GEOLOGICAL WORK IN BRITISH LANDS.

I.—IN ASIA AND IN AFRICA.

PART iv. of vol. xxxviii. of the Records of the Geological Survey of India (1910) contains two papers by Mr. Murray Stuart on the oil-bearing beds of western

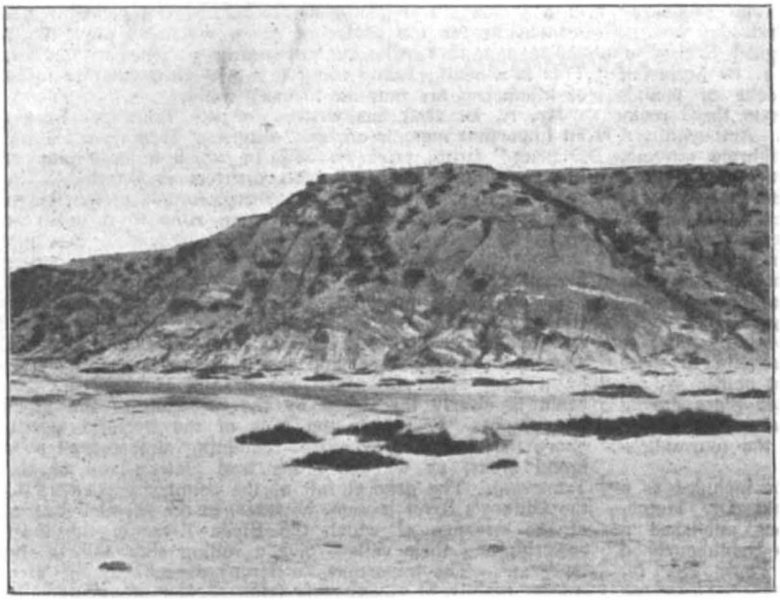

FIG. 1.—Silt-beds uptilted by recent earth-movements, near head of Son-Sakesar Lake, Punjab.

Prome and Kama, in Lower Burma. Maps and an ideal section are provided. The strata of economic interest, the Kama clays, are of Miocene age, ranging from Burdigalian to Pontian. The author considers the palæontological evidence in some detail, following the determinations of Dr. Noetling. Mr. Cotter treats of part of the Yenangyat oilfield, of which a special map is given. Mr. Datta describes siliceous hæmatites from Chanda, in the Central Provinces, some of which are already used as iron ores. One would like to hear something of the relations of the lodes to the surrounding rocks, for comparison with similar materials in South Africa. The remainder of part iv. is occupied with the results of Captain R. E. Lloyd's visit to the Aden Hinterland, a country rarely visited. The author was able to travel ninety miles inland along a line due north from Aden, terminating at the town of Dala. Here bedded lavas and ashes cover much of the country, and Mr. Vredenburg (p. 322) suggests that these are representatives of the Deccan Trap. Captain Lloyd shows them to be younger than certain Jurassic strata, and they have been carved out by denudation into plateaus. These lie (p. 317) as much as 6000 feet above sea-level. The volcanic rocks are mostly basalts and dolerites without olivine, in this recalling the Deccan series. A curious rock is described on p. 330, consisting of minute augite prisms in a green ground of devitrified glass, with spherical vesicles infilled by zeolites, triclinic felspar, and epidote. It may be of interest to remark that a precisely similar infilling of vesicles is found in an andesite from Brighton, Massachusetts. Mr. G. H. Tipper describes (p. 336) the Jurassic fossils collected by Captain Lloyd, which agree with a series previously described by Messrs. Newton and Crick as indicating a fairly high horizon. Perisphinctes is the prevailing ammonite.

Vol. xxxix. of the Records is occupied by a review of mineral production from 1904 to 1908. In vol. xl. (1910) Mr. F. R. Cowper Reed, of Cambridge, discusses (p. 1) the distribution of life in pre-Carboniferous life-provinces, with especial reference to recent work in Asia. "It is no longer possible," as he usefully remarks, "to maintain that the diffusion of Lower Palæozoic life was uniform." Mr. La Touche (p. 30) very interestingly shows that recent beds of silt, laid down in some cases in old channels of overflow, have been tilted by earth-movements in the lake-district of the Punjab Salt Range (Fig. 1). The hollows of the lakes themselves are, with one exception, due to faults or synclinal basins in nummulitic limestone. Among the plates from this area is a fine one (Plate x.) showing a "bad land" produced by the erosion of æolian loess. Mr. La Touche also illustrates excellently "certain glaciers in Sikkim" (p. 52, and Plates xv.–xxiv.). These glaciers show marked features of retreat during the last fifty years. One of them is formed from snow-slides already charged with débris, and is choked from its very beginning "to its fullest capacity with moraine stuff" (Fig. 2). It thus becomes almost a rock-flow, in which the stones are held together by ice, and no ice is visible except where it breaks into cliffs (p. 56). Mr. G. E. Pilgrim (p. 63) describes several new genera and species of mammals, mostly from the Siwalik beds. A giraffoid skull in the British Museum is now styled Indratherium.

On p. 185 Mr. Pilgrim summarises his present results as to the correlation of the tertiary fresh-water deposits of

FIG. 2.—Part of the stone-filled Alukthang Glacier, Sikkim, showing ice only where fracture occurs.

India. He points out that more than a hundred species of vertebrates from N.W. India have been assigned to no special horizons, though derived from a series of beds some 20,000 feet in thickness. He therefore supplies a table showing their vertical distribution, which should do much to clear the way for an appreciation of the successive faunas. The Lower Siwalik Beds, with *Deinotherium indicum* and *Tetrabelodon angustidens* are classed as Tortonian and Sarmatian; the Middle Siwalik Beds, with Mastodon, Stegodon, Hipparion, and Helladotherium, as Pontian; and the Upper Siwalik Beds, with Equus, Bos, Elephas, and Sivatherium, as truly Pliocene. Mr. C. S. Middlemiss (p. 206) revises the "Silurian-Trias sequence" in Kashmir, in a paper covering a wide field.

In the Quarterly Journal of the Geological Society of London, vol. lxvi., part iii., p. 420, Mr. J. B. Scrivenor describes the relations of the igneous rocks of islands between Johore and Singapore, and connects these rocks successfully with types in Borneo and Amboyna. A granite has caught up masses from a gabbroid magma, while this magma has in turn invaded the consolidated granite. The paper is important for those who have to consider the question of segregation-patches as against inclusions brought up from below. In a subsequent paper (p. 435) Mr. Scrivenor describes a number of remarkable rocks from the Kinta Valley of Perak, consisting of tourmaline and corundum. These mostly contain carbon as a separate constituent, and are "evidently derived from certain beds forming part of a series overlying massive beds of limestone." Residual structures remain in these highly altered rocks which strongly suggest oolitic grains. The mineralisation is believed to have taken place during extensive intrusions of granite in the district. Cassiterite "frequently occurs in schists with which the tourmaline-corundum rocks are associated."

If Egypt, for geological purposes, may be included as a British land, it should be mentioned that Dr. Hume, the director of its Geological Survey, has published a memoir on "The Building Stones of Cairo Neighbourhood and Upper Egypt" (Survey Department Paper No. 16, 1910, price 150 mmes.). Maps of the quarry-areas are given, with names in Arabic and English. Analyses of many of the limestones are quoted, and their durability and power of absorbing water are considered. Much of the information was collected by the late Mr. T. Barron.

Dr. Hume also states his views on "The Origin of the Nile Valley in Egypt" (*Geological Magazine*, 1910, p. 385). He believes that the dome-structure of the strata in the Gulf of Suez has been cut across by notable fractures, of which there is still more marked evidence in Sinai. But the main structure of Egypt and of the Nile Valley lying in it has been determined by folding and erosion rather than by trough-faulting. Egypt is formed by a synclinal following on the "wave-crest" that is revealed by the Eastern Desert and Sinai. The Nile ravine follows the axial line of the centre of the synclinal trough, and has been assisted by the presence of easily eroded Cretaceous and Middle Eocene strata. A transverse system of folds, fairly east and west, is also traceable. The oases seem to be due, in the first instance, to the main north and north-west folding.

The Cairo Scientific Journal for September, 1910, contains a general review of the origin of petroleum, by Dr. Hume, with special bearing on the Egyptian oil-area at Gebel Zeit. The author inclines to the view that the Egyptian oil is derived from animal matter included in the deposits of a drying Mediterranean Sea, and points out that the associated gypsum supports this theory. Major H. de Lotbinière (p. 221) shows how the clays in the Nile Valley bear up the water now introduced by irrigation into the overlying sands and the cracked clays of the surface. This rise in the water-table, discussed by Mr. Ferrar and others, is one of the newest agricultural problems that Egypt has to face.

South Africa continues to produce a wealth of geological memoirs. The Transvaal Mines Department issues an explanation of Sheets 5 and 6 of the large-scale geological map, covering the country round Zeerust and Mafeking (price 2*s*. 6*d*.). The Geological Commission of the Cape of Good Hope has allowed the use of its map to complete the Mafeking sheet drawn up by its neighbour. Messrs. Hall and Humphrey, authors of the memoir, point out the large part played by contact-metamorphism in the rocks of the Pretoria series of the Transvaal system. The Bushveld plutonic complex is held to be responsible for the widespread production of slates with biotite, cordierite, and andalusite. The gold-bearing quartz-reefs along the Malmani River near Ottoshoop are reported on, and it is suggested that work in them was abandoned when the water-level in the adjacent dolomite was reached. Hill-shading has been added to these maps, which is a great improvement. It is doubtful, however, if the rivers on a heavily coloured geological sheet should be shown in blue, since it is always important to trace out their courses at a glance. The geologists, moreover, are probably not responsible for the choice of scale, which is provokingly near 1 cm. to 1 mile, but still nearer 3 inches to 7 miles. This is a heart-rending thing to work with, whether miles or kilometres are familiar to one's mind.

Mr. A. L. Hall has written for the Transvaal Survey an important memoir on the "Pilgrims' Rest Gold Mining District" (1910, price 7*s*. 6*d*.), in which a large map of the Lydenburg and Barberton districts is inserted. The great escarpment of the Drakensberg, formed of the lowest sandstones of the Transvaal system, runs from north to south down the eastern part of the area, and the hill-shading portrays for the first time the numerous immature valleys dropping steeply from it to the broken granite lands of Barberton. The Blyde River has an interesting course, mainly on the Dolomite, past Pilgrims' Rest, within and parallel with the escarpment, catching the first waters on the dip-slope, and escaping finally over the edge by a long notch in which the granite is exposed. Its basin is clearly threatened by the recession of the great escarpment. Westward, the beds of the Pretoria series, above the Dolomite, come in, remaining almost level over broad areas, as we reach the true plateau-land of the Transvaal. The general fall of the country northward to the Olifant's River is seen, however, in the parallel courses of the streams, of which the Blyde River is the most easterly, and their valleys give a rolling character to the landscape. The important auriferous deposits of the area consist mainly of quartz-reefs lying at definite horizons in the Dolomite, with certain cross-reefs cutting across the bedding. An area for future prospecting is indicated towards the Olifant's River (p. 144). The handsome illustrations in this memoir will interest anyone who has stood on the Drakensberg edge in eastern Transvaal, and has seen the huge inland plains terminate suddenly against the highland air. Yet here, as Prof. Penck has urged, it is not necessary to invoke a fault to account for the rapid fall towards the Indian Ocean. Folding and erosion, the same processes that have given us our Chilterns and our Cotteswolds, seem alone responsible for the impressive margin of the veld.

The Geological Commission of the Colony of the Cape of Good Hope has published in 1910 Sheets 32 and 40 of the map on the scale of 1 inch to 3·75 miles. Here, again, the scale, 1 : 238,000, has a truly British and uncompromising air. Sheet 32 has Van Wyk's Vlei near its centre, where depressions occur on rocks of the Ecca series, between flat-topped kopjes. The dolerites in the Karroo system form characteristic ring-like outcrops. Sheet 40, showing the country around Marydale, includes the north-westerly stretch of the Orange River on the edge of Griqua Land West. It is a very interesting map for the student, as may be seen at once in the section at its foot. The contrast of the old schists on the west, invaded and almost eaten up by granite, with the undulating beds of the Transvaal system on the east, is only one of its many attractive features.

We cannot do justice to the numerous papers in the Transactions of the Geological Society of South Africa. Prof. Schwarz (vol. xi., 1909, p. 107) points out the interest of the occurrence of high Senonian or Danian beds (the Alexandria formation) on the south coast of Africa. Their age appears to be determined by Mr. W. D. Lang from the polyzoa only, and they seem to have been deposited near a shore. Their position implies an epoch of submergence after the elevatory movement that carried the Lower Cretaceous Uitenhage beds to a height of 4000 feet above the sea. The discussion on this paper will be found in vol. xii., 1910, p. xxxv. Dr. Rogers here points out that there may not be such a gap in the African Cretaceous as Prof. Schwarz suggests, if we regard the Pondoland beds as Senonian rather than Cenomanian. Mr. Recknagel (vol. xi., p. 83) has the advantage of describing a new field in his paper on some mineral deposits in the Rooiberg district, where tin-ore and tourmaline figure largely. Yet even here (p. 89) certain unknown primitive miners sought tin in fairly deep diggings before the present natives occupied the country. The same author (vol. xii., 1910, p. 168) reviews all the occurrences of tin-ore in South Africa, and concludes that cassiterite in workable quantities is a product of differentiation in granitoid magmas, and that lateral secretion accounts for its concentration in certain veins.

Mr. A. L. Hall (vol. xii., p. 8) describes schistose structures in the Bushveld granite as having arisen marginally through pressure during consolidation. Mr. H. Merensky (p. 13), in a short but important paper, urges that the diamonds of Lüderitzland, in German South-West Africa, which occur in an æolian sandstone, must be derived from an underlying sandstone, which he proves to be of Cretaceous age. Mr. P. A. Wagner (vol. xiii., 1910, p. 56) shows that dykes of monchiquites, allied to kimberlite, occur in the Pomona district of this region, and in this district the largest diamonds have been found. Prof. R. B. Young, of Johannesburg (vol. xii., p. 82), supports the view that the gold of the banket conglomerate of the Rand was imported, with the pyrite, after the deposition of the beds. He believes that a heavy mineral, such as titanic iron-ore, was present as an original detrital constituent, and promoted the precipitation of auriferous pyrite. He traces a second generation of gold, distributed more irregularly than the first. He suggests that the gold was brought in by solutions arising from igneous rocks, both basic and acid, that penetrate the Witwatersrand series. The acid intrusive rocks have been described for the first time by Mr. M. Weber (*ibid.*, p. 67), who has detected gold in them. The future must show whether the gold in these igneous rocks has or has not been derived from other rocks through which they have passed in their ascent.

A question that attracts even more interest in South Africa is raised by Mr. H. S. Harger's paper (p. 139) on the occurrence of diamonds in Dwyka conglomerate and amygdaloidal lavas, and the origin of the Vaal River diamonds. Mr. Harger is a specialist in diamond-bearing pipes, and he believes that some of the material in old alluvial gravels above the Vaal River has been derived from local kimberlite. He regards, however, most of the blocks associated with the diamonds as torn from more distant masses by the ice of Permo-Carboniferous times. The gravels are, in fact, concentrates from lost patches of Dwyka conglomerate. He shows that the so-called "bantam" pebbles, commonly associated with diamond on account of their specific gravity of 3·3, are probably worn from a metamorphic rock rich in manganese-garnet, and he traces these pebbles to the Dwyka beds. He finds, moreover, diamonds in the andesitic lavas that are older than these strata, and urges that the gems originated in these lavas, and were carried thence into the conglomerate, and thence into the residual gravels. In the discussion reported on pp. lvii–lix of the Proceedings of the society for 1909–10, Mr. Harger defends his position by recording the occurrence of diamond in the Dwkya conglomerate at Windsorton. He does not, however, encourage the exploitation of this intractable and unconcentrated series. We do not seem nearer to the actual parent rocks of the diamond, which may well lie in some metamorphic zone, from which the gems became picked off into the lavas. Mr. C. Baring Horwood (vol. xiii., p. 29) publishes and discusses a number of analyses of typical Transvaal rocks, including the dolomite and its partly silicified varieties. In association with Mr. A. Wade, he has recently reviewed the whole series of "old granites" in South Africa (*Geological Magazine*, 1909, pp. 455 and 497), and concludes that there is a real fundamental granite-gneiss formation in that portion of the globe. The state of affairs, however, as he fairly enough points out, is somewhat suspiciously like that in Canada, where the fundamental series tends to become more and more visionary every year. Dr. Rogers, in his address to the South African Association for the Advancement of Science, in November, 1910, clearly differs from Mr. Horwood in regard to the African series, and points out that the oldest gneisses are igneous intrusions including flakes of sediments (Reports, Section B, p. 30).

Mr. F. P. Mennell (Quart. Journ. Geol. Soc. London, vol. lxvi., 1910, p. 353) claims the great mass of rocks in southern Rhodesia as "Laurentian"; but he is convinced that the granitoid mass which forms so large a part of the country is younger than the series of schists, banded ironstones, and limestones, and he holds that mixed rocks are important features of the contact-zones. The present writer has had the advantage of seeing some of these composite gneisses under Mr. Mennell's guidance near Bulawayo. Interesting cases of the absorption of granite by dolerite, recalling the reverse action near Carlingford in Ireland, are described on p. 372. Mr. Mennell, in referring to two Rhodesian examples of "blue ground" pipes containing diamonds, declines to connect the diamonds with the prevalence or non-prevalence of eclogite-fragments or of garnet. This is in contradiction to the view of the Vaal River diggers, as quoted by Mr. Harger in the paper already referred to, since the "bantams" on which they so much rely prove to be largely made of spessartine. Geologists may well envy the field open to Mr. Mennell, Mr. Molyneux, Mr. Zealley, and now to Mr. Maufe, who between them are attacking an area at least as large as the Transvaal. G. A. J. C.

THE AIRSHIP FOR THE BRITISH NAVY.

THE leading article in *Engineering* for February 17 gives some account of the airship for the British Navy built by the Vickers Company at Barrow. Trials were conducted on Tuesday, February 14, in presence of the Government's Advisory Committee on Aëronautics, these being analogous to the basin trials of a warship, and have proved to be quite satisfactory. The structure for accommodating the hydrogen reservoirs or balloons is 512 feet in length and 48 feet in diameter. It is in the form of a decagon in section, and the ten sides are built up of longitudinal lattice-girders, with vertical intercostal girders, the top and bottom boom in each case being formed of angles or tees of duralumin. Each bay has diagonal wire bracing. The form is whale-like, with a bluff entry, and a sweet run aft to a point, where, at the bottom, there is a big fin, increasing in depth aft according to the upward rise to the point of the stern. Aluminium was first tried, but the girder structure of this metal collapsed under stress. The metal adopted—duralumin—is one of the magnesium alloys of aluminium, and contains 91 per cent. of aluminium. It has a specific gravity between 2·77 and 2·84, a melting point of about 650° C., a yield point varying from 12 to 16 tons per square inch according to the hardness, and a breaking resistance from 22 to 29 tons per square inch. The elongation varies from 23 to 18 per cent., and the contraction of area from 34 to 26 per cent. It will thus be seen that, despite its lightness, it bears comparison with mild steel.

For more than half the length of the structure there is a bottom girder, or keel, of **V** shape, carried on the girder structure of the decagon. The bottom is flattened with spruce grating, laid inside to form a gangway, and serves as a means of communication between the two gondolas. The gondolas are connected to the central girder, and are constructed of timber of ship-shape form. Should the ship alight on water, the structure will float by reason of the buoyancy afforded by the hydrogen gas contents of the reservoirs. Both gondolas contain a typical ten-cylinder Wolseley marine petrol-motor with reversing clutch. The engine in the forward gondola has two propellers, each with two wooden blades. There is one on each side at a considerable elevation above the gondola, supported on duralumin raking girders. The engine in the after gondola drives a single two-bladed propeller abaft the gondola, with only a reversing coupling between propeller and engine.

To give lifting power, eighteen or twenty gas-bags are used, the structure for the hydrogen reservoirs being divided vertically into compartments by rope netting. The covering of the structure was the subject of experiments at the National Physical Laboratory, and, as a result, silk coated with a proofing by the Ioco process was preferred. This weighs about 100 grams per square metre, has fire-resisting qualities, and is of British manufacture. The upper half is coated with aluminium dust in order to reflect the sun's rays, while the lower half retains the yellow shade of the silk.