## GEOLOGY IN BRITISH AFRICA.

MEMOIR No. 6 of the Geological Survey of South Africa, by A. L. Hall, on "The Geology of the Murchison Range and District," deals with picturesque features of the Drakensberg scarp. Plate xv. finely illustrates the youthful nature of the Groot Letaba River (Fig. 1), which is represented (p. 29) as having cut back into the mature drainage-system of the M'Thlapitsi. The banded ironstones near Thabina (p. 66), associated with metamorphosed sediments, are regarded as also of sedimentary origin, although they are now composed of magnetite. We believe that this view must be generally accepted, and it has an obvious bearing on theories of the origin of the sheet-like magnetite ores of Sweden. Pp. 124 to 130 contain an interesting account of the formation of hybrid rocks between syenite, pyroxenite, and limestone. The limestone now contains olivine,

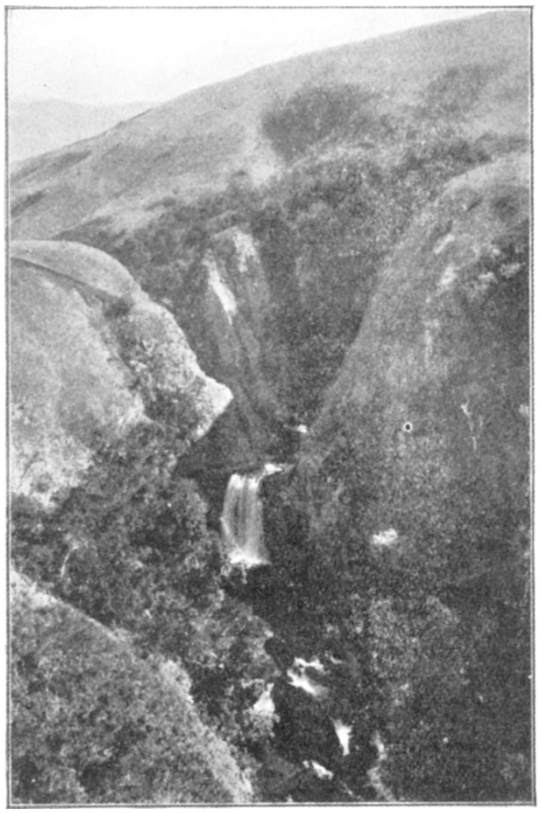

FIG. 1.—Gorge cut by the Groot Letaba River in its recession from the escarpment; the stream now receives water captured from the M'Thlapitsi.

magnetite, and apatite. The Olifants River mica-fields come within the scope of this memoir (p. 153). We notice (p. 19) that "neck" is used, perhaps unwisely, in its English form for a notch produced by weathering.

Sheet 13 of the geological map, and the accompanying memoir on "The Geology of the Haenertsberg Goldfields" (1914), are concerned with similar country, and the great scarp of the Black Reef quartzite appears conspicuously on the map. The memoir and map (Sheet 12) of the Pilandsberg, a great igneous centre north of the Witwatersrand and Rustenburg, are due to W. A. Humphrey, and direct attention to a region of great petrographic interest. The rocks have been previously described; they are syenites rich in alkalies, forming a great wall-like ring that surrounds a region of tuffs and lavas, also of the alkali type. Aegirine, leucite, and nepheline occur in the volcanic rocks. The ring suggests a "cauldron-subsidence," and an oozing up of matter along the marginal crack, as described by E. B. Bailey in the Cruachan area. The circular group of rocks is shown to be later than the Waterberg system, but has no kinship with the Drakensberg outflows. The map of this basal relic, sixteen miles across, forms one of the most striking lessons in volcanic structure with which we are acquainted.

The annual report of the Geological Survey of South Africa for 1912, published at the close of 1913, contains a summary by the director, H. Kynaston, both in Dutch and English, a memoir by him on the Marico and Rustenburg districts, one on the western Witwatersrand by E. T. Mellor, and a finely illustrated memoir by A. T. Hall on the country between Belfast and Middelburg. A. L. du Toit reports on Pondoland.

It is difficult in a few notes to do justice to the large amount of mineral and petrographic information issued regularly in the Transactions of the Geological Society of South Africa. In vol. xiv. (1912) p. 71, G. S. Corstorphine records a further occurrence of diamond in eclogite from the kimberlite pipe of the Roberts Victor Mine, Orange Free State. He still maintains that such eclogites are segregations from the peridotite (kimberlite) magma. C. T. Mellor (p. 99) contributes a detailed revision of the Lower Witwatersrand system, with a map and sections. He concludes that the conglomerates indicate a steady progression from deposits on the seaward margin of a delta up to true beaches on a shore. In vol. xv., p. 31, A. W. Rogers publishes his correlation of the Nieuwerust, Malmesbury, and Ibiquas Series of the Cape Province with the Nama system of German South-West Africa. The three series are now shown to have the sequence given above, the Nieuwerust beds being the oldest. P. Range's paper (p. 63) on the topography and geology of the German South Kalahari contains an interesting account of the nature of "pans." The author points out that good supplies of water are within reach of the dry lands of the Kalahari, in the Karroo and Nama beds that underlie the calcareous sandstone and dune-sand of the surface.

The Proceedings of the society include a lengthy discussion of Mr. Mellor's stratigraphical paper, and a presidential address by R. B. Young on the problem of the Rand Banket (1911, p. xxi.). Dr. Young argues against the detrital origin of the auriferous pyrite in the conglomerates. In vol. xv. (p. 83) he urges that the black colour of the quartz in the banket is due to dark inclusions, and he shows by thin sections how these are commonly related to shattered areas in the pebbles. The colour, then, arose after the vein-quartz had become included in the conglomerate.

Prof. Schwarz (*ibid.*, vol. xvi., 1913, p. 33) revives interest in the contacts of granite and schist near Cape Town, which were described by Playfair and Basil Hall in 1813, and by Clarke Abel in 1818. He does not mention Darwin's fruitful observations; but he accepts the view that the granite has absorbed the slates, and that the parallel flakes of biotitic matter represent residues from the sedimentary series. The advance of the granitic matter into the slate has allowed of the development (p. 35) of felspar crystals 2 in. long as replacements of digested matter. F. E. Studt provides (p. 41) an important regional paper on Katanga and Northern Rhodesia, involving a review of South African structure as a whole. He believes that the extensive lava-flows of East Africa were connected with subsidences which date back to Middle

Carboniferous times (p. 95), and that the Karroo strata of Katanga and Rhodesia were formed in the lowered areas. The "graben" of the great lake region is of much younger age. H. S. Harger, in his presidential address (vol. xvi., p. xxii.), points out that the Drakensberg lavas are of Jurassic age, and probably extended at one time right across the Free State. He is concerned with the immense amount of subsequent denudation, but does not explain how the "vast peneplain" over the entire Karroo (p. xxviii.) came about, if the surface remained high above sea-level. A great inland lake might, of course, supply a base-level. He contrasts the periods of great river-action with those of subsequent desiccation, and gives striking illustrations of denudation by sand-storms in German South-West Africa. May we ask that this energetic society should consider those members who cannot promptly bind the Transactions? They have a way of falling to pieces when one cuts the pages which renders them very liable to denudation.

F. Oswald, well known for his researches in Armenia, has described "The Miocene Beds of the Victoria Nyanza and the Geology of the Country between the Lake and the Kisii Highlands" (Quart. Journ. Geol. Soc. London, vol. lxx., 1914, p. 128). His journey through a fly-infested region was undertaken to collect vertebrate remains from lacustrine strata, which underlie extensive flows of nepheline-basalt. C. W. Andrews describes the mammalia, including Dinotherium and two anthracotheres, and R. Bullen Newton shows that the associated freshwater mollusca represent existing species. The mammalia, however, assign the deposits, which were formed probably in a delta, to the Burdigalian epoch, and the history of the Victoria Nyanza is thus carried back into the middle of Cainozoic time.

R. B. Newton enters the African field in another paper (Records of the Albany Museum, Grahamstown, vol. ii., 1913, p. 315), in which he shows that the extensive Alexandria formation of the Cape Province is of Cainozoic age, and distinct from the Cretaceous strata occurring near East London. Several new molluscan species are represented in a beautiful series of photographic plates.

A. E. V. Zealley ("Zinc and Lead Deposits of Broken Hill, N. Rhodesia," South African Journ. Sci., vol. viii., 1912, p. 396), remarks that the phosphates in this area, including the beautiful deposits of hopeite, are connected with the decomposition of a bone-breccia, and that vanadinite arises in connection with the zinc and lead phosphates in a way which suggests that vanadium occurs also in the bones.

## THE INSTITUTE OF METALS.

IN the study of the constitution of alloys, as well as in the practical and commercial use of both pure metals and alloys, that form of heat treatment known as annealing plays an important part, and a complete knowledge of the effects of various temperatures and conditions of annealing is of vital importance. This statement is not invalidated by the fact that many of our large metal works conduct their annealing operations in the most crude and haphazard way, a state of affairs which is, happily, becoming a thing of the past. In this connection it is interesting to note that one-third of the papers read at the recent meeting of the Institute of Metals deal, to a greater or less extent, with this important subject. J. Phelps shows that the presence of hydrogen in the atmosphere surrounding silver which is being annealed, increases the temperature required to obtain complete softness in thirty minutes, from below 150° C. to about 300° C. F. Johnson emphasises the necessity of annealing Admiralty brass castings to a temperature of about 700° C. Bengough and Hanson show that copper tested to destruction in an oxidising atmosphere has an elongation four times as great, and a maximum stress one-third as great, as that obtained when the test is carried out in a neutral atmosphere such as carbon dioxide.

Bengough and Hanson's paper also contains much interesting information as to the tensile properties of copper at high temperatures. They show that this metal fits in very well, on the whole, with Rosenhain's amorphous theory, the fracture changing from a ductile, crystalline one at low temperatures, to a non-ductile, intercrystalline, and very brittle one at high temperatures. A remarkable difference, however, is that Rosenhain and Ewen found that the intercrystalline fracture occurred within a few degrees of the melting point, whereas the present workers have found that, in the case of copper, it is evident as low as 720° C., or about 350° C. below the melting point.

From time immemorial, manufacturers of zinc-copper alloys have known that, at temperatures somewhat below a red heat, 60/40 brass becomes very brittle, recovering its normal strength as it cools. This fact was referred to by Bengough and Hudson in a paper read to the Institute of Metals in September, 1910. At the next meeting Carpenter and Edwards showed that there was an arrest point occurring at about 470° C. in the heating and cooling curves of this alloy. They pointed out that this could be explained by assuming either (1) that there was a polymorphic modification of the $\beta$ constituent at this temperature, or (2) that the $\beta$ splits up into $\alpha+\gamma$. On microscopic and other grounds they accepted the latter view. In the discussion which followed the reading of the paper, Mr. Hudson, amongst others, confessed himself unable to accept Prof. Carpenter's interpretation. Since then the fray has raged more or less continuously between the supporters of the two theories, and at this meeting. a paper has been read by Mr. Hudson, which, in the opinion of the writer, definitely settles the question in favour of the polymorphic theory. Briefly, the $\beta$ constituent has been synthetised from $\alpha$ and $\gamma$ at temperatures below 470° C., *i.e.* at a temperature at which the "decomposition theory" supposes that it does not exist in equilibrium. This result was obtained by annealing a piece of 70/30 brass in contact with a piece of zinc at a temperature ranging between 420° C. and 430° C.; after annealing for several days, a section was cut at right angles to the junction of the two metals, and it was found that $\beta$ was present.

The third part of Arnold Phillip's "Contribution to the History of Corrosion" consists in a refutation of the statement (made by Bengough and Jones in their "Report to the Corrosion Committee") that coke in condenser tubes does not promote corrosion. He brings forward evidence to prove that the reverse is the case.

Thorneycroft and Turner continue the work commenced some years ago by Prof. Turner on the volatility of metals *in vacuo*. The present paper describes the results of experiments on the zinc-copper series, and the authors show that those alloys containing more than 40 per cent. of copper can be quantitatively separated into their constituent metals by distillation *in vacuo*, while in the case of those which contain less than 40 per cent., part of the copper comes over with the zinc.

Amongst other papers read at the meeting is an interesting one by Captain Belaiew, which has been reprinted already in NATURE (p. 107), a description of the Schoop process of spraying metals by R. K. Morcom, and a paper by S. W. Smith on the surface tension of molten metals. J. L. H.