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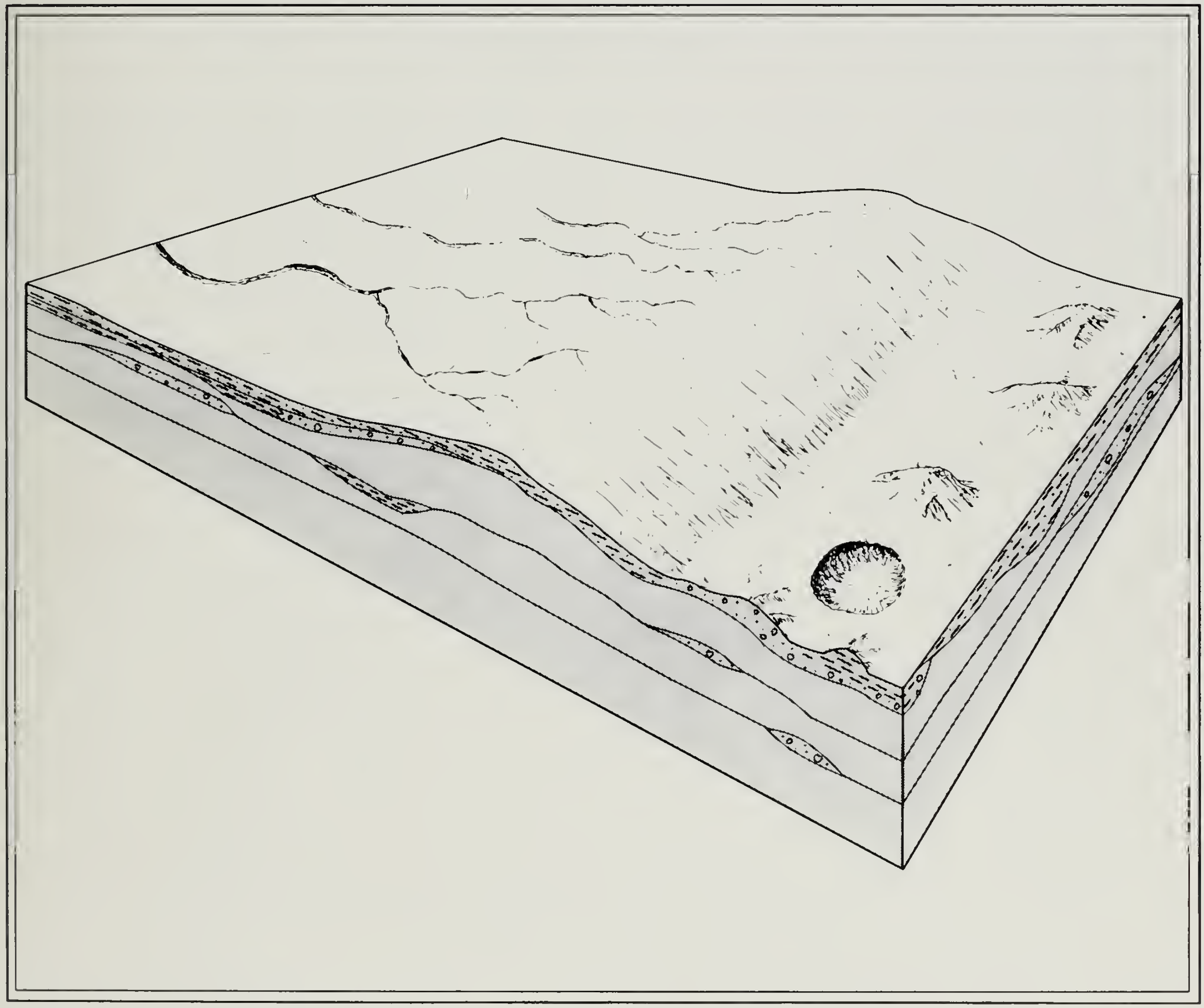
GLACIAL GEOLOGY OF NORTH-CENTRAL AND WESTERN CHAMPAIGN COUNTY, ILLINOIS

Jerry T. Wickham



ILLINOIS STATE GEOLOGICAL SURVEY DIVISION, URBANA, ILLINOIS
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Cover Illustration: A two-point perspective block diagram illustrating a typical landscape association in Champaign County. The strata depicted represent the sequence of Woodfordian glacial deposits underlying the region.

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GLACIAL GEOLOGY OF NORTH-CENTRAL AND WESTERN CHAMPAIGN COUNTY, ILLINOIS

Jerry T. Wickham

ABSTRACT

The glacial deposits of Woodfordian age in north-central and western Champaign County, Illinois, include four members of the Wedron Formation: the Oakland Till Member, Fairgrange Till Member, Piatt Till Member (new), and Batestown Till Member.

The Piatt Till Member, the surficial till in western Champaign County, occurs in a variety of ice-marginal landforms in that area. One former ice margin is represented by the Cerro Gordo Moraine, which grades northward into two subparallel sets of stagnant ice features, which in turn grade into the Rantoul Moraine. The Rantoul Moraine is a buried feature in the northern portion of the study area where Batestown Till overlaps the Piatt Till. The overlapping Batestown Till is thinner on the Rantoul Moraine than in adjacent areas, where it forms a ground moraine.

The two surficial till units within the study area, the Piatt and Batestown Till Members, were probably deposited by the same sublobe of ice. The ice repeatedly advanced into and melted from Champaign County along ice margins which varied highly in their configurations. Each readvance was less extensive than the preceding advance.

A comparison of ice-marginal configurations to clay mineral and textural data and to some trend surface analyses indicates that each readvance of the Woodfordian ice front was also characterized by deposition of till with a different composition from till deposited during the previous readvance. The differences in composition range from changes that are recognizable only statistically in laboratory data to changes that are recognizable in the field.

INTRODUCTION

This study has examined in detail many of the geomorphic and stratigraphic features of the Woodfordian drift in a small part of Champaign County, Illinois. The study confirms many of the basic concepts proposed by previous workers in the area. The narrow scope of this study, however, allowed refinement of the glacial history and indicated that the geomorphology and stratigraphy of the study area are not as clear-cut as previous studies may have suggested, when viewed in greater detail.

The exclusive use of end moraines for delineating ice margins in east-central Illinois provides only general information on deglaciation. The detailed mapping of other features, such as minor ridges, ablation deposits, and outwash sediments, provides evidence for a series of former ice margins subparallel to and grading into end moraines.

A series of ice marginal features in western Champaign County displays evidence of closely-spaced changes in the types of glacial features deposited along the ice margin. Depositional changes at the margin are also apparent along the Urbana Moraine, where a series of ablation features grade into the back side of the Urbana Moraine.

The pattern of ice marginal deposition in the study area indicates that the Woodfordian ice sheet markedly reoriented its margin between advances. The major configurational changes may not represent major withdrawals and readvances as previously assumed. Based on the sets of interconnected ice marginal features in the study area, it appears that on at least two occasions, the Woodfordian ice margin changed its configuration over a relatively short distance. Also, the lack of oxidation between three of the drift units suggests a short time-interval between advances.

The morphology of end moraines is not always obvious from topographic expression alone. For example, the Rantoul Moraine was constructed during deposition of the Piatt Till Member. A later ice advance, related to the Batestown Till, established a position over the northern portion of the Rantoul Moraine. Batestown Till was deposited as a thin veneer over Piatt Till while the cross-sectional profile of the Rantoul Moraine remained similar to many Woodfordian end moraines in east-central Illinois. Subsurface data from wells in the Pesotum and Champaign Moraines suggest that the lower till units may also occur at topographically high positions beneath these moraines. In relating these findings to other end moraines in Illinois, it is apparent that moraine morphology and configuration can present misleading evidence when viewed on too broad a scale or with insufficient subsurface data.

The study area, located primarily in Champaign County about 40 miles (64 km) north of the southern limit of Woodfordian-aged drift (fig. 1), includes the north-central and western part of the county and a small area in eastern Piatt County. At present, most of Champaign County is under row crop cultivation, but prior to the arrival of white settlers, the area supported woodlands along the major streams, and tall prairie grasses covered most of the upland areas.

Glacial deposits of the Kansan, Illinoian, and Wisconsinan Stages are present in the study area. These deposits span approximately 600,000 years of glacial episodes separated by long interglacial periods. The combined thickness of these glacial deposits in the study area ranges from a minimum of approximately 100 feet (30 m) to a maximum of greater than 300 feet (91 m) (Piskin and Bergstrom, 1975). Only the upper two till units and their associated deposits representing a portion of the Woodfordian Substage of the Wisconsinan Stage have been investigated for this study.

Methods

Samples taken from subsurface borings were analyzed for grain size and clay mineral content. Results of the textural analyses are presented in the appendix as percentages of sand (2.00 to 0.62 mm), silt (0.62 to .004 mm), and clay (less than .004 mm). The clay mineral composition of the less than 2-micrometer fraction of 97 samples was determined using an oriented aggregate X-ray diffraction method. Results of the clay mineral analyses are presented in the appendix in terms of percentages of expandable clay minerals, illite, and chlorite plus kaolinite.

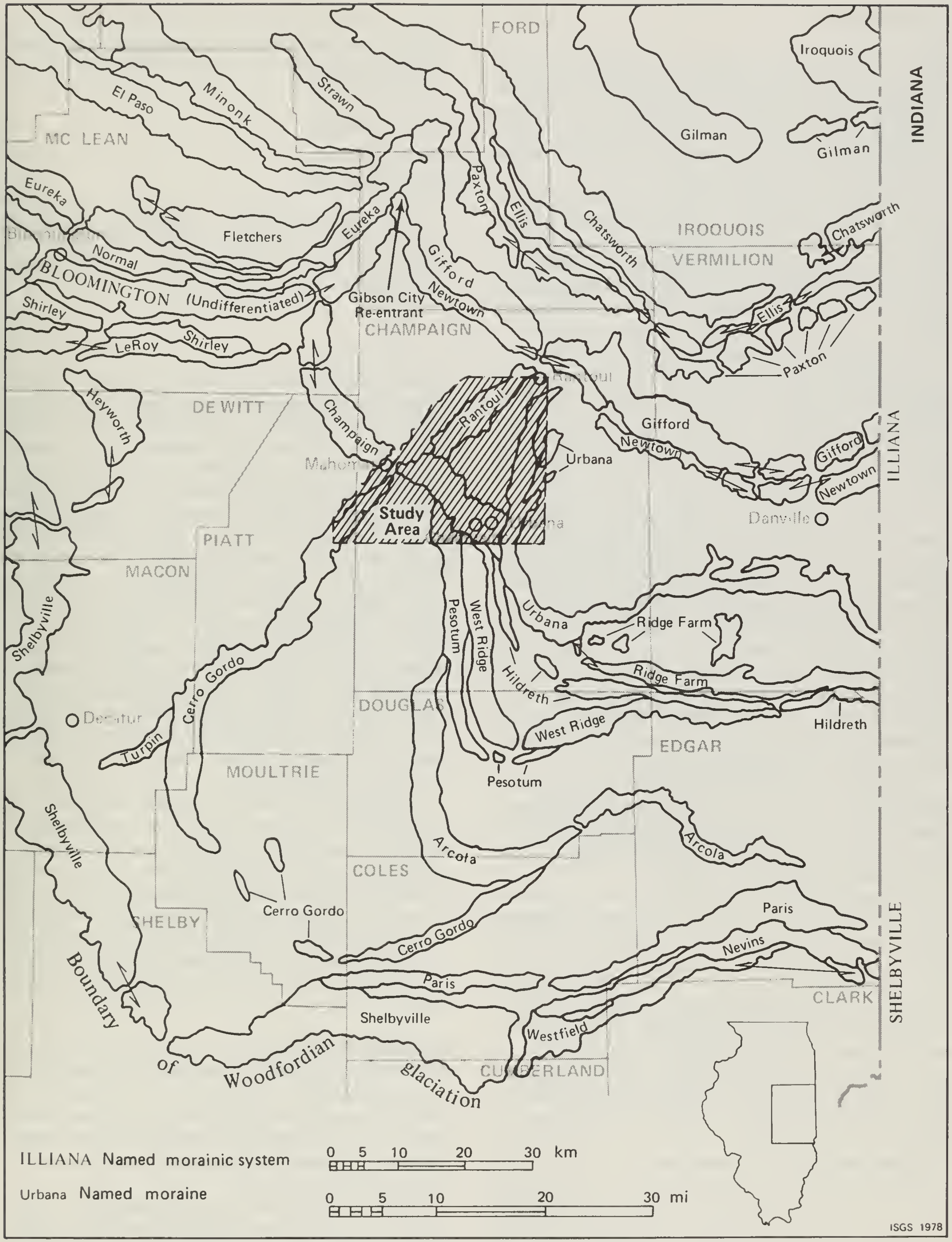

Figure 1. Study area in relation to Woodfordian moraines in Illinois (after Willman and Frye, 1970).

Previous work

One of the earliest investigators of glacial deposits in Champaign County was Frank Leverett, who named the Champaign Moraine (1897) and the West Ridge Moraine (1899). Savage (1931) included a broad discussion of the Pleistocene deposits of Champaign County in his report on the geology of Champaign County.

Horberg (1953) drew a north-south cross section of the Pleistocene deposits in Champaign County and decribed an exposed section in western Champaign County. George E. Ekblaw did extensive work in Champaign County, most of which was not published. Ekblaw named the Urbana Moraine in a 1960 revision of his 1941 glacial map.

Anderson (1960) mapped the sand and gravel resources of Champaign County. He discussed the glacial history of the surficial deposits in the county based on trends of moraines and drainage development in the area. He also noted the occurrence of laminated lake silts west of the Urbana Moraine, which indicated the presence of a glacial lake.

Gaudette (1962) compared grain sizes of till samples from the Champaign Moraine with till samples from the Urbana Moraine. He found that till from the Champaign Moraine had a mean matrix texture of 24 percent sand, 46 percent silt, and 30 percent clay, whereas till from the Urbana Moraine had a mean matrix texture of 32 percent sand, 46 percent silt, and 22 percent clay. Based on this textural difference and the apparent truncating contact of the Urbana Moraine with the Champaign Moraine, Gaudette concluded that the Urbana Moraine represents a major reorientation and readvance of the glacial margin following the formation of the Champaign Moraine.

Willman and Frye (1970) outlined the Pleistocene stratigraphy of Illinois using multiple stratigraphic classifications. They discussed each of the moraines within the study area using morphostratigraphic units which are based on sediments related to each moraine.

Johnson, Gross, and Moran (1971) named the Batestown Till Member of the Wedron Formation in east-central Illinois. Near the type section, 20 miles (32 km) east of the study area, the Batestown Till Member is a gray loam till with an average matrix texture of 28 percent sand, 38 percent silt, and 34 percent clay and an average clay mineral composition of 3 percent expandables, 79 percent illite, and 18 percent chlorite plus kaolinite.

Kempton, DuMontelle, and Glass (1971) correlated three Wisconsinan till units in McLean County across the Gibson City interlobate reentrant to the Champaign-Urbana area. Units 2 and 3 in that study correspond to two surficial till units in the study area.

Hooten (1973) described stagnation of the Batestown ice sheet in eastern Champaign County. He cited the frequent presence of ablation materials on top of the Batestown Till and the presence of circular and linear ridges in the area as evidence for stagnation. Hooten also discussed the development of a drift-impounded glacial lake which he related to the retreat of the last ice sheet to cover the area.

STRATIGRAPHY

Wedron Formation

The Wedron Formation as defined in Frye et al. (1968) includes all Woodfordian-aged tills within the study area (fig. 2). Outwash deposits under or within the Wedron are included in the formation.

Oakland Till Member. The Oakland Till Member (Ford, in preparation), a reddish-brown to grayish-brown loam till, occurs as the basal Wedron till in east-central Illinois and is overlain by the Fairgrange Till Member (Ford, in preparation). The till has an average matrix texture of 36 percent sand, 42 percent silt, and 22 percent clay in the type area in Coles County, Illinois. Comparison of limited data in western Champaign County with Ford's data for Coles County has shown that the till contains less sand and more silt and clay in the study area (table 1). In the McLean County region, the Oakland Till was termed unit 5 by Kempton, DuMontelle, and Glass (1971) (table 1). The Oakland Till Member can normally be separated from other Wedron Formation till members by its higher percentage of expandable clay minerals in the clay-sized fraction. Ford listed a typical clay mineral composition of 25 percent expandable clay minerals, 59 percent illite, and 16 percent chlorite plus kaolinite. Wood fragments are commonly found in the Oakland Till.

The Oakland Till Member has been recognized in the subsurface in an area extending from Coles County to southern McLean County. The unit does not occur as a surficial till but locally is exposed below younger tills in stream cuts. Ford interpreted the Oakland Till to be related to the same ice advance as the overlying Fairgrange Till. He suggested that the lithologic distinction between the two tills was the result of incorporation of silts, organic silts, and peat of the underlying Robein Silt into the Oakland.

Fairgrange Till Member. The Fairgrange Till Member stratigraphically lies between the Oakland Till Member and the overlying Piatt Till Member. The Fairgrange Till is typically pinkish brown to pinkish gray and has a loam texture. It can be separated from the other three Wedron tills in the study area by its distinctive pinkish hue and by lithologic differences (fig. 2).

Within the study area, the Fairgrange has an average matrix texture of 30 percent sand, 38 percent silt, and 32 percent clay. Clay mineral composition of the till averages

TIME STRATIGRAPHY			ROCK STRATIGRAPHY			
QUATERNARY SYSTEM, PLEISTOCENE SERIES	Wisconsinan Stage	Woodfordian Substage	Equality Formation	Henry Formation	Richland Loess	
					Wedron Formation	Batestown Till Member Color: 2.5Y 5/4 lt. olive brown (oxidized) 5Y 5/1 gray (unaltered) Mean matrix texture: 28% sand 42% silt 30% clay Mean clay mineral content: 3% exp.* 79% illite 18% chlorite/kaolinite
						Piatt Till Member Color: 2.5Y 5/4 lt. olive brown with an orange tint (oxidized) 5Y 4/1 gray to violet gray (unaltered) Mean matrix texture: 38% sand 33% silt 29% clay Mean clay mineral content: 4% exp. 74% illite 22% chlorite/kaolinite
						Fairgrange Till Member Color: 7.5YR 5/4 brown (oxidized) 7.5YR 4/2 dark brown (unaltered) Mean matrix texture: 30% sand 38% silt 32% clay Mean clay mineral content: 12% exp.* 68% illite 20% chlorite/kaolinite
						Oakland Till Member Color: dark brown (no typical Munsell color) Mean matrix texture: 29% sand 45% silt 26% clay Mean clay mineral content: 31% exp.* 52% illite 17% chlorite/kaolinite

ISGS 1978

*exp. is expandable clay minerals (clay minerals which expand to 17 Å (1.7 nm) upon glycolation).

Figure 2. Time- and rock-stratigraphic classifications of the Pleistocene deposits of the study area.

Table 1. Clay mineral and textural compositions of the Wedron Formation till units from various studies in east-central Illinois.

Till units	Champaign County[a]		McLean County[b]		Coles County[c]	
	Clay mineral composition[d]	Texture[e]	Clay mineral composition	Texture	Clay mineral composition	Texture
Batestown Till Member	3-79-18	28-42-30	3-79-18	27-45-28	3-79-18	34-41-25[f] 27-41-25[g]
Piatt Till Member	4-74-22	38-33-29	6-76-18	39-38-23	Not identified in Coles County	
Fairgrange Till Member	12-68-20	30-38-32	8-70-22	30-40-30	11-69-20	30-40-30
Oakland	31-52-17	29-45-26	20-59-21	24-54-22	25-59-16	36-42-22

[a] This study
[b] Kempton, DuMontelle, and Glass (1971)
[c] Ford, in preparation
[d] Clay mineral composition represents percentages of expandables, illite, and chlorite/kaolinite, respectively.
[e] Texture is percentages of sand, silt, and clay, respectively.
[f] East
[g] West

12 percent expandables, 68 percent illite, and 20 percent chlorite plus kaolonite. These values correspond closely to data obtained for Fairgrange Till near the type locality in Coles County (Ford, in preparation) and data for unit 4 in the McLean County region (Kempton, DuMontelle, and Glass, 1971) (table 1).

The Fairgrange Till Member forms the southern boundary of Woodfordian glaciation in Coles County and may be equivalent to the Delavan or Tiskilwa Till Members (Willman and Frye, 1970) to the northwest or the Glenburn Till Member (Johnson, Gross, and Moran, 1971) to the east, or all three.

Piatt Till Member. The Piatt Till Member of the Wedron Formation is named herein for Piatt County, Illinois. The type section is the Mahomet I-74 Bridge Section (Appendix 1).

The Piatt is a gray loam till somewhat similar to the overlying Batestown Till in appearance. The Piatt Till can usually be distinguished from Batestown Till by its higher sand content (35-42 percent), and lower illite content in the clay fraction (71-76 percent), and sometimes by a pink or violet cast (table 2). The pinkish cast is probably the result of incorporation of underlying pink and reddish-colored tills. Upon weathering, the Piatt Till may develop a light brown or slightly orange hue depending on the color of the original unoxidized till.

Stratigraphically, the Piatt Till lies between the Fairgrange and overlying Batestown Till Members. The unit has previously been identified as Unit 3 in the McLean County region by Kempton, DuMontelle, and Glass (1971) (table 1). The Piatt Till occurs as the surface till in Piatt, Moultrie, western Champaign, western Douglas, northeastern Shelby, eastern Macon, eastern Dewitt, and southeastern McLean Counties (Lineback, 1975). Till with a clay mineral composition similar to that of the Piatt was recognized in Coles County but was not named by Ford (in preparation). Ford noted that the surface till south and west of the Arcola Moraine had a clay mineral composition different from that of the till on and north of the moraine, but included all surficial gray till in the Batestown Till Member.

Borings on the University of Illinois campus have frequently revealed zones of lacustrine sediments, sand and gravel, and texturally variable till within the stratigraphic interval of the Piatt Till Member. These deposits within the Piatt Till appear to be localized in extent. The significance of the variable zones is that they perhaps represent a rapid ablation phase of the Piatt ice sheet.

Texturally, the Piatt Till averages 38 percent sand, 33 percent silt, and 29 percent clay in the less than 2 mm size fraction over the entire study area. The mean matrix texture varies from this value over an area surrounding the southern extension of the Rantoul Moraine. In that area, the Piatt Till Member has an average matrix texture of 33 percent sand, 35 percent silt, and 32 percent clay (fig. 3). The textural variation on the Rantoul Moraine does not appear to be part of a smooth, monotonic trend but may be the result of localized variations in regimen of the ice or changes in source material.

A comparison of these variations in the textural data with clay mineral data shows no obvious correspondence between the two. The Piatt Till maintains an average clay mineral composition of 4 percent expandables, 74 percent illite, and 22 percent chlorite plus kaolinite for unaltered till samples throughout Champaign County.

For altered till samples, the clay mineral composition changes upward in the weathering profile and should not be used for stratigraphic purposes. With oxidation of the

Table 2. Textural and clay mineral composition of the upper rock-stratigraphic and morphostratigraphic units in the study area.

	Matrix grain size (%)									Clay mineral composition[a] (%)								
	Sand			Silt			Clay			Expandables			Illite			Chlorite & Kaolinite		
Location	X[b]	SD[c]	N[d]	X	SD	N	X	SD	N	X	SD	N	X	SD	N	X	SD	N
ROCK-STRATIGRAPHIC UNITS																		
Batestown Till	28	3.0	181	42	4.3	181	30	4.7	181	3	0.9	67	79	2.2	67	18	2.6	67
Piatt Till	38	3.4	106	33	3.3	106	29	4.0	106	4	1.9	64	74	2.4	64	22	2.4	64
MORPHOSTRATIGRAPHIC UNITS																		
Urbana Drift	30	2.3	29	39	3.2	29	31	2.6	29	2	0.6	14	78	1.4	14	20	2.1	14
Champaign Drift	27	3.0	144	43	3.8	144	30	4.8	144	3	0.9	53	79	2.4	53	18	2.6	53
Pesotum Drift	28	1.1	8	34	4.1	8	38	3.7	8	-	-	-	NO DATA		-	-	-	-

[a]Clay mineral compositions were determined from unaltered calcareous till samples.
[b]X=mean.
[c]SD=standard deviation.
[d]N=number of samples.

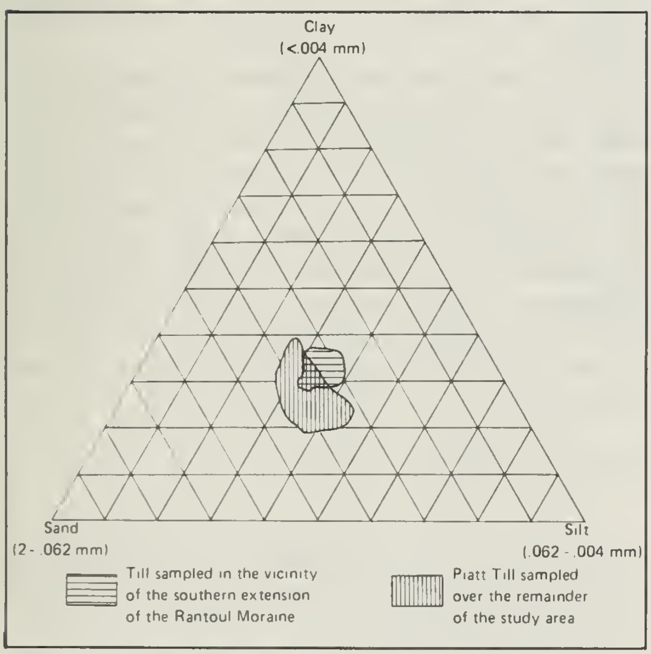

Figure 3. Triangular diagram showing the matrix textures of the Piatt Till Member in the study area.

till, the amount of chlorite decreases but with no proportional increase in expandables. The result is an apparent upward increase in the percentage of illite and a decrease in the percentage of chlorite and kaolinite in the till weathering profile. For clay mineral averages, only unaltered till composition should be used.

Batestown Till Member. The surficial till in the northern portion of the study area correlates with the Batestown Till Member named by Johnson, Gross, and Moran (1971). The unit has been identified as Unit 2 in the McLean County region (Kempton, DuMontelle, and Glass, 1971) (table 1). The Batestown is a gray loam till altering to a light olive brown where oxidized. The unit overlies the Piatt Till and is the surficial till throughout the northern portion of the study area. North of the study area, it is overlain by the Snider Till Member (Johnson, Gross, and Moran, 1971) which forms the Illiana Morainic System.

As indicated in table 1, the Batestown Till is siltier than the Piatt Till and has a higher illite content. The Batestown also normally has a lower calcite content in the clay fraction. Anomalous pink zones of highly calcareous material frequently occur in the upper part of the Batestown Till throughout the Champaign-Urbana region (Sharp, 1974).

Northwest of the study area, the Batestown Till Member takes on a silty clay loam texture (McKay, unpublished data). The transition from a loam to a silty clay loam till appears to be abrupt, with the boundary occuring parallel to and near the northwestern boundary of the study area.

Within the study area, the Batestown Till Member can be subdivided into three texturally distinct units. These units generally conform to existing morphostratigraphic units defined by Willman and Frye (1970), which in the study area are: Pesotum Drift, Champaign Drift, and Urbana Drift (table 1; fig. 4). Second-order trend surfaces of percentages of sand, silt, and clay calculated for the Batestown Till Member and one of the subdivisions within the Batestown Till Member, the Champaign Drift, indicate that the textural break between the Champaign Drift and the Urbana Drift occurs abruptly along the front of the Urbana Moraine. This relationship strongly suggests that Batestown Till of the Urbana Drift was deposited as a texturally distinct unit over Batestown Till of the Champaign Drift. Color, clay mineral composition, and less than 2 micrometer carbonate content of the Champaign and Urbana Drifts are identical.

Limited data are available for the Pesotum Drift, but based on textural analyses of 8 samples, the Pesotum Drift has an average texture of 28 percent sand, 34 percent silt, and 38 percent clay. No clay mineral or carbonate content data are available for Pesotum Drift, but field descriptions including color, structure, and weathering characteristics make no differentiation between Pesotum and other drifts.

The textural differences noted above are difficult to recognize in the field and are not adequate for rock-stratigraphic differentiation. The significance of the differences lies in their implication of separate depositional events related to the moraines in the study area.

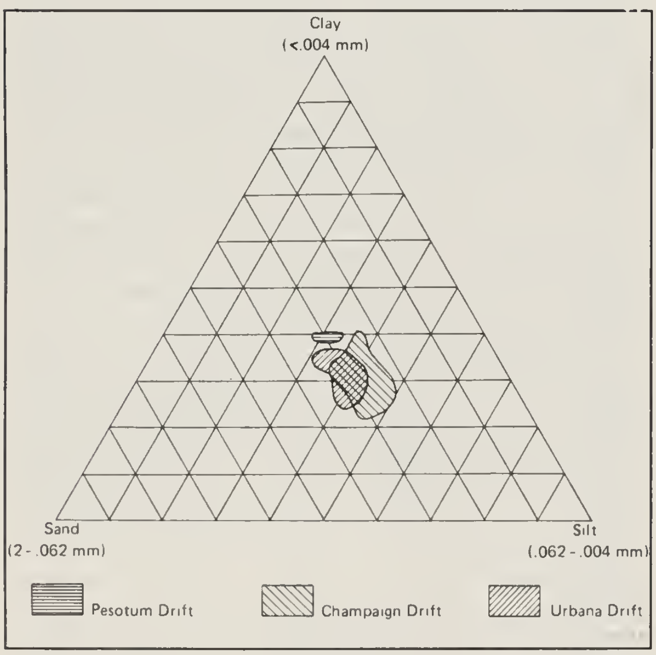

Figure 4. Triangular diagram showing the matrix textures of the Batestown Till Member with subdivision into morphostratigraphic units.

Equality Formation

The Equality Formation consists of lacustrine silts and clays overlain by loess or Holocene deposits. The Equality Formation can be separated from overlying loessial silts and clays by its lower expandable clay mineral content and by the presence of intercalated outwash sediments. A thin layer of Equality Formation (ranging from 0 to 10 feet [3 m]) underlies much of the study area north of Urbana, Illinois. Within the study area the Equality Formation typically consists of silt (70-80 percent) and minor amounts of sand and clay. Lacustrine sediments in the area commonly show an increase in expandable clay mineral content upward in the lacustrine sequences (Hooten, 1973). This is due to the fact that the early lake sediments were derived mainly from till sources close to the ice which had a low expandable clay mineral content while later sediments were derived from incoming loess, which had a high expandable clay mineral content.

Henry Formation

The Henry Formation (Willman and Frye, 1970) consists of outwash sand and gravels and is overlain by either the Richland Loess or Holocene deposits. Although subdivided elsewhere (Willman and Frye, 1970), the Henry Formation as used in this study includes all surficial deposits of sand and gravel. The Cahokia Alluvium (Willman and Frye, 1970) is also included in the Henry Formation for mapping purposes.

The Henry Formation is thickest along the Sangamon River where it occurs as a valley train deposit (fig. 5). Sand and gravel of the Henry Formation occur similarly along Saline Branch. A thin blanket of outwash (0-10 feet [0-3 m]) covers a large area west of Champaign (fig. 5). This sheet of outwash thickens in proximity to the frontal slopes of the Champaign and Pesotum Moraines and becomes thinner away from the moraines. Overlying, or in some cases interbedded with this thin layer of outwash, are patchy slackwater deposits of the Equality Formation.

Richland Loess

The Richland Loess (Frye and Willman, 1960) consists of loessial silt overlying till of the Wedron Formation, outwash of the Henry Formation, or silt of the Equality Formation. Richland Loess has the Modern Soil developed in its upper portions and is present throughout the study area, averaging around 3.3 feet (1.0 m) in thickness.

The term *loess* in this case is applied to silty materials which are primarily wind-blown in origin or derived from wind-blown sediments. Much of the material identified as loess has been secondarily modified by slopewash and related phenomena.

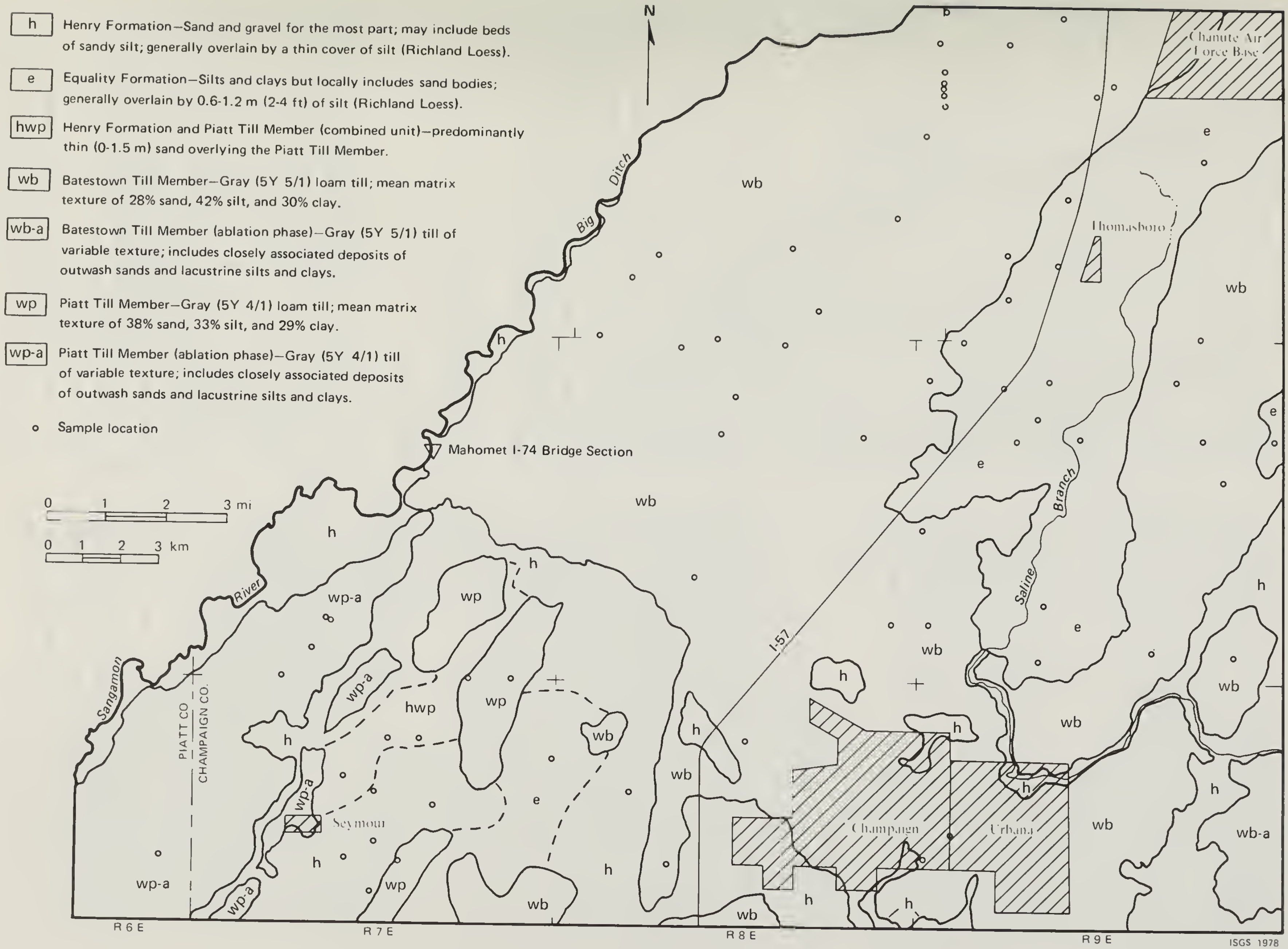

Figure 5. Surficial deposits of north-central and western Champaign County, Illinois. Mapping control in some areas was enhanced by use of soils maps prepared by the University of Illinois Department of Agronomy and U.S. Soil Conservation Service.

Cahokia Alluvium

The Cahokia Alluvium (Willman and Frye, 1970) consists of floodplain and channel deposits of modern rivers and streams. The formation is present along most Illinois streams except in areas of active erosion. In this report, the Cahokia Alluvium is included within the Henry Formation for mapping purposes.

SURFICIAL DEPOSITS

The Surficial Deposits Map (fig. 5) does not include deposits of less than 80 acres in area or less than 5.0 feet (1.5 m) thick. These small or thin deposits are included within the dominant unit present in an area. Separate ablation units are used to map the Piatt and Batestown Till Members in areas where the surficial material consists of highly interspersed deposits of sand, silt, flow till, and till.

GLACIAL GEOMORPHOLOGY

Significant glacial landforms within the study area are shown on the Geomorphic Map (fig. 6). One large feature north of Urbana is the flat (0 to 1 degree slopes) Lake Leverett Lake Plain (Wickham, 1976). The lake plain is underlain by massive and bedded glaciolacustrine silts of the Equality Formation. The silts are commonly underlain by or interbedded with water-laid sands.

Lake Leverett, named for the town of Leverett, Illinois, had a maximum strand line elevation of approximately 735 feet above mean sea level. This is indicated by termination of the lake plain at this elevation and by the absence of lacustrine sediments above 733 feet above mean sea level (MSL). The lake had two former drainageways south of Champaign-Urbana which are indicated on figure 6 .

Sand dunes (fig. 6) appear to have developed following the drainage of Lake Leverett when the accumulated lake bottom sediments were exposed to the wind.

An extensive outwash plain lies south of the Champaign Moraine and west of the Pesotum Moraine. Two outwash terraces extending southward from the Champaign Moraine south of Mahomet (fig. 6) mark former drainageways for glacial meltwater. A series of fan-shaped features, which appear to be mudflows, extends from the front of the Rantoul Moraine in western Champaign County (fig. 6).

The Rantoul Moraine, as named by Willman and Frye (1970), originally included only the ridge segment north of the Champaign Moraine. In this study, the Rantoul Moraine is extended to include a parallel and aligned morainic ridge to the south. This southern segment is believed to continue beneath the Champaign Moraine and to connect with the northern segment of the Rantoul Moraine.

Borings in the Rantoul Moraine have shown that the morphology of the moraine is related to the Piatt Till Member (fig. 7). Piatt Till is the only till present in the Rantoul Moraine over the segment south of the Champaign Moraine. North of the Champaign Moraine, a thick sequence of Piatt Till forming the bulk of the Rantoul Moraine is buried by a thin veneer of Batestown Till (fig. 7).

The Batestown Till is thinner on the Rantoul Moraine than in adjacent areas of ground moraine. This finding agrees with theoretical work by Nobles and Weertman (1971), who postulate that till deposition should be greater in depressional areas than on elevated areas.

Data from a small number of engineering borings in the Champaign-Urbana region suggest that Piatt Till may occur at topographically high points within the Champaign and Pesotum Moraines (fig. 7). These occurences of Piatt Till may be topographic highs formed during Piatt deposition or may reflect shear stacking during Batestown deposition (Kempton, DuMontelle, and Glass, 1971; Moran, 1971). Additional subsurface data are needed to confirm the morphologic relationships within the Champaign and Pesotum Moraines.

The area mapped as an ablation moraine on the Geomorphic Map (fig. 6) has in the past been mapped as part of the Cerro Gordo Moraine (Willman and Frye, 1970; Ekblaw, 1941). The ablation moraine consists of randomly oriented knolls, irregular hummocks, and flat, partially closed depressions. It was probably formed by deposition from stagnant ice. In this study, the area is separated from the Cerro Gordo Moraine due to basic geomorphic and stratigraphic differences. Approximately three miles (4.8 km) southwest of the study area, the hummocky features of the ablation moraine grade into a continuous till ridge which is the Cerro Gordo Moraine.

GEOLOGIC HISTORY

Introduction

A lobe of glacial ice advancing from the Lake Michigan Basin covered much of central Illinois during Woodfordian time. The ice margin alternately advanced and retreated in response to climatic variations and physical conditions within the ice sheet.

The pulsations of the Woodfordian ice sheet were accompanied by deposition of morainic ridges along the ice margin (Willman and Frye, 1970). Converging and crosscutting trends of the morainic ridges in Champaign County indicate that the Woodfordian ice margin had many different configurations during glaciation of the study area. Glacial flow directions probably varied greatly during the Woodfordian ice advances.

The two surficial till units within the study area, the Piatt and overlying Batestown Till Members, have somewhat similar colors and clay mineral contents. The compo-

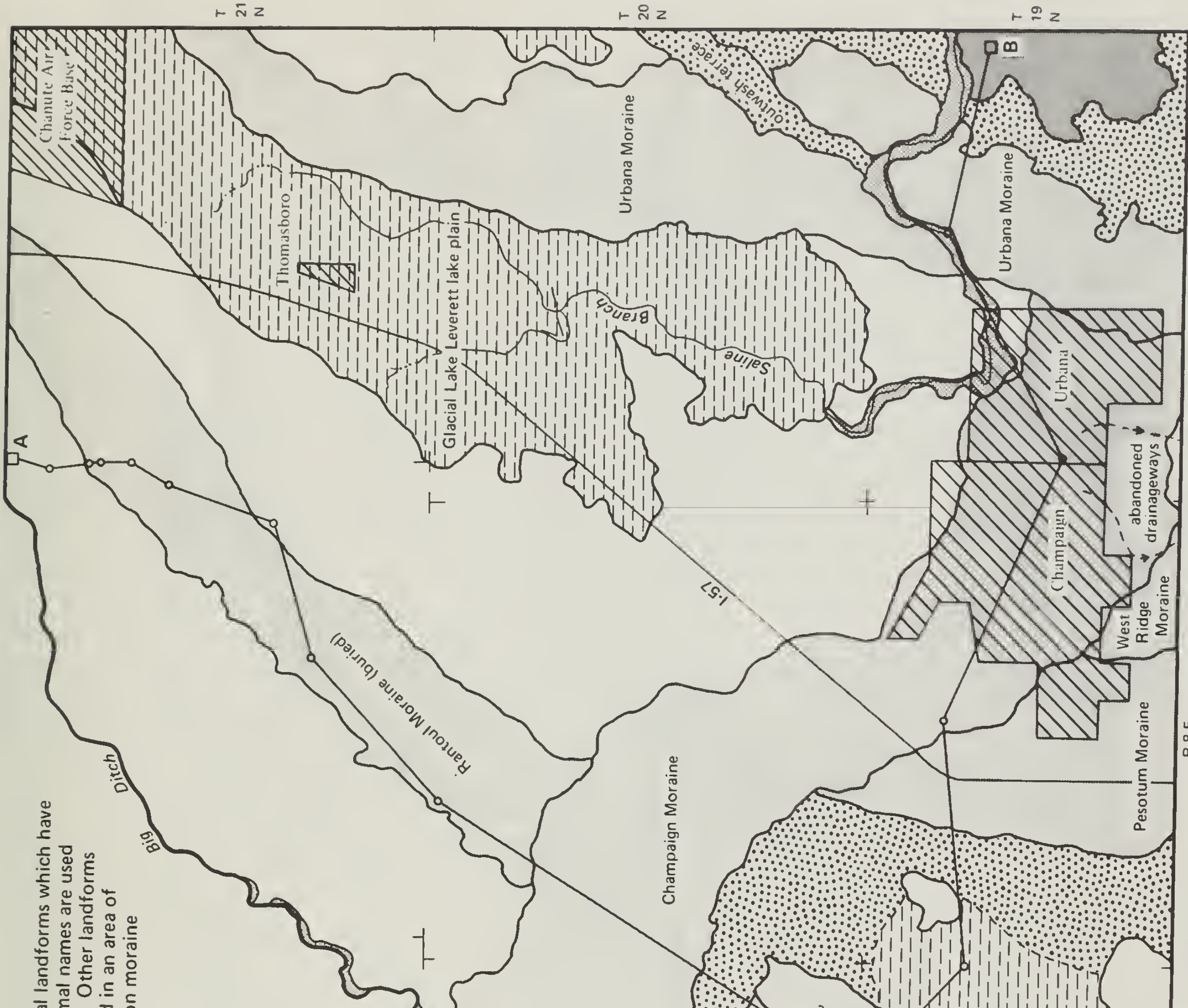

Figure 6. Geomorphic map of north-central and western Champaign County, Illinois.

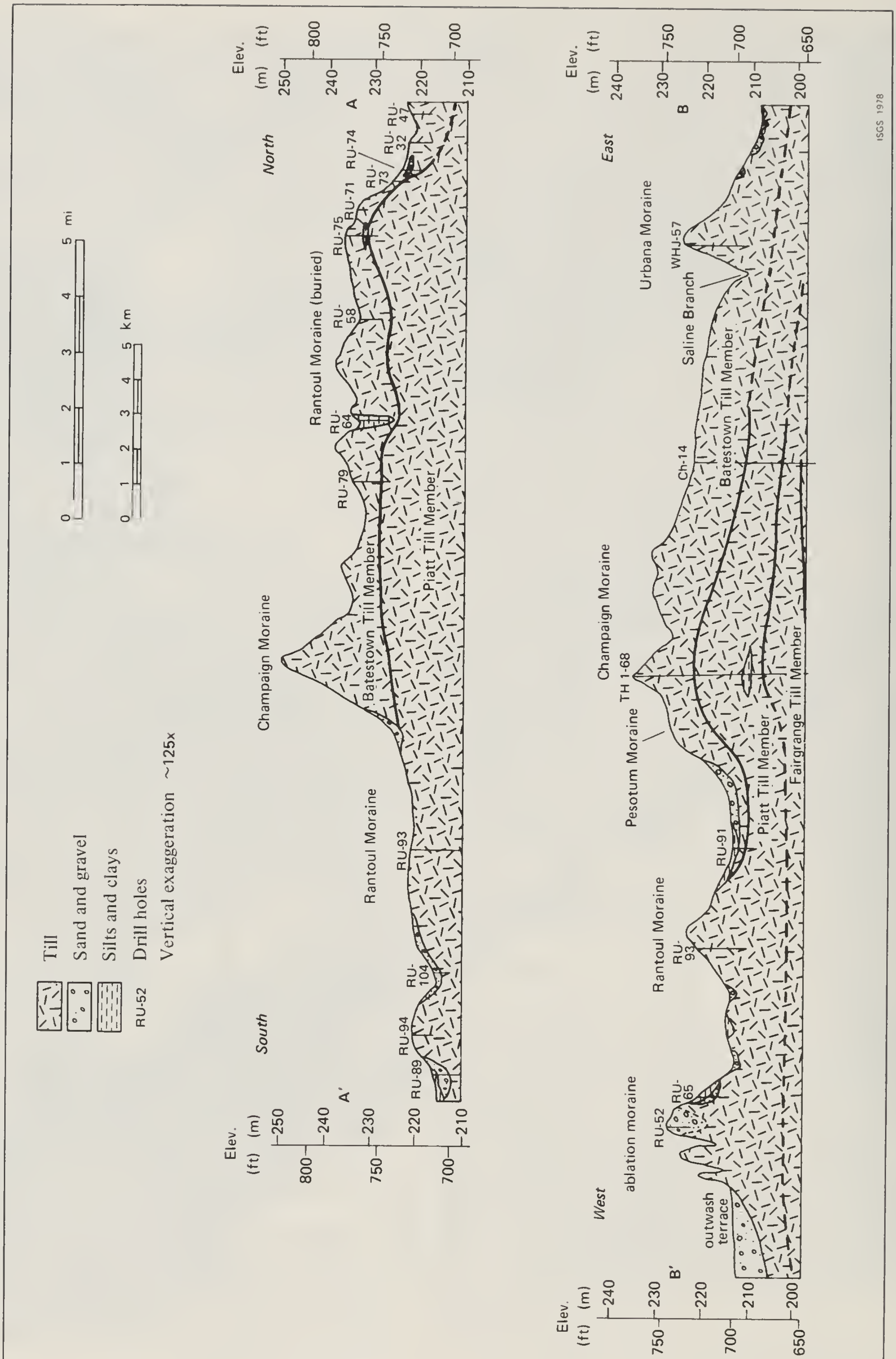

Figure 7. Cross sections illustrating the morphology of surficial features in the study area. Location of cross sections shown on figure 5.

sitional difference between Piatt and Batestown Tills appears to follow a trend within the four Wedron till units of the study area. The color of the four till units changes sequentially upward from dark red-brown to "pink" to pinkish-gray and finally to gray. Clay mineral composition changes in a similar manner, with illite progressively increasing and expandables progressively decreasing upward in the stratigraphic sequence. These data strongly suggest that the two till units considered in this study, the Piatt and Batestown Tills, were deposited by the same sublobe of ice.

The composition of debris carried in the ice apparently changed with each readvance. One cause of this change may be the progressive dilution of locally derived material with distantly transported material. Assuming that during each readvance the ice carried the same proportion of locally derived material to distantly derived material, with each readvance there would be a shift in till composition towards the distantly derived composition. This would result from continued local erosion and reworking of previously deposited till which would contain a percentage of distantly derived material. Therefore, the distantly derived material becomes an increasing percentage of the local deposits. The net effect is that multiple readvances increase the percentage of distantly derived material deposited in a locality.

If only one sublobe of ice entered the study area, the sublobe was probably part of the Lake Michigan Lobe. Early studies (Anderson, 1955; Horberg and Anderson, 1956; Leighton, 1960; Willman and Frye, 1970) indicated that the areas east of the Gibson City reentrant (fig. 1) had been subject to glaciation from the Saginaw or Erie Lobe which advanced from the east. More recent work by McKay (1975) has shown that the Gibson City reentrant represents the divergence of two sublobes of the Lake Michigan Lobe. Furthermore, McKay (1975) found that the Batestown Till Member had a source within the Lake Michigan Lobe. McKay's work strongly suggests that the surficial tills within western Champaign County were deposited by an eastern sublobe of the Lake Michigan Lobe.

Deposition of the Wedron till units in the study area occurred between 13,980±200 (ISGS-69) and 21,670±130 (ISGS-79) radiocarbon years before present. These radiocarbon dates from the overlying Equality Formation and underlying Robein Silt bracket till deposition in the study area into the Woodfordian Substage (12,500 to 22,000 radiocarbon years B.P.).

Glacial events

The Piatt Till was probably deposited by an ice sheet which advanced into Champaign County from the northeast The ice overrode early Woodfordian deposits which consisted predominantly of the pinkish brown Fairgrange Till and associated stratified sediments. The ice sheet advanced west beyond Champaign County, depositing ground moraine and disintegration features over a large region west of the study area (Lineback, 1975).

Following its advance to the west and subsequent beginning of its retreat, the Piatt Till ice margin was established in Champaign County along a northeast-southwest trending front (fig. 8a). The ice stagnated along a front east of the Sangamon River (fig. 8b), which acted as a marginal drainageway during retreat of the Piatt ice sheet. The ice sheet apparently ablated rapidly over the position of the ablation moraine with the active ice front receding to the position of the southern Rantoul Moraine (fig. 8c). The ice deposited Piatt Till over the positions of the Cerro Gordo and Rantoul Moraines. Contemporaneous with this was stagnant ice deposition over the ablation moraine west of the southern Rantoul Moraine.

Following deposition of these moraines, the Piatt ice sheet melted from the area, leaving the landforms depicted in figure 8d and a ground moraine of Piatt Till to the east. Subsequently, the ice sheet that deposited Batestown Till readvanced into the study area. A weakly-developed oxidation zone on top of Piatt Till overlain by Batestown Till suggests that a brief time interval separated retreat of the Piatt Till ice margin and advance of the succeeding ice margin.

The ice sheet readvanced along a north-south trending margin represented by the Pesotum Moraine. The ice may have developed a thin zone at the margin which was susceptible to stagnation beyond the active ice front (fig. 9a). Upon reaching its position of maximum advance, the ice sheet deposited only a thin layer of till along the margin (fig. 9b). This is indicated in the study area by a narrow tract of thin Batestown Till west of the Pesotum Moraine. The Pesotum ice deposited Batestown Till which has a mean matrix texture of 28 percent sand, 34 percent silt, and 38 percent clay. Water wells in the area indicate 50 to 60 feet (15 to 18 m) of Batestown Till overlying Piatt Till (Kempton, Sherman, and Cartwright, 1970).

The stand at the Pesotum Moraine is also recorded by outwash material in front of the moraine (fig. 9c). In many places, the outwash buried the zone of thin Batestown Till that lies to the west of the moraine (fig. 5).

The Pesotum ice melted eastward from the Pesotum Moraine, probably depositing till that forms the West Ridge and Hildreth Moraines (fig. 9d). After melting from the area, the ice sheet apparently took on a new marginal orientation.

The ice readvanced along a northwest-southeast trending front, truncating the Pesotum, West Ridge, and Hildreth Moraines at a high angle (fig. 10a). The advance culminated at the Champaign Moraine (fig. 10b). Reorientation and readvance of the ice to the Champaign Moraine was marked by deposition of more Batestown Till.

The time span between retreat of the Pesotum ice and advance of the Champaign ice was probably relatively short as indicated by the lack of oxidation between drifts. A

Figure 8. Reconstruction of depositional environment of Cerro Gordo Moraine, Rantoul Moraine, and ablation moraine: (a) ice margin retreats toward study area from the northwest; (b) stabilization of the ice margin west of Champaign, Illinois and deposition of Piatt Till; (c) continued stillstand with construction of Cerro Gordo Moraine, Rantoul Moraine, and ablation moraine; (d) general retreat.

Figure 9. Advance and retreat of Pesotum ice sheet: (a) ice advance with development of thin marginal zone; (b) maximum advance with deposition of thin Batestown Till at margin; (c) retreat of margin with construction of Pesotum Moraine; (d) continued retreat with probable construction of West Ridge and Hildreth Moraines.

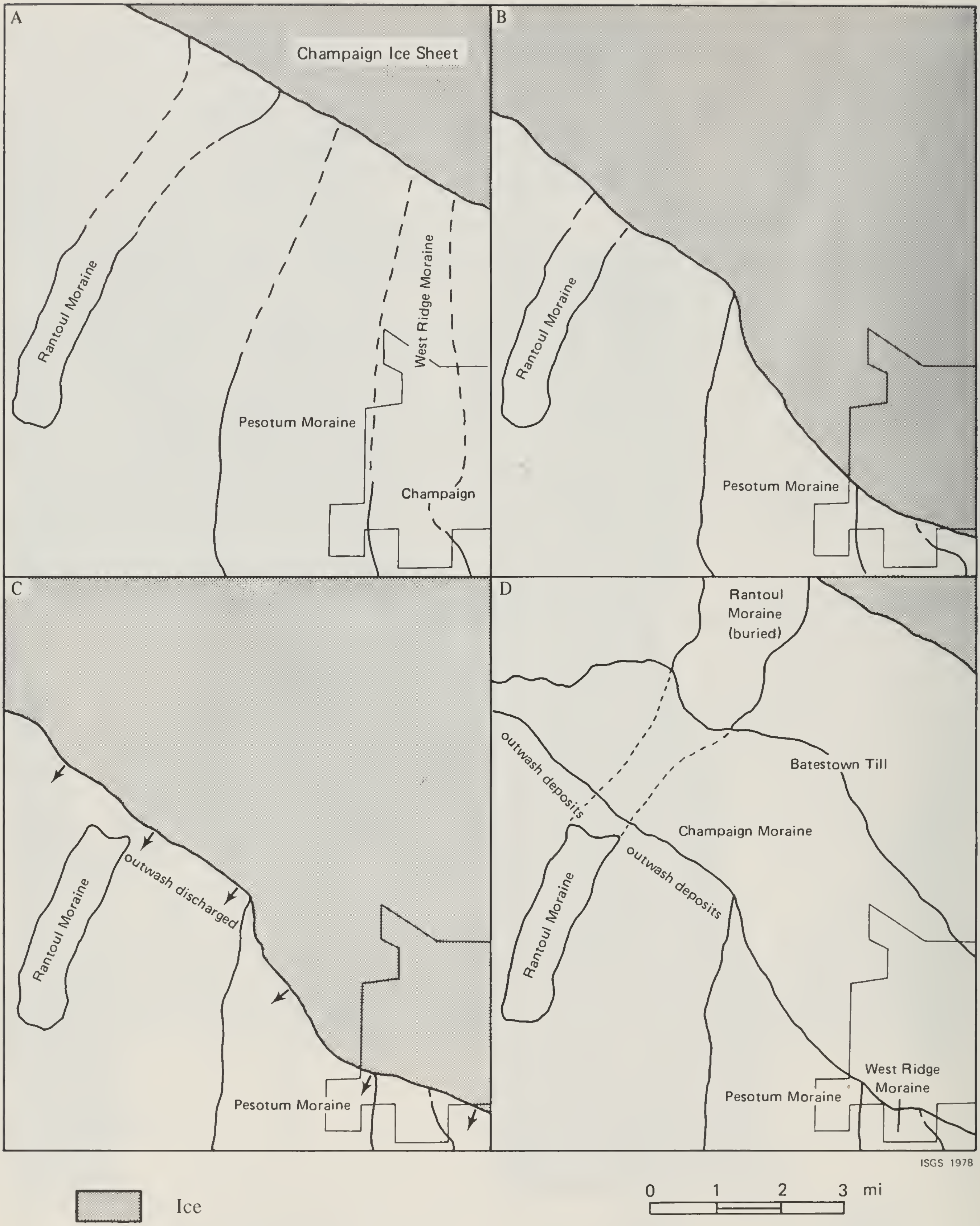

Figure 10. Advance and retreat of Champaign ice sheet: (a) ice advances along northwest-southeast trending margin; (b) ice reaches maximum advance; (c) deposition of outwash and construction of Champaign Moraine; (d) retreat with burial of Rantoul Moraine.

large amount of outwash material was deposited while the ice was stabilized over the Champaign Moraine (fig. 10c). The outwash was deposited in fan-shaped bodies south of the moraine and in terraces along Camp Creek and the Sangamon River. The Sangamon valley continued to act as a drainageway for the meltwater from the north even after the withdrawal of Champaign ice. The Champaign Moraine was breached by a large flow of water from the north, probably off the melting Champaign ice sheet and later from ice over the Illiana Morainic System.

Upon retreat from the Champaign Moraine, the ice sheet deposited Batestown Till over a broad area north of the Champaign Moraine extending from McLean County on the west (Kempton, DuMontelle, and Glass, 1971) to the Crawfordsville Moraine in west-central Indiana on the east (N. H. Bleuer, personal communication to W. H. Johnson). Withdrawal of the Champaign ice left a thin covering of Batestown Till (fig. 10d) overlying the northern portion of the Rantoul Moraine.

Following the retreat of Champaign ice from the area, the ice sheet again reoriented its marginal configuration. The ice sheet subsequently readvanced along an arcuate front (fig. 11a), reaching a maximum advance position represented by the Urbana Moraine. The lack of any oxidation between the Champaign and Urbana Drifts again suggests that a short time span separated their deposition.

The Urbana advance was apparently a weaker readvance, extending in a small lobe only as far west as Urbana, Illinois (fig. 11b). The advance overlapped the Champaign Moraine southeast of Urbana for a distance of about 15 miles (24 km). Farther east, however, the edge of the Urbana advance lies 10 miles (16 km) north of the Ridge Farm Moraine. The Ridge Farm Moraine may be a continuation of the Champaign Moraine (Willman and Frye, 1970). In its overall extent, the Urbana advance was much smaller than the preceding Champaign advance.

The Urbana ice sheet melted erratically from the Urbana Moraine (fig. 11c). The ice margin retreated in the segment northeast of Urbana, Illinois, while it remained stationary farther south. The northern segment stagnated approximately one mile (1.6 km) east of the Urbana Moraine, depositing a belt of stagnation features subparallel to the moraine (fig. 11d). These features terminate at the Urbana Moraine northeast of Urbana.

The generally weak nature of the Urbana readvance may indicate that the ice lost its impetus quickly and therefore was prone to stagnation. In eastern Champaign County, Hooten (1973) identified stagnation features on Batestown Till which he correlated with retreat of the Urbana ice sheet.

Contemporaneous with retreat of the Urbana ice was the development of Lake Leverett. Since the ice sheet was at the position of the Urbana Moraine, meltwater flowing to the west (Ekblaw, in Anderson, 1960) was impounded by the intersecting Urbana, Champaign, and Rantoul Moraines. At that time, the lake level was able to rise to an elevation of approximately 733 feet above MSL before spilling over into two drainageways in the Champaign-Urbana area (fig. 6). Both drainageways today are at approximate elevations of 736 feet above MSL with a 3 to 4 ft (0.9 to 1.2 m) loessial cap.

Simultaneous with or following the development of Lake Leverett was the development of an ancestral Saline Branch. Saline Branch originated as a marginal drainageway during the staggered retreat of the Urbana ice sheet (fig. 12a). Meltwater confined by the Urbana Moraine on the west and Urbana ice sheet on the east flowed southwest across the Urbana Moraine into Lake Leverett.

With retreat of the Urbana ice sheet, the impounded water in Lake Leverett was no longer confined to the east. Thus, the water in Lake Leverett spilled over the Urbana Moraine at the conjunction of ancestral Saline Branch and the low eastern extension of the moraine (fig. 12b). The opening of the lower divide along the Urbana Moraine caused the abandonment of Lake Leverett's two southern drainageways.

A later ice event, related to deposition of the Illiana Morainic System to the north, discharged meltwater into the area. The large flow of water from the north caused Saline Branch to downcut its channel, eventually reversing the gradient of the entire stream to accomodate an eastern flow (fig. 12c). Following the retreat of glacial ice from east-central Illinois and subsequent drainage of Lake Leverett, Saline Branch developed a small channel which it occupies today.

Concurrent with glaciation of the study area was deposition of windblown sediments derived from a western source. After the withdrawal of ice from the study area, the loess accumulated to a thickness of 3 to 4 feet (0.9 to 1.2 m) on top of earlier glacial deposits. Essentially, all of the soils at the present land surface have formed in the loess. At a few locations, the loess has been removed by erosion and the modern soil has formed in the underlying till.

Acknowledgments

This report is adapted from a Master's thesis submitted to the University of Illinois. I am grateful to Professor W. Hilton Johnson of the University of Illinois for supervision of the study and for his many contributions of data and helpful suggestions. Herbert D. Glass of the Illinois State Geological Survey performed the clay mineral analyses and was involved in making stratigraphic determinations throughout the project.

Figure 11. Advance and retreat of Urbana ice sheet: (a) advance of Urbana ice; (b) maximum advance with construction of Urbana Moraine; (c) retreat of northern portion of ice sheet with continued stillstand in southern portion; (d) present configuration of landforms.

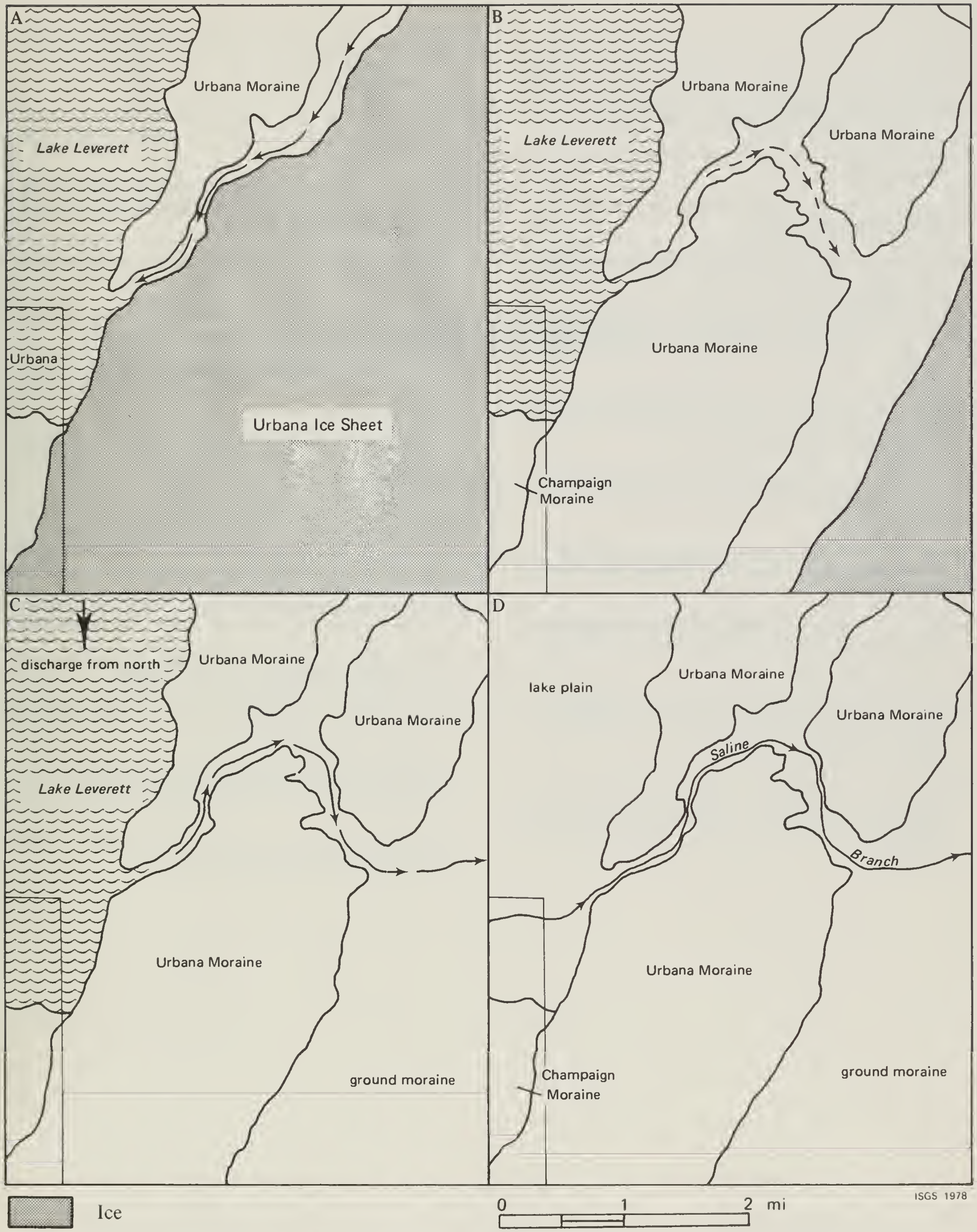

Figure 12. Development of Saline Branch: (a) marginal drainageway draining into Lake Leverett develops during staggered retreat of Urbana ice sheet; (b) drainageway may have developed a southern flow with some spillover from Lake Leverett; (c) discharge from ice to the north into Lake Leverett causes development of eastern drainage; (d) present course of Saline Branch.

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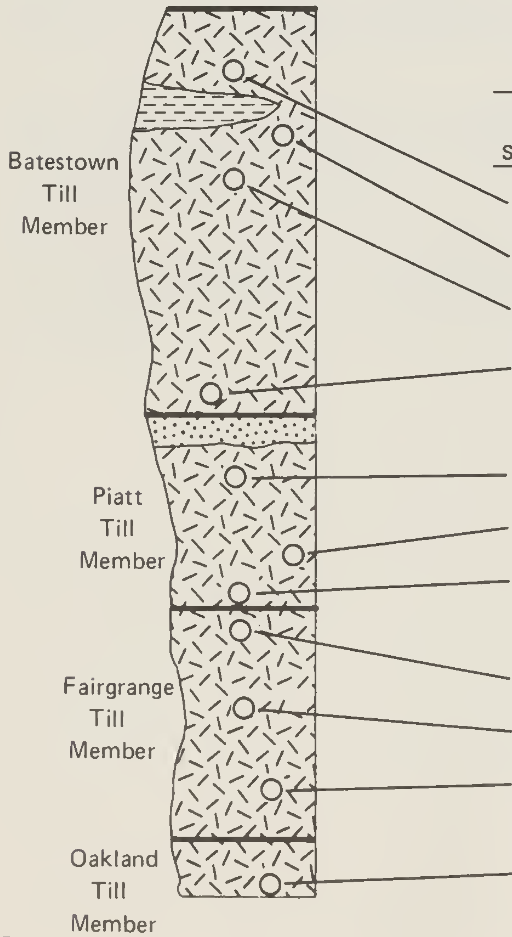
APPENDIXES

MAHOMET I-74 BRIDGE SECTION

This section was measured on the east bank of the Sangamon River, north of I-74, in the NE¼, SE¼, NE¼, Sec. 15, T. 20N., R. 7E.; Champaign County, Illinois. It is the type section for the Piatt Till Member. The section was originally described by W. Hilton Johnson in 1971 and is used herein with his permission.

Pleistocene Series	Thickness (feet)
Wisconsinan Stage	
Woodfordian Substage	
Wedron Formation	
Batestown Till Member	
Till, loam, calcareous, light olive brown (2.5Y 5/4) where oxidized, dark gray (5Y 4/1) where not; till contains irregular sand and silt zones (Samples 10530, 10531, 10532, and 10533)	21.0
Piatt Till Member	
Till, loam, calcareous, brownish gray to dark gray; zone of sand at the upper contact; oxidation is common in the upper portion but is variable along the exposure (Samples 10534, 10535, 10536)	9.0
Fairgrange Till Member	
Till, loam, calcareous, dark brown (7.5Y 4/2); oxidized down joints (Samples 10539)	12.0
Oakland Till Member	
Till, loam, dark brown; not well exposed, base covered (Sample 10540)	3.0
Total	45.0



Member	Matrix textures (%) Sand	Silt	Clay	Clay minerals (%) Expandables	Illite	Chlorite and kaolinite	<75-μ carbonates (%) Calcite	Dolomite	Total carbonates
Batestown Till Member	27	44	29	4	81	15	5	17	22
	25	46	29	2	82	16	6	20	26
	26	42	32	3	81	16	6	19	25
	28	43	28	3	80	17	8	19	27
Piatt Till Member	46	40	14	4	75	21	5	23	28
	35	36	39	12	67	21	6	20	26
	41	33	26	8	73	19	6	19	25
Fairgrange Till Member	26	41	33	9	67	24	9	18	27
	27	35	38	11	63	26	8	20	28
	28	40	32	7	67	26	8	20	28
Oakland Till Member	31	39	30	20	58	22	3	16	19

ISGS 1978

Appendix 2–Sample locations and data

Site No. RU-	Depth (in cm)	Location	Unit	Matrix textures (%) Sand	Silt	Clay	Clay minerals (%) Expandables	Illite	Chlorite & kaolinite	< 2-μ Carbonates counts/sec Calcite	Dolomite
6	135-140	NW NE SW 31, 20N-10E	Henry Formation	43	40	17					
6	210-215	NW NE SW 31, 20N-10E	Equality Fm.	7	77	16					
6	240-245	NW NE SW 31, 20N-10E	Batestown Till	27	42	31					
6	315-320	NW NE SW 31, 20N-10E	Batestown Till	29	38	33					
7	330-335	NW SW SW 28, 20N-9E	Batestown Till	30	46	24					
8	270-280	NE NW NW 11, 20N-9E	Batestown Till	32	32	36					
11	225-230	NW NE SE 34, 20N-9E	Batestown Till				5	83	12	9	31
11	315-325	NW NE SE 34, 20N-9E	Batestown Till	31	39	30					
11	375-385	NW NE SE 34, 20N-9E	Batestown Till				1	80	19	14	26
11	430-440	NW NE SE 34, 20N-9E	Batestown Till	32	40	28					
14	200-205	NW SW NW 10, 20N-8E	Fairgrange Till?	35	41	24					
18	205-210	NE NE SE 32, 20N-9E	Equality Fm.	7	49	44					
18	270-275	NE NE SE 32, 20N-9E	Equality Fm.	2	45	53					
18	300-305	NE NE SE 32, 20N-9E	Batestown Till	25	47	29					
23	175-180	NE NW NW 23, 21N-9E	Equality Fm.	15	50	35					
24	125-130	SW SE SW 18, 21N-10E	Batestown Till	34	31	35					
25	180-185	SE SW SW 35, 21N-9E	Batestown Till	29	41	30					
26	95-100	NE NW NE 6, 20N-9E	Richland Loess				90	7	3	-	-
26	230-235	NE NW NE 6, 20N-9E	Equality Fm.				9	81	10	?	22
26	335-340	NE NW NE 6, 20N-9E	Batestown Till	28	39	33					
27	80-85	NE NW NW 3, 20N-8E	Richland Loess	13	55	32					
27	160-165	NE NW NW 3, 20N-8E	Fairgrange Till?	30	29	41					
27	205-210	NE NW NW 3, 20N-8E	Batestown Till	25	39	36					
29	50-60	SE SE SW 31, 21N-8E	Richland Loess	12	53	35	54	36	10	-	-
29	100-110	SE SE SW 31, 21N-8E	Batestown Till	36	33	31	8	81	11	-	-
29	120-130	SE SE SW 31, 21N-8E	Batestown Till				9	80	11	?	8
29	140-150	SE SE SW 31, 21N-8E	Batestown Till	29	39	32	6	83	11	-	8
29	160-170	SE SE SW 31, 21N-8E	Batestown Till				4	86	10	14	20
29	180-190	SE SE SW 31, 21N-8E	Batestown Till	30	39	31	4	87	9	10	30
29	200-210	SE SE SW 31. 21N-8E	Batestown Till				3	86	11	10	21
29	220-230	SE SE SW 31, 21N-8E	Batestown Till	30	39	31	3	85	12	6	22
29	240-250	SE SE SW 31, 21N-8E	Batestown Till				3	88	9	9	16
29	260-270	SE SE SW 31, 21N-8E	Batestown Till	25	43	32	3	87	10	8	28
29	300-310	SE SE SW 31, 21N-8E	Batestown Till	25	38	37	1	89	10	15	23
29	340-350	SE SE SW 31, 21N-8E	Batestown Till				2	87	11	11	19
29	380-390	SE SE SW 31, 21N-8E	Batestown Till	29	37	34	2	79	19	12	24
29	420-430	SE SE SW 31, 21N-8E	Batestown Till	30	41	29	1	79	20	14	28
29	440-450	SE SE SW 31, 21N-8E	Batestown Till	30	41	29	1	79	20	12	20
29	460-470	SE SE SW 31, 21N-8E	Batestown Till	31	39	30	2	78	20	16	29
29	480-490	SE SE SW 31, 21N-8E	Batestown Till	27	42	31	2	78	20	17	23
29	500-510	SE SE SW 31, 21N-8E	Batestown Till	28	48	24	1	77	22	21	31
30	150-155	SW SE SW 33, 21N-8E	Batestown Till				5	84	11	12	21
30	250-260	SW SE SW 33, 21N-8E	Batestown Till				3	86	11	?	24
30	300-310	SW SE SW 33, 21N-8E	Batestown Till	30	42	28	3	79	18	16	24
30	350-355	SW SE SW 33, 21N-8E	Batestown Till	31	41	28					
30	370-380	SW SE SW 33, 21N-8E	Batestown Till	30	43	27	2	76	22	18	23
31	150-160	SW SE SW 9, 21N-9E	Batestown Till	30	41	29	5	83	12	7	16
31	320-330	SW SE SW 9, 21N-9E	Batestown Till	27	42	31					

(continued)

Site No. RU-	Depth (in cm)	Location	Unit	Matrix textures (%) Sand	Silt	Clay	Clay minerals (%) Expandables	Illite	Chlorite & kaolinite	< 2-μ Carbonates counts/sec Calcite	Dolomite
31	400-410	SW SE SW 9, 21N-9E	Batestown Till	25	44	31	2	78	20	12	20
31	520-530	SW SE SW 9, 21N-9E	Piatt Till	37	38	25	2	78	20	36	27
32	250-260	SW NE NE 12, 21N-8E	Batestown Till	28	44	28					
32	300-310	SW NE NE 12, 21N-8E	Batestown Till	28	43	29					
32	400-410	SW NE NE 12, 21N-8E	Batestown Till	28	43	29					
32	440-450	SW NE NE 12, 21N-8E	Batestown Till	27	46	27					
33	140-150	NE NE SE 14, 20N-9E	Richland Loess	11	74	15	52	38	10	-	17
33	250-260	NE NE SE 14, 20N-9E	Batestown Till	29	39	32	3	88	9	16	28
33	300-310	NE NE SE 14, 20N-9E	Batestown Till	30	41	29	2	88	10	11	25
33	350-360	NE NE SE 14, 20N-9E	Batestown Till	31	38	31	2	86	12	11	23
33	390-400	NE NE SE 14, 20N-9E	Batestown Till	31	39	30					
34	100-105	NW NW NE 16, 20N-9E	Equality Fm.				81	14	5	-	-
34	125-130	NW NW NE 16, 20N-9E	Equality Fm.				88	8	4	-	11
34	150-155	NW NW NE 16, 20N-9E	Equality Fm.				82	13	5	12	?
34	175-180	NW NW NE 16, 20N-9E	Equality Fm.				80	16	4	10	36
34	205-210	NW NW NE 16, 20N-9E	Equality Fm.				61	32	7	11	30
34	230-235	NW NW NE 16, 20N-9E	Equality Fm.				34	52	14	11	11
35	350-360	SW SW SW 12, 20N-8E	Batestown Till	28	39	33					
35	425-435	SW SW SW 12, 20N-8E	Batestown Till				2	79	19	12	29
36	260-270	SW SE SE 9, 20N-8E	Batestown Till	25	47	28					
37	320-330	NE NE SE 14, 14N-9E	Batestown Till	33	41	26	2	79	19	9	27
38	205-210	NW NW NE 36, 20N-8E	Batestown Till	28	43	29					
39	250-260	NE NW NE 14, 20N-9E	Batestown Till	29	37	34					
39	300-310	NE NW NE 14, 20N-9E	Batestown Till	27	38	35					
39	370-380	NE NW NE 14, 20N-9E	Batestown Till	27	43	30	2	80	18	14	24
39	390-395	NE NW NE 14, 20N-9E	Batestown Till	28	42	30	1	79	20	17	22
39	405-410	NE NW NE 14, 20N-9E	Batestown Till	27	43	30	1	77	22	25	34
39	420-425	NE NW NE 14, 20N-9E	Batestown Till	28	41	31	1	77	22	19	32
39	435-440	NE NW NE 14, 20N-9E	Batestown Till	28	39	33	2	77	21	17	33
39	450-455	NE NW NE 14, 20N-9E	Batestown Till	27	42	31	2	77	21	20	29
39	465-470	NE NW NE 14, 20N-9E	Batestown Till	28	40	32	2	76	22	16	24
39	480-485	NE NW NE 14, 20N-9E	Batestown Till	28	38	34	1	78	21	14	25
40	290-300	NW NW NW 19, 20N-9E	Equality Fm.	12	49	39					
40	350-360	NW NW NW 19, 20N-9E	Equality Fm.	15	53	32	2	81	17	?	22
40	480-485	NW NW NW 19, 20N-9E	Equality Fm.	26	35	39	2	77	21	19	28
42	150-160	NW NW NE 17, 20N-9E	Richland Loess	19	63	18	56	33	11	?	27
42	300-310	NW NW NE 17, 20N-9E	Equality Fm.	24	60	16					
42	310-320	NW NW NE 17, 20N-9E	Equality Fm.				3	83	14	?	25
42	390-400	NW NW NE 17, 20N-9E	Batestown Till	28	46	26	2	80	18	13	18
42	520-532	NW NW NE 17, 20N-9E	Batestown Till				1	79	20	10	25
43	50-60	SW SE SE 12, 20N-9E	Richland Loess				82	13	5	-	-
43	70-75	SW SE SE 12, 20N-9E	Richland Loess				84	12	4	-	-
43	90-95	SW SE SE 12, 20N-9E	Richland Loess				84	12	4	12	7
43	110-115	SW SE SE 12, 20N-9E	Richland Loess				82	14	4	11	9
43	130-135	SW SE SE 12, 20N-9E	Equality Fm.				66	27	7	-	-
43	150-155	SW SE SE 12, 20N-9E	Equality Fm.				63	29	8	12	18
43	170-175	SW SE SE 12, 20N-9E	Equality Fm.				65	28	7	8	23
43	190-195	SW SE SE 12, 20N-9E	Equality Fm.				53	38	9	10	35

(continued)

				Matrix textures (%)			Clay minerals (%)			< 2-μ Carbonates counts/sec	
Site no. RU-	Depth (in cm)	Location	Unit	Sand	Silt	Clay	Expandables	Illite	Chlorite & kaolinite	Calcite	Dolomite
43	210-215	SW SE SE 12, 20N-9E	Equality Fm.				49	41	10	15	31
43	230-235	SW SE SE 12, 20N-9E	Equality Fm.				6	85	9	18	22
43	250-255	SW SE SE 12, 20N-9E	Equality Fm.				6	84	10	18	32
43	270-275	SW SE SE 12, 20N-9E	Equality Fm.				5	87	8	8	17
43	290-295	SW SE SE 12, 20N-9E	Equality Fm.				2	89	9	16	24
43	310-315	SW SE SE 12, 20N-9E	Equality Fm.				2	81	17	12	35
43	330-335	SW SE SE 12, 20N-9E	Equality Fm.				4	85	11	17	29
43	350-355	SW SE SE 12, 20N-9E	Equality Fm.				3	89	8	17	25
43	370-375	SW SE SE 12, 20N-9E	Equality Fm.				2	78	20	21	25
43	390-395	SW SE SE 12, 20N-9E	Equality Fm.				1	79	20	18	21
43	415-420	SW SE SE 12, 20N-9E	Equality Fm.				2	81	17	15	25
43	450-455	SW SE SE 12, 20N-9E	Equality Fm.				2	77	21	16	35
43	500-505	SW SE SE 12, 20N-9E	Equality Fm.				2	81	17	15	25
44	300-310	NE NE SW 29, 21N-8E	Batestown Till	26	41	33					
45	150-160	SE SE SE 30, 21N-8E	Batestown Till				8	82	10	?	14
45	200-210	SE SE SE 30, 21N-8E	Batestown Till				3	87	10	14	33
45	250-260	SE SE SE 30, 21N-8E	Batestown Till				4	85	11	10	16
45	300-310	SE SE SE 30, 21N-8E	Batestown Till	26	45	29					
45	350-360	SE SE SE 30, 21N-8E	Batestown Till				2	85	13	8	26
45	400-410	SE SE SE 30, 21N-8E	Batestown Till				2	78	20	15	31
45	450-460	SE SE SE 30, 21N-8E	Batestown Till				3	77	20	13	27
46	200-210	SE NE SE 8, 20N-9E	Equality Fm.	6	59	35	34	53	13	-	-
46	345-355	SE NE SE 8, 20N-9E	Equality Fm.	12	65	23	5	84	11	12	21
46	400-410	SE NE SE 8, 20N-9E	Batestown Till	31	42	27					
46	450-460	SE NE SE 8, 20N-9E	Batestown Till	29	42	29	2	77	21	14	28
46	530-540	SE NE SE 8, 20N-9E	Batestown Till	29	44	27	3	76	21	18	27
47	150-160	NW NW SW 6, 21N-9E	Batestown Till				5	84	11	9	15
47	200-210	NW NW SW 6, 21N-9E	Batestown Till				4	88	8	10	22
47	250-260	NW NW SW 6, 21N-9E	Batestown Till				4	87	9	10	30
47	300-310	NW NW SW 6, 21N-9E	Batestown Till				4	86	10	13	20
47	350-369	NW NW SW 6, 21N-9E	Batestown Till				4	87	9	13	26
47	400-410	NW NW SW 6, 21N-9E	Batestown Till				3	76	21	15	29
47	460-470	NW NW SW 6, 21N-9E	Batestown Till				2	76	22	16	29
48	200-210	SE NE NE 12, 20N-9E	Batestown Till	32	36	32					
48	300-310	SE NE NE 12, 20N-9E	Batestown Till	32	37	31					
48	350-360	SE NE NE 12, 20N-9E	Batestown Till	32	40	28					
48	400-410	SE NE NE 12, 20N-9E	Batestown Till	32	38	30					
48	450-460	SE NE NE 12, 20N-9E	Batestown Till	33	38	29	1	80	19	23	28
48	560-570	SE NE NE 12, 20N-9E	Batestown Till	34	37	29	2	77	21	15	31
48	610-620	SE NE NE 12, 20N-9E	Piatt Till?	44	37	19					
49	250-260	NE NW NW 7, 20N-9E	Batestown Till	26	42	32					
49	300-310	NE NW NW 7, 20N-9E	Batestown Till	27	41	32					
50	420-430	NW NE NE 3, 20N-8E	Batestown Till	30	41	29					
50	470-480	NW NE NE 3, 20N-8E	Batestown Till	29	41	30					
51	200-210	SE NE SE 5, 21N-9E	Piatt Till	39	30	31					
51	260-270	SE NE SE 5, 21N-9E	Piatt Till	36	29	35	5	82	13	10	25
51	340-350	SE NE SE 5, 21N-9E	Piatt Till	38	29	33	6	81	13	24	38
51	400-410	SE NE SE 5, 21N-9E	Piatt Till	39	34	27	3	75	22	20	23

(*continued*)

				Matrix textures (%)			Clay minerals (%)			< 2-μ Carbonates counts/sec	
Site no. RU-	Depth (in cm)	Location	Unit	Sand	Silt	Clay	Expandables	Illite	Chlorite & kaolinite	Calcite	Dolomite
51	450-460	SE NE SE 5, 21N-9E	Piatt Till	39	31	30	4	76	20	19	21
52	250-260	NE NW NW 33, 20N-7E	Henry Formation	44	31	25					
52	450-460	NE NW NW 33, 20N-7E	Henry Formation				7	79	14	26	37
53	100-110	NW SW NW 32, 21N-9E	Equality Fm.?	26	54	20					
54	250-260	SE NE SE 20, 21N-9E	Equality Fm.	15	45	40					
54	350-360	SE NE SE 20, 21N-9E	Batestown Till	25	42	33					
54	450-460	SE NE SE 20, 21N-9E	Batestown Till	28	43	29					
54	550-560	SE NE SE 20, 21N-9E	Batestown Till	28	43	29					
55	300-310	NE NW NW 14, 21N-8E	Batestown Till	26	40	34					
55	400-410	NE NW NW 14, 21N-8E	Batestown Till	25	45	30					
55	450-460	NE NW NW 14, 21N-8E	Batestown Till	27	44	29					
56	150-160	SE SE NE 34, 21N-8E	Richland Loess	2	65	33					
57	210-220	SW SW NW 19, 20N-9E	Batestown Till	26	39	35					
58	250-260	NE NW NW 25, 21N-8E	Batestown Till?	29	60	11	3	84	13	10	20
58	300-310	NE NW NW 25, 21N-8E	Batestown Till?	30	59	11	2	85	13	10	26
58	350-360	NE NW NW 25, 21N-8E	Batestown Till?	30	56	14	2	76	22	11	30
58	420-430	NE NW NW 25, 21N-8E	Batestown Till	29	43	28	2	77	21	14	32
59	180-190	NW SW NW 29, 21N-9E	Batestown Till	23	36	41					
59	300-310	NW SW NW 29, 21N-9E	Batestown Till	26	35	39					
60	150-160	NE SE NW 28, 20N-8E	Batestown Till	25	38	37	2	85	13	?	14
60	200-210	NE SE NW 28, 20N-8E	Batestown Till	25	38	37	2	85	13	8	23
60	250-260	NE SE NW 28, 20N-8E	Batestown Till	25	40	35	4	85	11		18
60	300-310	NE SE NW 28, 20N-8E	Batestown Till	26	38	36	3	85	12	10	18
60	350-360	NE SE NW 28, 20N-8E	Batestown Till	26	43	31	2	77	21	12	28
60	400-410	NE SE NW 28, 20N-8E	Batestown Till	27	43	30	3	79	18	12	24
60	430-440	NE SE NW 28, 20N-8E	Batestown Till	31	43	26	3	77	20	25	25
61	300-305	SE NW SE 13, 21N-8E	Equality Fm.				2	78	20	15	25
61	315-320	SE NW SE 13, 21N-8E	Equality Fm.				2	77	21	12	26
61	330-335	SE NW SE 13, 21N-8E	Equality Fm.				2	78	20	14	29
61	345-350	SE NW SE 13, 21N-8E	Equality Fm.				2	77	21	21	23
61	360-365	SE NW SE 13, 21N-8E	Equality Fm.				3	77	20	14	26
61	470-475	SE NW SE 13, 21N-8E	Piatt Till	37	42	21	4	75	21	31	44
61	485-490	SE NW SE 13, 21N-8E	Piatt Till	43	35	22	3	78	19	38	41
61	500-505	SE NW SE 13, 21N-8E	Piatt Till	33	42	25	3	77	20	28	46
61	610-615	SE NW SE 13, 21N-8E	Piatt Till	36	40	24	3	77	20	27	34
61	625-630	SE NW SE 13, 21N-8E	Batestown Till	26	38	36	1	79	20	?	18
61	640-645	SE NW SE 13, 21N-8E	Batestown Till	18	37	45	1	77	22	?	17
61	655-660	SE NW SE 13, 21N-8E	Batestown Till	29	36	35	1	77	22	16	35
61	780-785	SE NW SE 13, 21N-8E	Batestown Till	28	36	36	2	79	19	12	26
61	795-800	SE NW SE 13, 21N-8E	Batestown Till	23	47	30	2	76	22	16	23
61	810-815	SE NW SE 13, 21N-8E	Batestown Till	28	33	39	2	77	21	6	19
61	1070-1075	SE NW SE 13, 21N-8E	Piatt Till	38	36	26	2	77	21	21	20
61	1085-1090	SE NW SE 13, 21N-8E	Piatt Till	37	34	29	2	79	19	24	31
61	1100-1105	SE NW SE 13, 21N-8E	Piatt Till	38	36	26	3	77	20	17	23
61	1120-1125	SE NW SE 13, 21N-8E	Piatt Till	39	34	27	3	76	21	19	22
61	1375-1380	SE NW SE 13, 21N-8E	Piatt Till	40	31	29	3	77	20	27	22
61	1390-1395	SE NW SE 13, 21N-8E	Piatt Till	35	33	32	2	78	20	24	31
61	1405-1410	SE NW SE 13, 21N-8E	Piatt Till	34	36	30	2	78	20	23	21

(*continued*)

Site no. RU-	Depth (in cm)	Location	Unit	Matrix textures (%) Sand	Silt	Clay	Clay minerals (%) Expandables	Illite	Chlorite & kaolinite	<2-μ Carbonates counts/sec Calcite	Dolomite
61	1425-1430	SE NW SE 13, 21N-8E	Piatt Till	39	32	29	2	78	20	19	29
61	1525-1530	SE NW SE 13, 21N-8E	Piatt Till	37	35	28	2	78	20	17	19
61	1540-1545	SE NW SE 13, 21N-8E	Piatt Till	36	41	23	2	75	23	20	29
61	1555-1560	SE NW SE 13, 21N-8E	Piatt Till	45	32	23	2	77	21	21	27
61	1570-1575	SE NW SE 13, 21N-8E	Piatt Till	39	41	20	2	76	22	13	21
62	150-155	NE SE NE 8, 19N-10E	Richland Loess	3	64	33					
62	200-205	NE SE NE 8, 19N-10E	Batestown Till	23	50	27					
62	240-245	NE SE NE 8, 19N-10E	Batestown Till	26	47	27					
62	260-265	NE SE NE 8, 19N-10E	Batestown Till	27	42	31					
62	280-285	NE SE NE 8, 19N-10E	Batestown Till	32	36	32					
62	300-305	NE SE NE 8, 19N-10E	Batestown Till	19	43	34					
62	340-345	NE SE NE 8, 19N-10E	Batestown Till	29	39	32					
62	360-365	NE SE NE 8, 19N-10E	Batestown Till	32	40	28					
62	380-385	NE SE NE 8, 19N-10E	Batestown Till	29	40	31					
62	400-405	NE SE NE 8, 19N-10E	Batestown Till	30	41	29					
62	420-425	NE SE NE 8, 19N-10E	Batestown Till	30	39	31					
62	440-445	NE SE NE 8, 19N-10E	Batestown Till	30	41	29					
62	490-495	NE SE NE 8, 19N-10E	Batestown Till	30	39	31					
62	520-525	NE SE NE 8, 19N-10E	Batestown Till	33	40	27					
65	140-150	NE NE SE 32, 20N-7E	Equality Fm.	2	72	26					
65	170-180	NE NE SE 32, 20N-7E	Equality Fm.	5	67	28					
65	200-210	NE NE SE 32, 20N-7E	Equality Fm.	19	55	26	27	59	14	-	-
65	240-250	NE NE SE 32, 20N-7E	Equality Fm.	7	62	31	8	77	15	?	11
65	260-270	NE NE SE 32, 20N-7E	Equality Fm.	2	54	44	11	77	12	-	12
65	280-290	NE NE SE 32, 20N-7E	Equality Fm.	2	63	35					
65	300-310	NE NE SE 32, 20N-7E	Piatt Till	34	36	30	7	81	12	11	26
65	320-330	NE NE SE 32, 20N-7E	Piatt Till	29	37	34	8	80	12	16	29
65	340-350	NE NE SE 32, 20N-7E	Piatt Till	33	42	25	6	81	13	28	42
65	380-390	NE NE SE 32, 20N-7E	Piatt Till	23	53	24	6	83	11	21	40
65	400-410	NE NE SE 32, 20N-7E	Piatt Till	38	34	28	4	87	19	26	40
65	420-430	NE NE SE 32, 20N-7E	Piatt Till	37	36	27	6	79	15	32	44
65	440-450	NE NE SE 32, 20N-7E	Piatt Till	40	32	28	7	72	21	28	43
65	460-470	NE NE SE 32, 20N-7E	Piatt Till	39	32	29	7	72	21	36	36
65	470-480	NE NE SE 32, 20N-7E	Piatt Till	39	32	29	5	71	24	33	39
71	70-75	SE NE NE 13, 21N-8E	Batestown Till	24	43	33					
71	90-95	SE NE NE 13, 21N-8E	Batestown Till	26	42	32					
71	110-115	SE NE NE 13, 21N-8E	Batestown Till	28	40	32					
71	130-135	SE NE NE 13, 21N-8E	Batestown Till	27	43	30					
73	100-105	NE SE SE 12, 21N-8E	Batestown Till	31	38	31					
73	130-135	NE SE SE 12, 21N-8E	Batestown Till	30	38	32					
73	190-195	NE SE SE 12, 21N-8E	Piatt Till	36	35	29					
73	220-225	NE SE SE 12, 21N-8E	Piatt Till	38	34	28					
73	260-265	NE SE SE 12, 21N-8E	Piatt Till	39	31	30					
73	290-295	NE SE SE 12, 21N-8E	Piatt Till	39	34	27					
74	80-85	SE NE SE 12, 21N-8E	Batestown Till	29	41	30					
74	100-105	SE NE SE 12, 21N-8E	Batestown Till	30	44	26					
74	220-225	SE NE SE 12, 21N-8E	Batestown Till	31	44	25					
74	280-285	SE NE SE 12, 21N-8E	Batestown Till	33	42	25					

(*continued*)

Site no. RU-	Depth (in cm)	Location	Unit	Matrix textures (%) Sand	Silt	Clay	Clay minerals (%) Expandables	Illite	Chlorite & kaolinite	< 2-μ Carbonates counts/sec Calcite	Dolomite
74	310-315	SE NE SE 12, 21N-8E	Batestown Till	28	40	32					
75	140-150	SE NW SE 13, 21N-8E	Richland Loess	10	60	30					
75	180-185	SE NW SE 13, 21N-8E	Richland Loess	16	51	33					
75	220-225	SE NW SE 13, 21N-8E	Batestown Till	21	45	34					
75	235-240	SE NW SE 13, 21N-8E	Batestown Till	24	42	34					
75	260-265	SE NW SE 13, 21N-8E	Batestown Till	26	45	29					
75	280-285	SE NW SE 13, 21N-8E	Batestown Till	24	45	31					
75	300-305	SE NW SE 13, 21N-8E	Batestown Till	23	47	30					
75	340-345	SE NW SE 13, 21N-8E	Batestown Till	25	43	32					
75	370-375	SE NW SE 13, 21N-8E	Batestown Till	28	44	28					
75	390-395	SE NW SE 13, 21N-8E	Batestown Till	20	52	28					
75	410-415	SE NW SE 13, 21N-8E	lacustrine	4	63	33					
75	440-445	SE NW SE 13, 21N-8E	lacustrine	6	61	33					
75	480-485	SE NW SE 13, 21N-8E	Piatt Till	41	32	27					
75	500-505	SE NW SE 13, 21N-8E	Piatt Till	42	31	27					
75	520-525	SE NW SE 13, 21N-8E	Piatt Till	43	30	27					
75	540-545	SE NW SE 13, 21N-8E	Piatt Till	41	32	27					
75	560-565	SE NW SE 13, 21N-8E	Piatt Till	43	30	27					
75	580-585	SE NW SE 13, 21N-8E	Piatt Till	41	32	27					
75	600-605	SE NW SE 13, 21N-8E	Piatt Till	39	34	27					
75	620-625	SE NW SE 13, 21N-8E	Piatt Till	38	24	28					
75	630-635	SE NW SE 13, 21N-8E	Piatt Till	39	36	25					
76	150-155	NW NE NW 33, 20N-7E	Richland Loess	11	60	29					
76	180-185	NW NE NW 33, 20N-7E	Richland Loess	13	60	27					
76	200-205	NW NE NW 33, 20N-7E	Piatt Till	41	32	27					
76	240-245	NW NE NW 33, 20N-7E	Piatt Till	41	35	24	8	83	9	21	32
76	270-275	NW NE NW 33, 20N-7E	Piatt Till	38	39	23	8	80	12	7	41
76	330-335	NW NE NW 33, 20N-7E	Piatt Till	40	33	27	10	77	13	14	10
76	355-360	NW NE NW 33, 20N-7E	Piatt Till	40	32	28	9	71	20	30	21
76	380-385	NW NE NW 33, 20N-7E	Piatt Till	40	35	25	7	72	21	30	30
76	410-415	NW NE NW 33, 20N-7E	Piatt Till	38	32	30	5	75	20	29	36
76	445-450	NW NE NW 33, 20N-7E	Piatt Till	40	32	28	6	75	19	22	35
76	475-480	NW NE NW 33, 20N-7E	Piatt Till	39	32	29	7	71	22	34	43
76	490-495	NW NE NW 33, 20N-7E	Piatt Till	40	32	28	7	71	22	28	32
76	520-525	NW NE NW 33, 20N-7E	Piatt Till	37	33	30	5	72	23	30	27
76	540-545	NW NE NW 33, 20N-7E	Piatt Till	37	31	32	4	72	24	32	44
76	570-575	NW NE NW 33, 20N-7E	Piatt Till	38	35	27	5	72	23	25	39
76	595-600	NW NE NW 33, 20N-7E	Piatt Till	36	32	32	4	74	22	41	47
77	160-165	SW NW NW 8, 21N-9E	Batestown Till				5	87	8	-	14
77	190-195	SW NW NW 8, 21N-9E	Batestown Till				5	88	7	?	12
77	240-245	SW NW NW 8, 21N-9E	Batestown Till				6	85	9	-	8
77	260-265	SW NW NW 8, 21N-9E	Batestown Till				7	85	8	-	-
77	290-295	SW NW NW 8, 21N-9E	Batestown Till				6	83	11	17	30
77	310-315	SW NW NW 8, 21N-9E	Batestown Till				4	84	12	20	45
77	330-335	SW NW NW 8, 21N-9E	Batestown Till				4	82	14	21	31
77	350-355	SW NW NW 8, 21N-9E	Batestown Till				3	83	14	12	30
77	425-430	SW NW NW 8, 21N-9E	Batestown Till				3	84	13	22	40
79	120-125	SE NW NW 4, 20N-8E	Richland Loess				71	21	8	-	-

(*continued*)

Site no. RU-	Depth (in cm)	Location	Unit	Matrix textures (%)			Clay minerals (%)			< 2-μ Carbonates counts/sec	
				Sand	Silt	Clay	Expandables	Illite	Chlorite & kaolinite	Calcite	Dolomite
79	180-185	SE NW NW 4, 20N-8E	Richland Loess?				27	63	10	-	-
79	210-215	SE NW NW 4, 20N-8E	Batestown Till	33	39	28	8	82	10	10	16
79	235-240	SE NW NW 4, 20N-8E	Batestown Till	32	35	33	3	88	9	14	21
79	260-265	SE NW NW 4, 20N-8E	Batestown Till	30	38	32	2	88	10	15	29
79	280-285	SE NW NW 4, 20N-8E	Batestown Till	31	39	30	3	88	9	?	24
79	300-305	SE NW NW 4, 20N-8E	Batestown Till	31	36	33	3	87	10	16	28
79	355-360	SE NW NW 4, 20N-8E	Batestown Till	32	37	21	3	84	13	9	37
79	420-425	SE NW NW 4, 20N-8E	Batestown Till				2	76	22	17	32
79	440-445	SE NW NW 4, 20N-8E	Batestown Till	31	39	30	2	79	19	20	27
79	460-465	SE NW NW 4, 20N-8E	Batestown Till				2	78	20	20	26
79	480-485	SE NW NW 4, 20N-8E	Batestown Till	29	41	30	2	77	21	19	36
79	510-515	SE NW NW 4, 20N-8E	Batestown Till	31	39	30	2	76	22	16	26
79	540-545	SE NW NW 4, 20N-8E	Batestown Till	29	40	31	2	79	19	18	30
79	595-600	SE NW NW 4, 20N-8E	Batestown Till	28	40	32	2	77	21	26	29
79	630-635	SE NW NW 4, 20N-8E	Batestown Till	33	38	29	2	79	19	26	36
79	650-655	SE NW NW 4, 20N-8E	Batestown Till	27	43	30	2	76	22	31	36
79	660-665	SE NW NW 4, 20N-8E	Piatt Till	38	33	29					
79	690-695	SE NW NW 4, 20N-8E	Piatt Till				7	73	20	24	30
79	720-725	SE NW NW 4, 20N-8E	Piatt Till	41	30	29	6	72	22	33	46
79	760-765	SE NW NW 4, 20N-8E	Piatt Till	39	31	30	6	72	22	25	36
79	800-805	SE NW NW 4, 20N-8E	Piatt Till	40	31	29	5	73	22	29	33
89	440-450	NE NE SE 21, 19N-7E	Piatt Till	34	36	30	4	78	18	25	50
89	470-480	NE NE SE 21, 19N-7E	Piatt Till	34	37	29	4	73	23	40	49
89	500-505	NE NE SE 21, 19N-7E	Piatt Till	34	32	34	4	73	23	32	46
90	200-205	NW NE NW 1, 19N-8E	Batestown or Piatt	25	43	32	5	82	13	16	27
90	235-240	NW NE NW 1, 19N-8E	Batestown or Piatt	35	37	28	2	82	16	12	33
90	300-305	NW NE NW 1, 19N-8E	Batestown or Piatt				4	82	14	12	34
90	350-355	NW NE NW 1, 19N-8E	Batestown or Piatt	31	38	31	4	82	14	14	24
90	420-425	NW NE NW 1, 19N-8E	Batestown or Piatt	35	32	33	6	79	15	12	36
90	440-445	NW NE NW 1, 19N-8E	Batestown or Piatt	30	43	27	4	78	18	18	25
90	470-475	NW NE NW 1, 19N-8E	Batestown or Piatt	42	37	21	5	77	18	11	28
91	300-305	NE SE NE 12, 19N-8E	Batestown Till	35	29	36	1	80	19	11	17
91	320-325	NE SE NE 12, 19N-8E	Batestown Till	33	31	36	1	81	18	8	12
91	335-340	NE SE NE 12, 19N-8E	Batestown Till	35	29	36					
91	345-350	NE SE NE 12, 19N-8E	Piatt Till				3	80	17	9	31
91	360-365	NE SE NE 12, 19N-8E	Piatt Till	39	32	29	3	79	18	19	26
91	375-380	NE SE NE 12, 19N-8E	Piatt Till	39	32	29	5	76	19	16	32
92	270-275	NW NW NE 5, 19N-7E	Piatt Till				7	76	17	41	55
92	290-295	NW NW NE 5, 19N-7E	Piatt Till				5	74	21	37	50
92	310-315	NW NW NE 5, 19N-7E	Piatt Till				6	73	21	40	41
92	330-335	NW NW NE 5, 19N-7E	Piatt Till				6	75	19	42	34
92	350-355	NW NW NE 5, 19N-7E	Piatt Till				6	72	22	42	53
93	160-165	NW NW NE 2, 19N-7E	Piatt Till?	28	37	35	35	53	12	14	21
93	185-190	NW NW NE 2, 19N-7E	Piatt Till				7	80	13	12	44
93	210-215	NW NW NE 2, 19N-7E	Piatt Till	32	33	35	8	81	11	36	40
93	235-240	NW NW NE 2, 19N-7E	Piatt Till				8	81	11	25	41
93	260-265	NW NW NE 2, 19N-7E	Piatt Till				9	80	11	23	35

(*continued*)

Site no. RU-	Depth (in cm)	Location	Unit	Matrix textures (%) Sand	Silt	Clay	Clay minerals (%) Expandables	Illite	Chlorite & kaolinite	<2-μ Carbonates counts/sec Calcite	Dolomite
93	285-290	NW NW NE 2, 19N-7E	Piatt Till				6	81	13	35	46
93	310-315	NW NW NE 2, 19N-7E	Piatt Till	33	35	32	7	76	17	22	44
93	335-340	NW NW NE 2, 19N-7E	Piatt Till				6	78	16	25	41
93	360-365	NW NW NE 2, 19N-7E	Piatt Till				4	80	16	24	47
93	385-390	NW NW NE 2, 19N-7E	Piatt Till	29	36	35	7	76	17	25	40
93	410-415	NW NW NE 2, 19N-7E	Piatt Till				7	77	16	29	31
93	435-440	NW NW NE 2, 19N-7E	Piatt Till	33	36	31	6	72	22	36	38
93	475-480	NW NW NE 2, 19N-7E	Piatt Till				6	74	20	36	47
93	530-535	NW NW NE 2, 19N-7E	Piatt Till	33	37	30	5	75	20	47	44
93	580-585	NW NW NE 2, 19N-7E	Piatt Till				5	74	21	30	52
93	630-635	NW NW NE 2, 19N-7E	Piatt Till	33	36	31	5	73	22	37	38
93	680-685	NW NW NE 2, 19N-7E	Piatt Till				4	76	20	30	41
93	730-735	NW NW NE 2, 19N-7E	Piatt Till	34	33	33	5	73	22	28	38
93	780-785	NW NW NE 2, 19N-7E	Piatt Till				4	75	21	30	32
93	830-835	NW NW NE 2, 19N-7E	Piatt Till	31	39	30	4	74	22	35	40
93	880-885	NW NW NE 2, 19N-7E	Piatt Till				5	73	22	39	34
93	930-935	NW NW NE 2, 19N-7E	Piatt Till	32	38	30	4	73	23	28	46
93	980-985	NW NW NE 2, 19N-7E	Piatt Till				3	73	24	44	51
93	1030-1035	NW NW NE 2, 19N-7E	Piatt Till				3	77	20	25	40
93	1080-1085	NW NW NE 2, 19N-7E	Piatt Till	32	36	32	4	71	25	32	51
94	220-225	NE NE NW 22, 19N-7E	Piatt Till	33	34	33	7	83	10	17	30
94	280-285	NE NE NW 22, 19N-7E	Piatt Till	37	32	31	8	79	13	21	36
94	320-325	NE NE NW 22, 19N-7E	Piatt Till	35	31	34	8	81	11	19	34
94	345-350	NE NE NW 22, 19N-7E	Piatt Till	34	34	32	6	84	10	29	30
95	150-155	NE NE NE 20, 19N-8E	Batestown Till	28	33	39					
95	160-165	NE NE NE 20, 19N-8E	Batestown Till	28	33	39					
95	190-195	NE NE NE 20, 19N-8E	Batestown Till	27	33	40					
95	205-210	NE NE NE 20, 19N-8E	Batestown Till	27	33	40					
95	235-240	NE NE NE 20, 19N-8E	Batestown Till	27	44	29					
96	310-315	SE SE SW 13, 19N-6E	Piatt Till	32	34	34					
96	330-335	SE SE SW 13, 19N-6E	Piatt Till	27	30	43					
96	355-360	SE SE SW 13, 19N-6E	Piatt Till	34	35	31					
96	595-600	SE SE SW 13, 19N-6E	Piatt Till	36	33	31					
97	300-305	NE SW NE 26, 20N-6E	Piatt Till	43	31	26					
97	330-335	NE SW NE 26, 20N-6E	Piatt Till	37	35	28					
97	355-360	NE SW NE 26, 20N-6E	Piatt Till	48	27	25					

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