GEOLOGY IN PRACTICE.[1]

IT will be sufficient to mention such names as the Black Hills, the Bighorn Mountains, the Foxhills and Laramie Range, and the Garden of the Gods to indicate that the preliminary report on the Central Great Plains (1) includes some classical and highly interesting ground. The area covered by the report comprises the greater part of South Dakota, Nebraska, and Kansas, and the eastern part of Colorado and Wyoming—an area of no less than 1½ million square miles.

A good deal has already been written about one portion or another of this vast region; the first half of this volume gives a clear generalised account of the stratigraphy and structural geology of the whole; it is, however, by no means a mere abridgment of previously gathered information—it embodies the results of much original work.

From the time when the middle-Cambrian sea washed the Rockies and the adjacent highlands up to the latest physiographic conditions, the geological history of the region is here depicted in a broad manner. One feature of this country at once arrests attention, viz. the repetition in one epoch after another of widespread, uniform conditions of sedimentation—thus the great expanse of Dakota-Lakota sandstone in Cretaceous times, the equally widespread Arikaree sands of the Tertiary, and to-day the sandy alluvial deposits laid down by the rivers when they can no longer bear their load, and spread far and wide as the streams slowly turn from course to course. Less striking, perhaps, but equally widespread, are the argillaceous deposits like the Pierre shale of the Cretaceous. Here, as in other parts of the world, a series of "Red Beds" puzzles the geologist to place a limit to the top of the Carboniferous or the base of the Trias.

But it is not so much for the pure geology that this report will be read as for a guide—a very practical guide—to the sources of underground water. The general conditions governing the underground water system of the Great Plains are simple. A thick succession of alternating sandy and impervious sediments constitutes the rocky floor of the country. These beds are tilted up in the north and west, and dip thence gradually southward and eastward. Water-bearing beds are found in the Cambrian and in every other formation locally up to the recent hills of blown sand; but by far the most important is the Dakota sandstone, which spreads out as a great sheet 150 feet to 300 feet thick beneath the entire area of the plain. This sandstone is underlain by the Red Beds or by the Carboniferous limestone and shale, or, in East Dakota, by the Sioux quartzite; it is overlain by the great mass of clays and shales of the Benton, Niobrara, and Pierre formations. The principal zone of intake lies 4000 feet to 6000 feet above sea-level on the flanks of the Rocky Mountains and the Black Hills; as a result, high pressures are found in wells hundreds of miles from this region.

In this country we trust that the bearing of geological structure upon the amount and quality of water to be obtained in any given area is as well understood as it is across the Atlantic. Yet, although to be "like mother makes it" may express the excellence of a soup, the same can in no wise be said of geo-hydrological literature. We have a curious shyness about graphic modes of presenting information, a diffidence about making unavoidably clear, so that he who runs may read. It is in this direction that the volume under discussion excels; there are no fewer than fourteen maps, and twelve of these bear directly upon water-supply problems.

The landowner, the engineer, the manufacturer, rarely has the time or the requisite special knowledge to sift the information usually conveyed in records of well borings. He cannot afford to spend hours in the endeavour to discover whether the "ratchel" of one sinker is the "muck and rubble" of another, whether "blue bungum" can really be distinguished from "hard bind," or Kimmeridge clay from Gault. The geologist must know these things; what the landowner asks him is, How deep must I sink for water here? and How much may I expect to find? It is true that none but Providence or the "dowser" could answer these questions in terms of precise exactitude, but the report before us proves how much can be done by taking the subject seriously and by the application of graphic methods to focus the geological information in its varied forms into one or more simple images, so that even the "man in the street" can see at a glance what are the possibilities of any particular situation. The maps, in addition to giving the general geology, show also the underground areas occupied by the more important formations separately, and, by means of contours, the depth of the bed-rock beneath superficial deposits, the depth of the most important water-bearing stratum, and the altitude of the head of water, as well as other useful information.

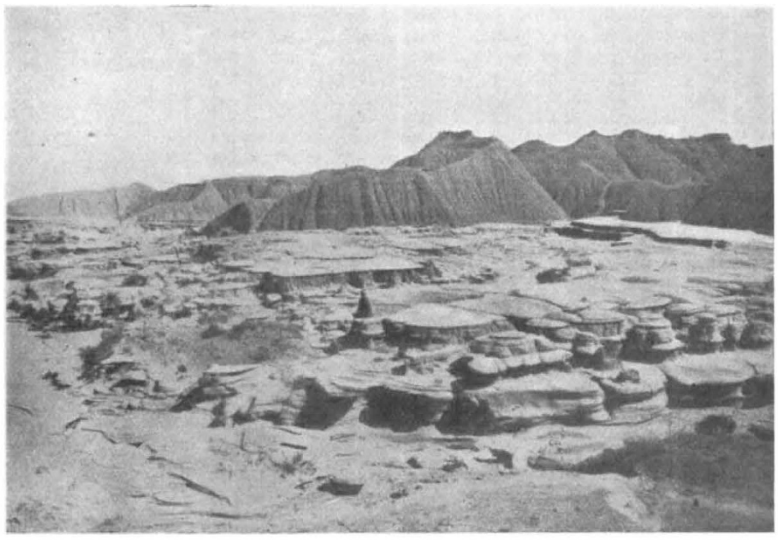

FIG. 1.—"Toadstool Park" in badlands west of Adelia, northern Sioux county, Nebr. Sandstones overlain by Brule clays

The volume is profusely and beautifully illustrated. Three of the plates, exhibiting forms produced by erosion, have been reproduced to accompany this notice.

Mr. Taff in his report (2) describes the structure and stratigraphy of the two groups of hills, the Arbuckle and Wichita Mountains, which rise abruptly, like islands, from the Red Rock plain in Oklahoma and Indian Territory, a region which lies south-east of that described in the previous report.

These two hill-groups have a common alignment, their axes trending north-westward and south-eastward. Their geological history appears to be identical; underlying the sedimentary rocks in each case are pre-Cambrian granites, granite-porphyries, and aporhyolites—the oldest rock is a gabbro, in the Wichita group. The succeeding Cambrian and Ordovician strata bear no evidence of folding; the period of uplift which has led to the exposure of the igneous pre-Cambrian rocks began in the middle of the Pennsylvanian (Carboniferous) epoch and culminated near its close, before the deposition of the Red Rocks (? Carboniferous or Permian) which in this region constitute the prevailing surface rock.

We are glad to see that the field staff records its appreci-

[1] Reports of the United States Geological Survey. (1) Preliminary Report on the Geology and Underground Water Resources of the Central Great Plains. By N. H. Darton. 1905. (2) Preliminary Report on the Geology of the Arbuckle and Wichita Mountains in Indian Territory and Oklahoma. By J. A. Taff. With an Appendix on Ore Deposits by H. Foster Bain. 1904. (3) The Geology of the Perry Basin in South-eastern Maine. By G. O. Smith and David White. 1905

ation of the arrangement by which the palæontologists were enabled to accompany the party—a very proper plan, and one which in this case greatly facilitated the speed and exactness of correlation and mapping, besides accumulating material for an important monograph on the fossils.

The report contains two geological maps and several views of the scenery. An appendix on the reported ore deposits of the Wichita Mountains, by Mr. H. Foster Bain, should be of use as a warning to prospectors.

(3) Henceforth let no man say there is coal in Perry. For seventy years have the dwellers in south-eastern Maine cherished the hope that coal lay within their borders; and had they not good reason? Perry lies near the edge of a structural basin, and they had been told that the "Perry" beds were Triassic, consequently that coal might be found beneath them; the Canadian Geological Survey had coloured the beds Carboniferous on their map—in spite of Sir William Dawson's diagnosis of the plants—and mining "experts," glancing at the same obscure plant remains, had said, "Here you are, the very thing," and had gladly bidden the people to bore; and they bored, through the Perry beds into the Silurian lavas, but into no coal. Still in hope, the sum of 15,000 dollars was asked for to put down more bore-holes; it was decided, however, first to call in the aid of the U.S. Geological Survey Department, with the result that Messrs. Smith and White were sent to examine the ground. Then, hey presto! the obscurity vanished—a ten days' reconnaissance was enough. There is no coal in the Perry beds, only conglomerate with a little sandstone and shale and interstratified basic lava. Subsequent examination of the badly preserved plants confirmed the age of the beds to be Devonian, probably Chemung, and, incidentally, produced two new generic types. The plants are figured in six plates. J. A. H.

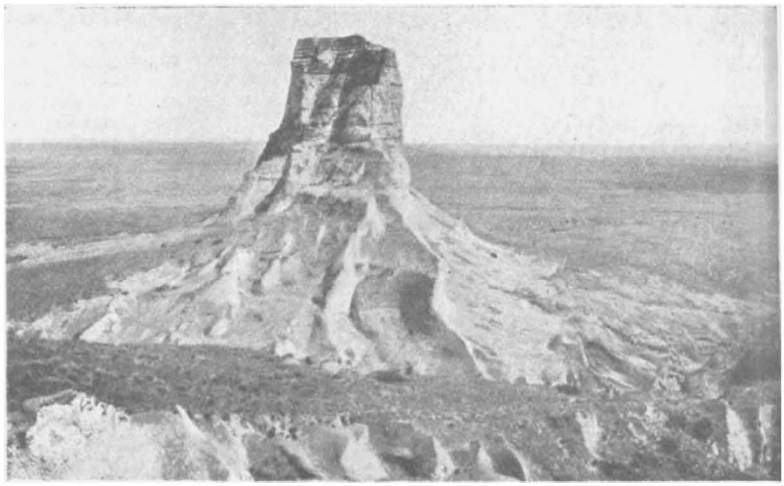

FIG. 3.—"Jail Rock," showing castellated form of weathering of Gering sandstone and slopes of Brule clay; valley of North Platte in the distance.

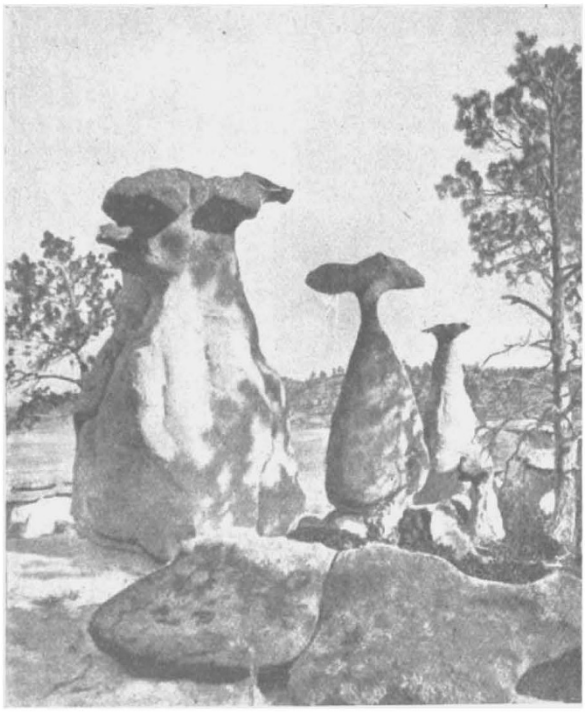

FIG. 2.—Eroded Sandstones, Monument Park, Colorado.

STUDIES OF TEMPERATURE AND PRESSURE OBSERVATIONS.

METEOROLOGISTS will be interested in a paper recently published by Dr. van Rijckevorsel, and entitled "Konstant auftretende secundäre Maxima und Minima in dem jährlichen Verlauf der meteorologischen Erscheinungen," part ii. (Rotterdam: Van Hengel, 1905). This is really the second portion of a previous publication, only in this instance the number of stations dealt with is more numerous, and the stations themselves more generally distributed over the earth's surface.

By the method explained in the pamphlet the author has obtained for twenty-two stations the mean annual temperature variations, the resulting curve representing the mean of observations of altogether 3636 years. The author then proceeds to eliminate the annual period of twelve months, and also discusses the residuals. The main result at which he arrives is that, no matter whether he deals with all the observations collectively, with the European stations alone, or with stations collected in north or south hemispheres, there is over the whole earth's surface during twelve months a half-yearly period of temperature the epochs of which are identical. It shows maxima in the beginning of March and September, and two minima in the first days of June and December. Another oscillation which is referred to is one composed of a series of very small maxima and minima.

With regard, however, to the six-monthly oscillation of temperature, a variation which seems to be clearly marked, it is interesting to note that the epochs of maxima seem to pick out the times when the north and south poles of the sun are consecutively turned towards the earth.

As the author finds that stations representing the north and south hemispheres give practically identical results, it would be interesting if he would try an east and west system of grouping of stations, and see if the same result is obtained. In the light of recent work, it seems quite possible, but not probable, that if stations in North-West Africa, South and North America, Honolulu, and Siberia be formed into one group, and the rest of the world into another, the same variation, but of opposite or nearly opposite phase, might be the result. The attempt is well worth trying, since the author has all the material at his hand, and the more stations employed in South America to counterbalance the larger number used and more easily obtained in the European area the better. In this pamphlet curves are given showing the variations derived, and