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FLORENCE VALLEY: AN ABANDONED STREAM VALLEY,  
FLORENCE TOWNSHIP, ERIE COUNTY, OHIO<sup>1</sup>

THORNTON J. F. HOLE AND CHARLES E. REDMOND

*U.S.D.A. Soil Conservation Service, Sandusky, Ohio*

ABSTRACT

An abandoned stream valley, here called Florence Valley, was found in eastern Erie County, Ohio. Florence Valley is about one mile long and connects the valleys of Chappel Creek and the Vermilion River. There is evidence that Florence Valley was formed as a result of the capture of a tributary of the Vermilion River by Chappel Creek. Chappel Creek, at the junction of Florence Valley and the valley of Chappel Creek, has a right-angled bend, which displays morphology characteristic of an "elbow-of-capture." The gradient of the eastern two-thirds of Florence Valley slopes toward the Vermilion River. Because the Vermilion River is more deeply entrenched than is Chappel Creek, this stream capture must have taken place at a time when the base level was at a higher elevation, when Chappel Creek had a shorter course and steeper gradient than did the Vermilion River. These conditions are believed to have existed during the time of Lake Maumee III.

An abandoned stream valley was found south of the village of Florence by the junior author, while mapping soils in Erie County. Subsequent study by both authors revealed the history leading to its abandonment. This valley lies between

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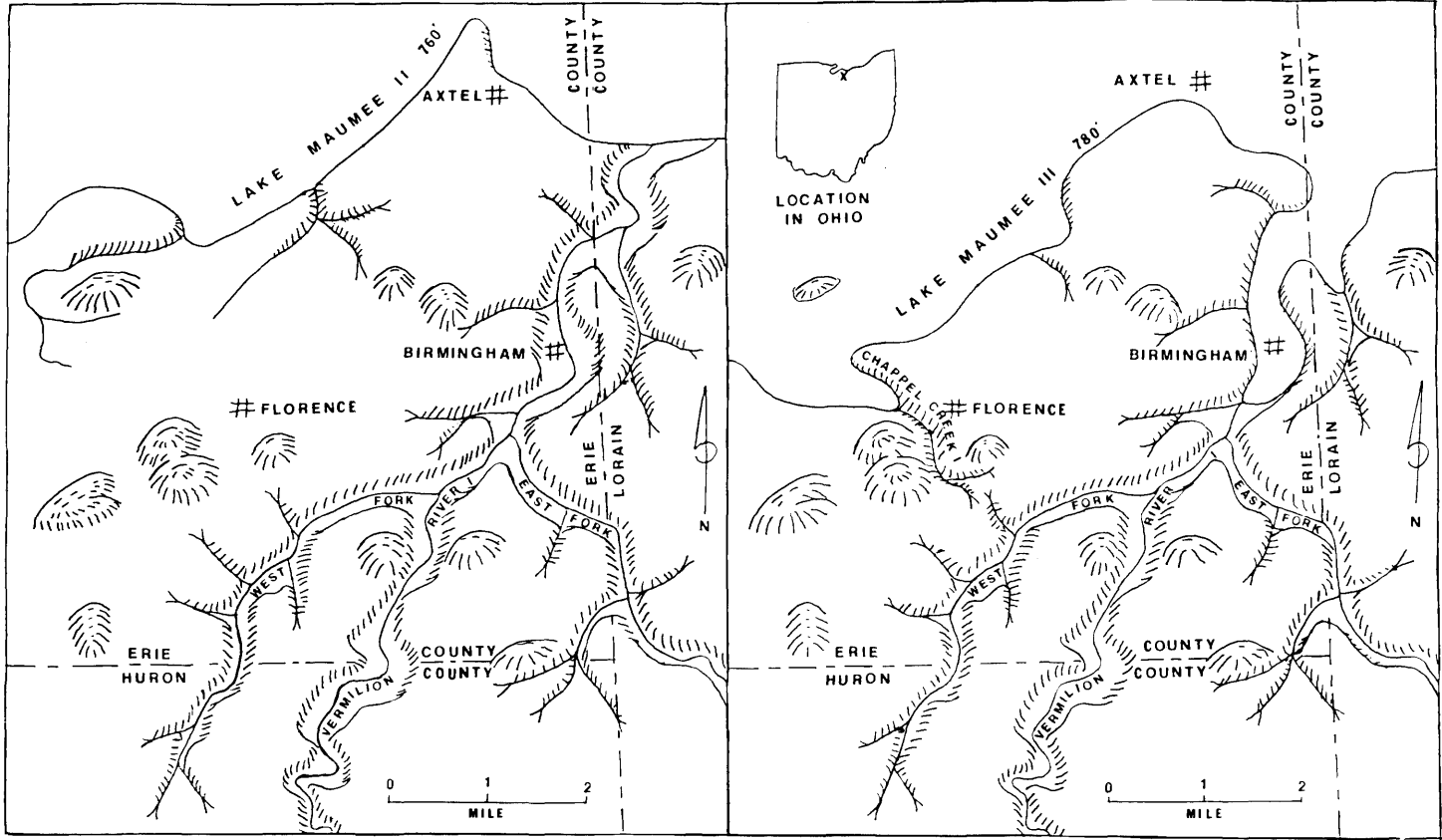


FIGURE 1 and FIGURE 2

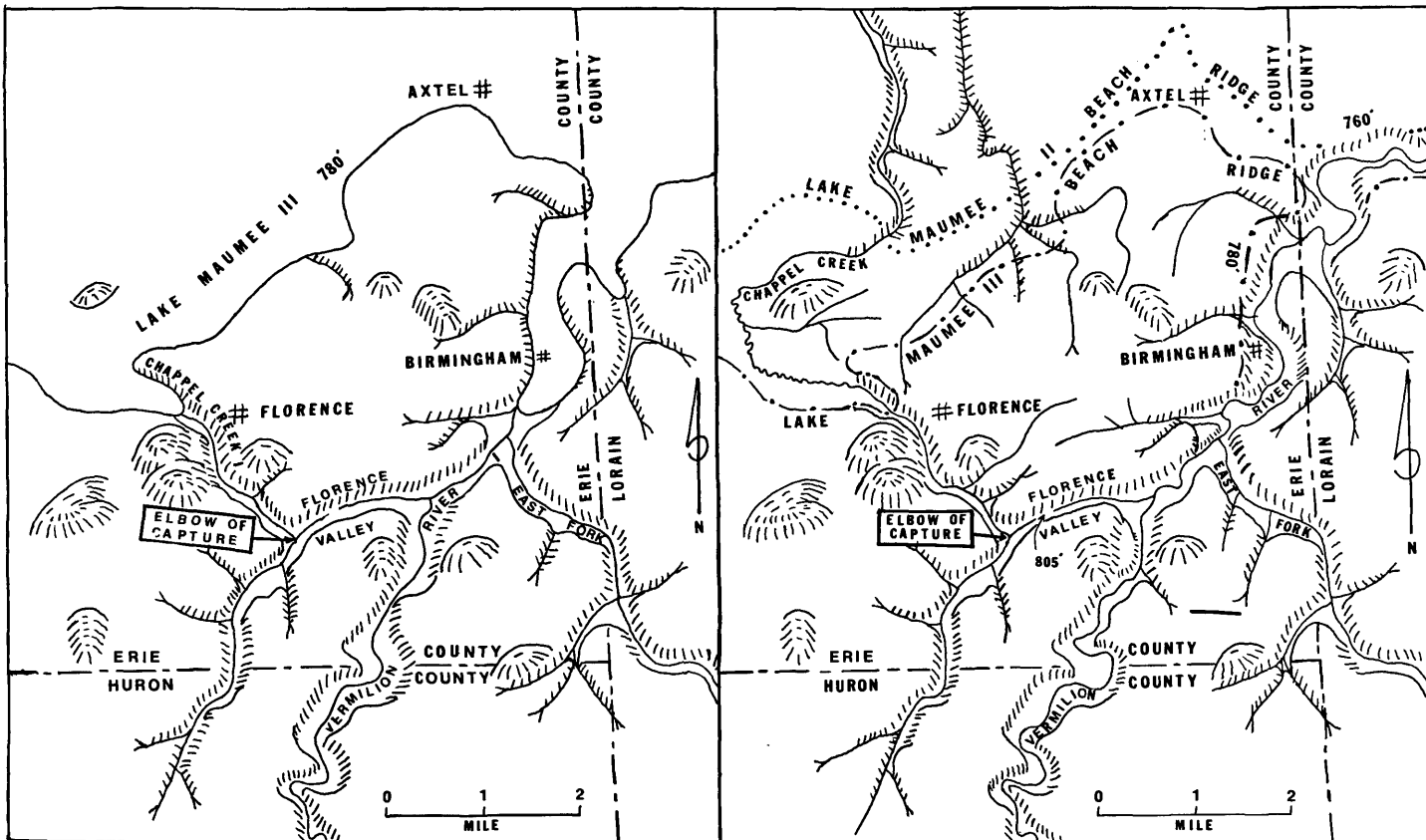


FIGURE 3 and FIGURE 4

the valleys of Chappel Creek and the Vermilion River, joining them, and will be referred to as Florence Valley, named for a nearby town (fig. 4).

#### GEOLOGY OF THE AREA

The general topography in the vicinity of Florence Valley is that of a nearly level to gently sloping plain developed on till, with elevations ranging from 820 to 840 feet. The glacial till is of Late Wisconsin age (Goldthwait, *et al.*, 1961) and is approximately 15 to 30 feet thick. Most of the underlying bedrock is shale of the Mississippian-age Bedford Formation (Hoover, 1960), but a number of knob-like hills rising 30 to 60 feet above the surrounding till plain consist of Mississippian Berea Sandstone, covered by glacial till. The till is thicker at the bases of these hills and gradually becomes thinner nearer their tops, where it ranges from one to three feet, being locally absent.

Details of the history of the present drainage in this area are related to stages of the glacial lakes, ancestral to Lake Erie, which covered the lake plain area of northern Ohio during the retreat of the Late Wisconsin ice (Leverett, 1902). As the glacier receded or advanced, lower outlets were exposed or existing outlets were blocked, and the level of the lake rose or fell accordingly (Forsyth, 1959). The old shorelines of all of these glacial lake stages are marked by beach ridges. The first three stages of the resulting series of thirteen stages (including the present Lake Erie) were named Lake Maumee I (absent in this area), Lake Maumee II, and Lake Maumee III. It is the latter two levels which are interpreted to play a role in the history of Florence Valley.

#### OBSERVATIONS

The streams in eastern Erie County are consequent on the regional slope of the till plain. As a result, the drainage pattern is generally parallel, with major streams flowing directly north into Lake Erie. Two of these streams are Chappel Creek and the Vermilion River (fig. 1).

Chappel Creek has its headquarters in Huron County and flows in a north-easterly direction into Erie County. About one and one-half miles north of the Erie-Huron County line, its course makes a right-angled bend and changes to a northwesterly direction (fig. 4). It is from this point that Florence Valley continues in a northeasterly direction, and joins the valley of the Vermilion River. From the right-angled bend, Chappel Creek flows northwestward to the Lake Maumee III beach. Between the Lake Maumee III and Lake Maumee II beach ridges, Chappel Creek flows in a horseshoe-shaped course through an area of low relief containing both till and outwash, and is entrenched to a depth of only about 10 feet. Downstream from the Lake Maumee II beach ridge, the valley of Chappel Creek is deeply entrenched into the underlying shale bedrock. In contrast to this angular course of Chappel Creek, that of the Vermilion River is simpler, trending northeastward down the regional slope to the present lake.

Florence Valley is about one mile long and 900 feet wide, and is cut into the till to a depth of 20 to 25 feet. The western one-third of the valley presently drains westward into Chappel Creek, and the eastern two-thirds now drains eastward into the Vermilion River. The maximum elevation of the floor of Florence Valley is 805 feet and the gradient of the longer segment sloping towards the Vermilion River is 10 feet per mile. Twelve feet or more of stream-deposited sediments, consisting of stratified silts, sands, and some clay, occur in the valley bottom.

#### DISCUSSION

A common cause of abandoned stream valleys is stream capture. The following facts, obtained from field observations and from the Berlin Heights 7½-minute topographic map, strongly suggest that the abandonment of Florence Valley was

the result of the capture of a tributary of the Vermilion River by Chappel Creek. (1) The gradient of the longer segment of Florence Valley slopes in the direction of the Vermilion River. (2) The right-angled bend at the junction of Florence Valley and the valley of Chappel Creek displays the morphology characteristic of an elbow-of-capture (fig. 4).

Because the present valley of the Vermilion River is entrenched about 100 feet, compared to only about 20 feet for Chappel Creek, this stream capture must have taken place at a time when the base level of the area was at a higher elevation than it is today, and when Chappel Creek had a shorter course and steeper gradient from point of capture to the lake than did the Vermilion River. The presence of the twelve feet of stream-deposited sediments in Florence Valley also indicates that base level was higher then and that aggradation must have been going on in the valley of the then-existing stream. These conditions are interpreted to have existed during the time of Lake Maumee III, as outlined in the following reconstructed sequence of events.

#### *Time of Lake Maumee II*

A consequent stream, here called Vermilion River I, is interpreted to have occupied the site of the present Vermilion River during Lake Maumee II time (fig. 1). According to this interpretation, this stream had several tributaries, which included the present East Fork of the Vermilion River and the present headwaters of Chappel Creek, here called West Fork. The fact that Florence Valley has a wide floor in relation to its depth indicates that Vermilion River I and its major tributaries had reached early maturity.

Assuming little alteration of Florence Valley since the time of capture, a reconstructed profile of Vermilion River I, with the same gradient as Florence Valley would have an elevation of 755 feet at the Lake Maumee II beach ridge. This elevation compares very favorably with the level of Lake Maumee II, which would have been base level at that time, and was approximately 760 feet (Forsyth, 1959). Actually the profile of the main stream would have been less steep than that of its tributary (in Florence Valley), so the discrepancy would have been even less, and the agreement still closer. With the readvance of the glacier, the outlet of Lake Maumee II became blocked, resulting in a shift to another, higher outlet, producing a higher lake at an elevation of 780 feet (Forsyth, 1959). This lake stage, Lake Maumee III, drowned the Lake Maumee II beaches and part of the valley of Vermilion River I (fig. 2). This rise of the lake raised the base level of the area about 20 feet.

#### *Time of Lake Maumee III*

To the west of Vermilion River I, at the time of Lake Maumee III, a small stream, here referred to as Chappel Creek I, is interpreted to have been extending its valley headward through a low area between two sandstone hills south of Florence. Earlier drainage systems had probably been present in this area during the time of Lake Maumee II, but their valleys had been flooded and filled with sediment by Lake Maumee III.

The base level of the area at this time was controlled by Lake Maumee III at an elevation of 780 feet (Forsyth, 1959). The present elevation at the elbow-of-capture is approximately 803 feet. By reconstruction of the gradient of Florence Valley back upstream from its maximum elevation of 805 feet, the approximate elevation at the point of capture at the time of capture must have been about 810 feet, 30 feet above the level of Lake Maumee III. From the point of capture to Lake Maumee III, Chappel Creek I would have had a length of two miles and a gradient of 15 feet per mile, whereas the West Fork of Vermilion River I would have had a gradient of 10 feet per mile and a length of three miles. These approximate lengths and gradients of Chappel Creek I and the West Fork of Vermilion

River I at the time of Lake Maumee III were determined by observations of these features, relative to the position of the 780-foot lake shore, on the Berlin Heights topographic map.

#### CONCLUSION

The abandonment of Florence Valley was the result of the capture of the West Fork of Vermilion River I by Chappel Creek during the time of Lake Maumee III (fig. 3). The conditions favorable for such an event were: (1) a shorter and steeper gradient for Chappel Creek I than for the West Fork of Vermilion River I, and (2) evidence of aggradation in Florence Valley by West Fork.

The stream capture could not have taken place after the time of Lake Maumee III, because the subsequent lowering of the level of that glacial lake would have caused the Vermilion River to become rejuvenated, increasing its energy and causing its valley to be cut much deeper. By contrast, Chappel Creek meanders over the flat lake plain between the Lake Maumee II and the Lake Maumee III shorelines, and incision of its valley has extended only a short distance upstream from the Lake Maumee II beach ridge (fig. 4).

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