Glacial Drift of the Shelbyville Moraine at Shelbyville, Illinois

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ABSTRACT

The Shelbyville Moraine is one of the best known end moraines in the central United States. Recent excavations for a new dam in the moraine at Shelbyville, Illinois, have shown that only one Wisconsinan till is present at the site and that its base lies at the same general elevation as the Illinoian drift plain to the south. At the type locality, therefore, the Shelbyville is a terminal end moraine of the Wisconsinan ice sheet. A radiocarbon date of 20,000 ± 200 years B.P. (ISGS 26) obtained from silty peat immediately below the Shelbyville Drift represents the approximate age of the glacial advance to the position of the moraine.

Morton Loess, Robein Silt, and Roxana Silt, as well as the Berry Clay and Vandalia Till Members of the Glasford Formation, are exposed below the Shelbyville Drift. A radiocarbon date of 21,400 ± 1,000 years B.P. (ISGS 46) from organic material in the upper 12 inches of the Berry Clay Member indicates that from late Illinoian time to early Woodfordian time accretion-gley accumulated locally in this area and that loess deposited during this period was incorporated into the Berry Clay. Radiocarbon dates of 21,300±500 years B. P. (ISGS 32) and 20,000±200 years B. P. (ISGS 26), respectively, from the base and top of Robein Silt indicate that at Shelbyville the Robein is Woodfordian in age and that it accumulated contemporaneously with Morton Loess.

INTRODUCTION

The Shelbyville Moraine is one of the best known end moraines in the central United States. It was first shown in 1894 on a map in an article by T. C. Chamberlin published in J. Geikie's The Great Ice Age. Chamberlin included the
moraine in the East Wisconsin Formation and noted that "the outer border is marked by a distinct terminal moraine, usually one to five miles wide, and from 50 to 300 feet thick." In 1897, Frank Leverett named the Shelbyville morainic system after the town of Shelbyville, which is located on the outer edge of the moraine. Leverett wrote that the "morainic system marks the southern limit of a sheet of thick drift, the thickest, perhaps, formed in Illinois at any stage of the glacial period." During the 73 years since the naming of the moraine, Shelbyville has come to be one of the most familiar Pleistocene names in Illinois.

The U. S. Army Corps of Engineers recently constructed a major dam across the Kaskaskia River at Shelbyville. The structure is located in the center of the Shelbyville Moraine where the moraine has been breached by the Kaskaskia River (fig. 1). During construction of the dam, several excavations were made which exposed internal details of the drift in the moraine as well as those of sediments that underlie the moraine. It is the purpose here to describe these recently revealed details and the character of the drift.

Locations of the Sections

Two sections, which unfortunately are no longer exposed, were particularly significant in the excavation area. The first, the Shelbyville Dam Section, was located on the west valley side, 200 yards southwest of the dam (fig. 1). Above bedrock, the excavation exposed Illinoian till, Sangamonian accretion-gley, Wisconsinan loess, and drift of the Shelbyville Moraine. The second exposure was located in a borrow pit 400 yards north of the dam and is here referred to as the Shelbyville Borrow Pit Section. In addition to Illinoian till, Sangamonian and Wisconsinan accretion-gley, and the drift of the Shelbyville Moraine, the section exposed Wisconsinan peaty silt between the accretion-gley and the overlying drift of the moraine.

A third exposure, the Lithia Section, is located in a borrow slope along Lithia Springs Creek immediately north of the crest of the Shelbyville Moraine and about three miles northeast of the dam (fig. 1). The Lithia Section exposes only Wisconsinan drift.

SHELBYVILLE MORAINES

Description of the Moraine

The Shelbyville Moraine, at Shelbyville, is a prominent topographic feature which rises to an elevation of 700 feet, about 100 feet higher than the Illinoian drift plain immediately to the south. The Wisconsinan drift in the Shelbyville Dam Section overlies the Sangamon Soil, which is in accretion-gley and Illinoian drift. The top of the soil lies at an elevation of 595 feet, the same elevation as the Illinoian drift plain, and therefore the moraine is interpreted as being entirely Wisconsinan in age.

The Dam Section is located on the valley side of the Kaskaskia River and contains only one till above the Sangamon Soil. The elevation of the top of the section at 630 feet is about 60 feet lower than the crest of the moraine (fig. 2). The Lithia Section, however, is higher and the top of the section is only about
10 feet below the general elevation of the nearby Wisconsinan drift plain. The base of the Wisconsinan till is not exposed in the Lithia Section, but the till is similar in character to that in the Dam and Borrow Pit Sections, and there is no evidence that more than one till makes up the Shelbyville Moraine. Consequently, the Shelbyville is interpreted to be a true end moraine at the type locality and probably was constructed by one major ice advance of the glacier. It is not a composite morainic feature composed of several tills deposited by different ice advances such as moraines recently described by White (1962); Totten (1969); Kempton (1963); Kempton and Hackett (1968); Deal (1970); and Kempton, DuMontelle and Glass (in press).

Age of the Moraine

In the Borrow Pit Section, till of the moraine and related proglacial sediments overlie 1.5 feet of silty peat. The upper 2.5 inches of the peat yielded a
Fig. 2 - Diagrammatic cross section showing relationships between the Illinoian drift plain, the Shelbyville Moraine, the described sections, the stratigraphic units, and the radiocarbon dates.
radiocarbon date of 20,000±200 years B.P. (ISGS 26). The peat is overlain by 6 inches of silt and clay. The silt and clay are mineralogically similar to the overlying till of the moraine and are interpreted to be related to the advance of the ice. Because a moss layer is preserved at the top of the peat and because there is no evidence of erosion at the contact of the peat with the overlying silt and clay, the date of 20,000 years B.P. is interpreted to mark the approximate time when the peat was buried and is the approximate date of the glacial advance to the position of the moraine at Shelbyville.

The date is in agreement with other dates which have been obtained from organic material below or at the base of the Shelbyville Drift elsewhere in Illinois. At the well known Farm Creek Section (Leverett, 1899; Leighton, 1926, 1931; Willman and Frye, 1970) northwest of Shelbyville, an organic zone at the top of the Morton Loess immediately below Shelbyville Drift has been dated as 20,340±750 radiocarbon years B.P. (W-349). Moss in the same stratigraphic position in the Danvers Section (Frye and Willman, 1965) was dated at 20,500±600 radiocarbon years B.P. (W-483). Wood from the base of Shelbyville till near these two sections has been dated as 19,200±700 radiocarbon years B.P. (W-187). Willman and Frye (1970) also report a date of 19,500±200 (ISGS 27) for wood in the Morton Loess (pro-Shebyville silt) at Charleston, Illinois, east of Shelbyville, and a date of 20,000±400 (I-2519) from the organic Robein Silt in a subsurface core from Douglas County northeast of Shelbyville. Thus an age of approximately 20,000 radiocarbon years B.P. or slightly less is well substantiated for the beginning of deposition of the Shelbyville Moraine.

The Shelbyville Moraine in the type locality appears somewhat younger than the moraines and drift in Indiana that have been correlated with the Shelbyville. Wayne (1965) lists a few dates which agree with the dates in Illinois, but most are about 1,000 radiocarbon years older, and Wayne suggests a date of 21,000 years B.P. for the Shelbyville (base of the Center Grove Till Member of the Trafalgar Formation, Wayne, 1963) in western Indiana. Dates on a silt which occurs above the Center Grove Till Member in Indiana fall between 19,930 and 20,300 years B.P. (Wayne, 1965) and are in closer agreement with the age of the silt below the Shelbyville in Illinois. Thus, it seems probable that the deposition of the moraine and drift called Shelbyville in Indiana was not contemporaneous with the deposition of the Shelbyville Moraine at the type locality and that the Woodfordian ice reached its outermost extent at somewhat different times in different areas along its terminus.

STRATIGRAPHY

Introduction

In recent years there has been an increasing need to treat the Pleistocene sediments in Illinois with multiple schemes of stratigraphic classification. In addition to time- and soil-stratigraphic units which have been widely used for the Pleistocene, informal rock-stratigraphic units (Jacobs and Lineback, 1969; Frye, Glass, Kempton and Willman, 1969) and morphostratigraphic units (Frye and Willman, 1960, 1962) have been introduced. These trends recently culminated in the establishment of a formal stratigraphic framework for Pleistocene deposits in
<table>
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<th>Radio-carbon years B.P.</th>
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<th>Rock Stratigraphy</th>
<th>Morpho-stratigraphy</th>
<th>Soil Stratigraphy</th>
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Fig. 3 - Classification of time-stratigraphic, rock-stratigraphic, morphostratigraphic, and soil-stratigraphic units present at Shelbyville.

Illinois (Willman and Frye, 1970) which recognizes rock-stratigraphic, soil-stratigraphic, morphostratigraphic, and time-stratigraphic classifications. Figure 3 shows the stratigraphic units that are present in each of these categories at Shelbyville.

Section descriptions for the three stratigraphic sections at Shelbyville are included in the appendix at the end of the report. Grain-size analyses under the supervision of W. A. White and clay mineral analyses by H. D. Glass were made in laboratories of the Illinois State Geological Survey and the carbonate analyses were made in the Pleistocene Geology Laboratory at the University of
Illinois. All laboratory data are tabulated in Table 1. Figures 4 and 5 show stratigraphic units in the Dam and Borrow Pit Sections, respectively, as well as sample numbers, locations, and laboratory data for these sections.

Time Stratigraphy, Rock Stratigraphy, and Morphostratigraphy (Figure 3)

The sections at Shelbyville expose sediments of the Wisconsinan, Sangamon, and Illinoian Stages. The till of the Shelbyville Moraine is included in the Wedron Formation (Frye et al., 1968) of the Woodfordian Substage of the Wisconsinan. The Wedron has not been subdivided into members in the Shelbyville area and no differentiation is made in this report. The till of the moraine, however, is included in the Shelbyville Drift, a morphostratigraphic unit (Willman and Frye, 1970).

The tills of Illinoian age are included in the Glasford Formation (Willman and Frye, 1970). The Vandalia Till Member of the Glasford (Jacobs and Lineback, 1969) is the surficial till south of Shelbyville and is present in the sections at Shelbyville beneath the Wisconsinan drift and on top of the bedrock. An accretion-gley type soil has developed on the Vandalia Till in both the Dam and Borrow Pit Sections and the sediments are included in the Berry Clay Member (Willman and Frye, 1970) of the Glasford Formation.

Wisconsinan sediments between the Shelbyville Drift and the Berry Clay Member are included in the Morton Loess, Robein Silt, and Roxana Silt (Willman and Frye, 1970). In this area, the Morton and Robein are assigned to the Woodfordian Substage and the Roxana is assigned to the Altonian Substage.

Description of the Units

Glasford Formation

Vandalia Till Member - The Vandalia Till has been described and characterized in the type area about 35 miles southeast of Shelbyville (Jacobs and Lineback, 1969). It has been assigned to the Monicam Substage of the Illinoian Stage (Willman and Frye, 1970).

At Shelbyville, the till is similar in character to the till in the type area. It is dark brownish gray and oxidizes to yellow-brown. The till is sandy (figs. 4 and 5) and in these sections the <2mm fraction averages 50 percent sand, 34 percent silt, and 16 percent clay. The carbonate mineralogy of the <74μ fraction is 8 percent calcite and 25 percent dolomite, and the clay fraction, taken from unaltered till, averages 13 percent expandable clay minerals, 62 percent illite, and 25 percent kaolinite and chlorite. Interbedded sand and gravel is common, particularly in the upper portion of the till, which is less compact and which probably accumulated during ablation of the ice. The upper part of the till is weathered in the Dam Section and is part of the Sangamon Soil.

Berry Clay Member - The Berry Clay Member includes sediments which accumulated as accretion-gley in depressional areas on the landscape after Illinoian glaciation (Willman and Frye, 1970). Sediments included in the Berry Clay Member occur in both the Dam and Borrow Pit Sections above the Vandalia Till Member.

The accretion-gley is predominantly gray in both sections. However, in the Dam Section the gray is mottled with brownish zones while in the Borrow Pit
### Table 1—Grain Size, Carbonate, and Clay Mineral Analyses of Samples

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<th>Sample no.</th>
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<th>Ft below top of unit</th>
<th>Grain size (% of &lt;2mm)</th>
<th>Carbonates (% of &lt;74%)</th>
<th>Clay minerals (% of &lt;2%)</th>
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<tr>
<td>45-3</td>
<td>Shelbyville Drift (till)</td>
<td>17</td>
<td>26 62 32 7 19 8 77 15</td>
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<tr>
<td>45-4</td>
<td>Shelbyville Drift (till)</td>
<td>23</td>
<td>25 44 31 6 20 6 73 21</td>
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<tr>
<td>45-5</td>
<td>Shelbyville Drift (till)</td>
<td>29</td>
<td>26 43 31 6 19 5 70 25</td>
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Fig. 4 - Stratigraphic units; sample numbers and locations; and grain size, carbonate, and clay mineral data for the Shelbyville Dam Section.
Fig. 5 - Stratigraphic units; sample numbers and locations; and grain size, carbonate, and clay mineral data for the Shelbyville Borrow Pit Section.
Section bluish-gray and greenish-gray colors are common, particularly in the lower portion. The gley is noncalcareous, and sand and pebbles increase in abundance with depth. The <2mm fraction averages 21 percent sand, 46 percent silt, and 33 percent clay, and the clay fraction averages 70 percent expandable clay minerals, 13 percent illite, and 17 percent kaolinite and chlorite (figs. 4 and 5). The large quantity of expandable clay minerals and the low amount of illite are typical of accretion-gley in Illinois (Willman, Glass and Frye, 1966).

The age of the Berry Clay Member varies in these two sections. In the Borrow Pit Section organic material in the upper 12 inches of the gley was dated at 21,400±1,000 radiocarbon years B.P. (ISGS 46). Thus, although gley accumulation began in late Illinoian time, the accretion process must have continued, although not necessarily continuously, into the Wisconsinan, and the uppermost portion of the Berry Clay Member in this section is earliest Woodfordian in age. A uniform increase in silt content from the base (36 percent) to the top (59 percent) (fig. 5) reflects the incorporation of Roxana Silt during the Altonian Substage of the Wisconsinan.

In the Dam Section, the Berry Clay Member is overlain by thin Roxana Silt. It appears that here the depressional area in which the sediments had been accumulating was filled near the end of Sangamonian time or during the early Altonian, and thus, Berry Clay deposition ceased at a considerably earlier time here than in the Borrow Pit Section.

Roxana Silt

In the Dam Section, silt which occurs above the Berry Member and below Morton Loess is included in the Roxana Silt of Altonian age (Frye and Willman, 1960). The silt is only four inches thick. It (sample 6-26) contains 13 percent sand, 59 percent silt, and 28 percent clay, and the clay mineral composition is 81 percent expandable clay minerals, 9 percent illite, and 10 percent kaolinite and chlorite (fig. 4). It is massive and the color and clay mineral composition are typical for the Roxana in this area. The total carbonate content in the <74μ fraction is less than 1 percent (fig. 4). The silt is probably loess that has been somewhat modified by colluviation.

Robein Silt

Frye and Willman (1960) established the Farmdaleian Substage of the Wisconsinan Stage on the basis of the Farmdale Silt. Because the term Farmdale has been used in a variety of ways, the rock unit has been renamed the Robein Silt (Willman and Frye, 1970) to include silts, organic silts, and peat that are bounded below by the Roxana Silt or underlying formations, and above by Morton Loess or units of the Wedron Formation. The organic zone at this stratigraphic position in the Borrow Pit Section is assigned to the Robein Silt. In the Dam Section the Robein Silt is not present, apparently because the area, which earlier had been depressional, became better drained and carbonaceous sediments did not accumulate.

The Robein Silt in the Borrow Pit Section is a silty peat 1.5 feet thick. Two samples (16-10 and 16-11) average 5 percent sand, 74 percent silt, and 21 percent clay, and the clay fraction averages 51 percent expandable clay minerals, 28 percent illite, and 21 percent kaolinite and chlorite (fig. 5).
Two radiocarbon dates are available from the Robein Silt. The age of the upper 2.5 inches of the peat is 20,000±200 radiocarbon years B.P. (ISGS 26), and the lower 2.5 inches of peat was dated at 21,300±500 radiocarbon years B.P. (ISGS 32). Thus, the Robein Silt in this section is entirely Woodfordian in age, and peat accumulation lasted approximately 1,300 radiocarbon years prior to burial by the first Woodfordian glacial sediments in this area.

Most dates from the Robein Silt in Illinois range from 22,000 to 28,000 radiocarbon years B.P., and Willman and Frye (1970) estimate that this is the approximate time span of the Farmdalian Substage in the type section. These dates, however, are from areas considerably north of Shelbyville, and the younger age for the Robein at Shelbyville is a result of the time transgression between the Robein Silt and the overlying Morton Loess and/or Wedron Formation (Kempton and Gross, 1970). Dates for the Robein at two nearby locations agree with the age of the Robein at Shelbyville. One is the earlier mentioned date of 20,000±400 radiocarbon years B.P. (I-2519) from a core in Douglas County, and the other is 21,300±200 (ISGS 28) from an exposure in Coles County east of Shelbyville.

Morton Loess

The Morton Loess consists of proglacial loess deposited in front of the advancing Woodfordian glacier (Frye and Willman, 1960). In the Dam Section, loess which occurs above the Roxana Silt and below lacustrine deposits related to the Shelbyville Drift is included in the Morton Loess.

The loess is gray, massive, and a foot thick. It (samples 6-23 to 6-25) averages 3 percent sand, 72 percent silt, and 25 percent clay, and the clay fraction averages 72 percent expandable clay minerals, 17 percent illite, and 11 percent kaolinite and chlorite (fig. 4). However, there is a significant increase in the illite content from 12 percent at the base to 25 percent at the top and a corresponding decrease in the expandable clay minerals from 77 percent to 65 percent. The calcite content is low (1-2 percent) in all samples, but the dolomite content increases from 1 percent at the base to 17 percent at the top (fig. 4). These gradations in clay and carbonate mineralogy are probably related to changes in the composition of the outwash from which the loess was derived.

Frye, Glass and Willman (1962) and Glass, Frye and Willman (1964) have related compositional characteristics of the Morton Loess to the drainage history of the Ancient Mississippi and Illinois Rivers. The lower portion of the Morton Loess in the Illinois Valley region contains more expandable clay minerals than the upper portion. This difference in composition resulted from the diversion of the Ancient Mississippi River by the Woodfordian glacier in Bureau County, Illinois. Prior to diversion, the outwash in the Illinois Valley was derived from both the Ancient Mississippi River draining from the northwest (montmorillonite source) and the Illinois River draining from the northeast (illite source). After the diversion, the predominantly montmorillonitic outwash from the Ancient Mississippi was not carried down the Illinois Valley and thus post-diversion loess in the Illinois Valley contains less montmorillonite and more illite than pre-diversion loess. Through detailed study of the loess mineralogy and available radiocarbon dates, Glass, Frye and Willman (1964) have shown that the diversion took place 21,000±500 radiocarbon years B.P. and that Morton deposition started about 22,000 to 22,500 years B.P.
The base of the Morton at Shelbyville has a clay mineral composition which is related to the pre-diversion source. However, the increase in illite and dolomite (fig. 5) in the upper portion evidently reflects the influence of the Woodfordian glacier from the Lake Michigan Basin. This glacier moved over Paleozoic dolomite and illitic shale in northern Illinois, and loess derived from its outwash is enriched in this material. Similar mineralogical gradations have been reported in the Petersburg Silt, the pro-Illinoian loess deposited in front of the first Illinoian glacier (Frye, Willman and Glass, 1964).

The age of the Morton relative to the Robein Silt is not definitely known in these sections. The evidence suggests, however, that the Morton was deposited in the Dam Section slightly before or in part contemporaneously with Robein Silt accumulation in the Borrow Pit Section. Because the base of the loess was derived from a pre-diversion outwash source, deposition must have begun prior to 20,500 radiocarbon years B.P., the earliest date for the Ancient Mississippi River diversion. However, in the Borrow Pit Section, Robein Silt accumulation lasted until approximately 20,000±200 radiocarbon years B.P.; therefore it is not possible for all of the Morton to be younger than the Robein. Consequently, at least part of the Morton Loess accumulated in a facies situation with Robein Silt, and in the Borrow Pit Section any loess equivalent to the Morton is incorporated into the Berry Clay Member, the Robein Silt, or both.

Wedron Formation

The Wedron Formation includes the tills and intercalated outwash occurring stratigraphically between the top of the Morton Loess and the base of the Two Creeks sediments in Wisconsin (Frye et al., 1968). The Wedron has been differentiated into named members in northeastern Illinois (Willman and Frye, 1970) and in east-central Illinois (Johnson, Gross and Moran, in press). As yet it has not been differentiated in central Illinois and no subdivision is made in this paper. The Dam and Borrow Pit Sections are located in the Shelbyville Moraine, and the till and related sediments are part of the Shelbyville Drift, a morpho-stratigraphic unit.

In both sections, sand, silt, and clay occur immediately below the till of the Shelbyville Drift. These sediments vary considerably in texture (figs. 4 and 5) but their mineralogy is quite similar. The <74μ fraction averages 6 percent calcite and 25 percent dolomite, and the clay fraction averages 8 percent expandable clay minerals, 73 percent illite, and 19 percent kaolinite and chlorite (samples 6-21, 6-22, 16-7, 16-8, and 16-9). The composition of these sediments contrasts strongly with that of the Morton Loess but is similar to that of the overlying till. The sand, silt, and clay accumulated in ponds closely related to the ice front.

The Shelbyville till is medium textured (figs. 4 and 5), and the till matrix averages 27 percent sand, 41 percent silt, and 32 percent clay. Discontinuous sand, gravel, and silt zones are common throughout the till. The unaltered till is gray with a slight violet cast and it oxidizes to tannish-brown. Joints are common, and iron staining and oxidation are present along the joints for a considerable depth below the surface.

The clay fraction (figs. 4 and 5) of the unaltered till contains approximately 6 percent expandable clay minerals, 73 percent illite, and 21 percent kaolinite and chlorite (samples 16-4, 16-5, 16-6, and 6-9). With oxidation there is an increase in expandable clay minerals and a corresponding decrease in chlorite. The carbonate composition (figs. 4 and 5) of the <74μ fraction averages 7 percent calcite and 20 percent dolomite.
The clay mineral and carbonate compositions of the Shelbyville till in these sections are slightly different from those of the underlying Vandalia Till. The Vandalia contains less illite and more kaolinite in the clay fraction and more dolomite in the <74μ fraction than the Shelbyville. The tills are distinct texturally, with the Vandalia containing about 20 percent more sand than the Shelbyville (fig. 4).

Soil Stratigraphy (Figure 3)

Willman and Frye (1970) have recently discussed the principles for use of soils in stratigraphy. Of particular importance is the practice of identifying a soil on the basis of the stratigraphic position of its top. Thus, the accreted paleosols in the Dam and Borrow Pit Sections are given different names, the Sangamon Soil for the former and the Farmdale Soil for the latter.

The Sangamon Soil in the Dam Section is typical of many of the buried soils which have been preserved in and on Illinoian drift in Illinois. The lower part developed in Vandalia Till by weathering while the upper part accumulated by slopewash into a depressional area. The soil is overlain by Roxana Silt and thus the name Sangamon is appropriate.

Clay mineralogy illustrates very well the processes which have functioned in these environments. The lowest sample (6-1) of Vandalia Till contains 10 percent expandable clay minerals, 63 percent illite, and 27 percent kaolinite and chlorite (fig. 4). Upward in the section, there is a more or less uniform increase in expandable clay minerals and a decrease in kaolinite and chlorite until at the base of the leached zone, the clay mineral composition is 20 percent expandable clay minerals, 65 percent illite, and 15 percent kaolinite and chlorite. These changes are primarily the result of oxidation and alteration of chlorite. In the next 12 inches, the expandable clay minerals increase rapidly to over 70 percent and the illite content decreases accordingly; this composition, with only minor variation, is characteristic of the entire upper part of the soil. The composition reflects the acid and reducing gleying environment in which pedogenic formation of montmorillonite takes place (Willman, Glass and Frye, 1966).

The Sangamon Soil has a pronounced clay bulge (fig. 4) with clay content increasing from 23 percent at the top to 45 percent in the middle and then decreasing to 15 percent in the calcareous Vandalia Till. There has been sufficient illuviation of clay in the leached upper part of the Vandalia to alter the clay mineral composition of the till so that the till has the same clay mineral composition as the overlying accretion-gley. The upper six inches of the accretion-gley is silty and probably contains a little loess (Roxana Silt) which was blown in during the earliest part of the Wisconsinan.

The buried soil in the Borrow Pit Section is also an accretion-gley. It differs from the Sangamon Soil in that it continued to accumulate until well into the Wisconsinan and is capped by an organic accumulation, the Robeín Silt. This soil, including the organic accumulation, is overlain by the Wedron Formation, and thus the top is at the stratigraphic position of the Farmdale Soil (Willman and Frye, 1970).

The gleyed portion of the Farmdale Soil is similar to the accretion-gley in the Dam Section. It contains abundant montmorillonite (fig. 5) and has colors which are characteristic of a poorly drained, reducing environment. The texture of the gley, particularly the silt content, reflects an increasing influence of loess
upward in the soil. The date from the upper part of the gley, 21,400±1,000 radiocarbon years B.P., also indicates that the gley must have accumulated during the time the Roxana Silt was being deposited and during at least part of the time that Morton Loess was accumulating. Thus, silt equivalent to both of these units has been incorporated into the gley and is responsible for the increased silt content.

The upper, organic portion of the Farndale Soil reflects a wetter, more marshy environment than the poorly drained depressional site of accretion-gley deposition. As a result, the sediments that accumulated during this time contain large quantities of organic matter and wood fragments are abundant. The illite content is higher than in the gley below (fig. 5) and is similar to the illite content of the upper portion of the Morton Loess in the Dam Section. This compositional similarity also implies that the soil contains a wind-blown component and supports the concept that the Morton Loess accumulated in the Dam Section contemporaneously with organic accumulation in the Borrow Pit Section.

GEOLOGIC HISTORY

There is no record of Kansan or early Illinoian (Liman Substage) glaciation in these sections. However, Kansan glaciation has been reported to the northwest (Johnson, 1964), and Kansan and early Illinoian glaciations have been reported to the southwest (Jacobs and Lineback, 1969), to the northeast (Johnson, Gross and Moran, in press), and to the east (J. P. Ford, personal communication, 1970). The Shelbyville region was covered by these earlier glaciers, but all evidence of them has been eroded from these sections.

The Vandalia Till was deposited by a glacier which advanced into this area during the middle Illinoian (Monican Substage). The glacier which deposited the Vandalia Till stagnated (Leighton, 1959; Jacobs and Lineback, 1968, 1969), and partially washed sediments were deposited during deglaciation of the area. The late Illinoian (Jubileean Substage) ice advance did not reach the Shelbyville area, and weathering of the Vandalia Till began during this time.

During Sangamonian time the drift was weathered and accretionary sediments, included in the Berry Clay, were deposited in low, poorly drained areas. A wind-blown silt component, picked up from valley trains derived from the Altonian glaciers in northwest Illinois (Frye et al., 1969), was added to these sediments in the early Wisconsinan. This earliest silt deposition filled the low area of the Dam Section and terminated the formation of the Sangamon Soil. Continued silt deposition resulted in the accumulation of Roxana Silt on top of the Sangamon Soil in this section. However, in the Borrow Pit Section, this silt and slopewash continued to accumulate in the depressional area as Berry Clay. This condition continued until about 21,300 radiocarbon years B.P., and the last phase of accumulation of Berry Clay probably included some wind-blown silt derived from the earliest Woodfordian glaciers.

Climatic change, related to and probably the result of the advance of Woodfordian glaciers, initiated a period of peat accumulation which lasted about 1,300 radiocarbon years and ended 20,000 years B.P. During this interval there apparently were lower temperatures and more precipitation and, as a result, the area of the Borrow Pit Section became a marsh, and peaty silt, the Robein Silt, accumulated. As the Woodfordian glaciers advanced southward, the Morton Loess
was deposited in the Dam Section and some of this wind-blown silt was incorporated into the Robelin Silt in the Borrow Pit Section. Local ponding occurred in front of the ice, and lacustrine silts and clays, derived directly from the glacier, were deposited and eventually overridden by the glacier. This ponding terminated the accumulation of peaty silts at Shelbyville as well as the formation of the Farmdale Soil.

The Woodfordian ice front advanced at a rate of approximately 67 m (218 feet) per year (Kempton and Gross, 1970) and reached its southernmost position in Illinois slightly after 20,000±200 radiocarbon years B.P., and the Shelbyville Moraine was deposited at the terminal position. With the ice front more or less stationary, a wedge of drift, about 100 feet thick in the Shelbyville area, was deposited before the margin of the ice began to retreat. During retreat, the Rich-land Loess was deposited over much of Illinois; however, this loess has been eroded from the sections in question. During and after loess deposition, weathering of the surficial drift occurred, and the Modern Soil continues to develop today.

REFERENCES


DRIFT OF THE SHELBYVILLE MORAINE

APPENDIX

Shelbyville Dam Section

Section located on west valley side of the Kaskaskia River and 200 yards southwest of the Shelbyville Dam in the NW¼, SE¼, SW¼, Sec. 8, T.11N., R.4E. Color notations and color names refer to those of the Munsell color charts and pertain to moist samples. Numbers in parentheses at the end of descriptions are sample numbers.

Wisconsinan Stage

Woodfordian Substage

Wedron Formation (undifferentiated)

Shelbyville Drift

Till, silty, tan-brown, noncalcareous; A-zone of Modern Soil

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Till, 10YR 4/3 brown to dark brown, silty clay loam, noncalcareous; B-zone of Modern Soil

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Till, calcareous, 10YR 4.5/4 yellowish brown to dark yellowish brown at top to 10YR 5/2 grayish brown at base, jointed with Fe and Mn stain on joints; upper 3 feet contains secondary CaCO₃ accumulation; discontinuous sand, silt, and gravel zones common throughout the till, these zones are usually thin but one gravel zone up to 5 feet thick is present near top; (6-9 base to 16-18 top; 6-19, 1.5 feet above base; 6-20, 0.75 feet above base)

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Sand, calcareous, yellow-brown, medium to coarse, fairly well sorted; (6-21)

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Silt, calcareous, yellow-brown, slight gray mottling, well sorted; (6-22)

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Morton Loess

Silt, calcareous, gray to brownish gray, massive, well sorted; (6-23 top to 6-25 base)

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Altonian Substage

Roxana Silt

Silt, noncalcareous, brown, massive; (6-26)

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Wisconsinan and Illinoian Stages

Glasford Formation

Berry Clay Member

Clay, contains a few pebbles, noncalcareous, gleyed, brown to grayish-brown, upper 12 inches mottled with yellow-brown, lower portion contains gray mottling; Mn and Fe concretions and wood fragments in the upper 12 inches; upper part of Sangamon Soil; (6-27 top to 6-34 base) 4.0

Vandalia Till Member

Till, pebbly, sandy and silty, leached, dark gray and yellow brown, many Fe concretions, secondary CaCO₃ near base; partially sorted and water laid; lower part of Sangamon Soil; (6-35 top to 6-39 base) 3.0

Till, calcareous, 10YR 5/3 brown at top to 2.5Y 3/2 very dark gray brown at base; sandy till, dense, jointed with oxidation and Fe cementation along joints; weathered shale and colluvium in basal portion of till, upper portion contains sand and gravel zones with CaCO₃ cementation; (6-40, 0.5 feet below top; 6-41, 1.5 feet below top; 6-8 top to 6-1 base) 18.5

Pennsylvanian

Sandstone, gray, micaceous

Total section 57.0
Shelbyville Borrow Pit Section

Section in borrow pit 400 yards north of Shelbyville Dam and in SW₁, NW₁, SE₁, Sec. 8, T.11N., R.4E. Approximately 5 feet at top of section not exposed as a result of construction.

Wisconsinan Stage

Woodfordian Substage

Wedron Formation (undifferentiated)

Shelbyville Drift

Till, calcareous, brown at top to gray at base; silty, upper part of till jointed with staining and clay concentration in joints; silt zones common in upper 10 feet, lower part contains wood; covered interval from 12.5 feet to 18.5 feet; (16-1 top to 16-6 base)

Silt, light and dark gray, calcareous, laminated, contorted; (16-7 top and 16-8 base)

Clay, gray, calcareous, laminated, contorted, olive at top and at base, abrupt contacts; (16-9)

Robein Silt

Peat, silty, moss layer on top, dark brownish black with local yellowish brown zones, contains much wood and carbonaceous material, upper part of Farmdale Soil; (16-10 top and 16-11 base; 16-12, upper 2.5 inches, 20,000±200 radiocarbon years B. P., ISGS 26; 16-17, lower 2.5 inches, 21,300±500 radiocarbon years B. P., ISGS 32)

Wisconsinan and Illinoian Stages

Glasford Formation

Berry Clay Member

Silt, clayey, noncalcareous, gleyed; upper 12 inches, dark blackish-gray, contains wood fragments and a thin carbonaceous zone 6 inches from top; lower portion contains more clay and sand and a few pebbles, brownish-gray to bluish-gray and greenish-gray, very tough and hard; lower part
of Farmdale Soil; base not exposed; (16-18, upper 12 inches, 21,400±1,000 radiocarbon years B.P., ISGS 46; 16-19 top to 16-25 base)  

Vandalia Till Member

Till, calcareous, gray, sandy, hard, contact with Berry Clay Member in 2.5-foot covered interval, base not exposed; (16-26)  

Total section 37.5

Lithia Section

Section located in borrow area on the north valley side of Lithia Springs Creek in the NE4, SW1/4, NW1/4, Sec. 2, T.11N., R.4E. The upper five feet of the section is not well exposed and contains thin loess and till in the Modern Soil.

Wisconsinan Stage

Woodfordian Substage

Wedron Formation (undifferentiated)

Shelbyville Drift

Till, calcareous, brown at top grading through brownish gray to gray at base, silty, sand zones locally interbedded in the till; secondary CaCO3 near top and oxidation along joints in lower portion; (45-1 top to 45-5 base)  

Total section 30.0
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