Classification of Wisconsin Glacial Deposits In Northeastern Ohio

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Prepared in cooperation with the Ohio Department of Natural Resources, Division of Water

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By GEORGE W. WHITE

CONTRIBUTIONS TO GENERAL GEOLOGY

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CONTENTS

ILLUSTRATION

TABLE

CLASSIFICATION OF WISCONSIN GLACIAL DEPOSITS IN NORTHEASTERN OHIO

By GEORGE W. WHITE

ABSTRACT

Wisconsin glacial deposits in northeastern Ohio are divided into several distinctive rock-stratigraphic units, each of which extends hundreds or thousands of square miles in the surface and subsurface. All units can be traced eastward into Pennsylvania.

The sandy Mogadore till of Tazewell age crops out near Akron and extends beneath later tills northward in Ohio and eastward into Pennsylvania. All the other units are of Cary age. The silty, sandy Kent till of early Cary age crops out in a large area around the margin of the Grand River lobe and occurs below later till in the central part of the lobe; it extends eastward into Pennsylvania. The Lavery till crops out in a belt as much as 2 miles wide in northern Trumbull and southeastern Ashtabula Counties and the belt widens considerably to the east in Pennsylvania. In Ohio the Lavery till is mainly a subsurface unit. The Windham sand is the outwash equivalent of the Lavery till. The clayey Hiram till of late Cary age is the surface material in the central part of the area formerly covered by the Grand River lobe and extends far westward into the area of the Erie lobe. The Ashtabula till of latest Cary age is the surface material near Lake Erie; it extends across Pennsylvania into New York.

INTRODUCTION

The Wisconsin glacial deposits in northeastern Ohio are made up of several stratigraphic units which can be differentiated and traced from surface and subsurface evidence over hundreds and even thousands of square miles (White and others, 1957; Shepps and others, 1959). Earlier reports have referred to some of these units as "Tazewell," "early Cary," and "late Cary" (White, 1953b; 1953c). In this and more detailed reports in preparation these deposits are more precisely defined as rock-stratigraphic units (table 1, figure 1). The author's classification results from field studies begun in 1949 as part of the cooperative program of the Division of Water, Ohio Department of Natural Resources, and the Ground Water Branch, U.S. Geological Survey. Laboratory studies were supported by two National Science Foundation grants and by grants from the University of Illinois Research Board.

PRE-WISCONSIN DEPOSITS

The Wisconsin drift overlies bedrock or drift of pre-Wisconsin age. South of the border of the Wisconsin drift the pre-Wisconsin drift is interpreted as Illinoian (White, 1951) and is similarly interpreted where it lies below the Wisconsin deposits (White, 1953a, 1953b). Drift of pre-Illinoian age may be at greath depth in buried valleys of early Pleistocene age, but has not been positively identified (Winslow and others 1953).

TABLE 1.—*Wisconsin glacial deposits in northeastern Ohio*

Epoch	Stage	Substage	Unit	Character of Material
Pleistocene	Wisconsin	Cary	Ashtabula till.	Silty to silty-clay till.
			Hiram till	Silty clay to clay till.
			Lavery till	Silty till.
			Windham sand.	Medium to fine sand; outwash equivalent of Lavery till.
			Kent till	Silty, sandy till.
		Tazewell	Mogadore till.	Sandy till.
		Farmdale(?)	Unnamed loess.	

FARMDALE(?) SUBSTAGE

The lower of two loesses found near Cleveland (White, 1953a) is early Wisconsin and on the basis of fossils (Leonard, 1953) may be correlative in age with the loess (Leighton and Willman, 1950) and the till (Shaffer, 1956) of the Farmdale in Illinois. No till corresponding in age to that of this loess is present in northeastern Ohio, and no-rock-stratigraphic name is proposed here for the loess.

TAZEWELL SUBSTAGE

The surface drift is early Wisconsin in the Akron area, in central and southern Summit County, and in small parts of southeastern Medina County and northeastern Wayne County. This drift is less weathered than the Illinoian till in Stark and Columbiana Counties but is more weathered than the Wisconsin till that surrounds it. It can be traced in all directions underneath the later drift, which is interpreted as Cary. This early Wisconsin drift, which is mainly till, is probably Tazewell in age (White, 1953c). However, as it cannot

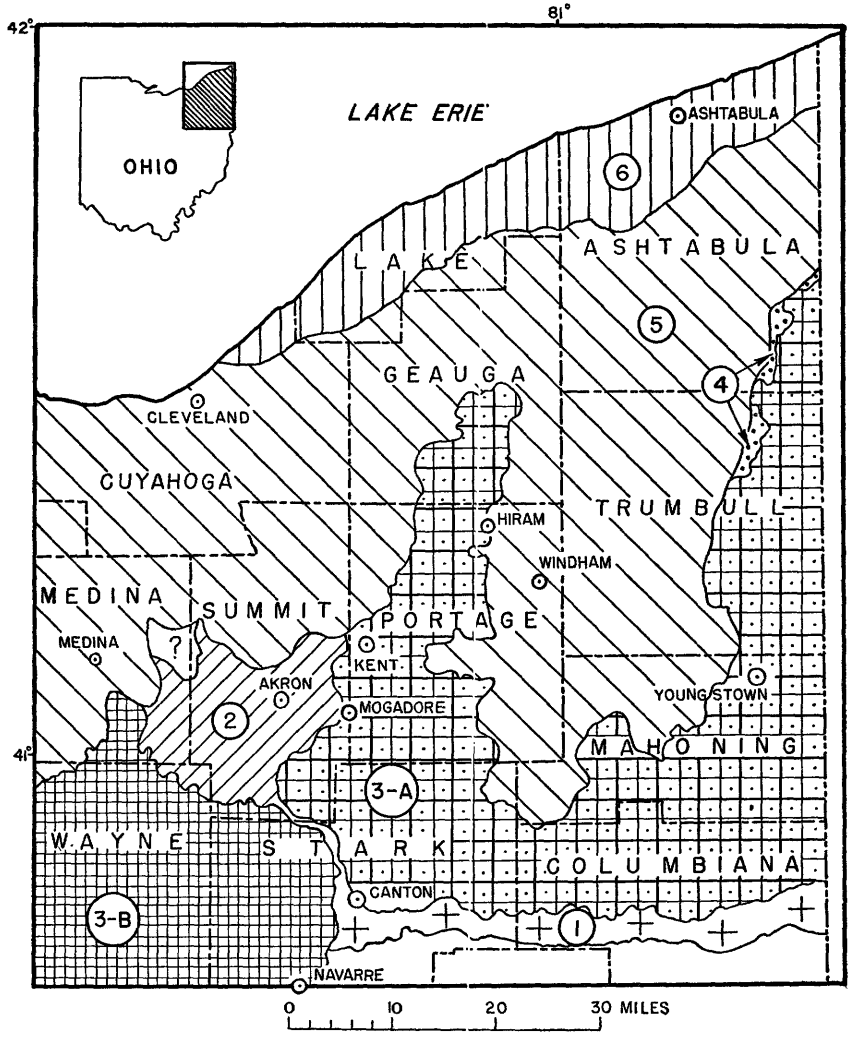

FIGURE 1.—Map showing surface extent of Illinoian drift and Wisconsin rock-stratigraphic units in northeastern Ohio. 1, Illinoian drift; 2, Mogadore till; 3-A, Kent till; 3-B, unnamed till of Killbuck lobe; 4, Lavery till; 5, Hiram till; 6, Ashtabula till.

be traced into the Tazewell drift of Tazewell County, Ill. (Leighton, 1933), it is proposed to apply to it a local rock-stratigraphic term—the Mogadore till.

MOGADORE TILL

The Mogadore till, referred to as Tazewell till by White (1953b) and Shepps (1953), is named from excellent exposures in Summit County, west of the village of Mogadore in Springfield Township, Summit County, and Suffield Township, Portage County.

Following is the type section of the Mogadore till in the south wall of the shale pit of the Universal Clay Products Co., Springfield Township, Summit County, 1 mile west of the center of Mogadore.

Tazewell:

Mogadore till:	Ft	In
Loam, gray-brown	0	7
Loam, dark-yellow	0	5
Loam, silty, pebbly, orange-yellow	7	2
Till, very sandy, pebbly, brown, yellow and gray, much weathered	1	4
Till, sandy, pebbly, noncalcareous, yellow-brown with a few gray stains	3	4
Till, sandy, pebbly, yellow-brown, calcareous	4	4
Till, as above, but mixed brown and blue gray	2	0
Till, sandy, pebbly, blue-gray, calcareous; sand, 60 percent; silt, 27 percent; clay, 13 percent	10	0
	23	2

The Mogadore till is sandy and pebbly. Cobbles and boulders are common. The high sand content is characteristic over the area of outcrop and in the subsurface (Shepps, 1953, fig. 5). The clay minerals are mainly illite and chlorite, but kaolinite is present in small amounts (Droste, 1956a, p. 189; Droste, White, and Vatter, 1958).

The Mogadore till, especially on uplands, generally overlies the bedrock. Till of Illinoian age, at places containing a weathered zone at the top, underlies it unconformably at a very few localities. Where the Mogadore till does not form the surface material it is overlain unconformably by the silty-sandy Kent till.

The Mogadore till is the surface material in southern Summit County and a small part of adjacent Medina and Wayne Counties. In many localities, especially in Portage, Stark, and northern Summit Counties, Mogadore till crops out below later deposits in road cuts, valleys, quarries, and strip mines. It has been traced beneath later till across Portage and Trumbull Counties, and has been found under the Kent till in western Pennsylvania (Shepps[1]; Shepps and others, 1959). The surface expression of the Mogadore till is mainly that of ground moraine, although in Summit County there are several small kame areas (White, 1953c).

Although the Mogadore till has not yet been correlated with drift of the Scioto and Miami lobes farther west in Ohio, it appears to be about the same age as the outer drift of these lobes which has been called Tazewell by Goldthwait (1952, map p. 2a). The Mogadore

[1] Shepps, V. C., 1955, The glacial geology of a part of northwestern Pennsylvania: Illinois Univ., Ph. D. thesis.

till may be correlative with the Olean drift (MacClintock and Apfel, 1944, p. 1162) of New York and north-central Pennsylvania.

CARY SUBSTAGE

Most of the drift in northeastern Ohio is younger that the Mogadore till, and the same age as the Cary drift of northern Illinois (Leighton, 1933). Several distinct sheets have been identified and given rock stratigraphic names to facilitate mapping, description, and discussion of them.

KENT TILL

The Kent till, formerly called "early Cary" (White, 1953b), is named from the city of Kent in western Portage County, in the vicinity of which the till is well exposed.

Following is the section of Kent till measured in an excavation for a sewage pumping station in a school yard on the south side of the Kent-Ravenna road, 4½ miles east of the Kent State University campus, and 1 mile east of the Pennsylvania Railroad overpass, in Ravenna Township.

Cary:

Kent till:	*Ft*	*In*
Loam, silty, gray-brown	0	9
Sand, with clay, brown to reddish-brown	0	11
Clayey loam, yellow-brown with gray stains along joints	1	2
Till, much weathered, brown	1	11
Till, noncalcareous, but not otherwise weathered, yellow-brown	1	0
Till, silty, sandy, moderately pebbly, calcareous, yellow-brown	4	0
Till, silty, sandy, moderately pebbly, calcareous, blue-gray; sand, 29.3 percent; silt, 50.4 percent; clay, 20.3 percent	7	0
Base of excavation.	16	9

The Kent till is silty, sandy, and moderately pebbly. It contains scattered cobbles and a few large boulders. Its yellow-brown color where it is oxidized contrasts with the darker, more drab brown of later tills.

Where its base is exposed the Kent till lies unconformably upon bedrock or the Mogadore till. Where the Kent till does not form the surface material it generally is overlain unconformably by the clayey Hiram till, though in places the Windham sand lies between the two tills. In northern Trumbull and southern Ashtabula Counties the Kent till is generally overlain by the Lavery till, which does not extend south of central Trumbull County.

The Kent till is at the surface in south-central Geauga, eastern

Summit, western Portage, northeastern Stark, northern Columbiana, Mahoning, eastern Trumbull, and southeastern Ashtabula Counties, and extends eastward a considerable distance into Pennsylvania (White and others, 1957; Shepps and others, 1959). It can be identified below later drift in northwestern and eastern Portgage, northeastern Mahoning, and western Trumbull Counties, and also underlies later drift in much of Geauga County (Baker [2]).

Where the Kent till constitutes the surface material near the margin of the Grand River lobe area it is aggregated in knolls as a prominent end moraine (White, 1953b, pl. 26), named the Kent moraine (White, 1957). Within the part of the lobe behind the end moraine the surface expression is that of more subdued ground moraine. Many bodies of sand and gravel are associated with the till in the end moraine; in the ground moraine there are few such bodies.

The Kent till appears to be of the same age as the outermost till of the Killbuck lobe, which occurs in western Stark County and in an as yet undetermined part of Wayne County. A name for this till of the Killbuck lobe will be proposed at the conclusion of detailed studies in progress. The Kent till is correlative with the "early Cary" drift of the Scioto and Miami lobes (Goldthwait, 1952, map, p. 2a), and with the Binghampton drift of western New York (MacClintock and Apfel, 1944, p. 1162).

LAVERY TILL

The surface material in a narrow belt, up to 2 miles wide, in northern Trumbull and southeastern Ashtabula Counties is till of somewhat finer grain than the Kent till to the east and south. The till surface has the form of an end moraine, called the Lavery moraine (Shepps and others, 1959, p. 38) for the crossroads of that name 1 mile west of the east line and 2 miles north of the south line of Elk Township, Erie County, Pennsylvania. The till is also named the Lavery till.

The Lavery till covers a wider belt in Pennsylvania, where it has been described by V. C. Shepps [3] and by Shepps and others (1959).

The Lavery till is underlain unconformably by the Kent till, and is overlain unconformably by the Hiram till, except in the small area where it constitutes the surface material. The Lavery till lies beneath later drift in southern Ashtabula County, in central and northern Trumbull County, and probably also in eastern Geauga County.

In Ohio the Lavery till exposed at the surface is part of an end moraine, most of which is covered by till (Hiram) of a later advance. The end moraine disappears beneath the surface in central Trumbull County, but its form, as well as the Lavery till itself, can be traced

[2] Baker, Jack, 1957, Glacial geology of Geauga County, Ohio: Illinois Univ., Ph. D. thesis.

[3] Shepps, op. cit.

westward across Trumbull County to about the common corner of Portage, Geauga, and Trumbull Counties. From this point the moraine has been traced under cover northwest and north into Geauga County (Baker [4]). The course across Trumbull County to Geauga County is beneath the Defiance moraine as mapped by Leverett (1931, fig. 8). This part of the Defiance moraine, which at the surface is made up of Hiram till, owes some of its form to the buried moraine of Lavery till.

The Lavery till has not been traced continuously west of the Grand River lobe. Subsurface material in northern Summit County and till at the surface in adjacent east-central Medina County seem to belong to the same episode of ice advance in which the Lavery till was deposited farther east. Work in progress suggests the possibility that the Lavery till can be correlated with drift of the Scioto and Miami lobes. This drift is older than that of the Fort Wayne and Wabash moraines and constitutes part of the drift called "middle Cary" by Goldthwait (1952, map. p. 2a).

WINDHAM SAND

An outwash sand, here named the Windham sand, is associated with buried Lavery till and extends south of the till into central and western Trumbull County and northeastern Portage County.

The type section is in the sand pit of the Miller-Dutter Sand and Gravel Co., 2 miles northeast of the village of Windham, 1 mile west of the east line of Windham Township and 1¼ miles south of the north line of the township, ¼ mile south of the Erie Railroad and 100 yards south of the Garrettsville-Warren road, Windham Township, Portage County.

	Ft	*In*
Cary:		
Hiram till:		
Fine silt loam, dark-gray	0	7
Heavy clay loam, tan	0	7
Till, clayey, sparingly pebbly, partly weathered, noncalcareous, drab-brown; a little sand in lower part	2	2
Windham sand:		
Sand, ranging from coarse to fine; a few granules; cut and fill bedding; brown and gray; calcareous in part	11	0
Kent till:		
Till, silty, sandy, moderately pebbly, yellow-brown, calcareous; sand, 22 percent; silt, 49 percent; clay, 29 percent	5	0
Till, silty, sandy, moderately pebbly, blue-gray, calcareous; sand, 23 percent; silt, 47 percent; clay, 30 percent	4	0
Base of pit.	23	4

[4] Baker, op. cit.

The Windham sand has been traced from the buried Lavery till in the core of the Defiance moraine in Champion and Southington Townships, Trumbull County, and Nelson Township, Portage County, southward 10 miles into Warren, Braceville, and Newton Townships, Trumbull County, and Windham and Paris Townships, Portage County.

The Windham is generally a medium-grained sand. It is coarse grained and contains a few pebbles near the Defiance moraine; it is fine grained and silty several miles south of the moraine. The Windham sand generally is 4 to 6 feet thick, but varies considerably from these thicknesses; in depressions on the pre-Windham surface it is 30 feet or more thick, as shown by well records.

The Windham sand was deposited by shallow, anastomosing streams on an outwash plain, and in shallow extensive pools. In places the upper part of the sand has been reworked by wind.

The Windham sand lies unconformably upon the Kent till and is generally overlain by the Hiram till. In small areas the Hiram till is very thin or absent and the sand constitutes the surface material.

HIRAM TILL

The Hiram till, formerly referred to as "early Cary" (White, 1953b) is named from the village of Hiram, Hiram Township, Portage County, near which the unit is well exposed.

The type section is in northern Hiram Township, in a road cut 100 yards east of Silver Creek and ½ mile east of the intersection of an east-west road and the Hiram-Welshfield road, 1½ miles north of Hiram village.

	Ft	In
Cary:		
Hiram till:		
Silt, loam, dark-gray	0	6
Silt loam, light-yellow	0	4
Clay loam, dark-yellow and gray	0	5
Till, much weathered, soft, brown, with yellow stains, leached	1	3
Till, drab-brown, noncalcareous; much manganese staining	0	10
Till, drab-brown, silty, clayey, sparingly pebbly, calcareous; 10.5 percent sand, 37.5 percent silt, 52 percent clay	3	8
Clay, plastic, olive-brown; strong calcite stains	0	3
Kent till:		
Till, yellow-brown, silty, sandy, calcareous; 45.5 percent sand, 41 percent silt, 13.5 percent clay	1	6
	8	9

The Hiram till is exposed also in road cuts in the eastern part of Hiram Township and along the Erie Railroad cuts in the south-central part of the township west of Hiram Station.

The Hiram is a clay-rich till, sparingly pebbly, and contains few cobbles and very few boulders. Its texture over part of the area has been described by Shepps (1953), who refers to it as "late Cary"; its clay minerals have been described by Droste (1956a; 1956b), and its microfabric by Sitler and Chapman (1955, fig. 6).

The Hiram till generally is thin; at many places it is less than 10 feet thick. West of the Grand River lobe the till is thicker, particularly in parts of Cuyahoga and Medina Counties, where it may be 20 to 30 feet thick or even thicker.

The Hiram till generally is underlain unconformably by the Kent till in the southern part of the Grand River lobe area. However, in east-central Portage County and west-central Trumbull County the Windham sand intervenes between the two tills. In the region of the Defiance moraine in southeastern Geauga, northeastern Portage, west-central Trumbull and southern Ashtabula Counties the Lavery till is below the Hiram till. In western Geauga and northwestern Portage Counties the Kent till of the Kent moraine lies below the Hiram till. The Hiram till passes under the Ashtabula till in Lake and northern Ashtabula Counties. In the Grand River valley in northwestern Trumbull County and in Ashtabula County lacustrine clay of variable thickness overlies the Hiram till. The stratigraphic relations are well shown in road cuts in Southington Township, Trumbull County, where the clay is 1 to 4 feet thick.

The Hiram till constitutes the surface material in the central part of the Grand River lobe area in northwestern Columbiana, extreme northeastern Stark, eastern Portage, northwestern Mahoning, central and western Trumbull, eastern Geauga, and much of Ashtabula Counties. The Hiram till can be traced from the Grand River lobe area westward across Geauga County into Cuyahoga, northwestern Portage, northern Summit, and northern Medina Counties, where it is part of the deposits of the Erie lobe, in sublobes called "Cuyahoga" and "Medina" (Shepps, 1953, fig. 1). The Hiram till extends west of Medina County and has been noted in Ashland, Richland, and Huron Counties, but here it has not been traced in detail. The Hiram till has been traced also into Crawford and Erie Counties, Pa.

The surface of the Hiram till is mainly that of gently undulating to flat ground moraine, except for the Defiance end moraine, the upper part of which is composed of Hiram till.

The Hiram till is late Cary in age. It is correlative and continuous with the till of northwestern Ohio called "late Cary" by Goldthwait (1952, map).

ASHTABULA TILL

The Ashtabula till is named from the city of Ashtabula, Ashtabula County, near which the unit is well exposed.

The type section of the Ashtabula till was measured in a road cut at the top of the bluff on the east side of the valley of the Ashtabula River at the Plymouth-Sheffield Township line, 1 mile south of the northwest corner of Sheffield Township and 3 miles east of the southeast corner of the Ashtabula corporation line.

Cary:

Ashtabula till:	Ft	In
Fine silt loam, gray-brown	0	7
Fine silt loam, tan	0	3
Silty clay loam, blocky, gray and brown	0	7
Till, much weathered; upper part stained gray and yellow	0	11
Till, as below, noncalcareous	1	5
Till, silty, clayey, brown, moderately pebbly; rough horizontal fracture; calcareous	5	9
Till, as above, blue-gray; sand, 22.5 percent; silt, 48.5 percent; clay, 29 percent	10	0
Road level.	19	6

The Ashtabula till is the surface material immediately south of Lake Erie, extending in a continuous belt 2 to 8 miles wide from eastern Cuyahoga County across Lake and Ashtabula Counties into Pennsylvania and thence into New York.

The Ashtabula till crops out extensively in the upper walls of the valleys of Conneaut Creek and the Ashtabula River in northern Ashtabula County and in the valley walls of the Grand River in northeastern Ashtabula County and in Lake County.

The Ashtabula till is a silty, clayey till, sparingly to moderately pebbly and containing a few cobbles and scattered boulders. The texture generally is somewhat less clayey than that of the Hiram till. The thickness of the Ashtabula till generally is more than 25 feet and probably exceeds 50 feet in many places.

The Ashtabula till overlies bedrock; the Hiram till; or, in several places where the Hiram till is absent, an earlier, coarser till. At some place a thin layer of silt lies between the Ashtabula till and this coarser till below. It is expected that more detailed studies of the high bluffs of the river valleys and the Lake Erie shore will provide further stratigraphic details. In the northern part of the area underlain by the Ashtabula till, lacustrine sand and silt unconformably overlie the till in considerable areas.

The surface expression in the southern part of the area of Ashtabula till is that of a series of end-moraine ridges. These are part of

the Lake Escarpment moraine system of Leverett (1902, pl. 15, p. 651). Leverett applied the name "Ashtabula moraine" to one of the major parts of the system (p. 652); but this name, with its definite geographic reference, would be more appropriate for the whole system. Detailed work in Pennsylvania (Shepps and others, 1959) and in New York (Muller, 1957) shows that the moraine system on the lake escarpment there includes not only elements originally defined by Leverett as "Lake Escarpment" but also at least two other elements, the Defiance and Lavery moraines formed by the Hiram and Lavery tills. The northern part of the area of Ashtabula till is a lake plain from which constructional features have been removed by wave erosion of the glacial Great Lakes.

The Ashtabula till is the youngest glacial deposit in Ohio. It is interpreted as very late Cary in age; it is definitely younger than the Defiance moraine but is pre-Valders or Port Huron, as shown by the relation of the glacial-lake beaches to the Ashtabula moraines and the lake escarpment (Hough, 1958, figs. 35, 57, 58). The Ashtabula till is correlated with the material of the Valley Heads moraines in New York (MacClintock and Apfel, 1944, p. 1160; Muller, 1957).

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