A SPECIAL CASE OF DRAINAGE ADJUSTMENT NEAR THE ILLINOIAN DRIFT MARGIN IN SOUTH-EASTERN OWEN COUNTY, INDIANA.

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The subject of this paper is an area of a few square miles in southeastern Owen County, Indiana. It is also represented in the north-western part of the Bloomington, Indiana, Quadrangle. Sections 2, 10, 11, 12, and 14, township 9 north, range 3 west, are the principal areas referred to in this discussion. The region is marginal to the Illinoian drift so that part of its topography is the result of glacial outwash while the remainder is characteristic of the unglaciated section of the state. The glacial outwash is primarily responsible for the drainage changes and adjustments herein described.

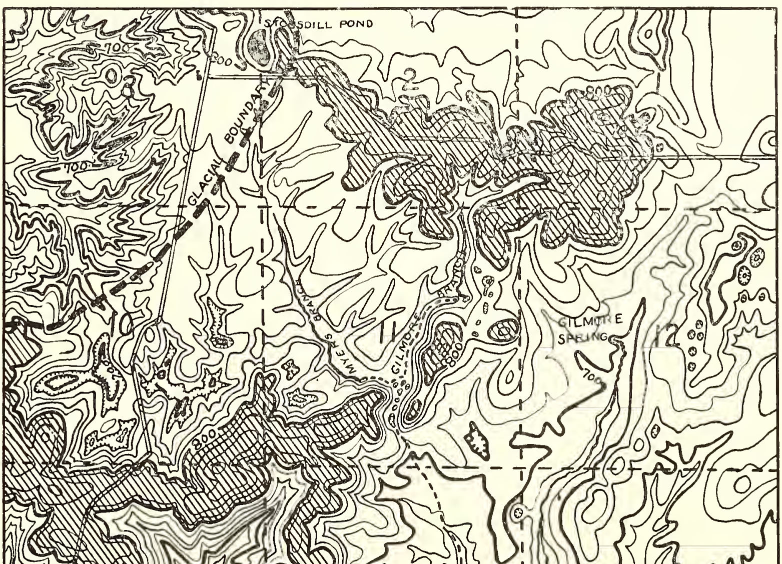

Fig. 1—A part of southeastern Owen County illustrating topography and present drainage conditions. The shaded area gives the general relation of the rock ridge to the glacial boundary. The dotted line gives the location of the stream that formerly flowed through the gap in the ridge. The area is reproduced from the Bloomington, Ind., Quadrangle. Contour interval 20 feet.

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Topography and Drainage. The region is a plain (fig. 1) that is considerably diversified by sinks, ridges, and valleys. The sinks are the result of solution of the Mitchell limestone which is the subsurface rock of the region. The large sinks to be seen in sections 10 and 11 (fig. 1) are partly clogged with glacial outwash that in some cases obscures the rock in which the sinks are formed. Many small sinks are present that are not represented in the figure.

A rock ridge extends from Stogsdill pond in a southeasterly direction across section 2 and into section 1. It bends to the southwest across section 11 and then follows a general westerly course beyond the limits of the mapped area. The shaded portion in figure 1 outlines in a general way the extent of the ridge.

The upper part of the ridge is composed of clastic rocks belonging to the Chester group. In places, especially in section 11, the capping of Chester rocks has been removed thereby exposing the Mitchell limestone which forms the basal part of the ridge. Where this condition exists sinks are found along the crest of the ridge.

In the south central part of section 11 a low gap crosses the ridge. This gap is the old surface outlet for the waters that formerly flowed

Fig. 2—The gap through which the surface waters escaped after the subterranean inlets were clogged with glacial outwash. View to the north. Outwash materials are found below the gap.

across the outwash plain that is partly preserved in the northwest part of section 11 and the adjacent parts of sections 2, 3, and 10. The gap, (fig. 2), is no longer used by surface streams.

The area northwest of the ridge in sections 3, 10, and 11, principally, is an area of moraine and outwash that is now considerably grooved by stream erosion. The westernmost part of this plain is drained by the headwaters of McBrides Creek. These headwaters are rapidly extending themselves into the glacial plain to the east. Immediately south of Stogsdill pond, the plain has been very little dissected. The surface drainage is chiefly by two small branches that become subterranean near the rock ridge in section 11. The trend of these streams and the slope of the plain which they drain is toward the gap in the ridge, a condition that suggests the gap as a former outlet for the streams. In places the depth of glacial materials forming the plain reaches 80 feet. The removal of part of the glacial outwash by streams has resulted in portions of the plain being preserved as terraces. The terraces are excellently preserved in section 11, (fig. 3).

Fig. 3—The terrace is of glacial outwash and was formed as the gap was made lower and as the streams graded their valleys to the level of the subterranean inlets. The inlet of Myers Branch is just out of view in the foreground of the picture.

The westernmost of the streams that become subterranean in section 11 will be referred to as Myers Branch. The other stream in the

Fig. 4—Myers Branch near the sink inlet. An old inlet that is now clogged is located to the right of the stream and near the cliff shown in the picture.

northeast part of the section is called Gilmore Branch. These streams are nothing more than spring branches and are supplied mainly from the storage of ground water in the glacial materials of the plain. They have been, however, the important factors in the sculpturing of the plain. Their drainage area is approximately one square mile.

Myers Branch (fig. 4), after flowing about one-half mile enters a sink, (fig. 5), at the base of a low cliff of limestone. The elevation of the

Fig. 5—The sink inlet for Myers Branch. Note accumulation of trash and debris surrounding inlet.

inlet is 715 feet as determined by barometer measurement. During periods of run-off the volume of water entering at the base of the cliff is considerable and at times is backed up as a small lake. Eventually all is drained away through the subterranean inlets. At times of high water trash and debris is carried to the inlet and this is sometimes effective in choking it, so that the actual point of entrance of water into the ground shifts somewhat from time to time. Figure 5 is the actual point of entrance for the stream at the present time and is situated to the left of the cliff shown in figure 4. Two years ago the entrance of the water was to the right of the stream shown in figure 4.

South of Myers branch inlet about three fourths of a mile is a large spring known as Blue Spring. The spring appears in the bottom of a sink, at an elevation of 650 feet. The stream flows across the bottom of this sink and beneath a wall of collapse fragments, that represents the collapsed portion of the sink rim. Within a distance of one fourth mile the spring waters enter Raccoon Creek.

Blue Spring is the outlet for Myers Branch. In a collapse sink a short distance back of the spring the stream may be seen flowing through the bottom of the sink. A deposit of freshly washed sand was found mantling the sides of this sink for a distance of about four feet up from the bottom. The position of the deposit in the sink indicated clearly that it must have been the work of the stream flowing through the bottom of the sink. Sand of a similar character was found in the bed of Myers Branch near the place where it enters the ground. The source of this sand is in the glacial outwash materials that form the plain in section 11.

Gilmore Branch enters a sink in the northeast part of section 11. The elevation of the inlet is 750 feet. Near the sink an abandoned channel follows along the base of the rock ridge and eventually joins the channel of Myers Branch at the point where that stream becomes subterranean. Gilmore Branch follows this channel only at times of excessive run-off. New sinks are developing about the inlet of the branch and it will be but a short time until the old channel will be permanently abandoned.

The outlet for Gilmore Branch is at Gilmore Springs, located to the east and south of the inlet near the central part of section 12. The elevation of the spring is 700 feet or 50 feet lower than the inlet of the branch. The waters of the spring flow into a tributary of Raccoon Creek that joins the latter near the western part of section 13.

From the previous discussion it will be seen that the area drained by Myers Branch and Gilmore Branch is a part of the drainage basin of Raccoon Creek although topographically it is distinctly separated from the Raccoon Creek basin. It is a part of the Raccoon Creek drainage area by virtue of subterranean drainage now taking place beneath the rock ridge that has previously been described. With this description of existing topography and drainage as a basis, the sequence of drainage changes that are believed to have occurred here will be discussed.

Drainage Changes and Adjustments.—Previous to the Illinoian glacial invasion the region was eroded to a mature state in which the rock ridge formed the divide between Raccoon Creek and the headwaters of a stream that followed practically the same route as that now followed by McBrides Creek. By virtue of relative position the valley of Raccoon Creek was at a lower level than the valleys of the headwater streams on the opposite side of the ridge. This difference in valley levels favored the development of subterranean drainage and it is probable that sapping of the headwater streams by subterranean drainage tributary to Raccoon Creek was in progress beneath the ridge. That this condition existed prior to the ice invasion is substantiated by the large size and stage of development of the sinks and by the fact that near Myers Branch inlet there is a cavern now clogged and choked by glacial sands and silts.

As the ice and moraine advanced into the region a small marginal basin was formed in connection with the rock ridge. The outwash material from the moraine soon filled the sinks and clogged the subterranean channels that were in existence. Subterranean drainage thus interrupted, escape for the waters would be by surface drainage. The escape of the surface waters would take place thru the lowest point of the basin rim. This was at the sag which crosses the ridge in the south central part of section 11.

The waters flowing through the sag entered Raccoon Creek which was also in a laked condition. The old outflow route is indicated by the dotted line extending from the gap to the valley of Raccoon Creek, a condition that can be seen in figure 1. The waters flowing through the gap doubtless lowered it somewhat and as this occurred dissection of the outwash plain and the formation of the terraces was begun. The height of the terraces has been increased by the streams grading their valleys to the level of the subterranean inlets.

Since the glacial invasion there has been a return to subterranean drainage due to re-excavation of the clogged channels and perhaps to discovery of new subterranean routes. The present conditions of subterranean drainage represent a post glacial adjustment to the Illinoian drift. This drift is now being transferred through subterranean routes to the valley of Raccoon Creek.

The headwaters of McBrides Creek are rapidly encroaching upon the plain from the west. As these headwaters assume positions farther and farther eastward some diversion of the waters now becoming subterranean will occur. The eastward extension of the headwaters of McBrides Creek is a post glacial adjustment on the part of that stream in attaining a former position with reference to the divide between it and Raccoon Creek.

The formation of marginal basins and the derangement of surface drainage along the border of an advancing or receding ice mass are well known phenomena and numerous illustrations of this sort could be pointed out. The derangement of drainage in this small area is somewhat unusual in view of the fact that subterranean drainage was the type interrupted by the glacial outwash.[1] The surface drainage that followed the clogging of the sinks was an intermediate phase of adjustment between preglacial and post glacial subterranean drainage development. The post glacial return of the streams to the subterranean channels has resulted in the total abandonment of the sag in the ridge as a surface outlet for the streams.

[1] C. A. Malott, Indiana Academy Science, 1914, briefly discusses this region in its relation to the Flatwoods Region of Owen and Monroe Counties, Indiana.