GEOLOGY OF THE JOLIET DISTRICT.*

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Geology is a science which is of value to man from three points of view: (1) the economic, for it serves as an aid to the discovery and efficient recovery of valuable mineral resources, (2) the scientific, and (3) the cultural and philosophical. It is the last of these which is emphasized in this paper. In our every-day life it is a source of considerable satisfaction to have a distinct knowledge of the part that we in our little span as individuals are playing in the much greater scheme of the story of the earth. The treatment is historical, and leads up to the present; the story of the future can be interpreted from the story of the past.

No one limited area serves the geologist in deciphering the whole earth history; each district has its gaps or "lost intervals" which must be filled in by information from other places. The geologist in his search for the truth may be likened to the scholar of ancient history who searches among the ruins of Egypt for records of its past; but with the decline of Egyptian progress, the story and search are transferred to Greece, and then to Rome.

The rocks are the records used by the geologist. Their physical characteristics and relationships, as well as any remains of organisms or fossils found within them, serve as the "dead language" from which his story must be deciphered.

The rocks known in the Joliet area are all sedimentary in origin; that is, they were deposited by cool water, wind, and ice. They were laid down, one on top of the other, in orderly sequence. Thus the older rocks lie beneath the younger rocks—just like a house in which the oldest or lowest story is always the one built first; no one ever heard of building a house by first putting up the roof in the air, and then constructing the walls to support the roof.

The rocks of the Joliet area are of two types—consolidated and unconsolidated. In the main, the former or bed rocks were deposited from waters and the latter or mantle

rocks were laid down by great masses of ice or glaciers which overrode the area relatively recently. Waters and winds were also important agents in the deposition of the incoherent material.

Imagine a cut straight down into the ground to a depth of 1000 feet below sea level along a line extending east from a point about five miles northeast of Morris through and beyond Elwood about two miles and thence N. 20° E. through a point 4 miles east of Joliet. (Fig. 1) An exaggerated diagram of the slice of earth revealed by the cut would look somewhat like figure 3. Figure 2 shows the details of the mantle rock deposits. Its vertical scale is larger than that of figure 3 in the proportion of 50: 13; i. e. the vertical scale of figure 3 is exaggerated 13 times, and of figure 2, 50 times. The horizontal scales are the same for both diagrams.

Figure 3 shows the various consolidated formations known to underlie the area. In the main these were laid down in relatively shallow seas that covered the district at different periods millions of years ago. Note the position of the Kankakee formation which outcrops in the southwest corner of the city of Joliet. A slab taken from this formation on Rock Run five miles west of Joliet is made up of a mass of petrified shells of animals somewhat resembling clams. They are not clams, however, but brachiopods, and are of a type that could live only in salt seawater. It is thus known that this formation must have been deposited in a sea that covered the area long ago.

The several formations shown in figure 3 in the main originated in this same fashion. What the lowest formation (Cambrian) rests on in this area is unknown, as no well near Joliet has been drilled through it, though a well at Bensenville (30 miles north of Joliet) penetrated it nearly 1000 feet.

The contact between the Lower and Middle Ordovician strata at the base of the St. Peter sandstone is particularly uneven, though none of the contacts shown is smooth. Following the deposition of the Prairie du Chien series a relative rise of the submerged land surface caused the withdrawal of the sea, and for some time the area was subjected to the erosive action of ancient streams and

winds. Later when the St. Peter sands were laid down, they filled old valleys. As a result of the rough surface developed during the "lost interval" between the times of deposition of the Prairie du Chien and St. Peter formations the thicknesses of the two vary notably in short distances. All the other contacts indicate "lost intervals" but during none was so uneven a surface developed, though the time interval may have been as long as or longer than that between Prairie du Chien and St. Peter depositions.

Following the deposition of the Niagaran dolomite all the older strata were tilted down in an easterly direction, as shown in figure 3, but the tilting was greater than the present dip of the rocks indicates.

At the extreme left edge of the diagram, Pennsylvanian rocks appear. These are much younger than the Niagaran dolomite; between these two is a great gap. The Pennsylvanian strata (or Coal Measures) dip to the west. They were presumably nearly horizontal when laid down; therefore it is obvious that following their deposition the region suffered a second tilt in a direction more or less opposite to the first one. This second tilt was smaller than the first one, but it was very important, for, without it Illinois would not have her present great coal resources.

The great "missing link" of the geologic section of the Joliet area is found in the essential absence of deposits younger than the Pennsylvanian and older than the glacial mantle rocks. For example, during this interval many thousands of feet of strata were laid down on the land and in a series of seas that covered the site of the present Rocky Mountains. Later these mountains were gradually formed by a succession of tremendous upheavals of the earth; still later much of the rock deposited was removed by erosive agents. The great niche of the Grand Canyon of the Colorado hardly represents a tithe of the rock thus removed; some of the debris collected in this fashion has accumulated at the head of the Gulf of California, partly filling in the gulf and adding thousands of square miles to the land area there. Equally important physical changes were taking place elsewhere and could be cited were the space available.

What happened in the Joliet area during these lost eras? All evidence points to the fact that erosive agents

slowly removing the solid rock were moderately active. The result was the planation of the tilted formations which was completed during this interval. Much of the Niagaran dolomite and other soluble rock was removed by means of the dissolving action of water. The relatively insoluble siliceous materials in the dolomite tended to be left, however, and remnants of such materials may still be seen as bluish clay in old solution cavities. Near the southwest corner of the quarry of the National Stone Company half a mile south of Joliet, one of these cavities has been exposed which, according to Mr. George Langford of Joliet, formerly contained blue clay. Just west of the corner of Clinton and Scott Streets, only 1200 feet west of the Joliet High School building, an excavation showed a similar pocket filled with beautifully laminated bluish clay; the curved laminae lay parallel the bottom of the bowl-shaped cavity.

But these deposits are a most meagre record from which to piece the history of this long interval. Of the dinosaurs and other life forms that flourished here during different portions of this time, not so much as a footprint remains. Truly "the mighty have fallen".

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The mantle rock of the area consists of a heterogeneous mass whose origin for a long time puzzled the early geologists. A characteristic exposure of this material, which is found both on hills and in valleys, would show pebbles and boulders surrounded by yellow clay. The boulders are of rock not belonging to any formation outcropping within 200 to 300 miles of Joliet. What could have brought them here? Were they blown south by the wind, or carried by some stream long since extinct? The only feasible transporting agent is moving ice. The conception that a great ice-sheet formerly covered this district is a stupendous one. Picture a mass of ice, probably half a mile or more in thickness, extending south some thousands of miles from the vicinity of Labrador, and covering a large part of the

northeastern portion of the United States. Think how such a mass of ice, sliding over the solid rock, would scratch it, break off chunks, and grind them to bits like a giant crusher. Such an ice-cap still covers all but the fringe of Greenland. It and its deposits there have been studied, and substantiate this conception.

Ice-caps near the pole are easily visualized, but ice-caps near Joliet, which is much nearer to the equator, are incongruous. But consider the large portion of North America that was covered by the sea in which the Niagaran dolomite formed. Outcrops of this formation are found near the north tip of Greenland as well as near Joliet. At Joliet and also in Greenland this formation carries among other forms fossil corals. Corals are now limited to warm, clear, shallow seas. The only explanation is that during the Niagaran epoch it was warmer here and in Greenland than it is now. In short, we know that at different times and in different places greatly different temperatures have prevailed.

Regional study leads to the conclusion that the ice moved out from two or three main centers, although the Labrador ice-sheet is the only one known to have covered the area about Joliet. Regional studies have also shown that four or five ice-sheets covered parts of the United States at different times, but the deposits of the last, or so-called Wisconsin sheet, are the only ones commonly recognized in this area.

Along Kankakee River, however, remnants of an earlier glaciation are well exposed. These were probably deposited by the Illinoian ice-sheet; they are separated from the Wisconsin deposits by an old soil buried under loess (fine, silty material) and lying on lake clays and gravel-sand deposits.

The Wisconsin ice-sheet advanced as far south as Cumberland County in Illinois. Its front remained there long enough so that a notable deposit of material—the Shelbyville moraine—was laid down. The edge of an ice-sheet, although it may temporarily hold a constant position, is far from static. Melting and evaporation cause a notable loss all the time, and it is only by the continued outward movement of the ice that its edge remains more or less

fixed. If melting and evaporation are less important than outward movement, the ice edge advances; if more important, it retreats. But even while the ice edge is retreating, the movement of the ice itself is always outward, and thus materials scraped up within constantly tend to be shifted out to the edge of the ice.

Following the deposition of the Shelbyville and two minor moraines, the ice edge next assumed a constant position over the site of the Bloomington moraine. At the time this moraine was forming at the ice edge, minor deposits were laid down here and there under the ice well back from its edge. One such deposit exists seven miles west of Joliet along a minor tributary of Du Page River. This is protected by later glacial deposits and is fifteen miles southeast of the nearest large body of Bloomington drift. It was recognized by its characteristic pink color.

Later the ice retreated to the position of the Marseilles moraine where its edge again remained constant for probably a few centuries while this moraine was built.

Following the building of the Marseilles moraine, the ice edge suffered great changes, and when it again became temporarily constant its shape in Illinois was fundamentally different, since it lacked the bulge so marked in it at an earlier date. The diminutive Minooka moraine next formed can be traced from Elgin to the head of Illinois River where it has been cut off. Its extension was probably to the southeast under younger moraines.

The retreat to this position first uncovered the general course of Kankakee River, and the present stream presumably had its inception at this time from the waters formed by the melting ice. But the present course of the river was dammed by the massive Marseilles moraine. As a result, a large lake formed. Its surface rose until it reached the level of the lowest gap in the Marseilles moraine. At different times when the flow of water was great several low gaps may have been in use, but finally all the waters were concentrated in the present outlet. The lake lasted a long time—probably until after the ice-sheet had retreated some distance from Illinois—but its level in general dropped (except during two temporary halting stages) as the outlet was cut down, and finally it was completly drained.

Following the Minooka stage, there was pronounced retreat of the ice and the country at least as far as five miles east of Joliet was uncovered. An extensive gravel sheet (the Joliet outwash plain) sweeping out from the ice edge was formed; then the glacier advanced and the Rockdale moraine was deposited. This sequence of events is indicated by the buried gravel sheet seen at many places near Joliet.

During the retreat from the Rockdale moraine the minor Manhattan ridge was formed. Later the extensive Valparaiso morainic system was built, and then the ice-sheet receded in an irregular fashion into the Lake Michigan basin. Figure 2 shows the general sequence in cross-section.

Following the retreat into the Lake Michigan basin, a large lake known as Lake Chicago developed between the edge of the ice-sheet and the Valparaiso moraine, which acted as a dam. The waters thus impounded rose to the level of the lowest gap in the Valparaiso moraine, which was near Lemont. Here they overflowed and followed valleys already established by the outwash waters from the Valparaiso ice-sheet. They wore away the materials of the moraine, and lowered the outlet. These materials, with those formed as outwash from the Valparaiso ice-sheet, were spread out downstream, and now constitute the great gravel deposits near Plainfield and between Joliet and Channahon.

By the time the Lake Chicago outlet was formed, the Kankakee flood had subsided, for the Erie basin waters were diverted into Lake Chicago. Since then the Kankakee has been a little river in a big valley. As the ice retreated farther northward the present St. Lawrence drainage was established and the diminutive Des Plaines River inherited the broad valley of the old outlet of Lake Chicago. Thus two mighty rivers had their rise and decline during minor stages of the last continental glaciation. Recently man has attempted to improve his condition by digging a ditch down the old Lake Chicago outet valley, and endeavoring to bring back the old drainage in a very small way—but there has been opposition to this "reversion to nature".

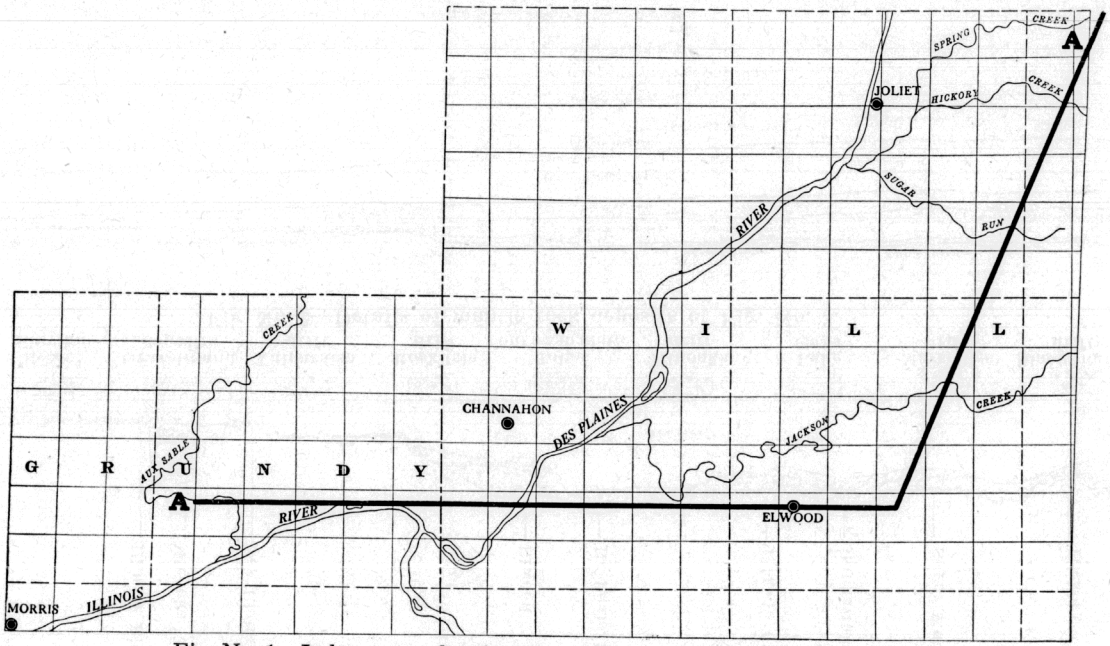

Fig. No. 1—Index map showing line of cross sections in Figs. 2 and 3 (A-A).

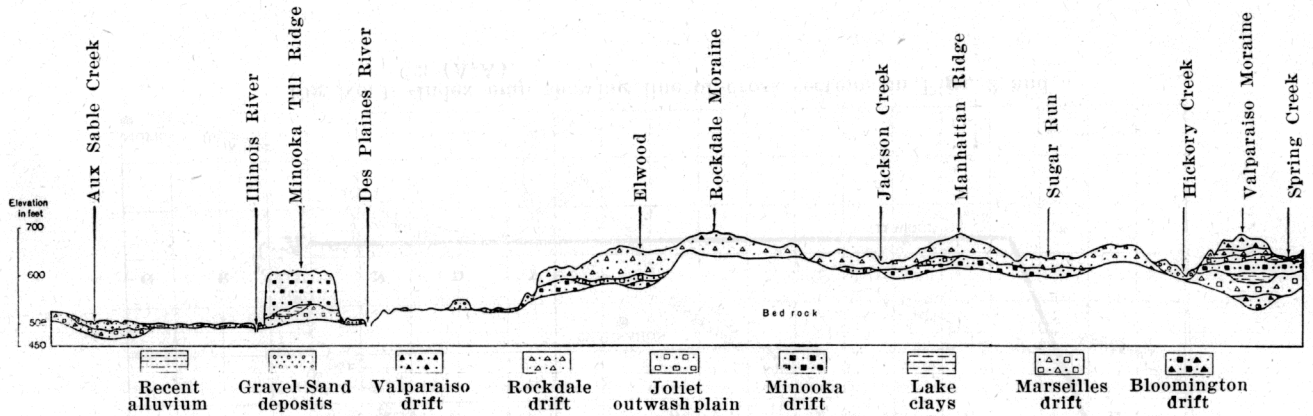

Fig. No. 2—Details of mantle rock deposits of Fig. No. 3.

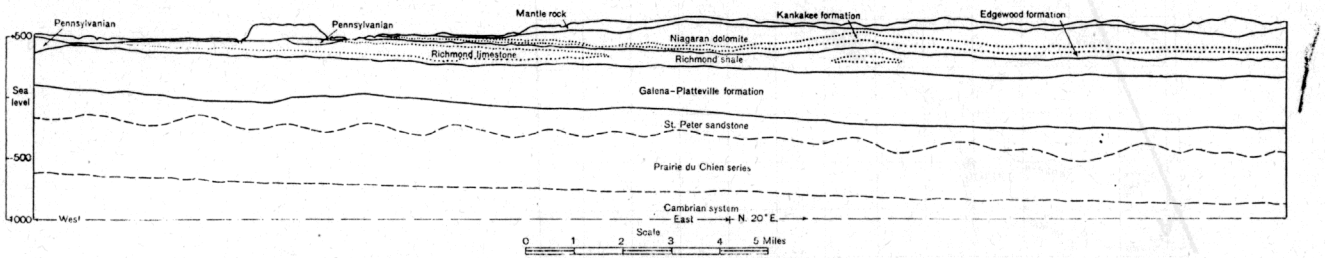

Fig. No. 3—Diagrammatic cross-section along line A-A (Fig. 1) showing strata of the Joliet District.

In summary—the area has had a long history; this paper skims over only a little of it. And the life side has been sadly neglected in favor of the physical side. But one can be sure that each physical change—and geologic history is replete with such changes—has had its effect on whatever forms of life were existing, and these had to meet the new environment imposed on them. Whole tribes have been driven out, suffered changes, and re-invaded the area. And now man is here. Perhaps we are living in an interglacial epoch. Another ice-advance may drive our remote descendants south, just as the last one forced primitive man in Europe to seek regions of warmer climates. But we are far more able to cope with new physical conditions imposed on us than has been any form of life known to have existed in the past. We owe much of our present condition to the striving of life down the long ages. Let us constantly aim to deserve that which we now have by contributing our share to the needs of the future.

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