RECENT WORK OF GEOLOGICAL SURVEYS.[1]

IV.—THE UNITED STATES.

THE United States Geological Survey frequently assists research by publications in which definite subjects are dealt with from a comprehensive point of view. The Bibliography of North American Geology for 1906 and 1907 was issued in 1909. A bibliography of Archæan and Algonkian geology, divided up under the various States, is given in Bulletin 300 (pp. 940, 1909), in which Messrs. Van Hise and Leith review the pre-Cambrian geology of North America. As the title shows, Canada is included, and the summaries given of published work make this volume welcome in every library of scientific reference. Bulletin 364 (1909) is by Messrs. Darton and Siebenthal on the Laramie basin in south-eastern Wyoming. The name Casper formation is proposed (p. 13) for Carboniferous limestones and sandstones resting on pre-Cambrian rocks on both sides of the Laramie Range. The Laramie beds, over which much discussion has arisen, may be represented by the highest sandstones and shales of the Cretaceous Montana series, and an unconformity, now widely recognised, occurs between this series and the Cainozoic beds (pp. 35 and 43). The Laramie question, it may be observed, has been recently discussed by Mr. Whitman Cross (Proc. Washington Acad. Sci., vol. xi., 1909, p. 27), who proposes the name Shoshone Group for the beds elsewhere styled Laramie, but lying above the unconformity. The coloured geological map in the memoir, and the illustrations, show well the character of the broad valley of the Laramie, with its floor 7000 feet or more above the sea, and gneissic hills rising some 3000 feet higher on the east and west (Fig. 1). Interesting contrasts are afforded in a great variety of strata, especially where Oligocene sands form level ground in hollows of the Archæan rocks of the Laramie range.

FIG. 1.—Alluvial flat of Rock Creek Valley, Laramie Basin, looking towards the Pre-Cambrian hills.

Mr. D. F. MacDonald, in Bulletin 384, carries us up to the old rocks of the Canadian border in the extreme north of Idaho, where a large series of strata exist that are presumably of pre-Cambrian age. Mr. J. S. Diller (Bulletin 353) describes the Taylorsville region at the north end of the Sierra Nevada in California, and to the south-east of the great cone of Shasta. Compression of the Jurassic and older sediments occurred here in early Cretaceous times; the present Sierra region began to rise, and the Great Basin slipped away from it along faults (p. 108). Though the sea, as happened in so many other areas, returned during the Upper Cretaceous epoch, it did not dominate the new mountains; soon after, it became excluded altogether. Elevation continued in the Eocene, and gold-bearing gravels streamed down until the end of the Pliocene, when great warping took place, accompanied by faulting. Hence (p. 110) interesting changes in the drainage-lines occurred, and old valley-floors are traceable that undulate up and down, with bulges rising 1000 feet high across the former courses of the streams. In describing the volcanic rocks, which are of various ages, from Silurian to Pliocene, the author uses the terms meta-rhyolite and meta-andesite for types much altered from their original condition (p. 81). The famous Lassen Peak volcano lies a little outside the area now described.

[1] Continued from vol. lxxxiii., p. 234, April 21.

Mr. W. T. Lee (Bulletin 352) has explored a part of western Arizona, where the Colorado River emerges from the Grand Canyon and runs southward, forming the State boundary. Fine examples of consolidated, and probably Quaternary, conglomerates and gravels, weathered out into huge bluffs, are given in the plates. The author describes the erosion of valleys that went on in Cainozoic time (p. 58), accompanied by faulting; then followed the great uplift of the plateau, and renewed excavation by the streams, the Colorado being now driven to carve out the Grand Canyon. The gravel deposits in the broad Detrital-Sacramento valley to the south are 2000 feet thick, and are believed to have been deposited after the erosion of the canyon. The obstacle that checked the southward flow of the river down this valley may have been a barrier of comparatively modern basalt, and the formation of a nearly flat cone of deposition above it allowed the river to wander westward and to start new excavation along its present course (p. 65). During this next epoch the alluvial conglomerates were eroded into their present fantastic outlines (Fig. 2). The history of the southern valleys, here somewhat modestly presented, must clearly be taken into consideration when we review that of the more famous plateau-region to the north. The coloured geological map, inserted, according to the present useful practice, in the memoir, enables one to follow the arguments, as well as the travels, of the author. It will be noted that the excavation of the Grand Canyon is here transferred from Cainozoic to early Quaternary times.

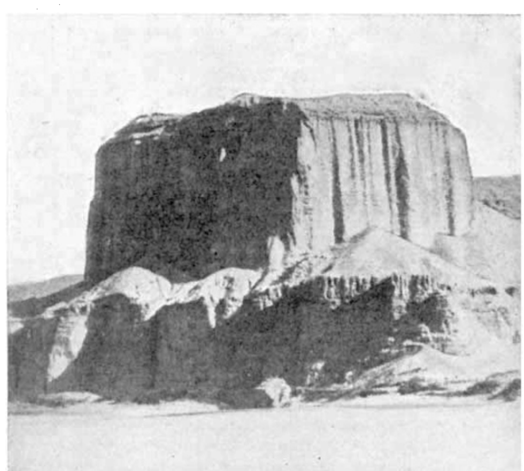

FIG. 2.—Bluff of eroded Quaternary Conglomerate, mouth of the Virgin River, Arizona.

Mr. Lee also describes the "Manzano Group" of marine red sediments in the Rio Grande Valley of New Mexico (Bulletin 389, 1909). Mr. G. H. Girty deals with the palæontology of these strata, which are now ascribed to the Upper Carboniferous (p. 38). Red beds were deposited in the Rocky Mountain region from Lower Carboniferous to Jurassic times. There seems here a suggestion of the continuity of the bright colour conditions that influence tropical and semi-tropical strata at the present day. The fauna includes numerous new species, and a new molluscan genus, Manzanella, allied to Nucula, is established (p. 75). The stratigraphical simplicity introduced by this systematic piece of work may be realised from the previous reference of the beds to Permian, Triassic, and Jurassic series (p. 11).

Mr. L. M. Prindle's account of part of the Yukon-Tanana region in Alaska, extending nearly to the Arctic Circle (Bulletin 375, 1909), is interesting for comparison with Canadian work, and has also an economic value. The lignites of the "Kenai formation" are placed, with other "Arctic Miocene" deposits, in the Eocene (p. 26). Our old friend *Corylus MacQuarrii* appears in the flora, which may, of course, prove ultimately to be Oligocene.

Professional Paper 61 (1909), by Mr. W. W. Atwood, describes the glacial history of the Uinta and Wasatch Mountains, which lie to the east of the now desiccated area of the Great Salt Lake of Utah. Here "it is certain that there were at least two ice epochs separated by a long interglacial interval" (p. 92). Lake Bonneville sediments rest upon the earlier drift, and are overlain by the later drift, and support is given to Gilbert's conclusion that "the inter-Bonneville epoch of low water was of greater duration than the time that has elapsed since the final desiccation." The correlation of glacial advance with lake-extension is interesting in connection with the association by Messrs. Davis and Huntington of pluvial flood-gravels in Central Asia with the growth of ice upon the highlands. Mr. Lee, in his Arizona bulletin, referred to above, seeks to connect epochs of erosion in the Colorado basin with those of high water in Lake Bonneville, so that we may now realise a good deal of "the face of the earth" as it appeared soon after Pliocene times, from the Wyoming border down to the Gulf of California.

Mr. G. H. Girty's memoir on the fauna of the Caney shale of Oklahoma, in which cephalopods are prominent (Bulletin 377, 1909), will interest students of Carboniferous zoning. Professional Paper 58 (1908), a quarto of 652 pages, is by the same author, on the Guadalupian fauna of New Mexico. The Guadalupe mountains are formed of marine limestones and sandstones, the Capitan Limestone in the upper part yielding a scarp reminding one of Tyrol. A large Fusulina, *F. elongata*, is abundant in the higher beds. The fauna as a whole furnishes a localised type (p. 28), and differs from the Upper Carboniferous and Permian faunas of the eastern and most of the western States, while it is younger than beds styled Permian in Kansas. The Guadalupian series is compared most nearly with the Fusulina Limestone of Palermo (pp. 35 and 50), and it is urged that the beds may possibly be younger than the European Permian, although truly of Palæozoic age. New genera of lithistid sponges and calcisponges are described. Attention is especially directed to the bryozoan species grouped under Domopora, as indicating Mesozoic affinities, and throughout the memoir discussions arise which must be considered by workers on Permo-Carboniferous horizons. In Professional Paper 59 (1909) Mr. W. H. Dall describes the Miocene of Astoria and Coos Bay, Oregon, including some Oligocene forms from the Aturia beds. Reprints of rare papers on Cainozoic strata of the Pacific coast are usefully given as appendices. Mr. True (p. 143) contributes an account of the Miocene sea-lion, *Pontolis magnus*, which has interesting alliances with *Eumetopias jubata*, still living in the district. The plates of fossils are of exceptional beauty, and include whorl-like groups of a singularly large Crepidula.

The Survey has also issued numerous bulletins on economic geology, among which may be mentioned those on the granites of Massachusetts, New Hampshire, and Rhode Island (No. 354); on the Great Falls Coal Field of Montana (No. 356), where the Carboniferous strata contain gypsum and the Lower Cretaceous sandstones contain valuable seams of coal; on the Book Cliffs Coal Field of Colorado and Utah (No. 371), where the coal is in the higher beds of the Upper Cretaceous; on the iron ores of southern Utah (No. 338), where igneous intrusions have introduced iron salts into limestone, and where the petrographic observations of the geological surveyor (p. 86) have a special bearing on future exploration; and on magnesite in California (No. 355), from which it appears that this mineral is in special demand for refractory bricks and for the production of carbon dioxide, the residue being more valuable than lime. Bulletins 328, 335, 337, and 345 deal with mineral resources in Alaska. In the first of these (p. 151) the famous beach-placers of Nome are described, which were practically exhausted, with great profit, in two years. In No. 335 the level Bering Glacier, a companion of the Malaspina, and also in part forest-clad, is described and illustrated (p. 46). No. 337, by Mr. Prindle, should be read in connection with No. 375, by the same author, noticed above. Professional Paper 62 (1908), by Messrs. Ransome and Calkins, describes the ore deposits of the Cœur d'Alène district, Idaho. The post-Glacial gravels (p. 77) are in this case referred to the epoch of the dwindling and recession of the ice, which was here localised in cirques and valleys. Lead, silver, zinc, copper, and gold are worked, and the district produces more lead than any other in the United States. The labour-wars in the district, waged with dynamite and rifles, show that the difficulties have not been all due to geological structure. The rich lead-silver ores, ranging through 4000 feet of contorted Algonkian rock, are believed to represent emanations from a great batholite (p. 137), which is represented by its uppermost intrusions (monzonite) at various points.

The papers on water-supply issued by the United States Survey are well known by their brown covers, and usually contain matter of geological as well as of economic importance. Two of them have been recently noticed in NATURE (vol. lxxxii., p. 379). No. 223 (1909), by Mr. F. G. Clapp, on the underground waters of S. Maine, includes a coloured geological map and useful illustrations of joint-structures in granite, diorite, and slate. In No. 221 (1909) Mr. C. A. Fisher describes the Great Falls region of Montana, where the Missouri is still fresh and vigorous, and liable to considerable additions when the snow melts off the mountains to the west. The destruction of forests by fire on these high slopes has further increased the risks of flooding. The copious water-supply is now being utilised for a system of irrigation-canals in the somewhat arid plains to eastward. In No. 220 (1908) Mr. G. A. Waring records a piece of pioneer work in southern Oregon, where no good topographical map previously existed. The country reminds us of N.W. Europe in Triassic days, with its large shallow lakes, liable to dry up at times, and at others to extend their boundaries, so as to find outlets and swell the diminished streams. Goose Lake has thus been known to flow over southward into Pit River. It receives, in all probability, a considerable supply from subterranean sources (p. 42). The problem of the region, of course, lies in the alkali-lands, where sodium chloride, sulphate, and carbonate may be brought to the surface during irrigation, the carbonate being much the most injurious. Sodium carbonate not only blackens the surface of stems and roots just below the surface, whence its name "black alkali," but also deflocculates the soil. References are, of course, made to the bulletins issued by the U.S. Department of Agriculture, and this memoir shows a promising correlation between the work of the Geological Survey and of the Bureau of Soils.

No. 225 (1909), by Mr. W. C. Mendenhall, continues the history of the Salton Sea, from its disastrous formation by the drawing in of the Colorado River in 1905 (see NATURE, vol. lxxv., p. 501) to the closing of the gap by the energy of the Southern Pacific Railroad early in 1907. If the work holds, it is estimated (p. 40) that the great lake will have disappeared by evaporation in 1925, to the detriment of the users of ground-waters in the valley to the north-west. This valley, and the Colorado Desert generally, were once occupied by the head of the Gulf of California. The surface of the Salton Sea had fallen to 200 feet below sea-level early in 1907. A remarkable water-line, 40 feet above sea-level, is traceable round the bluffs, and is attributed (p. 18) to an important predecessor of the Salton Sea, formed before the Colorado took up its present course across its delta (Fig. 3). In this rainless region it is estimated that such indications, often accompanied by deposits of calcium carbonate, have lasted through a thousand years. The same author describes, in Paper 222 (1908), the conditions of the San Joaquin Valley, California, and urges the importance of small farming with individual hard work, as carried out by the Italian immigrants, in opposition to the characteristically American "desire to get rich overnight, to control large holdings, and to avoid personal labour." The warning is also true in regard to English agriculturists in South Africa, and may in time become applicable even to the enormous prairie-lands of Canada.

The Geological Survey of New Jersey, in its annual report for 1908 (1909), records its continued cooperation with the Survey of the United States. In a paper on the building-stones of New Jersey, the rocks are excellently illustrated by coloured photographs of polished surfaces, as well as by views of the buildings constructed from them.

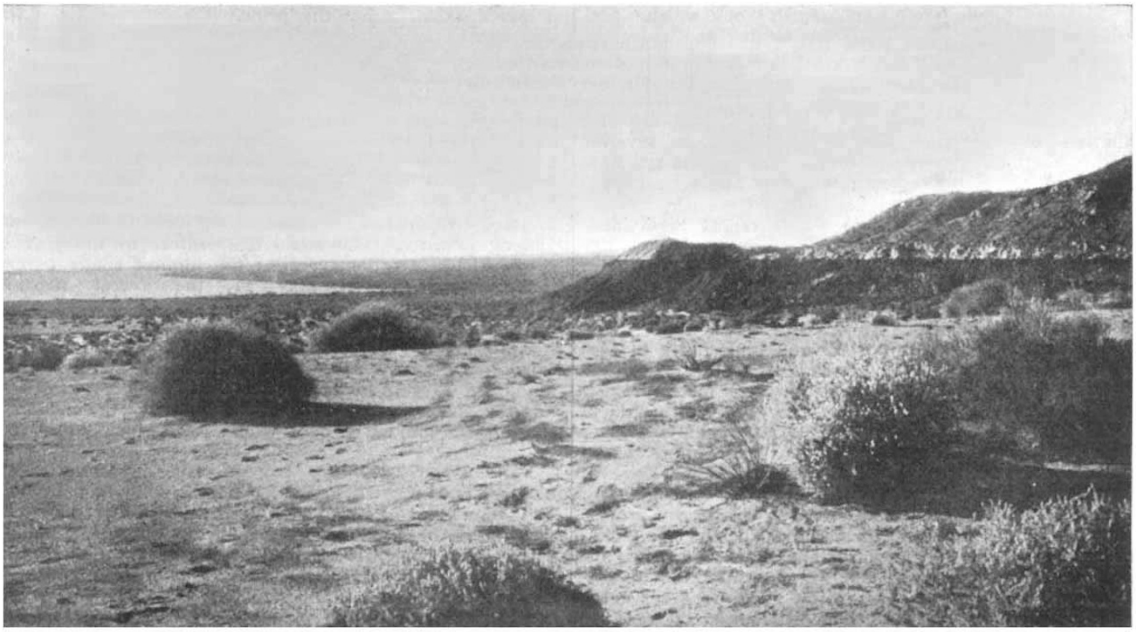

FIG. 3.—Old water-line above west side of the present Salton Sea, California.

The annual report of the Iowa Geological Survey for 1908 has been received in 1910, and is mainly occupied (pp. 21–687) by a comprehensive series of papers on the coal-deposits of the State. The peat bogs and their flora are described in the concluding papers.

G. A. J. C.

REPORTS OF METEOROLOGICAL OBSERVATORIES.

THE *Meteorological Service of Canada* (1906).—This report extends to nearly 650 quarto pages; the geographical position, and height above sea where known, of the numerous stations in operation in that year are given, also hourly observations at Victoria, Winnipeg, Toronto, and Montreal. From a monthly chronicle of weather conditions it would appear that, generally speaking, temperature was above and rainfall below the normal. Temperatures exceeding 100° and below −50° were, as usual, recorded at many stations, the highest being 107°, at Point Clark, Ontario, and the lowest −65·5°, at Dawson City, Yukon. The absence of maps, the impracticability of comparing data contained in various tables, and the frequent practice of separating rainfall and depth of snow, render it somewhat difficult to obtain a general idea of the characteristics of the year over such a vast area beyond that given by the chronicle referred to. For this purpose the excellent summaries in the *Monthly Weather Review*, although based chiefly on telegraphic reports, are more convenient. The weather predictions were very successful; the general total percentage of fulfilment (including partial verifications) varied from 81·3 in November to 92·4 in July, the average being 86·3 per cent.

Toronto Observatory (1907).—The results of the meteorological and seismological observations for the year are interesting and valuable. In the annual summary the results are compared with the means for the last sixty-eight years. The mean temperature of 1907, 44·2°, was practically normal; mean of maxima, 51·6°, of minima, 36·7°. The absolute maximum was 88·8°, in July (highest on record, 99·2°); absolute minimum, −10·0°, in January (lowest on record, −26·5°). The highest solar radiation was 112·3° (June); lowest night radiation, −13·9° (January). The annual rainfall was 25·56 inches (normal, 26·88 inches); depth of snowfall, 52 inches (normal, 66 inches). Rain fell on 100 days and snow on forty-seven days. Bright sunshine was recorded on 1921 hours, being 43 per cent. of the possible amount.

Bombay and Alibag Observatories (1909).—The equipment of these institutions is very complete; the routine operations, which include terrestrial magnetism, meteorology, seismology, and astronomical observations, so far as these relate to time-keeping and signalling, are carried out with great minuteness and regularity. The annual rainfall was 71·22 inches, being 3·94 inches below the normal (1873–96); the mean temperature was 78·9°, 0·5° below the average. Milne's seismograph registered fifty-three earthquakes; great disturbances occurred on April 11, June 3, July 8, and October 21. The table representing the magnetic character of each day shows there were 149 calm days, 182 days of small, and 34 days of larger disturbance. The mean declination was 1° 0′ 16″ E.

Helwan Observatory (1909).—The magnetic observations made during the year have been published in pamphlet form by the Egyptian Survey Department. The tables include mean monthly values of the various elements, and hourly deviations from the mean. The mean annual results were:—westerly declination, 2° 49·2′; dip, 40° 40·4′; horizontal force, 0·30031 (C.G.S. unit); vertical force, 0·25804. A list is given of the maximum and minimum values of the elements during fifteen of the principal disturbances with a daily range of more than 100 γ in the horizontal intensity (γ=0·00001 C.G.S. unit). The greatest disturbance was recorded on September 25 (to which we have already referred as regards Kew Observatory). At Helwan the range of horizontal intensity was >585 γ (the curve extending below the limit of the photographic sheet), vertical intensity 237 γ, declination 38′. The range of horizontal intensity in most of the cases quoted was from three to four times that of the vertical intensity.