
STREAM DIVERSION NEAR LAKEVILLE, OHIO.*

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The announcements of stream modifications have come to us so often in the last generation that we no longer wonder at them. They are very common and most of the larger streams have been subject to one or more of them. With all the examples which have been described and explained there has come a great variety of form and cause, yet a classification under three heads is possible. Some are simply diversions in which the stream had nothing to do but to get out of the way; these occur most frequently in glaciated regions. Other causes are land and snow slides, lava flows, volcanic eruptions and artificial obstructions. Some are adjustments in which the stream modifies its course or the form of its valley because the one or the other is out of harmony or adjustment with the needs of the stream; these occur in regions where superposition or rejuvenation have occurred and the stream in its later stages is in different rocks from those in which it worked in youth. The third class

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is actual piracy, stream robbing or stream capture, and may be associated with superposition of streams or rejuvenation, but is a common accompaniment of crustal tilting or shifting of shorelines.

The case at Lakeville is an example of the first kind, simple diversion, where streams have been forced out of their former courses and have been obliged to pursue new courses ever since.

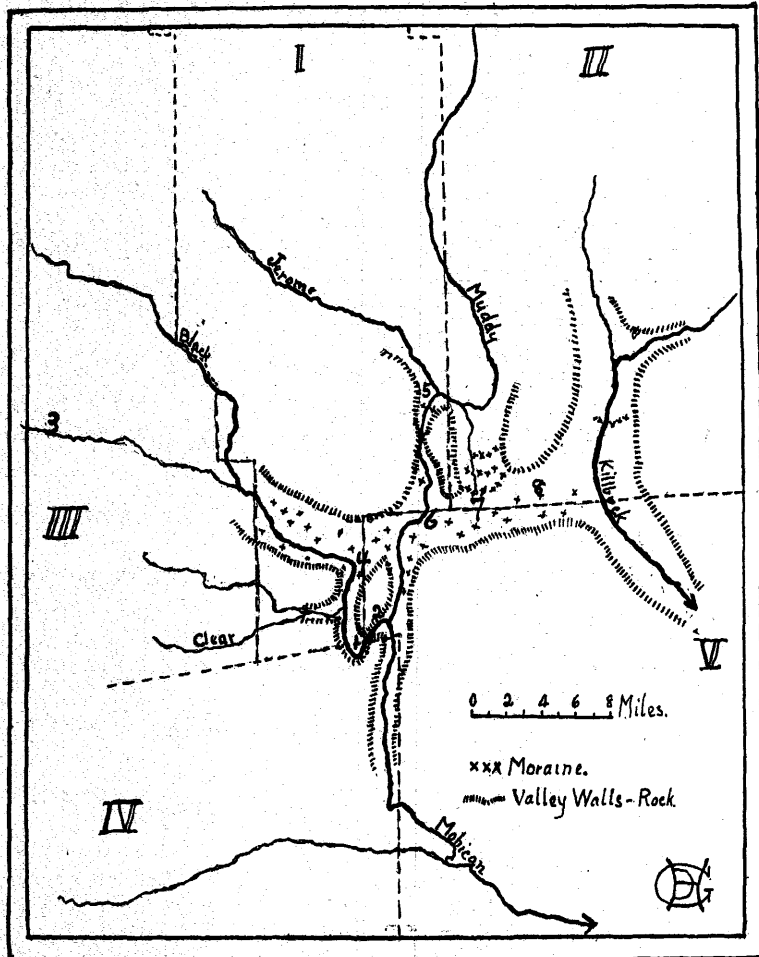


FIGURE 1.

Counties.—I. Ashland, II. Wayne, III. Richland, IV. Knox, V. Holmes.
Towns.—1. Uncas, 2. Spellacy, 3. Mansfield, 4. Loudonville, 5. Lakefork,
 6. Lakeville, 7. Big Prairie, 8. Shreve.

I want to examine it as to fact and nature of evidence, and thus discover the cause, treating it as illustrating a method of research rather than as telling of a new kind of phenomenon.

The region is that of the head waters of the Mohican, a stream which unites with Owl Creek to form the Walhonding, which in turn unites with Killbuck Creek and enters the Tuscarawas at Coshocton. The critical places in the case are in southern Ashland County and western Holmes County.

The Mohican Creek proper is made up of the waters of several smaller creeks, Muddy or Lake Fork from the northeast which also brings the waters of Jerome Fork, Black Fork from the north-west, and Clear Fork from the west, which joins Black Fork just above the narrows at Uncas and Spellacy.

Black Fork comes down from north of Mansfield in a post-glacial valley hitting the rocks occasionally and then leaping over falls and rapids or winding through gorges. Fleming's falls and gorge above Mifflin furnish a good example of this habit. But just before entering Ashland County above Perrysville, Black Fork enters a broad, mature, rock valley, more or less plugged with moraine of Wisconsin age and pursues it to Loudonville. Here it abruptly turns into the south wall of the big valley and winds through a six or seven mile gorge into Knox County, where it joins the Muddy Fork and the two constitute the Mohican.

In like manner Jerome Fork heads in post-glacial valleys in the drift of northeastern Ashland County, but before joining Muddy Fork at the town of Lakefork it finds itself in a broad, open, mature, rock valley leading southeast. At Lakefork, having entered Muddy Fork, its waters turn abruptly into the hills and lead southward into a rapidly narrowing valley. The narrowest part is found about midway between Lakefork and Lakeville where the stream seems to have cut a notch in a low mature divide. Below this place, the valley widens southward and emerges into the very broad mature valley, which Black Fork followed seven or eight miles; and the stream, turning westward in the large valley, winds about among morainic hills for some two miles, then turns again into a hill-enclosed narrowing valley and follows it southward through two morainic loops, and on southward to the Mohican, which is said to flow through a narrow valley in a very hilly country. The author has not seen this portion of the Mohican.

A sluggish little branch of Muddy Fork rising among a series of morainic loops northeast of Big Prairie flows through a broad clay-bottomed, level-floored valley for five or six miles and enters the Muddy just before the latter goes into the hills at Lakefork.

Recognizing the fact, as all of us probably do, that valleys are made by streams, and, in similar rocks are proportionate in size and form to the size of the stream and the length of time the latter has had to work, it becomes very apparent that we have an anomalous condition here, where the larger streams Black and Muddy Forks flow in broad open valleys, then in narrow ones and again in broad ones, while some small streams are in much broader valleys than they could possibly have made during the time at their disposal. These are the features that appeal at once to the traveler and invite his attention if not his curiosity.

Upon looking a little more carefully other items in the problem are found. In the course of Muddy Fork from Lakefork village to Lakeville, and of Black Fork from Loudonville to the Mohican, not only do the valleys narrow but the upland topography changes as the narrowest portion of the valley is reached. The high hills become more youthful and draw in closer to the present main valley, suggesting that formerly at these two narrows, streams once headed and flowed away in opposite directions. In accordance with a law of valley development, that youth is more marked near the headwaters, this theory accounts for the more youthful character of the slopes and form of valley at the narrows.

The side streams entering these two sections of the courses of Muddy and Black Forks respectively, have a story to tell. North of the narrows they enter with their small angles down stream contrary to the normal habit of stream arrangement, and south of the narrows they enter in a thoroughly normal manner with the small angle up stream, suggesting that, at present, the flow of the main stream north of the narrowest places is in the reverse direction from that of the stream occupying the valleys when the drainage patterns were outlined; but that in the portions south of the narrowest places, the flow is in the same direction as during the early history of the region.

It has already been suggested that Muddy and Black Forks have cut at their respective narrows new gorges in rock, through what was formerly a low rock divide between small streams flowing in opposite directions. Still further confirmation of this hypothesis is found in the small laterals entering the main stream near the narrows. The side stream entering Muddy Fork nearest Lakefork shows a very little rejuvenation and down cutting in its mature higher valley in order that the stream may enter Muddy Fork at grade. In the case of the side stream next nearer the narrows, the mature valley seems to hang higher above the level of Muddy and to have a deeper recent gorge valley in its bottom. The third and fourth hang still higher and the recent gorges are still deeper. Moreover the mature hanging

valleys enter the main valley essentially at the top of the gorge of the main valley showing that when the rejuvenation occurred, the valley bottoms of laterals and the main valley floors were at accordant levels, just as are those of the present streams. South of the narrows on Muddy Fork similar conditions obtain, and likewise adjacent to the narrows of Black Fork the phenomena of hanging valleys and recent gorges in their floors are repeated.

This whole series of facts makes it very certain that the streams have been diverted from their old courses and forced over low divides and made to flow in new courses. We are ready then to formulate an hypothesis to explain the observed facts. The hypothesis must account for all the facts and be in harmony with the general conditions of this part of the state.

It was pointed out that there were large deposits of glacial drift in several of the valleys in this vicinity. Glacial moraines are especially developed in the large east and west valley from north of Loudonville to north of Shreve, also in the broad valley north of Big Prairie. Neither of these valleys contains a large stream except for short distances while the smaller valleys with relatively less drift contain the larger streams. The slopes of the valley walls are not steep enough for landslides to occur and interfere with drainage and no evidence of landslides was found. No volcanic lava or ejecta occur here. In fact, the glacial drift is the only material found about here which could plug up valleys and divert the streams. But diversion might be caused by tilting and folding of the strata if these had occurred. Folding and faulting sufficient to induce the stream modifications noted are unknown here. Superposition caused by a leveling up sufficient to send streams over hills and cause them to select entirely new courses independent of old courses has not occurred. Moreover the strata are similar sedimentary rocks all through the region so that neither superposition nor change in the character of the rocks encountered as the streams cut down can be used to explain the conditions. Rejuvenation has been considered. There has been no local uplifting that could rejuvenate in some places and not in others as the conditions would require, nor are the results those consequent on broad or general rejuvenation. Streams in isolated areas only are revived and entrenched. By elimination, we are left to the drift as the immediate cause of the obstructions and diversions. A study of the drift shows it to be deposited in loops and curves as if around the ends of ice tongues extending southward along the valleys and against the margins of broader ice lobes, which must then have advanced into the region from the north.

Working out the relations between the theory of ice invasion of these valleys, and the facts observed regarding stream diver-

sions, the following conclusions may be reached. During pre-glacial time a system of valleys was here developed—valleys which had reached maturity. This maturity was more marked in and near the master valleys but became less and less strong as one pushed back up the little valleys. Many of the latter, especially south of the large east and west valley, gradually widened northward showing that the line of headwater divides must have lain near but south of this large valley.

The advancing ice would move more easily into the broad, mature valleys and into those lying more nearly in the direction of ice movement. The ice pushed in from the north, as it came into rougher and rougher topography it broke up into tongue-like dependencies,* which extended into the valleys. While the ends of the tongues were fairly stationary, melting freed rock waste which accumulated in moraines. Any stream flowing toward the advancing ice would of necessity find its course closed during the ice advance by ice and moraine. The water, augmented by the melting of the ice, would accumulate in a lake between the advancing ice on the north, the valley walls on the sides and the divides on the south. Its outlet would be over the lowest places, whether of moraine or rock, whether in valleys or over low cols between ridges at the very heads of the streams. Thus was begun the discharge of water over the divides. As the ice continued to advance it crossed one of the divides and may have lowered it some by ice erosion, but this if done, is not very apparent.

While the ice front lay along the large east and west valley studied, it built masses of moraine in the valley and water rose in the tributary valley leading southward from Loudonville until it was pushed over the divide at Spellacy. When the ice withdrew, it became more markedly a series of valley dependencies, and the water accumulated in front of their noses until it went over the col in Muddy Fork northwest of Lakeville, but because of ice obstructions it could not go along the large valley leading to Big Prairie. Thus was started the stream over the divides between the narrow valleys and not along the earlier mature valleys.

Once started it was easier for the stream, when the ice withdrew, to maintain its course over the divides than to seek its old routes. Hence the cutting down continued and the little narrows were finally cut to present dimensions. The cutting down of the divide gave all side streams near the divide a chance to deepen their courses near their mouths which they proceeded

*Carney, F. (*Jour. Geol.* XV, 1907 pp. 488 ff.) very happily applies this term to peripheral protuberances, which extended from the great ice sheet into preglacial rock valleys.

to do. Thus the theory seems to explain and incorporate every observed fact and not to be out of harmony with the general conditions of the vicinity.

Since drift of Wisconsin age lies in the smaller valleys and since the observed stream erosion, accomplished subsequent to the diversions, is so great, it is believed that the original diversion must have occurred in connection with some pre-Wisconsin ice invasion probably the earliest to come to this region.
