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THE PRAIRIE DU CHIEN - ST. PETER UNCONFORMITY IN IOWA.

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Unconformable relations between the Prairie du Chien and St. Peter formations have long been known in Minnesota, Wisconsin, Illinois and Missouri. The existence of this unconformity in Iowa, though long suspected, has never been demonstrated, or if it has been known to exist here, the fact has not been recorded. There is nothing in the reports of the State Geological Survey suggesting anything but conformable relations between the two formations.

The purpose of this paper is to place on record various evidences of unconformity at this stratigraphic horizon within the boundaries of the state. The data here presented have been gathered within the last few years during the progress of field work in that part of the state commonly known as the Driftless Area.

The Prairie du Chien and St. Peter formations outcrop abundantly in the rough topography of Allamakee, Clayton and Dubuque counties. There are hundreds of exposures of each formation in this part of the state. In spite of this fact, the writer does not know of a point where the exact contact between the two formations can be seen. The dolomite is resistant and the overlying sandstone is so non-resistant that it washes down over the contact and obscures it. This doubtless explains why the discovery of the unconformity was so long delayed. However, it is possible to get the altitude of the contact approximately in a great many places.

There are several evidences of unconformable relations between the Prairie du Chien and St. Peter formations in Iowa.

(1) The contact between the two formations is irregular. The top of the St. Peter and the base of the Prairie du Chien are parallel and dip almost uniformly in a south by southwest direction at an amount of about seventeen feet to the mile. But between these two horizons the interformation contact is found at all stratigraphic positions from just above the base of the Prairie du Chien to just below the top of the St. Peter. The

surface of the Prairie du Chien formation where covered by the St. Peter has a relief of as much as two hundred feet. The roughness of this surface is illustrated south of

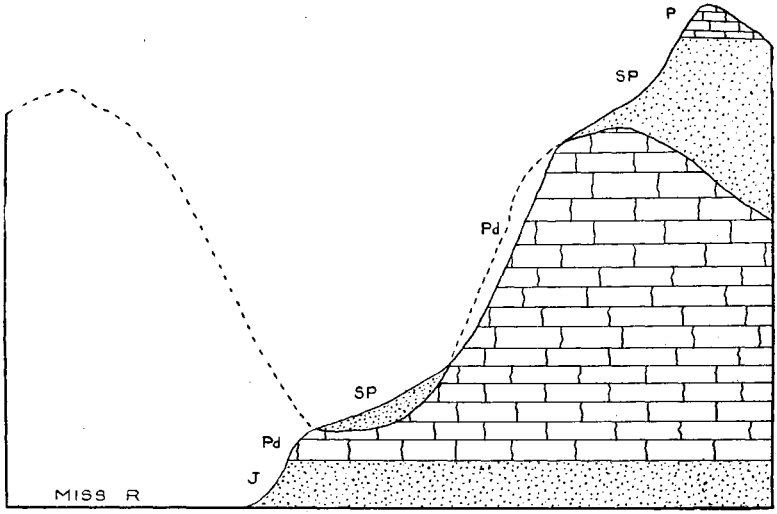

Fig. 15—Diagram showing the irregular contact between the Prairie du Chien and St. Peter one and one-half miles south of Waukon Junction.

Waukon Junction where it has a slope of eighty-four feet in fifty yards (figures 15 and 16), in the northwest corner of McGregor where its relief is one hundred nine feet in less than one-half mile, and at the Clayton sand pit, where it changes

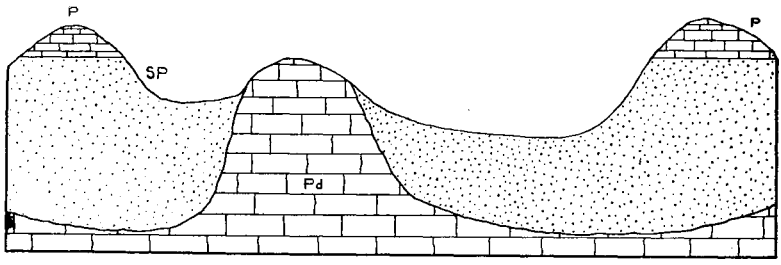

Fig. 16—Diagrammatic sketch of the relations between the Prairie du Chien and St. Peter formations seven-eighths of a mile south of Waukon Junction.

altitudes by an amount of fifty feet within the pit. The irregularity of this surface is further illustrated by figures 17 and 18.

(2) The thickness of each of the two formations varies greatly from point to point, but the sum of the thicknesses of the two at given places is practically constant and not far from 300 feet. This is best shown at Pikes Peak and Pictured Rock.

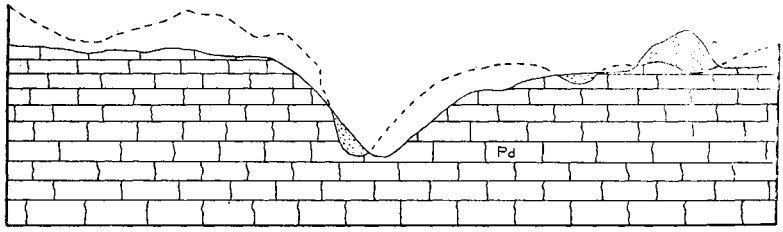

Fig. 17—Diagram illustrating the conditions one and one-half miles south of Church.

The Prairie du Chien overlies the Jordan sandstone conformably along the Mississippi river at 632 feet above tide and on the slopes of Pikes Peak the St. Peter-Platteville contact is found. There are three trails leading from one of these contacts past the other. Three parties of students each making a traverse

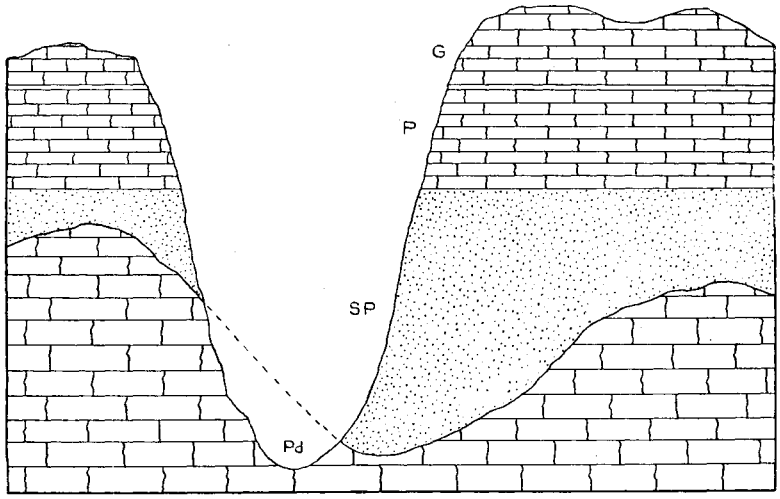

Fig. 18—Cross section of the valley of Pictured Rock Creek.

up one of these trails, with a handlevel, ascertained the thickness of the St. Peter and Prairie du Chien formations. All the time they were within shouting distance. The results are shown in the accompanying table.

TABLE SHOWING VARYING THICKNESSES AND THE SUMS OF THE THICKNESSES OF THE PRAIRIE DU CHIEN AND ST. PETER FORMATIONS AT PIKES PEAK AND PICTURED ROCK.

TRAIL.	THICKNESS OF PRAIRIE DU CHIEN	THICKNESS OF ST. PETER.	SUM OF THICKNESSES OF PRAIRIE DU CHIEN AND ST. PETER.
Short trail up nose of peak	177 ft.	123 ft.	300 ft.
Long trail by way of falls and spring	84 ft.	223 ft.	307 ft.
Middle trail	115 ft.	178 ft.	293 ft.

(3) Not only are the sums of the thicknesses of the two formations approximately constant around 300 feet at specific points, but the sum of their average thicknesses is approximately the same. The greatest known thickness of the Prairie du Chien formation is 268 feet and the least known thickness is 80 feet. Corresponding figures for the St. Peter are 238 feet and 50 feet respectively. The average of thirteen known thickness of the Prairie du Chien formation is 167 feet. The average of an equal number of known thicknesses of the St. Peter is 146 feet. The sum of these two averages is 313 feet.

(4) In several places, notably in the vicinity of Church, the basal portion of the St. Peter sandstone contains fragments of chert which came from the Prairie du Chien dolomite. This shows that calcareous materials had been deposited, cementation, dolomitization and silicification had been accomplished, and the dolomite had been exposed and partly disrupted before the deposition of the St. Peter.

The four points discussed above seem to demonstrate that the St. Peter formation lies unconformably on the Prairie du Chien. The irregular surface of the Prairie du Chien is due to erosive agencies operating after the withdrawal of the Prairie du Chien sea and before the deposition of the St. Peter sandstone.

The basal portion of the St. Peter, where the formation is thick, is quite different from the lowermost beds where the sandstone is thin. That is, there are two phases of the St. Peter in Iowa; namely, a valley phase and an unland phase. The sand-

stone which occurs down in the valleys, below the general surface of the Prairie du Chien, is soft, friable, highly and variously colored. It breaks to pieces in the fingers and can be excavated easily with the chisel-edge hammer. Some of it is massive, but most of it is so bedded as to weather out in small, thin, wavy scales. The upland phase of the formation, on the other hand, is massive, firmly cemented, and gray. These differences within the formation are due doubtless to the different conditions which existed in the valleys and on the divides during the early part of the St. Peter stage.

This unconformity also explains the discontinuity of the New Richmond member of the Prairie du Chien formation. In Minnesota the formation is subdivided into the Oneota dolomite at the base, the New Richmond sandstone above that, and the

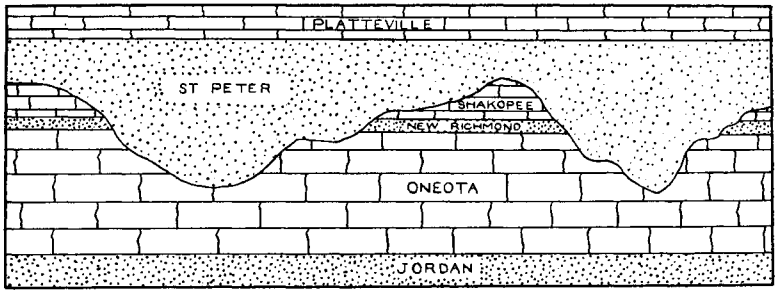

Fig. 19—Diagram explaining the discontinuity of the New Richmond sandstone in Iowa.

Shakopee dolomite at the top. The basis for this division is the New Richmond sandstone separating the two dolomites. It has been a source of worry to some workers in Iowa, because this sandstone, although it occurs at many places, is clearly wanting in the section in other places. The pre-St. Peter erosion period resulted in the removal of Shakopee, New Richmond and part of the Oneota, where the main valleys were, so that the St. Peter was deposited here on Oneota and there on Shakopee. The New Richmond is missing where the Prairie du Chien formation is thin, and present where the formation is thick. At the Clayton sand pit the New Richmond is thirty-four feet from the top of the formation where it is thickest. Two and one-half miles west of McGregor the sandstone is fifty feet below the top of the formation. This explanation of the irregular occurrence of the New Richmond is made clear in figure 19.

The magnitude of the Prairie du Chien-St. Peter unconformity in Iowa is impressive. It represents a time during which many valleys 150 or more feet in depth were cut in silicified dolomite. If it be assumed that half as much was removed over wide areas as was taken from the valleys and that the degradation took place at the average rate of a foot in 6,000 years, the time involved amounts to almost half a million years. This constitutes one of the two greatest physical breaks in the Paleozoic of Iowa, the other being between the Mississippian and Pennsylvanian systems.

The unconformity is also important taxonomically. The Cambro-Ordovician line should be drawn at the top of the Prairie du Chien where the unconformity is, rather than at the base of the Prairie du Chien where conformability with the Jordan sandstone is demonstrated by the presence of twenty feet or more of transition beds.

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