GEOLOGY IN NORTH AMERICA.

THE Geological Survey Branch of the Department of Mines of Canada continues to cover a wide field of research. Even its "Summary Report" for 1911 includes topographic and structural papers, in which coal-mining areas are dealt with, as well as notes on peat and clay, and (p. 316) on petroleum in New Brunswick. J. W. Goldthwait's paper (p. 296) on post-glacial changes of level in Quebec and New Brunswick continues work previously published (Mem. 10) on the shore-lines of the extinct lakes Algonquin and Nipissing in south-west Ontario. In this earlier memoir the author draws isobases across the Great Lake region, showing the warping of the beaches of Lake Algonquin and its successor, the greater uplift being in both cases in the north.

M. E. Wilson, in a publication numbered 1064, describes country on the east side of Lake Timiskaming, Quebec, where for the most part pre-Cambrian rocks prevail. The relations of the fragmental Huronians to the older granites are described. A large colour-printed map (18A), on the scale of one inch to one mile, has been issued of the mining region round the lake, and includes on the west the interesting basic igneous rocks and green schists of Cobalt.

M. E. Wilson, in Memoir 17E, shows how the geological surveyor is quickly following the extension of the railway into the gold-bearing region of northern Ontario.

G. S. Malloch, in Memoir 9E, describes the Bighorn Coal Basin of Alberta, where a large area of undeveloped coal exists in Upper Jurassic or Lower Cretaceous strata. The region lies near the United States border, and is so far only accessible by horse-trails.

Memoir 27 (1912) is concerned with a serious report on Turtle Mountain, which rises above the town of Frank, Alberta. This limestone mass is tunnelled into at the base for coal, and a destructive landslide occurred in 1903. R. A. Daly, W. G. Miller, and G. S. Rice, the commissioners appointed, now show that great fissures traverse the upper portion of the mountain, and that the modern forest growth is affected by their widening. The illustrations, especially plate viii., record impressive instances of the creep of massive rocks. It is recommended that the town of Frank, at the foot of the great scarp, should be moved to another site in the valley, since the mountain is structurally unsafe, irrespective of its possible weakening by the mines.

In Memoir 13 (1912), C. H. Clapp describes the mountainous region of southern Vancouver Island. A recent uplift of some 250 ft. has taken place (p. 13), whereby the coast-features have become rejuvenated, and the streams now fall from upraised coastal plains over rock-cliffs into the ocean. The prospects of copper-mining are discussed, but pyrite and pyrrhotine are the most prevalent ores. The metallic veins arose (p. 173) in connection with igneous intrusions of Upper Jurassic and Lower Cretaceous age.

W. H. Twenhofel, of Yale University (*Am. Journ. Sci.*, vol. xxxiii., 1912, p. 1), summarises the physiography of Newfoundland, in a paper that will interest geographers. Fault-scarp features remain prominent on the Long Range in the south-west of the island, and the faulting is later than the formation of a peneplain, which is tentatively correlated (p. 19) with the late Cretaceous peneplain of the Appalachians.

In Memoir 21 (1912) of the Canadian Geological Survey, on the geology and ore deposits of Phœnix, B.C., O. E. Le Roy makes some interesting observations on the silicification of large bodies of limestone, whereby nodular "jasperoids" are produced (p. 34).

Memoir 16E, on the clay and shale deposits of Nova Scotia and portions of New Brunswick, by H. Ries and J. Keele, and Memoir 24E, by the same authors, on the clay and shale deposits of the western provinces, both contain (pp. 115 and 177) a useful general essay on clay-rocks and their impurities. H. S. de Schmid has similarly incorporated a broad review of the mica industry throughout the world in his memoir on mica (Department of Mines, Mines Branch, 1912). The development of the "mica-board" trade now allows of the use of material that formerly was thrown aside.

In a monograph of 200 pages on pyrites in Canada (Mines Branch, 1912), A. W. G. Wilson describes the uses of iron sulphides, and the processes employed in roasting and in the manufacture of sulphuric acid.

The Mines Branch has also issued vol. i. (376 pp.) of a "Report on the Building and Ornamental Stones of Canada," by W. A. Parks, in which technical questions are prominent; and numerous papers on applied mineralogy appear in the "Summary Report" for the year 1911, including an account (p. 103) of the use of magnetic observations in tracing pyrrhotine. Pyrrhotine in Canada, of course, to the miner implies pentlandite and nickel.

L. M. Lambe, of the Geological Survey of Canada, has reviewed the past vertebrate life of Canada (Trans. R. Soc. Canada, vol. v., 1911, ser. 3, p. 3). Due prominence is given to the deinosaurs of the Judith River beds.

O. P. Hay, in a paper on the recognition of Pleistocene faunas (Smithsonian Miscell. Collections, vol. lix., No. 20, 1912), shows, in a series of maps, the distribution of a number of mammals in North America since the Pliocene period. The limit set by the fluctuating ice-margin in the north is clearly seen; but the author regards temperature-changes as of far less importance in promoting changes in the fauna than the mere element of time, whereby one type of mammalian fauna disappeared before another, which was itself already doomed to disappear. We presume that the doom thus referred to implies some cause other than the mere decay of specific energy during time; but this question trenches on physiology.

The work of the United States Geological Survey, equally with that of Canada, maintains a broad outlook, from topography to mineral research. The succession of severe earthquakes that occurred in the central Mississippi Valley in 1811–12, when the region was thinly populated, has been investigated by M. L. Fuller (Bull. 494, 1912). The possibilities of recurrence are considered (p. 110). Interesting surface-features due to the sudden extrusion of sand from fissures still indicate the earthquake-area, and a large region of sunken land is marked by stumps of trees standing in water, as was noted by Lyell in 1846 (p. 70).

The second edition of F. W. Clarke's "Data of Geochemistry" (Bull. 491, 1911) now takes the place of the copies of this manual that have been used with such advantage in scientific libraries. Its 731 pages form a summary of the chemistry of the earth, with abundant references to sources of information. The origins of minerals and rocks are steadily borne in mind, and the results of the evolution of gases from the earth, of processes of subaërial weathering, and of the multiplication of marine organisms in the ocean, are alike brought under review. The work, indeed, is for the general geologist quite as much as for the specialist in petrology. The passages on aragonite and calcite, on laterite, and on dolomitic limestone may serve as good examples. Nearly a hundred pages, moreover, are devoted to the origins of metallic ores.

T. N. Dale and H. E. Gregory (Bull. 484) describe the granites of Connecticut, with remarks (p. 17) on the composite origin of some of the associated gneisses. As is usual in such memoirs, examples are given of the monumental use of the quarried stones.

T. N. Dale also reports on the marbles of Vermont (Bull. 521), in which graphitic bands are ascribed to marine algæ of Ordovician age.

Bull. 492, by G. F. Loughlin (1912), contains some interesting examples of the effects of dynamic metamorphism upon gabbro in Connecticut, well illustrated in plates x. and xi.

C. W. Hayes and W. Lindgren edit the report on the developments in economic geology during 1910 (Bull. 470, 1911). Considerable attention is given (pp. 371–483) to the oolitic phosphate beds of Idaho, Montana, and Wyoming. R. W. Richards and G. R. Mansfield (p. 377) hope to show later that the Upper Carboniferous phosphatic deposits of Idaho were formed at a time of abnormal enrichment of the sea-water with phosphoric acid or its salts, and not by subsequent infiltration. In Bulletin 471, M. R. Campbell continues this report by an extensive review of mineral oils, coals, and lignites in many districts now under exploration W. T. Lee (Bull. 510) has explored the area of Cretaceous coals in north-west Colorado. These coals have been improved in calorific value by the influence of quartz-monzonite laccolitic intrusions, which are clearly shown in the published sections.

H. S. Gale (Bull. 523) reviews the nitrate deposits of the United States, none of which seem at present to be of commercial value. The sketch of the origin of nitrates in soils (pp. 31–5) is just what teachers of mineralogy and agriculture require.

The demands of agriculturists are further considered in Bulletins 511 and 512. The former, by B. S. Butler and H. S. Gale, deals with a newly found deposit of alunite in Utah, which is believed (p. 36) to result from the uprising of solutions from below. The mineral occurs in veins in andesite, the main one being 20 ft. thick. The purity of the mass is shown by analyses which yield respectively 10·46 and 9·71 per cent. of potash. Alunite may be converted into a soluble sulphate by calcination, and a useful review is given of its commercial use in Australia and other places. In Bulletin 512, A. R. Schultz and Whitman Cross, with a somewhat prophetic outlook, consider the future of the potash-bearing rocks of the leucite hills in Wyoming. The percentage of potash in these lavas is about the same as that in alunite, and may reach even 12 per cent. The greater portion of the potash occurs in the two minerals leucite and phlogopite, and the authors look forward to the possibility of the separation of these minerals and the extraction of potash and alumina from them, or even from the lavas as a whole. The estimate of the alumina available in millions of tons (p. 35) seems premature, and any commercial process that may be devised will probably, so far as this substance is concerned, be applied also to common clay.

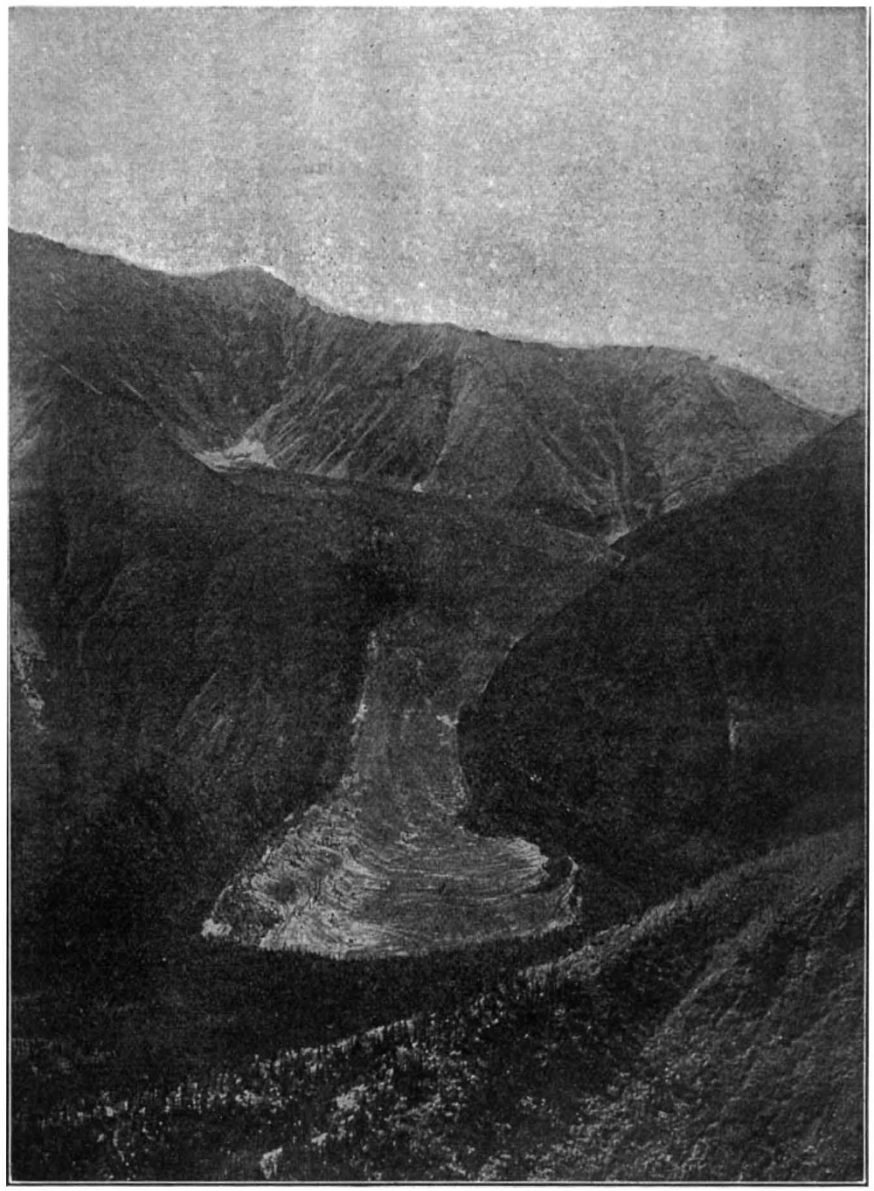

FIG. 1.—Rock-glacier on McCarthy Creek, Nizina district, Alaska. From Bull. 448, U.S. Geol. Survey.

Petrographers as well as miners will find much of interest in Professional Paper 77, on the Park City District, Utah, by J. M. Boutwell. A novel and effective feature is the illustration of the ores and

associated rocks by photographs taken in the tunnels of the mines.

Mining districts in a hitherto unmapped region in Elko County, Nevada, are described by F. C. Schrader in Bull. 497 (1912). The gold ores of Jarbridge, which are here beautifully illustrated, are attributed (p. 63) to the rise of waters at a high temperature, following on the eruption of Miocene rhyolites. The metallic ores are sometimes referred to as "mineral" and sometimes as "metal values," terms which seem out of place in a scientific treatise. A. Knopf (Bull. 504, 1912) describes briefly the Sitka mining district, Alaska, where gold in quartz reefs and gypsum are the valuable materials. The gold, as well as certain copper ores, is regarded (p. 17) as connected with the uprise of intrusive diorite.

F. H. Moffit and S. R. Capps (Bull. 448, 1911) show very interestingly how slowly moving rock-glaciers succeed true glaciers where warmer conditions now prevail in Alaska. Snow-slides, of course, assist in moving the material, but rock undoubtedly now predominates in the flow. The illustration here reproduced (Fig. 1) is one of several instructive plates. Gold is now the main product of the Nizina district, though chalcosine and native copper offer attractions.

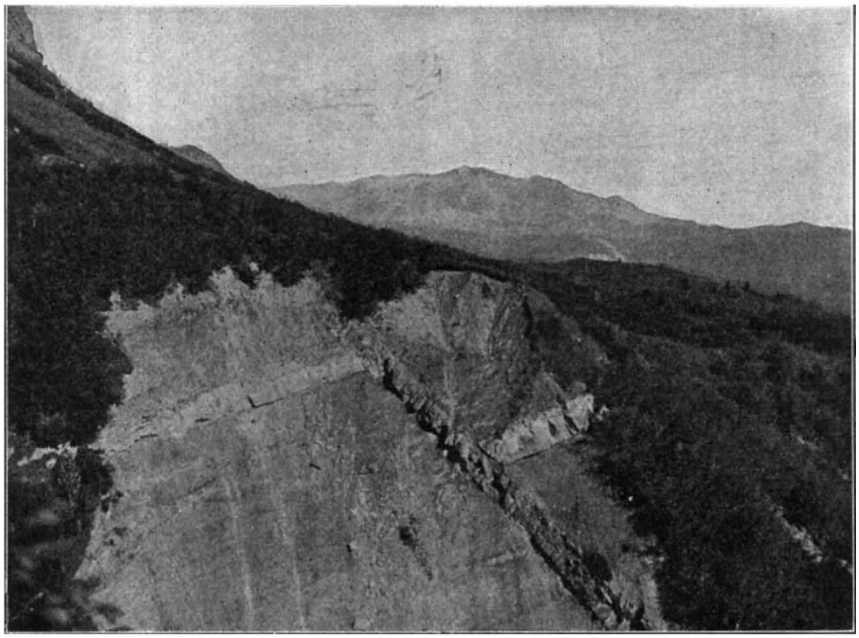

FIG. 2.—Diabase dyke in fault-plane in Cainozoic (Chickaloon Coal-measure) strata, Castle Mountain, Alaska. From Bull. 500, U.S. Geol. Survey.

Alaska claims continued notice. Bulletin 485, by G. C. Martin and F. J. Katz, describes the Iliamna region, where Triassic cherts are associated, as seems almost inevitable, with "green rocks" of volcanic origin. The same authors, in Bulletin 500, deal with the coal-bearing Lower Matanuska Valley, above Cook Inlet in lat. 62°. The coals are in Cainozoic strata, and are probably of Eocene age (p. 52). Basic lavas have intruded through these beds, and form conspicuous features on the bare hillsides (Fig. 2).

The development of Alaskan areas is also seen in Bulletins 449, 498, and 502. In Bulletin 467 (1911), W. W. Attwood deals with the coals and possible gold ores of the Alaska Peninsula, and furnishes several very interesting photographs of the coast. Bulletin 520, by a number of authors, brings our knowledge of the mineral resources of Alaska up to date. The review (pp. 45–88) of the possibilities of railway construction between the Pacific coast and the interior is of special interest, and the sketch-map provided, with "coal reported" marked on the seaboard of the north-east passage, is the sort of thing to captivate a Frobisher or a Cabot. The Cainozoic coal of the Bonnifield region is reported on in Bulletin 501, which also contains interesting notes on glaciation. Other economic papers on Alaska have been already noticed in NATURE (vol. xc., 1913, p. 659).

Professional Paper 71 (1912), constituting a large memoir on the stratigraphy of North America, by Bailey Willis, and accompanied by a coloured geological map of North America, on the scale of 1 : 5,000,000, is of such wide educational importance that it has already received special mention (NATURE, vol. xci., p. 93). Changes in nomenclature are somewhat rapid in the United States, and, since this great index was published, C. D. Walcott (Smithsonian Miscell. Collections, vol. lvii., No. 70, September, 1912) gives reasons for withdrawing his terms Georgian for Lower Cambrian and Saratogian for Upper Cambrian, and replacing them by Waucoban and St. Croixan respectively. Both these new names offer puzzles in pronunciation for the stranger. "St. Croixan" was first published by Walcott as a stratigraphical term in the preceding number of the Collections, p. 257, in which some very interesting tracks of Upper Cambrian trilobites are illustrated.

Four of the recent Professional Papers deal with western districts. No. 70, by A. H. Brooks, describes the difficult survey of the Mount McKinley region in Alaska in 1902, where almost all the geological systems are represented. From the historical summary on pp. 29–32, it seems doubtful if any explorers had reached the summit of Mount McKinley (20,300 ft.) by the close of 1910. The decay of the upland is shown by the immense areas of post-Pliocene detritus recorded on the preliminary geological map. The maps add considerably to our knowledge of the topography of the divide between Cook Inlet and the Yukon system.

In No. 73 W. Lindgren discusses the Tertiary gravels of the Sierra Nevada of California, well known as the scene of hydraulic gold-mining. The Great Valley of California has received detritus from the rising continental land ever since the opening of Cretaceous times, the shore-gravels becoming purely fluviatile during the Pliocene period (p. 28). J. M. Boutwell (p. 54) has had an opportunity of resifting the first-hand evidence as to the antiquity of the Calaveras skull, which at one time obtained a celebrity akin to that of the bones—also from Calaveras—which "were found within a tunnel near the tenement of Jones."

Professional Paper 74, by W. H. Weed, describes the Butte District, Montana, and is bound in cloth, a mode of presentation which makes it far more convenient than most of these large and

frequently consulted volumes. The Big Butte is a conspicuous rhyolitic hill rising above a somewhat dreary country of quartz-monzonite and andesite. The bare surface, however, allows the mineral veins to be traced over wide areas, and the district is now second only to the South African Rand as a producer of metals. The main ores are those of copper, containing 14 per cent. of silver. The volume includes a large number of vein-plans, and illustrations of the connection between separation-planes and ore-deposits in the crystalline igneous rocks. The ores were accumulated in these fundamental masses at some epoch prior to the eruption of the volcanic rocks at the close of the Cretaceous period. The conclusions as to their modes of origin may be compared with those of J. D. Irving and H. Bancroft for the district of Lake City, Colorado (Bulletin 478), where similar conditions occur.

Paper 75 is by F. L. Ransome, on the Breckenridge District, Colorado. Here gold is again the attraction, and the district has rapidly developed since 1909, when new dredges were introduced for dealing with the gravels. The glacial deposits show, as is so very general in America, two epochs of ice-advance and ice-retreat (p. 72). The fissures containing the sulphide ores and the gold from which the placer ores are derived were formed by earth-movements in early Cainozoic times.

It is impossible in a brief outline to do justice to the large volume (Monograph LII.) on the geology of the Lake Superior region, by C. R. van Hise and C. K. Leith. Much of the discussion on the pre-Cambrian series concerns the Dominion of Canada also, and miners will find a comprehensive account (pp. 460–596) of the ores of iron, copper, gold, and silver in the district. The ferruginous cherts, with hæmatite or limonite, are held to have arisen from the oxidation of cherty iron carbonates and of the green silicate greenalite, $(Fe,Mg)SiO_3.nH_2O$. The green oolitic ores with hæmatite of Dodge County, Wisconsin (pp. 567 and 536), which are regarded as having been deposited in a granular form in the sea, and the greenalite rocks of the Mesabi District (p. 165), invite comparison with the ironstones containing green oolitic grains in the Silurian rocks of North Wales (p. 509), concerning which the last word has by no means been said; while the red banded cherts remind us of similar stratified deposits in South Africa. The authors believe that the iron, whether hæmatite or magnetite, was largely introduced into the Lake Superior sediments from the adjacent basic igneous rocks, at a time when the latter were hot and capable of sending magmatic waters into the sea in which the sediments were accumulating (pp. 516 and 527).

In Bulletin 503, E. C. Harder indicates the development of the iron and steel industry on the Pacific coast of California.

Bulletin 505 (1911), by A. C. Veatch, is a summary of the mining laws of Australia and New Zealand, with testimony by practical miners as to their operation. The material of the bulletin was brought together for a report to Congress, to assist in framing regulations for granting leases of public coal-lands in the United States.

The Geological Survey of Alabama, working in cooperation with that of the United States, reports (Bulletin No. 10) on the Fayette Gas Field in the north-west of the State, where gas rises freely from small "gas-pools" in a coalfield of Upper Carboniferous age. Further explorations are recommended. The development of roads throughout Alabama by the use of selected material is discussed by W. F. Prouty in Bulletin No. 11, and there seems evidence that the lesson taught to Europe by the Romans, and long neglected by their successors, is at last spreading in the United States. It will be many years, however, before these civilised communities will possess the advantages given by French rule to the Berbers of North Africa.

The Wisconsin Geological and Natural History Survey issues (1912) a neat volume on the sandstones of Lake Superior, by F. T. Thwaites. The Bayfield group is the centre of interest, and is placed (p. 104) below the Cambrian, representing a sandy terminal phase of the Keweenawan sediments, in a region where a basin had been established which became choked by alluvial fans from the surrounding hills. The Survey also issues a large geological wall-map of the whole State, with a view to the requirements of public education.

In continuation of its handsome series of cloth-bound volumes, the Maryland Geological Survey publishes a work by W. B. Clark (State geologist), A. B. Bibbins, E. W. Berry, and R. Swann Lull, on the Lower Cretaceous deposits of the State. Mr. Berry (p. 99) takes the opportunity to summarise, with specific lists, the Lower Cretaceous floras of the world. As regards British deposits, he points out that we are not yet in possession of all that may be expected from the work of Dr. Stopes. Vol. ix. of the reports of the Survey treats largely of highway construction, but includes a history and description of the iron industry in the State. Prince George's County has been described in the latest of the interesting county monographs, with complete topographical and geological maps on the scale of one inch to one mile. We can imagine nothing better for the information of teachers in the local public schools.

The Iowa Geological Survey, in a massive volume issued at the close of 1912, includes its annual reports and papers for 1910 and 1911. More than 1100 pages are devoted to a thorough study of the underground waters of the State, including (p. 268) several mineral springs.

In *The American Journal of Science*, vol. xxxv. (1913), p. 1, J. W. Goldthwait, whose Canadian work has been already mentioned, describes cirques in New England, which, as seems natural, were occupied by small glaciers both before and after the great extension of continental ice. On p. 139, F. A. Perret carries us to "The Lava Fountains of Kilauea," which may now be fairly styled American. The mobility of the lava is ascribed (p. 143) to its being highly charged with an inflammable gas. The blue, and therefore highly actinic, cloud due to the combustion of this gas is here shown in photographs. It is well to learn, in view of the great interest aroused by Brun's researches, that the evolved gases are being carefully studied on the spot. The author regards those emerging from a lava-surface, that is, from a mass subject to oxidation, as quite distinct from the far purer gas of a great paroxysmal eruption. We must admit, in spite of all the work done on fumeroles, that we are still on the verge of this great question. In the same volume of the journal, p. 611, Mr. Perret directs attention to the evidences of occasional explosive action during the past history of Kilauea.

RÖMER'S "ADVERSARIA."

"ETUDES sur les notes astronomiques contenues dans les Adversaria d'Ole Römer," is the title of a paper by G. van Biesbroek and A. Tiberghien, published in the Bulletin of the Royal Danish Academy of Sciences (112 pp.). The "Adversaria" were published in 1910, and were reviewed in NATURE (vol. lxxxvi., p. 4). The authors of the present paper give a detailed analysis of most of