THE GEOLOGY OF MINING AREAS.

MR. R. G. McCONNELL has contributed to the "Annual Report of the Geological Survey of Canada," vol. xiv., part B (1905, price 25 cents), a well-illustrated paper of wide interest on the Klondike gold-fields. The general topography and the communications with other regions are described, and the full-page landscapes convey an excellent idea of the conditions under which mining is carried on. Roads have been developed, the White Pass railroad is completed, and it now takes less than a week to reach Dawson City from Vancouver. In the latitude of only 60° N., the surface-stratum is continuously frozen, and unfrozen ground is reached at depths of from 60 feet to 200 feet. In summer, gravel-beds which are unprotected by moss thaw down to a depth of from 6 feet to 10 feet (p. 9). The gold-bearing quartz-veins are included for the most part in the Klondike series of schists. Microscopic evidence supports the view that these schists are of igneous origin, since a passage is traceable from uncrushed granitoid types to mylonitic sericite-schist (p. 19). Cainozoic rocks are found folded in with the schists in Last Chance Creek, thus proving the recency of earth-movement in this area. In the basin above Rock Creek these beds contain lignites of Upper Eocene age. The low-level gravels of the creeks, which are so important to the gold-miner, include bones of the mammoth, as well as of many existing northern animals (p. 29). The greater part, at least, of the Klondike gold is detrital, and is derived from the small but very numerous quartz-veins associated with the older schists (p. 61). Many of the grains of alluvial gold enclose quartz, and a few are themselves enclosed in quartz. The decay of the rocks must have been enormous to allow of the vast accumulation of auriferous gravels. The quartz-veins are much younger than the schists in which they lie, but are older than the andesites and quartz-porphyries of the district. Lode-mining has so far made little progress, but work among the gravels seems still increasing.

Mr McConnell has also issued through the Geological Survey of Canada a paper on mineral discoveries on Windy Arm, Tagish Lake, Yukon (1905), where a new mineral district has been opened The quartz-veins here bear a considerable variety of silver ores, ranging from highly argentiferous galena to stephanite and pyrargyrite.

In the twenty-sixth *Boletín del Cuerpo de Ingenieurs de Minas del Perú* Señor Luis Pflücker describes the gold-bearing deposits of the province of Sandia. All the detrital material at the foot of the mountains contains gold, without regard to the nature of the underlying rock. The proximity of a moraine formed by an existing glacier makes it probable that the detritus has been brought into the field by glacial action. Hydraulic mining is carried on, as may be seen in the illustrations to the bulletin.

Mr. Harold S. Harger brought together a very instructive exhibit of diamond-bearing rocks, and of the minerals associated with the diamond in South Africa, during the meeting of the British Association in Johannesburg in 1905. His paper on the diamond-pipes and fissures of South Africa is now published (Trans. Geol. Soc. of South Africa, vol. viii., 1906, p. 110), and forms a comprehensive and welcome contribution, certain details of which are sure to meet with healthy criticism. Many hundreds of pipes of the Kimberley type are now known to exist, "from the central and northern portions of Cape Colony, throughout Griqualand West, in parts of Damaraland and Rhodesia, also north of the Zambezi, and as far east as British East Africa. . . . In the Orange River Colony, there is hardly a district between the Wesselton Mine near Kimberley, the Drakensberg Range, and the Orange River, in which the much-sought-for volcanic breccia has not been discovered." The diamond-pipes were opened, in all probability, after the outpouring of the amygdaloidal lava of the Drakensberg, since fragments resembling this rock occur in the "blue ground" of the Jagersfontein Mine. From this and other evidence (p. 115) Mr. Harger concludes that they are of late Triassic or Jurassic age. The pipes occur typically in groups, perhaps twenty or thirty near one another, and the large ones seem to contain the truly rich material. While some are necks, circular or ovar in section, others are mere swellings along lines of fissure, their thinned-out ends being sometimes traceable for miles. Mr. Harger discusses the composition of the breccia that fills them, and believes that olivine was not an important constituent of the original mass. The analyses quoted from Vogelfontein and the Schuller Mine (p. 120) certainly do not indicate a peridotite-magma, though the rock in the Kimberley Mine, on the other hand, yields 32·38 per cent. of magnesia. The "diamond-fissures," to which special attention is invited by the author, contain a hard basic rock of a less brecciated and more porphyritic character. Mr. Harger believes that the material in the pipes was injected by explosive action, accompanied by a certain amount of heat, though this was not enough to metamorphose the surrounding rocks distinctly. The breccia, in his opinion (p. 122), boiled and churned up its constituents in the vent. Thus, in opposition to Prof. Bonney's view (p. 126), he holds that the rounding of such masses as the included eclogite boulders is due to attrition in the pipe. Certainly no one who has seen the breccia of a diamond-pipe, such as that of the Schuller Mine, near Pretoria, abutting on its apparently unaltered wall, can associate

FIG. 1.—Weathered Kantoor Sandstone, Transvaal.

the rock with the phenomena of ordinary igneous flow. Equally distinctive is the evidence of the derivation of the green pyroxenes and the garnets, to mention no other minerals, from some previously consolidated and deep-seated mass. Few geologists, we fancy, will now dispute the conclusion, first indicated by Prof. Bonney when he described the eclogite from Jagersfontein, that the diamond itself is a derived mineral in the pipes and fissures, and arose (p. 134) from "an ultra-basic 'carbon-saturated' zone at great depth," through which the "kimberlite" broke. The diamond becomes thus linked in our minds with the primitive masses of inorganic graphite, and, still more interestingly, with the nascent carbon dioxide, which still streams upward from the unexplored regions of the crust.

In the same number of the Transactions of the Geological Society of South Africa (p. 147) direct reference is made to these "juvenile" emanations by Prof. Beck, of Freiberg, in a paper on the relation between ore veins and pegmatites. The author's purpose is to connect the pegmatites with the aqueous solutions which remain after the consolidation of an igneous mass. The old theory of "segregation-veins" is set aside, as has been done by

other writers, and Prof. Beck remarks that, since the aqueous solutions in the fissures cooled very slowly, and "their great liquidity was extremely favourable to diffusion of the dissolved substances, crystals of large size are frequently found in pegmatites." While thermal waters found their way to upper parts of the crust, the solutions that resulted in pegmatite-veins represent material retained at considerable depths. Hence ore-deposits associated with pegmatites become exposed only after long ages of denudation. Prof. Beck cites several examples where tin, copper, and gold are among the substances deposited in connection with pegmatites.

Dr. G. B. Trener (*Verhandlungen der k.k. geol. Reichsanstalt*, 1905, pp. 366 and 372) is conducting experiments to show that metals undergo diffusion in solid crystalline rocks at temperatures far below the melting points of the metals employed. The complete results are to be published in the *Jahrbuch* of the Reichsanstalt as a chapter of the description of the Cima d'Asta, but the preliminary announcements have already aroused discussion. Among the curious points raised by Dr. Trener, is the resistance of mica to diffusion of metals in a direction perpendicular to its cleavage planes; well-developed mica-schists may thus be practically impenetrable when their foliation-planes are perpendicular to the direction of diffusion.

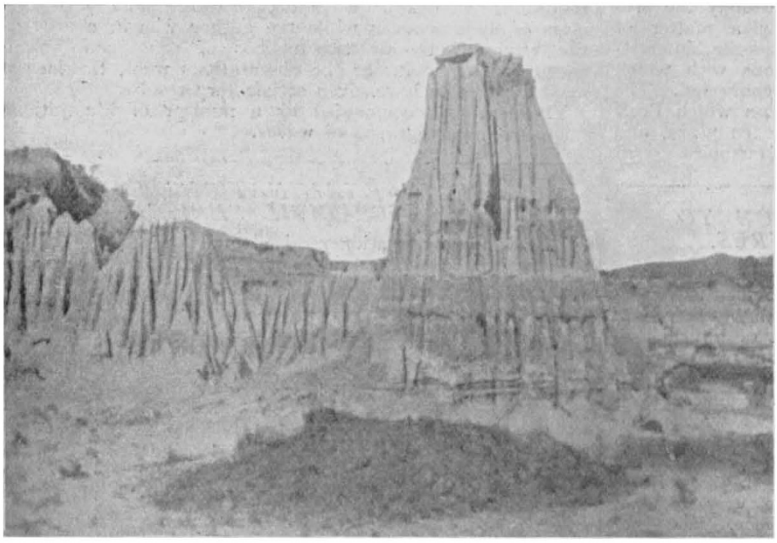

FIG. 2.—Earth-pillars, south of Alkmaar, Transvaal.

The Report of the Geological Survey of the Transvaal for 1904 has been noticed already in NATURE (vol. lxxiv., p. 646). The volume for 1905 has now been issued, dated August, 1906, liberally illustrated with plates and coloured geological maps and sections, and at the same moderate price of 7*s*. 6*d*. The director, Mr. H. Kynaston, describes a recent survey of the Komati Poort coalfield, which is conveniently situated on the Delagoa Bay side of the country. He reminds us of the record of 25 feet of coal in 33 feet of strata passed through by a bore-hole near Tenbosch Station in 1903, and remarks that this massive seam may underlie the smaller ones that have been proved at various points. Arguments are given to show that the horizon of these coal-bearing beds, and those of the Transvaal generally, may be in the Beaufort series, and not in the underlying Ecca series, as has been generally supposed (p. 25). Mr. Kynaston also describes a Coal-measure series (p. 35) in the Bushveld area west of the Pietersburg railway. The igneous rocks of this region present many points of interest, especially in the occurrence of bands of magnetite, resembling dykes, associated with, but not passing into, a considerable mass of norite. Similar bands are well dealt with by Mr. Hall in a later paper in this report (p. 73). Our field-inspection of these iron ores, under the guidance of Mr. Kynaston, would certainly suggest that they were igneous intrusions of an extremely basic type.

Mr. A. L. Hall (p. 41) describes the fine country between Lydenburg and the Devil's Kantoor, or Devil's Shop, so-called from the fantastic weathering of the sandstone masses near the edge of the great escarpment. Gold-mining is carried on in this hilly region, and a lime industry has sprung up near Godwan River Station through the working of secondary deposits of calcite in the dolomitic series. Mr. Hall, we think wisely, introduces the descriptions of the microscopic characters of his rocks, as explanations of their structure, side by side with the account of their features in the field. A rock believed to be a tuff is interestingly recorded (p. 53) among the otherwise intrusive igneous masses found in the Transvaal system. The fine illustrations to the report show the escarpment of the Kantoor quartzite, with the rapid descent towards the old granite on the east; the gorge in the far younger quartzite of the Pretoria series, between Waterval Boven and Waterval Onder, where the traveller from the monotonous plateau of the Transvaal welcomes the picturesque notching of its edge; and other scenes from this noble region, including the weathered quartzite (Fig. 1) of the Kantoor itself.

Another photographic illustration (Fig. 2) shows the detrital sand resulting from the weathering of the older granite, which is now eaten out into pillars as much as 25 feet high, with sometimes a cake of more resisting rock upon the top.

Passing over other papers in this report, as unfortunately must be the case in a general notice, we may mention Mr. Mellor's account of the Witbank Coalfield near Middleburg on the main plateau (p. 81). The Permian glacial conglomerate has here supplied, during an epoch of denudation, much of the material of the overlying Beaufort (?) Coal-measures. The coal-seams, one of them being 24 feet thick, are described and illustrated by sections (p. 97, &c.). The presence of fine muddy layers raises the ash, even in some of the workable coal, to 17 per cent., and the ash rarely falls below 7 per cent.

Mr. Tweddill (p. 106), in a handsomely illustrated paper, describes some ruby-bearing rocks from the Leydsdorp district, notably a beautiful example consisting of a pale pyroxene, kyanite, and finely granular ruby. He holds out hopes, if we read him rightly, that ruby may be in time discovered on a scale of commercial importance in the Transvaal. G. A. J. C.

MEN OF SCIENCE IN AMERICA.

THE issue of *Science* for November 23 contains an article by Prof. McKeen Cattell on the selection, and arrangement in order of merit, of a thousand American men of science. A table was compiled from lists of fellows of societies, biographical dictionaries, "Who's Who," &c., of the numbers of persons engaged in each branch of science. It appears that chemists are the most numerous, in America at all events, forming 164 per 1000 of all scientific men, zoologists coming a close second with 155 per 1000. Anthropologists stand at the foot of the list with only twenty-three, but neither statisticians nor economists, it would seem, were taken into account. Ten leading representatives of each science were then asked to arrange in order of merit a certain number of students of that science, the numbers fixed being roughly proportionate to the totals in the table first compiled. The positions assigned by the different judges to every individual were averaged, and the probable error of the average posi-