
GEOLOGICAL SITUATION OF THE ORLETON FARMS MASTODON

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The finding of a rather complete skeleton of a mastodon, *Mammul americanum*, on the Orleton Farms in Madison County, Ohio, in November 1949 aroused great public interest and led to extensive investigations of the nature of the late- and post-glacial deposits which enclosed the bones. A general account of the find by Dr. Edward S. Thomas appears in this number of The Journal. A careful study of the mollusks and one of the pollen in the same beds follow this account. This is an account of the glacial deposits and the layers representing post-glacial time. Most of the field study was made in 1949, prior to the discovery of the mastodon, as part of a continuing surficial survey by the Water Division of the Ohio Department of Natural Resources and the Groundwater Division of the U. S. Geological Survey.

The bones were found in a depression on Orleton Farms in the northeast part of Sommerford Township, Madison County. The pit lies about 500 feet north of State Highway 29 two thirds of the way from West Jefferson to Mechanicsburg. All of the bones lay from 16 to 26 inches below the surface. Most of them lay in the upper part of a 22-inch thick gray clay layer. Upper parts of large bones projected well up into a black muck layer 13 inches thick and just under the plow-turned surface. These two layers, black muck above and gray marl below, rest directly upon glacial till.

THE UNDERLYING GLACIAL DEPOSITS

The glacial till beneath the mastodon excavation is Cary (?) drift of the Wisconsin glacial stage. It is a sticky clay till oxidized light brown and containing rock fragments of all sizes. That the till is of "Wisconsin" age is agreed by all who have studied the region (Leverett, 1902). The topography is constructional with less than ten percent of area in dissected valleys; soils are of the young Miami catena with less than three feet depth of leaching of carbonates and no thoroughly rotted gumbo- or meso-till. Whether this surface dates from the Cary ice advance or the older Tazewell substage is debatable. It is proposed here that it is probably of Cary age because:

(1) The undisputed Miami soils (B horizon to 30 inches depth) are typical of some areas of Cary drift further north in Ohio and Indiana.

(2) Analyses of the Carbon-14 ratio in logs buried in related drift south of Dayton, Ohio, and in Oxford, Ohio, indicate antiquity of "more than 17000 years" and "at least 15000 years" (Arnold and Libby, 1950). These imply a time lapse

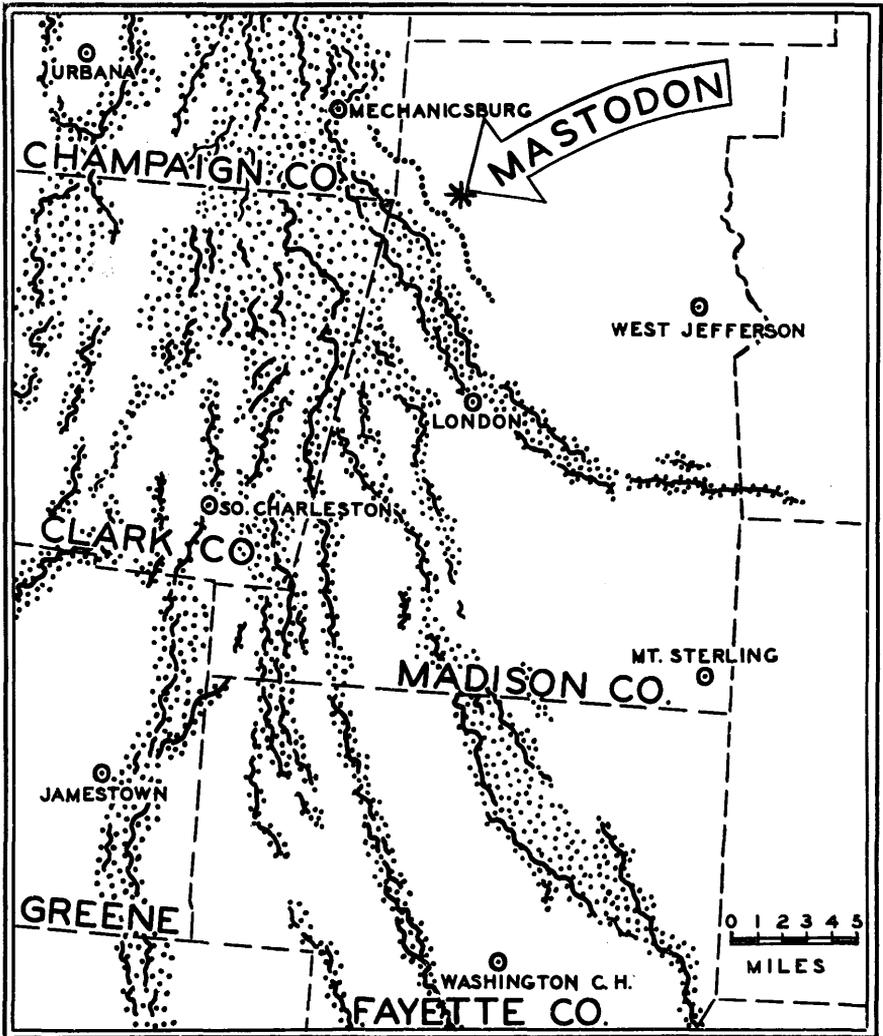


FIGURE 1. Map of the end moraines of central Ohio. Solid lines are crests of moraines; stippled areas have hummocky moraine topography; dotted line shows crest of poor moraine near mastodon site.

far short of acceptable Tazewell substage but older than similar dating for the Mankato substage (Flint and Deevey, 1951).

(3) The dimpled till plain topography with distinct hilly belts of end moraine and a scattering of fresh crystalline boulders simulates typical Cary drift in Illinois and Wisconsin.

Thus the proposal is that this area was uncovered as Cary ice withdrew less than 17,000 years ago.

The uncovering by the ice sheet came at the conclusion of a long period of repeated halts in the recession of the ice edge because the mastodon site lies on the northeast "inside" edge of a nested series of end moraines (fig. 1). Less than 2½ miles west of this site is the edge of the 8-mile wide belt of Cable Moraine. It comprises coalesced chains of rugged hills rising 200 feet above the till plain, and it is composed of unconsolidated drift about 300 feet deep.¹ This was deposited along the west edge of the ice lobe which spread southwestward out of the Scioto Valley. Counts of pebble lithologies in the moraine demonstrate that it is the same sort of drift found in the deposits throughout Madison County, as shown in table 1. Furthermore the chains of hills in the Cable Moraine fray out southward

TABLE 1
Counts of pebble lithologies.

Area	Number of counts	Limestone	Dolomite	Chert	Shale	Crystalline erratics
Cable Moraine..... (Champaign Co.)	12	8.5%	84.6%	0.5%	1.0%	5.5%
Till Plains..... (Madison Co.)	7	10.8%	82.7%	0.6%	1.0%	5.2%

into several lower separate belts of end moraine. Since these curve to the east they mark the nose of the retreating ice lobe in the Scioto Valley.

Most northeasterly and youngest of these distinct hummocky moraine belts is the London Moraine. Parallel with London Moraine, but one mile northeast of it where it joins the Cable Moraine, is a belt of less distinctly rolling topography between Lafayette and Mechanicsburg (line of dots, fig. 1). Undoubtedly this

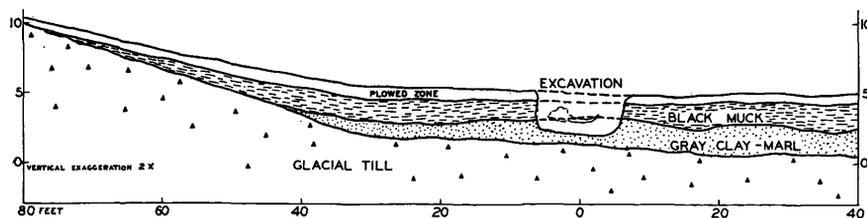


FIGURE 2. Cross section of west edge of kettle hole in which excavation for mastodon was made. Based upon soil auger test holes.

poorer moraine topography marks a short final halt of the curved ice edge as the ice sheet began to disappear rapidly up the Scioto Valley. The mastodon was found on the gentle northerly slope of this last halting belt.

The hollow in which the bones were found appears to be a glacial kettle hole. The bottom four (or 7 before filling) feet of the depression was completely undrained, and rolling uplands of till still rise 15 to 30 feet higher on three sides. Dozens of similar depressions may be found nearby. The dissolving away of carbonates did not produce these hollows because the bedrock is buried 80 feet down and is not sufficiently soluble to produce good sink holes.² Nor has sufficient time elapsed

¹Two wells in lower hills near Mechanicsburg penetrated 230 and 385 feet to reach bedrock. Some 56 water wells in the moraine in Champaign County south of Cable (where bedrock is shallow) never reach bedrock and average 117 feet depth.

²Fourteen water wells within a 2-mile radius reach bedrock at an average depth of 86 feet; the well at farm buildings not 500 feet away reaches bedrock 83 feet down. The rock is Monroe dolomite.

to permit differential settling from solution within the till. Since dozens of similar hollows are found in a zone all along the east edge of the indistinct northeasterly end moraine they must be the products of glacial deposition. We know that the ice margin oscillated extensively for there are wide areas near London of ice-laid till over sands previously deposited by meltwater. It is easy to suppose that when the broad fringes of the ice sheet melted thin the last scraps in one marginal zone were dirt-littered lenses of dead ice. A minor advancing pulse of the active ice lobe may have deposited more till over these buried masses. Long after the edge of the moving ice lobe retreated to the north the buried ice melted out leaving kettle holes. Under periglacial conditions these dirt-protected ice masses may have lasted for centuries.

LAYERED DEPOSITS AFTER THE ICE

As buried ice melted and depressions developed, water collected in the hollows. In these poorly drained pools clay and marl lie directly on top of slightly oxidized brownish till (fig. 2). The water oozing in from surrounding slopes was charged with carbonates leached out of the upper 30 inches of soil on adjacent uplands. The waters were too saturated with carbonates to dissolve carbonates out of the till at the bottom of the pond for this till is calcareous to the top. Instead, marl was precipitated through evaporation, temperature change, or bacterial action, together with clay "impurities" washed from the adjacent till slopes. The dearth of organic matter expressed by the whiteness and the scarcity of pollen grains suggest that vegetation was sparse. Since the gray clay is only 22 inches thick at the deepest points and does not lap up onto adjacent slopes more than two feet above, the lowest known point (fig. 2) the pool may have been only a few feet deep.

Into this pond the mastodon wandered, for the bones are imbedded in the upper part of the clay. Since all of the bones are 13 or more inches above the underlying till, the clay and marl had begun to collect long before the animal came. Did he fall through the ice in winter? Did he bog down in sticky clay? There is no sign of any animal large enough to drag the carcass here.

The upper layer of black calcareous muck on top of the clay denotes a marked change in environment.³ The muck is made up of organic matter suggesting luxurious swamp vegetation. Leaves and bits of wood demonstrate a shallow alkaline swamp surrounded by woodland. Unlike the clay this muck layer laps as much as six feet up onto adjacent slopes showing that surrounding ground was soggy but well bound by roots. Contributing to the change from open pond to swamp was the 22-inch layer of clay already filling the pool, and possible slight lowering of a surface outlet through a low saddle to the north. Flow was insufficient to produce any visible or lasting cut in this threshold which is four feet above the bottom of the hollow today.

How recent are these layers in which the bones are imbedded? Certainly it took several centuries to develop the swamp muck on top. Dr. P. B. Sears and Kathryn Clisby (1951) find pine and spruce to be the most abundant pollen in the lower clay. The maximum abundance of such pollen clearly predates the first mixed deciduous forest of warmer postglacial time (6000 years ago) and probably before "pine time" 6000 to 9000 years ago. It is usually associated with the last ice retreat, namely the Mankato. (Sears, 1941; Flint and Deevey, 1951.) The radiocarbon dating, reported in the preceding article by Dr. Thomas, suggests that wood in the lower part of this muck layer is 8420±400 years old, thus we may conclude that the open pool condition resulting in the gray clay lasted from about 15,000 to about 9,000 years ago.

³This is fully corroborated by the nature of the mollusk assemblages in the two layers described by Dr. A. LaRocque in an article following this one.

SUMMARY

Thus the geological nature and date of the layers may be summarized as follows:

1. Underlying the whole area is some 80 feet of glacial till deposited by the Wisconsin ice sheet, probably during its Cary advance about 17,000 years ago.
2. Mastodon bones were imbedded in the upper part of a 0 to 22-inch thick layer of gray marl and clay directly on top of the till. At this time, there was a small poorly-drained pool a few feet deep.
3. Overlying most of the bones is 0 to 15 inches of black calcareous muck indicating heavy forest vegetation around an alkaline swamp.
4. Plowing has disturbed the upper 8 to 12 inches of surface soil within the last century.

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