

Late Wisconsin Glacial History of the Area Around Lake Maxinkuckee¹

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Introduction

The glacial geology and soils of the area around Lake Maxinkuckee formed the theme of the geology-soils field trip of the 1965 spring meeting of the Indiana Academy of Science held at Culver, which is at the north end of Lake Maxinkuckee. The area traversed on this trip is in southwestern Marshall County, northwestern Fulton County, north-eastern Pulaski County, and southeastern Starke County within a 12-mile radius of Culver (Fig. 1). The present paper summarizes the glacial history of this area and thus more or less outlines the itinerary of the field trip, the details of which may be found in the guidebook (1). Incorporated are several new ideas that amplify the basic sequence of events worked out by Frank Leverett (2) and other geologists, including Malott (3), earlier this century.

The Maxinkuckee Moraine and Extent of the Saginaw Lobe

One of the largest lakes in the State, Lake Maxinkuckee³ occupies a huge ice-block depression at the western edge of the massive Maxinkuckee Moraine (Figs. 1-3). This moraine is one of the most prominent physiographic features of north-central Indiana, trending in a general north-south direction for a distance of about 40 miles between South Bend and Rochester (Fig. 3). Like most of the glacial features of the Lake Maxinkuckee area, the Maxinkuckee Moraine was formed during the latter part of the Wisconsin Age, probably fairly early in the Cary Subage. It owes its origin to the advance and subsequent stagnation of the Saginaw Lobe, a tongue-shaped protuberance of ice that entered Indiana from the northeast after crossing southern Michigan from its source in the basin now occupied by Saginaw Bay.

The terminus of the Saginaw Lobe on the southeast stood along the present course of the Eel River from western Whitley County southwestward through Kosciusko, Wabash, Miami, and Cass Counties to the vicinity of Logansport. Stagnation of the glacier in its marginal zone produced the belt of hills and kettle holes known as the Packerton Moraine, whose outer edge follows the river in this area (Fig. 2).

The western limit of the Saginaw Lobe is not definitely known, partly because it is not represented by any known moraine. The terminus may have trended in a northwesterly direction through Pulaski and

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3. Lake Maxinkuckee covers an area of 1,854 acres and thus is second in size only to Lake Wawasee among the natural lakes in Indiana. It is also one of the deepest (88 feet).

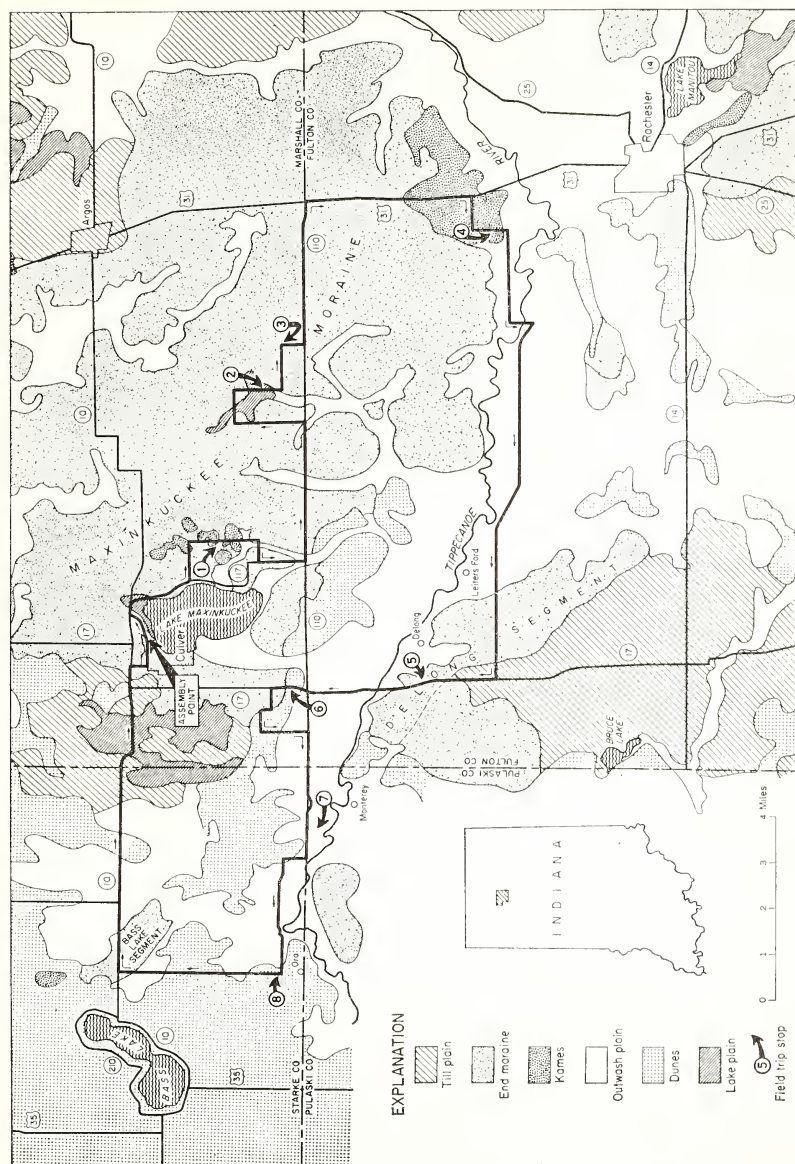


Figure 1. Map showing glacial geology of the area around Lake Maxinkuckee and route of the 1965 geology-soils field trip.

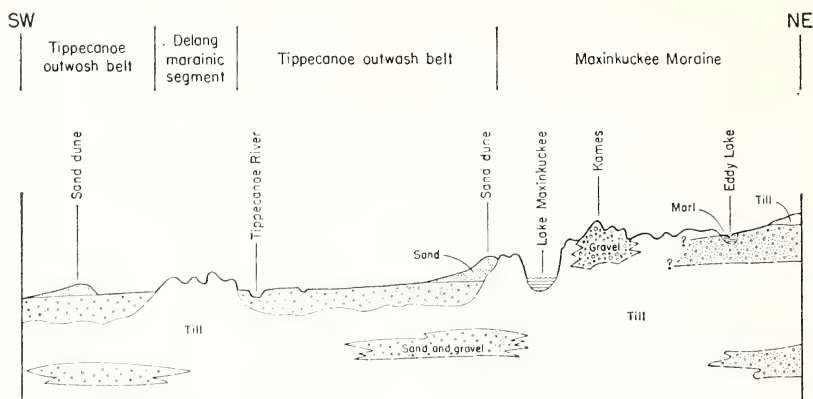


Figure 2. Diagrammatic cross section showing landforms and glacial deposits in the area around Lake Maxinkuckee.

Starke Counties, but thick deposits of outwash and windblown sand (Fig. 3) effectively obscure the evidence. Zumberge (10), however, has argued that the Saginaw Lobe reached farther west; he contends that a narrow tongue of ice pushed entirely across Indiana into eastern Illinois. According to this interpretation, two nearly parallel morainic ridges—one extending across Jasper and Newton Counties and the other across northern Benton County (Fig. 3)—respectively define the northern and southern limits of the ice. The morphology of these two moraines, our inability to trace one moraine into the other in Illinois, and certain outwash patterns leave us unconvinced that this interpretation is the correct one.

Retreatal Features of the Saginaw Lobe

Northeastward retreat of the Saginaw Lobe from its terminal position was apparently punctuated by a series of pauses, as suggested by several linear to very gently arcuate ice-marginal features beyond the Maxinkuckee Moraine in parts of Starke, Pulaski, Fulton, and Cass Counties. These features are short segments of end moraine that trend northwest-southeast and shallow elongate troughs, many of which have a similar trend.

Most of the troughs are between 10 and 30 feet deep, but some are shallower. The typical depression is probably about 15 feet deep and between 500 and 1,000 feet across, but the features range in width from 200 feet to perhaps 2,000 feet. Because of their low relief, the troughs are not conspicuous features in the field, nor are they immediately apparent from a casual inspection of topographic maps of the area. They are more readily detectable, however, on air photographs and soil maps. They are best displayed on soil maps of Fulton and Cass Counties (5, 7), which show the troughs to be underlain by poorly drained mineral soils of the Brookston, Kokomo, and Maumee series and partly filled with muck or other organic soils mapped as Carlisle and Wallkill. The depressions are generally discontinuous, but a few can be traced for distances of several miles. Commonly they are crossed

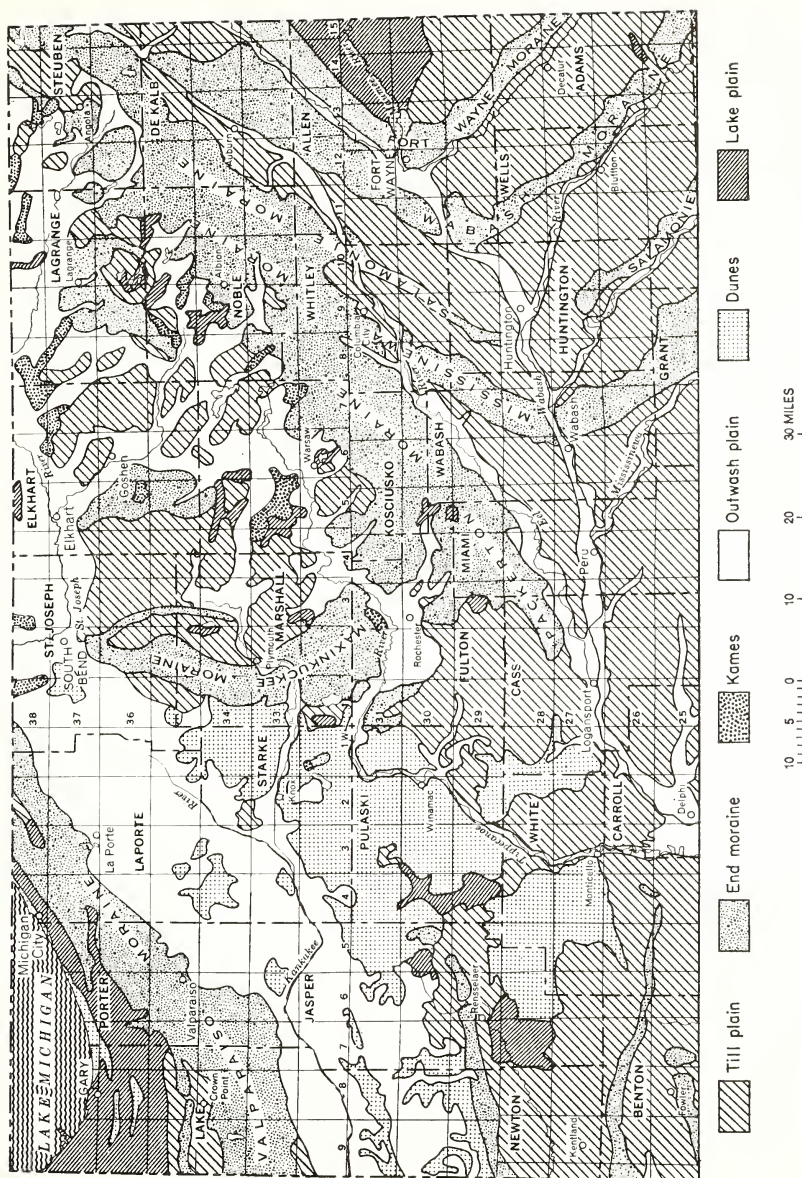


Figure 3. Map showing glacial geology of northern Indiana. Modified from Indiana Geological Survey Atlas Map 10 by W. J. Wayne, 1958.

or joined by even less conspicuous transverse to oblique depressions, also having very low relief; thus, the overall pattern, though weak, resembles the fracture pattern that characterizes the marginal zone of present-day glaciers (4, 8). Certainly it is much unlike the east-west topographic lineation in southern Cass County and in much of Carroll and Howard Counties that was described and interpreted by us at a previous meeting of the Academy (6). Even a casual examination of the Cass County soil map (7) reveals a marked difference in soil patterns north and south of the Wabash Valley.

The short end-moraine belts, though not so numerous, are much more distinct than the troughs. The two most prominent morainic segments are about equidistant south and west of Lake Maxinkuckee near DeLong and Bass Lake, respectively (Fig. 1); consequently, they are descriptively referred to here as the DeLong and Bass Lake morainic segments. Their similar trend (northwest-southeast), their virtual alignment along this trend, and their similarity in position just beyond the Maxinkuckee Moraine suggest that these segments are correlative—that they were deposited simultaneously as parts of a more or less continuous moraine, a low part of which was subsequently breached and eroded by sediment-laden meltwaters when the terminal zone of the Saginaw Lobe stood along the Maxinkuckee Moraine or farther east.

The DeLong morainic segment is composed largely of calcareous loam till (Fig. 2) leached of carbonates to a depth of about 4½ feet (Fig. 1, stop 5). The Bass Lake segment also contains till but in addition is made of stratified ice-contact sand and gravel deposits. The north end of the moraine, for example, terminates in a kame complex (Figs. 1 and 3), from which commercial gravel is currently being removed from at least one of several large pits. Kame deposits are also being mined farther south in the moraine. Both the DeLong and Bass Lake segments have been modified by the deposition of eolian sand, which partially obscures their morainic morphology.

The DeLong and Bass Lake morainic areas were recognized by Leverett (2), who interpreted them in much the same way as we do: recessional morainic belts deposited at the snout of an ice lobe retreating to the northeast. Leverett also mapped as morainic a slender arcuate belt of land that trends in a general north-south direction through western Fulton County and northwestern Cass County between the DeLong segment and the Wabash Valley. This belt was later considered to be part of the Maxinkuckee Moraine by others (3, 9), but it appears to us to have been misinterpreted. More probably the Maxinkuckee Moraine swings eastward in the vicinity of Rochester and merges with the Packerton Moraine in eastern Fulton County.

Construction of the Maxinkuckee Moraine

Continued wastage of ice caused the front of the Saginaw Lobe to recede farther to the northeast, possibly first to the position of the Maxinkuckee Moraine and then to some unknown position well behind the moraine. The ice apparently soon readvanced, however, as suggested by a cap of calcareous loam till that overlies stratified sand and gravel in much of the area. This relationship (Fig. 2) is demonstrated by several exposures in the moraine east of Lake Maxinkuckee as, for

example, in a pit of the Standard Materials Corporation (Fig. 1, stop 3), where the till cap is as much as 12 to 15 feet thick. The stratified deposits are thought by one of us (Johnson) to represent an extensive high-level proglacial outwash plain deposited as the ice receded from the position of the moraine and probably also as it readvanced.

Most of the Maxinkuckee Moraine in the area of Lake Maxinkuckee probably owes its origin to this later advance of the Saginaw Lobe. A fairly long stillstand of the ice is indicated by the massive character of the moraine in this area and by several kinds of stagnant-ice features. Between Culver and Rochester, for example, the moraine is marked by numerous small kames (Fig. 1, stop 1), meltwater troughs (traversed between stops 1 and 2), undrained ice-block depressions filled with water (Lake Maxinkuckee) or with organic accumulations of muck, peat, and marl (Fig. 1, stop 2; Fig. 2, Eddy Lake), and a very striking massive kame complex (Fig. 1, stop 4). Some of these features, particularly the larger kames, may have formed during the earlier period of stagnation, but the evidence for this is not conclusive.

Outwash and Dune Deposition

Debris-laden glacial streams flowed through the troughs, winding over, around, and through stagnant ice masses toward the Tippecanoe sluiceway, and thence continued westward and southward toward the Wabash Valley far downstream (Fig. 3). As the meltwaters poured through the sluiceway, they dropped their load of sand and gravel (Fig. 1, stop 7) to build up a broad outwash belt of low relief (Figs. 1-3). Because the outwash belt heads well behind the Maxinkuckee Moraine (Fig. 3), the Tippecanoe sluiceway must have been used for some time after the construction of the moraine. It was undoubtedly used at least until stagnant ice in the moraine had largely melted away and the Saginaw Lobe had retreated from the Tippecanoe drainage basin.

Strong westerly winds subsequently reworked the sandy materials of the Tippecanoe outwash belt, and large crescentic sand dunes were constructed on its surface (Fig. 2). Although these dunes assume different shapes and many sizes, the great majority of them are parabolic or U-shaped dunes. In plan they are convex to the east, and in cross section they are distinctly asymmetric; the steeper slip faces or lee sides face east to northeast—positive proof that the prevailing winds were, as now, from the west (or southwest). The morphology of many of the dunes (including those at stops 6 and 8) is virtually perfect.

Much windblown sand was, in addition, swept eastward onto the Maxinkuckee Moraine, so that the front of the moraine in many places is now largely obscured (Fig. 1, stop 6; Fig. 2). The topography and composition of the interior of the moraine were also considerably modified by the deposition of sand. With the establishment of vegetation and the development of soils, however, most of the dunes eventually became stabilized, but in places where the protective vegetative cover is absent loose sand continues to be drifted about by the wind.

Summary

The known glacial history of the Lake Maxinkuckee area centers about the Saginaw Lobe, which entered Indiana from the northeast

during the Cary Subage of the Wisconsin Age. On the southeast the terminus of the ice was along the Packerton Moraine; the western limit of the lobe is not represented by any known moraine but probably trended northwestward through Pulaski and Starke Counties.

Northeastward retreat of the Saginaw Lobe was apparently spasmodic, as suggested by several linear to gently arcuate ice-marginal features that trend northwest-southeast; these include short end-moraine segments composed partly of kame deposits and shallow elongate troughs underlain by poorly drained mineral soils or partly filled with organic sediments. Continued withdrawal of the ice front, possibly first to the position of the Maxinkuckee Moraine and then farther northeast, was apparently followed by a readvance to the moraine, as suggested by the cap of calcareous till that in many places overlies stratified drift. Most of the Maxinkuckee Moraine was built at this stage; a fairly long stillstand of the ice is indicated by numerous small moulin kames, melt-water troughs, undrained ice-block depressions, and the massive kame complex near Rochester.

Debris-laden meltwaters poured through the troughs, winding over and around stagnant ice masses toward the Tippecanoe sluiceway, along which they dropped their load of sand and gravel to form a broad outwash belt of low relief; thence they continued westward and southward to the Wabash Valley. Prevailing westerly to southwesterly winds subsequently whipped across the sandy outwash belt, and large crescentic sand dunes were constructed on its surface. Much sand was swept eastward onto the Maxinkuckee Moraine, considerably modifying its character and obscuring its distal boundary in many places. With the establishment of vegetation and the development of soils, most of the dunes became stabilized; but where the protective cover is absent, loose sand continues to be drifted about.

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