitable catastrophe, but the viceroy suffered cruelly during the two years of British occupation, and not least from the supreme indifference which the British Ministry showed, and the faults it committed, in regard to everything Corsican. Previous to the British occupation, Paoli and Pozzo di Borgo had worked in admirable harmony. "He was the head, I was the hand," afterwards wrote Pozzo. But whilst Paoli was now sulking in his tent or scattering sedition, Pozzo di Borgo stood loyally by the British viceroy, incurring thereby the wrath of Paoli, who considered him a traitor to his cause.

Had Paoli been appointed British viceroy instead of Elliot, it is possible that Corsica might have remained a British possession to this day; for, with the Corsicans defending it from within, and the British fleet defending it from without, the French could never have captured Corsica. As it was, the British Government, on 31st August 1796, finding from Elliot's letters that Corsica was only a source of trouble, weakness, and expense, ordered the abandonment of the island. Elliot and the British garrisons accordingly left in October 1796, Paoli having previously retired to London, where he lived and died a pensioner of King George. Elliot was created Lord Minto, and afterwards was appointed Governor-General of Bengal.

V. A great figure had now arisen and filled Europe with awe.

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[1] Sir Walter Scott refers to him (afterwards first Earl of Minto) in his *Journal* as "a man among a thousand," and extols his high breeding, ease of manner, and eloquence. Scott says he knew him "very intimately in the beginning of the century."

Born at Ajaccio on 15th August 1769, the son of a Corsican lawyer of noble descent who was secretary to Pasquale Paoli, NAPOLEON BUONAPARTE had in 1796, at the head of the republican troops of France, invaded Piedmont and Lombardy, defeated the Austrians at Castiglione, Arcola, and Rivoli, and compelled the Pope to sue for peace. His career in Corsica had not been a successful one. In fact, he and his mother and family were chased from the island by the supporters of Paoli. In France he found room for his military genius and vast ambition, and every one knows his history. On the British retiring from Corsica, French troops immediately seized it, and have held it ever since. To do the French justice, they have proved excellent masters of the island. They have, for example, covered it with as fine a system of roads as any in Europe. These Corsican roads are divided into four classes :—(1) *Routes nationales* (703 English miles in length), among the finest in the world, so good and level that a railway could be laid down on them and ascend thousands of feet above the sea-level—that between Vico and Evisa ascends to 3300 feet; (2) *Routes forestières* (303 English miles in length), also very good, and passing through forests; (3) *Routes départementales* (130 English miles in length), also good; and (4) *Routes vicinales*, roads resembling the ordinary up-and-down British road. I understand that France loses heavily financially every year by Corsica; and if the fortification of the island is to be undertaken, as M. Ardouin Dumazet proposes in his *La Défense de la Corse*, published in 1894, Corsica will cost France many millions sterling more. Corsica, however, furnishes France with admirable soldiers and sailors, whilst her harbours, such as the noble Bay of Ajaccio, afford ample shelter for the French fleet.

As Paoli is the idol of Corte and Ile Rousse, so Napoleon is that of Ajaccio. Her inhabitants do not forget that his mother obtained from him the transference of the Prefecture of Corsica to Ajaccio from Bastia, which still remains the seat of the supreme courts of law. The Bonapartes' house at Ajaccio and their country seat near there, called the Jardin des Milelli, are now the property of the municipality; but the Bonapartes themselves are gone. The chief proprietor of land near Ajaccio is the descendant of Napoleon's lifelong foe, Pozzo di Borgo. This family have a town house in Ajaccio, but have recently erected, 2165 feet above the sea, the splendid Château de la Punta, which is built of the stones of the Tuileries Palace, burnt by the Commune of Paris. The interior of this château is one of the finest specimens of modern French decorative art on a princely scale.

RACE, AND CUSTOMS.—The Abbé Girolami-Cortona recognises in Corsica four leading racial types, viz. : (1) the *Celtic* or *Celtiberian* type, formed by the mixture of invaders from Liguria and Gaul; (2) the *Greek* or *Pelasgic* type, formed from the descendants of the Greeks or Pelasgians; (3) the *Arab* type, of mixed Arab and Moorish features; and (4) the *Saxon* type, very rare, furnished very probably by the Etruscans.

However this may be, there has always been a strong affinity between the Italians and the Corsicans; and this is what might be expected, seeing that Cap Corse is only 50 miles distant from Italy. Nomenclature and language in Corsica are entirely Italian. French people and French names are conspicuous by their absence, although the Corsicans are getting into the way of Frenchifying their Italian names, just as the original name Napolione Buonaparte was clipped down to Napoleon Bonaparte.

It is but right to say, however, that the Corsicans consider themselves superior to Italians, and in some respects they are. If less industrious, they are graver, quieter, more religious, and more honest. Robbery is unknown in Corsica, whilst brigandage flourishes in the Italian islands of Sardinia and Sicily. The so-called "bandits of Corsica" are not, and never were, robbers like the Italian brigands. A Corsican bandit is an individual who, from some motive, probably a quarrel over a piece of property, or jealousy, or a family feud, has killed another individual, and takes to the *maquis*, or Corsican bush, to elude capture by the police. Such a bandit (and there were at least ten in hiding when we visited Corsica last spring) is quite harmless so far as tourists are concerned, being supplied by friends with food and clothing, and being only anxious to keep out of the way of the gendarmes.

I do not wish, however, to minimise the low value set by Corsicans upon each other's lives. When a Corsican visited Napoleon at Paris, the Emperor asked with a smile, "Well, are you still killing one another in Corsica as much as ever?" A friend who had lived in Ajaccio from November 1893 to April 1894 told me that ten deaths by violence had during that short period occurred there; and that of these, seven were certainly due to the vendetta, the other three being the result of ordinary quarrels. The vendetta is the revenge taken by a Corsican on some one who has slain one of the Corsican's relatives. Deaths arising from this cause were once very common. Gregorovius cites the speech of the Corsican Préfet in 1852 as proving that 4300 murders (*assassinats*) had been committed since 1821, or on an average 138 per annum. Most of these must have been due to the vendetta. At the same time, dreadful as a Corsican may become when under the baneful influence of this ancient custom, no man is more courteous, kind, hospitable, or amiable to tourists. In no country do tourists travel with greater safety or obtain more politeness and respect.

The Corsican type of man is small, strong, and well made. Deformed people are extremely rare in Corsica. Hence, as a recruiting ground, no department of France is so good, and some of the finest regiments of French "Chasseurs des Alpes" consist of hardy Corsican mountaineers, all of whom have to serve as conscripts in the French army. From the Cap Corse district, again, France obtains admirable sailors.

Writers are very fond of dwelling on the Corsican's indisposition to work. This applies solely to the men, for the women are and have always been overworked. When the French fortified St. Florent against the English and Paolists in 1793, the French commissaries reported to their Government: "We were obliged to employ foreign hands in order to transport earth and build walls to strengthen the fortifications. Pray note that the men of Corsica never work; it is the women who make embankments and excavations." Will it be believed that towards the end of last century Hugo Arnot, in his *History of Edinburgh*, thus describes the poor Scottish labourer or mechanic of his day: "He abhors industry, and has no relish for the comforts arising from it, his chief pleasure in this life being indolence," and so on. No one would bring that charge against Scotsmen now. And why? Because since Arnot's day Scotland has, owing to the introduction of steam-power and the consequent wonderful expansion of commerce, mining, and manufactures, become a hive of industry. If the Corsicans had a similar chance, if lucrative employment offered, if mines and manufactures were established, if steamers connected their island not merely with France and Italy but directly with England, the Corsicans would have something to work for, and they would work well. But the golden shower of economic prosperity has not yet descended upon Corsica. It is a poor, over-populated island, and wants lucrative employment for its population, who, although living in poverty, sometimes in squalor, possess many sterling qualities, which make one sincerely hope that its inhabitants will some day enjoy the prosperity they deserve.

The burial customs of Corsica are curious. Although cemeteries occur, yet every family who can afford it has its own mausoleum placed on its own ground. Thus one passes a street of tombs in driving from Ajaccio to the Iles Sanguinaires. Rude crosses by the wayside are said to indicate where one Corsican has dealt another a death-blow, and where his victim lies buried.

We witnessed at Ile Rousse an imposing funeral ceremony. A youth had died, and all the members of the burial society to which he belonged turned out clothed in white and blue robes. Headed by crucifix-bearers and a church choir, and attended by the village priests, the burial society marched two by two accompanying the youth's coffin to the parish church, where a funeral ceremony, which lasted for more than an hour, took place. The procession was then re-formed, and bore the coffin to the grave. The ancient Corsican custom of singing the praises of the dead by means of a *vocero*, or lament, is still practised in some localities.

Nor are the Corsicans less respectful as regards religious ceremonies. We were present at Ajaccio on the day of its patron saint, St. Joseph. His statue, as well as that of the Virgin Mary, was carried through the streets, all the men uncovering when the latter passed, whilst women showered rice on the Virgin with a gravity which bespoke their belief in its efficacy.

I must mention the, to us, curious custom of the Corsican women of carrying burdens, waterpots, etc., on their heads. A Corsican woman went aboard the Ajaccio steamer at Marseilles carrying her baby in her arms and her portmanteau on her head. Washerwomen carry their clothes-baskets on their heads. As nearly all water in Corsica is carried from wells by women in waterpots, there is not only a great scarcity of it in houses, but also the women acquire from youth the practice of carrying burdens on their heads. This custom leads to the women in Corsica having a fine upright carriage.

However honourable and trustworthy Corsicans may be, I repeatedly heard it stated that they do not make good servants. They are said to be too proud and independent to submit to discipline. For this reason, and also on account of their industry and economy, large numbers of Italians cross over from Italy to Corsica and work as gardeners, labourers, etc. These usually come from Lucca, which, from the industry of its inhabitants, derived long ago the title of "Lucca l'industriosa." As Rob Roy looked down on weavers, so the Corsican looks down on the Luccan, and to be called a Luccan is a term of reproach—so much so, that a lady told me that, if any Ajaccio schoolboys annoyed her, she had just to call them "Lucquains," and they crept off horrified and ashamed.

Beggary is little known in Corsica; and so proud are its inhabitants, that a sexton, who showed me over a country church, refused to accept a gratuity. But in Corte the young folks have no such scruples, and simply mob the tourist, shouting, "Anglais, Anglais, jetez un sou!" I remonstrated with an inhabitant regarding this annoyance, and was informed that British tourists had brought it on themselves by giving money indiscriminately. One of the charges levelled by M. Maurice Jollivet against "la venale Angleterre" is that in Elliot's time she "prodigua l'or" in Corsica. The Corsicans have known no such "golden shower" since.

Political Divisions, and Commerce.—Corsica is a department of France administered by a prefect called "le Préfet de la Corse," who resides at Ajaccio (pop. 20,197), with sous-préfets at Bastia (pop. 23,397), Calvi (pop. 2162), Corte (pop. 5029), Sartene (pop. 5615), and Ajaccio. The Prefét is assisted by a Conseil de Préfecture consisting of three members, and also by the Conseil Général de la Corse, composed of 62 members, one elected in each canton of Corsica. This Conseil Général was sitting at Ajaccio when we were there last April, and very strained relations existed between it and M. le Préfet, who was a Frenchman. I remembered the trials of our Sir Gilbert Elliot, and thought that history was repeating itself. Corsica is divided into five arrondissements, viz.:

Arrondissement.	Area in hectares (1 hectare = $2\frac{1}{2}$ acres).	Cantons.	Communes.	Pop. Census of 1891.
Ajaccio,	219,099	12	80	76,830
Bastia,	108,017	20	94	81,598
Calvi,	78,749	6	35	26,050
Corte,	173,526	16	108	61,776
Sartène,	169,172	8	47	43,342
	748,563	62	364	289,596

There is a mayor and municipal council in every commune. Every male citizen of twenty-one, with no legal disability, may vote (1) in his commune at an election of the municipal council; (2) in his canton at that of a councillor of arrondissement and of a member of the Conseil Général; (3) in his arrondissement at that of a deputy for his circonscription; and if he is a delegate of a municipal council he may also vote at an election of senators of the department. Corsica returns to the French Chamber of Deputies five members, and to the French Senate three senators.

In 1887 the value in pounds sterling of the external commerce of Corsica was £1,464,598 of imports, and £378,291 of exports.

Details of the imports and exports are given in the Abbé Girolami-Cortona's valuable work. Assuming that they include everything exported from Corsica, it does seem remarkable that the export of building timber is so small—only 14 tons in 1888—considering the magnificent forests of pines and other trees suited for building purposes. The Abbé, however, touches a sore subject in pointing out how much Corsica's export trade has suffered by the repeal in 1888 of the treaty of commerce between France and Italy. "Italy," he complains, "our sole market, is now closed to us," and he calls upon the naval authorities of France to use Corsican pine-wood in the construction of French ships, so as to make up to Corsica for the loss of her commerce owing to her connection with France.

It was on account of its proximity to Italy, "notre unique débouché," as the Abbé terms it, that BASTIA became the commercial metropolis, and was for long the capital of Corsica. It is a busy town compared with Ajaccio. It is also a town of greater intellectual activity, four newspapers (two dailies) being published there. An excellent learned society has its headquarters in Bastia.

Next in commercial importance to Bastia is Paoli's creation, ILE ROUSSE. Whilst one-half of the imports and one-fifth of the exports are entered in Bastia, more than one-seventh of the imports and more than one-half of the exports are entered in Ile Rousse, her proximity to the fertile Balagna being the cause. In the third rank, as regards exports, comes AJACCIO with a little over one-fourth of the imports and one-fifth of the exports. For the tourist, however, no town in Corsica can compare with Ajaccio, especially as a winter resort; and the splendid new hotel recently erected there by an enterprising Corsican gentleman, and opened last November, completes all that was wanting to make Ajaccio a delightful tourist centre. Besides, being the birthplace of the great Napoleon, Ajaccio will attract travellers to the end of time.

THE FUTURE OF CORSICA.—What then is to be the future of Corsica? Is it to remain a little-known and seldom-visited island, with rather a bad name for assassination, or is it to become an attractive tourist centre, and a bustling mart of commerce and industry? The answer will depend partly on the French Government, partly on the Corsicans themselves. I shall, in conclusion, refer only to two respects in which Corsica requires waking-up.

In the *first* place, as regards *Tourists*, greater facilities for reaching Corsica must be afforded them. Thus, a line of swift steamers ought to be established between Nice and Ile Rousse (as is so much desired by the Ile-Roussians themselves), which should do this, the shortest passage between France and Corsica, in 9 hours. The leading lines at present are Marseilles to Ajaccio in 15½ hours, and Nice to Bastia in 10½ hours.

As Ile Rousse possesses an excellent harbour, one of the best hotels in Corsica, and is on the railway line to Bastia and Ajaccio, and as it furnishes the quickest passage between France and Corsica, it enjoys many advantages for tourist traffic. The railway line between Ajaccio, Bastia, Ile Rousse, and Calvi will be opened throughout its entire length during the autumn of 1894.

Then the country inns of Corsica must be overhauled. Whilst their sanitary arrangements, from an English point of view, are shocking, their internal accommodation leaves much to be desired. Unless these country inns are improved, tourists will not leave the railway line; they will only visit the leading towns, and they will thus miss some of the grandest scenery in the world.

In the *second* place, as regards *Commerce and Industry*, the mineral wealth of Corsica deserves particular investigation. The island possesses, as I have shown, mines of valuable minerals, but hardly any of these are worked. For example, I found that the copper-mines near Ponte Leccia railway-junction are no longer worked by the joint-stock company. Why was this? Want of copper, or want of capital, or energy, on the part of the company? Then there is an area of anthracite coal at Osani 980 English acres in extent. Can anything be made of that to assist manufactures or iron smelting?—for there is an iron-mining area in Cap Corse 2687 acres in extent. Both of these areas are still unworked.

Finally, although Corsica has three lines of steamers between Ajaccio, Bastia, and France, two between Bastia and Leghorn, and one between Ajaccio and Algeria, she has none connecting her directly with Great Britain. Now, there is no market in the world like London, which could, and probably would, for instance, take all Corsica's orange crop. I was told by a Corsican orange-grower that Spanish oranges commanded the London market because of their being shipped direct there. Then the immense timber supplies of Corsica would be taken advantage of by the British building, mining, and other trades; whilst Corsican wines, with their good body and flavour, would be appreciated by the British public. Besides, London is the greatest tourist centre in the world, and a direct line of well-found steamers between London and Corsica would be very attractive to many British tourists.

I have now concluded my notes on my recent visit to Corsica, which, although desultory, have at least the merit of being impartial, and are written with the view of benefiting an island in which we Scots, "for auld acquaintance sake," have more than a passing interest; for did not a Scotsman, James Boswell, first bring Paoli and his "brave Corsicans" under the notice of the British public? and did not another Scotsman, Sir Gilbert Elliot, act as Viceroy of Corsica during the British occupation?

APPENDIX.

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II.—Meteorological Observations in Corsica (Ajaccio) compared with those in Britain, France, and Algiers, showing the Average Climate over a long series of years.

1. *Mean Temperature in Degrees Fahrenheit.*

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean for Year.
Edinburgh, .	36·3	39·1	40·0	45·1	50·6	55·6	58·3	57·7	54·0	47·7	40·9	39·8	47·1
London, . .	38·5	40·9	42·4	49·0	55·1	61·3	64·6	62·9	59·0	51·8	42·5	40·6	50·7
Paris, . .	37·4	40·1	43·4	51·9	57·9	63·0	66·3	65·2	60·9	52·4	42·4	38·8	51·6
Nice, . .	45·4	46·5	50·9	57·1	61·0	68·8	73·8	72·6	67·8	60·8	52·0	46·9	58·6
Mentone, . .	48·2	48·5	52·0	57·2	63·0	70·0	75·0	75·0	69·0	64·0	54·0	49·0	60·8
Ajaccio, . .	51·0	51·3	52·5	58·1	63·3	70·8	75·3	77·2	71·8	63·6	56·8	51·8	62·0
Algiers, . .	54·0	55·0	56·1	61·2	64·8	70·7	76·6	78·1	73·4	67·6	59·5	54·7	64·3

2. *Average Rainfall in Inches.*

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean for Year.
Edinburgh, .	1·81	1·61	1·55	1·36	1·68	2·38	2·68	2·70	2·33	2·50	2·07	1·94	24·61
London, . .	1·80	1·57	1·55	1·65	2·12	1·90	2·56	2·29	2·36	2·73	2·23	1·90	24·66
Paris, . .	1·47	1·42	1·21	1·25	1·44	1·93	1·90	2·02	1·79	1·94	1·79	1·72	19·89
Nice, . .	3·12	2·13	2·49	2·92	1·70	1·14	1·10	0·95	3·98	3·51	4·65	3·47	31·16
Ajaccio, . .	2·39	1·69	1·94	2·07	1·55	0·72	0·15	1·07	1·01	2·81	4·96	2·40	22·76
Algiers, . .	3·0	2·64	3·04	1·93	0·99	0·67	0·04	0·32	1·02	2·84	3·63	4·38	24·50

REFERENCE NOTE.

FORESTS COLOURED GREEN

Tetti=Forest of Tetti

Forest Trees	B.	Beech.
	C.	Cork Oak.
	E.	Evergreen C
	M.	Maritime P
	P.	Corsican Pi

MINERALS SHOWN THUS

Copper Mines	Cardo
Antimony "	Luri Castill
Iron "	× Olmeta
Lead "	Prato
Silver Lead "	Calenzano
Anthracite "	Osani
Lignite "	Saliceto

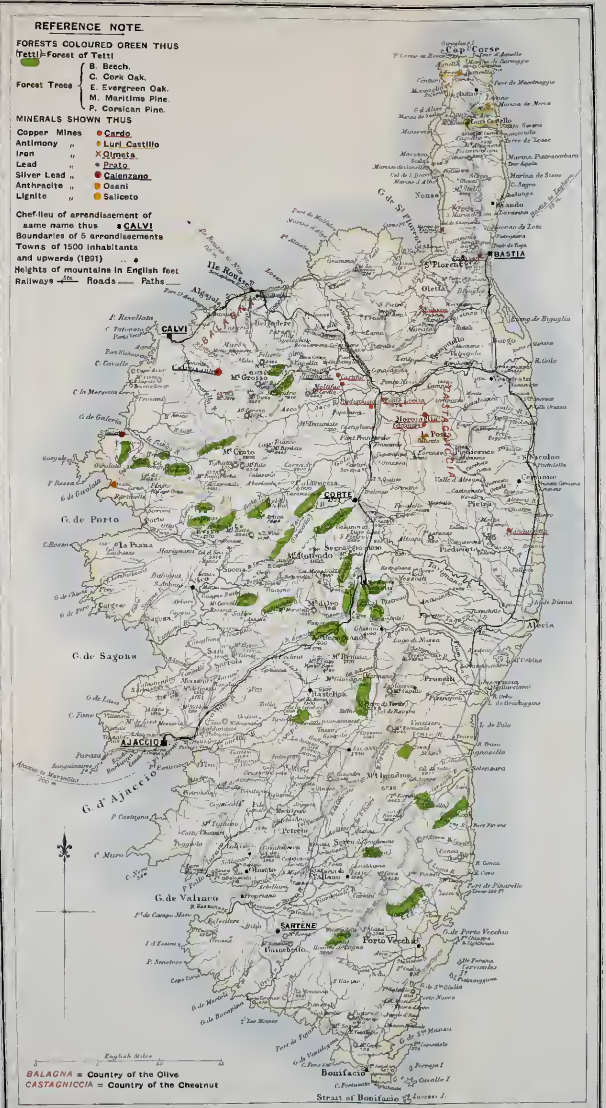
Chef-lieu of arrondissement of
same name thus...... ■ CALVI

Boundaries of 5 arrondissemer

Towns of 1500 inhabitants
and upwards (1891) . . . . ●

THE FORESTS AND MINES OF CORSICA.

By Ralph Richardson, F.R.S.E.



The Edinburgh Geographical Institute

John Bartholomew, F.R.G.S.

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A REVIEW OF SWEDISH HYDROGRAPHIC RESEARCH IN THE BALTIC AND THE NORTH SEAS.

By Otto Pettersson.

V.

The Waters in the Swedish fiords and in the submarine ponds and channels of the coast—Changes in the Coast-Water at the close of the winter season, and their effect upon the Herring Fishery.

The depth of the water on the Swedish coast-bank[1] does not generally exceed 30 mètres. Through this coast-bank some deeper channels stretch obliquely in a direction from SW. to NE. Each channel may be regarded as a submarine continuation of one of the fiords of Bohuslän, a deep furrow ploughed by the glaciers during the Glacial Period in the rocky ground of our continent. The Scandinavian fiords, as a rule, are deeper in their inner parts, where the bottom forms a deep basin, which, at the entrance to the fiord, is shut off from communication, below a certain depth, with the waters of the open sea. It depends upon the depth of this submarine ridge whether the changes in the deep water of the Skagerack will affect the bottom waters of the fiord or not. The conditions, physical and chemical, of such bottom-layers, which are periodically shut off from communication with the ocean, is of extreme interest; and I shall devote the greater part of this chapter to the description of the most typical of Swedish fiords, the Gullmar fiord, which G. Ekman and I, with the assistance of a number of scientists, have studied from the beginning of 1890 until now.

In order to show the relation between the waters within the Gullmar fiord and the corresponding layers of the Skagerack, I have drawn the sectional diagrams 5, on Plate VII., from Öster Risör, passing through the Stations S_x, S_{ix}, S_{viii}, S_v , S_{iv}, A_{xv}, etc., into the inner part of the fiord[2] (see the chart on Plate VIII.). Section 5A represents the state of the water in the middle of February 1890; Section 5B in the beginning of May 1893 (see Plate VII.).

It will be remembered from foregoing remarks that all isohalines across the Skagerack assume the form of curved lines, sloping downwards in the vicinity of the coasts. The isohalines of 35, 34, 33, 32°/$_{oo}$, therefore, on every diagram, will be seen to crop out against the bottom at a greater or lesser distance from the coast.

It will also be remembered that, owing to the periodical inflow and outflow of the waters of the Skagerack at different seasons, the salt

[1] By this term I denote the bottom of the sea from the shores of the mainland as far as the outermost rocks and shoals. From here the bottom gradually slopes (as shown in the diagrams on Plate VII.) to the great deep basin of the Skagerack.

[2] The line of section forms an obtuse angle at its apex in S_{vii}. This is necessary in order to show in the diagram the state of the waters in the great deep basin of the Skagerack. A straight line from Öster Risör to the entrance of the fiord would not pass over the greatest depths.

waters from the North Sea and Atlantic attain a higher level in summer than in winter. This appears in the diagrams in the following manner:—

1. The isohalines of 35°/₀₀ and 34°/₀₀ are found at a higher level, and assume a more flattened shape in summer than in winter, because the corresponding waters then flow more abundantly into the Skagerack, and reach higher up on the coast-bank than in the cold season.

2. The isohalines of 34°/₀₀ and 30°/₀₀ in summer approach very closely to each other, because the intermediate waters of 33, 32, and 31°/₀₀, which are found to be of considerable thickness in winter, when they form the surface layer of the central part of the Skagerack, are in summer greatly reduced in volume and displaced by the Baltic waters.[1]

Such oscillations in the *niveau* of the deep waters affect the fiord in the following manner:—

Water of 35°/₀₀ salinity never enters into the basin of the Gullmar fiord. Water of this kind can rise to within 30 mètres, or even 20 mètres, from the surface in the eastern part of Skagerack, as will be seen from Section 5B; but on approaching the coast-bank its level sinks so low that it cannot surmount the submarine ridge at the entrance to the fiord, which is about 40 mètres below the surface.

Water of 34°/₀₀ salinity is constantly found as a bottom layer in the fiord, but the inflow of this water is *periodical*.

Waters of less salinity than 33°/₀₀ seem to have free access to the fiord at all seasons of the year.

The interest is thus chiefly concentrated upon the condition of the bottom water. From the first deep soundings in this fiord, 17th February 1890, we obtained gas samples singularly deficient in oxygen. Moreover, the gas samples taken at Station A_{xv}, outside the fiord, in the open sea, showed a marked discrepancy from the gas samples taken at stations within the fiord, below a certain depth.

TABLE A.—THE GULLMAR FIORD, 17*th February* 1890.

	Station A_{xv}, outside the fiord.					Stations inside the fiord.					
Depth in M.	t°.	Salt °/₀₀	N_2 cc. in 1 L.	O_2 cc. in 1 L.	$\frac{100.\ O_2}{N_2+O}$	t°.	Salt °/₀₀	N_2 cc. in 1 L.	O_2 cc. in 1 L.	$\frac{100.\ O_2}{N_2+O_2}$	CO_2 cc. in 1 L.
30	...	...	...	...	...	3·0°	29·16	14·10	6·86	32·70	44·33
40	3·9°	31·15	13·21	6·46	32·79	...	...	...	...	...	...
50	...	...	...	...	...	5·4°	33·11	13·12	5·65	30·10	47·53
55	...	...	...	...	...	5·2°	33·33	13·53	5·58	30·60	...
70	...	...	...	...	...	5·0°	33·93	11·11	2·46	18·12	50·34
100	...	...	...	...	...	4·5°	34·14	13·39	2·19	14·10	51·55
130	...	...	...	...	...	4·2°	33·91	13·00	1·88	12·70	...
140	5·2°	33·81	13·07	6·41	32·87	4·2° bottom	33·91	12·70	1·58	11·05	...

[1] In another chapter of this paper I have said, in reference to this phenomenon, that "the bank-water is swept away from Skagerack by the increasing outflow of the Baltic waters." This, however, applies to the open sea; in the fiords large masses of 32 and 33 water find shelter, and remain during the summer, as will be seen in the diagrams, Plates VII. and VIII.

The bottom water from a depth of 140 mètres in the Skagerack contained 6·41 cc. oxygen, being 32·87% of the atmospheric gases in a litre of water, while one litre of the bottom water from nearly the same depth in the fiord contained only 1·58 cc., or 11·05% of oxygen! Both waters had absorbed air under the same conditions of temperature, for the amount of nitrogen was nearly the same (13 cc. in 1 litre).

The diminution of oxygen in the waters of the fiord commenced from the depth of 50 mètres (which is a little lower than the depth of the submarine ridge at the entrance to the fiord), and reached its minimum in the vicinity of the bottom. The diagram 5A on Plate VII. shows that the bottom water in the fiord was not then in communication with the corresponding layer in the Skagerack. The isohaline of 34‰ is intercepted by the ridge. Water of 34‰ salinity, which is found at a depth of 80 mètres inside the ridge, is *not* found at 140 mètres at Station A_{xv} outside the ridge. We infer from this that the deep water in the fiord is a *residue from some previous time* when the 34‰ water rose so high on the Swedish coast that it passed over the ridge and entered into the basin of the Gullmar fiord.

Since that time the deep water in the fiord had been cut off from communication with the sea, and the oxygen held in absorption by the water had been consumed by the action of organic (animal) life. This is evident from the fact that simultaneously with the consumption of oxygen the amount of carbonic acid had increased to the abnormally large quantity of 51·5 cc. in one litre. The amount of carbonic acid usually found in a sea-water of 34‰ is about 47 or 48 cc. Thus the quantity of carbonic acid had increased by 3 or 3·5 cc., while the oxygen had diminished from 5·5 cc. to 1·6 or 1·8 cc. in the litre. No other action than the respiratory process of animal life could have produced this effect.[1] Then the question is, can sea-water so destitute of oxygen as only to contain 1·8 or 1·5 cc. in a litre maintain animal life any longer, or can it be regarded as practically sterile?[2] At my request Miss H. Lovén[3] in the following summer made experiments during some months upon the absorption of oxygen in sea-water by sea-weeds and fishes. From Miss Lovén's investigation it appears that—

Algæ can by their act of respiration (in darkness) extract from sea-water every trace of absorbed oxygen. In sea-water thus entirely deprived of oxygen the sea-weeds can live at least 60 *or* 70 *hours uninjured, and will vegetate again when the water is ventilated.*

With regard to the absorption of oxygen by animals, it is a well-known fact that different kinds of fishes require different quantities of oxygen. Cod can live where mackerel or trout are suffocated. Large fishes require a larger percentage of oxygen in the water than smaller

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[1] No sample of perfectly ventilated sea-water will be found to contain so much carbonic acid. This quantity is in fact more than sufficient to convert the alkali of sea-water into bicarbonate.

[2] The Gullmar fiord is noted for the fishing of cod and John Dory in its deep water, which *always* takes place in winter, but not *every* winter.

[3] See H. Lovén: *Några rön algernas andning. Bih. K. V. As. handl.*, Bd. 17, Afd. iii., No. 3.

ones.[1] Miss Lovén's experiments were chiefly made with codfishes. Some of these experiments throw light upon the question which concerns us here, viz., What is, approximately, the minimum of oxygen in a sea-water necessary to maintain the respiratory process?

A codfish, 140·1 grammes in weight, lived six hours in a closed aquarium containing 18·5 litres of sea-water. In one litre of this water was found—

Before the experiment.	After.
11·90 cc. N_2	12·20 cc. N_2 (or inabsorbable gases)
5·18 cc. O_2; $\left(\frac{100\ O_2}{N_2+O} = 30·34\right)$	0·19 cc. O_2; $\left(\frac{100\ O_2}{N_2+O} = 1·54\right)$
39·56 cc. CO_2 (total)	44·17 cc. CO_2

The loss of oxygen = 5 cc., the increase of carbonic acid = 4·61 cc. In six hours the respiratory process had thus altered the composition of the gases absorbed in the water of the aquarium as follows :—

18·5 litre sea-water contained—

Before the experiment.	After.
95·83 cc. O	3·51 cc. O_2
731·86 cc. CO_2	817·14 cc. CO_2

In another experiment two specimens of *Gadus merlangus*, of 11·62 grammes and 8·1 grammes respectively, reduced the amount of oxygen per litre from 5·18 cc. to 0·83 cc. The larger fish died, the smaller recovered when the water was ventilated.

Consequently we cannot regard the bottom water from February 1890 of the Gullmar fiord, which contained per litre—

At 70 mètres depth, . . .	2·46 cc. O^2
„ 100 „ „ . . .	2·19 cc. „
„ 130 „ „ . . .	1·58 cc. „

as *sterile*, or quite unfit to support animal life. I shall show hereafter that we have found waters still more destitute of oxygen in some of the deep ponds of the Baltic. In a water sample from the *Challenger* Expedition (No. 1001), Dittmar[2] found 15·08 cc. N_2, and only 0·6 cc. O_2, in one litre. But, although the water had not been deprived of oxygen to such a degree as to render the existence of animal life impossible, it was so exhausted that we could foresee that the fishing in the deep water must be unsuccessful if this state of things continued much longer.

The next question, therefore, was to ascertain if any alteration was likely to occur in the conditions of the fiord waters. Miss A. Palmqvist, at my request, undertook this investigation for the summer of 1890, since which time Mr. G. Ekman and I have kept watch at the Gullmar fiord.

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[1] It is also known that deep-water fishes can supplement the oxygen in the water by the oxygen contained in their swimming-bladders. It appears from Miss Lovén's experiment that the *Fucus-algæ* can similarly use the oxygen stored up in their bladders.

[2] *Chall. Rep.: Phys. and Chem.*, part i. p. 226.

The changes which have occurred will be seen from the diagrams in Plate VII. The number of gas analyses is too great to be given here, and therefore I cite only such determinations as were made on water samples taken from depths below 40 mètres at the deepest station in the centre of the fiord during the following years (see Plates VII. and VIII.).

From diagram B it will be seen that already before the middle of June 1890 an alteration had taken place. The isohaline of 34 °/₀₀ then passed over the ridge. Fresh sea-water, salter and more aërated, penetrated into the fiord and displaced the stagnant bottom layer.

TABLE B.—THE GULLMAR FIORD, 26*th August* 1890.

Depth in Mètres.	t°.	Salt °/₀₀	N_2 cc. in 1 L.	O_2 cc. in 1 L.	$\frac{100\ O_2}{N_2+O_2}$	CO_2 cc. in 1 L.
50	9·50°	33·00	12·35	5·16	29·47	47·37
70	5·80°	34·64	13·20	4·77	26·54	49·35
100	5·80°	34·77	13·34	4·47	25·13	48·92
120	5·80°	34·74	13·31	3·81	22·24	49·71

The difference in the bottom water is evident, and would sufficiently prove the renewal of the water between February and August, even if Miss Palmqvist had not found water of 34 °/₀₀ on the ridge in June.

The maximum salinity in February was = 34·14 °/₀₀; in August it was found to be 34·77 °/₀₀. The amount of oxygen in the litre of the bottom water in February was 1·58 cc. (= 11·05 °/₀), while in August it was 3·81 cc. (= 22·24 °/₀); the carbonic acid in February was = 51·5 cc., in August only 49·71 cc. in one litre.

The influx of 34 °/₀₀ *water took place, then, in spring* 1890, *and continued during a part of the summer. But in August the niveau of the* 34 *isohaline had sunk below the level of the ridge, and the bottom water of the fiord was again cut off from communication with the corresponding layer in the Skagerack.*

Our next investigation took place in February 1891. The result is shown in diagram C, Plate VII., and in the following :—

TABLE C.—THE GULLMAR FIORD, 26*th February* 1891.

Depth in Mètres.	t°.	Salt °/₀₀	N_2 cc. in 1 L.	O_2 cc. in 1 L.	$\frac{100\ O_2}{N_2+O_2}$	CO_2 cc. in 1 L.
50	5·8°	33·29	...	...	...	...
60	6·7°	34·41	13·02	4·26	24·64	48·07
80	6·8°	34·41	12·73	4·73	27·08	...
120	...	...	13·08	4·30	24·74	...
130	6·7°	34·72	12·79	4·14	24·44	...

The 34 °/₀₀ water stands at the same level as it did in August, and is still shut off from communication with the water outside the ridge (see the diagram C on Plate VII.). The salinity and the percentage of oxygen are a trifle less than in Table B. A thermic wave conveying the heat of the previous summer stored in the upper layers passes downwards to the depths.

The same state of things was found to obtain on 14th August 1891, as shown by the diagram D. The only exception is that the *niveau* of the isohaline 34°/₀₀ was found somewhat deeper, and that the effect of the cold of the foregoing winter on the deeper layers was then perceptible. The salinity was scarcely altered.

Nor does there seem to have been any new influx of 34 water after the summer of 1891 up to the 22nd December of that year, for on that day G. Ekman and I found the following results :—

TABLE E.—THE GULLMAR FIORD, *22nd December* 1891.

Depth in M.	t°.	Salt °/₀₀	N_2 cc. in 1 L.	O_2 cc. in 1 L.	$\frac{100\ O_2}{N_2+O_2}$.
40	9·10°	33·64	13·17	4·86	26·9
50	9·35°	33·89	13·15	4·63	26·0
60	9·50°	34·05	12·16	4·45	26·7
80	5·60°	34·44	11·93	3·00	20·0
100	5·05°	34·41	14·27	3·49	19·6

whence it appears that the 34 water had not increased in bulk or in salinity, and that the diminution of oxygen proceeded slowly, the least percentage of oxygen in one litre being 19·6%, while it was 24·44% four months earlier.

The same remarks hold good also for the state of the fiord in the following summer. See diagram F, where we find the volume of the bottom water much reduced by diffusion and commixture with the upper layers, and the saltness fallen to 34·24°/₀₀.

The next investigation was made in the beginning of May 1893, and the result, graphically represented in section 5B on Plate VII., shows that the bottom water of the fiord, after a long period of stagnation, had been renewed by a fresh inflow from the sea. This is shown by the form of the isohaline of 34°/₀₀ which is seen in the figure to cross the ridge, and is confirmed by the gas analyses and chlorine titrations, which gave the following results :—

TABLE F.—THE GULLMAR FIORD, *2nd May* 1893.

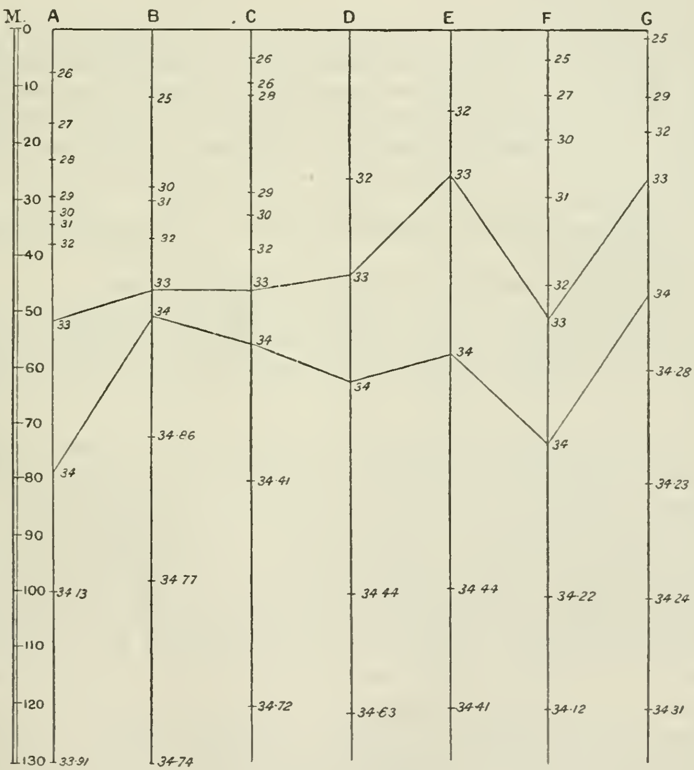
Depth in M.	t .	Salt °/₀₀	Cc. N_2 in 1 L.	Cc. O_2 in 1 L.	$\frac{100\ O_2}{N_2+O_2}$
40	3·60°	33·76	14·56	5·47	27·39
60	4·16°	34·23	14·30	5·95	29·36
100	3·74°	34·23	14·25	4·83	25·32

It is obvious that fresh water, richer in nitrogen and oxygen than the former, had entered the fiord.

On Plate VII. the salinity and temperature of the water of the Gullmar fiord at the deepest station (see the chart) are represented by the figures *A*, *B*, *C*, etc., which show the *niveau* of the isohalines of 34, 33, 32°/₀₀ at the different dates of observation. The coloured areas indicate the increase or diminution in volume of the waters. The maxima of the 34-line mark the beginning and end of the period of inflow, viz. in spring 1890 and 1893. In the interval the water of 34°/₀₀ decreased in volume and salinity as well as in the percentage of dissolved oxygen, just as we might expect in a bottom layer of stagnant water.

The figure beneath exhibits the changes of level of the various waters during the whole period.

From the contour of the isohaline of 33°/₀₀ we infer that the inflow of this water, which ordinarily is not intercepted by the ridge, has been more abundant in later years.[1]



In the following summary I will endeavour to make a clear distinction between fact and hypothesis.

[1] There seems to exist a certain connection between these phenomena and the fishery. For the following communications I am indebted to my friend Mr. E. Giers of Gullmars-

It is a fact that the bottom water of the Gullmar fiord, in the winter 1889-90, was extremely poor in oxygen, and, instead, extraordinarily rich in carbonic acid. It is very probable, but not absolutely certain, that this alteration was due to the influence of animal life in the depths of the fiord.

It is a fact that we found a fresh inflow of 34 water taking place in spring and summer 1890 and 1893. It is probable that the deep basin of the fiord was shut off from a fresh supply of water in the meantime, because we have found the bottom water to decrease in volume and in oxygen; but it is not certain, for there may have been shorter periods of inflow which may have escaped our notice. If the former hypothesis is right, the change in the temperature of the bottom water, which moves in an opposite direction to the temperature of the seasons, must be the effect of thermal waves transmitting the variations of temperature from the surface downwards; if not, the temperature of the deep water must be considered as dependent upon that of the inflowing water.

On Plate VIII. I have drawn a chart of the fiord district of Bohuslän. Sixteen miles south of the Gullmar fiord is situated another fiord—the Stig fiord. The diagrams numbered 6 represent sections from Station S_{iii} in the Skagerack across the submarine ridge and the deep inner basin of this fiord in winter and in summer. The submarine ridge of the Stig fiord is only 10 mètres deep. On the inner side the depth is over 30 mètres.

G. Ekman and I found the following rules to hold good with regard to the Stig fiord:—

Water of 34°/₀₀ *and* 33°/₀₀ *salinity cannot pass the ridge.*

Water of 32°/₀₀ *and* 31°/₀₀ *penetrates periodically into the fiord. Water of this kind plays the same part in the hydrography of the Stig fiord as water of* 34°/₀₀ *in the Gullmar fiord; when it has filled the deep basin, it remains there, as long as its niveau remains below the ridge, until a fresh inflow takes place.*

On our expedition in February 1890 we found such an isolated water-stratum of 31 and 32°/₀₀ salinity in the fiord. We found water of this kind at a depth of 50 mètres, on the slope of the coast-bank (see the position of the isohaline 32 in section 6). Consequently there had previously been a period of inflow of 32 water over the ridge (10 mètres). Then the *niveau* of this water-layer had sunk outside the ridge to a depth of 50 mètres. The water left in the fiord seemed to have preserved its original temperature better than the corresponding layer in the open

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berg. We must distinguish between deep-sea fishery (cod, John Dory, etc.) and the herring fishery with nets along the shore. The former we naturally should expect to be affected by changes in the bottom water; the latter, as I shall presently show, is in some way or other dependent upon the inflow of 32 and 33°/₀₀ water *in winter*. Mr. Giers informs me that the deep-sea fishery in the winter of 1889-90 and some previous years was very poor. In the winter 1890-91 it was very successful. In both winters herring appeared at the shores of the fiord, but were far more plentiful in 1890-91 than the year before. In the two winters, 1891-92 and 1892-93, the herring fishery was extremely successful in the inner parts of the fiord, at Holma and Gullmarsberg.

sea, which was only at 3·7° C. But it had suffered a loss of oxygen, as shown by the following comparison :—

	Station S_{xiii}, outside the ridge.	Station S_{xvi}, inside the ridge.
Depth in M.,	42	30
t° C.	3·7°	4·8°
Salinity °/₀₀,	31·79	32·30
N_2cc. in 1 L.,	14·12	13·18
O_2cc. in 1 L.,	7·19	5·25
$\frac{100\ O_2}{N_2+O_2}$	33·74	28·48

Thus the interior of the Stig fiord—owing to the isolating ridge—formed a submarine pond which contained a residue of water salter and warmer than that which at the same season covered the entire coast-bank. This residual water had been deprived of a part of its oxygen by animal life.[1] The figure shows that not only the isohalines 32 and 31, but all isohalines from 32 to 27°/₀₀, were intercepted by the ridge. We found, in fact, a remarkable diminution of the dissolved oxygen at all depths below 13 mètres, where the percentage of oxygen was 31. In the upper layers of the Stig fiord, which were in free communication with the open sea, we found 33·40% oxygen. The lower diagram (sect. 6) shows the state of the fiord six months later. The bottom water of 32°/₀₀ had then been replaced by a fresh volume of 31°/₀₀ water, which, on July 26th, had the temperature 14·4° C. In the following February we again found water of over 32°/₀₀ salinity and 3·8° temperature at the bottom of the fiord. The amount of dissolved oxygen was then reduced to 29·57%.

From the behaviour of the Gullmar fiord and the Stig fiord we conclude that every fiord of the Scandinavian coast is subject to changes of longer or shorter period, which depend upon the periodic rise and fall with the seasons of the extraneous water-layers. The water of 32°/₀₀ flows in, or attains its maximum level, in the Skagerack in autumn and winter, whereas the 34°/₀₀ water enters in spring and summer.

We have paid special attention to the great changes in the waters on the Swedish coast-bank which characterise the transition between the winter and spring seasons. These changes are the more important that they coincide with the disappearance of the winter herring from our coast and fiords. The first winter expeditions along our coast were made in 1878 and 1879 by Mr. G. Ekman, in order to study the hydrographic conditions at the fishing-grounds. In figs. 1, 2, 3 on Plate III. I have drawn diagrams reproducing Ekman's sections along the coast of Bohuslän from south to north. Fig. 1 represents the condition of the coast-water in the middle of December 1878, before the herring had appeared.[2]

[1] At the time of our expedition, in February 1890, the herring season was at its close. The only place where we found the fishery still going on was at Stat. S_{xv}. I should not have mentioned this fact if we had not made, the following winter, a similar observation at another submarine pond in the coast-bank at the close of the fishing season.

[2] After the usual seventy years' period of absence, the herring again appeared on our coast in the winter of 1877. In that and the following years the fishery was chiefly restricted to

The configuration of the water-layers is typical for the autumn season. The salt water of 34°/$_{oo}$ reaches as high as 30 to 40 mètres, and fills the deep coast channels, as may be seen from fig. 1 (Pater-Noster—Måseskär—Koster). Upon this stratum we find superposed water-layers of 33 and 32°/$_{oo}$, which are evidently remnants from the inflow of bank-water in autumn mentioned in a former chapter, as we may infer from the high temperature, 8° and 9° C. The outflow of Baltic water, which in summer covers the entire area of the Skagerack, is at this season of the year rapidly ebbing out, and is, moreover, deflected to the westward by easterly winds. We do not know the state of the Skagerack off the Swedish coast at this time, but we may infer that new water-strata are approaching the coast, from the great alterations which took place in the space of a month, from 16th December 1878 to 14th January 1879. We see from fig. 2, Plate III., that the level of 34°/$_{oo}$ water had sunk from 30 to 60 mètres in the coast-channels, the former layers of 32 and 33°/$_{oo}$ waters of 8° to 9° C. temperature being replaced by a fresh inflow of bank-water of the same salinity, but with a temperature of only 4° to 6° C.

This change was the result of the stormy weather in December. We have observations showing that great displacements occurred in the deeper strata of the coast-channels at Väderöbod and Koster (see fig. 2) during the latter part of December. The last inflow of fresh 32-33°/$_{oo}$ water occurred on the 28th-29th December in the deepest layers of the channels, and simultaneously therewith the herring fishery began on the coast inside (or east of) the Wäderö islands. Two days afterwards herring were caught at a great number of places north of the Wäderös up to Koster and Strömstad. But the fishing season did not last long. In the middle of January 1879 it began to decline at the same place (in the vicinity of the Wäderö islands) where it had commenced. The herring gradually disappeared from the coast, first at the southern, then at the northern fishing-grounds. The cause was as follows :—

On the 11th or 12th January the wind, which till then had blown from the north-east, changed and began to blow from the south and south-east. Simultaneously with this change in the wind, fresher and colder water belonging to the Baltic Stream, which had previously been dammed up in the Kattegat, or diverted westward at the mouth of the Kattegat by winds from the north and east, began to stream northwards along the Swedish coast, propelled by the southerly wind. On the 7th January the northern limit of the Baltic waters was as far south as between Marstrand and Vinga (west of Gothenburg), where the water at the surface had 27 °/$_{oo}$ of salt, and a temperature between + 1° and + 2° C. The diagrams in figs. 2 and 3 show the gradual advance of this Baltic water

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the north part of Bohuslän, from Hållö to Koster (see fig. 1 on Plate III.), and lasted a very short time. The fishing season usually commenced at the end of the year, and closed as early as January or February.

Of late years it has been otherwise. The herring now appear in the Kattegat and the southern part of the Skagerack, 10 to 20 miles off shore, as early as August or September. Net-fishing along the shore begins in October or November, and usually lasts till February or March. The winter herring is, as a rule, inferior in quality to the autumn herring.

northwards along the coast of Bohuslän (see Plates III. and VIII.). Wedge-shaped tongues of cold and relatively fresh water, gradually increasing in depth and volume, advanced northwards, until the entire coast-bank was covered with Baltic water. The foremost streams of this water contained up to 30°/₀₀ of salt, and had a temperature between + 1° and + 2° C. It reached Pater-Noster on the 12th or 13th January, was found between Hållö and Väderöbod (see fig. 2) on the 14-17th, and had passed the Koster islands and the Swedish frontier on the 23rd January 1879 (see Plate III. fig. 3). It seems to have lost velocity during its progress northwards, and was overlapped by tongues of fresher and colder water with more rapid motion, which, in quick succession, proceeded northwards, every succeeding layer overtaking in its turn and overlapping the foregoing, as is clearly seen from fig. 3. In this manner the cold and relatively fresh Baltic water gradually accumulated along the Swedish coast and lined the shore from the surface of the sea down to the coast-bank. The salter (32-33°/₀₀) and warmer (+ 3° and + 4° C.) "bank-water," which was found from the 1st to the 15th January at all the fishing-grounds off the northern part of Bohuslän, began to disappear from the coast. Its level sank, and it flowed off from the coast-bank through the deep coast-channels as it was displaced by the waters of the Baltic Stream.

Simultaneously with the outflow of the bank-water the herring also disappeared from the fishing-grounds.

Fig. 2 shows that there was still left a stratum of warm and salt water at the bottom of the coast-bank between the Wäderös and Koster on the 14-17th January. Fig. 3 shows that such water was confined to the deepest parts of the coast-channels on the 19th-23rd January. The upper fresher layers had increased in depth and volume at the expense of the bottom water. We have observations which enable us to follow the departure of the herring from one fishing-ground to another, almost from day to day. I will take one example.

I have described how the first wave of the Baltic current proceeded from Hållö to the Wäderös between the 14th and the 17th January. On the coast east of the Wäderös there is a fishing-ground, Florö. At this place, on the 13th January, water of 33°/₀₀ salinity and 4·5° C. was found from the surface to the bottom (23 mètres). Northerly wind. Herring-fishery going on.

The 15th January the surface water contained only 30·6°/₀₀ salt, and its temperature was found to be only + 1·5° C. (the day before it had been + 3·5° C.). But the bottom water was still unchanged (salt 33°/₀₀ and temperature + 3·7° C.). This was the last day of the herring-fishery at Florö in the winter of 1879.

On the 16th January the bottom water of 33°/₀₀ and 4° C. had also disappeared. At 22 mètres the salinity was found to be 29·8°/₀₀. The Baltic water, then, had displaced the bank-water at all depths. At the more northern fishing-grounds the same change took place a few days later, until the fishing entirely ceased on the 26th January 1879.

In the two following winters, 1880 and 1881, we witnessed the same phenomenon, viz., that the herring-fishery ceased whenever the warmer and salter bottom water, which in winter is found in the Swedish coast-channels and on the coast-bank, was displaced by the fresher and colder waters of the Baltic current. Of late years this has, as a rule, taken place in February or March. There seems to be a connection between the inflow and outflow of the bank-water and the herring-fishery. The substitution of one of these waters for the other occurs very suddenly everywhere; but as it seems to depend upon the season, the direction of the winds, and the development of barometric maxima and minima over the Scandinavian peninsula, and to proceed from south to north, I entertain little doubt that it could be forecast weeks before, with great probability of accuracy, if systematic and simultaneous observations were arranged at certain stations along our coast. The changes of level, and the inflow and outflow of the bottom water in the coast-channels especially, should be watched carefully, for these channels are the subways through which the *first* inflow must pass. The ebb and flow of the undercurrents in these channels is worthy of attention, even from a practical point of view. Great bodies of salt water may, in the course of a few hours, fill these channels and their numerous ramifications (see the charts of the Bohuslän fiord district on Plates III. and VIII.), or flow back into the open sea, as happened at Florö on the 15th and 16th January 1879. Hence we can explain the sudden appearance or withdrawal of the herring from the Swedish fishing-grounds.[1]

After this digression I will resume the thread of my demonstration of the changes in the state of the coast-water of Bohuslän which occurred in the latter weeks of January 1879.

On fig. 3, Plate III., which represents the condition of the sea from the 19th to the 23rd January, the cuneiform tongues of Baltic water are shown in their progress northwards along the coast. It will be observed that the temperature of the upper strata is rapidly decreasing, as well as the salinity. Each new tongue of water is *colder* than the foregoing layers which it overlaps. Thus the distribution of temperature is as shown in fig. 3, viz., a warm layer of 32 and $33^\circ/_{\circ\circ}$ water at 5° to 6° C. undermost, and above it water-strata of 3°, 2°, +1°. The temperature at the surface is a little above zero in the northern part, but new layers of fresher water with less than $26^\circ/_{\circ\circ}$ of salt, and a temperature below zero, are streaming northwards, at a rate of 13 knots in 24 hours, from the Kattegat. The temperature of the air was very low in January 1879. During the first period of northerly winds it sank even to −10° C., but this cold had no effect upon the temperature of the sea, which continued to be 3° or 4° as long as the bank-water was at the surface and the herring-fishery was going on. This fact is explained by the physical properties of sea-water. The point of maximum density of water containing 32 or $33^\circ/_{\circ\circ}$ salt is fully 2 or 3 degrees below zero.[2] Consequently, every water-particle at the surface which is cooled by contact with the air must sink to the bottom of the sea through the entire

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[1] It is said among the fishermen that the herring *radiates* into the fiords.

[2] In the following table I give the freezing points and points of maximum density of sea-water of different specific gravity :—

homogeneous mass of sea-water at $+4°$ C. Therefore, the convection currents in the salt water which were in action on the coast during the fishery season prevented the surface temperature from sinking perceptibly. It is otherwise with the thin layers of Baltic water, which in fig. 3 are seen to overlap the bank-water. The density of such waters is so low compared to that of the salt bottom water, that the cooled particles from the surface cannot sink to the bottom, but remain floating upon the subjacent warmer layer. Thus every layer of the Baltic current is cooled through its entire mass[1] by contact with the colder atmosphere, as far as it can be cooled without freezing. The limit to which the water can be cooled without freezing is different for different kinds of sea-water, and depends upon the salinity. The salter water-layers of 27 or 26°/₀₀ can be cooled to about $-1·4°$ or $-1·6°$ C., while the fresher waters congeal if cooled to a lower temperature than $-1°$. Now, as I have already described, as the Baltic Stream proceeded northwards in January 1879, layers of fresher water overtook and overlapped the foregoing salter ones. If such a stratum of salter water, *e.g.* of about 26°/₀₀, which has been cooled by contact with the atmosphere to $-1·4°$ C., is overlapped by a layer of fresher water which has already been cooled down to its freezing point (say $-0·9°$ or $-1·0°$ C.), *ice will form from the fresher water at its surface of contact with the underlying colder water, and rise to the surface.*

This is, so far as I can see, the only admissible explanation of the singular phenomenon of the freezing of sea-water which took place on the 26th January off the Swedish coast. Scoresby first witnessed such a formation of ice in the Greenland sea, and described it as "pancake-ice," because plates or circular discs of clear ice were seen suddenly to rise to the surface from below with the edge upwards. An eye-witness describes the phenomenon as follows: "Every disc of ice comes with the edge upwards (in calm weather) to the surface, where it turns over and falls with a splashing sound flat upon the water. In the course of a quarter of an hour the sea may be covered for miles with a thick layer of such pancakes or lumps of ice." The fishermen of Bohuslän call such ice "bottom-ice," which is, as may be understood from the preced-

Specific gravity of water.					
$S\frac{0°}{+4°}$	$S\frac{0°}{0°}$	$S\frac{17·5°}{17·5°}$	Freezing point in C.	Maximum density at C.	Observer.[1]
1·00534	..	..	−0·35°	+2·9°	O. Pettersson.
..	..	1·00602	..	+2·43°	L. Weber.
1·00950	..	..	−0·64°	+1·5°	O. Pettersson.
..	1·01603	..	−1·1°	−0·44°	F. L. Ekman.
..	1·02084	..	−1·4°	−1·68°	" "
..	1·02424	..	−1·7°	−2·75°	" "
..	1·02831	..	−1·9°	−4·00°	" "

See O. Pettersson: *On the Properties of Water and Ice. Vega Expedition.* Stockholm, 1883. See L. Weber: *Über die Temperatur d, Maximaldichtigkeit für Wasser, etc. Jahresb. Kiel. Comm.* iv., v., vi., p. 3. See F. L. Ekman: *Om hafsvattnet i Bohuslän, etc. K. V. A^s. Handl.* Bd. 9, No. 4, p. 43.

[1] Because the thermal circulation in this case does not involve a transmission of heat from the surface to the bottom, but only from the surface to the lower limit of the same layer of water. Accordingly, the cooling effect of the air soon becomes perceptible.

ing, a wrong expression.[1] The ice does not come from the bottom but from an intermediate layer, as is clearly proved from observations at Måseskär and Wäderö between the 22nd and the 27th January. I will first discuss the surface observations at these places:—

Käringön (Måseskär).				Wäderöbod.			
1879. Jan.	Temp. Air.	Temp. Water.	Salt °/₀₀	1879. Jan.	Temp. Air.	Temp. Water.	Salt °/₀₀
22	− 8·17°	− 0·4°	26·0	22	− 7·5°	+ 0·2°	27·8
23	− 10·4°	− 0·8°	26·2	23	− 7·5°	+ 0·2°	28·6
24	− 7·5°	− 1·0°	26·2	24	− 6·2°	− 1·5°	29·1
25	− 6·0°	− 1·0°	26·2	25	− 4·6°	− 1·8°	28·9
26	− 7·2°	ice	ice	26	− 6·5°	− 1·0°	28·3 ice
27	− 5·0°	ice	ice	27	− 5·3°	− 1·2°	27·4 ice

It will be observed that the salinity of the surface water, which on the 23rd January (see fig. 3, Plate III.) was about 27 or 28°/₀₀ at Wäderö and 27°/₀₀ at Måseskär, remained almost unaltered during the following days. But the temperature sank at Wäderö from +0·2° to −1·5° and −1·8°; and from −0·4° to −1·0° at Käringön (Måseskär on the chart). Thus the surface layer had in the course of three days been cooled through its entire mass, so far as it could be cooled without forming ice, at both places. In the Wäderöbod journal it was noted that the sea was filled with ice which came up from the bottom on the 26th January. Then the temperature *rose* to −1·0° C. (from −1·8° on the preceding day), showing that the surface water contained less salt than before, which means that a layer of fresher water had on the 26th January overlapped the layer of 28 or 29°/₀₀, which was cooled to −1·8° the day before. For the temperature of −1·0° C. is not the freezing-point (or point of thermal equilibrium) of a mixture of ice and 29°/₀₀ water, but of a less saline water.

We can thoroughly grasp the situation if we suppose the surface layer of 26°/₀₀, which is seen in fig. 3 at Måseskär, to move beyond Wäderö between the 23rd and 26th January, and the water of 24°/₀₀, which occurs at Pater-Noster in fig. 3, likewise to move northwards beyond Måseskär during those days. Both water-layers would then be thoroughly cooled by contact with the atmosphere to their normal freezing temperature, and would, moreover, when they reached their destination, be *superimposed upon a layer of still colder water.* At the surface of contact,

[1] The "bottom ice" is much feared by sailors and fishermen. Their nets and boats are caught by the ice-pack which comes up suddenly from the depths, cutting them off from the shore. In January and February 1879 a number of ships were caught in this ice in the Skagerack and detained for weeks. Still greater danger and loss of ships was caused by the ice-pack in the Skagerack during the winter 1892-93.

then, ice would form. We may infer that this formation of ice, when it has once begun, will proceed rapidly, great masses of "bottom ice" being thrown up within a short time, because the subjacent colder layer can absorb the latent heat set free. *But the formation of ice is strictly confined to a certain niveau of the upper layers less than* 14 *mètres from the surface.* For at that depth the temperature was found to be $+1{\cdot}0°$ C. At the bottom, from which the pancake-ice is said to come, the temperature was $+4{\cdot}4°$ C., the depth being 30 mètres and the salinity $32{\cdot}3°/_{oo}$.

(*To be continued.*)

GEOGRAPHICAL NOTES.

By The Acting Editor.

ASIA.

Kafiristan.—On June 25th Mr. G. S. Robertson, C.S.I., read a paper before the Royal Geographical Society on Kafiristan (*Journal*, September), which he explained to mean "the land of the infidel," originally a term of reproach applied to the country by the neighbouring Mohammedans. Before Mr. Robertson made his first visit to the country in 1889 no European had ever entered it, except Sir William Lockhart, who, in 1885, crossed from Chitral into the upper part of the Bashgul valley, where he remained a few days, for M'Nair only reached some of the Kalash villages of Chitral, which he mistook for the true Kafiristan. Mr. Robertson was able to explore only a part of the country ; he traversed the whole of the Bashgul valley, and crossed into the upper part of the Minjan valley of Badakshan. He also examined the Kunar valley, and many of its side valleys, and penetrated into one of the inner valleys of Kafiristan, called Viron or Wiron by Mohammedans, and Presun by the Kafirs. Mr. Robertson's reception by the natives was not exactly cordial, for they do not like strangers to visit their country, but he was never actually attacked by them, and recovered any property that was stolen. On the whole, considering that the Kafirs are hereditary brigands and assassins, he thinks he was treated as well as he could expect.

Kafiristan consists of a series of main valleys, for the most part deep, narrow, and tortuous, into which a number of still narrower and deeper glens pour their waters. The passes that lead into Badakshan are certainly over 15,000 feet in height, and those on the Chitral side, though somewhat less elevated, are completely closed by snow in winter. And as the natives are thus cut off from the outer world, so also are the various tribes isolated from one another, particularly in winter, by lofty and rugged mountains. Some of the ravines are most picturesque and romantic, while others are bare rocky glens. In the lower parts fruit-trees abound, and horse-chestnuts and other large trees afford a welcome shade, while the hill slopes are covered with shrubs, wild olives, and evergreen oaks. Somewhat higher, from 5000 to 8000 or 9000 feet, grow dense forests of pine and cedar. Still higher the hills are rocky and nearly bare ; the willow, birch, and juniper are met with, and wild rhubarb grows abundantly.

All the rivers of Kafiristan drain into the Kabul river, either directly, or first emptying themselves into the Kunar river. The Ramgul and Kulam torrents in the west probably unite and reach the Kabul river through Lughman. The next towards the east, the Kti, unites with the waters of the Presun valley, and, after receiving the Wai, flows into the Kunar at Chigar Serai. The Ashkun river also probably joins the Kti and Presun. The Bashgul joins the Kunar just above the village of Arundo.

In Mr. Robertson's opinion the present inhabitants of Kafiristan are chiefly descended from the old Indian population of Eastern Afghanistan, who, refusing to embrace Islam, fled in the eleventh century to these retired valleys, where they found ancient peoples, whom they subjugated, or partially amalgamated with. These ancient peoples are probably represented by the Presuns, Jazhis, Arams, etc. There are three distinct languages, and hence the tribes may be divided into the Liah Posh ; the Wai, including probably the Ashkun, a mysterious people unknown even to the majority of Kafirs ; and the Presun. The affairs of the tribes are managed by headmen, called *jasts*, who have to go through certain preliminary ceremonies, chiefly consisting in feasting the people. The usual type of face observable among the Kafirs is distinctly good and pure Aryan, while the degraded types are either of the bird of prey kind, or a flattish nose and coarse features. The physique of the people is magnificent of its kind ; they are lightly built, and seem almost always to be in good training. The women are of low stature, and many are weakly-looking, but they have remarkable powers of endurance. The commonest dress, worn by the poorest classes, is a goatskin confined at the waist by a leathern strap. The favourite dress among the well-to-do is a coarse cotton shirt and trousers, a brown Chitrali or black Minjani robe, brown soft leather boots, and sometimes footless Chitrali stockings. But the national garment, always worn by the women, is a tunic of brown cloth reaching to the knees, and girded at the waist by a flat dark red cord. It is edged with red at the bottom, and is sleeveless. The religion of the Kafirs is idolatry, with traces of ancestor worship.

Central Asia.—In August 1893 Captain Roborofsky and Lieutenant Koslof started from Okhotnichy along the Tekes, which they crossed towards Gilian, lying at an altitude of 4900 feet above sea-level. They then followed the Tekes for a distance of sixty miles, leaving the heights of Atan-ula on one side and crossing again to the right bank. The inhabitants—Eleuts—hunt and rear cattle, and are to a slight extent engaged in agriculture, planting small fields with barley and millet. The cattle and dairy products find a market in Kulja and Kashgaria. After crossing the Tekes, the party marched to its large tributary, the Kok-su, and came to the valley of the Kapsalan-su. Here they entered the territory of the Kirghiz. The heights of the Karajun were then crossed at an elevation of 9000 feet. The northern slope is clothed with forest broken by fertile meadow-land. The wooded gorge of the Mukhurdai-su led the travellers up to the glaciers descending from the peak of the same name, which rises to the height of 12,000 feet. On the northern slope the snow descends to a height of 11,000 feet, and butterflies and midges were observed on it. The Jerghalan was next visited, and one of its tributaries followed to a glacier descending in a precipitous fall of 200 to 230 feet. The Sary-tiur, a mountain over 11,000 feet high, is covered with a layer of red sand and small round pebbles derived from the weathering of the conglomerate. The northern slopes are bare, but on the southern side grow saxifrage, reeds, etc. The descent leads to the Kok-sai-su. To the east of the Sary-tiur there is a marked difference in the meadow flora : the broad-leaved grasses, hellebore, geranium, and leeks disappear, and their place is taken by various kinds of gentian and reeds. Here, too, pinewoods are no longer to be seen. After crossing a low range of conglomerate hills, Captain Roborofsky came again to the Kok-su, which here flows eastward over a bed of red conglomerate. He soon left this river, and, crossing the Karagai-tasnyn-daban, came to the valley of the Great Yuldus, which gradually widens out towards the east, and is bordered to the north and south by lofty snow-covered mountains. The Great Yuldus was at a remote period a large alpine lake, of which the Little Yuldus formed a part. The waters of the lake burst through the wall of mountains on the east, and the river Khaidyk-gol, flowing through the Great Yuldus from west to east, eroded a narrow rocky gorge through the mountains 12,000 feet high. The river bed lies 5000 feet below the level of the surrounding country. The mountains on the north, partly covered with snow, contain several easily accessible summits: their southern slopes have very little vegetation. On the south three routes lead from the Great Yuldus to Kashgaria. The absolute height of the Great Yuldus is about 8000 feet. The vegetation is luxuriant, and the fauna fairly abundant. The inhabitants are Torguts who migrated from the Volga more than two hundred years ago. They hold no communication with other tribes, except the few traders—Dungans and Sarts—who visit the valley. They possess large herds of horses and flocks of sheep; they have few cattle, and hardly any camels.

While Koslof travelled over the Kok-teke southwards to Kashgaria, Roborofsky proceeded eastwards, entering the district of the Dalyn-daban, or seventy summits, through which the Khaidyk-gol has cut its gorges. The ravines are clothed with pines, and high up among the slates, which crop out everywhere, good pasture-land is found up to an elevation of 10,000, or sometimes even 12,000, feet. After a march of sixty miles the country began to slope down towards the east, and the fauna and flora changed their character. Thirty miles farther the river Zagan-usu, a tributary of the Khaidyk-gol, rising in the mountains to the north, crosses the route; and here the latter river emerges from its narrow gorge, and, dividing into several arms, forms a number of wooded islands. Twenty-five miles from the Zagan-usu lies the Chubogorin-nor, below the level of the river, and watered by artificial channels. Torguts from the Yuldus live here, and cultivate millet, wheat, barley, hemp, melons, and vegetables. This valley, stretching far to the east, is the dry bed of a lake, part of which still exists under the name of Bagrash-kul.

At the river Ulastyn-gol Koslof joined Roborofsky again, and the two travellers marched at first eastwards and then northwards to reach the Algo river. It flows in a deep ravine, now expanding and now contracting, and its banks are clothed with poplars, willows, roses, and other bushes. Cattle are numerous, and the fauna is very varied. At length the river emerges on to the steppe and separates into several branches choked with tamarisks and reeds. Soon, however, it vanishes into the earth, the vegetation ceases, and a dry bed filled with water during the melting of the snow is the only indication of the existence of a river. At the village of Ilianlyk the water is drawn up to irrigate the extensive fields. Here begins the Liukchun oasis. On October 15th the expedition arrived at Toksun. The water-supply is drawn from the river Davan-chin-su, which descends from the Davan-chin-daban, a range on the way to Urumchi. At Liukchun a meteorological station was erected, and Roborofsky proceeded to survey the depression. The hollow is about 100 miles long from west to east, and 45 to 50 broad from the southern spurs of the Thian Shan to the Chol-tagh. The south-eastern part is a perfect desert; the western is watered by channels from the Subash and Algo, and is fairly fruitful. A number of springs are situated in the hollow, the water of which usually stands three feet below the surface, but rises in winter and forms brooks. Ruins are numerous; at Assa-Shara are the remains of an old fort, and between Turfan and Liukchun stand the ruins of the old town of Idygot. The present inhabitants of the oasis are Mohammedans, known to the Chinese as "Chaitu"; they are of Turkish origin and speak Turkish. They grow millet, wheat, barley, cotton, tobacco, vegetables, and fruits, especially peaches, apricots, mulberries, walnuts, pears, apples, and jujubes. At Tuyok, eight miles to the west of Liukchun, grapes are grown for raisins.

Koslof, as mentioned above, left the main expedition at the junction of the Great and Little Yuldus to cross the Tsin-dyr-ulu, named on maps Kok-teke, into Kashgaria. After a march of twenty miles he came to a ridge 1000 feet in relative height, which hems in the rapid Khaidyk-gol, and two days later reached the confluence of the Kiuiukiunnuk and Zagan-sala. Following the former, he found a glacier which he could climb only to the height of 12,270 feet. Returning to the confluence, Lieutenant Koslof followed the main stream downwards; it is a tributary, and probably the most important, of the Yuldus (Khaidyk-gol). The weather during the march was, on the whole, favourable; the thermometer marked 41° to 60° F. in the evening, and sank below freezing-point at sunrise, while at one o'clock in the day it stood at 68°. Marching in a south-south-westerly direction from the Yuldus valley, Koslof reached the summit of the Kok-teke, 14,000 feet high. Both slopes were extraordinarily steep, and the descent was attended with great difficulty. On the northern side are forests—pines, and at the foot cork, elms, and willows; but the southern slope is very poor in vegetation. As the party descended they found more abundant vegetation; the bush was full of berries, a favourite food of the bears, of which there are three kinds—black, white, and grey. Over the Sasyk-daban and the district of Aikamysh, Koslof came to Bugur, an oasis of 2320 inhabitants, chiefly Sarts, situated on the high road from Kucha to Kurla. The oasis is seven miles from east to west, and thirteen miles from north to south. It is drained by the river Dinar, which is connected through the swampy hollow, Chajan, with the Tarim. In Bugur the thermometer indicated 104° F. in the shade at one o'clock. The return journey was made by Kurla and the Shikshin settlement, a tract twenty-five miles long by twelve broad, watered artificially from the Khaidyk-gol.

On September 23rd Lieutenant Koslof made another excursion, this time north-westwards up the river Narin-kurgut-gol and its tributary, the Kharkhat-gol, ascending the Beergin-daban, which has an elevation of 13,450 feet: the thermometer stood at $16\frac{1}{2}$° F. in the shade. The descent of the Beergin-daban was still more difficult, steeper and more rocky than the ascent. In the plateau that was then crossed the head-waters of the Algo collect into lakes at an elevation of 11,200 feet. The largest of the lakes has a circumference of about two miles. After the exploration of the Upper Algo, Lieutenant Koslof joined the main expedition again, only, however, to leave it at Toksun for Kizil-Synur. Marching south-eastward, he emerged from the southern spurs of the Chol-tagh into the depression of Kumy-shin-tuse, thirteen miles broad, overgrown with reeds, tamarisk, and saxaul, where antelopes, hares, and small rodents were abundant. Then, passing round the Karaksyl ridge, he came to the Karaksyl-tuse, a hollow thirty miles long by twelve broad, and, crossing the Igerchi-tagh, 4600 feet high, came to other depressions, and by the Kizil-tagh and Kuruk-tagh reached Kizil-Synur, 150 miles from Toksun, lying at an elevation of 4600 feet. It is a fertile oasis, and enjoys an excellent climate. In the neighbourhood is found a wild camel (*Camelus bactrianus favus*). Lieutenant Koslof returned to Liukchun across mountain ranges running from north-west to south-east, valleys covered with reeds and tamarisk, and barren wastes.—*Petermanns Mitt.*, Bd. xl. No. 5.

From the *Izvestiya* of the Russian Geographical Society, No. 1, 1894, we learn that the salt lake Bojaite, which occupies the lowest part of the Liukchun hollow, is about 330 feet below Turfan, and as the latter is about 160 feet below sea-level (see vol. vii. p. 378), this depression reaches a depth of nearly 400 feet below the sea.

In the next number of the *Izvestiya* is another letter from Captain Roborofsky, in which he continues his narrative. Marching across the desert he came to Bugass, 26 miles south of Khami, on the river of Khami, which he followed westwards for 65 miles to the lake Shon (Shar ?) Nor. This lake, a mile and three-quarters long by one and a quarter broad, occupies an eastern prolongation of the Liukchun hollow, and lies about 300 feet below the level of the sea. It is smaller than usually represented on maps, and lies a little farther to the north. The lake Kana-chi or Koara Nor, which M. Roborofsky visited from Sa-chau, is also misplaced. It lies only 10 miles from the meridian of Sa-chau, and is nearly 10 miles in length. Of the country between Liukchun and Sa-chau, M. Roborofsky says that it is a highland tract 80 to 100 miles long, of an average absolute height of 4500 feet, with a longitudinal valley in the middle. On the north of the valley lie the parallel ranges of the Chol-tagh, and on the south ranges rising to an average height of 6000 feet, named the Kuruk-tagh. The Chaitu between Toksun and Khami know no other name than Chol-tagh (desert, waterless mountains), and the Lob Nor tribes, who are acquainted only with the latter range, call it Kuruk-tagh (dry mountains). The Chinese living on the southern slopes of the Thian Shan call them the Nan Shan (southern mountains), while those living on the northern slopes of the Kuen Lun name them the Pei Shan (northern mountains). *Conf.*, vol. vii. p. 378.

AFRICA.

Sierra Leone.—The Administrator of the Colony, Colonel Cardew, C.M.G., made in the spring of this year a tour in the *Hinterland* of Sierra Leone. The route chosen passed by Waterloo, Ro Tofunk, Taiama, and Monghierri to the Konno country, and thence northwards to Kintiballia in Kuranko and on to Fallaba in Dembellia. From there the party marched through Warra-Warra Limba to Samaya in Tambakka, and Tokuna in Tonko Limba to Robat, on the Great Skarcies river, where they embarked on a steamer which took them back to Freetown. In the Konno country the results of the recent Sofa raids were painfully conspicuous in ruined huts and districts totally depopulated. The slave trade is still rife, and several slaves were released by the Administrator. Waima (not Warina, as usually spelt), the scene of the collision between British and French troops, was visited and the graves fenced in. Beautiful flowers were seen all along the route, and the natural vegetable products were very abundant. In the Konno country palm nuts were plentifully strewn along the track, and the rubber vine hung in graceful festoons from the trees. Here, and in Kuranko, travelling was extremely difficult through strangely contorted mountains and deep ravines, clothed with tall forest trees. Several wide rivers were crossed, as the Bafi, the Bagweh, and the Seli, an affluent of the Rokel. Where the Bafi was crossed, it was 120 yards wide and choked up with huge boulders, so that the water that roared beneath was quite invisible. Swamps and quagmires are very numerous, no fewer than one hundred and seventy-one being passed in six days on the march from Waima to Kamaror. Enormous quantities of granite were observed; gigantic masses, boulders, and blocks were everywhere, and entire hills of bare grey granite were frequently crossed. The only plant which appeared to thrive around the bare granite, where there was a sprinkling of soil, was the pine-apple. In Dembellia the country was less mountainous and more populous. The Mohammedans of Limba are a tall, fine race, living in well-built houses, and cultivating the soil systematically; but as regards slaving propensities, they are as bad as any less civilised tribe.

The richness of the country is visible in its natural vegetable produce. Its mineral wealth is yet unexplored, but as quartz is plentiful, it is probable that gold may be found in the interior as well as in other parts. The great drawback is the want of means of rapid communication.

German South-West Africa.—The geography of the German territory is sketched by Dr. Karl Dove in *Petermanns Mitt.*, Bd. xl. No. 3. Damaraland has been usually described as a country of plateaus and terraces. This is true of the southern part, lying between 21° and 23° S. lat., in so far as this region rests on a huge base rising from the coast up to the 17th meridian of E. long.; but it is a mistake to consider this extensive country as a succession of elevated plains. Innumerable summits and a large number of regular chains attain to a considerable height above the general level. To the north-west of Otyimbingue, in the neighbourhood of Ubib, they rise to 1000 or 1300 feet, and the Awas mountains south of Windhoek have an altitude of 1300 to 2000 feet. Between the ranges are certainly some level tracts, but not of sufficient extent to give the land a plateau character. Only to the east of 17° E. long. and south of 23° do the plains stretch farther than the eye can reach. In some parts the whole country is filled with gentle undulations, as in the Khomas district on the Upper Kuiseb, where the differences of level range from 300 to 600 feet. The base on which these varieties of landscape are to be found rises gradually to the Awas mountains in the south-east and the adjoining uplands, the most important watershed in the German territory. Southern Damaraland may be divided, with regard to its vertical configuration, into four districts following one another from west to east, and in other respects constituting independent geographical provinces. The land of the Bastards of Rehoboth forms a fifth division, though it possesses many points of similarity with the most eastern parts of Damaraland.

The littoral of Central Damaraland consists of plains gradually ascending towards the interior, and, except in the river valleys, has a desert character. Its breadth to the east of Walvisch Bay is about 30 miles. Beyond, after a belt of firs 5 or 6 miles broad, succeed gradually rising plains of coarse detritus, passing into the stony country of the Lower Tsoachoub (or Swakop). The valleys are deeply eroded, the Tsoachoub having excavated between Usab and Kanikontis a cañon with almost perpendicular walls 400 to 650 feet high. The transition to the plateaus of the interior is only marked by the change of vegetation. Where a scanty covering of grass replaces the *Welwitschia* and the stunted flora of the desert, and the ground is occasionally moistened with showers, begins the zone of steppe leading to the high and better-watered highlands of the interior. For a long distance to the north of the Tsoachoub the moving sandhills, which render the passage from Walvisch Bay into the interior so laborious, are totally absent. At the mouth of the river they never exceed a breadth of 400 yards, being yearly swept away by the rushing stream, and therefore the coast is reached without difficulty from the last watering-place, which, indeed, is only a few hours' journey from the coast.

The western steppe forming the slope of the huge pedestal supporting the ranges and highlands of Damaraland rises from an elevation of 2300 feet on the west to nearly 4600 on the east (16½° E. lat.). The change of level is perceptible in the fall of the streams, and these, with their deep channels, together with the numerous solitary summits and steep chains, give variety and some charm to the landscape. The valleys have not been excavated solely by the action of rain and the erosion of the streams, many of which seldom carry down sufficient water to undermine the rocks, but owe their formation in great measure to fissuring caused by the great changes of temperature between day and night. At the end of the winter of 1892, Dr. Dove noticed in the valley of the Middle Tsaochoub a range of

38° F., and in the middle of the winter of 1893 on the Usib river the difference was 43° F., while in the narrower valleys the variations are still more considerable.

The principal elevations of Southern Damaraland—the drainage area of the Upper Tsaochoub and of the upper course of the Kuiseb—though their absolute height is considerable, have less the character of lofty mountains than of a hilly country and undulating plateaus. Yet the relative heights, though surpassed in other individual parts of the territory, are on the whole so great, and the whole country has such a considerable mean elevation above the sea-level, that it must be considered the most important elevated mass between the Cape and the Kunene. It consists of two divisions—the drainage basin of the Otyizeva, a southern tributary of the Tsaochoub, and the Khomas highlands, the source-region of the Kuiseb. The former begins where the Khomas highlands join the Awas range, and runs north and south in a narrow belt, the broadest section of the basin, near Windhoek, having a breadth, from east to west, of only 18 to 22 miles. The whole country is occupied by a series of undulations with a general strike running south-east and north-west. The rivers of Otyizeva and Windhoek fall very gradually towards the north, the valley at Windhoek being 5250 feet above sea-level, and at Otyizeva, 25 miles down the stream, 5090 feet; and, consequently, a considerable quantity of water is found in the valley just below the surface of the ground, even in the dry season.

The Khomas uplands are of a very different formation. They consist of rolling plains bounded on the south and west by a strip of level country. On the west the outer terrace (5600 to 5900 feet high) sinks rapidly to the middle course of the Kuiseb and to the mountains east-south-east of Otyimbingue; to the south the country slopes down to the land of the Rehoboth Bastards in flat terraces, and only at the north and east, in the direction of Windhoek and the Otyizeva river, is the descent from the highlands effected by a series of gradually decreasing ranges. The elevated country thus bounded consists of undulations lying 6200 to 6500 feet above sea-level and never exceeding an elevation of 500 feet above the intervening valleys. The only rivers which, even in South Africa, are worthy of the name are the Haris and the upper course of the Kuiseb, but the erosive action of the small rivulets is very remarkable.

The drainage basin of the Elephant river begins 10 miles to the east of Windhoek with a number of low undulations running from south-east to north-west, of an average elevation near Windhoek of 5900 feet, and gradually disappearing eastwards. The river, a tributary of the Nosob, has its head-waters in some of the most rainy country of German South-West Africa, and therefore carries a fair quantity of water; some of its numerous side valleys send subterranean streams down to the main river, which, in some places, appear on the surface as springs.

To the south of the Haris the Khomas country rises into low mountains, of which the western ridges merge into the Awas mountains. In this direction they form the watershed between the Elephant and Schaf rivers, and from this elevation the country sinks in terraces to the south. About half-way to Rehoboth, between Kransneus and Nanas, a group of mountain ranges rises suddenly from the low lands, and beyond lies a plain 4600 to 4900 feet above sea-level, bestrewn with isolated summits and ridges. In its northern terraces the land is well watered, and with the valleys of lesser Rehoboth river, the broad Usib, and the Schaf or Mantye forms the most northern part of the basin of the Great Fish river. The Usib passes through the range mentioned above for a distance of 20 miles in very winding reaches, and therefore, though the route by its banks is the shortest between Rehoboth and Windhoek, it is seldom used, as the country to the west has less change of level.

AUSTRALASIA.

Humboldt Bay and the Santani Lake.—A missionary, Heer Bink, visited this part of New Guinea in the autumn of 1893. The country around the bay is very beautiful. The hills are not high or steep. An inner bay is cut off from the outer by a low strip of land. No rivers enter the sea in the neighbourhood of the bay. Four native villages are situated near the sea, all the inhabitants of which are subject to one chief, whose commands they implicitly obey. The young men are well built and have pleasant countenances, and some of the girls have really handsome features. Clothes are hardly worn at all, except by married women, who dress in a short skirt of bark. Ornaments are much used ; rings of tortoise-shell are worn in the ears, and strings of beads are highly valued. The men have the bone of the nose pierced, and thrust in a bit of wood, bamboo, or bone. Young men have the hair on the sides of the head cut off. At the feasts, the men's faces are painted black and red. The men build the houses, make *prauws*, attend to the plantations, fish, and make nets, while the women prepare the food and make pottery. Heer Bink made an excursion to the lake Santani, a march of five hours to the south-west. The hills, the highest of which was 500 feet high, were clothed with *alang-alang*, and bushes grew in the valleys. The lake is about as large as Humboldt Bay. Its water is very good for drinking, and fish is very plentiful in it. The Cyclops mountains are visible from the lake, and the northern shore, especially towards the east, is skirted by fairly high mountains. To the south-east is a place named Rusman, whence are brought the stones which the natives make into hatchets, and with which, as well as with tools of shell, they carve wood with considerable skill. A naturalist might spend a couple of months here with great advantage, and would easily purchase the goodwill of the natives with some beads, axes, and cutlasses.—*Tijdskrift van het K. Nederl. Aardrijksk. Genootschap*, Deel xi. No. 2.

MISCELLANEOUS.

The French traveller, **M. Dutreuil de Rhins**, was murdered on June 5th by a Tibetan horde at the river Tung-tien, while on his way to Si-ning.

Captain Lugard has entered the service of the Royal Niger Company, and has started for Akassa to take command of an expedition to Lake Tsad.—*South Africa*, August 18th.

A bill has passed through Congress by which **Utah** becomes one of the states of America, the forty-fifth. Bills have also been submitted to Congress for the purpose of raising New Mexico and Arizona to the same rank.

Observations of **temperature** have been made on the summit of **Mount Etna** by Professors Ricco and Saija, of Catania, with self-recording instruments. The observations were commenced on August 27th, 1891, and since then the highest temperature recorded was 61° F., on September 2nd, 1892, and the minimum $-13{\cdot}5°$ F., on March 2nd, 1894. As a rule January is the coldest month and August the warmest. The mean daily range is 2·9° in winter and 12·2° in summer, and the annual mean temperature is 1·9° F.—*Globus*. Bd. lxvi., No. 9.

The arrangement with the **Congo State** reported on page 374 has since been modified. In answer to a protest from Germany, Great Britain has resigned the lease of the strip of territory between Lakes Tanganika and Albert Edward. The Congo State has agreed not to occupy the territory offered in lease by Great Britain farther north than 5° 30′ N. lat. An agreement has been made with France by which the boundary of the Congo State is to follow the bed of the Mbomu from its confluence with the Mobangi to its source, and then cross the watershed of the Congo and Nile to the eastern limit of the State in long. 30°.

Most of the members of the Society are doubtless aware that an **International Geographical Congress** is held from time to time for the discussion of important geographical problems. The sixth of these meetings will take place in London during the first week of August 1895, and it is hoped that all who take an interest in geographical science will combine to make it a success. The subjects proposed for discussion will be of wide importance and permanent interest, and will be selected from all branches of the science. Problems relating to colonisation will probably be dealt with in some detail, and therefore those interested in the colonies are specially invited to attend. A circular will presently be issued giving full details as to arrangements, division of subjects, etc.

An organising committee has been formed, with Major Leonard Darwin, M.P., as Chairman, and Mr. Scott Keltie and Dr. Mill as secretaries. Mr. Faithfull Begg represents the Royal Scottish Geographical Society.

NEW BOOKS.

Scottish Gypsies under the Stewarts. By David MacRitchie. Edinburgh: David Douglas, 1894. Pp. viii + 123.

In this work Mr. David MacRitchie, the accomplished editor of the *Gypsy Lore Journal* (3 vols., 1889-92), has made a contribution of great value to the social history of Scotland, and his readers would willingly have welcomed a much larger book giving a complete history of the gypsies in Western Europe. We hope that Mr. MacRitchie may give this to the world at some future day, but meantime we have to thank him for a monograph of exceptional interest, written in excellent English, full in learning and fairly argued, and having the merit, nowadays rare, of being entirely original. For Mr. MacRitchie's gypsies wear the sober colour of reality, in notable contrast to the sham-picturesque gypsies of some recent Scottish novels. The whole forms a singular chapter of Scottish criminal jurisprudence, with extraordinary alternations of leniency and severity, from the remarkable privileges granted by James v. in 1540 to John Faw, "Lord and Earl of Little Egypt," down to the stern edicts of 1576 and 1579, and 1611-17. During the seventeenth century many gypsies were deported to Virginia, Jamaica, and Barbadoes, there doubtless to add a strain of strange blood to the population. It is by no means easy to trace the thread of identity with the Saracens in Galloway, the Moors, Tinklers, Cairds, Faws, etc., and Mr. MacRitchie shows all due caution in generalisation, while yet inclining to the belief, not only that all the later varieties under whatever designation were more or less pure gypsies, but that long before the fifteenth century gypsies existed in Scotland, although not formally designated as Egyptians until that date. Not the least interesting of his chapters is that on the gypsy strolling players who acted at Roslin Castle every summer about the latter part of the sixteenth century. But the most attractive figure in this delightful book is that swaggering blackguard, "Captain William Baillie," whose brave career of "sorning," "masterful oppression," and "masterful begging" would have given a rich subject to the pen of Defoe or Fielding.

The Story of the Nations: South Africa. By GEORGE M. THEAL, of the Cape Colonial Civil Service. London: T. Fisher Unwin, 1894. Pp. xx + 398. *Price* 5s.

The latest addition to *The Story of the Nations* series is a volume on South Africa, by Mr. George M. Theal, of the Cape Civil Service, author of a complete *History of South Africa* in five volumes, and of a *History of the Boers in South Africa.* Though South Africa cannot be called in any strict sense a "nation," it possesses a "story" which is full of a peculiar interest; and that story is very appropriately recalled at the present time, when the different colonies and states of South Africa have come to hold so prominent a place in the eyes of the world, and especially in those of the British people. Mr. Theal possesses some undoubted qualifications for the task he has undertaken. His unquestionable knowledge of South African affairs is only equalled by his deep interest in them, and by his sympathy with the aspirations of the colonists. He possesses, moreover, a very fair and judicial mind, which saves him from partisanship, and enables him to mete out praise and blame with equal impartiality. He always writes calmly and temperately—too calmly and too temperately, some readers will think. His narrative seldom glows, and his style never rises into picturesqueness. The scenes of Isandlwana, Rorke's Drift, and Majuba Hill are described with the cold and passionless precision of a statistician.

The story, nevertheless, abounds with points of interest. Regarding the aborigines of South Africa Mr. Theal has nothing new to say, and no time is wasted on prehistoric speculations. His narrative begins within the region of historic fact, with the discoveries of Bartholomew Diaz and Vasco da Gama. This is followed by a history of the Cape Settlement as a Dutch colony, first under the Dutch East India Company, and subsequently under the Batavian Republic. Then the British come upon the scene, first as the rivals of the Dutch, and afterwards as their masters; and the various steps are noted by which a Dutch was turned into a British colony. The story of the expansion of the colony, of the development of its resources, of the conflicts with the native races, of the founding of the Orange Free State and the Transvaal Republic, of the discoveries of diamonds and gold, of the advance of railways and the growth of cities, is told with careful particularity and accuracy; and the book may safely be consulted by those who wish to have in brief form the leading incidents in the recent history of South Africa. There are some very good illustrations.

Le Continent Australe; Hypothèses et Découvertes. Par ARMAND RAINAUD, Professeur Agrégé d'Histoire et de Géographie. Paris: Armand Colin et Cie, 1893. Pp. 487.

The various hypotheses and discoveries connected with a Southern continent play a very large part in geographical speculations from the earliest periods down to our own time. Aristotle admitted that there must be a Southern Temperate zone, corresponding to the Northern Temperate one in which the known habitable world was situated. There were many speculations as to whether this land was inhabited or not. Pomponius Mela speaks, as an undoubted fact, of the existence of Antichthones or Antipodes inhabiting continental land in the Southern Hemisphere; but he held that these people were inaccessible owing to the intervening torrid tract. This opinion prevailed throughout the Middle Ages. The voyages of the Portuguese along the west coast of Africa during the fifteenth century gave a death-blow to the idea of an impassable fiery zone, for in 1486 Bartholomew Diaz not only crossed this zone but proceeded farther and doubled the Cape of Good Hope. A few years later Amerigo Vespucci announced the discovery in the Southern Hemisphere of an inhabited land, a fourth part unknown to the ancients. These great discoveries, together with the circumnavigation of the world by Magellan, had a profound effect on men's minds. Still, Ptolemy's geographical ideas prevailed during the Renaissance period, and the existence of a great extent of land around the South Pole was believed in down to the time of James Cook. Some geographers of the eighteenth century regarded this continent as equal in extent to the whole civilised part of Asia, and to contain fifty millions of inhabitants.

In the work before us we have all the opinions and all the discoveries bearing on the search for a great Southern Continent collected with great care and with full references. The various views and discoveries are likewise criticised with great judgment. The work is most readable and full of interesting matter.

In conclusion, the author seems to doubt the existence of any Antarctic continent; but he may be assured that the *Challenger's* dredgings have shown that there must be a true Antarctic continent, although we have very scanty information as to its extent.

Travels amongst American Indians, their Ancient Earthworks and Temples; including a Journey in Guatemala, Mexico, and Yucatan, and a Visit to the Ruins of Patinamit, Utatlan, Palenque, and Uxmal. By Vice-Admiral Lindesay Brine. London: Sampson Low, Marston, and Co., 1894. 38 illustrations, 10 maps and plans, pp. 430. *Price* 21*s*.

An author is no doubt at a considerable disadvantage in publishing a record of his travels a quarter of a century after they were made. The unreasonable public hankers after information up to date, and is apt to contemn such antiquated notes. To do so in this case, however, would certainly be unjust, for Central America is still so rarely visited that the difficulties and hardships encountered by the Admiral in his ride across Guatemala and Yucatan would doubtless be the same for any traveller who essayed the same route in 1894.

The contents of this well-illustrated volume are extremely multifarious. The Admiral took an intelligent interest in everything. He has a word on the origin of coral reefs and on the prehistoric shell-mounds of Maine and Florida. An inscription at Dighton, supposed to be old Scandinavian, excites his attention. He goes out of his way first to visit and describe beaver dams, lodges, and canals, then to inspect the old copper-workings on the shores of Lake Superior. The mounds and enclosures of geometrical outline in Ohio are carefully described and commented upon, as well as the native traditions regarding them. The customs of the Red Indians, their religious beliefs and human sacrifices, were an unfailing source of interest, and receive due notice. Nor does he fail to note the habits of the prairie dog, of the rattlesnake, and the useful services of the common hog. It seems that the native Indians of Guatemala and Yucatan have never been thoroughly Christianised, and still perform in secret many idolatrous practices. The priests have little power over their flocks, and do not pretend to know much about them. The chapters on the great ruins at Utatlan, Palenque, and Uxmal are well worth perusing. These places were built by the Toltecs, the descendants of the Ohio mound-builders, that are supposed to have arrived in the north of Mexico about the seventh century, and then to have migrated southwards to Guatemala and Yucatan. The Aztecs arrived about the twelfth century. But a mystery still hangs over the origin of the civilisation that built these wonderful structures—one that will not readily be dispelled.

The Literary Associations of the English Lakes. By the Rev. H. D. Rawnsley. 2 vols. Glasgow : James Maclehose and Sons, 1894.

Canon Rawnsley has evidently fulfilled a congenial task. Himself a poet and a dweller in the land of mere and mountain, he has collected with loving enthusiasm memories of the host of celebrated men who have sojourned in the Lake District. Though borrowing largely, perhaps too largely, from published sources, the book contains many extracts from private letters, many personal recollections of the writer and his friends, while not the least interesting pages are those describing the scenery whose beauty could bewitch even city-loving Lamb.

The feature of the book, indeed, is its local colour. So faithfully and exactly, and withal so poetically, are the country and its inhabitants portrayed, that with Carlyle we stand on the summit of Great Gable, we climb with Southey the steep slopes of Skiddaw to kindle the bonfire which shall tell of Waterloo, or wander over heath and meadow with "owd Wudsworth o' Rydal" and his sister Dorothy. "Lile Hartley," beloved of all who knew him, and little dark De Quincey live again in these pages, which also bring vividly before us the giant figure of the "yaller-haired" professor, "warstling" with the dalesmen at Wastdale Head, or watching in his turf-laid dining-room at Elleray the warfare of the rival cocks.

The admirable division of the work, by which the associations of each portion of the district are grouped together, as well as the map and most exhaustive index, will specially commend it to the traveller. Indeed it is eminently fitted to be a companion in the land haunted by "great ghostly presences," the beautiful land of the English Lakes.

L'Isola delle Donne. Viaggio ad Engano. Di Elio Modigliani. Milano : Ulrico Hoepli, 1894. Pp. 312.

The explorations of Signor Modigliani have often been noticed in these pages, and his book, *Un Viaggio a Nias*, was reviewed a few years ago. It may be remembered that in 1891 his work in the forest of Si Rambé, south of the Toba lake, was interrupted by the Dutch officials. It then occurred to him that Engano might offer attractions to the explorer and naturalist, and, after overcoming many obstacles, he landed on the island in May.

Signor Modigliani devotes a chapter to notices of the island by former European travellers. The designation "Isola delle Donne" is founded on a belief, long held in Sumatra, that Engano was inhabited solely by women. The same myth is related by Pigafetta of the island Ocoloro, supposed by Yule to be identical with Engano. Perhaps the Portuguese Diego Pacheco, in 1520, was the first European to set foot on Engano, and gave it the name because he was disappointed at not finding gold there, or was disgusted at the hostile reception he met with from the natives. In the present century the island has been visited by a few naturalists and Dutch officials, but none seems to have remained long enough to examine thoroughly the natives, fauna, and flora.

The Enganese, owing to immorality, insufficient food, and other causes, are fast approaching extinction, and it is fortunate that their mode of life and customs have been recorded. In physical characteristics they differ entirely from the Bataks of Sumatra and the natives of Nias, while they exhibit a marked similarity with the Nicobarese, build conical huts of much the same style, and have many similar habits and customs. The fauna also exhibits a marked affinity with that of the Nicobars, and after examining the specimens brought home by Signor Modigliani, Professor Vinciguerra supports the opinion of Doherty that the Andamans, Nicobars, Nias and Engano are the remains of an ancient continent or peninsula.

A volume which throws some light on such important problems must be of great interest to the ethnologist and naturalist. A bibliography at the end of the book will be of great service to the student.

Sierra Leone after a Hundred Years. By the Right Rev. E. G. INGHAM, D.D., Bishop of Sierra Leone. With many Illustrations. London: Seeley and Co., Ltd., 1894. Pp. 368.

The first settlers in Sierra Leone arrived from London in 1787; and now that a hundred years are past, Bishop Ingham takes up his pen to contrast between the beginning and the end of the hundred years, and to indicate the progress made—to bring out as forcibly as possible the features and circumstances of the present.

The author has, we may say, divided the book into three parts: one contains copious extracts of considerable interest from the diary of the first governor of the colony, John Clarkson; another deals with the Church Missionary Society's efforts in Sierra Leone; and the people, their manners and customs, are depicted in a third division.

The author wishes to enforce the conclusion that "men like John Clarkson, of his disinterested zeal and conscientiousness, are greatly needed *now*, not only among Englishmen, but also among Africans, if the objects and aims of a hundred years ago are not to be utterly ruined."

Governor Clarkson's diary is of considerable interest, and well illustrates the condition of affairs in the young colony. The C.M.S. enterprise in Sierra Leone is briefly detailed, and it is shown that over a hundred missionaries of both sexes have died in the colony, or in connection with the mission to Sierra Leone.

Their labours have not been in vain, however, as is abundantly proved in the volume before us. The present condition of the colony and its people is well given, and the book will be read with interest by all students of African affairs. The illustrations are fair.

A travers le Monde. De ci de là. Par ARTHUR DE CLAPARÈDE, Docteur en droit, etc. Genève: Georg et Cie.; Paris: Librairie Fischbacher, 1894. Pp. 419.

M. de Claparède has collected in these pages various articles contributed to the Swiss journals and reviews during the years 1880 to 1893, in which he recorded his impressions and observations of many widely separated countries. Though his travels did not carry him into unfrequented regions, he has compiled a very interesting book, containing much that the ordinary traveller would have failed to notice. The descriptions, without being diffuse, are enlivened by many light touches, historical notes, comparisons, and illustrations; and, while the style is popular, the name of the author is a guarantee of the accuracy of the information.

Promenade Historique dans Paris. Par EDOUARD FOURNIER. Paris: E. Dentu, 1894. Pp. vii + 427. *Price* 5 *f.*

This book, though useful as a summary of the growth of Paris, is on the whole somewhat disappointing. Paris resembles Edinburgh in its wealth of romantic and historic associations, and in the survival of the picturesque ancient city side by side with the prosaic modern capital. M. Fournier has written a careful and minute account of the boulevards, streets, churches, *hôtels*, and other features of Paris. But his method is conscientious rather than picturesque, and even in dealing with Old Paris and the Quartier Latin the old-world charm is lacking, though much valuable historical information is accurately given. The volume needs to be supplemented by a plan of the city.

En Dahabièh du Caire aux Cataractes. By JOSEPH JOÛBERT. Paris: E. Dentu, N.D. Pp. 470, index, and nine woodcuts.

Although M. Joûbert is a thoroughgoing Anglophobist as regards the British occupation of Egypt, he has written an interesting account of Cairo, the Nile, Thebes, and Nubia, accompanied by a chapter on Egypt under the Ptolemies.

He seems to have been much struck by the external change which has taken place in Egypt during the past few years. He remembers the time when French was spoken everywhere, when the Egyptian press was French, as were the officials; and he deeply regrets the present predominance of Britain. He opines, however, that the sentiments of the natives have not changed, and that they still have the sympathy and love for the French that they had in former decades. He holds the view very strongly that the "intelligent, enlightened Sultan" should have supreme power in Egypt, and that the Suez Canal should no longer be guarded by the British leopard (we thought it was lion), which to his mind bars France's way to her extensive possessions in the East. Apart from this, however—and this is not the place to enter into a discussion upon the subject—M. Joûbert appears to know Egypt fairly well, and, doubtless, there may be many who will be interested in reading his impressions of the country and what he has to say concerning its ancient history.

Reminiscences of a Sailor. By WILLIAM R. LORD, Shipmaster. Leith: Mackenzie and Storrie; Edinburgh and Glasgow: John Menzies and Co., 1894. Pp. xv + 308. *Price* 5s.

In a simple, pleasant style Mr. Lord presents us with the record of his experiences at sea, a long catalogue of adventures and escapes, with the narrative of less exciting and dangerous events. The story will be read with interest by all who know the value of our merchant navy, and have any fellow-feeling for the sailors who man it in so efficient a manner. The author, who comes of a seafaring family, began his career as ship's-boy and cook, gradually working his way up, until, for a number of years back, he has had command of several large steamers. His career led him to most parts of the world; and though his modest remarks on the places he thus visited are seldom very original or geographically important, we have, nevertheless, read the book with a considerable amount of interest and enjoyment. One of the author's reasons for publishing his experiences was the desire to more fully awaken the sympathy of the public with "Jack afloat," and thus to assist in adding somewhat to the comfort of his still uncomfortable lot. In this connection he especially calls for the more perfect lighting of the Pentland Firth. The Commissioners for Northern Lights have at last, to some extent, awakened to the crying necessity for something being done there, and are now engaged in building another sorely needed beacon. The commendable aim of the author has our warm appreciation, as, no doubt, it will have from the great majority of his readers. It ought to be noted, also, that although Mr. Lord's chief object is to awaken sympathy and promote improvement, yet the whole narrative is free from the least trace of ill-conditioned grumbling, but, on the contrary, exhibits everywhere a cheerful, hearty, and happy disposition.

Three Hundred Miles in Norway. By GEORGE C. MOSSMAN, Presbyterian Minister of Bewcastle. London: Presbyterian Publication Committee, N.D. Pp. 100.

So much has been published on Norway and its scenery that we cannot expect much that is new and striking in a tour up the Sætersdal and over the mountains to the Röldal, Odde, and Vossevangen. There are some errors, as, for instance, that a steamer plies from Christiansand to Kile, and Norwegian words (place-names included) are often incorrectly spelt. The illustrations are good, if not new.

La Palestine et la Syrie à vol d'oiseau. Par ALEXANDRE BOUTROUE. Paris: Ernest Leroux, 1894. Pp. 23.

This is a popular account of the principal places of interest in Jerusalem, Galilee, Damascus, Baalbec, and Tyre, written in an attractive style, and illustrated by numerous historical notices. It appeared originally in the *Revue de Géographie.*

Other Lands and the People who Live there. By MINNA C. DE LA PLANTE. London: Church Missionary Society, 1894. Pp. 48.

This little missionary volume is a collection of articles which have already been published in the periodicals of the Church Missionary Society. They have been, it appears, written for men and women: to us they seem better fitted for the use of children. The numerous illustrations are, as a rule, very rough.

Die Gebirgbildenden Felsarten. Eine Gesteinskunde für Geographen. Von Prof. Dr. FERDINAND LÖWL. Stuttgart: Verlag von Ferdinand Enke, 1893. Pp. 159.

It often happens that a geographer in a new country is unable to give an intelligible account of the rocks he sees from a lack of geological knowledge. The author of this work has done a good service by stating in plain language the characteristics of the principal rock-forming minerals; the principal plutonic and volcanic rocks, as well as those of clastic origin, are likewise described, and the marks by which they can be distinguished are pointed out. The rocks of chemical and organic origin are dealt with in clear language. The book will be useful to all who desire to make themselves familiar with rocks in the field.

Praktisches Handbuch der Arabischen Umgangssprache ägyptischen Dialekts. Mit zahlreichen Übungsstücken und einem ausführlichen Ägyptoarabisch-deutschen Wörterbuch. Von A. Seidel. Berlin: Gergonne et Cie., 1894. Pp. 310.

This book supplies a long-felt want, and it is very creditable to the author; for, apart from numerous slips of the pen, he has provided a most useful guide to the language spoken by the people in Egypt and in the Sudan.

We can very warmly recommend the book to all travellers in Egypt or the Sudan; and to officers of the army it will be a most welcome aid.

We should have liked to have seen the alphabet in bolder type; the one used is trying to the eyes, and does not show up the letters with sufficient clearness.

A Pocket Flora of Edinburgh and the Surrounding District. A Collection and Full Description of all Phanerogamic and the Principal Cryptogamic Plants, Classified after the Natural System, with an Artificial Key and a Glossary of Botanical Terms. By C. O. SONNTAG. London and Edinburgh: Williams and Norgate, 1894. Pp. xii + 246.

This is an admirable little book. It combines the handiness and clearness of Hayward's *Flora* with the local interest of the list which the late Professor Balfour published many years ago. As far as we have been able to test it, Mr. Sonntag's work is accurate. The book is clearly printed and slips easily into one's pocket. As it deserves soon to pass into a second edition, we have a few suggestions to offer. If the map is necessary, it should be backed with cloth and in a pocket ; as it is, it soon tears in the field. The sub-title is cumbrous and not quite correct ; thus the book is surely neither a collection nor a full description, and mosses (which are not included) are quite as "principal" as the horse-tails. Then, is it not time to reject for ever some of the needless terms, which grow, like mould, on botany, and of which we at once see at least a dozen in the glossary ? Moreover, is there not room for a little more originality in "Floras," such as was so excellently begun (at least) in a Flora of Dumfriesshire, where insect-visitors and the like were noted ? Notwithstanding, this is an admirable little book.

Elementos de Geographia Geral. Por CARLOS DE MELLO. Fasc. I. and II. Lisboa : Typographia do Commercio, 1893 and 1894. Pp. 496.

Under the modest title of *Elementos*, Professor de Mello has published what should rather be called a *Handbook* of general geography. It is not, however, by any means a schoolbook of the ordinary type. A brief survey of the coasts, islands, peninsulas, peaks, etc., with remarks on the nature of the surface, which forms a useful accompaniment to an atlas, is, indeed given, but the larger part of these volumes is devoted to broad and scientifically treated laws and facts of geography. The morphology of the land and water is thoroughly investigated, and the distinctive features of the continents are brought into prominence by numerous illustrations, so that the student may obtain a clear and complete idea of the forms of land and water and their mutual relations, and will be prepared to understand the other parts of the work, of which the third is to deal with Biological and Political Geography.

We are somewhat doubtful whether the division into horizontal and vertical morphology is the best, or if it would not have been better, after a general survey of the world as a whole, to have discussed each continent separately, and the oceans in a distinct chapter.

To test all the information contained in these pages, and especially the numerical data, would be impossible. As far as we can judge they are correct. The only important mistake we have detected is the statement that an arc of a great circle is represented by a straight line in the simple cylindrical projection. Nor is this what is commonly known as "Mercator's Projection," but that accurately described by the author under the name of *Projecção reduzida.*

Such an excellent work deserves a better dress ; the paper and printing are poor. The illustrations, though also rough in execution, are exceedingly helpful in elucidating the text.

Class Book of Geography, adapted to the Education Code of the Colony of Victoria. By ALEXANDER SUTHERLAND, M.A., Melbourne. With Maps and Illustrations. London and New York : Macmillan and Co., 1894. Pp. x + 270.

This book is designed for use in the Colony of Victoria, and it follows faithfully the Education Code prescribed by the Government. It contains the work of two classes—the fifth and the sixth—arranged in chapters. The book is sensibly written in the form of interesting descriptive lessons. It must be said, however, that some of the descriptions of European cities are rather fanciful. The maps and illustrations are good, although the former are somewhat meagre.

Cassell's New Geographical Readers. Second Book. London, Paris, and Melbourne : Cassell and Company, Limited, 1894. Pp. 143.

The lessons in this book profess to be written by a country-bred boy of twelve, who has as companions a brother and two sisters and a friend from London. The country children possess a superior knowledge of nature, but they are excelled by their town friend in acquaintance with physical laws and with distant countries. The combination of gifts leads to a number of interesting discussions on such subjects as springs, rivers, waterfalls, clouds, lakes, islands, and volcanoes. Some of the illustrations are excellent.

The Oriel Geographical Readers. Standards VI. and VII. With Maps and Illustrations. London : Marcus Ward and Co., Limited ; and at Belfast and New York. Standard VI., pp. 256, *price* 1s. 9*d.* Standard VII., pp. 252, *price* 2*s.*

Standard VI. of *The Oriel Geographical Readers* deals with the British Empire, but by some mistake the table of contents promises a wholly different series of lessons from that which the book contains. After a few general lessons on the British Empire as a whole and on the history of colonisation, the separate colonies are taken up and described in detail. There are special lessons on Climate and the Interchange of Productions, and there are summaries of all the lessons at the end of the book.

The reader for Standard VII. is devoted to the United States, which are treated very fully. The physiography lessons are on Tides and Ocean Currents. The illustrations and the coloured maps are excellent.

In the same series there are small atlases for the Standards at a very cheap rate.

Ordnance Gazetteer of Scotland: A Survey of Scottish Topography, Statistical, Biographical, and Historical. Edited by FRANCIS H. GROOME. Vol. IV. : I—Lyth. London, Edinburgh, and Glasgow : William Mackenzie, N.D. Pp. 281-568.

We can add but little to what we have already said (vol. ix. p. 432 ; vol. x. p. 163) in praise of the new edition of this splendid work. The greatest care and attention have evidently been given to this as to the former volumes, making it a mine of information, much of which is wanting in other like publications. The illustrations are, if possible, more beautiful than before, and make a very attractive feature of the work. The necessary maps are also included. There are no very long articles, such as those on Edinburgh and Glasgow, in the present volume ; but all places of any importance are fully and intelligently noticed. It is certainly the best work of its kind dealing with Scotland, and displays an amount of accuracy and breadth of treatment as admirable as it is unusual.

Geographical Encyclopædia of New South Wales. By WILLIAM HANSON, A.L.S. Lond. Sydney : Charles Potter, Government Printer, 1892. Pp. 462. *Price* 12*s.* 6*d.*

We have in this handsomely produced volume the fullest and best gazetteer which has yet appeared for any of our Australasian colonies. Prepared by Government authority for the late World's Columbian Exposition at Chicago, it not only contains adequate descriptions of all the counties, towns, and villages in New South Wales, but also of the rivers, with their sources, courses, and tributaries, ports and harbours, lighthouses, mountains and mountain ranges, postal, money order, and telegraph offices, savings banks, railways with their stations, public schools, etc. The information has been well arranged, and the whole volume is most tastefully produced, and embellished with a map and a useful coast-chart, showing the lighthouses with the range of their respective lights. The work may be warmly welcomed and recommended.

Lexique Géographique du Monde entier. Publié sous la Direction de M. E. LEVASSEUR (de l'Institut). Par J.-V. BARBIER, avec le collaboration de M. ANTHOINE. Fasc. 1-2 : A—Altenberge. Paris et Nancy : Berger-Levrault et Cie., 1894. Pp. xvi + 48 and 49-112. *Price* 1 *fr.* 50 *c. each.*

As this work progresses we shall notice it at greater length. In the meantime it is only necessary to announce its appearance, and to state that the rubric appears to be very complete, while the entries, although terse, are pointed and, for their length, contain good store of information. A series of symbols show what places have post and telegraph offices and railway stations.

Ritters Geographisch-Statistisches Lexikon. Achte, vollständig umgearbeitete. vermehrte und verbesserte Auflage. Unter der Redaction von JOH. PENZLER, Erster Band, Lief, 1-5. Leipzig : Verlag von Otto Wigand, 1894.

These numbers bring the rubric down to "Camels-Rump" only, and therefore it is too early to judge of the whole arrangement and execution of the work. We have naturally looked for places in the British Isles, and it seems to us that places of too little importance have been inserted, such, for instance, as Ardlaw in Aberdeenshire, and Bransford in Worcestershire. Villages containing even fewer than 200 inhabitants are inserted, and therefore it is not surprising that larger villages and towns are omitted. On the other hand, we should have made no objection to the insertion of Abbotsford. Aberdovey and several other Welsh towns are said to be in England.

The Tidal Streams on the West Coast of Scotland. By F. HOWARD COLLINS. London : J. D. Potter, 1894. 12 Charts. 5*s. net.*

These charts show by 2700 arrows the direction in which the tidal current is moving at various places in the west of Scotland at all states of the tide, and on any day of the year. The time of high-water at Greenock is taken as standard, and charts are prepared for the six hours before and the five hours after that time. A skipper knowing the state of the tide at Greenock at a given hour has only to consult these charts to find out the direction of the tidal current at the place where he is. The charts are based on official publications, are very clear, and should be most useful to yachtsmen.

In some of the western lochs the wind has great influence on the tides, sometimes masking their action altogether ; but as a rule the wind would be favourable when the tidal current could not be made use of.

The Tidal Streams of the North Sea. By F. HOWARD COLLINS. London : J. D. Potter, 1894. 12 Charts. 5*s. net.*

These charts are constructed on the same plan as those for the West Coast of Scotland, high-water at Dover being used as the keynote. In addition to the direction of the current, its speed at spring tides is given in knots per hour. The great complexity of the tidal currents in the narrower and more southerly part of the sea is well shown : and the position of the Dogger Bank is fairly indicated at most states of the tide by the diversity of direction of the arrows around it.

The Range of the Tödi. By W. A. B. Coolidge. *Conway & Coolidge's Climbers' Guides.* London: T. Fisher Unwin, 1894. Pp. xxx. + 167.

It may be well to remind our readers of the nature of these guides, several of which we have already noticed. The volumes are, of course, intended for the use of Alpine climbers, and accordingly give particulars of passes and peaks, distances, heights, etc. Notes are given of previous ascents and references to the works which contain descriptions of the locality in question. The volumes are of a convenient size for the pocket, and are bound in a covering that cannot be much injured by water. No climber should be without them. The present volume describes the range separating the valley of the border Rhine from Uri and Glarus, and others are promised. The Engadine and Tarantaise guides are now in preparation.

Walks in Belgium, Cycling, Driving, by Rail and on Foot. With some Fishing and Boating Notes. Edited by Percy Lindley. London: 30 Fleet Street; New York: 379 Broadway, N.D. Pp. 94. *Price* 6*d.*

This little volume is brightly written, full of useful data, and with many illustrations, all good and some distinctly clever, by Mr. J. F. Weedon and others. The little volume is of handy pocket size and a marvel of cheapness. The index is fairly full, but there is no map except a skeleton outline of routes, too small for the general purposes of the tourist.

The Great Eastern Railway Company's Tourist-Guide to the Continent of Europe. Edited by Percy Lindley. London: 30 Fleet Street and 61 Regent Street. Pp. 158. *Price* 6*d.*

Like all Mr. Lindley's guides, this one is pleasantly written, full of the usual, and some unusual, information, with many illustrations, several of which are distinctly clever. The book is not a complete Continental guide, but any one intending to make a trip through Holland, Germany, Belgium, or Switzerland will find it a handy companion. Cyclists should value the notes specially added for their benefit. The map is rather rough, and, in places, might have contained some additional names without any danger of overcrowding.

London in 1894. Originally compiled by Herbert Fry. Revised and Corrected to date. London: W. H. Allen and Co. Pp. xviii + 252. *Price* 1*s.*

It is needless to repeat former praise of this excellent guide. It has been brought down to date, and the bird's-eye views of the principal streets continue to make one of its well-marked and important features. An excellent companion for strangers visiting the Metropolis.

New Pictorial and Practical Guide to London. London, New York, Melbourne, and Sydney: Ward, Lock, and Bowden, 1894. Pp. xxiii + 353. *Price* 1*s.*

Strangers in London will find this a useful and practical guide, with numerous illustrations of rather unequal merit, and serviceable maps. The information conveyed is sufficient for the ordinary tourist, and the advice as to hotels will be found worthy of attention. The volume is of handy pocket size.

The Bristol Channel Illustrated. London: Simpkin, Marshall, Hamilton, Kent, and Co.; Cardiff: Edwards, Robertson, and Co.; Weston-super-Mare: Lawrence Brothers. Pp. 205. *Price* 6*d. net.*

This little volume describes the pleasure-steamers which annually carry an increasing number of tourists over the waters of the Bristol Channel, and gives accounts of the places visited by these travellers. It is well illustrated, and has a rough route-map.

Walks in and around Rugby. Written, Printed upon the Handpress, and Illustrated with Wood Engravings by A. E. TREEN. Rugby : A. E. Treen, 1894. Pp. vi + 112. *Price 2s. 6d. net.*

We have here a book the production of which should rejoice the soul of Mr. Ruskin ; for not only did Mr. Treen perform the usual work of the author by writing the MS. of these pages, but also set up the type and printed the pages by means of a small handpress, drew the pictures (with two exceptions) and engraved them upon wood, and now acts as his own publisher. The author's style is homely; but he has set forth all such information about Rugby and its neighbourhood as the ordinary visitor is likely to require, and references are given to more exhaustive works on the district. We congratulate Mr. Treen upon the production of this unique volume, the price of which, he informs us, is to be immediately raised.

Illustrated Guide to Perthshire. By THOMAS HUNTER. Perth : Thomas Hunter, 1894. Pp. xi + 204. *Price* 1s.

This well-known *Guide* is now in its tenth year of issue, and, as usual, provides full information likely to be needed by tourists in one of our most beautiful and interesting counties. Every effort has apparently been made to bring the numerous details up to date. There are a number of illustrations, an excellent and clear plan of the city of Perth, and a fairly good map.

"*The Scottish Cyclist*" *Road Book and Annual*, 1894-95 : *A Concise Book of Reference for Road and Path Riders in Scotland.* Glasgow and London : Hay Nisbet and Co. Edinburgh : D. F. Bremner. Pp. 97.

This handy little manual is sure to be welcomed by many cyclists. It not only gives descriptions and distances for the more popular routes in the country, but contains very many useful tables and directories, with hints to wheelmen which, if loyally carried out, would make cycling an even more popular recreation than it is. The book is of convenient pocket size.

The Up-to-Date Guide to North Berwick. North Berwick : Geo. Shiel and Sons, N.D. Pp. 108.

The numerous attractions and conveniences of North Berwick as a holiday resort are most enthusiastically described in this well-printed, neat, and convenient guide. There are numerous illustrations, for the most part well produced. It must be added that the paging given above includes a quantity of advertising matter. The publishers have also sent the Society a very clear, nicely tinted map of the town. Both are very creditable productions.

The Little Man Island : Scenes and Specimen Days in the Isle of Man. By HALL CAINE. Douglas : The Isle of Man Steam Packet Company, Limited, 1894. Pp. 50.

No one has done more, in a literary way, for the Isle of Man than Mr. Hall Caine, and he has put the inhabitants still further under obligation to his facile pen by the production of this little guidebook. Needless to say, the reading matter is excellent and the information correct and up-to-date ; but some of the numerous illustrations might have been better produced.

NEW MAPS.

EUROPE.

BRAEMAR AND BLAIR ATHOLE. Bartholomew's Reduced Ordnance Survey. Sheet 16.

John Bartholomew and Co., The Edinburgh Geographical Institute.

This is an improved edition of a sheet already issued. Contours are drawn at intervals of 250 feet instead of 500, and heights above 3000 feet are coloured in shades of purple, so that the chief mountain masses stand out conspicuously.

GLASGOW, A B C Guide and Map of ——.

Sinclair Brothers, Glasgow.

A map of the city, to which a few details concerning public buildings and institutions are added.

ASIA.

CHINA, JAPAN, AND KOREA, Bartholomew's Special War Map of ——. Scale 1 : 6,000,000. *Price* 1*s.*

John Bartholomew and Co., The Edinburgh Geographical Institute.

KOREA, NORDOST-CHINA UND SÜD-JAPAN, Neue Special-Karte von ——. Nach den neuesten russischen, englischen, französischen und deutschen Quellen bearbeitet von A. Herrich. Massstab 1 : 4,500,000.

Verlag von Carl Flemming, Glogau.

Both of these are very good maps. The former is on rather a smaller scale, but embraces the whole of Japan and Eastern China, while in the latter the names are rather more numerous. Both contain inset maps.

Critics may find fault with the spelling of the names in some cases, but, in the present absence of a recognised system, all that can be expected is a certain degree of uniformity, and this has been aimed at in these maps.

ATLASES.

EGYPT, an Atlas of Ancient ——. With complete Index, Geographical and Historical Notes, Biblical references, etc. Special publication of the Egypt Exploration Fund.

London: Kegan Paul, Trench, Trübner and Co., 1894.

No author's name is affixed to this atlas as responsible for its preparation. It contains one general map of Modern Egypt, coloured for physical features, to a scale of about 90 English miles to 1 inch ; one general and six sectional maps of Ancient Egypt and Ethiopia, mostly to different scales. Why Nos. iii. to vi. should not all have been drawn to the same scale is not evident : the scale of No. iv. is 20 English miles, and the rest 21½ to 23 to the inch; for No. vii.—or Upper Ethiopia—the scale of 50 English miles to an inch is sufficient; but for No. viii.—the Land of Goshen—no scale is in any way indicated ; comparison with No. iii. shows that it is about 7·4 miles to 1 inch. The maps of Ancient Egypt are of course the special object of the publication, and will be most useful and valuable. The modern names are added in italics. When preparing these, however, it would have been worth while to make the modern map agree in the representation of at least all names mentioned in the ancient ones. This is far from being the case: thus, on Map iii. we have Abuḳîr, Damanhûr, Lake Burlus, El Ḳanṭareh (in the text

Kantarah), Tell Atrîb, Belbês, Turra, Dahshûr, Atfiḥ, Faîyum, Kurûn, Beni Suêf, whereas on the modern map these names are given apparently haphazard, according to the spellings of French writers, English engineers, etc., as Aboukir, Damanhoor, Lake Bourlos, El Kantara, Tel Atrib, Belbeis, Toura, Dashoor, Atfeh, Faioum, Kerun, Benisouef. So on Map ii., as compared with iv. and v., we find Sharona and Sharôneh; Eshmunein, Eshmunên; El Hawarte, El Ḥawâteh; Taneh, Tehneh; Siout, Asyût; Gau el Kebir, Ḳau el Kebir; Ekhmin, Ekhmîm; El Menshieh, El Menshiyeh; Denderah, Dendereh; Koft, Kuft; Kous, Kûs; Asfoun, Asfûn; Edfou and Edfû; Silsili, Silsileh; Kharjeh, Khargeh; Koom Ombo, Kûm Ombô; Assouan, Aswân; Debod, Debôt; Kardaseh, Kerṭassi; Tafa, Tâfeh; Kobban, Ḳubbân; Maharroka, Maḥarraḳeh; Sebou, Es Sebû'a; Ebsamboul, Abu Simbel; Adda, 'Addeh; Halfah, Halfeh; Soleib and Soleb. It is time such spellings as Aboody, Desoor, Koom, Debbee, Goorti, Goorgote, Gallaweeh, Seflac, Toogh, etc., were banished from maps of Oriental countries. And since the compiler has used *q* for the hard guttural *k* sound in ancient names, it would have been quite consistent with forms like R'aqeṭy, Qes, etc., which he employs, to have written also Fâqûs, Saqqârah, Qolzum, Qûs, Neqrâsh, Taq, El Qanṭarah, etc.

The Indexes to both the modern and ancient maps are very complete; and much valuable information is condensed in the introductory letterpress. This is, in fact, a most important feature, embracing a succinct account of the Ancient Egyptians, their country, and their foreign intercourse; a summary of M. Naville's geographical discoveries relating to the sojourn of the Israelites in Egypt, and to the route of the Exodus (for which Map viii. has been prepared); a list of Egyptian place-names mentioned in the Bible, with references; and a short chronological table of the Egyptian dynasties based on Professor Petrie's adjustment of the first eighteen, and on Böckh and Wiedemann for the later dynasties. To this is added an account of the principal authorities, classical and modern, on the geography and history of Egypt, and to each map is added a table of the Nomes with their capitals, and the god worshipped in each; the hieroglyphic representations of the names of the twenty Nomes in Lower Egypt, and the twenty-two in Upper Egypt, being given along with the same in Roman letters. The Atlas will be useful to Bible students and teachers.

FORMÆ ORBIS ANTIQUI: Henrici Kiepert.

Dietrich Reimer (Hoefer und Vohsen), Berlin.

We have to announce the publication of the first part of this important work. Each map is accompanied by a few pages of letterpress printed in English and containing valuable topographical notes. A full review of the atlas will be published in a future number.

SCHWEIZ, Topographischer Atlas der ——, im Massstab der Original-Aufnahmen nach dem Bundesgesetze von 18. December 1868 durch das eidg. topogr. Büreau gemäss den Direktionen von Oberst Siegfried veröffentlicht.

Lief. xliii.:—

No. 209 Lowerz.
„ 296 Thierrens.
„ 303 Cossonay.
„ 376 Pilatus.
„ 386 Flühli.
„ 387 Sörenberg.
No. 388 Giswilerstock.
„ 442 St. Cergue.
„ 444 Crassier.
„ 471 Tornettaz.
„ 545 Mendrisio.
„ 547 Chiasso.

Presented by Prof. Paul Chaix.

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

TWO MONTHS IN KOREA.

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(Read at a Meeting of the Society in Edinburgh, May 1894.)

(With a Map.)

Before trying to put before you some of the internal features of Korea, I may as well briefly touch upon its past history. Its name is derived from the old kingdom of Koryo, one of the many which have risen and fallen in this part of Asia; the Portuguese called it *Kori*, which the French turned into *La Corée*, with a C; hence our name *The Corea*, also with a C; but *Korea*, with a K, is the more correct spelling. The Chinese name is *Kaoli*; while the Japanese and Korean term is *Chao-sen*, or "The Land of the Morning Calm." The Koreans appear to belong to the same stock as the Mongols, Chinese, Manchus, Japanese, Tibetans, Burmese, and Siamese, though the author of a curious Japanese book, which I procured at Yokohama, traces their descent from a remnant of the Israelitish tribe of Dan.

Chinese records mention Korean tribes, as vassals, as early as 2350 B.C., but the authentic history of Korea begins with the founding, in 1122 B.C., of the kingdom of Chaosen by the Chinese Prince Kitzu, whose capital was Phyöng-an (or Ping-yang) in the west, where his tomb is still to be seen.

The north-east, south, and south-west parts of the country still formed various clans and kingdoms, always at war with one another and with China; but at length one of these, Koryo, asserted its supremacy at the close of the fourteenth century A.D., when the present dynasty of Korea was established by Ni, who also founded the modern capital.

The Japanese appear to have first invaded the south of Korea in A.D. 200, and ruled there till 562, when they were expelled. They reappeared in 1592, when they overran the whole country with an army of 150,000 men. Many sanguinary battles were fought with the Koreans, aided by Chinese armies; and on our journey to Wönsan (the Wen-san of the map) we were shown the field of one of these conflicts; the huge grass mounds, still carefully tended, were said to cover the remains of 18,000 fallen warriors. Eventually, in 1615, the Japanese withdrew, retaining only the island of Tsushima and the settlement at Fusan. Henceforward Korea enjoyed rest from the persecutions of her neighbours, and kept herself rigidly secluded until 1876. Christianity spread to the country about the beginning of the present century, and 100,000 converts are said to have been made, but in 1866 the late Regent ordered a general massacre, and nine French missionaries, with 10,000 Christians, suffered martyrdom. To avenge this, a French naval force invaded the country, but was ignominiously repulsed; and the same fate befell, in 1871, an American expedition, undertaken to avenge the burning of a trading schooner and the murder of her sailors. In 1876 Japan induced Korea to sign a treaty allowing her subjects to enter the kingdom; and in 1882, 1883, and 1884 followed treaties with other great Powers, by which the ports of Chemulpho, Wönsan, and Fusan were declared open to foreign trade.

The attractions of this country, inhabited by a curious people, and by man-eating tigers and leopards of unusual size, beauty, and ferocity, irresistibly drew Captain Goold-Adams and myself to visit it, and on 22nd August 1891 we landed at Chemulpho.

This thriving port can only be approached at high-water, for at low-tide the whole of this, the west, coast becomes a vast expanse of brown mud and shallow channels; strange to say, although the tide rises and falls 36 feet here, the range is only 18 inches on the east coast.

We put up for the night at the hotel of Mr. Steward, a Chinaman, who, having made some money as a steward on board a steamer, had assumed the name, instead of his proper designation Ah Chang, as a pleasing reminder of the source of his wealth.

In the afternoon, as we were returning from a walk, we were overtaken by the Korean superintendent of trade, who is prefect of the district. This dignitary was being borne along in a sedan-chair, preceded and followed by a crowd of attendants, some armed with pikes, some with trumpets, and some with fans. A respectful removal of the ever-lighted pipe is required from bystanders when the great man passes; and we were amused to see, every now and then, one of his retinue rush at a man who, too busy staring at us to mind his manners, had forgotten to stop smoking, snatch his pipe away and break it in pieces, at the same time beating the culprit over the head with his fan. In the course of our journey we had great difficulty in preventing our attendants from turning people off our path and making them put away their pipes.

From Chemulpho we made our way partly by steam-launch, partly by Japanese junk, up the coast and the river Han, to Söul, the capital. The shifting bed of this river, its shallowness and strong current at ebb-tide, make the navigation extremely difficult. Low barren hills, gradually merging into brown and dreary mountains, shut in its valley on both sides. We passed numerous dilapidated stone walls and forts, which were erected after the Japanese invasion of 1592 to bar the road to the capital, and it was from behind these that the Koreans successfully withstood the French and Americans.

At Söul we were for six days the guests of Mr. Hillier, the British Consul-General; and through his kindness and that of other foreign residents we were furnished with a letter of introduction from the Minister for Foreign Affairs, with the necessary passports and permits (huge documents about two feet square), with a Chinese cook, who could speak a little Korean, Japanese, and English, with an interpreter, speaking Chinese, Korean, and no English, and with Yeung, a Korean servant, who knew some English but no Chinese.

Though Korean is not very easy to speak on account of its numerous vowel-changes, yet its alphabetical symbols are considered by philologists to be the simplest in the world, and it is precisely for that reason that they are only used by women and coolies; as part of the general admiration of things Chinese, Korea has borrowed the characters, and these are used by every educated person and in official documents. The language is also complicated by honorific distinctions of phrase; and thus it came about that our cook and Yeung had to talk pidgin-English to one another, for Yeung, who belonged to a class higher than a coolie, would not be talked to in the coolie dialect, which was all the cook knew.

Söul, or Sowl, or Syool, as it is sometimes called by foreigners, may fairly rank as one of the great cities of the East; its walls, running up and down the rocky hills which surround the trough in which the city stands, enclose an area of ten square miles, within which 30,000 houses shelter a population of 200,000, while the growing suburbs account for another 50,000. The eight gates are closed an hour after sunset, and no access to the city is possible until they are again opened at sunrise, except by scaling the wall where it is partly in ruins. The interior consists of a labyrinth of narrow, filthy, and uneven lanes between thatch- or tile-roofed hovels, which swarm with human and insect life, and there is a total absence of even elementary sanitation. In sharp contrast to these lanes are the three main streets, one of which intersects the city from east to west, with branches to the royal palace and to the south gate. All these are 60 yards wide and well kept, and that leading to the palace is bordered by the barracks of the garrison; but the others are so encroached on by temporary booths and shanties, only removed when the King proceeds abroad, that the road-space is reduced to a few yards. Crowded as the streets are by day with transport animals and their attendants, with official retainers and white-robed civilians, every man smoking a long-stemmed pipe, at night they are practically deserted, for the hours of darkness are set apart for the women to take exercise in, and then no man may be abroad, under pain of arrest and flogging by the police patrol.

For its size and age, dating as it does from A.D. 1397, Söul is singularly deficient in public buildings of importance; this want, which it shares with the kingdom in general, is to be ascribed to the fearful destruction and impoverishment caused by the numerous invasions, more especially that of 1592. Save the two palaces, the only objects of interest in the city are, *first*, the great curfew bell, said to be the third largest in the world, which since 1468 has sounded the hours for opening and closing the gates; and, *second*, a small white stone pagoda, once richly adorned with Buddhistic religious scenes, but now badly defaced. Near at hand once stood a stone bearing the ex-Regent's inscription, calling upon all Koreans to put to death any foreigners who might enter the kingdom.

Whichever palace the King resides in is termed the New Palace; but at the time of my visit he occupied that which used to be the residence of his father, the ex-Regent or Tai-wen-Kün, the older of the two. It is entered by a huge latticed gateway of three arches, and this is approached by a broad terrace, flanked by two grotesque stone monsters, apparently lions; here all visitors must dismount from chair or pony, and proceed on foot. Three great quadrangles lead to the Hall of Audience, a huge double-roofed hall, with a carved ceiling, coloured green, red, and blue, and supported on immense circular pillars. Within the palace enclosure are innumerable buildings, forming the private apartments of the King, Queen, and Crown Prince, while others are occupied by the 500 guards and the 2000 retainers of the court. The Old Palace contains an even larger number of buildings, and the two are connected by a covered way.

Söul is a hotbed of ignorance, cruelty, intrigue, vice, and disease; but it is as much the heart of Korea as Paris is the heart of France. It is the object of every Korean gentleman-idler to live in the capital, for there every pleasure and vice is more easy of attainment, the chances of getting coveted posts by judicious interest-making are multiplied, while the finest and best of the foreign and native produce is to be procured. There is the fountain-head of official corruption and dishonesty; there lives the King, the "Son of Heaven," the "Lord of the Ten Thousand Islands," the "Father of his People;" and the presence of his Majesty is felt to vivify and glorify every inhabitant of Söul, be he ever so humble. The contempt shown for provincial life by all Söul-bred men is most amusing, and many were the lamentations we afterwards heard from some of those obliged to live elsewhere. The acceptance of an office in the country is merely a means to an end, and that end the amassing of wealth which may be spent in the pleasures of this life in the capital of Korea.

As in China, all preferments are nominally given to those who successfully pass the periodical examinations; but, nine times out of ten, money and interest decide the result.

Society in Korea is divided into several castes; broadly speaking, these are (first) the "Nyang-pan," forming a kind of hereditary nobility and gentry, whose members cannot engage in any commercial or industrial occupation, and whose energies are limited to public offices and teaching; next comes the class of semi-nobles, who may be country squires, wholesale traders, secretaries, and so on; next the traders and artisans, who are the working population; and, lowest of all, the Buddhist priests, so little regarded that none is permitted to live in Söul, though the King is not above having one or two mountain strongholds near, garrisoned by militant monks, to which he can retire in case of danger.

There are eight governors of provinces and 332 prefects; each of these has a retinue of from 50 to 1500, of whom only the higher ranks get paid any salaries (and these are always months in arrears), while the rest depend on what they can squeeze or extort from the industrial classes. I am within the mark when I say that 20 per cent. of the population live on the labours of their fellow-countrymen; and it is this and the universal corruption which hinder the development of the country. The King draws a large revenue from the country, including some £90,000 a year from the Customs, but very little of this is properly applied to the benefit of any one; he is always in debt, and sets an example of extravagance and waste. For instance, a Royal Hospital was established, and nine months afterwards, although not a single patient had been treated, yet thirty-two officials, with all their families, were living on the premises. Again, a Royal College was started, and a foreigner obtained to teach in it, who, two years later, was told he was no longer required, as native teachers could now do his work equally well: to solve the difficulty of deposing the pedagogue, it was decided to keep him on for three years at double salary, but with no duties.

Although generally considered a poor country, Korea is not really so. The value of the foreign trade through the treaty ports in 1891, exclusive of gold, was over $1\frac{1}{2}$ millions sterling; to this must be added the value of the large overland trade with China, and of the 10,000 head of cattle and the large quantities of oats which the Russians annually obtain for their troops in Siberia. The great drags on her prosperity are the laziness of the men, the corrupt administration of affairs, and the difficulties of transport. Although the export of food-stuffs in one year amounted to 908,000 tons, yet in many districts the people exist in a chronic state of semi-starvation; this is entirely due to the want of decent roads. Except in Söul, such a thing as a road in our sense of the term does not exist in Korea; all communication by land is by bridle- or foot-paths, worn by traffic to such degree of passability as they possess. Generally the track follows a watercourse, and *no repairs are executed* but what stern necessity demands, such as filling in an unusually deep hole, or placing a few planks or hurdles over a gap caused by a slip of the soil. So bad are these tracks, that one day we were absolutely unable to ride for more than tne minutes during a march of four and a half hours. Most of the streams have to be forded, and the few rough bridges which exist here and there are only put up for winter use; hence travellers are often delayed for days by summer rains.

So fertile is the soil in the valleys generally, that the agriculturist only works four months in the year, and spends the rest of the time in smoking and visiting his friends. Irrigation is little practised, and much valuable land consequently lies waste. Though the seas swarm with fish, the fisherman will work one day and idle six; and the real profit from this industry, so bountifully provided by Nature, is secured by the Chinese and Japanese, whose boats make rich hauls in Korean waters.

Except in a few places, such as the Hamheung plain, where we saw rough carts in use for carrying the harvest, everything has to be transported on the backs of coolies, cattle, or ponies. Koreans are great walkers, and coolies have been known to carry for several days the astounding load of 460 lbs. of copper ingots. The cattle are splendid beasts of a short-horned breed, and are extensively used as pack, draught, and saddle animals; although much beef is eaten by the natives, and numbers of cattle are exported, yet dairy produce is almost totally unknown. But the animal for travelling is the pony, which, never groomed and never clipped, and stabled in an open shed even in the severest weather, can do an immense amount of hard work on a soft diet of beans, chopped straw, and hot water. It is a wonderfully hardy, strong little beast, sure-footed as a goat, and always bad-tempered. Hardly ever more than 11½ hands high, a Korean pony will take a load of 100 lbs. anywhere; and one of them, blind of both eyes, carried his pack without mishap through three of the worst fords and over the vilest piece of road we came across. The constant ascents and descents cause terrible galls and sore backs, and even now it makes me feel quite ill when I think of some of the awful wounds I saw. A Korean never beats his pony, yet, unless it is exceptionally bad, he does not take his poor beast out of work for a mere gall.

Having hired ten of these useful ponies, we quitted Söul on September 5th by the main road to Wönsan. However, very soon our *mapus*, or pony-attendants, branched off along what is called a "small road" to Wönsan; we did not detect this divergence for a couple of days, but this road had the advantages that we had it to ourselves and that it had not before been traversed by a European.

The chief geographical feature of Korea is its backbone, a range of igneous mountains, 3000 to 7000 feet high, which runs more or less along the east coast from the north-eastern almost to the south-western extremity of the country; it sends out numerous offshoots, and the whole of Korea is a jumbled heap of mountains not as yet reduced to any systems. East of Söul this backbone forms a chain of remarkably jagged and rugged peaks, and, under the name of the "Diamond Mountains," shelters in its recesses many ancient Buddhist monasteries, of which Chang-an-sa is the oldest, dating from the fourth century. Buddhism was introduced from China about A.D. 372, and rapidly overspread the whole country; the solitudes and wild beauty of these Diamond Mountains attracted the old monks, and it is here that the ancient religion mainly flourishes, kept up in forty or fifty monasteries, many of which are very wealthy. Christianity made many converts, but there are very few now; and although in Söul there are English, French, and American missions, yet, as open proselytising is forbidden, the results are not very encouraging. Very few Koreans have any religion at all, except, perhaps, worship of Nature and ancestors.

Three days after leaving Söul our course lay along a plain of lava thirty to forty miles long and five or six wide, stretching up to the mountain backbone. This plain was covered with coarse grass; occasionally a few stunted oaks and pines were seen, and here and there, beside a stream, a small hamlet, with a few fields of the beans which are food for men and cattle and the basis of Japanese soy and our Worcestershire sauce. It formed a remarkable contrast to the fertile country around Söul, where grew heavy crops of rice, tobacco, flax, maize, cotton, and millet.

We took with us a small tent—in spite of the horrified expostulations of the foreign residents in Söul, who declared we should some night be fetched out of it by a tiger—and found it most useful, saving us much discomfort by enabling us to avoid the filthy inns. Still, the tent caused much curiosity; and all eating, dressing, washing, etc. had to be performed while eyes belonging to Koreans of both sexes stared in at every hole and crevice. We generally pitched our camp in a graveyard, for there we found short grass and a grove of trees to give us shelter; in other cases we made use of the highroad, or the village threshing-floor, for very seldom did we come across other spots level enough for the purpose. It was only at the last extremity, when we got in too late at night, or it was too cold or wet to pitch the tent, that we slept in a house. Nearly all Korean houses are built on the same pattern—a kitchen at one end, leading to one or more small rooms. In large inns, the yard has open sheds for stables on three sides; but in small places off the main roads the kitchen is stable as well, and we often found it difficult to sleep owing to the chattering of human beings, the fighting and kicking of ponies, and the lowing of cattle, not to mention swarms of vermin of every kind. The walls are of lattice-work plastered with mud; the windows and doors of lattice-work covered with oiled paper; while the roof is borne by huge rough beams out of all proportion to the slight upright supports. The houses of many exalted mandarins are no better than what I have described. The simple apparatus for warming the whole house is the *kang*; underneath the clay floors are numerous intersecting flues, starting from the kitchen fire and ending in a chimney outside the opposite end of the building. The heated air and smoke from the fire pass along these flues and efficiently warm the rooms; even in winter it is not long before the small room, totally without ventilation, acquires a temperature of 80°, and we found the heated floor most useful for drying wet clothing and boots. The Chinese *kang* is not so good, for it only forms a raised bench along one side of the room.

After a journey of 140 miles we arrived at Wönsan, which stands at the southern end of the bay of which Port Lazaref is the northern extremity. It consists of a native town of 15,000 inhabitants, and, a mile distant, a foreign settlement with 1000 residents, grouped about the Custom-house, bank, steamer- and post-offices. Here we were most kindly entertained by the two officers of the Chinese Customs Department, which, under Sir Robert Hart, administers the Korean trade duties. The immense harbours of Wönsan and Port Lazaref are sheltered and good, and they are open all the year round. Between Wönsan and Fusan there are several other good harbours; and Russia, whose southern outlet on the Pacific, Vladivostok, is closed by ice for five months in the year, is generally credited with designs upon one of them, preferably Port Lazaref. But the Trans-Siberian Railway is still far from completion; and until Russia is very much stronger in Eastern Siberia than at present, it is not likely she will move to the south.

Great Britain, China, and Japan, who furnish 90 per cent. of the imports, would not regard with equanimity the presence in Korea of such an aggressive neighbour, who, if hostile, would be in a most favourable position for paralysing their trade.

The Japanese are making strenuous efforts to get the upper hand in Korea. They manage the mint, post-office and banks, and support the progressive party, which has caused several dangerous insurrections in the capital; but they are so overbearing in their dealings with the people, that they are cordially detested. The King of Korea, though really independent, is nominally a vassal of China; and it is to China, as represented by the envoy at Sönl, Yuan-Shih-Kai, that he turns for advice in any foreign complication, notwithstanding that he has as "Foreign Adviser" an American, General Le Gendre; but, from all I can learn, this General is merely used as an encyclopædia of foreign ideas and customs. The internal affairs of State are ruled over by one of the Min princes, a near relative of the Queen, who appears to be a masterful woman; and all the important appointments are held by members and adherents of this powerful Min family.

At Wönsan we made acquaintance at a dinner-party with the prefect of the district. He was magnificently dressed in silk robes of blue and crimson, which showed he held both military and civil rank; and from his black hat hung a chain of fine amber beads, which encircled his neck. The seals of office, without which an official dare not move, were deposited under his chair by the seal-bearer, a boy of sixteen, round whose waist were slung his master's tobacco-pouch, spectacle-case, and purse. The prefect ate his dinner like a man, and drank of everything—beer, Moselle, champagne, *kümmel,* and whisky—but only one glass of each; after dinner, his yard-long pipe was lighted, and he smoked some of our tobacco, greatly appreciating its strength. We particularly noticed his small, delicate, and carefully kept hands; indeed, in Korea the standard of beauty lies in small and delicate hands and feet, not in beauty of features. The men in general are well built and well set-up, but have a rather timid and dull expression. To a Western eye many of them are handsome, but the females are hideous, even in childhood.

It is said that a Korean is only washed twice—once when he is born and once when he is dead; but I have seen them bathing in the streams. Nevertheless, they are essentially a dirty people, which makes it all the more surprising that they habitually dress in white; and when one learns that in winter the cold is as intense as 30° below zero, one wonders that their clothes are almost always of cotton. The usual costume is a baggy pair of cotton trousers, above which is an equally loose jacket, tied at the waist; the trousers are tied over wadded socks, and straw sandals or Chinese shoes form the foot-gear.

These white garments give much trouble to the laundress, for they have to be boiled and cleansed three times, and are then beaten on a flat board with a wooden roller; this gives them a fine silky gloss.

Clothing more unsuited to the climate could not be invented. The loose garments and wide sleeves are little protection from the biting winter winds; while in hot weather the cotton cloth sticks to the limbs—

so closely, that wicker-work armlets and gaiters are worn, to allow a circulation of air over the skin.

The Korean hat is a very important thing; there is a different one for every class and every phase of life, and the study of the various *genera* and species of hats is quite a science in itself. But the ordinary black hat is shaped like a Welshwoman's, is made of plaited bamboo and perched on a black horse-hair frame, rather like an arm-chair, which fits tightly on the head; in fact, the smarter the man, the tighter his skull-cap. This hat is so precious that in rainy weather every one carries an oiled paper cover, which is put over it like an extinguisher and tied under the chin.

The costume of women of the lower orders consists of a short jacket which covers only the upper part of the chest, a very baggy pair of trousers, and a cotton petticoat; but the higher classes wear coloured silks, and follow more nearly Western ideas of costume.

A Korean is engaged to be married as soon as his parents can afford it, and till that event he is a boy, goes bareheaded, and wears his hair in a pigtail; as soon as the contract is made, the top of his head is shaved, his hair is done up into a knot, he dons the hat and becomes a man. We often saw engaged boys, nine or ten years old, wearing men's hats and top-knots; while one of our *mapus*, being unengaged, wore a pigtail and was still a boy, though past forty years of age.

The provision of money caused us much difficulty at various times. At Söul and the treaty ports, Mexican dollars and Japanese *yen* are current; but elsewhere the only coins are copper cash tied up in strings of 100 or 1000. A sovereign's worth of these exceeded 3500 in number, and weighed 7 lbs. However, in Söul, by way of adding to the amenities of life, a debased cash is used; and one of these, though intrinsically worth less than an ordinary cash, is by royal decree equal to five; consequently, one gets 700 of these coins for a sovereign. In addition to proper cash, we took up-country with us an ingot of pure silver, called a *sycee* or "shoe of silver," from its likeness to a Chinese lady's shoe, and worth about £14. On bartering this at Kapsan for 41,000 cash, we exhausted the whole capital of the town; and this is the only time in my life when I have felt overburdened with cash.

The prefect supplied us, or rather our interpreter, with a pony-letter, by which we were empowered to requisition post-ponies wherever we went. The posting system in Korea is a typical instance of the way in which the country people are oppressed. Along almost every road in the kingdom posting-stations are established about five miles apart; and the pony-man, generally the headman of the village, has to provide, free of charge, ponies, bulls, or coolies for any official or other person provided with a pony-letter; also food and lodging for him and his suite. These animals are not generally kept ready, but are working in the fields or elsewhere; consequently, on a demand for them, a delay takes place while they are brought from ploughing or harvesting. We always paid so much a stage, and also for our food and lodgings. When once the traveller makes it clearly known he is going to pay for services rendered, the amount of civility and attention he receives] is quite astonishing.

Another difficulty lies in finding out how far it is from one place to another. There are no good maps—a Korean does not care how far it is to a place; as long as he gets there this month or next he is quite content, and his standard measure of distance, the *li*, is remarkably elastic. Properly, the *li* is 486 yards long, and in Söul it actually measures so much; but the farther one travels from the capital the longer grows the *li*, till in the extreme north and south it measures on fairly level ground 555 yards, while in mountainous country it shortens to 430 yards. This is a thoroughly Chinese idea; and perhaps some of you do not know the story of the Chinaman who told a Western traveller that the distance between two places depended upon which end you started from. The explanation of this is that transport ought to be more expensive on an uphill road; but it is troublesome to adjust the tariff according to the varying gradients of a road, and much easier to assume that a given place is farther off, and to charge accordingly; therefore, both in China and Korea a statute mile sometimes equals three *li*, but occasionally fifteen.

In Wönsan we were told many stories of tigers and leopards, which abound in the hills around—how they stalked through the settlement at night, and levied contributions on the poultry-yards and kennels of the foreigners; and we were never allowed to go about after dark without a lantern. Even the coolies who go out to cut brushwood do so in parties, and are carefully counted at a fixed rendezvous in the evening to see if one of them has fallen a victim, for hundreds of Koreans are annually devoured by these brutes, which seem to have a liking for human flesh.

From Wönsan we intended to go along the Vladivostok road as far as Chyöng-phyöng (Cheng-phyeng on map), then branch off into the mountains to Chang-jin, and so to Samsu on the Yalu, seek for tigers on both banks of that river, and find our way to the summit of the White Mountain. Accordingly, we left on September 15th with a train of thirteen ponies, and slowly made our way north through endless fields of rice and millet, passing several gold-washings. The whole of Korea is gold-bearing, but nowhere are there very valuable deposits. The methods of mining are so primitive that few diggers can make more than a bare living; yet in 1891 £200,000 worth of gold was exported, and it is believed that nearly as much more left the country without being declared, or was smuggled across the borders. After passing Chyöng-phyöng we left the warm, smiling rice-fields, in which numerous cranes, storks, and lovely pink ibis were placidly wading, and crossed the backbone of Korea by a pass 4000 feet above the sea. The transition from summer on the south side of the pass to late autumn on the north side was most abrupt; already the early frosts had touched the leaves of the magnificent beeches and oaks, while scarlet maples, glowing in the sunshine amidst the dark-green pines, and varied yellows and browns, made the mountain sides lovely pictures of gorgeous colouring.

At Chang-jin our progress was checked, because we were told that the road to Samsu, only forty miles off, was very bad, and had no stabling on it. Having had experience of what were deemed good roads and stabling, we reluctantly agreed to strike across country to Kapsan, a town we particularly wished to avoid, because Mr. Campbell, who visited the place four years before, had been badly stoned by the inhabitants.

Chang-jin is chiefly remarkable for its silver mines and the manufacture of a kind of gun, which consists of an iron tube bound by brass bands to a wooden stock; it is fired from a rest, without putting it to the shoulder, by means of a flintlock, helped, in case of failure of the priming, by a slow match. This weapon is named a "tiger-gun," not because it is intended for slaying tigers—indeed, that animal is the last the owner would wish to face—but because it is considered such a powerful fire-arm, the tiger being the emblem of strength.

Retracing our steps some thirty miles, we struck off to the east to Kapsan, crossing two passes 5300 and 5700 feet above the sea; and we had some fair sport with wild-fowl, pheasants, and blue rock-pigeons. This route of sixty miles had never been traversed by Europeans, and the natives took us for Chinamen, who were the only strangers they had hitherto seen.

The town of Kapsan—which we reached on October 1st—once the capital of a petty kingdom, is now a wretchedly poor place, with half the houses in ruins, though the district abounds with copper and other minerals. However, its surrounding wall had lately been repaired and whitewashed, and altogether the town was much cleaner than Söul or any other place we visited.

Hence we made our way to Pochön (Po-chhen), the limit of officialism towards the north, where we were to leave our ponies, and make our way with coolies to the White Mountain. Much to our disgust, owing to the harvest and the expectation of immediate snow, we could not get enough coolies to enable us both to go to the mountain, for every scrap of food would have to be carried. As I was somewhat pressed for time, and the mountain trip might occupy three weeks or more, according to weather, Captain Goold-Adams, whose leave was longer than mine, went on alone, and I had to content myself with a view of the mountain.

The Paik-tu-san, or White Mountain, is the most remarkable in this part of Asia. It has watched the growth and departure of the many clans which have overrun China and Korea, and to its mysterious deities their present Majesties of both these countries trace their ancestry. At a small temple on the ridge above Pochön, whence a fine view is obtained, sacrifices are annually offered, by order of the King of Korea, to the spirits of the mountain. Gleaming white with snow in winter, and with wet pumice in summer, it towers, with its irregular summit, 4000 feet above the surrounding forest-clad country; and its springs form the head-waters of three large rivers flowing to the north, east, and south-west. Between Pochön and this mountain the subsoil consists of many feet of volcanic dust, and in this crust the rivers have worked out ravines from 100 to 500 feet deep. One road lies on the Manchurian side of the Yalu, along the crest of the Chang-pai range, and it is wearisome in the extreme: one constantly clambers over, under, or round the many fallen trees which cumber the spongy soil in all directions; and in the gloomy forest one cannot see more than ten yards in any direction. Wherever the ground was dry enough, Goold-Adams saw many fresh tracks of tigers and leopards, and at night a huge fire was as necessary for protection as for warmth. He could not object when his unsavoury attendants cowered close to him, shivering not so much with cold as with fear of wild beasts and mountain spirits. It took him ten days of travel under these conditions to get over the seventy miles to the White Mountain; but at length he emerged from the forest at the foot of the final slope, and, after a stiff climb of 2000 feet over cinders and powdered pumice, stood on one of the twenty or more peaks which form the summit. Three hundred feet beneath, filling the crater of this long-extinct volcano, lay an azure-blue lake, fifteen miles in circumference, called by the Chinese the Dragon Prince's Pool, whence flows the Sungari river. Almost at the moment Goold-Adams turned to retrace his steps, heavy snow came on; and this, serving as a spur to his unwilling coolies, made them hasten home, his return journey to Pochön occupying only six days. He followed my route to the coast at Wönsan, and thence went overland to Söul by the proper highroad.

I mentioned just now that Koreans are Nature-worshippers, and one finds evidence of this in several ways. With that reverence for the serpent which has come down from earliest times, they will not kill snakes, though the country is plentifully supplied with them, and at least one species, the brown adder, is said to be very venomous; however, there is no objection to a foreigner killing the reptiles, and I put an end to many, once just escaping a bite from an adder on which I accidentally put my bare hand. To checkmate the malignant spirits of the elements, one finds, at cross-roads, on mountain passes, and often outside villages, a heap of stones, a sacred tree, or a small joss-house dedicated to the neighbouring deity; a stone added to the heap, a rag to a branch, a bow, or even an expectoration, secures immunity to the traveller, though in very dangerous places the deposit of a copper cash in the shrine is considered requisite. The children from the nearest dwellings make periodical visits to the shrines to see if there is anything worth picking up among the votive offerings. Even these precautions are not enough, for at every ten *li* along the road is a wooden post, the top grotesquely carved as a human face, with an inscription giving the distance from the capital and the nearest town; these league-posts, called *changsung*, are said to be dedicated to a very strong man and a noted robber in olden times, whose spirit is believed to haunt the king's highway. But the most absurd antics were those indulged in by Goold-Adams' attendants on the way to the White Mountain. Every evening, before commencing their meal of millet porridge, a small pinch of rice was cooked, spread out on the trunk of a fallen tree, and left there for a quarter of an hour, his men in the meantime muttering incantations and bowing; after this the rice was solemnly eaten, for the spirit, being such, could not eat rice, and only required the smell, so it was unnecessary to waste such a luxury as a few grains of rice. Only two Koreans out of his party of ten could be induced to brave the wrath of the spirit by ascending the mountain.

From Pochön I returned to Kapsan, where the inhabitants were quite glad to see me, and manifested the utmost curiosity as to my belongings and clothing. One old fellow pulled open my flannel shirt and made the discovery that my skin was white, for my face and hands, from exposure and dirt, were of a dingy brick colour; this was a source of extraordinary joy and excitement, and I had some difficulty in getting away without being altogether undressed.

My next goal now was Puk-chöng (Puk-chhen) on the Vladivostok road, to reach which I crossed the backbone of Korea by a series of passes, from the last of which one descends 1500 feet by a zigzag path to the river below. Between here and Wönsan, I saw every evening towards sunset myriads of wild-fowl coming in from the sea-shore to feed on the ripe crops; while to frighten them off the natives were all abroad making a hideous din with guns, crackers, trumpets, tom-toms, and kerosene oil-tins. Swans, geese, duck, and teal were easily shot; but the fat pheasants were much more wily, and had to be very carefully stalked.

From the time we left Wönsan till we returned there, the prefects of the various districts we entered always provided us with a "soldier," whose duty it was to see that we were treated with proper respect by the peasantry. This warrior had probably passed through the ranks of the army, but was one of the many thousands of official retainers whose business is not fighting but tax-gathering. Theoretically, Korea can furnish one of the largest armies in the world, and she reckons up some 1,200,000 men fit for military duty; in reality, her army is a ludicrous farce. Each of the eight provinces has by tradition its army and fleet. the capital in addition having an army and two fleets. All these fleets and armies are represented by two small 800-ton steamers, used for trade, and by the armies of Söul and Phyöng-an; the latter is about 1500 strong, and is always sent for to Söul in case of danger, its men being thoroughly reliable. The army of Söul is *nominally* about 5000 strong, and is divided into three divisions; at the head of each is a general, who draws pay for the full strength of this division from the royal treasury (that is to say, when there is any money in it), and the amount due to any absentee is his perquisite. Service in the ranks is entirely voluntary, and the men only stay long enough to qualify as official retainers. The duties are truly hard! Three days' drill, then three days' holiday in the country, then three days on guard at the palace, then another three days' holiday, and so on; but there is no punishment for failing to return to military duty.

The officers must be of the Nyang-pan class, and their duty is equally arduous—nominally, forty-eight hours with the army, and then forty-eight hours with their friends; but, as a matter of fact, they seldom do any duty at all, except on pay-days and at State ceremonies.

The men are armed with various rifles; and I learnt that, although they get no musketry instruction, they are very good shots up to 800 yards.

The kingdom boasts of two batteries of machine-guns—that is, it has fourteen Gatling guns, which have never been fired off; and, as far as I could make out, the Royal Korean Artillery consists of seven men permanently absent in the provinces. As for a small arsenal of 9-inch Krupp guns, with all necessary armourers' tools, these lie rusting away, while breech-blocks and sights have all been stolen.

The "Military Adviser" to the King is an American, General Dye; but neither he nor Lieut.-Colonel Nienstead, who has the thankless post of drill-instructor to the army, are allowed any powers of discipline over the members of this very oddly constituted force.

In conclusion, I should like to draw attention to a remarkably tough paper which is made in Korea from vegetable fibre. It is in great request in China and Japan, and I am trying to introduce it into this country for military map purposes; I can strongly recommend it to any one who is in want of an almost untearable paper.

ON THE DETERMINATION OF SEA-WATER DENSITIES BY HYDROMETERS AND SPRENGEL TUBES.[1]

By W. S. Anderson, F.C.S.

The two principal methods of ascertaining the density of a sea-water are, first, a weighing method, preferably by weighing the water in a Sprengel tube; and, second, by using a hydrometer. The latter method is used exclusively on board ship, where weighing is generally impossible.

For some time, as chemist to the Marine Station, Granton, I have had occasion to estimate the densities of a large number of sea-waters for Dr. Murray and Mr Irvine, and have employed both methods. Some observers have supposed that there was a difference in the results obtained by these methods;[2] the hydrometer giving, it was stated, results lower than those of the Sprengel tube by 0·12 (water = 1000), and it was proposed that a correction of that amount should be added to the densities obtained by hydrometers in order to render the results accurate. Dr. Murray requested me to investigate the whole matter, together with any bearing the results might have on the *Challenger* work, and provided me with such hydrometers and other instruments as were required for the investigation. This paper is the result of experiments comparing the density values given by the Sprengel tube and the hydrometer; observations by the latter instrument having been taken both on land and on board ship.

Weighing the water in a Sprengel tube is admitted by all observers to be the more accurate method. The instrument is a glass tube bent into a U or V shape, with a capillary tube at each extremity, one of them having bulbs blown into it. The instrument used for the experiments

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[1] Read before the Royal Society of Edinburgh, on May 21st, 1894.

[2] *Scot. Geog. Mag.*, Jan. 1893, Dickson on the Waters of the English Channel.

EXPLANA
OF COLOU
Vladivostock
SEA OF JAPAN
Broughton Bay
Port Lazaref
Wen-san or Gen-san
Chang-pai-shan
Paik-to-san White Mountain
HAM-GYENG
Kil-ju
C. Kozakov
Kyeng-seng
C. Schlippenbach
C. Petit Thouars or Schwartz
Kamok-jang
Posyeta B.
Krasnoyeselo
Tumen-ula
Gashkevicha B
Kyeng-heung
Puk-chhen
Ham-heung
Kap-san
Cheng-phyeng
An-ju
Phyeng-yang
C. Duroch
Kan-seng
Tek-san
KANG-WEN
Yang-yang
Kang-neung
Matsu Shima (Dagelet)
KYENG
SEOUL
Wen-ju
Chhung-ju
Chheng-ju
Kong-ju
Hong-ju
CHHUNG-CHHENG
Hai-ju
Sam-chhek
Kyeng-hai
Unkovsky B.
KYENG-SANG
Seng-ju
Tai-ku
Mil-yang
Ul-san
Fu-san
Chin-ju
Chen-ju
CHEL-LA
Mu-ju
Kwang-ju
Na-ju
Neung-ju
Korean Archipelago
Port Hamilton
Washington Gulf
Che-ju
Broughton Strait
STRAIT
Tsu-shima
Toyo Saki
Izdzuhara
Ko Saki
Krusenstern Strait
KOREA
Iki Shima
Genkai Nada
Saga
Kurume
Tai-yuen-fu
Ning-wu-fu
Hwai-ki
Ho-nan-fu
SHAN
42
40
38
36
34
112
126
128
130

OROGRAPHICAL MAP OF KOREA AND ADJOINING PART OF CHINA

ILLUSTRATING CAPT. A. E. J. CAVENDISH' PAPER

J.G. Bartholomew

had a capacity of 82 cc., and the inner diameter of the capillaries was from 0·3 to 0·5 millimètre, so that a length of 4 to 9 millimètres weighed 0·001 grm. With a more delicate balance than was at my disposal, the Sprengel tube may be about one half the capacity, and the capillaries narrower.

The instrument was standardised in the following manner:—The dry tube was weighed in air, preferably on both sides of the balance, and the weight reduced to *vacuum*. Then distilled water (boiled and cooled) was drawn up one of the capillaries to completely fill the instrument without air-bells, and the whole was placed in a bath of the temperature at which the sea-water density was afterwards to be taken. At 0° C. a bath of melting ice was used, and into this the Sprengel tube was plunged, the capillaries being left outside. Care was taken that the line of water in the capillary containing the bulbs was not broken on the contraction of the water. On the subsequent expansion of the water, the capillary with the bulbs was emptied nearly down to a mark etched on its lower end, and after all change in the volume of the water had ceased, the excess was removed by blotting paper. As little of the capillaries as possible was allowed to project above the surface of the bath. On the removal of the Sprengel tube from the ice-bath it was placed in a bath of the temperature of the balance room, or a degree or two higher to prevent condensation of moisture on the chilled glass. The water expanded into the capillary bulbs, when the instrument was carefully dried and the weight reduced to *vacuum*.

The determination of the weights of the Sprengel tube full of pure water at the temperatures desired was the most important part of the operation, as on it depended the accuracy of the sea-water densities, and the weighings were repeated till the results were constant. The tube was also weighed filled with pure water at other temperatures, such as 4°, 10°, 15°, 15·56°, 17·5° C., as it was found better to test every sea-water at two temperatures; any error in weighing being thus easily detected.

The operation was practically the same at the higher temperatures as at 0° C., except that a bath containing 15 litres of water was used. This was heated with a flame, an accurate thermometer giving the temperature after well stirring. There was little difficulty in keeping the temperature within $\frac{1}{20}$° C. by careful application of the flame, especially when the temperature of the laboratory and the bath were nearly the same. The Sprengel tube was suspended between two wires over the bath, and the standardising completed for the higher temperatures as already mentioned for 0° C.

While in the water bath the sea-water, if recently collected, gave off air-bells, which accumulated into one on tapping the tube, and were drawn up into the bulbs by suction.

On subtracting the weight of the tube from its weight when full of water the standard '1000' was found, and with this value the weight of the sea-water which filled the tube, at the same temperature, was compared. The weight of the sea-water was divided by the weight of the distilled water, and the result was the density of the sea-water, represented by ${}_tS$. When ${}_4S_t$ was required, the density at ${}_tS_t$ was multiplied by the density of pure water at t° C. (4° C. = 1). Some tables at the end of the paper facilitate the reduction of ${}_tS_t$ to ${}_TS_T$.

The hydrometer is an instrument the principle of which is well known; the density of water is ascertained by dividing the weight of the instrument by the volume. The volume of the glass body at the given temperature must be known, as well as the volume of the stem immersed in the water. All the results require reduction to one temperature for comparison, as it seldom occurs that the temperature of the water remains the same during a series of observations.

There was a hydrometer of the *Challenger* kind at the Marine Station. It had accompanied others on the voyage, but had never been used; all the densities having been taken with No. 0 hydrometer. This hydrometer was carefully standardised in pure water, according to the method described in full by Mr. Buchanan.[1] After the constants were obtained, the hydrometer was tested with sea-waters collected from various places in the North Sea. The results tended to show that the densities found by the hydrometer were fairly in agreement with those determined by direct weighing, but that the individual results varied to a small amount. It was hardly to be expected that a hydrometer of the ordinary size, where one division of the stem was equal to 0·05 or 0·06 in density (water = 1000) should give results up to 0·01, unless the mean of a number of readings was taken, and in practice it was found that, the greater the number of readings taken, the more correct became the mean result from the whole. One of the waters was employed for ascertaining its density at three very different temperatures. The value ${}_0S_0$, that is, the weight of sea-water at 0° C. compared with the weight of an equal volume of distilled water at 0° C., was previously estimated by the Sprengel tube to be 1028·51. The chlorine, or total halogen, in the water was also estimated by Volhard's process, and found equal to 19·547 grammes per kilogramme. The following are the hydrometer results reduced to ${}_0S_0$:—

Temperature	1·4° to 2·7° C.	16·7° C.	26·2° C.
Density	1028·40	1028·53	1028·46
	·47	·49	·47
	·58	...	·60
	·53	...	...
	·52	...	...
	·52	...	...
	·60	...	...
	·60	...	...
	·51	...	...
	·57	...	...
Mean density	1028·53	1028·51	1028·51

Although the average density was very nearly correct, still the individual readings sometimes varied considerably—as much as three or four millimètres on the scale of the instrument. The cause of this

[1] *Challenger Report*, "Chemistry and Physics," vol. i. part 2.

was afterwards found to be the insufficient mixing of the sea-water before taking the reading. This error affected particularly the first series of readings, when the water was cooled by ice, and also the third series, when the water was warmed in a bath up to 26° C.

Two hydrometers of the *Challenger* pattern, marked 18 and 19, were kindly lent me by the Scottish Fishery Board, and were tested in like manner as the last mentioned, with the use of the constants supplied with them. The sea-water employed had a density of 1021·335, the weight of sea-water at 15·56° C. being compared with the weight of an equal volume of distilled water at maximum density. The hydrometer results were:—

	Station Hydrometer.	No. 18.	No. 19.	Temperature of Readings.
	1021·34	1021·36	1021·36	
	·34	·30	·31	
	...	·37	·36	6·1° to 6·9° C.
	...	·36	·36	
	...	·32	·33	
	...	·34	·36	
	...	·34	·37	
Mean density	1021·34	1021·34	1021·35	
	...	1021·36	1021·32	
	...	...	·33	23° to 24° C.
	...	...	·35	
Mean density	...	...	1021·33	

Mean density from all readings = 1021·343.

This result was satisfactory, the average density being nearly the same as that obtained by the Sprengel tube, and the greatest errors ± ·035, equal to ± half a millimètre of scale-reading.

Owing to uncertainty as regarded the standardising of these two instruments, it was still impossible to consider the question of hydrometer error as settled, although the preliminary experiments seemed to show that the hydrometer method was a perfect one and did not require any correction. But the personal equation in reading, and any instability of the instrument, might cause an error on the scale of one millimètre, equal to 0·06 in density; and this was half of the difference in question.

To settle this, I made a hydrometer of more than double the usual volume, leaving the stem about the same, *i.e.* 3 millimètres diameter. This had much more delicacy, and any difference could be more easily detected. The instrument was made in the manner described so fully in the *Challenger Report*. The data required for the standardising of a hydrometer are:—the weight of the instrument *in vacuo*,[1] the volume of the glass body at 0° C., the expansion of the body for each degree, and the

[1] For a hydrometer of the size mentioned, the weight may be taken to ± 0·02 grm. No appreciable error is introduced, as the volume is relative to the weight decided on.

volume of the stem for each millimètre of the scale. The expansion of the stem with increase of temperature is too minute to be taken into account. A set of suitable weights are necessary for taking readings at various parts of the stem. To find the volume of the instrument during a reading, the volume of the body at the observed temperature must be known, and to this volume is added the volume of the stem immersed. The total weight of the instrument, during the observation, divided by the total volume so found, gives the density of the water at the temperature. As the comparison is made with distilled water at 4° C., when each cubic centimètre weighs one gramme, the sign ${}_4S$ will represent the density of the water, t being the temperature of the water during observation. The data for standardising may be expressed in the following formula :—

$$\frac{\text{Weight of hydrometer } \textit{in vacuo} \text{ (+additional weights)}}{\text{Volume in cc. at } 0^\circ \text{ C.} + \text{expansion in cc. for } 1^\circ \text{ C.} \times t^\circ + \text{cc. of stem immersed}} = {}_4S_t.$$

The ${}_4S_t$ so obtained may be reduced to ${}_4S_{15\cdot56}$, for comparison with other results, by means of Table I., page 588. In finding the data for the large hydrometer the weight *in vacuo* was first obtained, and then the volume of one millimètre of the stem, found by loading the hydrometer with weights and sinking the stem in distilled water. On dividing the volume of water so displaced, at the temperature chosen, by the number of millimètres immersed, the result obtained was the value of one millimètre of the scale, and was equal to 0·0098 cc. The stem was also tested in a sea-water of known density by using it as a hydrometer. The weight used in sinking the stem was divided by the stem immersed, and the result was an approximation to the density of the water. The volume of the body of the instrument at any temperature (t) was next obtained by floating it in distilled water and taking readings, generally three or four, at various parts of the stem. It was thought better to take readings at every degree up to 29° C., a wrong reading or an irregularity in glass-expansion being thus easily detected. It was found to be of the greatest importance that all the water should be of the same temperature, and this was only secured by thorough mixing.[1] At first it was erroneously supposed that the water could be well mixed by plunging the hydrometer many times through it. But the bottom layer was often found to differ in temperature from the surface by nearly half a degree. This difficulty was overcome by attaching a stiff rubber washer or ring to a glass rod, and, before taking a reading, the water was well mixed up by moving this up and down encircling the hydrometer, which was held in the middle of the water. No water remained on the stem more than ten millimètres above

[1] On 1st October 1893, Professor Pettersson, Stockholm, wrote the following in a letter to Mr. Irvine : "The most dangerous error of the hydrometer—because the experimenter has no means of correcting it, at least when he works on board a ship—is this : you obtain very sensible indications by using a hydrometer with a large body. But, remember, there must then be equilibrium of temperature through the whole system—water, glass, etc. That takes time, and meanwhile the water in which swims the instrument is heated or cooled by the wind, the warm water rises, the cooler sinks down ; you do not know if your instrument does not swim in a fluid of which the uppermost layer has a different temperature from the lower : you may not stir, for then a sharp reading is rendered impossible for a minute or so."

the surface, so that there was free vertical motion, and every reading was checked twice or thrice by disturbing the equilibrium of the hydrometer. The temperature of the water was taken before and after every reading, of which about 150 were noted. The volume of the body of the hydrometer, at any temperature, was calculated by multiplying the total weight of the instrument by the volume of pure water at that temperature ($4°$ C. $=1$), and subtracting the volume of the stem immersed. The last datum was obtained by multiplying the reading in millimètres by 0·0098 cc. (volume of one millimètre of the scale). The experiments gave the following data for the new hydrometer:—Weight *in vacuo* $=353·36$ grammes; volume of body at $1°$ C. $=354·504$ cc.: expansion of body for $1°$ C. $=0·0095$ cc.; volume of each millimètre-division of the stem $=0·0098$ cc. These values having been proved to be nearly accurate for pure water, they were applied to the determination of sea-water densities. An Atlantic water collected in 51° 20′ N. lat., and 30° 0′ W. long. was chosen, and was used for all the subsequent experiments, as it was expected to follow Dittmar's tables of sea-water expansion more closely than any other. The chlorine was estimated by Volhard's process to be equal to 19·696 grammes per kilogramme. The density was taken carefully by the Sprengel tube at 0° C., 15° C., and 17·5° C.

$$ {}_0S_0 = 1028·685,\ {}_{15}S_{15} = 1027·338, \text{ and } {}_{17·5}S_{17·5} = 1027·185. $$

Reducing these to the standard hydrometer temperature, the resulting density was ${}_4S_{15·56} = 1026·353$, and was probably correct to $\pm 0·005$. The density at $0°$ C. is ${}_0S_0 = 1028·685$, and the D value, or the ratio between the chlorine and $1028·685\ (-1000)$, is 1·4565, a value generally admitted to be correct for the whole of the North Sea, and which may also hold good for the whole ocean, with the exception of small enclosed areas, water confined in sea-muds, estuaries, and comparatively fresh water like that of the Baltic.

The densities of the Atlantic water, obtained by the large hydrometer, were as follows:—

	${}_4S_{15·56}$.	
	1026·35 9	
	·35 5	
	·35 8	Temperature between 8·4° and 8·5° C.
	·33 7	
	·35 9	
	·34 1	
Mean	1026·35 1	
	1026·36 7	
	·36 6	Temperature between 18·6° and 18·8° C.
	·36 2	
	·36 5	
Mean	1026·36 5	

	1026·34 1	Temperature between 28·7° and 29·2° C.
	·34 7	
	·35 0	
	·34 1	
Mean	1026·34 5	

Mean of all readings = 1026·353.

These results were very satisfactory, the mean densities obtained by the Sprengel tube and hydrometer being identical. The difference between the lowest reading and the highest was 0·03, equal to an error in reading the scale of ± half a millimètre.

It was thus shown decisively that a delicate hydrometer, if properly standardised, and all precautions taken to secure correct readings, will give good results, not requiring any correction whatever to make them agree with the Sprengel tube results.[1]

Any errors of reading, during the experiments, were mainly due to insufficient mixing of the water. When the water was colder than the air of the laboratory, the temperature of the surface rose on standing, and a layer of cold water remained at the bottom of the hydrometer jar. When standardising, readings should be taken in distilled water warmed up gradually and mixed well before reading. During the cooling of the water a second series of readings should be taken, and these ought to agree with the first series.

It has been stated that one source of errors in hydrometer work has connection with the size or diameter of jar used, and this is no doubt true, but only indirectly. Nearly all the experiments with the large hydrometer were made in a glass jar of 13 cc. diameter, but a few readings taken in a jar of only six centimètres (two centimètres more than the diameter of the hydrometer) showed that the results were less reliable. The instrument tended to cling to the sides of the jar, and came more quickly to rest than in a wide jar, but the readings were the same. The difficulty in mixing the water sufficiently showed that for such delicate work readings ought never to be taken in a jar of a diameter less than two and a half times the diameter of the hydrometer.

Occasionally there are observational errors, such as reading 43 or 33

[1] *Capillarity.*—The influence of capillarity on a hydrometer was expected, during the experiments stated above, to manifest itself in a direct, instead of an indirect manner. This effect is caused by the difference in weight of the hillocks of pure water and sea-water drawn up round the stem, and was estimated by Dittmar to be equal to + 0·04 in density. In the hydrometers examined by me this influence was not manifest, not even in the large hydrometer where the error would have been equal to + ·02. In a larger and more delicate hydrometer, the capillarity error, if it exists, would tend to disappear. But experiments with capillarity tubes of various diameters showed that sea-water will rise in them to the same height as distilled water, and this would tend to show that the influence is in the other direction, though hardly perceptible. I am inclined to think that it may be neglected altogether, and, so far as sea-water hydrometers are concerned, it is of no great importance, as such instruments ought always to be compared by some weighing method before they are extensively employed.

for 37, and there is greater liability to read wrong when the figures run down the scale instead of up.

Although hydrometers give accurate results on land, it is known that results may be different at sea, no doubt owing to the rolling and lurching of the ship and the consequent instability of the instrument and difficulty in reading. Under such conditions the temperature of the water ought to be within a few tenths of a degree the same as that of the surrounding air, and well mixed before every reading, of which three should be taken at different places on the stem.

The following differences in density between the hydrometer readings at sea and the subsequent determinations by weighing on land may be placed in a table, each of the columns representing a water obtained during a cruise in the North Sea.

Waters with difference of		Waters with difference of		Waters with difference of		Waters with difference of	
7 .	± ·03	1 .	+ ·06	1 .	+ ·01	1 .	+ ·03
5 .	± ·05	1 .	+ ·15	1 .	+ ·03	2 .	+ ·05
3 .	± ·08	2 .	+ ·17	1 .	+ ·08	1 .	+ ·08
3 .	± ·11	1 .	+ ·18	4 .	+ ·10	6 .	+ ·10
3 .	± ·16	1 .	+ ·19	2 .	+ ·12	2 .	+ ·12
3 .	± ·21	1 .	+ ·20	1 .	+ ·14	1 .	+ ·14
3 .	± ·80	2 .	+ ·21	1 .	+ ·16	3 .	+ ·17
1 .	−1·11	1 .	+ ·23	1 .	+ ·17		

The large errors in the first column are no doubt due to reading the scale of the hydrometer the wrong way. The other results are difficult to explain, as a smooth sea lasted during the cruise. In the second column the results are given of a cruise in bad weather, and in the third and fourth column results recorded when the weather was fairly good. Why the errors are all plus may be difficult to explain. If the readings were all taken when the vertical motion of the ship was downwards, the tendency would be to give plus results; and minus results would occur when the ship was rising during a reading. The observer, however, is inclined to consider the errors as due to temperature. There seems to be no doubt that an error of 0·16 in density, or 3 millimètres of the scale, is not uncommon, even on a comparatively smooth sea. The waters of one cruise were also examined for density by a hydrometer of the same size on land, and gave the following differences when compared with the Sprengel tube results:—

At Sea.	On Land.
+ ·01	− ·02
+ ·03	·00
+ ·09	− ·07
+ ·10	− ·06
+ ·14	+ ·08
+ ·10	+ ·04
+ ·17	− ·02

At Sea.	On Land.
+·12	+·06
+·08	·00
+·16	+·03
+·12	−·04
+·09	−·04

The errors at sea are all plus quantities, and the greatest is equal to 3 millimètres of reading. On land the plus and minus quantities nearly balance, and the greatest error is equal to 1·5 millimètres. Experiments at sea might yet be tried with a hydrometer of a capacity of 600 cc., where an error of 3 millimètres would only equal ±·04.

If the samples of water collected are to be afterwards tested in the laboratory, they must be filtered and well stoppered to prevent evaporation, which sometimes takes place notwithstanding every precaution. Whether glass should be used at all for storing waters is questionable.[1]

From Dr. Murray and Dr. Buchanan I obtained the hydrometer used on board the *Challenger* for all the waters collected. It was examined for the purpose of seeing what corrections, if any, would be necessary for the interpretation of the results as detailed in the *Report*,[2] in the hope that the variableness or constancy of the composition of ocean water might be detected. Professor Dittmar had estimated the error of this hydrometer to be −·08 in density, and the error of the scale to be +·0002 cc. per millimètre. That is to say, the data he found for the hydrometer differed by the above quantities from the data given by Dr. Buchanan. My examination of the hydrometer gave the following general results. Like Dittmar, I found it to be too low generally, but not so low at the higher temperatures. At 10° C. the error in density was −·07, at 24° C. only −·01, and the scale error was +·0001 cc. per millimètre. With reference to the *Challenger* hydrometer, and to any inferences drawn from its present condition, it is assumed in the following

[1] The following examples of evaporation and change in sea-water are interesting. Two or more samples of the same *Challenger* water, No. 1687, were collected, and one of them was examined twelve years ago by Dittmar. Two of the samples were also examined last year :—

	Chlorine per Kilogramme.	Alkalinity (CO_2) per Kilogramme.	Year of Analysis.
Sample A, ...	20·64	53·05	1878-82
	20·63	52·61	1893
Sample B, ...	20·83	66·71	1893

So that while one sample had remained the same for about a dozen years, the other had evaporated sufficiently to increase the density by 0·30 (water=1000), and the alkalinity was greater than this evaporation could account for. Whether this increase of alkalinity is caused by solution of the alkali of the glass, or by the decomposition of sulphates by organic matter, is doubtful. Not only may the action of the glass tend to increase the alkalinity, but, as the following fact shows, it may tend to *decrease* the alkalinity of the water, a tendency which has, I believe, been overlooked. A bottle of sea-water, with 0·1 gramme mussel flesh added, after standing for nine months, was examined for alkalinity, and found to have lost 14 milligrammes of combined carbonic acid. A white deposit on the bottom of the bottle was supposed to be carbonate of lime, but on examination turned out to be mainly silicate of magnesia along with silicates of alumina, iron, and a trace of lime, the action of the alkaline sea-water on the glass being thus very distinct. What reaction had taken place, and what was the influence of the organic matter, is not yet clearly understood.

[2] *Challenger Report*, "Chemistry and Physics," vol. i., part 2.

part of the paper that the volume of the glass and its power of expansion have not altered since it was first made, though it is not impossible that changes may have occurred during twenty years which would alter the readings. In examining the *Challenger* hydrometer I checked the brass weights and the table for holding them (see page 10), and compared them with the values of the weights as given in the *Challenger Report.* The two weights principally used during the cruise had become lighter, Nos. IV. and V. having lost 0·0015 and 0·003 grammes respectively, and the table for laying them on had lost 0·003 grammes. No doubt these weights had become lighter by use, the other unused weights having remained constant. Two readings were taken with the hydrometer at 10° C., the table and weights and all the data as given by Buchanan being employed. The Atlantic water used for the other hydrometer experiments was also used in this case.

	${}_4S_{15·56}$
	1026·335
	26·355
Mean	1026·345

The correct density, as ascertained by the Sprengel tube, was 1026·353, and therefore the error of the instrument at 10° C. was only about −·01 in density. It is plain that towards the end of the cruise the given data would tend to render the observed densities more correct than they would be at the commencement, at which time the real mass of the brass weights would agree with the values given in Buchanan's data. To show this more fully we should subtract 0·04 of density from the mean result of the two readings given above, 0·02 for the loss in weight of the table, and 0·02 for the loss in weight of No. V. brass weight, and the resulting density is 1026·305, too low by −·05, which would give the error of the hydrometer when the cruise began. Further experiments were carried out, using another set of weights altogether, showing that the error was more probably −·07 at 9° C.

	${}_4S_{15·56}$		
	1026·34	6	
	·26	9	
	·25	5	Temperature from 9·2° to 9·4° C.
	·25	7	
	·31	2	
	·25	6	
Mean	1026·28	3	
	1026·37	2	
	·36	5	
	·33	4	Temperature from 23·4° to 24° C.
	·30	1	
	·33	4	
	·33	9	
Mean	1026·34	1	

The mean error at 9° C. was equal to $-\cdot 07$, and at 24° C. only $-\cdot 01$. There was also a distinct tendency to read higher than the mean at the lower part of the stem of the hydrometer, and correspondingly lower at the upper part of the stem. The corrections necessary for this tendency I found to be $-\cdot 02$ and $+\cdot 02$ respectively.

From the above experiments the following data were found for the hydrometer as it is at present, and beside these values I have placed Buchanan's, as found by him before the cruise.

	Buchanan.	Anderson.		Buchanan.	Anderson.
Weight of Hydrometer,	160·2128	—	Volume of body at 0° C.,	160·277	160·262
Weight of Table,	0·836	0·833			
,, No. I.	0·856	—	Expansion for 1° C.,	0·00456 cc.	0·00527 cc.
,, No. II.	1·601	—			
,, No. III.	2·4225	—			
,, No. IV.	3·2145	3·213	Volume of one millimètre of stem,	0·00865 cc.	0·00856 cc.
,, No. V.	4·071	4·068			
,, No. VI.	4·8245	—			

I have assumed, then, that the hydrometer itself has not altered since it was made, but that the weights have become lighter by use, and in the following table all the corrections have been taken into account for the period of the voyage, and for the temperature of the water.

Temperature of water °C.	1st Period, from Feb. 1873 to Mar. 1874.	2nd Period, from April 1874 to April 1875.		3rd Period, from May 1875 to May 1876.	
	Correction for any weight.	Correction for weights No. I., II., III., VI.	Correction for weights No. IV. and V.	Correction for weights I., II., III., VI.	Correction for weights No. IV., V.
0°	+ ·10	+ ·09	+ ·08	+ ·08	+ ·06
10	+ ·07	+ ·06	+ ·05	+ ·05	+ ·03
17	+ ·04	+ ·03	+ ·02	+ ·02	·00
24	+ ·01	·00	− ·01	− ·01	− ·03

For the stem correction ·02 must be subtracted when a high reading is noted, and ·02 added when a low reading is noted.

An attempt has been made to apply the corrections of the above table to about 70 of the *Challenger* densities, those, namely, which were partially checked by Professor Dittmar,[1] by an estimate of the chlorine and other constituents of the water.

[1] *Challenger Report*, "Chemistry and Physics," vol. i. p. 23.

It is interesting to note that the mean D value was 1·4571, which is very near the value for the North Sea and the Atlantic waters. Considering the doubt attached to hydrometer estimations at sea it is very questionable whether the differences of D value, found by dividing Buchanan's densities reduced to 0° C. by Dittmar's chlorines, can be accepted as evidence of difference in the composition of sea-water at various places in the ocean. There are only two or three of the *Challenger* waters still in existence, but the following comparison of the estimate of density by the hydrometer during the voyage, and a later estimate by a Sprengel tube is interesting. That the chlorine had remained the same since the first analysis is a sign that the density had undergone no alteration in the interval, and had probably remained unchanged since collection.

Chlorine.			Density.		
Water No.	(Dittmar) 1878-82.	1893.	Hydrometer value reduced to ${}_0S_0$.	Sprengel tube value ${}_0S_0$	Difference.
1700	20·57	20·58	1029·79	1029·96	– ·17
1687	20·64	20·63	30·00	30·03	– ·03

This result would tend to show that errors of 0·17 in density, equal to three millimètres on the scale of the hydrometer, may have occurred in the determinations during the cruise.

If it be assumed that the differences of the value of D are due to the hydrometer error, and not to any real difference in the ratio of chlorine to the other salts, it may be interesting to place in a short table the errors of density required for the seventy waters, to reduce the values to one uniform value of D. Besides these D values derived from Buchanan's results, I have attempted to derive a ratio, or D value, from Dittmar's estimate of the total salts, as well as chlorine.[1] A difference in the ratio of chlorine to the total salts in sea-water is really synonymous with a change of the D value, and ought to compare with the ratio of chlorine to density.

The chlorine is given in the *Report* in parts per 100 of the total salts.[1] A mean D value of 1·457, and a hypothetical density of 1080·747, have been used by me as standards, and the probable D value has been found for each analysis. The variations from the mean values were found in terms of the density, and these variations are collected and compared with the variations from the mean obtained from the hydrometer densities. The variations are also given in millimètre divisions of the scale.

[1] *Challenger Report*, p. 23.

Variation.	By the Hydrometer.		From Dittmar's Analysis.	
	+ Results.	— Results.	+ Results.	— Results.
Within ·03 of density	9	6	19	18
" ·06 "	9	7	11	12
" ·12 "	7	6	4	3
" ·17 "	5	4		
" ·22 "	5	4		
" ·28 "	3	1		
" ·35 "	...	2		
Within 1 millimètre of scale	19	12	32	28
" 2 " "	7	8	3	4
" 3 " "	5	6	...	...
" 4 " "	9	2	...	...
" 5 " "	...	2	...	...
" 6 " "	...	1	...	...

There is not one of Dittmar's results which shows a variation greater than 0·12 in density, equal to two millimètres on the scale of the hydrometer, while twenty-five of Buchanan's results give greater variations. It would thus seem that the probable error at sea, owing to the various causes before mentioned, is very much greater than any errors attaching to the hydrometer constants. Only in 36 out of the 70 waters do the D values, from both methods, agree in direction from the mean value, and in the majority of these 36 waters they disagree to a considerable extent.

If a difference, between the results derived from both methods, of 0·04 in density be considered of comparatively small importance, only 13 out of the 70 waters are in satisfactory agreement, and it is to be observed that they are all practically normal waters.

No.	D value.	No.	D value.
22	1·4587	434	1·4590
226	74	437	88
283	70	865	91
312	73	875	81
386	84	922	92
392	61	962	67
393	79		

But the table of the full analysis referred to[1] cannot be used for such a purpose as the determination of the D value within certain limits, as the analysis of such a complex substance as sea-water is difficult. The irregularity in the precipitation of lime,[2] and the fact that the soda must be estimated by difference, might give rise to errors, and the varying amounts of surplus base shows that such must have crept in. On combining together the bases and acids found by analysis, an excess of base

[1] *Challenger Report*, "Chemistry and Physics," vol. i. p. 23.

[2] *Op. cit.* p. 9.

is generally left over. The amount of the surplus base, from the analysis of each water, is given in the column of alkalinity,[1] in units in the fifth place of decimals, and on page 125 (vol. i., "Chemistry and Physics"), is given the correct quantity of surplus base, in terms of combined carbonic acid, as found on titration with acid. Only in very exceptional circumstances does the alkalinity really fall below 110 or rise above 160 units of alkalinity per kilogramme, but from the full analysis there are the following values :—

3	waters	with	400 or over.
9	„	„	300-400
33	„	„	200-300
14	„	„	160-200
10	„	„	110-160
6	„	„	70-110
2	„	below	70

The mean of all is 220, or 100 too high, and the conclusion is evident that the total bases have as a rule been slightly over-estimated, and the results cannot be used for calculation of the D value within that probable error.

The fact remains, however, that from theoretical considerations small changes in the relation of chlorine to density in ocean water must occur. Bottom waters were found to be more alkaline than surface waters, owing to the solution of carbonate of lime shells falling from the surface, and to the action of mud.[4] The extremes of alkalinity found by Dittmar for all the waters he examined, would raise the D value in some cases from 1·457 to 1·458, and in other cases lower it to 1·456. But, as already shown, the alkalinity of waters may alter during storage in glass bottles. Other causes of small differences in the D value of ocean waters are the abstraction of bromine by sea-weeds, and also the freezing of sea-water at the Poles.

But after a consideration of all these facts, it must be concluded that the data as yet obtained are not sufficient to throw any certain light on the non-uniformity or otherwise of the composition of ocean water, any differences that occur being probably hidden by the analytical errors, and the errors entailed by storage of water.

Table I.

An extended form of this table was found useful in hydrometer work for reducing the densities ${}_4S_t$ to $S_{15\cdot56}$. It is a reconstruction of Dittmar's table, *Report*, page 70, giving the result of all the calculations of Dittmar's table simply as a quantity to be added or subtracted. For example, given by hydrometer $S = 1023$, what is ${}_4S_{15\cdot56}$? The temperature is found on the horizontal line, and opposite in the column headed 1023 stands 1·65; $1023 - 1\cdot65 = 1021\cdot35$, which is the required ${}_4S_{15\cdot56}$. Intermediate results are found by interpolation. When t is below 15·56 the figures are subtracted from ${}_4S_t$, when t is higher they are added to ${}_4S_t$.

[1] *Challenger Report*, "Chemistry and Physics," vol. i. p. 23.

[2] Murray and Irvine on Blue Muds, *Transactions of the Royal Society of Edinburgh*, vol. xxxvii., part ii., No. 23.

Minus.

t° C.	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030
0·	1·83	1·88	1·93	1·97	2·02	2·07	2·12	2·17	2·22	2·27
1·0	1·81	1·86	1·90	1·94	1·99	2·03	2·08	2·12	2·17	2·21
2·0	1·78	1·82	1·86	1·90	1·95	1·99	2·03	2·07	2·11	2·15
3·0	1·73	1·77	1·81	1·84	1·88	1·92	1·95	1·99	2·03	2·06
4·0	1·67	1·70	1·74	1·77	1·80	1·83	1·87	1·90	1·94	1·97
5·0	1·59	1·62	1·65	1·68	1·71	1·74	1·77	1·80	1·83	1·86
6·0	1·50	1·53	1·56	1·58	1·61	1·64	1·66	1·69	1·71	1·74
7·0	1·40	1·42	1·44	1·47	1·49	1·51	1·54	1·56	1·58	1·61

t° C.	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029
8·0	1·26	1·28	1·30	1·32	1·34	1·36	1·38	1·40	1·42	1·44
9·0	1·14	1·15	1·17	1·19	1·21	1·22	1·24	1·26	1·27	1·29
10·0	1·00	1·01	1·03	1·04	1·06	1·07	1·08	1·10	1·11	1·13
11·0	·84	·85	·86	·87	·89	·90	·91	·92	·93	·94
12·0	·68	·69	·70	·71	·72	·72	·73	·74	·75	·76
13·0	·50	·51	·51	·52	·52	·53	·54	·54	·55	·56

t° C.	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028
14·0	·31	·32	·32	·32	·33	·33	·34	·34	·34	·35
15·0	·12	·12	·12	·12	·12	·13	·13	·13	·13	·13
16·0	·09	·09	·09	·09	·10	·10	·10	·10	·10	·10
17·0	·31	·31	·31	·32	·32	·32	·33	·33	·33	·34
18·0	·54	·55	·55	·56	·57	·57	·58	·58	·59	·59

Plus.

t° C.	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027
19·0	·78	·79	·80	·81	·81	·82	·83	·84	·85	·85
20·0	1·03	1·04	1·05	1·06	1·07	1·08	1·09	1·10	1·11	1·12
21·0	1·29	1·30	1·32	1·33	1·34	1·35	1·36	1·37	1·39	1·40
22·0	1·56	1·57	1·58	1·60	1·61	1·62	1·63	1·65	1·66	1·67
23·0	1·83	1·84	1·86	1·87	1·89	1·90	1·92	1·93	1·95	1·96

t° C.	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026
24·0	2·09	2·10	2·12	2·14	2·15	2·17	2·19	2·20	2·22	2·24
25·0	2·37	2·39	2·40	2·42	2·44	2·46	2·48	2·50	2·52	2·54
26·0	2·66	2·68	2·70	2·72	2·74	2·76	2·78	2·80	2·83	2·85

t° C.	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024
27·0	2·93	2·95	2·97	2·99	3·01	3·04	3·06	3·08	3·10	3·12
28·0	3·23	3·25	3·28	3·30	3·32	3·35	3·37	3·40	3·42	3·44
29·0	3·54	3·57	3·59	3·62	3·65	3·67	3·70	3·72	3·75	3·77
30·0	3·85	3·88	3·91	3·94	3·96	3·99	4·02	4·04	4·07	4·10
31·0	4·17	4·20	4·23	4·26	4·29	4·32	4·35	4·38	4·41	4·44

If ${}_4S_{15}$ be preferred as the standard, reduce the sea-water as in above table and then *add* the following quantity, which depends on the density at ${}_4S_{15\cdot56}$.

${}_4S_{15\cdot56}$	
1000	+·095
1010	+·105
1026	+·125
1034	+·135

After the density ${}_4S_{15\cdot56}$ is found, comparison with a determination by weight may be necessary. The result may be reduced to ${}_0S_0$ in the following manner:—

Find the difference between 1026 and the observed density, and multiply the difference by 1·0514. If the ${}_4S_{15\cdot56}$ be greater than 1026, add the product to 1028·18, and the result is the density at ${}_4S_0$. If ${}_4S_{15\cdot56}$ be less than 1026, subtract the product from 1028·18.

After ${}_4S_0$ is found add 0·132, and the result is the density of the water at ${}_0S_0$.

To reverse the process begin by subtracting 0·132, and multiply the difference between the remainder and 1028·18 by 0·9511, and add the result to, or subtract the result from, 1026.

If the density by weighing be taken at 15° C. or 17·5°, two commonly occurring temperatures, it may be reduced to ${}_4S_{15\cdot56}$ by subtracting the following values:—

${}_{15}S_{15}$	To find ${}_4S_{15\cdot56}$	$S_{17\cdot5}$	To find ${}_4S_{15\cdot56}$
1020	−0·972	1020	−0·856
24	−0·981	23	−0·846
28	−0·990	26	−0·835
32	−0·999	29	−0·824
		32	−0·813

But the density by weighing may be taken at any temperature, as ${}_tS_t$, and reduced to ${}_4S_t$, by multiplying the density (${}_tS_t$) by the density of distilled water at t° C. (4° C. = 1.) The reverse, ${}_4S_t$ to ${}_tS$ may be found by dividing ${}_4S_t$ by distilled water at t° C.

To convert the densities of ordinary sea-water obtained by Sprengel tubes to comparable temperatures, the following table will be found useful. Column *b* gives the D values of sea-water at temperatures from 0° C. to 30° C. They are calculated from Dittmar's Tables. (See *Report*, pages 70 to 81.) The D value is the density $S_t - 1000$, divided by the chlorine per kilo. It may be used in the following manner for reducing ${}_tS_t$ to ${}_TS_T$, as in Sprengel tube determinations, by multiplying the density minus 1000 by the D at T°, and dividing by the D at t°. A more convenient way of doing this is by using the logarithms, Column *c*, which, added to the logarithm of the density (minus 1000), give the logarithm of the density at ${}_0S_0$. To reduce from t to T subtract as before 1000, find the logarithm of what is left, add the logarithm opposite t°. This gives the logarithm of ${}_0S_0 - 1000$, which is next calculated to ${}_TS_T - 1000$ by subtracting the logarithm in a line with T°. When a water, such as one diluted with river-water, does not expand like ordinary sea-water, it is better to take the density at 0° C. by the Sprengel tube.

TABLE II.

a. Temperature °C.	b. D value.	c. Logarithm to reduce to $_0S_0$	a. Temperature °C.	b. D value.	c. Logarithm to reduce to $_0S_0$
0	1·4584		16	1·3869	·0218360
1	1·4528	·0016709	17	1·3836	·0228857
2	1·4475	·0032545	17·5	1·3821	·0233225
3	1·4422	·0048492	18	1·3805	·0238245
4	1·4371	·0063897	19	1·3774	·0248141
5	1·4320	·0079337	20	1·3748	·0256372
6	1·4274	·0093395	21	1·3719	·0265390
7	1·4226	·0107939	22	1·3696	·0272830
8	1·4179	·0122328	23	1·3672	·0280417
9	1·4135	·0135918	42	1·3652	·0286967
10	1·4093	·0148732	25	1·3632	·0293171
11	1·4049	·0162429	26	1·3612	·0299438
12	1·4012	·0173766	27	1·3592	·0306017
13	1·3972	·0186220	28	1·3576	·0311122
14	1·3939	·0196451	29	1·3559	·0316490
15	1·3902	·0207994	30	1·3545	·0320977
15·56	1·3883	·0213934			

The D given above is equal to $\frac{S_t - 1000}{\chi}$ and is not the D of Dittmar (on page 57 of the *Report*), which is the density of sea-water, $_4S_t$, minus the density of pure water, $_4W_t$, divided by the amount of chlorine, that is, $\frac{_4S_t - {_4W_t}}{\chi}$. The value of D in the table may be reduced to that of Dittmar's D by multiplying by W^t and subtracting ·0016 from the product.

THE CAMPAIGNS OF ALEXANDER THE GREAT IN TURKESTAN.[1]

By J. W. M'CRINDLE, M.A., M.R.A.S.

THE geographers who, in days not far remote, set themselves to determine the routes followed by Alexander the Great in his Asiatic Expedition, and to identify the districts, cities, and strongholds which in succession submitted to his arms, met with comparatively few difficulties until they came to deal with the regions in which the great conqueror found himself after he had passed through the Caspian Gates in pursuit of Darius. The countries lying between these Gates and the far-distant banks of the Jaxartes and Indus, which had been subjected to Persian rule by Cyrus and his successors, presented a striking contrast, both in

[1] *Alexander des Grossen Feldzüge in Turkestan.* Von Franz v. Schwarz. München : Dr. E. Wolff, 1893. Pp. 103.

their physical features and in the character and habits of the races by which they were peopled, to the Western dominions of the same empire. In the latter were comprised all those fair and fertile regions in which mankind had first acquired the arts of civilised life. They contained many large and opulent cities with the fame of which the world was filled; and they were traversed by numerous highways, along which frequently passed the caravan of the merchant, and the couriers carrying post-haste the mandates of the Great King. The inhabitants, living in ease and luxury, passively submitted to be despotically ruled; and, when summoned to take the field in arms, trusted more to their numbers than to their valour. The tracts, on the other hand, which lay beyond the Gates consisted for the most part of pathless deserts and of colossal mountain-ranges crested with eternal snow. The inhabitants, as might be expected, were rude and barbarous; but they were at the same time stalwart, intrepid warriors, inured to toil and privations, and animated with a fierce love of independence. Alexander found in them antagonists of far other mettle than those displayed who filled the ranks which he had slaughtered like sheep on the plains of Issus and Arbela. They faced him in fight with numbers but little superior to his own, rose against him even after defeat, and on one occasion totally annihilated a powerful detachment of his troops. It was not until the British armies had conquered Northern India, and until Russia had later on extended her sway in Central Asia to the borders of Afghanistan, that the regions which he overran in the far East were opened up to the investigations of scholars and antiquarians. But since then the work of discovery has proceeded apace, so that we can now trace with certainty the line of march pursued by Alexander from the time he passed through the Gates till he reached the mouth of the Indus. Nay, even the long-hidden recesses of the terrible Gedrosian desert which lay beyond have at length been explored, and the route ascertained by which the Macedonians traversed its burning sands. amidst which so many of them were doomed to perish from the effects of overpowering heat, thirst, and famine.[1]

The reduction of Turkestan, to which we must now limit our remarks, occupied the arms of Alexander for upwards of two years. Scholars who have hitherto taken in hand to describe the campaigns by which this was effected have found their task beset with unusual difficulty, due partly to their imperfect knowledge of the geography of the seat of war, and partly also to discrepancies in the accounts of these campaigns as given by Arrian and Q. Curtius, who neither drew their facts from the same original sources nor relate them in quite the same order of sequence. It is in these circumstances fortunate that a work has at last appeared, the author of which, in discussing Alexander's operations in the regions of the Oxus and the Jaxartes, writes with full personal knowledge of nearly all the places mentioned by his historians. He informs us in his preface that he resided, without a break,

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[1] Colonel Holdich, in a lecture delivered at Simla in June last, and entitled *A Retreat from India*, has from personal knowledge shown the route followed by Alexander in traversing Gedrosia.

for fifteen years in Turkestan, and that during that time he had frequent opportunities of travelling through the territories traversed by Alexander and his Macedonians. These opportunities he has turned to the best account, for he has satisfactorily identified all the important positions, cleared away hitherto prevalent misconceptions, and enabled us, with the aid of the excellent maps which accompany his work, to follow with certainty from point to point the movements of the conqueror from the time he crossed till the time he re-crossed the Indian Caucasus. He sets out by translating from Arrian, whom he has properly selected as his principal authority, those passages of the *Anabasis* in which the campaigns in question are described. Then follows his commentary, in which we find, interspersed, passages from Curtius which supplement or confirm the information supplied by the other historian. The space at our disposal will hardly permit us to do more than to indicate the identifications which he has established without our adducing the proofs by which he supports them.

In the early spring of the year 329 B.C., Alexander left Afghanistan, and, having crossed the lofty range of mountains called by the Greeks Caucasus, and now known as the Hindu-Kush, arrived at Drapsaka, and from thence continued his march to Aornus and Bactra. It has never been doubted that Bactra is Balkh of the present day, but opinions have differed with regard to the situation of the other two places. Our author identifies Drapsaka with Kunduz, and Aornus with Tash-Kurgan, near which lie the ruins of Khulm.[1] From Bactra, Alexander marched through a frightful desert, of which Curtius has given a description as accurate as it is vivid, and reached the banks of the Oxus. The passage of this river, which occupied five days, was made on floats of stuffed skins. Schwarz shows that the passage was made from Kilif and not from Kizil, farther down the stream, as has heretofore been generally supposed. He is also inclined to think that Kilif is the city of the Branchidæ, which, with its inhabitants, Alexander so remorselessly destroyed. From the Oxus, he advanced by way of Karshi (near which, at the hill Kungur-tau, he was wounded in a skirmish) and Jam to Marakanda, which he reached in four days. Marakanda is the famous city of Samarkand, which sixteen centuries later became, under Timour, the capital of an empire in which were included, besides other dominions, all Alexander's Asiatic conquests. It was situated on the banks of the river Polytimêtus, which is the Zerafshan or Kohik of our times. From Marakanda the march was continued to the river Tanais—the Jaxartes or Syr-darya—which bounded the Persian empire on the east, and protected it in some measure from the Scythians who inhabited its farther, or right, bank. On the Persian side of the river, where Khojent now stands, Alexander proceeded to found a city, which, with the view of attracting settlers, he called after his own name, Alexandria. The natives, meanwhile, who had hitherto been quiescent, at the instigation of a bold and enterprising chief called Spitamenes, revolted against him and began to put some of their

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[1] The modern names of places are not spelled as by Schwarz, but as in Curzon's well-known map of Persia, where they are nearly all to be found.

towns into a state of defence. These, however, he quickly captured. They were seven in number, but the names of two only have been recorded—Gaza and Cyropolis. The former Schwarz identifies with Nau, and the latter with Ura-tübe, a considerable city about forty miles distant from Khojent, which occupies a commanding position and is strongly fortified. Cyropolis, as its name shows, had been founded by Cyrus the Great, who meant it to serve as the frontier bulwark of his empire against Scythian inroads. Having quelled the revolt in this quarter, Alexander crossed the Jaxartes to call the Scythians to account who had shown themselves in threatening masses along their own side of the river. He defeated them in battle, and pursued them as far as what Curtius calls the boundary-stones of Father Bacchus, which our author describes as a pass over Mogul-tau, near the post-station Mursa-rabat, which is about seventeen miles distant from Khojent. He then hastened back to Marakanda, having learned that a large body of his troops had been utterly destroyed by Spitamenes in the ravines of the Polytimêtus, and he reached that place in three days. As the distance from Khojent to Samarkand is 172 English miles, this march, made in broiling heat, and through a country without roads, must have tried to the utmost the powers of endurance of the Macedonian soldiers, some of whom were hoplites wearing their brazen helmets, carrying their shields, and clad in mail. Spitamenes, who had returned from the scene of his victory to renew the siege of Marakanda, on learning that the enemy was approaching, fled back to the desert, and, though hotly pursued, escaped into its wilds. Alexander, on reaching the island in the Polytimêtus where his men had fallen in squadrons, transfixed with the arrows of the Scythian horsemen, buried their remains, and to revenge their death ravaged all the country with fire and sword. Nothing is known of the island, and it probably no longer exists, as the sands of the desert have in these parts been making continual encroachments on the cultivated lands. Schwarz thinks it must have been situated in the neighbourhood of Ziadin and Kermineh. From thence Alexander, burning with vindictive rage, pursued his way down the course of the river past Bokhara, the Sogdian capital, till he reached Karakul, beyond which the river is lost in the sands of the desert. He then retired to Zariaspa, where he allowed his troops some repose during the winter season. Zariaspa has generally been taken to be another name of Bactra, but Schwarz shows conclusively that this is an altogether erroneous opinion, and identifies the place with Charjui, which is some six or seven miles distant from the Oxus where it is spanned by the bridge of the Trans-Caspian Railway.

From a passage in Curtius which states that Alexander, after having crossed the Ochus and the Oxus, arrived at Margiana, it has been concluded that Alexander made about this time an excursion from Bokhara to Merv, which stands on the river known to the Greeks as the Margus, and is now the Murgh-âb. Our author, however, points out that a march of some 215 miles through the intervening desert, which is very scantily supplied with wells, would have been utterly impracticable; and he therefore refers the visit to the time when Alexander had as yet advanced no farther eastward than Parthia, and supposes it may have been made from Sarakhs. From Zariaspa, Alexander returned to Marakanda, passing on his way by Karakul, Bokhara, Kermineh, and Kata-Kurgan. The places in Sogdiana which still held out were then reduced, and Coenus was directed to act against the redoubtable Spitamenes, who had mustered a force of 600 Scythian cavalry. At the head of this he made an irruption into Bactriana, captured a fort, and swept away a large booty from the neighbourhood of Zariaspa itself, though some Macedonian soldiers had been left there as invalids. These men, mustering a small band, attacked the raiders somewhere on the verge of the Turkoman desert, but were repulsed with some loss. Coenus, on receiving tidings of this fresh disaster, made a forced march to overtake the Scythians, whose numbers had meanwhile been considerably augmented, and after a fierce engagement put them to rout. Spitamenes, however, again turned upon him, and with a body of 3000 Scythian horsemen, whom he had collected at Bagae, prepared to invade Sogdiana. Our author identifies Bagae with Ustuk, a fortress on the Bokharan frontier on the Oxus, about 28 miles below Charjui, but on the opposite side of the river. In the fight which followed, Coenus was victorious; and the Scythians who fled into the desert with Spitamenes turned traitors, cut off the head of their leader, and sent it as a peace-offering to Alexander. So perished the most astute, audacious, and persistent enemy with whom Alexander ever had to contend. Alexander had meanwhile withdrawn to Nautaka, where he remained during the winter of 328-327 B.C. Nautaka has generally been identified with Karshi, but Schwarz takes it to be Shaar, which lies 40 miles to the south of Samarkand.

Alexander left Nautaka early in spring, before the snows of winter had yet fled; and the next place which requires identification is the famous Sogdian Rock, which is connected with one of the most romantic episodes in his whole career. The Rock was deemed impregnable, and within the fortress which crowned its summit, Oxyartes, a Sogdian chief, had placed for safety his wife and daughters, the eldest of whom, Roxana, was considered by the Greeks to be the most beautiful woman in all Asia, next after the wife of Darius. Alexander captured both the Rock and the fortress; and when the maiden was brought into his presence, he was so fascinated with her surpassing beauty that he fell in love with her at first sight, and notwithstanding the remonstrances of his friends made her his wife. Curtius calls this stronghold the Rock of Arimazes. Some have identified it with the steep crags, about 500 feet in height, which on one side line the narrow gorge in the neighbourhood of Derbent, which is called the Iron Gate, and which forms the only direct approach from West Bokhara to Hissar. Schwarz allows that this is a very strong position, but says that the Iron Gate, through which he has himself passed six times, answers neither to the description of Arrian nor of Curtius. The position which he himself has selected is a mountain which ascends precipitously from a gorge similar to that of the Iron Gate, and distant from it some five miles in a north-east direction. Some of the commentators of Curtius, taking his Rock of Arimazes to be different from the Sogdian Rock, have assigned to the former a position somewhere on the route between Merv and Balkh, regardless of the fact that on that route there are no mountains at all.

From the Rock, Alexander marched eastward into the country of the Paraetacae, which, as this name shows, was a mountainous region. It is easily to be identified with Hissar. In this district Alexander's progress was arrested by another mountain fortress no less formidable than the Sogdian. It is called by Arrian the Rock of Chorienes, and by Curtius the Rock of Sysimithres. Its identification presents no difficulty, as in all Hissar, our author says, there is but one place which suits the indications given by the two historians. It is the narrow pass at the river Waksh where the suspension-bridge of Pul-i-Sangin overspans it on the way from Hissar through Faizabad to Badshuan; and this pass, he says, is the most remarkable point to which he came in the course of his travels. Chorienes, notwithstanding the extraordinary strength of his position, surrendered—partly through fear inspired by the sight of the formidable preparations which Alexander was making for an assault, and partly through the persuasions of Oxyartes. The conqueror did not advance farther in this direction, but returned to Balkh by way of Faizabad, Hissar, and Karatag to Yurchi, and thence down the right bank of the Surkhan to Tormiz, a place now in ruins, and to the passage of the Oxus at Pata-gisar. On reaching Bactra he began to make his preparations for the invasion of India, and, having completed them, set out on this long-meditated expedition in the summer of 327 B.C. In ten days he recrossed the Hindu-Kush, and arrived at Alexandria, the city which he had founded at the foot of that range before he first crossed it to enter Bactria. Our author takes this place to be Kabul, but we cannot accept such an identification. Kabul has been proved to be beyond question the Ortospanum mentioned in the famous itinerary preserved by Pliny, which states that the City of Alexander was distant therefrom 50 miles. We are thus directed to the neighbourhood of Charikar, a village in the valley of Koh-daman, where the three roads dispart which lead from Afghanistan into the regions of the Upper Oxus, and where, in a position of great strategic strength and importance, extensive ruins have been found, apparently those of an ancient city, which can be no other than Alexandria-apud-Caucasum.

We may add that this excellent volume, besides making Alexander's campaigns in Turkestan clearly intelligible, contains valuable information on other points—as, for instance, on the origin, racial affinities, and distinctive physical characteristics of the various tribes by which Turkestan is inhabited. It is, we are told, the precursor of a larger work now in preparation, and treating at length of the same country. Its appearance, we doubt not, will be gladly welcomed in all geographical circles.

GEOGRAPHICAL NOTES.

By The Acting Editor.

EUROPE.

The White Sea.—During the month of August, 1892, M. Knipovitch made some interesting researches in the Dolgaia Guba, a long bay in the island of Solovetski. *Yoldia arctica* was found, a mollusc which lives only in water below freezing point, and also *Cyprina islandica*, rarely found in cold waters. The presence of the former is explained by the peculiar conditions of the bay. At the commencement of August, when the temperature of the Solovetski Gulf had risen to 46½° F. even at a depth of 125 feet, M. Knipovitch found the temperature in the Dolgaia Guba to be 54° at a depth of 23 feet, while at 540 feet it sank to freezing-point. The bay is connected with the White Sea only by a narrow passage with a bar, and consequently the bottom waters are isolated from the general circulation of the sea. M. Knipovitch considers the *Yoldia* to be a survival of a fauna that existed there during the Glacial Period.—*Nouvelles Géogr.*, September, 1894.

The Lake of Joux and the River Orbe.—Professor J. J. Egli has kindly sent us the following information concerning the connection of the Joux and the Orbe, briefly mentioned on p. 492 :—" The Orbe is an affluent of the Lake of Neuchâtel, descending from the Jura range. It falls into two portions—the upper course, from its source to the Lake of Joux, 3310 feet above sea-level ; and the lower course, from the source of the Orbe, 2569 feet above sea-level, to the Lake of Neuchâtel. Its middle course, from the Lake of Joux to the source of the Orbe, runs underground for a distance of one mile and seven furlongs. The water of the Lake Brenet, an appendage of the Lake of Joux, falls into the funnels at the Bonport mill, and springs out of a wall of rock as the source of the Orbe.

On September 1st, 1893, the chemist Piccard poured several kilogrammes of fluorescein—a substance with enormous colouring power—into the funnel, and fifty hours later the water at the source of the Orbe became of an arsenical green colour, and so remained for eighteen hours (*Neue Zürcher Zeit.*, September 22, 1893). It was thus proved that the Lake Brenet and the source of the Orbe are connected by a subterranean channel.

This successful experiment was, however, preceded by several similar observations. The great *Dictionnaire hist. geogr. et statistique du Canton de Vaud*, by D. Martignier and A. de Crousaz (Lausanne, 1867), is, certainly, silent about them, asserting simply the subterranean connection. But in its predecessor (*Dict.*, pp. 56 and 230, Lausanne, 1824), Levade refers to Saussure's report, and this is incorporated in the work of E. Vulliemin (*Gemälde der Schweiz*, xix. p. 151. Wehrli-Boisot's translation, St. Gallen, 1847). The famous Genovese (*Voyages dans les Alpes*, i. § 358, Neuchâtel, 1803) states that in 1776 the water of the Lake Brenet was thoroughly stirred up and rendered muddy by the bursting of a dam, and that the source of the Orbe became likewise muddy.

Through the courtesy of my colleague, A. Forel of Morges, the best authority on Swiss lakes, I have been made acquainted with the thermometrical experiment of MM. Burnier, Ch. Dufour, and Yersin (*Bulletin des séances de la Société Vaudoise des sciences naturelles*, iv. p. 226, Lausanne, 1856). From October 1853 to September 1854, monthly observations of temperature were made on the Lake of Joux, at the source of the Orbe, and at other springs of the Jura. While the latter maintained a fairly constant temperature of 44½° to 48° F., the water of the lake varied in temperature between 32·7° and 67·6° F., and at the source of the Orbe the variations were approximately the same."

A Canal from the Rhone to Marseilles.—Monsieur J. Charles-Roux has contributed an elaborate article on this project to the *Revue de Géographie* (July). The most important ports are situated on navigable waterways leading into the interior of the country, while Marseilles, which is the eighth of the great commercial centres of the world, though occupying a favourable site in other respects, does not possess direct communication by water with the heart of France. The delta of the Rhone is not easily navigable, owing to the irregularity of the bed of the river and its constant changes ; besides which, its lagoons and marshy tracts, engendering malaria, render it unsuitable as a site for a town.

The opening of the Mont Cenis and Saint Gotthard routes has drawn the trade to the east, and increased the traffic through Switzerland between Germany and Italy. The result has been that the merchandise passing through Genoa has increased in weight by 116·21 per cent. during the years 1880 to 1890, and Hamburg and Antwerp show an increase of 144·88 and 81·30 per cent. respectively, while Marseilles has gained only 21·92 per cent.

It has, therefore, been proposed to construct the canal under discussion, which, it is believed, would greatly benefit the trade of Marseilles. A scheme was drawn up in 1879 by M. Bernard, chief engineer, and completed by his successor, M. Guérard. The canal traced was to leave Marseilles at the Madrague creek, and follow the coast as far as a point about 500 yards west of the Pointe de la Lave ; it would then pass, by a tunnel under the mountains, to the pool of Bolmon, and be continued through the Etang de Berre to Martigues. From Martigues it would be carried through the Etang de Caronte to Bouc, where it would meet the existing canal from Arles to Bouc, which would be utilised as far as the Etang du Galéjon, and, from this lagoon, would be carried in a straight line to the sluices of Bras-Mort, on the Rhone. The total length of the canal wonld be 34 miles, of which 4½ belong to the tunnel above-mentioned. The fall of the Rhone, estimated to have a maximum of about 13 feet, would be provided for by locks at Bras-Mort and Bouc. The depth proposed is three mètres (about 10 feet) between Marseilles and Port-de-Bouc, and two mètres (6½ feet) for the remainder of the distance. The cost is estimated at more than three million sterling.

Connected with the above scheme is the utilisation of the Etang de Berre, which has an area of more than 12,000 acres and anchorage for the largest vessels, as a harbour of refuge. It is not a mere lagoon subject to constant changes, but is separated from the Mediterranean by a rocky ridge. In 1874 a canal was opened, connecting this lake with the Port-de-Bouc. It has a depth of 6 mètres, which was sufficient at the time, but now barely half the steamers plying to Marseilles can pass through it.

ASIA.

Central Asia.—A letter from Dr. Sven Hedin, sent from Kashgar, is published in *Petermann's Mitt.*, Bd. 40, No. viii. He left Marghelan on February 22nd, and stayed in the Russian fort on the Murghab from March 18th to April 7th. The lowest temperature—56·8° F., was observed on the Kok-sai, to the south of the Kizil-art pass. A series of soundings in the Kara-kul proved the maximum depth to be 756 feet. The Kizil-su carried down 5943 gallons per second on February 22nd, while the Murghab, on March 29th, was carrying only 1541 gallons. On April 7th Dr. Hedin continued his journey past Rang-kul and the Sary-kol chain to the Little Kara-kul, and began some observations on the Mustagh-ata, particularly its glaciers. He ascended to a height of about 18,000 feet, but was obliged, by acute inflammation of the eyes, to make a hasty retreat to Kashgar. After a fortnight's rest he intended to descend the Tarim on a raft, and explore the ruins to the south and south-west of the lake visited by Przhevalski. On his return, should the season not be too far advanced, he will continue his examination of the movements and velocities of the Mustagh-ata glaciers, and in the spring will start on a journey to Ladak and Tibet.

Petermanns Mitt., Bd. 40, No. 9, contains details of Dr. Hedin's soundings in the Kara-kul, with a map. The lake has a maximum length of about 15 miles, and maximum breadth of 12 miles. A peninsula, projecting from the southern shore, and an island, divide it into two basins. The eastern basin, shallow and full of banks, is surrounded by steppe and low land, whereon are numerous fresh-water ponds and springs; whereas the western basin is bordered by high mountains, and is of considerable depth. In March, Dr. Hedin rode on the ice over the eastern basin, and made three soundings, and then over the western basin to its southern extremity, making four soundings. In the former the soundings gave a depth of 41 feet to 63 feet, and in the western the maximum depth was, as already stated, 756 feet, while about 256 feet were found towards the southern end. The ground temperature in the eastern basin was 34·2° F. at the shallowest sounding, rising to 38·3° at the deepest part of the western basin. The thickness of the ice varied from 16½ to 42 inches, being greater over the shallower water. When the ice was broken, the holes were quickly filled with crystal-clear water, so bitter that the horses would not drink it. The ice was covered with about three inches of snow, and the water in the holes had a temperature of 32° to 31° F. On the island there are hills of about 150 feet in height; on the peninsula they attain an elevation of 300 to 500 feet, while the mountains on the western shore rise to 4000 or 5000 feet. Dr. Hedin gives 12,690 feet as the elevation of the Kara-kul.

The basin of the Rang-kul seems to be very shallow. A Russian officer found a maximum depth of only 21 feet. On April 8th, Dr. Hedin took two soundings to the north and south of the small island in the eastern half, and found in the first case a depth of 4 ft. 10 in., of which three feet were ice; and 6½ ft., with 40 in. of ice, in the second. The Russian map gives 12,241 feet as the elevation of Rang-kul, but Dr Hedin's observation indicated an altitude of 12,730 feet. Neither this determination, nor that of the altitude of Kara-kul can be relied on, only one observation having been made in each case, and the necessary data for correction being wanting.

Sze-chuen.—At a meeting of the Paris Geogr. Soc. in February, Dr. Meyners d'Estrey read a communication from his brother, then travelling in China. If, writes M. d'Estrey, you draw a line from the point where the three provinces of Shen-si, Kan-su, and Sze-chuen meet, passing a little to the west of Lung-ngan-fu and Cheng-tu and running southwards to Song-fu (Siu-chu-fu ?) and the northern corner of Yunnan, you will there find a series of rivers and mountains which form the real, natural frontier of Sze-chuen, though on maps this province extends farther to the west. Beyond this line the country has a very different aspect. Here are numerous lofty mountains intersected by deep valleys in which flow torrential streams with banks often covered with forest. In these mountains the aborigines, known to the Chinese by the names Miau-tse and Si-fan, have maintained their independence. They occupy the country between China proper and Tibet from the great southern bend of the Yang-tse-kiang up to the Kuku Nor, and admit the

Chinese only into the nearest of their principalities, such as Mupin (Ma-pien ?). They are divided into more than 80 petty States. Buddhism is the religion professed by the majority. Their dialects, more closely allied to Tibetan than Chinese, vary considerably, and would be an interesting subject of study for philologists. The people are fairly well made and robust. They do not wear pigtails, and dress in coarse woollen fabrics of home manufacture. The men wear shirts with collars, and the women dresses divided at the waist—fashions unknown in China. The houses, built of stone, have usually one or two storeys above the ground floor, which is occupied by the cattle.

The Miau-tse rear horses, yaks with and without horns, two breeds of cattle, sheep with long spiral horns, and goats, of which one variety has four horns. The pigs, dogs, cats, and fowls are like those seen in other parts of China. Wheat, maize, and buckwheat are cultivated.

On Chinese maps a line of mountains is represented along the western frontier of Sze-chuen, said to be the highest in the empire, and designated by the name Su-shan (snowy mountains). In Mupin M. d'Estrey climbed one of these peaks, taking a barometer with him, and found the elevation to be about 15,000 feet. To the north and to the south-west grand mountain masses were visible apparently rivalling the Himalayas. It is singular that the principal mountain of Mupin, Hong-shan-tin, is not covered with snow in winter, in which season the clouds discharge their contents over the country below, but it frequently is in summer. The winter in this district is long, and rain and fogs are common all through the year.

As to the minerals of South Central China, gold is collected from the sands of almost all the rivers when the water is low, that is, in winter. In Mupin copper sulphate and carbonate are used, and a little farther north galena is obtained. The best iron ores are plentiful in the district of Lung-ngan-fu, on the borders of the country of the Miau-tse. The Chinese part of Sze-chuen is traversed by hills where strata of Carboniferous rocks frequently crop out. They retain their original horizontal position, and the formation of valleys has been effected solely by atmospheric forces. By piercing the yellowish or reddish strata of sandstone the Chinese obtain brine, petroleum, and gas. Coal is found to the north and south of Cheng-tu, and mines of less importance are worked in the mountains more to the west; but M. d'Estrey saw none among the Miau-tse, who have abundance of wood for fuel.

The Mentawei Islands.—Dr. Modigliani is continuing his exploration of the islands off the west coast of Sumatra. On April 18th the *Valk*, a Dutch man-of-war, with Dr. Modigliani on board, cast anchor in the roadstead of Si-oban. The bay is full of coral reefs, and, as it has not been accurately charted, it must be entered with caution. In some places there is good anchorage in 24 fathoms. Its opening extends in a semicircle from north to south-east, but as there are no mountains to shelter it, it is exposed to the north-westerly winds. On the west is the mouth of the river Si-oban, which leads to a village of the same name. Dr. Modigliani left Si-oban in a dug-out canoe with an outrigger, and entered the mouth of the Si-oreina, the largest river of the island, three miles from Si-oban. He landed at the village of Si-ma-tobe, and ascended the river to the village of Si-oreina. Of the natives, he says that he never saw such a primitive people, so full of superstition and fears. The huts are small and poor; there are no idols, but there are altars, beneath which are small receptacles, where the people place small offerings of food to appease the devils. They are very fond of the flesh of monkeys, which they boil in long bamboo canes.—*Boll. della Soc. Geogr. Italiana*, Fasc. viii.

The Kapuas Expedition.—The *Tijdschrift van het K. Nederl. Aardrijkskundig Genoots.*, Deel xi., Nos. 3 and 4, contains letters from Herr J. Büttikofer and Dr. Molengraaff, sent from Smitau, above Sintang. To the north-west rises the Gunong Kenepai, a large and regular pyramid with steep slopes, which resembles the Niesen as seen from the Lake of Thun. Herr Büttikofer spent six weeks on the flanks of this mountain, and found plenty of booty—large game-birds, reptiles, and insects. On January 18th he ascended the mountain, starting from his camp at 6.30 and reaching the top at 8.30 A.M. At first the weather was splendid, but soon mists arose and covered the whole flank of the mountain. This is a daily occurrence, and is no doubt the reason why, above a height of about 2600 feet, the rocks and trunks are thickly covered with moss. A few yards from the top the wood comes to an end, and the summit is clothed with bushes, rising out of a deep bed of moss. The summit is 100 yards long, and from two to six broad, its longer axis running north and south. On the east and west it is confined by almost perpendicular walls of rock. The height, calculated from an observation of a boiling-point thermometer, was 3930 feet. The temperature in the sun at ten o'clock in the morning was 74°. About eleven o'clock the mist began to collect in rising clouds, and soon a fine view was obtained of the country. Orang-utans are remarkably numerous in the woods of Kenepai, and gibbons were also seen. Herr Büttikofer also mentions the *Cervulus muntjac*, the rhinoceros bird, the Argus pheasant, and other species. As he had not seen on Kenepai the mountain animals he had found in the highland districts of Sarawak, Herr Büttikofer wished to visit some more lofty summits, and, after a conference with the Resident, who came up the river on the 8th February, fixed on a group of mountains lying near the head-waters of the Mandai, a southern affluent of the Kapuas, of which the highest, Liyang Kulung, rises to 6009 feet.

Professor Molengraaff has examined G. Kenepai geologically, and ascended the Mandai, climbing the Liyang Agang (or Gagang), and has also visited the G. Rayung to the south of Smitau.

AFRICA.

Temperature of the Earth's crust in the Sahara.—M. Georges Rolland has made a communication to the Académie des Sciences on the rise of temperature with the depth, as ascertained by observations in Artesian wells, mines, etc. About one degree Fahr. for every 53 feet is the usual increase of temperature below the level of constant temperature, but in the Sahara the rise is much more rapid. In the Wed Rir the temperatures of the subterranean reservoirs has been found to be from 73·4° to 80·2° F., and the mean of the most reliable observations along the principal artery is 78° for an average depth of 246 feet. It may be estimated, according to MM. E. Renou and L. Teisserenc de Bort, that the stratum of constant temperature lies at a depth of about 65 feet, and that its temperature is 71° to 73°. Thus the difference of level between the stratum of no variation and the great reservoir of the Wed Rir would be about 180 feet and the difference of temperature 6°, and consequently the rate of increase about one degree for every 30 feet. Farther south, at Wargla, M. Rolland's observations indicated a yet more rapid rise. It is true that these observations apply only to the water in the wells, but M. Rolland believes that, under the actual conditions, the temperature of the wells of the Sahara may be taken to be that of the surrounding strata. In conclusion, M. Rolland affirms that in many parts of the Sahara, between lat. 33° and 35°, the temperature of the ground really rises with the depth in the ratio of not less than one degree to 35 feet, and often more rapidly ; but he does not consider that so high a variation of temperature inversely to the latitude can be inferred as a comparison with observations in Europe would give.

The Cross and Calabar Rivers.—A member has kindly forwarded us a copy of a letter from the Rev. James Luke. In the first place, Mr. Luke gives one or two particulars about the situation of certain points on the Cross river. The southern bend of the river near Alaha begins just on the meridian of 9° E., and Frufa (Afarufa on some maps) is two and a half miles west of that parallel.

Mr. Luke then describes the journey he made with Dr. Fischer in 1893 between the Cross and Calabar rivers. It was his intention to ascend the Cross river to Frufa and return westwards across the entirely unknown country lying within the bend of the river; but, as the steamer did not arrive, he set out on Thursday, November 30th, by land from Emuremura. After a march of two and a half hours he reached the town of Abini, which is nearly as populous as Creektown. The people differ from the Akunakuna in language and manners. Their houses are lower, and are constructed of slabs of wood plastered with mud on the inside. The women wear hardly any clothing, and twist their hair into small ringlets, thickly clotted with a dark greasy substance; sometimes the front hair is shaved. On December 1st the party came to Agoi Ibami, a town unknown before; and, continuing their journey on the following day through an immense forest, caught sight of a river to which the natives gave the name Okpon, and reached the town of Agoi Ikpo. As at Agoi Ibami, the women were better dressed than those of Abini, and wore a lofty headdress, somewhat resembling the form in fashion at Emurumura. The next town, Iyami, was a small place, but important as being the first inhabited by a new tribe, the Akam. Akunakuna was not understood here, but several of the natives could speak Efik. The Akam tribe have the peculiar custom of pouring their libations into a special trough, instead of throwing them on the ground. Mr. Luke passed through the towns of Ogomuruk and Otshön-ton-egök and came to Isabanya and Otshön-Okpon, beautifully situated on the high banks of the Okpon river, which is here as wide and almost as pretty as the Tay at Perth. It was flowing north, and was said by the natives to join the Cross river at Agbaragba. Passing Bijang, the party came to Ululumö, on the Cross river, a little farther north than Frufa. The people told them that Bijang was the real Frufa, and gave the name of Ikune to Ululumö. At this point Mr. Luke turned westwards, and passing through Bijang again had a beautiful view of a range of hills running east and west. He called it the Ntsöfang range, because it began with the Ntsöfang hill. At Ekorikori the Okpon, which probably rises in the Ntsöfang hill, was again met with. The Uyanga hills were then crossed, and at last the town of Uyanga was reached. A march of two hours and a half brought the party to the Calabar river, which they descended in a canoe. It will be seen from the map that Mr. Luke has traversed some quite unknown country.

The sketch-map, kindly lent us by the Rev. James Buchanan, enables us to describe Mr. Luke's route with exactness. From Emuremura he journeyed nearly in a straight line to Otshön-ton-egök, within a short distance of Agbaragba. The latter lies at about 5° 57′ N. lat., and 8° 52′ E. long. On the way four streams were crossed, all flowing north towards the Cross river. As regards the Okpon, the map does not seem to accord with the letter. The Okpon crossed near Agoi Ikpo, almost due north of the Calabar river, which, Mr. Luke says, "we were to meet again," appears to be a different river from the Okpon flowing between Isabanya and Otshön-Okpon and joining the Cross at Agbaragba. The latter rises, as stated above, in the Ntsöfang hill, a few miles south-west of the point where the Cross river turns eastwards from the ninth parallel. From Otshön-ton-egök Mr. Luke's route ran south-east to Bijang, and from that town south-west to the Okpon, whence it took an almost westerly direction to the Owai hill at the source of the Old Calabar river, in about the same latitude as the rapids on the Cross river, viz., 5° 40′. From the Ntsöfang hill a range runs westward towards the source of the Calabar river.

The Omo.—Dr. Traversi writes that King Menelik has always maintained that the Omo flows into the Nile, and not into Lake Rudolf, as inferred by Lieut. von Höhnel (vol. v. p. 667). Captain Bottego decided that the Omo was not the Jub; and therefore the question is, whether it is the Nianam or a tributary of the Nile. King Menelik takes great interest in geographical questions, and orders his generals to make inquiries during their expeditions. One of these, lately returned from the country to the south-west of Kaffa, has brought the news that the Omo flows neither to the east nor into Lake Rudolf, but that it bends round towards the Nile. Certain kings of these parts informed him that the Omo beyond Ghimira was a large and deep stream, and that boats were used on it. Dr. Traversi concludes that the Omo may be the Sobat, and that the country of the Wolami is the watershed between the Omo and the Jub.—*Boll. della Soc. Geogr. Italiana*, Fasc. vii.

AMERICA.

La Guaira, Venezuela.—*Commerce* (June 27th) contains some interesting information about La Guaira, one of the healthiest towns in Venezuela, which is now much frequented by visitors from Caracas and the interior, attracted by its mild climate and facilities for sea-bathing. The town, situated on the Caribbean Sea, lies in lat. 10° 37′ N., long. 66° 56′ W., and contains a population of 10,000. Meteorological observations show that during the warm season, from March to November, the thermometer ranges from 77° to 94° F. It is the emporium for Caracas, which lies ten miles distant, and from which it is approached by a coach road, two old mountain roads—one paved throughout but in a bad state of repair—of Spanish construction, and a line of railway belonging to and controlled by an English company, and which is admitted to be one of the best-managed railways in the country. Another line, built with native capital and five miles in length, connects the town with Macuto and Maiquetia, two good-sized villages where many of the merchants of La Guaira have their residences. A breakwater has been completed with English money, and vessels are now able to discharge and load alongside the wharfs instead of by means of lighters as formerly. About eighty miles east of La Guaira is the port of Carenero, a large natural bay, which from its position and other advantages promises to become the chief port of Venezuela, and from which steamers regularly ply to La Guaira. A railway line runs thirty miles inland by Higuerote and Paparo to Rio Chico. Paparo is situated at the mouth of the river Tuy, and the neighbouring country produces cocoa and coffee. It is intended to extend the railway line to Altagracia de Orituco, on the plains in the interior of the State of Miranda, opening up a country rich in coffee, cocoa, tobacco, corn, beans, sugar, and tropical fruits, which only await cheap means of transport to find a market. At present the line has been constructed as far inland as El Guapo, at the foot of Los Cerritos, fifteen miles from Rio Chico, from which point it begins to ascend the hills.

The Rio Napo.—On this river, so little known and yet of considerable importance, not only because of its natural wealth, but also as the boundary claimed by Colombia, Herr Richard Payer gives a few interesting particulars in *Petermanns*

Mitt., Bd. 40, No. VIII. In 1890 he steamed up the river in the *Putumayo* as far as a fortress 3½ miles below the mouth of the Tiputini, and, apparently, some 30 miles above the mouth of the Aguarico. In this distance he enumerates eight settlements, Miraños at the mouth of the stream which drains the lake of the same name being the last place occupied by civilised Peruvians, the others being peopled by natives of Ecuador and Colombia. The inhabitants of the basin he estimates at 398, of whom 300 are semi-savages, and the remainder Peruvians, Ecuadorians, Colombians, etc. The natives belong chiefly to the family of the Zaparos, and are divided into numerous tribes named after the rivers and lakes by which they dwell. Their language is guttural and nasal, and their physiognomy closely resembles the Mongolian. The Anguteros, who occupy the left bank of the Napo near Santa Maria, are, like the Zaparos, useful as workmen. The Encabellados (depilated) on the Rio Aguarico resemble the Anguteros, but have different customs. The Orejones owe their name to the practice of stretching the lobes of the ears to a length of about four inches and ornamenting them with discs of wood. The Ahuishires are quite uncivilised, and the numerous acts of pillage and destruction that are perpetrated along the Napo are attributed to them. But the blame should rather be laid on the traders, who treat them as beasts of burden and sell their wives and children, and on the supineness and powerlessness of the authorities.

The Napo is navigable only for vessels drawing six feet of water, owing to the irregularities of the bed and the sudden changes of depth. Above the mouth of the Curaray the breadth and volume of the waterway become less, so that the rivers Tiputini and Coca can be reached only by vessels drawing three feet. The forests which clothe the banks of the river offer magnificent tropical vistas. Particularly noticeable are the numerous islands, some floating and others stable, formed by the collapse of portions of the banks. Most of the plantations and settlements on the islands are in constant danger of being undermined and carried away. Floating masses of reeds, grass and trunks, close the mouths of lakes and streams, and often force the natives to seek new abodes. On the so-called *terra firma*, the high-growing vegetation contains palms, *Myrtaceæ*, *Euphorbiaceæ*, mimosas, *Lauraceæ* and *Cæsalpineæ*, which may be utilised in various ways. Amongst the well-known species are sarsaparilla, arnotto, copaiva, india-rubber, vegetable ivory, cocoa, vanilla, cinnamon, mahogany and other timber; the cereals and fruits include bananas, manioc, sugar, maize, rice, coffee, tobacco, oranges, lemons, and melons.

The Indians extract gold from the sand of the Napo and its tributaries. In the Bermejo, an affluent of the Aguarico, twenty days' journey from its mouth, the gold is most plentiful. The trade is confined to india-rubber, of which nearly sixty tons are shipped to Iquitos annually. Above the Tiputini the trade takes the route to Ecuador. The country is exceedingly rich and well suited for agricultural settlers; but a proper administration is much needed for the security of life and property.

The chief tributary of the Napo is the Curaray, a fine stream 90 to 130 yards broad with a depth of five to six fathoms. Its length from the mouth to Aravela is 942 miles. The banks are low and frequently flooded. In this valley most of the india-rubber which is carried down the Napo is collected.

MISCELLANEOUS.

By an agreement between the German and Portuguese Governments, the frontier line from the coast to the Rovuma will henceforth follow the parallel of 10° 40′ S. lat. Consequently, the mouth of the Rovuma and Kionga will be transferred to Germany, while Cape Delgado will remain in Portuguese territory.

On the 14th June the new railway from **Monastir** to **Saloniki**, 136 miles long, was opened. Many large bridges and viaducts have been constructed, and the tunnels, thirteen in number, have an aggregate length of 1500 yards. Works of special importance were required to carry the line up to the heights of Vladova. —*Deutsche Rundschau*, Jahrg. xvi. Heft 10.

Falcon Island, in lat. 20° 19′ S. and long. 175° 21′ 20″ W. (among the Friendly Islands), which was produced by volcanic upheaval in 1885, was at that time 2230 yards long by 1780 broad, and contained an area of 570 acres. The schooner *Isabel*, which in last June sighted the island, found it reduced to a low strip of black rock.—*Deutsche Rundschau*, Jahrg. xvii. Heft 1.

Two lines of railway connecting **France** and **Spain** are to be constructed. One is to run from Saint Girons in France to Lerida in Spain, while the other will start from Oloron, in the Basses Pyrénées, and join the railway from Saragossa to Barcelona. The tunnel under the Pyrenees will in each case be about five miles in length. In Spain the work has already been commenced; and the whole scheme will probably be completed in ten years.

The *Geogr. Journal*, vol. iv. No. 4, reports the existence of a remarkable trough in the **lagoon of Venice**, opposite the Porto di Malamocco. It sinks to a depth of 164 feet, while the adjoining parts of the lagoon do not exceed 60 feet in depth; and, indeed, it is as deep as any part of the Adriatic north of a line from the mouths of the Po to the southern points of Istria. The origin of the trough is difficult to explain. It can hardly be due solely to the action of currents, and if it be a submerged hollow, it is not easy to understand why it has not been filled up by alluvial matter.

The commission for the construction of the Trans-Siberian railway has, in consequence of representations made by the Minister of Marine, organised an expedition for the hydrographic investigation of the mouths of the **Ob** and **Yenesei** and part of the **Kara Sea**. The task of the expedition will be to determine astronomically thirty points on the coast; to describe the coast for a distance of 2500 nautical miles; and to take soundings over about 19,000 square nautical miles. Two vessels with seven officers, will be engaged in the work for the next five or six years.—*Deutsche Rundschau*, Jahrg. xvi. Heft 10.

Whereas Algiers has over 1800 miles of railway, Tunis has only 259. On July 10th the French Chamber passed a bill for the construction of a network of **railways in Tunis**. Besides the railway from Bizerta to Tunis, lately opened, two lines will be made from Tunis to Susa. From the latter place a line will be carried to Kairwan, and another south-eastwards to Moknine, which will probably be continued, eventually, to Sfax. Hence a line is projected to the Algerian frontier for the better exploitation of the rich phosphate deposits. New harbours will be constructed at Sfax and Susa.—*Globus*, Bd. lxvi. No. 9.

NEW BOOKS.

The History of Sicily. By EDWARD A. FREEMAN, M.A., Hon. D.C.L., LL.D. Vol. IV. From the Tyranny of Dionysios to the Death of Agathoklês. Edited from Posthumous MSS., with Supplements and Notes, by ARTHUR J. EVANS, M.A. With Maps and Numismatic Plate. Oxford: At the Clarendon Press, 1894. Pp. xxvii + 551. *Price* 21*s.*

This posthumous volume—the fourth of Mr. Freeman's great *History of Sicily*—has been worthily and piously edited by Mr. Evans. The task was no mere honorary one, nor has Mr. Evans so conceived it. Though hitherto Mr. Evans' own peculiar work has not been, except indirectly, historical, his special researches have enabled him to make notable additions to the MS. left by Mr Freeman. Thus, besides many useful notes, he has given us five valuable supplements dealing with the monarchy of Dionysios in both its constitutional and its territorial aspects, his Adriatic colonies (Mr. Evans would exclude Numana, and include Ancona), the finance and coinage of Dionysios, numismatic lights on the Sicily of Timoleon, and the "Despot's Progress" on the coinage of Agathoklês, on the last three of which Mr. Evans is able to write with luminous authority. Occasionally, it has been necessary to bridge over gaps in the narrative, and for this purpose Mr. Evans has wisely had recourse to Mr. Freeman's small work on Sicily in the *Story of the Nations* series. It will thus be seen that we have much to thank the editor for. For this, indeed, not least, that wherever it was possible he has given us Mr. Freeman as Mr. Freeman wrote.

We must regret that one of the gaps referred to above is a final and critical estimate of the place and character of Dionysios, only roughly and imperfectly bridged by an excerpt from the smaller book. Still, the present volume does not leave us in doubt regarding Mr. Freeman's conception of the Tyrant, as two extracts may show. "He is not the first Greek ruler, not the first lord of Syracuse, to destroy Greek cities. Gelôn had done that before him. But he is surely the first Greek ruler to turn Greek cities, emptied of their Greek inhabitants, into dwelling-places of barbarians. . . . But we may say that even in this matter, if he sinned against Greece, he did not sin against Europe. . . . In one way or another, in peace and war, his reign is a marked time in the process of bringing the Sikels, as adopted and assimilated Greeks, within the Hellenic pale. On the other hand, by the settlement of Italian mercenaries in the island he foreshadows and prepares the way for the subjugation of Sicily, first of all lands out of Italy, to an Italian power. Yet, on the whole, his reign is, in a certain sense, a time of Greek advance, in the same sense, that is, in which the reigns of the Macedonian conquerors is a time of Greek advance." "After having, for a moment, betrayed Hellas and Europe to the Semitic invader, he turns about and gives his best energies to win back all, and more than all, that he has betrayed. And, if in his later warfare he again loses part of what he has recovered, the state of things at his death is at least more favourable to Greece than that which was in existence when his career began. But this and his Hadriatic colonisation are the only parts of his life on which we can look with any satisfaction." We are forced back to the small *Sicily* for a comparison, a contrast, between Agathoklês and Dionysios. But the narrative of events is so clear, and the interpretative judgments of the writer are so distinct, that we cannot fail to discover Mr. Freeman's real view.

The maps, not over-filled, are apt and are carefully executed. Of the four, three are by the editor, who has also provided a numismatic plate. Mr. Evans lessens our sense of a premature loss by assuring us that sufficient was written by Mr.

Freeman to cover the Roman Conquest and the Norman. The section treating of the latter will be awaited with peculiar interest.

Rulers of India. Lord Amherst, and the British Advance eastwards to Burma. By ANNE THACKERAY RITCHIE and RICHARDSON EVANS. Oxford: At the Clarendon Press, 1894. Pp. 220. *Price 2s. 6d.*

The series of rulers of India would have been incomplete if it had not contained an account of the administration of Lord Amherst. He himself cannot rank with the great men whose genius created the British Empire; but his term of office was honourably distinguished by the attention given to the perfecting of the administrative system, and what was done to open up for the country the path of peaceful progress makes his place in the development and consolidation of British rule not an unimportant one. Nor was the period wholly devoid of the stirring incidents of war. The storming of the famous fortress of Bhartpúr was an event of far-reaching importance as it definitely proclaimed the acceptance of responsibility for the maintenance of order and peace throughout the whole Peninsula; and, as the result of a long and expensive war with Burma, the wild mountainous regions between that country and India were added to the British Empire, and the frontier pushed far forward to the East. Still the prominent characteristic of the period was that it was the transition from the epoch of fighting and diplomacy to that of social reform. In this direction, as the authors of this volume say, there was giant's work to be done. Much was accomplished, more was prepared for, and the measures which gave *éclat* to the administration of Lord Bentinck were in many cases practicable only because of the action of his predecessor, whose contribution to the final result ought not to be forgotten. The work is the joint production of two authors. The respective contributions of each might, one imagines, be guessed with tolerable certainty, but invidious comparison is uncalled for. The mixture is a harmonious one of elements, all of which neither writer could have supplied alone. The best section of the book is the second chapter, which gives a luminous and comprehensive sketch of Indian society, and of the administrative problems waiting for solution at the time when Lord Amherst entered on office. The rest of the volume suffers somewhat from the admission of rather trivial details and incidents of travel and ceremony drawn from Lady Amherst's journal, which, however lively and interesting in themselves, are rather out of place in a work of the character of the series to which the volume belongs. The reader, however, who wishes for a lively sketch of Lord Amherst's life, will probably not regret the admission of the lighter element and find the volume most interesting.

Ore Deposits of the United States. By JAMES F. KEMP. New York: Scientific Publishing Company, 1893. Pp. xvi + 302. *Price 20s.; net cash, 16s. 6d.*

The author's purpose in writing this book has been to furnish his readers with a condensed account of the metalliferous resources of the United States, and, at the same time, as far as possible, to produce a work which should serve as a textbook for metalliferous deposits in general.

The first part of the work, extending to 65 pages, is devoted to a general account of the chief phenomena connected with mineral veins and ore deposits, and includes a review of several of the many schemes of classification of these enigmatical phenomena which have, from time to time, been put forward by geologists and others. This review will, doubtless, prove valuable to those who are interested in the subject; but, as the author's information appears to have been collected chiefly from either American or German sources, the views of some of the British workers in the same field of research do not receive as much attention as some may think they deserve.

The second portion, which very properly fills the greater part of the book, deals with ore deposits in considerable detail. No less than 64 pages are devoted to the ores of iron. Nevertheless, the author has omitted any reference to the works of either Mr. J. D. Kendall or Mr. Huddlestone, both of whom have done so much to advance our knowledge respecting the mode of occurrence and origin of the chief ores of iron. Blackband iron ores, which are so valuable and important in Scotland, occur, it seems, though sparingly, also in the United States, where they are found not only in rocks of Carboniferous age, but also in the Older Neozoic (Jura-Trias) as well as in the succeeding Cretaceous rocks. In each case, as with us, they are associated with coal seams.

Lead ores being found in so much abundance in the United States, the author has devoted over forty pages to the mode of occurrence and geological relations of these valuable deposits. These will, doubtless, be perused with considerable interest by those who have to do with similar ore deposits in Britain, even though the days of profitable lead-mining in our own country are gone without hope of return.

Silver and gold receive also considerable notice, particulars regarding all the chief localities being given in some detail. Chapters xiv. and xv. deal with ore deposits of the lesser metals. The last chapter contains a few general conclusions regarding ore deposits, in which the author emphasises "the extreme irregularity in the shape of metalliferous deposits," and points out the unwisdom of the United States law in the west, which is based on the assumption that all metalliferous deposits occur in well-defined fissure veins. He also confirms the statement commonly made by practical miners that there is a close connection between the occurrence of ore at a given locality and the proximity of eruptive rocks. And he concludes as follows:—"We know, from the investigations of Sandberger and others, that the dark silicates of many rocks contain percentages of the common metals. The choice is open whether to refer the ore to original dissemination in these, and derive it by gradual concentration, probably at great depths, or to some indefinite unknown source, which can only be described as 'below.'"

La Florida, su Conquista y Colonización por Pedro Menéndez de Avilés. Por EUGENIO RUIDÍAZ Y CARAVIA. Madrid: Los Hijos de J. A. Garcia, 1893. 2 vols. Pp. ccxxix + 413 and 861.

The object of this work is stated in the first words of the preface to be the vindication of the memory of Pedro Menéndez, which has been aspersed by some foreign historians. The principal charge brought against Pedro Menéndez is that in Florida he massacred a large number of French Protestants. This act, which is openly acknowledged by the Spanish commander, is defended by the author on the grounds that it was prompted by zeal for the true faith and for the glory of God, and that it was in accordance with the orders of Philip II. Like a Spaniard of the 16th century, he seems to consider that Protestants deserved no mercy, especially such as invaded territory granted by the Pope to the Spanish crown. At length it seems to dawn upon him that the morality of the age must be pleaded in excuse for the merciless acts that were perpetrated in America. On no other grounds can we withhold our severe condemnation. The deeds were often atrocious; but when we remember the bigotry of the times, and the hazardous lives of the adventurers, which led them to set little value on human life, we must often conclude that they only acted according to their lights.

But though the author's defence of his hero may not be judicious, a favourable opinion may be expressed on the character of that hero. Besides the heresy of the French adventurers and their presumption in setting foot on Spanish soil, the difficulty of guarding and feeding a large number of prisoners may be alleged in excuse for a massacre in those times, and the testimony produced is, we think, sufficient to rebut the charge of breach of faith. The retaliation taken by Gourgues on the garrison of San Mateo should, however, be judged with the same leniency. In his treatment of the Indians, Pedro Menéndez compares favourably with most of his compatriots. He does not seem to have employed the usual methods of conversion, nor to have turned the feuds of the tribes to his own advantage, but to have exerted himself to establish peace between hostile chiefs.

The author has done good service in publishing letters and documents relating to Pedro Menéndez and his achievements, especially the *Memorial* of Dr. Gonzalo Solis de Merás. Some of these have no connection with Florida, but they contain interesting information on the events of the time.

Atti del Primo Congresso Geografico Italiano. Tenuto in Genova Dal 18 al 25 Settembre 1892. Publicati a spese del Municipio di Genova. Genova: Tipografia del R. Istituto Sordo-muti, 1894.

In the Society's *Magazine* for November 1892, our delegate published a narrative of the first Italian Geographical Congress, which was most successfully held at Genoa on the occasion of the fourth centenary of Christopher Columbus. We have now received the three portly and beautifully-printed volumes, which contain the record of the proceedings and papers of the great Congress, published by the munificence of the Municipality of Genoa, which, in September 1892, generously entertained the Congressisti. The first volume of 456 pages reproduces all the records apart from the papers read; the special conferences at which an account was given of Candeo's visit to Somali-land, Modigliani's travels in Sumatra and the island of Engano; Taramelli's paper on the valleys of the Po at the Quaternary epoch, and Pigorina's speculations on the earliest inhabitants of these valleys. The papers on Columbus written in the other European languages are translated into Italian. The first part of the second volume publishes, in 454 pages, the papers read in the Scientific Section of the Congress. The second part of that volume, consisting of 692 pages, contains the papers read at the Commercial Economy and Educational Sections. The book, beautifully illustrated where necessary, is of permanent value to all Italian geographers, and forms a worthy memorial of a great historical as well as scientific gathering.

Winter and Summer Excursions in Canada. By C. L. JOHNSTONE. London: Digby, Long, and Co., 1894. Pp. 213. *Price* 6s.

This book is written with the laudable desire to furnish reliable information to young men who purpose settling in Canada, and to defeat "those unscrupulous gentry who are prepared to welcome the novice and dispose of unprofitable land, unsaleable machinery, worn-out cattle, and anything else they want to get rid of—at his expense." It also contains some interesting "statistics of cold" in Canada. Thus, during one week of January 1893, at Calgary, the maximum heat was 2° below zero, Fahrenheit, while the maximum cold was 48° below zero! "Canadian officialdom seems very sensitive about the climate; and many a poor fellow has left the country again with his health permanently damaged because he had believed when he read that the cold in Canada was not felt so much as in England, and that ordinary English clothes are quite sufficient." We also find statistics of the emigration to the North-West provinces between the census of 1885 and that of 1891, showing that Assiniboia has gained a little over 8000 in these six years, Saskatchewan only 504, whilst Alberta, "the great ranching province," has added 9744 to her population. As to "low rates of interest" officially promised to settlers, the author remarks, "We know of more than one young Canadian farmer who is paying 24 per cent. on money borrowed from the bank!" Young ladies accompanying their brothers to Canada seem to enjoy themselves. "The sister of a bachelor settler who is known to be a good housekeeper is regularly competed for by his bachelor acquaintance. We knew one who combined household duties with dancing, and enjoyed herself nearly all the winter." The author writes honestly, impartially, and with knowledge, and his book should be read by all intending settlers.

The Wealth and Progress of New South Wales, 1893. By T. A. COGHLAN, Government Statistician. Seventh Issue. Sydney, Melbourne, Adelaide, and London: Charles Potter, Government Printer; and E. A. Petherick and Co., 1893. Pp. vi + 828.

We need but announce the issue of the present edition of this well-known and useful publication. The name of the author is a guarantee for accuracy and clearness, and the pages show how well and how successfully he continues to perform a difficult task. The volume under notice ought to have even more than the usual interest after the late Australian crisis; and many valuable details with regard to it may be gleaned from these pages, although the general statistics show less startling results than many might expect. The diagrams are very clear, and, when coloured, tastefully tinted. The index appears to be well compiled. The historical sketch is scrappy, however, and appears hardly called for in a volume of the kind, now that we have got so many excellent histories of Australia.

Voyage en France. 1ère Serie. Par ARDOUIN-DUMAZET. Paris et Nancy: Berger-Levrault et Cie., 1893. Pp. 352. *Price 3 fr. 50 c.*

This is the first of a series of handbooks descriptive of different districts of France. In the form of pleasantly written sketches, dated from the various centres of interest in the author's tour, it deals with the classic and picturesque country of the Upper Loire from Touraine to Nivernais. The author takes up the leading features of interest—geographical, agricultural, social, economic, and historical—and outlines them with a clearness and freshness which could only be attained by local study and a thorough grasp of his subject. Compared with a guidebook, a book of such a type as the present should be of special interest to the intending tourist. It forms an introduction to all that is most worthy of notice in the country, and is in an eminently readable form—an ideal to which guide-books cannot well aspire.

The Gypsy Road: A Journey from Krakow to Coblentz. By GRENVILLE A. J. COLE. London: Macmillan and Co., 1894. Pp. 166.

A well-written book with a misleading title, for one would imagine the book was about gypsies, whereas it narrates the adventures of two cyclists who journeyed on wheels from Krakow through Hungary, Moravia, and Bohemia to Coblentz, a distance of 1055 miles. It is prettily illustrated by Mr. Edmund H. New, but lacks a map. There are, indeed, two highly artistic charts prepared in imitation of the earliest maps ever published, but this map-drawing *à l'antique* is rather retrograde. As to the advantages of cycling, the author remarks: "The peasant is to cyclists a living personality; we may see how he adapts himself to his surroundings, how he varies from one valley to another, how the country lives in him and by his labour; we sit with him at the plain deal table of an inn, and lament not the swallow-tails and shirt-fronts of Lucerne." He also insists that cyclists should always carry passports bearing at least one recent *visa*.

The Kingdom of the "White Woman": A Sketch. By M. M. SHOEMAKER. Cincinnati: Robert Clarke and Co., 1894. Pp. 207. *Price* $1.50.

Another well-written book with a misleading title, for the book narrates the author's adventures in Mexico in 1889, and the "White Woman" is the snow-clad mountain called Ixtaccihuatl. An American might have found "the Kingdom of the White Woman" much nearer home. The book is profusely and beautifully illustrated, and shows to what a pitch of perfection American publishers have brought the arts of book illustration, printing, and binding. The author reached Zacatecas, "the highest point in Mexico, over 8000 feet." He is struck with the "inexhaustible resources" of Mexico, and speculates as to what its future might be "under an honest rule and a different religion." He admits, however, that "the Government of Mexico is struggling hard and with much success to counteract the effect of three hundred years of misrule."

Corea of To-day. London and Edinburgh: T. Nelson and Sons, 1894. Pp. 128. *Price* 6*d.*

This prettily illustrated volume contains valuable information regarding the little-known country which is the scene of war between China and Japan. Much of the book has been extracted from *Corea from its Capital*, by G. W. Gilmore, but new matter has been added with special reference to the present crisis. The author defends the Coreans from the charge of poverty and indolence. "It must be remembered," he remarks, "that the people have no incentive to labour. Their laziness is not innate, but results from a knowledge that all fruit of toil, above what is required for the veriest necessities, is liable to be stolen from them by corrupt and insatiate officials, against whom they are powerless." The King of Corea and his advisers are to blame for appointing these thievish native officials, and for boycotting honest and competent foreigners. If they would allow the latter to direct Corean affairs, the author thinks the finances of the kingdom and the government itself would soon be put into an excellent condition. A neat map of Corea is given.

Annamites et Extrême-Occidentaux. Recherches sur l'Origine des Langues. Par le Général FREY. Paris: Librairie Hachette and Cie., 1894. Pp. 272.

This work is a most remarkable specimen of the A-kill-ease and Age-aches method of philology. From Annamite words or simple sounds the author derives all languages under the sun. As an instance we may quote the derivation of *doré aduler, adulte, adorer* from the Sanscrit and Annamite *der, dir, do.* Why not add add devious, dell, diverse, and the Latin *dolus, doleo, dolium*, etc.? Normans (Nor*mands*), Manchu (*Mand*choux), and the *Mand*eh of Senegal have, of course, a common origin. By this system it is easy to divide the races of the world into those whose names contain *ba* or *ber*; *ga, go*, etc.; *la, le*, etc.; or *ma, me*, or *mi*.

We may remark that *Ver da* is not the German spelling, nor is *saga* German for a saw, while in Scandinavian *sax* means scissors, not saw.

Heroes of American Discovery. Second Edition. Pp. 370. *Heroes of North African Discovery.* Fourth Edition. Pp. 389. *Heroes of South African Discovery.* Fourth Edition. Pp. 395. By NANCY BELL (N. D'Anvers). London : Marcus Ward and Co., N.D.

These are well written, full, and interesting accounts of the travels and adventures of those explorers who have made us acquainted with North America and Africa. They are illustrated by a number of fair woodcuts, and each of the African volumes contains a map of Africa, showing its modern divisions. The title of the American volume is somewhat misleading, as the book deals only with Canada and the United States. In all three volumes the tables of contents need revising; once "Pacific" is misprinted for "Mississippi," and twice the Albert and Victoria Nyanzas are confused.

The History and Antiquities of the Parish of Mid-Calder. By HARDY BERTRAM M'CALL, F.S.A. Edinburgh : Richard Cameron, 1894. Pp. 272. *Price* 21*s.*

The titles of the six parts composing this work indicate its contents, viz.:—(1) The Parish ; (2) Calder House and the Lords Torphichen ; (3) and (4) County Seats and Historic Lands ; (5) The Parish Church ; and (6) Ecclesiastical History and the Religious House of Torphichen. Well written, well printed, well illustrated, the volume reflects credit both on author and publisher. The only thing wanting is, as usual, maps. A series of reproductions of maps of various dates, showing the parish at different stages of its history, would have been very instructive as displaying its gradual development from a quiet, thinly-populated agricultural parish to a busy centre of mining and other industries.

Pictures from Bohemia, drawn with Pen and Pencil. By JAMES BAKER, F.R.G.S. London : The Religious Tract Society, N.D. Pp. 192. *Price* 8*s.*

Bohemia has many attractions for the tourist in its beautiful scenery, ancient buildings, and historical associations ; and for us the Hussites, connected as they were with the Wycliffites, and the election of the Elector Palatine to the throne, lend the country a special interest. The scenery, historical associations, national customs, etc., are portrayed in a light and agreeable style in this volume ; and many of the illustrations, by Walter Crane, H. Whatley, and other artists, are of considerable merit. The reproduction is in some cases rather faulty ; but, on the whole, is quite up to the standard of the series.

Columbus and Cook: The Story of their Lives, Voyages, and Discoveries. London and Edinburgh: W. and R. Chambers, 1895. Pp. 152.

The main facts connected with the careers of these two great discoverers, the first of whom initiated the discovery of new continents, while the second may be said to have completed the work, are here given in a clear and condensed form. The latest authorities have been consulted, and, on the whole, the views expressed are those generally accepted at the present day.

The Aborigines of Western Australia. By ALBERT F. CALVERT. London : Simpkin, Marshall, Hamilton, Kent, and Co., 1894. Pp. 55.

Mr. Calvert breaks new ground in this little volume, and, leaving gold and other minerals alone, turns to a subject likely to interest a larger class of readers. While neither his knowledge nor treatment is scientific, he has collected a good deal of information about the manners and customs of the aborigines, which he relates in a popular manner. The book ought to find numerous readers, although the student of ethnology and anthropology may not be always able to agree with the author.

Merveilles de la Nature. A.-E. BREHM. *La Terre, Les Mers, et les Continents.* By FERNAND PRIEM. Fasc. III. Paris : Baillière et Fils, N.D.

The present fascicule, which extends from pp. 369 to 544, may fairly be said to be mainly geological in character, seeing that it deals with the origin of mountain-chains, the elements of petrography, and the origin of rocks in general, coals and coal-mining, and the natural history of the useful metals. It is illustrated by over two hundred and forty figures, some of which, especially those printed from process blocks, are really good.

A Handbook to the Study of Natural History for the use of Beginners. With an Introduction by Sir MOUNTSTUART E. GRANT DUFF, G.C.S.I., F.R.S. Edited by Lady ISABEL MARGESSON. London : George Philip and Son, 1894. Pp. xx. + 232. *Price* 3*s*. 6*d*.

To the many, varied, and important subjects embraced under the above title we here have devoted a little book of 232 small octavo pages of large print. In this limited and absolutely inadequate space are crowded a series of articles treating on the following subjects :—Zoology, Birds, Shells, the Study of Flowers, the Study of Mosses, Fungi, Seaweeds, Minerals, Fossils, the Microscope, and, as if this were not enough, on How to Study without Destroying, Teaching Natural Science, a Band of Mercy, Home Museums, Object-lesson Cases in the Schoolroom, and a Portion of an Almanack. These have been contributed by no less than fifteen different authors ; and although some of them may be regarded as admirable epitomes of the subjects upon which they treat, yet no one need be surprised to learn that they are scarcely calculated to afford the necessary guidance to "would-be learners who are baffled at the beginning of their studies by the ignorance of the right lines on which to work"—the editor's object in offering this little handbook to lovers of nature. A volume which will lay "before the beginner a clue to the many paths of the somewhat bewildering labyrinth called natural science" must of necessity be somewhat bulky, and cannot be produced within the covers of a pocket volume such as the one under consideration.

The Amateur Telescopists' Handbook. By FRANK M. GIBSON, Ph.D., LL.B. London : Longmans, Green, and Co., 1894. Pp. xi + 163. *Price* 3*s*. 6*d*.

As this little book is addressed to amateurs, it is discouraging for the author to tell them at the outset that there is scarcely a possibility of an amateur, with a small alt-azimuth telescope, accomplishing any work of scientific value. We may cite, among other cases, the discovery by Dr. Anderson of Nova Aurigæ with an opera-glass.

The tests given for achromatism and aberration are not sufficient, except for very small instruments. The instance given of finding a star by the equatorial is wrong, as a star whose R.A. is less than the sidereal time, as in the example, has passed the meridian, and is therefore west of south.

The catalogue of objects appears a good one, and should aid the amateur in finding objects easily, after he has mastered the chief stars, and thus obtained guides in finding smaller objects.

Longmans' Geographical Reader for South Africa. Compiled by J. R. WHITTON, Rector of the Normal College, Cape Town, and W. MILNE, Headmaster of the Public School, Stettenbosch. London and New York : Longmans, Green, and Co., 1894. Pp. xii + 240. *Price* 2*s*. 6*d*.

Here we have, under the name of a *Geographical Reader*, simply a systematic Geography of South Africa in the form of narrative and descriptive lessons, interspersed with poetical selections from Pringle, Forbes, Doyle, Shelley, and others. The narrative form, however, does not conceal the hard and uninteresting character of many of the lessons. Geographical names are printed in Clarendon type, and some of the pages present a terribly black and forbidding aspect. The solitary map is not very helpful, and the illustrations, especially those reproduced from photographs, are far from being successful. The natural history lessons are fairly interesting.

Handbook for Travellers in Scotland. Sixth Edition. With Travelling Maps and Plans. London: John Murray, 1894. Pp. xxxvi + 475. *Price* 9s.

The new edition of Mr Murray's well-known *Handbook* is very compactly and serviceably got up, being printed on thin paper, and covered with flexible binding. The most welcome additions are over a dozen large-scaled contoured maps of special districts, all bearing the name of Bartholomew of Edinburgh, and the complete map of the country, cut into twenty-three convenient sections, which may be referred to on a wet and windy day without hopeless loss of temper and map.

The letterpress has been revised, and, on the whole, is up to date; the new West Highland Railway route being fully described. We have detected no important error when using it this summer, but found the information accurate and satisfactory, so far as it goes.

It is a pity the sections in the introduction of older editions, dealing with geology and giving hints for yachtsmen, have been practically dropped. This is a retrograde step, for there is an ever-growing public which is interested in such subjects. A guidebook should not be a mere catalogue of castles and their owners, with an occasional historical note, and now and then a hint, "fine view to rt.," etc. To the tourist it does not matter whether Netherby Hall is "the seat of Sir F. V. Graham, Bart.," as this guidebook tells us, or of Sir Richard Graham, Bart., as has been the case for several years; but it is unpardonable in any first-class guidebook to omit to point out the remarkable change of landscape that takes place on passing from one formation to another, say, at New Cumnock, or beyond Callander.

A satisfactory guidebook to Scotland has yet to be written; of its kind, the one under notice is a very fair and trustworthy example.

King's Handbook of New York City. An Outline History and Description of the American Metropolis. With over 1000 Illustrations from Photographs. Boston: Moses King, 1893. Pp. 1008.

This is the second edition of the most comprehensive illustrated history ever published of any city. The book has, in its opening historical pages, a certain geographical value, because of the reproduction of such old maps as Vanderdonck's map of the New Netherlands colony of the Dutch in 1656, as they called New York and the neighbourhood; and of the early English maps of 1664, 1728, 1776, and 1789. For the rest, almost every public building and store, and every street and square of New York City as it is, is here pictured on small quarto pages, with the latest facts in the letterpress. A vast index opens up the whole.

Paterson's Guide to the Rhine Provinces. Pp. xiii + 174. *Paterson's Guide to Switzerland.* Seventh Edition. Pp. xvi + 162. London: William Paterson and Co., N.D.

The ordinary tourist, who follows the beaten tracks, will find all the particulars he wants in these guides. With one or two exceptions, the information is, we believe, up to date and accurate. The maps and plans cannot be praised, and the misprints are far too numerous.

Mountain, Moor, and Loch. Illustrated by Pen and Pencil on the Route of the West Highland Railway. London: Sir Joseph Causton and Sons, 1894. Pp. 180. *Price* 2*s.*

On 5th August 1812, Henry Bell of the Helensburgh Baths advertised that his steam passage boat," *The Comet*, would ply "between Glasgow, Greenock, and Helensburgh, for passengers only." On 7th August 1894 the West Highland Railway Company opened its line from Helensburgh through a romantic yet little-known district, stretching from Gareloch past Lochs Lomond, Tulla, Lydoch, and Rannoch, Ossian and Treig, to Fortwilliam and Banavie at the head of Loch Linnhe. The book before us describes this district. It is lavishly illustrated, some of the illustrations being exceedingly well done. It is well written, and contains numerous excellent maps. Altogether, it is a work of which both its publishers and the West Highland Railway Company may deservedly feel proud.

Handbook to the Highland Railway, West Coast, Orkney Islands, etc. Season 1894. Thirteenth Edition. Inverness: *Northern Chronicle* Office. Pp. 227. *Price* 1*s.*

The present issue contains new matter dealing with the lately-opened Black Isle Railway, the Carrbridge extension, etc. Otherwise the information is much the same as in late editions. The volume is nicely illustrated, and ought to be in the hands of all travellers by the Highland Railway.

A Trip from Callander to Staffa and Iona, with Descriptive Sketches of the Route by Sea and Land, and the Sacred Rock-bound Isle of I-Colm-Kill. By Malcolm Ferguson. Dundee: John Leng and Co., 1894. Pp. 164.

The author not only describes the country he visited, but also gives brief sketches of its history and legends, and those who wish to know something more of the country than its scenery, will do well to take this book with them on a tour to the islands of Argyllshire. Iona is described at considerable length. The volume is adorned with a number of illustrations.

Ettrick and Yarrow: A Guide. With Ballads and Songs of Ettrick and Yarrow. By Wm. Angus. Selkirk: James Lewis, 1894. Pp. 228.

A comprehensive guide to a beautiful district renowned in history and song. With such a mine of information before him as Mr. Craig-Brown's *History of Selkirkshire*, supplemented by Dr. Russell's *Reminiscences of Yarrow*, Mr. Angus was spared the labour of research. He gives us numerous pleasant itineraries, an excellent map of Ettrick and Yarrow, and a good collection of popular songs of Ettrick Forest. Everything of interest to the tourist seems noted, except, perhaps, (in the "Newark to Abbotsford" chapter) reference to Faldonside, which has remarkable associations. An index should be appended to the next edition, from which, also, should be omitted certain personal allusions.

Climbing in the British Isles. 1.—*England.* By W. P. Haskett Smith, M.A. London: Longmans, Green, and Co., 1894. Pp. xii + 162. *Price* 3*s.* 6*d.*

There is far more practice in rock-climbing to be obtained in the British Isles than many people are aware of. In this little volume is given information about some of the more difficult ascents, accompanied, where necessary, with plans or lettered sketches. Some of the views, as far as our memory serves, are somewhat idealised.

We should have preferred a division into districts or counties, to the alphabetical arrangement adopted.

Ferguson's Tourist's Guide to the Beautiful and Romantic Scenery of Killin, Loch Tay, Loch Earn, etc. With Map and Illustrations. Dundee : John Leng and Co., 1894. Pp. 116. *Price* 1s.

This is a new edition—the third—of an excellent *Guide* to the "Breadalbane" district of Perthshire and Argyllshire. Killin is the starting-point of a series of excursions in different directions—to Kenmore, Glenlyon, Balquhidder, Tyndrum, and Oban. There is an excellent map, but the illustrations are of indifferent merit.

The Clyde and the Western Highlands. By ROBERT WALKER. Illustrated by W. G. Gillies and others. New Edition. London : J. S. Virtue and Co., 1894.

The original edition, published in 1892, and then noticed in the *Magazine*, has been simply reprinted ; the views and letterpress are identical. A pleasing memento of the west coast.

A Week in the Channel Islands: being Personal Experiences of Two Recent Trips. By JAMES LOCH, C.I., R.I.C. Dublin : Hodges, Figgis, and Co. ; London : Simpkin, Marshall, and Co., 1894. Pp. 43.

A few sketchy notes, which call for no special remark.

Maldon and the River Blackwater. By E. A. FITCH, F.L.S. Maldon : H. C. and E. Gowers, N.D. Pp. 92. *Price, paper*, 6*d.* ; *cloth*, 1s.

The archæology and history of Maldon and the neighbourhood are fully given in this handbook. It is an annual publication, containing a calendar, postal information, lists of local officials, etc. The illustrations are often interesting as regards the objects represented, but are poor as works of art.

Handbook to St. Andrews and Neighbourhood. New Edition. By D. HAY FLEMING. *St. Andrews Citizen* Office : J. and G. Innes, 1894. Pp. 160. *Price* 1s.

When the author expressed in his preface the hope that this would be found to be "at once the handiest and fullest, the most compact and the most accurate guide to St. Andrews yet produced," he rather trenched on the critic's province. However, this does seem to be a very excellent guide to a city which, in its old age, is attracting more people to its Links than it probably ever did to its colleges and churches. Archbishop Sharp's monument in the Town Church is both described and figured, and the author refers to it "as a monument of Presbyterian toleration." He seasons the details of his guide-book with many an anecdote and apt quotation. The credit for "one of the latest and most conspicuous improvements —the trees in South Street"—is awarded to a public-spirited gentleman ; but we have heard that a lady residing there was the first to suggest this undoubted embellishment to the municipal authorities. Copious illustrations and maps and plans accompany this admirable guide-book ; but it ought to have also had an index, so that its multifarious and scholarly contents might easily be consulted. The map of Fife and Kinross, likewise, sadly requires bringing up to date, for it contains no Forth Bridge, or railway from North Queensferry to Burntisland !

Tourists' Guide to Kinross-shire. Perth : Cowan and Co., Ltd., 1894. 90 pages. *Price* 4*d.*

This is an interesting little guide, well illustrated by reproductions of photographs and sketches. Many quotations are taken from Mr Burns-Begg's *History of Loch Leven Castle,* and several pages of angling hints from the same author's book, *The Loch Leven Angler.* There is no map.

NEW MAPS.

ASIA.

EASTERN CHINA, JAPAN, AND KOREA, Stanford's Map of ——. The Seat of War in 1894. Scale, 110 miles = 1 inch. *Edward Stanford, London.*

To judge by the differences in spelling, a large inset map of Korea has been printed on an older sheet. Nor even on the same map are the spellings uniform. Thus, on the inset the sound of the German *ö* is represented by *ö* in Söul, by *o* in Wonsan and *ê* in Shên-yang; to these may be added from the large map *u* in Fung-yang, and *e* in Wenteng. Again, *Jenchuan* should be In-chön; *Pai Shan*, Paik-to-san; and as Phyöng-yang is given solely in the form *Ping-yang*, the name of the province should not have been printed *Phyong-an-do*. For newspaper readers this map will, nevertheless, be sufficient.

AFRICA.

BRITISH SOUTH AFRICA, Stanford's Map of ——. Scale, 1 : 5,977,382, $94\frac{1}{3}$ miles to 1 inch. *Edward Stanford, London,* 1894.

South Africa is here represented from the Cape to Lake Tanganika, and the boundaries are given according to the latest agreements. Cape Delgado has only recently been definitely resigned to the Portuguese. Mutassa should have found a place in the map in view of its importance with regard to the boundary.

AMERICA.

UNITED STATES, Stanford's General Map of the ——. Scale, 1 : 5,274,720, $83\frac{1}{4}$ miles to 1 inch. *Edward Stanford, London,* 1894.

This is on the whole a useful map, though we have discovered a few errors. For instance, in North Carolina the railway connecting Mocksville, Salem, Germanton, etc., is not inserted. By this time the railway to Wilkesborough is, we believe, completed. Salem is in the township of Winston, which is the more important place. So also, in New Mexico, Lincoln, which is not marked, is more important than Fort Stanton. Pecos in Texas, and Las Cruces in New Mexico, should have been inserted; also Fort Stockton, the chief town of Pecos county. Quiv*e*ra should have been spelled Quiv*i*ra; Rio Hond*a*, Rio Hond*o*; Sierra Blanc*o*, Sierra Blanc*a*; and Mohave is the usual form, not Mojave.

The names are numerous, and the size and importance of the towns are indicated by different types. The execution is rather rough.

AUSTRALIA.

WESTERN AUSTRALIA, Geological Sketch Map of ——, 1894. By Harry P. Woodward, F.G.S., F.R.G.S., F.I.Inst., Government Geologist, Perth. Scale of nature, 1: 3,000,000. *George Philip and Son, London and Liverpool.*

The geology of Western Australia has yet to be investigated in detail, and therefore all that could be done in this map is to represent its broad features. As a preliminary map it is very creditable indeed. The execution is also good and the colouring agreeable.

QUEENSLAND AND BRITISH NEW GUINEA. Constructed at the Surveyor-General's Office, Brisbane, from the most recent surveys and information obtainable, with additions and corrections to 1894. Scale 1 : 1,013,760, or 16 statute miles to one inch. *Presented by the Surveyor-General.*

THE SCOTTISH

GEOGRAPHICAL

MAGAZINE.

A REVIEW OF SWEDISH HYDROGRAPHIC RESEARCH IN THE BALTIC AND THE NORTH SEAS.

By Otto Pettersson.

(*With Plates.*)

VI.

The Baltic in 1877 according to Professor F. L. Ekman's Observations.

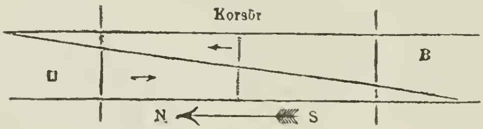
The real boundary between the North Sea and the Baltic from a hydrographic point of view is the broad and shallow submarine ridge between the Danish islands Falster and Möen and the coasts of Mecklenburg and Rügen. The circulation of the sea and the stratification of its water-layers, as well as the distribution of temperature, assume different characters east and west of this line. The western part of the Baltic between this ridge and the Belts is on the whole similar in character to the Kattegat. In this part of the Baltic we find great and rapid changes in the salinity, temperature, and position of the water-strata. The periodical variation depending upon the seasons of the year is also very marked, and affects the waters of all depths from the surface to the bottom. In the great basins and ponds of the Baltic proper, from Rügen to the Gulfs of Bothnia and Finland, the conditions are different. There we find water-strata of extraordinary thickness, 30 to 70 mètres deep, almost homogeneous in saltness, which do not change 1°/$_{oo}$ at the surface for hundreds of miles. Under these great and bulky water-strata we find layers of salter water which evidently must have passed over the ridge between Falster and Mecklenburg; but their further extension is checked by the other submarine ridges which separate the deep ponds in the Baltic from each other, so that the waters which lie in the inner ponds beneath the level of these ridges are nearly stagnant, and in some cases seem—as far as we can decide from observations and analysis—to have been stationary for an indefinite time. The yearly range of temperature from summer to winter, which is very great at the latitudes of the Baltic, affects its water only to a certain depth, below which it becomes nearly or entirely insensible.

The two sections on Plates X. and XIII., which I have constructed from the observations of the Swedish expedition of 1877, will elucidate, better than any description, the hydrographic state of the Baltic and the entrances to the Baltic in July of that year. The longitudinal section through the Great Belt and the western part of the Baltic in Plate XIII. is drawn on a different scale from that generally used.

The track of the *Alfhild* through the Great Belt and the western part of the Baltic is marked by a black line in the map on Plate X., connecting the Stations 40, 41, 42, and 43, 44, 45. With Station 46 the *Alfhild* began her cruise in the Baltic proper. From the succeeding stations I have selected Nos. 47, 51, 57, 66, 75, 83, 96, in order to get that section through the deepest channel of the Baltic, from Rügen to Gotland, which is graphically represented in Plate X. and in the longitudinal section on Plate XIII. In the first place, I wish to call attention to the left part of the fig. on Plate X., and section 9 on Plate XII., which represent the section through the deep channel of the Great Belt (Stations 40, 41, 42).

The isohalines (in black) from $18°/_{oo}$ to $27°/_{oo}$, which are so thickly crowded upon each other in a space scarcely exceeding 10 mètres in thickness, mark the line of demarcation between the upper (outgoing) and the ingoing undercurrent. The latter seems temporarily to have come to a standstill, because a great part of the isohalines belonging to the salt-water current crop out against the acclivities of the bottom of the sound.

The two water-strata are superposed on one another like two wedges, an arrangement which is graphically represented in the adjoining figure.



It will appear from this that if the pressure upon the lower wedge (*i.e.* the bottom layer of inflowing salt water) increases—*e.g.* owing to an anticyclone passing over the North Sea, or to strong gales from the west and north—the upper strata of fresher Baltic water in the northern part of the Belt will be raised to a higher level, until the water at the surface begins to flow backwards, giving rise to an inflowing current through the Belt. Such changes in the direction of the surface current are very frequently noticed at Korsör. Löffler found that out of 179 observations at Korsör an ingoing current was found in 67, an outgoing in 104, and still water in eight cases. We must bear in mind, however, that an entering current in the Great Belt, as a rule, means only a *reflux of Baltic water*, and does not necessarily involve any change in the properties (saltness, for instance) of the water. The Baltic Stream—like the opposite current of salt water beneath it—may be intermittent, or even assume a retrograde movement, but it is always easily distinguishable by the relatively low salinity of its water. Occasionally it happens that the cuneiform Baltic water-layers thin out or entirely disappear from the surface, so that the ingoing salt water is found in the Belt at all depths. Or, *vice versâ*, the wedge B of Baltic water, represented in the figure, may expel the bottom stream U from the channel of the Belt. To such causes we must attribute the remarkably high range of variations which occurs in the observations of salinity and temperature from Korsör. In some cases such widely different values as 28 or 30°/₀₀ and 10°/₀₀ of salt have been noted in the surface water.

The same explanation applies also to the changes in the direction of the surface stream so frequently observed at the Danish lightships in the Kattegat. As a rule, the direction of the stream is far more constant at the sides of the Kattegat, on the Swedish coast and in the Læsö channel, than in the middle, at Anholt and Trindelen. I have pointed out in the preceding pages that, under certain circumstances, water from the North Sea, "the Danish Stream," sweeps round the Skaw, and penetrates as a wedge into the Baltic water at the surface of the Kattegat. Such was the case in the first week of February 1890, as I have already shown. Such inrushes of salt water into the middle of the Kattegat may stop the outflow of Baltic water, or turn the direction of the stream in its central part, while it still continues to flow along the Swedish and Danish coasts.

The next part of the diagram in the longitudinal section and section 10 on Plate XIII., containing the Stations 43, 44, and 45, represent the configuration of the water-strata in the western part of the Baltic. The effect of the outflowing Baltic water upon the deeper strata, which are for the moment stopped in their passage over the threshold of the great basins of the Baltic proper, is apparent from the peculiar form of the isohalines. The observations of the Swedish expedition in the middle of July 1877 thus prove the fact *that the inflow of salt water into the Baltic proper is intermittent.* The diagram on Plate XIII., where the isohaline of 8°/₀₀ is the only line which passes unbroken over the ridge between Falster and the coast of Mecklenburg, satisfactorily demonstrates this. A deep sounding in the southern shallow part of the Sound, which is represented at Station 55 on the same plate, shows that the same rule holds also with regard to this entrance to the Baltic. In such cases as that which I have described, when the supply of salt water is cut off, the condition of the Baltic resembles that of a great inland lake, *e.g.* the Mälar lake.[1]

[1] The southern part of the Sound is very shallow, the depth being only about 7 mètres. Numbers of observations from Swedish and Danish lightships prove that the salt water from the Kattegat rarely crosses this ridge. But if this occasionally takes place, it seems to me very probable that water of higher salinity will enter the Baltic by this way rather than any other, because I have occasionally found isohalines of relatively high order cropping out against the northern slope of this ridge. In my opinion, a slight augmentation of only one or two mètres in the depth of the navigable channel through the Sound, which will, perhaps, be necessitated some day by the exigencies of commerce, would essentially alter the hydrographic and biological conditions of the Baltic.

How long this state of things lasted we do not know, but there is sufficient evidence to prove that the salt undercurrent from the western part of the Baltic, which had ceased to flow at the time of the Swedish expedition, had previously passed over the ridge between the Danish islands and the German coast. At the bottom of the first deep pond of the Baltic proper, east of Bornholm, the Swedish expedition found water of the same salinity, $16°/_{oo}$, at a depth of 70 mètres (Station 66), which at Station 45 was found 9 to 10 mètres below the surface. Thus it is evident that water of $16°/_{oo}$ salinity or more must previously have passed over the ridge and collected in the deep pond east of Bornholm.

Another proof I have found in the observations of the German expedition on the *Pommerania* in 1871. The *Pommerania* did not, however, follow exactly the same track as the *Alfhild* in 1877. From her observations I have constructed the section which is placed beneath the longitudinal section on Plate XIII. The hydrographic state on the boundary between the western and eastern parts of the Baltic was very different then. It will be seen from the figure that the isohaline of $14°/_{oo}$, which must belong to the undercurrent of salt water, then passed over the ridge; and the isohaline of $15°/_{oo}$, which in July 1877 was found at 66 mètres, in August 1871 reached up to 45 mètres. *The foremost great basin of the Baltic proper was being filled with salt water in* 1871, *while it was sending out its store of salt water in* 1877.

The longitudinal section, together with the chart of depths, enables us to study the further progress of the ingoing undercurrent eastwards.

In the first place, it will be seen from the chart on Plate XI. that the salt water of the bottom current cannot flow into the Baltic between Rügen and Bornholm on account of the submarine plateau (with Rönnebank and Adler bank) which extends between these islands. *The entire mass of inflowing water must pass to the north of Rügen and Bornholm.* On account of the action of the earth's rotation it keeps close to the south side of this passage. In section 12 on Plate XIII. we find the ingoing undercurrent, characterised by higher salinity and temperature, along the bottom at Stations 51 and 50. The isohalines of 9 and $10°/_{oo}$, which have a very peculiar form, mark the boundary between the outgoing and ingoing waters. The former fill the entire area of section 12 between Sweden and the island of Rügen, with the exception of the right corner of the figure, where the salt and warm (up to 10° C.) water of the undercurrent is seen to "bank up" against the coast of Rügen. The upper layers at the Stations 50 and 51 down to 20 mètres, and down to 40 mètres at 52, 53, 54, are a part of the great water-stratum of from $7°/_{oo}$ to $8°/_{oo}$ salinity which in the chart and the section on Plate X. is denoted by green colour. This water-stratum is characterised by a minimum temperature (+5° C.) at a depth of about 30 mètres, which is also found at the same depth at Stations 53 and 54. The range of temperature from the surface down to 40 mètres is exactly the same at Stations 53 and 54 as at Stations 68, 69, in section 15 on Plate XIV. Consequently, the water at 53 and 54 is of the same kind and belongs to the same layer as that in Stations 68 and 69 in section 15, which is moving westward, *i.e.* out of the Baltic.

Section 12 is the most representative of all with regard to the circulation of the water in the Baltic. The ingoing and the outflowing currents are here found side by side, the former marked by a maximum of 10° C., the latter by a minimum of 5° C. This maximum and minimum were found, in July 1877, at the same depth, not more than sixteen miles distant from each other!

In the next section, 13, we find the ingoing undercurrent, after passing Stations 50 and 51, at the bottom of the strait between Bornholm and Sweden.

The forms of the isotherms at Stations 54 and 53 in section 12 and Stations 56 and 57 in section 13 must be considered in connection with those found at Stations 68 and 69 of section 15. In these three sections we recognise, from the singular distortion of the isotherms (which I cannot explain), parts of the same water-layer on its way out of the Baltic.

East of Bornholm is situated the first deep basin of the Baltic. The deep soundings at Station 66 (see the longitudinal section on Plate XIII. and section 15 on Plate XIV.) account for the hydrographic constitution of the deep waters in this pond. The undercurrent has filled the basin with water of from 16°/₀₀ to 14°/₀₀ salinity. Water of 12°/₀₀ is free to continue its course over the Middelbank, which separates (at a depth of about 55 mètres) the Bornholm basin from the next great excavation in the bottom of the Baltic, viz., the deep basin east of Gotland, which is the largest pond of all. Sections 18, 20, and 22 are representative of this part of the sea. Section 17, from Rixhöft to Memel, is of minor importance, since it does not pass over the deep pond of the "Danziger Tiefe."

The condition of the great deep basin east of Gotland in July 1877 was as follows:—

The upper water-layer from the surface down to about 60 mètres (see section 20 on Plate XIV.) was found to be of almost uniform saltness, 7 to 8°/₀₀. Under this great surface-layer the isohalines of 9, 10, 11°/₀₀ followed at regular intervals of 20 mètres. Only the deepest parts of the great submarine pond contained water of 12°/₀₀ salinity (see Station 96 on Plate X.). I have pointed out already that the Gotland basin is separated by a submarine ridge (the Middelbank), rising to within 55 or 60 mètres of the surface, from the Bornholm deep basin. We infer from this *that the undercurrent must first fill the latter from the bottom to the brim (within* 60 *mètres of the surface) with salt water before it can flow over the ridge and enter the great pond east of Gotland.*

I have shown before that no isohaline of higher order than 12°/₀₀ passed unbroken over the Middelbank. From the longitudinal section in Plate XIII. it seems as if also this isohaline, together with those of 11 and 10°/₀₀, were intercepted before it reached the Gotland basin (see station 75). The only kind of water which in July 1877 had free access to the Gotland deep basin was that of not more than 9°/₀₀ salinity. But it is evident that some time before an undercurrent of 11 and 12°/₀₀ salinity must have flowed into this basin, since water of 10°/₀₀ was found at 95 mètres, and water of 11°/₀₀ at 118 mètres. The bottom water of 12°/₀₀ salinity must, therefore, be a *residue* from a previous inflow. For the same reason we must consider the deepest layers in sections 18 and the central part of 22 (Stations 104, 105, 106), found in July 1877 by the expedition, to be *stagnant waters.* The peculiar contour of the isohaline of 10°/₀₀ to the east and west of Gotland, in section 22 (see Plate XV.), is worthy of notice. The isohalines of 8 and 9°/₀₀ are found at the same depth on both sides of Gotland, but the isohaline of 10°/₀₀ at 90 mètres east (Stations 104, 105) and north of Gotland (Station 108, section 21, and Stations 86, 87, section 26), while it stands at 170 mètres west of Gotland (Station 110, section 21).

This shows that the undercurrent must pass to the east and north of Gotland before it reaches the deep ponds on the west of that island. On its course the saltest water-layers are intercepted by the submarine ridges, so that in July 1877 the bottom water of

The deep pond east of Bornholm	contained	16°/₀₀	at a depth of	73 m.
,, ,, ,, Gotland	,,	12°/₀₀	,,	205 ,,
,, ,, west of ,,	,,	10°/₀₀	,,	170 ,,

The deepest pond of the Baltic is situated a few miles east of Landsort at Station 94 in section 24 (see chart, Plate XI.). This basin is of small extent, being a hole 420 mètres deep, with a bottom of very soft mud, into which the water-bottle sank 20 or 30 mètres, so that the strength of the bronze cord was tried to the utmost in hauling up the apparatus. Below the depth of 110 mètres the salinity of the water was found to be 10°/₀₀, and the temperature uniform at +3·7° or 3·8° C. This is evidently a stagnant water of the most typical kind. How long it has remained in this pool it is impossible to ascertain, but the study of the state of this deep basin in the future will be of extraordinary interest.

In the Baltic proper we must, then, henceforth distinguish between movable and stagnant water-layers. To the former belonged, in July 1877, the waters of salinity up to 8 and 9°/₀₀. Water of less salinity than 8 or 9°/₀₀ passes over all submarine ridges in the Baltic proper, and the movability of these layers finds expression in the irregular form of the isohaline of 8°/₀₀ (see, for instance, section 20 on Plate XIV.). The deeper isohalines, from 10 to 12°/₀₀, which belong to the stagnant water-layers, are horizontal lines of regular contour.

To this great water-layer of almost homogeneous salinity (7 to 8°/₀₀) the yearly variation of temperature and the thermal circulation are chiefly restricted. The range of temperature in the atmosphere from winter to summer being very considerable in the latitudes of the Baltic, a thermal wave of great amplitude will pass every year through the water from the surface downwards. The propagation of this wave is indicated by the isotherms in the diagrams. I am, however, bound to explain what I mean by thermal waves and thermal circulation in sea-water. Heat can be propagated through water in three different ways:—

1. By molecular motion, *i.e. conduction of heat.* Professor C. G. Lundqvist[1] has found the conductivity of pure water, measured in the usual units, to be k=0·0933. The conductivity of aqueous solutions of

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[1] C. G. Lundqvist: *Undersökning af några vätskors ledningsförmåga för värme.* Upsala, 1869.

chloride of sodium is inferior to that of pure water. According to Lundqvist, a temperature maximum of summer heat could not reach farther downwards than a few mètres in the course of six months, if propagated by conduction alone, through sea-water not stirred by any mechanical agency.

2. By ascending or descending currents of heated or cooled water particles, or *convection of heat.* Sea-water so diluted as that of the upper layers of the Baltic shares the property of pure water in having its point of maximum density higher than its freezing point. But it differs from pure water in so far that its point of maximum density is *lower* than $+4^\circ$ C.[1] Consequently, the water will be cooled at the surface in winter and sink as far as it can sink, either to the bottom or to the boundary of some underlying stratum of higher density, where it reaches a surface of minimum temperature. In the Baltic proper this boundary is formed by the water of $9^\circ/_{\circ\circ}$. Beyond this limit there is no thermal circulation by convection. Below this, the propagation of heat is extremely slow, because it depends upon the conductivity alone. All sections from 15 to 26 bear out this fact in the most striking manner. In all these diagrams we find a temperature minimum in the vicinity of the isohaline of $8^\circ/_{\circ\circ}$. From the isohaline of $9^\circ/_{\circ\circ}$ and downwards the temperature is almost uniformly $+3$ to $+4^\circ$ C.

In the Bothnian Sea, between Åland and the Quarken (secs. 31 to 35) the isohaline of $6^\circ/_{\circ\circ}$ forms the limit to which the cooled water sinks. In the Gulf of Bothnia, north of the Quarken, where the salinity of the bottom water is only $4^\circ/_{\circ\circ}$ or less, the minimum temperature was found at the bottom.[2] The cause will be explained in the following chapter.

3. By wave motion and the upheaval by winds of deep water off a lee shore. These causes will chiefly affect the upper water-layers. The effect of winds upon the temperature of the surface water is very remarkable on the coasts of the Baltic. In the course of a few hours the temperature at the west coast of Gotland, for example at Wisby, may sink from 14° or 16° to 6° C. if an easterly wind sets in. The same observation applies to the Russian coast. Winds from the east draw up from the deeper layers to the surface waters which have the same salinity (7-$8^\circ/_{\circ\circ}$) but a considerably lower temperature, because they come from the vicinity of the minimum region. After the foregoing discussion, we shall be prepared to find the upper layer of 7 and $8^\circ/_{\circ\circ}$ water well ventilated. The lower stagnant water-strata of 10, 11, $12^\circ/_{\circ\circ}$ will, in all probability, be found deficient in oxygen. How far this conclusion has been verified by experience I shall proceed to show.

The Gulf of Finland is to a considerable depth open to the influx of the deep water of the Baltic, which here has a maximum salinity of $9{\cdot}76^\circ/_{\circ\circ}$ (section 28, Plate XV.). This bay forms an integral part of the hydrographic system of the Baltic proper.

Between Stockholm and Hangö in Finland is situated a great sub-

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[1] See O. Pettersson: *On the Properties of Water and Ice. Report of the Vega Expedition,* Bd. ii., Plate 22.

[2] It must, however, be observed that the serial temperature observations in 1877 in these parts of the Baltic were somewhat defective.

marine ridge which prevents the deep water of the Baltic proper from flowing into the deep basin of the Åland Sea, lying between the Åland Islands and Sweden, which, therefore, is entirely filled with water of 7-8°/₀₀ salinity (see section 30, Plate XVI., and the longitudinal section on Plate X.).

Between the Åland Sea and the Bothnian Sea is also a submarine ridge, the depth of which has not been thoroughly ascertained by soundings on the Finland side. It seems, however, to very effectually check the further progress northwards of the deep water of the Åland Sea. The deep water of the Bothnian Sea (sections 31 to 35) has only 6-7°/₀₀ of salt. The dilution of the surface water on the west side of the Bothnian Sea caused by the great Swedish rivers—the Angerman-elf and the Indals-elf—is seen from the section and the chart of salinity on Plate X.

The Bothnian Sea and the Gulf of Bothnia are separated by a narrow strait, the Quarken (section 36). The bottom water of the Gulf has only 4°/₀₀ of salt. In this part of the sea the influence of the river-water predominates. North of the Quarken the marine character of the water is modified. Professor E. Hjelt,[1] of Helsingfors, has by a series of analyses studied the alteration in the chemical composition of the water between the Baltic proper and the Bothnian Gulf. The alteration takes the same form as found by myself in the waters of the Siberian Sea. The admixture of river-water causes an increase in the amount of sulphates and a decrease in the chlorine. The colour also of the sea-water changes; in the Bothnian Sea it is green, while in the Bothnian Gulf it becomes brownish (Nordqvist).

VII.

The Baltic in 1893, according to the Survey of the Swedish Commission.

In 1893, sixteen years after Professor F. L. Ekman's investigations, the Royal Academy of Sciences at Stockholm appointed Professor A. Wijkander, Mr. G. Ekman, and myself to conduct the Swedish part of the international hydrographic research of the North Sea and Baltic, which was to take place in the course of twelve months, from May 1893 to May 1894. The first order of the committee was to repeat the most important and representative of the deep soundings in the Baltic taken in 1877, in order to study the changes which had taken place in the composition of the waters, especially the deep waters, in the interval of sixteen years. Besides the usual determination of salinity and temperature, special attention was paid to the amount of gaseous matter, nitrogen, oxygen, and carbonic acid, in the waters. My new apparatus and methods, described in the foregoing pages, were exclusively employed in this research. There could be no doubt as to the stations which ought to be selected for a comparison with Ekman's work. Instead of wasting time on a detailed repetition of Ekman's numerous deep soundings, we

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[1] E. Hjelt: *Kemisk undersökning af hafsvattnet i Finlands Sydvestra Skärgård*, Helsingfors, 1888.

determined to concentrate our efforts upon the five stations (see the chart and the diagrams on Plate X.), Nos. 67, 96, 94, 70, 35. Each of these stations is remarkable as being situated at the deepest place in one of the five great submarine ponds of the Baltic, the Åland Sea, and the Bothnian Sea. A closer inspection of the diagram on Plate X. reveals the fact that the entire configuration of the waters of the Baltic can be studied in its general outlines at these stations. In the following tables I have arranged side by side the results of Ekman's deep soundings in July 1877 and our own in the summer and autumn of last year.

Station 67.

Lat. 55° 23′ 10″, long. E. 16° 2′ 0″ (E. of Bornholm).

	Ekman, 24th July 1877.		Swedish Commission (Mr. Jensen), 6th Nov. 1893.						
Depth M.	Temp. t°.	Salt $^{\circ}/_{\circ\circ}$	Temp. t°.	Salt $^{\circ}/_{\circ\circ}$	N_2 cc. in 1 L.	O_2 cc. in 1 L.	$\frac{100\ O_2}{N_2+O_2}$	CO_2 cc. in 1 L.	Temp. of absorption τ° C.
0	15·7°	7·44	8·55°	7·64	...	...	...	...	...
10	15·3°	...	8·55°	7·53	...	...	...	...	...
13	14·8°	...	8·55°	7·55	...	...	...	...	...
18	14·0°	...	8·55°	7·53	...	...	...	...	...
20	10·5°	7·53	8·55°	7·52	...	...	...	...	...
22·5	6·6°	...	8·55°	7·53	...	...	...	...	...
25	5·0°	...	8·55°	7·55	15·23	7·41	32·73	31·63	7·6°
30	4·8°	7·60	8·65°	7·53	...	...	...	...	...
40	3·4°	7·72	8·45°	7·50	...	...	...	...	...
45	...	...	8·55°	7·57	...	...	...	...	...
50	3·3°	9·30	3·90° (min.)	9·92	17·03	6·12	26·43	...	+1·6°
60	2·7°	14·04	7·00° (max.)	13·48	...	...	...	...	...
70	2·8°	15·73	5·90°	14·65	15·47	5·14	24·93	41·26	4·0°
80	2·8°	16·61	4·45°	15·16	...	...	...	...	...
90	2·8°	16·89	2·80°	16·28	16·55	4·48	21·30	41·32	+0·8°

In the first great basin of the Baltic proper, to the east of Bornholm, the condition of the waters with regard to salinity was almost the same in November 1893 as in July 1877, with the exception that the salinity of the deep water had diminished. The isohalines of 14 and 15·89 $^{\circ}/_{\circ\circ}$ were found at deeper levels, and the saltness of the bottom layer was 16·28 $^{\circ}/_{\circ\circ}$ instead of 16·89 $^{\circ}/_{\circ\circ}$ as found by Ekman. The limit of the great upper layer of 7-8 $^{\circ}/_{\circ\circ}$ was found at exactly the same depth, 40 to 45 mètres, in 1893 as in 1877. But the temperature was different. In July 1877 a thermal wave was descending from the surface downwards to 30 or 40 mètres, where the effect of the cold of the foregoing winter was still felt. In November 1893 the thermal circulation carried on by descending vertical currents of cooled water from the surface had begun to take effect, rendering the entire water-layer almost perfectly homogeneous in salinity (7·5 $^{\circ}/_{\circ\circ}$) and temperature (8·55° C.). As might be expected under such circumstances, the water at 25 mètres was very well ventilated (32·73 $^{\circ}/_{\circ}$), and possessed an amount of nitrogen nearly corresponding to its actual temperature ($t=8{\cdot}55°$; $\tau=7{\cdot}6°$). It had evidently left the surface shortly before, and was sinking down saturated with air.

Between 45 and 50 mètres there was a surprisingly abrupt change in the properties of the water. The water-layer of 9°/$_{\circ\circ}$ had only 3·90° temperature, and had been saturated *in winter*, at $\tau' = 1{\cdot}6°$ C., with air. Moreover, it had remained at this depth sufficiently long to be *remarkably deficient in oxygen* (=26·43°/$_{\circ}$). *The thermal circulation had, therefore, evidently been restricted to the great upper layer of* 7-8°/$_{\circ\circ}$. At a greater depth, 60 mètres, there was also an abrupt change in salinity (from 9·9 to 14·6°/$_{\circ\circ}$), in temperature (3·9° to 7·0° C.), and in dissolved nitrogen (17·03 cc. to 15·47 cc.). The intermediate layer of 9°/$_{\circ\circ}$ was sharply differentiated from the uppermost water-layer (outflowing water), and from the deep water (ingoing or stagnant water of the undercurrent). The percentage of dissolved oxygen diminished with the depth.

The state of the next great deep basin of the Baltic, east of Gotland, in July 1877 and 1893 will be seen from the following table :—

Station 96.

Lat. 57° 23′ 50″, long. E. 19° 51′ 50″ (E. of Gotland).

	Ekman, 1st August 1877.		Swedish Comm. (Captain Wessblad), 27th April 1893.							
Depth in M.	Temp. t° C.	Salt °/$_{\circ\circ}$	Temp. t° C.	Salt °/$_{\circ\circ}$	Cc. N_2 in 1 L.	Cc. O_2 in 1 L.	$\frac{100\ O_2}{N_2+O_2}$	Cc. CO_2 in 1 L.	Temp. of absorp. τ° C.
0	14·4°	7·08	1·70°	7·46	...	...	...	...	...
10	14·7°	7·10	1·90°	7·50	...	...	...	...	...
15	14·1°	...	1·60°	7·50	18·44	9·67	34·39	32·22	−0·7°
20	7·8°	7·14	1·65°	7·50	...	...	...	...	...
30	3·2°	7·42	1·60°	7·50	18·25	9·40	34·01	31·98	−0·4°
40	2·8°	7·62	1·60°	7·46	...	...	...	...	...
45	2·2°	...	1·55°	7·50	...	...	...	...	...
50	1·8°(min.)	7·78	1·45°	7·53	...	...	...	...	...
60	2·0°	8·03	+0·80°(min)	7·61	18·39	9·09	33·15	32·38	−0·5°
70	3·0°	8·19	1·05°	7·77	...	...	...	...	...
80	3·5°	9·39	2·85°	8·81	...	...	...	...	...
90	3·9°	9·91	3·50°	9·72	...	...	...	...	...
100	3·9°	10·41	3·60°	10·26	16·40	3·98	19·51	36·13	+3·0°
120	3·8°	11·05	3·95°	10·89	...	...	...	...	...
140	3·8°	11·62	4·05°	11·32	...	...	14·58	39·31	...
160	3·8°	11·75	4·15°	11·64	...	...	...	...	...
170	3·7°	11·87	4·0°	...	..	...	...	...	...
180	3·2°	12·00	4·20°	11·82	..	...	...	...	...
200	3·2°	12·07	4·25°	11·84	16·59	1·21	6·83 6·96	41·18 41·38	+2·1°
213	3·1°	12·19	4·25°	11·87	...	...			

Here, also, the limits between the water-layers have not changed their positions. The upper layer of 7-8°/$_{\circ\circ}$ water is about 70 mètres deep, as sixteen years ago. The salinity of the bottom water *is a trifle less than in* 1877.

From the surface to 70 or 80 mètres, where the boundary of the waters is situated, the thermal circulation caused by the cold of the foregoing winter has rendered the water almost homogeneous in temperature and salinity. It is completely aërated, the percentage of oxygen at 15 mètres being 34·39%, and at 30 mètres 34·01%, and has evidently been saturated with air in winter at a temperature near to its freezing point. The upper layers at 15 mètres are slightly supersaturated with oxygen, like sea-water at high latitudes in the Arctic (Tornœ) and Antarctic (Buchanan) Oceans.[1]

The condition of the deep waters from 70 mètres downwards is strikingly different. Thermal circulation by convection seems not to exist here, as might be expected from the physical properties of these waters; a thermal wave of small amplitude seems to descend towards the bottom; the ventilation of the water is utterly deficient. Consequently, the amount of dissolved oxygen has sunk to 1·21 cc. in 1 litre (=6·9%), and the carbonic acid has increased to 41·3 cc. The bottom water has every criterion of a stagnant water. I must leave undecided the question whether the great deficiency in oxygen is due to the respiratory process of animal life, or to the combining action of the bottom clay and mud upon sea-water, recently discovered by Murray and Irvine.[2] I am, however, inclined to ascribe the deficiency of oxygen to the action of organic life, for two reasons: *firstly*, because the carbonic acid has increased almost proportionally to the diminution of oxygen; *secondly*, because the bottom water does not contain the least trace of sulphuretted hydrogen. If the bottom water in the Baltic deep basins had remained there stagnant as long as the deep water in the Black Sea, according to the recent Russian researches, the remarkable constancy in the salinity of the upper layers of the Baltic would be incomprehensible. It seems more probable that the undercurrent has periods of long duration of inflow and cessation, and that the present state is only one phase of such a period, characterised by the failure of the undercurrent, which at some future time, more or less remote, may flow in more abundantly and renew the bottom water in the deep ponds of the Baltic, just as we have found to be the case in the fiords of the Skagerack.

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[1] This singular fact, that the waters of the Baltic upper layers may occasionally be supersaturated with oxygen, like Arctic water, is worthy of attention. I have discussed this phenomenon with the eminent specialist on diatoms, Professor Cleve of Upsala. We both arrived at the conclusion that supersaturation with oxygen, as well as deficiency of oxygen, is probably due to the influence of organic life. The predominance of *vegetable* Plankton (diatoms, algæ), which is characteristic of Arctic as well as Baltic water, may cause the former, the respiratory organs of animals and animal Plankton the latter phenomenon.

Be this as it may, it is certainly a fact to be borne in mind by biologists, that the conditions of organic life are very different in the Baltic and in the North Sea, on account of the relatively high amount of dissolved oxygen in the upper layers of the Baltic. Owing to the low salinity, the perfect aëration of the water down to a considerable depth, and the low temperature ($\tau°$) at which their water is saturated with air in winter, the upper layers of the Baltic contain about 30 per cent. more oxygen than the waters of the North Sea.

[2] See John Murray and Robert 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. Trans. R.S.E.*, vol. xxxvii. part ii. No. 23.

Station 94.

Lat. 58° 41′ 30″, long. E. 18° 25′ 0″ (E. of Landsort).

	Ekman, 27th July 1877.		O. Pettersson, 7th Sept. 1891.		Swed. Comm., 5th July 1893.	
Depth in M.	Temp. t° C.	Salt °/₀₀	Temp. t° C.	Salt °/₀₀	Temp. t° C.	Salt °/₀₀
0	15·4°	6·13	10·4°	...	13·55°	6·52
10	11·3°	6·60	...	...	13·65°	6·63
15	8·7°	6·27	...	...	12·45°	6·61
20	3·9°	6·54	8·00°	...	7·85°	6·78
30	2·0° (min.)	7·12	5·05°	...	4·00°	7·08
40	2·1°	7·48	...	...	3·25°	7·12
50	...	...	3·00°	...	2·35°	7·35
60	2·3°	7·62	2·60° (min.)	...	2·10° (min.)	7·84
70	...	...	2·80°	...	...	...
80	3·4°	9·52	3·10°	...	3·45°	9·43
100	...	9·52	3·30°	...	4·80° (max.)	9·86
120	3·7°	10·48	3·60°	...	3·75°	10·04
140	...	10·41	...	...	·85°	10·09
160	3·7°	10·20	...	...	...	...
200	3·7°	10·36	3·70°	...	·90°	10·22
240	3·7°	10·41	...	...	3·90°	10·32
260	3·7°	10·45	...	...	3·90°	10·32
280	3·7°	10·48	..	...	3·95°	10·32
300	3·7°	10·48	3·70°	...	3·85°	10·32
320	3·8°	10·50	...	...	3·85°	10·32
360	3·8°	10·54	3·75°	...	3·90°	10·34
380	3·9°	10·61	...	..	3·85°	10·36
400	4·6°	10·73	...	...	3·90°	10·36
411	...	...	3·8°	...	...	...

In 1891 and 1893 the gaseous contents of the waters were also investigated, with the results shown by the following table :—

Table of Quantities of Gases dissolved in the Waters of Station 94.

7th September 1891.

Depth in M.	Temp.		Salt °/₀₀	N_2 cc. in 1 L.	O_2 cc. in 1 L.	$\frac{100\ O_2}{N_2+O_2}$
	t° C.	τ° C.				
20	8·0°	...	...	...	...	...
50	3·0°	...	...	...	...	...
60	2·6°	...	limit of 7·00	...	...	...
100	3·3°	1·4°	limit of 8·00	17·08	4·41	20·53
200	3·7°	...	limit of 10·00	...	...	...
300	3·7°	+0·5°	...	17·48	3·51	16·73
363	3·75°	2·7°	...	16·56	3·04	15·51
400	3·8°	2·7°	...	16·45	3·19	16·24
400 bis.	3·8°	2·6°	...	16·67	3·21	16·15

5TH JULY 1893.

Depth in M.	Temp. t° C.	Temp. τ° C.	Salt °/₀₀	N_2 cc. in 1 L.	O_2 cc. in 1 L.	$\frac{100\ O_2}{N_2+O_2}$	CO_2 cc. in 1 L.
20	7·85°	3·5°	6·78	16·51	8·17	33·12	...
50	2·35°	−0·4°	7·35	18·18	8·58	32·05	32·31
60	2·10°	+0·3°	7·84	17·82	6·67	27·23	33·73
100	4·80°	1·6°	9·86	17·04	3·09	15·37	38·26
200	3·90°	1·6°	10·22	17·08	2·73	13·80	38·36
300	3·85°	2·2°	10·32	16·77	2·82	14·41	...
363	...	...	...	...	...	...	...
400	3·90°	2·2°	10·36	16·82	1·33	7·31	40·65
400 bis.	...	...	...	...	...	...	...

In this deep pond the hydrographic state below 200 mètres seems to have remained entirely unaltered during the last sixteen years, with the single exception that the amount of oxygen dissolved has rapidly diminished in the bottom layer since 1891. The salinity, the temperature, and the nitrogen are exactly alike in all cases at 400 mètres, but the oxygen has diminished from 3·2 cc. in 1 litre, or 16·15°/₀, in 1891 to 1·33 cc., or 7·31°/₀, in 1893. No aëration and no fresh inflow of salt water has taken place; the water below the level of the ridges seems to have remained stationary for an indeterminable time.

In the Åland Sea there is a deep pond at Station 70.

STATION 70.

Lat. 60° 8′ 20″, long. 19° 18′ 18″ E.

Depth in M.	Ekman, 22nd July 1877. Temp. t° C.	Salt °/₀₀	Swed. Comm. (Mr. Jensen), 6th July 1893. Temp. t° C.	Salt °/₀₀	Cc. N_2 in 1 L.	Cc. O in 1 L.	$\frac{100\ O_2}{N_2+O_2}$	Cc. CO in 1 L.
5	12·5°	5·39	8·00°	5·79				
10	11·8°	5·39	7·65°	5·79				
15	9·4°	5·53	6·90°	5·88				
20	3·4°	5·89	4·10°	6·12				
30	3·3°	6·04	3·00°	6·31	17·95	8·69	32·62	28·79
40	1·0° (min.)	6·81	1·75° (min.)	6·67	18·04	8·29	31·49	30·81
50	1·1°	7·01	2·90°	6·72				
60	...	7·10	2·60°	6·83	18·17	8·64	32·21	31·07
70	...	7·10	2·90°	6·96				
80	...	7·15	2·90°	7·01				
90	...	7·17	2·65°	7·01				
100	...	7·23	2·65°	7·01				
110	1·9°	7·23	2·55°	7·03	18·53	8·65	31·82	31·50
120	...	7·23	2·45°	7·06				
130	...	7·28	2·35°	7·06				
140	2·0°	7·33	2·05°	7·14				
160	2·0°	7·33	2·05°	7·14	18·09	8·45	31·86	31·31
180	1·9°	7·35	1·80°	7·17				
200	1·9°	7·37	1·70°	7·21	18·07	8·17	31·13	31·98
250	1·8°	...	1·65°	7·23				
255	...	7·44	1·70°	7·23				
265	...	...	1·60°	7·23	18·24	8·03	30·56	32·48

This circulation is confined to the upper layer of the Baltic, which is thereby kept very *homogeneous* in salinity and thoroughly *aërated.* The cooled water-particles sink down to the boundary of the denser layers, and there form a region of minimum temperature which has its lower limit approximately at the isohaline of $7^{\circ}/_{00}$. From this limit the circulation by means of vertical currents or *convection* ceases, and is replaced by *conduction, which, as already mentioned, acts extremely slowly, and does not cause any aëration or renewal of the gaseous matter dissolved in the water.*

In the Åland Sea and the Bothnian Sea the circumstances are different. The submarine ridge between Stockholm and Hangö forms a barrier which the salt undercurrent from the Kattegat, the Belt, and the Western Baltic can never cross. The undercurrent, here consisting of the water of the great upper layer in the Baltic proper, fills the depths of the Åland Sea to the bottom at 255 mètres (see the chart and sectional diagram on Plate X.). This water is, as already mentioned, very well aërated, and the undercurrent is in full flow.

The thermal circulation by convection seems to act principally in the upper layers, as we may infer from the fact that the minimum temperature in the Åland Sea (see section 30 on Plate XVI., and the preceding table) has for its lower limit the isohaline of $7^{\circ}/_{00}$; and in the Bothnian Sea (see sections 31 and 33 on Plate XVI.) the isohaline of $6^{\circ}/_{00}$. But, the undercurrent being in full flow, the deeper strata are constantly renewed by aërated waters from more southerly parts of the Baltic. Therefore the oxygen percentage cannot sink to the singularly low numbers registered in our tables for the depths of the Baltic proper. In the deep water of the Bothnian Sea the oxygen is, however, reduced to $26{\cdot}30^{\circ}/_{0}$, as is seen in the table.

STATION 35.

Lat. 63° 9′ 13″, long. E. 19° 27′ 44″ (Bothnian Sea).

	Ekman, 9th July 1877.		Swedish Comm. (Mr. Jensen), 9th July 1893.					
Depth in M.	Temp. t° C.	Salt $^{\circ}/_{00}$	Temp. t° C.	Salt $^{\circ}/_{00}$	N_2 cc. in 1 L.	O_2 cc. in 1 L.	$\frac{100\ O_2}{N_2+O_2}$	CO_2 cc. in 1 L.
0	...	4·80	13·85°	5·17	...	...	...	...
10	9·4°	5·01	10·15°	5·37	...	...	...	...
15	...	5·34	9·65°	5·39	...	..	...	...
20	6·0°	5·50	6·00°	5·44	17·11	8·11	32·15	24·99
25	...	...	3·10°	5·60	...	...	...	...
30	3·0°	5·68	1·70°	5·68	...	. .	...	...
40	2·5°	...	1·40°	5·82	..	...	...	...
50	...	...	1·30°	5·86	18·35	9·10	33·14	...
60	...	5·97	1·05° min.)	5·98	18·04	8·39	31·74	27·91
80	...	6·42	1·70°	6·20	17·86	7·79	30·35	29·42
100	...	6·67	2·45°	6·45	17·74	7·20	28·85	30·95
120	2·5°	...	2·85°	6·51	...	...	...	...
140	2·5°	...	2·90°	6·56	...	...	...	...
150	2·5°	...	2·90°	6·56	...	...	...	...
160	2·5°	...	2·85°	6·56	...	...	...	...
170	...	...	2·85°	6·56	17·65	6·30	26·30	31·47
180	2·8°	...	2·85°	6·58	...	...	...	...
185	...	6·69	...	...	...	...	...	...

The distribution of temperature and the ventilation of the deep water in the Bothnian Sea assume a different character from that in the Baltic proper. North of the line Stockholm—Hangö (section 29, Plate XV.) in the deep ponds of the Åland Sea and the Bothnian Sea there is no water-layer which has remained stagnant sufficiently long, without communication with the undercurrent of salt water which once brought it thither, to be deprived of a great part of its oxygen, as is the case in the great basins of the Baltic proper (see Stations 96 and 94). The waters in the Åland Sea, from 20 mètres to the bottom, have been saturated with air at a temperature of about zero, and the percentage of oxygen is nowhere less than 30%. Thus, for example, we find from the preceding tables that the gaseous matter contained in one litre of sea-water from a depth of 200 mètres is—

At Station 94 (Landsort deep basin) 17·08 cc. N_2; 2·73 cc. O_2 = 13·80 %.
„ 96 (Gotland deep basin) 16·59 cc. N_2; 1·21 cc. O_2 = 6·83 %.
„ 70 (Åland Sea) . 18·07 cc. N_2; 8·17 cc. O_2 = 31·13 %.

The cause of this remarkable difference in the gaseous constituents of the water becomes evident when we find that the salinity of these three water-samples was as follows :—

Baltic,	Station 94, at 200 m.	= 10·22 ‰.
	Station 96, „	= 11·84 ‰.
Åland Sea,	Station 70, „	= 7·21 ‰.

The undercurrent of the Baltic proper, of which the waters from Stations 94 and 96 once formed an integral part, has its origin *outside* the Baltic. We may assume that these waters absorbed their oxygen, say, in the Belts or in the Sound, at some previous time (whether years or centuries ago we do not know). This undercurrent is at present slackening, and seems to have been so at least since 1877. The great deep basins of the Baltic proper, which with regard to the supply of salt water are dependent upon the inflow of the undercurrent from the Kattegat and the Belts, are at present only partially filled with salt water which is a residue from a previous period of inflow, and has in the course of years been exposed to loss of oxygen either through the agency of organic life or the chemical action of the organic matter in the bottom mud. These stagnant water-layers, on account of their superior density, form an impenetrable floor at a certain level below the surface, beyond which the thermal circulation by means of vertical currents cannot pass. The state of the waters of the Bothnian Gulf has not yet been investigated by the Commission.

VIII.

Proposed Scheme for an International Hydrographic Survey of the North Atlantic, the North Sea, and the Baltic.

At the request of the Scandinavian meeting of naturalists in Copenhagen, 1892, G. Ekman and I drew up the following scheme of an International Hydrographic Survey of the Baltic, the North Sea, and adjacent parts of the North Atlantic.

1. *The Baltic.*

The general conformation of the water-strata in the Baltic having been ascertained minutely by the Swedish expedition in 1877 (see the chart on Plate X.), the chief interest is now concentrated upon the following questions:—

The conditions of the waters in the deep submarine ponds of the Baltic.

The alterations in the position of the upper layers (of salinity less than $8°/_{oo}$).

The distribution of temperature, and the thermal circulation in the waters at different seasons of the year.

The quantities of atmospheric gases dissolved in the water at different depths.

All these problems may be studied by a small number of soundings made at the deepest places of the Baltic, viz.:—

(*a*)	E. of Bornholm, . . .	Ekman's Station	67.
(*b*)	E. of Gotland, . . .	,, ,,	96.
(*c*)	E. of Landsort, . . .	,, ,,	94.
(*d*)	At Svartklubben (Aland Sea),	,, ,,	70.
(*e*)	At Skags Udde (Bothnian Sea),	,, ,,	35.
	At Bjurö Klubbe (Bothnian Gulf),	,, ,,	21.

We proposed that the deep soundings at these stations of the Swedish expedition in 1877 should be repeated yearly, if possible, at different seasons of the year.

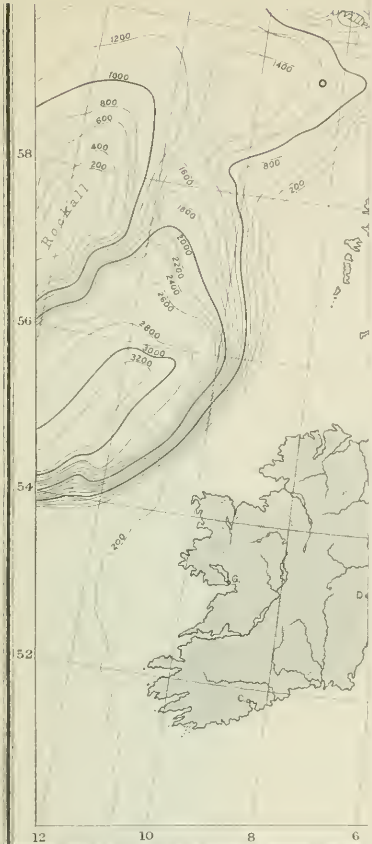
Besides these isolated deep soundings, which could conveniently be made on board a Swedish, Finnish, or Russian pilot-steamer, the entire hydrographic section 12 of Plate XIII., between Arcona and the Swedish coast, where the ingoing and outgoing waters flow at the same level alongside each other, should be repeated either by Swedish or German ships.

2. *The Western Baltic, the Sounds, and the Kattegat.*

On account of the great changeableness of the waters in these and the following parts of the sea, isolated deep soundings will not suffice for the investigation of the hydrographic conditions of the water-layers. Surface observations taken at coast stations will be next to worthless if they are not combined with regular hydrographic sections, which must be drawn up not once only, but at least four times every year. Such sections are, at present, made under the auspices of the Danish Hydrographic Office on thirteen lines across the Kattegat and the Sounds on 1st February, 1st May, 1st August, and 1st November.

We proposed that the same dates for deep soundings should be adopted also for the hydrographic researches in the Skagerack and the North Sea, and that such researches should be arranged for the space of a year, from 1st May 1893 to 1st May 1894, in co-operation with German, Danish, Swedish, Norwegian, and British hydrographers.

In the chart on Plate IX. are marked the hydrographic sections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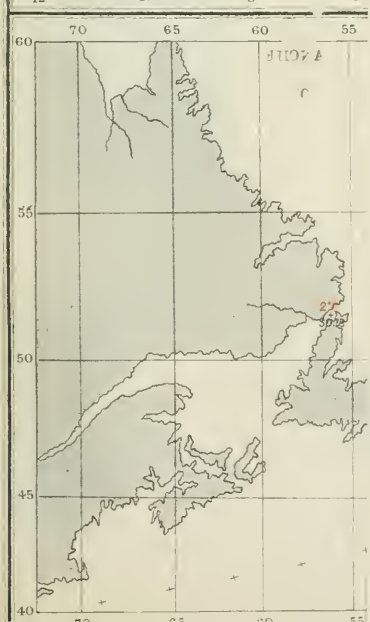
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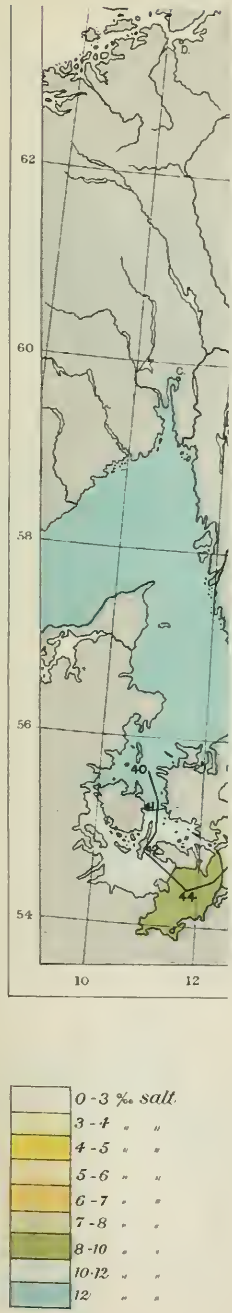
CHART SHOWING SOUNDING STATIONS

PLATE IX

Surface Observations · Deep Sounding Stations o–o o o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C.
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3 - 4 " "
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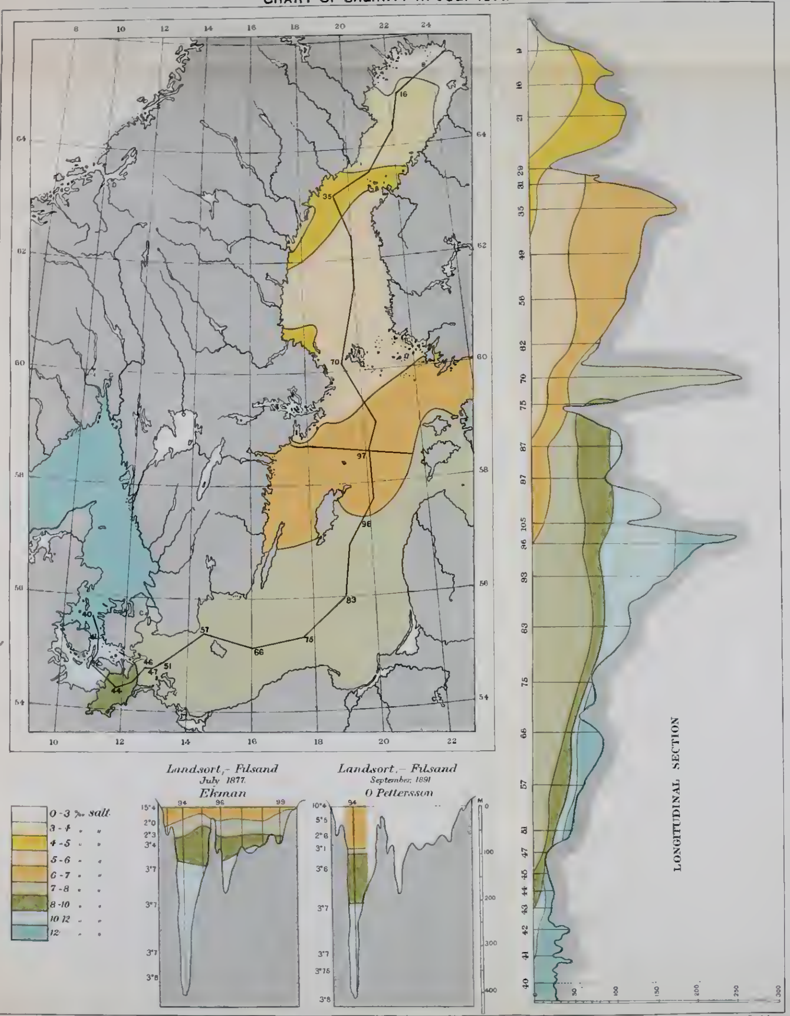
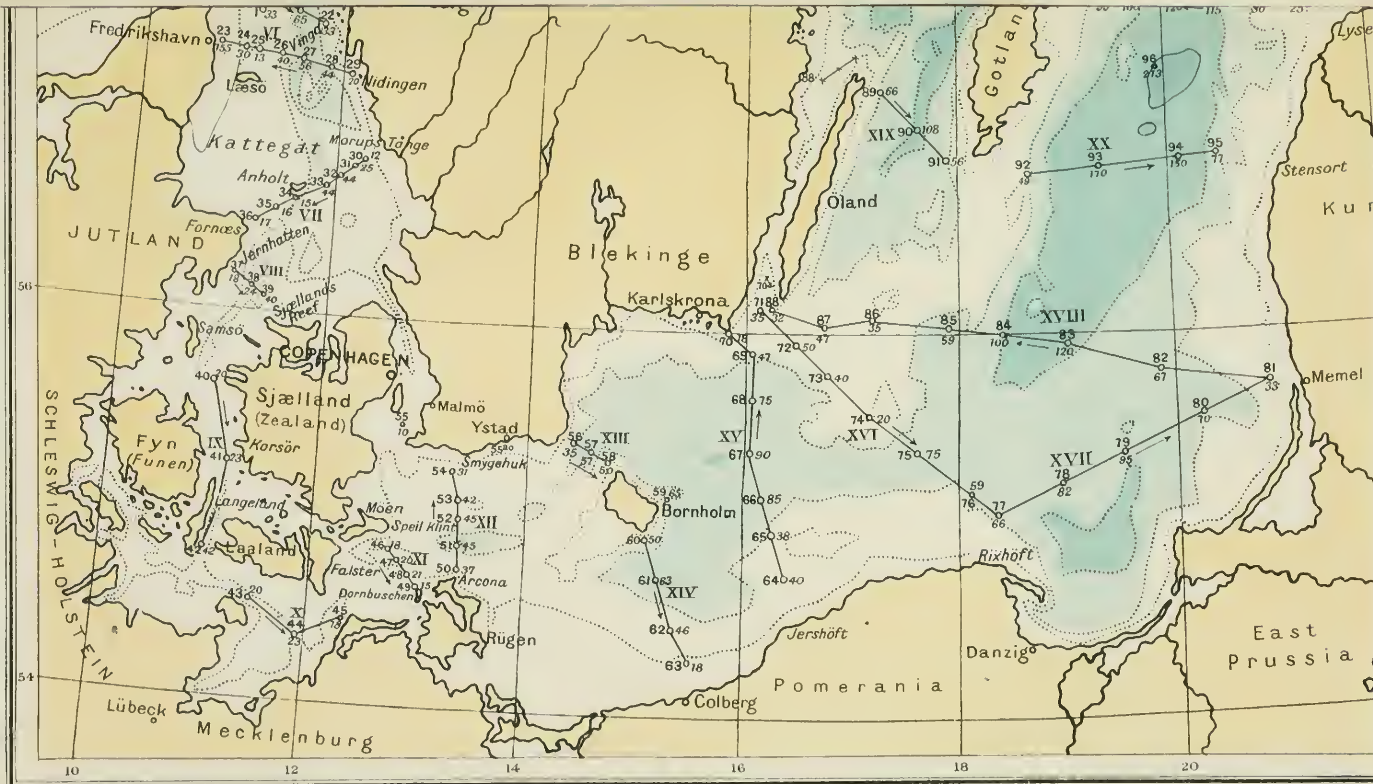
CHART OF SALINITY IN JULY 1877.



The Edinburgh Geographical Institute

Bartholomew



The Edinburgh Geographical Institute

Scottish Geographical Magazine. 1894

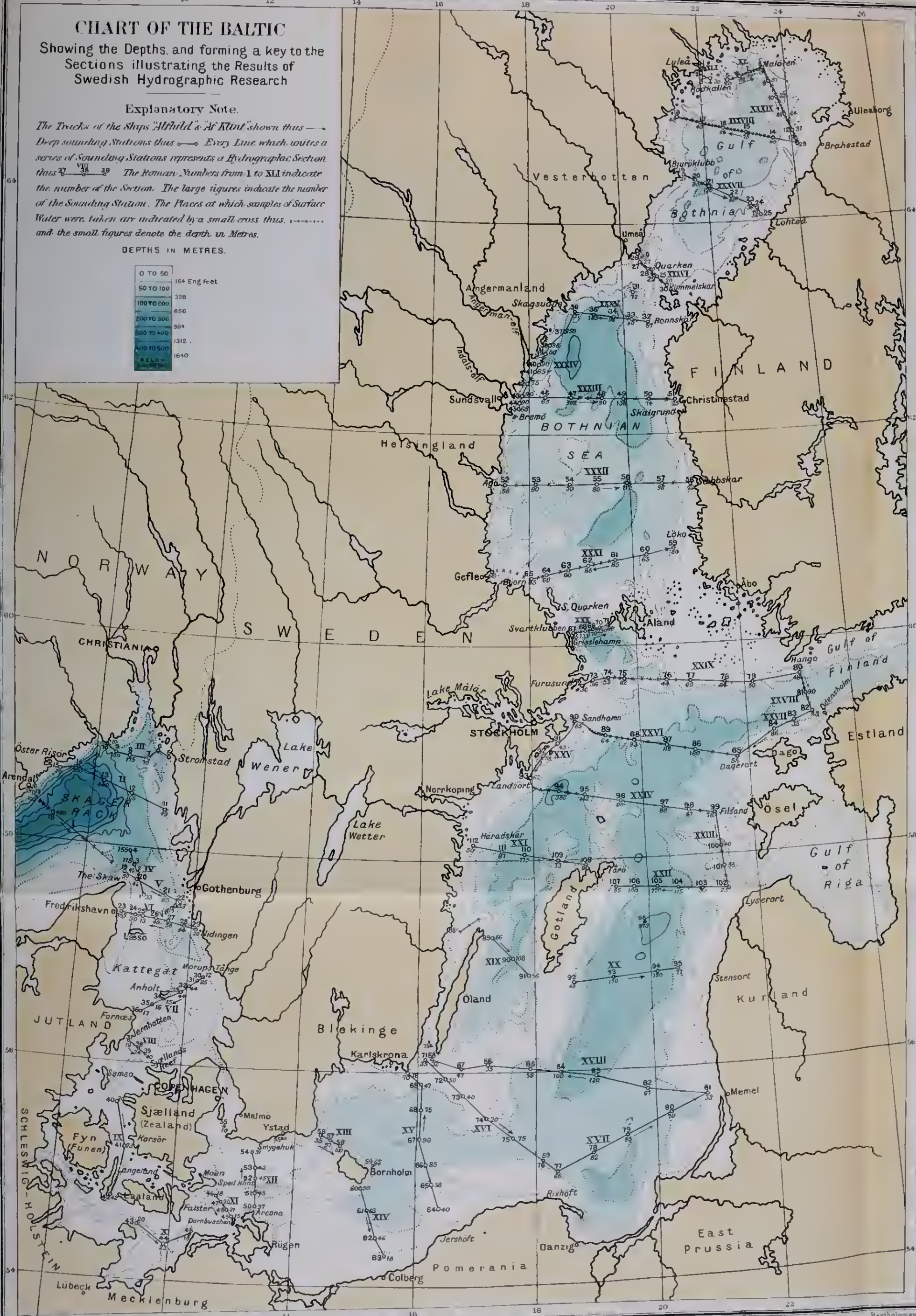
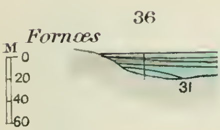


CHART OF THE BALTIC
Showing the Depths, and forming a key to the Sections illustrating the Results of Swedish Hydrographic Research
Explanatory Note.
The Tracks of the Ships "Alfhild" & "Af Klint" shown thus
Deep sounding Stations thus
Every Line which unites a series of Sounding Stations represents a Hydrographic Section thus 37 VIII 38 39
The Roman Numbers from I to XLI indicate the number of the Section. The large figures indicate the number of the Sounding Station. The Places at which samples of Surface Water were taken are indicated by a small cross thus,
and the small figures denote the depth in Metres.
DEPTHS IN METRES.
0 TO 50
50 TO 100
100 TO 200
200 TO 300
300 TO 400
400 TO 500
BELOW
164 Eng. Feet
328
656
984
1312
1640
NORWAY
SWEDEN
FINLAND
CHRISTIANIA
STOCKHOLM
COPENHAGEN
Gulf of Bothnia
BOTHNIAN SEA
Gulf of Finland
Gulf of Riga
Kattegat
SKAGER RACK
JUTLAND
SCHLESWIG-HOLSTEIN
Mecklenburg
Pomerania
East Prussia
Kurland
Estland
Ösel
Dago
Gotland
Öland
Bornholm
Rügen
Sjælland (Zealand)
Fyn (Funen)
Laaland
Langeland
Samsø
Læsø
Anholt
Blekinge
Helsingland
Vesterbotten
Angermanland
Aland
Lake Wener
Lake Wetter
Lake Mälar
Gothenburg
Norrkoping
Karlskrona
Malmo
Ystad
Lübeck
Colberg
Danzig
Memel
Libau
Gefle
Sundsvall
Umeå
Luleå
Uleaborg
Brahestad
Christinestad
Åbo
Hango
Stromstad
Arendal
Öster Risör
The Skaw
Fredrikshavn
Lyserort
Stensort
Rixhöft
Jershöft
Arcona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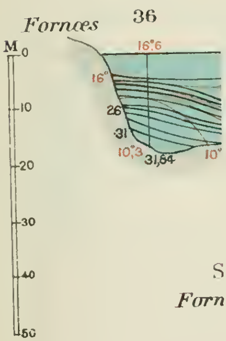
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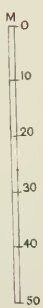
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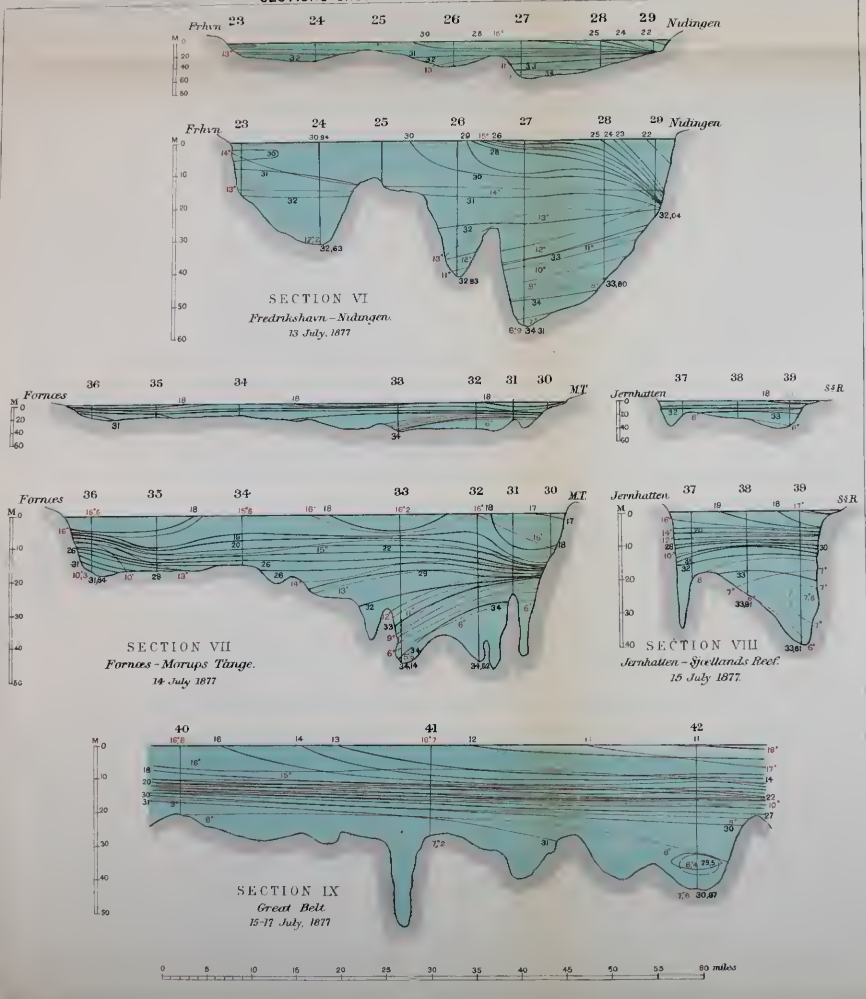
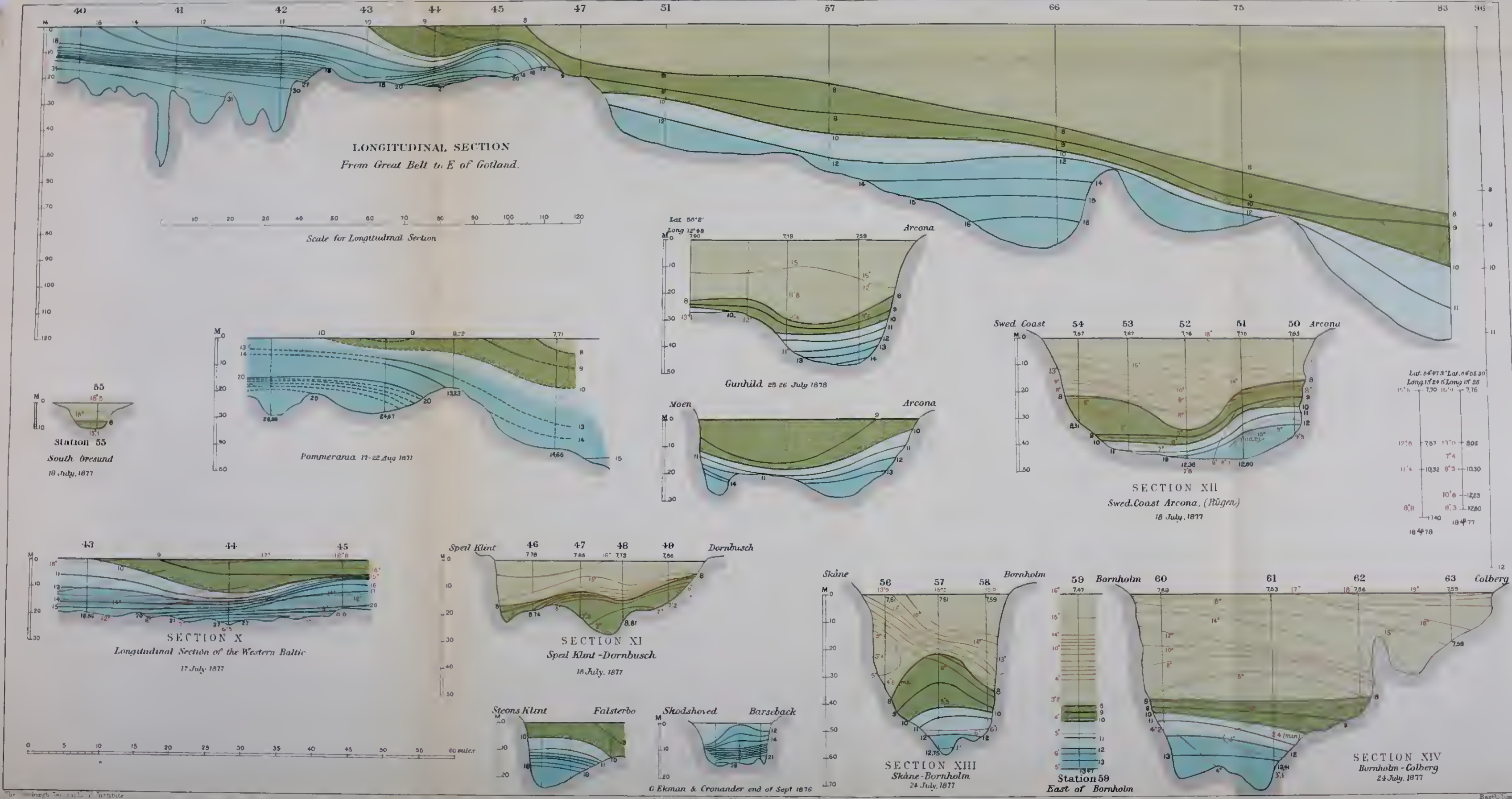
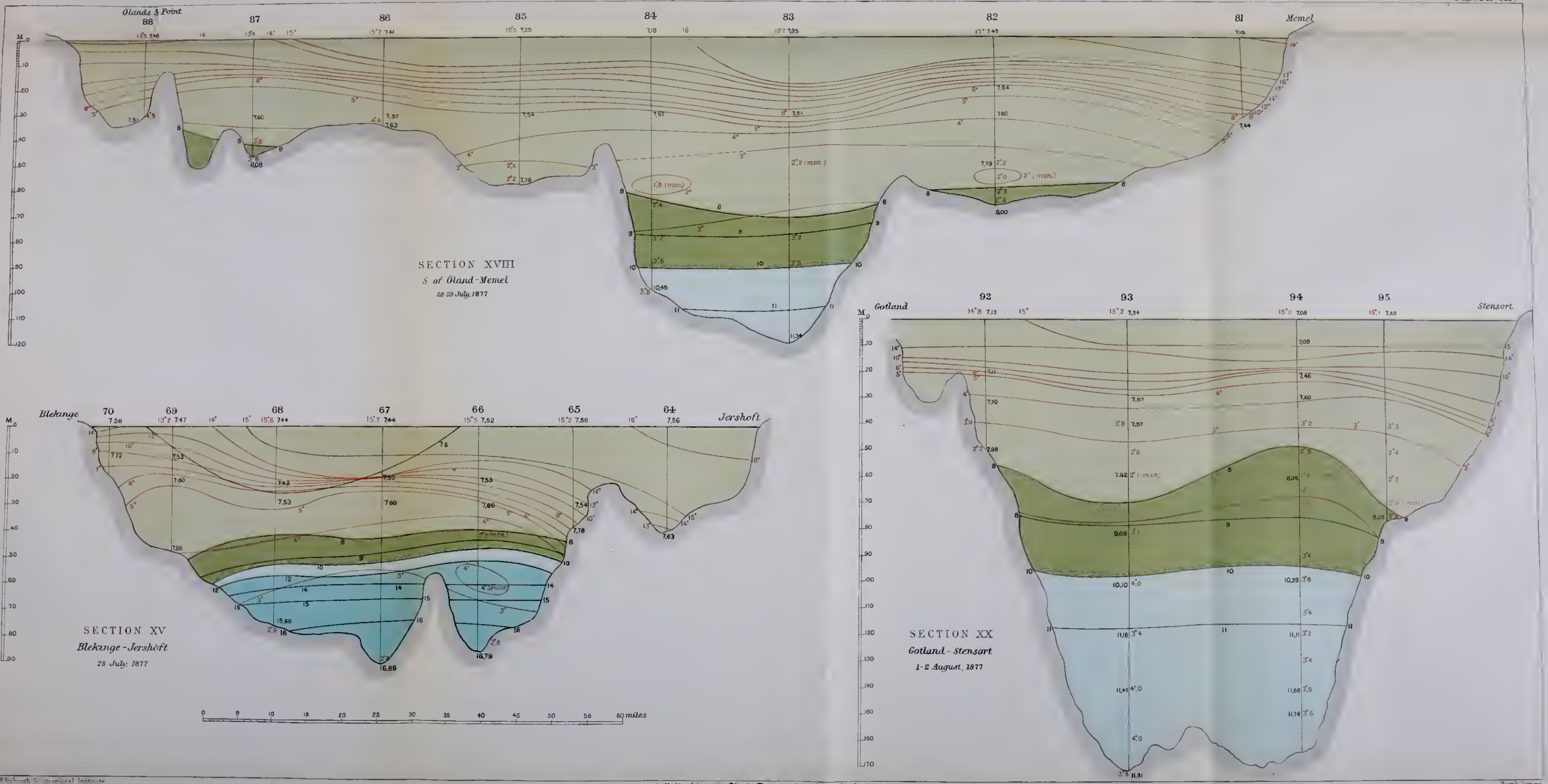


Salinity Lines in Black, Temperature Lines in Red.

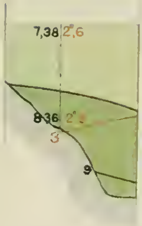

4
15°
12°
14
9
5



Salinity Lines in Black, Temperature Lines in Red.



Salinity Lines in Black, Temperature Lines in Red.



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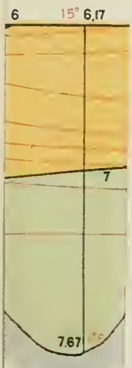
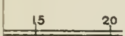
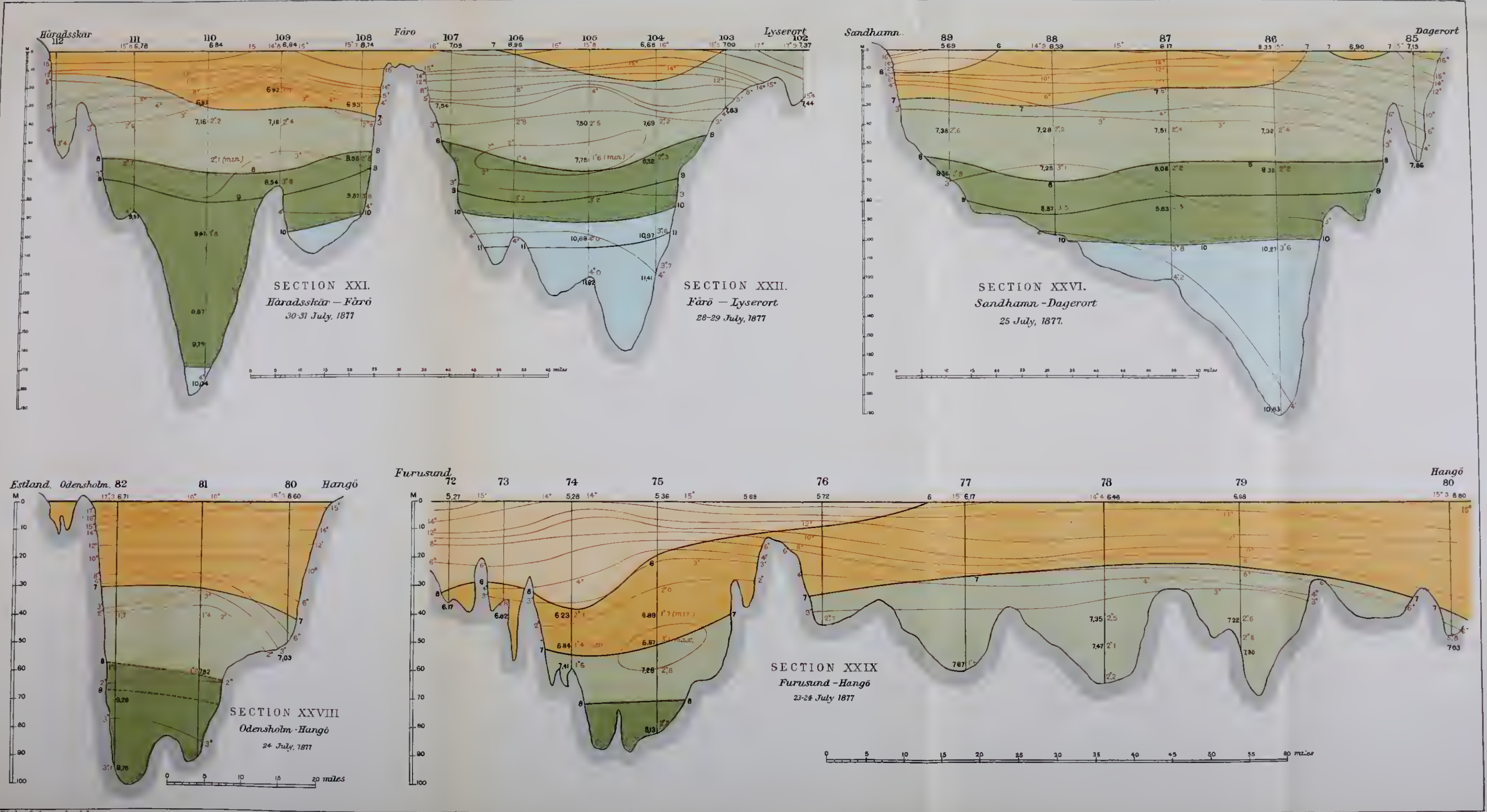
77





SECTIONS SHOWING TEMPERATURE AND SALINITY.

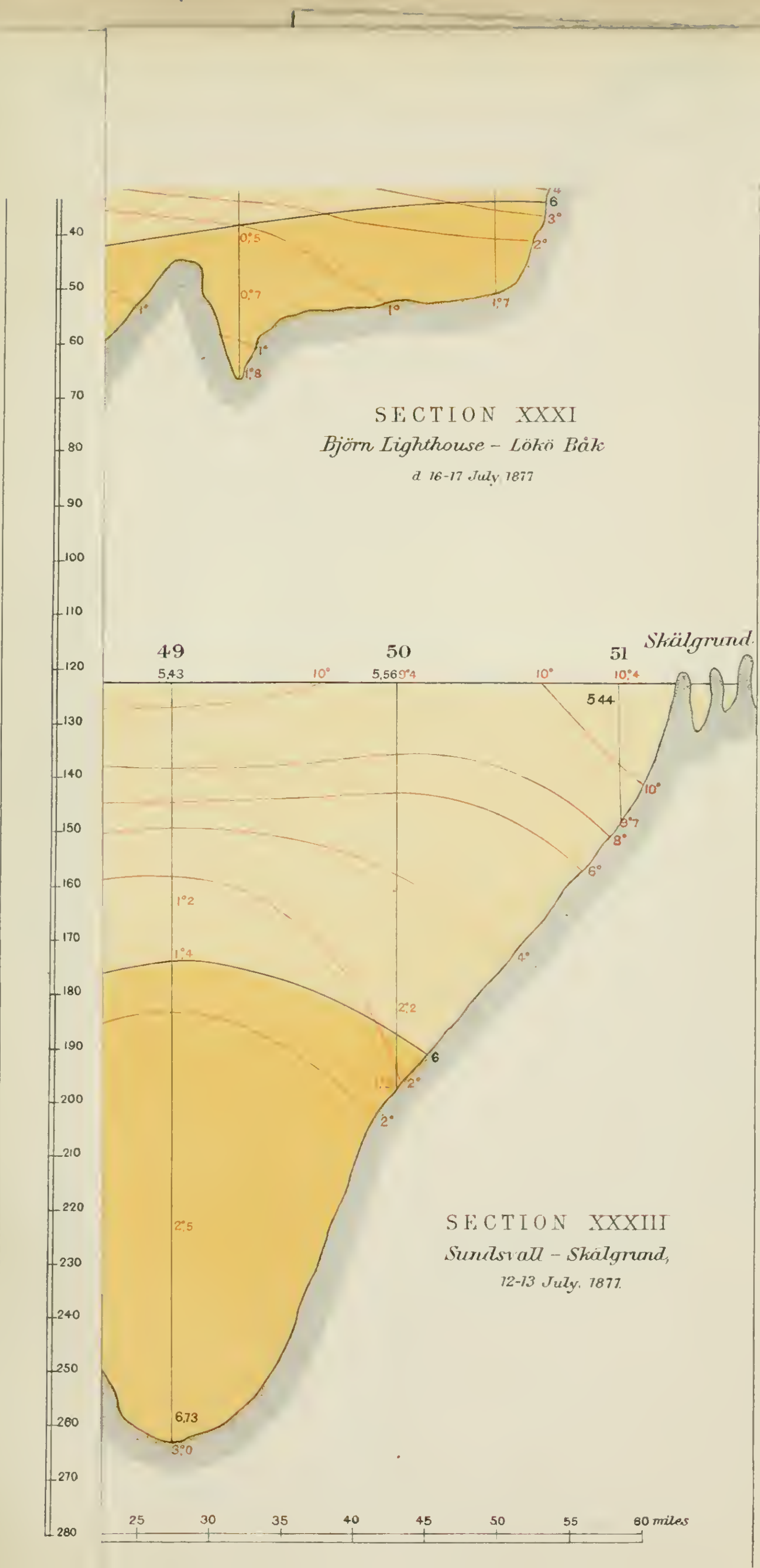
PLATE XV



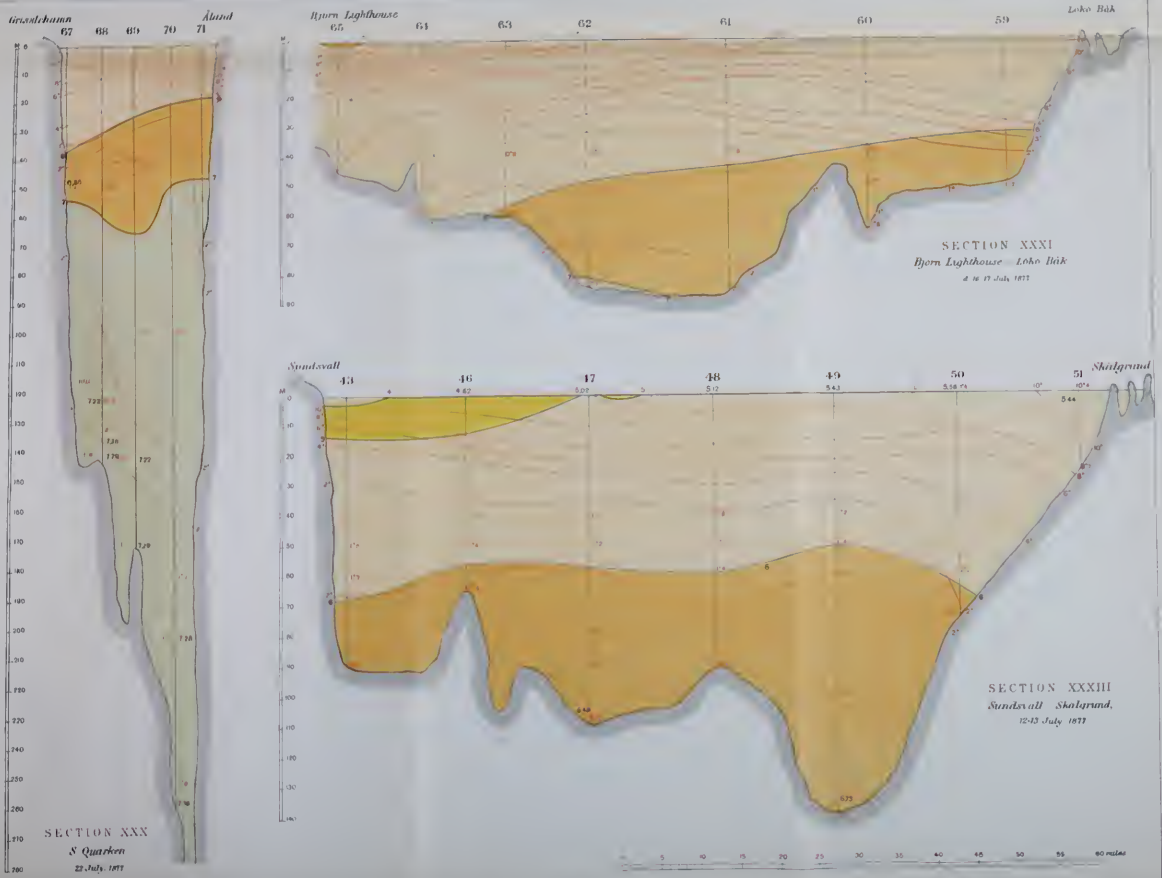
The Edinburgh Geographical Institute

Bartholomew

Salinity Lines in Black, Temperature Lines in Red.

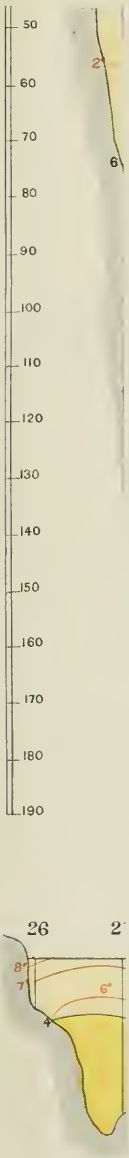

SECTION XXXI
Björn Lighthouse – Lökö Båk
d 16-17 July 1877
SECTION XXXIII
Sundsvall – Skälgrund,
12-13 July. 1877.
Skälgrund
49
5,43
50
5,56
51
5,44
6,73
60 miles

SECTIONS SHOWING TEMPERATURE AND SALINITY

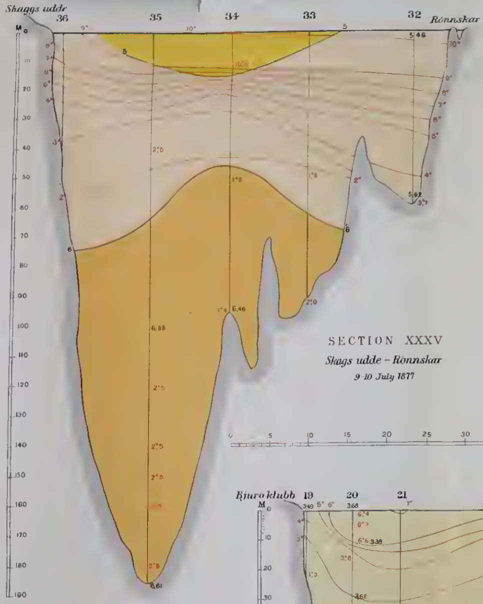


Salinity Lines in Black, Temperature Lines in Red

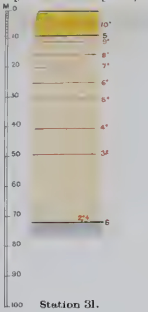
Edinburgh Geographical Institute
Bartholomew



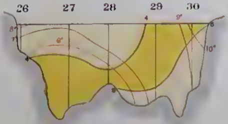
S E



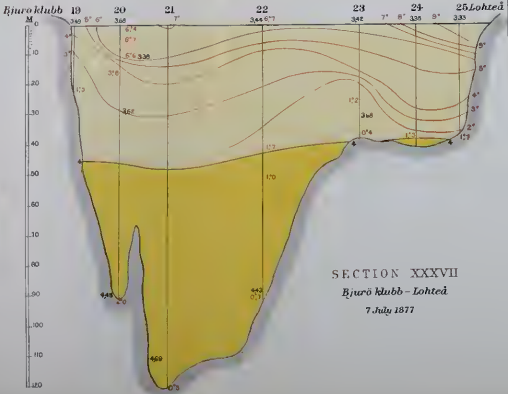
SECTION XXXV
Skags udde – Rönnskar
9-10 July 1877



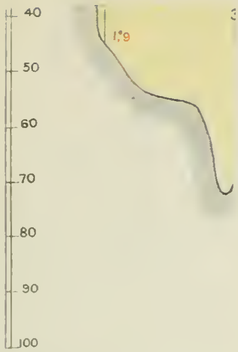
Station 31.
18⁸/₇ 77



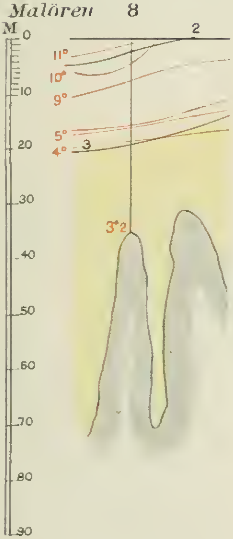
SECTION XXXVI
North Quarken
9 July 1877

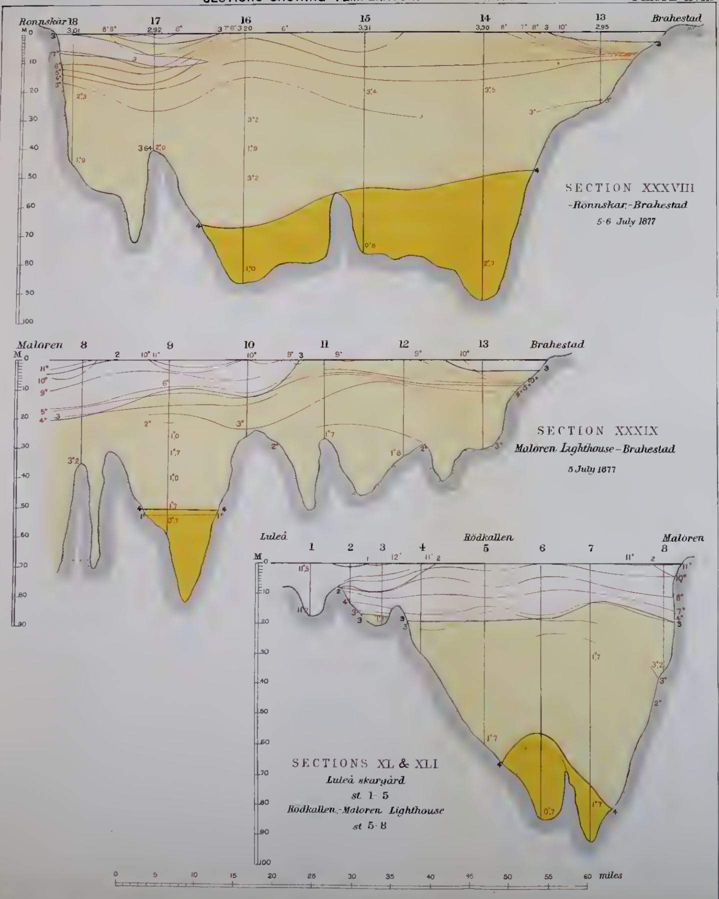


SECTION XXXVII
Bjurö klubb – Lohteå
7 July 1877



Malören 8





Salinity Lines in Black, Temperature Lines in Red which we considered necessary to give a complete purview of the conditions of the sea at different seasons. They are:

(*a*) A longitudinal section across the West Baltic from Alsen through the Fehmern belt and Cadettenrinne to the north of Rügen.
(*b*) A longitudinal section, from north to south, through the Great Belt.
(*c*) A section across the southern part of the Kattegat.
(*d*) A section across the Kattegat to the south of Læsö.
(*e*) A section across the Kattegat to the north of Trindelen.

Of the highest importance for the investigation of this part of the sea are the regular observations which are taken at the Danish lightships at the Drogde Channel, Anholt, Læsö Rende, Trindelen, and the Skaw. These lightships are, on account of their situation, hydrographic stations of the first rank, and ought to be provided with the best instruments and, if possible, with automatic or self-registering apparatus for the measurement of the velocity and direction of the current at various depths. Three places on the Swedish side of the Kattegat also would be well adapted for serial hydrographic observations, viz., the new lightship of Fladen, and the pilot-stations of Vinga and Pater-Noster.

3. *The Skagerack, the North Sea, and North Atlantic.*

Two lines of deep sounding across the Skagerack are marked upon the chart, viz.:

(*a*) Gothenburg—The Skaw—Christiansand.
(*b*) Lysekil—Öster Risör.

The southern plateau of the North Sea to the south of the Doggerbank is so shallow that the salinity and temperature have always been found identical in the bottom water and at the surface. Consequently, this part of the sea can be satisfactorily explored by surface observations taken on board steamers plying across it. The same remark applies, with certain exceptions, to a great part of the northern plateau of the North Sea. In all cases it is extremely important, not only for hydrographic but also for meteorological purposes, to ascertain the variations in temperature and salinity of the surface water of the entire North Sea in every month of the year. This can be done by regular surface observations along the following lines (marked by + + + on Chart IX.):

(*c*) Gothenburg—Havre.
(*d*) Gothenburg—Pentland Firth—Glasgow.
(*e*) Bergen—Rotterdam.
(*f*) Bergen—Shields.

Such observations will enable us to draw *synoptic hydrographic charts* of the North Sea and North Atlantic. It would, of course, be very important for meteorologists as well as for hydrographers to keep a record of the variations in the direction, volume, salinity, and temperature of the Atlantic drift-current and its counterpart, the Labrador ice-current, in different years and seasons of the year. The great work commenced by Petermann[1] ought to be continued.

Surface observations taken by steamers along the lines,

(*g*) Ireland—St. Lawrence,[2]
(*h*) Bremen—New York,

would give all the information desirable on this head.

On Chart IX. I have represented such a series of observations, taken, at my request, every day at 8 A.M. and 8 P.M. by Mr. Sohlman on his voyage from Gothenburg to Canada in the beginning of October 1892. The situation of the axes of maximum heat and maximum salinity of the Atlantic water, as well as the limits of the Atlantic drift-current and the Labrador current, may be discerned from the chart. At 35° long. W. was the limit between the water of 35 and $34^{\circ}/_{\circ\circ}$, which in the temperature series was marked by a fall of 2 or 3 degrees.

There are, however, parts of the North Sea which cannot be investigated simply by means of surface observations. On Chart IX., therefore, are marked :

(*i*) Three sections of deep soundings across the Norwegian Channel, and
(*k*) A number of deep sounding stations on the northern slope of the North Sea plateau, the Wyville Thomson Bank, and the Færö-Shetland Channel.

This project, which is naturally only a *preliminary programme for an international hydrographic survey*, is now under trial. In November last year, hydrographic expeditions from Scotland, Norway, Sweden, Denmark, Germany, collaborated in the North Sea and the Baltic. I hope that the experience gained from this scientific co-operation will lead to an international agreement about the division of labour, and satisfactorily settle the question of methods and measures to be adopted in the course of future hydrographic survey.

This hydrographic survey has now advanced so far that co-operation in biological researches with regard to the Plankton, etc. in different parts and different layers of the North Sea and Baltic has become necessary. By means of dredging at the surface with ordinary Plankton nets, or in the deeper layers with apparatus of similar construction to that I have described, it would be possible in no very long time to collect material for the representation on charts of the distribution of the living organic matter in the North Sea and North Atlantic at different seasons of every year, in the same manner as Ekman and I have proposed to represent the hydrographic conditions of the sea by means of synoptic charts.

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[1] See *Petermanns Mitteilungen*, 1870, vi. and vii. *Der Golfstrom.*

[2] Salinity and temperature observations taken on board the Danish steamers from Copenhagen to the Færös, Iceland, and Greenland, would also be of the highest importance. But it is indispensable that strict conformity with regard to the analytical method of ascertaining the salinity, etc., should be ensured beforehand by international agreement.

ERRATA.

Plate I.—Fig. 3 is inverted.

Plate II., Fig. 4.—The small uppermost layer immediately under the Roman cipher I. should have been coloured *light buff*, indicating water of 20 to 30°/₀₀ salinity.

Plate II., Fig. 6.—The thin uppermost layer should have been coloured *dark buff*, indicating water of 30 to 32°/₀₀ salinity.

Plate VII.—Under the small section B, for "8th Aug. 1890," read 26*th Aug.* 1890.
Under the small section C, for "26th Feb. 1893," read 26*th Feb.* 1891.
Under the small section F, for "14th Aug. 1893," read 14*th Aug.* 1892.

Page 358, 5 lines from bottom.—For "*in winter than in summer*," read *in summer than in winter*.

Page 530.—"Table F' should have been headed *Table G*, corresponding with section 5 B on Plate VII.

Page 535, second line from bottom.—For "1880 and 1881" read 1890 *and* 1891.

(*Conclusion.*)

BHUTAN AND THE HIMALAYAS EAST OF DARJEELING.[1]

LIEUT.-COLONEL H. H. GODWIN-AUSTEN read a paper with this title before the British Association at Oxford, giving an account of his experiences while accompanying the mission of the late Sir Ashley Eden to Punakha, in 1863-64. No European traveller has since visited Western Bhutan, and the members of the expedition were, of course, prohibited at the time from giving information, except that contained in their reports to the Government, so that little is generally known of the geographical results of the expedition. The best account of Bhutan and the adjacent country on the north, which has hitherto appeared, is the admirable, painstaking compilation by Mr. Clements Markham from the original letters and journals and Government papers, collected and published under the title, *Narrative of the Mission of George Bogle to Tibet, and of the Journey of Thomas Manning to Lhasa* (1876). In May 1774 Mr. Bogle journeyed into Bhutan from Kuch Behar through Baxa and Tassi Sudan, and on to Pharhi. Colonel Godwin-Austen referred also to the mission sent by Warren Hastings, in 1783, under the command of Captain Turner, and that of Captain R. Boileau Pemberton, accompanied by Dr. Griffith, in 1837. The mission of Sir Ashley Eden, to which Colonel Godwin-Austen was attached, followed Pemberton's route, entering Bhutan from the west.

From Dalingkot towards Chamurchi the mountains rise very suddenly from the plain to a height of 8000 or 10,000 feet. Dense forests stretch from their summits down to their bases, and for some distance into the plains, until the flatter, high-grass country is reached. Skirting the foot of the hills are plateaus of gravelly deposits, fringing the mountains to a breadth of five or six miles, and often terminating in a low scarp. These are cut through by the Nar-chu and Mo-chu, two small streams. The first large river is the De-chu, which drains the Jangtsa valley. We are here confronted by two remarkable physical features, and unique, for

[1] Abstract published by the kind permission of the author.

along the whole southern face of the Himalayas, from the Panjab to Eastern Assam, nothing similar can be found. The first is geographical, and is the existence of a mountain mass, 14,500 feet high, within twenty miles of the foot of the range. The second, a geological feature, is the absence of the usual Tertiary formation, commonly known as the Siwâlik, for some fifty miles from the Tsel nulla, which drains the Dalingkot valley, up to Baxa fort. Owing to the source of the river De-chu lying in such lofty snow-covered hills, there is a great development of gravel and conglomerate beds where the river leaves the hills.[1] These rise in steep scarps from the river, and can be traced up the valley to Jangtsa, where they are 800 to 1000 feet above the river, and as far down as Tondu, eight miles from the base of the hills, where the scarp is 150 feet above the Jhuldaka, as the river is there called. The extreme coarseness of the materials thus spread over the plain is remarkable; even at this point one boulder measured ten feet in length, pointing to very different conditions from those now obtaining, and such as might be due to the proximity of very high ground and a greater snowfall. After the capture of Dalingkot Fort and the Chamurchi stockade, Colonel Godwin-Austen visited Jangtsa with a small guard of Sikh sepoys, and thence ascended through magnificent forests to the Pango La, 9300 feet high, where he passed a night. At that elevation the forest gives place to dense thickets of a slender bamboo, with thorns at the joints. The view up the valley was very grand, with the bare grey frowning precipices near Giepmochi, streaked with snow and towering above the primeval forest below. The elephant roams through these forests up to about 8000 feet, and is found up the valley beyond Jangtsa.

From Sip-chu the country rises steadily, for 8000 feet, up to the Tule La, 10,000 feet. The forest is here more open, enclosing grassy glades. At the pass the road fairly enters the mountains, and descends to the Ammo-chu, which rises in the main range near Pharhi and passes Chumbi. At and around Tsangbe, the scenery in this deep valley is most exquisite, exhibiting a grand mixture of rocky precipice and tropical forest, while a fine body of water boils among huge water-worn masses of gneiss; to the north and east the valley is bounded by high mountains, with snowy peaks on the north-east. The spurs of the mountains descend very abruptly to the river from shoulders 2500 feet above it. At this elevation the ridges are in general broad and level, and here are situated the villages, surrounded by good patches of ground under cultivation. Snow falls at a height of 6000 feet, and, on February 6th, the effects of a recent fall were visible in broken and prostrate underwood. The Ammo-chu is the Boro Torsha of the plains, and leaves the mountains at Balla. Though it is so much larger in volume, and has so long a course in the heart of the mountains, it has not caused so great development of the gravel and boulder-beds, so conspicuous a feature in the De-chu gorge. The forest extends as far as Mirim, and consists of oak and magnolia, with a few chestnut trees, on the lower slopes, while at

[1] See *Notes on the Geological Features of the Country near the foot of the hills in Western Bhutan.* By Captain Godwin-Austen.—*Jour. Asiat. Soc. of Bengal*, 1868.

9000 feet yews are seen, and above them pines. About two miles beyond Mirim rhododendron becomes more common. At 11,800 feet the pine forest was much thinner, the trees were much broken, and juniper grew in abundance where the camp was formed, near the Tegong La. The pass and ridge, running north-west, are quite bare of trees, but on the descent to the Har valley rhododendron and pine forest is soon entered again. This valley is very high, its mean altitude being 9000 feet. Here the whole character of the scenery changes; the mountains are much higher, and clothed with dark forests of pine, gradually thinning out towards the summits, which are bare and rocky. The mountains to the north are bare down to 3000 or 4000 feet from the top. The Har river is of considerable size, and flows along a broad channel with a gentle fall, so that it is fordable in many places. Good bridges, substantially built of long fir poles, span the stream at several points. Near Hartumphiong the hills slope gradually to the wide, flat valley, which is $\frac{1}{4}$ mile to 600 yards across, and is, most of it, under cultivation—barley, wheat, and turnips of excellent quality being produced. This valley feeds more sheep, probably, than any other part of Western Bhutan, on the extensive pastures above the forest-line; herds of yak were also seen. Here we are really within the limits of a purely Tibetan climate, with its peculiar fauna and flora, and it is interesting to note that this region approaches to within forty miles of the plains of India. Another twenty miles into the hills, and the *khiang*, or wild ass, may be seen, and the wild sheep of Tibet (*Ovis vignei*). There is, in fact, no cause, climatic or otherwise, to prevent the yak, wild sheep, and marmot, from wandering during the winter months along the high open ridges, above the forests tenanted by the elephant, down to within thirty miles of the plains, which are only a few feet above sea-level, and are the home of the rhinoceros, buffalo, and crocodile. It is thus quite possible that the bones of such a mixed fauna may find a resting-place together in the plains in deposits of the same age, and puzzle future geologists.

Between the Har and Paro valleys, a high ridge is crossed by the Chi La, which is 12,490 feet high (considerably higher than the Tegong La), with peaks rising to another 1000 feet or so. The thin scattered pine forest begins at 300 feet above the valley, and, leaving the pass free, becomes denser on the north-east side, where it descends to the edge of the rice-fields. The Paro valley is lower than the Har, its altitude being 7700 feet. When the expedition crossed the pass, on February 19th, it was covered with deep snow, so that, though a start was made from the Har at 7 A.M., it was not until 11.30 P.M. that the first of the party reached the village on the Paro side. From the summit of the Chi La a magnificent view of the surrounding country is obtained; the range on the north rising in fine snow-clad peaks, 16,000 feet high at least, while farther north-west, one or two much over 17,000 are seen. On the farther side there is a still finer view of the Paro valley, bounded on the north by precipitous mountains, culminating in the well-known peak of Chumularhi, while to the south the gorge of the Par-chu is lost among round-topped ridges running towards the plains; nearly due east the view is bounded by the snowy ridge of the Tagu La, with an elevation of about 14,000 feet. Monasteries, conspicuous from their solid white-washed walls, are perched, as in Ladak and all Buddhist countries, on high commanding points—that of Dangala, on a terminal spur between the Par-chu and the river descending from Tashichozong, being the most prominent. In the direction of Paro the country assumes another aspect, the hills being clothed with grass, often brown and dry, instead of trees.

The mountains around Paro fall, as a general rule, by easy gradations to the valley, the breadth of which is fully a quarter of a mile wide, and, where lateral valleys join it, as much as half a mile. Towards Domgiay Zong, the Dukka Jong of Turner, and the Duko Jong of Bogle, it increases in width, and then precipitous mountains hem it in again. The whole of the level ground is well cultivated, and is principally under rice, which is almost too easily irrigated by the river. The boulder-strewn channel of the Par-chu has, through silting up, spread on either side, wherefore very extensive embankments have been constructed along the right bank to a considerable distance above the confluence of the Tho-chu; they are made of oblong frames of wood, filled with large stones. On the return of the expedition, 300 men at least were repairing these embankments. Wheat and barley are grown on the high-terraced slopes, and the fields are kept extremely neat and clean. Bullocks draw the ploughs, and the greater part of the field-work is performed by the women. During the seventeen days the mission stayed at Paro, the weather was uniformly clear and bright; the snowy peaks to the north were seldom enveloped in cloud, while those to the south were often veiled by heavy masses of vapour, which, however, never advanced far along the Chi La ridge. Paro is evidently beyond the range of clouds rising from the plains, and the vegetation of the country shows that the climate is dry. The nights and mornings were calm and still, but between nine and ten A.M. a breeze began to blow up the valley, increasing in strength up to one or two o'clock, when it was often so violent and cold as to be most disagreeable. This wind, which also blows in the Har valley, is to be attributed to the warmer rarified air rising from this country, so sunny and bare in comparison with the forest-clad hills to the south, and moving northwards. The arid plains, only 25 miles north of Paro, also tend to give this valley a climate very Tibetan in character.

The fort of Paro is a most imposing and well-built stronghold, standing on a rock rising from the left bank of the Par-chu. It is comparatively new, or previous travellers would certainly have noticed its fine proportions and handsome bridge.

The next great main valley descending from the Tibetan highlands is the Wang-chu, and it is entered after crossing the Bie La (11,166 feet). The country thence to Punakha presents very much the same character. The slopes of the Tagu La are covered with pine forests, but in the valley of the Wang-chu the forests have been cut down to a great extent, and are left only in the lower ravines and in narrow strips tailing off up the spurs. This is the most populous and thriving part of the country; the villages are large and the houses well built. The monasteries and *mengdongs,* of which Gensaka and Talokpa are the most striking, are nearly as numerous. Tashichozong itself is not visible from the main road, but its position could be fixed from a bearing of a few houses near it.

The Dokim La, 10,000 feet high, leads from the Wang-chu valley into that of the Ma-chu, in which Punakha is situated. The view is very fine up the two streams, the Ma-chu and Pha-chu, and also up the tributary on the Tongsa side. The whole country is much barer than on the west, and the grass, withered at the season the expedition passed through, gave the country a very bleak appearance. The elevation of the valley is much less than that of the preceding, being only 4,500 feet, and therefore it has been chosen for the winter residence of the rulers of the country, who move up to Tashichozong as summer approaches. Many Buddhist monks make pilgrimages to Punakha from Tibet, and even from as far as Ladak.

As may be seen from the map, Bhutan may be divided into two parts, the Western, of which we now know a good deal, and the Eastern, of which we know scarcely anything. In 1864, before the field force entered the Dwars, Colonel Godwin-Austen fixed trigonometrically some peaks in the Eastern Bhutan hills from two stations of the Assam series, Boirab and Jogigopa, six miles apart, and several other peaks were laid down on a plane-table from other stations near the Brahmaputra. With these, and peaks which may have been fixed since, there are enough to enable a surveyor using the plane-table to base a very good map of the country on, even if he could only follow Captain Pemberton's route and have time and opportunity to ascend a few of the higher peaks. Should another mission be sent into Bhutan, it is to be hoped that it will endeavour to enter the country from the side of Diwangiri.

In conclusion, Colonel Godwin-Austen made a few remarks on the extension of our knowledge of countries beyond the Himalayan range. Thanks to the able explorations of Bower, Younghusband, and Rockhill, we have of late years added to our topographical knowledge, but on several occasions much more might have been done, and the future exploration of the country beyond our frontier is of the greatest importance. On the northern frontier of our Indian Empire, along a distance of over 1000 miles, live a people speaking Tibetan, and yet there is, probably, not a single officer in our service who can speak and read the language. If some Moravian missionaries in Lahul and elsewhere have made themselves proficient in the language, why should not some of our officers do the same, and be capable of holding direct communication with people we are brought in contact with, politically or otherwise? By this means we should be able to establish much more intimate and friendly relations with the governors of these border States. The failure of the last mission to Bhutan was in a great measure due to want of knowledge of Tibetan among the members of the mission, which placed them completely in the hands of the interpreter. Ladak would be an excellent place to study the language in. Handsome rewards should be given for proficiency.

Mr. Manning, who travelled in 1811, set an excellent example that it would be well to follow now. He received little assistance from the East India Company, but his knowledge of Chinese, acquired three years before at the English factory in Canton, carried him through all his difficulties; without it he would never have reached Lhasa and returned to India.

The lecturer also described the reception of the mission in Paro and Punakha.

THE ISLAND OF SAGHALIN.[1]

EUROPEANS first visited Saghalin almost simultaneously by land and sea. In 1643 the Dutch navigator Gerriss de Vries visited the southern part of the Sea of Okhotsk, and touched at the great bays of Saghalin, the Aniva and Tierpienia. In the following year Russian subjects—Cossacks and fur-hunters—made their appearance at the mouth of the Amur, and seem to have crossed over to the island, for Russian reports make mention of a large island or peninsula opposite the mouth of the great Siberian river, covered with dark forests and buried under ice and snow. The first reliable geographical information about Saghalin was obtained by La Pérouse, who in 1787 sailed up the coast of Korea to the mouth of the Amur, and, turning southwards, passed through the straits between Saghalin and Yezo which bear his name, and thus proved Saghalin to be an island.

At the time of La Pérouse's journey the Japanese maintained a brisk commerce with the fishing and hunting tribes of Saghalin, and had permanent settlements at Aniva Bay. Subsequently to 1807 Russian expeditions frequently landed on the island, but it was only in 1853 that a military post was founded at Dui for the protection of traders and seafarers who visited Saghalin to hunt sable and catch seals. Soon afterwards the extraordinary wealth of the coal deposits was discovered, and the island became a point of attraction to Russia. In 1867 an arrangement was made with Japan regulating their joint possession of Saghalin; but as the mining industry developed in Russian hands, and convicts were sent out in ever-increasing numbers, absolute control of the whole island became desirable, and in 1875 Japan resigned all their claims, receiving in exchange sovereignty over the whole of the Kurile Islands. The present administration was established in 1882; Saghalin was incorporated into the coast province of which Vladivostok is the chief town, this province being in turn under the control of the Governor-General of the Amur territory, who resides at Khabarovka.

The area of Saghalin, according to the latest measurements, is 30,790 square miles, of which 1350 have been topographically surveyed. From north to south the island extends nearly on the meridian of 143° E. long., from Cape Elizabeth to Cape Krilon, for a distance of 584 miles, or over about $8\frac{1}{2}$ degrees of latitude. Its breadth is small, being only 94 miles at the broadest part, under lat. 49° 30′, while under 48° it contracts to 18 miles.

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[1] From an article by Fr. Immanuel in *Petermanns Mitt.*, Bd. 40, No. 3.

Saghalin is essentially a mountain land, a series of ridges running north and south forming its backbone. While the northern coast has a simple outline without any important bays, in the southern half the two peninsulas of Cape Tierpienia (Patience) and Cape Aniva form the bays of the same names. The almost unknown northern portion is occupied by a mountain mass rising to an average height of 3300 feet, with bare, fissured rocks, which on the west, where the most important chain is to be found, sinks abruptly to the cliffs of the coast. In the middle of the island a meridional mountain system, consisting of two chains, falls rapidly to the west coast, continuing the line of elevation of Northern Saghalin. On the east, separated by the basins of the rivers Tym and Poronai, lies a mountainous region differentiated into several chains, of which the highest summit, the Peak Tiara, about 5080 feet high, is the most important elevation of the island. The watershed between the Tym and Poronai is nearly 2000 feet above sea-level. In the northern part Glehn counted three parallel ridges, and five in the southern portion, with summits rising to 4600 and 4900 feet above the sea. Only between the promontories of Poghibi and Golovatsheff, nearly opposite the mouth of the Amur, are there to be found low shores and sandbanks on the west coast, where also there are no harbours but the tolerable roadsteads of Alexandrofsk and Dui. The best anchorage in any part of the island is the bay of Nyisk, the lagoon-like mouth of the Tym; the bays of Tierpienia and Aniva are, to some extent, choked with sand, though the harbour of Korsakofsk in Aniva Bay is of some importance owing to its sheltered position and southern aspect.

It may be argued whether Saghalin belongs to the Japanese archipelago, or should be included in the mountain system of Eastern Siberia. It is separated from Yezo by the straits of La Pérouse, 20 miles broad; while the Gulf of Tartary, between the capes Lazareff on the Siberian shore and Poghibi in Saghalin, is only five miles broad and very shallow. At first sight Saghalin seems to form a north-westerly continuation of the curve of the Japanese islands, but the strike of its mountains and their geological composition indicate an intimate connection with the mainland. The chains of the island, like those of the East Siberian plateau, converge towards the south-western corner of the Sea of Okhotsk, so that Saghalin may reasonably be considered the outermost rampart of the Siberian mountain system. The basalts and the numerous active volcanoes, which are characteristic of the Japanese islands, the Kuriles and Kamchatka, do not occur here, but in their place Mesozoic and Tertiary formations are found resting on a base-rock of crystalline schists, which are also common to the East Siberian coast. The soil has proved not unfavourable for agriculture. The loosely compacted, crumbling, clayey slates are exposed, where not protected by forests, to the weathering forces of great changes of temperature, a sharp wind, and abundant precipitation, and the products of denudation, carried down by the melted snow and the autumn rains, are deposited on the stony or sandy bottoms of the valleys. Thus, in the course of time, a fertile layer has accumulated on the low-lying lands, which under proper management, offers a fair prospect of successful cultivation, though Saghalin, with its short summer and severe winter, lies without the zone specially adapted for the growth of cereals. The alluvial deposits of the central, and especially the southern, part of the island, with its milder climate, present no less favourable conditions for corn cultivation than, say, Western Russia. Such deposits occur in the valley of the Tym down to Slavo, in that of the Poronai down to Valise, and in the valleys of the Naibuchi and Susuia in the extreme south. Isolated patches of good soil are also found on the west coast about the middle of the island. The *tundras*, on the other hand, which lie in the lower valley of the Tym, along the lower Poronai, and on the north coast of Tierpienia Bay, are quite sterile.

Saghalin is undoubtedly rich in mineral wealth. The Saghalin Company extracted, in 1890, 2,400,000 tons of coal, of heating power little inferior to that of English coal, and furnished the Amur steamers and the harbours of Vladivostok and Yokohama with a large proportion of their supply. Lately coal has been discovered in other places, and the mining industry is capable of great development, if the necessary capital is forthcoming. Iron also exists near Dui, mineral springs occur near Mauka on the west coast, and extensive petroleum-fields have been found at the bay of Nyisk.

Only the largest streams, the Tym and Poronai, are navigable, on each of which boats can ply for a distance of 110 miles. All the rivers are characterised by an abundance of water, a plentiful fish fauna, shifting beds, and a tendency to floods.

Extending over $8\frac{1}{2}$ degrees of latitude, and situated between the largest continent on the one side and the largest ocean on the other, Saghalin presents interesting contrasts of climate, vegetation, and conditions of existence. Exposed to the influence of the summer drift-ice and to the piercing Polar wind, the island, though its middle portion lies on the 50th parallel, or at the same latitude as the most fruitful districts of Germany, suffers from a climate not inferior in severity to that of Lapland and the coasts of the White Sea, and the limit of corn here reaches its most southern point. At the same time, the climate of the Polar regions here comes into contact with that of the more fortunate Japanese archipelago, and the east coast feels to some degree the benign influence of the Kuro-shiwo, which, turning to the east at the latitude of Yezo, sends a small branch northwards. The west coast, on the other hand, is swept by the northern current descending from the Sea of Okhotsk. Drift-ice descends on the east coast as far as the mouth of the Naibuchi and on the west coast to the vicinity of Dui.

Meteorological observations have been made since 1884 at Alexandrofsk and Malo-Tymofsk, and a third station is to be established at Korsakofsk, which will furnish interesting material, as the southern part of the island exhibits certain climatic peculiarities. The climate of Saghalin is raw, dreary, windy, and variable. Spring, summer, and autumn last for 61 days each, and winter for 182 days, the mean temperature of this season being below freezing point, while in summer it is above 59° F. The spring, when the snow melts in the valleys, when ice is carried down the rivers and the ice breaks up on the coast, begins in the middle of April, though even in May the thermometer often falls to 23°. The short summer has an average heat of 80° in the centre and of 91° in the southern part of Saghalin. The heat is, then, considerable, and it melts the snow on the highest summits, none of which rises into the region of perpetual snow. Autumn, from the middle of August to the middle of October, is the rainy season, when destructive floods regularly take place. By the end of October the rivers and coast are beset by ice, and the whole island is covered with snow three feet deep, which remains until the following April. The mean winter temperature is 2° F., and every year the thermometer falls occasionally as low as $-31°$ F.

In 1890 strong winds were recorded on 322 days at Alexandrofsk, and on 262 days at Malo-Tymofsk, which is more sheltered by hills. During the season when the corn was ripening, from May 20th to August 20th, only 18 days were calm. On 44 days a warm wind blew from the south-west, and on 30 a cold wind from the north-east, and yet the year was considered favourable for corn. Barley, the most hardy cereal, is supposed to require a total heat of 2880 to 3420° F.—that is, the sum of the daily means during its growth and ripening should be within these limits. In Saghalin, with 2835°, a heavy crop can only be expected in favourable years. Precipitation occurs on 52 per cent. of the days, and the ratio of rainy days to those on which snow falls is 42 to 58. The distribution of the rainfall is unfavourable, for a large proportion falls in August and September when the corn should be ripening, while the eight or nine clear and sunny days come in May and the young seed is scorched.

The indigenous fauna of Saghalin comprises only one domestic animal, the dog, which, as in Polar lands, is used to draw sledges across the snow-fields. Cattle and horses have been introduced by the Russians. The cattle are small and big-boned, and yield little milk, but are hardy and suited to the soil and climate. The breed shows, however, signs of degenerating. Horses of the large West Siberian breed prove serviceable, but the small Trans-Baikal animal cannot endure the severe climate. A few reindeer are kept by the natives at the northern extremity of the island. The Siberian stag, the roe-deer, the bear, the lynx, and the wolf inhabit the forests; the elk is found in the north and middle of the island, and the musk-ox in the south. Far fewer sable are caught than formerly, but they are said to be still plentiful in the pathless northern forests. The seal also is much scarcer than it used to be. Salmon and herring are caught in quantities more than sufficient for the local market, and eighty tons of dried fish were exported in 1890 to Japan.

The flora is remarkably rich and varied. It combines the characteristic forms of north-eastern Siberia and of the milder climate of Japan. *Tundras,* marshes, and moss-covered steppes, like those of Kamchatka and the north-east coast of the Sea of Okhotsk, stretch up to the foot of impenetrable forests, such as occur in the basin of the Amur. The mountain slopes are clothed with conifers, while the rocky ridges are decked with an alpine flora and dwarf trees of great beauty.

Ninety-two per cent. of the surface of Saghalin is occupied by forest. The low-lying coast-lands and the *tundras* in the valleys adjoin the lower forest zone, composed in the south of elm, white birch, and maple, with which are mingled, in the north, larches and firs. At the edge of the swamps and on the dry spots of the *tundras* grows a more varied flora—wild vine, roses, cornel-cherries, and hazel-nuts—and poplars, ashes, willows, and elms thrive on the flooded tracts. The second forest zone is that of the conifers, which near the coast are found up to an elevation of 1600 feet, and as high as 2300 feet in the interior, where they are more sheltered from storms. Above these again grow full-foliaged trees, chiefly the short-stemmed Siberian birch. On the wild west coast and in the extreme north, the higher slopes of the mountains, where the bare rock does not appear, are covered with almost impassable bush of the *Arundinaria kurilensis*; while in the south bamboo as high as a man covers the higher mountain slopes.

The settled population of Saghalin, on December 31st, 1891, numbered 19,644 souls, of whom 16,416 were Russians and 3228 natives. Besides these, a number of Chinese, Koreans, and Japanese are employed in the mines of Dui and at the ports, or visit the island as traders and fishermen. The natives belong to four different tribes. The Gilyaks, with the few Orochons and Tunguses, are fragments of the North Siberian race, which should probably be included in the Mongolian family. They have degenerated in the trying climate of Saghalin, and are approaching extinction. In winter they dwell in small hamlets along the coast and river banks, building huts of wood or reeds, and in summer wander about, hunting and fishing. Much uncertainty still prevails regarding the affinities of the mysterious Aino. In occupation and low state of civilisation they resemble the Gilyaks, but their dark skin, long skulls, and singular hairiness distinguish them sharply from the Mongolian race. They are supposed to be the original inhabitants of Japan, and now inhabit Yezo, and in smaller numbers Saghalin and the Kurile Islands. They are bold mariners, venturing far out into the ocean in pursuit of seals and fish, and carry on a trade by barter in fish and skins. They occupy fixed dwellings, and differ from the northern races in their religion, which is not shamanism but the worship of a number of fish-gods. The Russian populace is chiefly composed of convicts, 10,687 in number, with soldiers and officials, besides which there are 3700 voluntary immigrants. The convicts are divided into three classes, viz., those who are occupied in mines, wood-cutting, draining, etc., under strict supervision; settlers placed in a certain district to bring it under cultivation, under the control of officials; and, thirdly, those who, provided by the State with cattle, implements, seed, etc., are allowed to cultivate lands allotted to them for their own profit, though they are not permitted to leave the tracts assigned to them.

The increase of the population is due almost solely to the importation of convicts. The natural increase is small; in 1890 it amounted only to 16, the number of births being 308, and of the deaths 292. Malaria and scurvy are the most dreaded diseases. A great hindrance to the development of colonisation is the inferiority in numbers of the female sex; in 1890, out of the convicts imported, 9388 were men and only 1299 women.

Since 1882 Saghalin has been divided into three districts—Alexandrofsk in the north-west, Tymofsk in the north-east, and Korsakofsk in the south. The administrative centre is Alexandrofsk, but Dui, the centre of the coal-mining district, is the most important town, and has the most frequented port in the island.

The land under cultivation, yielding corn, vegetables, and potatoes, had in 1890 an area of 14,080 acres, or less than 2 per cent. of the surveyed land. The most promising districts for agriculture are the valleys of the Naibuchi and the Susuia, which at present are quite uninhabited. The largest extent of cultivated land lies in the interior, in the upper valleys of the Poronai and Tym. Vegetables—cabbages and cucumbers—are raised in sufficient quantities to supply the wants of the inhabitants, while hay is extensively exported to the mainland and Japan. But the cereals, even in the good year of 1890, fell far short of the demand, and large supplies of rye, wheat, rice, and salt meat were imported for the use of the Russian population.

The clearing of the soil is attended with great difficulties, for in the lower forest region the ground is interlaced with a network of roots a hundred years old, and in the early summer weeds spring up with great luxuriance to the height of a man, choking the young seed. The settler, also, does not possess the necessary implements for properly preparing the ground, the pickaxe and the hoe being his only tools. In the low lands the alluvial deposit is of varying depth, and often very thin, so that the soil is soon exhausted, unless it be well manured; and as this is impossible in the languishing state of the cattle-grazing industry, agriculture in Saghalin is at a very low ebb, sufficing only to provide the barest necessaries of existence. Even after the good harvest of 1890 the Government was obliged to provide 90 per cent. of the seed corn for the following year. The administration of Saghalin has recognised the fact that the most effective way of preparing land for corn is to plant on it first some other crop; and potatoes, which thrive well on the island, have been found to answer the purpose. Little improvement, however, can be expected while the land is tilled by convicts, who look forward to removal after a few years to a more genial soil, or to their homes, and therefore have no interest in the future productiveness of the lands they occupy.

The future of the island depends principally on its undoubted wealth of coal, which, under proper management and with adequate capital, may play an important part in the industrial development of Eastern Siberia. Whether Saghalin will ever be raised from a convict station to an agricultural country peopled by free colonists is doubtful, situated as it is to the north of the proper limits of corn-growing. Nevertheless, the climatic conditions of its southern portion are such as to give some hope of successful colonisation, if the administration will establish there free settlers in the place of convicts, released criminals, and a constantly changing population.

MR. ANDERSON'S ARTICLE ON THE DETERMINATION OF SEA-WATER DENSITIES.

In my paper, published in last month's number of the *Magazine,* I unfortunately omitted to make special reference to the work of Mr. H. N. Dickson, and used without acknowledgment some data due to him, and included in his paper in Part III. of the *Report of the Fishery Board for Scotland* for the current year, which had not at that time been issued. This is a mistake I much regret, and which, I need hardly say, was unintentional. The table on page 581, which originally, in my first manuscript, was in the form of four separate tables, had a reference to Mr. Dickson and the Fishery Board ; but their subsequent re-arrangement into one brought about the unfortunate omission of the reference attached to them.

On page 577, the determinations with the hydrometers Nos. 18 and 19 belonging to the Fishery Board were, as stated in my paper, calculated by means of the data given me along with the instruments by Mr. Dickson. These data were originally computed by him from observations he made on board the *Jackal,* under the same conditions as existed during all his other work, and were afterwards verified by myself. On page 581, the first column of differences is derived from the work in the North Sea of Professor Gibson and Dr. Mill, published in the *Fishery Board Report* of 1887-88. The other columns were obtained from Mr. Dickson's observations on the *Jackal,* which were made when the vessel was either in harbour or in dock, and not, as I had supposed, in the open sea like the *Challenger* observations. The *Jackal* results given are in each case averages of at least four readings with the two hydrometers, and are, therefore, only valuable in estimating a constant error, and not any uncertainty of the instrument.

Mr. Dickson corrects my statement that he proposed to make an addition of $+0{\cdot}12$ to all hydrometer results. He stated in the paper, referred to in a footnote, that "my present purpose" was "merely to justify the application of a correction $= +0{\cdot}12$ to the hydrometer values concerned." I must have been misled by his reference to the *Challenger* hydrometer, and his supposition that "on these various grounds it seems fairly reasonable to conclude that, apart from observational errors, there is a constant difference between the results of these two methods of determination."

I wish to take the opportunity to mention the kind assistance given by Mr. A. Ritchie Scott, B.Sc., in some of the hydrometer work.

W. S. Anderson.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

The Annual Business Meeting

was held in the Society's Hall on Friday, November 9th, at 4 P.M. The Chair was taken by Mr. Coutts Trotter.

The following Resolutions were adopted :—

1. On the motion of the Hon. John Abercromby, seconded by Dr. Geo. Smith, "That His Grace the Duke of Argyll, K.G., K.T., be thanked for his services as President during the past five years, and that the Most Hon. the Marquess of Lothian, K.T., be elected President for the current Session."
2. On the motion of Dr. Burgess, seconded by Mr. J. W. M'Crindle, "That the Honorary Office-bearers of the Society be re-elected."
3. On the motion of Colonel Sconce, seconded by Captain Hamilton Dunlop, R.N., "(*a*) That the following twelve Members of Council retiring by rotation be re-elected :—Mr. F. Grant Ogilvie, Sir J. N. Cuthbertson, Prof. Cargill G. Knott, Mr. W. C. Smith, Dr. W. Scott Dalgleish, Mr. Coutts Trotter, Mr. Chas. Robertson, Dr. W. G. Blackie, Sir W. Renny Watson, Lord Provost Stewart, the Hon. John Abercromby, and the Rev. Dr. Colin Campbell ; (*b*) that, in room of the eight other Members retiring in rotation, the following gentlemen be requested to serve on the Council :— Colonel Cadell, V.C., Major Wardlaw Ramsay, Mr. D. M. Westland, Mr. D. F. Lowe, Prof. Calderwood, Dr. David Patrick, Prof. Copeland, Mr. David MacRitchie, and Mr. James Henderson ; and (*c*) that Mr. John Robertson, Dundee, be invited to join the Council in the room of Captain Clayhills Henderson, R.N., who resigns."
4. On the motion of Mr. W. B. Blaikie, seconded by Mr. Chas. Robertson, "That Prof. James Geikie, Vice-President, and Lieut.-Colonel Bailey, Secretary of the Society, be appointed delegates to the International Geographical Congress to be held in London in August 1895."

In the unavoidable absence of Colonel Bailey, Mr. Ralph Richardson, Hon. Secretary, submitted the Annual Report of Council, which was adopted on the motion of the Chairman, seconded by Mr. A. J. Herbertson.

The Anniversary Meetings.

At Edinburgh, the Anniversary Meeting was held in the Synod Hall, Castle Terrace, on Monday, November 12th, at 8 P.M. The Marquess of Lothian, President of the Society, was in the Chair.

The Hon. Sir Charles Tupper, Bart., High Commissioner for Canada, delivered an address on "The Economic Development of Canada." At its conclusion the Marquess of Lorne, formerly Governor-General of the Dominion, addressed the meeting, and a vote of thanks to the lecturer was proposed by the Rev. Dr. MacGregor, and seconded by Dr. John Murray. A vote of thanks to the Chairman, moved by Dr. W. Scott Dalgleish, terminated the proceedings.

The Glasgow Meeting was held in the Berkeley Hall on Friday, November 16th, at 8 P.M. The Lord Provost presided, and an address was delivered by Sir W. Renny Watson, Chairman of the Branch, on "Hawaii." A vote of thanks was awarded to the lecturer, on the motion of Sir J. N. Cuthbertson.

The Dundee Branch held its Anniversary Meeting in the Kinnaird Hall, at 8 P.M. on Wednesday, November 14th, when Sir Chas. Tupper repeated his address on Canada. The Chair was taken by Sir John Leng, M.P., and a vote of thanks to the lecturer was moved by Mr. J. Weinberg, and seconded by Mr. Thomas Bell.

The Aberdeen Meeting was held in the Hall of the Christian Institute on Friday, November 16th, at 8 P.M. Lord Provost Stewart presided, and Sir Chas. Tupper was again the lecturer. He was awarded a vote of thanks, on the motion of Sir J. F. Clark, seconded by Bailie Edwards.

MEETINGS IN DECEMBER.

On Thursday, December 6th, Mr. W. M. Conway will lecture on "Himalayan Exploration," in the Society's Hall, Queen Street, at 8 P.M.

On Thursday, December 13th, Dr. H. R. Mill will address the Society on "The Geographical Work of the Future," in the same Hall, at 4.30 P.M.

Dr. Gunn has kindly consented to deliver a Christmas Lecture to young people. Due notice of the day and hour will be given to Members by post-card.

GEOGRAPHICAL NOTES.

By THE ACTING EDITOR.

EUROPE.

The Rainfall of Scotland, 1866 to 1890.—Twenty-three years ago a paper was published in the *Journal of the Scot. Meteor. Soc.*, vol. iii., on this subject. The monthly and annual averages were then given for 163 stations from observations extending from 1815 to 1871, but in the case of some stations the records covered only a small number of years, and hence the results could only be regarded as provisional. Since then the number of stations has increased to 327, and a large number of returns has been collected from all parts of the country. With this material to work on, Dr. Buchan has been able to draw up a set of charts showing the average monthly and annual rainfall over the country during the 25 years from 1866 to 1890 (*Journal of the Scot. Meteor. Soc.*, Third Series, No. x.).

The three prominent causes which determine the amount of rainfall are the rise and fall of the temperature with the season, the prevailing winds, and the physical configuration of the country with reference to these winds. In Scotland the temperature rises from February to July, and falls from August to January. During the former six months the rainfall relatively to the annual amount is 3 per cent. greater at eastern than at western stations, and 3 per cent. greater at the western stations during the other six months. The force of the winds is greatest from November to March, and least from June to September. South-westerly and westerly winds are the most prevalent, making 37 per. cent. of the whole; they fall to a minimum in March, April, and May, when easterly and north-easterly attain their greatest frequency. In these three months the south-westerly and westerly winds prevailed on 29 days, on an average, and the north-easterly and easterly on 24 days. The rainfall with westerly winds is heaviest on the west side of the country, and gradually increases towards upland and inland stations. Beyond the watershed the rainfall diminishes greatly, and in many cases does not extend eastward from the watershed. On the other hand, heavy rains with easterly winds are greatest on or near the coast, and very often do not extend farther inland than about 20 miles. Again, at western stations, where the annual fall does not exceed 60 inches, a fall of 2 inches is comparatively rare, while in the east, where the total amount is under 30 inches, a fall of 2 to 3 inches, or even more, is not infrequent.

The driest part of Scotland is the low-lying district from Dornoch to Lossiemouth, where the fall varies from 23 to 26 inches. The absolute minimum occurs at Nairn. In Mid and East Lothian also the fall is less than 26 inches, and only just reaches that amount on the Lower Tweed above Coldstream. These districts are all well protected to the west and south-west and south-east by hills of considerable height. Lower Tweeddale, a strip of coast from Berwick to a little north of Montrose, Caithness and a district extending along the Moray Firth from Banff to beyond Dornoch, receive under 30 inches of rain; the middle part of Clydesdale also belongs to this group. On the other hand, three districts have a rainfall of upwards of 80 inches. These are the south-western part of Skye, the highest mean being 92·02 in. at Sligachan; the central parts of Ross-shire, Inverness-shire, and the north of Argyll, where the average is 108·46 at Glenquoich and 107 at Glenaladale; and a broad tract from Glenspean to Ben Lomond, with 127·65 in. in Glencroe, 118·35 at the Bridge of Orchy, and 115·45 at Ardlui.

Annual Report of the Sonnblick Verein.—The second *Report* is noticed in the *American Meteor. Journal*, No. 5 (for first *Report* see vol. ix., p. 647). Observations have been made in connection with atmospheric electricity, and show that the condition of the summit remains practically unchanged during a clear day, as also during the year; and, therefore, the top is evidently above the influences which cause fluctuations on the Earth's surface. During rain and thunderstorms the manifestations of St. Elmo's fire are very striking. In snowstorms, St. Elmo's fire is positive when the flakes are large, negative when they are small. The following are the general meteorological results:—Pressure: mean of year, 20·476 in.; mean maximum, 20·945 in.; mean minimum, 19·622 in. Temperature: mean of year, 19·94° F.; maximum, 49·64°; minimum, $-25·96°$. Humidity: mean absolute, 2·6; mean relative, 86. Cloudiness: mean, 6·3. Precipitation: total, 52·36 in.; rain, 4·21 in. Days with precipitation, 252; with rain, 33; thunderstorms, 18; hail, 11; fog, 241; storms, 125. Number of days with north wind, 199; north-east, 158; east, 86; south-east, 30; south, 51; south-west, 166; west, 160; north-west, 173; calms, 72.

The Level of the Black Sea.—The physical condition of this sea, which covers an area of about 147,300 square miles and is one of the deeper land-locked seas, has of late years been thoroughly investigated. The results obtained by the Russian expedition under Captain Spindler were noticed in vol. vii. p. 274; and, besides these investigations of the waters and bottom of the sea, the meteorological elements have been studied by MM. Wild, Rykacheff, and Spindler, and the formation of storms by MM. Sreznefsky and Panchenko. Furthermore, M. Klossofsky has organised a network of meteorological stations in the south-west of Russia, and in *Ciel et Terre*, July 1st, he treats of the changes of level of the sea as connected with meteorological phenomena.

The isotherms over the basin of the sea in the month of December show a gradual rise of temperature from 32° F. on the north-western shore, and 26·8° near the north-eastern extremity of the Sea of Azof, to 46·4° along the shores of the Caucasus and Asia Minor. In January the isotherms move southwards; the thermometer marks 24·8° on the north-western shore, 20·3° at Rostof and 42·8° off Asia Minor. From the month of February the isotherms move in the opposite direction, forming curves which seem to follow the contour of the sea. In July the temperature over the central part of the sea scarcely exceeds 71·6°. In the month of August the isotherms commence to move northwards again. In general it may be said that the air is milder over the Black Sea than over the adjoining continent from October to February, and fresher from April to August. March and September are epochs of transition; in March the western part of the sea is cooler than the eastern part and warmer than the adjacent littoral, and the same conditions are repeated in September. As regards barometric pressure, M. Rykacheff's charts show that in January the pressure of the air diminishes from north-east to south-west by about ·16 inches. This difference gradually diminishes towards spring and summer, and about the month of June an almost uniform anticyclonic area extends over the sea. M. Spindler concludes, from a series of observations, that from September to March the prevailing winds are the north, north-east, and east—that is, from the continent; while the south, south-west, and north-west blow during the remainder of the year. The Black Sea is, on the whole, stormy; at two stations, at least, on the Russian coast there are violent winds on ninety days in the year. The months of January, February, March, and December are particularly dangerous for navigation.

Since 1873 twenty stations have been established for observing the changes of level of the water, and observations have been taken three times a day—at 7 A.M., 1 P.M., and 5 P.M. The records show that the surface is subject to variations amounting sometimes to two feet or more in twenty-four hours. At first these oscillations appear to follow no regular sequence, but, by examining the means and comparing the results with meteorological data, a certain interdependence may be discovered. With regard to annual variations, it appears that the water is affected by the pressure of the atmosphere and the action of air currents. M. Klossofsky gives a table showing the range of the monthly means, and remarks that the curves indicate a rise of the surface during the summer months and a fall during winter. As for the amplitude of the oscillations, the variation of the monthly mean ranges from 5·5 inches at Yalta to 10·3 at Poti, while at Taganrog it reaches the exceptional amount of 18 inches. The absolute range is much greater, being 2 feet at Yalta and as much as 14 feet 3·7 inches at Taganrog. It is greater in the winter and less in summer. The annual precipitation received by the basin of the Black Sea varies from 9·8 inches at Tarkhankut to 82·5 at Batum. The evaporation is also considerable, being, for instance, at Kichineff 24·68 inches, or more than the precipitation. According to M. Wild, the maximum rainfall occurs in summer only on the north-west coast. Now, in summer the rise of level ought to be counteracted by the excess of evaporation, and, moreover, the greatest rise of level precedes the rains. At Poti and Novorosiisk the lowest level occurs during the abundant precipitation of winter. Lastly, the extreme rise should not exceed the difference between the precipitations of winter and summer, which at Odessa, for instance, amounts to 1·5 inches. There seems, then, to be no clear connection between the oscillations of level and the annual precipitation. Nor does the level of the sea follow the rise and fall of the discharge of the rivers; to give one example, the discharge of the Don is greatest in April, while the water at Taganrog attains its highest level in July.

On the other hand, the changes of level are in close relation to the variations of the barometer, and are affected by the prevailing winds, as may be seen from M. Klossofsky's tables. The atmospheric pressure is greatest in winter, diminishing from north to south; and in that season air currents passing from the continent to the sea predominate, while in summer the pressure is uniformly distributed, and winds blowing landwards force the water towards the shore. Thus, at Odessa, the annual range of pressure is 6 inches, and the change of winds may be estimated to cause an oscillation of 3·6 inches, and accordingly the change of level, viz., 9·6 inches, is accounted for. Of course, these agencies may, in some cases, partially counteract each other. The rise of the water on the northern shore ought to be accompanied by an opposite movement on the southern shore. Unfortunately, observations have been recorded at only one station in the south, but these confirm the correctness of the theory.

ASIA.

The Survey of India.—During the year 1892-93, the *Report* for which has lately been received, twenty-one parties and three small detachments were engaged in field work. The aggregate area surveyed in detail was 104,711 square miles, and the traverse operations in the Central Provinces to furnish a basis for field surveys under the Settlement Department, and the skeleton survey of village boundaries, extended over 3563 square miles more.

In Burma the principal series of triangles, on the meridian of 96° 31′, was continued northwards for a distance of 70 miles, covering an area of 1240 square miles and reaching the parallel of 23° 30′ N. A secondary series, commeneed the previous year (see vol. ix. p. 537), was extended 104 miles to a distance of 180 miles from its origin. It began a little to the east of Fort Stedman, and its terminus is near the Mekong river; it embraces an area of 3200 square miles, lying between the meridians of 96° 30′ and 99° 30′ E. long.

Three parties and two detachments were occupied in topographical surveying in the Bombay Presidency, Baluchistan, the Himalayas, the tin-bearing tracts of the Mergui district, and on the Indus river. The area surveyed was 10,215 square miles.

The forest survey was continued in the Central Provinces, the Bombay and Madras Presidencies, in Lower Burma and the Himalayas; and the cadastral surveys covered an area of 7755 square miles lying in Bengal, Burma, Assam, and the North-Western Provinces.

There was a considerable increase in the area geographically surveyed. It includes nearly 50,000 square miles in the Helmand desert, Sistan, and Perso-Baluchistan, 5853 in Kentung and in Siamese territory, executed by the Boundary Commission, and 17,982 in the Northern Shan States. The total area was 83,955 square miles. Levelling operations were executed along the sections Rangoon to Elephant Point and Rangoon to Mandalay.

AFRICA.

Meteorology of British East Africa.—A *Report on Meteorological Observations in British East Africa for* 1893, by Mr. E. G. Ravenstein, has been published by authority of the Directors of the I.B.E.A. Company. Observations have been taken by the officers of the Company since 1891. The earlier records have been lost, but fortunately Mr. C. H. Crawfurd had previously extracted the rainfall table. The report contains records from Chuyu, Mombasa, Malindi, Magarini, Lamu, Witu, and Kismayu, on or near the coast, and from Machako's and Fort Smith in Kikuyu. Rainfall only was measured at Ikuthu, Jilori, Mbungu, and Takaungu. The author of the report unfortunately knows nothing of the instrumental errors, and the formation of means has presented some difficulty owing to the unsuitable hours chosen for observation. The mean annual temperature varies from 78° F. at Chuyu and Magarini to 82° at Mombasa. The coolest month (June, July, or August) has a mean temperature of 74° to 76°, and the hottest (February or March) of from 81·5° to 86°. The lowest temperature recorded was 63°, at Lamu in June, and the highest 94°, at Magarini in December. The annual range amounts to 5·8° at Mombasa, just as at Zanzibar, while at Kismayu it is probably over 10° F. The daily range is 7·8° at Zanzibar, 7·7° at Mombasa, and 13° at Magarini, the last figure being much larger owing to the situation of Magarini on the slope of a hill at some distance from the coast. The small daily range is favourable to health.

The relative humidity at Mombasa, Malindi, and Witu amounts to 81 per cent.; at Lamu it is probably higher. The air is driest before, or shortly after the commencement of, the heavy rains, and dampest in the month of heaviest rainfall, April or May.

The rains, as in other tropical countries, follow the sun, commencing soon after the sun has passed the zenith. The greater rains culminate in April or May, and the lesser rains last from October to November or December. "After rains" in July, so anxiously looked for in Uganda and Zanzibar, do not occur on the coast of the British territory. The amount of rain varies exceedingly from year to year. At Zanzibar, where the average is 64 inches, 46 inches were recorded in 1874, and 164 inches in 1859. The average for ten years was 51 inches at Mombasa, the extremes being 26 inches in 1892 and 91 inches in 1877. Still more marked is the difference in the amount of rain for the same month in different years. This uncertainty seems to demand the formation of reservoirs to regulate the supply. Taking the annual rainfall at Mombasa at 51 inches, the mean fall is probably 45 inches at Malindi and Jilori, 39 at Magarini, 37 at Lamu, and 11 at Kismayu. The rainfall, therefore, decreases rapidly as we proceed along the coast northwards. The frequency of the rainfall is very important to agriculturists. The number of rainy days varies as much as the quantity; at Mombasa it ranges from 72 to 164. Some very heavy falls were recorded in April 1893, the rain in twenty-four hours exceeding 3·5 at Lamu, Mombasa, and Chuyu. From observations at Chuyu, Malindi, and Witu, it may be said, generally, that southerly and south-westerly winds prevail from March or April to September and October, while easterly or north-easterly predominate during the remainder of the year.

In the elevated interior it would be easy to find stations where the mean temperature is the same as in a European town, but no elevation can obliterate the distinguishing features of a tropical climate—a small annual range and a large daily range of temperature—which have a marked influence on European constitutions. At Machako's, in some respects the most favoured station of the company, the mean temperature is 65°, while the extremes recorded range from 48° to 81°. At the inland stations the daily range approaches, or perhaps exceeds, 20° F., which is nearly double that of Greenwich. The annual rainfall is estimated as 28 inches at Mbungu, 47 inches at Machako's, and 43 inches at Fort Smith.

Kilimanjaro.—The elevated mass of Kilimanjaro rises very gradually from the lowlands, and hence it makes no very striking impression on the observer when seen from the plain. Consequently the zone of cultivation is very extensive. Beginning at an elevation of 3600 to 3900 feet and ending at 7000 feet, it embraces an area of, perhaps, 650 square miles; but on the eastern side it is somewhat contracted owing to the greater drought and the absence of perennial streams, except the Lumi. The Jagga population cannot exceed 60,000 souls.

Kilimanjaro constitutes a peculiar and isolated region, such as is not to be found elsewhere in German East Africa. Its fauna and flora have a close affinity with the Abyssinian. From the surrounding steppe, 2600 to 3000 feet above sea-level on the southern, and 3200 to 3900 feet on the northern, side, Kilimanjaro rises, under 3° S. lat. and 37° E. long., at first gradually and then more rapidly to a height of 13,000 feet, where it divides into the two summits of Kibo and Mawenzi described by Dr. Meyer (see vol. vi. p. 156). If the whole mass be assumed to be a symmetrical cone, its surface up to a height of 19,000 feet would be about 2600 square miles. In this comparatively small space are found almost all the zones of the inhabited and uninhabited world, from the dry burning steppe of tropical countries to the eternal ice of Polar regions. From the southern side the traveller, leaving the grass- and bush-covered steppe, passes through bush and forest increasing in density up to the lower limit of cultivation, at an elevation of 3600 to 3900 feet. Then he wanders beside murmuring brooks and the irrigation channels of the natives up to a height of 6200 feet. Higher up again to 10,000 feet spreads primeval forest, at first interspersed with grassy glades and clumps of fern, but becoming closer as it extends upwards. Above this again are found alpine pastures and low shrubs up to 14,000 feet, from which height the detritus of the lava-fields is clothed only with lichens and other small eryptograms up to the limits of the snow and ice.

Of these zones only those parts lying between 3300 and 7200 feet—that is, the cultivated land of the Wajagga and the adjoining higher tracts—are suitable for European colonisation. The lower part of the forest might be cleared and brought under cultivation, but the upper parts are not fitted for habitation because of the prevailing dampness and cold ; besides which total deforestation would be disastrous for the irrigation of the tilled fields. On the other hand, a settlement at a less elevation than 3300 feet would fail owing to the comparative dearth of water in these tracts. At the same elevation, also, the mountain does not present on all sides equally favourable conditions, the exposure, quality of the soil, and quantity of running water differing considerably.

The mountain owes its origin to volcanic energy, which has forced the eruptive rocks through the gneiss of the surrounding steppe. It is composed, then, of basalts, more or less compact lavas, porous tuff, and ash conglomerate, the latter having been ejected by the two great cones of the summit and numerous smaller ones situated on the flanks of the mountain. It must be thousands of years since the volcanic forces were strong enough to cause eruptions, and at the present day they manifest themselves only in occasional shocks. Atmospheric agencies have been at work forming a rich soil, which has in the course of time been covered with a thick layer of humus. This fruitful stratum is almost everywhere present, and extends to a depth of 3 to 10 feet. As the slope of the mountain is on all sides continuous, especially in the cultivable zone, and a step or terrace formation is absent, no moors or swampy tracts occur. The supply of water, except on the northern side, is excellent. The water from the snow and ice of the twin summits collects into hundreds of small streamlets, which, increased by the precipitation from the clouds and mists that float most of the day above the forest throughout the year, find their way to the fields of the Wajagga, and produce a fertility and luxuriance astonishing in the midst of dry and hot East Africa. Below the Jagga country these watercourses, natural and artificial, unite to form large brooks, which ultimately find their way, with the exception of the Tsavo, an affluent of the Sabaki, into the Pangani river. In the rainy season their beds are unable to contain all the water that descends from the mountain, and hence swamps are formed round the foot of the mountain, rendering the climate of the plain extremely unhealthy.

The precipitation takes the form of abundant tropical rains, but often also of fine mists, characteristic of the mountain region, which at certain seasons collect at daybreak at the foot of the mountain, ascend its sides, soaking the cultivated zone with a fine and penetrating drizzle, and part with their remaining moisture to the primeval forest. No month of the year is entirely deprived of rain ; at the beginning of March the greater rains set in with thunderstorms, and continue nearly to the end of August. The mists already mentioned are particularly frequent in July and August. September and October are the finest months, and are succeeded by the season of lesser rains, lasting to the middle of December. January and February are particularly hot and dry, though some rain falls even in these months.

Tables of the rainy days and of the temperature at the Marangu station, 4690 feet above sea-level, are given by Dr. Brehme in the *Mitt. aus den Deutschen Schutzgebieten*, Bd. vii. Heft 2. The latter, which are monthly means for the hours 7 A.M., 2 P.M., and 9 P.M., do not, he says, give a complete notion of the temperature conditions. The peculiarity of the mountain climate—the great difference which, especially in the warmer months, occurs between the day and night temperatures—does not appear. From April to August the weather is uniformly cool, but at other seasons 75° F. have been recorded at midday, while at night the thermometer has fallen to 50°. Minima below 46° have been observed at the Marangu station. Kilimanjaro, lying in the region of the regular trade winds, which blow from the south-east, and sometimes from the south-west, during the months from April to October, and from the north-east during the other half of the year, is constantly supplied with fresh air, and detrimental exhalations are immediately swept away. The climate of the cultivated belt has, on the whole, more resemblance to that of the Temperate zones than that of the Tropics, and the sanitary conditions, though not as excellent as they have often been described, are by no means prohibitive to European settlement. The cases of malaria observed by Dr. Brehme were often the consequence of travelling through the plain.

The most promising form of colonisation is that of small crofters. For plantations on a large scale there are no favourable prospects; tobacco is the only crop which is likely to turn out profitable, and there are no large tracts of virgin soil available for cultivation, for most of the land is already in native hands. The distance from the coast is another drawback, which would not be removed by a railway, as only valuable products of the best quality would pay for transport. Labour is another difficulty, as the natives cannot be employed as day labourers. Europeans, however, would be able to work sufficiently in this climate to keep a small farm in order.

The Limpopo.—Major A. A. Caldas Xavier, a member of the commission for the delimitation of the frontier between the Portuguese territory and the Transvaal, ascended the Limpopo in 1890. His narrative, published in the *Bol. da Soc. de Geogr. de Lisboa*, No. 3, contains some interesting information regarding the navigation, etc., of the river. From the mouth of the Pafuri to Mahamba it runs in a sandy bed, varying in breadth from 500 to 1400 yards. From Mahamba to the mouth of the Shengani or Waluize it is much contracted, having in summer a mean breadth of 170 yards, and its bed becomes more muddy as it approaches the coast. During the summer, when Major Xavier navigated the Limpopo, its mean current, as far down as Mahamba, was $\frac{1}{4}$ to 2 miles per hour, while lower down it sometimes attains a speed of more than $2\frac{3}{4}$ miles. As regards the depth of water, the river below the Pafuri may be divided into three sections. The first, 190 miles long, extends to the mouth of the Olifant river (150 miles from the sea). This cannot be navigated in summer, for on some reaches, several miles in length, it consists of pools connected by channels with less than 20 inches of water, while in other places it extends to a great breadth, and is divided by islands into a number of still shallower channels. This section is navigable only for three or four months in the year by small steamers, such as ply along the second section at all seasons. From the mouth of the Lipallula, or Olifant, down to Mahamba, a distance of 60 miles, stern-wheel steamers drawing only 12 to 20 inches of water can ply. At Mahamba, the high lands that border the upper course of the river recede from the banks, giving place to a densely-populated plain, which extends down to the sea, a distance of some 90 miles. The water is a little more than 3 feet deep as far as the mouth of the Shengani, and 5 feet lower down. The Shengani also is navigable by canoes as far as the territory of the Makwakwa tribe.

The Seychelles.—These islands are covered with luxuriant forests and other vegetation, and are some of the most beautiful in the world. Their climate is excellent. The yearly rainfall amounts to 80 or 100 inches. On the islands of Silhouette and Mahé granite mountains rise to a height of 2000 feet—the culminating peak, Morne Séchellois on Mahé, being 3000 feet high (Reclus says 3240) —and are clothed with the richest verdure. All the islands are more or less surrounded by reefs, especially Mahé, where the steamers of the Messageries Maritimes are obliged to anchor at a distance of $1\frac{1}{4}$ miles from the capital, Victoria. Fish are abundant round the coasts, but, as usual in the Tropics, are not well-flavoured. The principal fruits and articles of food produced in the islands are coco-nuts, bread-fruit, bananas, guavas, mangoes, alligator pears, and oranges. Maize, manioc, sweet potatoes and sugarcane are also grown on small patches near the huts of the natives. The forest trees are of many varieties ; the most common and the least useful are the dragon's-blood and wild cinnamon. The most remarkable is the double coco-nut, or *coco de mer* ; its fruits grow in pairs joined together along half their length, and weigh as much as sixty pounds. This tree is found only on the islands Curieuse and Praslin.

The population, according to the census of 1891, is over 16,000. It is composed of half-breeds of all shades, Hindus, Chinese, Arabs, a few Malays, and Europeans, chiefly British. The trade has passed almost entirely into the hands of the Hindus and the Chinese. Coco-nut oil and vanilla are the chief exports ; the cultivation of rice and cotton ceased on the abolition of slavery, and the hawksbill turtle is becoming very rare. The islands could support a much larger population than at present, and produce a much larger quantity of exports. One obstacle to their development is the high freightage rates charged by the Messageries Maritimes, the only line trading with the islands. Capital is also needed for a more regular and systematic cultivation ; and the very fertility of the islands is a hindrance, the natives having no stimulus to exertion where Nature so easily provides the means of subsistence.—*Deutsche Rundschau*, Jahrg. xvi. Heft 11.

The Cameroons Mountain.—In February and March the Deputy-Governor, with Dr. Plehn and Consul Spengler, made an attempt to ascend the Cameroons mountain. At an altitude of about 10,800 feet they were obliged to turn back, several of the porters having fallen ill owing to the low temperature. Nevertheless, some new information was obtained. The base on which the mountain stands stretches from the coast in a north-easterly direction for a distance of 22 miles, and has a breadth of 18 to 23 ; its area is about 460 square miles. The rocks, as also in the islands of Principe and Fernando Po, are of purely volcanic origin. Eleven craters were counted, most of them lying near the longitudinal axis at an elevation of nearly 6000 feet, and the total number is probably twice as great. Volcanic energy appears to be not yet completely exhausted. The natives speak of two eruptions during the past century. The mountain is composed chiefly of dense basaltic lava full of cracks. Trass and tuff are found in the spurs and on the south-western slopes of the little Cameroons mountain, where ravines are numerous and wood and water abundant ; whereas the south-eastern slope, from a height of 1600 up to 5000 feet, forms a sloping plain, intersected only by a few periodical streams. Few traces of fallen ashes were found, most of them having, no doubt, been carried out to sea.—*Globus*, Bd. lxvi. No. 7.

In May, Lieut. Haering climbed the Little Cameroons Mountain. He started from the Bay of Batoki, and in three hours reached the village of Boando. Next day he ascended the low ridge on the south-western side, which consists of lava, and is covered with dense forest. It is separated from the mountain by a broad flat hollow. Haering almost reached the bush-covered summit, but could see little owing to the thick mist. Eight torrents descend to the shore along the four miles between Bakingib and Batoki, but there is a lack of water on the south-east side.—*Globus*, Bd. lxvi. No. 12.

AMERICA.

The Population of Greenland.—The *Nouvelles Géogr.*, No. 7, gives an extract from the *Geografisk Tidskrift.* The population of Greenland has been steadily increasing since the beginning of the century. In 1805 the Danish settlements contained only 6046 persons, whereas in 1891 the number had risen to 10,244. The increase, singularly enough, is due to the movement of population in the northern districts, where the climate is most severe. In Northern Greenland there has always been, since 1861, an excess of births over deaths, while in Southern Greenland, except from 1881 to 1891, the latter have been more numerous. The excess is due not to a high birth-rate but to low mortality. The births vary from 33 to 35 per 1000, and the deaths from 26 to 28, the latter figure referring to Upernivik. In Southern Greenland the ratio of births is 34 to 43 per 1000, while that of deaths is as much as 36 to 44.

The Barren Lands of Canada.—In 1892 Mr. J. Burr Tyrrell was sent by the Geological Survey of Canada to explore the unknown country, extending over about 60,000 sq. miles, which lies to the north of the Churchill river, and south of Lake Athabasca. The *Geographical Journal* for November contains a narrative of his journey. From Prince Albert on the Saskatchewan river he travelled by land to the Green lake, where the canoes were launched, and the Beaver river was descended to the Isle à la Crosse lake, on the Churchill river. After descending the Churchill river for 90 miles, Mr. Tyrrell and his party ascended to the source of the Mudjatic river, in a sandy plain, whence a short march brought them to a small affluent of the Cree lake, never before visited by a civilised man. The lake lies on the line of contact of the highly altered Archæan and the unaltered Palæozoic (Keweenawan) sandstones, and the river which drains it flows over the latter rocks to the south end of Black lake. Both Black lake and the eastern end of Athabasca lake lie along the line of contact of the altered and unaltered rocks, their northern shores being composed of granites and gneisses, while their southern shores are of horizontal sandstone. A survey was made of the western shore of Wollaston lake, which was found to lie on the same line. Here the party divided, one detachment travelling southwards to the Reindeer lake, and Mr. Tyrrell ascending the Geikie river, which enters Wollaston lake at its south-western corner, and thus finding his way back to the Churchill river. On his return he offered to lead an expedition to the Barren grounds, and, leaving Ottawa with Mr. J. W. Tyrrell, he returned to Athabasca lake, and starting from Fort Chippewyan on June 22, proceeded to the Hudson's Bay Company's deserted trading-post of Fond du Lac, and to the northern shore of Black lake. Then a portage of two miles and a half brought the party to a small lake 1200 feet above sea-level, and 200 feet above Black lake. Through a series of small lakes they came to the Chipman lake, and ascended the Chipman river, past five rapids, to the Selwyn lake, 55 miles long and 1350 feet above sea-level, with wooded shores. A mile and a half farther they came to another lake 50 feet lower, which Mr. Tyrrell named Daly lake, after the Minister of the Interior for Canada, and travelled for 20 miles along it. A few aspens were seen here, marking the northern limit of this tree, and occasionally white birch was noticed among the scattered groves of tamarac and black spruce draped with festoons of thread-like black lichen (*Alectoria jubata*), the principal food of the caribou in winter. Gently sloping stretches of bright green turf were frequent round Daly lake. Their surface was firm to the tread, and was covered with a thin growth of light green lichen, cranberry, eyeberry, dwarf Labrador tea, etc. The subsoil was found to consist of bright yellow moss (*Sphagnum sp.*), which had ceased to grow, and at a depth of about a foot was frozen into a solid mass.

At the northern end of the lake the expedition entered a stream known to the Chippewyan Indians as the Telzoa, or Wide Shallow river. The country traversed from Athabasca lake to this point consisted of gently rounded rocky hills of Laurentian gneiss, but here, at 61° N. lat. and 104° W. long., the river enters a flatter country, expanding into small irregular lakes, and again contracting into swift rapids with boulders. The country is low and mossy, and dotted with a few groves of small black spruce. Here and there long *åsar* of sand and gravel stretch across the country in a direction 60° S. 70° W., parallel to the line of glaciation. Fine large spruce, 50 to 60 feet high, grow on the crests and sides of these ridges. Farther north the country becomes more stony, and the west shore of Barlow lake, in lat. 62°, is composed of low hills of boulders and masses of granite. On the eastern shore of Carey lake an immense herd of caribou was seen, and some bucks were shot.

On August 6th Mr. Tyrrell's party came in sight of a great lake, apparently covered with a sheet of ice, probably the Doobaunt lake which Samuel Hearne walked round in 1770. A passage was found between the ice and the shore. Here the red and grey granitoid gneisses of Laurentian age give place to sandstones, red quartz, porphyries, and dark green trap, similar to the Keweenawan or Upper Copper-bearing rocks of Lake Superior. On Lady Marjorie lake Eskimo were found, and several fine fat bucks were shot. Next, Aberdeen lake was visited, and on September 2nd Baker lake was reached, which Captain Christopher had seen a century and a quarter ago. Since leaving Black lake the party had travelled 810 miles, 538 miles over lakes and 272 along rivers, and the Keweenawan rocks had been traced from Doobaunt lake to Lake Baker, a distance of 225 miles as the crow flies. On September 12th a rocky point, just south of the mouth of Chesterfield Inlet, was reached, and a dangerous voyage was commenced along the shores of Hudson's Bay. Storms were frequent, and provisions began to run short, and it was with great difficulty that the expedition succeeded in reaching Churchill. Here they procured a dog-team, and continued their way to York Factory, and thence travelled over the snow to Oxford House and Lake Winnipeg. The total distance traversed was 3200 miles, viz., 2150 in canoes, 610 on foot, 350 in conveyances drawn by dogs, and 100 in conveyances drawn by horses.

Weather of the United States in 1893.—The *Annual Summary* for 1893 has been published by the Weather Bureau. The mean annual temperature was above the normal in the South Atlantic and Gulf States and on the Eastern Rocky Mountain slope, the maximum excess being 2·2° at Abilene. Elsewhere, it was below the normal, the maximum deficit being 4° at St. Vincent, Minnesota. The maximum temperatures were 111° at Yuma; 107° at Tucson, Arizona, and Miles City, Montana; 106° at Red Bluff, California, and Dodge City, Kansas. The lowest maxima were 88° at San Diego and Hatteras, North Carolina; 87° were recorded at Nantucket; and 86° at Block Island, Rhode Island. The lowest temperature, – 45°, was recorded in Havre and Miles City, and the thermometer sank to – 42° at Helena, Montana, and St. Vincent. The minima were above 30° at Yuma, Corpus Christi, in Texas, and at several stations in California and Florida; the highest being 52° at Key West, 36° at San Francisco, and 38° at San Diego. The smallest annual ranges were found in the same States, and ranged from 39° at Key West to

55° at Galveston, Texas. The greatest ranges were 152° at Miles City, 148° at Havre, and 144° at Helena and Bismarck, North Dakota. The greatest annual precipitation was 104 inches at Tatoosh Island and at Neah Bay, Washington. The precipitation exceeded 80 inches on the coast of Washington, and 40 inches on the coast of California. It was 2 to 10 inches in Nevada, 10 to 40 inches in Idaho, and 5 to 20 inches in Arizona. In the Mississippi valley it ranged from 25 inches at the northern end to 45 or 50 inches at the southern. At Charleston occurred the maximum for the Atlantic coast, 71 inches, or fully 14½ inches above the normal. North-eastwards the precipitation gradually diminished to Eastport, Maine, which had about 30 inches, and also southwards to Key West, with 22 inches. The fall was in general deficient, especially in Louisiana, Kansas, and the interior of Georgia. The deficit was greatest, 31·04, or 51 per cent., at Kittyhawk, North Carolina; and 10·82, or 52 per cent., at Dodge City. At Astoria, Oregon, the excess was 29·29 inches, or nearly 50 per cent.

The Drainage of the Valley of Mexico.—The city of Mexico lies in a basin surrounded by hills, so that there is no drainage for the rain-water and sewage except into the lake of Tezcuco. Consequently, floods are of common occurrence, and the question of constructing an artificial channel has been frequently discussed since the time of the conquest. The present project was commenced by the Emperor Maximilian, but at his fall all the works were stopped; and it was only in 1888 that a loan was negotiated, and the undertaking intrusted to the present contractors. The works consist of a canal about 21¾ miles in length, and the tunnel of Tequixquiac, 6¼ miles long, now driven through the western mountain ranges. The depth of water is 9 feet, with an estimated velocity of 4½ feet per second, and a discharge of 200,000 gallons per minute.—*South American Journal*, August 18.

Juan Fernandez.—Dr. Ludwig Plate, of Bremen, visited this island, noted as the scene of Alexander Selkirk's adventures, in January last. The island lies about 360 miles from the coast of Chile and is in the form of a crescent, measuring 12½ miles by 5. In the centre a mountain, called the Yunque (anvil) from its shape, rises to a height of some 3000 feet. The volcanic soil is covered with magnificent forests. The climate is mild but variable. The population numbers about fifty, half of whom are Chilians and the rest Europeans. In 1868 Herr Wehrhahn, a Saxon engineer, settled a number of colonists on the island and imported cattle, pigs, and poultry, but the enterprise does not seem to have been successful.—*Mouvement Géogr.*, July 22nd.

MISCELLANEOUS.

In the *Tijdschrift van het K. Nederlandsch Aardrijksk. Genoots.*, Deel xi., No. 6, p. 854, is very seasonably published a bibliography of **Korea**.

Mrs. Bishop visited Mukden in August, and left it when an attack of the Japanese was expected. She had a pleasant journey to Niu-chwang, where she took steamer to Chi-fu.

Mr. G. F. Scott Elliot has ascended Mount **Ruwenzori** to a height of 11,000 feet. A deciduous forest extends from 7600 to nearly 9000 feet, above which are bamboos. A cloud hangs over the forest most of the day, making it very damp.—*Natural Science*, vol. v., No. 32.

Two Russian travellers, Menkhujinoff and Ulanoff, have succeeded in reaching **Lhasa** and obtaining an audience from the Dalai Lama. They disguised themselves as Tartars, and in two years and seven months traversed Asia from Astrakhan past the Kuku-nor to Pekin.—*Petermanns Mitt.*, Bd. xl. No. 8.

Plans for the construction of the **Simplon Tunnel** have been approved by the Federal Council and transmitted to the Italian Government. The line is to be single, but the tunnel is to be constructed so as to admit of its being eventually enlarged. The work is to be completed in five and a half years. The cost is estimated at £2,180,000.—*Mouvement Géogr.*, Sept. 30th.

A lively interest is taken in Russia in a proposed continuation of the Transcaspian railway from Samarkand to **Tashkent** and **Marghelan.** At present the carriage of goods from Ferghana to Samarkand, 260 to 330 miles, is two and a half times as dear as by rail from Samarkand to Uzun-ada, 895 miles. The branches to Tashkent and Marghelan would diverge at Khojent.—*Globus*, Bd. lxvi., No. 13.

On July 15, 1893, Mr. A. Harven observed an **Aurora Borealis** at Toronto, which was also observed by Mr. Lumsden at Bala, 110 miles north of Toronto. From their observations it was calculated that the perpendicular height of the arc was 166 miles and its breadth 15 miles. On the supposition that the height of the arc was everywhere the same, it was reckoned that the extremities were 1150 miles distant, and that the magnificent spectacle had an extension of 2300 miles.—*Ciel et Terre*, Oct. 16th.

A line of railway has just been opened to traffic which connects the northern provinces of **Sweden** with the south. From Gallivara in the north, celebrated for its iron mines, there is now uninterrupted railway communication as far as Malmö in the south, a distance of 1205 miles, or about as far as from Stettin to Naples. At Bodon the railway is connected with another State line running from Lulea to Ofoten. It is also proposed to construct a line from Gallivara to the coast of Norway, and another from Gallivara to Haparanda at the head of the Gulf of Bothnia.—*Revue Française et Exploration*, Oct.

NEW BOOKS.

The Ruling Races of Prehistoric Times in India, South-Western Asia, and Southern Europe. By J. F. Hewitt, late Commissioner at Chota Nagpore. With numerous Diagrams and Maps. Westminster: Archibald Constable and Company, 1894. Pp. lxv + 627. *Price* 18*s*.

Mr. Hewitt thinks that he has made out the real history of the childhood of humanity, shown the order in which the leading epochs of civilisation succeeded each other, and traced the wanderings of the races which laid the foundations of the existing social order and spread civilisation throughout Asia and Europe. He has extracted this information by careful study from existing and recorded social laws and institutions, religious ritual, mythic tales, and linguistic changes and resemblances. He contends that the mythic tales, which, it has been found, are told and cherished in more or less variant forms by widely-separated races throughout the world, are not mere stories framed to amuse lazy savages, but serious and trustworthy records of past history, elaborated by earnest, practical, intelligent men, the pioneers of civilisation, who looked carefully after the education of their children, and wished by this means to equip them with the knowledge they had themselves painfully acquired. Handed down at first orally, from generation to generation, they were at a later stage recorded in a permanent form, with some recognisable modifications, by bards, epic poets, priestly corporations, etc. On careful analysis they yield a valuable kernel of truth. Hardly second in importance to the evidence of the tales is the testimony of language; for though not explicitly affirmed by Mr. Hewitt, it is implied in much of his argument that Aryans, Semites, Turanians, Basques, etc., all spoke languages which, however dissimilar they apparently in many ways became, were only modifications, produced by recognisable laws, of a common primeval language, the original form of which, and therefore the meaning of kindred roots in the branches, can be recovered. From the sources indicated, and having at his command this potent instrument of linguistic similarity, Mr Hewitt has made some wondrous discourses, which he sets forth at great length with unhesitating confidence.

It is manifest that, for all who do not accept Mr. Hewitt's premises, his conclusions will have no validity; and such, we must say, is our conviction. The basis is not sound, the whole method is erroneous, and the superstructure a confused and confusing dream. In regard, for instance, to the mythic tales, he seems ignorant that really scientific inquirers have gradually been led to the now well-established conclusion that myths have grown up out of ritual, and have been framed to explain and account for it, and although valuable as showing the working of the human mind, the beliefs men have cherished, and their attitude to external nature, are valueless as records of history. Again, mere resemblances of names in themselves prove nothing any more than mere figures. They may be purely accidental (as they often are) and become evidence of value only when the connection can be traced and the names are proved to have sprung from one source. Many amusing illustrations of the neglect of this principle could be quoted, but it is unnecessary to occupy space with them. The book gives indications of wide reading; but what has been read has not been digested. It displays marvellous ingenuity in guessing, but wild guesses have been mistaken for demonstrated truths.

Slav and Moslem: Historical Sketches. By J. MILLIKEN NAPIER BRODHEAD. Aiken, S.C.: Aiken Publishing Co., N.D. Pp. viii + 301. *Price* $1.50.

Whether Mr. Brodhead has ever come in contact with Mme. Novikof or any other Panslavist with a persuasive tongue we are unable to say, but at any rate he writes as a partisan from a purely Panslavist standpoint. He has even acquired the hatred of the Slav for the German, the Moslem, and the Jew. Absolutism or autocracy is to him a natural and normal growth of Russian soil; it has saved the country from the aristocratic oppression and anarchy which ruined Poland, and is by no means the anomalous tyranny it is misrepresented to be. Indeed, it is essentially a popular government. One of the sores of the country is bureaucracy, but that was introduced by the Germans. Yet the author does not explain why in Germany, which is quite as bureaucratic and where the officials are badly paid, they are so honest compared with Russian officials even of the highest position. The proverbial dishonesty of the peasants is excused on the ground of the centuries of serfdom they have lived through, though, as a matter of fact, this institution had a life of very little over two hundred and fifty years. In his defence of the Russification of Finland he uses an illustration which is quite beside the mark, for he ought to know that the Finns have a right to their national language and parliaments by virtue of a solemn treaty.

If Mr. Brodhead has written to controvert the books and magazine articles of Mr. George Kennan, Lanin, and Co., we fear he has given himself a great deal of trouble for little purpose. For no one of any experience puts much faith in the one-sided statements of enemies or of violent partisans; when the character of a nation or of an individual is painted for him entirely in black, especially in a magazine article, he knows very well there must be another side to the picture.

Every educated man is aware that the civilisation in Russia is Occidental, not Oriental, and that the Slavs are as much Europeans as the Teutons.

When Mr. Brodhead discusses the history of the Crimean War, and holds up his hands in holy horror at the idea of Great Britain supporting the "wicked Turk," "the miserable, insolent, parasite boarder," the "Upas tree," "the superannuated, rotten institution on the Bosphorus," he never hints at the real cause of England's objection to Russia being in possession of Constantinople. It does not seem to have struck him that this would practically make the Black Sea into a Russian lake, and that Russian protective tariffs would make British trade well-nigh impossible, just as in Central Asia. In the fifties most of our corn was imported from Russia and the Danubian provinces, and it was of the greatest importance to keep the Bosphorus in friendly hands. That the Turks happen to be Moslems is an accident in the matter; England is friendly to them not because they are of that religion, but because they hold the entrance to the Black Sea. So that any cry against them on that score is a mere appeal to the gallery, and carries little weight, especially when we know that Christianity is so often a mere label very loosely attached to an individual.

In addition to all Russian names being spelt in a manner suitable for Frenchmen, but not English speakers, the book is marred by many misprints; there is even one in the Errata—Dhagestan for Daghestan. The following do not exhaust the list:—Ogni, Veruna, Velos, ogina, Chagars and Khagars, Messoudi. Blacherun, Sviastolf, Yarosolof and Yarsolf, Mouron (2), Illya, Illmen, Dneiper, Kinaz, kayionne, Tchinovik, Troista, prikazeno, mouji, Sousdalia, Tungund Bund, otshïnia and otchainia, Bosphorous, Amon Daria, Rhaman (3), Luthurans, for Agni, Varuna, Volos, ognia, Khazars, Massudi, Blachern, Sviatoslav, Yaroslav, Murom, Ilya, Ilmen, Dnieper, Kniaz, kazyonni, Tchinovnik, Troitska, prikazanno, muzh, Suzdalia, Tugend Bund (?), ottchayanie, Amu Daria, Rahman.

Five Months' Sport in Somali Land. By Lord WOLVERTON. With Illustrations from Photogravures by Colonel PAGET. 8vo. London: Chapman and Hall, 1894. Pp. 108, and Map. *Price* 7*s.* 6*d.*

Lord Wolverton gives a careful map, drawn up by Mr. Vine, and tells us in a simple, direct way how he and his party shot lions, panthers, gazelles, koodoos, *Zebra Grevii*, and so on. There is little that is new in the book, but the author describes without any fuss some of the interesting sights he saw, such as a battle between foxes and vultures over a dead bullock, and the onslaught of two lions and three lionesses on a flock of sheep. The illustrations are copious and beautiful.

Travel and Adventure in the Congo Free State, and its Big-Game Shooting. By BULA N'ZAU. Illustrated from the Author's Sketches. With Map. 8vo. London: Chapman and Hall, 1894. Pp. xiv + 327. *Price* 14*s.*

Mr. Henry Bailey writes under the *nom de plume* Bula N'Zau (The Elephant Smasher), which the natives gave him, and in truth he seems to have smashed considerably. Not only elephants, but hippopotami, buffaloes, antelopes, and tigers fell in numbers before his successful rifle, and we are grieved to learn that he added a gorilla to his bag. The author spent four years in the Congo Free State (1884-8), exploring and prospecting; and though his record has been intentionally restricted to sporting adventures, there are occasional notes of wider interest. He tells us of geese roosting on trees, of snakes killed by tobacco juice, of the dread march of the driver-ants, of chimpanzees as thieves, and of many other interesting facts of natural history, besides saying not a little regarding the natives. Above all, however, the book is full of elephant-smashing; chapter after chapter we read "a herd of elephants," "trying day after elephants," "bag two elephants," "the kill," "a herd of thirty-three," "a good day with elephants," and so on, until of smashing we have had enough. Of course the Congo State is a big place, and for some years yet there will be elephants to spare; but we agree with Bryden and Selous that there is a time to kill and a time to abstain from killing. But the Elephant Smasher can tell a good tale.

Naples Contemporaine. Par MARCELLIN PELLET, Ancien Deputé. Paris: Charpentier et Fasquelle, 1894. Pp. 321.

Those who have visited Naples—and they are many—will certainly add enormously to what they already know by a perusal of M. Pellet's very interesting and instructive pages. He begins with, in many ways, a ghastly, though unfortunately too true, picture of the life and habitations of the teeming population of that venerable city. The marvellous thing is that in spite of a very poor diet, mephitic and airless sleeping-places, coupled with absolute lack of sanitary arrangements, the population is on the whole robust, and suffers less from typhoid and scarlet fever than in most large cities. This may be attributed to the healthy sea-breezes.

One of the most interesting chapters is that devoted to the history of the Camorra, the worst of the baneful legacies left to the kingdom of Naples by the Spaniards, who are said to have adopted it from the Moors. According to the author, it is founded on the model of the Society of Jesus, and like this it imposes a long noviciate, passive obedience, and absolute self-renunciation. The younger members have to suffer imprisonment or penal servitude for the offences of their leaders without a murmur, and without divulging the names of their chiefs. Stoicism under physical suffering is one of their merits, and in the hospitals it has often been remarked that a Camorrist patient allows himself to be dreadfully cut about without showing any sign of pain. As among Negroes of the United States, their favourite weapon is a razor with a fixed handle. This they use with remarkable dexterity, slashing the face of any one to whom they owe a grudge, without more injury than a flesh wound.

Few, if any, towns in Europe have a larger number of benevolent institutions than Naples. Some of these are of very ancient foundation and very wealthy; but till quite recently a huge percentage of their income was absorbed by administrative expenses, while the administrators and their families occupied quarters that were intended for the sick and needy. The chapter devoted to this subject is worth reading, if only as a vivid illustration of the difficulty of doing good without at the same time doing a great deal of mischief. Other chapters tell about the water supply, the sewage system, the banks, the lottery, public festivals, and the missions of the Liguorist fathers. This last is a curious chapter, and throws a singular side-light on the methods of the revival preachers of this society of missioners—they beat the Salvation Army.

Voyage aux trois Guyanes et aux Antilles. Par G. VERSCHUUR. Paris: Hachette and Cie., 1894. Pp. 363.

Although M. Verschuur did not penetrate far into the interior of Guiana—indeed, this was not his object—he gives us a clear, succinct, and pleasantly written account both of the physical features of the country so far as it is in European occupation, and also of the degree of development reached, and the success of the systems adopted by Great Britain, Holland, and France respectively in their several territories. Guiana, one of those regions in South America which retains its native name, is bounded on the north by the Atlantic, and the part occupied by the colonies in question is separated from Brazilian territory by the Tumuc Humac and other mountain ranges. These colonies, which during the last three centuries have often changed hands, have since 1814 been held by their present possessors, and, their physical characters being very similar, the comparison which the author draws between the three is curious and interesting. The French colony is the least advanced of the three, but it is heavily handicapped (and the author does not dwell on this point) by the problem of having to combine, or trying to combine, a free and a convict settlement. He dwells strongly on the absence not merely of industrial activity, but of any resolute attempt on the part of the French residents to make life comfortable ; the shops are miserably provided, carriages, tramways, and conveniences of all sorts are absent, and people look on their life there as a temporary exile, to be endured, but terminated as soon as possible. In Demerara everything is in contrast to Cayenne ; the residents surround themselves with all the comforts and amusements so desirable in such a climate, while the plantations are somehow, the writer says, made to pay. The planters understand how to manage their Indian coolies, and no doubt the utmost skill, as well as a free expenditure of capital, is brought to bear. M. Verschuur seems puzzled as to the comparative stagnation of the Dutch colony in spite of the efforts of the colonists. It has now recovered from the abolition of slavery, which was perhaps unwisely managed. There is a considerable amount of gold in all three colonies, the working of which, by withdrawing labour from agriculture, has hitherto done more harm than good ; but if any great find of gold takes place the country will go ahead very fast.

The author's account of Curaçoa and the neighbouring islands, their phosphate of lime mines and salt works, is also interesting, and he points out that if the Panama Canal is ever constructed, the position of Curaçoa, with its good harbour and good sanitary conditions, will be of considerable importance.

De Montélimar à Constantinople par Mer et retour à Bicyclette. Par le Lieutenant Guyot, du 22^e^ Régiment d'Infanterie. Paris : E. Plon, Nourrit et Cie., 1894. Pp. 307.

This little volume contains a good deal of detailed and, especially to the pedestrian traveller, useful topography of the author's route—followed mainly on his bicycle, but, owing to bad roads and a defective *monture*, often on foot or with lapses into train and steamer—from Constantinople by Philippopolis, Sofia, Belgrade, Pesth, Vienna, Salzburg, and Switzerland to his home at Montélimar. (His commonplace and not always accurate diary of the voyage from Marseilles by Alexandria, Beyrout, and Smyrna to Constantinople might have been omitted.) He started from Constantinople in March, *i.e.* before spring had well set in, when, to say nothing of incessant rain and snowstorms overhead, the roads were to a great extent invisible or impassable from the mud. His difficulties are graphically told, and no doubt do not lose in the telling ; but they were gallantly faced, and the hardships were considerable. For food and lodging he was at times dependent on the charity of the Turkish soldiers in roadside guard-rooms. He met with much kindness and help, however, often in the most unlikely quarters. This he attributes patriotically to the universal goodwill felt towards his country ; but the traveller's own personal qualities, his sense of good-fellowship and *gaieté de cœur*, must also, we are well persuaded, count for something in this matter.

The naïve way in which he details his various emotions of rage and indignation, of apprehension or pleasure, hope or despair, as well as his bodily weaknesses and troubles, will, by the more reticent Britisher, be found very amusing reading.

In the towns he does his sight-seeing, and describes it, conscientiously, without, he says, caring much about it, his chief pleasure being in the country and the people. He is interested, too, in all that he sees relating to his own profession. In politics he confesses he is "d'une crasse ignorance." Knowing (we had almost said "of course") no language but his own, his transcription of foreign names and words is defective. At the end of his journey, however, he draws a moral—which he enunciates as an original discovery—viz., "que la connaissance des langues étrangères est d'une grande utilité dans les voyages"!

The Downfall of Lobengula: The Cause, History, and Effect of the Matabeli War. By W. A. WILLS and L. T. COLLINGRIDGE. London: African Review Office. Pp. 335. Map and Illustrations.

An authoritative account of the recent campaign of the troops of the British South Africa Company in Matabeliland, this book should prove at once interesting and instructive.

Mr. Selous, in the opening chapters, discusses with his usual ability the question: "Was the war against the Matabeli justifiable or not?" He argues that it was, and adduces facts which are weighty if not conclusive. Still, Mr. Selous' denunciation of a well-known London editor, who does not accept them as conclusive, is not argument.

Major Forbes, who was, it will be remembered, himself in command, gives a detailed account of the organisation of the British Company's forces and the march through the Matabeli country. Writing of one's own generalship, it is perhaps difficult to avoid being considered egotistical, and a severe critic might perhaps accuse Major Forbes of fault in this respect. Still, his account of the march is clear and graphic, and, illustrated as it is by maps, etc., affords delightful reading. Such material as Major Forbes has to deal with could doubtless in more experienced hands be made more of. Major Forbes is a soldier, not a *littérateur*, or he would not have mentioned the fact that Captain Finch suffered on a certain day from toothache, or that Captain Raaff served out cookies to his men. Nevertheless, those chapters for which he is responsible are on the whole well written, and abound in adventure and daring of a type ever dear to a British heart, and they vividly recall episodes which illuminate the careers of Blake and of Raleigh, of Clive and of Hastings.

Mr. Rider Haggard, so well known in literary circles and so experienced in South African matters, contributes an interesting chapter dealing with what is known as the Patterson Embassy to Lobengula in '78.

Besides the history of the war from the pens of the leaders, the book contains a biography and photograph of each man who paid with his life for his share in this triumphant advance of the frontier of British South Africa, in this grand and successful attempt to plant the Union Jack upon the citadel of Buluwayo.

Pioneering in Morocco: A Record of Seven Years' Medical Mission Work in the Palace and the Hut. By Dr. ROBERT KERR, as Agent of the Presbyterian Church of England. London: H. R. Allenson, N.D. Pp. 251.

The necessity for medical men in a country like Morocco, where the hot iron and the knife are the only native surgical instruments, is well established by a book like this. Dr. Kerr left Scotland in 1886 as pioneer medical missionary to the Jews and Moslems in Morocco, and sailed for Rabat on the western Moorish coast, where he still has a "Medical Mission-House," although he has resigned his office as agent of the Presbyterian Church of England. His labours in Morocco have proved a blessing to its inhabitants, no fewer than five thousand annually applying to him for medical aid. The volume before us is beautifully illustrated from photographs, and contains much interesting information regarding Morocco. Although chiefly resident in Rabat and vicinity, Dr. Kerr visited Fez and Mequinez, and he appends useful "Notes on Health or Hygiene" for those intending to sojourn in Morocco. As an appeal for *medical* missionaries, his book is most convincing, for people of all classes flocked to him from far and near in order to have their sufferings allayed by his knowledge of medicine and surgery. In spite of their fanaticism, the Moors learned to love and respect Dr. Kerr. When a small-pox epidemic visited Rabat, he vaccinated the Jewish and Moorish children, although their parents had to overcome "a superstitious belief that if their children are vaccinated by a Christian, he will insert a small quantity of blood, and sooner or later they are sure to become Christians." It is touching to read Dr. Kerr's stories of the insistence with which suffering men and women, Moslems and Jews, demanded that he should stop and heal them; and one cannot fail to hope that many male and female medical missionaries will yet be prompted to follow his example, and to lighten the load of ignorance and suffering under which Morocco groans.

A Girl's Ride in Iceland. By Mrs. Alec Tweedie (*née* Harley). Second Edition. London: Horace Cox, 1894. Pp. 166. *Price* 5s.

Mrs. Tweedie strongly advocates the abolition of the side saddle, and when she rode through Iceland she rode astride, after the manner of the Icelandic women, and found riding man-fashion less tiring than on a side saddle. The first thing that struck her on landing in Iceland was "the sad, dejected look of the men and women who surrounded us. There was neither life nor interest depicted on their faces, nothing but stolid indifference. This apathy is no doubt caused by the hard lives these people live, the intense cold they have to endure, and the absence of variety in their everyday existence." At the same time, the weather she experienced was often very fine, a cloudless blue sky over-head, and magnificent sunsets closing the day, making, for instance, Snaefell Jökull, with its snowy summit, stand out against the most perfect sky, the colours constantly changing like a kaleidoscope. Of course, Mrs. Tweedie visited the Geysers and saw "a splendid spectacle, and one which left a great impression on our minds"; the height of the column of the "Stroker" Geyser being fully 60 feet. The party travelled in autumn, were five in number, and their total expenses for twenty-five days in Iceland amounted to £20, 1s. 8d., wine not included. The book contains numerous illustrations, a map, and a good deal of scientific information about a tour which, the authoress declares, "will ever remain engraven on my memory as one of the most agreeable experiences of my life." The chief guide in Iceland (Thorgrimmer Goodmanson) is by profession the English and Latin schoolmaster, acting as guide during the summer months. English cartridges and salmon-flies can now be procured in at least one shop in Iceland.

Cruising in the Netherlands: A Handbook to certain of the Rivers and Canals of Holland, Friesland, and the North of Belgium. By G. Christopher Davies. London: Jarrold and Sons, 1894. Pp. 208. *Price* 1s. 6*d.*

Mr. Davies describes three cruises, and notably an interesting tour he accomplished in the *Atalanta*, a screw steam yacht of 60 feet in length by 10 feet beam, and drawing 5 feet of water. He sailed from Lowestoft to Ymuiden, Amsterdam, Hoorn, Urk, Kampen, Stavoren, Medemblik, Helder, Alkmaar, Purmerend, Haarlem, Rotterdam, Dordrecht, Wemeldinge, Antwerp, Dendermonde, Ghent, Terneuzen, Middleburg, Veere, Zierickzee, and Flushing. The photographs are not very clearly reproduced, but there is a good map of the Dutch waterways, and the book will be invaluable to all desiring to enjoy what Mr. Davies styles "a glorious cruise." As Dutch canals "smell a little in hot weather," he recommends the cruiser to "select the long days of June." The Zuyder Zee and the great rivers and canals are, however, always fresh and pleasant.

Die Heiden-Neger des ägyptischen Sudan. Von HERMAN FROBENIUS. Berlin: Dietrich Reimer, 1893. Pp. 466. Index and Map.

This book is a well-written and accurate monograph on the Sudan, dealing with the geographical, ethnographical, and political condition of the country. There is also a good account of the history of the Sudan from Mehemet Ali's time to the present day.

The author has tried, and not unsuccessfully, to focus all the information we possess on the subject, and has of course laid the ancient and recent literature under contribution.

We think, on the whole, that he has been most successful in his descriptions of the various tribes, their habits, and customs.

There is no book in English which can compete with this, and for this reason we are glad to welcome it, and can assure those who may still be interested in the Sudan, that its perusal will save them a great deal of trouble, and that they will gain from it a graphic and accurate idea of the subject.

First Footsteps in East Africa, or an Exploration of Harar. By Captain Sir RICHARD F. BURTON, K.C.M.G., F.R.G.S., etc. Edited by his Wife, ISABEL BURTON. Two volumes. London: Tylston and Edwards, 1894. Pp. xxxiv + 209 and 276. *Price* 12*s. net.*

These are two volumes of the "Memorial Edition," of which two or three other parts have been already noticed in the pages of the *Magazine.* Besides the account of Sir Richard Burton's adventurous journey to Harar, the Appendices contain Speke's diary of his attempt to reach the Wady Nogal, meteorological observations by Lieutenants Herne, Stroyan, and the author, a condensed narrative of an attempt to reach Harar made by Lieut. Barker in 1841, etc. Every effort has been made to collect all the material incorporated in the work by Sir Richard Burton, and the publishers have been successful, except in the case of one Appendix which was omitted in the first edition, and may well be dispensed with in a work intended for the general reader.

Like others of the series, these volumes are well printed on good paper and are neatly bound.

China to Peru over the Andes. A Journey through South America. By Mrs. HOWARD VINCENT: with Reports and Letters on British interests in Brazil, Argentina, Chili, Peru, Panama and Venezuela, by Col. HOWARD VINCENT, C.B., M.P. With numerous Illustrations. London: Sampson Low, 1894. Pp. x + 333.

Mrs. Vincent is a well-known traveller, and has already published the record of more than one considerable journey. She therefore brings experience to aid her natural powers of description, and an apparently intuitive faculty of observing and noting down all that is specially interesting or characteristic, while omitting the wearisome trivialities which are the stock-in-trade of so many tourist authors. The result is a narrative which, like the author's energy, never flags, and a series of rapid but (as we well believe) accurate and certainly bright and intelligent sketches. Socially, these are sufficiently varied ; groups of fair devotees in the churches, and of fashionable loungers on the Alamedas, alternate with half-savage Gauchos and squalid and degraded "Indians." To her enthusiastic admiration of the magnificent Andean scenery, also, she gives eloquent expression. Nothing, she certainly supposed when crossing the ranges from Mendoza to Santiago de Chile, could exceed the grandeur of their scenery ; and yet, she declares afterwards, this "pales into insignificance" beside the scenes on the famous Oroya railway. But this was viewed from the comparative luxury of a railway carriage, and not in the condition of fatigue and collapse in which, as she so graphically describes, she crossed the pass of Uspallata.

Her account of the nitrate industry, in which such large fortunes have been made, is clear and interesting, as is her description of the Panama Canal track, with its lines of empty huts and idle waggons, deserted dredgers, and rusting machinery.

The opinions of a passing traveller on grave questions, social, political, and commercial, must necessarily be formed a good deal on hearsay. Mrs. Vincent by no means avoids such questions ; but she mainly leaves them to be dealt with in an appendix containing various reprints of recent papers on these subjects by her husband, whose name is a sufficient guarantee that they will be found both valuable and interesting. Inaccuracies of spelling, etc., might have been corrected with advantage.

Sunrise-Land: Rambles in Eastern England. By Mrs. Alfred Berlyn (Vera). London : Jarrold and Sons, 1894. Pp. 345. *Price* 3*s*. 6*d*.

The writer of this little book has one characteristic in common with her illustrious predecessor over the same ground—the author of *Robinson Crusoe*, whose *Tour through the Eastern Counties* was written more than one hundred and seventy years ago. Like Defoe, Mrs. Berlyn takes a roseate view of things ; she has an alert faculty for generous admiration ; she finds something to admire, and little to condemn, in nearly every place which she has occasion to mention in her pages. Indeed, in our sober judgment, she is over-profuse in the employment of eulogistic epithets, particularly in her description of the Broads, though the blemish obtrudes itself throughout. One other property she has in common with Defoe : like him, she is diffuse ; but whereas his is a diffuseness of matter, hers is a diffuseness, or rather a redundancy, of verbal description. Mrs. Berlyn is infected with that all too common, but none the less reprehensible, weakness, the desire to be "up-to-date," and accordingly resorts to "up-to-date," *alias* smart, phraseology. Nevertheless, we must do her the justice to add that her style, in spite of its ornate tendencies, and certain inaccuracies, as when she talks about "twirling streets" (p. 15), and a "town returning from an early stroll" (p. 87), is on the whole very pleasant and agreeable to read, as free from lapses of taste as it is bright and cheerful. In places she often drops, quite naturally, into punning (pp. 35, 88, 151). The chapter on Shiffkey shows something of real literary ability. The little book is one which we should be glad to put in our pocket when setting out for any of the districts it covers ; and we have no doubt it will particularly commend itself to those who have already made acquaintance with the sea-side resorts of East Anglia. The pages are plentifully variegated with illustrations, which are, however, of very unequal merit. Whilst several are excellent, others are poor and misleading, for instance, those appropriated to Cambridge ; others again really illustrate nothing specifically associated with the places whose names are appended to them. We do not care, we confess, for the somewhat pretentious title.

Sur les Routes d'Asie. Par GASTON DESCHAMPS. Paris: Armand Colin et Cie., 1894. Pp. 362.

Like ready-made clothes the title of a book is sometimes too ample for its contents. The volume before us is a case in point and in an exaggerated form. More than half the volume is taken up by retailing M. Deschamps' journey from Athens to Smyrna *via* Chios, where he spent a short time. The riding tour in search of inscriptions took him from Eski Hissar on the Smyrna-Ephesus railway by Harpas Kalesi, Bozdogan, Chinar, the ruins of Heraclea of Latmos, Asin, Melesso, Eski Hissar, Mugla, Buldur to Lake Egedir where he got tired of keeping a journal, and abruptly breaks off. To all intents and purposes the routes of Asia are limited to those of Caria, though he actually proceeded as far to the east as Egedir in Pisidia. Little is said about the inscriptions, but the author, who certainly has the eye of a painter, describes what attracts him with undeniable vivacity and spirit. Part of the country he visited can scarcely be said to be known in Europe even to geographers, and there even Kiepert's map was found to be of no service.

Expeditions to Prussia and the Holy Land, made by Henry, Earl of Derby (afterwards King Henry IV.), in the years 1390-1 *and* 1392-3. *Being the Accounts kept by his Treasurer during Two Years.* Edited from the Originals by LUCY TOULMIN SMITH. Printed for the Camden Society, 1894. Pp. cxiv + 360.

If this, the latest publication of the Camden Society, possesses little direct geographical interest, it nevertheless throws abundant light on the work and ways of travellers in the fourteenth century. The accounts, written in quaint dog-Latin, were kept with great fulness and, we are inclined to think from the internal evidence which they afford, with accuracy, and should, therefore, prove of considerable use to the antiquary. The manner in which the papers have been edited is admirable, the notes pointed and helpful, the introduction and indexes full and exhaustive. But we should have liked to have seen this handsome volume accompanied by a couple of route-maps.

Studies in Forestry. By JOHN NISBET, D.Oec., of the Indian Forest Service. Oxford: At the Clarendon Press, 1894. Pp. 335. *Price* 6*s. net.*

The title of this handy volume on Forestry is somewhat misleading to the general reader. It contains nothing relating to the artistic nature or habits of trees, or to the æsthetics and technique of Landscape Forestry. The book is simply an elaboration of a series of lectures on Sylvicultural subjects, delivered by the author, in 1893, in the Botanic Garden at Oxford. The substance of the lectures is founded upon the science and methods of sylviculture in vogue in Germany. From a sylvicultural point of view, the work is a useful contribution to our literature on the subject, and will well repay the careful study of all interested in the Forestry question.

With the object of utilising waste lands, and those that cannot in these times be more profitably used for agricultural purposes, the establishment of forest schools and training institutions on Continental methods for British foresters is ably advocated, under the conviction that the greater part, or all, of the £9,000,000 annually paid for timber imported from Northern Europe would thereby be saved to this country, and add much to the prosperity of our rural districts. It is further maintained that, if due attention were paid to the selection of the proper species of trees for the various soils and situations, and the correct principles of all Forestry operations were properly understood and practised throughout Britain, there would be no necessity for the stipulation in contracts which compels the use of foreign wood in preference to home-grown timber.

The principles of sylviculture, as propounded by German authorities, and their application to British Forestry, are discussed in detail ; and the two last chapters are devoted to a useful summary of the diseases of trees arising from fungoid and insect attack. The planting of mixed woods, and the under-planting of them at a certain stage of their growth, is strenuously advocated as the great panacea for nearly all the diseases and accidents which affect tree life in forests.

The geographical designations "Britain," "Great Britain," "United Kingdom," and "England" are rather loosely used. Much confusion also arises from the indiscriminate use of the common names of trees abroad, which are not generally known and used in this country. "Black Pine," "Pitch Pine," "Yellow Pine," and the like, are not terms applied to any class of trees cultivated for timber in Britain. The "Cluster Pine" and the "Maritime Pine" are stated, on p. 30, to have been introduced to Britain two centuries apart! while both are only common names of the same species of pine, *Pinus Pinaster*. On the previous page, the Beech, it is stated, was not introduced to Scotland until the beginning of the eighteenth century! Errors of such a nature in an educational work are blemishes that call for a careful revision, although they may not affect the principles of sylviculture that are so well expounded.

Les Kolas Africains. Monographie Botanique, Chimique, Thérapeutique et Pharmacologique. Par le Dr. ÉDOUARD HECKEL. Paris : Société d'Editions Scientifiques, 1893. Pp. 406.

This large work, by Professor Heckel of Marseilles, contains every fact of interest that is known concerning the kola nut ; and, as might be expected from one who has contributed so much to the knowledge of the useful plants found in the French colonies, the work is in many respects a model of careful research. Professor Heckel gives a very complete account of the natural history of the true plant, *Cola acuminata*, Robert Brown (nat. ord. *Sterculiaceae*), which is found especially in West Africa, between 10° lat. N. and 5° lat. S. The chemical analyses and representations of *Cola digitata*, Mast., *Cola gaboniensis*, Mast., *Heritiera littoralis*, Ait., *Pentadesma butyracea*, Don., are of particular value, as the seeds of some of these plants resemble those of the true kola and occur in commerce as adulterations ; but they are found to contain no caffeine, the alkaloid upon which the value of kola mainly depends, and which is also the chief active principle of tea and coffee. The analysis of the kola seed made by Professors Heckel and Schlagdenhaufen, and published in 1884, is reproduced and extended here. In addition to between 2 and 3 per cent. of caffeine they found a minute quantity, 0·023 per cent., of theobromine (the active principle of *Theobroma Cacao*, Linn., the cacao or chocolate tree), between 1 and 2 per cent. of tannin, a small percentage of fat, and a body named kola-red.

In 1892 a German chemist, Knebel, made the important observation that the kola contains a body, kolanine (Heckel's kola-red), which is easily broken up into caffeine, glucose, and kola-red. This gives kola a higher percentage of caffeine (3·785 per cent.) than usually found in either tea or coffee.

The author enters at considerable length into the question of the action of kola upon muscle, and, basing his conclusions partly upon a comparison of the muscle tracings taken by Marie and other investigators into the administration of caffeine, kolanine, and kola respectively, and upon a considerable number of general observations made during marches by French military officers and military surgeons, he holds strongly the opinion that the action of kola is not to be explained, as is held by Sée and others, solely by the action of the *free* caffeine which it contains, and that kola is able in a higher degree than other caffeine-containing substances to sustain muscular power during severe exertion. Except in degree, therefore, the pharmacological and therapeutic actions of kola would seem to be essentially similar to those of other caffeine-containing substances.

It is scarcely accurate for the author to say that the properties of kola were unknown before he made them known in 1884 (p. 16). Caffeine was found in kola by Daniell, and an analysis was made in 1864 by Attfield, who found a little over 2 per cent. of caffeine—a fact referred to by the author on p. 157.

Geographisches Handbuch zu Andrees Handatlas. Herausgegeben von A. Scobel. Bielefeld und Leipzig: Velhagen und Klasing, 1894. Pp. viii + 687.

Political, commercial, and statistical aspects of geography are dealt with by a dozen specialists in this handbook to Andree's *Atlas.* The first 44 pages are given to Physiography, the last 36 to Commercial Geography. The great bulk of the book deals in detail with the various countries of the world. The headings under Great Britain and Ireland may be quoted to show the nature of the treatment: position and dimension, relief and climate, population, constitution, law, army, churches, schools, products, trade and industry, commerce, finance and customs, German consulates, gold and credit, weights and measures, transport, counties and towns, with statistics. Over one hundred excellent diagrams of statistics and diagrammatic maps are scattered throughout the book. A full index completes what is a most useful reference-book, especially for those who possess Andree's *Atlas.*

Manual of the Administration of the Madras Presidency. Vol. III. *Glossary, containing a classification of terminology, a Gazetteer and Economic Dictionary of the Province, and other information, the whole arranged alphabetically and indexed.* Madras: Government Press, 1893. Folio, 1162 pp.

This is the concluding volume of the *Madras Administration Manual*, begun about ten years ago under the government of Sir M. E. Grant Duff, by Mr. C. D. Macleane, Mus. Doc., an able member of the Civil Service. In a folio of 1046 pages, double columns, brevier type, we have here a cyclopædia of information relative to places, products, fauna, castes, etc., in Southern India, with an amount of etymologies that may well appal the reader, who had better receive them *cum grano salis.* Mr. Macleane says the matter is arranged alphabetically, but the reader soon finds that, besides printing most proper names without a capital, he has adopted a method of spelling that neither we nor our fathers have known; and under a heading like *Pau* you find such subjects as Palamcottah, Pali, Pitamaha, Poligar, etc., all arranged without a break. Well did such an alphabetical arrangement require an index of 460 columns to tell us that *sânt* is found under "tikry," *pâl* under "paul," etc., and even this fails us occasionally. The amount of condensed information on such a vast variety of subjects makes it all the more unfortunate that it has not been arranged in a form more readily accessible to people of ordinary intelligence.

Gazetteer of the Gujrat District, 1892-93. Second Edition. Revised by Captain D. S. P. Davies, B.S.C., Settlement Collector, Punjab Government. Pp. viii + 170 + xlviii.

The Gujrat District, which comprises the northern portion of the tract between the Jhelum and Chenab rivers, is a purely agricultural district with no large town in it and hardly any manufactures. In its history there is little of general or special interest, but it is notable as containing the field on which was fought the great battle in which Alexander the Great defeated Porus, and where he built a city to commemorate his victory. The inhabitants belong mainly to the Jat and Gujar tribes ; but though Hindu by blood, the vast majority of them are Mohammedan in religion, and it seems certain that this is the result of proselytising during the last 200 or 250 years. The Gazetteer, like the other district memoirs issued by the Indian Governments, gives a very complete and trustworthy account of the district, and in this new edition the statistical information has been thoroughly revised and brought up to date. The chapter on social and religious life is specially full, and contains many interesting particulars. The value of the work would have been much enhanced if it had contained a map of the district and a glossary of vernacular and technical terms. The absence of any map is the most noticeable defect.

The Story of Africa and its Explorers. By Robert Brown, M.A., Ph.D., etc. Vol. III. London : Cassell and Co., 1894. Pp. 312, with 200 Illustrations.

This, the third volume of *The Story of Africa*, concludes the work, and both author and publisher are to be congratulated upon the highly successful efforts they have made to produce such a splendid and valuable contribution to the literature of Africa.

The volume before us deals with some minor journeys across Africa, The Equatorial Province and the Emin Pasha Relief Expedition, The Sahara, Missionary Effort in Africa, and The Scientific and National Explorers. It is well up to date. Again we have to notice the excellence of the illustrations, and the gallery of explorers' portraits adds greatly to the value of the book.

The young can see for themselves the kind of men who have thrown light upon the Dark Continent, and who in so many cases have given their lives in endeavouring to open up the country to the blessings of civilisation.

It is impossible to refer in detail to the contents of this book, but we can as warmly commend it as we did the two former volumes.

Canadian Independence, Annexation, and British Imperial Federation. By James Douglas. New York and London : G. P. Putnam's Sons, 1894. Pp. xii + 114. *Price 75 cents.*

The author, a Canadian long resident in the United States, here very ably discusses the alternative relations into which the Dominion can possibly enter, when the political change, which is, he believes, imminent, takes place. The slow progress of Canada he attributes to its climate, the poverty of the soil in the eastern provinces, the obstacles to the development of its mineral resources, etc., and believes that annexation by the United States would have no effect in improving the well-being of the Canadian workman. Nor is it expedient for the United States to add more States to its large and loosely connected federation. On Imperial Federation Mr. Douglas looks with a favourable eye, and holds that independence is a first step towards such a union. Greater independence with regard to internal affairs would no doubt accompany the establishment of a federation ; but we doubt the advantage to be derived from independence previously established, especially with regard to foreign relations, which might not be willingly resigned into the hands of an imperial council.

The Great Pyramid, by Modern Science, an Independent Witness to the literal Chronology of the Hebrew Bible and British-Israel Identity, in accordance with Brück's "Law of the Life of Nations": with a new Interpretation of the Time-Prophecies of Daniel and St. John. Translated from the French of M. CHAS. LAGRANGE. London: Charles Burnet and Co., 1894. Pp. xiv + 278. *Price* 10s. 6d.

The title shows sufficiently the character of this work. Readers who are enthusiasts on the subjects of which it treats will find many curious manipulations of figures in the volume.

Cassell's Gazetteer of Great Britain and Ireland. With numerous Illustrations and Sixty Maps. Vol. I. A-Ched. London: Cassell and Co., Limited, 1894. *Price* 7s. 6d.

There are several excellent features about this new Gazetteer. The printing is clear, the illustrations good, and the binding pretty. The extremely difficult task of writing clear, comprehensive, and concise notes on hundreds of places is very well done. The population, the distance from the nearest railway station, and from London or Dublin, are tabulated at the foot of each column for the places mentioned in it. It would have been desirable to give the distance of Scottish places from Edinburgh. We have read many of the notices, and have found few points we should wish altered. Perhaps the present is occasionally sacrificed to the past, and we wish that some space devoted to the notice of churches had been given to telling more about the industrial conditions of a town or district. The maps are not quite worthy of the rest of the work, but we hope that contoured, climatic, geological, and economic maps will be published before the completion of the Gazetteer, and so make it an altogether admirable book of reference about these islands.

The Story of the Sea. Part I. London: Cassell and Co.

In this part are chapters on sailing vessels and their rigs, on the old and the new man-of-war. It contains much that is interesting and instructive, and for boys especially it is a capital work.

The Statistical Year-Book of Canada for 1893. Ottawa: Government Printing Office, 1894. Pp. 924, and Index.

An excellent series of papers treating of the success, or otherwise, of various industries in our Western Empire, this work, published for the ninth year, will be valuable as a work of reference for those interested in the welfare of Canada. The various reports, illustrated by statistical tables, are exhaustive, and will prove extremely valuable to speculators and intending emigrants. The book maintains its reputation for accuracy in detail.

Cartografia. Manuale teorico-pratico, con un Sunto sulla Storia della Cartografia. Di EUGENIO GELCICH, Direttore dell' I.R. Scuola navale in Lussinpiccolo Milano: Ulrico Hoepli, 1894. Pp. vi + 257.

On p. 277 the *Kartenkunde* of E. Gelcich and Professor Sauter was noticed. That work was devoted more to the history of cartography, whereas the present little volume treats of the construction of the various projections both geometrically and analytically. The explanations and calculations are given in a remarkably simple and clear style; and tables are added of the elements used in constructing the network of each projection. The manual will certainly be useful, as the author claims in his preface, to all those whose profession demands a knowledge of the elements of cartography. A bibliography at the end contains the titles of works that should be studied by more advanced students.

The Coolgardie Goldfield: Western Australia. By ALBERT F. CALVERT, M.E., etc. London: Simpkin, Marshall, Hamilton, Kent and Co., Limited, 1894. Pp. ii + 114. *Price* 1s.

At a time when so much attention is being directed towards the gold discoveries at Coolgardie and its neighbourhood, Mr. Calvert's compilation ought to be welcome. He has gathered a very considerable amount of information contained in letters, reports, "opinions," and interviews, with some original matter, the whole making a useful manual. Want of water and of means of transport are the two great barriers in the way of the prosperity of what promises to be a very rich auriferous region; but since the author's pages went to press additions have been made to the water supply, and the means of communication have been improved. Mr. Calvert justly remarks upon the want of population and capital in Western Australia. The latter must first be obtained, but it may be questioned if the policy of the Government of the colony in the past will encourage British investors to sink much money in that part of Australia. The matter is, however, one for individual capitalists to settle each for himself; and those wishing further knowledge regarding a new and, to all appearance, a promising gold-yielding area may consult this little volume with advantage.

The Traveller's Guide to Western Australia. Accompanied by latest Maps and Plans, and a Directory of Mining Companies. Perth, W.A., Adelaide, Broken Hill, and London: E. S. Wigg and Son, 1894. Pp. 52. *Price* 3s.

The chief feature of this work is the collection of large and clear maps and plans by which it is accompanied. These will be found useful, as they convey much information, and are creditably produced. The text gives particulars on such points as gold fields, other minerals besides gold, and the localities in which they occur, routes, fares, hotels, government officials and departments, banks, postal and telegraphic information, duties, positions of the principal places in Australia, railways, tariffs, Chinese immigration, and a directory of mining companies. Travellers in Western Australia are certain to find the volume of considerable practical utility.

Finland, or "The Land of a Thousand Lakes:" A short Description of a Voyage to and a Sojourn there. With numerous Illustrations. Helsingfors: Central Printing Office, 1894. Pp. 41, and a map.

This little book has been prepared at the instance of the Finnish Tourist Association with the laudable desire of inducing Englishmen to visit the country. The prices of tickets, the cost of living, and other particulars are given; and various routes to see the principal sights are suggested. The illustrations are numerous, but unfortunately are process blocks of poor quality, and several of them might advantageously be dispensed with in future editions.

Handbook for Norway. With some Account of the Route viâ the Götha Canal to Stockholm, and the Route viâ Sweden to St. Petersburg. By E. J. GOODMAN. Hull: Thomas Wilson, Sons, and Co., 1894. Pp. viii. + 85, Illustrations, and Route Map.

Mr. Goodman, who is well known as the author of *The Best Tour in Norway*, has compiled this *Guide* for Messrs. Wilson and Sons, the shipowners. It contains sketches of four tours in Norway and one in Sweden, as well as information of a general character for the guidance of tourists. On the whole the work has been well done, and the book will be of great service to tourists. It may be useful to point out a few inaccuracies we have detected. Thus, Næsset is *in* Bygland not 2 kil. from it (p. 55), and the road up the Sætersdal does not end at Viken, but at Bykle. The height of the Rjukanfos is given, as in Baedeker and elsewhere, as 800 feet, whereas it is actually only 267.

There are numerous illustrations in the book, most of them rather rough.

Authorised Guide to Craigmillar Castle. By George Good, F.S.A. Edinburgh: Andrew Elliot, 1894. *Price* 6*d.*

A very interesting and useful little book. The author devotes the first part to a description of the panorama from the Castle tower, many historical anecdotes of the places seen being introduced. Then the architecture of the Castle is described, the changes that the building has undergone being detailed at length. The last part of the book is occupied by a history of the various occupants and visitors the Castle has had. Two views and a plan are given.

Black's Guide to Belfast, the Giant's Causeway, and the North of Ireland. 22nd Edition. London: A. and C. Black, 1894. Pp. 267-348. *Price* 1*s.*

When a book reaches its twenty-second edition, nothing remains to be said about it unless it has been allowed to fall out of date. That is not the case with the above *Guide*, which gives full particulars about routes and means of travelling, and is well provided with maps.

Black's Guide to the Trossachs, Stirling, Loch Katrine, and Loch Lomond. Twenty-third Edition. London: Adam and Charles Black, 1894. Pp. xxvi + 46.

This guide is an excerpt from *Black's Guide to Scotland* with a chapter prefixed on the topography of "The Lady of the Lake," by the late Sir G. Biddell Airy. The large map of Stirling is omitted, and a new map is given of the Trossachs and Loch Lomond district.

De Stroomen op den Nederlandsche Kust. (*The Tides off the Dutch Coast.*) Uitgegeven door het Koninklijk Nederlandsch Meteorologisch Instituut. 2de Vermeerderde Druk. Utrecht: J. Van Druten, 1894. *Price* 0.90 *fl.*

For the benefit of sailors cruising off the Dutch coast, particulars as to the turning of the flood and ebb-tide, the direction and speed of current, are given in diagrams for each day after full and new moon for the following stations:—Terschelling Bank, Haaks, Maas, Schouwen Bank, Noord Hinder Bank. The average mean monthly temperatures of air and of surface-water are tabulated. The number of thunderstorms at each station is given, and shows an increase with the latitude. The text is in Dutch and English.

South America: The Neglected Continent. By E. C. Millard. With a Historical Sketch from a Missionary Point of View, by Lucy E. Guinness. London: Marlborough and Co., n.d. *Price* 1*s.*

This continent, almost neglected by the English-speaking preacher, was visited last year by a missionary party, whose chief interest was in Protestant propaganda. The letterpress describes their tour from this point of view, and narrates the story of Protestant missions to Catholics and natives in South America. Some of the illustrations and maps are of interest geographically.

NEW MAPS.

WORLD.

BRITISH EMPIRE, Map on a Uniform Scale of the ——, showing its Extent and the Dates of the Acquisition of its Parts. By T. Ruddiman Johnston, F.R.G.S. *Price* 21*s.* *Ruddiman Johnston and Co., London.*

The above is a large wall map, measuring 72 inches by 63. The various possessions are represented in a series of maps, a small map of the world showing their relative position. Various forms of colouring are used to indicate the dates of acquisition of territory, but, as one form is used for all annexations up to 1800, recourse must be had to chronological notes printed on each map. Much useful information is also given with regard to population and areas. Errors have not been entirely excluded. There is nothing to show that the territories of North Borneo, with the exception of Labuan, form a protectorate ; Western Australia should not be coloured as though acquired before 1800, seeing that it was only in 1826 that formal possession was taken of King George's Sound in order to anticipate the French. Nor do we know why the whole south coast of Arabia is assigned to Great Britain.

ASIA.

CHINA, Map of North-Eastern ——. By Ch. Waeber, 1893. Scale of Mid-latitude, 1:1,355,000, or 1 inch = 185 miles. 4 sheets.

L. Friedrichsen und Co., Hamburg.

A long residence in Korea as Russian Minister has enabled M. Waeber to collect abundant and accurate topographical data for the compilation of this map The execution is clear, and the chief towns are distinguished by large type. We believe that these sheets are a first instalment of a map of the whole empire.

ATLAS.

ATLAS GÉNÉRAL VIDAL-LABLACHE : Histoire et Géographie. 137 cartes, 248 cartons, index alphabétique de plus de 40,000 noms.

Paris : Armand Colin et Cie., 1894.

With the publication of the index part this excellent atlas is completed. Over ten years have been spent in its preparation by M. Vidal de la Blache and his numerous collaborators, who have prepared special portions of the work. Thus Professor Welsch is responsible for the geological maps, Dr. Seignobos has edited many of the historical ones, and various specialists have been intrusted with others. The drawing is the work of M. Eugène Létot, who has succeeded in producing a volume of maps clearly outlined, remarkably free from confusion and crowding of names, and effectively as well as pleasantly coloured, though the tints are not always quite distinguishable by artificial light.

The historical section occupies over sixty pages, and is very rich in maps illustrative of mediæval and modern times. Maps showing the discoveries of the fifteenth, sixteenth, seventeenth, and eighteenth centuries are given, and an attempt has been made to show the economic conditions and trade routes in the second century. Several old maps are reproduced, but on a small scale. These ancient maps should occupy a much more important place in historical atlases than they usually do. We cannot properly understand the history of any period without a knowledge of the geographical notions of the people then living; and this contemporary maps help us to acquire, whereas modern ones are too often only a hindrance. An infinite amount of nonsense has been written about the discovery of America alone owing to this "bondage to the modern map." The gradual colonial expansion and contraction of various States might be more fully illustrated on world maps, which would present a picture of all the possessions of a country at a given period to the student, who has usually to piece them together for himself from a few regional maps.

The maps in the modern division of the atlas illustrate not only the political boundaries and the relief, but also show the geological, climatic, and various economic and social conditions of the countries about which such information can be obtained. These are not put into separate sections but brought together, so that not only is it easy to make comparisons, but one is almost forced to do so. Thus Sheets 64 and 65, which face each other, contain a map of the principal food-products of the world, and also maps of France showing the distribution of agriculture, forests, and vineyards, with small large-scaled insets of the Bordeaux, Burgundy, and Champagne districts: the relative proportions of land covered by forests in several European States are shown by clear diagrams, as also the mean annual vintage of European countries, and the mean annual wheat crop of various countries of the world. From this example it will be evident how often within the compass of a double page an enormous mass of information is collected and co-ordinated. Colonial maps follow those of the mother-country. An excellent inset is one showing the antipodes of New Zealand. The large number of economic maps is a praiseworthy feature of this atlas, which is rightly called a General Atlas.

As many of the maps have been published for some time, there are several corrections to make; for instance, the recently fixed African boundaries are not inserted. One of the great drawbacks of the atlas is the lack of proportion among the scales of the various maps; but probably this is due to economical considerations. Another fault is the want of systematic colouring, a country and its colonies being sometimes distinguished by one tint, sometimes by another. It would be well if some international agreement could be come to, not only about the colouring of countries but also of contours, climatic maps, density of population, and so on.

But M. Vidal de la Blache has given us so much to be grateful for that it is almost ungracious to complain. Every time we turn over the pages of his atlas we find something of new interest, and are confronted by materials for fresh generalisations. It is the most interesting and useful atlas we know, full of excellent suggestions and not a few realisations of effective diagrammatisation. We look forward to the extension and systematisation of these many excellences, and their embodiment in a really complete systematic atlas, of which this work is a hopeful forerunner.

CHARTS.

COLUMBIA BAY, Gulf of Darien. No. 1405.

MANDINGU HARBOR, Gulf of San Blas. No. 1406.

CHIRI-CHIRI BAY, Pacific Coast of Colombia. No. 1407.

SAN MIGUEL BAY AND DARIEN HARBOR, Gulf of Panama. No. 1410.

Presented by the Hydrographer, U.S. Navy.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

TENTH SESSION, 1893-94.

THE Council has the honour to submit the following Annual Report on the Session.

MEMBERSHIP.

The gains and losses in the number of Members have been as follows :—

Number on 31st October 1893,		1417
New Members elected,		77
		1494
Deduct by Deaths,	24	
,, Resignations,	53	
		77
Number remaining on 31st October 1894,		1417

There has, therefore, been no change in the number of Members.

This number is made up as follows :—

Edinburgh,	792
Glasgow,	280
Dundee,	85
Aberdeen,	52
English and Foreign,	208
	1417

Of the above, 184 *are Life Members.*

DIPLOMAS OF FELLOWSHIP.

The Council, acting on the recommendation of the Education Committee, has conferred the Ordinary Diploma of Fellowship, without fee, on Lieutenant D. S. Buist.

Ordinary Diplomas of Fellowship were also conferred on the following gentlemen :—Matthew A. B. Gilmour ; Alfred Charles Jonas, F.R.Hist.S.; J. Mackay Bernard, B.Sc., J.P., F.R.S.E.; Arthur Giles ; Lieut. George Johnstone, R.N.R.; Andrew J. Herbertson, F.R.G.S.; and George S. Smart, M.A.

FINANCE.

The Council submits the following Financial Statement :—

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

From 31st October 1893 *to 31st October* 1894.

FUNDS AT CLOSE OF LAST ACCOUNT :—			
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,			£1102 19 9
£400 North British Railway 4 per cent. Consolidated Lien Stock, cost, 30th December 1890,			496 2 0
			£1599 1 9
Cash in Account Current with Bank of Scotland at Edinburgh, £313, 13s. 8d., and at Glasgow, £7, 14s.,		£321 7 8	
Due by Secretary, £11, 0s. 4d., and by Honorary Treasurer, £1, 17s.,		12 17 4	
			£334 5 0
			£1933 6 9
ENTRANCE FEES—73 at £1, 1s.,		£76 13 0	
ORDINARY SUBSCRIPTIONS :—			
9 Life Members at £10, 10s.,		91 10 0	
4 Annual Subscriptions of £1, 1s. for year 1891-92,	£4 4 0		
25 Do. Do. 1892-93,	26 5 0		
1144 Do. Do. 1893-94,	1201 4 0		
20 Do. Do. 1894-95,	21 0 0		
		1252 13 0	
Diploma Qualification Fees—3 at £1, 1s.,		3 3 0	
		£1,426 19 0	
FEES received for Society's Diploma—7 at £1, 1s.,		7 7 0	
SUMS received under the Society's Scheme for the encouragement of Geographical Education,		6 19 6	
LECTURE TICKETS sold,		46 6 0	
PROCEEDS OF MAGAZINES sold,		63 19 11	
DIVIDENDS,		54 5 10	
			1605 17 3
			£3539 4 0

MAGAZINES, Printing, Paper, Lithographing, etc., from Nos. 9 to 12 of Vol. IX., and Nos. 1 to 8 of Vol. X., all inclusive, and for Postages, etc.,		£677 0 5
Less: Received during the year for Advertising,		60 0 0
		£617 0 5
GENERAL PRINTING,		26 5 6
BOOKS and other Furnishings for Library,		50 3 4
RENTS OF HALLS, and other expenses of Lectures,		185 9 8
RENTS OF COUNCIL ROOM, Taxes and Gas, Repairs, Insurance, etc.,		129 17 10
SALARIES :—		
To *Secretary*, year to 15th October 1894,	£200 0 0	
,, *Librarian and Clerks*,	269 10 0	
		469 10 0
EXPENSES connected with Society's Education Scheme,		16 3 5
MISCELLANEOUS, including Stationery, General Expenses, Advertising, Cleaning, Bank Charges, Postages, and Office Furniture,		103 12 4
		£1598 2 6
FUNDS AT CLOSE OF THIS ACCOUNT :		
£1000 Glasgow and South-Western Railway 4 per cent. Funded Debt, cost, 29th May 1885,	£1102 19 9	
£400 North British Railway 4 per cent. Consolidated Lien Stock, cost, 30th Dec. 1890,	496 2 0	
£300 New Zealand Government 3½ per cent. Inscribed Stock, cost 30th May 1894,	305 13 6	
	£1904 15 3	
Cash in Account Current with Bank of Scotland at Edinburgh, £12, 14s. 1d., and at Glasgow, £5, 5s.,	17 19 1	
Due by Secretary, £3, 1s. 3d., and by Honorary Treasurer, £15, 5s. 11d.,	18 7 2	
		1941 1 6
		£3539 4 0

Edinburgh, 9*th November* 1894.—I have examined the Accounts of the Royal Scottish Geographical Society, for the year ending 31st October 1894, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and find the same correct and sufficiently vouched.

HUGH BLAIR, C.A.

The Statement shows that during the past year the Society's funds have increased by £7, 14s. 9d.

The Council desires to express its acknowledgments to Mr. Hugh Blair, C.A., the Honorary Auditor, who has again examined the accounts of the Society.

Meetings.

Twenty-four meetings were held during the Session. Of these 12 were in Edinburgh, 5 in Glasgow, 3 in Dundee, and 4 in Aberdeen. Lectures were delivered at these meetings by Mrs. Grove, Miss Flora Shaw, Miss Annie Taylor, Mr. W. S. Bruce, Mr. W. L. Calderwood, Captain A. E. J. Cavendish, Dr. C. W. Donald, Mr. Herbert Giles, Mr. Alex. Hosie, Mr. E. Delmar Morgan, Mr. W. G. Burn Murdoch, Mr. George R. Parkin, General Lord Roberts, M. Joël le Savoureux, Mr. Henry Seebohm, and Mr. Stuart-Glennie.

Education.

Again two courses of lectures were organised by the Education Committee. In November and December 1893, Mr. W. B. Blaikie delivered a course of four lectures, "On Teaching the first Principles of Geography and Map-making." The number of tickets taken out was 70.

After Christmas, Mr. W. L. Carrie, M.A., English Master in George Watson's College, delivered a course of six lectures on "Historical Geography." About 90 tickets were taken out.

Both courses were attended to a large extent by teachers, and were highly appreciated.

A Christmas Lecture for young people was delivered on December 27th by Mr. A. J. Copplestone, the subject being "Travel in East Africa." The lecture was illustrated with numerous lantern slides.

Two courses of lectures have been organised for the ensuing Winter Session :—

Professor Patrick Geddes will give a course of six lectures on "Scotland, Past and Present : a Study in Regional Evolution."

Mr. H. M. Cadell will give a course of four lectures, after Christmas, on "Mountains and Mountain Ranges."

Both courses will be specially adapted for teachers.

The Society's Magazine.

The *Magazine* has been conducted to the satisfaction of the Council, which desires to express its obligations to the writers of signed articles, as well as to the undermentioned, who, amongst others, have rendered valuable assistance to the editors :—Miss Scott Dalgleish ; The Hon. J. Abercromby ; J. G. Bartholomew ; J. T. Bealby ; W. B. Blaikie ; F. Bosse ; Dr. James Burgess ; H. M. Cadell ; C. G. Cash ; Dr. Scott Dalgleish ; H. N. Dickson ; Dr. G. Dods ; Dr. R. W. Felkin ; General Forlong ; J. G. Goodchild ; Alexander Gow ; John Gunn ; D. P Heatley ; S. Heatley ; Rev. Dr. Henderson ; A. J. Herbertson ; J. Graham Kerr ; Professor G. Cargill Knott ; J. W. M'Crindle ; Sheriff Mackay ; R. J. Mackenzie ; R. C. Mossman ; Dr. John Murray ; Dr. David Patrick ; Ralph Richardson ; Charles Robertson ; Dr. George Smith ; General Sir R. Murdoch Smith ; J. Arthur Thomson ; Dr. R. H. Traquair ; Coutts Trotter ; Professor Wallace ; A. Silva White.

LIBRARY AND MAP DEPARTMENT.

During the past Session 525 books, 76 pamphlets, 28 atlases, and 172 map-sheets have been added to the Library and Map-Room. Six new exchanges of periodicals were effected, and others await consideration. The number of books borrowed by Members was 2266. The expenditure amounted to £50, 3s. 4d., which included the cost of binding.

Both Members of the Society and the general public continue to make increasing use of the Library, the time of the officials being much taken up in supplying geographical information to inquirers.

Maps of places which the events of the day bring into prominence are exhibited, from time to time, on a screen, for the convenience of callers at the Society's Rooms.

The Council desires to thank the Foreign and Colonial Governments who have continued to present official publications to the Library, and also private donors, among whom may be mentioned Mr. Geo. F. Black ; Mr. T. R. Buchanan, M.P.; Dr. Hugh Cleghorn ; Mr. John Craig, of Cheltenham ; Sir Geo. Grey, K.C.B. ; Mr. J. Gunn ; Mr. David MacRitchie ; Prof. Carlos de Mello ; Mr. A. G. Nash ; Prof. Penck ; M. Nicolas de Seidlitz ; Dr. E. Tietze ; and Mr. Wm. Young ; and to record its acknowledgments in particular to Mr. Clements R. Markham, C.B., Pres. R.G.S., for the *Raccolta di Documenti e Studi pubblicati dalla R. Commissione Colombiana*, a magnificent work lately presented by him to the Society.

PLACE-NAMES COMMITTEE.

The Committee has held sittings throughout the Session, having been engaged in the revision of place-names in various counties of Scotland, especially Ayrshire, Wigtownshire, and Caithness.

CORRESPONDING SOCIETIES.

The Tyneside and the Liverpool Geographical Societies have granted the privileges of Corresponding Societies to this Society, and have accepted similar privileges in return.

THE SOCIETY'S BRANCHES.

The Council desires to express its acknowledgments to the Conveners, Secretaries, Honorary Treasurers, and Members of the Committees in Glasgow, Dundee, and Aberdeen, for the efficient control they have exercised over the Society's Branches in those cities.

INDEX: VOL. X.

In the following Index the Alphabetical Order *is adhered to throughout. The more important references and all sub-headings of Articles are indicated by small capitals. Names of Books and of Vessels are in Italics; titles of Papers in deeper type. Contraction,* rev.=*Review in the Magazine.*

MAPS AND ILLUSTRATIONS.

MAPS.

ILLUSTRATIONS.

END OF VOLUME X.

PRINTED BY T. AND A. CONSTABLE, PRINTERS TO HER MAJESTY,
AT THE EDINBURGH UNIVERSITY PRESS.

BINDING SECT. AUG 2 - 1967

G 7 S43 v.10

The Scottish geographical magazine

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