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NORTHERN NIGERIA.*

By Brigadier-General Sir FREDERICK D. LUGARD, K.C.M.G., C.B., D.S.O., High Commissioner.

The Protectorate of Northern Nigeria, concerning which I have been invited to address you this evening, is almost the only part of British tropical Africa which possesses a history extending over many centuries, or a semi-civilization of its own which dates long prior to the advent of Europeans within its borders. These facts give to it a unique interest. The Niger Sudan, as a whole, may be said to extend from Lake Chad and the Shari river on the east to the Atlantic on the west, and from the Saharan desert on the north to the forest belt bordering the Gulf of Guinea on the south. The eastern part of this great area forms what is now called Northern Nigeria, its western boundary being approximately the 3rd meridian of east longitude.

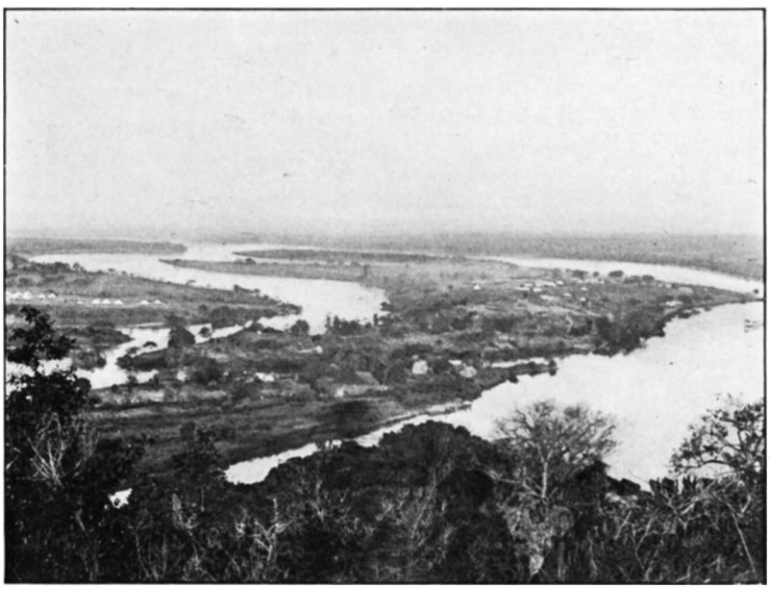
The early history of this part of the continent is wrapped in much obscurity. About 500 B.C. the Phœnicians had sailed to the west coast, and it is possible that Necho, king of Egypt, had visited it a century earlier. Herodotus, however, writing in the fifth century B.C., knew nothing of West Africa beyond legend, and the first mention of the "Niger" is found in the writings of Pliny, A.D. 77, and was the result of the Roman explorers, Julius Maternus and Suetonius Paulus, some few years previously. Ptolemy's map, A.D. 140, is the first to give a sketch of the upper part of the Niger of Lake Chad. In the seventh century the Mohammedan religion, then in its infancy, was carried by conquering armies into Africa, and spread across the Sahara. Great cities arose in the Niger Sudan, and the battle-fields of rival dynasties, of whose origin

* Paper read at the Royal Geographical Society, November 4, 1903. Map, p. 152, from a map supplied to the Intelligence Department by Sir Frederick Lugard.

and wars we have no record, studded the fertile plains of the Niger. Sir H. Johnston assigns 1100 as the probable date of the founding of Timbuktu, and the map of the Sicilian Edrisi (1154), on which Kano appears, summarizes the information acquired by Arab geographers up to this date. The trade, chiefly in ivory, pepper, and slaves, the pilgrimage to Mecca, and the conquering zeal of the Moslems, were the principal factors which tended to make known these countries to Europe, and to promote communication between them by means of the camel, which the Arab invaders had introduced.

It was, says Dr. Keltie, between the eleventh and thirteenth centuries that Islam appears to have penetrated to the kingdom of Songhay (which at that time extended from Lake Chad to the western Niger), "and brought with it political organization, a certain amount of civilization, commercial activity, and slavery as an institution." Before the end of the thirteenth century we find the caravan routes to the Mediterranean established. The fourteenth century saw the first really historical record of travel in the Niger Sudan in the book of Ibn Batuta, who described the Niger as far as Kuka. In the fifteenth century the voyages of the great geographer, Prince Henry the Navigator, gave a new importance to West Africa by inaugurating the export of slaves to Europe and America, a trade which was found more lucrative than that in gold, and which lasted for four centuries. Before the close of the fifteenth century the entire coast of West Africa had been explored and mapped.

Our knowledge of the great cities of the Niger Sudan, Timbuktu, Jenne, Kano, Katsena, and Kuka was added to greatly in the beginning of the sixteenth century by the writings of Leo Africanus, a Christian Moor educated in Fez and in Europe (1526). The ruling dynasties on the Niger, which had founded these cities some four or five centuries previously, had at this time attained great wealth and power, and the Songhay empire appears to have extended from Timbuktu to Bornu at the time when Leo visited it (1513). Kano had already fallen from its supremacy and become a vassal of Timbuktu, the capital of the empire. Its king, proceeding on a pilgrimage to Mecca, had obtained from the Khalif of Cairo the title of "Prince of the Believers of the Sudan." His grandson Ishak was attacked in 1590 on this account by the Emperor of Morocco, who captured his capital and overran the whole country as far as Bornu. Pory, Leo's biographer, tells us that the Niger was so called by the Arabs, its native name being Astabus, and he identifies it with the Rio Grande, and not with the Senegal and Gambia rivers, which flow eastward. Leo travelled from Morocco to Jenne, Gober, Kano, Katsena, Zaria, and Bornu at the age of sixteen, and was himself a witness of the conquests of Iskia. He relates that cloth was exported to the north, and speaks of the manufacture of leather shoes; while cowries, even at this early date, formed a medium



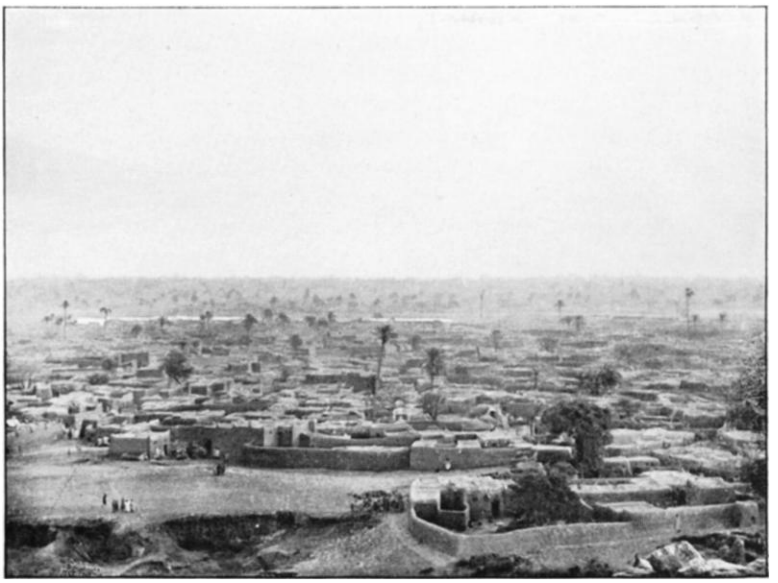
VIEW ON THE NIGER FROM JEBBA.

of exchange, the kola-nut—Goron—was eaten, and slaves were held in great numbers. The Tuaregs, he says, live in tents and wear a veil, leading, as he expresses it, a "roguish and vagrant life in the deserts, troublesome alike to their neighbour-inhabitants and to merchants." Thus far his descriptions might have been written to-day, but his account of Bornu is more surprising. All the plates and utensils of the king's household, even the chains of his dogs, he says, were of pure gold. The king maintained an army of 3000 horsemen, with innumerable footmen, and imported horses from the north, in exchange for which he paid slaves which he captured in annual raids. Leo's natural history notes are often amusing, and Pory's comments still more so. The elephant, for instance, is described as a "wittie beast" of an amiable disposition, who, "in sporting manner gently heaveth up with his snowte such persons as he meeteth;" while the hippopotamus is said to be tawny in colour like a lion, and often tamed by the Africans, when he becomes exceeding swift; but riders are warned not to cross deep rivers on his back, as he has a habit of diving under water.

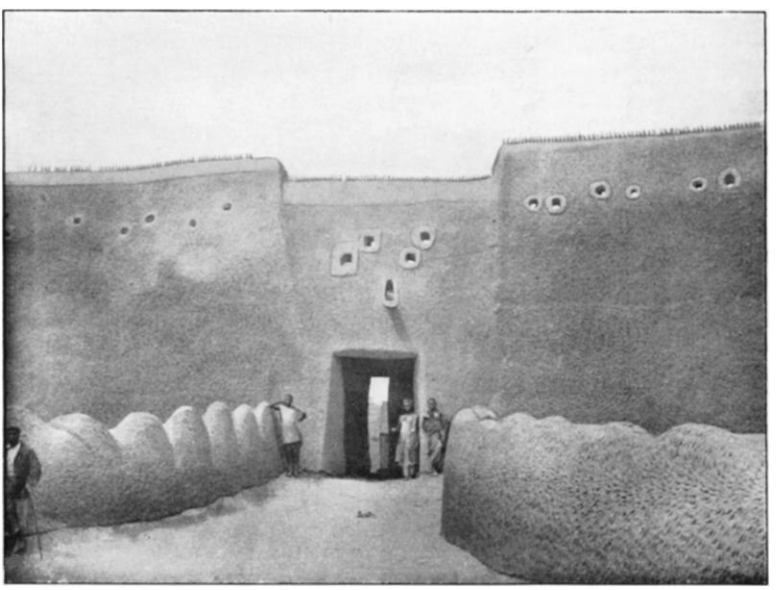
No substantial addition to our knowledge of the Niger Sudan was made in the seventeenth century. The map of Van Moeurs (1668) reproduced the great river running from Chad in the east to the Atlantic, for the Gambia and Senegal were still supposed to be the mouths of the Niger, in spite of Pory and Leo. Camwood dye, hides, beeswax, gums, feathers, and amber were by this time added to the slaves, ivory, and gold which formed the exports from the country. The advent of the Portuguese on the coast had benefited the country by the introduction of many of the grains and roots which have since become the staple foods of the people. Sir H. Johnston attributes to them the introduction of maize, sweet potatoes, and manioc from Brazil, besides the chili, tobacco, tomatoes, pine-apples, the Muscovy duck, the pig, and cat, while from India they brought the lime, orange, lemon, and sugar-cane. The Arabs also probably introduced the latter, as well as rice and onions, together with the camel, horse, fowls, and pigeons. Moll published his map in the beginning of the eighteenth century (1710), perpetuating the errors of his predecessors as to the course of "the great river Niger." Zeg-zeg (Zaria) and Casena (Katsena) appear on it, and also a curious note referring to the Niger Sudan, to the effect that the country is "credibly" supposed to be inhabited "by white men, or at least a different kind of people from the blacks, who wear clothes and have the use of letters, and make silk, and that some of them keep the Christian sabbath." These words most probably refer to the Arab Mohammedan invaders. The close of the eighteenth century saw several British expeditions sent to explore the Niger, of which Mungo Park's alone succeeded (1795). In 1805 this great explorer again returned to the Niger, but by the time he reached Sego, only four out of his

thirty-eight companions remained alive. He traced the river to Bussa, where he lost his life.

It was at this time that the Fulani dynasty arose, and imposed its sway upon the great cities of Hausa-land, which had formed a part of the now decadent Songhay empire. The population was at this time chiefly pagan, and though Islam, as we have seen, had penetrated to these countries many centuries before this, it had probably ceased to be a vivifying and virile influence. Othman Dan Fodio, a Fulani herdsman, preached a war of conquest, and to him at Sokoto the chiefs of the clans who were already established in the country repaired, and received a flag and a mission of conquest. Fortified by religious enthusiasm, each band of warriors carried its sacred symbol to victory, and founded the various emirates of the Fulani dynasty much as they exist to-day. Dan Fodio, who died in 1817, is said to have prophesied that his green flag would only be a passport to victory for a hundred years, and that after this period the Fulani dynasty would cease to hold sway. It is a curious fact that this period, by the Mohammedan calendar, has just expired, and the Fulani are said to have expected their overthrow, and believed that the late sultan would be the last of his dynasty. A number of expeditions from Europe followed on the discoveries of Mungo Park in the first half of the nineteenth century, and Great Britain even appointed Oudney as consul to Bornu, which had never yet been seen by a European. With Denham and Clapperton he reached Chad in 1823, by the Tripoli route, but died shortly afterwards. Clapperton visited Kano, and returned to Europe. He again went out to complete his investigations, landing this time at Lagos, and made his way to Busa and Sokoto, where he died in 1827. His companion Lander travelled through the Hausa states, and returned to Lagos. Subsequently returning, he ascended the Niger from its mouth to Rabah, and the Benue for 140 miles. MacGregor Laird and others endeavoured to push trade with these regions, and in 1841 four naval officers were sent to survey the river, to establish a model farm, and to suppress slavery at Lokoja. Other European expeditions followed, and a consul was created later at Lokoja; but the appointment lapsed with the death of its first holder, Baikie, in 1866, being declined by Sir J. Kirk. In 1850, Barth, the great traveller and historian of the Niger, reached Chad from Tripoli, and visited all the great cities of Bornu and Hausa-land, leaving to us the first detailed account of their history, language, and condition at the time of his visit. No enthusiasm, however, was aroused by these explorations, and in 1865 the House of Commons, disregarding the appeal which McQueen thirty years before had made that England should establish a great Central African Empire on the Niger, and heedless of the constant appeals from native chiefs, passed a resolution that further extension of territory was inexpedient. The Niger was abandoned to private traders, the assistance from Government being



VIEW OF KANO FROM THE DALLAH HILL.



A KANO GATE.

limited to the occasional despatch of a gunboat to avenge outrages by the natives. It was not until the period between 1877 and 1885 that the struggle for the possession of the river Niger took place, and was decided in favour of England.

It is hardly necessary for me to inform an audience of this Society that it was chiefly due to the foresight and devotion of Mr. Goldie Taubman (now Sir George Goldie) that this result was achieved. Imbued with the conviction that no lasting progress could be made until the white traders sank their differences and combined to obtain peace and security under some settled form of government, he succeeded, in 1879, in amalgamating the interests of the few British merchants who alone remained on the Niger, and applied for a charter in 1881. The National African Company was formed, with the object of opening up direct relations with the great kingdoms of the interior. Treaties were made with native chiefs, stations were founded on the Niger and Benue, and a flotilla placed on the river.

But meanwhile the foresight of Gambetta, who in this same year (1881) had approved the commencement of the abortive Saharan railway by Colonel Flatters, had prompted the establishment of two very powerful French companies on the Niger, and, aided by the resources of their Government, some thirty French stations were formed. So long as a foreign flag remained, a charter could not, of course, be granted. Sir G. Goldie devoted all his energies to meet these new difficulties, and partly by the pressure of competition and presents to chiefs, partly by amalgamation with the British Companies, he succeeded in securing the disappearance of all foreign flags just in time to announce at the Berlin Conference of 1885 that the Union Jack alone flew on the lower Niger, and thus to secure to Great Britain the sole custodianship of its navigable waters. In the same year a new danger arose from the mission of Herr Flegel to secure treaties on behalf of Germany with Sokoto and Gando, but he was anticipated by Mr. Thomson as the agent of the company. In 1886 the frontier between Nigeria and the Kameruns was settled as far as Yola, and a charter was at length granted to the company under the name of the Royal Niger Company, and the territories adjacent to the river were declared a protectorate. To Sir G. Goldie belongs the credit of having thus secured Nigeria to the British Crown.

A few years later, by the Anglo-French agreement of 1890, the northern frontier of the British protectorate was fixed at a line drawn from Say on the Niger to Barrua on Lake Tchad. The Anglo-German agreement of 1893 provisionally determined the eastern frontier from Yola to Lake Chad. England thus finally shut herself out from communication between the Niger Sudan and the Nile valley, and in later years the alluring alliteration of the Cape to Cairo railway took the place of the far more rational (and equally alliterative) development

from the Niger to the Nile, since it is east and west that the rivers flow to the sea, and the trade routes carry the produce of the interior to the coast. Subsequently, after a period of strain which forms no part of my subject to-night, but which led incidentally to my own first participation in the work of West African development, and to the formation of the West African Frontier Force, the western frontier of the protectorate was determined by a further Anglo-French convention, signed on June 14, 1898.

Did time permit, I would have desired at this point to pay a well-deserved tribute to the brilliant series of explorations conducted by French officers. The additions made by them to geographical knowledge of the regions are such as claim the hearty appreciation of this Society. My own relations with those officers whom I have met since I took up the position of High Commissioner have been so entirely agreeable, that in doing justice to their scientific achievements I should be giving myself the pleasure of praising friends.

The circumstances which led to the transfer of the territories of the Royal Niger Company to the Crown are fresh in the memory of the public. They have political bearings which are very rightly excluded from the scope of these meetings, and for the moment I need only remind you that the negotiations relating to the transfer were completed by the end of 1899.

I had been recalled from Lake Ngami, on the far side of the Kalahari desert, in August, 1897, for the purpose of organizing the West African Frontier Force. On January 1, 1900, I assumed the duties of High Commissioner of Northern Nigeria, and the Union Jack replaced the company's flag.

The task of creating every department of an administration was an exceedingly heavy one. The political or administrative staff which I had at my disposal numbered eight. You will recognize that it was a matter of necessity, no less than of choice, to adopt the policy (a policy which, under any circumstances, I believe to be essential to success in the administration of tropical Africa) of ruling through the native chiefs. These in the Mohammedan states are Fulani, of whose advent in Northern Nigeria I have already spoken. At the present day they occupy in West Africa a position curiously analogous to the Wahuma in the East. Originally herdsmen, both tribes, driven by the necessity of finding fresh grazing-grounds, became invaders and conquerors. One section thus supplied the ruling dynasty; the other remained, not merely herdsmen, but often occupied a servile position in charge of the herds of the conquered Bantu races. In Uganda, Unyoro, Karagwe, etc., the Wahuma founded the royal dynasties, while their tribesmen tended the cattle of the Negroids. And so in Nigeria, the emirs and officers of state and the horsemen of the armies are Fulani, while the Cow-Fulani, as they are called, tended the herds of the Baribas in Borgu, and

of the Kanuri in Bornu. The ruling branch in each case became largely admixed with the Bantu stock, while the herdsmen retained their racial purity. These ruling races are far more intelligent than the Bantus whom they conquered. The Fulani are often strikingly handsome in features, and their natural pride has been increased by the arrogance which the Mohammedan faith inculcates. They soon, however, lost the simple austerity of life which had marked their earlier rule, and grew sensual, avaricious, and cruel. Barth speaks of their decadence fifty years ago, and at the time that Government assumed the administration of the country the dynasty was already tottering to its fall.

The Fulani system of rule is said by some to have been adopted from the Habe dynasty which preceded them, modified by the Koranic law. The alkalis (judges) were generally men of much learning in Mohammedan law, and they boasted that their courts were no respectors of persons. Summonses were invariably obeyed, and the sentences of the court enforced; estates of deceased persons were administered, and a regular system of court fees obtained. The system of taxation was very complete, though very onerous. The title to all land appears to have been vested in the emir as feudal lord, while the chief officers of the state were fief-holders, generally resident at the capital. The emir received 50 per cent. of the taxes, and the fief-holders 25 per cent. His principal retainer also resided at the capital, and received half of the remaining 25 per cent. The other half was again divided between the Fulani tax-gatherer in the district and the local headman. Mohammedans appear to have paid a tithe, while pagans were arbitrarily assessed, and the taxes doubled in case of rebellion. In addition to this land tax, every form of handicraft (weavers, dyers, blacksmiths, etc.) paid a tax; caravans, canoe-owners, sellers in the market, and collectors of sylvan produce all alike paid, while a complete system of death duties was, I believe, enforced. It is the aim of the British administration to regulate the incidence of this taxation, and, while freeing the peasantry from oppressive imposts, to enforce uniform payment of a fair and just tribute, of which perhaps Government may itself claim a share. Inherent in the system was the ceaseless raiding for slaves, both for use by the rulers and for payment of the Sokoto tribute. The country was thus rapidly depopulated, since the numbers captured, vast as they were, were but a small proportion to those killed or left to die of starvation. These raids were made against independent pagan tribes, for the Fulani had never thoroughly conquered the country, and had only partially subdued the cities of the plains, where their horsemen were effective. Large areas were still occupied by independent tribes even in the plains, while the hill country was wholly pagan. Raids were also made upon the subject peoples on the excuse of rebellion, or on no excuse at all. Where a Fulani army passed it left a depopulated desert.

The growth of luxury and large harems, the increase of the large class of idle princes, office-holders, and armed retainers, had, as I have said, so vitiated the system of rule, that when the transfer took place in 1900, it was already a chaos in the southern states. Its collapse had been hastened by the advent of Europeans, and especially by the overthrow of the Nupe power by the company. The ancient *régime* had been discredited and broken, and nothing substituted for it. Bribery and corruption marked the so-called justice of the courts. Taxation had degenerated into the grossest forms of oppression, accompanied by violence and outrage, so that no man's life was safe. Trade was paralyzed by extortion, and by the insecurity of the roads, for on every side the subject peoples were in rebellion, and the tax-gatherers were forcibly expelled from various districts. The peasantry and slaves of Nupe were bolting by thousands to the south bank of the Niger, there to lead a life of vagrancy or comparative idleness. The company's treaties of friendship with Sokoto had been set aside by the war against Nupe, which no doubt was regarded by that chief as putting an end to them. He himself cannot be said to have ever been bound by them, for no European's life would have been safe who had attempted to enter his capital. It was in these circumstances that the present Government wrested the suzerainty from the Fulani, an alien race detested for their misrule. What they won by conquest they lost by defeat, and Government now claims those rights—the right of legislation and taxation, the right to appoint rulers, and the ultimate title to land. The position of the Fulani, it must be remembered, was very different from that of the Yoruba chiefs of Lagos, who had ruled for years over peoples of their own race with a well-established system of communal land tenure. The British conquest of this vast country has been almost bloodless, for the mass of the people were not opposed to the overthrow of the Fulani. The problem is what should now be done with the Fulani. Their misrule has compelled interference; their over-weening self-confidence has rendered conciliatory overtures abortive. Throughout the length and breadth of Northern Nigeria, therefore, they have now been conquered. But bad as their rule has been, I believe myself that the future of the virile races of the protectorate lies largely in the regeneration of the Fulani. Their ceremonial, their coloured skins, their mode of life and habits of thought, appeal more to the native populations than the prosaic rule of the Anglo-Saxon can ever do. It is our task to regenerate this capable race, to mould them to ideas of justice and mercy, so that in a future generation, if not in this, they may become worthy instruments of rule under British supervision. I do not hope for any very great success in the present generation, but the tradition of British rule has ever been to arrest disintegration, to retain and build up again what is best in the social and political organization of conquered dynasties, and to develop on

the lines of its own individuality each separate race of which our great Empire consists. That has been our policy in India, and Northern Nigeria, though many centuries behind the great Eastern dependency, still presents to my imagination many strangely parallel conditions.

The Mohammedan Fulani, though the ruling race, form but a very small item in the population of Northern Nigeria. The indigenous people, who are subject to them, are of many different tribes. In the northern states of Sokoto, Kano, Zaria, and Hadeija they are chiefly Hausas. South of these are the great Nupe tribe, and south again in Illorin are the Yorubas. Of these the Hausas are the most considerable. They are found as settlers and traders in every province, and even as far as Sierra Leone and the Gold Coast. Their language is the *lingua franca* of Northern Nigeria, especially of trade, and their keen commercial instincts have earned for them the name of "the business-men of West Africa." They make admirable soldiers, and are brave and reliable, but probably inferior in mental ability and alertness to either the Nupes or Yorubas. The latter are hardly less keen traders than the Hausas, at least equally industrious, and much quicker to learn, though hardly equal to them in stolid pluck. The Nupes are the finest of the three in physique, and very intelligent; but they have not the pluck of the others, and their ability is apt to degenerate into cunning treachery and falsehood. These tribes have, to some extent, embraced the faith of Islam, especially the Hausas. There are other great tribes who are pagans. These include the Baribas of Borgu—never conquered by the Fulani—the Gwaris, Kejes, and Kedaras of Central Nigeria; the Basses, who appear to have originally constituted the bulk of the population, but now chiefly occupy the districts near the junction of the Niger and Benue. With them are much mixed up the large tribes of Igaras and Okpotos, who also populate the districts south of Lokoja, while the Kanuri form the original population of Bornu. In addition to these, there are innumerable other pagan tribes chiefly occupying the dense forests and hilly countries in the east, speaking an enormous diversity of languages. They are very brave in war, and have maintained their liberty against the Fulani. We cannot at present say much about them, but I hope before long to have completed the collection of some interesting information regarding their origin and tribal customs and languages. Such are the Munshis on both banks of the Benue, the Bassemas, and Yergums, and Marghis further east, and the Yauri in the north-west. They are in a primitive stage of development; many go quite nude. They are addicted to murder and robbery, and are usually divided up into small village communities owning allegiance to no paramount chief.

When it is considered that these diverse peoples, with their widely differing standards of development, are scattered over a territory of one-third the size of India, equally diverse in its geographical

characteristics, scarcely known in its physical features, imperfectly surveyed, and almost wholly destitute of means of transport and communication, it will readily be understood that one of my first objects was to endeavour to obtain some more accurate knowledge of the geography of the country and to open the means of communication, without which civilized government and civilized trade must remain impossible. I shall not, in this hall, ask in vain for sympathy with that object.

I desired to explore without delay the basins of the Kaduna, Gurara, and Okwa rivers, by one or other of which it was hoped to gain a means of access into the interior towards the Hausa states, the political centre of Northern Nigeria. Separate expeditions were sent by these three routes for the peaceful exploration of the country, with the special view of finding a site for the administrative headquarters away from the Niger valley and in closer contact with the Mohammedan emirates. For Jebba, which had only been selected by me as a military base, had not proved healthy.

In the early days when the force was raised, before the very temporary houses for Europeans were erected, we had lived in grass houses, whose roofs were not impervious to the tropical sun and rain, while the floors were of saturated mud. No wonder that some 80 per cent. of the Europeans died or were invalided.

Colonel Morland traversed the Kaduna, till then almost unknown, and it was mapped with great care by Captain Abadie. Colonel Lowry-Cole did excellent work, starting from Loko along the Okwa, but both he and the party on the Gurara found that the escarpment of the Bauchi mountains offered a gradient too steep to be surmounted by any light railway without the expenditure of a very large sum of money and the loss of some years of time. Easy means of transport to the new capital was essential, and neither the Okwa nor the Gurara offered facilities for navigation. The Kaduna, on the other hand, flowing due north and south, was navigable for 75 miles, according to season, for steamers and canoes, till the rapids were reached near Wushishi. The three parties converged on Ghirko, and Zaria was visited, and much useful survey work accomplished. I decided on a site 12 miles north of Wushishi, away from the Kaduna valley, but to be connected with the navigable river by a surface line, and I was eager to erect the houses for the civil staff without delay, but this could not be done till the tramway to convey the material should be finished.

Events, unfortunately, prevented the early execution of this and other urgent tasks. The young administration was not three months old when the Ashanti war broke out, and Northern Nigeria contributed half her troops and every available officer under Colonel Willcocks, who so ably conducted the operations. The South African war had reached its darkest crisis at this time, and the proper number of officers could not be spared for the command of even the residue of the troops in

the protectorate. Lying reports of defeat in Ashanti reached the country, and rumours of disaffection among the Mohammedan chiefs were rife. All progress, even the necessary housing of Europeans, had to be delayed. So we, too, had our difficult times in Nigeria, and felt in no indirect way the strain to which the whole empire was put in 1900.

Meanwhile, in the early months of 1900 beginnings had already been made in a system of administration in the provinces bordering the Niger and Benue, which alone had been in contact with the company's rule. Muri had a resident with his headquarters at Ibi; Loko, on the lower Benue, had another; a third was quartered at Lokoja, and a fourth at Illorin.

The troops returned from Ashanti at the close of the year, and by this time native unrest in the protectorate had taken an active form. Causes into which the limits of a "geographical hour," forbid me now to enter compelled me, during the years 1900, 1901, and 1902, to despatch expeditions against Kontagora, Nupe, Yola, Bauchi, and into Bornu, as well as others rendered necessary by the interference of pagan tribes with the erection of the telegraph, or on account of outrages and murders perpetrated upon traders. The expeditions to Kontagora and Nupe resulted in the capture of the town of Kontagora by Colonel Kemball, and the reinstatement in the province of Nupe of the emir who had, in 1897, been appointed by the Niger Company. The increased political staff, for which, with Mr. Chamberlain's sanction, I had been able to make provision, enabled me to appoint residents to the three provinces of Kontagora, Nupe, and Zaria. In the east the expedition under Colonel Morland captured Yola after severe fighting, and substituted the next heir for a fanatical emir who would listen to no terms. A resident was established in this province also. The second expedition under Colonel Morland deposed, without fighting, the slave-trading emir of Bauchi, who had closed the trade routes to the Niger. It also defeated and captured a local Mullah named Jibrella, who had proclaimed himself to be the Mahdi, and was becoming a serious danger owing to his unbroken series of victories. Colonel Morland then penetrated to Lake Chad, visiting Gujba, Maidugeri, and Kuka (the seat of the dynasty which had ruled Bornu for 1000 years), reinstated the native sultan, who had been deposed in consequence of friction with a French border force, and settled some difficulties on the German frontier. This Bornu expedition is, in my opinion, one of the hardest and most important achievements which the officers and men of the West African Frontier Force have successfully accomplished in Northern Nigeria. As a result of the expedition, British residents are established in Bauchi and Bornu. In addition to carrying out these expeditions, the West African Frontier Force was also called upon to furnish a contingent for the Aro campaign in Southern Nigeria.

Here again, under Colonel Festing, they fought the chief actions. Our little army had thus already vindicated its claim to be considered a factor in imperial defence, and not a mere local corps. Its soldiers were already veterans who had never experienced a check or reverse, and Mr. Chamberlain paid a high compliment to its organization by deciding that the constabularies of all the Crown colonies in West Africa should be reorganized on its model and become battalions of an enlarged West African Frontier Force, of which the Northern Nigeria Regiment should be the premier corps.

Thus by the end of 1902 the effective control of Government had been extended over the greater part of the protectorate, with the exception of the Northern Hausa states, and the trend of events made it more and more clear that it was impossible to stop halfway, and that the Government of the country would be compelled to accept the full burden of the task for which England had made herself responsible before Europe. In what manner this necessity was thrust upon us, I will presently relate.

But before passing to the continuation of my narrative, I should wish to say something about the physical characteristics of the country. Nigeria is a land of tornados. Towards the close of the dry season —end of February — cyclones from the north-east, usually accompanied by storms of thunder and rain, burst with great fury. Increasing in frequency, they merge into the heavy rains which last from July to October. With the cessation of the rains, the whole Sudan presents a vista of grass fires, and the Hamattan wind begins to blow from the north-east. The clear atmosphere of the rainy season gives place to a thick haze, which, like a London fog, obscures the whole horizon, and objects only a few hundred yards distant are indiscernible, so that surveying is difficult. The sun disappears like a crimson disc about 5 p.m. behind this pall of haze, which consists chiefly of impalpable dust. The so-called Tuareg "veil," and the habit of wearing the pugari over the mouth and eyes, is adopted as a protection against this dust. The wind itself blows intermittently for several days with violence, and anon with moderate force or abates altogether, but always from the same quarter, especially between 8 a.m. and 4 p.m.

The Hamattan is the herald of cold nights, and in the northern states even during the day, in the months of January and February, the cold is often quite trying. The excessive dryness of this wind from the desert of the Sahara causes an evaporation when it meets the wall of humid atmosphere in the Niger valley, and produces these effects of cold. Where the lakes around Timbuktu, and the waters of Chad, impinge on the desert, I am told that frost is not uncommon. These cool nights add to the health and comfort of Europeans, and, though the Niger valley is undoubtedly trying, I think that the health

conditions of the interior are good, and will improve greatly as our resources enable us to build proper houses and to transport the necessaries for European life and comfort. Even what we have already been able to do has reduced the mortality from 32 per cent. in 1898 to 6 in 1901; deaths and invalidings 87 per cent. to 34 per cent.

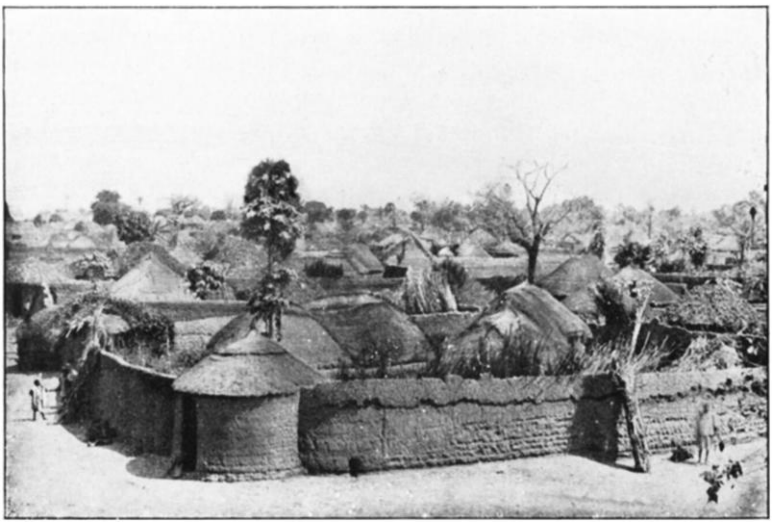
Another point in connection with the physical characteristics of Northern Nigeria is the annual rise of the Niger, upon which its navigability depends. The great river rises in the Sierra Leone Hinterland about lat. 10°, and flows north to Timbuktu, lat. 17°, and thence south-eastwards to the sea, forming a great bend. The annual rise caused by the rains occurs in August and September; but since the river rises in the zone of heavy rainfall, and the lakes around Timbuktu form a vast storage, the surplus water, traversing 2000 miles of country before it again reaches lat. 10°, causes a second flood towards January, which is very marked at Jebba, and tends to keep the whole river at a higher level for the greater part of the year. Northern Nigeria has two hydrographic systems—that which the Niger drains, and that of which Chad is the centre. The water-parting is more or less along the line from Kano to Katsena, and along the northern slopes of the Bauchi hills. We are all enthusiastic surveyors in Northern Nigeria, and I hope, now that some of the initial difficulties have been overcome, to fill in the map of the protectorate rapidly and with accuracy.

I hope that on some future occasion I may be able to give a more detailed account of the lakes, rivers, and mountains of Northern Nigeria. I can at present only add that the general altitude of the country is not great. From the foot of the rapids near Fort Goldie to the sea the fall of the Niger is probably not more than 1 foot per mile. The altitude of Lokoja, therefore, is not more than 300 feet above the sea; of Jebba, 500 feet; and of Illo above the rapids on the French frontier, probably 1000 feet. There are no actual rapids on the Benue, and Yola probably is not more than 800 or 900 feet. The valley of the Niger and Benue is therefore extremely low-lying, as also is that of the Kaduna up to its limit of navigation at Wushishi (approximately 500 feet). Zaria is situated on a plateau about 1000 feet, which falls away on all sides except towards the east, where it rises into highlands, of which Bauchi is the centre. Bauchi itself is about 3000 feet, and is surrounded by mountains of much greater altitude. On the east this mass of hills falls to the Gongola hills, beyond which (eastwards) extend the plains of Southern Bornu. To the south the Benue drains the southern slopes of the Murchison range, while on the west the escarpment ceases somewhat abruptly, approximately along the 8th meridian. To the north the Katag..n country has not yet been explored sufficiently for me to say where the mountains shelve down to the plains, but it is probable that they do not extend beyond the

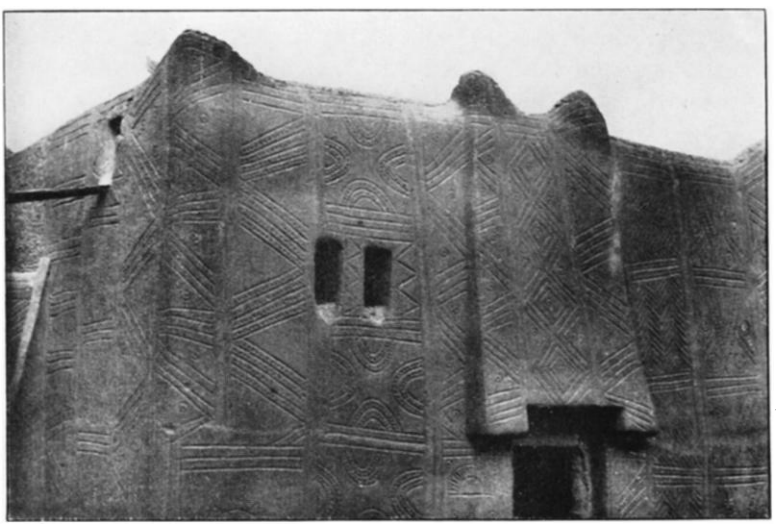
latitude of Kano (12°). This mountainous area, of some 50,000 square miles, may in the not distant future prove of the highest importance to the country. Already very valuable tin deposits have been found in it, and other minerals may follow; while its value as a sanatorium, when means of communication render rapid access to it feasible, will assuredly be great, and may obviate the necessity of continual health trips to England, which form at present so costly an item to the administration, and destroy its continuity.

The northern Hausa states, as I have said, border on the Great Sahara desert, and it would seem as though the desert was encroaching southwards. Much of the distance we traversed between Zaria and Kano, and thence to Sokoto and Katsena, was over heavy loose sand, where walking is most laborious. Ever through the centuries there is being deposited the wind-borne sand from the Sahara, which forms the dust-laden atmosphere of the Hamattan. But probably more important in the process of desiccation is the deforestation of the country. Some years ago a writer showed in a very striking way how, in no very distant epoch, the waterless arid country between the Red sea and the Nile must have been full of trees and of grass. The shepherds who grazed their herds in this once-fertile district have left rude pictures on the rocks of the animals which frequented the grazing country, among which the giraffe is easily recognizable, while the deep-worn "wadis," the channels of streams long since dried up, prove the existence of an abundant rainfall in those bygone times. The writer—was it Mr. Theodore Bent?—ascribed the desiccation of the present day to "the Arab and his axe." Wherever the Bedouin grazed his camels he hacked down the fodder trees, to facilitate the grazing of his beasts; and so the well-treed country became a bare sun-scorched treeless plain, and with the passing of the forests the rainfall which they had attracted, and the moisture they had stored and protected, ceased. The same process is going on to-day in Northern Nigeria. The Asbenawa with their camels are destroying every young acacia and tamarind by hacking them down as fodder, and every great giant tree by lopping off all its limbs till only a dying bole remains. I hope to effect a check on this before it is quite too late.

But other causes still, besides the sand-bearing Hamattan and the deforestation of the country, are at work to effect the diminution of the rivers and the lakes of Africa. In the Kalahari district this tendency is most marked. The lake Ngami, whose waves were so great that they are said to have dashed hippopotami to pieces when Livingstone discovered it in 1850, was, when I lived near it in 1896, only a dry bed of the smouldering ashes of lacustrine vegetation, while the Home river and the upper Botletle were both dry and their channels hardly distinguishable. In every direction were abandoned wells. Year by year they had had to be deepened to catch the failing supply of water till it



VIEW INSIDE ZARIA.



EXTERIOR OF THE EMIR OF KANO'S HARIM.

ceased. Three times in a few years had the chief of the Tawana to shift his capital because the apparently inexhaustible supply had wholly failed at each in turn. In Nyasaland, as I have pointed lout in former writings, the old surface-level of the lake may be seen far inland to-day, and it is possible to trace various different levels on the surface of the water-worn rocks. And so it is in West Africa. Yearly the Niger becomes less navigable. Where steamers drawing 8 feet could ascend within the memory of Mr. Wallace (now deputy High Commissioner), 3-feet vessels can now with difficulty make their way for a much more limited period. As the lips of the rapids and waterfalls are worn away in the course of time, and the obstructing rocks are eroded, the rivers will of course run off their volume of water more rapidly to the sea; but this is a process of ages, and it remains to assign the cause for so great a decrease in the rainfall, or such other causes as may have combined to produce these results.

Admirable work has been done by civil and military officers alike in the mapping of the protectorate, and the I.D.W.O. are now engaged in incorporating an enormous number of sketches and surveys in a new map, which will correct many existing errors and add a very great deal of new material. What is chiefly required, however, is that a first-class surveyor should devote his entire time to fixing the exact positions of the various important cities throughout the protectorate—say, for instance, the capital of each province; the detail could then be easily and rapidly filled in. Major Burdon, to whom the R.G.S. have awarded the Cuthbert Peek Grant, and Captain Abadie have done especially good work in this direction. Mr. Temple in the Bauchi province, and Mr. Hewby in Bornu, have also done much careful work. The Kaduna and the Gongola rivers are the two streams whose exploration is likely to have the most important practical bearing on the development of the country. Mr. Moran has proved that the latter is navigable for a short period when in flood as far as Gombé, and by taking advantage of this waterway we shall be able to push up telegraph and building material and requisite stores without the enormous cost of overland transport to Gujba and Bauchi.

Turning to political geography. The country has been divided into sixteen provinces, coinciding as nearly as may be with existing emirates and tribal divisions. Each resident-in-charge will be assisted by two political officers and a police officer with fifty native constables, and in most of the provinces there is also a medical officer and a military garrison. With such a staff of zealous and able officers, the administration will, I hope, be fairly effective, though it is none too large to deal with all administrative questions, to collect revenue, compile statistics of population, etc., to carry on the judicial work of the British courts and to supervise the native courts, to carry out the survey, to superintend road-making and other public works, and

to develop the economic resources and trade. The resident holds a provincial court for the trial of serious offences and of non-natives and Government employés. His powers are limited by the necessity for confirmation of all serious sentences by the High Commissioner, assisted by his legal adviser. The supreme court of the protectorate has concurrent jurisdiction, and occasionally holds assizes in the different provinces; but the great distances and the time taken in travelling render this difficult, while the transmission of cases with all evidence to headquarters is well-nigh impossible, and would cause great hardship and injustice. Native courts, especially in Mohammedan centres, are established by warrants, and encouraged to deal with all offences between natives, more especially with civil cases. These courts are under the supervision of the resident and his staff, who see that barbarous punishments are not inflicted, and who may, for good cause, transfer any case to the provincial court. In some districts it has been found feasible to set up these native courts in pagan communities, but it is still under consideration what form of court will best serve the needs of these primitive aboriginals—at once effective for the substitution of law and order for force and violence, and in harmony with the ideas and customs of the people. In these matters it must be remembered that the Nigerian Government is only three years old, and the country is very large.

The cases tried by judicial officers are often puzzling. How, for instance, shall an officer trained in British ideas of law deal with the case of a man who confesses with full conviction and sincerity that he is guilty of transforming himself into an alligator or hyena and devouring the children of his neighbours? Common report may, in a second case, accuse a man of witchcraft or murder; the local chief is appealed to, to test his criminality by the poison ordeal. He despatches his messenger to administer it; the accused perhaps dies, but all are convinced that he ran no risk if he were innocent. Who is to be convicted? The inflexible logic of British-made law lacks elasticity to deal with such cases. The commonest and most troublesome of the offences with which the courts have to deal, however, is that of personation or extortion. Wearing a fez cap, or some other article of disused soldier's uniform, or carrying some discarded envelope carelessly dropped, a man will present himself at a village and claim by this token to be an emissary from Government. The credulous natives deliver up all he demands. Any hesitation is met by the threat that on his report the Government will destroy the town. Many cases have been before the courts in which such extortion had been going on for months undiscovered, and several trusted Government agents have been convicted of slave-dealing, and forced levies in the name of the administration.

In executive work some beginnings have been made in collecting

statistics of population, assessing tribute to chiefs, tabulating the nature and volume of trade conveyed by caravans, collecting economic products, and in many other matters which time does not admit of my speaking of now. British coinage has been largely introduced, the former currency having consisted of slaves and cowries, and a home for freed slave women and children had been instituted. But real progress and satisfactory results in these directions belong to the future, for the past has been an era of initiation only. The result of the cessation of raiding, and of the security of the roads, has been not only to greatly increase trade, but has caused a large number of the people hitherto employed as carriers to revert to the land and become producers. Excellent as this result would seem to be, it has caused great difficulty in the supply of transport, and if Northern Nigeria is to become a self-supporting country, growing, for instance, cotton for export to the failing Lancashire looms, it will be necessary to construct a light and very cheap surface line, working in conjunction with the river steamers, and costing a minimum either for construction or upkeep. With such a narrow-gauge tramway, Nigeria might become one of the cotton-producing centres in the Empire, and her great population might afford a new and important market for the manufactured cottons of Manchester. Without such cheap transport, however, neither cotton nor other agricultural or sylvan produce can bear the cost of carriage from the interior, where the bulk of the industrious population live.

I have found it impossible, in the limits of this paper, to say all I would wish regarding the economic value of the country and the nature of its products and industries. The principal exports at present are shea, rubber, palm kernels, ivory, gum, and wood-oils. The imports are chiefly cottons and salt, since liquor for sale to the natives is entirely excluded. If this were introduced, Nigeria would secure a large revenue and probably be self-supporting almost at once, but I sincerely trust it never may be, and it would be contrary to our pledges under the Brussels Act if it were. If the cheap form of transport of which I have spoken were introduced, by means of which produce could be cheaply brought from the interior to the great waterways, the existing imports at present simply wasted for lack of transport might be almost indefinitely increased, and many new products could be profitably exploited. Prominently amongst the latter would be cotton, for which there is so great a demand in England, and which has been grown for 1000 years in the Hausa states. Minerals, too, will soon become a profitable source of revenue. The mines at Bauchi have proved to be of the highest quality, and are now being exploited by the Niger Company. It is under consideration to send a mineral survey to North Nigeria next year, and the results will be of the highest interest. With the assistance of Prof. Dunstan, director of the Imperial Institute, who has already afforded us much advice and help, I hope before long to

have a considerable body of reliable and useful data on the known products of the country, and to discover and put on the market many as yet unknown. The local industries and manufactures are varied, and the products are often of high excellence. The weavers of Kano and the other great cities produce admirable cloth, coloured by the native dyers with their own fast dyes. The leather work is admirable, and the tanned goatskins exported from Kano across the desert to Morocco were the original Morocco leather of commerce. You will see in the next room some samples of these, and of the brass and copper flagons of Bida, the glass armlets, the saddle-cloths, and other articles of Nigerian manufacture.

The difficulty of development lies in the fact that Northern Nigeria is as yet largely dependent on a grant in aid, and expenses must, therefore, be cut down to the lowest possible margin. It has been necessary to increase the military force by a third battalion, though, as I have shown, this force is an item of imperial defence, and its sphere of action has not been limited to Northern Nigeria. With the civil staff I have named, and the increased troops, the grant in aid will amount to upwards of £360,000 per annum. Large though this sum appears, I venture to say that it is no true economy to cut down the margin below the minimum which will render it possible, on the one hand, to keep in effective touch with the people and prevent discontent before it develops into a hostility which it may cost a far greater sum and a great sacrifice of life to quell, or, on the other hand, may render it impossible for residents to promote the development of the economic resources of their provinces, so that, by the increase of trade, the protectorate may be a benefit to England, and may enlarge its revenue till it becomes self-supporting. Some progress has been made in the collection of a local revenue, but it is a policy of doubtful wisdom to enforce direct taxation in the very early stages of British rule, and I feel myself that economy can only be effected by the realization of Mr. Chamberlain's original scheme of amalgamating Northern and Southern Nigeria and Lagos into one single administration. It is only in this way that Northern Nigeria, which is the Hinterland of the other two, can be properly developed, and economies introduced into the triple machinery which at present exists. The country, which is all one and indivisible, can thus be developed on identical lines, with a common trend of policy in all essential matters.

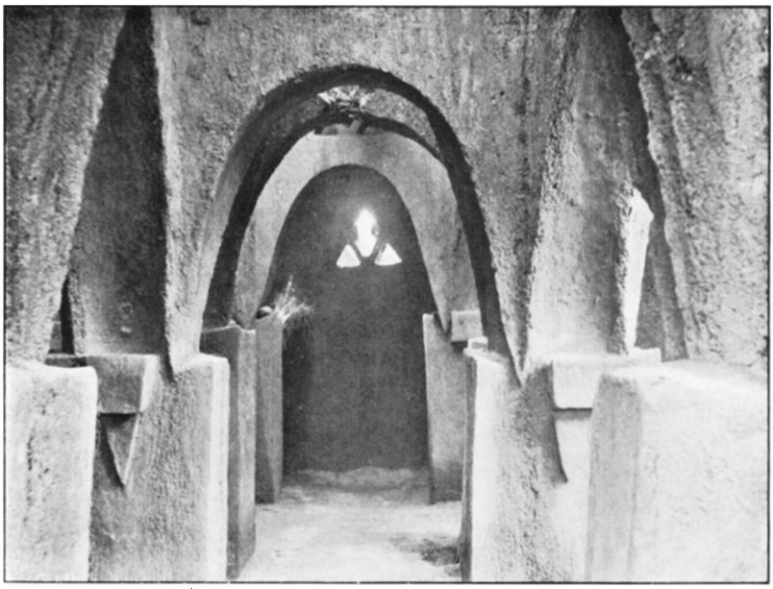
The aim of the Government has been to rule through the native chiefs, and, while checking the extortionate levies of the past, to fairly assess and to enforce the ancient tribute. By this means a fair revenue will be assured to the emirs, in lieu of their former source of wealth, which consisted in slaves and slave-raiding, and in extortionate taxes on trade. A couple of years ago there was not, I suppose, in Africa any country in which slave-raiding was carried on to the extent which it

was in Northern Nigeria. Regular armies took the field each dry season, and the country had become depopulated. Ruined towns met the eye in every direction. This is now a thing of the past, and even though we have not as yet succeeded in raising a revenue to meet our needs, I submit that to have carried out so great a revolution without serious discontent is the first step towards eventual success. The abolition of this curse deprived the rulers of their wealth, yet in the provinces which have been longest under Government, Nupe and Illorin, the emirs show much loyalty and contentment at the assured tribute which has taken the place of the old system. The population, on the other hand, will now increase rapidly, and the productive capacity of the country will grow in equal proportion. These are the ideals towards which we shape our efforts; much remains to be done to achieve them, but whatever success has been obtained is due to the very exceptionally good officers who compose alike the civil administration and the military force in Northern Nigeria. I do not think that any colony or any protectorate in the Empire can boast of a more capable and a more zealous set of men.

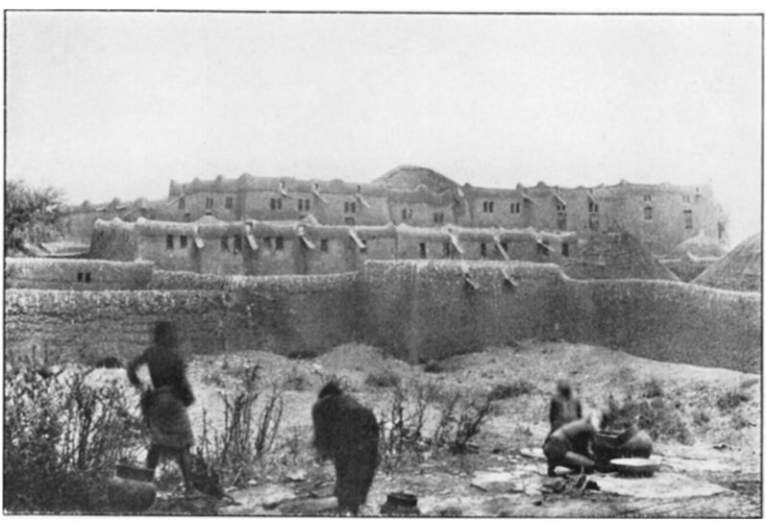
I have left myself but little time to relate to you the causes which led to the recent inclusion of the northern states under administrative control, and I must therefore be as brief as possible. On our north-west frontier the French press complained of the inability of the British to control the people in our protectorate. The boundary commission which was to survey this frontier must be supplied with necessaries on its way to Chad, but no Englishman since the time of Barth had visited these frontier towns, while the company's envoys who negotiated the treaties with Sokoto had come only as supplicants, with presents in their hands. Kano now assumed an attitude of open hostility, which threatened alike the small garrison at Zaria and the safety of the boundary commission; nor were the latter able to go to Sokoto, the position of which it was necessary to fix as the centre of the arc of 100 miles' radius which formed the Anglo-French boundary. The efforts of the Zaria resident to check slave-raiding and to gain influence with the emir were rendered futile by the threats of Kano. In October, 1902, a sad event had occurred at Keffi, where the resident, Captain Maloney, had been murdered by a chief with whom he had preferred to use his personal influence rather than to arrest him for slave-dealing and other misdeeds by force. The murderer fled to Kano, whither other recalcitrants had already preceded him, and was received with ostentatious honour. His arrest was imperative if the prestige of Government was to be upheld, and, ladies and gentlemen, I feel strongly that, in countries where many millions are ruled by a few score, where the subordinate races are held together by the common tie of the Mohammedan religion, with chiefs of great ability who can correspond by letter, prestige is but a synonym for

self-preservation. My conciliatory overtures to Sokoto had resulted only in a letter, in which he said that between us there was nothing but war. The treaties of friendship were dead. The reinforcements I had sent to Zaria to ensure the safety of its little garrison close to the Kano frontier were interpreted throughout Northern Nigeria as an acceptation of the challenge to war, and nothing remained but to put it to the issue of battle whether or not Government could maintain its suzerainty, and arrest the murderer of one of its chief officials, killed in the execution of his duty.

Meanwhile the emir of Kano blustered, and rebuilt his walls, and ordered the innumerable walled towns in his dominions to prepare for the fight. I was well assured that the bulk of the population would not fight against us. On January 29, Colonel Morland, with 36 officers and 722 rank and file, advanced from Zaria. Opposed at Babeji, he endeavoured to persuade them not to fight; but since they were determined to do so, the town was taken by assault. The Fulani fighting men of all the other towns bolted, while the people brought supplies and water for our men without fear. Trade received no check even during the actual progress of the campaign, and we met thousands of laden men and donkeys on the road unarmed, who smilingly greeted us. It seems to me a striking testimony to the reputation the British had acquired in the country that here, beyond its furthest influence, in a district hardly traversed by white men, our troops should be treated with such confidence, while a Fulani army would have inspired terror, and found only deserted towns. Even women traversed the roads alone, and did not turn from the path as we passed. Sellers in the market and others who conceived themselves unfairly treated by the soldiers and carriers (the latter being hard to discipline and control), freely brought their complaints, assured of justice and redress. The force reached Kano, and faced the stupendous walls, 30 to 50 feet high and 40 feet thick at the base, with a double ditch in front. Their perimeter was 11 miles, with thirteen gates set each in a massive entrance tower. A small breach was made by our guns, and a storming party charged under Lieut. Dyer. The determined nature of the assault, and the prestige our troops had gained, and the effect of our shells combined to dissipate the courage of the defenders. Their leisurely retreat was changed into a panic-stricken route by the charge of the mounted infantry. The town lies at the further end of the *enceinte* enclosed by the walls, and a distance of $1\frac{1}{2}$ miles separated it from the scene of the fighting, so that no one was hurt except the actual combatants, and no damage whatever was done to the city. The troops marched to the king's enclosure—itself no mean citadel, covering 33 acres of ground. Sentries were posted at the gates, and no man was allowed to go out with arms, so that no friction might occur and no violence be perpetrated in the town. Later three soldiers did manage



INTERIOR OF NATIVE EMIR'S PALACE.



THE EMIR OF KANO'S PALACE.

to break out, and killed a man in a quarrel in the market. The murderer was tried by court martial and shot, and I desired that one or two of the Kano chiefs should be witnesses of this vindication of British justice. In the arsenal was found every conceivable kind of ammunition and a great quantity of powder. About 20,000 rounds were destroyed, and 350 firearms. Within three days of our occupation three large caravans left for the south, and the great market was in full swing as though nothing had happened. Alieu, the emir himself, was a tyrant who was detested by the people, but had inspired so deep a dread and fear that his will was law. Certain death awaited any one who disobeyed or who was even suspected of wavering, and thus he managed even in his own absence to compel a resistance which few besides himself desired. I had given orders to Colonel Morland that immediately after the occupation of the city he should close the slave market, and visit the dungeon and take out the prisoners and inquire into their cases. So well, however, is our policy known that the slave market closed itself.

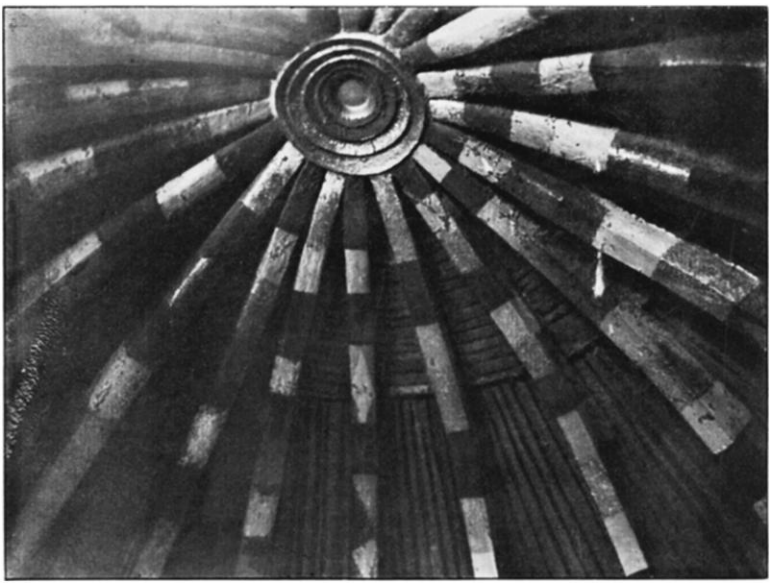
I visited the dungeon myself. A small doorway 2 feet 6 inches by 1 foot 6 inches gives access into it. The interior is divided (by a thick mud wall with a similar hole through it) into two compartments, each 17 feet by 7 feet and 11 feet high. This wall was pierced with holes at its base, through which the legs of those sentenced to death were thrust up to the thigh, and they were left to be trodden on by the mass of other prisoners till they died of thirst and starvation. The place is entirely air-tight and unventilated, except for the one small doorway, or rather hole, in the wall through which you creep. The total space inside is 2618 cubic feet, and at the time we took Kano 135 human beings were confined here each night, being let out during the day to cook their food, etc., in a small adjoining area. Recently as many as 200 have been interned at one time. As the superficial ground area was only 238 square feet, there was not, of course, even standing room. Victims were crushed to death every night, and their corpses were hauled out each morning. The stench, I am told, inside the place when Colonel Morland visited it was intolerable, though it was empty, and when I myself went inside three weeks later the effluvia was unbearable for more than a few seconds. A putrid corpse even then lay near the doorway. Even the memories of the Black Hole of Calcutta cannot eclipse this plain statement of the state of things in a British protectorate in the twentieth century, of which, in general terms, I have of course long been aware. One of the great pools in the city is marked as the place where men's heads were cut off at the arbitrary order of the king; another, near the great market, is the site where limbs were amputated almost daily for theft or some less real crime. I do not myself take too harsh a view of these barbaric methods of rule, which have characterized the tyrannies of alien despotisms both

in the East and West from time immemorial, but I venture to think that it is time that these things ceased in a protectorate under the British flag.

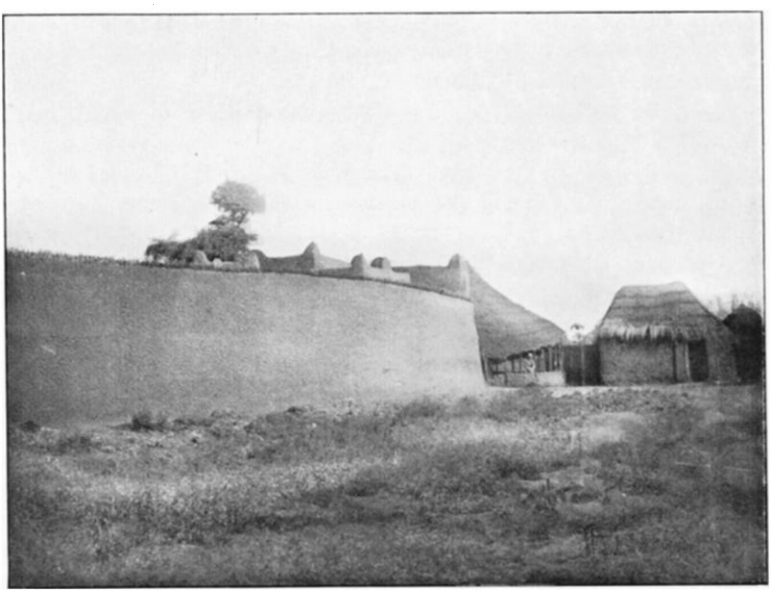
Alieu, it was found, had left for Sokoto a month previously, escorted by 1000 to 2000 horsemen, to salute the new sultan, and he was now on his way back. The defenders of Kano and the surrounding towns now joined him, and formed a great army which had to be met and overcome. Leaving a garrison in Kano, the force, 600 strong with 34 Europeans, marched to meet him. Time does not allow of my telling once more the story of Captain Wright's fight, in which he won the V.C. by opposing the bulk of the Kano army with only 45 men, or of Captain Porter's gallant charge with 25 mounted infantry. These actions finished the opposition of the Kano army. A notable incident, proving once more the attitude of the bulk of the people, occurred during Captain Wright's fight. Lieut. Wells would have been cut off had not the people of a small village, seeing his danger, received him into their town, shutting their gates in the face of the Kano horsemen. Had the little force (as seemed inevitable) been defeated, this act would have meant their own annihilation. Alieu fled north disguised as a salt merchant, but was seized by the king of Gober and handed over to me. He was sent down country, and will be given a small pension for his subsistence. The defeated army reunited under the Wombai Alieu's brother, who had refused to fight against us, and marched to Kano to surrender. I replied that I cordially welcomed the return of fugitives now that the fighting was done, but I made it a condition that they should surrender their arms. About 2500 horsemen and a vast number of footmen came in.

I had myself joined the force after the capture of Kano, marching up from Zungeru by the wonderful caravan road which leads through Zaria. I have seen nothing like it in Africa. The track is often 50 feet wide, and one meets ceaseless caravans of laden donkeys, men, women, and live stock along its whole length. I must have passed many thousands in the 250 miles we traversed to Kano. Beyond Zaria the road is frequently enclosed between hedges of great age, a very striking contrast to the universal bush path of Africa. There is a steady rise to Zaria through open forest of finer growth than the stunted jungle further south; thence there is a considerable fall to Kano, and the road leads for the most part through cultivation and villages. The method of cultivation is more thorough and more advanced than is usual in Africa. The soil is worked to a depth of over a foot, and here and there rude forms of irrigation are employed, while for the first time in Africa I saw with surprise that the fields are manured. The tamarind, the Dum palm, the acacia, and the Adansonia take the place of the shea, copaiba, he and the locust trees of the south.

I wish that time permitted me to give you a description of the city



CEILING OF THE EMIR OF KANO'S AUDIENCE CHAMBER.



WALL OF EMIR OF ZARIA'S COMPOUND.

of Kano. It alone, among the cities of Africa which I have seen, with the exception of Katsena, is worthy of the name of city, for its houses are of solid mud, with flat roofs impervious to fire, and lasting through the centuries, instead of the beehive-shaped huts of the populous towns of the south. Traces of Moorish architecture are visible everywhere, and the horseshoe arch, which some writers assert was introduced by the Arabs from Syria and Mesopotamia, modified by the Berbers and Egyptians, is a feature of the buildings. I took up my quarters in the small hall of audience, a room 25 feet square, 18 feet high, decorated with quaint shapes and designs in black, white, pale green, and yellow—the latter formed of micaceous sand which glistens like gold. The dome-shaped roof is supported by twenty arches, all of mud, but admirably fashioned, and converging on the centre. The photo will give you a better idea of its structure than my words can convey. Kano thus marks the limit of the northern type of building, of which only occasional reminiscences are seen in some emir or chief's house in Zaria and Bida. Admirable in design as were the great houses of the king and chiefs of Uganda before the Pax Britannica taught the people to prefer architecture of the railway-shed pattern, they were but of grass and palm-stems, which a fire would destroy in a night; but the greatest fire would leave Kano intact as a city. The city is divided, like all others in Nigeria, into quarters where the different races congregate, and it is striking to see white-faced Tripoli merchants with their wares of tea and sugar, silk and spices, in the Arab quarter of this African city. There are large open spaces everywhere in Kano, each with its enormous hole of reeking sewage, from whence the clay has been dug to build the houses. Unlike Bida, which, as you approach it, looks like a forest, Kano is almost treeless. Over these bare spaces sweeps the dusty wind, and on the margins of the great holes or stagnant tanks the vultures fight for the carcase of some dead dog or the stray leg of a bygone fowl. The great market is said to contain a floating population of 30,000 persons, and camels, horses, asses, oxen, and goats are exposed for sale. Tripoli merchants, Asbenawa from the desert, Salaga merchants from the Gold Coast, and Hausas each sell their own particular class of wares. I would linger here and describe to you this interesting town, the nature of the trade, and the history of its people, but I must pass on with my narrative. Suffice it to say that in an Arabic document obtained by Mr. Wallace some years ago, I find that the history of forty-two kings of Kano is given, covering a period of 768 years. The manuscript breaks off suddenly, and it is not possible to fix with accuracy the date of the events it records, but the last king is probably identical with the man whom the Fulani ousted, which would carry back the history to 1040 A.D.

On March 7, the day after the fugitives had returned to Kano, I started for Sokoto. Our route led through a thickly populated country

in which large walled towns of great strength succeeded each other every few miles, and in some districts groups of these must have numbered 30,000 people. That the high commissioner himself should have been able to traverse this country with but three officers and an escort of only 80 men, and should everywhere have received supplies and an apparently friendly welcome, while Sokoto was at the very time collecting its forces to fight, was, I submit, a very striking confirmation of the state of feeling throughout the country on which my plans had been based. The force meanwhile had suffered much from thirst in its march from Kano, and the Hamattan gale and cold at night had caused the death of 52 men from lung diseases. Effecting a junction with a detachment under Captain Merrick, who was escort to the Boundary Commission near Argungu, the little army of 25 officers and 656 natives advanced on Sokoto and defeated the Fulani, who were estimated at 1500 horse and 3000 foot. The sultan fled, and on my arrival two or three days later, the bulk of the fugitives returned, headed by the pathetic figure of the blind old Waziri, and were received as they had been at Kano. I summoned the elders to elect a sultan, and they unanimously chose Atahiru, who was in due succession and had not fought against us. I was glad there was no apparent desire to restore the fugitive king, since he too, like Alieu, had received Maloney's murderer with honour. I told them, however, that he might return to his own farms, and would not be molested. I fully explained to them, as I had done at Kano, the conditions of British rule, and that we were now the suzerains of the country; since they themselves had not kept the treaty and had challenged us to war, they must abide by its arbitrament. The new sultan was installed with some ceremony. The troops, with guns and maxims mounted, were drawn up in a hollow square in front of the royal residence in the centre of the city, where a carpet was spread for the sultan and his principal elders. On arrival I was received with a royal salute by the troops, and I spoke a few words to the assembled crowds, wishing the sultan long life and prosperity, and telling them that he would receive the support and protection of Government so long as he observed the conditions of his appointment. I added that the British had no intention of interfering with their religion, for under the king's flag all were free to worship God as they pleased. These words were received with a deep murmur of approval, which was very striking. The priests then recited aloud a prayer, and the ceremony was completed by the bestowal of a gown and turban as insignia of office.

Hitherto the Sultan of Sokoto had received no present on installation, since he recognized no superior from whose hands he could receive it. It was, indeed, his custom to present the insignia to his vassal emirs as a token of his suzerainty. The fact, therefore, that it was represented to me that the ceremony would be incomplete without

this present, was a remarkable acknowledgment before all his people that he accepted the British as his suzerains. A similar ceremony was performed at the installation of the new emirs of Kano and Zaria. In the former case the presents consisted of a sword, a dagger, and an umbrella; and after the ceremony a breach was made in the massive walls of the king's enclosure for the new emirs to enter by, since it is the tradition of Kano that a newly appointed king shall make a gateway for himself. At Zaria, according to local custom, I led the new king into the royal enclosure amid the discordant brayings of 10-foot trumpets and the beating of drums, which are the signal to the populace of the completion of the ceremony, and which none but a duly constituted emir may use. In both cases they intimated to me the proper insignia, and appeared to consider it natural that it should be received from my hands instead of from Sokoto. The influence of Sokoto extends from Bornu in the east to Timbuktu in the west, and as far as Agades in the Sahara. Throughout this vast area he is considered the religious and temporal chief, and no king is made and no war waged without his consent. I felt, therefore, the very great significance of the ceremony we had just completed, and the importance of the cordial understanding which appeared to have been arrived at. The day after the installation the expedition broke up, and I took the road to Katsena with an escort of sixty men. The sultan, with throngs of horsemen, led us on our way for a mile or two, as is the custom with an honoured guest in Hausaland, and would hardly be persuaded to turn back. They thanked me profusely for all that had been done; and, indeed, I believe that their cordiality was not a mere assumption, and that they were not altogether sorry that the long-expected crisis had come and gone, and were genuinely surprised and pleased at their treatment. Marching fast across the arid and often waterless tract of forest and sandy desert which lies between Sokoto and Katsena, we reached the latter on March 28. The emir had sent me friendly messages, and we found that he had prepared his own house for our reception.

Katsena boasts itself to be the seat of learning of Hausaland. It is probably a more ancient town than even Kano, and is built in the same style. I explained to the king the conditions of British suzerainty, which he accepted with apparent cordiality; and having interviewed the brother kings of the ancient kingdom of Gober, and settled various matters regarding their territory and their disputes with the Asbenawa, I marched back to Kano. These people of Asben are nomads of the Southern Sahara in French territory, large numbers of whom visit Nigeria for nine months in the year, returning to graze their cattle in Asben during the rains.

On leaving Kano, I was escorted as usual by the emir and his horsemen for a couple of miles. My account to-night is necessarily a brief

one, but I wish I had time to describe to you some such scenes as these. Imagine a level plain stretching to the horizon, the surface covered with the stubble of the garnered crops. The atmosphere is thick with the Hamattan haze, which shuts out the further distance with a fog-like wall. On every side are throngs of excited peasants. Mounted men, on horses covered with gorgeously embroidered saddle-cloths and jingling trappings, with attendant slaves to hold their stirrups, dash hither and thither at a wild gallop, their bright-coloured robes spread out in the breeze. Around the emir a dense phalanx of horsemen proceed at a dignified and solemn pace, holding high over his head an immense and gorgeous umbrella. The swords of the horsemen clatter against their horses' flanks; here and there a Tuareg spear flashes in the sun. The air is filled with the braying of trumpets and the din of the drums. And stolidly through the midst of all this barbaric show ride the handful of British officers in their prosaic kharki, worn, travel-stained, and dirty, heading the phalanx of stolid Hausa soldiers with their business-like rifles on their shoulders, indifferent to the tinsel and noise around them. Since I had left Kano to march to Sokoto, just thirty-eight days had elapsed before I reached Zungeru (the capital) again. In this period we had traversed 800 miles (all of which had been mapped by Captain Abadie), and the emirs of Kano, Sokoto, Zaria, and Katsena had been installed. Our marching averaged 25 miles per diem throughout.

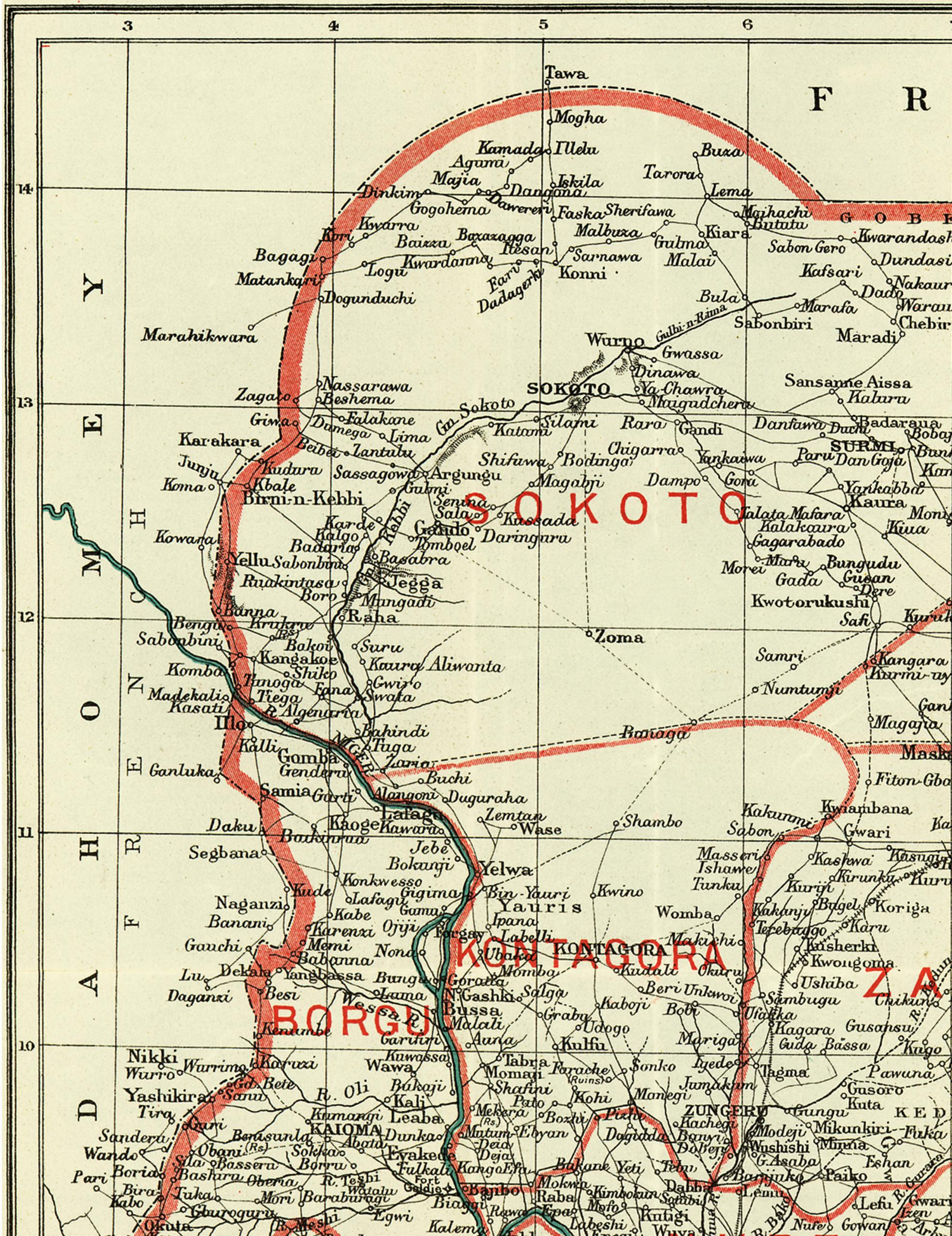
The ex-sultan of Sokoto, probably imagining that such clemency to one who had lately headed the fighting against us could only be a treacherous ruse, did not accept my conciliatory offers to come in and settle down peaceably. He had with him, moreover, the murderer of Maloney, and several irreconcilable chiefs of Kano, Bida, and Kontagora, who probably prevented his return. The Sokoto garrison turned him out of a village near the town, and he then passed eastwards, giving out that he was on his way to Mecca as a pilgrim. Not a single man from Kano joined him, but the peasantry of the villages he passed through, including women, flocked to him in great numbers on religious grounds. He carefully avoided our garrisons, and did not molest the resident, near whose camp he passed. Travelling eastwards, he reached the country between Kano and Bornu, which alone our troops had not traversed, and to which as yet no resident had been appointed. On the confines of Bornu, at a place called Burmi, there is a small colony of Tuareg origin, and composed of fanatical warriors. Thither the remnant of the following of the mullah whom Colonel Morland had defeated had taken refuge. They elected Jibrella's son as mahdi, and our troops in pursuit of the ex-sultan stumbled upon this hornets' nest. A very severe fight took place, in which the enemy suffered heavily, but the town could not be taken, as Captain Sword, the commander, had no big gun to breach the walls. It appears doubtful whether this

resistance had anything to do with the ex-sultan, and it is reported that he was not there. He had, in fact, sent in word to say that his following were starving, and he did not wish to fight. A large force was now concentrated for a renewed attack on Burmi, where it is said the ex-sultan was now detained by force. A most sanguinary battle ensued, in which the town was captured, and the ex-sultan, with the Keffi murderer and several other prominent outlaws, with some seven hundred of the Burmi fanatics were killed. Our casualties were heavy, and included Major Marsh, the commander, one of the best and most valued officers in the force. The only remaining province was thus brought under the administration.

The British flag is now hoisted over the whole of Northern Nigeria. In two and a half years (not counting the initial year of the Ashanti war) this vast country has been brought under administrative control, and organized slave-raiding has become a thing of the past in the country where it lately existed in its worst form. Trade will, I trust, follow the flag, and a sufficient civil organization now exists to permit of its extension throughout the whole country. The one thing needful is a cheap form of transport to bring the produce of the country to the great waterways, and thus to open up a new and great market. This means money—the investment of capital in a great and productive estate of the Empire, and I trust the mother-country will not grudge this initial assistance to the last-born of her children. I can assure you that the expenditure of every penny is jealously guarded and turned to account by the zealous and enthusiastic officers, civil and military, who are my colleagues and comrades in the task with which I have been entrusted in Northern Nigeria.

Before the reading of the paper, the PRESIDENT said: We have the great pleasure this evening of welcoming our old friend, Sir Frederick Lugard, who has done such great work since we last received him in this hall, now, I think, eight and a half years ago. He is so well known to you all that it is quite unnecessary for me to introduce our Gold Medalist, and therefore I will ask him to read his paper.

After the reading of the paper, the PRESIDENT said: I am sure the meeting will regret very much the absence of Sir George Goldie on this occasion, and its cause. He has asked me to read a letter to the meeting: "As I was for very many years a Vice-President of the Royal Geographical Society, and also much interested in Nigeria, I had hoped to be allowed at our meeting on the 4th to add a few words to the tribute which I feel sure you will pay to Sir Frederick Lugard. Nothing less serious than the death of a near relative, whose executor I am, would have kept me away from London on such an occasion. It seems to me only the other day that Major Lugard gave us, at a crowded meeting, an account of his first services in Northern Nigeria, in 1895, when he defeated the representative of another colonizing nation in what the foreign press described as 'a veritable steeplechase to Nikka.' His subsequent splendid career in Northern Nigeria, first as commandant of the West African Frontier Force during a serious international crisis, and afterwards as High Commissioner, has been a matter of general knowledge; but it has



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Sherifawa
Maihachi
Kiara
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Sarnawa
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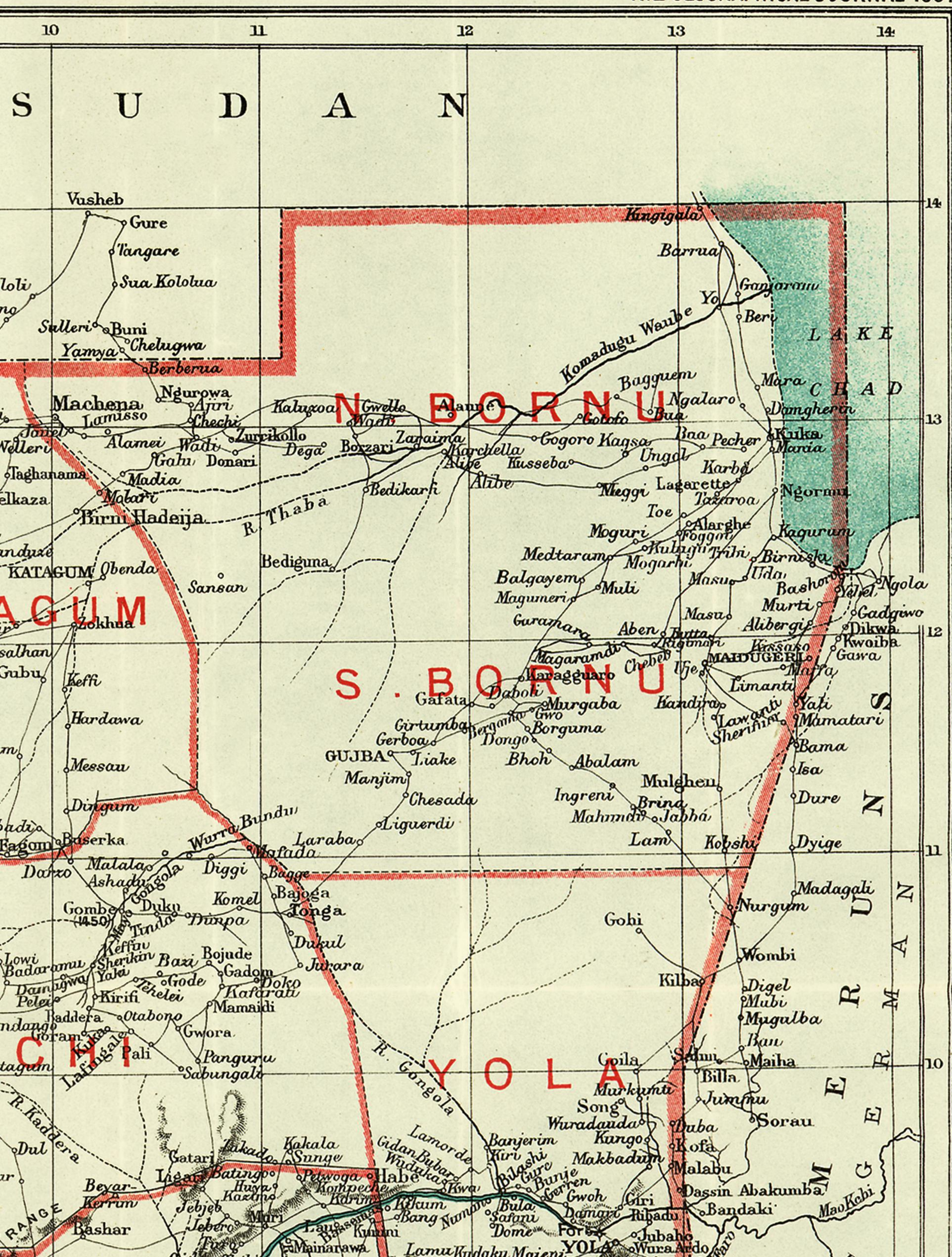
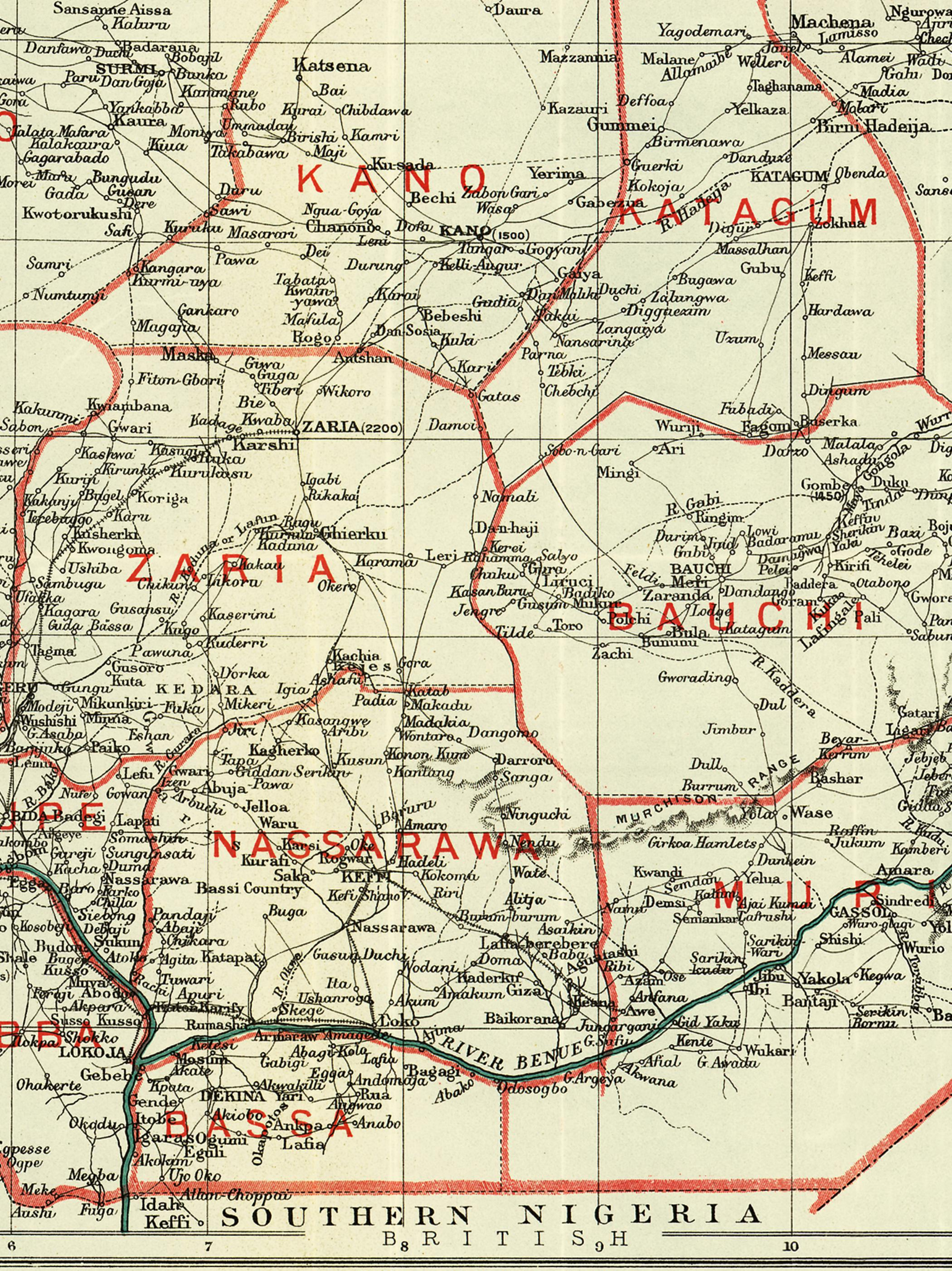
Tapa
Kusun
Konon Kum
Darroro
Lefu
Gwari
Giddan Serikin
Kantang
Sanga
Abuja
Pawa
Nufe
Gowan
Wurji
Fagom
Baserka
Fubadi
Ari
Mingi
Sobo-n-Gari
Darzo
Malala
Ashadu
Gongola
Gombe (1450)
Duku
Tinda
Namali
R. Gabi
Ringim
Dan-haji
Durim
Gabi
Jiud
Lowi
Badarawa
Dambugwa
Pelei
Keffu
Sherikin
Yaki
Bazi
Gode
Kirifi
Tehelei
Kerei
Rahamma
Salyo
Chuku
Gura
Liruci
Feldi
BAUCHI
Mefi
Baddera
Otabono
Kasan Buru
Badiko
Zaranda
Dandango
Goram
Jengre
Gusum
Mukum
Polchi
Lodge
Katagum
Kulta
Lafingale
Pali
Tilde
Toro
Bula
Zachi
Bumuu
Gworading
R. Kaddera
Dul
Jimbur
Dull
Burrum
RANGE
Beyar
Kerrum
Bashar
Gatari
Legari

NORTHERN NIGERIA
LUGARD.

THE GEOGRAPHICAL JOURNAL 1904.



Secant Conical Projection



Published by the Royal Geographical Society.


SKETCH MAP
OF
NORTHERN NIGERIA.
to illustrate the paper by Brig. Gen. Sir F. D. Lugard, K. C. M. G.
Scale of Miles.
0 50 100
Nat. Scale 1:3,000,000 or 47·3 Stat. miles to 1 inch.
Telegraphs
Railway
Heights in feet.
N. BORNU
S. BORNU
YOLA
KATAGUM
CHAD
KAMERUN
GERMAN
YOLA
Kuka
Ngornu
Dikwa
Maifa
Bama
Madagali
Mubi
Sorau
Garua
Jimmu
Song
Jubako
Bandaki
R. Benue
R. Gongola
R. Thaba
Birni Hadeija
Machena
Gujba
Gombe
Tonga
Bakundi
Wukari
Gassol
Yakola
Amara
Bird Pk. (Vogel Spitze)
Gongonosa
Ganyagam
13
12
11
10
9
8
10
11
12
13
14

not, to my mind, received the full attention it deserves. No doubt this has been partly due to the want of public interest in West African affairs, but partly also to Sir Frederick Lugard having a weakness shared by many other truly great men —excessive modesty."

Sir HARRY JOHNSTON: I shall not attempt to detain you by any extended remarks, as we have listened to a paper of very great interest which has carried us on to this late hour of the evening. I should only like to ask one or two questions for future answering, but above all to direct your attention to this primal fact as regards the reader of the paper—that before he went to play this great part, the part of Warren Hastings, in Nigeria, he had been the Clive of Uganda. Uganda certainly owes its incorporation in the British Empire to the really remarkable efforts of Sir Frederick Lugard, whose work in that direction may certainly be placed on quite the same level as the work of Cortez and Pizarro in the great empires of Central and South America, with this exception, that Sir Frederick Lugard's work was entirely in the cause of the best kind of civilization that desired to heal old quarrels and promote peace, whereas we know the efforts of earlier explorers were actuated very often by greed of gold. When I journeyed about the territories of Uganda under much more favourable circumstances, I confess I really stood amazed at intervals when I realized what my predecessor had done under circumstances of great difficulty. The mere amount of ground traversed on his own feet in the time was remarkable, and wherever he had been I found he had left those excellent memories behind him that I used to find in the similar case of Joseph Thomson. The only suggestion I would make is, that in the development of his work we may take the utmost care to gather up all that can be found in the way of adding to our knowledge of the native races of this very important territory, ranging from the very lowest type of African savage to a race with African features and intellect who bear a remarkable resemblance in many ways to the Caucasian (Hamite) invaders of Uganda. I shall not trespass upon your patience any longer, but I shall only add that, in common with every one present, I have listened to this paper with great interest and admiration.

The PRESIDENT: It now remains for us to thank the author of the paper, and Captain Abadie for the beautiful series of photographs we have just enjoyed the sight of; but before offering them our formal thanks, I should like to point out the early and long connection that this Society has had with the region of the Niger. When the African Association was amalgamated with the Geographical Society the mouth of the Niger had just been discovered, and our first Gold Medal was given to Richard Lander for his discovery. Since that time our Society has taken the very deepest interest in this region. Dr. Baikie, who established the consulate many years ago on the Niger, was selected by our President, Sir Roderick Murchison, for that service. He went out there and did wonderfully good work, which on his death ceased, and there was a complete pause until the work was taken up, and was magnificently brought to a conclusion by Sir George Goldie fourteen years after the death of Dr. Baikie. And to show what valuable work has been done in that region, I think I need only mention the fact that amongst those Nigerian travellers three have received our Gold Medal, including our friend Sir Frederick Lugard, and that others have received various awards from this Society. I cannot help alluding to our losses also. Two of the most promising geographers of the rising generation are connected with this country of Northern Nigeria. One, who not many years ago addressed us in a most interesting paper, was young Colonel Vandeleur. His death represents one of the greatest losses, I think, that geography has sustained for many years. The other was David Carnegie, who died in the execution of his duty, a man distinguished for ability, for energy, for unselfishness,

and for the powerful influence he had over others. I remember, at the time of his work in Australia, I said he deserved one of the highest honours that this Society could bestow, and I repeat that opinion now. But there are many other rising young geographers, and we must all have rejoiced when we heard Sir Frederick Lugard say that he and his officers in Northern Nigeria were all enthusiastic surveyors. We have to thank Sir Frederick Lugard for the way in which he has always kept the importance of surveying and of geographical work in the forefront, because, as an administrator, he knows well its great importance. I find that there are now under Sir Frederick Lugard's command no less than seven officers who have received instruction here from Mr. Coles and from Mr. Reeves. One of them has received our diploma, another has received one of our awards, so that we may feel confident that under Sir Frederick's able guidance geography will always take an important share in the work of the administration of the colony. The advances that have been made, I am sure you will all see, from what Sir Frederick Lugard has told us, have been most extraordinary. The thought that in three years so much has been done, must leave us full of hope for the future. I will now ask the meeting to pass a unanimous vote of thanks to Sir Frederick Lugard, our Gold Medallist, for the admirable paper he has given us this evening.

GEOGRAPHICAL RESEARCH.

By Colonel Sir T. H. HOLDICH, K.C.M.G., K.C.I.E., C.B., Chairman of the Research Committee.*

THE Research Department of this Society owes its initiative, like so many other useful branches of the Society, to the President. His memorandum on the subject has already been circulated amongst the members of the Society, and I cannot do better, in the first instance, than read that memorandum, with extracts from the resolutions passed thereon by the Council at the recommendation of the special committee which was appointed to consider the subject.

At a meeting of Council of February 9, 1903, the following memorandum by the President was approved :—

The time seems to have arrived when further steps should be taken to encourage geographical research, both in its purely scientific and in its practical aspects (applied geography). The stated ordinary meetings of the Society are naturally and rightly occupied with the narratives of explorers, and such other objects as can be rendered intelligible to a cultured audience, few of whom are, however, specialists. There is still room for pioneer exploration, although scientific research in limited areas is becoming of more and more importance.

Mainly through the continued activity of the Society during the last twenty-five years, a school of young geographers has grown up, who are carrying out research in various departments of the subject, and who are thus helping to raise the standard of geography in this country.

It seems the duty of the Society to do what it can to encourage work of this

* Read at the opening meeting of the Geographical Research Committee.

kind, and to invite those taking part in it to lay the results before the Society. In recent years this has been done occasionally at afternoon meetings in the map-room, but these have been somewhat spasmodic; a more organized procedure is necessary, so that we may secure a regular supply of suitable papers, and pre-arrange the meetings, so that it may be possible to obtain an audience capable of discussing the subjects.

The Council appointed a special committee to consider the subject of the memorandum; this committee held several meetings, and the Council on May 18 passed the following among other resolutions:—

That a department of the Society's work be constituted to be known as the Research Department; that in connection therewith an advisory committee be appointed, to be known as the Research Committee of the R.G.S., and that papers giving the results of researches on the geography of this country and other regions, and on geographical methods and problems, be read and discussed at periodical meetings organized by the Committee.

That the Research Committee be empowered to elect from among its members an executive sub-committee of nine, of whom not fewer than three shall also be members of the Council.

That the Research Committee may recommend to the Council awards not exceeding £200 in any one year for the encouragement of geographical research. That the applicants recommended for grants shall be either about to undertake work with the approval of the Research Committee, or, having submitted an adequate piece of work to that committee, shall have made application for a grant to defray expenses incurred.

At a meeting of the executive sub-committee on June 29, it was decided to issue an invitation to members to submit papers on subjects suitable for discussion, and especially to introduce other workers in geography who might be willing to submit papers; also to suggest any line of investigation that seemed specially desirable, and the names of persons or institutions competent and likely to undertake the work.

So far as the working programme suggested by the committee is concerned, there is little more to be said. It appears to me that we must regard that programme as tentative. So much depends on the number and nature of the subjects raised for discussion, that we may find that monthly meetings of an hour or an hour and a half will not meet the demand arising for such discussions. Until we have had a little experience it is impossible to say. But as regards the nature of the papers submitted, the methods and manner of discussion, there are a few points which we may usefully consider to-night. The Presid nt has pointed out that the stated ordinary meetings of the Society are naturally and rightly occupied with narratives of exploration, which are intended to appeal to a general audience interested in geographical matters, but not necessarily scientists or specialists. It is intended, therefore, that the discussions of the Research Committee meetings should be of quite another character. They need not be popular (in the technical sense of that word), and they *should* appeal to scientists

and specialists. It is exactly this class of interest which we wish to arouse. Consequently, we wish so to frame our methods as to induce those who possess information of a special character to impart their knowledge readily and concisely, so as to give ample opportunity for discussion to those who desire to attain such special information. It must be obvious, then, to all, that papers or subjects introduced for discussion at these meetings should be short and to the point. Narrative must as far as possible be excluded, and discussion which does not deal directly with the subject in hand will be discouraged. Analogous methods of discussion are familiar to the members of many scientific institutions around us—the astronomical, the meteorological, geological, and others, all of which offer the opportunity for short concisive statements on special points of scientific interest which arise from time to time, and so limit the statement of the subject-matter in hand that frequently three or four such subjects will be introduced, explained concisely, discussed, and dismissed within an hour. It should be understood, therefore, that it is quite useless to submit papers for these meetings which will occupy more than half an hour in the reading. If they can be compressed into half that time so much the better. It will happen, no doubt, now and then, that some subject of special significance may demand the full attention of the meeting for the full time at our disposal. No hard-and-fast rule can be made, but it is desirable to impress upon contributors to the discussions, which we trust will be well sustained at these meetings, firstly, that they should limit themselves as far as possible to a simple statement of facts and observations, and draw attention only to such points of their subjects as may be open to comment or discussion. I do not see why references should not be made to the committee, and questions asked bearing on subjects of geographical significance. Such questions may demand care and consideration in formulating a reply. Consequently due notice should be given beforehand of the question which it is proposed to ask, and then all we can promise is that the committee will endeavour to provide an answer; but questions proposed without due notification are hardly admissible, unless they refer to the subject under discussion.

There is nothing that I can usefully add by way of suggestion to the resolutions passed by the Council of the Society on May 18. It appears to me that in this special branch of the work of the Royal Geographical Society new opportunities for usefulness are opened to an extent which at present perhaps we can hardly realize. New impulses can be given to the progress of geographical education which is already advancing appreciably in our great educational centres; new fields can be opened for students anxious to make practical use of the theoretical instruction which they have acquired at those centres; and it is certain that the labours of this new department will tend to raise the scientific status of the Society itself. It will, we hope, render

its verdict, in matters appertaining to the political, commercial, economic, and military phases of geographical inquiry, of appreciable value in assisting the counsels of those who administer the government of this world-wide Empire.

A word or two remains to be said on the subject of the research work which it is proposed to undertake. It will be observed that, amongst the examples of the kind of research work which may be reasonably undertaken by this department, the majority may be expected to lead up to practical issues. They deal generally with certain natural phenomena affecting the area of regional geography, involving the collation and discussion of facts which may be turned hereafter to economic advantage. Whilst our researches are to be conducted in a spirit of scientific inquiry, we still have an eye to the practical advantages which may accrue from the study of such facts. But it seems to me that we might go yet a step further, and endeavour to constitute ourselves a useful authority on points which are not mere matters dealing with cause and effect, but which require the consideration of a body of practical geographers to give a final verdict as to their theoretical value.

But I need make no further suggestions. I only wish to point out that such suggestions will be welcome to the committee. I have not the least doubt that we shall soon find our hands full of them.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

Introductory.

The field work connected with the sounding of the Scottish fresh-water lochs was brought to an end for the season in the month of October. Two members of the staff—Mr. E. R. Watson and Mr. James Murray—have, however, been stationed at Fort Augustus on Loch Ness during the winter for the purpose of making continuous observations on the changes of temperature, the seiches, and the organisms in the waters of

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* Continued from vol. xxii. p. 541. Maps, p. 152. The maps illustrating this paper are reduced from the 6-inch Ordnance Survey charts, and are published by permission of the Controller of H.M. Stationery Office. The map showing the surface geology of the headwaters of the Tay, generalized from the maps of H.M. Geological Survey where the ground has been surveyed, is published by permission of the Director-General of the Geological Survey of the United Kingdom.

Loch Ness and some of the adjoining lochs. These observations have already yielded some interesting results, which will be published in a later paper.

Part III.—Lochs of the Tay Basin.

This paper concludes the account of the work of the Lake Survey among the lochs of the Tay basin, and deals with over thirty of the smaller lochs which were surveyed early in the summer of 1903 by Mr. James Murray. It is accompanied by biological notes concerning the distribution of organisms in the lochs of the Tay basin, and by a description of the surface geology of the region by Messrs. Peach and

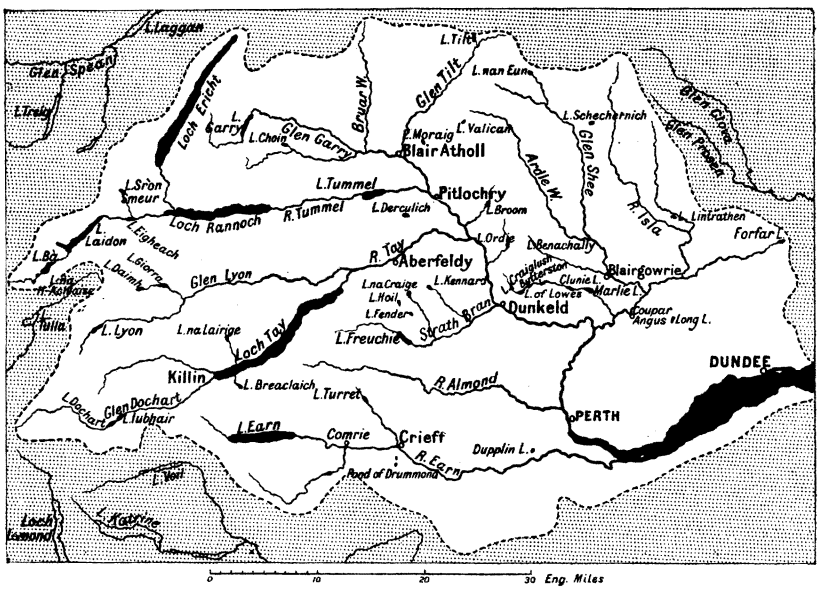


FIG. 1.—INDEX MAP OF THE TAY BASIN, BY J. G. BARTHOLOMEW, F.R.G.S.

Horne. Some of these little lochs are remotely situated among the hills, and could only be reached by cycling and walking, the soundings being taken by means of the small machine figured in the September number of the *Journal*, which could be lashed to a bicycle or carried in the hand; in this work Mr. Murray had the assistance of Mr. William Fraser, cyclist-boatman. For the signification of the names of the lochs we are indebted to Mr. Hew Morrison, librarian of the Edinburgh Public Library.

10. *The Remaining Smaller Lochs of the Tay Basin.*

A dozen of the smaller lochs in the basin of the Tay were dealt with in the previous article of this series, published in the November number of the *Journal*, and in this article it is proposed to deal with the remaining thirty-one smaller lochs. The bathymetrical and other details

regarding these lochs are collected together in the opposite table for convenience of reference and comparison, and other particulars are given under the name of each loch. Where the elevation above the sea has not been determined by levelling from bench-mark, the approximate elevation has, where possible, been indicated within brackets.

From this table, it will be seen that in the thirty-one lochs under consideration nearly 1650 soundings were taken, and that the aggregate area of the water surface is over 4¼ square miles, so that the average number of soundings per square mile of surface is 383. The aggregate volume of water contained in the lochs is estimated at 2300 millions of cubic feet. The area drained by these lochs is nearly 105 square miles, or 24½ times the area of the lochs.

*Loch Bhac.**—Loch Bhac (Bhaic, or Vach) lies to the north of Loch Tummel, and flows by the Allt Bhaic into the river Garry between Struan and Blair Atholl. It contains fine trout, but the fishing is strictly preserved. It is surrounded by low heather-clad hills, which slope gradually up from the shores of the loch. There are few weeds, and the bottom is sandy or (in parts) gravelly. Loch Bhac trends in a north-east and south-west direction, and is extremely simple in outline and in conformation. The water rises and falls very little, the range being probably less than 1 foot. On commencing the survey at 6.15 p.m. on July 6, 1903, the temperature of the surface water was 53°·0 Fahr. (the air-temperature being 46°·0), and in the centre of the loch a little later readings at the surface, at 25 feet, and at 40 feet gave identical results, 45°·0 (the air-temperature being 44°·0).

Loch Con.†—Loch Con (Chon, or Choin) lies to the east of Loch Garry, and flows by the Allt Choin into Erochy Water, which joins the river Garry at Struan. It was formerly a good trout loch, but now contains many pike, which are supposed to have been maliciously introduced. Its gradually sloping shores are heather clad, with few large boulders. The outflowing burn goes through a large flat mass of moraine *débris*, which extends far down the burn. It trends in an east and west direction, and is extremely irregular in outline, being almost divided into two portions by a narrow constriction near the middle of the loch. Drift-marks were observed about 3 feet above the water. The temperature of the surface water on commencing the survey at 3 p.m. on July 4, 1903, was 54°·0 Fahr. (air-temperature 50°·0), and at 5 p.m. readings at the surface and at a depth of 8 feet both gave 55°·0 (the air-temperature being 51°·0.)

Loch Tilt.‡—Loch Tilt, at the head of the glen of that name, consists in reality of two lochs, a broad burn flowing from the larger (northern) loch to the smaller loch, which is about one foot lower and full of weeds. The larger loch is nearly half filled with weeds (*Equisetum*), and the bottom is stony where free from weeds. The shore is stony,

* = Loch of the peat bank. † = Loch of the otter.
‡ = Loch of the burns.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean. Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Bhac	[1070]	29	0·38	0·17	0·13	33·3	42	16·500	39·3	48	122	22	0·05	1·80	36·00
Con	—	63	0·94	0·27	0·11	11·5	9	3·474	38·6	551	1430	10	0·10	3·67	36·70
Tilt	1653·5	23	0·35	0·20	0·08	21·5	5	2·500	50·0	370	740	2	0·03	0·62	20·67
Moraig	[1105]	39	0·55	0·28	0·11	19·1	14	5·540	39·6	207	524	9	0·06	2·07	34·50
Loch	[1450]	100	1·23	0·16	0·10	8·4	81	29·225	36·1	80	222	103	0·13	2·49	19·15
Nan Eun	[2575]	53	0·45	0·23	0·13	28·2	50	21·642	43·3	47	110	34	0·06	0·31	5·17
Craiglush	327·6	51	0·58	0·29	0·19	32·4	44	16·130	36·7	70	190	49	0·11	5·72	52·00
Lowes	327·6	62	1·20	0·55	0·28	23·7	53	20·400	38·5	138	360	194	0·34	7·69	22·61
Butterstone	314·4	54	0·58	0·50	0·29	50·3	25	11·289	45·2	122	271	53	0·17	8·37	49·23
Clunie	156·5	83	0·62	0·59	0·34	54·7	69	29·123	42·2	47	112	170	0·21	16·29	77·57
Drumellie	146·7	74	0·86	0·46	0·32	36·9	58	29·180	50·3	78	156	222	0·27	23·26	86·14
Rae	195·2	33	0·44	0·18	0·11	24·5	16	6·590	31·2	145	353	9	0·05	0·37	7·40
Fingask	140·6	38	0·35	0·25	0·14	41·1	48	22·835	47·6	38	81	32	0·06	0·27	4·50
White	153·7	43	0·34	0·15	0·07	20·3	32	12·952	40·6	56	138	8	0·02	0·09	4·50
Black	162·8	29	0·28	0·09	0·04	15·7	7	4·730	67·6	211	313	2	0·01	0·04	4·00
Stormont	168·1	31	0·66	0·34	0·18	26·7	3	1·500	50·0	1162	2324	5	0·12	0·32	2·66
Monk Myre	—	32	0·52	0·15	0·08	14·4	12	5·085	42·4	229	538	6	0·04	0·25	6·25
Long	724·0	52	0·70	0·28	0·17	23·6	42	9·924	23·6	88	373	32	0·16	0·87	5·44
Pitlyal	606·5	30	0·21	0·15	0·11	52·3	19	8·320	43·8	58	133	5	0·02	1·89	94·50
Freuchie	867·5	86	1·74	0·43	0·31	18·0	62	22·834	36·8	148	402	347	0·54	23·20	54·96
Hoil	[1600]	36	0·36	0·32	0·15	42·5	46	19·090	41·5	41	99	29	0·06	0·34	5·66
Fender	[1888]	59	0·33	0·19	0·11	32·2	78	31·770	40·7	22	55	31	0·04	0·36	9·00
Turret	[1132]	70	1·04	0·37	0·25	23·7	79	31·790	40·2	70	173	228	0·26	5·91	22·72
Uaine	[1520]	37	0·14	0·11	0·05	35·4	10	3·500	35·0	74	211	0·7	0·01	0·60	60·00
Drummond Pond ...	—	60	0·68	0·30	0·21	30·7	12	5·094	42·5	299	704	20	0·14	0·58	4·14
Monzievaird	[200]	62	0·55	0·20	0·11	19·3	39	14·700	37·7	74	198	24	0·06	1·64	27·33
Benachally	1004·9	59	1·05	0·52	0·24	23·0	64	25·060	39·2	87	221	178	0·25	3·09	12·36
Shechernich	[1330]	30	0·46	0·20	0·14	31·1	8	4·013	50·2	304	605	7	0·07	1·15	16 42
Auchenchapel	—	43	0·37	0·27	0·15	40·3	17	8·263	48·6	115	237	13	0·06	0·33	5·50
Lintrathen	674·6	117	1·38	0·73	0·45	32·6	70	23·423	33·5	104	311	405	0·62	28·87	46·56
Forfar	166·3	63	1·07	0·24	0·15	14·0	29	11·430	39·4	195	494	51	0·16	2·19	13·68
		1641										2300·7	4·28	104·65*	24·45

* It must be remembered that the drainage area of Loch Drumellie includes the areas draining into Lochs Craiglush, Lowes, Butterstone, Clunie, and Rae; that of Loch Fingask includes the area draining into the White Loch; that of Loch Pitlyal includes the area draining into Long Loch, and that of Loch Turret includes the area draining into Lochan Uaine.

and the loch is surrounded by an almost flat terrace of peat with stones, with high, rounded, heather-clad hills on the west side. Weeds are abundant off the south-western shore, and in the northern angle of the loch, where there are many large stones in the water. Drift-marks were observed about a foot above the water. The surface temperature at 6 a.m. on July 9, 1903, was 54°·0 (the air-temperature being 58°·0).

*Loch Moraig.**—Loch Moraig is an artificial loch, having been originally an old snipe marsh, banked up on the south; it flows by a short stream (the Allt Chluain) into the river Garry, between Blair Atholl and Killicrankie. It is well stocked with fine trout, but the fishing is strictly preserved. It trends in a north and south direction, and is very irregular in outline. Temperatures taken in the deepest part of the loch on July 9, 1903, gave the following results:—

Surface	52°·2 Fahr.
8 feet	51°·8 „
14 „	51°·4 „

(the air-temperature being 52°·0)

To the north-east of Loch Moraig, at the head of Glen Girnaig, lies the little Loch Valican (or Valigan), also a good trout loch.

Loch Loch.—Loch Loch, a good trout loch, and containing char also, is situated amid wild mountainous scenery, the hills on both sides being very steep—Ben-y-gloe on the west, and the precipitous crags of Craig an Loch on the east. Mounds of gravelly morainic *débris* occupy the greater part of both shores, forming the prominent points. It flows northward by the An Lochain into the river Tilt, which also receives the waters from Loch Tilt at the head of the glen. It is a long narrow loch, or rather two lochs, there being a very narrow constriction near the middle dividing it into two portions, and it trends almost due north and south. The two lochs were quite distinct on the date of the survey, with a difference in level of about half a foot. There was no evidence that the loch rises more than a foot higher than on the date surveyed. Serial temperatures were taken on July 9, 1903, in the two halves of the loch: (1) in 40 feet of water near the southern end of the loch, and (2) in the deepest part of the northern portion of the loch, with the following results:—

	Southern half.	Northern half.
	°	°
Surface	52·5	51·7
5 feet	51·7	—
10 „	51·2	—
20 „	51·2	—
25 „	—	50·8
40 „	51·0	—
50 „	—	50·0
75 „	—	49·5
Air-temperature	58·0	59·0

* Moraig is a personal name.

These observations indicate a lower temperature throughout the deeper water in the northern half as compared with the shallower water in the southern half of the loch.

*Loch nan Eun.**—Loch nan Eun (or na-Nean), a beautiful but lonely little loch at the head of Glen Taitneach (or the Pleasant Glen) amid extremely wild scenery, is well stocked with trout said to be as fine as in any loch or river in Scotland. It flows into the Shee water at the head of Glenshee. It is the highest loch hitherto sounded by the Lake Survey, and is surrounded by high hills with rounded tops, and grey with bare rock or screes. Its shores are peaty, with many small stones and a few large ones. Loch nan Eun trends in a north-east and south-west direction, and is very peculiar in outline, consisting of a subcircular body with a broad arm, in which are two comparatively large islands, and a short narrow arm extending towards the north-east. There is evidently very little variation in the level of the surface of the water, since no drift-mark indicating a higher level could be seen. A fall of a few inches would cease to feed the outflowing burn, which forms a waterfall a few yards from the loch, the top of the fall being at nearly the same level as the loch. The temperature of the surface water on commencing the survey at 10·30 a.m. on July 2, 1903, was 50°·0 (the air-temperature being 55°·0), and a series of temperatures taken at noon in the deepest part of the loch gave the following results:—

Surface	50°·8 Fahr.
25 feet	50°·5 „
45 „	49°·8 „

(the air-temperature being 50°·0)

Lochs Craiglush, Lowes, Butterstone, Clunie, Drumellie, Rae, Fingask, White, Black, and the Stormont lochs form a connected series of lochs all draining into the Lunan Burn, which flows into the river Isla shortly before its junction with the river Tay; they all contain pike and perch, and trout also are taken in Lochs Craiglush, Lowes, and Drumellie. The group nearest the source of the Lunan Burn consists of Lochs Craiglush, Lowes, and Butterstone.

Loch of Craiglush.†—The Loch of Craiglush is situated in Drumbuie Wood near Dunkeld, and is almost surrounded by trees. Its shores are weedy, and where the Lunan Burn enters there is a large grassy flat formed of material brought down by the stream. It trends in a north-east and south-west direction. The Loch of Craiglush forms a simple basin, the bottom sloping gradually down on all sides towards the deepest part without any pronounced irregularities. Temperature observations taken in the deepest part of the loch at 7.45 a.m. on June 2, 1903, gave the following results:—

Surface	61°·2 Fahr.
5 feet	61°·3 „
8 „	61°·2 „

* = Loch of the birds. † = Loch of the burnt rock.

9 feet	... ...	57°·4 Fahr.
10 „	... ...	54°·5 „
20 „	... ...	52°·0 „
30 „	... ...	50°·0 „
42 „	... ...	49°·0 „

(the air-temperature being 49°·0)

Loch of Lowes.—The Loch of Lowes, like the Loch of Craiglush, is surrounded by trees; its shores are mostly composed of stony *débris*, and weeds are abundant off the south-western shore where the artificial channel from the Loch of Craiglush enters. It trends in a north-east and south-west direction. The Loch of Lowes forms, on the whole, a simple basin, but with here and there minor undulations of the bottom. Temperature observations taken in the deepest part of the loch at 1.15 p.m. on June 2, 1903, gave the following results:—

Surface	... ...	60° 0 Fahr.
10 feet	... ...	59°·5 „
13 „	... ...	57°·0 „
15 „	... ...	52°·2 „
20 „	... ...	51°·0 „
30 „	... ...	50°·2 „
40 „	... ...	50°·0 „
50 „	... ...	50°·0 „

(the air-temperature being 49°·0)

*Loch of Butterstone.**—The Loch of Butterstone (or Butterston) is, like the two neighbouring lochs, to a large extent surrounded by trees; its shores are sandy or weedy, and many coots nest among the weeds. It is almost circular in outline, and forms a simple basin, the maximum depth of 25 feet being observed approximately in the centre of the loch, but nearer the western and southern shores. Temperature observations were taken in the deepest part of the loch in the afternoon of June 1, 1903, with the following results:—

Surface	... ...	63°·0 Fahr.
5 feet	... ...	62°·8 „
8 „	... ...	62°·5 „
10 „	... ...	57°·0 „
25 „	... ...	53°·0 „

(the air-temperature being 57°·0)

Loch of Clunie.†—The Loch of Clunie lies in a well-wooded valley, and is surrounded by cultivated ground, except at Forneth woods. The castle on the island in the loch, which seems to be artificial, is said to have been the birthplace of the Admirable Crichton. On this island a pair of herons built their nest in 1903, but nest and young were destroyed by excursionists. Near the middle of the north side of the loch, and about 100 yards from the shore, is a mound of stones (two of which were above the water on the date of the survey), said to have been put down to indicate a sandbank. The Lunan burn at the exit

* = Loch of the archer's stone. † = Loch of the calm hollow.

of the loch is a long weedy stretch with no perceptible current, the fall to the Loch of Drumellie being only 10 feet in a mile. The Loch of Clunie is triangular in outline, with the apex pointing south, and forms, generally speaking, a simple basin, but with a few minor undulations of the bottom. Temperature observations taken at 6.30 p.m., on June 4, 1903, in the deepest part of the loch gave the following results:—

Surface	62°·3 Fahr.
5 feet	62°·0 „
10 „	54°·2 „
15 „	52°·4 „
25 „	49°·0 „
50 „	47°·4 „
65 „	47°·2 „

(the air-temperature being 70°·0)

Loch of Drumellie.—The Loch of Drumellie (or Marlee Loch) lies about a mile to the east of the Loch of Clunie, and is surrounded by cultivated ground, the fields sloping gently up on all sides. Its shores are stony or weedy, and the narrow portion leading to the outflow is quite choked up with weeds, except for an artificial channel about 4 feet deep leading to the landing-stage, where the burn flows out over a weir. Large yellow masses of decaying vegetable matter were floating everywhere. The Loch of Drumellie forms a flat-bottomed basin, the bottom sinking in two places below the 50-feet line, with shallower water between. Temperature observations taken in the deepest part of the loch at 11.30 a.m., on June 4, 1903, gave the following results:—

Surface	60°·2 Fahr.
10 feet	59°·0 „
15 „	53°·7 „
20 „	50°·7 „
30 „	49°·5 „
40 „	49°·2 „
58 „	48°·7 „

(the air-temperature being 70°·0)

Compared with the temperatures taken in the Loch of Clunie in the evening of the same day, this series shows a much smaller range of temperature, the surface temperature being 2° lower and the bottom temperature 1°·5 higher, although the difference in depth is only 7 feet; the position of greatest fall in the temperature is nearer the surface in the Loch of Clunie, and the amount of fall is greater.

*Rae Loch.**—Rae Loch (or Ardblair Loch) lies a quarter of a mile to the east of the Loch of Drumellie, into which it flows, and about a mile to the west of Blairgowrie. It is surrounded by low fields and wooded country, and its shores are all weedy, while the western portion of the loch is quite filled with weeds. The water formerly stood at a higher

* = Loch of the Rath or Dun.

level, and frequently flooded the road on the north side; it was consequently lowered about 10 feet by a cutting, which has since, however, become choked up. Temperatures taken in the deepest part on June 23, 1903, gave the following results:—

Surface	60°·8 Fahr.
5 feet	60°·5 „
10 „	57°·9 „
15 „	57°·1 „

(the air-temperature being 57°·0)

*Fingask Loch.**—Fingask Loch lies about three-quarters of a mile to the south-east of Rae Loch, and $1\frac{1}{4}$ miles to the south-west of Blairgowrie. It is surrounded by low cultivated ground, and weeds occur in the north-western angle of the loch and near the shore in other places, but not in any great abundance. It receives the outflow from White Loch by a mill lade, and it flows into the Lunan Burn by a short sluggish stream. Fingask Loch forms a simple basin, the bottom sloping down gradually on all sides to the deepest part, which is approximately centrally placed. The north-western angle is shallow and obstructed by weeds, but the remainder of the loch is comparatively deep, and forms a sub-circular basin. Temperature observations taken in the deepest part of the loch in the afternoon of June 19, 1903, gave the following results:—

Surface	58°·8 Fahr.
10 feet	57°·6 „
20 „	55°·3 „
30 „	49°·4 „
45 „	48°·7 „

(the air-temperature being 52°·0)

White Loch.—The White Loch lies immediately to the east of Fingask Loch, into which it flows by an artificial mill-lade, and the water has apparently been raised several feet by damming, in order to supply the mill. At the east end of the loch, in the direction of the Black Loch, a copious burn flows out of the bank into the White Loch, but there is no evidence that it comes from the Black Loch, and the local people think the burn has its source in a spring. The eastern portion of the loch, called the Eie Loch, is separated from the larger and deeper portion by a narrow constriction; it is shallow, and almost filled with weeds, with a central depression 15 feet in depth. Tradition says this was once a separate loch, and that the connection was cut, the depth in the constriction being 2 feet. The king eider is said to have bred in the White Loch for some years, and to have successfully reared its young. The loch is surrounded by gently sloping fields and wooded ground. Temperatures taken in the deepest part of the loch on June 19, 1903, gave the following results:—

* = Loch of the white gask or white meadowland.

Surface	...	59°·0 Fahr.
10 feet	...	58°·0 „
20 „	...	52°·5 „
30 „	...	50°·2 „

(the air-temperature being 49°·0)

Compared with the temperatures taken in Fingask Loch on the same day, this series indicates that the temperature of the upper layers of water was comparable in both lochs, but at 20 feet the temperature was nearly 3° lower than at that depth in the larger loch, the position of the great fall in the temperature being nearer the surface in the smaller loch.

Black Loch.—The Black Loch lies immediately to the east of the White Loch, the main road from Perth to Blairgowrie passing between them. Neither inflow nor outflow was observed, but if the water were to rise 6 or 8 feet it might overflow by the channel under the road into the White Loch. It is almost surrounded by woods, and the shores are weedy. Temperatures taken in the deepest part of the loch on June 23, 1903, gave the following results :—

Surface	...	60°·1 Fahr.
3 feet	...	60°·0 „
4 „	...	59°·8 „
5 „	...	58°·5 „
6 „	...	57°·1 „

(the air-temperature being 56°·0)

To the south-west of the Black Loch lies Hare Myre,* which was visited on June 22, 1903, but could not be sounded because no boat was available. The keeper said it was all shallow, and that the oars when rowing stirred up the mud everywhere, the depth probably not exceeding 2 feet. More than two-thirds of the superficial area is overgrown with weeds, there being a very little open water of a black colour. Neither inflow nor outflow was seen.

The term Stormont Lochs is sometimes applied to the group of small lochs in this neighbourhood, including Loch Bog or Stormont Loch, Monk Myre, Hare Myre, Black, White, Fingask, and Rae Lochs. Myriads of water-fowl breed on these lochs, and ducks of several species were nesting on the artificial island in Stormont Loch at the time of the survey.

Stormont Loch.—Stormont Loch (or Loch Bog) lies immediately to the east of Hare Myre. It is a stagnant bog in a flat country, surrounded by woods and fields, and it receives no water except rains. It rarely rises high enough to overflow, but in February, 1903, it did so, the outflow being artificial and leading to the Lunan Burn. The water was turbid, light brown in colour, and dense with animals—so much so that the tow-nets could only be used for a very short time. About half the area of the loch is unapproachable on account of weeds, and the

* = Loch of the battle muir, or field of slaughter.

other half is very uniform in depth (2 to 3 feet), and free from weeds. The keepers say that the mud on the bottom is of great depth, 18-feet poles having been sunk in it, and that it has accumulated greatly of late years. It is said that within the memory of old men now living there was a depth of 17 feet near where the boathouse was built (of which the remains are still visible). The temperature of the surface water at 1 p.m. on June 22, 1903, was 64°·0 (the air-temperature being 59°·0).

Monk Myre.—Monk Myre lies about half a mile to the east of the Stormont Loch, but it flows in the opposite direction by the Monkmyre Burn into the river Ericht; there are no inflowing burns. It is surrounded by flat grassy country, and is divided into two portions by a narrow constriction, through which it is now impossible to take a boat. The smaller western portion is mostly overgrown by weeds, with a very little open water, and never entirely freezes over, owing probably to the existence of numerous springs. Temperatures taken at 7 a.m. on June 20, 1903, gave 55°·8 both at the surface and at a depth of 10 feet (the air-temperature being 44°·0).

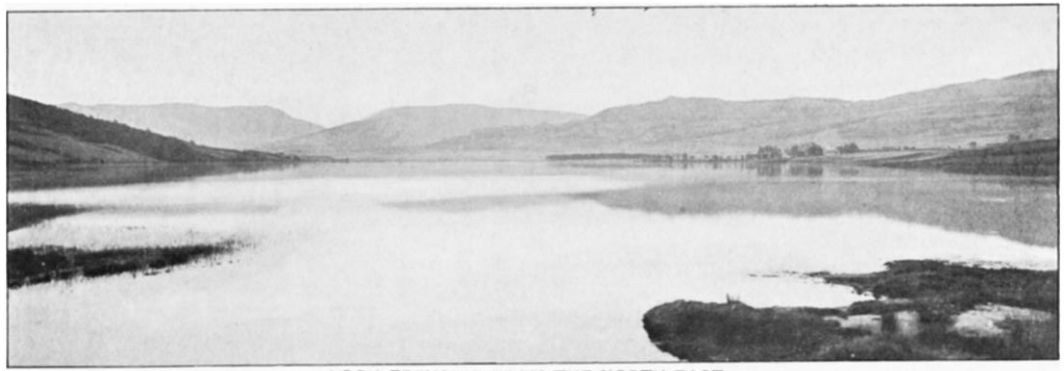
Long Loch and Pitlyal Loch form the headwaters of the Dighty Burn, which flows eastward and enters the estuary of the Tay at Monifieth; a burn flows from Long Loch to Pitlyal Loch.

Long Loch.—The Long Loch is bordered on the west by steep grassy hills, while the eastern shore is low and wooded. No burns of any size enter the loch, but there are many springs on the hillside to the west. It contains pike and perch. The outflow is artificial, by dam and sluice, but at the time of the survey the water was very low, and very little water was flowing out at the sluice. The dotted line on the map shows approximately the shore-line on the date of the survey, and the water would have to rise $4\frac{1}{2}$ feet to reach the overflow. Temperatures taken in the deepest part of the loch on June 24, 1903, gave the following results:—

Surface	58°·4 Fahr.
10 feet	57°·0 „
15 „	55°·4 „
20 „	54°·0 „
40 „	53°·2 „

(the air-temperature being 60°·0)

Pitlyal Loch.—Pitlyal Loch (or Round Loch, or Thriepley Loch) lies about a quarter of a mile to the south-east of Long Loch, and is surrounded by gently sloping cultivated fields. There is a fringe of weeds all round the shore. Grebe and coots were seen, and there were swans on the small islet with bushes about 100 feet north-west of the boat-house. The outflow to the Dighty Burn is by artificial dam and sluice; the water may rise 2 to 3 feet above its level on the date of



LOCH FREUCHIE FROM THE NORTH EAST.

LOCH TURRET LOOKING NORTH FROM THE SOUTH END.

the survey. Temperature observations taken on June 24, 1903, gave the following results:—

Surface	... ...	59°·0 Fahr.
10 feet	... ...	59°·0 „
11 „	... ...	58°·8 „
12 „	... ...	55°·8 „
13 „	... ...	55°·0 „

(the air-temperature being 55°·0)

*Loch Freuchie.**—Loch Freuchie (or Fraochie), near Amulree, is a very pretty loch amid pastoral scenery, the grassy shores sloping gently up on both sides, with here and there patches of wood (see Fig. 2). It was formerly a good trout loch, but in recent years it has been overrun by pike; steps have been taken, however, to keep down the pike, and the fishing is now improving. It flows by the river Bran into the river Tay at Dunkeld. Loch Freuchie forms on the whole a simple basin, but with a few minor undulations of the bottom. Cones of alluvium have been formed at the mouths of the Turrerich Burns at the northern angle of the loch, and at the entrance of the Allt a' Mhuilinn about midway along the western shore. Temperature observations taken in the deepest part of the loch at 7 p.m. on June 5, 1903, gave the following results:—

Surface	... ...	58°·6 Fahr.
10 feet	... ...	58°·3 „
15 „	... ...	57°·6 „
25 „	... ...	53°·0 „
40 „	... ...	50°·0 „
60 „	... ...	49°·4 „

(the air-temperature being 54°·0)

Loch Hoil.†—Loch Hoil (Oyl, or Thuill) lies to the south of Aberfeldy, and flows by the Cochill Burn into the river Bran. It contains trout, perch, grayling, and gudgeon. It is surrounded by low, rounded, hummocky, heather-clad hills. Its shores are stony; the bay leading to the outflow is very shallow and full of weeds. Temperatures taken in the deepest part of the loch on May 28, 1903, gave the following results:—

Surface	... ...	57°·0 Fahr.
10 feet	... ...	52°·0 „
20 „	... ...	48°·0 „
40 „	... ...	47°·0 „

(the air-temperature being 53°·0)

Loch Fender.—Loch Fender lies to the north of Loch Freuchie, and flows by the Glenfender Burn into the river Bran. It contains large trout, but the fishing, which is preserved, is uncertain, sometimes yielding splendid sport, at other times none at all. The Marquis of

* = Heathery loch, or loch of the heathery banks. † = Loch of the holes.

Breadalbane sounded Loch Fender about forty years ago from a portable boat, and found a maximum depth of about 30 yards (= 90 feet); the maximum depth recorded by the Lake Survey was 78 feet. Loch Fender is thus extremely interesting on account of its great depth, considering its small dimensions. The shores are rocky all round, and the southern shore is a steep slope of bare rock, rising gradually to Creag an Loch; at other places the shores are less steep, and surrounded by smooth, rounded, heather-covered hills. The water was very dark in colour, and, though there was apparently no great amount of inflow, there was a considerable outflow. Temperatures taken in the deepest part of the loch at 1 p.m. on June 5, 1903, gave the following results:—

Surface	58°·0 Fahr.
5 feet	57°·8 „
10 „	52°·0 „
15 „	45°·0 „
25 „	44°·0 „
50 „	43°·0 „
75 „	42°·4 „

(the air-temperature being 56°·0)

*Loch Turret.**—Loch Turret, in Glen Turret near Crieff, is used as the source of the water-supply to the town of Crieff. It is a good trout loch, but strictly preserved, and is situated amid wild and beautiful scenery, the hills being steep and high on both sides, especially to the west, where crags border the loch (see Fig. 3). It flows by the Turret water into the river Earn, and it receives the waters from the little Lochan Uaine, lying at the head of the glen, which was surveyed on the same day by request of the proprietor. The temperature of the surface water on commencing the survey at 9 a.m. on June 9, 1903, was 60°·0 (the air-temperature being 58°·0), and a series of temperatures taken later in the deepest part of the loch gave the following results:—

Surface	60°·8 Fahr.
10 feet	59°·0 „
15 „	54°·0 „
25 „	47°·7 „
50 „	44°·8 „
75 „	44°·4 „

(the air-temperature being 56°·0)

Lochan Uaine.†—Lochan Uaine, at the head of Glen Turret, lies in a corrie; its shores are peat, and the bottom weedy. In the middle of the loch towards the north end is a mud islet 2 or 3 feet in length and a few inches above the water. Sir Patrick Murray tried to drain the loch, but failed, and subsequently a rough dam was built at the outflow. The Turret Burn, flowing from Lochan

* = Loch of the height. † = The green lochan.

Uaine to Loch Turret, passes among a series of very perfect moraine mounds. The surface temperature at 2 p.m. on June 9, 1903, was 67°·0 (the air-temperature being 60°·0).

Pond of Drummond.—The Pond of Drummond, within the policies of Drummond Castle near Crieff, is a pretty artificial loch, well stocked with trout, but strictly preserved; it flows into the river Earn. The temperature of the surface water on June 18, 1903, was 60°·0 (the air-temperature being 53°·0).

*Loch Monzievaird.**—Loch Monzievaird (or Ochtertyre), within the grounds of Ochtertyre near Crieff, flows into the river Earn; it contains pike, carp, and perch, but few, if any, trout. Its shores are said to be all reclaimed moorland, wooded and high on the north side, grassy slopes with scattered trees on the south side. The large island near the north-eastern end of the loch is covered with trees and grass, and is said by Mr. Patrick Murray to be natural; the small island to the south is artificial, composed of stones, with a submerged causeway running eastward to the shore; the island in the south-western portion of the loch is also artificial, built on piles, and is said to have been used as a prison. The outflow is controlled by a sluice, and on the date of the survey the water in the loch was very low. Temperature observations taken in the deepest part of the loch on June 8, 1903, gave the following results:—

Surface	68°·0	Fahr.
5 feet	68°·0	„
10 „	60°·5	„
15 „	53°·0	„
20 „	51°·0	„
36 „	47°·4	„

(the air-temperature being 58°·0)

Loch Benachally.†—Loch Benachally, a good trout loch in the Forest of Clunie, is used by the Blairgowrie Corporation as the source of the town's water-supply. It flows by the Lornty Burn into the river Ericht, which further on joins the river Isla. Its shores are of shingle and stones, except at the north-western corner, where the material brought down by the Craigsheal Burn has formed an extensive flat covered with short weeds. This flat was dry at the time of the survey, the water in the loch being very low. It is surrounded by low hills covered with heather and grass. The loch is on the whole comparatively deep, very few of the soundings being under 10 feet. Temperature observations taken in the deepest part of the loch on June 3, 1903, gave the following results:—

Surface	57°·2	Fahr.
10 feet	55°·8	„
15 „	54°·3	„
20 „	49°·0	„

* = Loch of the upper lands. † = Loch of the hill of the wood.

30 feet	... ...	47°·4 Fahr.
40 „	... ...	47°·2 „
50 „	... ...	47°·0 „
60 „	... ...	46°·8 „

(the air-temperature being 61°·0)

Loch Shechernich.—Loch Shechernich (or Bainie), a small loch in Glenshee, situated amid fine mountain scenery, is a good trout loch, but strictly preserved. It flows by the Allt Mòr into Shee Water, thence by the Black Water into the river Ericht, a tributary of the river Isla. Its shores are low and peaty, rising gradually to the surrounding heather-clad hills. Near the centre of the loch is an artificial island composed of small stones. At 6 p.m. on July 2, 1903, the temperature of the water at the surface and at a depth of 7 feet was in each case 59°·2 (the air-temperature being 54°·0).

*Auchenchapel Loch.**—Loch Auchenchapel (or Auchintaple) in Glenisla, near Inverharity, is an artificial loch made in 1884, and flows by a short stream (Allt na Beinne) into the river Isla; it is a good trout loch, without pike. Temperatures taken at 10 a.m. on July 2, 1903, in the position of the deepest sounding gave 58°·0 at the surface and 57°·5 at a depth of 16 feet (the air-temperature being 54°·0).

Loch of Lintrathen.—The Loch of Lintrathen, from which Dundee draws its water-supply, has been raised in level to the extent of 22 feet in connection therewith; the water in the loch was 14 inches below the overflow on the date of the survey, so that the 20-feet contour-line would show approximately the size and position of the original loch. It receives the drainage from a large tract of the hilly country to the north, and it flows by the Melgam Water into the river Isla. It is surrounded by gently sloping cultivated ground or woods, with gravelly margin, except in the north-western angle of the loch, where the Melgam Water and Inzion Burn enter, which is shallow and obstructed by weeds. Temperature observations taken in the deepest part of the loch on June 25, 1903, gave the following results:—

Surface	... ...	55°·5 Fahr.
10 feet	... ...	55°·2 „
25 „	... ...	54°·0 „
50 „	... ...	52°·5 „
55 „	... ...	50°·8 „
60 „	... ...	48°·2 „
65 „	... ...	48°·0 „

(the air-temperature being 57°·0)

Loch of Forfar.—The Loch of Forfar lies immediately to the west of the town of Forfar, surrounded by cultivated fields. It flows by the Dean water into the river Isla, the outflow being a broad ditch with no perceptible current on the date of the survey, the water in the loch being very low. It contains pike, perch, and trout. The Loch of Forfar

* = Loch of the field of the horses.

is peculiar in conformation, due to the peninsula of Queen Margaret's Inch jutting out into the loch about midway along the northern shore. From the extremity of Queen Margaret's Inch a submerged causeway runs out, on which depths of 1, 2, and 3 feet were found. Temperatures taken in the deepest part of the loch on June 26, 1903, gave the following results:—

Surface	58°·9 Fahr.
10 feet	58°·3 „
15 „	57°·7 „
20 „	56°·0 „
27 „	56°·0 „

(the air-temperature being 55°·0)

NOTES ON THE GEOLOGY OF THE TAY BASIN.*

By B. N. PEACH, LL.D., F.R.S., and J. HORNE, LL.D., F.R.S.

The Tay basin may be divided geologically into two parts, the boundary between the two being defined by the great fault along the Highland border which runs from Glen Artney, by Crieff, Murthly, and Blairgowrie, towards Cortachy and Stonehaven. The area north-west of this line is mainly occupied by the metamorphic rocks of the Eastern Highlands, which are pierced by masses of granite, diorite, and other igneous intrusions, the latter being of special importance in connection with the history of the glaciation of the region. In the western part of the metamorphic area, on the lofty peaks of the Black Mount Forest, there is a remnant of the contemporaneous volcanic rocks of Lower Old Red Sandstone age which are so prominently developed in the Lorne plateau. The tract, south-east of the Highland fault, embraces the lower and smaller portion of the Tay basin. With the exception of a small patch of Carboniferous strata near Bridge of Earn, the whole of this tract is occupied by rocks of Old Red Sandstone age.

In connection with the Lake Survey, the area north-west of the Highland fault is of special interest, as it includes most of the lochs which have been sounded by the staff. The metamorphic rocks, which floor the greater part of this tract, are bounded on their south-east margin, for a considerable distance, by the great dislocation along the Highland border. Indeed, the fault-line in places gives rise to a prominent feature, and the change, in the geological formations on either side, is indicated by a marked difference in the topography. The age of the metamorphic rocks of the Eastern Highlands has not been definitely fixed, and the original sequence of deposition is still uncertain, but they have been arranged in certain groups, which appear in a definite order as the observer proceeds northwards from the border fault.

Apart from the crystalline schists termed the "Moine Series" by the Geological Survey, which occur in the northern part of the area, the groups of metamorphic strata met with in the Tay basin are given in the subjoined table:—

11. Quartzite and quartz-schist with pebbly conglomerate and boulder bed.
10. Blair Atholl limestone.
9. Black schist with thin limestone bands.

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8. Calc-sericite schists and phyllites.
7. Garnetiferous mica-schists.
6. Loch Tay limestone.
5. Garnetiferous mica-schists of Pitlochry.
4. Hornblende-schists of clastic origin and epidote-chlorite schists (Green Beds).
3. Schistose grits (Ben Ledi grits and schists).
2. Dunkeld slates.
1. Schistose grits next the Highland fault.

The members of the metamorphic series have been injected by sheets and bosses of acid and basic igneous materials, which have shared in the folding and schistosity of the altered sediments into which they have been intruded.

The distribution of these various groups of altered sedimentary strata, and the intrusive sheets of basic igneous material (epidiorite and hornblende-schist), have had an important influence in determining the trend of the tributary valleys and their surface features. The subdivisions given in the above table form sub-parallel belts crossing the basin in an east-north-east and west-south-west direction, the outcrops of which have been affected by several powerful faults, to be referred to presently.

Beginning at the Highland border, we find immediately to the north of the marginal fault a narrow band of schistose grits, extending from the river Almond to Birnam Wood on the Tay, which may represent the Leny and Aberfoil grit of the Callander district. Next in order, comes a zone of slate, traceable almost continuously from the forest of Glen Artney, by Comrie, to a point south of Dunkeld, where it is exposed in various quarries. The Ben Ledi grits and schists, which, as they are followed northwards, become more schistose and highly crystalline, form a belt several miles in width, extending across the basin from the heights round Loch Earn, north-eastwards by the Almond, Strath Bran, and the Tay between Birnam Hill and Logierait, and onwards by Strath Ardle to Kirkton of Glen Isla. Over much of the area where the metamorphism is not highly developed the schistose grits of this group give rise to prominent rock features.

The Ben Ledi grits are followed northwards by an important zone of epidote-chlorite schists (Green Beds), which, in their ultimate stage of alteration, merge into hornblende-schists that are almost indistinguishable from rocks of this type of igneous origin. They are usually associated with intrusive sheets of epidiorite that pass into hornblende-schists, the latter sharing in the folding and schistosity that have affected the Green Beds. Like the members of this zone in the Callander region, these epidote-chlorite schists and accompanying sills of epidiorite form prominent rock features in the landscape, which have more successfully resisted glacial erosion than the overlying zone of garnetiferous mica-schist. On both sides of the valley of the Tay at Aberfeldy these rocks may be studied, and they appear on the moorland between the Tay and Strath Ardle, and eastwards by the Kirkton of Glen Isla, either as isolated patches in the form of outliers, or as more or less continuous outcrops. Again, towards the south-west the Green Beds reappear at intervals on the heights between Loch Tay and Loch Earn till they are abruptly truncated by the Loch Tay fault.

One of the best-defined zones in the metamorphic series of the Eastern Highlands is that of the Loch Tay limestone, with its overlying and underlying garnetiferous mica-schists. In the Tay basin the members of these groups (5, 6, 7) usually indicate a stage of high metamorphism, the beds being easily eroded by surface agencies. Save where deflected by powerful faults, their outcrops are traceable almost across the basin. From Glen Fernate, at the head of Strath Ardle, the

Loch Tay limestone has been followed south-westwards by Pitlochry, along the north slope of the Tay valley at Aberfeldy, to the heights overlooking Fortingal, where the outcrop has been deflected by the Loch Tay fault. West of this line of disruption the limestone reappears, about 4 miles further south, on both sides of Loch Tay (see geological map), whence it can be traced westwards up Glen Dochart and across Strath Fillan almost to the slopes of Ben Lui, at the south-west margin of the Tay basin. Owing to folding, the Loch Tay limestone and its associated strata reappear to the north of the line of outcrop just indicated, as, for instance, in Glen Lyon and in the valley of the Lochay north-west of Killin. And to the south of this line, it is met with at Lochearnhead and on the Braes of Balquhidder. An important feature connected with this limestone is the frequent occurrence of a massive sill of epidiorite in conjunction with it.

Still further north the subdivisions just described are succeeded by calc-sericite schists, phyllites, and black schists with thin lenticular bands of limestone (groups 8, 9), which present lithological characters that are, as a rule, readily identified. The trend of the outcrop of these zones has been affected by the north-east and south-west faults which traverse the basin, and the black schist spreads over a broad area, in certain localities, by means of sharp isoclinal folds. Taking first the most southerly outcrop of the calc-sericite schist, phyllites, and black schist, they are traceable from Ben Vrackie south-west by Faskally on the Tay, to the Loch Tay fault north of Fortingal. West of this line of disruption, they have been followed from Glen Lyon, by Ben Lawers, and across Glen Lochay to the heights above Glen Dochart, where they terminate in a synclinal fold of the underlying garnet ferious mica-schists associated with the Loch Tay limestone. Still further west they reappear and form a broad outcrop stretching from the upper part of Glen Lyon in a south-south-west direction towards Tyndrum, where they are again interrupted by a north-east and south-west fault (see geological map).

The Blair Atholl limestone has an important development in the neighbourhood of Blair Atholl, and up the valley of the Tilt towards the limit of the basin. Sharing in all the folds of the associated phyllites and black schists (group 9), its outcrop is irregular and involved. Where these zones appear, in the Tilt, in the Tay and Strath Tummel, they generally give rise to softer outlines than the quartzite which apparently overlies them.

The Perthshire quartzite (group 11) is, perhaps, the most striking geological subdivision in the metamorphic series of the Eastern Highlands, from its greater durability and the lofty mountains to which it has given rise. Along its northern margin the rock is more or less coarse-grained, due to the presence of pebbles of quartz and felspar, but this band is repeatedly brought to the surface by means of folding. An interesting feature of this group is the presence of a conglomerate or boulder bed with rounded blocks of granite foreign to the area, the matrix of which seems to vary with the rock in contact with it. Sometimes appearing as lenticular or boat-shaped masses surrounded by black schists, phyllite, or limestone, and again as narrow belts traceable for several miles, the quartzite is always one of the dominant features of the landscape, occasionally forming lofty peaks, as in Beny-Ghlo and Schichallion.

In addition to the subdivisions of the metamorphic rocks of the Eastern Highlands which have just been described, there is a group of crystalline schists termed the "Moine series" by the Geological Survey, which have a wide distribution in the north-west part of the Tay basin. Their lithological characters are remarkably persistent over wide areas. Consisting mainly of quartzose granulitic schists or fine-grained gneisses with bands of mica-schist, they represent without doubt a

highly altered series of sediments, the original clastic grains of which have been destroyed. They form nearly the whole of the area north of Loch Rannoch, up Glen Garry, and northward of Glen Tilt.

Reference has already been made to the intrusive sheets of basic igneous rock which appear in association with the Green Beds and Loch Tay limestone, but others occur in connection with the zones of calc-sericite schist and black schist. Perhaps the most remarkable example of the latter is the mass of epidiorite and hornblende-schist on Ben Vrackie north of Pitlochry, where the altered sediments have been deflected and bent round the laccolitic intrusion.

The acid igneous rocks which were injected into the sedimentary series, before the folding and development of schistosity in the latter, are best represented by the foliated granite of Ben Vuroch, north-east of Ben Vrackie. On the north-west slope of that mountain, the sediments, which still retain their original bedding, have undergone contact alteration, the calcareous shales having been converted into calc-silicate hornfels.

In the central part of the metamorphic area there is a well-defined line, extending from Ben Vrackie south-west by Ben Lawers to Glen Lochay, which marks the axis of a fan-shaped arrangement of the folding of the strata. Along this line, the axial planes of the folds are vertical, and on either side they are inclined towards the centre of the fan. Hence on the south-east side of this central axis, there is a remarkably persistent dip of the folds towards the north-west, while on the north-west side the general inclination is towards the south-east. A fine example of the latter is to be found in the river Garry, where between Blair Atholl and Dalnaspidal the granulitic schists of the Moine series dip persistently towards the south-east for a distance of about 15 miles, and yet it is highly probable that the same bands are repeated indefinitely by means of folding. This remarkable reduplication of the strata can be clearly demonstrated in the case of the black schist, limestone and quartzite groups, where the lithological types are clearly differentiated from each other. For a distance of 6 miles across the strike, between Ben Vrackie and Glen Tilt, these groups constantly reappear, the sill of garnetiferous hornblende-schist being indefinitely repeated with the black schist.

Reference has already been made to the system of north-east and south-west dislocations which traverse the metamorphic area. Of these, apparently the most powerful is the Loch Tay fault, which has been traced from near Blair Atholl, across Loch Tay, Loch Earn, and Loch Lubnaig till it is truncated by the fault along the Highland border at Aberfoil. Further west, and roughly parallel with the foregoing, comes the line of disruption which extends from Loch Garry across Loch Rannoch and the valleys of the Lyon, the Lochay, and the Dochart towards the Braes of Balquhidder. Again, from Tyndrum another dislocation has been followed north-east by Loch Lyon and the west margin of Loch Rannoch in the direction of Loch Ericht. Finally, in the north-west part of the basin there is a line of fracture running along Loch Ericht and Loch Laidon, which is roughly parallel with the Loch Tay fault. In the case of the Loch Tay, the Loch Garry, and the Loch Lyon dislocations, the downthrow has been on their western side; in other words, on that side the outcrops of the sedimentary bands and epidiorite sills have been shifted further to the south by each fault in turn.

Within the metamorphic area, as already indicated, there are various masses of igneous rock which are later than the folding and foliation of the crystalline schists, and have been referred to the newer granite intrusions of the Highlands. Of these, the most important is the large mass of diorite on the moor of Rannoch, which stretches northwards to Loch Ericht and west towards Loch Treig, boulders

of which have been carried far during the glaciation of the region. Other masses appear on both sides of Loch Ericht, in Glen Tilt, on the lofty plateau north of that valley, and far to the south in Glen Lednoch between Comrie and Loch Tay. Several of these igneous intrusions consist partly of diorite and partly of granite, the more basic type being erupted prior to the more acid.

At the western margin of the basin on the lofty peaks of the Black Mount Forest there is a terraced plateau of contemporaneous igneous rocks of Lower Old Red Sandstone age, pointing to the former extension of this volcanic series, the distribution of which is of importance in connection with the glaciation. These are pierced by plutonic rocks (granite), which have produced a certain amount of contact alteration in the lavas.

In the lower part of the basin of the Tay, which is almost wholly occupied by Old Red Sandstone, both the lower and upper divisions of that system are represented. The Lower Old Red Sandstone has by far the greater development, being divisible into a lower volcanic series and an overlying group of sandstones, conglomerates, and marls. Two great flexures cross the basin in a north-east and south-west direction, roughly parallel with the fault along the Highland border. One of these flexures forms a broad arch, exposing a great series of contemporaneous volcanic rocks in the Ochils and the Sidlaws; the other forms a great trough, in line with the valley of Strathmore, containing the highest members of this division in the basin of the Tay. The anticlinal fold is prolonged far to the north-east into Forfarshire and Kincardineshire, where sandstones and flags appear in the crest of the arch. In the Ochils the total thickness of lavas, tuffs, and agglomerates in the north limb of the fold is about 6000 feet, and they were probably deposited on a gradually sinking area; nevertheless, some of the volcanic cones may have ultimately appeared above the level of the water and become subaërial. Rising out from underneath the overlying sandstones and marls, along the highland border, the volcanic series again appears, though in a very attenuated form, consisting of andesitic lavas, which are associated with coarse conglomerates containing pebbles of volcanic rocks. Indeed, the lavas, conglomerates, and sandstones occur on the north side of the fault at Blairgowrie, and again at Crieff, where they rest unconformably on the metamorphic rocks. The broad tract of low ground between the Sidlaws and the Highland border has been carved out of the softer sandstones and marls overlying the volcanic series. The river Isla, when it enters the area occupied by this overlying sedimentary series, is deflected towards the south-west till it joins the Tay.

The long interval which elapsed between the Lower and Upper Old Red Sandstone periods was marked by great denudation of the members of the lower division of that system. The strata were thrown into anticlinal and synclinal folds, the axes of which are roughly parallel with the trend of the fault along the Highland border. And further, along the crest of the arch, the higher members of the lower division were worn away, and the volcanic rocks were laid bare, before the Upper Old Red Sandstone was deposited. The members of the upper division occur near Bridge of Earn, and extend beneath the estuary of the Tay and the Carse of Gowrie to near Dundee. Between Forgandenny and Bridge of Earn, the basement beds are found resting unconformably on the denuded Lower Old Red Sandstone volcanic rocks, where fragments of the latter occur in the breccias. On both sides of the estuary of the Tay, however, the Upper Old Red Sandstone is brought into conjunction with the volcanic series of the lower division by two parallel faults. The members of the upper division are composed mainly of friable brick-red sandstones and marls, which have yielded near Errol fine specimens of the genera of fishes characteristic of this division.

Reference has already been made to the fact that a small patch of Carboniferous rocks appears about half a mile to the south of Bridge of Earn, which are brought into conjunction with the Lower Old Red volcanic rocks to the south by means of a fault. The strata consist of blue clays and shales, sandstones, and calcareous bands belonging to the Cementstone group. Small though it be, this remnant is of great importance in proving the former extension of the Carboniferous rocks over the lower part of the Tay basin, from which it has been almost wholly removed by denudation.

The existing valley system of the basin of the Tay furnishes admirable examples of the influence of geological structure in determining the direction of the water drainage. The upper part of the Tay itself, and many of the tributaries within the metamorphic area, flow approximately in the direction of the strike of the crystalline schists. The massive Ben Ledi grits, the Green beds, the sills of epidiorite and hornblende-schist, and the Perthshire quartzite have each had a powerful influence in the development of the prominent rock features of the region. Where these occur in association with zones of mica-schist and phyllite, they have more successfully resisted erosive action, and have given rise to rocky barriers or precipitous escarpments, thereby contributing to the formation of gorges, and in some cases of rock-basins.

The evidence relating to the glaciation of the Tay basin leads to the conclusion that, during the climax of the Ice age, the region must have been covered with one continuous sheet of ice, the movement of which must to some extent have been independent of the existing valley system. Where the rocks have been able to retain the striæ, the latter have been found up to elevations of 3000 feet, showing that the highest mountains were over-ridden by the ice. This stage was followed by a period of confluent glaciers, when the ice streamed over passes connecting adjoining valleys, leaving in its track lines of moraines. Finally, there is the phase of corrie glaciers, when the glacial detritus was borne for no great distance from the local centres of dispersion.

During the maximum glaciation, the ice-shed lay round the north-west margin of the Tay basin, from the mountains beyond Rannoch Moor, by Ben Alder west of Loch Ericht, eastwards to the watershed separating Glen Garry from the tributaries of the Spey and the Dee.

Beginning in the western part of the basin, with the lofty watershed between the head of Glen Lyon and Glen Lochay, in the Mamlorn forest, striæ are found at intervals along this ridge for a distance of 3 miles, at elevations which in some cases vary from 2700 to 3000 feet, trending E. 20° to 30° S. Further east, about 3 miles north of Killin, on Creag-na-Caillich at a height of 2250 feet, the direction is about south-south-east. Again, to the west of Ben Lawers, the ice-markings point S. 40° E. about the 2000-feet level. Proceeding northwards to the dividing ridge between Glen Lyon and Strath Tummel, the evidence is no less remarkable, for on Schichallion, at an elevation of 3000 feet, the trend is E. 30° S. Still further north, on Beinn a' Chuallaich—a high mountain between Glen Erichdie and Kinloch Rannoch—the striæ point S. 30° E. at a height of 2700 feet. Again, on Ben Vrackie, about 3 miles north of Pitlochry—a mountain which is glaciated to the top—the trend is east-south-east. Similar conclusive evidence is obtained on the dividing ridge that stretches eastwards from Schichallion towards Pitlochry and separates Strath Tummel from the upper course of the Tay between Aberfeldy and Logierait. Part of this ridge is composed of the Perthshire quartzite, the glaciated surfaces of which show finely preserved striæ, the direction varying from E. 20° S. to E. 45° S. On one of the prominent peaks of this ridge—Ben Eagach—south of Loch Tummel, ice-markings are found on the top at a height

of 2250 feet, which point E. 35° S. Further south, on the dividing ridge between Strath Bran and the valley of the Almond, on Meall nan Caoraich, the direction is E. 30° S., close to the 2000-feet contour-line. Additional instances might be given from the mountainous region within the metamorphic area, but the above examples establish the conclusion that during the maximum glaciation there must have been a movement of the *mer de glace* independent of the valley system, in an east-south-east or south-easterly direction.

During the great extension of the ice, on the broad plateau of the moor of Rannoch the ice seems to have radiated partly towards the east-south-east or south-east, and partly towards the south-west in the direction of the Tulla and Glen Orchy (see geological map).

The evidence obtained from the dispersal of the boulders is no less remarkable, for in some cases they have been carried far from their parent source, and over lofty cols. The boulders of diorite or hornblendic granite from the moor of Rannoch have been found in Strath Tummel, in Glen Lyon, in Strath Fillan, in Strath Tay, and across the watershed into Glen Almond. Again, all along Strath Fillan, Loch Tay, and Strath Tay, boulders of the Perthshire quartzite, black schist, limestone, and calc-sericite schist have been carried several miles to the south of the various belts from which they were derived. Of course, in many of these instances, the boulders may have been distributed during the later glaciation. On the slopes of Ben More (3843 feet), which is composed of grits of the Ben Ledi group, blocks of calc-sericite schist occur that have been carried from the hills to the north-north-west in the direction of the Mamlorn forest. Confirmatory evidence is furnished by the dispersal of the stones in the boulder clay—a deposit formed during the great extension of the ice. Within the metamorphic area, sections of boulder clay occur up the Tay valley as far as Loch Tay, in the valleys of the Tummel and the Garry as far as Struan, and in Strath Bran from Amulree to Dunkeld. Outlying patches are found also at the east end of Loch Rannoch and round Loch Tummel.

After the stage of the great ice-sheet, there followed a period of confluent glaciers when the ice was still thick enough to stream over passes connecting adjoining valleys, as, for instance, over some of the cols between Glen Lyon and Glen Lochay, between Glen Lyon and Loch Tay, and between Glen Lochay and Glen Dochart, between the upper course of the Tay and Strath Bran, and between Loch Tay and Glen Almond. Again, the glacier which moved eastward from the high mountains in Black Mount forest and at the head of Glen Coe and Glen Etive was deflected southwards, part of it flowing into Glen Orchy, and part into Strath Fillan. The numerous groups of moraines, frequently showing a terraced arrangement along the hill slopes, indicate the great development of the later glaciation. Fine examples of the local dispersion of moraines are to be found in the neighbourhood of the Black Mount forest and the mountains round the head of Glen Etive and Glen Coe. The *débris* of Old Red Sandstone volcanic rocks has been traced in the moraines eastwards from the Black Mount forest to the drift-covered plateau at Loch Bà.

Within the Tay basin by far the larger number of the lochs lie in the midst of drift deposits, most of which are of no great size, and are comparatively shallow. In the southern part of the Moor of Rannoch, along the river Bà and its tributaries, in Allt Lochain Ghaineamhaich and on the drift plateau, about twenty-five lochs occur in the midst of morainic drifts. Numerous examples of this type occur in other parts of the basin.

Again, several lochs, some of which are of considerable size, lie along lines of displacement or fault-lines, for which reason they need not now be discussed. For

example, Looh Ericht and Loch Laidon are situated on one line of disruption which has been traced over a considerable distance in the eastern Highlands. Loch Garry, at the head of Glen. Garry, and Loch Lyon, near the head of Glen Lyon, likewise occur along lines of fault. In each of these cases, the long axis of the loch coincides with the course of a more or less powerful dislocation, which has been traced for miles.

The following instances might be discussed in relation to the question of the glacial origin of rock basins: Loch Rannoch, Loch Tummel, Loch Tay, Loch Earn, Loch Iubhair, and Loch Dochart. Of these, the first four have been previously described by our colleague, Mr. J. S. Grant Wilson, in the *Scottish Geographical Magazine* for May, 1888, in connection with the soundings made by him in the course of the geological survey of the district. It is not necessary, therefore, to give in detail the evidence in support of the view that these lochs, with the exception of Loch Tay, have been eroded by ice-action. His soundings have been, as a rule, confirmed by Sir John Murray and his staff.

Loch Rannoch is a fine instance of a rock basin, for though, at the lower end, the river Tummel, which issues from the loch, flows along an alluvial flat for a distance of 3 miles as far as Dun Alastair, a rocky barrier appears at the latter point in the river and on the hill slopes. Near the foot of the loch, on either side of the valley, there is a prominent mass of high ground, culminating in Schichallion (3547 feet) and Beinn a' Chuallaich (2925 feet). The streams draining this high ground to the north and south have silted up the loch at the lower end, and have produced the long stretch of alluvium between Kinloch Rannoch and Dun Alastair. The longitudinal section of Loch Rannoch shows that the loch gradually deepens from the west margin towards the centre and lower end. The soundings further show that between the mouth of the Dall Burn and the foot of the loch there are three small basins, each over 400 feet in depth. The deepest sounding—440 feet—is in the centre of the largest and most easterly of these three basins, and within 2 miles of Kinloch Rannoch. On referring to the geological map, it will be seen that the Loch Garry fault crosses Loch Rannoch near Dall in a south-south-west direction, and, notwithstanding the fact that the downthrow side of this fault is towards the west, yet the deepest sounding is found on the upthrow side.

Loch Tummel is another typical example of a rock basin, the rocky barrier appearing in the stream and on the hill slopes at Allean House, about a mile below the mouth of the lake. For several miles downstream, as far as Faskally, the Tummel cuts through solid rock, composed mainly of the Perthshire quartzite, with bands of black schist. This loch has had originally a greater extension westwards, for it has been silted up by alluvial matter deposited by the streams. It is about 2½ miles long, and the soundings show that it forms three separate basins of no great depth, the deepest sounding of the western basin being 128 feet; of the central, 119 feet; of the eastern, 99 feet. Where these slopes and barriers appear, streams enter the lake from the south, which have given rise to cones projecting for some distance into the loch. It is probable, however, that they may be formed partly of solid rock. Judging from the evidence round the sides of Loch Tummel, the floor of that loch consists mainly of black schist, with infolds of the lower part of the quartzite.

Loch Earn may be described as the best instance of a typical rock basin within the catchment area of the Tay. Upwards of 6 miles long and about three-quarters of a mile broad, the soundings show that it is a simple basin. The deepest sounding—287 feet—occurs about halfway down the loch. The Loch Tay fault crosses the lake about a mile from the upper or western end; and along its course there is

a small basin, the greatest depth of which is 240 feet. West of this fault, the floor of the loch is composed of the Loch Tay limestone and the underlying garnetiferous mica-schists; east of it, for some distance, the lake lies obliquely across the strike of the schists overlying the Green Beds and the Green Beds themselves; while at the foot of the loch the Ben Ledi grits appear as a rocky barrier crossing the valley at St. Fillans.

Lochs Iubhair and Dochart may be cited as further instances of rock basins. Originally forming one sheet of water, they have been isolated by alluvial matter brought down by the stream that drains the great corrie west of Ben More. The deepest sounding of Loch Iubhair—65 feet—is near the foot. *Roches moutonnées* appear in that lake, both about the middle and near the foot. Loch Dochart is being rapidly silted up; indeed, it must formerly have extended for 3 miles up the valley of Strath Fillan. The deepest sounding of Loch Dochart is 11 feet.

Further down Glen Dochart there is a strip of alluvium about 5 miles long, between Luib station and Easter Lix, which may probably represent a silted-up rock basin.

Loch Tay presents certain features which differentiate it from the rock basins already described. There is no rocky barrier close to the lake; the Loch Tay fault runs along the course of the lake for a distance of 5½ miles from Ardeonaig to Stronfearnan; the greatest depth, which is 508 feet, lies on the downthrow side of this dislocation; and finally there is a basin 12 miles long, the whole of which is below the level of the sea. The first appearance of solid rock in the bed of the Tay is north of Grandtully castle, about 8 miles below the foot of the loch, where mica-schists appear, belonging to the group of the Ben Ledi grits. For a distance of 1½ miles below this point to near Ballinluig village the river flows at intervals over rocky ledges. There can be no doubt that the deflection of the original valley of the Tay between Ardeonaig and Stronfearnan was due to the Loch Tay fault, whereby the Loch Tay limestone and associated schists, on its western side, were brought into conjunction with the intrusive igneous masses of Tomnadashan and Beinn Bhreac. The soundings show that the deepest part of the basin, which is bounded by the 400-feet contour-line, lies along the course of this fault. Under these circumstances Loch Tay cannot be regarded as a typical example of a rock basin.

The other rock basins, however, seem to us to furnish strong evidence in support of the theory that they have been eroded by ice-action.

BIOLOGY OF THE LOCHS OF THE TAY BASIN.

By JAMES MURRAY.

While it was not compatible with the bathymetrical work of the Lake Survey to study in detail the biology of the lochs, it has been customary to make collections of the plankton of each loch, a coarse and a fine net being used in each case. It is thus possible to compare only the biology of the open water of the different lochs. The number of species living in the open water is not very great, and does not vary in different lochs so much as might have been expected. The fauna of the shallower lochs is usually much richer than that of the deeper ones, owing to the occurrence in them of many species which in larger lochs would be confined to the shore region. Even thus limited, it is found that the lochs differ

sufficiently from one another to render a comparative review of them of much interest. Each loch has a distinct character, which, notwithstanding a considerable amount of seasonal variation, is pretty constant.

A small number of animals and plants occur so constantly in the open water of all our lakes, large or small, that they mainly determine the character of the plankton of this pelagic region. They are so generally present that the absence of any one of them is occasion for remark. The most important of them are—*Diaptomus gracilis*, *Cyclops strenuus*, *Daphnia lacustris*, *Bosmina obtusirostris*, the Rotifers *Conochilus* (two species), *Anuræa cochleare*, and *Notholca longispina*, and the Diatom *Asterionella gracillima*. These are found at all seasons. In the summer, *Holopedium*, *Leptodora*, *Bythotrephes*, and *Polyphemus* are as generally distributed.

Only less common are *Asplanchna priodonta*, *Polyarthra platyptera*, *Peridinium tabulatum*, *Ceratium hirundinella*, and *Mallomonas*. Some Desmids, mostly of the genus *Staurastrum*, but including also species of *Micrasterias*, *Xanthidium*, and *Closterium*, are generally present. The Rotifers *Floscularia pelagica* and *Notops pygmæus* are of frequent occurrence. Although all of those species may be present in most of the lochs, the varying proportions in which they occur in the plankton give rise to great differences of character in the lochs. Other species of *Diaptomus*, *Daphnia*, and *Bosmina* are occasionally found, but the species included in the preceding list are so much more common, that when the generic name only is mentioned it will be understood that the common species is referred to.

This small association of animals and plants constitutes what may be called the lacustrine type of plankton. A not very dissimilar association is found in small ponds, but the species for the most part are different. The *Diaptomus* may be *D. castor*, the *Daphnia D. pulex*, the *Bosmina B. cornuta*; Rotifers and Algæ will be more abundant and varied, and there will probably be some Ostracodes. It might have been expected that the shallowest lochs would have had a plankton of the pond type, but it has been found that even the smallest lochs surveyed had the plankton distinctly lacustrine. A few nearly or quite stagnant lochans showed a slight approach to the pond type in the presence of *Bosmina cornuta* and *Volvox*, and in the abundance of Rotifers and Algæ.

The remarkable variations of the loch trout, which have so much puzzled naturalists, cannot be touched on here, but parallel cases are found among the smaller animals. *Diaptomus gracilis* varies remarkably in colour, and is usually constant for each loch, and several other Entomostraca vary greatly in size and form; chief among these is *Daphnia*. The typical lacustrine form of this genus, which will be referred to as *Daphnia lacustris*, has an evenly rounded head, with a depression on the line of the forehead marking off the brow from the beak. Where this depression is obliterated, the head of the animal has a very different appearance, resembling that of a parrot. The form differing most from the typical *Daphnia lacustris* is that in which the head is produced upwards into a sort of peak or helmet. For convenience, this form will be referred to as *Daphnia galeata*, though it is doubtful if the points of difference are of specific value, and intermediate varieties are found.

After *Daphnia*, the species which varies most is *Bosmina obtusirostris*. The typical lake-form has a short mucro at the posterior angle of the valves. It varies much in size and in colour, being usually hyaline, but sometimes purple, or rarely orange and purple.

During its season *Holopedium* from its large size is very conspicuous in those lochs in which it occurs. It is frequently so abundant that it chokes up

the nets in a short time, and makes it impossible to get a fair proportion of the other animals present. It appears in some lochs as early as May, and continues till August.

Commonly a single organism, usually vegetable, will so increase in a loch as to form what the Germans call a "Wasserblut." The Algæ *Clathrocystis, Oscillaria, Botryococcus, Anabæna,* and *Volvox* are among those which most frequently increase to this extent, but almost any of the smaller organisms, as Diatoms, Rotifers, or Protozoa, may on occasion do so. *Asterionella, Notholca longispina, Asplanchna priodonta, Ceratium hirundinella,* and even on one occasion the rather uncommon Rotifer *Dinocharis Collinsii,* have been observed to form a "Wasserblut" in the shallower lochs.

The abundance of certain species in a loch on a single visit may be exceptional or temporary; the small lochs may vary greatly at different seasons. It is believed that, except for the seasonal appearance of certain species which are known to live for only a few months of the year, a loch is pretty uniform in character throughout the year. This is known to be the case with the large lochs and with some small ones.

The points to which attention will be called in reviewing the biology of the Tay lochs will be—the abundance or scarcity of life on the whole; the preponderance of one or a few species in each loch; the abundance of an animal or plant that is usually scarce; the absence or scarcity of some very common species.

The lochs of the valley of the Earn differ much in size and physical conditions, so that they might be expected also to differ much in their biology. There is one great lake, Loch Earn, two hill lochs, Turret and Uaine, the latter at a great elevation, one deep but stagnant pond, and one shallow artificial dam.

Loch Earn.—The only abundant organism was *Diaptomus gracilis,* which was bright red in colour. There was almost no life at the surface, the *Diaptomus* being in myriads at a depth of 40 or 50 feet. The loch was rather remarkable for the scarcity of common lacustrine species. *Bythotrephes* was somewhat frequent; *Polyphemus, Cyclops strenuus,* and *Bosmina obtusirostris* were present, but not plentiful. *Daphnia* was very rare, only one example being seen. Smaller organisms were almost entirely absent, except for a few examples of the two commonest pelagic Rotifers: *Anuræa cochleare* and *Notholca longispina,* and some unicellular Algæ.

Loch Turret.—This was one of the lochs where *Holopedium* filled the net with a slimy mass and rendered it difficult to catch anything else. *Diaptomus gracilis, Daphnia* (typical *D. lacustris*), *Asterionella,* and *Peridinium tabulatum* were noted.

Lochan Uaine.—This little shallow tarn, in a corrie at a considerable elevation, had nothing remarkable in its pelagic life. *Diaphanosoma brachyurum* was most numerous; *Diaptomus gracilis,* of a brown colour, and *Polyphemus* were common. Only a few examples of *Daphnia lacustris* and *Holopedium* were seen.

Loch Monzievaird (or Ochtertyre).—This loch, though fairly deep, was almost stagnant at the time it was visited. As might be expected from this and from the very high surface temperature, life was abundant and varied. The collection was green from the abundance of *Volvox. Bosmina cornuta, Daphnia lacustris, Diaptomus gracilis* (of a brown colour), *Ceratium hirundinella, Asplanchna, Anuræa cochleare, Anabæna* were among the most abundant organisms. Many others were present in smaller numbers.

Drummond Pond.—This is a shallow and nearly stagnant artificial pond, and

many species were plentiful in the water. *Daphnia lacustris* was most numerous. Many males and females carrying ephippia were present. Other abundant species were *Ceriodaphnia* (some with ephippia), *Anuræa cochleare*, *Conochilus*, *Asplanchna*, *Notops pygmæus*. *Volvox* was scarce. The beautiful Rhizopod *Difflugia corona* was seen.

The lochs of Strath Bran, though completely isolated one from another and draining by different streams into the Bran, are fairly comparable one with another, being all, with the exception of Loch Freuchie, hill lochs of small size, lying at considerable elevations.

Loch Freuchie.—This was one of the lochs where *Holopedium* for the time being abounded to the exclusion of everything else. Only a few individuals of *Diaptomus gracilis* (brown in colour) were seen. Hardly any small organisms were noticed.

Loch Fender.—Life was abundant, but few species were present. The most numerous animals were *Diaptomus* (pale brown), *Notholca longispina*, *Daphnia* (parrot-shaped head), *Bosmina longispina*, and *Peridinium tabulatum*. *Holopedium* was not seen.

Loch Hoil.—Life was very abundant. The commonest animals were *Holopedium*, *Diaptomus gracilis*, *D. Wierzejskii* (blue, red, or red and blue), *Daphnia*, and *Asplanchna*.

Loch na Craige.—Animals of many species were present, but only four were plentiful: *Diaptomus gracilis* (blood-red), *Bosmina obtusirostris* (of large size), *Daphnia lacustris* (very large), and *Conochilus unicornis*.

Loch Kennard.—Some seven or eight species of animals were common in the loch, but *Diaptomus* predominated. *D. gracilis* and *D. Wierzejskii* were both present. Blood-red individuals of both species occurred, and *D. Wierzejskii* was also seen of the usual blue colour or red and blue. *Holopedium*, *Notholca longispina*, and *Asplanchna priodonta*, and the somewhat rare crustacean *Latona setifera* were numerous.

Loch Skiach.—The characteristic animals were *Holopedium*, *Daphnia lacustris* (very large), *Bosmina obtusirostris* (very small, purple). *Gammarus pulex* of large size and orange colour was found. A few examples of *Bosmina* were large and brightly coloured, orange and purple.

Loch Tay.—Comparing Loch Tay with Loch Rannoch, it is found that the plankton differs in several important particulars. Besides the common *Diaptomus gracilis*, there is another species, *D. Wierzejskii*, pretty common in the loch. This is a larger species, usually dark blue in colour. It is a northern species, of general occurrence over the north and west of Scotland, but hardly known south of Loch Tay. *Daphnia* was always very scarce. Desmids of the genera *Staurastrum* and *Arthrodesmus* were more numerous than is usual in great lakes. As in Loch Rannoch, skeletons of *Clathrulina* were abundant.

Lochs Iubhair and Dochart.—Both these lochs, being very shallow, had, at the time they were visited, in addition to the usual pelagic species of *Diaptomus*, *Daphnia*, and *Bosmina*, several species in abundance which are not truly pelagic. *Chydorus sphæricus*, *Alonopis elongata*, and *Alonella nana* were as numerous as the pelagic species. Rotifers and Protozoa, especially Rhizopods, were more varied than usual.

Loch Essan.—Life was abundant and varied. *Daphnia* was of three forms: large typical *Daphnia lacustris* with rounded head, smaller with tall helmet (*D. galeata*), and an intermediate form. *Diaptomus gracilis*, some dark brown, some hyaline, *Polyphemus*, *Diaphanosoma brachyurum*, *Bosmina obtusirostris*, and water-mites (Hydrachnidæ), which do not usually occur in the open water, were all common.

Loch Breaclaich.—This loch was quite unusual from the great numbers of a Rotifer, *Asplanchna priodonta*, which formed a "Wasserblut," appearing as a grey slimy mass in the net. *Diaptomus gracilis* (hyaline), *Cyclops* (dark red), and *Diaphanosoma brachyurum* were seen.

Loch na Lairige.—The characteristic organisms were *Bosmina obtusirostris* (large dark brown, and purple) and a species of *Conochilus*. *Daphnia galeata* (with tall helmet), *Polyarthra*, and *Diaptomus gracilis* (pale, immature) were frequent. A few dark-red *Diaptomus gracilis*, *Sida crystallina*, and *Bythotrephes* were also present.

Loch Lyon.—The biology of this loch was notable for its unusual richness. Most abundant were *Diaptomus gracilis* (pale yellow), *Bosmina obtusirostris* (with somewhat long spine), *Cyclops strenuus* (of large size), and Rotifers of many species. Larvæ of *Diaptomus* were exceedingly numerous.

Lochs Daimh and Giorra.—These two lochs are so nearly alike in size and so close together, being connected by a river, that they might be expected to resemble one another in their biology, but they were found to differ greatly. In Loch Daimh, *Holopedium* was abundant, but very young. *Diaptomus gracilis* (hyaline, with dark-brown eggs) was numerous, and the larvæ still more so. Nothing else was found in any numbers. Loch Giorra, on the other hand, had half a dozen common species: *Diaptomus gracilis* (pale yellow), *Cyclops strenuus*, *Daphnia lacustris*, *Bosmina obtusirostris*, *Dinobryon*, and *Tabellaria* (two species). *Holopedium* was not seen.

Loch Derculich.—The characteristic animals were *Diaptomus* (brown), *Daphnia lacustris* (with parrot-shaped head), *Bosmina obtusirostris* (with long beak), *Notholca longispina*, and *Dinobryon*.

Loch Scoly.—The most abundant animals were *Daphnia lacustris*, *Diaptomus gracilis* (dark brown, mostly immature), *Conochilus volvox*, *Bosmina obtusirostris* (small), and *Peridinium tabulatum*.

Loch Rannoch.—The plankton of Loch Rannoch may be fairly taken as the type of all the large Scottish lochs. Almost every one of the species included in the list of the lacustrine organisms was found in it, and there was nothing in it not given in the list. Of the Entomostraca, *Bosmina* was the most abundant. Skeletons of the Rhizopod *Clathrulina elegans*, though this is not a pelagic animal, were always found in it. The biology of the littoral region of the loch has been studied with some care by Mr. D. J. Scourfield and others, but as this region has not been studied in the other lochs of the system, it is thought better not to enter into the details of it here.

Loch Bà.—Most of the common pelagic animals were not seen, while many species belonging rather to the shore (or littoral) fauna were numerous, as *Eurycercus lamellatus*, *Acroperus harpæ*, *Alonella nana* and *A. excisa*, *Alona affinis* and *A. guttata*, and *Chydorus sphæricus*. Many Rhizopods were observed, as well as mites and Ostracodes.

Loch Laidon.—Only the Entomostraca of this loch were studied by Mr. D. J. Scourfield. The species were all the same as in Loch Rannoch. No collections were made of the other groups of animals.

Lochan Sròn Smeur.—Notwithstanding the high elevation and the early season at which it was examined, this loch was found to be exceptionally rich in both animals and plants, particularly in Rotifers, Rhizopods, and Desmids. *Holopedium* was here seen unusually early in the season. Besides the ordinary pelagic animals, *Diaptomus*, *Daphnia*, *Bosmina*, etc., *Latona setifera* was present.

Loch Bhac.—The commonest animals were *Diaptomus gracilis* (red), *Bosmina obtusirostris* (with long beak), *Daphnia lacustris*, *Diaphanosoma brachyurum*.

Among the Rotifers was the brilliant red and blue *Notops pygmæus*, and the curious Desmid *Micrasterias Wallichii* was present.

Loch Con.—Entomostraca were few, and Algæ more numerous than usual. The commonest animal was *Bosmina obtusirostris* (small). *Diaptomus gracilis* (some large, yellow, others red). The Rotifer *Notops pygmæus* was unusually large.

Loch Tilt.—In common with a few other lochs, usually lying at considerable elevations, the only common animal was *Diaptomus gracilis*, so bright red in colour that the net, when taken up, seemed filled with blood. Hardly anything else was seen.

Loch Moraig.—Entomostraca were here scarce, and Protozoa and Algæ abundant. The commonest organism was a form of *Ceratium hirundinella*, which was so abundant as to constitute a "Wasserblut."

Loch Broom.—This shallow marshy pool, with *Menyanthes* growing almost everywhere, yet had a quite ordinary lacustrine fauna, including *Diaptomus* (dark brown), *Daphnia lacustris* (very large), *Cyclops strenuus* (large, hyaline), *Bythotrephes*. *Conochilus* was much the commonest animal. An unusual form of *Ceratium hirundinella*, having both the median spines long, occurred.

Loch Ordie.—The most abundant animals at the time this loch was visited were *Holopedium*, *Daphnia* (parrot-shaped head), and *Diaptomus* (hyaline). *Bosmina* of two forms was found: *B. obtusirostris* (small) and *B. longispina*.

Loch nan Eun.—The highest loch in the Tay system visited. The predominant animal was *Diaptomus gracilis* (blood-red); *Daphnia lacustris* (very large), *Bosmina obtusirostris*, and several species of Desmids, notably *Staurastrum arctiscon*, were present in some numbers. There was a scarcity of smaller organisms.

Loch Shechernich.—The water was turbid from the abundance of life. The most conspicuous examples were *Diaptomus* (dark red, red and yellow, red and blue, or all blue), probably *D. Wierzejskii*, *Daphnia* (parrot-shaped head), *Bosmina* (very large, purple), *Notholca longispina*, and *Polyarthra*. *Asterionella* was of a smaller size than usual. Numbers of a small yellow water-mite were seen.

Loch Auchenchapel.—*Ceratium hirundinella* formed a "Wasserblut" in the loch at the time it was visited. Other common animals were *Bosmina obtusirostris*, *Daphnia lacustris* (small), *Diaptomus* (reddish), *Conochilus*.

Loch of Lintrathen.—The water was very clear and organisms sparingly distributed. *Daphnia lacustris* (large) and *Diaptomus gracilis* (hyaline) were the only animals at all common.

Loch Benachally.—*Holopedium* was common on the surface, but not below. *Diaptomus gracilis* (brown, mostly immature) and *Daphnia lacustris* (large) were most abundant. *Bosmina* was scarce.

Long Loch.—Very few animals were present, the commonest being *Daphnia lacustris*, *Diaptomus gracilis* (hyaline), and *Conochilus*.

Pitlyal Loch.—This differed from most lochs visited about the same time, in the general scarcity of life, especially of Entomostraca. It was one of the few lochs in the system where *Bosmina cornuta* took the place of the common *B. obtusirostris*. There was a "Wasserblut" of a pale filamentous Alga. *Volvox* and several other Algæ occurred. Although in those various respects the biology approached the pond type, *Leptodora* was rather numerous.

Forfar Loch.—The water was very turbid throughout, yet the fauna was mainly lacustrine, the commonest animal being *Cyclops strenuus*. *Daphnia lacustris* (large) was also common. The *Cyclops* was covered with parasites of many species, both animal and vegetable.

The lochs which are drained by the Lunan Burn form a connected series, all of

moderate size or very small and shallow, several being quite stagnant and overgrown with weeds. The most important are Loch of the Lowes, Lochs Drumellie and Clunie, the last being the deepest of the whole chain. *Volvox* was present in most of the lochs.

Loch of Craiglush.—Most of the ordinary pelagic animals were seen. *Holopedium* was abundant. *Daphnia* was tinged with pink, and some males were seen; *Diaptomus* was dull brown; *Bosmina* was small. Several small Algæ, as *Volvox*, *Pediastrum*, *Eudorina*, were common, and several Rotifers, as *Sacculus viridis* and a species of *Synchæta*.

Loch of the Lowes.—The plankton resembled that of Loch Craiglush, but differed in a few points. *Holopedium* was more numerous, *Daphnia* larger and not pink, *Bythotrephes* was seen, and there were fewer Algæ and Rotifers.

Loch of Butterstone.—Life was abundant, and the species were almost all the same as in Loch Craiglush. There was less difference between those two lochs than between Loch Craiglush and Loch of the Lowes, which are connected by a broad canal. The *Daphnia* was pink-tinged as in Loch Craiglush, and there were some males. Another form of *Daphnia* also occurred, larger, and with a purple spot on each valve.

Lochs Drumellie and Clunie.—These two lochs may be treated together, as they are connected by a short burn and differ little in the character of the plankton. The *Daphnia* in both had the parrot-shaped head which results from the elimination of the depression in the forehead. *Bosmina* was not noted in either. *Volvox* was more plentiful in Loch Drumellie, and *Leptodora* was common in it and not seen in Loch Clunie.

Rae Loch (or *Ardblair Loch*).—The most common animal was *Notholca longispina*. The *Daphnia* was small, the *Diaptomus* mostly immature, and *Bosmina* was not seen. A large bizarre-shaped Infusorian with green body-contents was numerous.

Black Loch.—The only common organisms were *Diaptomus* (pale red), *Daphnia* (large), *Polyphemus*, and some small Diatoms.

White Loch and Fingask Loch.—These two lochs, which are connected by a short burn, are very similar, *Daphnia* (large) being much the most abundant animal, a few bearing ephippia and some males being seen. *Diaptomus* was hyaline and immature. *Volvox* was more plentiful in Fingask Loch. *Leptodora* was only seen in the White Loch.

Stormont Loch.—The water of this stagnant pond was quite turbid and yellow in colour from the superabundance of *Daphnia*. The nets could not be drawn through the water in the usual way without getting quite choked with animals. A single dip of the net, by which about half a gallon of water would be strained, collected enough material to fill a 2-oz. bottle. The *Daphnia* was of two forms, one small and the other much larger than usual, and many males were seen. There was little else in the loch, only *Diaptomus* (hyaline) and a species of *Anabæna* being at all plentiful.

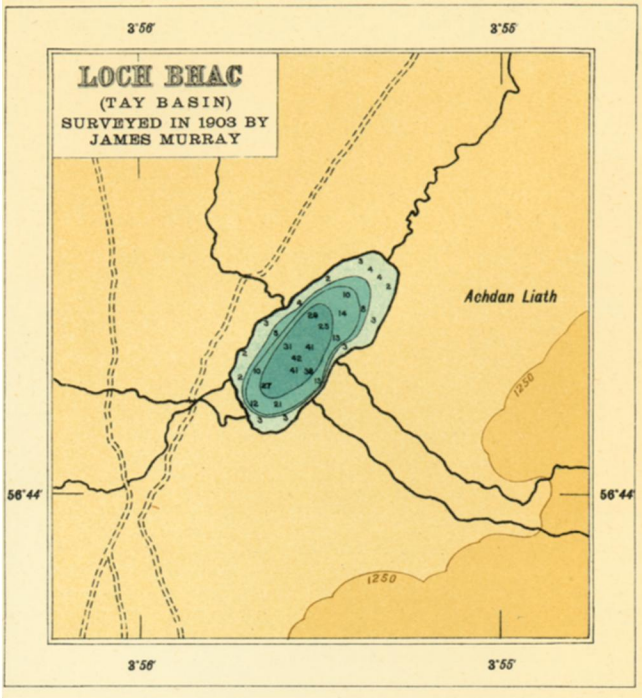
Monk Myre.—*Notholca longispina* formed a "Wasserblut" here, giving the collection a reddish colour. *Diaptomus* (grey or hyaline), *Bosmina cornuta*, and *Polyphemus* were common.

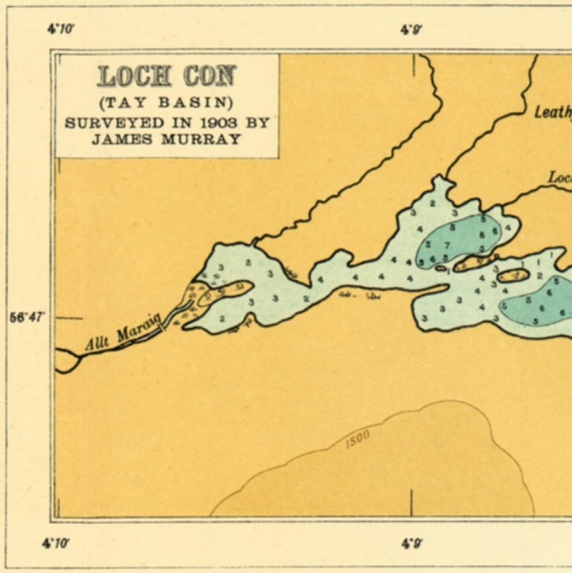
BATHYMETRICAL SURVEY OF THE FRESH-WAT

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAUREL

PLATE I



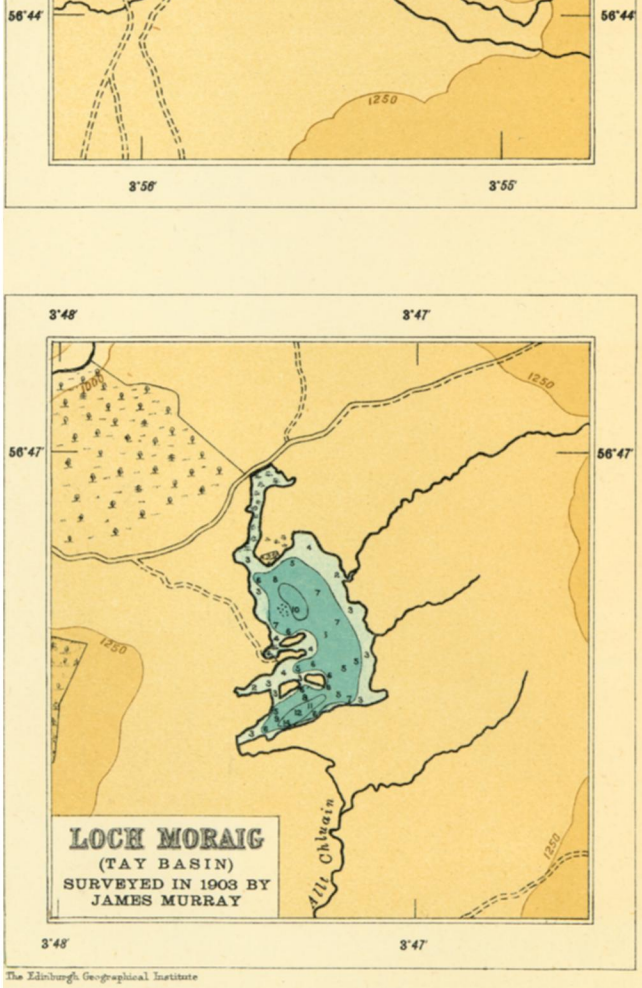


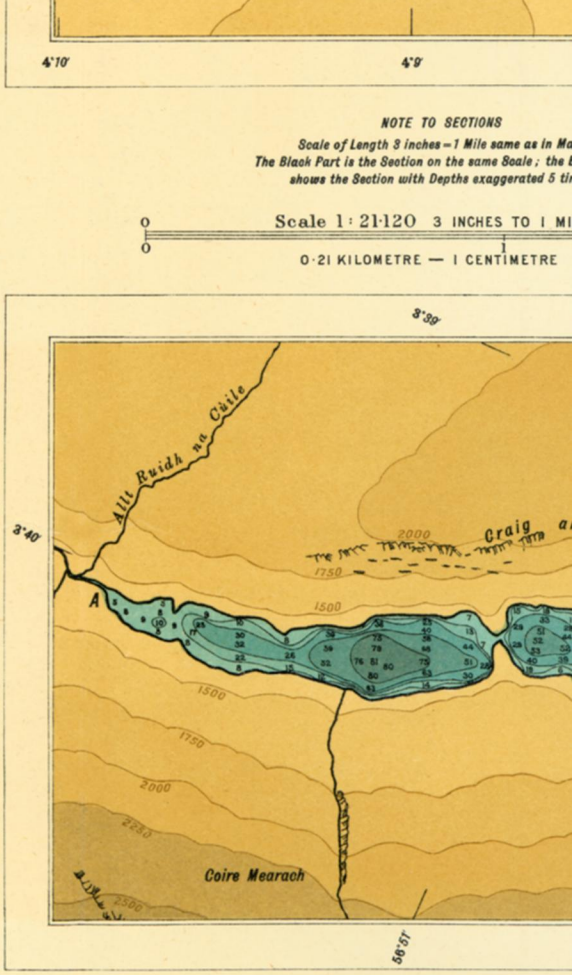
NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in Ma
The Black Part is the Section on the same Scale; the b
shows the Section with Depths exaggerated 5 ti

Scale 1 : 21·120 3 INCHES TO 1 MI

0·21 KILOMETRE — 1 CENTIMETRE





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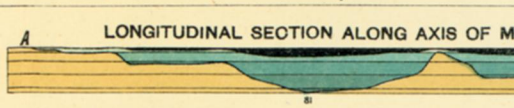

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RESH-WATER LOCHS OF SCOTLAND

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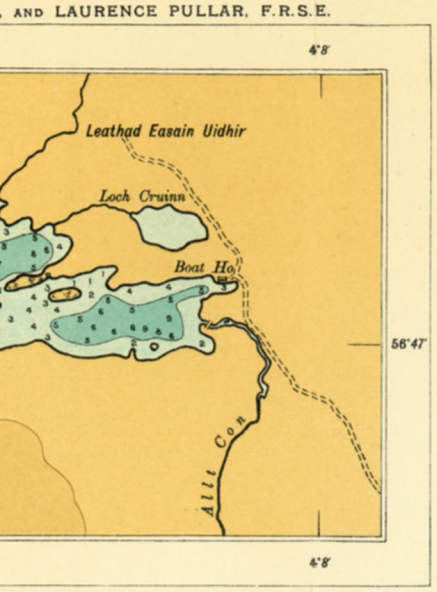
, AND LAURENCE PULLAR, F.R.S.E.



SECTIONS

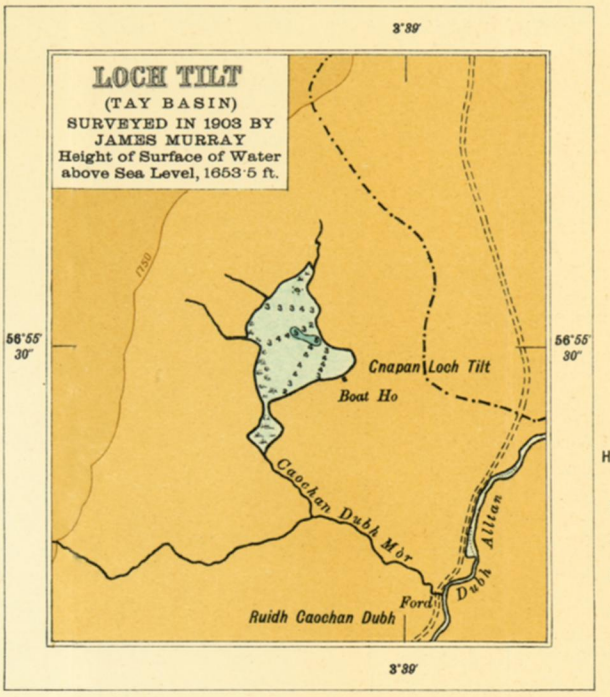
1 Mile same as in Map.

the same Scale; the Blue Colour

ths exaggerated 5 times.

INCHES TO 1 MILE — Mile 1

1 CENTIMETRE — Kilometres 1·61



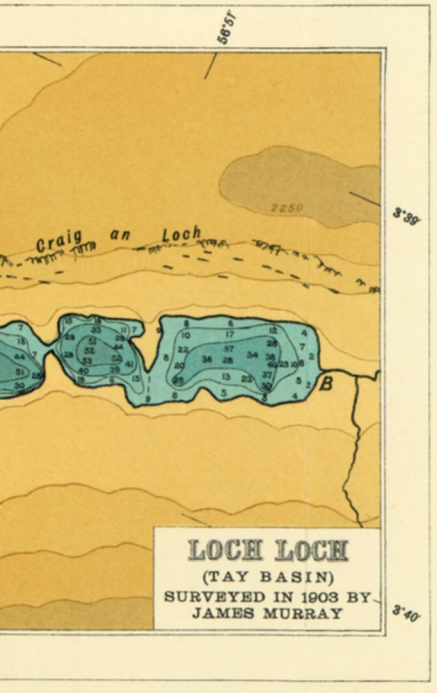
The Land Contours are from the Ordnance Survey

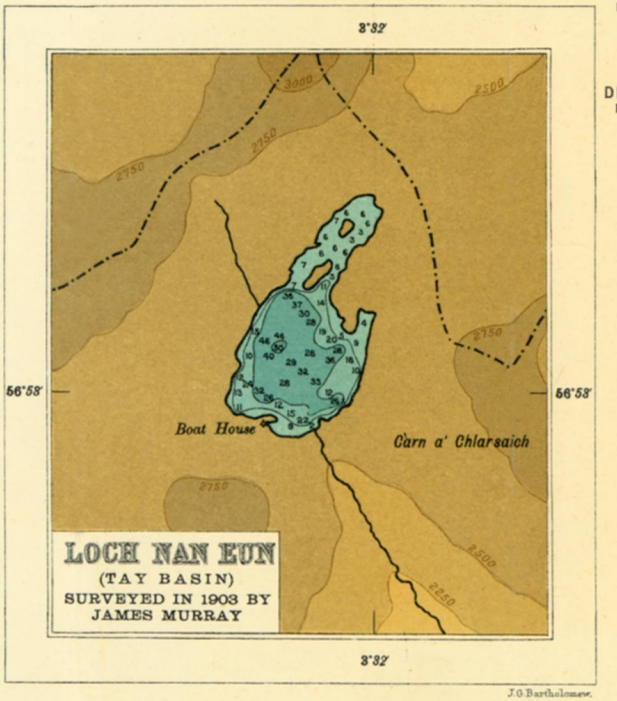
HEIGHTS IN FEET

FEET	METRES
3000	914·4
2750	838·2
2500	762
2250	685·8
2000	609·6
1750	533·4
1500	457·2
1250	381·1
1000	304·8

DEPTHS IN FEET

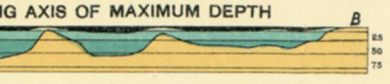
FEET	METRES
5	1·5
10	3·05
25	7·6
50	15·2
75	22·8





J.G. Bartholomew.

IG AXIS OF MAXIMUM DEPTH

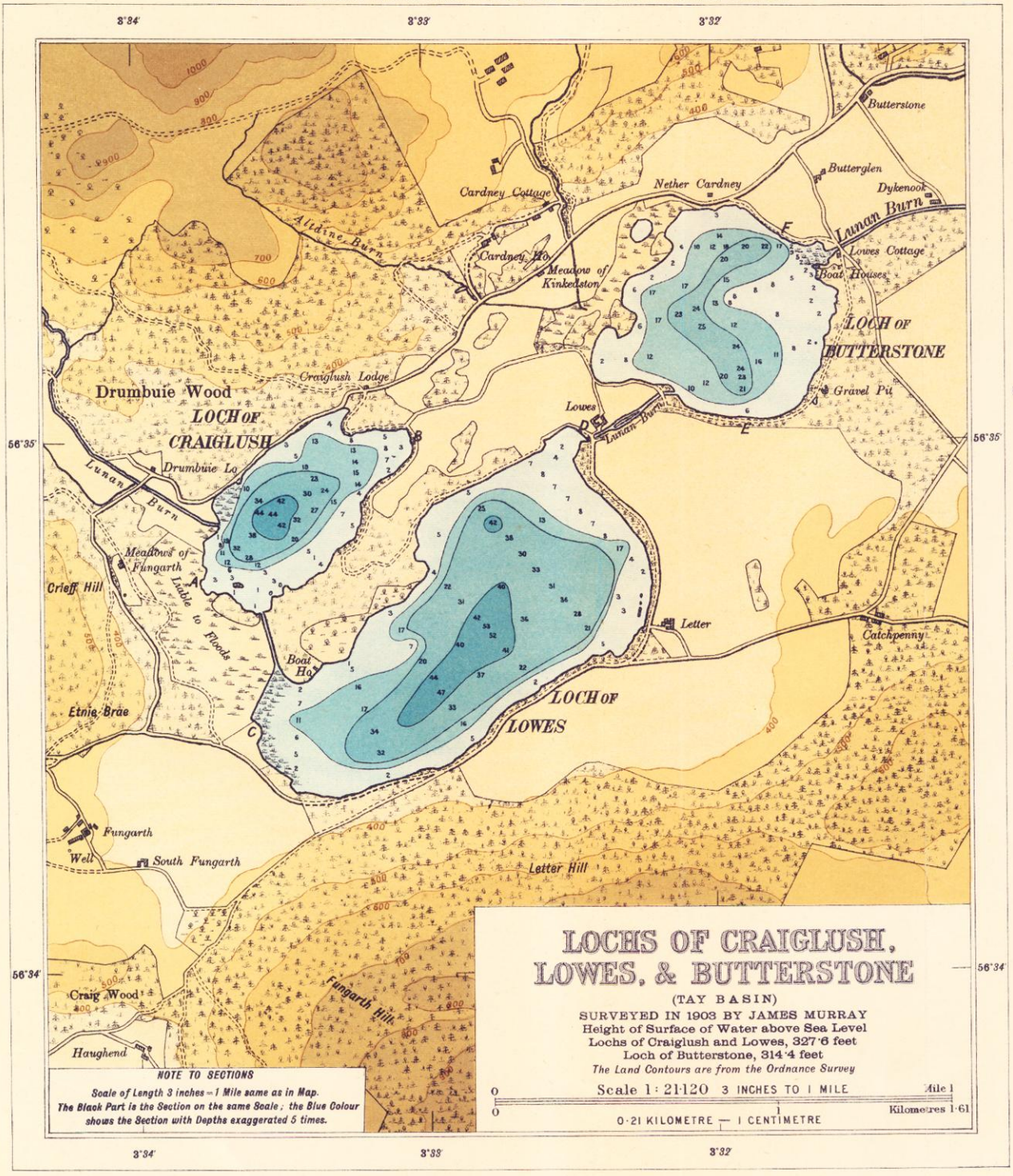


BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.

PLATE II — GEOGRAPHICAL JOURNAL



LOCHS OF CRAIGLUSH, LOWES, & BUTTERSTONE

(TAY BASIN)

SURVEYED IN 1903 BY JAMES MURRAY

Height of Surface of Water above Sea Level
Lochs of Craiglush and Lowes, 327·6 feet
Loch of Butterstone, 314·4 feet

The Land Contours are from the Ordnance Survey

Scale 1: 21120 3 INCHES TO 1 MILE — Mile 1

0·21 KILOMETRE — 1 CENTIMETRE — Kilometres 1·61

HEIGHTS IN FEET

FEET	METRES
1000	304·8
900	274·3
800	243·8
700	213·4
600	182·9
500	152·4
400	121·9

DEPTHS IN FEET

FEET	METRES
10	3·05
20	6·1
40	12·2

NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in Map.
The Black Part is the Section on the same Scale; the Blue Colour shows the Section with Depths exaggerated 5 times.

SECTION A B — 20 40 — 44

SECTION C D — 20 40 — 53

SECTION E F — 75

The Edinburgh Geographical Institute

J. G. Bartholomew

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LOCHS OF CLUNIE & DRUMELLIE

(TAY BASIN)

SURVEYED IN 1903 BY JAMES MURRAY

Height of Surface of Water above Sea Level
L.of Clunie, 156·5 ft., L.of Drumellie, 146·7 ft.

3°27′ 3°26′ 3°25′

56°35′

Kinloch
Quarryhill
Easter Tullyneddie
Clunie Cot.
Wester Tullyneddie
Cattymill Burn
Boat Ho.
Forneth Ho.
Bankhead
New Mill
Lunan Burn
Boat Ho.
Bridge-end
LOCH OF CLUNIE
Cottertown
Ch.
Castle
Clunie
Craigie Cot.
Mains of Clunie
Craigie
West Pendicle
Hawkhill
Hillocks of Gourdie
Blackloch
Logiebrae
Pott Burn

SECTION A B

SECTION C

RAE LOCH

(TAY BASIN)

SURVEYED IN 1903 BY JAMES MURRAY

Height of Surface of Water above Sea Level, 195·2 feet

3°22′

56°35′

Hillbarns
Mains of Ardblair
Leys of Marlee

3°22′ 3°21′

56°34′

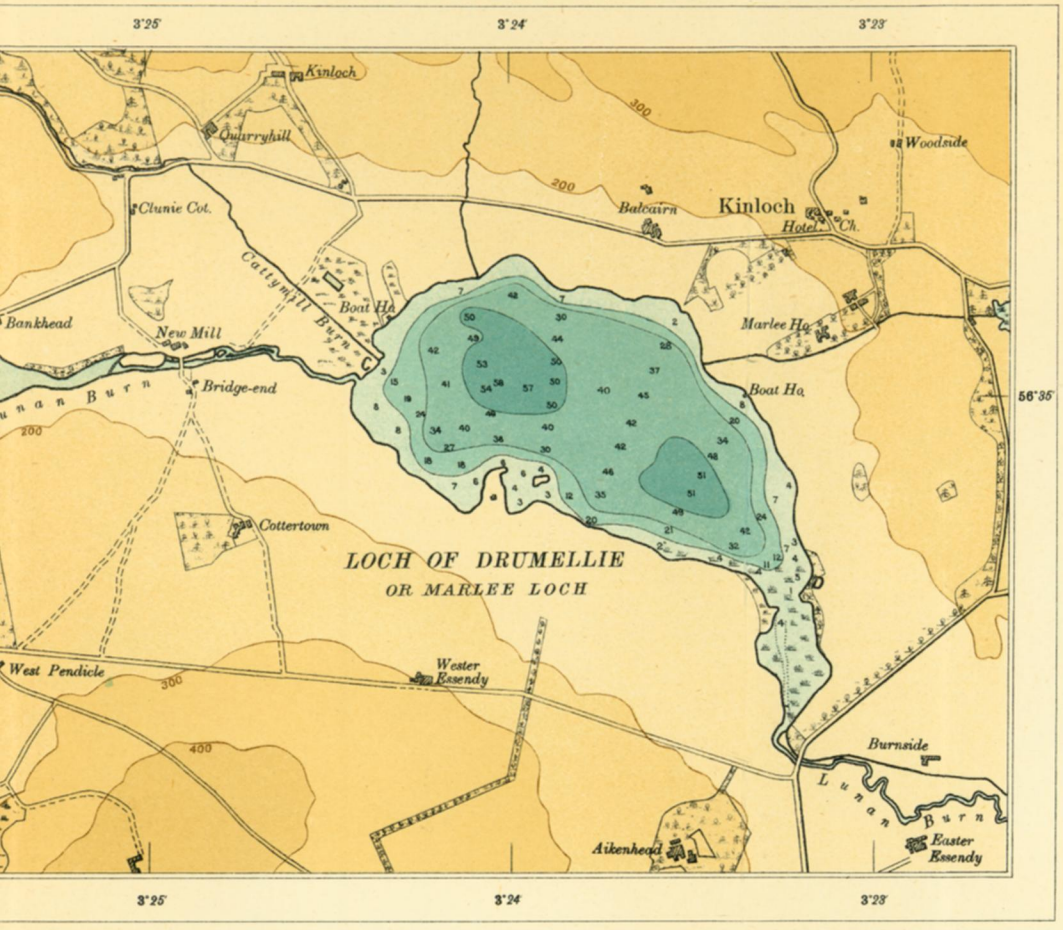
Cleaves
FINGASK LOCH
Whiteloch
Druidsmere
White Loch
Newbigging

The Edinburgh Geographical Institute

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

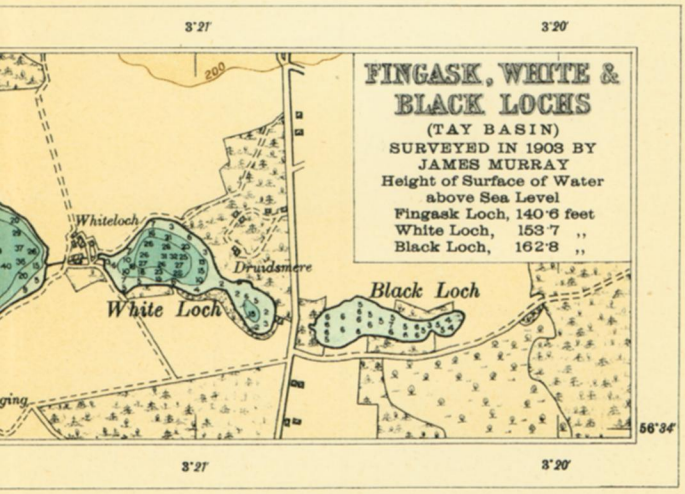
SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.

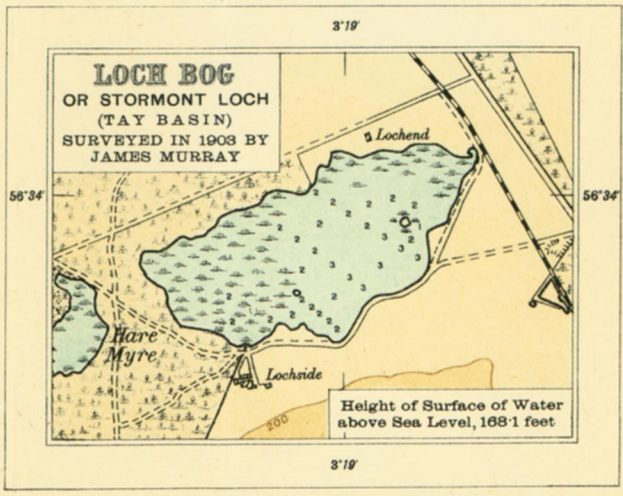


SECTION D

Scale 1 : 21·120 3 INCHES TO 1 MILE Mile 1

0·21 KILOMETRE — 1 CENTIMETRE Kilometres 1·61





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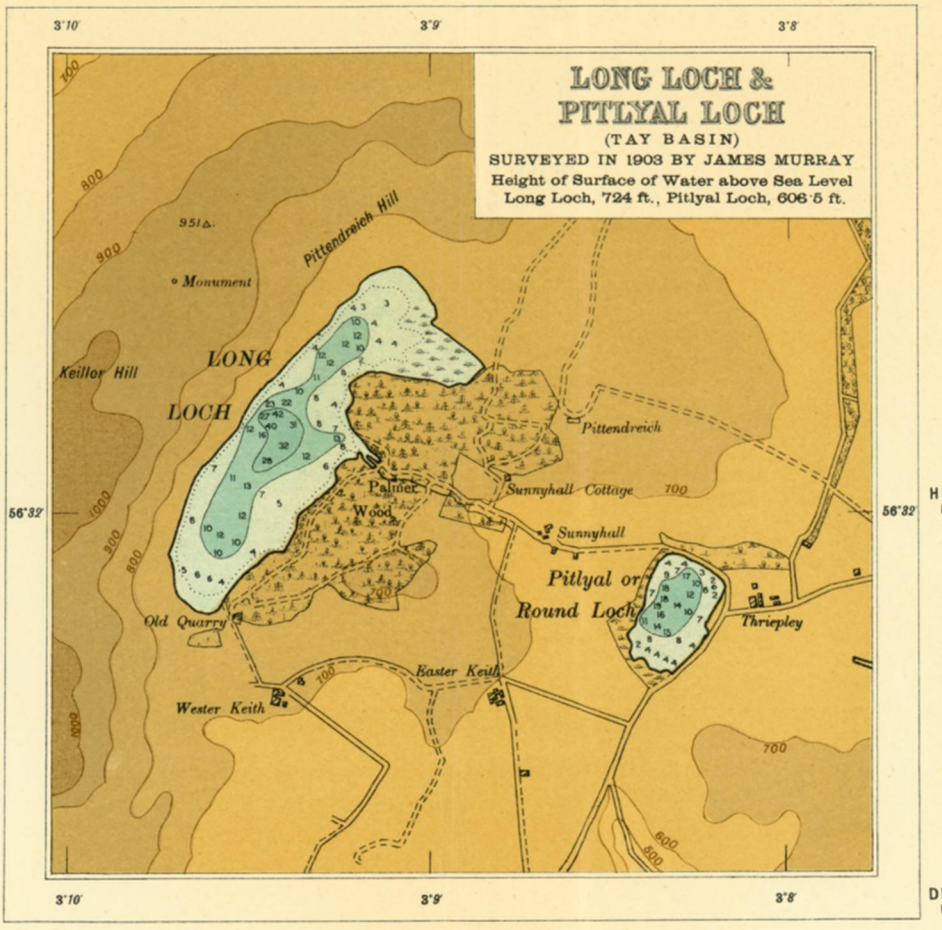
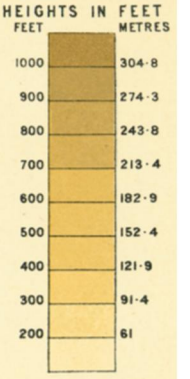
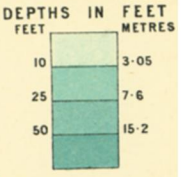




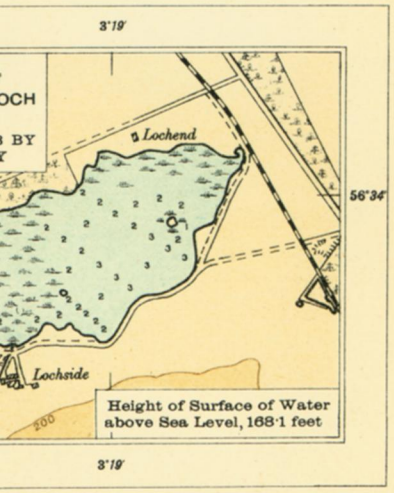


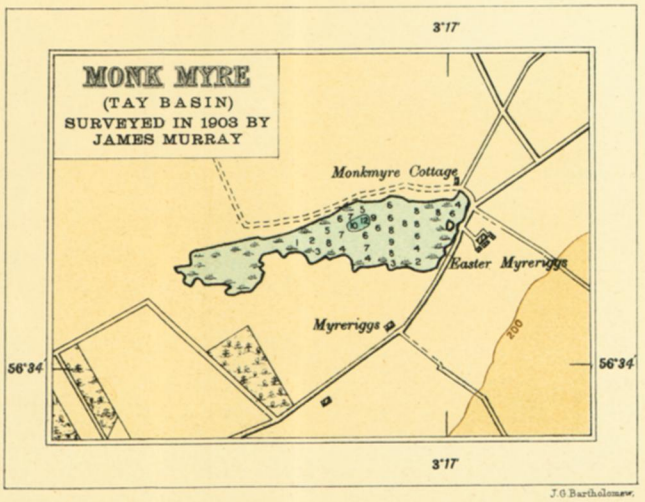
ES TO 1 MILE Mile 1

NTIMETRE Kilometres 1·61

NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in Map.
The Black Part is the Section on the same Scale: the Blue Colour shows the Section with Depths exaggerated 5 times.





J.G.Bartholomew.

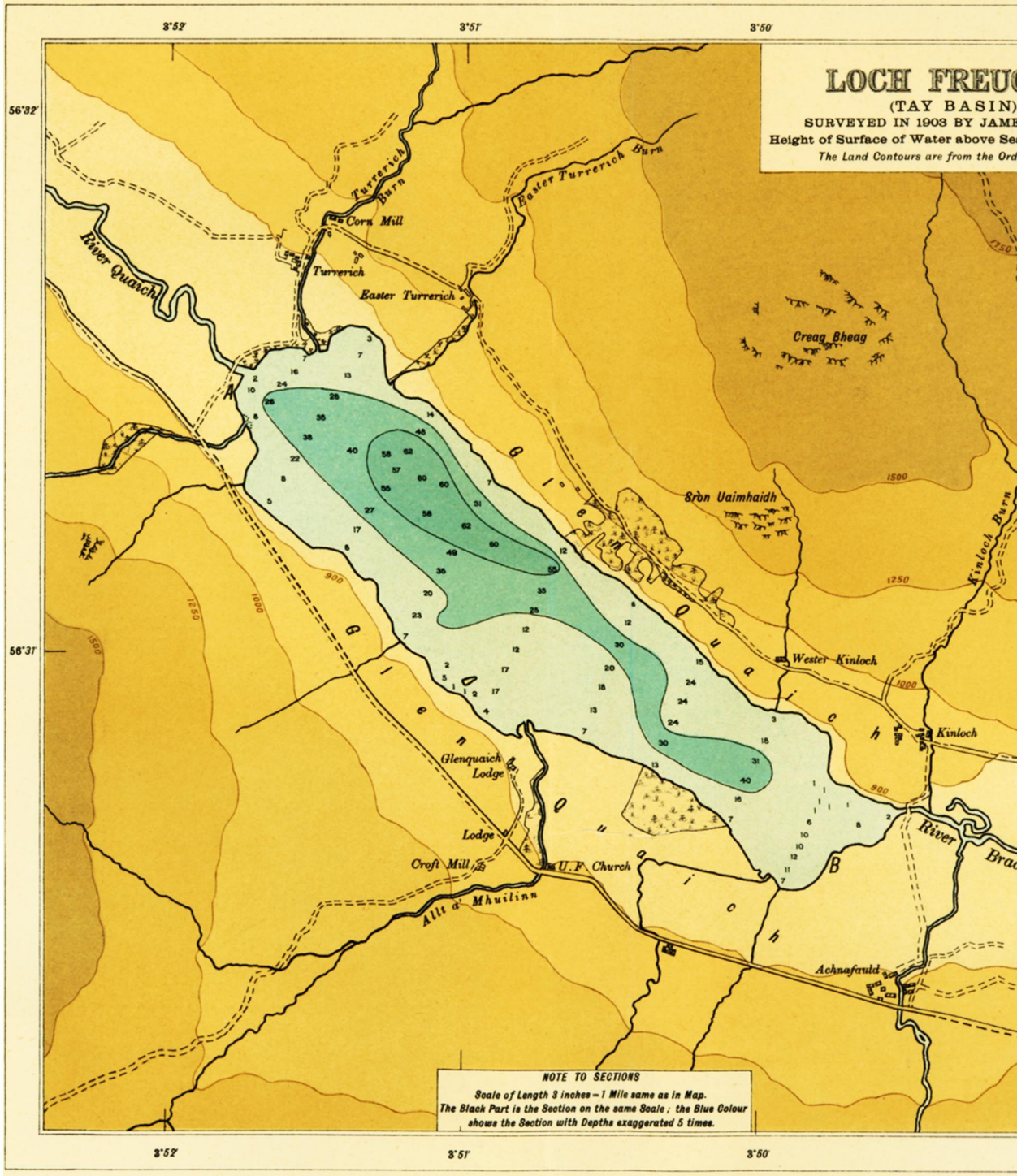
The Land Contours are from the Ordnance Survey

PLATE IV

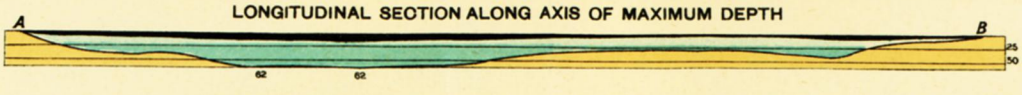
BATHYMETRICAL SURVEY OF THE FRESH-WAT

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAUREL



LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH



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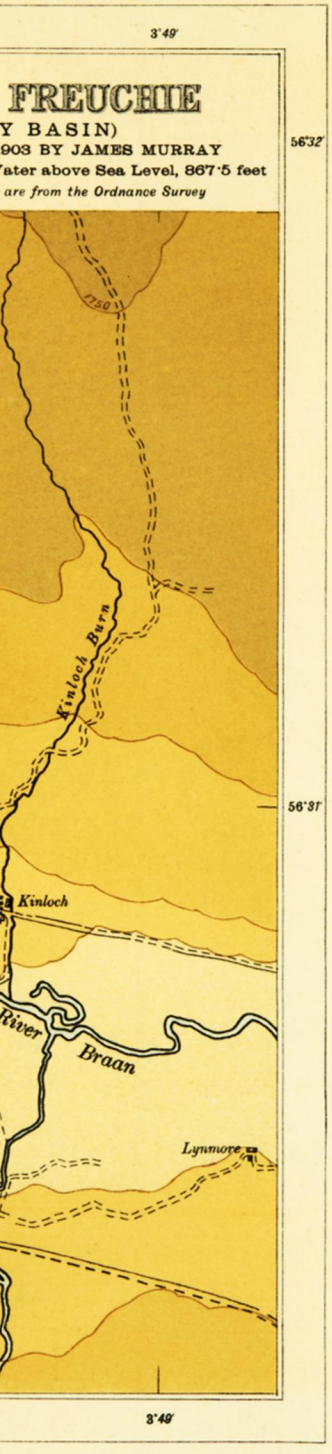
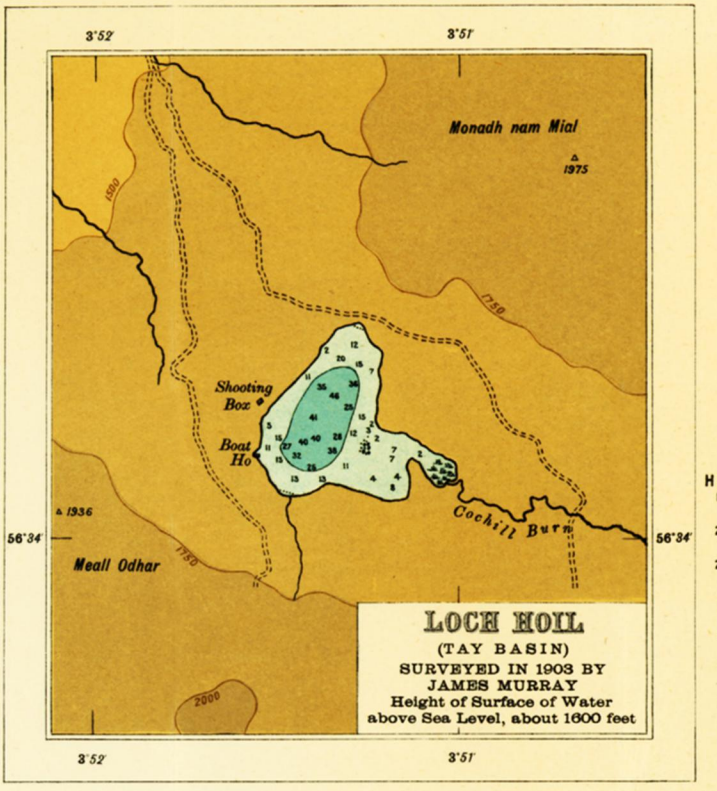
ESH-WATER LOCHS OF SCOTLAND

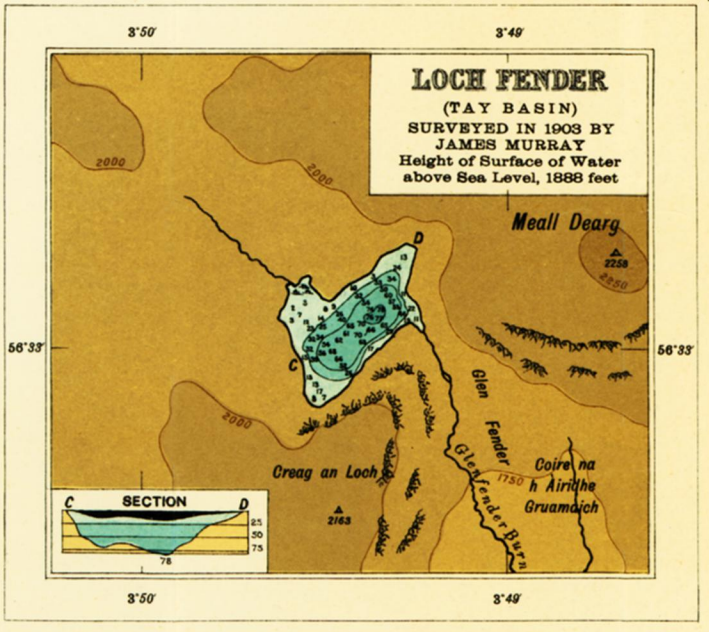
CTION OF

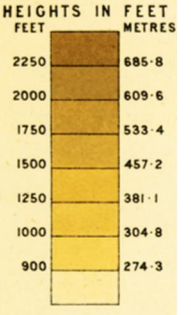
AND LAURENCE PULLAR, F.R.S.E.

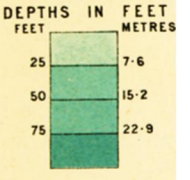


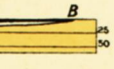


The Land Contours are from the Ordnance Survey









0 Scale 1 : 21·120 3 INCHES TO 1 MILE Mile 1

0 1 Kilometres 1·61

0·21 KILOMETRE — 1 CENTIMETRE

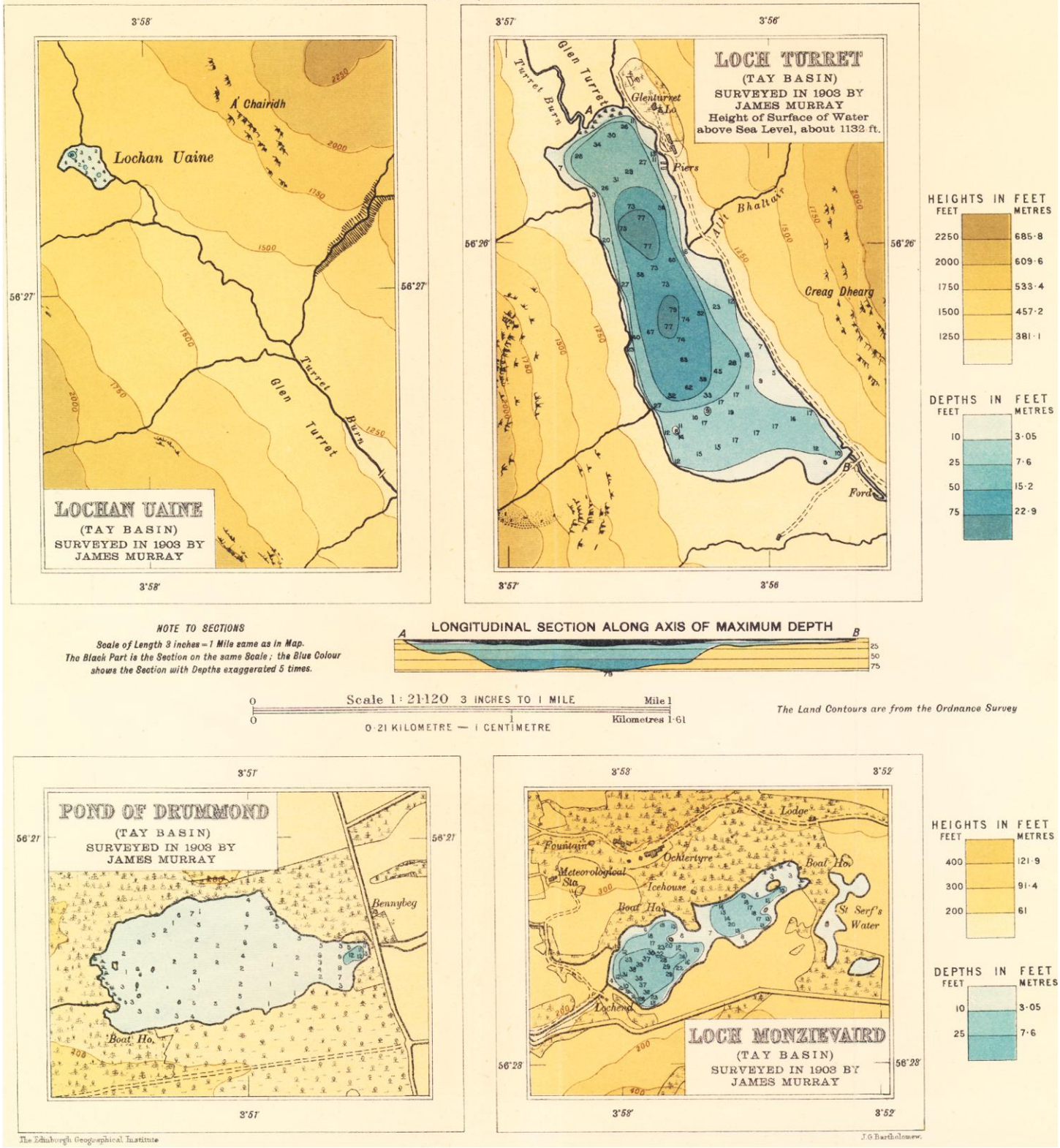
eographical Society.

J.G.Bartholomew

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



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J.G Bartholomew.

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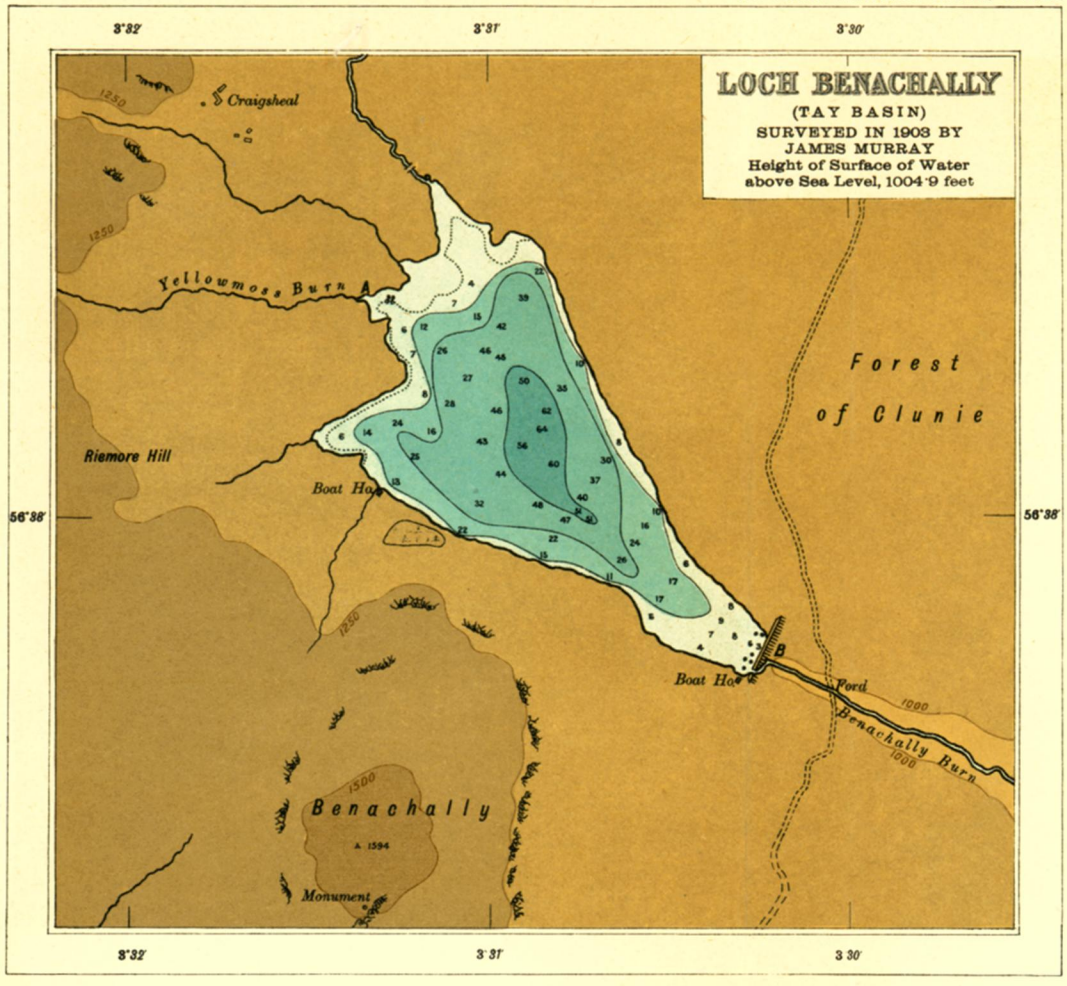
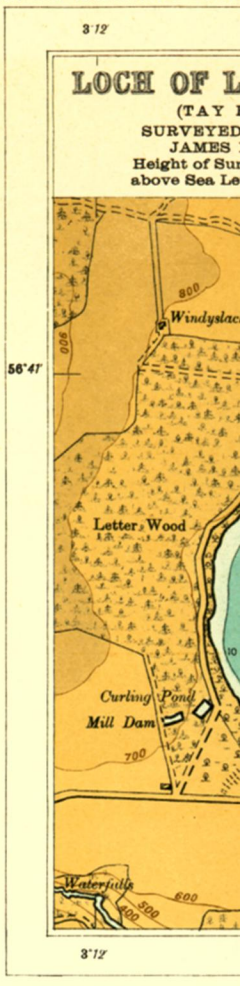
PLATE VI

BATHYMETRICAL SURVEY OF THE FRESH-WATER LO

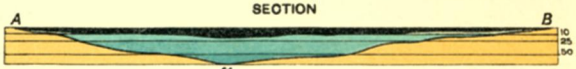
UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULL





SECTION

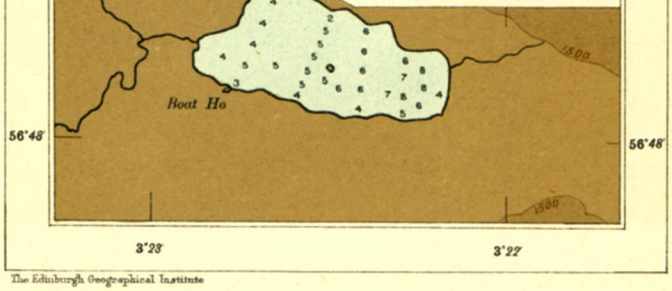


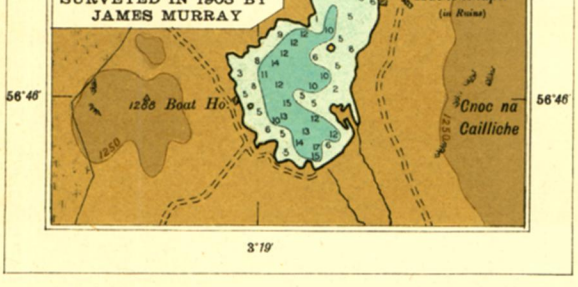
NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in Map.
The Black Part is the Section on the same Scale: the Blue
shows the Section with Depths exaggerated 5 times.

Scale 1 : 21·120 3 INCHES TO 1 MILE

0·21 KILOMETRE — 1 CENTIMETRE





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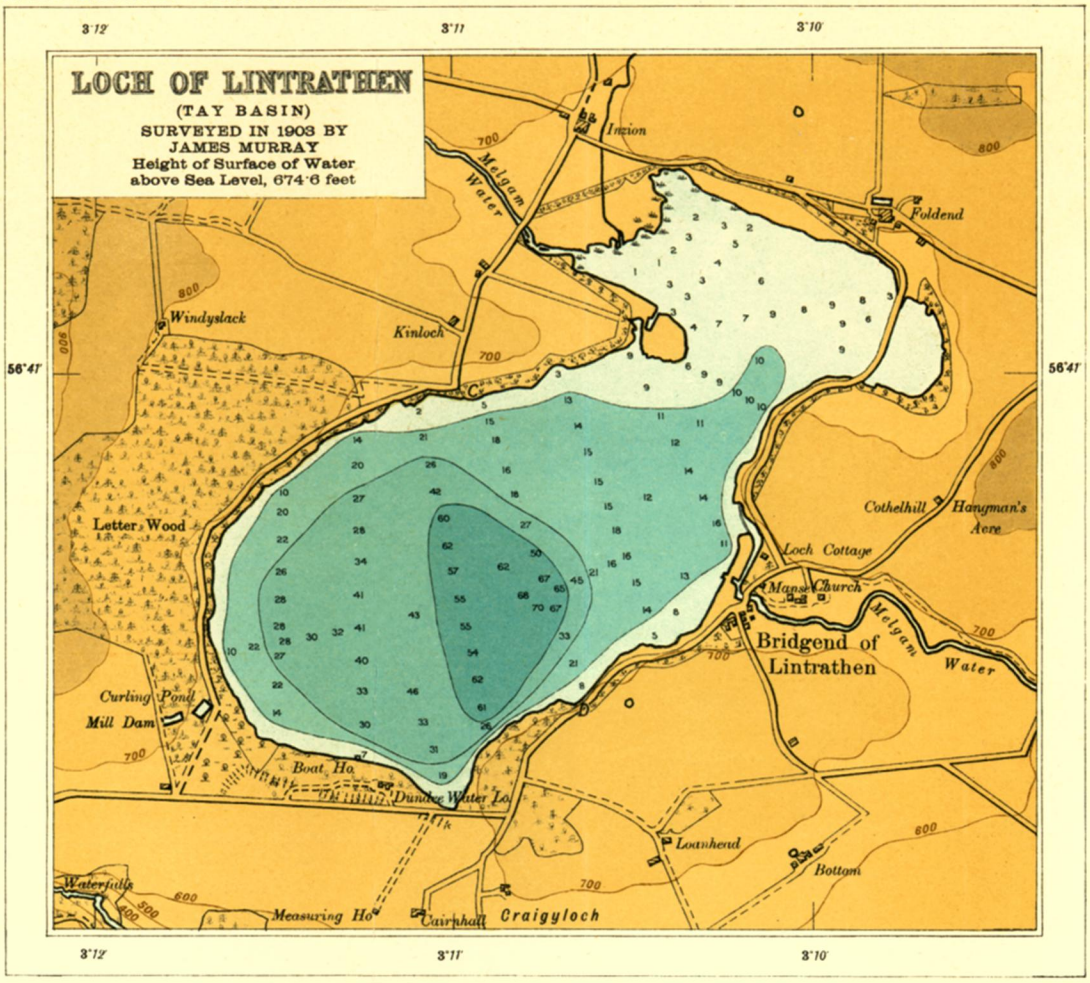


HEIGHTS IN FEET

FEET	METRES
1500	457·2
1250	381·1
1000	304·8
900	274·3
800	243·8
700	213·4
600	182·9
500	152·4
400	121·9
300	91·4
200	61

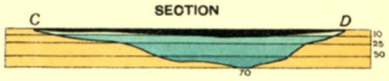
DEPTHS IN FEET

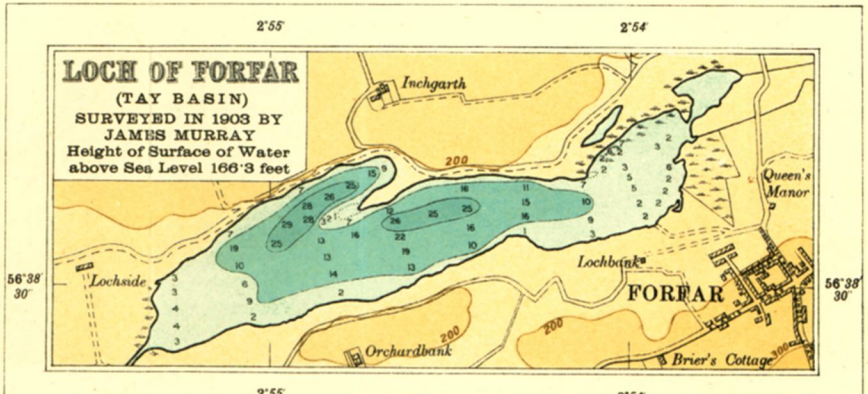
FEET	METRES
10	3·05
25	7·6
50	15·2

NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in Map.
Black Part is the Section on the same Scale: the Blue Colour shows the Section with Depths exaggerated 5 times.

Scale 1:21120 3 INCHES TO 1 MILE
Mile 1
0·21 KILOMETRE — 1 CENTIMETRE
Kilometres 1·61





J.G.Bartholomew

The Land Contours are from the Ordnance Survey

HEAD WATERS OF THE TAY

SURFACE GEOLOGY

GENERALISED FROM THE MAPS
OF H.M. GEOLOGICAL SURVEY
WHERE GROUND HAS BEEN SURVEYED

Scale 2 Miles to an Inch

0 1 2 3 Miles

SCALE OF GEOLOGICAL COLOURING

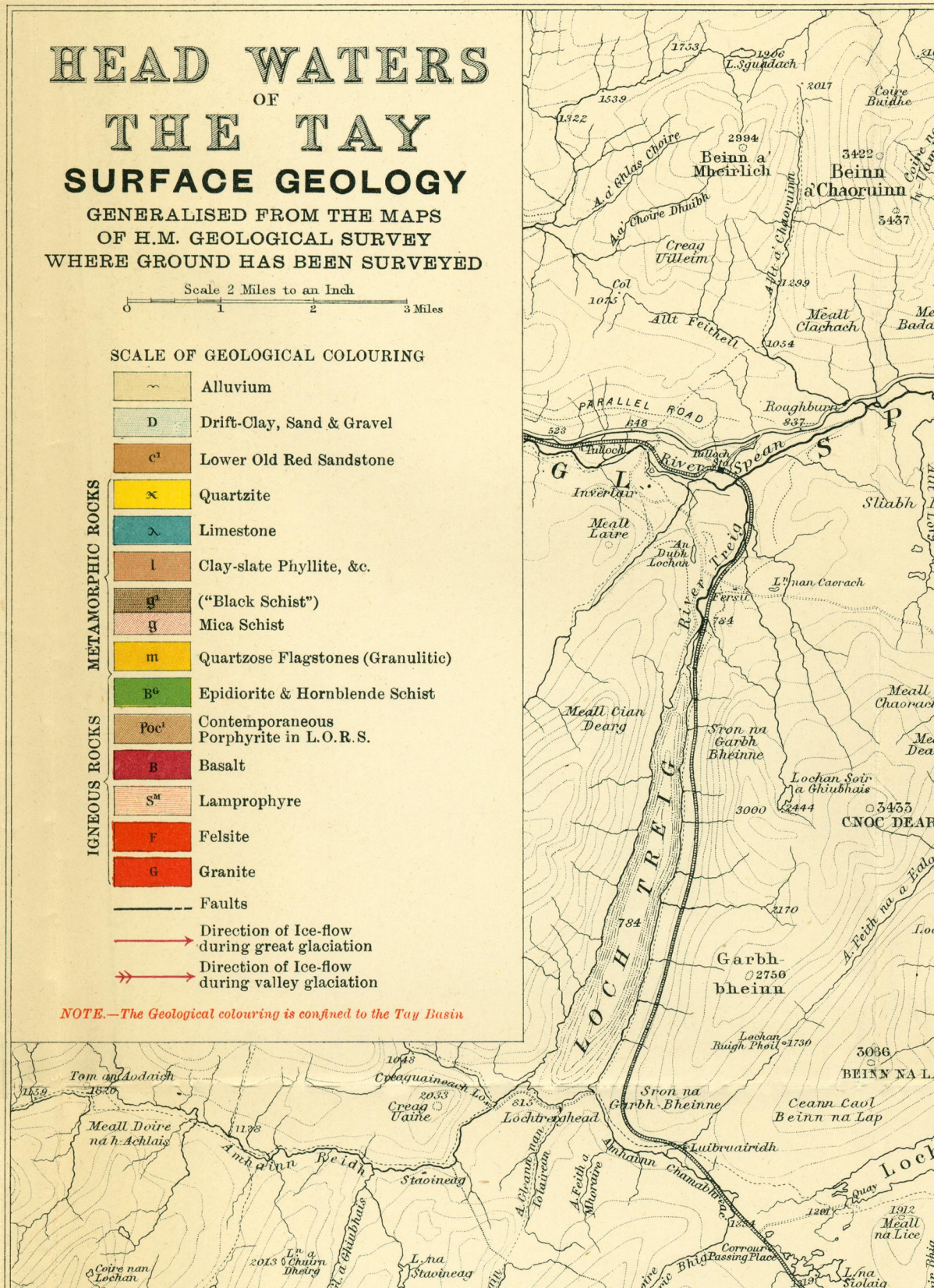
	~	Alluvium
	D	Drift-Clay, Sand & Gravel
	c^1	Lower Old Red Sandstone
METAMORPHIC ROCKS	ϰ	Quartzite
	ϰ	Limestone
	l	Clay-slate Phyllite, &c.
	g^1	("Black Schist")
	g	Mica Schist
	m	Quartzose Flagstones (Granulitic)
	B^G	Epidiorite & Hornblende Schist
IGNEOUS ROCKS	Poc^1	Contemporaneous Porphyrite in L.O.R.S.
	B	Basalt
	S^M	Lamprophyre
	F	Felsite
	G	Granite

Faults

Direction of Ice-flow during great glaciation

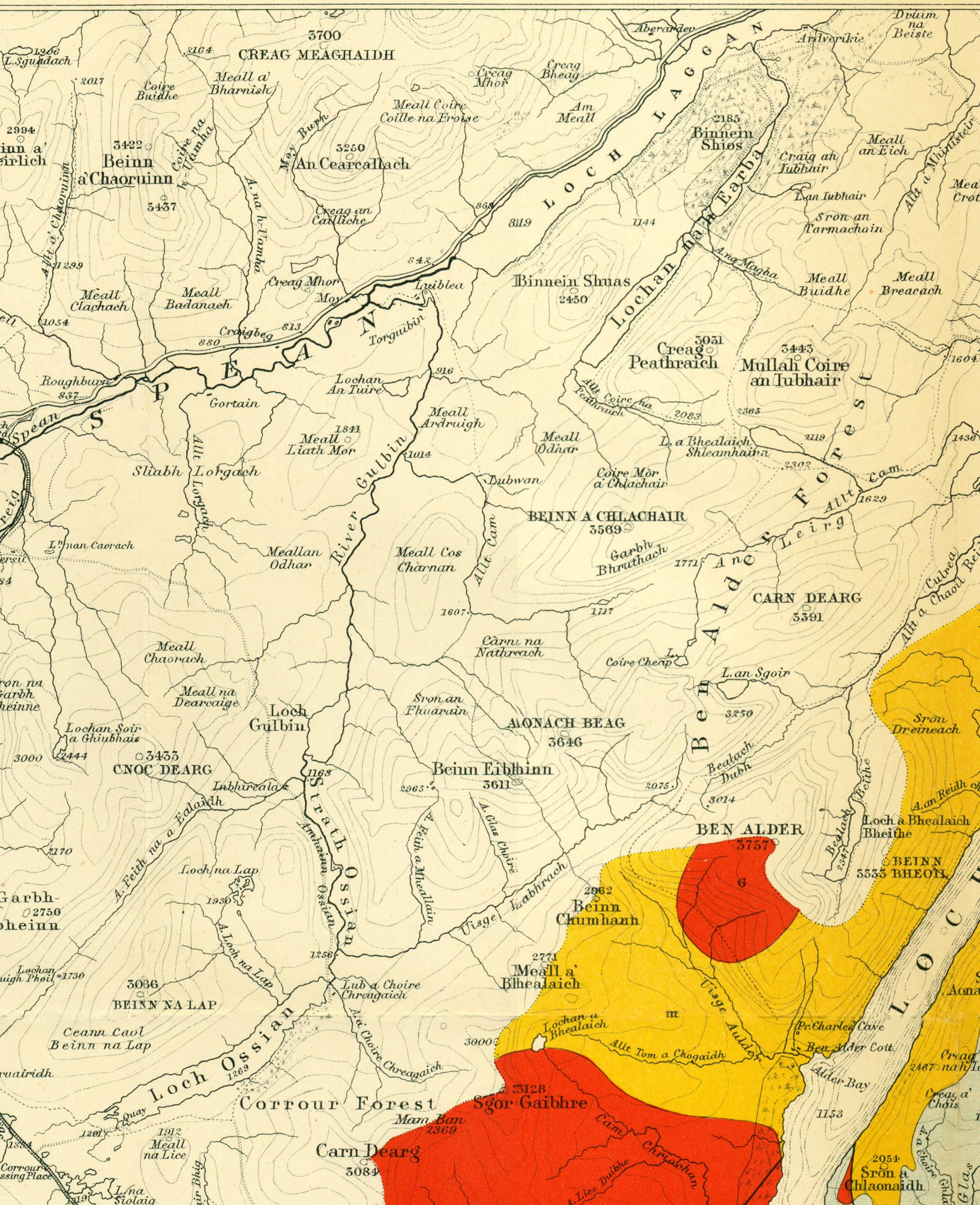
Direction of Ice-flow during valley glaciation

NOTE.—The Geological colouring is confined to the Tay Basin



Bathymetrical Su

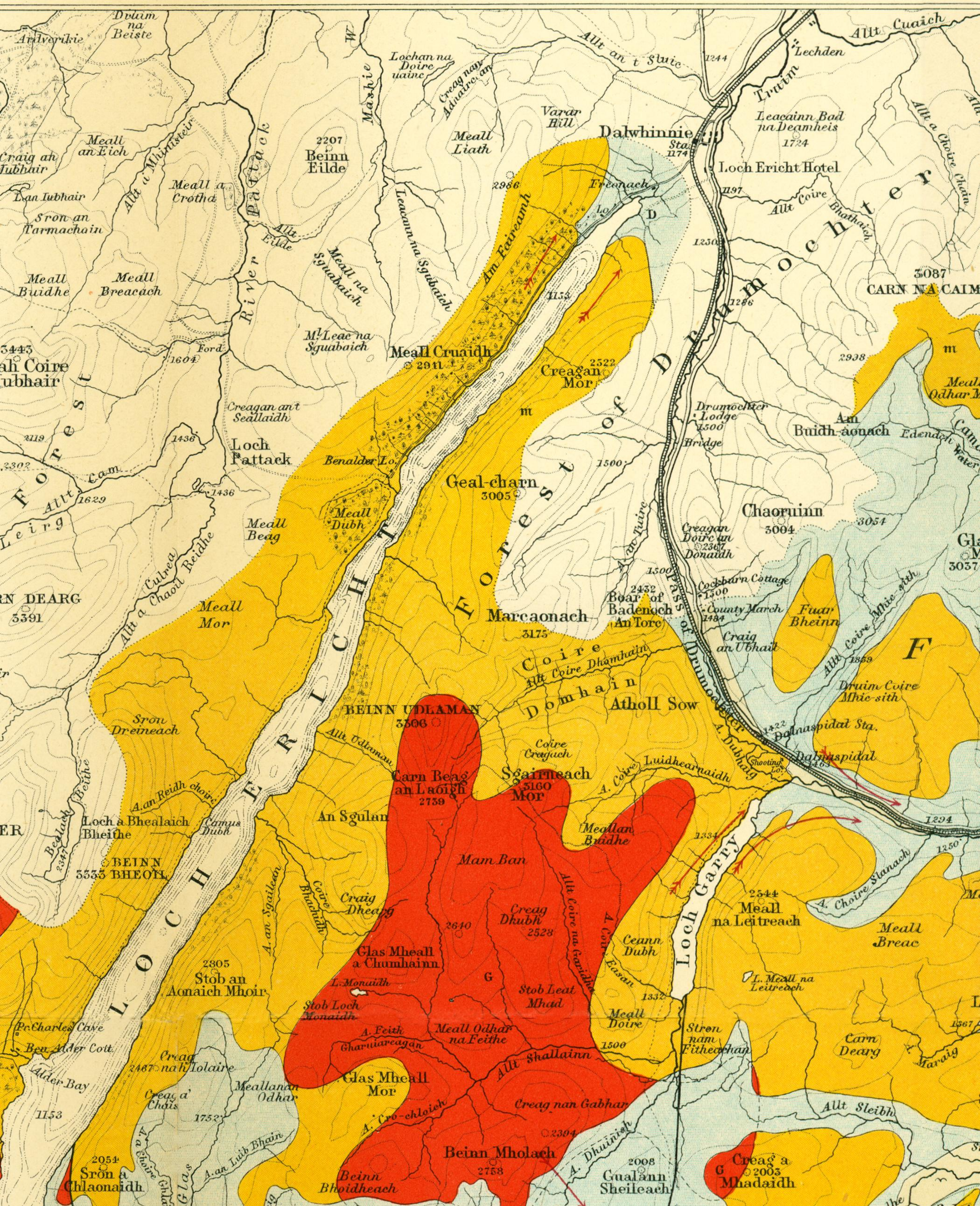
Sir John M



TRICAL SURVEY OF THE FRESH-WATER LOCHS OF

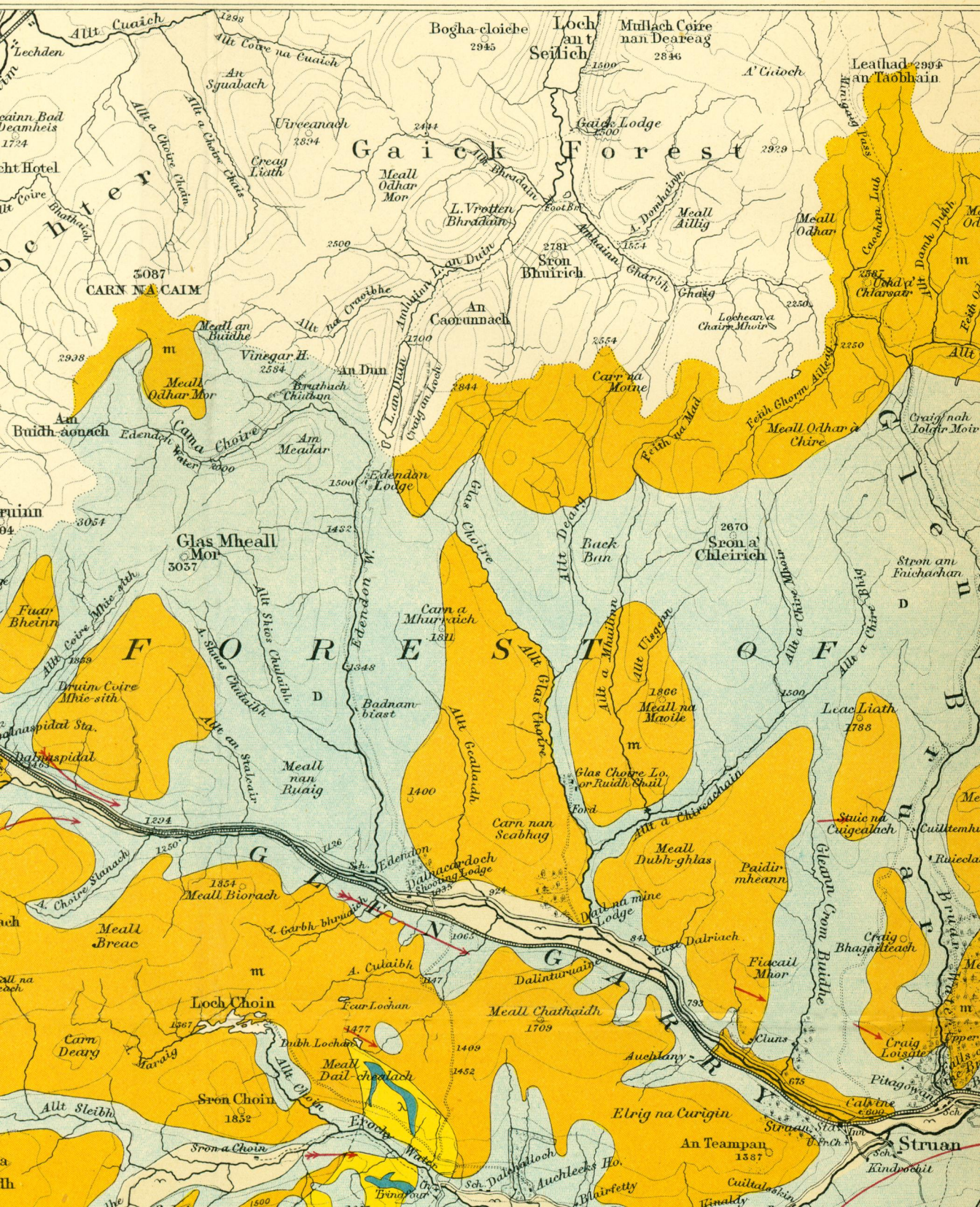
UNDER THE DIRECTION OF

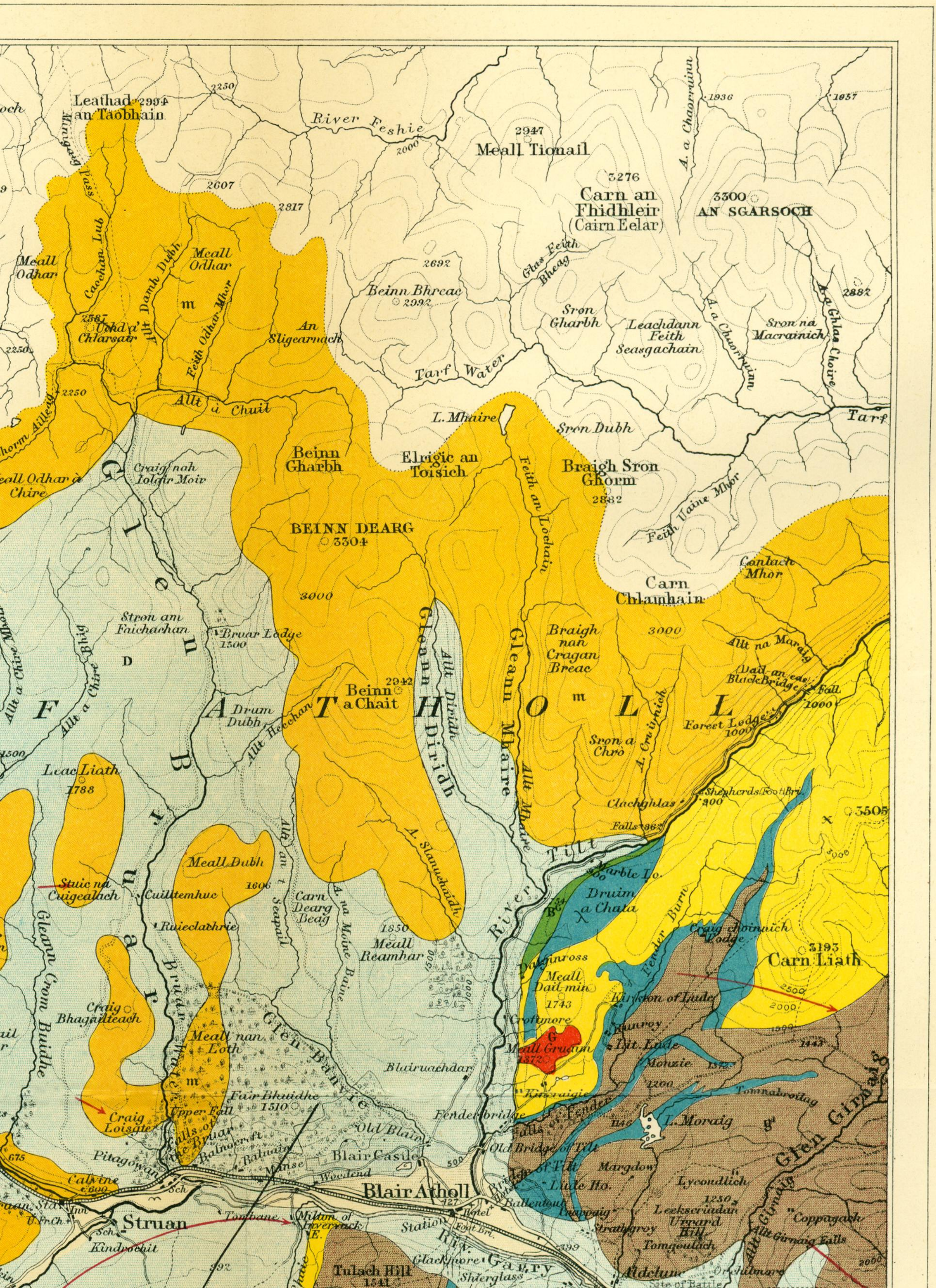
SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.

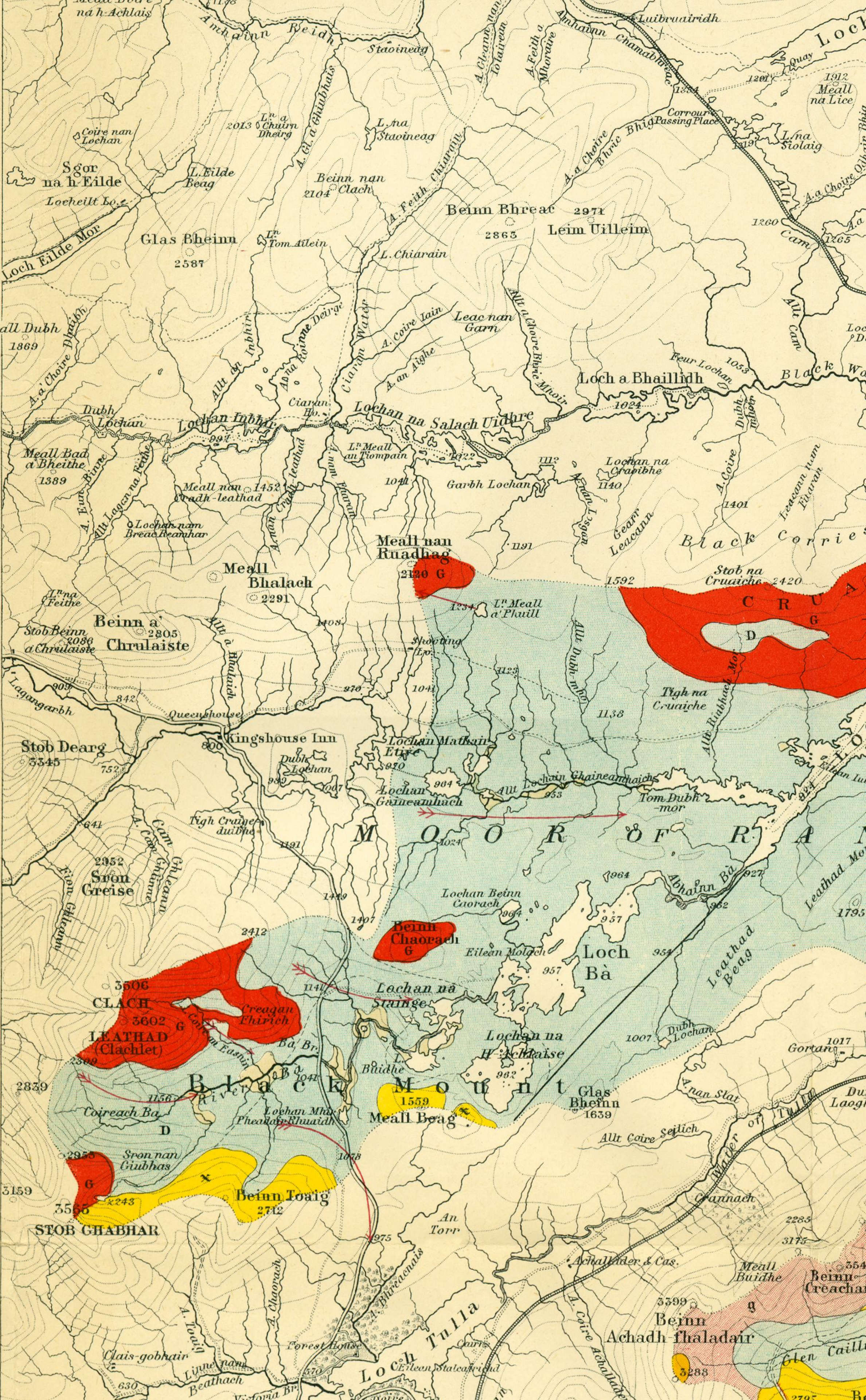


LOCHS OF SCOTLAND

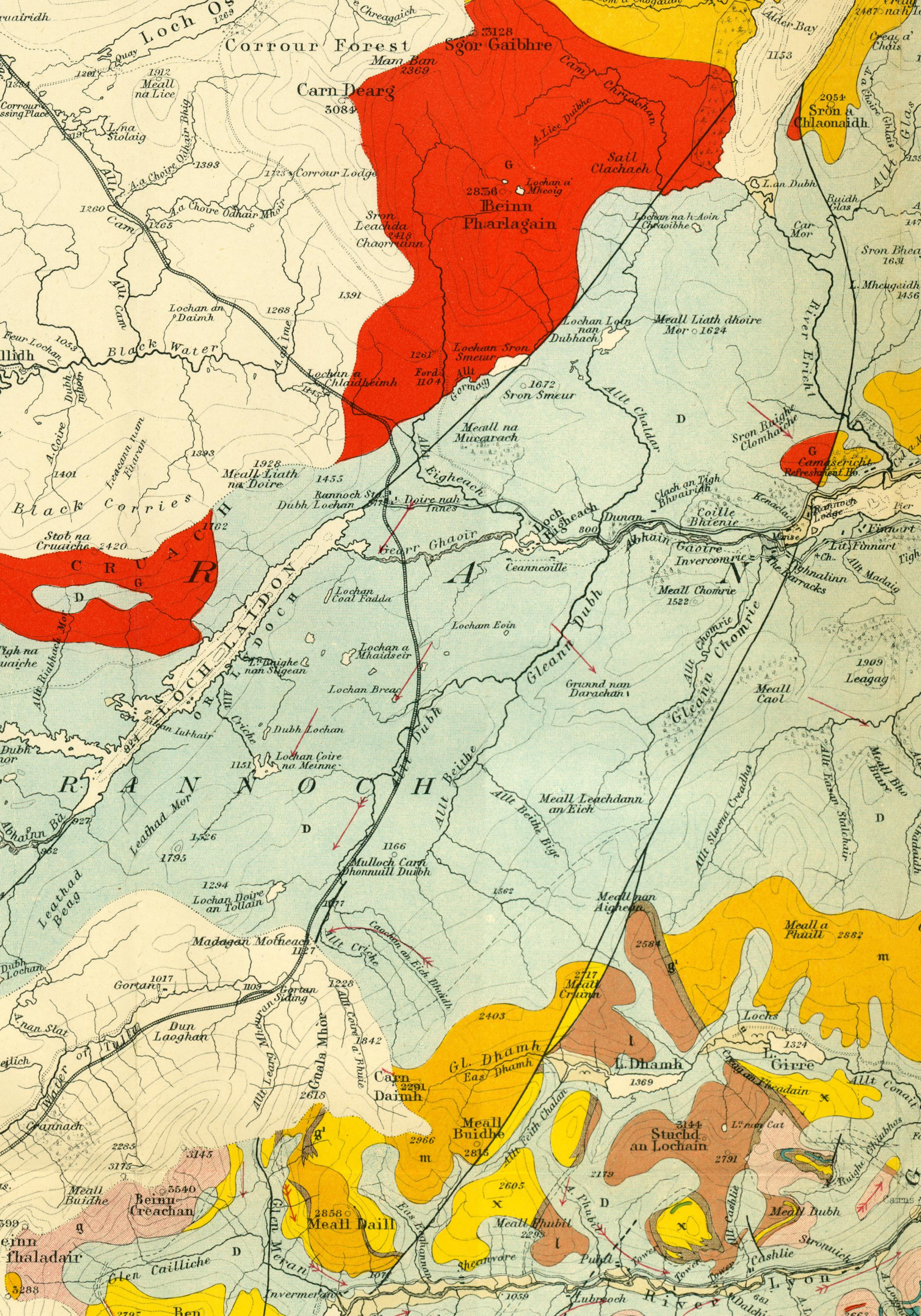
AR, F.R.S.E.



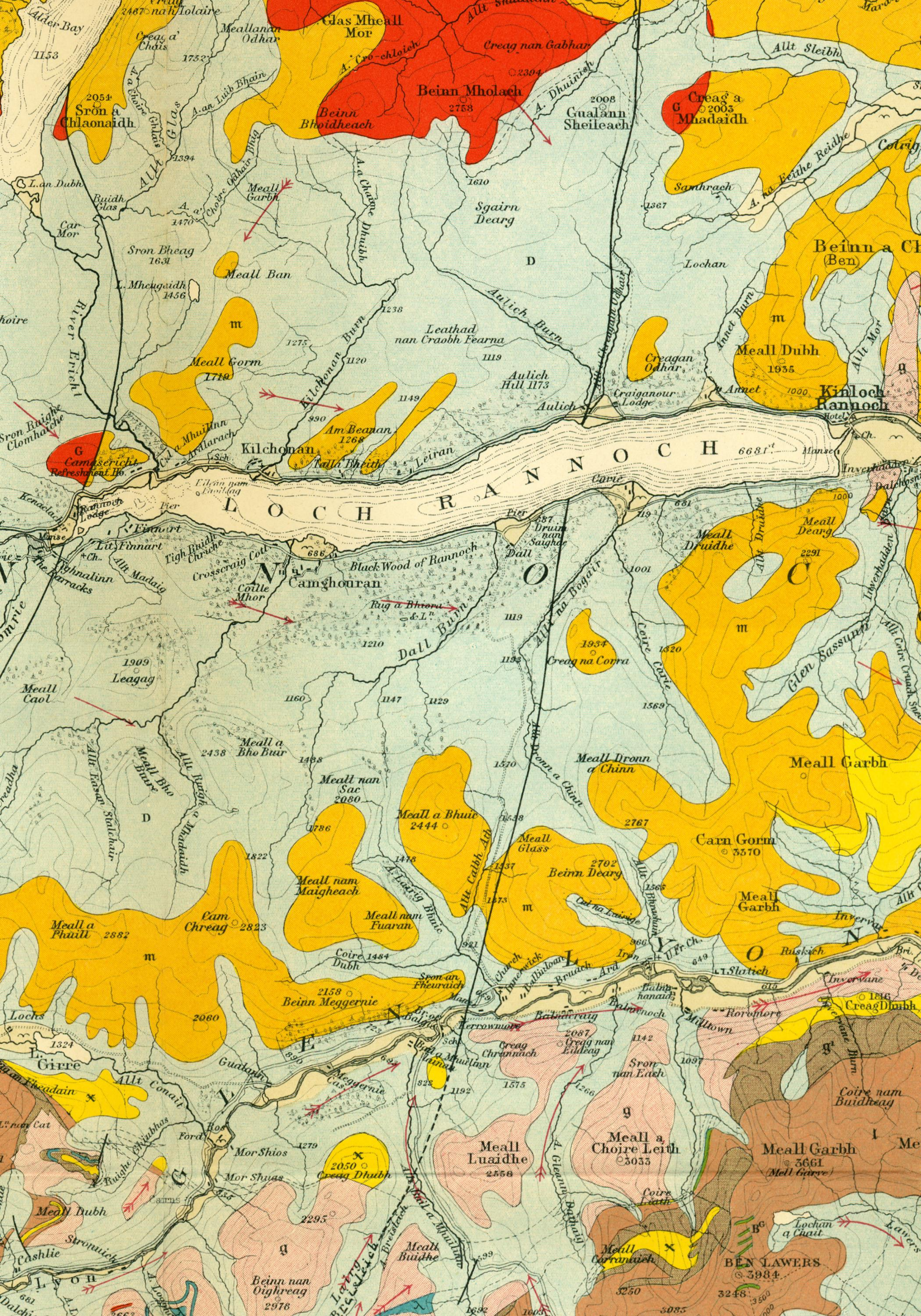

Leathad an Taobhain
2994
River Feshie
Meall Tionail
2947
Carn an Fhidhleir (Cairn Eelar)
3276
AN SGARSOCH
3300
Meall Odhar
Beinn Bhreac
An Sligearnach
Tarf Water
Sron Gharbh
Leachdann Feith Seasgachain
Sron na Macrainich
Allt à Chuil
L. Mhaire
Sron Dubh
Tarf
Beinn Gharbh
Elrigic an Toisich
Braigh Sron Ghorm
2882
Craig nah Iolair Moir
BEINN DEARG
3304
Feith an Lochain
Carn Chlamhain
Stron am Faichachan
Bruar Lodge
Braigh nan Cragan Breac
3000
Allt na Moraig
Beinn a Chait
2942
Gleann Diridh
Gleann Mhairc
Forest Lodge
Drum Dubh
Sron a Chro
Leac Liath
1788
Clachghlas
Falls
Meall Dubh
River Tilt
Marble Lo.
Druim a Chata
Stuic na Cuigealach
Cuilltemhuc
Carn Dearg Beag
Meall Reamhar
Craig Choinnich Lodge
3193
Carn Liath
Ruieclachrie
Gleann Crom Buidhe
Craig Bhagailteach
Meall Dail-min
1743
Kirkton of Lude
Croftmore
Meall Gruidh
Meall nan Loth
Glen Banvie
Blairuachdar
Monzie
L. Moraig
Craig Loisgte
Fair Bhuidhe
1510
Fenderbridge
Old Blair
Glen Girnaig
Pitagowan
Balnacroft
Blair Castle
Old Bridge of Tilt
Margdow
Calvine
Manse
Woodend
Lude Ho.
Lyoncoulich
Blair Atholl
Struan
Tomaine
Milton of Invervack
Station
Strathgroy
Coppagach
Kindrochit
Tulach Hill
1541
Glackmore
Garry
Aldclune
ATHOLL



Luibruairidh
Staoineag
Coire nan Lochan
Sgor na h-Eilde
L. Eilde Beag
Locheilt Lo.
Loch Eilde Mor
Glas Bheinn
2587
Beinn nan Clach
2104
L. na Staoineag
L. Chiarain
Tom Ailein
Beinn Bhreac
2863
2971
Leim Uilleim
Corrour Passing Place
L. na Siolaig
Meall na Lice
1912
Leac nan Garn
Meall Dubh
1869
Loch a Bhaillidh
Feur Lochan
Black Water
Dubh Lochan
Lochan Inbhir
Ciaran Ho.
Lochan na Salach Uidhre
Meall Bad a' Bheithe
1389
Meall nan Cradh-leathad
1452
Lochan nam Breac Reamhar
Garbh Lochan
Lochan na Craoibhe
Gearr Leacann
Black Corries
Meall nan Ruadhag
2120
G
Meall Bhalach
2291
Stob na Cruaiche
2420
1592
CRUA
D
Lt. Meall a' Phuill
Beinn a' Chrulaiste
2805
Stob Beinn a' Chrulaiste
2086
Shooting Lo.
Allt Dubh-mhor
Tigh na Cruaiche
1138
Lagangarbh
Queenshouse
Kingshouse Inn
Stob Dearg
3345
Lochan Mathair Etive
Dubh Lochan
Lochan Gaineamhaich
Allt Lochain Ghaineamhaich
Tom Dubh-mor
MOOR OF RAN
Tigh Crainn-duibhe
Sron Greise
2952
Lochan Beinn Caorach
Beinn Chaorach
Eilean Molach
Loch Bà
Abhainn Bà
Leathad Beag
3506
CLACH LEATHAD (Clachlet)
3602
Creagan Fhirich
2412
Lochan na Stainge
Lochan na H-Achlaise
Dubh Lochan
Black Mount
Glas Bheinn
1639
Coireach Ba
D
Lochan Mhic Pheadair Ruaidh
1559
Meall Beag
Sron nan Giubhas
Beinn Toaig
2712
3565
STOB GHABHAR
3159
2839
Allt Coire Seilich
Water of Tulla
An Torr
Achallader & Cas.
Meall Buidhe
Beinn Creachan
Beinn Achadh-fhaladair
3399
3283
Glen Caill
Forest Lodge
Loch Tulla
Eilean Stalcaire
Clais-gobhair
Linne nam Beathach
Victoria Br.



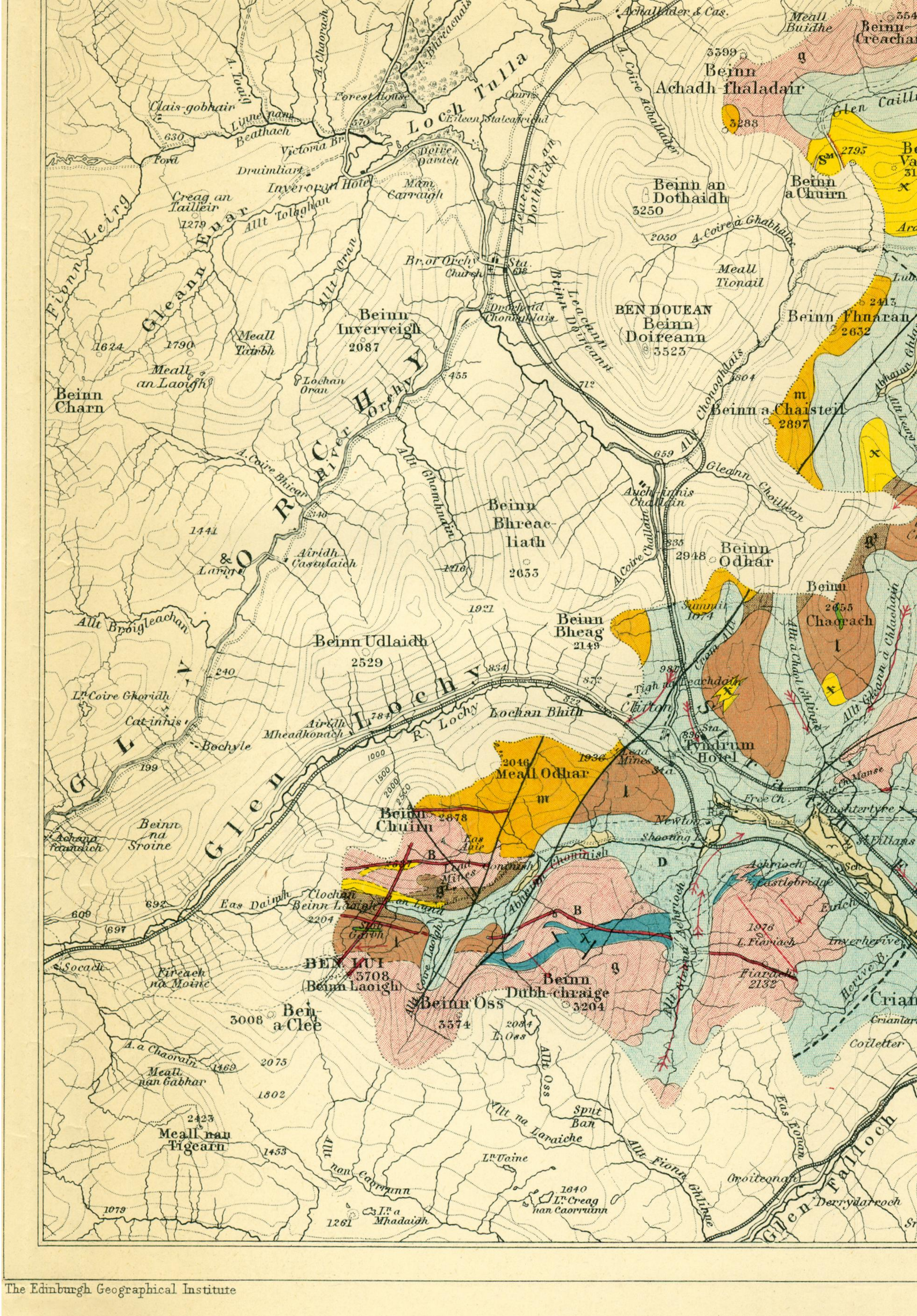
Loch Ossian
Corrour Forest
Sgor Gaibhre
3128
Mam Ban
2369
Carn Dearg
3084
Corrour Lodge
Beinn Pharlagain
2836
Lochan a' Mheoig
Sail Clachach
Sron Leachda Chaorruinn
Lochan na h-Aoin Chraoibhe
Lochan Loin nan Dubhach
Meall Liath dhoire Mor
1624
Lochan Sron Smeur
Sron Smeur
1672
Lochan an Daimh
Black Water
Lochan a Chlaidheimh
Allt Chaldar
River Ericht
Meall na Mucarach
Meall Liath na Doire
1928
Rannoch Sta.
Dubh Lochan
Doire nah Innes
Allt Eigheach
Loch Eigheach
Dunan
Clach an Tigh Bhvairidh
Coille Bhienie
Camaserichl
Refreshment Ho.
Rannoch Lodge
Black Corries
Stob na Cruaiche
2420
CRUACH
Gearr Ghaoir
Ceanncoille
Abhain Gaoire
Invercomrie
The Barracks
Meall Chomrie
1522
Lochan Coal Fadda
Lochan Eoin
Lochan a Mhaidseir
Lochan Breac
Gleann Dubh
Grunnd nan Darachan
Gleann Chomrie
Allt Chomrie
Leagag
1909
Meall Caol
LOCH LAIDON
Dubh Lochan
Lochan Coire na Meinne
RANNOCH
Allt Beithe
Meall Leachdann an Eich
Allt Slaena Creadha
Mulloch Carn Dhonnuill Duibh
1166
Leathad Mor
Leathad Beag
Lochan Doire an Tollain
Madagan Motheach
Gortan
Gortan Siding
Meall nan Aighean
2584
Meall a Phuill
2882
Meall Cruinn
2717
L. Dhamh
Gl. Dhamh
Eas Dhamh
L. Girre
Carn Daimh
2291
Dun Laoghan
Gualla Mhor
Meall Buidhe
2966
Stuchd an Lochain
3144
Meall Dubh
Beinn Creachan
3540
Meall Daill
2858
Glen Meran
Glen Cailliche
Invermeran
Meall Phubil
Pubil
Cashlie
Stronuich
River Lyon



LOCH RANNOCH
Kinloch Rannoch
Glas Mheall Mor
Beinn Mholach
Beinn Bhoidheach
Creag nan Gabhar
Gualann Sheileach
Creag a Mhadaidh
Sgairn Dearg
Beinn a Chr
Sron a Chlaonaidh
Meall Garbh
Sron Bheag
L. Mhcugaidh
Meall Ban
Meall Gorm
River Ericht
Leathad nan Craobh Fearna
Aulich Burn
Aulich Hill
Creagan Odhar
Craiganour Lodge
Meall Dubh
Am Beanan
Kilchonan
Camasericht
Rannoch Lodge
Finnart
Camghouran
Black Wood of Rannoch
Dall Burn
Coille Mhor
Leagag
Meall Caol
Meall Druidhe
Meall Dearg
Creag na Corra
Glen Sassunn
Meall Dronn a Chinn
Meall a Bhuie
Meall nan Sac
Meall a Bho Buir
Meall Bho Buirr
Meall nam Maigheach
Meall nam Fuaran
Meall Glass
Beinn Deary
Carn Gorm
Meall a Phuill
Cam Chreag
Beinn Meggernie
Meall Garbh
Ruskich
Innerwick
Bridge of Balgie
Kerrowmore
Creag Chrannach
Creag nan Eildeag
Sron nan Each
Meall a Choire Leith
Meall Luaidhe
Meall Garbh
Meall Corranaich
BEN LAWERS
Creag Dhubh
Meall Dubh
Meall Buidhe
Beinn nan Oighreag
Lochan a Chait
Cashlie
Mor Shios
Mor Shuas
L. Girre
G L E N   L Y O N

Sron Choin
1852
Allt Sleibh
Meall Dail-chealach
Elrig na Curigin
An Teampan
1387
Struan
Calvine
Kindrochit
Glen Erochy
Erochy Water
Dalsheallach
Auchleeks Ho.
Blairfetty
Kinaldy
Trinafour
Druim Cruaidh
Torr Dubh
1667
Cragan Liath Mor
Meall Reamhar
Lochan na Curr
Dubh Chnocan
1383
Meall Ban
Meall na Moine
L. na Caillich
Beinn a Chuallaich
(Ben)
2925
Colrig
Over Bohespie
Teighmore
Up. Gaskin
E. Bohespie
Craig nan Garsean
Tom na Moine
Lochan Dubh
Auchtarsin
Dalno
Grennich
Blairbute
Portnellan
Meall Dubh
1935
Kinloch Rannoch
Maragdubh
Balliemore
Druim glas
River Tummel
Tummel Br.
Hotel
Free Ch.
Dalcroy
Bohally
Drumchastle
Crossmount
Tullochcrosk
Coille Kynachan
Craig Kynachan
1358
Foss
Dalnacaul
Cragan Dubh
1451
Inverhadden
Dalchosnie
Tempar
Lassintullich
Meall Dubh
Lochan Beoil Chathadhaich
Allt Strath Fronan
Allt Kynachan
Dalbist
Drumnakyle
Meall Dearg
2291
Creag Mor
Tigh An't-socaich
Pitterrin
Drumbhae
Doire Leathan
Loch Kinardochy
1262
Meall Tarruin chon
2559
SCHIEHALLION
3547
Aonach Ban
Geal Charn
2593
Glen Sassunn
Creag an Earra
Dun Coillich
1866
White Br.
Craig Cheanan
Meallanan Odhar
Allt Mor
Gleann Mor
Glengoulandie
Sliabh Fada
Craig Odhar
1710
Meall Garbh
3419
Carn Mairg
Allt Coire a Pheilinn
Garth
Meall Crumach
2217
Camserney Burn
Gleann Muilinn
Creag Mhor
Allt Odhar
Beinn Dearg
Keltney Burn
Strath of Appin
Dull
Coshieville Inn
Nthr Blarish
Comrie
Carse
Dalrawer
Carnbanemore
Balintyre
Chesthill
Blackcroft
Drumcharry
Garth Ho.
Achloa
Invervar
Inverinane
Craig Dhubh
1816
River Lyon
Cuildaremore
Fortingal
Hotel
Roman Camp
Kinnaillin
Newhall
Taymouth Castle
Taymouth Park
Drummond Hill
Dunlaves
Tynayere
Kenmore
Hotel
Easter Achtar
Wester
Lochan Creag Madaidh
Allt Da ghob
Gleann Da Ghob
Coire nam Buidhsaig
Caldaurbeg
Boreland
Cromrar
Clach an Tuirc
Fearnan
Acharn Pt.
Acharn
Falls
Croftmoraig
Creag an Fhudair
1853
Meall Garbh
3661
(Mell Garve)
Meall Gruaidh
3280
Balnearn
Tomintyvoir
Achianich
Callelochan
Up. Acharn
Tom na Moine
Allt Mhucaidh
Meall a Choire Chreagaich
2177
Lochan a Chait
Lawers Burn
Ballinlaig
Creag Dhubh
Shenlarich
Ardradnaig
Tom a Moine Sinas
Kepranich
Skiag F.
Ben Lawers
3984
Tay

Blair Castle
Blair Atholl
Old Bridge of Tilt
Struan
Kindrochit
Tulach Hill
1541
Glackmore
River Garry
Shierglass
Strathgarry
Lude Ho.
Margdow
Lycoulich
Aldclune
Site of Battle 1689
Urrard Ho.
Alldgirnaig
Pass of Killiecrankie
Ben Uan
Killiecrankie Sta.
Soldiers Leap
Tenandry Church
Craigour
1300
Baledmund
Drumchorrie
Moulin
Pitlochry
Tulloch
Fincastle
Ardtulichan
Clochkan
Dundavie
Balnald
Milton Lo.
Carrick
Edintian
Lochan na Leathain
L. Bhaic
Dubh Chnocan
1383
Achinree
Tomintianda
Balnabodach
Grennich
Portnellan
Croftdouglas
Knockgarry
Borenich
Queen's View
Allean Ho.
Balintarg
Loch Tummel
River Tummel
Coille Mhor
Cammoch Hill
1590
Falls of Tummel
Meall Fead
Clunie
Chapelton
Spardon
Drumchabar
Middleton
Duntanlich
Frenich
Foss Ho.
Donafoul
Foss
Drumnakyle
Cragan Dubh
1451
Frenich Burn
Beinn Eagach (Ben)
2259
Lochan a Chait
Lochan Sgarabh Gobhair
Doire Leathan
Farragon Hill
2559
Meall Tarruin chon
2559
Craig Cheanan
Creag Dhubh
Balmore
Overton
Portnacraig
Ballinluig
Carra Beag
Lochan na Moine Mhor
Dunfallandy Hill
Loch Derculich
L. na Ba
Tullypowrie Burn
Brae of Tullypowrie
Brae of Pitcastle
Pitcastle
Middleton
Derculich Burn
Toberandonich
Clochfoldich
Lurgan
Derculich
Blackhill
Loch Glassie
Brae of Cluny
Findynate
Tullypowrie
Balnacree
Ballechin
Haugh of Grandtully
Grandtully Sta.
Balnabeggan
Westbrae of Grandtully
Balnaguard
Castle Dow
Balinluig
Balnacraft
Laidneaskea
Coshieville
Grandtully Cas.
Pitcairn
Craggan
L. of Grandtully
Balnaguard B.
Sliabh Fada
The Bonnets
1558
Cluny Ho.
Tombuie
Balnacraig
Glassie
Killichassie
Weem Hill
Camserney Burn
Balmore
Lurgan
Camserney
Dull
Rock of Weem
Weem Hotel
277
Aberfeldy
River Tay
APPIN OF
Tomtayewen
Duntaskin
Tomchulduine
Croftcrear
Burnside
Grandtully Hill
1717
L. Scoly
Duntaggart
Strone Ghamhain
1208
Moness
Errichel
Duntuim
Dunacree
Carse
Dalrawer
Ford
Bolfracks
Crofthouse
Falls of Moness
Tomnagro
Gatehouse
Urlar
Urlar Burn
Bolfracks Hill
Tullichuill
Newhall
Taymouth Castle
Craig Hill
1845
Craig Formal
1676
Loch na Craige
1406
1658
Lodge
L. Kennard
Meall Reamhar
1659
Monadh nam Mial
1975
Meall Mor
1626
L. Creagh
Glen Cochill
L. Hoil
Meall Dearg
2258
L. Fender
Meall Dubh
2021
Meall Dun Dhomhnuill
2061
Meall a Choire Chreagaich
2177
Tombane Burn
St. Louis
Beinn Liath
Pitmackie
Tirchardie
Shian



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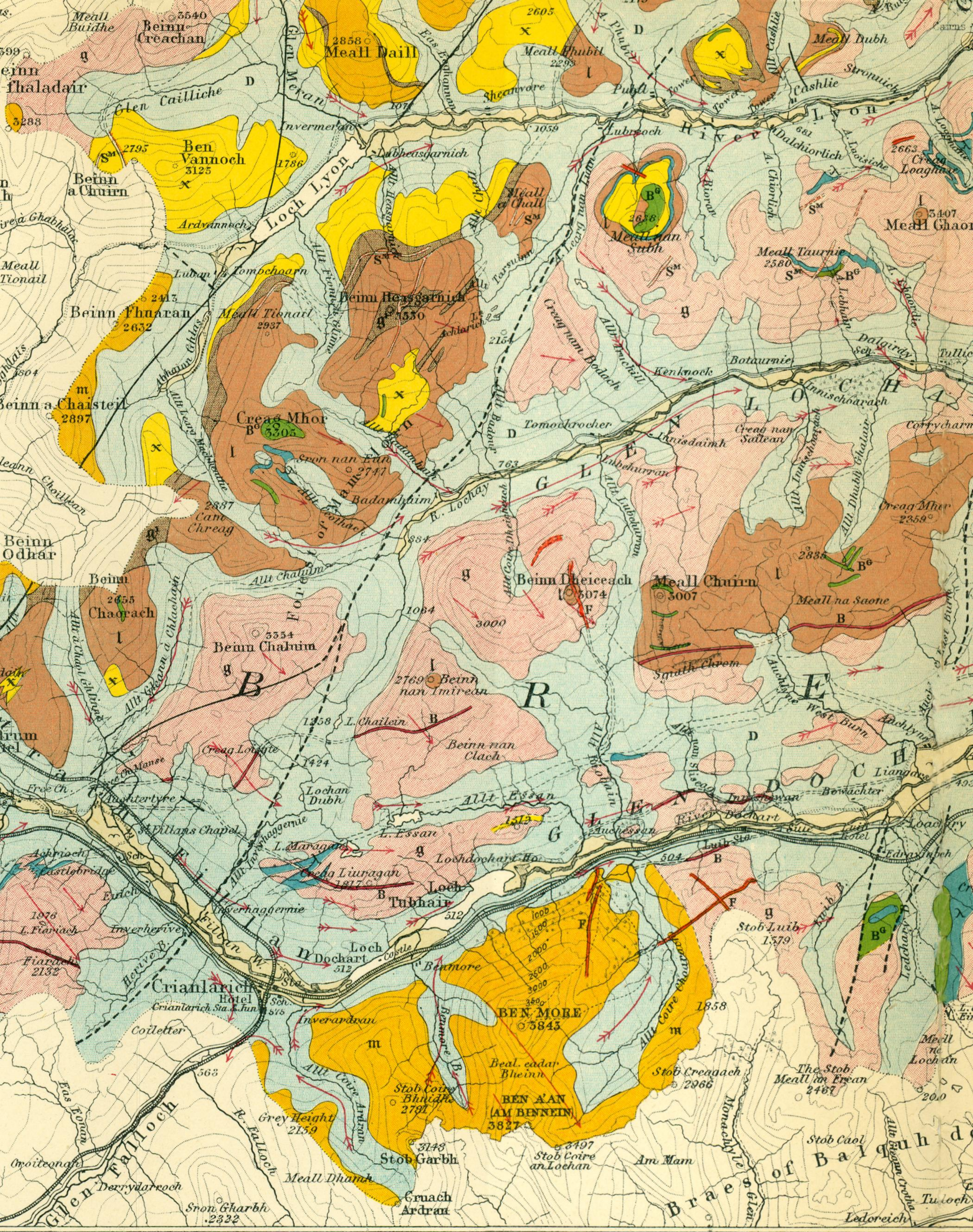
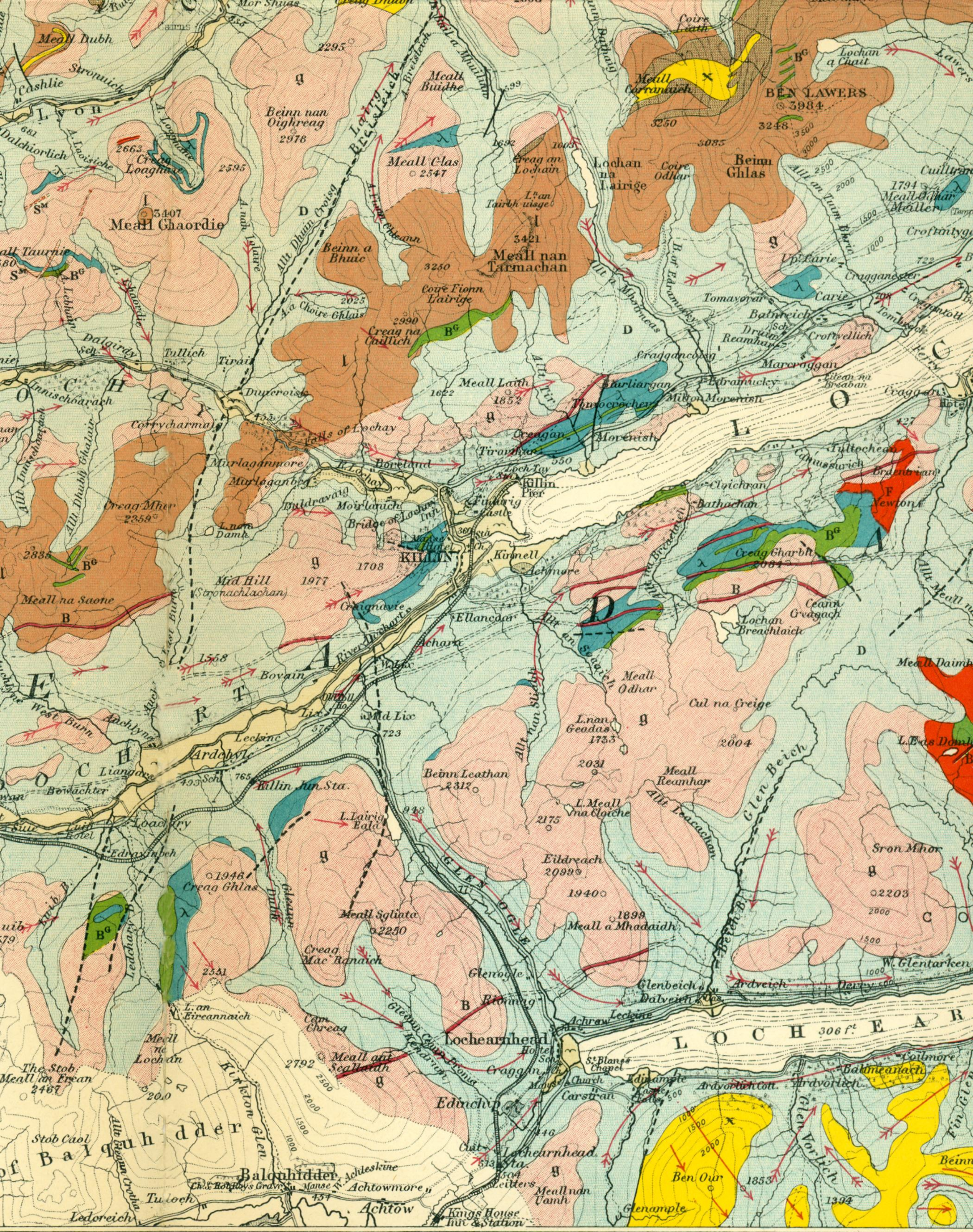


Meall Buidhe
Beinn Creachan
3540
Glen Meran
2858
Meall Daill
Eas Eoghannan
2605
Meall Phubuil
2293
Shenavore
A. Phubuil
Pubil
Meall Dubh
Cashlie
Stronuich
River Lyon
Glen Cailliche
Invermeran
Dubheasgarnich
1059
Lubreoch
Dalchiorlich
Ben Vannoch
3125
2795
1786
Beinn a Chuirn
Loch Lyon
Ardvannoch
Meall Chall
Meall nan Subh
2686
2663
Creag Loaghan
3407
Meall Ghaor
Meall Tionail
Lubar
Tomochoarn
Meall Taurnie
2580
Beinn Fhuaran
2413
2632
Meall Tionail
2937
Beinn Heasgarnich
3530
Achlarich
2154
Creag nan Bodach
Allt Inchill
Kenknock
Botaurnie
Dalgirdy
Beinn a Chaisteil
2897
Creag Mhor
3305
Sron nan Eun
2747
Tomochrocher
Innischoarach
Creag nan Saltean
Corrycharm
Glen Lochay
Badamhuim
R. Lochay
763
Lubchurran
Cam Chreag
2887
Beinn Odhar
Creag Mhor
2359
Beinn Chaorach
2655
Allt Chaluim
884
Beinn Dheiceach
3074
Meall Chuirn
3007
2833
Meall na Saone
Beinn Chaluim
3354
1064
3000
Sgiath Chrom
2769
Beinn nan Imirean
Breadalbane
1358
L. Chailein
Beinn nan Clach
West Burn
Auchlyne
Creag Loisgte
1424
Lochan Dubh
Allt Essan
Liangan
Bowachter
Auchtertyre
St Fillans Chapel
Glen Dochart
River Dochart
Luib Hotel
L. Essan
L. Maragan
Creag Liuragan
1817
Lochdochart Ho.
Loch Tubhair
Auchessan
504
Edramucky
Ledcharrie
Castlebridge
L. Fiarach
Fiarach
2132
Inverhaggernie
Inverherive
Herive B.
Crianlarich
Crianlarich Hotel
Crianlarich Sta. & Jun.
Loch Dochart
Castle
512
Benmore
Ben More
3843
Stob Luib
1379
Coilleter
Inverardran
Allt Coire Ardrain
1858
Stob Creagach
2966
The Stob
Meall an Fhiodhain
2467
Grey Height
2159
Stob Coire Bhuidhe
2791
Beal. eadar Bheinn
Ben A'an (Am Binnein)
3827
Stob Garbh
3148
3497
Stob Coire an Lochan
Am Mam
Stob Caol
Glen Falloch
Eas Eoghan
R. Falloch
Derrydarroch
Meall Dhamh
Cruach Ardran
Sron Gharbh
2322
Braes of Balquhidder
Monachyle Glen
Ledoreich
Tulloch



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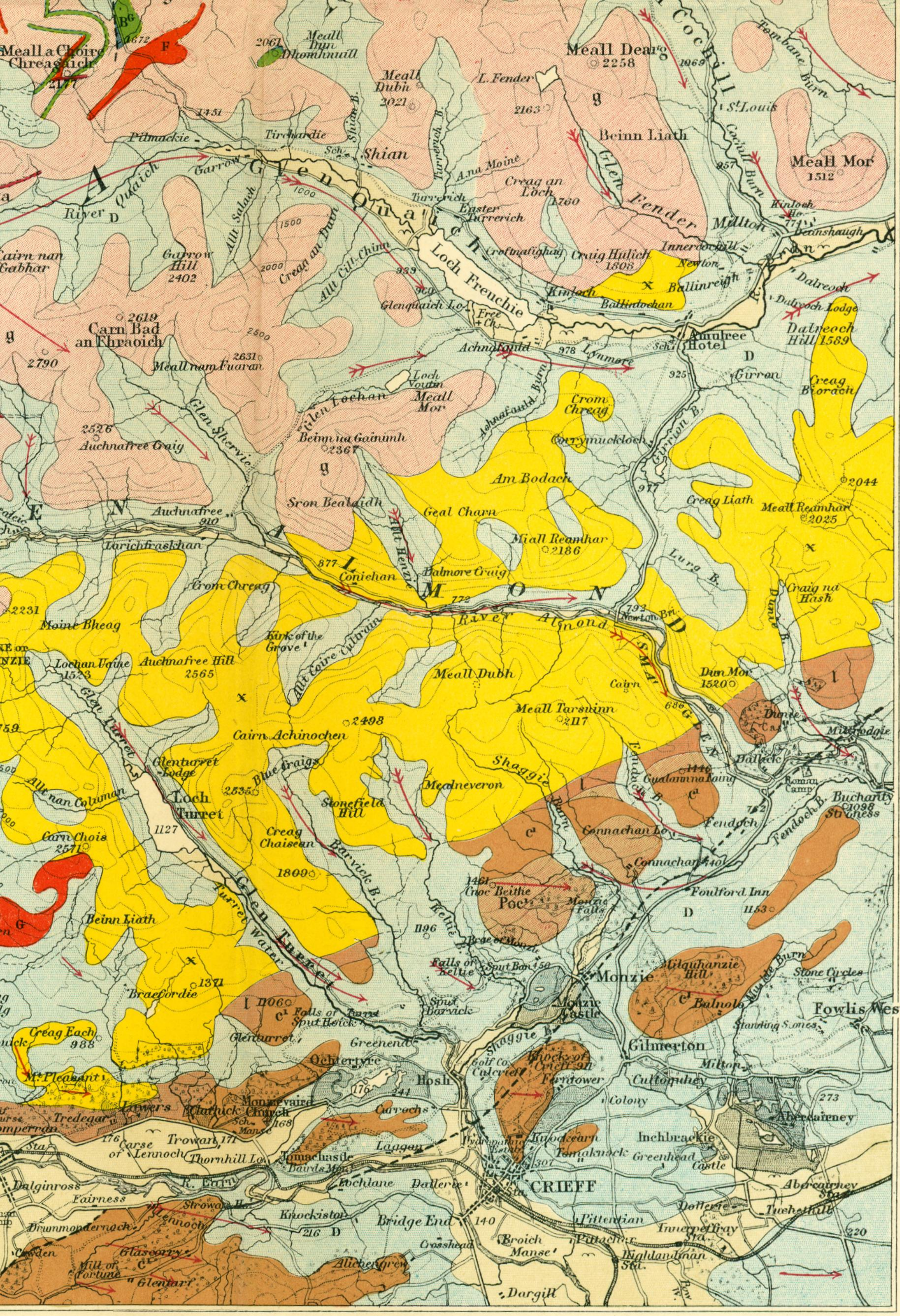
BEN LAWERS
3984
Lochan a Chait
Lawers Burn
Ballinlaig
Cheng Dhubh
Shenlarich
Dhallin
Lawers Hotel (Temperance)
Milton
Croftintygan
Balnasuim
Up. Carie
Carie
Craggan
Tullich
Tomnadashan
Ardeonaig
Finglen
Ardtalanaig
Beinn Bhreac
2341
Skiag
Claggan
Leadour
Gleann a Chilleine
Meall Gleann a Chloidh
2238
Tullichglass
Creagan na Beinne
2909
Creag an Sgliata
2288
Meall a Choire Chreagaich
2177
River Quaich
Cairn nan Gabhar
Garrow Hill
2402
Carn Bad an Fhraoich
2619
2838
2790
2656
Dunan Hill
Lechrea Hill
2470
Auchnafree Craig
2526
Dunan
R. Almond
Meall na Creige
2683
2685
Creag Uigeach
2640
Creag nan Eun
2790
Meall Daimh
Ruadh Bheul
2237
Allt an Drucha
Glen Lednock
BEN Y HONE or BEN CHONZIE
3048
Moine Bheag
Lochan Uaine
Auchnafree
2759
Creag Tharsuinn
Bovaine
Allt Mathaig
Glenmaik
Carn Chois
2571
Beinn Liath
Meall nam Fiadh
2000
L. Boltachan
Glen Boltachan
Glen Tarken
Sron Mhor
2203
COMRIE
E. Glentarken
W. Glentarken
St Fillans
Little Port Hill
Dundurn
Balnacoul Castle
Funtullich
Kingarth
Balmuick
Creag Each
988
Mt Pleasant
Tomperran
Tredegar
COMRIE
Dalginross
Fairness
Drummondernoch
Glascorry
Trowan
Ross
Ross Wood
Aberuchill Castle
Tomanour
Ben Halton
Cultybraggan
Dalchonzie Ho.
Mor Bheinn
Birran or Dundurn
2011
Beinn Fuath
Beinn Bhan
2225
Gleann Gonan
Glen Vorlich
Ardvorlich
Coilmore
Finglen
LOCH TAY
LOCH EARN
306 ft.



J. G. Bartholomew

THE LAND OF MAGELLANES, WITH SOME ACCOUNT OF THE ONA AND OTHER INDIANS.*

By W. S. BARCLAY.

It is proposed to give a brief sketch of the territory of Magellanes, comprising the uttermost extremity of the South American continent, and to treat of the tribes who dwell therein—the Yaghans, the Alacalufs, and more especially the Ona Indians of the island of Tierra del Fuego.

There are few regions whose physical features and climate present more startling contrasts. The settlements of Sandy Point and Ushuaia lie in almost the same latitudes south as do London and Edinburgh in the north, yet the steamers which pass constantly along the Beagle channel and the Magellan straits, bearing the varied freight of modern commerce, pass here by great glaciers which have pushed their way to the water's very edge, in whose shadow dwell primitive races still practising the arts of the Stone Age.

Politically, the name Tierra del Fuego applies only to the largest island of the Magellan archipelago. The anxiety of Argentina to share with Chili the command of these southern passages led her to retain as Argentine territory all the land east of a line dropped from Cape Virgers along the 68° 36′ parallel of longitude to the shores of the Beagle channel. Thus she has about one-third of Tierra del Fuego, or "Terra Del," as the Anglo-Saxon brevity of the sheep-farmers has rechristened the big island, and also Staten island. Her use of this latter as a military penal settlement has been one of the many factors which have combined to overwhelm the Fuegan aborigines. Chilian Magellanes also includes a large portion of the Patagonian mainland. This paper takes for its scope, however, only that portion of Magellanes which lies south of the straits bearing the name of the great navigator.

The land of Magellanes divides itself naturally into three portions, each of which claims a tribe. These we may roughly class as (1) The Yaghans of the Horn and Beagle channel; (2) the Alacalufs of the Magellan straits; (3) the Onas of Tierra del Fuego. Let us study them in this order.

The first portion, comprising the extreme south and south-west lands of the archipelago, presents the aspect of a submerged mountain chain, whose summits now are alone visible. The islands thus formed are exposed to the full force of continual southerly gales. Their steep sides, naked save for the moss that clings to some meagre crevice, are streaked 500 feet high with the white sea-drift. On their lee side, and in less exposed situations leading to the inner channels, they are covered with a dense growth of stunted beech woods. In a latitude of only

* Map, p. 152.

55° to 56° S., the line of perpetual snow comes as low as 1500 feet above sea-level. During a short week the summer climate will present all the variations which, in the same latitude north, might reasonably be looked for throughout a twelvemonth. Hurricane gusts alternate with breathless calms, showers of rain and sleet with a hothouse sun.

This is the land of the Yaghans, the men who mark the limit of human life in the south, whose hunting-grounds are disputed only by the sleek seals and screaming gulls that play around the Horn.

Our knowledge of this tribe is remarkably complete, since the South American Mission Society has maintained a station amongst them for over thirty years. This station was formerly fixed at Ushuaia, but the reduced numbers of the tribe and the settlement of the Argentine Government at this spot rendered it advisable to remove to Tekinike, on Hoste island, some 60 miles back of the False Horn, where it is actually established. The Rev. Thos. Bridges, late missionary at Ushuaia, compiled a dictionary of the Yaghan language, which, according to his statement, possesses thirty thousand words. It must be presumed, however, that many of these are compound, for the language is essentially an agglutinative one. As an example, we find the use of verbs in three separate numbers, each a distinct word conjugated apart from its fellows. This flexibility of language is marked in a tribe whose intellect in other directions is so limited, for they do not know how to count above the fingers of one hand. There is, moreover, a marked divergence between the speech of the Wollaston or Cape Horn natives and those who frequent the shores of the Beagle channel. The variety of land and climate in Magellanes extends to the speech of its inhabitants, for there is, again, a difference between the speech of the Onas living in the northern and southern portions of "Terra Del," so great as to make them almost unintelligible to one another.

Darwin confounds the Yaghans with the Onas, which latter he only saw once, on that occasion when the *Beagle* anchored in Good Success bay. He also asserted, on the statement of a captured Yaghan, "Jimmy Button," that the tribe were cannibals, and although this statement has since been repeatedly disproved, it has none the less gained popular credence. With all the three tribes, but especially with the Onas, the injury of any member of a family implies a blood vendetta against the aggressors. It is difficult, therefore, to see how such a practice could ever have obtained without some marked modification of their social usage. The report may take its origin in the fact that strangulation is resorted to to remove the burden of malformed infants and the incurably sick.

Judging from the specimens who have attained maturity in the service of the English missions, the natural intelligence of the Yaghan

appears at least equal to that of other aboriginal South American tribes. Under the severe and above all the uncertain stress of his surroundings, however, his mental capacity appears to become stunted or atrophied. He must constantly shift camp, to seek his food-supply on a coast where the most that can be hoped is that the new camping-ground will not be worse than the old. In northern latitudes the Esquimaux can build himself a temporary home, and in the regular sequence of slow-changing seasons lay up provision for himself and his family. The Yaghan, who is born 1500 miles nearer the equator, lives, literally, from hand to mouth. He braves the seas of the Horn, naked, in a frail bark canoe. He owns no faith, religion, or tribal tie other than that of the family which huddles together for food and sustinence. His only household goods are the smouldering firebrands which he carries on a slab of shingled turf in his canoe to each fresh halting-place. The women (usually two) paddle the canoe from the stern. The man crouches in the bow, on the look-out for prey. On the shore run one or two dogs, to sniff out and turn any lurking otter or sea-bird. The long kelp that fringes the coast serves as a breakwater for the frail craft, whose crew only venture out into the open channels when their foresight tells them that a calm will be of sufficient duration to enable them to pass from one inhospitable beach to another. They are unduly developed in the torso at the expense of the lower limbs, for they pass their lives thus circling the coasts. Fishing without hooks, living on mussels and fungus, this tribe marks the limit to which man may strip himself of all aid or comfort and yet survive and perpetuate his kind. This warfare against the elements has not only stunted the mental growth of the Yaghans; it has drained their vitality, till the ravages of disease following on their contact with whites have been startling. Since the seal-fisheries opened up thirty years ago, followed by the gold rush of later years, their numbers dropped from 2500 till to-day they number a bare two hundred all told. The most fatal diseases are pulmonary, and if the present rate of mortality continues, in another five years only a very few members of the tribe can survive. This remnant have the name of making excellent and fearless sailors, but both men and women have a passion for drink, are incurable liars, and lazy.

The Yaghans tell a story—which is current among the Alacalufs also—of a giant of stone, who was wont formerly to rush out from a recess in the channels, capsizing the canoes, and killing the men, but fetching the women alive to his wigwam. This monster was finally killed by a heroic youth of the tribe, but not the dread of him, which survives to the present day. The story is probably an embodiment of the many accidents to which these canoe-folk are liable from dangerous winds which, wandering among the splintered hilltops, come down the ravines and glaciers in fierce gusts which not even an Indian's instinct

can foresee. This is confirmed by mention of the drowning of the men, who, although canoe-dwellers, cannot swim, while the women all boast an accomplishment which is to a measure forced upon them. It is part of their duty to moor the canoe, and on a weather shore this must be done by tying it to the kelp some distance out, after which they return as best may be to the camp-fire on shore.

The second portion of Magellanes lies along the network of fjords which open out to both sides of the western Straits. This country is protected by the outermost breakwater, or breakweather, and is therefore of a less inhospitable nature than the Yaghan territory. Never-

TYPICAL ONAS.

theless the landscape is wild, gloomy, and incredibly intricate. Long peninsulas hang to their title by the merest shred of land; channels wind unexpectedly away through refts in the living rock. Such a one was discovered in 1901 leading from the Cockburn channel to Desolate bay, and though only practicable for small craft, a previous knowledge of it would have spared many a disaster to schooners seeking the Beagle channel by the dangerous Brecknock Pass. Along the shores of the creeks are strips of open ground, with abundant fish and bird life, and inexhaustible stores of shellfish. Further inland the country is uninhabitable. The hillsides are clothed with dripping beech woods,* which

* *Fagus antarcticus* and *Fagus betuloides*, in its greater part.

shelter few if any living creatures. On every hand in their gloomy depths lie wrecks of the short-lived forest, rotting trunks bedded knee-deep in spongy moss, fern-coated and solid to the eye, but shattering to pieces at a blow. Truly in these stagnant ravines death, not life, seems the predominant spirit. Higher up, on the knees of the cliffs, there may be some open ground; a tiny tarn, or a bog, whose waters, collected from a dozen brown streamlets, hurry along under the quaking peat. This is the country of the Alacalufs.

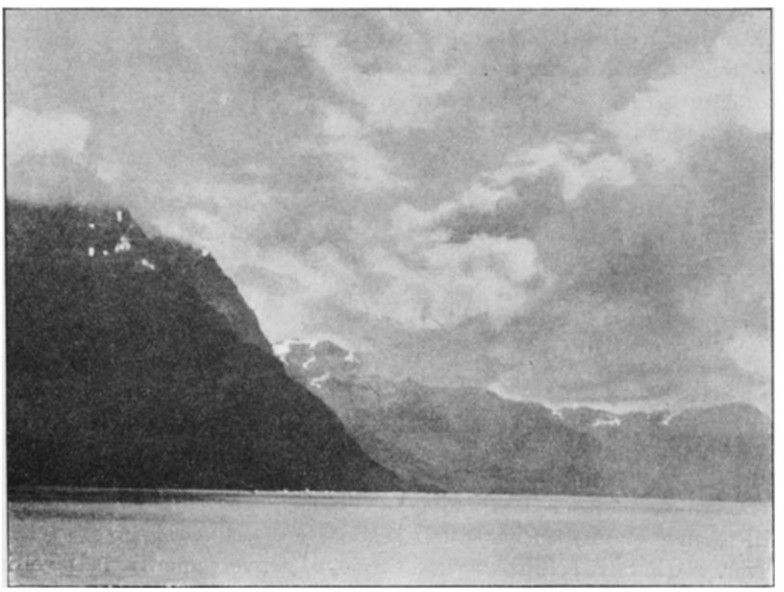
This tribe, who number to-day some 800, are the most numerous of the Fuegan aborigines. Little or nothing is known of their inner life. Mr. Thomas Bridges, who once spent a week with a friendly group, reported their speech as differing in structure from the Yaghan, though with much oral similarity. This likeness arises from the free use by both tribes of the nasal consonants and vowels, and in a Welsh pronunciation of the *ll*. Of the two, the Alacaluf is the harsher tongue. The character of this tribe is crafty, sullen, enduring, and treacherous. Their constant intercourse with ships passing through the Straits, while enabling them to acquire most of the white man's vices—notably that of drink—has in no way modified the suspicion and dislike with which they regard him. They have an evil reputation for attacking helpless, shipwrecked crews, yet they are the reverse of warlike; nor will they seek an encounter unless in overwhelming numbers, and when tempted by the prospect of plunder. Equally at home on land or water, their outfit includes the bow and arrow—unknown to the Yaghans—as well as the sling, spear, or harpoon, knife, and humbler implements of the chase. Their canoes of beech dug-outs are the largest of any on the South American coast, and will often hold twenty or thirty persons. The knot with which they weave their fishing-nets of seal-sinew is the same as that used by European fishermen.

The last portion of Magellanes, where the Onas once held undisputed sway, shows us a brighter and infinitely more varied country than either of those we have reviewed. With its snow-clad mountains, dense forest, and rugged coast on the one hand, on the other wind-swept tableland and open pampa facing a shelving shore, the island of Tierra del Fuego is an epitome of Southern America.

The northern portion of the island, facing the first and second narrows of the Straits, is a continuation of the Patagonian tablelands, which terminate in a transversal depression between Useless and San Sebastian bays. Boulder erratics, some of which weigh many tons, and numerous salt and brackish lakes, point to glacial action at this spot, and a comparatively recent immersion below sea-level. South again we get a true pampean formation—light alluvium resting on sandy marl—which nestles in the last crook of the Andes. Owing to the shelter thus afforded, the lowlands of Tierra del Fuego boast a better climate than the Patagonian coast for 500 miles north, the latter being

exposed to biting south-westerly winds which blow without ceasing and form the chief drawback to settlement in an otherwise desirable region. The grasses of the Fuegan pampas are nutritious on the higher slopes, and in the river-bottoms luxuriant. They have an additional advantage in abundant running streams, fed from the snowclad hills behind. An experienced Australian sheep-farmer once summed the region up to the writer as "the best natural sheep country in the world."

Back of the Pampas the land rises in broken hill-spurs, whose sides are the more densely forested as they approach the Martial mountains, a triple range that parallels the greater length of the Beagle Channel. Entering the channel from the east, we halt first at Har-



THE LAND OF THE HORN.

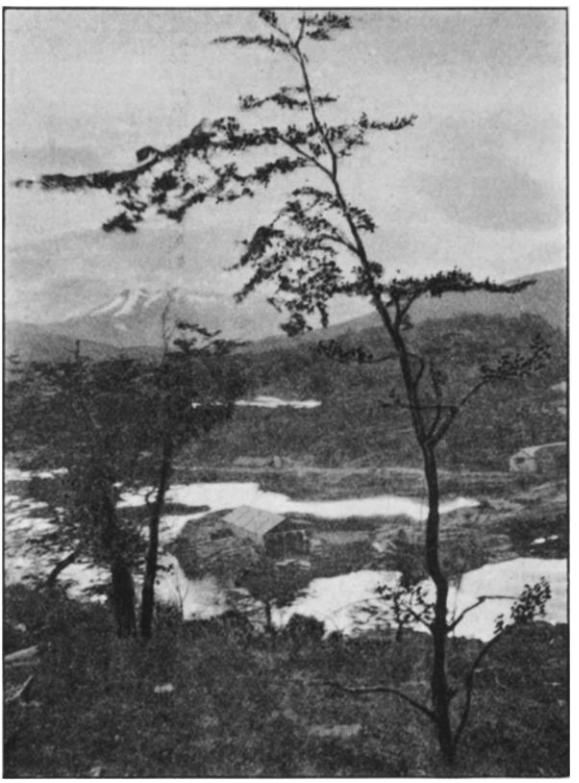
burton creek, where flourishes the stock farm of Messrs. Bridges, pioneers of such enterprise in the far south. Back of Harburton stands Mount Cornu, its 4300 feet marking the last notable peak of the great Andean range. Forty miles to westward the clear-cut pyramid of Mount Olivia signals Ushuaia—"the little bay within a bay"—if we translate from the soft Yaghan tongue. The triple peak of Mount French rising beyond Yandegaia inlet buttresses the eastern point of the Darwin range, at whose other extremity stands Mount Sarmiento (7330 feet), the highest peak in Magellanes. A counterfort of the Darwin range forms the Brecknock peninsula, where the snowfields vanish and bare ribs and knuckles of rock show more plainly as they push into the teeth of the south-west gales. The interior of this

peninsula, and indeed of all the land south-west of the cordon formed by Admiralty Sound and Lake Fagnano, is uninhabited. Only jagged summits of rock pierce the packed snow-fields, and on every hand great glaciers descend to the broken coast-line. Here, save along the course of some torrential stream, the dark beech forest grows on every possible slope. At sea-level its trunks attain a height of 80 feet, but as they near the snow-line the woods are dwarfed and twisted into the intricacy of a box-hedge, and further progress is only possible by walking, not through, but on top of the trees.

Lake Fagnano, so named after the pioneer bishop of the Silician monks, lies to the north of the Martial mountains. The lake, which is some 200 feet above sea-level, with a length of 54 miles and an average breadth of 3 miles, forms a catchment basin for mountain torrents, whose waters it distributes in a general north-easterly direction. After halting through various minor lakes and morasses, these emerge on the Atlantic shore under the names of the Rio Grande, Sauce, and Ewan. The Rio Azopardo, flowing west into the Admiralty sound, forms an exception to this rule. From the Beagle channel two deep valleys wind between the Martial ranges to within 20 miles of the lake. One starts from Lapataia inlet, and follows the course of the Rio Roca; the other, known as the Moat valley, debouches some 12 miles east of Harburton. Some idea of the difficult nature of this lake district may be given by the "road" opened by Messrs. Bridges from Harburton to Rio Grande, in order to establish overland connection between the Beagle channel and the Atlantic shore during the frequent intervals, when the Le Maire straits are impassable or at least dangerous to small craft. This road, the only one which connects the official capital of Ushuaia with the northern settlers in Tierra del Fuego, measures as the crow flies 72 miles, and for any one not Indian-born formerly took three weeks to cover. A hundred Indians were employed a twelvemonth in levelling its difficulties, yet even now it is impracticable save on foot, when a strong and active man may do the journey in six days. An inaugural trip was arranged last year for the Governor of Ushuaia, but after climbing two mountains, and looking from a third into a ravine where the path continued through part forest and part morass, that gentleman decided to declare the highway open on the good faith of its makers. It is this Lake Fagnano district, *i.e.* the western and central portion of the island, which shelters the remnant of the Ona tribe, numbering about 600 all told. Between the Indians who fringe on the pampa region and those who are confined to the more hilly country in the south there is a marked division, intensified by many a long-standing feud.

What is the origin of these Fuegan tribes? Do the Onas, true foot hunters, claim ancestry from the Patagonians of the Atlantic seaboard, marooned by some vagary of the coast-line on what is now an island, though formerly part of the mainland? Are the Yaghan and Alacalup

canoe-men offshoots of the Chronos Indians of Chili, creeping down to the Horn by the narrow channels of the archipelago? The surmise obtains partial confirmation from the wide divergence of speech between these two branches of the Fuegan tribes. That of the Yaghans is soft and liquid—a chatterbox tongue. The Ona, on the contrary, frames his thoughts in short words and laboured sentences, in a language of harsh clicks and gasping gutturals, "scarcely deserving," says Darwin, "according to our notions, to be called articulate." They make use of



LAPUTAIA WOODLAND STREAM.

an elusive, half-breathed final *n*, which in ordinary conversation is inaudible to all but Ona ears. The whole impression given to the hearer is that of a language in its raw beginnings. In their names for common objects, they attempt a direct phonetic interpretation, as in "glo-glollsh," the river duck, "kerr-prrh," the red-tailed parroquet, and many others. To stormy Cape Penas, on the north-east coast of the island, they have given a name which resembles nothing so much as the whistling of wind through a narrow crevice.

Whatever be the origin of the Ona tribe, it at least dates back to a

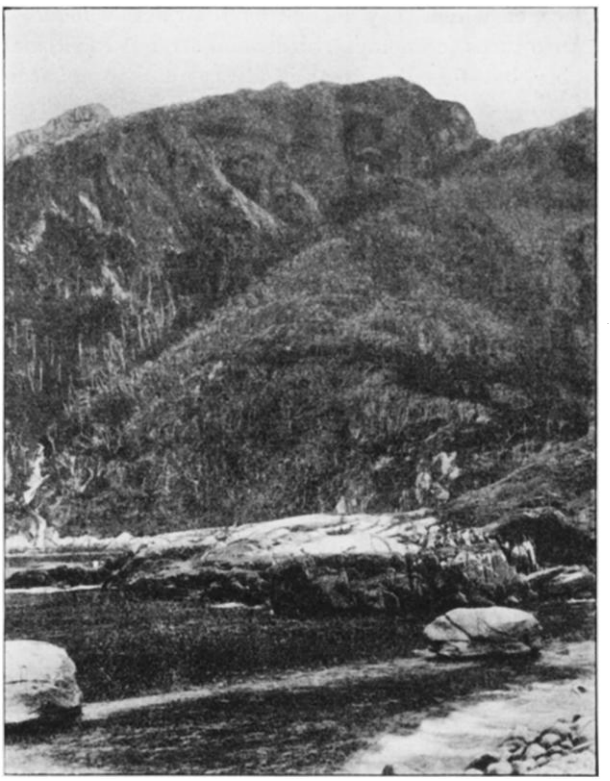
time sufficiently remote for their language to establish itself as a medium quite apart and distinct from their neighbours. Their anomalous position as an island tribe which does not venture upon water endows them with a special interest. They stood apart from the restless migration and fusion, which that common graveyard of the South American races, the valley of the Rio Negro, proves to have taken place among the tribes of the Patagonian mainland. Moreover, the Onas are without that taint of European blood from which few, if any, of the existing aborigines in Latin America can be accounted free. Spain's colonies in Magellanes, founded by Sarmiento in 1580 for purely political reasons, perished to a man. After the discovery of Cape Horn robbed the straits of their paramount importance as a gateway to the East, there was nothing in these bleak shores to tempt settlement by the descendants of the Conquistadores, or, till quite recent times, by any one else. So there are no half-breeds among the Ona. They are a prehistoric fragment of humanity, preserved to us intact.

In appearance the Ona men average some 5 feet 10 inches in height, but the women fall a good four inches short of this. The apparent corpulence of both sexes, induced by the cold climate, disguises an immense muscularity. Their skin is of a light copper hue, though usually much overlaid with grease and clay pigment. The characteristic American physiognomy, with its prominent cheekbones, strong chin, and slightly aquiline nose — the eyes free from the Mongol obliquity which marks the Yaghan—has an intelligent and for the most part a good-humoured expression. The hair is straight, black, and coarse. A slight beard is removed by plucking, and the eyebrows are treated in the same way, all growth except on the scalp being considered a blemish, or at all events unfashionable.

The tribe is scattered through the island in small groups, each rarely exceeding thirty or forty members, who are all in some way connected by blood or marriage ties. These groups maintain traditional friendship or vendetta with their neighbours, the latter usually arising from a poaching dispute on their respective hunting-grounds. They have no headmen, but individuals naturally take the lead from their exceptional skill in hunting or else as "doctors," who take the same place, though with much less influence, as the African medicine-man, and have charge of all sick persons. Their stock-in-trade consists of a rude massage, accompanied by a few simple accomplishments of the palming and trick-swallowing kind. The sufferer is mouthed over and kneaded with much grotesque pantomime, and after a time an arrow-head, a piece of long sinew, or a pointed stick is brought to light and shown as the cause of pain. Identical ministrations to the same end are in common use among the Matacos of the Argentine Chaco, but a peculiarity of the Ona system of massage is that it is often done by treading the patient with the feet Among a folk whose complaints in a

natural state arise mainly from rheumatism, over-fatigue, and indigestion, the practice seems to have a basis of common sense.

A woman hides away for two or three days during childbirth, when she will return to her appointed tasks, and even add to them, making long journeys to fetch extra firewood, in order that her energy may flow in the veins of her suckling. She will not publicly exhibit the infant, nor is it etiquette for the father even to inquire its sex for fifteen or twenty days more. When on the march, women bear the



THE ANTARCTIC BEACH, RISING TIER ON TIER.

burdens of the camp equipment, as well as any stores of food, the whole carried in guanaco-skin bags of surprising lightness in proportion to their capacity. The infant takes his place amongst this mixed load, but at night he is bound to a kind of miniature ladder whose lower stakes are sharpened and stuck into the ground. The child is thus held in a half-recumbent position above risk of damp and chill. The preparations of the rest of the family are simple in the extreme. A fire is lit; a few low sticks and skins are placed to windward, and

the grass and moss in the space between is scraped away to the depth of 6 inches with the shoulder-blade of a guanaco, which useful implement also serves as a plate at meal-times. Wrapped in the long fur robes which are their only garment, men and women lie down together with no other cover than the stars. The family circle is completed by many dogs, which pile up in the centre to add their warmth and cover any protruding limb. These dogs are trained to lie alongside the younger children when left alone by their parents in cold weather.

The Onas are forced to a nomadic life by the wandering habits of the guanaco, on which they depend for their staple food. This fare is varied by tuco-tucos (ctenomys), birds, and stranded fish, and they are fond of blubber, but this last treat is always due to an accident, and not to their own provision. As an anti-scorbutic they eat the roots of the tussock, somewhat resembling those of asparagus in appearance, and also wild celery, which abounds all over the island. The meat diet creates in them a craving for farinaceous food, and their greatest luxury is a hard ship's biscuit.

The only weapon known or used by the men is the bow, with which they will shoot as far as 120 yards with great rapidity, while they are fairly certain of hitting a 6-inch bull's-eye at 30 paces. They are chary of wasting arrows, however, trusting rather to get an easy shot by careful stalking, which they have carried to a science. A guanaco fur peak is worn on the forehead on purpose not to scare the wary game. With their stock of clay pigments they stain their naked bodies to match the ground over which they must advance; over snow they paint themselves white, yellow when among the pampa-grass, slate-colour spotted with red when among rocks. Ona arrows have beautifully chipped though small heads, and the plentiful supply of bottles to be found near the white settlements furnishes them with a material which they consider superior to the original flint. This is probably the only important change which has taken place in Ona arrow work since remote times. As the tools used for working up either material are the same, it may be of interest to give a list of them.

1. The bottle, or piece of flint, is smashed into small pieces.

2. Small guanaco bones are selected to chip the fragments of flint or glass.

3. Another sharp stone is necessary to prepare the guanaco bone "tool."

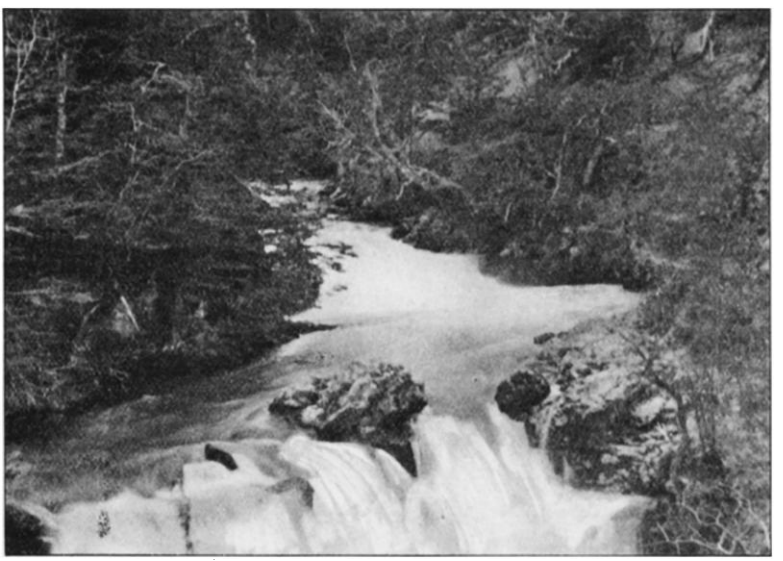
4. A larger stone to serve as anvil.

5. A piece of pumice-stone to grind and polish the point. This is for finishing touches only.

The other necessaries for arrow-making are: a smaller bone chisel to work down the birch arrow-shafts; a bit of foxskin to use with polishing-dust; goose feathers, which must be taken from the tip of the right wing to have the proper bias; sinew taken from the back of a

guanaco to bind on the feathers; and, finally, a little pitch to finish off the whipping. From this list it will be seen that if ingenuity is wanting to invent better tools, dexterity is required to produce with them a piece of finished work, which the Ona arrow undoubtedly is.

In fighting, the men shoot first from ambush, then in the open, and finally close empty-handed, the object being to break the opponent's back or neck by wrestling, but they will not mutilate or torture a foe. During a skirmish the women and children are left some distance back in the woods. When swift flight is necessary, men and women retreat together, leaving the children buried in a long trench, packed like sardines, with a skin to cover each helpless head and provide a breathing-hole to the air. Under cover of night the women steal back to



A TYPICAL FUEGAN STREAM.

recover their offspring, who are apparently none the worse for a twenty hours' fast passed in absolute silence. Thus the child early imbibes the protective instinct of all wild things, and will, if alarmed, blot himself out like a partridge behind a shrub or tuft of grass. A race of the finest hunters and stalkers in the world, their moral code is based up on a standard of physical culture and health, in which unsoundness is condemned as vice; their recreations mainly in wrestling and footraces, more of endurance than speed, where they run 10 miles across a forest country to some hilltop. They also amuse themselves practising with the bow and arrow, acting themselves as moving targets for each other. In both men and women the sense both of sight and hearing is extraordinarily acute. They will distinguish details with the naked eye as

far as a white man, even a sailor, can with a good field-glass. They are capable of long abstinence, and follow a week-old trail across the island with no other food than a few dried sinews or a piece of guanaco hide to chew. Their only drink is cold water, and they have a horror of tobacco or other drugs.

The tie between man and man, whether as blood relation or simple friend, is far more binding than that between man and woman, even when they are man and wife. There is a legend current that in former days it was the women who held the whip-hand among the Onas. Theirs was all the hunting, theirs the conclaves apart, while to the men was assigned the monotonous drudgery of the camp. So now the men have peopled the rocks and woods, the white mists and running water, with phantoms—bogies in which they themselves do not believe, but which are a strong moral aid in dealing with refractory wives and wilful children. The men personify these ghosts, which have no legend or story attached to them, being simply a representation of the more striking natural objects among which their lives are passed.

The number and qualification of these ghosts is as follows:—

Sh'ord,* a malicious underground spirit with crooked legs. He is represented covered all over with the feathers of birds (stuck on with grease).

Hach'i, the spirit of the moss and lichen-covered rocks. He is painted slate-colour, with daubs of red and yellow clay, and wears horns.

H'alpin is a woman, the spirit of the clouds and mists. She is dressed all in white, and has a very long head. This shape is given by binding twigs to the back of the head, which are then covered with skin and painted.

Fan'u is the spirit of the streams and lakes. She is the sister of Halpin, and is got up in the same way, except that her colour is red.

C'mantu is the spirit of the beech forests, and is clothed with tree-bark and moss.

Hash'ai is very squat, and has a claw on the forefinger of each hand. He is always gathering firewood, but never makes a fire. This spirit seems an embodiment of that nervous fear which makes itself felt in the deep forest, when branches creak and twigs snap for no apparent reason. Finally there is—

Olimin'cke, the little surgeon-doctor, who attends to the ailments of all this crew.

Although the cult of these mysterious beings does not reach the dignity of a religion, it binds them together in a freemasonry so strong

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* N.B.—The division in these names represents a gasping aspirate, which it is impossible to set down in writing.

that the man who betrays or the woman who is suspected of having penetrated its secrets is quietly put to death.

Up to the age of about fourteen, the boys also are firm believers in the reality of these phantoms, and with good reason, for they have been purposely chased and frightened to that end. As the time of their initiation approaches they are seriously exhorted by their elders. They must be keen hunters, and equally keen to follow up the family vendetta. They must be careful of their own bodies, despising greed, and, above all, allowing no woman to share their intimate thoughts. At a succession of night meetings the boys are then introduced to the

YAGHAN MEN AT THE ENGLISH MISSION, TELINIKE.

various spirits, who disclose themselves as members of their own family. The boy's staunchness in keeping the secret is tested in various ways. A common one is to insert a pine splinter into the arm or thigh and to set light to it, leaving the flesh to extinguish the flame—an operation of which the victim is supposed to be cheerfully unconscious. The scars thus made are afterwards worn by the boys with the same pride that a German student shows in the sword-cuts which are tokens of his duelling-days. The name given to these ceremonies is clock'ten; and after he has passed through them, a boy drops his own name for a time, and is known as "clock'ten," or probationer. This "clock'ten" period usually lasts about two years. It must be passed by the youth apart from his family in making long excursions and in hunting (poaching on

the land of a neighbouring group is preferred). He is only allowed the help of a single dog. Only hard sinewy meat may be eaten, and no fat—a very real deprivation in the Fuegan climate. Gradually he becomes admitted to the full confidence of the older men, who count it, meanwhile, one of their chief amusements to set traps for his inexperience.

During his wanderings the young brave looks out for a suitable mate among neighbouring groups, for with all their promiscuity of family life, the Onas do not permit the marriage tie between two persons connected by the blood-tie, even to the degree of cousins. On the other hand, a deceased wife's sister is regarded as that lady's natural successor. Neither may a youth marry until he has proved his capacity to provide for extra mouths among the group. Thus, although he practises polygamy, an Ona will rarely take a second wife until the cares of his household are more than one pair of hands, or shoulders, can manage. The routine of courtship is Spartan. When the girl is from a friendly group, the gallant presents her with his hunting-bow. If the girl returns it by her own hand, it is a sign of acceptance; if by the hand of a messenger, it is a refusal. But refusals are not common. The persevering brave watches for an opportunity which brings him alone with the object of his affections. He then commands her to follow him with all speed through the bush to his own camp. The girls are used to yield prompt obedience, for a disappointed suitor may emphasize his displeasure by an arrow directed lightly at the thigh or at her calves—the especial vanity of an Ona belle. No dower or present is in either case given to the father of the bride, wherein again the Ona custom differs from the Yaghan.

It is considered unmanly to show hunger or fatigue. If a hunter kill game, the tribal law rules that he may not partake of it—save for the "hunter's meat," *i.e.* intestine fat—but must first bring it back to the camp, even if it be a day's march distant. It is then portioned out among the family by some other person, and in this division the hunter will often be content with the smallest share, though he claims the pelt as his by right. As they have no pottery, and skin utensils will not stand fire, they are ignorant, beyond a simple roast, of the art of cooking. The women warm water to give to little children by holding it in their mouths.

When an Ona dies, his more valuable possessions, such as the bow, the arrows, and his fur robes, become the property of his relations; small personal effects, such as fire-stone, scraping flints, pigments, etc., are buried with him. Saplings are bound to the body with raw-hide thongs, which is buried deep, lying flat and straight. The grave is then stamped down, the sods which have been removed are once more carefully fitted to their place, and a fire is kindled over them to remove all trace of the interment. The chief mourners express their grief

during and after this ceremony by long-drawn howls, repeated at intervals, much as a dog might. Yet if their rites are few, their grief is sincere. Recently an old Indian clasped the body of his son, who had died from the effects of a dog-bite, in his arms, and, refusing comfort, deliberately starved himself to death.

The period of mourning lasts from one year to three, during which time the head is tonsured. This operation is effected by passing a bone comb close to the scalp, and burning off all protruding hair with a live ember. The dead are never mentioned by name, but always in some roundabout way. Their spirits are vaguely supposed to exist after death under the name of Meh'n ; but as these spirits, though they are supposed to know what passes on earth, are unable to influence the course of events, this practical race pays them little heed.

Of gods, as we understand that term, the Onas have none. The men are as devoid of any faith as they are of fear or superstition. But they recount by the fireside tales of a mighty hunter and "doctor," called Coanyipe, in whom is embodied all their admiration of manly skill and prowess. Moreover, their imagination has given personal attributes to the sun and moon, to hill and wood, bird and beast—in a word, to all that nature to which they lie so close. The following legends, chosen from many, will sufficiently illustrate their mental range. They are noticeably free from the disgusting animalism which taints every Yaghan tale.

Ona Legends.

Legend of the Sun and Moon.

Cr'en, the sun, was once a great hunter, and the most beautiful man in Onaland. One day after hunting, as he was coming home with a great load of guanaco meat, he noticed his wife talking to another woman at the edge of a lake. Leaving his load, he crept close to them through the rushes and listened. Here he learned that his wife Kerren, the Moon, had discovered the secrets of clock'ten, and was telling them to the other, so that all the women might know how the men deceived them and rise in revolt. When Cr'en heard what his wife was saying, he rushed out, and in anger struck her a blow upon the face, from which come the marks that she bears there to-day. Then she fled from him frightened, and he followed after, pursuing her till at last they came to the edge of a high bluff which overlooks the sea. The Moon, being blinded by her fear, sprang out beyond the cliff into the air, and when the Sun reached the cliff he sprang out too. So they may be seen, sometimes both in the sky, and sometimes only one; but although he still pursues her, Cr'en, the Sun, has never yet been able to catch his wife Kerren, the Moon.

When a shooting star crosses the sky, the Ona say that it is a young man who goes to look for a wife.

The Story of the Shag and the Flat-crested Vulture.

Cwa-u-ishen, the Flat-crested Vulture, came from a country in the far south. It is so cold in that country that all the water is frozen, and the marrow in the bones of Cwa-u-ishen dried up, because he could find no water to drink. All the same, he was a very fierce, strong man, and he came to the land of the Ona to challenge them to wrestle. There stood up to meet him Cti'aishe, the Shag, who was a good wrestler, but a smaller man than the other. When they joined hands, the vulture got the lower grip, and putting out all his strength he pulled toward him, breaking the other's back. For that reason the shags now sit up very straight, with their backs a little hollowed in. But meantime Cti'aishe had caught him by the throat with one hand, driving the blood from it, so that it remained white, and with the other hand he tugged at the top of his head, and Cwa-u-ishen's head has been bald and wrinkled since that time. So neither of them won; but in shame because he had boasted of victory, Cwa-u-shen changed his name, and now he is called Carcaai. He is the doctor of the south wind, and when he calls storms come, and mist and snow.

The names bestowed upon Magellanes by the early mariners were ominous. Fury rocks, Famine reach, Desolation island, Useless bay—we read in them a tale of hardship, peril, and loss. As if to continue the parallel through its later history, the currents which harry the shores of Tierra del Fuego have cast upon them a driftwood of reckless seamen, fur-traders, convicts, and last of all gold-seekers. The sheep-farmers who hold the fertile northern pampas are comparatively few; but at the beginning of the last decade it was reckoned that there were three thousand Austrians alone working in scattered parties as miners along the gold-bearing sands, or as sealers. The refuse of every seaport in South America was congregated in Magellanes. Even now the Argentine Government counts as double the time served there by its officials. It is not necessary to dwell on the consequence to the aborigines of this lawless and unsettled immigration. On that point their reduced numbers speak with silent eloquence. Nowhere has the history of the white men's contact with a native race been carried to its inevitable conclusion with more ruthless severity. Yet if the Onas have been forced to give their ground, they have not yielded their independence, nor forfeited their self-respect. They are still ignorant of the manufacture of any fermented drink, and twenty years of unscrupulous trading has not conquered their aversion to spirits, even when members of the tribe have for a time accepted work among white settlements. This record alone marks them a natural aristocracy among the aboriginal races of South America.

Helpless, hopeless, yet defiant, the Onas have defended their hills

with a devotion and tenacity unknown to the degenerate Yaghan or the loose-living tribes of the Patagonian mainland. So it has come about that the impress of that land is stamped deep and clear upon them. Surely they are worthy of some little heed before they vanish for ever from our view; a race whose past is the tale of a continent, and their future—silence.

TIBET.

I. THE ROADS TO TIBET.

By DOUGLAS W. FRESHFIELD.

THE following pages are an attempt to give, in a concise and convenient form, some of the information we possess with regard to the region and the roads likely to be traversed by British troops within the next few weeks. Most of this information has been gathered in the works of travellers and surveyors, from the narrative of Turner, and those of Bogle and Manning (as collected and annotated many years ago by our indefatigable President), down to the excellent *Routes in Sikhim* compiled mainly for military purposes by Captain (now Major) O'Connor, and published by the Indian Government for the information of travellers in 1900. I have been able to add, with regard to the Tista valley routes and the general character of the Tibetan uplands they lead to, some details from my own visit, four years ago, to the pastoral wilderness behind Kangchenjunga.

Tibet is a very large country, some 1100 miles in length from east to west, and some 900 miles in breadth from north to south. Its boundary is coterminous, in three different directions, with that of British India, counting the states of Kashmir and Sikhim as British India. The frontiers meet in the far east, where the Brahmaputra breaks out of the mountains through narrow valleys of which their wild inhabitants still preserve the mystery; they meet again in the far west, where bleak passes connecting lofty plains admit of passage along the chain of the Himalaya by a route followed from time to time by embassies from Kashmir bearing presents to the Dalai Lama.*

Between these points all but a narrow space in the centre is covered by the territories of Nepal and Bhutan, still inaccessible to European travellers and merchants. It is with this narrow central space alone, and the portions of Tibet adjacent to it, that we are at present concerned.

In the first place, I must ask the reader to dismiss from his mind and his memory many of the crude generalizations based on imperfect recollection of travellers' descriptions of other parts of Tibet that have

* The present Dalai Lama was born in 1874, and assumed temporal power over Tibet in 1893. He is not therefore, as is often assumed, a child.

been presented to the public eye in the last few weeks. The region beyond the Brahmaputra and the north-western deserts traversed by Littledale, Sven Hedin, Prjevalsky, and others have little in common with the country lying between the outer range of the Himalaya on the south and Shigatse and Lhasa on the north. In the district our troops have to traverse, the temperature is not always below zero during the winter months. Commerce is not exclusively carried on on sheep's backs, though sheep were occasionally employed, until an Abbot of Gyangtse discovered that to put them to such hard service was contrary to pure Buddhist tenets. So far from being enormous and extremely difficult, the journey from our frontier to Lhasa can be covered in eight days to a fortnight. The roads in the interior of Tibet between the chief towns are good mule-roads or tracks similar in character to an Indian by-road.

It would occupy too much space here, were it otherwise desirable, to enter into the chain of events by which the territory of Sikhim has been preserved from annexation by Nepal, and incorporated as a Protected State in the British Empire. I must, however, briefly define its boundaries.* From the point of view of the physical geographer, it is the district drained by the Tista and its tributaries, and the water-parting of that river forms its limits under the treaty with China and Tibet, ratified in 1890. Formerly Sikhim was, or was reputed to be, more extensive; in the map to Sir C. Markham's 'Tibet' (1876), it is made to extend far north beyond Kambajong. This cartographic extension was probably due to the fact that the Sikhim Raja had private property in this district, as he had also in the Chumbi valley to the east, but it is doubtful whether he has exercised any political power there since early times. On the other hand, before Great Britain intervened, Tibet was extending its influence over the villagers, Bhutanese by race, who dwell above the upper gorges of the Tista, and this influence extended as far as Chung-thang, at the junction of the two main sources of that river.† For present political purposes, Sikhim is the basin of the Tista. It stretches up beside Nepal very nearly, if not quite, to the Himalayan water-parting. On its east, between it and Bhutan, Tibet in turn possesses a long tongue of territory, the upper basin of the Ammo Chu, the next stream flowing towards India east of the Tista. Geographically the basin of the Ammo Chu belongs to Bhutan, but that country, politically, possesses only the lower part of its valley. The fertile upper basin has in times past been held alternately by Bhutan and Sikhim, and it is only comparatively recently that the Lhasa Government has succeeded in intruding itself there.‡ Neither

* For fuller details, see the *Gazetteer of Sikkim*, pp. 1, 2.

† See Waddell's 'Among the Himalayas,' p. 163.

‡ See Hooker's 'Himalayan Journals,' vol. ii. p. 111.

geographically nor politically has it any sound claims to come south of the Himalaya. Owing to these political boundaries, the trade route from India through Chumbi to Tibet, in place of ascending the valley of the Ammo Chu, crosses the ridge that divides that river from the Tista. This ridge is traversed by several native horse-paths. Of these the Chola was formerly the most frequented, while the bridle-road over the Jelep La has been recently improved and made good by British engineers.

Through these two strips of territory, bridging as it were the zone neutralized in war and closed to commerce in peace by Nepal and Bhutan, run two of the main high-roads—high roads in all senses of the word—from India to the chief towns of Tibet: Shigatse, Gyangtse, and Lhasa. Through the Tibetan strip runs what may be conveniently called the Chumbi route; through the British strip, Sikhim, what we may term the Lachen-Kambajong route.

It was by the Chumbi road that the Tibetans invaded Sikhim in 1886–8. It meets the historical road to Lhasa and Tibet, coming from Bhutan, by which Bogle, Manning, and Turner travelled at Pari, and the fortified town of that name, standing some distance below the water-parting and 14,000 feet above the sea, was in their time, and has been since, the chief gateway of Tibetan trade with India.*

The following sketch of these two routes may be helpful in following the British advance.

Our railway base is Siliguri, and not Darjiling. For Darjiling is a city set on a hill 7000 feet high, and to take men and stores up there in order to bring them down again to 700 feet would be obviously futile. From Siliguri a cart-road leads across the plain and up the narrow vale of the Tista for 30 miles to the Tista bridge. Last spring a line on the gauge of the North Bengal railway was surveyed as far as the spot where the Tista leaves the foothills; and, beyond this, the cart-track, which had been destroyed by floods in 1892, has been repaired and doubled as far as the Tista bridge. At this point the first climb begins; in 10 miles Kalimpong, and in 12 more Pedong (4000 feet), is reached. There the wheel-road ends, and the track henceforth is a fair horse-road. After descents and ascents innumerable, it reaches in 42 miles, or four stages from Kalimpong, the post of Gnathong, 12,000 feet, where our troops were quartered through the winter of 1888. So far "the road is metalled in places and bridged throughout, and is passable to infantry, baggage animals, and mounted artillery without any difficulty." † Thence it is a day's march to Yatung, the

* There are, of course, other roads from India to Tibet through Nepal and Bhutan. These have been traversed, and described by Pundits, but are at present closed to Europeans and commerce.

† Where the source of quotations is not indicated, they come, as a rule, from the official 'Routes in Sikhim,' 1900.

Tibetan frontier, over the Jelep La, "the easy, smooth pass," 14,400 feet, the most frequented of several practicable passes leading into the Chumbi valley.

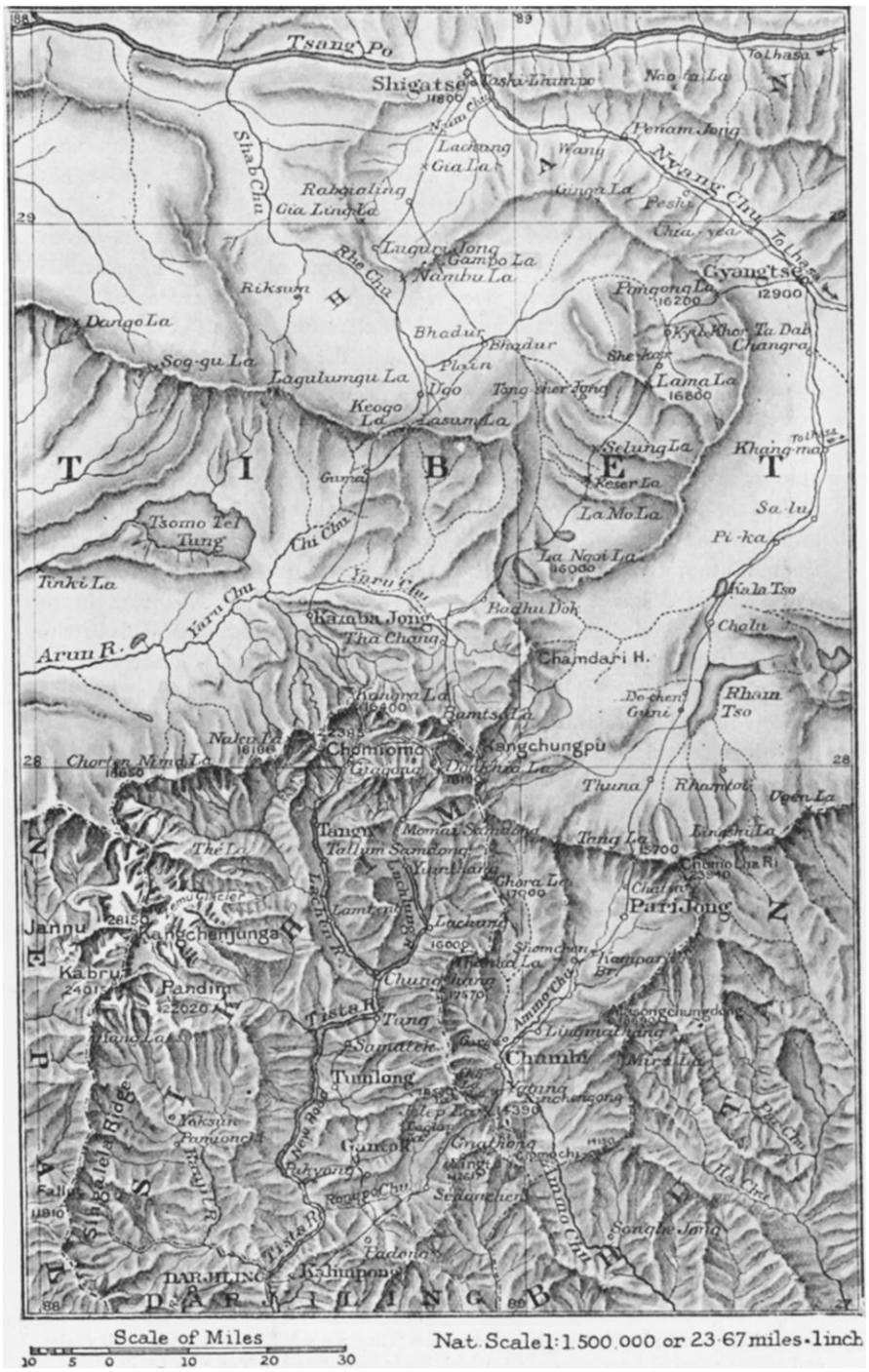
On the Jelep La may be seen the remains of the walls behind which the Tibetans hoped to stop our advance in 1888. The surrounding scenery is bare and rugged, resembling that of an ordinary Swiss mule-pass; the track such as those of the Furka and the Oberalp in the days before carriage roads. Seven miles of descent by a rough path, "regularly travelled by laden mules," leads to Yatung (11,000 feet), where is the house of the Chinese customs commissioner, a Tibetan guard-house, and "eighteen shops in four blocks, which were intended for traders, but are unoccupied except by the Chinese custom officials." This is the spot where the Tibetans are bound by treaty to keep open a trade mart.

Just beyond Yatung, which lies near the opening of a side valley, the Chinese frontier wall, a somewhat elaborate structure, but useless from a military point of view, is encountered. It is 15 feet high and 10 feet thick at the base, and supported by blockhouses. The valley now opens, and frequent villages occur; one of the largest is Rinchengong, with (according to the Route-book) fifteen well-constructed, two-storied houses, situated at the junction of the Yatung glen with the main valley. Mr. A. W. Paul thinks there are more. A mile or two further, 20 miles from Gnathong, is Chumbi, where stands the large three-storied building used as a summer palace by the Sikhim Raja before the British Government required him to reside within his own dominions. The mean elevation of this part of the valley is 10,000 feet, or 4000 feet below the Jelep La, which is the most formidable obstacle on the road to Gyangtse or Lhasa. The late Mr. Louis has described Chumbi in his book, 'The Gates of Tibet,' as "the Engadine of the Himalaya." *

"The valley," he says, "is at an elevation of 9000 feet, but the climate is warm and dry, and the finest weather prevails there while Darjiling and Sikhim are flooded with rain and reeking with mist. The valley is about a mile in width, with the river and its numerous islets in the centre, eminently fertile everywhere, and highly cultivated with fields of corn and barley, while there are rich pasturages on the hill-slopes around it, dotted all over with clumps of fruit and other trees—a varied, rich vegetation quite different from that of Sikhim. There is good fishing to be had in the river, and the whole valley is, in fact, a lovely bit of smiling landscape, terminating on every side in snow-clad mountain-tops. Pervading it all is said to be an air of affluence and *bien être* to which the interior of Sikhim, rich as it is, can bear no comparison whatever." This picture may be somewhat overcoloured, but all authorities agree that Chumbi is by comparison a

* Mr. Louis, 'Gates of Tibet;' see also 'Round Kangchenjunga,' pp. 62, 63.

THE ROADS FROM SIKHIM INTO TIBET.



pleasant, dry, and wholesome place. One of the few Englishmen who knows it tells me "our troops may winter there in a delicious climate, and find plenty of substantial houses." "A flourishing valley, where cultivation and grass are particularly abundant," writes another authority. Again, "The people of the Chumbi valley are prosperous, and the arable land of the valley is sufficient to support three times the present population."

From Chumbi to Pari is a distance of 21 miles, and an ascent of 4000 feet by a "road used at all seasons of the year by mule caravans." Many villages, one of 140 houses, are passed, and the road is barred (according to the Route-book) by a series of Chinese walls, which can, however, easily be turned by a hill path.

Pari is a considerable town, lying at the foot of a Jong or fort five stories high. According to Hooker, it was fifty years ago, "next to Darjiling, the greatest Tibetan, Bhutan, Sikhim, and Indian entrepôt along the whole Himalaya east of Nepal." "It contains 300 mud-walled houses and many shops, where provisions and clothing of all kinds are obtainable. Tobacco, cloth, and fruit, which are brought in from Bhutan, are to be had in the bazaar, and fish are said to be plentiful. Vegetables are scarce, but cattle are very numerous. No grain crops ripen in the vicinity, but wheat is grown for fodder and sold in the bazaar at two rupees per maund." Manning found the place "abundantly bare, bleak, and uncomfortable." Here tolls and customs are collected by the Tibetan authorities.

Beyond Pari the detailed description in the Route-book is quoted below. Illustrative passages might easily be accumulated from the narratives of the eighteenth-century travellers. The Tang La, 15,700 feet, the pass over the water-parting, from which a stream descends to the upper Brahmaputra, is a very mild affair; "a gradual and hardly noticeable ascent," it has been called.* Nor does any part of the track to Gyangtse appear to offer any serious difficulty. The reader must bear constantly in mind that the "tremendous passes" and "stupendous natural obstacles" we hear of exist only in the imagination of writers who, not having realized the character of the Tibetan tableland, naturally think any pass of the height of Mont Blanc must deserve the strongest adjectives at their command. Beyond Pari the character of the landscape has completely changed. The charms of Chumbi are all left behind, and the traveller finds himself in typical Tibetan scenery. Cultivation is confined to the shallow valleys of the streams, where frequent villages are found. These are separated by rolling uplands, bare and brown except for a few weeks in spring, over which roam the *dokpas* or shepherds with vast flocks of sheep. The sun is hot by day when it is not overmastered by bitter winds, and the nights are very

* There is an alternative pass east of the Tang La which is said to be still easier and to be preferred after a snowfall, which leads back into the Tang La track.

cold. It is an inhospitable region, but one which has never formed a barrier to frequent intercourse between the dwellers in the pleasant valleys of Shigatse and Gyangtse and their southern neighbours. In 1888, according to Captain Iggulden, the transport of the Tibetan force on the Jelep La was "in first-class working order. They had 1000 yaks and 500 mules working supplies up regularly from Gyangtse, a large town in the interior of Tibet, where provisions are said to be plentiful."

Bogle, who travelled early in November, gives the following description of scenes on the road: "Our route continued almost due north, through valleys little cultivated and crowded by bleak and barren hills, between whose openings we saw distant mountains covered with snow. Here and there we saw a few houses, with some spots of rushy ground or of brown pasture, but not a tree or plant was to be seen." Again, "The . . . hills, although in many places abundantly steep and high, are so bare and sterile that they are left in a state of nature. The valleys only are cultivated, and the roads lead through them, which cuts off any climbing of mountains. Goods are chiefly carried on bullocks and asses; the corn is trod out by cattle, and ground by water-mills." I quote last the approach to Gyangtse: "The first part of our ride next day, the 2nd of November, was through the same bleak country we had hitherto met with; but the valley in which Giansu (Gyangtse) stands is extensive and well cultivated, and full of whitened villages; . . . altogether it makes a fine prospect."

Chandra Das furnishes a more detailed account of the valley at Gyangtse, which extends 70 miles in the direction of Shigatse.

"The Nyang Chu valley is one of the richest in Tibet; . . . every inch of it is cultivated. Its great natural fertility, and its being so very favourable for the growth of different kinds of millet and pulses, has given the whole district the name of Nyang, or the Land of Delicacies. Flocks of wild geese and ducks were swimming on the river, and long-billed crows were stalking about searching for food. From the bushes of furze and other plants with which the banks were overgrown hares leaped out and made off towards the mountain recesses, and beautiful little birds, probably a variety of kingfisher, were seen fishing in the river. In the village of Gyatski the people seemed very industrious, the woman engaged with their looms or spinning, the men tending sheep or collecting fuel from the fields."

This picture was drawn on January 4, in midwinter. To sum up, the distances on this road are as follows: Siliguri to Gnatong, 83 miles; Gnatong to Parijong, 41; Parijong to Gyangtse, 89 miles. Total 313 miles. Parijong to Lhasa, 203 miles, or 12 marches. Parties take, as a rule, a fortnight from Lhasa to the British frontier, but the distance can be covered in eight days by a quick traveller; from the British frontier to Gyangtse is a week to ten days' travel.

The alternative road through Sikhim to Tibet to that by Chumbi, the Tista valley, or Lachen-Kambajong route, does not admit of such simple and straightforward description. In past times it has abounded in variations, the chief reason for which was the extraordinarily precipitous character of the ravines to be traversed in the western or Lachen branch of the valley, and the absence of permanent bridges. Owing to this cause, the Lachen track, though it leads to the lowest and easiest access to the Tibetan upland, the Kangra La (or Kangra Lama La) (16,400 feet), was considered by the Tibetans a winter route, the torrents being at that season less impassable. In summer the yak caravans were forced to cross the higher Donkia La (18,100 feet), well known from Sir J. Hooker's visit fifty-five years ago, and come down the more open Lachung valley to the junction of the streams at Chungthang. Another side track leads over a series of high grass passes on the flanks of Kangchenjunga, and finally reaches Tibet by the Naku La (17,300 feet).

In 1899, when I was in this region, the Lachen gorge had been made passable, and the track, if very steep and narrow in places, and liable to bad earth-slides in others, was throughout passable for beasts of burden up to Giagong, where, some miles within our treaty frontier, the Tibetans had established themselves and built a wall. The object of this petty aggression was apparently to secure the control of the passes and the user of the wide pastures—a rolling country, "like Wiltshire downs," writes Captain O'Connor—on which the springs of the Tista rise. More recently, however, my Sikhim friends inform me, this road above Chungthang has been very largely repaired, and provided with rest-houses and a telegraph line, over which, in September last, the officers of the Mission at Kambajong were able to send their greetings to Sir J. Hooker in a message which reached him on the same day. Readers of my recent volume will find a description and a criticism of the part of the road below Chungthang, as it was four years ago. The hope there expressed that a new road on a better line might be made has been fulfilled, and the old track practically abandoned. I owe to Mr. A. W. Paul, one of the first authorities on all matters relating to Sikhim, the following interesting facts as to the progress in roads up to last spring in the Tista valley.

A new road, lately constructed by Mr. White, the Political Officer in Sikhim, runs from Tista bridge along the left bank of the Tista to the Rungpochu, which it crosses on a fine bridge. Thence there is a branch—to be extended—to a point 4 miles below Gantok. The main road is to be carried on up the valley of the Tista, until it joins the old track somewhere beyond Ringem, probably between Samatek and Tung. A new branch bridle-road connects it with the Penlong La near Gantok.

A cart-road is also being pushed up to Laghyap below the Yakla. This is likely to be in the future the main Chumbi route, as the pass is easy and the descent on the further side being along a ridge and

not through a narrow glen, as in the case of the Jelep La, is preferable, and, owing to the absence of bridges, less liable to interruption.

Returning to Rungpo, there is a "level road" up the side stream to Rongli, on the Rhenok-Lingtu road.

The first pass to which the Lachen route leads, the Kangra La, traverses the water-parting between the Tista and the Arun, the great stream which, flowing to the plains of India, divides the block of Kangchenjunga from the "Mount Everest" or Chomokankar group. In its basin Kambajong lies. Chandra Das's description of this frontier fort and town may be quoted. It has been depicted in the *Sphere*, and it cannot surely be long before the public will be permitted to profit by the more recent accounts that must have been sent home by members of the Mission.

Kambajong lies 13,800 feet above sea-level, and is, according to the Route-book, "a circular fort 1500 paces round, built on the top of a small mound; the walls, 6 feet thick, are built of uncemented stones. . . . There are 50 soldiers and 15 or 20 inhabitants besides." Captain O'Connor passed within sight of it in 1896.

Chandra Das, who visited the place in 1879, is more picturesque. He writes—

"The fort of Khambajong is situated on the top of an isolated cliff. The fortifications rise in several storeys from the north-west foot of the cliff till they reach the summit, which they entirely cover. This castle, second only to the Shigatse Jong, is one of the highest and grandest in Tibet, and a distant view of it from the south is most impressive. At the foot of the hill is the village of Khamba, famous for its mutton. Thousands of sheep are annually killed here in January, and the carcasses are dried and sold at from eight annas to one rupee each. Khamba is also famous for its carpets and blankets. . . . There are about 300 houses in the town with a prosperous population of nearly 1000 souls. Wheat and barley grow in the valley. The stream works a barley flour mill, an old one recently repaired. The castle is very ingeniously planned, and has accommodation for 1000 men. The river rising within the castle ensures a supply of water during a siege."

The above extract is taken from the report of Chandra Das's first Tibetan journey, which has not been reprinted in England. In his later report he tells us that "the fort is supplied with water brought there by clay pipes from the mountains to the north, a piece of work of which the people are not a little proud"—a somewhat important discrepancy!

Beyond the Kangra La the scenery and the roads are of the same character as beyond the Tang La on the Chumbi road. "The legs have been climbed and the top of the table reached"—to adapt the remark of the British private. The road to Shigatse appears to be an easy one, crossing low passes and frequently traversed at all seasons; the direct

track, however, to Gyangtse, crossing two steep, if short, 16,000-feet passes, seems less suitable for the advance of any considerable force. It is not improbable, therefore, that the main advance will be made by the road through Chumbi to Gyangtse.

The distances on the Lachen-Kambajong route are as follows: Siliguri to Gantok, 73 miles; Gantok to Kambajong, 89 miles; Kambajong to Gyangtse (direct road), 90 miles. Total, 252 miles. The *détour* by Shigatse adds 45 miles. With regard to the effects of wintering on an Indian force, we have the experience of 1888. Major Iggulden writes, "Our men have been wonderfully fit, and the cold and bracing climate of these lofty altitudes has agreed with them extremely well." Some of the native troops, however, suffered to a certain extent from bronchitis and pulmonary affections. There will, no doubt, be more hardships for troops on the move than for those who were hutted in quarters at Gnatong. We may expect to hear of some suffering on the passes, the Jelep La and Tang La. But if these are crossed in fair weather and before too heavy a snowfall, troops either at Chumbi or Gyangtse should be able to endure and even enjoy life in midwinter.

There is no space in this *Journal*, nor have I the material at hand, to enter at any length on the prospects of Tibetan trade. I may say, however, that they appear to be considerably underestimated by most writers. Amongst other wares there should be a large demand for broadcloths and tea, while the possibility of—with quicker communications—making Tibet a source of meat-supply for India seems to have been generally overlooked. There is no doubt that the Nepalese merchants, despite their longer and more arduous access to Tibet, have found their commercial intercourse highly profitable. The report of Bogle to Warren Hastings is still, having regard to the stationary condition of Tibet, not without a certain value, and may be consulted together with our President's remarks in his volume already referred to (p. lxviii.).

There is no doubt that if due use is made, as we have every hope under the present Viceroy will be the case, of the opportunities afforded by the present expedition, it may add considerably to our knowledge of the orography and geology of the inner Himalaya. No geographer, of course, would wish an armed expedition to be sent forth for merely geographical purposes, but when political considerations make such an expedition expedient, we are naturally desirous that the occasion should not be lost. That the expression of such a desire should be made an excuse for reproach is characteristic of what is, or rather is supposed by some of his literary providers to be, the attitude towards science of the average educated English reader. The public we have reason to believe, has learned more from recent events than some of its instructors, and takes such comments at their proper value.

I should like to add here that I have just learnt that the hope expressed in my recent volume, 'Round Kangchenjunga,' that our

British officials may be able to protect the primitive inhabitants of Sikhim, the Lepchas, and preserve them from being driven out of their home by the more energetic Nepalese, has been anticipated by the Viceroy, Lord Curzon, who has constituted a reserved district for Lepchas, from which extraneous settlers will be excluded. It may also be desirable, in view of recent statements to the contrary, to remind public writers that the eastern Himalayas have been successfully crossed by invaders from the north. In 1792 a Chinese army of 70,000 men invaded Nepal by two passes, and gained a decisive victory within a day's march of Katmandu, which established Chinese dominion for a time on both sides of the chain.

I am informed at the last moment that another suggestion on which I ventured has been anticipated. It is reported from India that Captain Wood of the Indian Survey has received permission to visit Katmandu in order to ascertain whether the highest mountain as yet measured, the 2900 2-feet peak, best known in this country as "Mount Everest," is visible from the heights in the neighbourhood of Katmandu, and forms part of the range known in Central Nepal as Gaurisankar. Mr. Bryan Hodgson, Emil Schlagintweit, and a recent German traveller, Dr. Boeck, have maintained this opinion, while the opposite view has been generally held by the Survey officers. It will probably be found that the great peak, if visible at all, is far from conspicuous, and only recognizable—like the Finsteraarhorn from Grindelwald—to those who know where to look for it. It need hardly be added that this inquiry will not settle, or indeed throw any light on, the question whether there are loftier peaks yet unmeasured in the region north of our "Mount Everest." That disputed point may possibly be elucidated by observations from the heights near Kambajong, whence Chandra Das enjoyed magnificent panoramas of the western snows.*

PARI JONG TO GYANGTSE.

EXTRACTS FROM 'ROUTES IN SIKKIM,' 1900, COMPILED BY CAPTAIN W. F. O'CONNOR.

Thuna.—Rise of 2 miles to village of Chu-Gya. Hence gentle ascent to summit of Tang La (very easy) at head of Mo Chu valley (6 miles). Then level to Thuna, 11 miles.

Chalu.—Level plain for 19 miles to Ram Tso (lake), lying on east of road; the road then crosses a rivulet which runs into a larger lake further north (named the Kala Tso) by a small bridge built on two stone piers. Chalu 3 miles further on. Water from stream.

Salu.—From Chalu the road runs along the bank of the stream for 5 miles to

* It is difficult to assign final heights to some of the passes, as the figures in Mr. White's recent map are largely in excess of previous measurements, and the Survey Department of Calcutta, which issues the map, disclaims responsibility for it by a printed notice on its face. I have, therefore, adopted the heights given in 'Routes in Sikhim.'

the village of Kalapanga on the shores of the Kala Tso. Hence 2 miles along the shore of the lake. After 4 miles the large village of Pika is reached; hence to Salu, 5 miles, the road lying over an extensive plain quite destitute of verdure and covered with small stones. About Kalapanga village there is extensive cultivation, irrigated by small hillstreams. Salu is a village of fifty houses with some cultivation round it. Water from stream.

From Salu the road runs level for 11 miles to Kangma, bordered by low, rounded, sterile hills. From Kangma the main trade route to Lhasa turns off. One and a half miles beyond Kangma a hot spring is passed; hence the road runs almost due north along the river, which further on has a considerable fall and is very rapid, and the roadway is cumbered with stones which fall from cliffs on either side. Where the valley is open there is a considerable amount of cultivation on both sides of the stream. Twelve miles from Kangma, Changra is reached, where a stream, the Niru Chu, joins the stream hitherto followed.

Gyangtse.—Some miles from Gyangtse the country opens out and appears more populous and better cultivated. Several villages are passed.

Gyangtse is a large and important town with a thriving trade. The monastery near by contains 600 monks. There are two bridges over the river, which in summer is navigated by hide boats. In the centre of the town is a fort which contains 50 Chinese and 200 Tibetan soldiers. Fine crops are raised here, and wheat, barley, radishes, peas, etc., can be procured in the market; also flour, oil, and ghi. Woollen cloth is manufactured in the city. Total, 89 miles.

From Donkhia La to Shigatse, viâ Gyangtse.

Tag-Mar-Khob.—Steep descent from summit of Donkhia La (18,100 feet) for more than a mile to a sloping plain called Tso-jyung-thang where travellers usually rest. Tag-mar-khob, 2 miles further on, is a cave. A short march would be necessary, as the stage would probably be from Monay Samdong on the Sikhim side, 12 miles from summit of pass. Camp near a stream which feeds the Cholamo lakes.

Tha-Tshang.—Road gradually improves after descent from pass, and runs over an elevated gravelly plateau to the Gompa of Tha-Tshang. A stream which runs past a monastery close by is the head-waters of the Arun river. From here to Kamba Jong is 22 miles.

*La-Ngoi (Dok).**—Level road for 11 miles up the Arun, passing several "doks," or herdsmen's camps. Then ascend the La-Ngoi La (16,000 feet), a difficult pass on the north, but easy on the south. Two and a half miles down the pass, reach La-Ngoi Dok.

Camp.—Three easy passes to be crossed on this march, the Lamo La, Keser La, and Selung La. Between these passes are open level plains with a certain amount of marsh land and many "doks" belonging to Tong-sher Jong, which is visible from Selung La. The day's march is continued through open gravelly plains, passing several "doks" and a few stone-built houses here and there. This route is much used by traders going to the market at Lar.

Pong-gong (Dok).—Cross the Lama La, a precipitous and rocky mountain pass, 16,800 feet. At the foot of it and the north side is the She-kar monastery. Ten miles further on there is a rock-cut cave at Kyil Khor Ta Dab (Kingatakdup). The road goes over open gravel-covered plains, with occasional fields of barley cultivation, past the village of Kab-shi, near to which the head of the Chi Chu river is crossed; hence to Pong-gong-dok at the western foot of the Pong-gong La.

* Dok = shepherd's hut; Dokpa = shepherd; Jong = fort; Chu = river; La = pass.

Gyangtse.—Cross the Pong-gong La (16,200 feet) after a steep and difficult ascent. From the summit a fine view can be had of Gyangtse and neighbourhood. Descend to town of Gyangtse over gravelly plains. To reach monastery cross the Nyang or Paina Chu by a stone bridge, 300 paces long (?), and then pass through half a mile of gardens. Gyangtse is 93 miles from Donkhia La or Kamba Jong.

Peshi.—Road lies down the river through a succession of villages surrounded by barley fields. Right and left are stupendous mountain chains.

Penam Jong.—Road as before until opposite to Penam Jong, where willow gardens and thick woods are found by the river. Jong, resting-place and village on right bank of river, which is here bridged.

Shigatse.—As Shigatse is approached villages and cultivation become more frequent, and the country consists of plains and widely extended fields, well-watered by the Nyang Chu. Frequent streams flowing into the river are crossed. The great monastery of Tashi Lhunpo is passed before arrival at Shigatse. Here there is a great daily market, which occupies the whole street between the monastery and the town. There are 3000 monks in the monastery. The Nyang Chu flows into the Brahmaputra, 3 miles north of Shigatse. Total, 145 miles.

FROM GYAGONG TO SHIGATSE, VIÂ KAMBA JONG.

Kamba Jong.—From Gyagong to Kongra La, about 7 miles. From the Kongra La gentle descent (7°) for 1½ miles. Hence 7 miles across plain to Kamba Jong. The fort is circular, about 1500 paces round, and is built on the top of a small mound; the walls, 6 feet thick, are built of uncemented stone.

Guma.—Lungdung village is reached at 5 miles. Hence road to Guma lies over an extensive plain. At 20 miles a road coming from the west from Singsohulung joins road under report. This place is 6 marches distant, and is much used by Nepalese trading with Shigatse.

Bhadur.—Fifteen miles from Guma the road ascends a moderate slope for half a mile to the summit of a pass called the Lasum La. From this pass 7 miles of slight descent leads to the Bhadur plain covered with villages and cultivation. Bhadur consists of fourteen groups of houses, three to the east of the road and eleven to the west; each group contains about thirty houses. Through the middle of the valley a small stream flows gently to the west; the fields are irrigated and manured; the crops are principally peas and barley.

Rabgialing.—Six miles beyond Bhadur is a monastery containing 500 lamas. Nine miles further on is a slight ascent to the pass called the Gampo La, where the road crosses a range of hills with peaks about 1000 feet above the level of the surrounding country; the descent on the other side is 1½ miles long, steep and stony. At the village of Rabgialing, 10 miles from the pass, there is a plantation of dwarf willow trees.

Shigatse.—From Rabgialing the road passes the large villages of Lugri and Lachung,* and meets the road from Ladalek at the south-east corner of the outer wall of the great Tashi-lhumpo monastery. Total, 101 miles.†

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* Not to be confused with Lachung in Sikhim.

† The following works, in addition to the 'Routebook,' may be consulted with profit: 'Himalayan Journals,' by Sir J. Hooker (1854); 'Narratives of Bogle and Manning,' edited by Sir Clements Markham (1876); 'An Account of an Embassy to the Court of the Teshu Lama,' by Captain Turner (1800); 'Journey to Lhasa and Central Tibet,' by Sarat Chandra Das (1902); 'Among the Himalayas,' by Major Waddell (1899); 'The Gates of Tibet,' by J. H. H. Louis (1894); 'Sikhim Expedition of 1888,' by Captain Iggulden (1900); 'Lepcha Land,' by F. Donaldson (1900); 'Itinerary of Route from Sikhim to Lhasa,' by G. Sandberg (1901); 'Gazetteer of Sikhim,' by H. H. Risley and others (1894); 'Sikhim, with Hints on Mountain and Jungle Warfare,' by Colonel Gawler (1876).

73
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71
70
Patagonian Table Lands
600 to 1000 feet
KING WILLIAM IV
LAND
Skyring Wr
PONSONBY
LAND
Bay of
S. Felipe
Northbrook B.
Otway
Water
Gente Grande
B.
MAGELLAN ST
53
Desolation I.
Xaultegua B.
Punta
Arenas
Cordova Pa
Jacques
BRUNSWICK PENINSULA
C. Boqueron
C. Valentin
Useless
Bay
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H
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SANTA INES
ISLAND
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Mission
High
Scrub
C. Forward
DAWSON
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54
CLARENCE I.
Admiralty Sound
Brecknock Pass
Mt Sarmiento
7330
Mt Buckland
D
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Brecknock
Pena
Desolate & uninhabited
Fury
Rocks
Camden
Is
New pass discovered 1901
Stewart I.
O'Brien I.
Gordon I.
55
Londonderry Is
Cook Bay
H
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THE LAND OF MAGELLANES
to illustrate the paper on
THE FUEGAN TRIBES.
by
W. S. BARCLAY.
District of
Ona Indians, about 600, live entirely on land.
Alacaluf Indians, nearly 800, part canoe & part land.
Yaghan Indians, under 200, entirely canoe dwellers.
Track of Ships
Scale of Miles.
20 10 0 20 40 60
Nat. Scale, 1: 2,000,000 or 31·56 miles = 1 inch.
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68
67
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65
53
54
55
Possession Bay
Pt. Dungeness
MAGELLAN STRAITS
Pt. Catherine
Lomas B.
Sheep Country
600 to 1000 ft.
Paramo (Gold washing)
Pampa Land
Salt Lakes
Pta. de Arenas
St. Sebastian Bay
C. S. Sebastian
R. Carmen Silva or Chico
TIERRA
ARGENTINA
R. Grande
Silician Mission
C. Peñas
ATLANTIC
OCEAN
Peaty Swamps
R. de la Turba
R. Candelaria
R. Sauce
Broken hills
Forest
Road Track made by Bridges 1901
L. Deseado
FUEGO
TIERRA DEL FUEGO
C. Ines
C. S. Paulo
R. Ewan
Capelh
Shaierh
Chepelmish L.
Jeuin L.
Lake Fagnano
Very broken country
Hills
Policarpe Cove
C. St. Vincent
C. S. Diego
Thick woods
Mt. Bell
Good Success Bay where Darwin saw Onas for the first time
Valentin B.
Aguirre B.
LE MAIRE St.
Mt. Darwin
The Pyramids
Martial Mts.
L. Roca
Ushuaia
Mt. Olivia
Mt. Cornu
Harburton
Mt. French
Beagle Channel
Gable I.
Dumas Pa.
Picton I.
Ponsonby Sd.
NAVARIN I.
Thickly wooded
C. S. Pio
Gold washing
Oglander B.
New I.
Lennox I.
Pasteur Pa.
Tekenika B.
NASSAU BAY
Sth. American Mission
Hardy Pena.
Grévy I.
Wollaston Is.
Cape False Horn
Seal & Otter grounds
C. Horn

II. JOURNEY TO LHASA.

By G. G. TSYBIKOFF.

The last number of the *Izvestia* of the Russian Geographical Society (1903, iii.) contains a very interesting account of the journey, made in 1900 and 1901, to Lhasa by G. Tsybikoff. The report is accompanied by eight photographs—two of Lhasa, from the north and the east, one of the hill Mar-bo-ri, with the palace of the Dalai-lama, several of the Potala, or palace itself, from different points of view, and two of the Galdan and the Tashilumpo monasteries.

M. Tsybikoff is a Buryat by birth, and a lamaïte by religion, who finished his education at a Russian university, and, after having prepared himself for this journey, went quite openly, like so many other Buryat pilgrims, to Lhasa. There he remained more than twelve months, making an excursion to Tsetan (or Chetan), and visiting some of the most venerated monasteries (after having previously stayed, during his journey to Lhasa, in the Mongolian monasteries of Labran and Gumbum). During his stay at Lhasa he made, moreover, a most valuable collection of books, written by all the most renowned lama-writers during the last nine centuries. This collection represents 319 volumes on philology, medicine, astronomy and astrology, history, geography, and collections of "hu-rums" (praises, prayers, incantations, and so on). It has been presented by the Russian Geographical Society to the Academy of Sciences. The *Izvestia* now give the author's report on his journey.

The caravan, which had left the Gumbum monastery, in Amdo, on May 7 (April 24), 1900, met the first inhabited post of Central Tibet at the northern foot of the Bumza pass; they were waiting for Kozloff's expedition. Proceeding further, the caravan was visited at the Nakchu monastery by the Tibet authorities, and, continuing its journey through the broad Su-shan valley and *viâ* the populous district of Penbu, or Pen-yul, they reached Lhasa on August 15.

Central Tibet, or the provinces of U (*pron.* as French *u*) and Tsan, has not been visited by Europeans for many decades, but Buryat and Kirghiz pilgrims have lately entered it every year, and the diaries of the Buryat lama Zayaeff (eighteenth century), and the Kalmuk, Baza-bakshi (recent), have been published in Russia—the latter, with a Russian translation, by Prof. Pozdnéeff, in 1897.

The portion of Central Tibet visited by M. Tsybikoff can be truly described as "the land of snow," *gairajan-yul*. He saw the snow-clad peak, Samtan-kansar, on the eastern extremity of the Nian-chen-tanla chain, and the snow-clad range Kar-la on the south-western side of the ring-shaped lake Yamdok-tso (*tso*=lake). In their upper parts the valleys are narrow and unsuitable for culture, but in their wide middle courses are entirely covered with cornfields. Most of the

streams dry up in the dry season, but the streamlets and springs supply water to a wide system of irrigation and to the mills. In 1900 the dry season began at Lhasa on September 26, when they had the last rain.

LHASA: GENERAL VIEW FROM THE EAST.

The first snowfall was on December 20, and during the next four months it snowed only ten times; in the valleys the snow thawed next day. As to rains, they began only in May, and during four months (May—August) it rained forty-five times. The coldest month was December, for which the averages were 21° Fahr. at sunrise, 34° at midday, and 37° in the evening; while the warmest month was June, for which the same averages were respectively 57° Fahr., 73°, and 63°.

The population of Tibet has been estimated at from $2\frac{1}{2}$ to 33 millions, of which the first estimate seems to be nearest to truth; of these, one million must be living in Central Tibet. The great numbers of unmarried clergy and the contagious diseases (like small-pox, which took in 1900 about 10 per cent. of the population round Lhasa) prevent a rapid increase. The foreigners are Chinese, Nepalese, Kashmiris, and Mongols—chiefly in the towns of Lhasa, Shigatse, and Gyangtse. Chinese garrisons live in special camps near to larger towns. The Nepalese and Kashmiris are mostly tradespeople, or artisans and artists. The Mongols are mostly lamas on a short visit.

The population consists of nobility (descendants from old feudal princes and from the fathers of the Dalai-lamas, who receive the title of prince from the Manchu kings), the clergy, and the peasants, who are serfs to the two former classes. We omit the further very interesting remarks of our traveller about the manners of living, polygamy and polyandry, and the independent position of women.

We omit also the description of Lhasa, and only remark that M. Tsybikoff confirms the estimate of the pundit Ak. concerning the circumference of Lhasa, and gives to the well-known circular road which pilgrims cover as they walk praying, a length of no more than $7\frac{1}{4}$ or 8 miles. The population of Lhasa hardly exceeds 10,000, of whom two-thirds are women; but the city appears to be more populous on account of the surrounding monasteries and numbers of pilgrims. The chief temples, as also the Potala, or palace of the Dalai-lama, are next described in full.

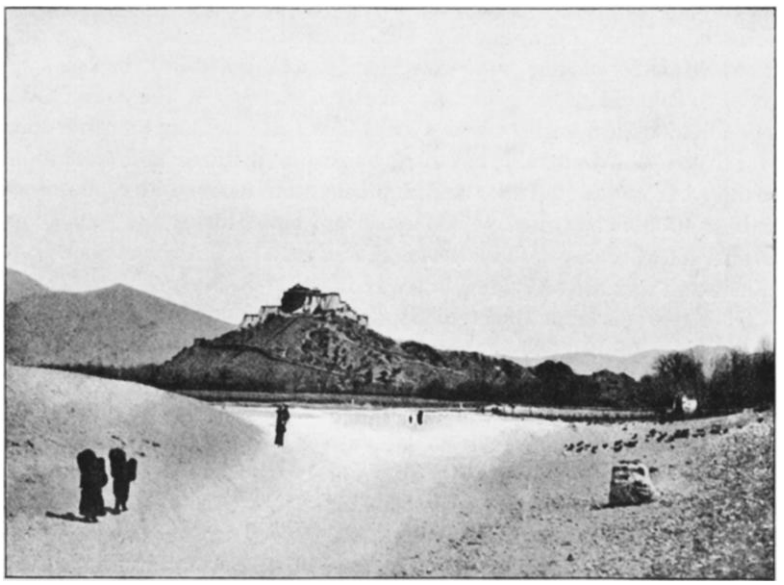
Several important monasteries are situated near Lhasa, the chief of them being Sera, Daibun, and Galdan. The second, 7 miles north-west of the capital, is the largest; Sera (3 miles to the north) comes next, and Galdan (20 miles) is on the south-east of Ui-chu, on the slope of Mount Bsog-ri.* All three were founded in the lifetime of Tsonhava, at the beginning of the sixteenth century, and they have from 15,000 to 16,000 monks (8000 to 8500 in Daibun). These monasteries are now not so much refuges of asceticism as schools for the teaching of philosophical theology for the Lamaite clergy. Still, the Sera monastery is as renowned for its ascetics, who live isolated in their *ritods*, or cells, plunged into contemplation, as Daibun is renowned for its prophets, or oracles, who foretell the future. Galdan, on its side, is famous for its relics.

M. Tsybikoff visited also a few other monasteries. One of them,

LHASA, VIEWED FROM THE NORTH.

Tashi-lhumpo, is situated 167 miles west of Lhasa, on the right bank of the Brahmaputra, which is called Tsan-chu, or Tsanpo-chu, in its

* *Ri* means "a holy mountain."



THE POTALA, LHASA.

course within Tibet. It was founded in 1447, and has now 3000 lamas. The castle Shigatse is less than one mile to the north-east of this monastery, and the town of Shigatse (6000 to 7000 inhabitants) is at the foot of the castle, and has both a Chinese and a Tibetan garrison. The castle is in ruins.

Some 50 miles south-east of this town, in the valley of the Nian-chu, stands one of the oldest towns of Tibet, Gyangtse, advantageously situated for trade with India. Carpets and cloth are made in this spot, widely renowned for its immense *suburgan* (temple), which is five stories high, and has numbers of rooms containing numerous statues of Buddha, some of them very old.

The Sam-yai monastery is on the left bank of the Brahmaputra, 67 miles south-east of Lhasa. It is the oldest in Tibet, having been founded in the ninth century. Its five-storied *sume* (temple), of which the style is both Tibetan and Indian, is its chief attraction.

The town of Tsetan stands 20 miles east of the above, on the right bank of the Brahmaputra, at its junction with the fertile valley of the Yan-lun, and is known for its cloth and the manufacture of the yellow lama caps. It carries on a lively trade, as it stands on the road from Bhutan to Lhasa, while on the Bhutan frontier is the little town Tsona, well known for its fair.

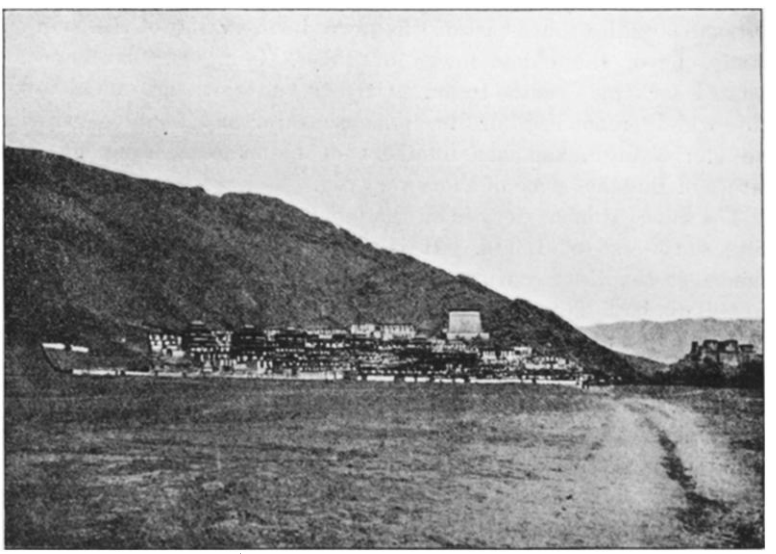
We omit again interesting details about the Dalai-lama and the now prevailing religion, only to say a few words about M. Tsybikoff's description of the administration. It is in the hands of a council

(*devashun*), consisting of four functionaries, three clerical and one laic, nominated by the Dalai-lama. This council nominate the governors of the districts (usually two—one clerical and one laic), or rents the district to some high functionary, usually a member of the council, who keeps his own man on the spot. Thus Tibet is ruled by an aristocratic oligarchy. The judicial procedure, with its tortures and executions, remains barbarous. The standing army, maintained by the state, numbers 4000 men, armed with lances and matchlock guns—all a very peaceful set of men; all Tibetans are, as a rule. Even the robber tribes of Eastern Tibet are anything but warlike.

Tibet receives from India chiefly cloth, velveteen, china, and all sorts of bagatelles of English make—looking-glasses, beads, matches, penknives, etc.; the exports being yak-tails, wool, borax, salt, silver, and gold, and partly yaks, as also some horses and mules imported from China. The chief imports from China are, however, tea, cottons, and silks, and the chief exports are various objects of worship—small statues, books, and the like—as also some Tibetan cloth, yellow caps, and so on. This latter trade is valued at about £10,000 every year, while fancy prices are paid, of course, for the objects of worship, and the returns vary very much from year to year.

As to Mongolia, all trade is carried on by caravans, which are sent out by the monasteries, and the pious collections made for the latter contribute a great deal to the prosperity of the lamas.

After having left Lhasa on September 23, 1901, M. Tsybikoff, after many delays, reached Urga only on April 18 of next year.



MONASTERY TASHI-LHUMPO.

It must also be said that about the same time, that is, at the end of 1899, the Russian Geographical Society took advantage of the offer of a Kalmyk, O. M. Norzunoff, who was going to Lhasa, and provided him with a good photographic apparatus. They are some of his photos that are reproduced now in the *Izvestia*, while those of M. Tsybikoff are still more interesting. Full lists of both series (sixty-six photos) are given in the *Izvestia*, with explanations.

BRITISH EAST AFRICA: FROM THE RAVINE STATION, FORT NANDI.

By Sir C. N. E. ELIOT, K.C.M.G., C.B., H.M. Commissioner.

ON August 5, 1903, we left the Ravine station, where my barometer registered an altitude of 7350 feet, or 100 feet higher than marked on the Intelligence Division map of Uganda (sheet 4), and marched about 12 miles through a forest of good timber in a west-north-westerly direction. We followed the old trade route, and had some difficulty in crossing the Es-saigiri (Tigrish or Tigrik) river, which was much swollen by the late rains. We camped on a salt-lick,* called by the Uas N-gishu the Ol-are le lang'alang. Height, 8250 feet. The L-uas N-gishu, or Uas N-gishu, are a clan of the Masai who formerly inhabited the great plateau called A-ng'ata † nanyuki (red plain) to the east and south-east of Mount Elgon. The name is probably taken from the words E-uaso, "a river," and N-gishu, "cattle." It, however, does not mean the "river of cattle," as stated by Sir H. Johnston on p. 798 of 'The Uganda Protectorate,' for this would be E-uas'o n-gishu. Uas likewise means "striped;" striped cattle, however, would be N-gish' uasin. Ol-are (*pl.* l-areak) means "salt-lick;" -lang' means "to cross" (a river, etc.), and the reduplicated form refers to the repeated crossings necessary before one's arrival at the lick in question (-lang'alang' also means "to light").

August 6.—We continued through the forest and along the old trade route in a north-north-west direction, camping, after a 10-mile march, at a spot called Araien, near a grove of bamboos. Patches of good grass-land were met with in several open places in the forest. Altitude, 8400 feet. Whilst out shooting in the evening, I saw a herd of thirteen roan antelopes.

August 7.—About 2 miles after leaving camp we crossed the E-motian swamp, which runs from north to south some distance, probably some miles. E-motian means "the quiver" in Masai. Six miles further on we arrived at the waterfalls of the E-uaso en essoit, a rapid stream which flows into the En-dó, or Kerio river. The meaning of E-uaso en es-soit in the Uas N-gishu dialect is "the river of the stone."

* A salt-lick is a brackish marsh or salt spring where the cattle are driven once or twice a month.

† *Ng'* is pronounced like *ng* in singer.

By the Masai it is called "E-uas' os-soit." This river is marked Nesoi on the Intelligence Division map. We marched for another 4 miles over rolling plains in a north-north-west direction to a swamp called by the Uas N-gishu, Em-bash' en o l-kekun, and by the Masai, Em-bash'o l-kekun, which means "place of the banks," *i.e.* "there is room on the banks (for camping)." Altitude, 8400 feet.

August 8.—After marching 8 miles in a northerly direction we reached a swamp called Ol-akapyemit, where our mules had some difficulty in getting through. Later on we crossed a river called En-airasarasa three times, and another river called the Naibor Tuli. We covered about 15 miles in all through good grazing country, and camped at a swamp called Es-siton o l-apitiogoriok. Height, 8200 feet Ol-akapyemit is the name of a tree. En-airasarasa means "wooded spot." Naibor Tuli (En-duli naibor) means the "white buttock." Es-siton o l-apitiogoriok is the name of a fruit. The game about here consists of Jackson's hartebeest, water-buck, buffalo, reed-buck, and oribi. The Anderobo hunt a good deal, and everything is consequently very wild.

August 9.—A 7-mile march in a northerly direction brought us to the En-osigelai river, which is otherwise called Ang'-ar'es-sinandi (the Nallosegella of the Intelligence Division map), and 5 miles further on we arrived at the L-nolmosigeyui river. We camped a mile nearer the hills on our right, on a swamp called N-jorá. Height, 7900 feet (7800 on the Intelligence Division map). According to tradition, there was once a tribe of people called L-osigelai, who were driven out by the Nandi and settled on the Ang'-ar'es-sinandi, which river was afterwards named after them. Sir H. Johnston calls them Essegelli and says they were agricultural Masai ('The Uganda Protectorate,' p. 789). The older name, Es-sinandi, is the name of a tree. Ang'-ar' means "water." L-nolmosigeyui is the plural form of a fruit-bearing tree. En-jorai is the Masai for mimosa (*pl.* N-jorá). Our guides informed us that the En-airasarasa and the Naibor Tuli flow into the Ang'-ar' es-sinandi.

August 10.—We climbed to the top of the El-geyo * escarpment, the latter part of the way through dense forest, where great care had to be taken to avoid the elephant pits. From the top we enjoyed, in spite of the haze, a glorious view of the valley which separates the El-geyo and Kamásia escarpments. The country is apparently fertile and thickly populated, as we saw shambas and villages on all sides. We were able to trace for some distance the course of the Endó or Kerio river, which flows into Lake Rudolph, and we noticed a lake called Kam-enarok.† At mid-day we returned to our camp of the night before, and later on proceeded in a westerly direction towards the Sirgoit rock, taking our firewood with us, as little or none is to be found except on the banks of the rivers. We camped after a 3-mile march at a nameless swamp.

* This should be L-geyu. One man of this tribe is Ol-geyuni.

† The black water (L-geyu).

The altitude at this spot was 8000 feet. Near this camp we saw for the first time the ruined stone kraals which are to be found everywhere on the Uas N-gishu plateau. These ruins are called Mokwan by the Masai and Uas N-gishu, and, according to tradition, they were built by people known as Sirikwa, who died out on the arrival of, or were driven out by, the Uas N-gishu. The kraals are built of boulders or rocks quarried from the outcrops of stone on the plain. These boulders are often piled one on top of the other to a height of 5 or 6 feet, with an upright one at the corner. They are oblong or square in shape, and some have small bastions. The cattle were evidently herded in the centre of the kraals, and the people perhaps lived in huts, the outside walls of which were formed by the outside walls of the kraals.

August 11.—We reached the foot of the Sirgoit rock (Sirgoi on the Intelligence Division map) after a 6-mile march. This rock has four peaks, the highest of which is called by the natives Es-sirgoit, and the other three is-surutia, or "earrings." From the highest of these surutia we enjoyed an extensive view of the plains on all sides. We also saw a small lake or salt-lick to the north called Ol-are l'es-sirgoit, and to the north-north-east the Karuna hill. North of Karuna are the Os-sagati and O-gwalal hills, and north-west of them again the Kyapkerang'ain or Chibcharang'an range (Mount Chibcharagnani on the map). In the afternoon we marched about 6 miles in an east-south-east direction, and camped on a small swamp near the L-nolmosigeyui river, at an altitude of 7500 feet. The game near the Sirgoit rock was fairly tame, and is probably not much hunted by natives. Jackson's hartebeest, reed-buck, and oribi are very common. There were also a few herds of zebra; and eland, elephants, and ostriches are reported to be plentiful, though we saw none.

August 12.—We marched in all about 11 miles in a southerly direction, crossed the L-nolmosigeyui and Ang'-ar'es-sinandi or En-osigelai rivers, and camped on the Naibor Tuli (height, 7500 feet). The whole country appeared to be good grazing land, but there is a great scarcity of firewood except on the banks of the rivers.

August 13.—Early in the morning we saw Mount Elgon. This mountain is called by the Masai Ol-doinyo lo l'gon, the "mountain of breasts," but it is better known by its native name, Masawa. We marched in a south-south-west direction, and took about six hours to do 12 miles. The whole plain was swampy from accumulated rain, and we had considerable difficulty in crossing the following rivers: En-airasarasa, En-olkijata, En-asambul, and En-aiururr. The meaning of the first of these rivers has been given, the second and third are the names of trees, and the last means a "waterfall." The En-olkijata is marked on the Intelligence Division map as R. Walerie, and the En-aiururr as Leosos. On the former we saw between 10 and 20 lions. At our camp on the En-aiururr my barometer registered 7400 feet. Shortly after passing the En-airasarasa river we noticed a small range of hills

running from north-west to south-east between us and the El-geyo escarpment. These hills are marked on the Intelligence Division map, but they are made to run nearly up to the L-nolmosigeyui river. They are called L-gek oiperi (lit. trees for cutting) and the Taragwa hills. Ol-daragwai or En-daragwai is the Masai for a juniper tree.

August 14.—After a 5-mile march in a south-westerly direction we reached the Tergée * river, and shortly afterwards we crossed the Ol-esos river, leaving a salt-lick called Ol-are l'ol-esos behind us. The words Ol-are l'ol-esos have possibly been wrongly copied on the Intelligence Division map as the rivers Walerie and Leosos. We passed to the west of the Ol-aruas, Ol-esos, and Koiseka hills, and shortly afterwards cut into Sclater's road, continuing along it for about 10 miles in a westerly direction. We camped some 3 miles from the old Nandi Boma (Kipturi's), at a place called Kyapkiribisi, in the Kyaptalum country. Height, 7200 feet.

August 15.—After a march of about 14 miles we reached Fort Nandi. Altitude, 6750 feet.

NOTES AND SUGGESTIONS ON GEOGRAPHICAL SURVEYING AND PRACTICAL ASTRONOMY SUITED TO PRESENT REQUIREMENTS.†

By E. A. REEVES, F.R.A.S., Map Curator and Instructor, Royal Geographical Society.

THE advance of geographical exploration and discovery during the last fifty years has been so rapid and continuous, that there remain at the present time few parts of the Earth's surface that are entirely unknown. With the exception of the polar regions, and certain very limited areas of Central Asia, Africa, and the other continents, the pioneers of Western civilization have penetrated into all the remote parts of the world, and brought back with them some account of the lands they have visited, from which it has been possible to fill in the large blank spaces that were but a few years ago so conspicuous upon our maps, although in many cases the cartographical material from which this has been accomplished is far from satisfactory. It is therefore true that, to a great extent, the romance of travel is fast disappearing. The grand old days of Columbus, Drake, and Cook are gone, never to return; and even to come much nearer to our own times, it is impossible for a future Livingstone or Stanley to penetrate into vast unexplored regions, however fearless and intrepid explorers they may be. The one exception is, perhaps, in the neighbourhood of the poles, but even here recent activity has considerably diminished the unexplored areas.

Although it is thus a fact that the work of the pioneer explorer of the old order is being brought to a close, yet that of the true scientific traveller and surveyor is but beginning. Far from it being the truth that the work of the Royal Geographical Society is coming to an end, we there are, in a sense, but making a commencement in our science, and beginning to obtain a correct idea of the Earth upon which we live, its natural phenomena and inhabitants. This is true in every branch of geography, but especially is it the case with reference to that

* En-dergé is the name of a tree.

† Paper read at the Southport Meeting of the British Association, Sept., 1903.

The Paper on British East Africa is not by Sir Charles Eliot, but by Mr. A. C. Hollis.

most important one, that which lies at the foundation of all the other branches, and upon which all these must necessarily depend—the accurate measurement of the Earth itself, the correct fixing of positions upon its surface, and true delineation of its natural features. Herein lies the work of the future geographical surveyor. The days of rough route-mapping are past. A man who only makes a hurried journey through some imperfectly known district, without proper previous training, and who is able, consequently, only to bring back with him a rough prismatic compass sketch of the route he has taken, will, at the present time, find that he has not rendered any great service to geography—in fact, it is quite likely that his labour will be found to be of no value whatever. That sort of work might be all very well in the early days of exploration, but what is wanted now is something better and more reliable—survey work which will take the place of first approximations and rough sketches, and which, if not possessing the extreme accuracy of a complete trigonometrical survey, shall at least have some scientific basis, and be far more reliable than anything previously existing. This is an important point, for it is quite painful at the present time to inspect a route-map made by a man with evident pains (but without any pretence at scientific accuracy), of a journey he has undertaken through perhaps some part of Africa, and of which there are possibly far better maps already in existence. There are hundreds of these route maps, so called, in the Royal Geographical Society's map-room, and many of them intended to represent the same district; but so extremely rough are they, and so little do they resemble one another, that no one would be aware of this fact but for the title they bear. But, further, even when there has been an attempt to correct the position of the places by astronomical observations, it is surprising what crude ideas are often possessed by those responsible for the work, and, through want of previous training and knowledge, it has frequently happened that these so-called "observations" are but delusions and snares, and give the maps an appearance of accuracy which they in no wise deserve. Not long ago I was requested to work out some observations into which time entered as an important factor, but I could make nothing of them; and, upon inquiry, was informed that the times were taken with a half-crown clock bought at Cape Town, and which was without a second-hand. However, the observer told me that he thought the times were near enough.

What is wanted for the future is not this sort of mapping work, but something far more reliable; and let the future surveyor in imperfectly known parts of the Earth remember that, although there may be less romance attached to the journeys he may make than there might have been fifty years ago, and less opportunity for the exercise of his imagination, by previous study and training, by providing himself with more reliable instruments, and generally aiming at a far higher standard of accuracy than his predecessors, he will be able to replace fiction by fact, much that is doubtful by certainty, and the approximation by actual truth.

We have, I believe, arrived at an important epoch in the progress of the science of geography, and this fact is, I feel sure, recognized by all its leaders, in whatever branch their special field of labour may lie. For my own part, and in that department with which I am particularly concerned, I am convinced that this is the case. We are, so to speak, to begin afresh now in earnest in our search for truth, to go over our work again, with the object of producing a cartographical representation of the "new lands" of the Earth, for the first time based upon true scientific principles, and upon systematic geographical surveys, which shall give a far more correct representation of these countries than have so far been possible. How is this best to be accomplished? This is the important question, and the one upon which I desire now to offer a few remarks, and to which I have naturally given considerable attention.

In a brief paper such as this, it is, of course, impossible to do more than deal in the broadest generalities with so vast a subject, and I shall not attempt anything further than to indicate the lines upon which it appears advisable to work in the future, and a brief mention of some of the more important instruments and methods which a surveyor is likely to follow with the best prospects of doing the work that is now required of him, and produce a fairly reliable map.

In the first place, I would call special attention to the excellent opening address of Sir Thomas Holdich, as president of this Geographical Section of the British Association last year, which is published in the number of the *Geographical Journal* for October last. Apart from giving a good general idea of what has been accomplished, he sets forth most clearly the work that remains to be done in the future, and I feel sure that many who have not read this paper would profit by a careful consideration of it.

In what I am now about to state, and the lines of operation I propose to lay down, I shall be guided a great deal by the course of instruction of the Royal Geographical Society as it is at present arranged, for the reason that considerable attention has lately been given to this matter, and every attempt is being made to make this course, as far as circumstances will admit, suited to modern requirements and conditions.

In the first place, before starting upon a surveying expedition, it is important that full inquiries should be made as to what has already been accomplished, and as to whether any points have been fixed previously, with sufficient accuracy to form a basis for future work. It may at first seem superfluous to call attention to this, but experience shows that this is not at all the case, and instances could be mentioned where extremely rough independent sketch-maps have been made through districts which have been known and mapped with greater accuracy before, and it often happens that, through not knowing what has been done beforehand, a traveller attempts to fix the position of places upon his map independently, with some small portable instrument that can only give an approximate result, when the latitude and longitude has been previously determined with fair accuracy.

With the recent rapid advance in the construction of telegraph lines, railways, boundary delimitations, and other surveys of considerable exactitude, the regions of the Earth's surface where an explorer is likely to be so situated that he will find no fixed points to which his mapping can be adjusted, or which will serve as starting-points for his surveys, are becoming fewer every year, and it is to be hoped that in a time not far distant lines of triangulation will be carried across all those regions of the Earth that are likely to be settled by Europeans. In Africa remarkable progress is already being made in this direction, and, what with the transcontinental telegraph line, the important geodetic base-line now being undertaken in Rhodesia; the Sudan, Uganda, Rhodesia, and other railways; the Nyasa-Tanganyika, Anglo-Portuguese, Sierra Leone, Abyssinia, and other boundary surveys; the work of French and German officers in West and East Africa, and other important surveys which cannot now be referred to, the traveller who is starting upon a surveying expedition in that continent will, even at the present time, stand a good chance to find some points upon which to base his work—points which have been fixed with greater accuracy than he will be likely to obtain during a hurried journey, and with the small portable instruments generally carried on such occasions. Then, again, in the case of Asia, full inquiry should be made as to what survey work has been done in the region to be visited, especially anywhere near the trans-frontier regions of India, where many points have been fixed with considerable accuracy by triangulation. The same remarks apply to other parts of the world, although of course there are still regions in all continents, except perhaps Europe, where nothing at all reliable in the way of

survey work has yet been attempted, and in which the traveller will be thrown entirely upon his own resources, and have to fix the position of places by the best means possible under the circumstances in which he may be placed.

Apart from the ordinary rough methods of route surveying with prismatic compass, which, if unchecked by some means or other, can only give the approximate and discordant results, alas! so familiar to many of us, there are, therefore, two methods of procedure open to a traveller who has a knowledge of practical astronomy and surveying. The first is that of making use of points accurately fixed already, extending the map by triangulation from these, and filling in detail between them; and the second, the independent method which has to be resorted to when no fixed points are available, and in which case positions of important stations have to be determined chiefly by astronomical observations before the filling in of detail can be undertaken. Upon these two methods I now venture to make a few remarks.

Where good points are available, as has been already stated, the former should be adopted, as it is far more likely to yield good results under ordinary circumstances than the latter, and therefore this shall be considered first. But, to begin with, there are important preliminary matters to be attended to, which apply equally to whatever method of survey is followed, such as the selection of instruments, the most suitable scale and projection for work in the field, and other things which should be fully discussed and settled before commencing work. As regards instruments, it is generally quite out of the question to take a large zenith telescope, and first and foremost in the geographical surveyor's outfit comes the transit theodolite. I am perfectly aware that there are times when it is even impossible to carry a theodolite, owing to its size and weight, and the more portable substitute, the sextant, has to take its place; but, from a somewhat lengthy experience of the work done with both of these instruments, I would strongly recommend that a good theodolite should be taken when it is at all practicable, and I have often found, in conversation with travellers, that the difficulty concerning its carriage is more imaginary than real, or, if it actually exists, it can be frequently overcome by a man who is intent upon doing good work. Other things are often taken of greater weight and bulk, but of much less importance, than a 6-inch theodolite.

However valuable the sextant may be to the mariner, and notwithstanding the good work that can be done with it on land by a capable man, my experience has convinced me that a good theodolite is the instrument for a surveyor, not only because it is more generally useful to him for all kinds of work, but on account of the greater accuracy of the results obtained. To take latitude as an example, with a 6-inch theodolite, a good observer, with an instrument of the most approved pattern, ought certainly to get a mean result from two sets of circummeridian altitudes of north and south stars that will not be more than one or two seconds in error, and, in fact, this is being done continually by gentlemen working with me; but with a sextant I should not like to trust the latitude to at least 10 seconds, even when the altitudes have been taken with the best instrument and by a most experienced observer, although, of course, results sometimes come out nearer than this. I should like to say a good deal more about the comparative merits of these two instruments, but time will not permit. There are, however, occasions when a sextant is the only instrument that can be taken for astronomical work, and in this case the most serviceable one is, I think, a 6-inch, reading to 10 seconds, to be used in conjunction with a folding roof mercurial artificial horizon.

Now, as to the kind of theodolite best suited to the surveyor in little-known countries, I cannot do better than recommend a 6-inch transit theodolite, reading with micrometers on both vertical and horizontal circles to 5 seconds, and by interpolation to 2 seconds, or failing this, by verniers to 10 seconds. It should,

of course, possess a complete vertical circle, and care should be taken to see that the telescope reverses freely when using either the direct or diagonal eyepiece set at focus. This is an important point, and one that is often overlooked. The level should be fitted to the vernier arm of the theodolite, and not on the telescope, as is the case with some instruments. This is most important for exact results, to obtain which the level readings have to be noted, both for "face right" and "face left" observations, and a correction for dislevelment applied to the mean altitude. When the level is on the telescope itself, this is impossible. The diaphragm of the telescope should be fitted with a horizontal wire and at least three vertical wires, which should be well illuminated for star work, and there should be only three levelling screws. The telescope might also be arranged to take a subtense diaphragm with two movable wires. These are some of the more important points to be considered in selecting a theodolite. There are others which I have not time to refer to now, but I shall be glad to give any advice in my power privately, if so desired. There is, however, one other matter upon which I must say a few words, and that is the magnetic needle; especially as our worthy President, Captain Creak, has, in conjunction with myself, lately given serious consideration to this matter. The trough compass needle of the plane-table kind, which should be made to reverse, is much to be preferred to the circular compass usually fitted to the theodolite, but even this is often far from what it should be, especially in reference to the method of setting. It is true that the magnetic bearing, when the needle has been made zero, can be read with an appearance of great accuracy by means of the verniers, but it is often with an appearance of accuracy only, as the means of setting the needle to zero is usually extremely rough. Several improvements have, however, been made recently in this matter, which it is to be hoped will facilitate greater accuracy; for although it is true that no good surveyor will make his map to depend upon the magnetic needle, yet there is no reason why he should not, as Captain Creak has pointed out, bring home with him valuable determinations of the magnetic declination in the regions visited.

For the first method of survey, previously referred to, the instrument next in importance to the theodolite, or its substitute the sextant, is doubtless the plane-table, and I will now say a few words upon this. In the first place, it should be as simple as possible, consistent with accuracy. It should not be unnecessarily large or heavy, and no attempt should be made to combine it with a theodolite. At the same time a simple telescope with cross-wires, which can be moved vertically through a few degrees, is a great assistance in distinguishing distant points, and for sighting on to points of considerable difference of altitude. I have had a telescope constructed upon an alidade which can be folded into a flat box, and it thus takes up very little more space than the ordinary alidade. This adds but little to the cost of the instrument, and the advantage gained is well worth the additional sum. The method of clamping the table is often faulty, and I have found a horizontal slow-motion screw, which I have fitted to the instrument, a great advantage. A small clinometer or vertical arc to give approximate angles of altitude will often be useful. For ordinary purposes a table measuring about 2 by $1\frac{1}{2}$ feet is perhaps the most serviceable, but for mountaineering expeditions one much smaller and lighter could be employed. The plane-table deserves to be more generally used than it has been, as even for traversing it gives better results than a prismatic compass. Of course, there are other instruments a traveller should take with him, such as half-chronometer watches, a portable barometer (George's is perhaps still the best), boiling-point thermometers, aneroids, etc.; but of these there is no time to speak now, although I feel compelled to say a few words about the watch. This should be of first-class manufacture; that in a water-

tight case of the pattern recommended by the Royal Geographical Society is perhaps the most suitable and reliable, although it is quite a mistake to imagine that any chronometer or watch will keep a perfect rate when travelling, and even if observations are taken as often as possible to obtain the rate, it has been found practically impossible to carry Greenwich time with the accuracy required for good results in longitude, and for this very reason geodetic longitudes, depending upon previously fixed points, are generally to be preferred. Still, good watches are important, as differences of longitude can often be obtained by them, in conjunction with careful observations for local mean time, with considerable accuracy, especially if the route passes between the places more than once, and careful observations have been taken for rate.

The scale and projection most suitable for work in the field next call for consideration. The former must of course depend, in great measure, upon the area to be mapped, the time that can be given to the work, the amount of detail required, and several other considerations; but for ordinary purposes of geographical mapping, perhaps the most serviceable is that of 1 : 250,000, or 3·94 miles to an inch. This has, I believe, been adopted at the Intelligence Division of the War Office as their usual scale for work in the field, and has proved to be satisfactory. It differs but little from the 4-miles-to-1-inch scale adopted for trans-frontier work in India. This scale admits of the leading features of a country being represented, and at the same time enables a surveyor to include a fairly large area upon his plane-table sheet. Where more detail is required, the scale of 1 : 125,000, or little larger than 2 miles to an inch, has been found to answer well; and, in fact, one of the maps, from their own surveys, that gentlemen working with me place before the examiners as a part of the work they have to do in order to obtain the Geographical Society's diploma, is upon this scale. But whatever scale is adopted, let it be some proper multiple of the 1 : 1,000,000, which is now taken as the standard or unit for all maps. In connection with this question of scale, it is most important that a geographical surveyor should learn how to generalize the physical features of a country, and be able to represent, in the first place, the leading characteristics of the region to be mapped, without giving undue prominence to detail, the amount of which must necessarily depend upon the scale adopted. This is not such an easy matter as it may appear at first, and requires considerable previous training. It is not at all unusual to find that a man has crowded his map with small hills and tiny streams, giving them an importance which they do not really possess, and at the same time altogether omitted to bring out the leading features of the region, which he has, indeed, often quite failed to grasp. One great thing for a geographer, as for all students of nature, is to learn to generalize, and for this previous training is absolutely necessary. Here a man who has some knowledge of geomorphology and physical geography has the advantage, and he is likely to bring home a far better map of a country than one who has not. Before commencing the practical survey work in the field, I generally find it worth while to take gentlemen over the ground to be mapped, and give them some idea of the characteristic structural features. The Oxford and Cambridge schools of geography are doing excellent work in this direction, and the fruit of the instruction there given will doubtless be apparent in the work of the geographical surveyor of the future. I should like to say more about this, but time will not admit. However, later on I may have occasion to refer to the subject again in reference to the drawing of the map and the delineation of physical features.

The next question to be considered is that of the projection, for unless the area to be surveyed is extremely small, some proper projection must be employed

to allow for the spherical form of the Earth, convergence of meridians, etc. This is a matter that has received considerable attention of late, and the general conclusion is that that usually known as the "Survey of India Projection" is, taking all things into account, the most suitable for the geographical surveyor to adopt for his plane-table work in the field. This projection is extremely simple, and merely supposes a small section of the curved surface of the Earth—say a degree square—to be planed off, when upon this plane surface the natural features of this small area can be represented without appreciable distortion. Several sheets can afterwards be joined together without much difficulty, but of course the distortion would appear if it were attempted to join many of them. Strictly speaking, each sheet is a separate projection. Tables have been computed to facilitate the construction of this projection, and these will be found in the 'Auxiliary Tables' of the Survey of India, the Chatham School of Engineering 'Handbook of Military Topography,' the R.G.S. 'Hints to Travellers,' and elsewhere.

So far all that has been said applies equally to the work of the surveyor, whether his map is to depend upon points previously determined, or he has to undertake an entirely independent survey. I will, however, now attempt to give a very brief outline of the process which it would be advisable to follow in each case.

In the first place, having made his projection, and constructed his diagonal scales—one of miles and decimals of a mile—and others to read seconds and decimals of seconds of latitude and longitude, the surveyor proceeds to place upon his plane-table sheet, in their exact latitudes and longitudes, as many of the fixed points as are likely to be of service to him. He should now set up his theodolite at one of the fixed points, or if this is quite out of the question, should set it up in some position from which he will be able to extend his survey in the line in which he is about to travel, and take angles to the fixed points from which he will be able to compute his new position. Making one fixed point zero, rounds of horizontal angles, both "face left" and "face right" and reading both A and B verniers, should now be taken, and the vertical angles observed, to all the more important distant peaks and other prominent objects, being careful to note the level readings. This same operation should, if possible, be repeated at several of the fixed points, and the surveyor will then be furnished with the means of computing geodetically, with considerable accuracy, the latitude and longitude of the new points observed, allowance being made for spherical excess where the distances are great. When computed, the latitudes and longitudes of these points should be tabulated. It sometimes happens that it is impossible to do more than make one fixed position a starting-point, in which case the theodolite should be set up in this position, and making some distant point in the line of march, which can afterwards be visited, the zero, a careful round of angles should be taken to all prominent objects that are likely to be seen later on from another position. Now, before the theodolite is moved, with the same distant point still zero, take careful observations for the true bearing of the distant point made zero, which can be done by east and west stars, reading at the same time as the altitudes the horizontal angle between the object and the star. From these observations it will be possible to compute the true bearing of the zero line with considerable accuracy. Later on, when the point made zero is reached, set up the theodolite, and, sighting back at the station left, which must now be made zero, repeat the operation. At this new position careful observations must be made for latitude, by circummeridian altitudes of north and south stars. As before stated, the latitude resulting from these observations, if carefully taken with a good 6-inch theodolite, should not be more than one or two seconds in error. With the latitudes of these two stations

and their true bearings known, it is possible to compute the distance between them, and their difference of longitude, with considerable accuracy. There is not time now to go into this matter fully, or to do more than suggest the method that might be followed. I shall be glad to go into detail afterwards with any one who wishes to know more about it, but it is dealt with in several good books on surveying. Special tables are given to facilitate the computations in the 'Auxiliary Tables' of the Survey of India and the Chatham Royal Engineers, 'Handbook of Topography.' Briefly, the computation consists of a suitable arrangement of the ordinary formulæ of spherical trigonometry, after first correcting the sides of the triangle, which are the co-latitudes of the two stations for the compression of the Earth. This, which is generally known as the latitude and azimuth method, is certainly the best means of obtaining an astronomical base-line for a survey, and when it is impossible to get a base by actual measurement or extension of triangulation, I would recommend that it should be adopted. In this matter I can now speak from considerable experience, for one of the maps, which takes in area of over 150 square miles, which my pupils present at their examinations, depends entirely upon a base-line obtained in this manner, and this base is rarely found to be more than 50 feet in error in a distance of over 9 miles, or say, an error of about 1 foot in 1100 feet. Sometimes the results come a good deal nearer, and this is by no means an exceptional degree of accuracy, for it is often repeated, although fresh base-lines are chosen. I do not, of course, recommend this method of getting a base-line when an actually measured one can be obtained, but on a journey, when time is pressing, it might often be adopted with advantage, although its value depends a great deal upon the general direction of the route, for on an east-and-west route it could not be used. By this method a survey can often be continued for a considerable extent, the operations being repeated from other stations, and rounds of angles again taken. The map should, however, be checked by measured bases wherever possible. When at all practicable, the length of a base line should always be obtained by actual measurement. A mile base can be chained three times over (to give a mean value) easily in a day, whilst from the two ends of it observations are taken with the theodolite, latitude and azimuth being only determined at one end. With the Jaderin apparatus the process would be far quicker. Observations can be computed at night, after being taken as soon as the stars are visible, and latitudes and longitudes (latter assumed at the base end) of observed points ready for projection on plane-table in early morning. As the party moves on past the points observed, a new base should be measured, and its position interpolated by computation from the old points (even a plane-table interpolation is good enough for the topographer), fresh points observed, computed, plotted, and utilized for topography; and so on, measuring bases at every opportunity. In this way a party of two surveyors and five or six chainmen can move at marching pace (say, 20 miles a day), and keep up continued mapping on favourable ground when good points are plentiful and visible. When it is impossible to see more than a short distance, traverse with the plane-table, get distances with pedometer or perambulator, and check with latitudes each night. In this way mountain-climbing is reduced to a minimum. The vertical angles will furnish the means of obtaining the relative altitudes of different stations, care being taken to correct for curvature and refraction. The system of exact contouring is generally out of the question, except in large-scale plans of small areas, and the general indication of the relief by horizontal "form lines" is, perhaps, the best to adopt, with as many fixed heights as possible given, not only of hills, but of valleys and low-lying lands as well.

So much for an outline of the theodolite part of the work, but now for the plane-table. With this instrument the observer should proceed to fill in detail between the triangulation points, starting from one of the fixed positions, and orienting his table by others, if possible; but where this cannot be done, he must find his position and orient his board by one of the applications of the three-point problem. Unless absolutely unavoidable, the magnetic needle should not* be employed for this purpose, as it can never be relied upon; and even if it is found necessary to make use of it occasionally in traversing, the surveyor should check his position by the three-point method as often as possible. Having determined his position and oriented the board, he then proceeds to fix as many other points as possible, drawing rays to all prominent objects, bends in rivers, etc. Even if the intersection of two rays drawn to any distant object should give a very bad angle, it is often well to draw the rays, for they will give a rough idea of the position, and assist in the identification of the point when it is seen from another position later on, which is often a very difficult matter, owing to the various forms an object, such as a distant peak, will assume when seen from different positions. The plane-table surveyor should not, however, be content with merely fixing points; another important part of his duty is to sketch in the topographical features of the district, and this should be done as far as possible on the spot, and at the time—not afterwards from rough notes and sketches. These latter are all very well, and will assist in making the final map, but the leading features should be drawn at once upon the plane-table. As examples of this method of surveying, I might mention the maps of Captain Deasy and Dr. Stein in Central Asia, and several others.

We now come to the other part of the subject, in which it is supposed that the explorer is so placed that he has no fixed positions to work from, and has to depend entirely upon his own determinations of latitude and longitude. The suggestions I have to make at the present time upon this subject must necessarily be very brief, and I cannot do more than indicate what appear to me to be the methods of operation most likely to give the best results, without attempting to deal with them fully. I shall be delighted to give fuller information to any one desiring it privately, but he cannot do better than consult the standard works on the subject, such as Chauvenet's or Loomis's 'Practical Astronomy,' 'Manual of Surveying for India,' 'Notes on Astronomy,' of the Chatham School of Military Engineering, the R.G.S. 'Hints to Travellers,' Wilson's 'Topographic Surveying,' Godfrey's 'Astronomy,' and several others I could mention.

On arriving at his field of operation, the first thing a traveller has to do is to get a good determination of the latitude of some place with a theodolite, which will serve as a starting-point for his proposed survey. There ought to be little difficulty about this, especially as it is not necessary to have exact Greenwich time for the purpose. The latitude should be fixed by circummeridian altitudes of north and south stars, and the altitudes, which must never be low, should, if possible, be taken both east and west of the meridian in each case, the hour angles not exceeding 15 minutes. In northern latitudes the pole star can often be taken as the north star, and the latitude computed by the Nautical Almanac tables. When care is taken in interpolating the differences between the quantities given in these tables, the proper proportional part being allowed in each case, sufficient accuracy can be obtained by this method of computation. We often get results differing not more than a second or two from the latitude as given on the

* The needle is very useful in order to get the first approximate orientation of the plane-table, and is always a useful check against mistakes in the identification of points.

6-inch Ordnance Survey. The latitude resulting from the meridian altitude of the south star will serve as the approximate latitude necessary for the more exact method of computation of this star.

It is most important that all observations should be balanced, and therefore the mean latitude arrived at from the results obtained from several stars passing the meridian to the north and south of the zenith should be that finally adopted. The other methods of obtaining latitude, of which there are, of course, many, do not as a rule give such good results; the double altitude method may be useful in cloudy weather, and, indeed, if a halt of some duration cannot be made, this has often been found to be the only available means of obtaining latitude. It must, however, be remembered that this method cannot be adopted with any satisfactory result if there is not a considerable change in azimuth corresponding with the change in the hour angle, or, in other words, it is useless when the declination and latitude are nearly the same.

Having obtained the latitude, the next thing is naturally to find the longitude,* and this is a far more serious business; not that there are any great difficulties in the way of the observations or in the computations, but the trouble lies in the fact, which has already been referred to, that it is almost impossible to carry Greenwich time. The best watches and chronometers, notwithstanding their many improvements, cannot be depended upon to keep a rate sufficiently reliable for giving the longitude with the accuracy now required, although they may go all right before leaving home.

The construction of ships' chronometers and half-chronometer watches has reached great perfection, and they go remarkably well under ordinary conditions, but it is quite another thing when either watches or chronometers are subjected to all the vicissitudes and oscillations which they must inevitably meet with on a long overland journey. True, careful observations may be taken for rate, but even then the difficulty is not anything like overcome, and I can assure you that the wasted labour and disappointment of travellers who have trusted to their watches for Greenwich time is lamentable. Doubtless, the best watch that a traveller can take with him is one of the R.G.S. pattern, a half-chronometer in water-tight case; but he must not rely implicitly on this, and should certainly take at least three of them. I have come to the conclusion that if a traveller is away from all telegraphs, and has no points the longitudes of which have been fixed, and no means of obtaining Greenwich time apart from his watches, the best thing he can do is to get differences of longitude between the various stations upon his route, by the latitude and azimuth method previously described, if possible; or, failing this, to fix the relative longitude of places in reference to one station, which should be taken as the standard, by the "meridian distance" method described in the 'Hints to Travellers,' for which purposes his watches ought to go sufficiently well. By so doing, the longitudes on his map will be relatively correct, and all that is required is that later on one of the positions should be accurately fixed. Whenever at all possible, the difference of longitude between the places should be determined more than once, but this generally means that the distance between the places has to be traversed several times, which is, of course, often out of the question. The observations for local mean time in connection with longitude observations (or, indeed, for any purpose) that I would recommend are the star

* It is better, perhaps, not to attempt observations for longitude at first. Its determination in no way affects the accuracy of the survey—only the geographical position, which very frequently can be determined at the end of the survey. Of course an approximation must be adopted for computing purposes.

equal altitude method, several stars of an altitude greater than 40° being taken at different times, and the east-and-west star method. The local mean time resulting from either of these methods has been found very satisfactory when the observations have been carefully taken. The sun, as a rule, does not give such good results. Of the so-called absolute methods of obtaining longitude, or observations from which the Greenwich Mean Time can be found, there are, of course, several—occultations of stars, lunars, moon-culminating stars, eclipses of Jupiter's satellites, and others—but there is only one of these that I can with any confidence recommend to the geographical surveyor, that is the occultation. The observation is simple, although a good telescope is necessary, and great accuracy is required in noting the time by the watch of the occurrence of the occultation. The disappearance usually gives a better result than a reappearance, and when the disappearance takes place on the dark side of the moon, at about first quarter, very fair results have often been obtained, say, with an error of longitude varying from 30″ to 1′ 30″. The computation is necessarily lengthy, but I think the method in the 'Hints to Travellers' is about the shortest and simplest of them all, and it can be relied upon for its accuracy. Colonel Grant's most ingenious method of predicting occultations, recently somewhat shortened by Mr. Crommelin of the Greenwich Observatory, has much facilitated the computation of the prediction. Wireless telegraphy will possibly come to our aid in the matter of fixing longitudes before long.

Next to the occultation perhaps the moon-culminating-star observation should be mentioned, but unless the instrument has been placed accurately in the meridian beforehand, the error in longitude is most serious.

I will not detain you longer, although I should much like to be able to enter more fully into these matters. There are many subjects that I have not referred to at all, and those that I have touched upon I feel have been so summarily dealt with that the few words I have been able to say can be of little use. I have not referred to the photographic surveying, and all I can say at the present time upon this is that, although it may be useful for obtaining rapidly the necessary detail for filling in a map, it can, of course, never be supposed to take the place of theodolite work, nor, indeed, to supersede the plane-table. Under certain conditions it has proved serviceable, and especially so in mountainous regions, when the peaks are often obscured by mists. With a photo-surveying camera views may be taken in a few minutes that will afterwards furnish the means of fixing a large number of peaks upon the map with more or less accuracy. Photographic surveying is, after all, but a form of plane-tabling, and depends equally on triangulation, or even more so, the chief difference between the two methods being that with the plane-table sights are taken to the objects themselves in nature, whilst with the photo-survey method the plane-tabling is done afterwards, in the office, from the representations of the various peaks upon the photographs. It stands to reason, whatever value the latter method may have under certain circumstances, that errors are very liable to creep in in plotting from the photographs, and that the plane-table should, under ordinary conditions, give the best results. For photographic surveying, as employed by the traveller, what is wanted, it seems to me, is, not an elaborate and costly combination of camera and theodolite, but some simple and cheap arrangement that can be employed in connection with an ordinary camera, which will enable a traveller to take photographs that are both interesting and instructive as representing the geographical features of the country, and at the same time can be employed for filling in his map.

As to the drawing of the map, let me say just a word. I feel very strongly that it is not enough for a surveyor to be able to fix points, but that he should

be able to give a correct representation of the characteristic features of the country himself, and not trust entirely to a draughtsman at home to do this afterwards.

It is doubtless true that comparatively few men would ever make really good draughtsmen, but training has a great deal to do with the matter. There are persons whom I could mention now, who are well able to interpret the leading features of a region, and can fix positions with considerable accuracy, but have not the slightest idea of map-drawing, and consequently the rough sketches they send home are often almost unintelligible. The draughtsman, who has never been out of England perhaps, cannot be expected to give such a faithful representation of the features of the region explored as the surveyor who has been in the country, and often a map suffers much in accuracy for this very reason.

In conclusion, let me lay stress on the importance of proper training for this work, for it is a great mistake to think that the necessary knowledge can be acquired from a few short lessons.

I have brought with me some specimens of maps from surveys made to a great extent on the lines here suggested, as well as examples of the work recently done by some of my pupils for their examination for the Society's diploma, and these you will see upon the table. I should also like to call your attention to a new clamp and slow-motion screw arrangement which I have had fitted to a sextant, but which is equally applicable to any other angular measuring instrument. It has at least one great advantage over the old form, inasmuch as it is impossible to get to the end of the tangent-screw, which often happens at a most awkward time, in the middle of a set of observations.

REVIEWS.

EUROPE.

Three Books on France.

'L'Histoire de la France:' Tome Premier I. Tableau de la géographie de la France. Par P. Vidal de la Blache. Paris: Hachette et Cie. 1903. Pp. 395, 64 maps and figs.

'L'Architecture du sol de la France.' Par le Commandant O. Barré. Paris: Colin. 1903. Pp. iii., 393, 189 maps and figs.

'Géographie agricole de la France et du Monde.' Par le Comte J. du Plessis de Grenédan. Paris: Masson. 1903. Pp. xx., 425, 118 maps and figs.

The development of geographical interest and ideas in France has been clearly indicated in the past eight months by the appearance of three new works, which discuss three different phases of its geography. The most general is the Tableau of Prof. Vidal de la Blache, which forms the opening half volume of a great history of France, which the indefatigable Prof. Lavisse is adding to the vast works he has already planned and supervised in such a masterly manner. The second, by Commandant Barré, discusses the architecture of the surface of the country, and continues and summarizes the series of papers which he has already published. The third deals with the agriculture of France, and is from the pen of the Count J. du Plessis de Grenédan, professor at the Angers Agricultural College, who supplements his account of the home conditions by a valuable survey of the agriculture of the colonies, and, more briefly, of the whole world.

Commandant Barré calls his book an essay in tectonic geography. He begins with a general chapter, then, after a brief account of the geological history of France, classifies France into regions, each with a typical land form, and finally describes the structure of these regions in some detail. He divides France into

a northern zone of tabular architecture—which we might compare to Egyptian—and a southern zone of folded architecture—a sort of Gothic type of structure. The term "tabular" is somewhat unfortunate in this connection, and it would be well to reserve it for structures which are composed of horizontally disposed strata. These block-mountains in the French region consist of the elevated regions of Britanny, the Central Plateau, the Ardennes, and the Vosges, and one region relatively depressed—the Parisian one, which is really part of the more extensive Anglo-Parisian area. The depressions of Aquitaine and of the Rhône valley separate the northern blocks from the southern zone of young folded mountains, of which the Pyrennes, part of the Alps, and the folded Jura may be reckoned with the French region; while in the massifs of the Maures and the Esterel are small fragments of an older land-mass, the Tyrrhenide. The special physiognomy of each region is determined by the conditions of the rejuvenescence of its relief. Britanny, with little recent change of level, presents the characteristics of a peneplain. The other block-mountains were much more affected by Tertiary crustal movements, and, being considerably varied, have more accentuated forms. In the Central Plateau, Southern Vosges, and Ardennes the elevation was sufficiently early and prolonged to lay bare the archæan rocks; in the northern Vosges their covering of Triassic rocks remains; while between the Vosges and Morvan only the Cretaceous rocks have been removed. Eruptive phenomena have completely modified the topography of the Central Plateau.

Of the sunken areas, in the Parisian region, protected from Alpine movements by the Central Plateau, the foldings are simple waves; in those between the Central Plateau and the Alps and Pyrennes, the sides bordering the plateau are faulted, the sides bordering the folded mountains are affected by the foldings, and are more regular in the wider Aquitaine than in the narrow Rhône trough.

The detailed descriptions of the structure of these regions contain useful summaries of the standard works and papers. Commandant Barré accepts Prof. Davis's view, about which there has been some dispute, that the Moselle formerly flowed by the depression to the Meuse near Toul. The commandant's own papers are laid under contribution, and a number of his excellent diagrammatic bird's-eye sketches are reproduced, and show very graphically the major peculiarities of each surface form.

Prof. Vidal de la Blache looks on France from a different point of view. While he does not neglect the morphology, he is concerned with all the geographical factors, and more particularly with those which have helped to determine the limits and characteristics of the diverse natural regions or *pays* of the chief centres of historic importance. It is interesting to compare his subdivisions with those of Commandant Barré. He divides the north into Ardenne and Flanders, the Parisian basin, Rhineland; he next examines the Saône-Rhône trough and the Central Plateau; then he deals with the west; and lastly with the Midi, in three divisions, Mediterranean, Pyrenean, and Oceanic.

The general chapters which form the first part of the book deal with the geographical organism called France. This conception was first suggested by Strabo, and the Sorbonne professor quotes with approval a phrase of Michelet's, "La France est une personne." He does well to begin with the idea of geographical "organisms," or rather macro-organisms, complex unities composed of rock, water, air, and living creatures, which are unities only when all the factors are taken into account. These macro-organisms are the object of the geographer's study, and of all politically defined non-insular areas France is among those which most nearly approach to one.

The structure and harmony of the parts, the general circulation of this macro-

organism are very briefly described, then the main channels of outside influence are examined, and the general physiognomy of the country is sketched. The characteristic of France is variety—variety of structure, soil, and climate—yet these varied features harmoniously blend to form a high self-sufficing whole.

The greater part of the book consists of descriptions of the different *pays*, expressed in admirably chosen words, which make them a contribution to the literature as well as to the geography of fair France.

The concluding chapter is entitled 'Centralization, and Life in Bygone Days,' but deals mainly with routes. The well-distributed Roman roads are contrasted with those in existence at the end of the eighteenth century, when Paris had become the nodal point. On these latter roads the railway system was modelled, but it is pointed out how the growth of ease of communication and the intermediate position of France has led to the development of routes, such as the one from Calais and Boulogne to Switzerland and Italy *viâ* Laon, which avoid Paris altogether.

A work on agricultural geography is a most welcome addition to the library of the economic geographer, and, we venture to think, to that of the economist as well. Concrete economics must be based on geography. The first chapter of concrete economics should be a review of the natural spontaneous wealth of the World, and the next undoubtedly deals with occupations, agriculture being one of the fundamental ones.

The Professor of Agriculture at Anger has done a great service in systematizing his studies from a geographical point of view, first for the pleasant fields of France, next for French colonies, and lastly for the great World. He considers first the general agricultural geography of France, beginning with the natural conditions of soil, water, and air. He next discusses the artificial conditions due to amelioration of the ground. Among them are drainage and irrigation, machinery, population, property (of 6,500,000 agricultural workers in France, 3,500,000 farmers are their own masters, and only 3,000,000 are paid labourers, while 3,400,000 possess some property), agricultural commerce and commercial routes, the relations of industrial to agricultural France, the general transformation of France by its inhabitants.

He criticizes most effectively the ten agricultural regions of France adopted by the administration—N.W., N., N.E., W., Centre, E., S.W., S., S.E., and Corsica—and adopts those of Prof. Vidal de la Blache—cultivated, rich, moderate, and poor; semi-pastoral, rich, and moderate; pastoral, rich, and poor. These are distributed as follows: In the centre, a rainy volcanic region at the foot of the highest peaks of the Central Plateau, is a rich pastoral land surrounded by poorer regions, more arable in the north-east, more pastoral in the north-west, mixed in the south. The narrow Limagne inlet in the north possesses the great fertility of the other rich arable Tertiary basins of Paris, Aquitaine, and the Saône. Between these are lands of moderate fertility, forming a band round the poor mountainous centre and extending along the borders of the similar poor pastoral slopes of the Alps and Pyrenees. The primary rocks of Armorica make poor pastoral land in the south and rich semi-pastoral land in the north and east. Normandy, Perche, and Maine are rich pastoral regions. Here and there are infertile islands where pastoral pursuits are almost exclusively followed, in Gascony, Sologne, and dusty Champagne; and agricultural oases in Bray, Tarbes, and the meadows reclaimed from the sea. The orange lands of the Albères and the coasts of Provence are bits of Spain and Italy fringing Southern France.

An analysis of statistics and a chapter on the agricultural riches of France end Part I. The second part, on special agricultural geography, discusses the

distribution of forests, industrial plants, gardens, and nurseries, alimentary plants, and stock-raising; and is well worth the study of the farmer and of the economist as well as of the geographer.

The third part is on the agriculture of the French colonies. These he divides into (1) those where the European can live and work himself, such as (*a*) Algeria and Tunisia, near to France; (*b*) the much smaller, more distant, and less economically important Antilles, Tahiti, New Caledonia, and Réunion; and (*c*) the vast territories of Madagascar and Indo-China, with immense agricultural possibilities, but only small portions of which are suitable for settlement: (2) The African colonies of the torrid zone, which present many obstacles to agricultural development, and may for the present at least be termed commercial colonies: and (3) the economically worthless desert possessions.

Part IV., on the agriculture of the World, is a most useful summary of the conditions and places under which the chief plants and animals of economic importance are produced.

A commendable feature in the work is the number of sketch-maps, which are not the ordinary statistical diagrams where political boundaries determine the limits, but true *geographical* maps, which, as we have previously had occasion to point out, are still comparatively rare. They are all the more welcome additions to a very valuable work.

We trust that in urging the value of practical applications of geography, those to agriculture will not be forgotten, and that the agricultural geography of Britain and of British colonies will receive as much attention in higher educational institutions for farmers' sons as commercial geography does in the case of town-bred boys and youths.

These three books lead us to compare the conditions here and across the Channel. The first is the opening part of a history of France. In the great Victoria history of the countries of England and Wales we find no geography at all. The second of these books is written by an army officer who teaches geomorphology. None of our officers are taught this subject. Except here and there in one or two text-books of regional and economic geography, no attempt has yet been made to deal systematically and fully with the agricultural geography of Britain. From the point of view of grasp of the value of geography by historian, soldier, and agriculturist, we see that in France they are ahead of us. While this is true from those points of view, it must, however, be remembered that the geographers and geologists on this side of the channel are not ignorant of the value of geography, nor have they neglected to present their conclusions to the public. We need only cite the works by Lord Avebury, Sir Archibald Geikie, Mr. Mackinder, and Mr. Chisholm as examples, among others, of what has been accomplished on this side of the Channel. What we lack is the want of comprehension on the part of our men of affairs, of letters, and of business of the vital importance of these subjects, due, no doubt, to the inconsiderate treatment of the subject in the schools. We hope that the appearance of these French works will induce the historian to follow Prof. Lavisse's example and preface his monograph with an adequate geographical sketch of the region in which the events and conditions he describes took place, the soldier to realize the value of a scientific study of the forms of the land and their relationship to movements of troops in a campaign, and the statesman to regard the distribution controls of farming and other economic operations, on the healthy development of which the prosperity of a country largely depends.

A. J. H.

ASIA.

Central Asia.

'Central Asia and Tibet.' By Dr. Sven Hedin. Hurst & Blackett, London. 1903.

Year by year we are gradually filling up the world's map until there is very little left to the imagination of the map-maker. The gaps that are still blank are not considerable anywhere, judged by the standard of the Atlas; but such as exist must appear inconceivably remote and desolate when they are faced by the intrepid explorer who means to plant his country's flag on either pole, or to unearth the secrets of Asiatic deserts. It takes an explorer of the Sven Hedin or Peary type to accomplish such feats. In this last great book of our greatest modern Asiatic traveller we have a record of difficulties and dangers encountered and overcome, which include fierce struggles with the forces of nature, intense heat, intenser cold, swift overwhelming black-browed storms, waterless wastes, and (extraordinary feature!) a migrating lake, all combining to defeat the aims of the determined seeker after geographical truths; yet the story bears the impress throughout of strict scientific adherence to fact, and is told with a grace and charm that make it quite fascinating. It is the healthy tone of human interest which is so enchanting. One quickly understands the nature of the service which Sven Hedin receives from the companions of his travels—their implicit trust and affectionate faithfulness (even unto death), when one realizes the strength of his own feelings towards them, and observes the level of human sympathy which he extends to all alike. Asiatics, whether they be Kashgar Muhammadans or Tibetan Buddhists, are separated by no great gulf from the European who can make himself at home with them and live with them. It would have been no matter of surprise to those who knew him, if Sven Hedin had succeeded in placing himself on terms of good fellowship even with the Dalai lama at Lhasa; it was obviously the fault of the Dalai lama, and not of Sven Hedin, that such was not the conclusion of his venture. One point of general interest in this connection must be noted. It is the admirable behaviour of the Cossack escort. Brave, faithful, handy, and intelligent, such men are a most valuable factor in all that pertains to the business of travelling or campaigning. Sven Hedin but echoes the sentiments of other previous travellers who have had Cossacks in their company when he records his admiration for their capability and for their sturdy character.

Three years spent in geographical exploration by the most strictly scientific geographer of the day have necessarily resulted in a great acquisition of new geographical material and increase of topographical knowledge. The survey of the Tarim river, carried out with patient painstaking accuracy, is one of the principal features of this remarkable journey; but the chief geographical interest of it centres in the migratory and shifting character of Lake Lop Nor; and in the evidence of the departed town of Lou lan which once flourished upon its margin. The little Buddhist state, or province (for it was scarcely more), of Lou lan, in the early centuries of our era existed as a bone of contention between the great nationalities of the Turkish Huns on the north-west and China on the east. Naturally it was finally crushed between them; but it must for many centuries have been one of those Buddhist centres where temples were erected and stupas marked the last resting-place of a Buddhist saint (or recalled some sacred event), through which the hosts of Chinese pilgrims made their way as they bent their weary steps towards India. Many time-worn and cairn-marked tracks were recognizable to Sven Hedin as he traversed the surrounding desert, and there can be little doubt that a great central highway

from the Chinese frontier to Kashgar, or to Khotan, passed through Lou lan. The explorations of Dr. Stein in the neighbourhood of Khotan derive an added interest from the discoveries of Sven Hedin. We are now introduced to an ancient Buddhist world, which appears to have been as much Indian in its affinities as Chinese. The difficulty which has always surrounded the efforts of geographers to unravel the threads of Chinese itineraries between China and India has greatly disappeared. From Khotan we can trace these early routes (not necessarily commercial routes) to Kashmir; and from Kashgar we can follow them across the Pamirs to Badakshan and Kabul, or to Gilgit and the Peshawar valley. The evidence of the writings unearthed by Sven Hedin and Stein show what important and well-worn Asiatic roads these were. It is also interesting to note that the final disappearance of these Buddhist towns was due, not to one, but to a variety of natural causes. The shifting of the lake Lop Nor was undoubtedly the ruin of Lou lan. The advance of the desert sand-waves was the ruin of the towns between Cherchen and Khotan. But whilst Sven Hedin records his opinion that climatic changes have also had something to say to the new distribution of civilized centres, may there not also be something due to that alteration of surface level, those gradual upheavals and depressions which are so much more easily recognized in other parts of Central Asia—in Afghan Turkestan, for instance? Amongst other results of his labours, Sven Hedin has finally disposed of the Gobi mountains and the Eastern extension of the Kurruk range. He has also verified the existence of a much-traversed pilgrim route from Mongolia *viâ* Temirlik, Ghaz Nor and Tsaidam, to Lhasa, which is not unimportant in spite of its terribly difficult and inhospitable nature. It still leaves the southern routes between Lhasa and China *viâ* Ta-chien-lu in possession of the commercial field, and Sven Hedin's account of the northern routes rendered it impossible to conceive that any practicable highway from the north will ever be developed across Tibet. By reason of the geographical position of Lhasa, Tibet must ever be affiliated commercially with the south and the east. The journey southward across the Altyn Tag (spelt Astyn Tag in the letterpress), over the northern Tibetan highlands, furnishes us with as good a story of a gallant attempt to reach Lhasa as was ever told; but there is not much in the physical characteristics of the country revealed, the desolate stony steppes stretching between the rugged hills daily swept by terrific winds and only affording a scanty subsistence to the starving caravan at irregular and far-distant intervals, which differs greatly from that which previous travellers have told us of regions farther west. It is indeed a ghastly country (somewhat redeemed, however, by an extraordinary amount of wild life), and great indeed must be the enthusiasm of an explorer who, looking across those cheerless grey wastes flecked by salt blue lakelets and spaced into mud flats and stony steppes, can feel his heart glow within him (with a temperature 20° below zero) as he realizes that it is "mine own." Sven Hedin but echoes the words of Peary when the latter great explorer looked across the ice-hummocks reaching from the north of Greenland to the north pole. Sven Hedin's return journey from north of Lhasa to Ladakh was by a route not far removed from those of the old pundit Nain Sing and of Bower. But the story of it (like the rest of the tale of his three years' wanderings) is delightful. It is the best book of travel that has been written since Palgrave's 'Arabia.'

Expansion of Russia.

'The Expansion of Russia, 1815–1900.' By F. H. Skrine. Cambridge University Press. 1903. Pp. viii., 386. (Cambridge Historical Series.) With 3 Maps.

The aim of this series is defined by the General Editor, Mr. G. W. Prothero, as an attempt to sketch the history of Modern Europe, with that of its chief colonies

and conquests. It is intended, in fact, for the use of all who are anxious to understand the nature of existing political conditions. Mr. Skrine's volume excellently fulfils the purpose so defined, as far as Russia and its action on the nineteenth-century world is concerned. He divides his subject into eight principal parts: An Introductory Survey of the 'Forces at Play;' Russia in 1815; Vacillation from 1815 to 1825; the First Reaction, from 1825 to 1855; an Era of Reform, from 1855 to 1865; the Second Reaction, from 1865 to 1881; the triumph of the Old Russian Party, from 1881; a Peaceful Revolution, from 1894. Perhaps the best parts of the present volume are those relating to Central Asia and the reigns of Alexander III. and Nicolas II. With the help of the clear and serviceable maps which follow the index (I. The Russian Empire in 1900; II. The Balkan Peninsula and Crimea; III. Russia in Central Asia and the Caucasus), Mr. Skrine has made the geographical part of his subject, without which no satisfactory treatment could be realized, clear enough for every student. It might, indeed, be suggested that in the first map the Kiakhta-Kalgan railway project here shown should be replaced by an indication of that along the west side of the Great Khingan mountains, where, according to recent observers, such as Mr. Gerrare, the eastern extremity of the Gobi is now being crossed by a light railway. It might also be well in another edition to give Mr. W. R. Morfill, the Oxford Professor of Slavonic, who has worked so long at Russian history and philology, his right initials (Morfill, G., occurs twice in the bibliography). The statement on p. 10, that the men of Kiev and Little Russia had never bent their necks to the Tartar yoke, seems strange in view of the events of 1238–41; and the dictum of p. 4, "nations borrow from each other little save their vices," seems a hard saying if we remember how closely all European progress has been bound up with this borrowing of nation from nation, and how unhealthy a policy of national isolation has usually been, as in the case of China. But no one can read Mr. Skrine's book and not be delighted with the honest care bestowed on every part of Russian history and geography within his period, with the clearness of the narrative, and with the successful compression of a very considerable mass of matter into a text of 348 pages. Excellent also, in its lucidity and discrimination, is his characterization of the three Alexanders and of Nicolas I.; it is to be regretted that he has not more often given us the well-judged results of his study of the leading figures in his story. Special attention is given to the Asiatic side of Russian history during the past century; here the author is on ground already covered by him with considerable detail and no little suggestiveness in the 'Heart of Asia;' the economic and industrial progress made under the influence of M. Witte is also well summarized. In almost all cases the spelling of Russian names and places is above reproach, though occasionally improvements might be made; is not, *e.g.*, Solovetskii better than Soloievsk, and Kamchatka than Kamskatka? A detailed bibliography will serve as a guide to original sources of information and more elaborate studies in Russian, French, English, and German.

C. Raymond Beazley.

Siberia.

'In Search of a Siberian Klondyke.' By W. B. Vanderlip and Homer B. Hulbert. New York (Century Company). 1903. Pp. xv., 315.

This is a cheerful and readable account of a fatiguing search for gold through North-Eastern Siberia in 1898 and subsequent years. It describes visits to Sakhalin, to Petropavlovsk and Southern Kamchatka, to the coasts of the Okhotsk sea, to

the eastern side of the Stanovoi mountains, to the shores of the Bering sea north of Kamchatka, and to the headwaters of the Kolyma in the Arctic basin, north of the Stanovoi range. In certain ways this expedition worked on parallel lines with that of M. Sliunin, recorded in the latter's 'Okhotskii-Kamchatskii Krai;' but the American traveller does not offer so bright an economic forecast as the Russian envoy of the Ministry of Finance.

The present volume is well illustrated with forty-eight photographs of scenes and racial types; and any one who wishes to learn the management of a sledge and dog-team, to understand the habits of reindeer, and to appreciate the merits of certain aboriginal tribes, the Chukches and Koryaks, for whom few have ever had a good word to say, will find plenty of material here. One thing, however, he will not find, and that is an index. Mr. Vanderlip's happy time among the Chukches forms a curious contrast to the sufferings of Mr. De Windt:—

"In view of my experiences, it is difficult to understand the treatment which Mr. De Windt received. I travelled all along the coast to the same places, and was always treated as an honoured guest by the natives. On the whole, they are the finest lot of savages it has ever been my lot to meet. . . . They would not listen to my offers of pay, and it was only with difficulty I could get them to take presents of tobacco or tea. I felt so safe among the Chukches, that never once did I take my guns into the tent with me" (pp. 226–229).

Mr. Vanderlip was practically unsuccessful in his search for the yellow metal, but he noticed a vast bed of coal near Baron Koff bay, at the extreme north-end of Kamchatka, originally discovered by a Russian man-of-war about 1880, and apparently containing fuel enough to supply all the navies of the Pacific. In the crater of an extinct volcano, near the same Baron Koff bay, he came upon deposits of sulphur, but these scarcely promised to repay exploiting. He began to work a copper vein in Avacha bay. Whether he thus laid the foundation of a valuable industry does not appear. Finally, as to gold, he satisfied himself that there were no extensive auriferous deposits on the streams flowing into the Okhotsk sea near its head, nor in the beach sands along the shore of Bering sea, south of the Anadyr river. In fact, nowhere in the extreme north-east of Asia did there appear to be a continuation of the Klondyke gold veins sufficiently rich and accessible to repay mining. At least, such was the negative result of this Russo-American inquiry.

C. R. B.

AFRICA.

Eastern Desert of Egypt.

'Topography and Geology of the Eastern Desert of Egypt, Central Portion.' By T. Barron, A.R.C.S., F.G.S., and W. F. Hume, D.SC., A.R.S.M., F.G.S. (Geological Survey Report, Cairo, 1902.) Pp. xi. and 331, with many photographic and other illustrations, maps, etc.

This volume is perhaps the most elaborate and valuable of the series of reports that has lately been issued by the Geological Survey of Egypt, and both in style of printing and wealth of illustration it might well serve as a model for the publications of surveys much nearer home. Indeed, to any one who is acquainted with the difficulties which must have been overcome in the production both of the text and most of the illustrations of an English work of such a nature in Cairo, it is a matter for wonder and congratulation that the authors should have attained such eminently satisfactory results.

The work contains the topographical and geological results obtained by two survey parties, working for the most part independently of one another, during

the season 1897–8. Roughly speaking, the district examined lies between the Qena-Qosseir road on the south and the parallel of 28° N. lat., and between the meridian of 33° E. long. and the Red sea. Of the region lying within these limits very detailed topographical and geological descriptions are given, and to these there has been appended much interesting information concerning the zoology, botany, and meteorology of the area, together with some notes on the chief antiquities, the earliest of which seems to be a cartouche of the fifth dynasty. In Roman times numerous quarries of ornamental building-stones were extensively worked, as also were some of the deposits of iron ore. At the present day, except a few places along the coast and in the neighbourhood of the Nile valley, the whole country is given over to a scanty population of nomadic Arabs, mostly of the Maaza and Abadba tribes.

The topographical section of the memoir occupies the first 113 pages, and the various traverses made by the survey parties are described in great detail. Some of the more important conclusions arrived at are—(1) The main western drainage of the district reaches the Nile valley at one point only, namely, at Qena by way of the Wadi Qena. (2) The Red sea hills do not form one continuous chain, but a series of ranges advancing in *échelon*, each new longitudinal *massif* to the south being further east, though remaining parallel to its predecessor. (3) The mountain system in many places is cut up into blocks by transverse and longitudinal rifts. (4) The presence of the Nubian sands and softer sandstones is the chief cause of many of the great plains and minor valleys.

The geological section occupies by far the greater part of the work (pp. 116–290), and in it a great mass of information has been brought together, much of which is of importance from its bearings on general questions. Here it will be impossible to do more than refer to some of the more important topics discussed by the authors.

A detailed account of the raised coral-reefs of the Red sea is given, and the observations made show that the true reefs do not, as a rule, attain any greater thickness than about 4 metres, and that they may be based on any rock, whether igneous or sedimentary. The highest reefs are about 200 metres above the sea-level, and date from the Pliocene, when the Red sea, as such, and many of the ranges of hills first came into being.

The writers give a valuable summary of the various views as to the age and mode of origin of the Nile valley. They themselves seem to incline to the view that the river did not begin to flow in its present bed at Qena till late Pleistocene times, a belief founded on the fact that the present channel cuts through gravels of Pleistocene age, containing pebbles of rocks exposed in the Red sea hills.

Other conclusions of importance are—(1) The metamorphic series of Jebel Meteeq, consisting from below upwards of gneisses, schists, and altered ashes, are the oldest rocks in the district. (2) The oldest sedimentary rock is the Cretaceous Nubian Sandstone, and the so-called Carboniferous or Devonian petroleum-bearing rocks do not exist. (3) There is a distinct unconformity between the Eocene and Cretaceous rocks, such as has been shown by Beadnell to exist at Abu Roash on the other side of the Nile.

The volume concludes with chapters on the economic geology and on the influences giving rise to the Eastern desert structure; and lastly, but by no means of the least importance to those using the book, a good index has been added.

The plates, maps, and sections are, with the exception of a few trifling errors, excellent, but it is to be hoped that in future some more simple method of numbering the illustrations may be employed.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Physical Geography.

'An Introduction to Physical Geography.' By Grove Karl Gilbert and Albert Perry Brigham. London and New York: Appleton. Pp. xvi., 380.

This is another excellent example of a good text-book on physical geography written for American secondary schools. The American teacher must be embarrassed when he attempts to chose one of the three or four excellent works available. Each has its own special merits, and all are reliable. The present work must be included in this list of first-rate works, and is worthy of the reputation of its authors. About half the space is devoted to the lands, which are dealt with before the atmosphere and oceans. This, on the whole, is the most satisfactory order. The treatment of each chapter is concrete: each subject is usually introduced by a description of an actual case of the phenomena to be studied, *e.g.* the chapter on volcanoes begins with a description of the Neapolitan volcanic area, and especially of Vesuvius, illustrated by a sketch-map and views; other volcanoes and volcanic regions are then discussed, and the section concludes with a summary of principles. In the part of the chapter on the atmosphere dealing with rainfall, the hyetal maps of the United States, British Isles, and Australia are first of all depicted and described. It will thus be seen that, although written for American schools, the book contains much of interest to teachers and others interested in physical geography in this country, who will gain greatly by a careful perusal of it.

HISTORICAL GEOGRAPHY.

Freeman's Europe.

'The Historical Geography of Europe.' By E. A. Freeman. Third edition. Edited by J. B. Bury. With atlas. London: Longmans & Co. 1903. Price 12*s.* 6*d.* Atlas 6*s.* 6*d.*

This work is too much a classic in the field of historical geography to require a detailed notice for the present edition. The second edition (issued like the first in 1881) has been for some time out of print, and the publishers have done a service to students by making it once more widely available, the moderate price at which it is issued contributing also to this end. The editor, who is Regius Professor of Modern History at Cambridge University, has introduced into the text the brief additions necessary to bring the work into line with the results of recent changes, but in all important respects it remains as it left its distinguished author's hands.

GENERAL.

Geographical Classics.

'Ausgewählte Stücke aus den Klassiken der Geographie für den Gebrauch an Hochschulen zusammengestellt von O. Krümmel.' Erste Reihe. Kiel and Leipzig: Lipsius & Tischer. 1904 [1903].

These judiciously chosen passages from the classics of geographical science should prove most useful to teachers and students who may not have access to the original works. The present instalment includes passages from Humboldt on the Evolution of Geographical Ideas, and on the Physical Features of Mexico; from Ritter on the broad relations of the Continents and on the Historical Element in Geography; from Peschel on the scope and aims of Comparative Geography and on Fiord-formation; and, lastly, one from von Sydow on Methods of Cartography. The issue of two further instalments is contemplated, one of which, in addition to further selections from Humboldt, Ritter, and Peschel, will include Darwin's monograph on the "Formation of Coral Reefs." The publication is also of use as bringing out once more in a striking way the great debt which geographical science owes to the three great masters whose works supply the bulk of the quotations.

THE MONTHLY RECORD.

EUROPE.

The Ain Valley and its Glacial Deposits.—The course of the Ain may be divided into four distinct parts: (1) The narrow upper parts of the three rivers, the Saine, the Lemme, and the Serpentine, or Ain proper, which lie in the mountains. Here and there moraines formed in the retreat of the glaciers are found, and on the plateau are areas where erratics have been dumped. This comes to an end with a vast moraine, 7 kilometres long and from 2 to 4 wide, below Champagnole, across which the river winds in deeply incised meanderings. (2) The Combe d'Ain, the widened valley, 2 to 4 kilometres broad and about 26 kilometres long, which lies between the first and second plateaus of the Jura. This contains glacial deposits from the Ain glacier, which also managed to cross the depressions between the hills which separate the Combe d'Ain from the first plateau. (3) From Largillay to Neuville-sur-Ain below Poncin the river flows in very narrow, deeply incised meandering gorges. Here there are glacial deposits, but no trace of a terminal moraine. (4) From Neuville-sur-Ain the valley opens out and joins that of the Rhone, and here is covered with erratics more from the Rhone than from the Ain. Mr. Delebecque concludes (*Bull. des services de la carte géologique de la France*, vol. xiii. No. 90) that there have been two important glacial manifestations in the Ain valley. In the first, the Ain, the Bienne, and the Oignon valleys were filled with morainic matter here and there to considerable heights, and this extended almost to Poncin without leaving any trace of terminal moraine or fluvio-glacial terraces. The second corresponded to a resting of the glacier in the Combe d'Ain, which gave rise to a central depression, moraine, and terrace, and the lakes of Chambly, the Val, and Clairvaux, and also to a resting phase of the Oignon glacier, which has left excellent examples of glacial working, especially in the lake of Nantua, which fills the central depression.

The Lakes of East Prussia.—Since noticing in the *Journal* the paper by Herr G. Braun on the Schilling-See, we have received from the author a copy of a dissertation for the degree of Doctor at Königsberg, in which all the lakes of East Prussia are systematically described, and an attempt made to elucidate their mode of origin (Königsberg: R. Leupold, 1903). In the descriptive section Dr. Braun divides the lakes of the Prussian section of the Baltic ridge into four groups, differentiated by the two marked natural furrows by which it is traversed, and the corresponding uplands. These are, (1) The Oberland group, or lakes of the Oberland canal, grouped round the lake of Drewenz—they may be characterized as furrow-lakes ("Rinnenseen"); (2) that of the upland of West-Masuren, the lakes of this group showing no regularity in their distribution; (3) the north-and-south series of lakes in the Masurian valley, including the largest lakes of East Prussia; (4) the lakes of Ost-Masuren, occupying the ascent towards the Seesker Höhe. In the section treating of the morphology of the lakes the author divides them into categories according to their physical character, the two main subdivisions being the "furrow-lakes" and the "ground-moraine lakes." The former of these are the most sharply defined of all. They are long and narrow, with generally uniform depth, and the form of the under-water contours is usually continued above the surface. The author discusses the geological history of the region, showing that the original valley-system of the Baltic ridge had a direction from north-west to south-east, while the motion of the ice-sheet took place principally from north-east to south-west. It is to the divergence between these two directions that he ascribes the abundance of lakes in this region, and especially the characteristic form of the "furrow-lakes," which

owed their ultimate form to the action of the running water beneath the ce-sheet. The lakes of this type occur in the area of greatest slope, where this sub-glacial water would act with greatest force. The water escaping from the front of the ice during the period of its retreat would act differently, being unfavourable to the formation of lakes, and this may account for the hieroglyphic aspect of the lake-ridge at the present day. In contrast to the furrow-lakes, the ground-moraine lakes show the influence of tectonic and eroding forces in a slight degree only, but they occur principally in areas where deposition by the ice is most strongly marked. They are found frequently on the summit levels of the ridge, and often have no outlet. A somewhat special type is that of the "end-moraine lakes," which, though long and narrow like the first class, owe their origin to the deposition of the morainic material, behind which they are dammed back. Their depth is very various. The remaining types are of less frequent occurrence. The author concludes by remarking that scarcely a single lake represents one type only, each owing its present form to a variety of causes acting simultaneously or in turn. A complete list is given of all the lakes with an area of over half a square kilometre, with a statement of the leading morphological elements of each.

Sand-dunes on the North Sea Coast.—In 1901 Dr. Otto Baschin made measurements of the movement of sand-dunes on the west coast of Fanö, the most northern of the islands of North Friesland. Between August 9 and 24 a strong, steady wind blew from the north-west, parallel to the coast, with a strength of 6 to 7 on the twelve-division scale, and raised small dunes on the level strand. These reached a height of about 40 inches, and were of crescent form (*barkhans*). The mean drift of moving sand-ridges has been recorded by several observers on the German coasts, the annual movement varying from about $12\frac{1}{2}$ to $55\frac{3}{4}$ feet, whereas the crests of the small dunes on Fanö moved, as shown by Dr. Baschin's record, about 10 feet a day. The explanation is that on a large dune more material must be driven to the lee side before any displacement of the crest becomes evident, and it must also be remembered that the measurements of Dr. Baschin were taken during a high wind. Bertololy suggests that the steep slope on the lee side of the dunes is the effect of the vortex of air round a horizontal axis which is formed on the lee side. Dr. Baschin, however, convinced himself that the slope is due simply to the fall of the sand as the crest of the dune moves forward. On the 26th the wind turned to the south, and it was interesting to watch the transformation of the dunes, how the crest gradually moved north-westwards till the shorter, steeper slope was formed on that side. The points of the crescent took longer to reform, and the old points were still longer than the new ones when a storm on the 27th flooded the strand and swept the dunes away. Dr. Baschin visited next the island of Sylt, where there is a dune marked on the Prussian survey map of 1878 as 85 feet high, which has now advanced further from the shore. At the highest part are two domes of white sand covered with vegetation, probably the remains of an old dune which have been buried by the moving dune, while the ridge between the wind and lee sides lies at a lower level. From the highest part the surface slopes down to the ridge, and there from an inclination of 20° suddenly passes to one of 33°, which is evidently the limit of equilibrium of the sand.—*Zeitschrift der Gesells. für Erdkunde zu Berlin*, No. 6, 1903.

ASIA.

Lakes Balkash and Kosso.—A Russian expedition under L. S. Berg has been investigating Lake Balkash. On arriving there in the middle of July, 1903, the expedition had to postpone its work for more than a week owing to a severe storm. Day after day the wind blew furiously, from the east in the morning, and

veering to north at midday and to north-east in the evening. Such continued storms never occur on the Aral sea in the middle of the summer. The water in Lake Balkash is quite fresh and fit for drinking, though the lake has no visible outlet, and lies in the middle of a steppe where the evaporation is very great in summer and the precipitation very insignificant, whereas Issik-kul, far more favourably situated, contains water that is much too salt to drink. The cause of this phenomenon M. Berg will investigate. Balkash has always been supposed to be a lake that is drying up, and Nikolski, who visited it in 1884, reported that the surface was falling at the rate of $2\frac{1}{3}$ feet in ten years. It has, however, been rising of late, and to a considerable extent. Poplar trees (*Populus diversifolia*), bushes of the steppe, etc., now stand amidst the water, peninsulas have been converted into islands, and the road from Verni to Karkarali, which skirts the lake, is now under water. Two kinds of fish were caught, one of them being the perch (*Perca Schrenki*) peculiar to Balkash. Plankton, of a fresh-water type, is abundant; but the bottom of the lake is entirely devoid of life. M. Yelpatyevski, who visited Kosso-gol this year, found ice on the lake, and could not commence his soundings until June 24. The lake is 80 miles long and 28 broad, whereas in the map of the Sayan expedition of 1887 the breadth is only about 17 miles. M. Yelpatyevski surveyed the shores and took soundings across the lake and in the bays. The transparency of the water is very remarkable, the limit of visibility being 80 feet. Fish, plankton, and birds, etc., were collected. No amphibia or reptiles were seen. The deep-water fauna is scarce, and the dredge brought up very scanty booty. Forms found in Lake Baikal are absent, as far as is known at present. Probably some new species of microscopic fauna may be discovered when the material has been examined.—*Izvestia* of the Imp. Russ. Geogr. Soc., No. 3, 1903.

Proposed New Route to Siberia.—A scheme has been set on foot for a new railway in the far north of the Russian Empire, for the purpose of facilitating commercial relations with Northern Siberia. The attempts to open up a sea-route to that region, made with such perseverance by Nordenskiöld, Wiggins, and others, had to contend especially against the difficulties of navigation caused by the ice in the Kara sea. It is proposed to obviate these by the construction of a railway from the mouth of the Ob to a point on the coast of European Russia, near Cape Savorot, easily accessible to vessels. The products of Siberia would be brought to this line down the great Siberian rivers. The project is not entirely new, but it has only lately become more or less of a practical question. Other Russian railway projects were referred to in the *Journal* for November, 1903 (p. 565).

The Western Himalayas.—In the Swiss Alpine Club's Jahrbuch, 1902–3, Dr. J. Jacob Guillarmod gives an account of the Anglo-Austrian Expedition to the Western Himalayas, in which he took part in the spring and summer (March —August) of 1902. Other members of the expedition were Messrs. O. Eckenstein, G. Knowles, A. Crowley, Dr. H. Pfannl, and Dr. V. Wessely. The expedition followed the route *viâ* Rawal-Pindi, Srinagar, Skardo, and Askole, to the Baltoro and Godwin-Austen glaciers. More than eleven weeks were spent on the Godwin-Austin glacier, including a month at the foot of the arête to the north-east of K^2. Drs. Guillarmod and Wessely made a further reconnaissance to a height of about 23,000 feet (7000 metres). This, Dr. Guillarmod claims, is a record in Himalayan travel. Apart from the more specifically scientific gains of the expedition, to be appraised more particularly in the larger work promised at the end of this year, the paper contains various topographic, cultural, and economic notes. Three full-page plates present views of Skardo with the confluence of Indus and Shigar, K^2 or Godwin-Austen peak, and Broad peak, while the text gives an excellent description

of the characteristic features of the region. Eleven successive encampments were made in ascending Godwin-Austen glacier. None of the travellers, with the exception of Dr. Knowles, had to complain of the rarefication of the air. Encamped June 20 on Conway's "Possible Saddle," on the east branch of Godwin-Austen glacier, they all found themselves in very good trim, hardly sensible of any breathlessness, and without sickness or discomfort. Tree vegetation ended at 13,500 feet, but pastures grazed by the ibex ascended to above 16,000 feet. At a height of 18,000 feet, in the middle of June, jackdaws (choucas) were seen flying over the heads of the travellers—a fact which, according to Dr. Guillarmod, had not previously been observed. The writer notes that the lateral glaciers of Baltoro were then manifestly advancing.

The French Yunnan Railway.—A Franco-Chinese agreement was signed on October 29 last, by which arrangements are made for the construction and working of the portion of the French Yunnan railway lying within Chinese territory between Laokai and the capital of the province. A sketch of the route now adopted for this section of the line, which runs to the east of that first selected *viâ* Mongtse, was given in the August number of the *Bul. du Com. de l'Asie Française* (p. 482).

The Gajo Territory, Sumatra.—The Report of the Frankfurt Geographical Society for 1902–3 contains an article by Dr. B. Hagen on the Gajo lands, accompanied by three sketch-maps. *Gajo*, as the spelling better answering to the native pronunciation, is preferred to *Gaju* or *Gajoo*. The military expeditions of 1901 and 1902, towards the close of the Dutch 30 years' war (1870–1903), have yielded valuable information respecting the interior of the northern third of Sumatra. Laut Tawar has for the first time been sighted by Europeans, while the Gajos have at last become more than a name. For the first time, Sumatra, so far north, has been crossed right through the Gajo lands, from Pasangan on the north to Melabu on the west coast. Dr. Hagen, in the article above referred to, has drawn on the report of Major van Daalen, commandant of the 1901 expedition, a report printed, together with two sketch-maps showing part of the Gajo lands and the route of the expedition, in the *Dutch-Indian Military Magazine;* but he has also made use of information gathered by himself during his long residence in Sumatra. Constituting the interior of the northernmost quarter of Sumatra, the Gajo lands form a fairly isolated plateau, 3000 to 4000 feet high, terminating in steep edges and crossed by mountain chains and peaks rising in Gunong Sinabong to 12,000 feet. The alluvial strips on the west coast are 6 to 12 miles, on the east coast up to 28 miles, broad. East and south-east of the plateau, beyond mountain chains rising to 10,000 feet, stretch the highlands of the Alas, a race akin to the Gajos. Beyond these, again, is the north plateau of Toba and Karo, the region of the Bataks. As a corner pillar of the Goja plateau, whose north frontier coincides with 5° north, stands on the north-west Periêt Sagu (10,000 feet). Thence the watershed stretches south-east along the longitudinal axis of the island. A line drawn from Abong-Abong (50 miles east of Melabu), 11,000 feet, eastwards to Intem-Intem mountains (40 miles east of Abong-Abong), 8000 feet, divides the Gajo lands into a northern and a southern half. The southern half—territory of the Gajo-Luas or Patiambang—is still almost a *terra incognita*. The northern half—Gajo territory proper—now traversed and mapped in many directions, is in the middle, occupied by a horseshoe of mountains 15 to 18½ miles across and open to the west, which encloses the lake Laut Tawr, and is cut off from other chains by deep valleys. At the north end of this horseshoe rises the still smoking Telong (8400 feet). In front of the open west side of the horseshoe spreads the plateau of Pasangan, averaging about 3000 feet high. The whole Gajo land is drained by the two river-systems

of the Pasangan and Jambu-ajer. The former springs from the west loop of Tawar lake, and, traversing the Pasangan plateau, gathers into itself all the waters from the horseshoe's concave side. The Jambu-ajer, on the other hand, gathers, by its two headwaters—Biden on the north, and Jambu-ajer proper on the south side—all the waters from the horseshoe's convex side, carrying them north into Malacca straits. The more northern of the Biden's two fountain-heads bifurcates and sends a part of its waters to Pasangan, thus uniting the two river-systems. The now almost newly discovered Tawar lake lies nearly 4000 feet above sea-level, to the east of the longitudinal axis of Sumatra, and is the most northern in the chain of central Sumatra lakes. It measures $10\frac{1}{2}$ miles east to west by $2\frac{1}{2}$ miles north to south, and is 50 fathoms deep. The lake comprises $15\frac{1}{2}$ miles area, and abounds in fish. There is a very careful and instructive account of the Gajos (who, with the Alas and Bataks, are classed as pre-Malayan and aborigines of the Sunda islands), their physique, character, habits, industries, politics, and marital relations. The article closes with a short vocabulary of the Gajo language compared with Malay and Batak.

AFRICA.

The Uganda Railway.—We learn, from the Report of the Uganda Railway Committee for 1902–1903 recently issued, that the whole of the bridges and culverts had been completed up to Muhoroni, 548 miles, while the station buildings were finished throughout the line. During the fifteen months under review, from January 1, 1902, to March 31, 1903, the mean mileage worked was for the first time that of the completed railway, 584 miles, the receipts from public traffic during this period being given as £115,313. The abstract list of principal commodities (Table 3 of the Report), when compared with that given in the previous Report, shows important increases in up-traffic under piece-goods, building material, metals, and salt; and decreases under grain and pulse, oil, liquor, provisions, and sugar. In down-traffic, increases are noticed under grain and pulse, hides and skins, potatoes, coffee, and ivory. It is pointed out that, owing to Lake Victoria being nearly 4000 feet above sea-level, the down-traffic is carried mainly on descending gradients, which tends to the cheaper working of the line, and is an important factor in the economical development of the country. It is gratifying to learn that this traffic has increased in quantity from 11·16 to 21·67 per cent. of the whole tonnage. The Report also refers to Commander Whitehouse's survey of the Victoria Nyanza already alluded to in the *Journal*.

The British Central Africa Protectorate.—Major F. B. Pearce's Report on the British Central Africa Protectorate for 1902–1903, recently issued, contains a large amount of information regarding the present condition and prospects of British Central Africa. We learn that during the year, in spite of difficulties, trade has generally increased, the figures for both imports and exports being in advance of those of last year, with an increase in the year's revenue of £20,446. The principal difficulty has been the abnormal scarcity of rain and the remarkable lowness of the River Shiré, which has greatly affected the transport of goods from the interior to the sea-coast, apart from the interior traffic which so largely relies on this main waterway. The natives also are said to have suffered severely owing to this cause, as in many places their crops have failed, particularly in the Ruo and Port Herald districts. In the list of exports, that of cotton is mentioned for the first time, and this product seems to promise good results. In the Blantyre district some 300 acres are under cultivation, and the samples sent home have been reported on satisfactorily. The cultivation of tea has been continued, although only in an experimental stage. The tea plantations are at present confined to the

slopes of Mlanje mountain, in the south-east corner of the Shiré highlands, where the average rainfall is 107 inches, nearly double that of the rest of the protectorate. Tobacco is still grown, while rubber has only been cultivated to a limited extent. As regards native cultivation, a steady increase is reported in the production of rice, though, owing to the recent drought, this cultivation was only possible in the northern districts of the protectorate, where the rains were sufficient to ensure a good crop. The cultivation of cassava has also increased in many districts. The health of the European population continues to improve, with a gratifying decline of the death-rate. During the past twelve months permission has been given and arrangements made for the construction of a railway from Chiromo, the British customs port on the lower Shiré river, to Blantyre, to be subsequently extended to Lake Nyasa. The report contains a rainfall map and chart of British Central Africa, and annexed are a number of special reports by officers of the protectorate, dealing with judicial, medical, agricultural, meteorological, and other matters.

The Volcanoes of Griqualand East.—Although the volcanic character of the Drakensberg range has long been recognized, it is only recently that any large number of actual centres of eruption in former times have been discovered. Some nineteen or twenty have been proved to exist in Matatiele, in Griqualand East, by a party of the Geological Survey, and a description of these, with a sketch of the general geological lessons to be learnt from them, is given by Mr. E. H. L. Schwarz in the *Transactions of the South African Philosophical Society*, vol. xiv., part i., 1903. These volcanoes are very old, belonging to the Upper Jurassic or Cretaceous period, and are of special interest as presenting a view, not merely of the stumps of the old volcanoes, showing the condition of things in the pipe far below the original orifice, but of some of the surface features as well, so that by piecing together the evidence, a natural section of a volcano, 4000 or 5000 feet in vertical extent, is obtained. All the vents discovered in Matatiele occur south of the Drakensberg range, the reason for this being that, owing to the rapid erosion on the rainier, seaward face of the mountains, the entire outer side of the old volcanic pile has been carried away, the vents themselves being worn down until most are now found quite at the foot of the mountains. Some, however, have been more capable of resistance, and occupy outstanding positions on the flanks of the mountains, permitting the lava-flows and other surface features to be traced. Mr. Schwarz describes in some detail certain of the pipes (the amygdaloid lavas from which now form the crest of the range), in order to give an idea of the general nature of the volcanoes; but the part of the paper of most geographical interest is that in which he draws conclusions as to the past geological history of this part of South Africa as a whole. The volcanoes appear to lie on a line of weakness in a direction about 60° east of north, and a similar direction seems to dominate the main tectonic lines of this part of Africa. In Permian times there was a shore-line running roughly north-east along the line of the lower Vaal river. Sediments (represented by the various beds from the Dwyka conglomerate to the upper Karroo) were deposited in a broad band to the south-east. This in time became dry land, and a well-marked watershed was formed, to be traced at the present day in the main water-parting running generally in a straight line from Cape Town to Delagoa bay, which can be seen to be anterior to the formation of the main ranges of the present day, as the rivers which run south-east from it traverse these in deep gorges. The upper Orange river alone cuts through the line of this watershed, and the rivers which feed it bear evidence of having been deflected from their natural course, which was to the south-east. The agency by which this was effected was evidently the elevation of the series of volcanoes along a line of weakness parallel to the watershed. From the composition

of the Stormberg beds, Mr. Schwarz concludes that at the time of their deposition an old land-mass existed to the south, of which Madagascar and the Seychelles are the remnants, and that it was in the sea enclosed between this land and the old northern land that the sediments from the Table mountain sandstone upwards were deposited.

The Geodetic Survey of South Africa.—Sir David Gill, the astronomer at the Cape, in his report to the Admiralty for 1902, states that the computation of the field work of the geodetic triangulation, as far as carried out in Rhodesia, is nearly completed; also that field work will be recommenced before the middle of 1903, on the arc along the 30th meridian between the Zambezi and Lake Tanganyika. The plans submitted to Lord Milner for an ordnance survey of the Transvaal and Orange River Colony have been adopted, and include the measurement of an arc of meridian from the northern triangles in Natal along the 30th meridian to the Limpopo. The work has been placed in charge of Colonel Morris, who is engaged in organizing the field parties. Field operations on the Anglo-German boundary between British Bechuanaland and German South-West Africa were suspended in May, the arid nature of the country proving particularly trying and difficult to the observers. With the exception of some minor details, the whole of the triangulation is now stated to be finished, the boundary from Reitfontein south to the Orange river has been beaconed, and the remainder of the boundary will probably be demarcated during the ensuing few months.

British Bornu.—It will be remembered that early in 1902 Colonel Morland led an expedition to Lake Chad with a view to establishing British influence in the portion of Bornu (forming, in fact, the bulk of the country) which is included within the British sphere in Northern Nigeria. The expedition was thoroughly successful, and on Colonel Morland's return Captain Cochrane was left as Resident in charge of the new territory, remaining there until March, 1903. During this time Captain Cochrane traversed the country in various directions, and though unable to undertake definite surveys, his work has resulted in considerable additions to our knowledge of the country and its present condition. We hope to receive from this officer a detailed account of his experiences in Bornu, meanwhile the following preliminary notes are supplied by him. Owing to difficulties between the native rulers of British and German Bornu (the newly appointed sultan of the latter being unfriendly to British influence, which had been accepted by the reigning sultan in the larger portion of the old kingdom), it was found necessary to arrange a preliminary demarcation of the boundary, which runs along the 13th meridian, in order that the people dwelling near it might know to whom their yearly tribute was due. This was carried out in conjunction with Lieut. von Bülow, the German resident for the northern Kamerun, and after completing the work Captain Cochrane went north through Yo to inquire into the state of affairs on the Anglo-French boundary, where the nomad tribes, Tubu (Teda) and Tuareg, were reported to be raiding. It was found that the Tubus had destroyed all the existing towns, and as water was also scarce, Captain Cochrane was unable to effect his purpose, but turned westward along the Yo river (the Yeou Komadugu of Barth), which, as stated by that traveller, brings down a fair amount of water in the rains, though dry in the dry season. After following it up for about 100 miles, Captain Cochrane marched north to the salt lake area on the edge of the Sahara, whither the natives come in the cool season (October to March) to make salt. For the greater part of the year it is inhabited. Hundreds of lakes were found to occupy depressions of the ground, surrounded by a few palm trees. Hence the route led south through dense forest country, peopled mostly by hostile pagans, named Beddis, who gave considerable trouble. Owing to the devastations of

Rabeh, very few of the old towns still exist, and as new towns have sprung up under different names, the map needs thorough revision. At Adiber, north of the Yo, a large party of Tuareg, with some 6000 camels, who had been defeated by the French, were met with. The Yo caravan route to Tripolis *viâ* Bilma is still closed, and the only one now in use is that from Zinder to Murzuk. Captain Cochrane thinks, however, that it would be quite possible to travel to Tripolis by either of these routes, though a more interesting one would be that through Wadai to Ol Obeid, which has been rendered possible by the recent acceptance of French protection by the sultan of Wadai.

Franco-Spanish Delimitation of the Gulf of Guinea Territory.—A circumstantial account of the work of delimitation, in accordance with the Convention of June 27, 1900, of the Franco-Spanish frontier in the Gulf of Guinea territory, is given by Lieut. Duboc, a member of the French Commission, in the July—August number of the *Revue Coloniale* for 1903. The commissioners on the French side were M. Bonnel de Mézières, colonial administrator, assisted by Captain J. B. Roche, of the Engineers, and Lieut. Duboc, of the Colonial Infantry. The commission on the Spanish side included MM. Jover y Tovar, royal commissioner, Vilches, staff-commandant, and the explorers Dr. Ossorio and Montes de Oca. At sunset, July 13, 1901, when the Spanish commission arrived at Gabun, the French colours were hauled down, and next morning the Spanish flag hoisted. Then the posts, Bata, Bonito, and Campo were evacuated by the French. On August 4 the two commissions proceeded to sound the Muni from Botica point to the confluence of the Muni and the Utemboni. The determination of the Thalweg assigned the islands of Ivelo, Grande, Evongue, and Bia to Spain, France retaining useless Tabalan. She regrets the loss of Gande as a customs port against the contraband traffic of the Muni. The river's greatest depth was found not to exceed 66 feet from Botica point to the ocean, nor 33 feet from that village to the confluence of the Utemboni. Only at high tide is there access for ships of light tonnage. A minute register was kept of the soundings of the whole bed of the Muni, so that the precise line of greatest depth was ascertained. MM. Duboc and Vilches laid down the itineraries, which had to be corrected and fixed by points determined astronomically. River distance was measured by the progress of the boat in a given time; land distance by hodometer and pedometer, verified by scrupulous determination of the number of steps taken. The depth of rivers on the line of route, which throughout traversed dense forest, was determined. Geographical positions were fixed—not by triangulation, a method found impracticable, but astronomically. M. Duboc gives a moving picture of the serious difficulties involved in astronomical labours in equatorial Africa. His notes on this head should be of service to later geographical expeditions in that region. The hypsometrical thermometer having got broken at the beginning of operations, recourse was had to the aneroid compensation barometer. A table is given detailing the positions and altitudes fixed by the expedition, the highest point (in 8° 55′ 24″ E. of Paris) being placed at 807·98 metres above sea-level. The article includes a sketch of the history of European influence in the region and exploration of the Hinterland, as also numerous geographical notes of the country along the line of delimitation.

German Surveys in the North-West Kamerun.—The extent of survey work carried out within recent years by German expeditions in the part of the Kamerun territory adjoining Southern Nigeria may be judged from a map constructed by Max Moisel and issued with the first part of the *Mitteilungen aus den Deutschen Schutzgebieten* for 1903. The officers who have done most of the newer work are Captains Glauning and Ramsay, Lieut. Lessner, Dr. Meyer, and

some others, and their extensive routes, combined with the work of earlier explorers, permits a large part of the map to be well filled with detail, although on the large scale of 1:250,000. The northern part of the map, however, shows a wide blank between the main upper branch of the Cross river (known as the Great Aya) and the smaller northern branch, or Little Aya. This area, which extends east almost to the German station at Bali, is inhabited by the Anyang people, said to be savage and warlike, and to differ in language and other respects from the Banyang. A short journey into the western part of this tract has lately been made by Count von Pückler-Limburg, chief of the Ossidinge station on the upper Cross river, who found the inhabitants entirely harmless, and was able to establish friendly relations with them. He examined a section of the Cross river, and found that it gave greater facilities for navigation than had been supposed, while, according to native report, the Little Aya is also navigable for a certain distance. An important trade centre is Kesham, where, as elsewhere in this district, the North-West Kamerun Company has already established a station for the collection of palm-nuts and other products.

Journey in Liberia.—The account of a journey into the northern interior of Liberia, lately made by Herr A. Hübner, is given in the eighth number of *Petermanns Mitteilungen* for 1903, accompanied by a sketch-map. The journey was of no great extent, but most of the back country of Liberia is such an unknown region that even small additions to our knowledge are welcome. The traveller ascended the Morfi river, which empties itself into Fisherman lake, and pushed across the forest zone to the town of Boporu, at the beginning of the elevated savanna country. This lies on the great Mandingo road to Messardu (Mussardu), and was passed by Benjamin Anderson on his journey to that place, which has hitherto been practically our only source of knowledge of this point of Liberia. The forest zone is the habitat of the Gola tribe, who have made clearings here and there for rice and other cultivation, especially around the town of Bassapama. The country abounds in iron ore, which is worked by the natives. The roughness of the way made the journey difficult, there being a constant alternation of valleys and hills. Two important rivers were crossed, both flowing south-east. Herr Hübner supposes the first to be the upper course of the Little Cape Mount river, and the second, which runs a little to the south-west of Boporu, to be a tributary of the St. Paul. Boporu, which is situated in Gondo-land, is said to have been visited by the French from the Sudan. Its inhabitants, who showed themselves friendly, work both in iron and leather, ornamenting the latter with silver obtained from Mexican dollars, which find their way in from the French Sudan.

The Konakri—Niger Railway.—Some details as to the Konakri—Niger railway in French Guinea are given in the recently published consular report. Begun some time ago, the difficulties encountered proved too much for the contractors, and the remainder of the work has been entrusted to the corps of military engineers. It was expected that the first section—about 94 miles in length—to Knidia would be open by the end of 1903. Work would then be commenced on the second section to Timbo, the capital of the Futa Jallon, in which the line will attain the height of 2430 feet above the sea, thence descending to Kurussa in the valley of the Niger. Between Kurussa and Bamako the Niger is navigable, and at the latter place is the terminus of the Sudan railway, which is shortly to join the head of the navigable part of the Senegal river at Kayes with the Niger. When these railways are completed there will be uninterrupted communication by rail and river between St. Louis and Konakri, and the commerce of the upper Niger will have the choice of three ports—St. Louis, Dakar, and Konakri, the two former in Senegal, and the latter in French Guinea.

AMERICA.

Eighteenth-century Projects for Piercing the American Isthmus.—We have received from M. Gabriel Marcel the reprint of an article contributed by him to the *Revue Hispanique* (vol. ix.) on an eighteenth-century map which he has had brought to his notice, on which is shown the project put forward by M. de la Bastide for a canal across the American isthmus by the Nicaragua route. The map, which is finely executed, is printed on silk, and forms the sector of a circle (or rather of the ring formed by two concentric circles), being evidently intended for the decoration of a fan. The map, which contains some spirited allegorical pictures bearing on the project, shows three ships sailing across the lake of Nicaragua, and clearly marks the suggested route of the canal to the west of the lake. It was lately brought to M. Marcel's notice in the shop of M. Chadenat of Paris, and though it must have been printed in some numbers, no other copy seems to be known to geographers. It is not, however, the only source whence a knowledge of M. de la Bastide's project is obtained, for a memoir on the subject was published by him in 1791, from which M. Marcel gives some particulars of the scheme. It is also mentioned by Fleurieu in his work on Etienne Marchand's 'Voyage round the World.' Singularly enough, the same idea suggested itself independently about the same time to M. de Laborde, who puts it forward in the first volume of his 'Histoire de la mer du Sud.' The difficulties in the way of the scheme were not then sufficiently realized, the maps then existing being, of course, too inaccurate to allow of their true appreciation; but it is an interesting fact that the idea of a Nicaraguan canal should have been already in existence in its main outlines before the close of the eighteenth century.

AUSTRALIA AND PACIFIC ISLANDS.

Dutch New Guinea.—The expedition under the leadership of Prof. A. Wichman has completed its work, and is on its way home. The party arrived in Geelvink bay in the month of February last, and, having heard of the existence of coal on the Wasiani river, marched inland from Sari (or Siari) westwards, crossing several rivers, some of considerable size. Among these was the Ingsiim, more than 30 yards broad, which is probably the Inse (see vol. xxii. p. 465). Shortly before reaching the Wasiani, Prof. Wichman and his companions marched along a ridge 950 feet above sea-level, and at the village of Horna enjoyed a fine panorama of mountains extending from the north round to the east, the table-topped Rabuki (2600 feet) and the somewhat pointed Mawi (3300 feet) being conspicuous among them. Along the bed of the Wasiani, a turbulent stream 20 yards broad, loose pieces of coal were abundant, and the whole district is built up of Carboniferous strata. This is the first time that coal of this formation has been discovered in the Dutch East Indies. As the provisions were giving out, it was not possible to ascend the river to the coal-beds. On the island Anggar Mios and at Wendesi Carboniferous slates were found, and in a piece from the latter place specimens of *Posidonomya Becheri*, which proves that the slate belongs to the lowest series of the formation. On March 3 the expedition arrived on the *Zeemeeuw* at Humboldt bay, and explored the neighbourhood, including the Santani lake (see vol. xxii. p. 465) and the Cyclops mountains, of which the chief is the Sar with three rounded summits, the highest being named Remor. Then an attempt was made to ascend the Tami river, which enters to the sea near the German boundary, but it proved impossible to proceed far with the coolies that had been provided. The party, therefore, returned to Humboldt bay, and made several excursions in the neighbourhood, one of them being to two small lakes in the basin of the Sebanto river.

The next halting-place was at Walckenaer bay, where the meandering coast streams, the Tawarim, Borowai, Sigiau, and Moaif were examined, and several coal-seams were found, which, however, were thin or of poor quality. Ammonites, very similar to those collected by Prof. Böhm in the Sula islands, were very plentiful. Next a cruise was made among the small islands off the coast as far as the Mapia, which are claimed by both the Dutch and German governments. They are of coral formation, and are covered with groves of coco-palms. Then another attempt was made to cross the island from Geelvink bay. The low watershed was crossed after a day's march, and by the Buama river the lake Yamur (or Yermor) was reached, which had never been visited by Europeans; and then the journey was continued along the Wa Udu and Urama rivers towards the McCluer gulf, but the mosquitoes gave the rowers no rest day or night, and therefore the expedition was obliged to turn back to Geelvink bay.—*Tijdschrift van het K. Nederl. Aardrijksk. Genootschap*, Deel xx. No. 5, and *Petermanns Mitt.*, No. 10, 1903.

POLAR REGIONS.

Baron Toll's Expedition.—Reference is made in a recent number of *Globus* (vol. 84, No. 20), to news received from Yakutsk, according to which Baron Toll would seem to have not been found on the New Siberia islands by the relief parties, the conclusion being drawn that he was still on Bennett island, to which Lieut. Koltschak had therefore proceeded. News was not expected from him until the present month. Captain Matthiessen, who had been commissioned to bring away the *Zarya*, left last year at the mouth of the Lena, is said to have succeeded in his task and to have returned home.

The Hydrographical Expedition to the Murman Sea.—The Russian investigation of the northern coasts under Captain Warneck, which has been referred to already in these pages, was continued in 1902. The islands on the northern part of the White sea were first visited, marks were set up on the island Gorainof and on one of the Three islands, the Orlof islets were investigated, and the position of the Orlof lighthouse determined. Its position turned out to be 67° 12′ 3″·7 N. lat. and 41° 20′ 16″·05 E. long. from Greenwich, or about two-thirds of a mile (nautical) from the position hitherto marked on charts. Lieut. Brovtsin observed the tides, and found that the difference between the levels of high and low water was 19·5 feet at the syzygies, and 10·3 at quadrature. The highest and lowest were 21·75 and 9 feet respectively. The weather was very cold, the mean temperature from June 8 to 14 being 35°·8. The expedition proceeded next to the cape Russki Zavorot (position of pillar, 68° 56′ 1″·4 N. lat. and 53° 45′ 57″·6 E. long.), and drew up directions for vessels sailing to the mouth of the Pechora. Thence the steamer *Pakhtusof* was steered to the Kara strait and entered the Dolgaya bay, but on June 20 sailed out again, as the ice then in the strait threatened to close the vessel in. There was ice also in the Yugor strait, and an attempt to pass through into the Kara sea was unsuccessful. Captain Warneck therefore turned again towards the Kara strait, and explored the entrance to the Dirovataya bay, on the north-west coast of Waigatz island. A plane-table survey on the scale of 200 sazhen (1400 feet) to the inch was executed of the shores of the bay, and a good roadstead where ships can anchor safely and even pass the winter was discovered. On August 22 the expedition succeeded in passing into Kara sea by the Yugor strait, and sailed south-eastwards as far as the mouth of the Kara river. The coast rises in gentle slopes to a height of 200 to 300 feet above the sea. Fifteen to twenty miles inland greater elevations were seen, on which snow still remained. The sea-bottom was very even, rising gradually from 18 to 20 fathoms at the Mestnoi island to 7 fathoms at the Kara river. The salinity decreased slowly,

from 1·0250 at the Yugor strait to 1·0185 at the mouth of the Kara. Observations at Cape Polkovnika gave its position as 69° 15′ 28″·6 N. lat., 65° 0′ 36″·15 E. long., or only a few seconds in longitude and latitude different from the determination of the Ural expedition of 1847–1850. On the voyage northwards Captain Warneck made for the point north-east of the Yugor strait, where Krusenstern in 1862 sounded a depth of 406 fathoms, and found only 100 fathoms; the greatest depth measured by the expedition in this part of the sea during five years' work is 120 fathoms. The *Pakhtusof* entered the Kara strait on August 28. The bottom proved to be very even. The best track through the strait lies in the middle, where there is a channel with at least 20 fathoms of water, whereas there is a large extent of shallow water off the Waigatz coast. On August 29 Captain Sorgeyef, who had been put ashore and had made a very complete survey of the coast from the north-western cape of Waigatz nearly to the Bolvanski point, was taken on board, and the return voyage to Archangel was commenced. During the whole voyage meteorological, magnetic, and other observations where made at various points.

The Antarctic Expeditions.—The *Scotia*, with Mr. Bruce on board, arrived at Buenos Aires from the Antarctic on December 15, but was soon to return southward to continue the scientific work in that region. The following telegram has been received from Mr. Bruce, at Buenos Aires: "Refitting here. Hydrographically surveyed 4000 miles unexplored ocean: 70° 25′ S., 17° to 45° W.: 2700 fathoms trawled there: wintered Orkneys; detailed survey. Mossman and five men continue first-class meteorological, magnetical, biological station. Ramsay died August 6. All other robust; *Scotia* splendid." Further particulars respecting Dr. O. Nordenskiöld's expedition have also come to hand. It appears that the *Antarctic* was crushed by ice before arriving at the rendezvous at Mount Bransfield, arranged between Dr. Nordenskiöld and Captain Larsen. The crew took to the boats, and after some time succeeded in reaching Paulet island, where they wintered. Captain Larsen made his way, with five men, to Snow Hill, where he found Dr. Nordenskiöld and his companions. The latter had undertaken a sledge expedition to the south-west during the first winter, reaching a point in 66° S., 62° W., and adding considerably to our knowledge of the topography of the region. He had since carried out important geological, magnetic and meteorological observations.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Disafforestation and Hydrology.—Opinions still differ as to the extent of the influence exercised by disafforestation on the flow of water in rivers, though that such an influence does exist can hardly be doubted, in spite of the efforts sometimes made to minimize its importance. An instance from European Turkey of changes in the fluvial *régime* of a country resulting from the destruction of forests, is brought forward by Dr. F. Schaffer in the *Mitteilungen* of the Vienna Geographical Society (1903, No. 3–4). The locality in question is the basin of the Ergene, the largest tributary of the Maritza, in Eastern Rumelia. Dr. Schaffer says that the case of this river presents unusual opportunities for gauging the effects of disafforestation, as observations of the high-water level are available for twenty-five years, while we can also trace the extent to which the forests have been reduced during the same period. He does not, however, make it plain what is the nature of the observations alluded to, referring in general terms only to the marked rise in the high-water level within recent years. As regards the destruction of forests, he shows that this has taken place over an area of some 200,000 hectares, or 2000 square kilometres (about 770 square miles), the existing forests occupying only some 14,000 hectares. Owing to this destruction the water now flows away with great rapidity, and Dr. Schaffer reckons that all the hydrographical phenomena

take place with double the intensity they showed twenty-five years ago. Erosion is excessively active, and great damage is done by the rivers at the time of high water. This takes place in spring, when the whole valley is often under water, the bridges even being quite impassable, though, as a rule, the Ergene is a small stream some 10 yards wide, only occupying *one* arch of the old Turkish bridge at Uzun Köprü. The existence of this shows that the valley was always liable to floods, but these are said to have become far more serious than ever within the last few years.

GENERAL.

London School of Economics.—Mr. H. J. Mackinder, lecturer in Economic Geography at the London School of Economics, has been appointed director of the school in succession to Prof. W. A. S. Hewins, who has resigned the post. Mr. Mackinder will retain his position as Reader in Geography at the University of Oxford.

OBITUARY.

Ernest Ayscoghe Floyer.

Mr. E. A. Floyer, Inspector-General of Egyptian Telegraphs, who died at Cairo on December 1, 1903, from heart disease, at the age of 51, was the eldest surviving son of the Rev. Ayscoghe Floyer, and of Louisa Sara, daughter of the Hon. Frederick John Shore, of the Bengal C.S. He was educated at the Charterhouse until 1869, when he received an appointment in the Indian Telegraph Service, being then in his seventeenth year. His work during the next seven years was along the Perso-Baluch coast of the Persian Gulf. His spirit of enterprise was noted and recorded by his superiors, and in 1876, when he received his long-deferred privilege leave, although at the time seriously ill, he started, unaided and practically alone, for the unexplored interior of Baluchistan. His observations and surveys on this difficult and dangerous journey were of considerable geographical and historical interest, as well as of political value. The journey, described in his 'Unexplored Baluchistan,' was prolonged through the heart of Persia, by way of Kirman and Ispahan, to Baghdad, and he returned to London, having made a name for himself at the age of three and twenty. He was soon afterwards appointed Inspector-General of the Egyptian Telegraphs. This department, which had hitherto been conducted at considerable loss, he so organized as to yield a handsome annual surplus. He also rendered substantial service to the military authorities in the campaigns of 1882 and subsequent years. He trained a large staff of native telegraphists, of whom a second generation grew up during his twenty-seven years' tenure of office. The personal devotion of his native subordinates was the best evidence of those fine qualities which fitted him so well to deal with Eastern races. In 1887 he was able once more to devote time to exploration, and surveyed "Two Routes in the Eastern Desert of Egypt," between the Nile and the Red sea (*Proc. R.G.S.*, ix. (1887), p. 659). In 1891 he was appointed by the Khedive to the command of an important expedition in the more southern part of the same desert, the work of which is recorded in his official publication, *Étude sur le Nord-Etbai* (see also *Geo. Jour.*, i., 1893, p. 408). His re-discovery of the ancient emerald-mines of the Egyptians attracted popular attention, and his maps and observations have been the basis for what has since been done in the exploitation of this region. In this expedition he showed, also, considerable aptitude for dealing with historical and linguistic questions.

During the last decade the leisure time and the official surplus, which were the rewards of good organization of the telegraphs, enabled Mr. Floyer to give much attention to the economic development of neglected resources in Egypt. He originated the "Nitrate Mission," experimented successfully in the growth of rubber-bearing plants, and supplied botanic material for research work at the Scientific Department of the Imperial Institute. But it was in the plantations for growing trees and economic plants which may be profitably cultivated upon waste land that he most delighted. He set himself to win back for cultivation the land lost on the western side of the delta by the encroachment of drifting sand, already with great promise of success. The work was carried out with that instinct of thrift without which no man succeeds in agriculture.

He knew the Desert as a sailor knows the sea, loved its stern features and severe yet spacious life, and will be remembered for his writings upon desert lore.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1903-1904.

Third Ordinary Meeting, November 23, 1903.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS.—*John Howard Bentley; Colonel Lord William Cecil, M.V.O.; Captain S. G. Craufurd (Gordon Highlanders, D.S.O.); James Duckworth; Horace Charles Martin; Max. Teichmann; Sir William Lawrence Young, Bart.*

The Paper read was:—

"Recent Exploration and Economical Development in Central and Western China." By Lieut.-Colonel C. C. Manifold.

Fourth Ordinary Meeting, December 14, 1903.—Colonel G. EARL CHURCH, Vice-President, in the Chair.

ELECTIONS:—*René R. Barber; A. A. R. Boyce; James Ewart Bridge; Rev. J. Frank Bright, D.D. (Master of University College, Oxford); Lieut. W. L. Campbell, R.A.; Leonidas Chalikiopoulos, Ph.D. (Berlin); Lieut. Hugh Jamieson Elles, R.E.; Rev. T. Flavell; T. Augustus Hardcastle; Mark Alan Hartnell; Bertram Henry M. Hewett, C.E.; James Brereton Hooper; Charles Onslow Master; Major J. Moore (Remount Department, W.O.); Dr. William Norman-Bott; Lieut.-Colonel Chas. Withers Ravenshaw, I.A.; George A. C. Sandeman; Charles Fletcher Argyll Saxby, F.S.S.; Ragmar Wettre.*

The Paper read was:—

"The Patagonian Andes." By Colonel Sir T. H. Holdich, K.C.M.G., K.C.I.E., C.B.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

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

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

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

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

EUROPE.

Austria—Bosnia. *G. Abh.* 7, Heft 3 (1903): pp. 200. **Grund.**

Die Karsthydrographie Studien aus Westbosnien. Von Dr. A. Grund. *With Illustrations.*

This will be specially noticed.

Austria—Hungary. *Rev. G.* **53** (1903): 289–308. **Henry.**

Questions d'Autriche-Hongrie. Par René Henry. *With Map.*

Black Sea. **Grigorovitch-Beresovski.**

Mém. S. Naturalistes Nouvelle-Russie **24** (1902): 103–122.

Les dépôts postpliocènes marins sur les bords de la Mer Noire. Par N. A. Grigorovitch-Beresovski. [In Russian.]

Europe—Historical. **Freeman.**

The Historical Geography of Europe. By E. A. Freeman. Third Edition. Edited by J. B. Bury. *With Atlas.* London: Longmans & Co., 1903. Size 9 × 6, pp. lii. and 612. *Price* 12*s.* 6*d.*, *Atlas* 6*s.* 6*d.* *Presented by the Publishers.*

See note, *ante*, p. 120.

Europe—History. **Helmolt.**

Weltgeschichte. Herausgegeben von H. F. Helmolt. Achter Band. Westeuropa, Zweiter Teil, Der Atlantische Ozean. Von Prof. Dr. A. Kleinschmidt, Prof. Dr. H. von. Zwiedineck-Südenhorst, Dr. H. Friedjung, Prof. Dr. G. Egelhaaf, Prof. Dr. R. Mayr, und Prof. Dr. K. Weule. Leipzig and Wien: Bibliographisches Institut, 1903. Size 10½ × 7, pp. xiv. and 646. *Maps and Illustrations. Price* 9*s.*

Deals with West European history from 1789 to 1902, with chapters on the modern progress of science, art, and culture, and on the historical importance of the Atlantic ocean.

France—Bordeaux. *Rev. G.* **53** (1903): 167–174. **Lavergne.**

Le port de Bordeaux et sa situation économique. Par J. Lavergne.

Germany—Wind and Water-mills. *Petermanns M.* **49** (1903): 169–173. **Krümmel.**

Die geographische Verbreitung der Wind- und Wassermotoren im Deutschen Reiche. Nach der Gewerbezählung vom 14. Juni 1895 dargestellt von Prof. Dr. O. Krümmel. *With Maps.*

Greece—Eubœa. *C. Rd.* **137** (1903): 666–668. **Deprat.**

Sur la structure tectonique de l'île d'Eubée. Note de M. Deprat.

Italy—Sardinia. *Sitzb. K.P.A.W. Berlin* (1903): 685–699. **Tornquist.**

Der Gebirgsbau Sardiniens und seine Beziehungen zu den jungen, circum-mediterranen Faltenzügen. Von Prof. Dr. A. Tornquist. *With Diagrams.*

Italy—Surveys and Cartography. ———

Cenni storici sui lavori geodetici e topografici e sulle principali produzioni cartografiche esequite in Italia dalla metà del secolo xviii. ai nostri giorni. Firenze, 1903. Size 9½ × 6½, pp. viii. and 80. *Portraits.*

Montenegro—Cartography. *B.S.G. Italiana* **4** (1903): 646–654. **Hassert.**
Lo sviluppo della cartografia del principato di Montenegro nel secolo xix. Conferenza del K. Hassert.

Rhine. *C. Rd.* **137** (1903): 389–391. **Lamothe.**
Sur le passage du Rhin par la vallée du Doubs et la Bresse pendant le Pliocène. Note de M. le general de Lamothe.

Russia. *Mém. Comité Géolog.* **20**, No. 1 (1902): pp. 188. **Domherr.**
W. Domherr's Geologische Untersuchungen in Süd-Russland in den Jahren 1881—1884. [In Russian; *résumé* in German.] *With Map and Portrait.*

Russia. *Globus* **84** (1903): 139–143. **Weissenberg.**
Die Karäer der Krim. Von Dr. S. Weissenberg. *With Illustrations.*

Russia—Finland. ———
The Grand Duchy of Finland. By the Author of "A Visit to the Russians in Central Asia." London: T. Fisher Unwin, 1903. Size 7½ × 5, pp. 128. *Map. Price 2s. 6d. Presented by the Publisher.*

A sketch of Finland, its people and history, which is likely to prove useful at the present juncture.

Russian Empire. *B. Comité l'Asie Française* **3** (1903): 297–300. **Labbé.**
Une nouvelle voie ferrée transouralienne, ses conséquences futures. Par Paul Labbé.

Scandinavia. **Baedeker.**
Norway, Sweden, and Denmark. Handbook for Travellers by Karl Baedeker. Eighth Edition. Leipsic: K. Baedeker; London: Dulau & Co. 1903. Size 6½ × 4, pp. lxxxii. and 486 and 40. *Maps and Plans. Price 8m. Two Copies, presented by the Editor and Messrs. Dulau & Co.*

Scandinavia. **Kennedy.**
Thirty Seasons in Scandinavia. By E. B. Kennedy. London: E. Arnold, 1903. Size 9 × 5½, pp. xvi. and 278. *Illustrations. Price 10s. 6d. net. Presented by the Publisher.*

Sweden—Lakes—Flora. **Carlson.**
Bihang K. Svensk. Vet.-A. Handl. **28** (Afd. iii. No. 5): pp. 40.
Om vegetätionen i nagra småländska sjöar. Af G. W. F. Carlson.

Switzerland. **Baedeker.**
Switzerland and the adjacent portions of Italy, Savoy, and Tyrol. Handbook for Travellers by Karl Baedeker. Twentieth Edition. Leipsic: Karl Baedeker: London: Dulau & Co. 1903. Size 6½ × 4, pp. xxxviii. and 538. *Maps and Plans. Price 8m. Presented by Messrs. Dulau & Co.*

Switzerland. *Vierteljahrs. Naturforsch. Ges. Zürich* **48** (1903): 49–270. **Düggeli.**
Pflanzengeographische und wirtschaftliche Monographie des Sihltales bei Einsiedeln. Von Max Düggeli. *With Map and Plates.*

Switzerland. **Heer.**
Die Schweiz. Von J. C. Heer. (Land und Leute. Monographien zur Erdkunde, v.) Bielefeld und Leipzig: Velhagen & Klasing, 1902. Size 10½ × 7, pp. 196. *Map and Illustrations. Price 4s.*

Switzerland. *Ann. G.* **12** (1903): 289–302. **Lacger.**
Étude de morphologie glaciaire: Le Hasli im Grund. Par l'Abbé L. de Lacger. *With Map.*

Switzerland—Simplon Tunnel. *Mouvement G.* **20** (1903): 430–433. ———
Le tunnel du Simplon. *With Map.*

Turkey. *M.K.K.G. Ges. Wien* **46** (1903): 126–130. **Schaffer.**
Entwaldung und Entwässerung des Ergenebeckens in der europäischen Türkei. Von Dr. F. X. Schaffer.

Turkey—Macedonia. **Petroph.**
Ιωαννου Πετρωφ του ἐκ Μοσχας ἐργον Ε'. Μακεδονια. Τομος Α'. Ἀρχαια και Βυζαντιακη ἐποχη. Leipzig: I. D. Nerantz, 1903. *Maps and Illustrations.*

The first instalment of a sketch of Macedonian history from the earliest times, of a popular character.

United Kingdom. **Neuse.**

Landeskunde der Britischen Inseln von Dr. Richard Neuse. Breslau: F. Hirt, 1903. Size 9½ × 6, pp. viii. and 164. *Maps and Illustrations. Price* 4*s.*

An instructive sketch of the physical and political geography of the British Islands.

United Kingdom—Bucks. **Roscoe.**

Buckinghamshire. By E. D. Roscoe. London: Methuen & Co., 1903. Size 6 × 4, pp. viii. and 286. *Maps and Illustrations. Price* 3*s. Presented by the Publishers.*

United Kingdom—Chichester. **Reid.**

Memoirs of the Geological Survey. England and Wales. The Geology of the Country near Chichester. (Explanation of Sheet 317.) By Clement Reid. With contributions by G. W. Lamplugh and A. J. Jukes-Browne. London: E. Stanford, 1903. Size 10 × 6½, pp. 52. *Illustrations. Price* 1*s.*

United Kingdom—Derbyshire. **Cox.**

Derbyshire. By Charles J. Cox. London: Methuen & Co., 1903. Size 6 × 4, pp. x. and 276. *Maps and Illustrations. Price* 3*s. Presented by the Publishers.*

United Kingdom—England. **Armstrong and Inglis.**

Short Spins round London (South of the Thames). By Arthur C. Armstrong and Harry R. G. Inglis. London: Gall & Inglis, 1903. Size 6 × 3½, pp. xx. and 152. *Maps, Contours, and Illustrations. Price* 1*s. net. Presented by the Publishers.*

A most useful and handy book for cyclists, on the lines of the well-known 'Contour Road-books' issued by the same firm, but with some special features.

United Kingdom—England. **Ward.**

Thorough Guide Series. North Devon [including West Somerset] and North Cornwall: from Exmoor to the Scilly Isles, with a description of the various approaches. By C. S. Ward. Eighth Edition. London: Dulau & Co., 1903. Size 6½ × 4, pp. 8, xvi., and 160. *Maps and Plans. Price* 3*s.* 6*d. net. Presented by the Publishers.*

United Kingdom—Geological Survey. ———

Memoirs of the Geological Survey. Summary of Progress of the Geological Survey of the United Kingdom and Museum of Practical Geology for 1902. London: E. Stanford, 1903. Size 10 × 6½, pp. 240. *Price* 1*s.*

United Kingdom—Peak District. **Baddeley.**

Thorough Guide Series. The Peak District of Derbyshire and Neighbouring Counties. By M. J. B. Baddeley. Eighth Edition. London: Dulau & Co., 1903. Size 6½ × 4, pp. xvi., 16, and 158. *Maps. Price* 3*s. net. Presented by the Publishers.*

United Kingdom—Roman Wall. *J. Manchester G.S.* **19** (1903): 13–22. **Gleave.**

The Roman Wall near Hexham. By J. J. Gleave. *With Illustrations.*

United Kingdom—Scotland. **Mackenzie.**

History of the Outer Hebrides. (Lewis, Harris, North and South Uist, Benbecula, and Barra.) By W. C. Mackenzie. With a chapter on the Geology, Physical Features, and Natural History of the Group by the Rev. William Morrison. Paisley: A. Gardner, 1903. Size 9 × 5½, pp. xl. and 624. *Illustrations. Price* 12*s.* 6*d.*

This is the first attempt which has been made to bring together all that is known of past events in the outer isles. The book contains chapters on pre-Norse records, the Norse occupation, and other early events, as well as more recent domestic history and relations with the British Government. A chapter on physical geography, etc., is added.

United Kingdom—Scotland. **Macnair.**

P.R. Philosph. S. Glasgow **34** (1902–1903): 147–224.

The Building of the Grampians. By Peter Macnair. *With Map and Sections.*

This was noticed in the Monthly Record for December.

United Kingdom—Surrey. **Lambert.**

Surrey. By F. A. H. Lambert. London: Methuen & Co., 1903. Size 6 × 4, pp. xii. and 212. *Maps and Illustrations. Price* 3*s. Presented by the Publishers.*

As in others of the "Little Guides," Mr. New's illustrations form perhaps the most striking feature. The bulk of the text is taken up with descriptions of places in alphabetical order, the sections on various aspects of the county as a whole being reduced to a minimum. More attention might with advantage have been given to these.

United Kingdom—Torquay. **Ussher.**

Memoirs of the Geological Survey. England and Wales. The Geology of the country around Torquay. (Explanation of Sheet 350.) By W. A. E. Ussher. London: E. Stanford, 1903. Size 9½ × 6, pp. 142. *Illustrations.* *Price* 2*s.*

ASIA.

Armenia. **Grothe.**

Jahresb. Frankfurter V.G. u. Statistik **66 & 67** (1901–1903): 87–90.

Wandertage in Hocharmenien. Von Dr. H. Grothe.

Central Asia—Tian Shan. **Friedrichsen.**

Jahresb. Frankfurter V.G. u. Statistik **66 & 67** (1901–1903): 143–148.

Forschungsreisen im zentralen Tienschan und dsungarischen Alatau. Von Dr. Max Friedrichsen.

China. *B. Comité l'Asie Française* **3** (1903): 318–323. ———

Le Chemin de fer du Yunnan. Par R. C. *With Map.*

China—Yangtse. *Asien* **2** (1903): 183–186. **Kürchhoff.**

Der Jangtse. Von D. Kürchhoff.

Dutch East Indies. **Weber.**

Siboga-Expeditie. Hydrographic Results of the Siboga Expedition. By G. F. Tydeman. Monographie III. of Uitkomsten op zoologisch, botanisch, oceanographisch en geologisch gebied verzameld in Nederlandsch Ost-Indië 1899–1900 . . . Uitgegeven door Dr. Max Weber. Leiden: late E. J. Brill, 1903. Size 13½ × 11, pp. 94. *Charts and Illustrations.*

Indian Ocean—Maldive and Laccadive Islands. **Gardiner.**

The Fauna and Geography of the Maldive and Laccadive Archipelagoes. . . . Edited by J. Stanley Gardiner. Vol. ii. Part i. Cambridge: University Press, 1903. Size 11½ × 9, pp. 473–588. *Map and Plates.*

Indo-China. *Tijds. K. Ned. Aard. Genoots. Amsterdam* **20** (1903): 633–653. **Patijn.**

Reis van Bangkok over Korat naar Saigon. Door J. A. N. Patijn. *With Map.*

Korea and Manchuria. *B. Comité l'Asie Française* **3** (1903): 232–240, 362–367. **Caix.**

Corée. Par Robert de Caix. *With Map.*

Mandchourie et Corée. By the same.

Siam. *J. Manchester G.S.* **19** (1903): 23–27. **Colquhoun.**

Siam: Present and Future. By A. R. Colquhoun.

Southern Asia. **Preyer.**

Indo-Malayische Streifzüge. Beobachtungen und Bilder aus Natur und Wirtschaftsleben im tropischen Süd-Asien von Dr. Axel Preyer. Leipzig: T. Grieben, 1903. Size 8½ × 6, pp. ix. and 288. *Illustrations.* *Price* 5*s.* 6*d.*

Contains some useful information on the economic (especially agricultural) development of the countries touched upon, the greatest space being devoted to Java.

Malay Archipelago—Borneo. **Nieuwenhuis.**

K.A.W. Amsterdam, P. Sec. Sci. **5** (1903): 525–540.

Influence of changed conditions of life on the physical and psychical development of the population of Central Borneo. By Dr. A. W. Nieuwenhuis.

Malay Archipelago—Borneo. **Spaan.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **20** (1903): 654–676.

In het Birang-stroomgebied (21–30 Mei 1901). Door A. H. Spaan.

Malay Archipelago—Java. **Niermeyer.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **20** (1903): 478–494, 677–703.

De bevloeiingswerken op Java. Door J. F. Niermeyer. *With Maps.*

On irrigation works in Java.

Malay Archipelago—Sumatra. **Cornelis.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **20** (1903): 716–718.

Het Tjoenda-Gebergte. Door W. Cornelis. *With Map.*

Persian Gulf. **Kemball.**

Trade of the Persian Gulf for the year 1902. Foreign Office, Annual No. 3036, 1903. Size 10 × 6½, pp. 58. *Price* 3*d.*

Turkey—Asia Minor. *M.K.K.G. Ges. Wien* **46** (1903): 12–43, 71–125. **Schaffer.**
Geologische Forschungsreisen im Südöstlichen Kleinasien. Von Dr. F. Schaffer.

Turkey—Syria. **Dussaud and Macler.**
Nouv. Archives Miss. Sci. et Lit. **10** (1903): 411–744.
Rapport sur une mission scientifique dans les régions désertiques de la Syrie moyenne. Par R. Dussaud avec la collaboration de F. Macler. *With Map and Plates.*

AFRICA.

Abyssinia—Mining. *B.S.G. Italiana* **4** (1903): 561–575. **Vannutelli.**
L'Uallega e l'industria mineraria. Nota del L. Vannutelli. *With Map, Plan, and Illustrations.*

Africa—Missions. **Stewart.**
Dawn in the Dark Continent, or Africa and its Missions. The Duff Missionary Lectures for 1902. By Dr. James Stewart. Edinburgh and London: Oliphant, Anderson & Ferrier, 1903. Size 9 × 6, pp. 400. *Maps. Price* 6*s. net. Presented by the Publishers.*

This is a useful and compact history of Protestant missions in Africa during the nineteenth century, and supplies a by no means unimportant chapter in the history of the modern opening up of the continent. The author discusses the future of Africa and the African race, and his views on this and other subjects give evidence of an open and impartial spirit.

British Central Africa. **Duff.**
Nyasaland under the Foreign Office. By H. L. Duff. London: G. Bell & Sons, 1903. Size 9 × 6, pp. xvi. and 422. *Maps and Illustrations. Price* 12*s. net. Presented by the Publishers.* [To be reviewed.]

Egypt. **Abbate.**
Dr. Abbate Pacha. Le Canal Abbas II. Projet. Cairo, 1902. Size 11 × 8, pp. 16. *Map.*

On the project for a canal across the desert between Abu Hamed and Maharaka, first put forward by the author in 1893.

Egypt. **Barron and Hume.**
Survey Department, Public Works Ministry. Geological Survey Report. Topography and Geology of the Eastern Desert of Egypt, Central Portion. By T. Barron and W. F. Hume. Cairo: National Printing Department, 1902. Size 11 × 7½, pp. viii. and 332. *Maps and Illustrations. Presented by the Survey.*

Noticed at p. 118, *ante*.

Egypt. **Garstin.**
Public Works Ministry. Report upon the Administration of the Public Works Department in Egypt for 1902. By Sir William Garstin, G.C.M.G., with Reports by the Officers in Charge of the several branches of the Administration. Cairo: National Printing Department, 1903. Size 11 × 7½, pp. 476. *Plans and Plates.*

Egypt. **Reitemeyer.**
Beschreibung Ägyptens im Mittelalter aus den geographischen Werken der Araber, zusammengestellt von Else Reitemeyer. Leipzig: Dr. Seele & Co., 1903. Size 9 × 6, pp. 238.

See note in the December number, p. 695.

French Congo. *Rev. G.* **53** (1903): 36–53. **Bourdarie.**
Islamisme et fétichisme. Par P. Bourdarie. *With Map.*
Traces the recent southward extension of Mohammedan influence.

Madagascar. *B.S.G. Lille* **40** (1903): 73–109. **Roux.**
Madagascar. Par C. Roux.

Morocco. *Nouv. Archives Miss. Sci. et Lit.* **10** (1903): 379–409. **Buchet.**
Rapport sur une mission scientifique dans le Nord du Maroc. Par G. Buchet. *With Maps.*

Morocco. *Beiträge Kolonialpolitik* **5** (1903–1904): 65–75. **Mohr.**
Von Mogador nach Marrakesch. Reiseeindrücke aus dem Maghreb el Aksa. Von Dr. P. Mohr. *With Illustrations.*

Rhodesia.

Report on the Administration of North-Eastern Rhodesia for the year ending March 31, 1903. Fort Jameson. Size 10 × 6½, pp. 36. *Presented by the Administrator, North-Eastern Rhodesia.*

Sudan—Cotton Cultivation. *B.S.G. Com. Havre* **20** (1903): 293–304. **Lenfant.**

La Culture du Coton au Soudan. Par Capitaine E. Lenfant.

Transvaal and Orange River Colony.

Papers relating to the Progress of Administration in the Transvaal and Orange River Colony. London: Eyre & Spottiswoode, 1903. Size 13½ × 8½, pp. 202. *Maps. Price* 1*s.* 11*d.*

Further papers relating to . . . the Transvaal. Pp. 46. *Price* 5*d.*

Tripoli. *Nouv. Archives Miss. Sci. et Lit.* **10** (1903): 245–277. **Mathuisieulx.**

Rapport sur une mission scientifique en Tripolitaine. Par H. Méhier de Mathuisieulx. *With Plan and Plates.*

NORTH AMERICA.

Canada. **Lumsden.**

Through Canada in Harvest Time, a Study of Life and Labour in the Golden West. By James Lumsden. London: T. Fisher Unwin, 1903. Size 8½ × 5½, pp. xx. and 364. *Map and Illlustrations. Price* 6*s. Presented by the Publisher.*

Much attention is given to the agricultural and other resources of Canada.

Mexico. *Z. Ges. Erdk. Berlin* (1903): 477–502. **Seler.**

Ein Wintersemester in Mexico und Yucatan. Von Prof. Dr. E. Seler. *With Illustrations.*

United States. **Carpenter.**

The American Advance. A Study in Territorial Expansion. By Edmund J. Carpenter. London and New York: Macmillan, 1903. Size 9 × 5½, pp. x. and 332. *Map. Price* 10*s.* 6*d. net. Presented by the Publishers.*

A clearly told history of the territorial expansion of the United States from the Declaration of Independence to the recent acquisition of the Philippines, etc.

United States—California. *American J. Sci.* **16** (1903): 240–250. **Hershey.**

Certain River Terraces of the Klamath Region, California. By O. H. Hershey.

United States—History. **Brigham.**

Geographic Influences in American History. By A. P. Brigham. Boston, U.S.A.: Ginn & Co., 1903. Size 7½ × 5, pp. xii. and 366. *Maps and Illustrations. Price* 6*s. Presented by the Publishers.* [To be reviewed.]

United States—History. **Semple.**

American History and its Geographic Conditions. By Ellen Churchill Semple. Boston & New York: Houghton, Mifflin & Co., 1903. Size 9 × 6, pp. 466. *Maps. Price* $3.00 *net. Presented by the Author.* [To be reviewed.]

United States—Meteorology.

U.S. Department of Agriculture, Weather Bureau. Report of the Chief of the Weather Bureau. 1900–1901. Vol. ii. Washington, 1902. Size 12 × 9½, pp. 1006. *Diagrams. Presented by the U.S. Department of Agriculture, Weather Bureau.*

United States—Surveys. **Wilson, Renshawe, Douglas, Goode.**

B. United States Geolog. Surv., No. 201 (1902): 164.

Results of Primary Triangulation and Primary Traverse Fiscal year 1901–1902. By H. M. Wilson, J. H. Renshawe, E. M. Douglas, and R. U. Goode. *With Map.*

United States—Surveys.

Report of the Superintendent of the Coast and Geodetic Survey, showing the progress of the work from July 1, 1901, to June 30, 1902. Washington, 1903. Size 11½ × 9, pp. 800. *Maps, Diagrams, and Illustrations. Presented by the U.S. Coast and Geodetic Survey.*

United States—Wisconsin. *J. Geology* **11** (1903): 289–313. **Weidman.**

The pre-Potsdam Peneplain of the pre-Cambrian of North-Central Wisconsin. By S. Weidman. *With Illustrations.*

CENTRAL AND SOUTH AMERICA.

Andes. **Petrocokino.**

Along the Andes. By A. Petrocokino. London: Gay & Bird, 1903. Size 9 × 6, pp. viii. and 148. *Maps and Illustrations. Price 7s. 6d. Presented by the Publishers.*

Notes from a diary during a trip through Bolivia, Peru, and Ecuador.

Argentine Republic. *B.A. Nac. Ci. Cordoba* **17** (1903): 263–323. **Doering.**

Resultados geográficos de un viaje al norte de la sierra de Córdoba (1896). Por O. Doering.

Argentine and Bolivia. *Globus* **84** (1903): 197–201. **Nordenskiöld.**

Einiges über das Gebiet, wo sich Chaco und Anden begegnen. Von E. Nordenskiöld. *With Illustrations.*

Central America. **Nicholas.**

Around the Caribbean and Across Panama. By Francis C. Nicholas. Boston and New York: H. M. Caldwell Co., 1903. Size 8½ × 6, pp. 374. *Map and Illustrations. Presented by the Author.*

Popular sketches of travel in Central and South America on behalf of an American commercial company, during which the author visited some out-of-the-way places, including the habitats of the Chaco and Goajiro Indians.

Peru. *B.S.G. Lima* **13** (1903): 54–89. **Muro.**

Vias al Oriente del Perú. Por M. A. M. Muro.

Peru—Frontiers. *B.S.G. Lima* **13** (1903): 92–115. **Bueno.**

La demarcación politica del Perú ó medios de asegurar su reforma. Por R. Tizón y Bueno.

Peru and Brazil. *B.S.G. Lima* **12** (1902): 361–479; **13** (1903): 30–54. **Villanueva.**

Fronteras de Loreto. Por M. P. Villanueva.

On the frontier question between Peru and Brazil.

West Indies. *J. of T. Victoria I.* **35** (1903): 208–227. **Lobley.**

Volcanic Action and the West Indian Eruptions of 1902. By J. Logan Lobley.

West Indies. *J. of T. Victoria I.* **35** (1903): 198–206. **Spencer.**

On the Geological Relationship of the Volcanoes of the West Indies. By J. W. Spencer. *With Map.*

AUSTRALASIA AND PACIFIC ISLANDS.

Gilbert Islands. *Ann. Hydrographie* **31** (1903): 348–354, 388–395. **Prager.**

Zur Meteorologie der Gilbert-Inseln mit einem Anhang über die Inseln und die Bevölkerung. M. Prager. *With Diagram.*

Hawaii—Molokai. **Lindgren.**

The Water Resources of Molokai, Hawaiin Islands. By W. Lindgren. (Water-Supply Paper, No. 77, U.S. Geol. Survey.) Washington, 1903. Size 9½ × 6, pp. 62. *Map and Illustrations. Presented by the U.S. Geological Survey.*

New South Wales. *Records Geol. Surv. New South Wales* **7** (1903): 140–216. **Andrews.**

An Outline of the Tertiary History of New England. By E. C. Andrews. *With Maps and Plates.*

New South Wales. **Card and Jaquet.**

Records Geol. Surv. New South Wales **7** (1903): 103–140.

The Geology of the Cambewarra Range, New South Wales, with especial reference to the Volcanic Rocks. By G. W. Card and J. B. Jaquet (Analyses by J. C. H. Mingaye and H. P. White). *With Map and Plates.*

POLAR REGIONS.

Antarctic. **Faustini.**

A. Faustini. Di alcuni risultati geografici della *Discovery* nella regione Antartica. (*Quadrante di Ross.*) (Rivista Marittima, Estratto dal fascicolo di luglio 1903.) Castello, 1903. Size 9½ × 6½, pp. 8. *Maps. Presented by the Author.*

Antarctic. *Naturw. Wochenschrift* **3** (1903): 20–25. **Meisenheimer.**

Die bisherigen Forschungen über die Beziehungen der drei Südkontinente zu einem antarktischen Schöpfungszentrum. Von Dr. J. Meisenheimer.

Antarctic—Ice. *Petermanns M., Ergänzungsheft* Nr. 144 (1903): pp. 122. **Arçtowski.**
Die antarktischen Eisverhältnisse. Von H. Arçtowski. *With Map and Illustrations.*

MATHEMATICAL GEOGRAPHY.

Mathematical Geography. *Nature* **68** (1903): 294–295. **Everett.**
On a map that will solve problems in the use of the Globes. By Prof. J. D. Everett, F.R.S. *With Diagram.*

Surveying. **Schulze.**
Das militärishe Aufnehmen unter besonderer Berücksichtigung der Arbeiten der Königlich Preussischen Landesaufnahme nebst einigen Notizen über Photogrammetrie und über die topographischen Arbeiten Deutschland benachbarter Staaten. Nach den auf der Königlichen Kriegsakademie gehaltenen Vorträgen bearbeitet von Bruno Schulze. Leipzig und Berlin: B. G. Teubner, 1903. Size 9½ × 6½, pp. xiv. and 306. *Illustrations. Price* 8*s. Presented by the Publisher.*

Surveying Instrument. *Petermanns M.* **49** (1903): 188–190. **Hammer.**
Der Pedograph von Th. Ferguson. Von Prof. Dr. E. Hammer. *With Illustrations.*

Time. *J.G.* **2** (1903): 351–360. **Moulton.**
Time. By F. R. Moulton. *With Map.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Climates. **Manson.**
The Evolution of Climates. By Marsden Manson. [Revised, enlarged and reprinted from the *American Geologist*, August, October, 1899.] July, 1903. Size 9½ × 6½, pp. 96. *Maps and Diagrams. Presented by the Author.*

Earth Structure. **Reade.**
The Evolution of Earth Structure, with a Theory of Geomorphic Changes. By T. Mellard Reade. London: Longmans & Co., 1903. Size 9 × 6, pp. xvi. and 342. *Diagrams and Illustrations. Price* 21*s. net. Presented by the Publishers.*

The author, whose investigations on the subject of mountain-building are well known, here gives a general sketch of his views on the origin of the morphological features of the Earth's crust, with descriptions of the practical experiments by which they are fortified.

Oceanography—Waves. *Ann. Hydrographie* **31** (1903): 329–341. **Rottok.**
Meereswellen-Beobachtungen. Von Geh. Admiralitätsrat Rottok.

Physics. *P.R.S.* **72** (1903): 88–92. **Buchanan.**
On a remarkable effect produced by the Momentary Relief of Great Pressure. By J. Y. Buchanan, F.R.S. *With Plates. Also separate copy presented by the Author.*

The effect here described was produced on a brass tube and copper sphere holding scientific instruments for oceanographic research. The author suggests that many earthquake shocks may be also due to *relief* of pressure.

Refraction. *Nautical Mag.* **72** (1903): 470–476. **Goodwin.**
Freaks of the Sea Horizon. By H. B. Goodwin.

The Earth. **Robin.**
Géologie pittoresque. La Terre, ses aspects, sa structure, son évolution. Par Aug. Robin. Paris: Larousse, [not dated]. Size 12½ × 10, pp. iv. and 330. *Maps and Illustrations.*

Whirlpool Erosion. *Le Globe, B.S.G. Genève* **42** (1903): 85–93. **Brunhes.**
Marmites fluviales et tourbillons. Par le Prof. J. Brunhes.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology—Malay Race. **Hagen**
Jahresb. Frankfurter V.G. u. Statistik **66** and **67** (1901–1903): 95–98.
Die geographische Verbreitung der malayischen Rasse. Von Dr. B. Hagen.

Buddhism. **Schermann.**
Jahresb. Frankfurter V.G. u. Statistik **66** and **67** (1901–1903): 136–138.
Ursprung und Ausbreitung des Buddhismus. Von Dr. L. Schermann.

Commercial Geography. **Trotter.**

The Geography of Commerce. A Text-Book. By Dr. Spencer Trotter. New York: the Macmillan Co.; London: Macmillan & Co. 1903. Size 8 × 5½, pp. xxiv. and 410. *Maps and Illustrations. Presented by the Publishers.*

Ethnography. **Keller.**

Queries in Ethnography. By A. G. Keller. London: Longmans & Co. 1903. Size 6½ × 4½, pp. x. and 78. *Price* 2*s. net. Presented by the Publishers.*

A guide to travellers as to ethnological subjects to which their attention may with advantage be directed.

GENERAL.

Bibliography. **Wright.**

Catalogue of the London Library, St. James's Square, London. By C. T. Hagberg Wright, LL.D. London: Williams & Norgate, 1903. Size 11 × 8½, pp. xiv. and 1626. *Presented by the London Library.*

This is most valuable for purposes of reference, the total number of volumes catalogued being 220,000, while, by a rigorous system of compression and abbreviation, the whole catalogue is brought within the compass of a single volume. It is not a mere catalogue, however, for a large amount of bibliographical information is given, and immense pains have been taken to discover the authors of anonymous works where possible. The system of cross-references is very complete.

British Empire. **Egerton.**

The Origin and Growth of the English Colonies and of their System of Government. An Introduction to Mr. C. P. Lucas's Historical Geography of the British Colonies, by Hugh Edward Egerton. Oxford: The Clarendon Press, 1903. Size 7½ × 5, pp. viii. and 224. *Maps. Price* 2*s.* 6*d. Presented by the Publishers.*

This is intended as a new edition of the Introduction to the 'Historical Geography of the British Colonies,' now out of print. The scope has, however, been considerably enlarged to meet the needs arising out of recent colonial development, and the book forms an admirable introduction to a study of the British Empire.

British Empire. *P.R. Philosoph. S. Glasgow* **34** (1902–1903): 257–271. **Elliot.**

Can the British Empire be made self-supporting? By G. F. Scott Elliot.

British Empire. *J.R. Statistical S.* **66** (1903): 582–598. **Giffen.**

The Wealth of the Empire, and how it should be used. By Sir Robert Giffen, K.C.B.

French Colonies. **Petit.**

Les Colonies Françaises. Petite Encyclopédie Coloniale publiée sous la direction de M. Maxime Petit. Tome Second. Congo, Madagascar et ses satellites, La Réunion, Côte des Somalis, Inde, Indo-Chine, Saint-Pierre et Miquelon, Antilles, Guyane, Nouvelle-Calédonie, Établissements de l'Océanie. Appendices. Paris: Librairie Larousse, [not dated]. Size 8½ × 6, pp. 840. *Maps and Illustrations.*

Geography. **Mill.**

The International Geography. By Seventy Authors. Edited by Hugh Robert Mill. Third Edition. London: George Newnes, Ltd., 1903. Size 8½ × 5½, pp. xx. and 1088. *Maps and Illustrations. Price* 15*s. Presented by the Publishers.*

This standard work has been brought up to date by careful revision throughout, the results of recent censuses being incorporated, and recent publications added to the lists of standard books.

Hints to Travellers. **Elliman.**

First Aid in Accidents and Ailments. The R.E.P. Book. Published by Elliman, Sons & Co., Slough, 1903. Second Edition. Size 8½ × 5½, pp. 246. *Presented by the Publishers.*

R.E.P. stands for "Rubbing Eases Pain," and the work is primarily intended to show the various ways in which Elliman's embrocation may be utilized by travellers. It contains some useful general instructions for treatment of ailments and injuries.

Mountaineering—Ski. *Alpine J.* **21** (1903): 441–455. **Rickmers.**

The Alpine Skee and Mountaineering. By W. R. Rickmers. *With Illustrations.*

Naval. **Cowie.**

The Sea Services of the Empire as Fields for Employment. By Archibald Greig Cowie. With forewords by Frederick, First Marquess of Dufferin and Ava, and Vice-Admiral D. H. Bosanquet, R.N. London: A. Treherne & Co., 1903. Size 9 × 5½, pp. 456. *Frontispiece. Presented by the Publishers.*

Tropical Diseases.

Colonies: Miscellaneous Papers relating to the Investigation of Malaria and other Tropical Diseases, and the Establishment of Schools of Tropical Medicine. London: Eyre & Spottiswoode, 1903. Size 13½ × 8½, pp. 44. *Price* 4½*d.*

Western Australia and Malaya. **Taunton.**

Australind. Wanderings in Western Australia and the Malay East. By Henry Taunton. London: E. Arnold, 1903. Size 8½ × 5½, pp. xii. and 248. *Price* 10*s.* 6*d. net. Presented by the Publishers.*

NEW MAPS.

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

EUROPE.

Balkan Peninsula. **Kogutowicz.**

Wandkarte der Balkan-Halbinsel. Entworfen und gezeichnet von Em. Kogutowicz. Scale 1:800,000 or 12·6 stat. miles to an inch. 4 sheets. Herausgegeben von Ungarischen Geographischen Institut Actien-Gesellschaft, Budapest, 1903. *Price* 14 *m.*

Bulgaria. **Peucker.**

Karte von Bulgarien mit Ostrumelien, und Türk. Thrakien. Scale 1:864,000 or 13·6 stat. miles to an inch. Mit kartographischen und statistischen Beilagen zum Verständnis der orientalischen Krise. Bearbeitet von Dr. Karl Peucker. Vienna: Artaria & Co., 1903. *Price* 1.80 *m. Presented by the Publishers.*

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from November 1 to 30, 1903.

2 miles to 1 inch:—

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XVIII. 11. **Worcestershire,** XIX. 5; XXI. 15, 16; XXVIII. 4, 6, 10, 11; XXIX. 6. **Yorkshire,** CCLXXXIII. 14; CCLXXXV. 1; CCLXXXIX. 3, 7, 15; CCXCV. 7, 15. 3*s. each.*

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(*E. Stanford, London Agent.*)

ASIA.

Asia Minor. **Diest.**

Karte des nordwestlichen Kleinasien nach eigenen Aufnahmen und unveroffentlichtem Material auf Heinrich Kiepert's Grundlange neu bearbeitet von Walther v. Diest. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Blatt B. Berlin: Alfred Schall, 1903. *Price* 5 *m.*

Major Diest's map of North-West Asia Minor is completed with the publication of this sheet, which contains the district between the Black sea coast and Angora, and extends as far as Ismid on the west. The whole map includes all that portion of Asia Minor from the Black sea on the north to Aidin on the south, and from the west coast to beyond Angora and Konia. The basis of the map is Kiepert's well-known map of Western Asia Minor, upon which the more recent survey work of the author and others has been added.

China. **Königl. Preuss. Landes-Aufnahme.**

Karte von Ost-China. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet: Amoy. Kartographische Abtheilung der Königl. Preuss. Landes-Aufnahme, 1903. *Price* 1.50 *m. each sheet.*

Japan. **Japanese Government.**

General Railway Map of Japan, 1902. Scale 1 : 887,040 or 14 stat. miles to an inch.

An outline map of Japan without hills, showing lines of railway and railway stations in clearly distinguished symbols, according to whether they are double or single, government or private lines, working or proposed, etc. Tables of distances are also given. The lettering is in native character and English.

Java. **Netherlands Government.**

Kaart van Java. Scale 1 : 100,000 or 1·5 stat. mile to an inch. Residentie Bagelen, 4 sheets; Residentie Banjoemas, 3 sheets; Residentie Besoeki, 9 sheets; Residentie Cheribon, 6 sheets; Residentie Djokjakarte, 4 sheets; Residentie Japara, 4 sheets; Residentie Kediri, 4 sheets; Residentie Kedoe, 2 sheets; Residentie Pasoeroean, 4 sheets; Residentie Pekalongan, 1 sheet; Residentie Rembang, 4 sheets; Residentie Semarang, 6 sheets; Residentie Soerabaja, 4 sheets; Residentie Tegal, 2 sheets. The Hague: Topographisch Bureau.

These are new editions.

Philippine Islands. **Military Intelligence Division, U.S.A.**

Map of the Philippine Islands. Scale 1 : 792,000 or 12·5 stat. miles to an inch. 4 sheets. Compiled from the latest official data in the Military Information Division, Adjutant-General's Office, War Department, Washington, 1903.

This is by far the most complete general map of the Philippine Islands that has hitherto been published, yet it is evident that, although a great deal of survey work has been done since the American occupation, many districts are still but very imperfectly known. The map is printed in colours—water blue, and hill-shading brown.

Tibet. **Hassenstein and Schmidt.**

Prof. Dr. Karl Futterers Routen-Aufnahme vom Küke-Nur durch Nordost-Tibet bis Min-Tschou. 11 August bis 29 November 1898. Von Dr. B. Hassenstein und C. Schmidt Blatt I. u. II. Scale 1 : 500,000 or 7·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen. Ergänzungsheft,* No. 143, Taf. 1 and 2. Gotha: Justus Perthes, 1903. *Presented by the Publishers.*

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheets (Provisional) : 55-H, Gedaref; 55-L, Doka; 55-P, Middle Dinder; 56-E, Setit; 56-I, Nogara; 56-M, Gallabat; 66-B, Renk; 66-D, Fazogli; 66-F, Kaka; 66-G, Keili; 66-H, Beni Shangul; 66-K, Kirin; 66-L, Walega; 66-N, Middle Sobat. London: Intelligence Division, War Office; Stanford. 1903. *Price* 1*s.* 6*d. each sheet.*

Bornu. **Cochrane.**

Route surveys in Bornu. By Captain J. K. Cochrane. Scale 1 : 500,000 or 7·89 stat. miles to an inch. London: Edward Stanford, [1903]. *Presented by Captain J. K. Cochrane.*

This is one of the numerous route surveys through parts of Northern Nigeria which have lately added to our knowledge of the region. Although making no pretence to accurate survey work, they have served to fill in provisionally many a gap on the map. However, it is to be hoped that before long a systematic survey of the country will be undertaken, for, after all, disjointed and approximate route-maps are unsatisfactory, and should now be superseded by better work. The routes here shown are from the south-west shores of Lake Chad to Gorgoram Gujiba and Nbila Kilba. Little information is given in addition to the routes themselves.

East Africa. **Wickenburg.**

Uebersichtskarte der Reisen des Grafen Eduard Wickenburg in Ost-Afrika während der Jahre 1897–98 und 1901–02. Nach den Aufnahmen des Reisenden bearbeitet von R. Dokaupil. Scale 1 : 8,000,000 or 47·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1903, Tafel 21. Gotha: Justus Perthes. *Presented by the Publishers.*

Maps showing the different sections of Count Wickenburg's latest journeys in East Africa have recently appeared in *Petermanns Geographische Mitteilungen*, but upon this general map of East Africa the whole of his important journeys in this region since 1897 are laid down. These extend from Berbera into the Ogaden country of Somaliland, then westward from Harar and Berbera to the Hawash valley, down the long chain of lakes to the south of Abyssinia to Lakes Stefanie and Rudolf, thence through the Rendile country to the east and south of the latter lake to Kenia, the river Tana, and Kilimanjaro. In several parts the routes pass through previously unexplored districts. The journey from Lake Stefanie through the country to the east of Lake Rudolf is specially important in this respect, and crosses the route of the recent Abyssinian Boundary Expedition. It is, perhaps, to be regretted that the publication of this map was not postponed until the surveys of Captain Maud, R.E., made upon this latter expedition, were published, as his work is most important, and would have rendered this map much more complete.

Egypt. **Egyptian Survey Department.**

District of Mersu Matru, showing the division of the lands into square kilometres, and the main outlines of the surface geology. Scale 1 : 25,000 or ·39 stat. mile to an inch.—District of Ras Allem Rum, showing the points established for the delimitation of the lands, and the main outlines of the surface geology. Scale 1 : 25,000 or ·39 stat. mile to an inch. Cairo: Public Works Department, Survey Department. *Presented by Captain G. H. Lyons, Director-General of the Survey Department, Cairo.*

Good progress is now being made with the publication of the maps of the survey of Egypt, under the direction of Captain G. H. Lyons, to whom this Society is indebted for the above sheets, in addition to others which have been previously forwarded. These maps showing the surface geology are especially interesting, and conta important information, by means of different colours, concerning the character of the soil and surface rocks.

German East Africa. **Sprigade and Nobiling.**

Karte von Deutsch-Ostafrika. Scale 1: 300,000 or 4·7 stat. miles to an inch. Sheet F 5, Mahenge Stat. Bearbeitet von P. Sprigade, gezeichnet von H. Nobiling. Berlin: D. Reimer (Ernst Vohsen), 1903.

Southern Nigeria. **Woodroffe.**

Map of Southern Nigeria (Provisional). Compiled under the direction of Captain A. J. Woodroffe, R.E. Scale 1 : 500,000 or 7·8 stat. miles to an inch. 2 sheets. London: E. Stanford. *Price* 21*s.*

A comparison of this edition with the first, which appeared about a year ago, shows that important additional information has been obtained during the interval, and the map may be taken to give a fair idea of our present geographical knowledge of Southern Nigeria. On this second edition, the spelling of names has been revised, and hill work has been added, as well as the names of divisions and districts, which are given in red. Much exploration and survey work still remains to be done, and many of the routes and positions of places laid down can only be considered as rough approximations.

AMERICA.

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1:190,080 or 3 stat. miles to an inch. Pelly sheet (28), West of Principal Meridan; revised to June 20, 1903. Ottawa: Surveyor-General's Office, 1903. *Presented by the Surveyor-General of Canada.*

PACIFIC OCEAN.

New Caledonia. **Laporte.**

Nouvelle Calédonie. Scale 1:300,000 or 4·7 stat. miles to an inch. Dressée pour l'Union Agricole Calédonienne par le Commandant Laporte d'après les travaux des officiers de la mission topographique, les cartes hydrographiques et les plans du cadastre. Paris: A. Challamel, 1903.

POLAR REGIONS.

North Polar Regions. **Isachsen.**

Twelve charts constructed by Captain G. Isachsen from surveys made during the Second Norwegian North Polar Expedition in the *Fram* under Captain O. Sverdrup, 1898–1902. *Presented by Captain G. Isachsen.*

These are the final charts showing the results of surveys made by Captain G. Isachsen during Captain O. Sverdrup's expedition in Arctic America in the *Fram*. They have been prepared to accompany the explorer's book, giving an account of the expedition, and consist altogether of twelve sheets—two large-scale charts, and ten small plans and outline-charts. An account of the important work accomplished was lately given to the Society in Captain Sverdrup's paper read last session, and the map distributed at the meeting gave a general idea of the new discoveries and surveys; but the present charts are much more complete, and contain a large amount of detail. The new discoveries extend from the head of Jones sound to the north as far as about 81° 40′ lat., and cover approximately twenty-seven degrees of longitude, extending from the western shores of Ellesmere island to Ellef Ringnes' Land. The charts are printed in colours, and the amount of work entailed in their construction reflects great credit upon Captain Isachsen, upon whose surveys they are based.

North Polar Regions. **Peary.**

Chart of the Polar Regions. Baffin Bay to Lincoln Sea. Showing the recent discoveries of Civil Engineer R. E. Peary, U.S.N., incorporated with the earlier surveys and examinations made by the U.S.S. *Polaris* Expedition, in 1871–2, under Captain C. F. Hall; British Arctic Expedition, in 1875–6, under Captain G. S. Nares, R.N.; Lady Franklin Bay Expedition, in 1881–4, under Lieut. A. W. Greely, U.S.A. Washington: U.S. Hydrographic Office, 1903. *Price* 40 *cents. Presented by Commander R. E. Peary.*

Upon this chart the whole of the discoveries and explorations of Commander Peary are laid down in detail, and the importance of the geographical work he has accomplished can be readily seen by a comparison with previous charts of this part of the Arctic Regions. His routes in 1900 and 1902 are shown in different symbols. The chart is printed in colours, and is certainly very clear and effective. Ice limits are indicated, and much detailed information given.

GENERAL.

World. **Rinaudo.**

Atlante Storico per le Scuole Secondarie del Prof. Costanzo Rinaudo. Parte Secondo: Il Medio Evo. 20 Carte e Repertorio di tutti i nomi. Disegni di Domenico Locchi. Turin: G. B. Paravia & Co. *Presented by the Publishers.*

The first part of Prof. Costanzo Rinaudo's School Historical Atlas appeared in 1902. This second part is devoted to mediæval history, and contains altogether twenty maps and an index to place-names.

World. **Sohr-Berghaus**

Neue zeitgemässe Bearbeitung von Sohr-Berghaus Hand-Atlas über alle Teile der Erde. Entworfen und unter mitwirkung von Otto Herkt herausgegeben von Prof. Dr. Alois Bludau. Früher herausgegeben von F. Handtke. Neunte Auflage. Lieferungs 2, 3, 4, 5, and 6. Glogau: Carl Flemming. *Price* 1 *m. each part.*

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich, 25 and 26 Lieferung. Gotha: Justus Perthes. *Price* 60 *pf. each part.*

Two parts in one cover, containing the following maps: Nos. 24 and 25, sheets 3 and 4 of a four-sheet map of Italy on the scale of 1:1,500,000; No. 39, Ireland, 1:1,500,000, with inset plans of Dublin and the surrounding country, and another of London; No. 41, Denmark, 1:1,500,000, with insets of Iceland, 1:3,000,000, Greenland, 1:10,000,000; Danish West Indies and the Faroe Islands, 1:1,500,000, and a plan of Copenhagen, 1:150,000. The map of Ireland is a new production; the others are revised editions.

World. **Waldseemüller.**

The Oldest Map with the name America, of the year 1507, and the Carta Marina of the year 1516. By M. Waldseemüller (Ilacomilus). Facsimiles, edited with the assistance of the Imperial Academy of Sciences at Vienna, by Prof. Jos. Fischer, S.J., and Prof. F. R. v. Weiser. Innsbruck: Wagner 'sche Universitäts Buchhandlung; London: Henry Stevens, Son, & Stiles. 1903. *Prices* £2 19*s.* to £3 14*s.* *Presented by Messrs. Henry Stevens, Son, & Stiles.*

These facsimiles of early sixteenth-century cartographical productions are certainly the most interesting and important that have appeared for a very long time, and their publication has been eagerly looked forward to by geographers since the announcement, about two years ago, that Prof. J. Fischer had accidentally discovered copies of the maps in the library of Prince Waldburg at Wolfegg Castle, in Wurttemberg. The first mentioned, Waldseemüller's map of the world of 1507, is of the greatest importance to students of the history of cartography and geographers generally, and it is certainly somewhat remarkable that, although it is understood that one thousand copies of the map were printed, until Prof. Fischer's happy discovery, not one of these was known to have survived. The facsimiles have been most carefully produced, and are of the exact size of the originals. An interesting article on these maps by Mr. Basil H. Soulsby appeared in the *Geographical Journal* for February, 1902, and as a special notice of the facsimiles will shortly be given, it is not necessary to go further into the subject here.

CHARTS.

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

Charts and Plans published by the Hydrographic Department, Admiralty, during September and October, 1903. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
2167 m	= 2·2	Scotland, north coast:—Firth of Cromarty. 2*s.* 6*d.*
1596 m	= var.	Harbours and anchorages on the coast of Italy:—Salerno bay. Port Salerno. Port Torre del Greco. Port of Naples. 2*s.* 6*d.*
1687 m	= 14·5	Sicily:—Messina harbour. 1*s.* 6*d.*
3351 m	= 6·0	Greece, south coast:—Port Skutari. 1*s.* 6*d.*
3379 m	= 9·8	Mexico, south-west coast:—Pichilinque harbour. 1*s.* 6*d.*
3380 m	= 2·98	Persian gulf:—Bahrien harbour. 1*s.* 6*d.*
3349 m	= 1·8	China sea:—Approach to Kwang chau wan. 2*s.* 6*d.*
3280 m	= 5·95	China, east coast:—Hongkong waters, west. 2*s.* 6*d.*
3294 m	= 5·6	China. Yangtse Kiang. Hupeh province:—Hankau. 2*s.* 6*d.*
3378 m	= 1·1	China, north coast:—Rocky point to Temple head. 1*s.* 6*d.*
3352 m	= 5·0	Tasmania, west coast. Port Davey:—Bramble and Schooner coves. 1*s.* 6*d.*
3322		South America, north-east coast. Orinoco river. Plan added:—Caño Imataca (Rio Corosimo).

(J. D. Potter, Agent.)

Charts Cancelled.

No.		Cancelled by	No.
2167	Firth of Cromarty	New plan. Firth of Cromarty	2167
1596	Harbours and anchorages on the coast of Italy.	New chart. Harbours and anchorages on the coast of Italy	1596
1687	Harbour of Messina	New plan. Messina harbour	1687
2248	Anchorages in the gulf of California. Plan of Pichilinque harbour on this sheet.	New plan. Pichilinque harbour	3379
875	Nau chau passage. Plan on this sheet.	New plan. Approach to Kwang chau wan	3349
3294	Hankau.	New plan. Hankau	3294

Charts that have received Important Corrections.

No. 2793, England, south coast:—Cowes harbour. 2076, Scotland, north coast:—Loch Eriboll. 3158, Norway:—Nevlunghavn to Torbiornskier. 3159, Norway:—Torbiornskier to Jælöen. 3160, Norway:—Torbiornskier to Rauö. 2298, Baltic sea, Gulf of Bothnia:—Nystad light to Stor fiärd. 2299, Baltic sea, Gulf of Bothnia:—Hornslandet to Stiernö point. 2368, Germany, north coast:—Jershöft light to Rixhöft light. 201, Adriatic sea:—The coasts of the gulfs of Venice and Trieste. 1986, Gulf and river St. Lawrence:—Buctouche river. 2892, East coast of United States:—Narragansett bay. 1325, Chile:—Gulf of Penäs to the Guaytecas islands. 2248, Mexico, south-west coast:—Anchorages in the Gulf of California. 2840, British Columbia:—Haro strait and Middle channel. 584, British Columbia:—Clayoquot and Barkley sounds. 20, Persian gulf:—Bahreïn harbour. 1750, Australia, south coast:—Port Adelaide. 1070, Australia, east coast:—Port Stephens. 214, Solomon islands.

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

Azores. **Thoulet.**

Carte bathymetric des îles Açores d'après les cartes française et anglaises, les sondages du *Talisman* du *Challenger* de S.A.S. le Prince de Monaco, *Hirondelle* et *Princesse Alice* et de *l'Açor*. Par M. J. Thoulet, corrigée d'après les sondages exécutés en 1902 par la *Princesse Alice* et les travaux les plus récents. Scale 1:437,184 or 6·9 stat. miles to an inch. Paris: Vieillemard Fils et Cie., 1903. *Presented by M. J. Thoulet.*

As its title indicates, most of the soundings on this chart of the Atlantic in the immediate neighbourhood of the Azores were taken during the surveying expeditions of the Prince of Monaco, whose oceanic investigations are already well known. The soundings obtained during the various expeditions are clearly distinguished by the different styles of figures employed, and, in addition to the figures, the relative depths of the ocean are shown by different depths of blue tinting, which increase in intensity with every 500 metres increase of depth. There is an inset plan on an enlarged scale of the Princess Alice bank to the south-west of the island of Fayal, showing depths from soundings taken from August 23 to 26, 1902, during the voyage of the Prince of Monaco's vessel, the *Princesse Alice*. This chart is another proof of the valuable hydrographical work which the Prince of Monaco has been carrying on for some years past.

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

Pilot Chart of the North Atlantic and Mediterranean for December, 1903. London: Meteorological Office. *Price* 6*d*. *Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for December, 1903. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Arctic Regions. **Peary.**

Forty-seven Photographs taken by Commander R. E. Peary, U.S.N., on his North Polar Expedition, 1898–1902. *Presented by Commander R. E. Peary*, U.S.N.

Many of these photographs were shown recently as lantern slides at the meeting of the Society when Commander Peary gave his interesting account of his latest Arctic exploration work. They are as follows:—

(1) A nip in Melville bay; (2) Breaking out of Foulke fiord; (3) Cape Albert; (4) Crossing Princess Marie bay; (5) Cape Hawkes; (6) Looking north from summit of Cape Hawkes, Cape Louis Napoleon and Hayes point in distance; (7) Landing supplies at Cape D'Urville; (8) Winter quarters at Cape D'Urville; (9) Fort Conger; (10) Bringing back the Greely records; (11) Cape Lawrence from the south; (12) Summer travelling, Ellesmere Land; (13) Herd of musk-oxen; (14 and 15) View on Benedict glacier; (16) On the Ellesmere Land ice-cap; (17) Winter quarters at Etah; (18) Cape Louis Napoleon; (19) Ice jam at Cape John Barrow; (20) View near Cape Norton Shaw; (21) Hewing an ice-foot passage; (22) Cape Joseph Good; (23) Supporting party at Cape Lawrence; (24) Leaving Fort Conger; (25) A polar bear; (26) Floeberg glacier; (27) Cape Morris Jesup, northern point of Greenland, 83° 39′; (28) Pack north of Cape Morris Jesup; (29) A pressure ridge; (30) Camp at 83° 50′; (31) Musk-oxen near Cape Morris Jesup; (32) Matthew Henson; (33) Farthest camp east, Wyckoff island; (34) Cairn on Cape Morris Jesup; (35) An ice-foot jam; (36) Commander Peary's quarters at Fort Conger; (37) Headquarters at Payer harbour; (38) Leaving Cape Hecla; (39) The pack north of Hecla; (40) Hard work; (41) A pressure ridge; (42) A hummock of the pack; (43) Camp at 84° 17′ N. lat.; (44) Ahngoodloo, Commander Peary's head Eskimo; (45) An Eskimo woman; (46) An Eskimo child; (47) Kangerdlooksoah, camp where Commander Peary left his Eskimo.

British Central Africa. **Harrhy.**

Thirty-six Photographs of British Central Africa, taken by E. E. Harrhy, Esq. *Presented by E. E. Harrhy, Esq.*

An interesting set of half-plate photographs of natives and scenery of the neighbourhood of Zomba, Blantyre, the Shire river, etc. The titles are as follows:—

(1) The residency, Zomba; (2) Sir H. H. Johnston in the residency grounds, Zomba; (3) Members of the staff, Zomba; (4) At Cheridzulu resting-house; (5) The consulate, Blantyre; (6) Three of the staff, Blantyre; (7) Tax-paying hut, Blantyre; (8) Postmen, Blantyre; (9) Malonda natives, Blantyre; (10) Native women and children, Blantyre; (11) Chief Kumtaja and headmen, Blantyre; (12) Sundanese sentries, Blantyre; (13) Church, Blantyre; (14) In Fort Anderson; (15 and 16) Ruo river, Fort Anderson; (17) Ruo river at Chiromo; (18) Lake Nyasa; (19) View of Lake Nyasa from the south; (20) Baron von Eltz; (21) Zambezi river; (22) Customs station, Port Herald; (23) Administration house, Chiromo; (24) Angoni war-dance; (25) Crocodile-shooting party, Mpimbi; (26) Encamped near Mpimbi; (27) A travelling party, Cheridzulu; (28) Chief prisoner captured during the native outbreak at Mlanje, 1894; (29) In camp near Murchison falls, upper Shire river; (30) Hippopotamus-shooting, upper Shire river; (31) Drying hippopotamus flesh; (32) A hippopotamus trophy; (33) Fixing geographical position, near the Murchison falls; (34) Upper Shire river; (35) Mr. Harrhy after a malarial fever bout, Chiromo; (36) After a day's hunting near Murchison falls.

British East Africa. **Hindlip.**

Fifty-five Photographs of British East Africa, taken by Lord Hindlip. *Presented by Lord Hindlip.*

In addition to the photographs noticed in the last number of the *Geographical Journal*, Lord Hindlip has now presented an excellent little set taken during his last journey in East Africa, during the early part of the present year. They are as follows:—

(1) View across gorge, Eldama ravine; (2) Collector's house, Eldama ravine; (3, 4, and 6) East African police, Eldama ravine; (5) Prisoners working in stone quarry, Eldama ravine; (7 and 8) Kamasia people at Eldama ravine; (9) Crossing a swift stream between Fort Ternan and Kericho; (10 and 11) Lumbwa market at Kericho; (12) Lumbwa natives; (13, 15, and 16) Lumbwa girls; (14) Mombasa; (17) Zebra; (18) Wakamba porter carrying rhinoceros scalp; (19 and 21) Carrying tree to bridge channel of the Molo near Njemps; (20, 22, and 27) Crossing Molo river; (23) Suk natives near Baringo; (24) Greater koodoo shot near Baringo; (25 and 26) Rhinoceros shot near Baringo; (28) Leading porters emerging from part of Elgeyo forest on way to Washanjesha plateau; (29 and 30) Hartebeeste shot on Washanjesha plateau; (31 and 32) Wanandrobo hunters and hut; (33 and 37) Scenery in the Elgeyo hills; (34) Elgeyo chiefs; (35) Kumeneen, chief of Mutei; (36) Landing camels at Obbia; (38–42) Crossing a tributary of the Kerio river; (43–46) Mutei warriors; (47) Unloading donkeys in Elgeyo hills; (48) Porters going alongside of Elgeyo hills; (49) Porters turning corner of shoulder to go down into Mutei from Elgeyo and Kamasia hills; (50) Wilderbeeste on Athi plain.

Formosa.

Forty-three Photographs of Formosa. *Presented by H. Kodama, Esq., Consul-General for Japan in London.*

These photographs form a welcome addition to the Society's collection. They are principally illustrative of the inhabitants and their mode of life, although some give a good idea of the scenery of the island. The titles are as follows:—

(1) Entrance to the harbour of Takao; (2) Buffaloes swimming; (3) Buffalo harnessed for tilling the land; (4) Women of North Formosa, aborigines; (5) Chief of an aboriginal tribe of South Formosa; (6–9) Groups of aborigines of South Formosa; (10) An aboriginal dwelling of South Formosa; (11) A street in Taihoku; (12) Buddhist priests; (13) Meteorological observatory, Taihoku; (14) The works and offices of the Camphor Monopoly Bureau; (15) A Chinese opium-smoker; (16) The shrine dedicated to the late Prince Kitashiragawa; (17) A native junk; (18) An itinerant hairdresser; (19) The Governor-General's official residence, Taihoku; (20) The official residence of the director of civil administration; (21) The stores of an inland store-keeper; (22) The native one-wheeled cart; (23) The southern gate of Taihoku; (24) The residence of Rin Hon Gen, the millionaire of Formosa; (25) The garden attached to Rin Hon Gen's residence; (26) Inside view of the building of the Governor-General's office; (27) A camp of the late Prince Kitashiragawa; (28) Harvesting the rice crop; (29) Bay of Keelung; (30) A native market; (31) A water-wheel; (32) A spring; (33) View of the Governor-General's office; (34) A street in Taihoku; (35) The school of Japanese language, Taihoku; (36) A monumental archway in Taihoku; (37) Chinese women of the wealthy class; (38) Maizi bridge leading to the "Taiwan temple;" (39) The post-office of Taihoku; (40) A Chinese tower for the deposit of waste paper bearing written characters; (41) Tea-curing factory; (42) A club in Taihoku; (43) Residences of the Government officials, Taihoku.

Gold Coast. **Campbell.**

Twenty-five Photographs of the Gold Coast, taken by J. Morrow Campbell, Esq. *Presented by J. Morrow Campbell, Esq.*

A set of photographs of scenery in the neighbourhood of the Half Assinie railway, Gold Coast. Mr. J. Morrow Campbell is evidently an expert photographer, and has spent considerable time in this part of Africa.

(1–8) Railway, Half Assinie; (9) Railway sidings and workmen's houses, Half Assinie; (10) Residence at Half Assinie; (11) Hammock travelling, Half Assinie; (12) Main street, Half Assinie; (13) Group on Half Assinie railway; (14) Group of natives, Half Assinie; (15) King and chiefs of Half Assinie; (16) Large mahogany log on bogies, Half Assinie; (17) Rolling a large mahogany log on the beach at Half Assinie; (18) Back view of house, showing railway siding, Half Assinie; (20) Native house used while erecting our own, Half Assinie; (21) Clearing at Uani lagoon; (22) Creek at Uani lagoon; (21) Slip at Uani lagoon terminus; (24) Canal connecting Tano river to Uani lagoon; (25) Canal looking north with Tano river.

Mount Everest. **White.**

Photograph of Mount Everest taken from Khamba Jong by J. C. White, Esq. *Presented by J. C. White, Esq.*

Khamba Jong, from which place this photograph was taken, is situated in Tibet, about 94 miles east-north-east of Mount Everest. The photograph is interesting from the fact that the peak has not been taken from this direction before.

New Zealand. **New Zealand Government.**

Three Photographs of the Great Waimangu geyser near Rotorua, New Zealand. *Presented by the New Zealand Government Department of Tourist and Health Resorts.*

(1) The crater of the Great Waimangu geyser; (2 and 3) The Great Waimangu geyser playing to a height of 1500 feet.

South Australia. **Maurice.**

Album containing sixty-nine Photographs of South Australia, taken by R. T. Maurice, Esq. *Presented by R. T. Maurice, Esq.*

(1, 9) Fowler's bay; (3, 4) Yalata station; (5) Tallaringa well; (6) Lady peak, Everard range; (7) Umgubbullarenna; (8) View from Ilbilli, looking west; (9) Mr. Maurice's camp at Ilbilli; (10) In the Everard range; (11) Wallalurga camp; (12) Yandana Talie, near Wardulka-Musgrave range; (13) View in the Musgrave range; (14) Flat near Oolarinna, an Everard range valley; (15) Ayers rock; (16) Ayers rock and Mount Olga; (17) Mount Olga and hills to east; (18) North side of Mount Olga; (19, 20) Lake Amadeus; (21, 22) Thomas' reservoir, Cleland hills; (23) Colonel Warburton's Eva springs; (24) Anthills at Mount Singleton; (25) Camel poisoned at Tananni by *gastrilobum*; (26) "Baby" poisoned by *gastrilobum*; (27) Camp on Dennison Downs station; (28, 38) Sturt creek; (29) Sheep and cattle yards, Sturt creek;

(30) Cutting out, Sturt creek; (31, 34) Cattle-branding, Sturt creek; (32) Catching and branding calves, Sturt creek; (33) Cattle yards, Sturt creek; (35) Outstation, Sturt creek; (36, 37) Dressing camels, Sturt creek; (39) A celebrated Mitchell grass plain, showing Cow creek; (40) Unfinished shed, Flora valley; (41, 42) Flora valley; (43) Shooting bull for blacks, Flora valley; (44) Carrying bull's head; (45) Blacks cutting up bull; (46, 47) Waramyma blacks, Flora valley; (48) Old and young men, Flora valley; (49) Flora valley aboriginals; (50) Old Lubras; (51) Lubras' grave; (52) "Ord station," now called "Plympton St. Mary;" (53–55) Forest creek, or Wild dog police station; (56) The pioneers of the East Kimberley goldfields, 1886; (63, 64) View near Wyndham; (65, 68, and 69) Wyndham; (66) Chain gang going to work, Wyndham; (67) Chain-gang returning to gaol, Wyndham.

Sweden. **Swedish Touring Club.**

An album of eighty-two views of Sweden, published by the Swedish Touring Club. Stockholm, Wahlström, and Widstrand. Leipzig: K. T. Koehler. *Presented by the Swedish Touring Club.*

An interesting little album of photogravures illustrative of farm life, scenery, and public buildings in Sweden, intended especially for tourists.

Stockholm: (1) The royal palace; (2) View of the Grand hotel, the quay, and the National museum; (3) The king's garden; (4) The North Blasieholm quay: (5) The royal opera-house; (6) Norr river; (7) Blasieholm, south quay; (8) Street scene, Sture place and Birger Jarlsgatan; (9) The Strandvägen; (10) The Vasa bridge and the Academy of Arts; (11) View at Skansen; (12) Drottningholme palace; (13) Bedroom used by Gustavus III., Drottningholm palace; (14) Gripsholm castle.—Skäne: (15) The harbour; (16) Market square and town hall; (17) Lund cathedral; (18) The university; (19) Lundagard and the library; (20) Following the plough; (21) Farmhouse in the province of Skäne; (22) Makers of wooden shoes; (23) Lake Oden; (24) View showing Mount Kullen.—Blekinge: (25) Ronneby spa; (26) View of the Ronneby river.—Gotland: (27) View of Visby; (28) The ruins of St. Olafs, Visby; (29) A portal near the cathedral, Visby; (30) Street scene in St. Hansgatan; (31) Street scene, Visby; (32 and 33) Old houses in Visby; (34) The ruins of St. Karin's, Visby.—Smaland: (35) Kalmar castle; (36) Woodland scene on the Gripenberg railway.—Halland: (37) The river Nissan; (38) The old bridge at Falkenberg; (39) A forest lake; (40) View over the lake Helsjön.—Gotenburg: (41) The harbour; (42) The town hall and the German church; (43) Street scene in the Norra Hamngatan; (44) Gullholmen Bohuslän; (45) Ling hung up to dry; (46) Fishing-boats in the harbour of Marstrand; (47) On Lake Vättern. Västergötland.—Dalsland: (48) Aqueduct at Hafverud on the Dalsland canal; (49) The Hafverud lock; (50) Melting-house near Filipstad.—Värmland: (51) Raft with windlass; (52) Interior of a farmhouse in the parish of Gräsmark. —Upland: (53) Upsala cathedral; (54) A Grisslehamn musician with old-fashioned hurdy-gurdy.—Dalarna: (55) The Njupeskär falls; (56) A forest lake near Rättvik; (57) Peasants' dance, Rättvik; (58) On Lake Siljan; (59) Hay-making; (60) The mountain Bomberget, Bergsjö.—Medelpad: (61) The Esplanade, Sundsvall; (62) The Indals river at Liden.—Angermanland: (63) Salmon-fishing on the Angerman river; (64) The Dal sawmills; (65) The Häggvik creek and the Gavik fiord, Nordingra; (66) Measuring of timber; (67) Lap caravan at Anundsjö; (68) Laplander's hut in the forest of Sanga.—Jämtland: (69) View of the Areskutan; (70) Railway bridge and the mountain Mullfjäll; (71) The Renfjäll mount as seen from Are; (72) Mount Sonfjället.—Lappland: (73) The Parkijaure falls; (74) Vuoimes glacier near Perikjaur; (75) Perikpakte; (76) View of the Torne lake; (77) Harbour scene on the Torne lake; (78) View at Lussavara; (79) The Rapa valley beneath Mount Laddepakte; (80) The lower falls, Stora Sjöfallet; (81) Reindeer-killing; (82) Bear shot in the Lule water.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Hefts: 4, Mexikanischer Wald der Tropen und Subtropen, von Dr. G. Karsten; 5, Vegetationsbilder aus Südwest-Afrika, von Dr. A. Schenck. Jena: Gustav Fischer, 1903. *Price* 4 *marks each part.*

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