

THE GEOLOGICAL MAP OF INDIANA.

BY T. C. HOPKINS.

EXPLANATORY.

The large geological map that accompanies this report is a compilation of the stratigraphic work of the assistants of the Indiana Geological Survey since 1895, or since the present State Geologist, W. S. Blatchley, has been in office. Much of the area is shown in greater detail on larger scale maps accompanying the different annual reports, but portions of the State were surveyed especially for this map, and the results are here shown for the first time.

The drafting of the geographical base was done by the writer with some assistance from Mr. Chas. J. Clark, Civil Engineer. It is a compilation from many different sources. The primary base was the record of the government land survey as delineated on the township sheets in the land office in Indianapolis. These were corrected in the field for a large part of the State, but for the portion of the State not covered by some of the assistants on the survey, the data is mainly that from the old government survey with such additions as could be obtained from other sources, and will be lacking in the accuracy of detail found in the portions covered by the field work of the assistants on the survey.

The geologic work was done by the different assistants on the survey. Geo. H. Ashley supervised all the work on the Coal Measures, and did a considerable portion of it himself. He also, with Mr. Kindle, traced the partings for the Lower Carboniferous groups in southern Indiana south of and including part of Orange County. The Coal Measure maps are published in seven map sheets in the Twenty-third Annual Report, and the maps of the Lower Carboniferous limestone of southern Indiana are published in two sheets in the Twenty-seventh Annual Report.

C. E. Siebenthal traced the boundaries of the oölitic limestone in Lawrence, Monroe and southern Owen counties, as delineated on the sheets published in the Twenty-first Annual Report. He also assisted Mr. Ashley in mapping the Coal Measures as indicated in the Twenty-third Annual Report. He also mapped part of the Devonian area of southern Indiana as shown on the map sheet in the Twenty-fourth Annual Report.

E. M. Kindle mapped the whetstone area in Orange County, and assisted Mr. Ashley in mapping the Coal Measures and the Lower Carboniferous of southern Indiana, and did part of the areal work on the Silurian and Devonian in north-central Indiana.

August F. Foerste mapped the Silurian and Ordovician areas in the southeast part of the State and also placed the work on the State map. Part of this work is shown on sketch maps accompanying his papers in the Twenty-first and Twenty-second Annual Reports, but a considerable portion of it is shown on the State map for the first time.

J. F. Newsom, aided by his students from Indiana University, mapped a section across southern Indiana and traced a considerable portion of the partings on each side of the Knobstone group.

J. A. Price mapped the Waldron shale in eastern Indiana, as shown on the map sheets accompanying his paper on that subject in the Twenty-fourth Annual Report, and assisted Mr. Ashley in mapping the coal field.

The writer, T. C. Hopkins, mapped the base of the Coal Measures from township 12 N. to its northern limit, as shown on the map sheets in the Twentieth Annual Report. He also traced the partings between the different groups of the Lower Carboniferous through Lawrence, Monroe, Owen, Morgan, Putnam, Montgomery, Fountain and Tippecanoe counties as delineated on this map for the first time. He also traced part of the Knobstone parting, and did some work on the Devonian shales in Tippecanoe County.

All of the work was done under the direction and supervision of the present State Geologist, W. S. Blatchley.

The geological partings in the central and north-central portions of the State are deeply buried beneath a heavy mantle of glacial drift, so that very few outcrops of the rocks can be seen; hence the partings between the different groups could not be traced with the same degree of accuracy as could those in the western, south-

ern and southeastern parts of the State, where the glacial drift is absent or much thinner, and where the streams have eroded deep valleys, thus causing many outcrops of the rocks so that their position can be determined. The greater detail in these areas is indicated by the greater sinuosities of the lines of parting.

It may be of interest to the general reader to know how a geological map is made. It will not be possible in a few lines to give all the details of such work, but in general the plan is somewhat as follows: The geologist first traverses the region to be mapped, visiting the outcrops wherever he can find them, studying them in their different characters and noting their relations to each other, so that he can make out a section of the geological column showing the kinds of strata, that is the different limestones, sandstones, shales, etc., their relation to one another and the thickness of each as they occur in the area to be mapped. He then decides upon how many of these subdivisions he will show on the map he is to make. Thus sometimes each single stratum is shown by a separate color or pattern and again a series of strata are grouped together and delineated by a single color for the whole group.

After determining how many and what groups are to be represented, and knowing the general characteristics and distinctions of each, he proceeds to find where these different groups outcrop and to trace the lines of parting where the outcrops of the different groups meet. If the rocks were perfectly bare this would be a very simple process and would only necessitate the worker's ability to properly locate on the map the line as he follows it out in the field. But the outcrops are, in many places, in fact in Indiana in most places, covered with a thick mantle of loose material and only in places here and there on the bluffs of the watercourses and the steep places on the hillsides can the rock be seen. To trace out the line of parting where the outcrops can be seen only here and there requires the application of considerable general knowledge and close observation. It is necessary to study the character of the soil produced by the different strata which is sometimes so characteristic as to enable one to follow out the parting in this way. It is necessary to observe the topographic peculiarities of each stratum, which is an assistance sometimes. If one is a bed of clay or shale underlying a limestone or sandstone, it is frequently a horizon for springs. Frequently the only data avail-

able is that obtained from well records. In many regions some of the wells, in some places all of them, are sunk through the soil mantle into the solid rock underneath and if the geologist can obtain a piece of the rock or obtain definite information about it, he will be greatly aided in his work.

If every person who sinks a well or has one made would keep a careful record it would be a great service to geology. The most desirable data are the thickness of the soil mantle to the solid rock, the kind of rock first struck and thickness of this and of any other underlying strata that are penetrated by the well digger or the drill. If a careful record had been kept of all the wells that have been sunk in Indiana and these records were accessible to the geologist, they would be of great service.

When, by the aid of these different methods and others, the geologist has determined the position of the lines separating the outcrops of the different strata, he draws them on his map and designates the different areas by different colors or different shading or marking, and the engraver and the printer make a reproduction of it by engraving it on copper or stone and then printing from it as from ordinary type.

The time, the expense and the skill required in the construction of a geological map are increased as the scale of the map increases, and as greater accuracy of detail is required. If an area is underlain by valuable mineral deposits it may be studied and mapped on a scale and nicety of detail that would not be justified on another area.

No attempt has been made on the accompanying map to show the different kinds of soil and glacial deposits of the State, as sufficient data for that part of the work has not been gathered.

Many of the minor subdivisions are too small to be readily represented on a map of ordinary size. Hence the Geological map of Indiana presents the distribution chiefly of the major subdivisions of the Paleozoic formations of the State, while many of the smaller subdivisions are recorded only in the text.

A brief discussion of the chief characteristics of the various divisions and subdivisions of the Paleozoic rocks of Indiana is presented in the following pages.