

Further on, the publications of the Survey are enumerated, and the alteration of the issue of the "*Palæontologia Indica*" from quarterly to annual parts is mentioned, the latter appearing to be the most advantageous form in which to send them forth. The Report concludes with notices of the additions to the Library and Meteorological Collection, the progress in cataloguing the Museum specimens and analyzing coals, the usual list of Societies and other institutions from which publications have been received being appended.

The remaining papers in this number of the "*Record*" are two: one on the alleged Discovery of Coal near Gooty, and of the indications of Coal in the Cuddapah District, by R. Bruce Foot, Esq., F.G.S., in which the first *discovery* above alluded to is more fully treated of, and another noticed; the dribblings from the guano of bats and birds issuing from cavities in recent travertin having been mistaken for petroleum by a certain Dr. H——, whose statements led to Mr. Foot's investigations, and whose name we charitably suppress, as his alleged discoveries can confer on him no credit according to this paper. The other is a sketchy but interesting record of the Mineral Statistics of Kuamon Division, etc., by A. W. Lawder, Esq., C.E., Divisional Engineer.

II.—AMERICAN GEOLOGICAL SURVEYS.

(Continued from page 225.)

1.—REPORT ON THE PROGRESS OF THE STATE GEOLOGICAL SURVEY OF MICHIGAN. Presented November 22, 1870. By ALEXANDER WINCHELL, LL.D., Director.

THE Government appropriate 8000 dols. annually for the Geological Survey of Michigan. Half of it is applied to the investigation of the rocks of the Northern Peninsula. Field-work, has been carried on for two years. The assistants are Major T. B. Brooks and Professor R. Pumpelly. The sub-assistants are Professors N. H. Winchell, M. W. Harrington, and E. A. Strong; A. S. Wadsworth, C. B. Headley, A. O. Currier, J. H. Emerton, J. N. Armstrong, C. M. Boss, S. W. Walker, A. R. Marvin, and L. G. Emerson. This pamphlet briefly sets forth the progress of the work, and the plan of the Final Report, much of the material for which is already in hand. Attention is paid to the Geography, Hydrography, Topography, Climatology, Magnetography, Vegetation, Sanitary Characteristics, Statistics of Population and Improvements, Fruit Production, and Agriculture of the State, as well as its Geology, the latter claiming the lion's share.

The Survey of the Iron region near Marquette is nearly completed. Eleven large maps of the most important mines are nearly ready for the engraver. Discoveries have been made of new and large beds of iron ore in the forest unsettled country, upon lands owned by the State. The older beds belong to the Huronian system, several thousand feet thick. All the rocks appear to have been of sedi-

mentary origin, though often presenting combinations suggestive of an igneous character. The following is their order, in descending scale:—1. Quartzite, 2. Hematitic and Magnetic Ores, 3. Ferruginous Quartzite, 4. Diorite, 5. Ferruginous Quartzite, 6. Diorite, 7. Ferruginous Quartzite, 8. Diorite, 9. Ferruginous Quartzite, 10. Diorite, 11. Talcose schist, 12. Quartzite, 13. Laurentian. The Copper region, under the superintendence of Professor Pumpelly, is being mapped upon the scale of 300 feet to the inch. The field-work has led to the accumulation of numerous details respecting the distribution of the several formations, which cannot be presented in a report of progress, but they have necessitated many improvements upon the Geological Map.

Closely connected with the results of the field-work is an elaborate paper by Professor Winchell upon the Marshall Group, in the *Proceedings* of the American Philosophical Society. The Michigan Reports present an array of many new local names. This has been necessitated by the isolated position of the Carboniferous and Devonian Rocks of the Lower Peninsula. The Marshall Group is proved to lie at the base of the Carboniferous system, and to be the equivalent of part of the Waverley series of Ohio, the Catskill group in New York, the Goniatite Limestone of Indiana, the Kinderhook group of Illinois, the Yellow Sandstones (Hall) of Iowa, the Chontean Limestone, vermicular Sandstone and lithographic Limestone of Missouri, and the Silico-bituminous shales at the base of the Siliceous group of Tennessee. This is a novel conclusion in American Geology. Most geologists have followed the lead of Professor James Hall, who regarded them generally as the equivalents of the Chemung and Portage groups, at the summit of the Devonian, while the Catskill Red Sandstone has headed the column of the New York system for the past thirty years as beneath the Carboniferous. This conclusion is adopted, at least for the State of Ohio, by Dr. Newberry and others. The theory is based both upon lithological and palæontological grounds. In this "Marshall group" Professor Winchell finds that there have been collected 416 species of fossils, viz., nine plants, thirteen Polypi, 27 Crinoids, one *Fenestella*, 124 Brachiopods, 116 Lamellibranchiates, 13 *Bellerophon*, four *Porcellia*, 48 Gasteropods, 46 Cephalopods, nine Trilobites, one Ostracod, four Fishes, and one *Pleurodictya*. These identified species have been collected in eleven detached districts or States, which have yielded severally the following numbers:—North Michigan, 23; South Michigan, 93; Ohio, 139; Indiana, 45; Illinois, 27; Iowa, 160; Missouri, 77; Kentucky, 2; Tennessee, 13; New York, 9; Pennsylvania, 9; total, 597. Great additions have since been made to this list in Ohio.

The Waterlime division of the Lower Helderberg formation has now been found in Michigan. It contains the *Eurypterus remipes* (De Kay). An apparently new assemblage of Hamilton and Corniferous Limestone species is found in the rocks of the Lower Peninsula, and has received the name of the "Grand Traverse group." The "Huron group" contains a peculiar assemblage of fossils, and the term may be a better one than its New York equivalent, the Genesee and Portage groups.

The Director shows that an immense amount of good field and office work has been well done, and he estimates that two appropriations of 30,000 dols. and two years' work will enable him to complete the Survey and publish the results. C. H. H.

2.—THE GEOLOGICAL SURVEY OF OHIO.—In 1836 and 1837 there was a public Geological Survey of the State of Ohio, under the direction of Mr. W. W. Mather. Nothing more was done towards exploring the geology of this interesting region for more than thirty years, when a bill was passed (1869) providing for a thorough Survey. Prof. J. S. Newberry, LL.D., was appointed chief geologist, assisted by E. B. Andrews, Edward Orton, and John H. Klippart; also by the following "local assistants": Rev. H. Hertzner, M. C. Read, Fred Prime, junr., W. P. Ballantyne, G. K. Gilbert, Andrew Sherwood, R. D. Irving, W. A. Hooker, W. B. Potter, Henry Newton, and H. A. Whiting.

During the interval of thirty years between the two geological Surveys of Ohio, the States on all sides had been explored, but it was impossible to synchronize satisfactorily all the formations of the West with those of New York, as they had not been traced across Ohio. It was generally believed that the Waverley group was Devonian, and the Black shales the equivalent of the Genesee slate. Dr. Newberry, immediately after his appointment, commenced to map the distribution of all the formations, and to collect their fossils, and has met with eminent success. His scheme for the Ohio rocks is the following, entitled, *Preliminary Geological Map of Ohio*, prepared from the notes of the Geological Corps, by J. S. Newberry, Chief Geologist, 1870.

SILURIAN, 1. Cincinnati group (Trenton and Hudson); 2. Clinton group; 3. Niagara group; 4. Waterlime and Salina. DEVONIAN, 5. Oriskany Sandstone; 6. Corniferous Limestone; 7. Hamilton group; 8. Huron shale (Genesee and Portage); 9. Erie shales (Portage and Chemung). CARBONIFEROUS, 10. Waverley group; 11. Lower Carboniferous Limestone; 12. Carboniferous Conglomerate; 13. Coal-measures.

No rock lower than the Cincinnati group appears at the surface in Ohio; but at an artesian boring at Columbus both the Calciferous and the Potsdam sandstones were found. The Cincinnati group is about 1,000 feet thick. The Clinton is from 10 to 100, and the Niagara about 80 feet thick. The Salina and Waterlime groups had not been known in the State previous to Newberry's explorations, and they seem to cover more of the territory than any other formation except the Coal-measures. They contain gypsum and salt. The Oriskany Sandstone was also a new discovery, and is about 20 feet thick, commonly destitute of fossils. The Corniferous Limestone, or the Upper Helderberg of New York, had long been known to exist in Ohio, and Dr. Newberry succeeded in finding enormous fishes in it, besides remarkable specimens of trees, the oldest land plants yet found in America. About 20 feet of the Hamilton group, with its characteristic fossils, was also newly discovered by the

Survey. The old band of the Black slate proved to be Nos. 8 and 9 of the series. The Chemung group, which is a sand-rock in New York, passes into a slate in Ohio. Not aware of this lithological change, it is not strange that the earlier geologists attempted to correlate it with the higher Waverley group. So satisfactory is the new identification, that it was immediately adopted by the Geological Section of the American Association for the Advancement of Science without a dissenting voice. The Huron shale is a new name borrowed from the Michigan Survey, and it seems to be a better designation than the New York equivalents. It had been supposed to be the equivalent of the Hamilton. It contains the *Dinichthys Herzeri*.¹ The Erie shales on a superficial view appear to be identical with the Huron group, but the imbedded fossils show that the two groups do not run parallel to each other,—they meet along the line of strike. They are 400 feet thick—and contain few fossils of interest.

The old Waverley series is now sub-divided in the north part of the State into the Cuyahoga shale 150 feet, Berea grit 50 feet, Bedford shale 60 feet, and the Cleveland shale 20 to 60 feet thick. It is the equivalent of the Marshall group of Michigan, as earnestly maintained by Winchell before the organization of the Ohio Survey. Fifteen species of fish rewarded the collectors in 1869, belonging to the genera *Palæoniscus*, *Ctenacanthus*, *Gyracanthus*, *Orodus*, *Helodus*, *Polyrhizodus*, *Cladodus*. The Carboniferous Conglomerate is a hard rock about 100 feet in thickness, forming the floor of the Coal-measures, and containing many plants like those of the Coal-measures. It is the Millstone Grit of the Old World.

None of the final results of the Survey will do more for the advancement of Palæontology than the history of the Coal-measures. Dr. Newberry has devoted many years of his life to the study of its plants and animals, and has finer illustrations of them than any other person in the country. Fifty plates of drawings are ready for publication. There are ten workable beds of coal in this State, covering about one-fourth of its area, or 10,000 square miles, and belonging to the great Appalachian Coal-field.

The material on hand a year since, ready for publication, was sufficient to form an octavo volume of 500 pages, consisting of an historical sketch of geological investigation in Ohio, descriptions of physical geography, the relations of Ohio geologically to North America, with detailed descriptions of the formations themselves and their characteristic fossils. The first part of it has already appeared, forming an octavo volume of 184 pages.

C. H. H.

¹ See GEOLOGICAL MAGAZINE, 1868, Vol. V., p. 184.