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Stratigraphy and Petrography of Illinoian and Kansan Drift In Central Illinois

W. Hilton Johnson

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John C. Frye, *Chief* URBANA

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STRATIGRAPHY AND PETROGRAPHY OF ILLINOIAN AND KANSAN DRIFT IN CENTRAL ILLINOIS

W. Hilton Johnson

ABSTRACT

The Pleistocene deposits of pre-Wisconsinan age in central Illinois include Kansan till, Yarmouth Soil, several Illinoian units (Petersburg Silt, Jacksonville till, Roby Silt, and Buffalo Hart till), and Sangamon Soil.

Petrographic evidence indicates that the Kansan till in central Illinois probably was deposited by two lobes of ice, one the Lake Erie lobe from the east and the other probably from the northeast and possibly from the Lake Michigan basin. The Lake Erie lobe till contains more calcite, more illite and less montmorillonite, and more Na-Ca feldspar and less quartz. It is coarser textured than the possible Lake Michigan lobe till.

The Petersburg Silt, primarily loessial in origin, is fossiliferous, montmorillonitic, and dolomitic. The Jacksonville till is divided petrographically into two parts. The lower part may include Mendon till and is called Jacksonville-Mendon. It is finer grained and contains more montmorillonite and less carbonate than the typical Jacksonville till. Roby Silt includes lacustrine deposits that lie stratigraphically between Jacksonville and Buffalo Hart drifts and is composed of a thin basal sand, a fossiliferous lower silt, a distinctive clay, and an upper silt. The entire unit is calcareous, and the clay-mineral fraction is largely illite and chlorite. Buffalo Hart till is similar petrographically to Jacksonville till except where incorporation of Roby Silt has modified its character.

The contrast between the relatively fresh glacial morphology of the Buffalo Hart drift plain and the subdued topography of the Jacksonville surface and the presence of lacustrine deposits between the two drifts suggest the possibility of a significant break in the Illinoian glacial sequence at this stratigraphic position. However, no weathered zone was found between the drifts, and the degree of development of the Sangamon Soil does not vary greatly on the two drifts.

INTRODUCTION

Central Illinois is the type region for the Illinoian Stage of glacial deposits, and the area between Springfield and Decatur is particularly important for the study of their stratigraphic succession. In this area occur the youngest Illinoian sediments and the type Sangamon Soil.

These deposits form the near surface materials in much of Illinois, and, therefore, a knowledge of their occurrence and petrography is important for many purposes. The principal objective of the present investigation was to determine, partly by use of mineral compositions, the stratigraphic relations within the Illinoian sequence. A particular search was made for evidence of weathering to evaluate the intervals between the Illinoian substages. The character of the Kansan drift also was studied.

The area under consideration includes a portion of the Illinoian drift plain east of the Illinois River where the Buffalo Hart is the surface drift and also a narrow strip south and west where the Jacksonville is the surface drift (fig. 1). The northeast boundary of the area is the outer margin of the Shelbyville Moraine of the Wisconsinan glaciation. The area includes portions of Christian, DeWitt, Logan, Macon, Mason, Menard, Sangamon, and Shelby Counties.

Early investigations of the glacial deposits in the area were by Bannister (1870 a; 1870 b), Worthen (1873), and Broadhead (1875). Leverett (1899) made a comprehensive study of the area and named the Buffalo Hart Moraine. Shaw and Savage (1913) made a small map of the prominent hills of the moraine.

In 1929 and 1930, George E. Ekblaw mapped the Illinoian moraines in this area and western Illinois, but the map was not published until later (in Wanless, 1957). Ball (1937) named the Jacksonville Moraine, and Leighton and Willman (1950) named the Payson Moraine.

On the basis of the moraines and the pro-Illinoian Loveland Loess, Leighton and Willman (1950) subdivided the Illinoian into the Loveland, Payson, Jacksonville, and Buffalo Hart Substages.

Wanless (1957) studied an area largely west of the Illinois River and found gravel, sand, and silt deposits between the Jacksonville and Buffalo Hart tills and between the Mendon and Buffalo Hart tills in the area where the Buffalo Hart ice advanced beyond the area covered by the Jacksonville ice. These intervening materials were not leached of carbonates but showed some oxidation of the iron.

Leighton and Brophy (1961) suggested that the Illinoian ice, upon reaching its outermost extent, stagnated and essentially melted in place. The Buffalo Hart Moraine is considered by them to be composed primarily of crevasse deposits and moulin kames rather than frontal end moraine and to record a brief time of renewed snowfall and glacial activity.

Willman, Glass, and Frye (1963) introduced the name Petersburg for the calcareous pro-Illinoian loess and water-laid silts that underlie Illinoian till, restricted the name Loveland Loess to the weathered loess outside the area of Illinoian glaciation where it represents all loess deposited during Illinoian time, and extended the Payson Substage downward to include the Petersburg Silt. This reduced the Illinoian to three substages—Payson, Jacksonville, and Buffalo Hart.

Recent work (Frye, Willman, and Glass, 1964) has shown that the Illinoian drift does not extend as far as the ridge originally mapped as the Payson end moraine in western Illinois. The Mendon end moraine, about 15 miles farther east, marks the limit of Illinoian drift in that area (fig. 1). The name Liman Substage was introduced to replace Payson, and the classification into Liman, Jacksonville, and Buffalo Hart Substages is used in this report.

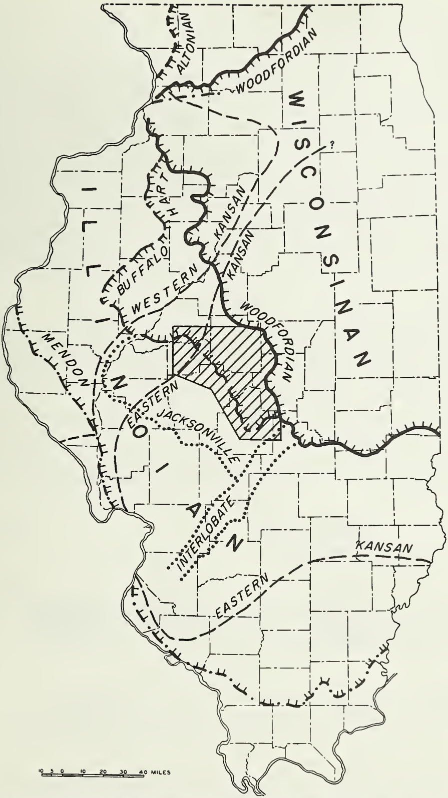

Figure 1 - Location of area studied and map showing areas of Illinois covered by the several glacial advances (after Willman, Glass, and Frye, 1963).

Within the area actually glaciated during Illinoian time, no intra-Illinoian soil development has been identified. However, in the Great Plains region, Frye and Leonard (1954) reported four buried soils, one of which is well developed and has a moderately thick B-zone in Illinoian deposits. Frye (1962) suggested that the best developed soil may represent the interval between the Jacksonville and Buffalo Hart in Illinois. The possibility of an important break between the Jacksonville and Buffalo Hart drifts prompted this study in the type Buffalo Hart area.

This report is adapted from a doctoral dissertation submitted to the University of Illinois. The writer is grateful to George W. White and Paul R. Shaffer of the University of Illinois for helpful suggestions and joint supervision of the study. Funds for obtaining a radiocarbon date were furnished by the Department of Geology, University of Illinois. Thanks also are expressed to John C. Frye, H. B. Willman, George E. Ekblaw, and Herbert D. Glass of the Illinois State Geological Survey for discussing various aspects of the problem with the writer, for visiting several exposures with him in the field, and for critical review of the manuscript. Constantine Manos of the Survey staff made heavy mineral analyses of seven samples.

STRATIGRAPHY

Deposits of Kansan, Yarmouthian, Illinoian, Sangamonian, and Wisconsinan age are present in the area (fig. 2). The oldest Illinoian unit is the Petersburg Silt, which is primarily loessial in nature. Jacksonville and Buffalo Hart tills are present, and Mendon till may be present. The Roby Silt, between the Jacksonville and Buffalo Hart tills, includes lacustrine deposits.

The Illinoian and older deposits are covered generally by the Roxana and Peoria Loesses of Wisconsinan age. These deposits have been studied in detail (Frye and Willman, 1960; Leonard and Frye, 1960; and Frye, Glass, and Willman, 1962) and will not be considered in this report. All geologic sections referred to by name are described at the end of the report, and their locations are shown in figure 3.

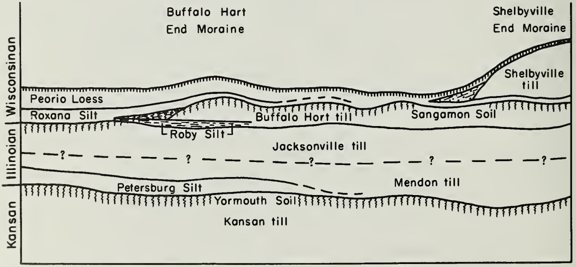

Figure 2 - Diagrammatic cross section across the study area. Length of section approximately 50 miles.

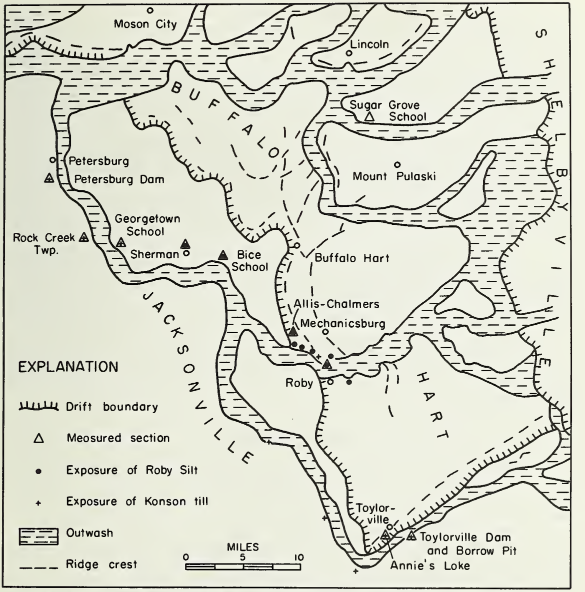

Figure 3 - Glacial map of the area, showing locations of measured geologic sections and of exposures of Roby Silt and Kansan till. (Drift boundaries after Ekblaw in Flint et al., 1959.)

Kansan Stage

Previous studies in Illinois have shown that two lobes of ice advanced into the state during Kansan time, one from the west and northwest, and the other from the east and northeast (Leverett, 1899; MacClintock, 1929, 1933; Horberg, 1956; Wanless, 1957; Flint and others, 1959; Willman, Glass, and Frye, 1963). The drift deposited by the ice from these two lobes has come to be called western Kansan and eastern Kansan, respectively. Both lobes advanced to a position near the present Illinois River Valley but are not known to have overlapped (fig. 1) and their relative ages are also unknown (Willman, Glass, and Frye, 1963). The study area is located along the western margin of the eastern lobe.

Kansan till.—Till, interpreted as Kansan in age, was encountered in two separate areas, one near Taylorville and the other near Petersburg, and in two isolated outcrops (fig. 3). In most of the exposures, a weathered zone developed in the upper portion of the till is overlain by calcareous Illinoian drift (Taylorville Dam, Annie's Lake, Petersburg Dam, Rock Creek Township, and Georgetown School geologic sections). The base of the till generally is not exposed, but in a few places, it lies upon either Pennsylvanian bedrock or colluvial material overlying Pennsylvanian bedrock.

The Kansan till, where unoxidized, is usually dark gray or gray, although in the Taylorville Dam section portions of the till have a distinct pinkish cast. The oxidized till is usually yellow-brown or dark yellow-brown. The till is extremely tough and compact, and joints in the till are not uncommon.

Lacustrine silts and sands associated with the till are calcareous, carbonaceous, and in some places fossiliferous. They probably were deposited in ponds associated with or near the ice front.

With the exception of an accretion-gley exposed at the Taylorville Dam and two in-situ soil profiles exposed at the Petersburg Dam, the weathered zone in the upper portion of the till has been truncated. The weathered zone represents the first soil below the Sangamon Soil and, lacking evidence of a significant soil-forming interval during Illinoian time, is the primary reason for assigning the till to the Kansan.

In several sections, the weathered zones are overlain by silts that are correlated with the widely recognized Petersburg Silt—the oldest Illinoian stratigraphic unit. Petrographic evidence, to be discussed later, also indicates a Kansan age for the till.

Yarmouthian Stage

Yarmouth Soil.—The soils in this area identified as Yarmouth are not as strongly developed as in some areas and, if a significant soil-forming interval is found within the Illinoian, it will be necessary to reconsider the possibility that they are intra-Illinoian soils. In the few exposures in this area, the Yarmouth Soil is not as strongly developed as the Sangamon Soil.

Two in-situ profiles that showed little evidence of truncation are exposed in excavations at the Petersburg Dam. These profiles are leached of carbonates to a depth of 5 to 6 feet. Soil structure in the B-zone is not greatly developed. Although thick, shiny clay-skins coat the fracture surfaces, the amount of clay accumulation is not great. Numerous manganese concretions are present in the lower portion of the B-zone.

The only other nontruncated profile was observed at the Taylorville Dam site, where three feet of accretion-gley overlies three feet of leached till. The accretion-gley is gray with a few dark gray and yellow-brown streaks. It is very clayey and faintly laminated, and it contains a few pebbles, some sand, and locally some secondary calcium carbonate. The upper portion of the leached till contains streaks of similar gleyed clay.

Illinoian Stage

Liman Substage

Petersburg Silt.—The Petersburg Silt was defined by Willman, Glass, and Frye (1963, p. 6) to include calcareous outwash and loess deposited during the advancing stage of the Illinoian glacier. These deposits previously were considered part of the pro-Illinoian Loveland Loess and were correlated with Loveland Loess of the Great Plains (Leighton and Willman, 1950; Wanless, 1957; and Leighton and Brophy, 1961). They occur below the oldest Illinoian till in Illinois, whereas the type Loveland is considered to be largely late Illinoian in age (Frye and Leonard, 1952). As the deposits are lithologically different from the weathered Loveland Loess, the local rock-stratigraphic name, Petersburg Silt, is preferred. The Petersburg was studied in six sections near Petersburg, and silts tentatively correlated with the Petersburg were examined in three sections near Taylorville.

Near the type locality, the Petersburg Silt is variable in character. It is generally a loess-like silt that is massive, compact, and locally contains a molluscan fauna. It typically is reddish brown, but locally it is gray or tan. The loess is usually weakly calcareous, but it varies locally from calcareous to noncalcareous. In one exposure the silt is carbonaceous, dark gray, and contains wood fragments, and it appears to have accumulated in a shallow pond. The Petersburg Silt is commonly 5 to 15 feet thick, and the maximum thickness observed was 25 feet.

Mendon (?) till.—Mendon till may be present in the area. In several sections outside or below the Buffalo Hart drift, beds of gravel, sand, and silt or pebble pavements may represent the contact between Jacksonville and Mendon tills. Strongly contrasting clay mineral and carbonate compositions, to be discussed later, suggest the presence of two Illinoian tills older than the Buffalo Hart, but no specific change in the physical character of the till was noted.

Jacksonville Substage

Jacksonville till.—Jacksonville till (fig. 1), as used in this report, refers to the surface till south and west of the Buffalo Hart end moraine and to the till that crops out locally below Buffalo Hart till and Roby Silt in the remaining portion of the area. The unit is based on the Jacksonville end moraine (Ball, 1937; Ekblaw, in Wanless, 1957), which is located south and west of the area.

The Jacksonville ground moraine is extremely flat and exhibits very little of the sag and swell topography typical of ground moraine. Near the major drainage ways, tributaries have eroded headward and greatly dissected the drift plain.

The unoxidized Jacksonville till is gray, but in the oxidized zones it varies from dark yellow-brown or yellow-brown to grayish brown. Along joints in the gray, unoxidized portion, the till is commonly oxidized for 1 to 2 inches bordering the joint surface, and secondary iron oxide or calcium carbonate accumulations occasionally coat these surfaces. The till is silty to sandy; thin sandy zones, lenses, and streaks are common. Locally the upper portion of the till is platy or slightly laminated.

Pebble pavements in which the tops of the pebbles have been faceted and striated along a planned surface also are common in the Jacksonville till. These represent successive withdrawals and advances of the ice, the extent of which is not evident. Their common occurrence, occasionally several within a few feet, and the lack of any notable change in the character of the till above and below the pavements suggest that, in most cases, they represent minor oscillations of the ice front.

Buffalo Hart Substage

Roby Silt.—The Roby Silt is named herein for exposures of lacustrine silt and clay near the town of Roby, in the northwestern corner of Christian County. The type section is described in the Roby geologic section.

The unit consists of silt, clay, and sand that occur below Buffalo Hart drift and above Jacksonville drift. The deposits are not associated clearly with either the retreating Jacksonville or the advancing Buffalo Hart glaciers, but because of some oxidation of the Jacksonville drift, as described later, the Roby is tentatively assigned to the Buffalo Hart Substage. The unit is exposed in several localities in the Mechanicsburg-Roby area inside the Buffalo Hart end moraine and in two localities near Sherman outside the moraine but overlain by Buffalo Hart outwash (fig. 3). It has not been recognized outside the area of Buffalo Hart drift.

In the type area, the Roby Silt lies upon Jacksonville till or outwash. The upper contact of the Roby Silt with the overlying Buffalo Hart drift is erosional.

A bed of sand occurs at the base of the Roby Silt in most (e.g., Roby) but not all exposures (e.g., Allis-Chalmers). The sand is thin (6-12 inches), calcareous, and strongly oxidized to yellow-brown, and it commonly contains a thin bed of brick red, sandy silt.

Above the sand is a calcareous and fossiliferous silt that is brownish gray to reddish gray-brown and has localized brown to yellow-brown streaks and specks that appear to be mostly decomposed organic matter such as stems or leaves. The silt is usually about 2 feet thick and occasionally contains thin sandy streaks. In one locality, however, it is 13 feet thick and contains 2 feet of sand. It is usually faintly laminated and locally contains secondary calcium carbonate concretions and small manganese pellets. In the Allis-Chalmers geologic section, the silt is carbonaceous and contains numerous wood fragments.

Overlying this silt is a distinctive, highly calcareous, commonly gray or brownish gray clay, $\frac{1}{2}$ to $3\frac{1}{2}$ feet thick. It varies from massive clay with little or no indication of lamination to strongly laminated clay and silt with a varve-like appearance. Secondary calcium carbonate in the form of coatings and concretions is characteristic of the unit.

Another silt overlies the clay in several exposures. The silt is similar to the lower silt with the exception that no fossils were noted in it. It is 1/3 to $4\frac{1}{2}$ feet thick, but it was thicker before its upper surface was eroded severely by the Buffalo Hart glacier and its meltwaters.

The Roby Silt is lacustrine in origin, but the extent and continuity of the lake or lakes in which it was deposited are not known. In the Roby-Mechanicsburg area the silt is thought to be generally continuous, because it is present in almost all exposures of this part of the sequence and at the same general elevation.

Exposures of the Roby Silt south and west of the Buffalo Hart end moraine were found only near Sherman, about 12 miles to the northwest. The elevation of the deposits appears slightly lower, and the deposits may not be continuous with those near Roby.

Frye (1962) suggested that the interval of time between the Jacksonville and Buffalo Hart deposits might correspond to a time of soil formation that is recognized within Illinoian deposits in the Great Plains region. An intensive search was made for a soil or evidence of a weathering break at this stratigraphic position, but other than oxidation, no weathering was noted. Jacksonville till, where lying subjacent to the Roby Silt, is usually oxidized for 2 to 3 feet, although locally oxidation may extend down from the contact for 6 to 8 feet. However, this till is sandy, and because the basal sand of the Roby Silt commonly overlies the till, some or much of this oxidation may be the result of percolating water.

Leached, clay-enriched outwash occurs locally below calcareous Roby Silt in the Bice School geologic section. The leaching and clay enrichment is interpreted to be the result of water percolating down joints in the clay zone of the Roby during Sangamonian and later time. This interpretation is based on the following observations: (1) the presence of joints in the clay; (2) the corresponding thicker development of the leached, clay-enriched zone where the clay is completely leached and its thinner development or absence where the clay is weakly to highly calcareous; (3) the local confinement of the leached, clay-enriched zone above a thin clayey sand in the outwash that appears to have been a permeability barrier to percolating water; and (4) the local, abrupt, lateral contacts between leached, clay-enriched and calcareous outwash. Similar leached, clay-enriched zones below calcareous till have been described in southwestern Ohio and southeastern Indiana (Gooding, Thorp, and Gamble, 1959).

Buffalo Hart till.—The Buffalo Hart till is the surface drift over most of the study area and extends under Shelbyville till of Wisconsinan age to the north and east. Its southwestern boundary is marked by the outer edge of the Buffalo Hart end moraine (fig. 3).

The end moraine is well developed in some areas but poorly defined in others. It is most prominent and distinct for about 20 miles in the type area just north and south of the town of Buffalo Hart. Elsewhere, the moraine is less clear.

In sharp contrast to the generally flat Jacksonville surface, the Buffalo Hart ground moraine shows sags and swells with a relief of 5 to 15 feet. The topography generally resembles that of the Wisconsinan drift plain to the northeast more than that of the Jacksonville drift plain to the south.

In the Roby-Mechanicsburg area, where the Buffalo Hart till lies upon Roby Silt, the till is silty, contains masses of silt, and locally is more like pebbly silt than silty till. The pronounced silty character of the Buffalo Hart till is the result of erosion of the Roby Silt by the Buffalo Hart glacier. Elsewhere in the area, the till contains more sand.

The oxidized till in the Roby-Mechanicsburg area is generally grayish brown with a mottled appearance, but in places it is yellow-brown, light yellow-brown, gray, and pale olive. The unoxidized till is gray. In other areas, the unoxidized Buffalo Hart till is gray to dark gray, and the oxidized till varies from brown to yellow-brown.

In the Roby-Mechanicsburg area the till is generally 5 to 10 feet thick, except within the end moraine where it is approximately 20 feet thick. Elsewhere, the thickness of the Buffalo Hart till is not known, but it is at least 25 feet in the Sugar Grove School geologic section.

Because of the youthful appearance of the Buffalo Hart topography, the possibility that the Buffalo Hart drift might represent an early Wisconsinan (Altonian) advance was considered. However, the presence of the Sangamon Soil on the drift was confirmed, and this eliminates the possibility of Wisconsinan age. A sample of wood from the middle clay of the Roby Silt had a radiocarbon date of >34,000 years B.P. (Isotopes, Inc., No. I-1263).

Sangamonian Stage

Sangamon Soil.—In this area, the Sangamon Soil is easily recognized underlying the Wisconsinan loess and developed on Buffalo Hart till, Buffalo Hart outwash, Roby Silt, Jacksonville till, Jacksonville outwash, and colluvium.

Where the Sangamon Soil has developed in a good drainage position on permeable material, it is typically reddish brown to brown. In poorly drained positions or in impermeable materials, it is commonly brownish gray to gray. Accretion-gley is present in depressions.

The soil is well developed and has strong soil structure. The B-zone is usually about 3 feet thick. The depth of leaching ranges from about 5 to 7 feet. No difference in the degree of weathering could be observed between Sangamon profiles in Jacksonville drift and those developed in Buffalo Hart drift. This suggests that the age difference between the two drifts was not sufficient to produce strongly contrasting soil profiles.

In Illinois, the Sangamon Soil has been the subject of recent investigations (Brophy, 1959; Frye, Willman, and Glass, 1960); therefore, laboratory study of the soil was not undertaken in this investigation.

PETROGRAPHY

Laboratory study was undertaken to determine the composition of the drift units, to see whether composition could be utilized to differentiate them, and to learn more about their provenances. Willman, Glass, and Frye (1963) have presented similar information for tills in Illinois on a regional basis, and comparisons are made with their data.

The grain-size distribution of the samples was determined by combined hydrometer and sieve analyses using a procedure slightly modified after that tentatively accepted by the American Society for Testing Materials (Designation: D422-54T). Particles >4mm in diameter were excluded from the analyses, and the smaller fractions were classified as follows: 2-4 mm = granules; .062-2 mm = sand; .0039-.062 mm = silt; and <.0039 mm = clay.

Light minerals (sp. gr. <2.86) of the .125-.250 mm fraction (fine sand) were analyzed according to the procedure outlined by Totten (1960). After separating the heavy minerals and removing the carbonates, approximately 800 grains were mounted on a glass slide. The grains were etched in hydrofluoric acid fumes for 12 to 14 minutes and then stained in a concentrated solution of sodium cobaltinitrite. The mineral grains on the slide were counted then and identified as follows: quartz—grains that were colorless and transparent; K-feldspar—grains with a yellow coating; and Na-Ca feldspar—grains with a white, slightly lustrous coating. Minerals and rock fragments, other than above, were grouped in a fourth class called others.

The clay mineral composition of the drift was determined from oriented aggregates of the <2 microns clay by X-ray diffraction procedures. The terms illite, kaolinite, and chlorite are used as generally accepted. Montmorillonite, as used here, refers to all clay materials that expand to about 17Å after treatment with ethylene glycol. Therefore, it includes not only montmorillonite but also mixed-layered and degraded clay minerals that are expandable. Percentage values are presented for montmorillonite, illite, and combined kaolinite and chlorite.

The amount of calcite and dolomite in the minus 200-mesh grade (<74 microns) was determined by use of a Chittick gasometric apparatus following the procedures of Dreimanis (1962).

The locations of samples used in the study are shown in figure 4 and are listed in table 1. Results of the analyses are given in tables 2 and 3 and figures 5 through 12. Averages of the petrographic data are given by stratigraphic unit in table 4. The tables are at the end of the report.

Kansan Till

Willman, Glass, and Frye (1963) have shown that eastern Kansan till can be differentiated mineralogically from western Kansan till in Illinois. The most important differences are that the eastern Kansan contains little montmorillonite, while the western Kansan contains large amounts (always over 30 percent in the clay mineral fraction). The eastern Kansan contains 4 times as much garnet as epidote, while the western Kansan contains 2 to 4 times as much epidote at garnet. Both are reported to contain more calcite than dolomite, except in the eastern margin of the western lobe, where dolomite exceeds calcite. They suggest, on the basis of carbonate and heavy mineral compositions, that the eastern Kansan was deposited by the Lake Erie lobe.

Samples of Kansan till were studied from outcrops near Taylorville and near Petersburg. Geographically both areas are in a position to be eastern Kansan. Samples from two isolated outcrops midway between the two areas are similar mineralogically to those near Taylorville and are considered with them.

Most samples from Kansan till in the Taylorville area contain about 42 percent sand and granules, 35 percent silt, and 23 percent clay, but locally the till is finer grained (fig. 5). The increase in silt and clay in the finer grained samples reflects the incorporation of local lacustrine deposits.

The unoxidized Kansan till in this area averages 65 percent illite, 32 percent kaolinite and chlorite, and 3 percent montmorillonite (fig. 6). With oxidation, the chlorite is altered, and there is a corresponding increase in expandable clay materials. The clay mineral content is typical of that derived from either the north or east in Illinois (Willman, Glass, and Frye, 1963).

The <74 microns fraction contains about 10 percent calcite and 17 percent dolomite (fig. 7). Although semi-quantitative X-ray analyses of ground whole samples indicate that eastern Kansan till contains more calcite than dolomite (Willman, Glass, and Frye, 1963), the reverse appears to be the case, with the exception of one sample, in the size fraction studied in this area. The till does contain more calcite than any of the other tills in the area. Tills with a high calcite content reflect either an eastern (Lake Erie lobe) or western source (Willman, Glass, and Frye, 1963).

This till also contains significantly more Na-Ca feldspar and less quartz than any of the other tills in the area. The average composition of the fine sand

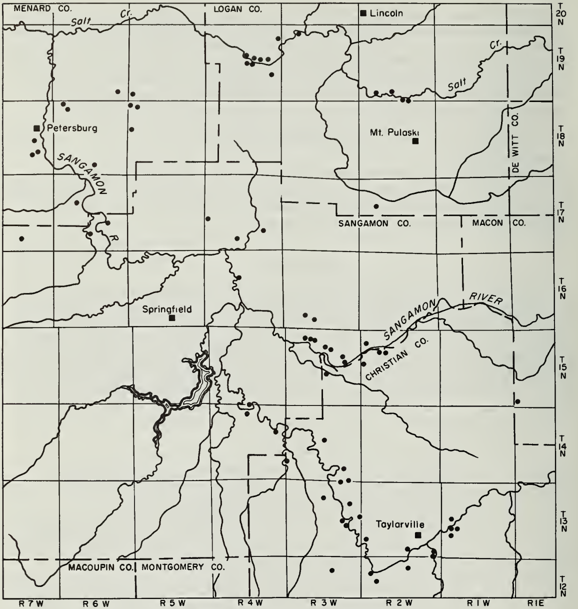

Figure 4 - Map showing sample localities.

is 69 percent quartz, 18 percent Na-Ca feldspar, 8 percent K-feldspar, and 5 percent other light minerals (fig. 8). Totten (1960) reports that Lake Erie lobe tills of Wisconsinan age in northeastern Ohio contain from 2 to 4 times as much Na-Ca feldspar as K-feldspar. On the other hand, Harrison (1959 and 1960) reports that orthoclase is the main feldspar contributor in the sand sizes of Lake Erie lobe Wisconsinan tills in central Indiana. The light mineral analyses have not provided much information about the source of the tills.

The high calcite and low montmorillonite contents indicate an eastern Lake Erie lobe source for the Kansan till of the Taylorville area. The relatively high calcite content also suggests a Kansan age for the till, because the Illinoian tills were deposited by ice entering the state from either the Lake Michigan basin or the Saginaw Bay area and they are more dolomitic (Willman, Glass, and Frye, 1963).

Analyses of Kansan till from the Petersburg area shows significant and consistent textural and mineralogical differences between two groups of samples.

One group of eleven samples has textural and mineralogical properties similar to the Kansan till near Taylorville (figs. 5, 6, 7, 8). These samples, with one exception, contain relatively low amounts of montmorillonite, although slightly more than the samples from the Taylorville area. They contain essentially the same amount of calcite and dolomite as the Taylorville samples, and they also have a relatively high Na-Ca feldspar and a low quartz content. The till on the average contains 37 percent sand and granules, 35 percent silt, and 28 percent clay. Three samples from till associated with interbedded silt units are finer grained (fig. 5). This group of samples appears to be from eastern Kansan till deposited by the Lake Erie lobe.

The group of thirteen samples (figs. 5, 6, 7, 8) is from finer grained till that averages 23 percent sand and granules, 40 percent silt, and 37 percent clay. The average clay mineral composition is 35 percent montmorillonite, 44 percent illite, and 20 percent kaolinite and chlorite. The carbonate content is low, averaging 4 percent calcite and 11 percent dolomite, and the fine sand contains approximately 80 percent quartz, 8 percent K-feldspar, 10 percent Na-Ca feldspar, and 3 percent other light minerals. Thus, this till differs from Lake Erie lobe Kansan till in that it is finer grained and contains more montmorillonite, less illite, less carbonate (both calcite and dolomite), less Na-Ca feldspar, and more quartz.

These differences strongly suggest that the till was derived from a source area other than that of the eastern Kansan till from the Lake Erie lobe. The two most likely alternatives are that this till is an eastward continuation of western Kansan till or that it is Kansan till of Lake Michigan lobe derivation.

The high montmorillonite content suggests a western origin, and the clay mineral composition is essentially the same as the easternmost portion of the western Kansan (Willman, Glass, and Frye, 1963). However, if there was a Lake Michigan lobe in Kansan time, it could have advanced over pro-Kansan, or older, loesses from the Ancient Mississippi Valley and incorporated the loess that has a high content of montmorillonite. Although generally eroded, pro-Kansan loess is known (Leighton and Willman, 1950; Wanless, 1957). The presence of a loess cover is suggested by the slight increase in montmorillonite in the eastern Kansan till in this area and the increase in the montmorillonite content of the eastern Kansan as it is traced to the southwest (Willman, Glass, and Frye, 1963).

Western Kansan till in northeastern Missouri contains approximately 10 percent calcite and 4 percent dolomite (Heim, 1963). As this drift is traced eastward across western Illinois, the dolomite content increases and the calcite content decreases until, at the eastern margin of the drift, dolomite exceeds calcite. This change is across the direction of flow of the ice and results from the eastern part of the lobe passing over more dolomitic formations (Willman, Glass, and Frye, 1963). The carbonate content of the till in question fits this general relation. However, the carbonate content does not preclude the possibility that this till was derived from the Lake Michigan basin. Although the tills in this area that were derived from the Lake Michigan basin contain more than twice as much dolomite as this till (fig. 7), a relatively low dolomite content in a Lake Michigan lobe till could result from dilution of the carbonates by inclusion of large amounts of low-carbonate surficial materials and Pennsylvanian bedrock. Interpretation of the carbonates, therefore, is not conclusive with regard to the source of the till.

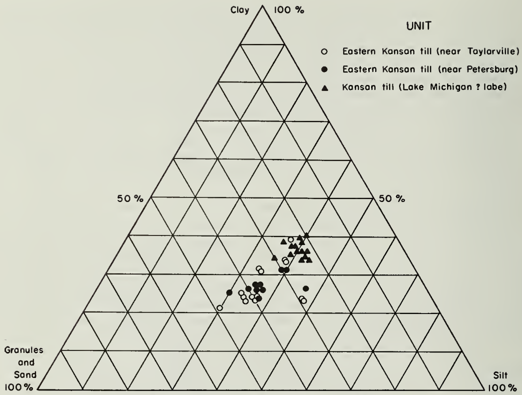

Figure 5 - Grain size distribution of Kansan till.

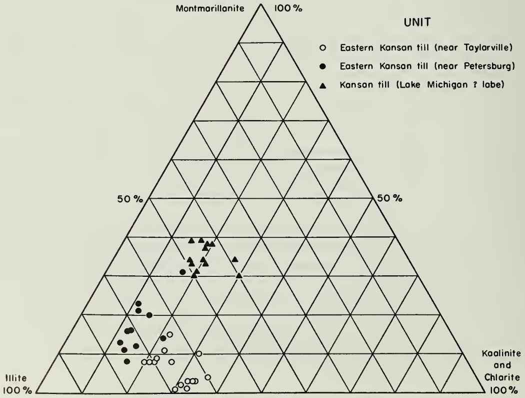

Figure 6 - Clay mineral composition of Kansan till.

Heavy minerals have proven useful in distinguishing eastern Kansan, western Kansan, and Lake Michigan lobe Illinoian tills in Illinois. Tills from a western source are characterized by considerably more epidote than garnet and relatively large amounts of kyanite, staurolite, and andalusite; tills from the Lake Michigan lobe are characterized by approximately equal amounts of garnet and epidote, although epidote is more abundant in the younger tills in the lobe; and the eastern-derived Lake Erie lobe tills are characterized by much larger amounts of garnet than epidote (Willman, Glass, and Frye, 1963).

Heavy mineral analyses were made of seven samples, three from eastern Kansan till and four from this Kansan till of questionable source (table 3).

The three samples from eastern Kansan till have heavy mineral compositions similar to eastern Kansan elsewhere in Illinois. The other four samples contain slightly more garnet than epidote. The epidote contents are greater than in eastern Kansan till but less than in western Kansan, and the garnet contents are slightly less than in eastern Kansan and slightly more than in western Kansan. The most distinguishing aspect of the heavy mineral composition of these samples is the extremely high content of opaques other than black opaques. These are primarily leucoxene and hematite (Manos, personal communication), and the significance of their great abundance is not known. The approximate equal amounts of garnet and epidote suggest that the till was deposited by an ice lobe from the Lake Michigan basin.

In two exposures in the Petersburg area, the till of questionable source occurs stratigraphically above eastern Kansan. In one exposure, it is stratigraphically below eastern Kansan, and in another, the two are interbedded. These field relations suggest deposition by two lobes that overlapped or coalesced.

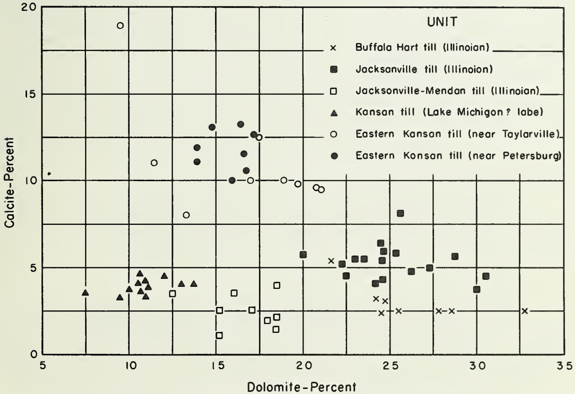

Figure 7 - Carbonate composition of Illinoian and Kansan till.

George E. Ekblaw (personal communication) has pointed out the following field evidence, which suggests the western Kansan glacier did not cross the Illinois River Valley and thus could not have deposited the till in question. First, western Kansan till is known to thin in the direction of the valley. It is not known to crop out anywhere along the valley bluff but is always found several miles back of the bluff. Secondly, if the glacier did cross the valley and possibly coalesce with the eastern Kansan glacier, the drainage system of the Ancient Mississippi Valley would have been blocked and widespread lacustrine materials should have been deposited. Such deposits have not been found.

Consequently, field relations and the limited heavy mineral data favor deposition of the till by an ice lobe moving from the Lake Michigan basin during Kansan time. The fine texture, high montmorillonite content and low carbonate content of the till can result from incorporation of either loess or weathered material over which the ice advanced.

Illinoian Drift

The Mendon (Payson), Jacksonville, and Buffalo Hart tills contain distinct clay mineral assemblages (Willman, Glass, and Frye, 1963). Mendon till usually contains the most montmorillonite (17-64 percent), Jacksonville till intermediate amounts (11-28 percent), and Buffalo Hart till extremely low amounts. Also the Jacksonville contains less kaolinite and chlorite than the other units.

Petersburg Silt

In the type area, loess from the Petersburg Silt contains little or no sand, about 86 percent silt, and about 13 percent clay (fig. 9), and the median diameter is about 21 microns. The mean size is essentially the same as for samples of Peoria Loess in this area (Smith, 1942), which suggests that the source area for the loess of the Petersburg, like the Peoria Loess, was at or near the position of the present Illinois Valley.

The Petersburg Silt has a high content of montmorillonite, which reflects the contribution of clays from a western source to the sediments in the Ancient Mississippi Valley (Willman, Glass, and Frye, 1963). The average clay mineral composition in the type area is 49 percent montmorillonite, 36 percent illite, and 15 percent kaolinite and chlorite (fig. 10), but the considerable variation in clay mineral composition suggests that the unit may have a more complex source and depositional history than can now be deciphered.

The calcite content of the Petersburg Silt is usually low (average 2 percent), and the dolomite content varies from 0 to 24 percent. These variations also suggest a complex history for the unit and probably reflect both variations in the rate of deposition and possibly time breaks during deposition of the loess.

Jacksonville till

Samples of Jacksonville till fall into two distinct petrographic groups that are referred to as Jacksonville and Jacksonville-Mendon in this report. The two groups are distinguished by their clay mineral compositions but also differ in texture and carbonate composition. Samples with more than 20 percent montmorillonite in the clay mineral fraction are termed Jacksonville-Mendon, those with less than 20 percent are Jacksonville.

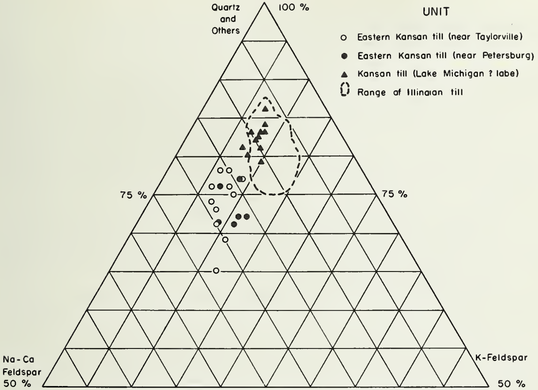

Figure 8 - Light mineral composition of the fine sand from Illinoian and Kansan tills.

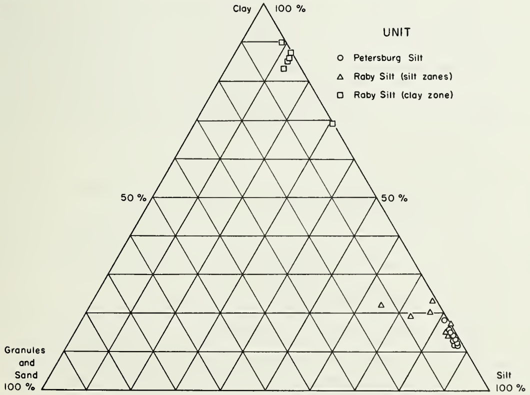

Figure 9 - Grain size distribution of Roby Silt and Petersburg Silt.

In geologic sections containing both Jacksonville and Jacksonville-Mendon samples, Jacksonville samples always occur above Jacksonville-Mendon, but a definite stratigraphic break has not been recognized between them.

The Jacksonville is the coarsest till in the area and on the average contains 44 percent sand and granules, 32 percent silt, and 24 percent clay. Although there is some overlap (fig. 11), samples of Jacksonville-Mendon are finer grained and average 26 percent sand and granules, 46 percent silt, and 28 percent clay.

The Jacksonville-Mendon till contains significantly more montmorillonite than the Jacksonville (fig. 12). Montmorillonite ranges from 21 to 51 percent in the Jacksonville-Mendon till, but only 0 to 16 percent in the Jacksonville. Both contain approximately the same amount of kaolinite and chlorite and do not have the low kaolinite and chlorite content as noted for Jacksonville till by Willman, Glass, and Frye (1963).

Jacksonville till samples contain approximately 10 percent more dolomite and 2 percent more calcite in the <74 micron fraction than the Jacksonville-Mendon (fig. 7). Both contain considerably more dolomite than calcite. With the exception of the Lake Michigan (?) lobe Kansan till, the Jacksonville-Mendon till contains less carbonate than the other tills.

The lightweight minerals of the fine sand from these two groups are similar, averaging 78 percent quartz, 9 percent K-feldspar, 10 percent Na-Ca feldspar, and 3 percent others.

The higher montmorillonite content, lower carbonate content, and finer texture of the Jacksonville-Mendon reflects incorporation of the widespread, thick Petersburg Silt. Mendon till in western Illinois contains large amounts of montmorillonite that is also attributed to the incorporation of Petersburg Silt (Willman, Glass, and Frye, 1963).

The lack of a definite stratigraphic break between the Jacksonville-Mendon and Jacksonville tills suggests that the Mendon glacier did not retreat this far to the northeast following its advance, and thus Mendon till would not be separated from Jacksonville till by a physical break. The gradual decrease upward in the montmorillonite content of till overlying Petersburg Silt in several geologic sections (e.g., samples 446-453) is attributed to a lessening influence of the Petersburg Silt as the unit was progressively buried by till deposition. However, there is an abrupt change in the montmorillonite content in other exposures, and in these areas, the lower part of the unit probably is equivalent to Mendon till in western Illinois.

Roby Silt

Sixteen samples of Roby Silt were analyzed—5 from the lower silt, 8 from the middle clay, and 3 from the upper silt.

The middle clay is extremely fine grained and contains little or no sand, about 12 percent silt, and 88 percent clay (fig. 9). The median diameter usually is less than 1 micron. The silt zones, although variable, usually contain about 2-3 percent sand, 80 percent silt, and 17 percent clay, and the median diameter ranges from 6 to 18 microns.

The clay mineral composition of the middle clay is uniform, but the silts have a variable composition. Illite is the predominant clay mineral in the middle clay, but small amounts of chlorite, montmorillonite, and kaolinite are present (fig. 10). In the silts, the montmorillonite ranges from 0 to 38 percent, illite from 40 to 80 percent, and kaolinite and chlorite from 9 to 32 percent (fig. 10). These variations occur in both silt zones and probably result from uneven mixtures of wind blown material with outwash.

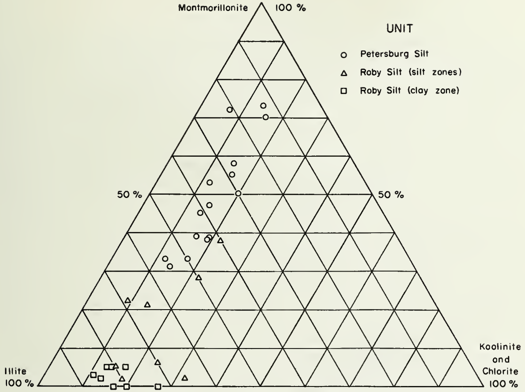

Figure 10 - Clay mineral composition of Petersburg Silt and Roby Silt.

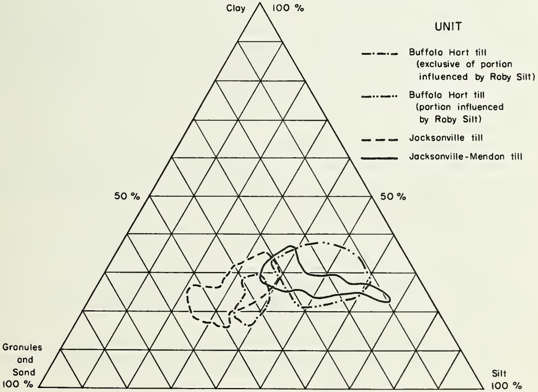

Figure 11 - Grain size distribution of Illinoian tills.

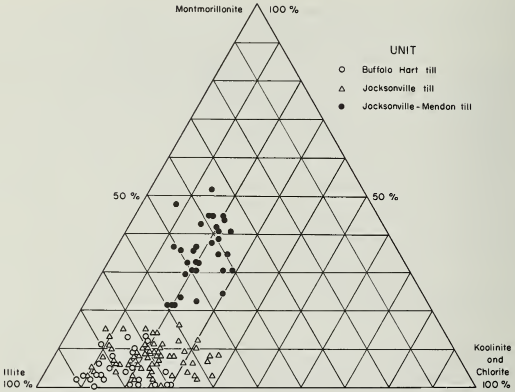

Figure 12 - Clay mineral composition of Illinoian tills.

The middle clay zone and the silt zones contain approximately the same amount of calcite, but the silt zones contain about three times more dolomite. The clay zone averages 6 percent calcite and 8 percent dolomite, while the silt zones average 5 percent calcite and 24 percent dolomite. The difference reflects variations in the amount of dolomite in different size fractions.

Buffalo Hart till

The Buffalo Hart till generally has about the same grain-size distribution as Jacksonville till. It contains approximately 38 percent sand and granules, 37 percent silt, and 25 percent clay. In areas where the Buffalo Hart glacier overrode Roby Silt, the sand content decreases about 20 percent and the silt and clay contents increase correspondingly (fig. 11).

The only notable mineralogical variation in the Buffalo Hart till is a slight increase in the montmorillonite content in areas where Roby Silt has been overridden.

The average clay mineral composition of the till is 4 percent montmorillonite, 78 percent illite, and 18 percent kaolinite and chlorite (fig. 12). Dolomite is the predominate carbonate (fig. 7), and the lightweight mineral composition is the same as other Illinoian tills in the area (fig. 8).

Mineralogical differences between Buffalo Hart till and Jacksonville till are slight, but Buffalo Hart till generally contains slightly less montmorillonite, more illite, and less calcite than Jacksonville till (figs. 7 and 12, table 4).

CONCLUSIONS

The principal interpretations and conclusions are as follows:

1. Petrographic differences between two groups of samples suggest that the Kansan till was deposited by two different lobes of ice. One lobe entered the area from a generally easterly direction, probably from the Lake Erie basin. The direction of advance of the other lobe is less certain, but the evidence favors its origin in the Lake Michigan basin.
2. The Yarmouth Soil in this area is not as strongly developed as the Sangamon Soil.
3. The Petersburg Silt is primarily loessial in origin but in part is water laid. The loess is fossiliferous, montmorillonitic, and usually dolomitic. It was probably blown off the valley trains of the first Illinoian glacier.
4. The Jacksonville and Buffalo Hart tills definitely are present, and the Mendon till probably is present.
5. The glacial morphology of the Buffalo Hart drift plain is considerably fresher than that of the Jacksonville drift plain. It may indicate a significant age difference, but the differences can be related to the character of the original depositional surface.
6. The Roby Silt is composed of lacustrine silts and clays and lies stratigraphically between Jacksonville and Buffalo Hart tills. It is fossiliferous, calcareous, illitic, chloritic, and locally carbonaceous. The Roby Silt indicates a significant retreat of the ice front before the Buffalo Hart advance.
7. The Sangamon Soil appears to be as well developed on Buffalo Hart till as on Jacksonville till. This suggests that the time between the deposition of the two tills is short when compared to that represented by the Sangamonian Stage.
8. Physical and compositional differences between the tills reflect variations in the mineral composition and physical character of the bedrock in the source areas and along the route of ice advance. The most important differences are:
   (a) Eastern Kansan till from the Lake Erie lobe differs from the Kansan till that probably was deposited by the Lake Michigan lobe. It contains more carbonates, especially calcite, more illite, less montmorillonite, more Na-Ca feldspar, and less quartz, and it is coarser textured.
   (b) Eastern Kansan till from the Lake Erie lobe differs from Illinoian tills of the Lake Michigan lobe in that it contains more calcite, less dolomite, more Na-Ca feldspar, and less quartz.
   (c) The undifferentiated Jacksonville-Mendon till is finer textured and contains more montmorillonite and less carbonate (both calcite and dolomite) than the definitely Jacksonville till.
   (d) The Jacksonville-Mendon till and the Kansan till of the Lake Michigan lobe are similar petrographically. Both apparently incorporated much loess and, as a result, are finer grained and contain more montmorillonite and less carbonate than the other tills in the area.
   (e) The Jacksonville and Buffalo Hart tills are similar, but Jacksonville till contains slightly more montmorillonite and calcite than Buffalo Hart. Texturally the two tills are similar, except the Buffalo Hart till is much finer grained where the glacier overrode Roby Silt.

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TABLE 1 - LOCATION AND DESCRIPTION OF SAMPLES

Sample No.	Location ¼ Sec., T-R, County, (geol. sec. no.)	Stratigraphic Unit (feet below top)
1	NW NW SW 5, 18N-5W, Menard	Jacks.-Mendon
7	SE SW NE 36, 13N-2W, Christian	Jacksonville (.7)
8	do.	Jacksonville (4.3)
9	do.	Jacksonville (5.5)
10	do.	Jacksonville (9)
14	do.	Kans. (East) (4)
15	do.	Kans. (East) (8.5)
19	do.	Kans. (East) (14)
46	SE SW NE 36, 13N-2W, Christian (11)	Jacksonville (2.3)
48	do.	Jacksonville (6.5)
50	do.	Jacks.-Mendon (9.5)
51	do.	Petersburg (?) (0.5)
58	do.	Kans. (East) (2)
60	do	Kans. (East) (8)
61	do.	Kans. (East) (10.5)
63	do.	Kans. (silt) (12.5)
64	do.	Kans. (silt) (13.5)
65	do.	Kans. (East) (14.5)
66	do.	Kans. (East) (16)
76	NW SE SE 11, 15N-3W, Sangamon	Jacksonville (8)
86	NW SE SE 11, 15N-3W, Sangamon	Jacksonville (5)
106	NE SW SE 6, 15N-2W, Sangamon	Jacksonville (3.5)
112	NW NE SE 8, 15N-2W, Christian	Jacksonville (.5)
113	do.	Jacksonville (3.5)
117	NE SW SE 4, 15N-3W, Sangamon	Buffalo Hart (2.5)
120	do.	Jacksonville (1)
124	NW SE SE 11, 13N-3W, Christian	Jacks.-Mendon
125	NW NE SE 11, 13N-3W, Christian	Jacksonville (6)
127	do.	Jacksonville (11)
128	do.	Jacksonville (15)
129	SE NE SE 11, 13N-3W, Christian	Jacksonville (4)
136	NE NW SW 23, 13N-3W, Christian	Jacksonville (1)
138	do.	Jacksonville (2.5)
141	SE NW NW 23, 13N-3W, Christian	Jacksonville (3)
144	do.	Jacksonville (11.5)
147	SW NE SE 23, 13N-3W, Christian	Kans. (East)
148	do.	Kans. (silt)
150	SE NW SE 13, 13N-3W, Christian	Jacksonville (5)
151	do.	Jacksonville (8)
156	NE SW NW 10, 13N-3W, Christian	Jacksonville
162	NE SW SE 26, 14N-3W, Christian	Jacksonville (2.5)
165	do.	Jacksonville (8)
167	SW SE NW 15, 14N-3W, Christian	Jacksonville (4)
168	do.	Jacksonville (7.5)
171	NW SW SW 36, 14N-3W, Christian	Jacksonville
173	NE NE SW 10, 15N-3W, Sangamon	Roby (1)
176	NE NE SW 10, 15N-3W, Sangamon	Jacksonville (4.5)
178	do.	Jacksonville (13)
181	NW NE SW 10, 15N-3W, Sangamon	Kans. (East)
183	NE SW NW 17, 17N-2W, Logan	Buffalo Hart (6)
193	NW SW SE 5, 15N-3W, Sangamon	Jacksonville (5)
195	do.	Jacksonville (11.5)
201	SW NW SE 5, 15N-3W, Sangamon	Jacksonville (6)
211	SE NW NW 10, 15N-3W, Sangamon	Jacksonville (4)
212	do.	Buffalo Hart (.5)
213	do.	Buffalo Hart (2.5)
214	do.	Buffalo Hart
220	SW SE SW 12, 14N-4W. Sangamon	Jacksonville (4)
221	do.	Kans. (East) (4)
222	SW SW NW 30, 14N-3W, Christian	Jacksonville (3)
224	do.	Jacksonville (8)
226	NE NE NW 2, 13N-3W, Christian	Jacksonville (8)
230	NW SW SW 18, 15N-2W, Christian	Buffalo Hart (.5)
231	do.	Buffalo Hart (2)
232	do.	Roby (.7)
233	do.	Roby (3)
234	do.	Roby (5.5)
235	do.	Roby (7)
241	SW SW NE 34, 13N-2W, Christian (2)	Jacksonville (1)
243	do.	Jacksonville (4)
246	do.	Kans. (East) (1)
247	do.	Kans. (East) (4)
248	SW SE NW 22, 15N-3W, Christian	Jacksonville (2)
256	NW NE SE 8, 15N, 2W, Christian	Jacksonville (14)
259	SW NW SW 3, 12N-2W, Christian	Jacks.-Mendon (4.5)
260	NE NE SE 7, 12N-2W, Christian	Jacks.-Mendon
263	do.	Kans. (East) (5)
264	do.	Kans. (East) (6)
266	SE SE SE 3, 12N-3W, Christian	Jacksonville (3)
267	do.	Jacksonville (7)
272	NE NE SW 30, 13N-2W, Christian	Jacks.-Mendon (4)
273	SW NE SE 23, 13N-3W, Christian	Jacksonville (2)
274	do.	Jacksonville (8.5)
283	NW SE NE 14, 15N-3W, Sangamon	Buffalo Hart (1)
284	do.	Buffalo Hart (6)
285	do.	Buffalo Hart (11)
286	do. (7)	Roby (.5)
287	do.	Roby (2)
288	do.	Jacksonville (1)
291	do.	Jacksonville (12)
292	do.	Jacksonville (4.5)
293	do.	Jacksonville (8.5)
297	SE SW SE 9, 19N-4W, Logan	Jacks.-Mendon (7)
298	SE SE SW 14, 19N-4W, Logan	Jacks.-Mendon (5)

TABLE 1 – Continued

Sample No.	Location ¼ Sec., T–R, County, (geol. sec. no.)	Stratigraphic Unit (feet below top)
299	NW SE NE 12, 19N–4W, Logan	Buffalo Hart (3)
302	SE SW SE 16, 19N–4W, Logan	Jacks.–Mendon
307	SW NE SE 29, 16N–3W, Sangamon (1)	Buffalo Hart (0.5)
308	do.	Buffalo Hart (2)
309	do.	Buffalo Hart (4)
310	do.	Buffalo Hart (6)
311	do.	Buffalo Hart (8)
312	do.	Buffalo Hart (8)
314	do.	Buffalo Hart (11)
315	do.	Buffalo Hart (11.5)
320	do.	Roby (1)
324	do.	Roby (3)
325	NE SW SE 29, 16N–3W, Sangamon	Buffalo Hart (2)
326	do.	Buffalo Hart (2.5)
327	do.	Roby (.2)
329	do.	Roby (2)
333	NW SW SW 5, 19N–3W, Logan	Buffalo Hart (4)
337	NE NE NE 21, 19N–4W, Logan	Buffalo Hart (4)
338	do.	Jacks.–Mendon (8)
340	NE NE NW 26, 19N–4W, Logan	Jacks.–Mendon (8)
341	NW NW NE 16, 16N–4W, Sangamon	Jacksonville (5)
343	NE SE NW 19, 17N–4W, Sangamon (9)	Roby (2)
344	do.	Roby (3.5)
345	SW NW NW 15, 19N–4W, Logan	Jacks.–Mendon (3)
346	NW SW SE 15, 19N–4W, Logan	Jacks.–Mendon (4)
347	do.	Jacks.–Mendon (14)
348	SE SE NW 15, 19N–4W, Logan	Buffalo Hart (3)
349	do.	Buffalo Hart (8)
350	SE SE NW 15, 19N–4W, Logan	Buffalo Hart
355	NE SE NW 19, 17N–4W, Sangamon	Jacksonville (2)
356	SE SE NW 26, 17N–4W, Sangamon	Jacksonville
357	NE SW SW 28, 16N–3W, Sangamon	Jacksonville (2)
362	do.	Buffalo Hart (5.5)
369	NW NE SW 31, 19N–5W, Menard	Jacksonville (5.5)
370	SW SE NE 36, 19N–6W, Menard	Jacks.–Mendon (4.5)
374	NW SE NE 36, 19N–6W, Menard	Jacks.–Mendon (8)
376	do.	Jacks.–Mendon (19)
378	SW SW NE 6, 18N–5W, Logan	Jacks.–Mendon (12)
380	SE NW SW 18, 18N–5W, Logan	Jacksonville (4)
384	SE SW SE 34, 19N–2W, Logan	Buffalo Hart (5)
385	do.	Buffalo Hart (9)
386	do.	Buffalo Hart (15)
387	do.	Buffalo Hart (16)
388	SE SE SE 34, 19N–2W, Logan	Buffalo Hart (10)
389	do.	Buffalo Hart (18)
397	SE SE NW 32, 19N–2W, Logan	Buffalo Hart (3)
398	do. (10)	Buffalo Hart (8)
399	do.	Buffalo Hart (13)
400	do.	Buffalo Hart (18)
402	SW NW NE 33, 19N–2W, Logan	Buffalo Hart (1)
410	SE NW SW 5, 18N–6W, Menard	Jacksonville (5.5)
413	SE NW NW 16, 17N–6W, Menard	Jacks.–Mendon (12)
414	do.	Jacks.–Mendon (22)
415	do.	Jacks.–Mendon (25.5)
418	do. (8)	Petersburg (4)
421	do.	Kans.–L.Mich? (4)
422	do.	Kans.–L.Mich? (11)
423	SW SW NE 34, 18N–6W, Menard	Jacks.–Mendon (10)
424	do.	Jacks.–Mendon (16)
426	do.	Jacks.–Mendon (28)
429	SE SE SW 23, 17N–6W, Sangamon	Jacksonville (4.5)
434	do.	Kans. (East) (2)
435	do.	Kans.–L.Mich? (8)
436	do. (4)	Kans.–L.Mich? (14)
437	do.	Kans.–L.Mich? (20)
438	do.	Kans. (East) (26)
439	do.	Kans.–L.Mich? (32)
440	do.	Kans.–L.Mich? (38)
441	SW SE SE 23, 18N–7W, Sangamon	Kans. (East)
446	SE NE SE 28, 17N–6W, Sangamon	Jacksonville (0.5)
447	do.	Jacksonville (2.5)
448	do.	Jacksonville (3.5)
449	do.	Jacksonville (10.5)
450	do.	Jacksonville (16.5)
451	do.	Jacksonville (22.5)
452	do.	Jacks.–Mendon (28.5)
453	do.	Jacks.–Mendon (34)
473	NE NE NW 8, 18N–6W, Menard	Petersburg (1)
474	do.	Petersburg (3)
475	do.	Petersburg (6)
476	do.	Petersburg (11)
480	do.	Petersburg (16)
498	NW NE NE 26, 18N–7W, Menard	Kans. (East) (3)
499	do.	Kans.–L.Mich? (7)
500	do.	Kans.–L.Mich? (15)
505	NE SE NW 26, 18N–7W, Menard	Jacksonville (2.8)
507	do.	Petersburg (8)
512	do.	Kans. (East) (8)
514	do.	Kans. (East) (10.5)
515	do.	Kans.–L.Mich? (15.5)
516	SE NW NE 23, 18N–7W, Menard	Jacksonville (3)
517	do.	Jacksonville (9)
518	do.	Jacks.–Mendon (17)
519	SE NW NE 23, 18N–7W, Menard	Jacks.–Mendon (10)
520	do.	Petersburg (1)
522	do.	Petersburg (6.5)
523	NE NW SW 31, 15N–1E, Christian	Buffalo Hart (10)
528	SW SE NW 20, 13N–1W,	Jacksonville (2)

TABLE 1 - Continued

Sample No.	Location ¼ Sec., T-R, County, (geol. sec. no.)	Stratigraphic Unit (feet below top)
529	SW SE NW 20, 13N-1W, Christian	Jacksonville (8)
532	NE SE NW 20, 13N-1W, Christian	Jacksonville (1)
533	do.	Jacksonville (6)
535	SW SE SE 6, 12N-2W, Christian	Jacks.-Mendon (4)
538	do.	Petersburg (4)
546	NW NW SE 36, 13N-2W, Christian	Jacksonville (12)
548	do.	Petersburg (?) (1)
549	do. (12)	Petersburg (?) (2)
550	do.	Petersburg (?) (2.3)
551	do.	Petersburg (?) (3.3)
554	SE NW NW 17, 13N-1W, Christian	Jacksonville (3)
556	SE NE NE 30, 13N-1W, Christian	Jacksonville (2.5)
565	NW NW SW 3, 14N-4W, Sangamon	Jacksonville (11)
566	NE NW NW 3, 14N-4W, Sangamon	Jacksonville (10)
567	S½ SW SE 28, 17N-4W, Sangamon (3)	Roby (0.5)
569	do.	Roby (1.8)
570	do.	Roby (3.0)
572	NW NE NE 26, 18N-7W, Menard	Kans.-L.Mich?
574	SE NE NE 34, 17N-7W, Sangamon	Jacksonville
581	NW NE NE 26, 18N-6W, Menard (6)	Kans. (East) (1)
582	do.	Kans. (East) (2.5)
586	do.	Kans. (East) (9)
591	NW NE NE 26, 18N-6W, Menard	Jacks.-Mendon (2.5)
592	do.	Jacks.-Mendon (5.5)
593	do.	Petersburg (2)
594	do.	Petersburg (5)
595	do.	Petersburg (8)
596	do.	Petersburg (11)
597	do. (5)	Petersburg (13)
598	do.	Yarmouth (.5)
599	do.	Yarmouth (1.8)
600	do.	Yarmouth (3.2)
601	do.	Kans.-L.Mich? (1.7)
602	do.	Kans.-L.Mich? (3.3)
603	do.	Kans.-L.Mich? (7.2)
610	NW NE NE 26, 18N-6W, Menard	Yarmouth (0.3)
611	do.	Yarmouth (1)
612	do.	Yarmouth (1.7)
613	do.	Yarmouth (2.8)
614	do. (6)	Yarmouth (4)
615	do.	Yarmouth (4.8)
616	do.	Kans. (silt) (0.4)
617	do.	Kans. (East) (0.7)
618	do.	Kans. (East) (2)
619	do.	Kans. (East) (4)

TABLE 2 - GRAIN SIZE AND MINERAL ANALYSES

Sample No.	Grain Size (percent) Granules and sand	Silt	Clay	Clay Minerals (percent) Montmorillonite	Illite	Kaolinite + chlorite	Light Minerals (percent) (carbonate-free basis) Quartz	K-feldspar	Na-Ca feldspar	Others	Carbonates (percent) Calcite	Dolomite
1	25	49	26	30	49	21						
7				15	77	8						
8	51	30	19	15	68	17	77	12	9	2		
9	43	35	22	14	67	19	80	10	8	2		
10				9	66	25						
14	42	34	24	8	72	20						
15	29	48	23	3	63	34	70	8	20	2	9.5	21.1
19	28	39	33	4	60	36	71	9	16	4	8.2	12.5
46	47	29	24	9	73	18	79	9	11	1	8.0	25.6
48				8	69	23					5.6	28.8
50	40	33	27	21	60	19	77	10	10	3		
51				36	44	20						
58				8	72	20						
60	40	37	23	3	65	32	73	6	18	3	10.0	17.0
61	29	48	23	2	67	31	69	7	19	5	9.7	19.7
63				15	60	35						
64				2	66	32						
65	24	37	39		69	31	61	12	23	4	19.0	9.0
66	28	39	33	1	66	33	64	11	20	5	11.1	11.5
76	50	28	22	6	70	18	77	9	13	1		
86	47	29	24	6	78	16	78	12	9	1		
106	47	30	23	4	72	24	78	13	9	1		
112	49	31	20	11	72	17	78	10	10	2		
113	49	32	19								6.0	25.3
117	16	47	37									
120	38	30	32	4	80	16	78	11	10	1	4.3	24.6
124	32	42	26	30	50	20						
125	49	30	21	15	73	12	78	10	11	1		
127	47	32	21	8	68	24						
128	39	35	26	3	59	38	78	10	9	3	5.5	23.1
129	54	28	18	5	74	21	78	11	10	1		
136	50	29	21	8	73	19	77	11	10	2		
138	32	34	34	2	63	35	76	11	10	3	6.0	24.9
141	52	22	26	11	78	11	78	10	10	2		
144	42	32	26	6	64	30	75	11	11	3	5.6	24.6
147	40	37	23	3	64	33	73	8	16	3		
148				8	58	34						
150	50	30	20									
151	48	29	23	7	79	14						
156	53	29	18	11	70	19						
162	52	29	19	10	71	19	80	11	8	1		
165	34	39	27	2	75	25	78	11	8	3		
167												
168				6	62	32						
171	41	36	23	6	71	23						
173				2	85	13						
176	47	30	23									
178	40	23	27	6	62	32	80	9	9	2		
181	35	35	30	8	66	28	66	10	22	2	13.0	12.6
183	45	37	18									
193	46	31	23									
195	46	30	24		72	28	81	9	9	1		
201	45	31	24		74	26	79	10	9	2	3.8	30.0
211	48	30	22	4	64	32	80	10	10	9		
212	30	49	21	10	73	17	78	11	9	2		
213	22	49	29									
214	24	49	27	3	72	25	79	9	10	2	2.5	28.4
220	46	35	19	16	60	24	75	11	11	3		
221	35	34	31	9	69	22					12.6	17.4
222	55	26	19									
224	40	35	25	3	63	34					6.2	24.5

TABLE 2 - Continued

Sample No.	Grain Size (percent) Granules and sand	Silt	Clay	Clay Minerals (percent) Montmor-illonite	Illite	Kaolinite + chlorite	Light Minerals (percent) (carbonate-free basis) Quartz	K-feldspar	Na-Ca feldspar	Others	Carbonates (percent) Cal-cite	Dolo-mite
226	39	37	24	3	68	29						
230	23	46	31	9	74	17	76	14	9	1		
231				13	73	14						
232	0	87	13	21	65	14					3.0	26.5
233	3	77	20	5	80	15					5.5	23.0
234	2	13	85		83	17						
235	7	77	16	38	40	22					6.5	16.0
241	49	28	23	13	77	10						
243	50	32	18	6	70	24	81	8	10	1		
246	42	33	25	8	70	22	73	9	14	4		
247	49	30	21	11	66	23	71	6	16	7	9.5	21.1
248	43	34	23	7	69	24						
256	49	34	17								4.8	26.2
259	25	50	25	44	39	17	77	11	11	1		
260	27	45	28	34	40	26	78	11	7	4		
263	42	35	23	20	63	17	72	7	15	6		
264	39	37	24	10	59	31	67	8	19	6	10.0	19.0
266	45	31	24									
267	28	31	41	10	67	23						
272	34	36	30	23	56	21	78	9	10	3		
273				5	72	23						
274	42	35	23	8	57	35					4.3	24.6
283	20	57	23									
284	24	47	29	11	80	9	75	14	9	2		
285	24	44	32	12	69	19	77	11	11	1	5.6	21.6
286	4	13	83	3	86	11					11.5	8.5
287	2	83	15	28	50	22					9.5	23.0
288	45	32	23	4	85	11	78	12	8	2		
291	41	35	24									
292	45	34	21	5	85	10	80	12	7	1		
293	42	34	24	9	70	21	80	10	7	3		
297	35	37	28	32	50	18	81	9	8	2		
298	26	39	35	42	42	16	82	9	8	1		
299	45	35	20	8	79	13	76	11	11	3		
302	31	39	30	37	42	21	80	8	10	2		
307	22	42	36									
308	23	45	32									
309	25	45	30									
310	21	49	30	4	78	18	79	10	9	2		
311	17	51	32	5	81	14						
312	17	52	31									
314	17	55	28								2.4	24.6
315	14	58	28		77	23	78	10	11	1	3.0	24.7
320	0	31	69		73	27					5.5	9.0
324	2	84	14	2	66	32					4.0	30.0
325	12	60	28									
326	14	57	29		70	30	81	9	9	1	2.6	25.4
327				2	80	18					4.5	26.0
329					80	20					5.5	10.5
333	36	37	27	2	84	16	80	9	9	2		
337	36	38	26		87	13						
338	31	36	33	35	50	15	81	8	9	1		
340	27	43	30	44	36	20	82	8	8	2	3.6	16.1
341	44	28	28	6	74	18						
343	0	13	87	5	81	14						
344	13	65	22	6	70	24					5.5	25.0
345	36	36	28	47	45	8						
346	27	41	32	36	46	18						
347	28	41	31	44	38	18	80	7	11	1		
348	37	37	26	5	76	19						
349	37	40	23	2	76	22						
350	25	57	18	4	69	27	75	13	10	2	2.4	27.7

TABLE 2 - Continued

Sample No.	Grain Size (percent) Granules and sand	Silt	Clay	Clay Minerals (percent) Montmor-illonite	Illite	Kaolinite + chlorite	Light Minerals (percent) (carbonate-free basis) Quartz	K-feldspar	Na-Ca feldspar	Others	Carbonates (percent) Cal-cite	Dolo-mite
355	48	28	24	8	81	11						
356	48	28	24	3	73	24					5.0	27.3
357	46	29	25	3	87	10	76	14	8	2		
362	12	54	34	6	83	11	74	14	11	1		
369	45	32	23	8	74	18	80	9	9	2	4.4	22.7
370	19	53	28	35	47	18	78	10	11	1		
374	20	54	26	32	48	20	82	8	7	3		
376	19	55	26	38	40	22	80	9	10	1		
378	24	49	27	29	52	19	75	16	14	2	2.5	15.1
380	42	32	26	3	77	20	76	11	10	3		
384	38	34	28	3	84	13	74	15	9	2		
385	37	35	28									
386	39	35	26		73	27	79	9	11	1		
387	40	37	25								3.4	24.0
388	37	35	28									
389	44	39	17		70	30	78	12	8	2	2.5	32.7
397	40	34	26									
398	39	35	26	3	88	9	77	11	11	1		
399	40	34	26									
400	39	28	23	9	79	12	77	10	12	1		
402	37	35	28	3	85	12	79	10	10	1		
410	42	32	26	8	69	23	74	12	11	3	4.6	30.5
413	25	51	24	21	59	20						
414	10	67	23	40	36	24	75	14	8	3	1.5	18.5
415				41	39	20					2.0	18.2
418				39	45	16					0.5	3.5
421	26	36	38	31	49	20					4.5	10.6
422	24	42	34	34	39	27	79	8	12	1	3.8	11.0
423	29	39	32	40	39	21	82	7	9	2		
424	26	39	35	32	48	26						
426	25	39	36	30	41	29	80	7	11	2	3.5	12.4
429	31	38	31	14	66	20	78	11	9	2		
434	38	36	26	14	65	21	71	7	17	5	13.0	14.7
435	22	39	39	34	46	20	79	8	9	4	4.0	10.0
436	23	42	35	33	49	18	80	8	10	2	3.2	9.4
437	20	40	40	33	47	21	79	9	10	2	3.4	7.5
438	37	36	27	6	76	16	70	11	18	1	11.0	14.0
439	22	40	38	37	44	19					4.2	10.4
440	30	36	34	38	43	19	80	8	8	4	4.0	10.8
441	40	34	26	20	65	15					10.5	16.9
446	40	34	26	7	79	14	81	7	7	5		
447	44	32	24	10	71	19	79	10	10	1		
448	44	32	24	11	68	21	83	8	8	1		
449	39	35	26	12	62	26	74	11	12	3	5.8	20.0
450	37	35	28	8	55	37	79	10	8	3	5.1	22.2
451	33	37	30	12	58	30					5.5	23.5
452	26	46	28	24	46	30	78	8	12	2	2.6	17.3
453	8	68	24	43	36	21					1.0	15.2
473				70	14	16					0.0	0.0
474				50	30	20						
475	1	84	15	72	21	7					0.4	2.0
476	1	87	12	73	13	14					2.5	19.0
480	1	87	12	45	41	14					3.0	16.5
498	38	35	27	16	71	13					11.9	13.9
499	26	39	35	34	49	17	79	7	12	2	4.0	13.0
500	24	39	37	39	41	20	79	8	10	3	4.6	12.0
505	32	39	29	11	70	19	77	12	9	2		
507				58	27	15					0.5	6.5
512	27	47	26	12	72	16	70	11	17	2		
514	37	37	26	11	75	14	69	9	20	2	13.2	16.5
515	24	39	37	30	50	20	82	8	9	1	3.9	11.2

TABLE 2 - Continued

Sample No.	Grain Size (percent)			Clay Minerals (percent)			Light Minerals (percent) (carbonate-free basis)				Carbonates (percent)	
	Granules and sand	Silt	Clay	Montmor-illonite	Illite	Kaolinite + chlorite	Quartz	K-feldspar	Na-Ca feldspar	Others	Cal-cite	Dolo-mite
516	44	30	26	10	78	12	73	9	14	4		
517				11	66	23						
518	14	60	26	34	42	24	76	10	12	2	2.0	18.0
519	27	46	27	22	53	25	75	9	10	6		
520				38	43	19					2.5	19.0
522				33	55	12					7.0	26.0
523	31	37	32		79	21	80	10	8	2		
528				6	75	19						
529	49	31	20	2	77	21	78	9	11	1		
532				8	71	21						
533	39	36	25	7	75	18	71	11	13	5		
535	26	48	26	36	51	13	77	11	12	2		
538	1	84	15	47	38	15					1.0	13.0
546	40	34	26	10	59	31	80	10	8	2		
548	14	36	50	69	15	16						
549				33	38	29						
550				58	21	21						
551				52	28	20						
554	46	30	24	9	62	29						
556				6	74	20						
565	35	40	25	7	58	35	80	12	6	2		
566	29	48	23	8	65	27	77	11	8	4		
567	1	76	23	22	69	9						
569	1	12	87	5	78	17					5.5	4.0
570	1	9	90	5	82	13					3.5	7.0
572	23	41	36	30	39	30	80	7	10	3	4.0	13.8
574				10	70	20						
581				21	68	11						
582	30	39	31	13	75	12						
586	39	37	24	16	72	12					12.6	17.0
591				21	59	20						
592				51	35	14						
593	1	86	13	33	50	17					0.3	2.5
594	1	87	12	38	43	19					3.5	24.5
595	1	86	13	53	35	12					0.4	13.5
596	1	85	14	31	35	14					0.5	7.5
597	1	81	18	55	29	16					0.5	4.0
598	18	47	35	48	34	18	70	11	18	1		
599	29	36	35	42	43	15	72	12	15	1		
600	23	41	36	49	35	16	73	11	14	2		
601	20	41	39	49	31	20	82	7	8	3		
602	23	41	36	38	42	20	76	10	11	3		
603	23	43	34	39	44	17	83	7	7	3	4.0	11.2
610	18	45	37	42	31	27	75	11	12	2		
611	19	38	43	46	37	17	72	11	13	4		
612	17	46	37	44	38	18	73	12	13	2		
613	15	47	38	47	38	15	74	10	11	4		
614	29	36	35	33	55	12	68	10	15	6		
615	17	50	33	47	40	13	72	10	13	5		
616	16	61	23	35	51	14	70	11	15	3		
617	44	30	36	21	68	11	68	11	18	3		
618	45	30	25	23	66	11	69	12	16	3	11.5	16.4
619	29	40	31	31	52	17	74	9	14	3	10.0	16.0

TABLE 3 - HEAVY MINERAL ANALYSES*
(carbonate-free basis)

Sample No.	Opaque		Transparent Heavy Minerals (%)														
	Black	Others	Tourmaline	Zircon	Garnet	Epidote	Rutile	Titanite	Kyanite	Staurolite	Andalusite	Actinolite	Hornblende	Enstatite	Hypersthene	Diop.-Aug.	Others
60	11	13		1	14	5		1	1		1	1	64	1	6	5	
247	8	20	1	1	19	3		1	1	1			61	3	3	2	4
422	11	56	4		14	10		2			1		55		8	3	1
499	8	51	1		13	12		1		3		2	60	1	1	2	4
500	5	51	4	1	18	8			1	1	1		62		2		2
514	9	8	2	1	25	6					1	1	61			2	1
515	6	51	1	1	20	12			1				57	1	1	2	4

* Analyses by Constantine Manos.

TABLE 4 - AVERAGES OF PETROGRAPHIC DATA BY STRATIGRAPHIC UNIT
(in percent)

	Grain Size				Clay Minerals				Light Minerals					Carbonates		
Stratigraphic Unit	Number of Samples	Granules and Sand	Silt	Clay	Number of Samples	Montmorillonite	Illite	Kaolinite + chlorite	Number of Samples	Quartz	K-feldspar	Na-Ca feldspar	Others	Number of Samples	Calcite	Dolomite
Illinoian																
Buffalo Hart	38	28	44	28	24	4	78	18	19	77	11	10	2	8	3	26
Roby Silt																
silt zones	7	4	78	18	8	16	64	20	—	—	—	—	—	7	5	24
clay zone	6	1	15	84	8	2	82	16	—	—	—	—	—	5	6	8
Jacksonville	66	44	32	24	68	8	70	22	43	78	9	10	3	17	5	25
Jacksonville-Mendon	28	26	46	28	31	34	46	20	21	79	9	10	2	9	3	17
Petersburg Silt (loess only)	9	1	85	14	15	49	36	15	—	—	—	—	—	14	2	11
Kansan																
Eastern (Taylorville area)	14	36	37	27	15	7	66	27	11	69	8	18	5	10	11	16
Eastern (Petersburg area)	11	37	35	28	12	17	69	14	7	70	10	17	3	8	12	16
Lake Michigan? lobe	14	23	40	37	14	35	44	21	12	80	8	10	3	12	4	11

GEOLOGIC SECTIONS

The locations of the geologic sections are shown on figure 3. Color notations and color names refer to those of the Munsell color charts and are for moist samples. Soil zone nomenclature follows that of Frye, Willman, and Glass (1960). Numbers in parentheses at the end of descriptions are sample numbers. The sections are arranged alphabetically by name.

Thickness (feet)

NO. 1 - ALLIS-CHALMERS SECTION

Measured in two lifts of a road cut on the Allis-Chalmers Testing Ground, in SW¼ NE¼ SE¼ sec. 29, T. 16 N., R. 3 W.; Sangamon County, Illinois (1961).

PLEISTOCENE SERIES
WISCONSINAN STAGE
WOODFORDIAN AND ALTONIAN SUBSTAGES
Peoria Loess and Roxana Silt undifferentiated
8. Loess, reddish brown (5 YR 4/4); present-day soil at top....................... 7.0
SANGAMONIAN STAGE
Sangamon Soil on Buffalo Hart drift
7. Soil, A-zone, yellow-brown (10 YR 4/4) to dark yellow-brown (10 YR 5/4); loam texture; fine subangular blocky to medium crumb structure; gradational to B-zone........... 0.7
6. Soil, B-zone, yellow-brown (10 YR 5/4) with dark brown (10 YR 4/3) clay-skins; clay loam texture; medium subangular blocky structure; Fe and Mn pellets in lower 2 feet..... 3.3
ILLINOIAN STAGE
BUFFALO HART SUBSTAGE
5. Till, silty; upper 3 feet leached; upper portion gray-brown (10 YR 5/2) with yellow-brown (10 YR 5/4) and gray (10 YR 5/1) mottles; grades to a light yellow-brown (2.5 YR 6/4) or pale olive (5 YR 6/4); lowermost portion brownish gray (10 YR 6/2); locally contains streaks of silt, fine sand, or clay in the lower portion; uppermost 9 feet exposed in the upper lift; lowermost 7 feet exposed in the lower lift (307 to 315)....... 14.5
Roby Silt
4. Silt, yellow-brown (10 YR 5/4) to gray-brown (10 YR 5/2), calcareous; few bands of brownish yellow (10 YR 6/6-8) iron stain... 0.5
3. Clay and thinly laminated clay and silt, calcareous; upper 4 inches laminated and brownish gray on 4 inches of massive gray clay on 4 inches of laminated light gray silt and dark gray clay; lower portion mostly massive; several pieces of wood (320).......... 2.5
2. Silt; upper few inches slightly calcareous, remainder calcareous; upper two inches peaty, lower portion carbonaceous grading from a dark chocolate-brown to a gray-brown (10 YR 5/2); fossiliferous, especially in the lower foot (324).......................... 1.5
JACKSONVILLE SUBSTAGE
1. Outwash, sand and gravelly sand, calcareous; upper 2 feet yellow-brown (10 YR 5/4) grading into gray-brown (10 YR 5/2) and eventually gray; unit described from augering; base not reached............................... 6.0

Total 36.0

NO 2 - ANNIE'S LAKE SECTION

Measured 20 yards SE of Annie's Lake and near the spillway in SW¼ SW¼ NE¼ sec. 34, T. 13 N., R. 2 W.; Christian County, Illinois (1961).

PLEISTOCENE SERIES
WISCONSINAN AND SANGAMONIAN STAGES
4. Loess and Sangamon Soil in slope and mostly covered............................... 5.0
ILLINOIAN STAGE
JACKSONVILLE SUBSTAGE
3. Till, calcareous, oxidized, yellow-brown, more oxidized down joints; two pebble pavements within the unit, one 1.5 feet from the top, the other 2 feet from the top; several silty inclusions (241 and 243)............... 6.0
YARMOUTHIAN STAGE
Yarmouth Soil on Kansan till
2. Till, leached, oxidized, yellow-brown; contains secondary $CaCO_3$, gray pebbly clay, and gleyed inclusion; upper contact erosional..... 2.0
KANSAN STAGE
1. Till, calcareous, oxidized, grayish brown; secondary $CaCO_3$ down joints; lower portion only slightly oxidized (246 and 247)... 5.0

Total 18.0

NO. 3 - BICE SCHOOL SECTION

Measured along the north bank of an abandoned gravel pit in S½ SW¼ SE¼ sec. 28, T. 17 N., R. 4 W.; Sangamon County, Illinois (1962).

PLEISTOCENE SERIES
WISCONSINAN STAGE
WOODFORDIAN SUBSTAGE
Peoria Loess
7. Loess, buff to yellow-brown, noncalcareous; present soil at top.................... 4.0
6. Loess, gray, mottled and streaked yellow-brown, noncalcareous; contains small Mn concretions.............................. 3.0
ALTONIAN SUBSTAGE
Roxana Silt
5. Loess, dark reddish brown to strong brown, noncalcareous......................... 3.0

Thickness (feet)

ILLINOIAN STAGE
BUFFALO HART SUBSTAGE
4. Outwash, sand, clayey, dark brown to yellow-brown with gray mottles, weathered, noncalcareous; contains Fe and Mn concentration throughout; thin clay-skins down fractures.. ....4.0
Roby Silt
3. Silt, thin, discontinuous, noncalcareous; variable shades of gray and brown; pockets of gray-brown clay; upper contact erosional (567) 0-1.0
2. Clay and thinly laminated clay and silt; varies from completely noncalcareous to calcareous with only the upper 18 inches noncalcareous; upper 18 inches is clay, gray-brown, somewhat jointed; next 6 inches is blue and blue-gray laminated silt and clay; next 12 inches is massive but faintly laminated gray and brown-gray clay; lower 6 inches is thinly laminated, gray and brown silt and clay (569 and 570)............................. 3.5
JACKSONVILLE SUBSTAGE
1. Outwash, sand and gravelly sand; sorting variable; persistent thin (2-8 inches), gray, fossiliferous, clayey sand approximately 12-18 inches below top; upper portion varies from gray to buff and strongly calcareous to dark yellow-brown, leached and clay enriched with Mn concentration; the clay-enriched material is usally thin but locally is up to 5 feet thick and commonly is confined to the area above the clayey sand; the clay-enriched material has an abrupt lateral contact with gray calcareous sand at one locality; base not exposed.......................... 6-10

Total 27.5

NO. 4 - GEORGETOWN SCHOOL SECTION

In SE¼ SE¼ SW¼ sec. 23, T. 17 N., R. 6 W.; Sangamon County, Illinois (1961).

PLEISTOCENE SERIES
WISCONSINAN STAGE
WOODFORDIAN SUBSTAGE
Peoria Loess
5. Loess, silty, yellow-brown (10 YR 5/4-6), poorly exposed....................... 4.0
ILLINOIAN STAGE
JACKSONVILLE SUBSTAGE
4. Till, dark yellow-brown to dark brown (10 YR 4/3-4); upper 2 feet leached and part of a truncated Sangamon Soil; lower portion calcareous (429)........................ 5.0
YARMOUTHIAN STAGE
Yarmouth accretion-gley
3. Soil, G-zone, gray and dark brownish gray with local yellow-brown mottling, blocky, clayey; more brownish toward base..... 2.0
2. Soil, CL-zone, colluvium, silty sand, light yellow-brown to yellow-brown with a few gray streaks; lower portion brownish to pinkish brown; possibly till................. 2.0
KANSAN STAGE
1. Till, calcareous, oxidized, yellow-brown (10 YR 5/4) near top grading to gray-brown (10 YR 5/2) toward base; several silty streaks and pinkish zones near top (434-440)...... 38.0

Total 51.0

NO. 5 - PETERSBURG DAM SECTION NO. 1

Composite section measured on the nose of first bluff west of the dam and on the south side of the lake in SW¼ NW¼ NE¼ NE¼ sec. 26, T. 18 N., R. 6 W.; Menard County, Illinois (1962).

PLEISTOCENE SERIES
WISCONSINAN STAGE
WOODFORDIAN AND ALTONIAN SUBSTAGES
Peoria Loess and Roxana Silt undifferentiated
11. Loess, upper 10 feet in slope and vegetated; lower 4 feet brown to yellow-brown, colluvial 14.0
SANGAMONIAN STAGE
Sangamon Soil on colluvium and Jacksonville till
10. Soil, A-zone, dark yellow-brown, mostly silt and clay; weak platy structure; light gray silt down fractures; minor amount Mn concentration.............................. 1-1.5
9. Soil, B-zone, dark reddish brown to dark brown in the lower 12 inches, clayey, quite pebbly and sandy; Mn concentration; clay skins down fractures; structure weak.. 3.0
ILLINOIAN STAGE
JACKSONVILLE SUBSTAGE
8. Till, leached, gray brown with Mn concentration and clay skins down joints; contains thin, oxidized, yellow-brown silt and sandy streaks............ .... 1.0
7. Till, calcareous, upper portion gray-brown with Mn and Fe staining down joints; grades into gray till with oxidation confined to area along joints and to thin sandy streaks; lower 2 feet locally very silty and brown; fossils in lower portion (591 and 592) 7.5
6. Colluvium and till, noncalcareous, very clayey, similar to soil below Petersburg Silt, present only in easternmost part of the section; thickens to the east; fairly abrupt contact with the silts below; does not appear to be in place..................... 0.2-4.0

Thickness (feet)

LIMAN SUBSTAGE
Petersburg Silt
5. Silts, loessial, variable in color and carbonate content, locally fossiliferous, pink, buff, and shades of gray and brown, compact to friable, oxidized down joints with Fe and some Mn stain; locally contains small Mn pellets; thickens to west (593-597).. 2-24.0
YARMOUTHIAN STAGE
Yarmouth Soil on Kansan till
4. Soil, A-zone, dark yellow-brown with local yellow-brown mottles, platy (598)..... 1.0
3. Soil, B-zone, compact, yellow-brown; dark Mn staining and thin clay-skins down fractures; no typical soil structure (599-600)... 3.0
KANSAN STAGE
2. Till, dark yellow-brown to yellow-brown, grayer toward base; upper 1-2 feet leached; Mn, Fe, and $CaCO_3$ concentration down joints; calcareous till pinches out to west and there contains thin streaks of calcareous silt occurring in leached till (601-603)........ 0-10.0
1. Silt, gray to gray-brown with brown, yellow-brown, and dark brown streaking, calcareous, fossiliferous; contains leaves and stems; Fe banding; exposed only in the western portion of the section where the overlying till pinches out........................... 0-2.0

Total 44.5

NO. 6 - PETERSBURG DAM SECTION NO. 2

Measured 40 yards east of section no. 1 and on the west side of the south dam abutment in SE¼ NW¼ NE¼ NE¼ sec. 26, T. 18 N., R. 6 W.; Menard County, Illinois (1962).

The upper part of the section consists of approximately 18 feet of Peoria Loess and Roxana Silt, and the Sangamon Soil developed into either colluvium or till with approximately 6 to 7 feet of leaching. All units thin to the north where the Yarmouth Soil is best exposed.

PLEISTOCENE SERIES
ILLINOIAN STAGE
JACKSONVILLE SUBSTAGE
6. Till, calcareous, oxidized, yellow-brown, less oxidized toward base; Fe and Mn concentration and intense oxidation down joints; lower contact irregular; leached till appears to have been locally squeezed up into this unit...... ....2-8.0
LIMAN SUBSTAGE
Petersburg Silt
5. Silt, calcareous, gray to buff, discontinuous; irregular thickness; contains small Mn pellets; probably not in place........... 0-3.0
YARMOUTHIAN STAGE
Yarmouth Soil on Kansan till
4. Soil, B-zone, locally cut out; where most complete the upper 2 feet is clayey, tough, yellow-brown with local dark Mn staining; contains thick (up to 1/16 inch), shiny, contincous clay-skins which thin toward base as Mn concentration increases; no apparent structure; lower 3 feet not as tough, light yellow-brown with many dark Mn pellets (1/8 inch diameter) and Mn stains on fracture surfaces; slight gray mottling; and thin, discontinuous clay-skins (610 to 615).... 5.0
KANSAN STAGE
3. Till, leached, brown to yellow brown; locally lower 12 to 18 inches is calcareous; Mn concentration down joints and locally Mn pellets in the upper portion (581 and 582)..... .... 2.0
2. Silt, calcareous except in the leached zone of the Yarmouth Soil; where leached is light yellow-brown and contains Mn pellets; where calcareous has a zone of secondary $CaCO_3$ at top, the upper 6 inches is brownish gray with bright yellow-brown iron streaks, then 6 inches is uniform gray silt, and 24 inches is uniform yellow-brown silt with a few bright iron spots; contains Mn pellets; upper 12 inches fossiliferous, mostly fragments; where thickest lower 12 inches locally is calcareous, yellow-brown to gray gravelly sand or silty sand (616)............. 0.5-4.0
1. Till; upper 6 inches leached where within the leached zone of the Yarmouth Soil; otherwise calcareous, oxidized yellow-brown, jointed with Mn stain on joint surfaces; base covered (586 and 617 to 619).......... 3-6.0

Total 17.0

NO. 7 - ROBY SECTION

Measured along the south bank of an abandoned meander channel in NW¼ SE¼ NE¼ sec. 14, T. 15 N., R. 3 W.; Sangamon County, Illinois (1961).

PLEISTOCENE SERIES
WISCONSINAN STAGE
WOODFORDIAN AND ALTONIAN SUBSTAGES
Peoria Loess and Roxana Silt undifferentiated
11. Loess, yellow-brown to dark yellow-brown, leached; present soil at top.......... 8.0
SANGAMONIAN STAGE
Sangamon Soil on Buffalo Hart till
10. Soil, A-zone, leached, pebbly silt, yellow-brown................................ 1.0
9. Soil, B-zone, dark yellow-brown with a few light mottles, clay loam; moderately strong subangular blocky structure; Fe and Mn concentrations and pellets in the lower portion 3.0
ILLINOIAN STAGE
BUFFALO HART SUBSTAGE
8. Till, leached, gray and yellow-brown, mottled, silty; considerable Mn concentration.. 2.5

Thickness (feet)

7. Till, calcareous, oxidized, grayish brown, locally gray or yellow-brown, silty; silt inclusions common in lower portion (283-285).. .... 4.8

Roby Silt
(upper contact distorted and unit locally repeated)

6. Clay, calcareous, weakly laminated; upper 3 inches brownish gray, remainder gray; contains much secondary $CaCO_3$ (286)...... .5-1.0
5. Silt, calcareous, brownish gray to reddish gray-brown, fossiliferous; contains small Mn pellets and locally sand inclusions (287)... .... 1-2.0
4. Sand, calcareous, brownish yellow to yellow-brown, locally gravelly; brick red silty sand near base........................ 1.0

JACKSONVILLE SUBSTAGE

3. Till, oxidized, calcareous, yellow-brown grading to brownish gray near base; more oxidation down joints; has local, thin, calcareous sand zones (292)................. 6.6
2. Till, slightly oxidized, brownish gray; upper surface is faceted, striated pebble pavement; local, thin, calcareous sand zones; lower 8 feet examined by augering (293)..... .... 16.0
1. Silt, calcareous, upper 2 feet gray-brown, lower 2 feet deep brown; base not reached... .... 4.0

Total 51.0

NO. 8 - ROCK CREEK TOWNSHIP SECTION

Measured along the south bank of a tributary to the Sangamon River in center W½ NW¼ sec. 16, T. 17 N., R. 6 W.; Menard County, Illinois (1961).

PLEISTOCENE SERIES
ILLINOIAN STAGE
JACKSONVILLE SUBSTAGE

3. Till, calcareous, oxidized except for the lower 6 feet, grades from grayish yellow-brown to gray; more oxidized down joints; lower 4 feet slightly oxidized, silty, and contains organic fragments (413-415).. 24.0

LIMAN SUBSTAGE
Petersburg Silt

2. Silt, slightly calcareous, pink to pinkish gray with gray zones more calcareous, sparsely fossiliferous...................... 12.0

KANSAN STAGE
Kansan till

1. Till; upper 12 inches leached; oxidized yellow-brown in the upper 6 feet, lower portion gray with oxidation down joints; not well exposed; base covered (421 and 422)... 10.0

Total 46.0

Thickness (feet)

NO. 9 - SHERMAN SECTION

Measured in road cuts along Interstate 55 in NE¼ SE¼ NW¼ sec. 19, T. 17 N., R. 4 W.; Sangamon County, Illinois (1962).

PLEISTOCENE SERIES
WISCONSINAN STAGE
WOODFORDIAN AND ALTONIAN SUBSTAGES
Peoria Loess and Roxana Silt undifferentiated

7. Loess; upper portion yellow-brown to dark yellow-brown grading to dark reddish brown in the lower portion; locally sandy; lower 5 feet is yellow-brown sand........... 16.0

ILLINOIAN STAGE
BUFFALO HART SUBSTAGE

6. Outwash, sand, clayey, noncalcareous, yellow-brown to dark reddish brown; zone of Fe concentration approximately 1 foot from base; contains Mn pellets; Sangamon weathered zone 3.0

Roby Silt

5. Silt, clayey, noncalcareous, grayish brown with yellow-brown and dark brown mottles, thin, discontinuous; contains Mn pellets, partially decomposed organic matter; upper contact erosional................... 0.5-1.0
4. Clay and thinly laminated silt and clay, noncalcareous except locally in the lower portion, gray to brownish gray, seconday $CaCO_3$ concretions near base (343)........ 1.5-2.5
3. Silt, calcareous except locally in the upper portion, gray to grayish brown with local yellow-brown oxidized areas around organic matter (stems, leaves, etc.), fossiliferous; local irregular $CaCO_3$ concretions in the lower portion (344)................ 0.5-3.0

JACKSONVILLE SUBSTAGE

2. Till, calcareous, yellow-brown, locally gray; pebbles and cobbles concentrated on upper surface; upper portion locally appears colluvial (355)......................... 0-3.0
1. Colluvium, sandy, calcareous, not well exposed; rests on Pennsylvanian sandstone..... .... 5.0

Total 33.5

NO. 10 - SUGAR GROVE SCHOOL SECTION

Measured in stream cuts along Salt Creek in SE¼ SE¼ NW¼ sec. 32, T. 19 N., R. 2 W.; Logan County, Illinois (1961). Upper part contains Peoria Loess which is slumped and poorly exposed.

PLEISTOCENE SERIES
SANGAMONIAN STAGE
Sangamon Soil on Buffalo Hart till

3. Soil, A-zone, dark gray-brown (10 YR 4/2 to 3/3), strong, medium, subangular blocky

Thickness (feet)

structure, grades to B-zone............ 1.0

2. Soil, B-zone; upper 12 inches is dark gray-brown (10 YR 4/2) to dark yellow-brown (10 YR 4/4), locally gray or yellow-brown, with strong blocky structure; middle 18 inches is dark yellow-brown (10 YR 4/4) to yellow-brown (10 YR 5/4), with coarse, strong, prismatic structure, considerable gray mottling, and dark clay-skins and Mn coatings down fractures; lower 12 inches is yellow-brown (10 YR 5/4) with considerable Mn and Fe staining and weaker structure....... 3.5

BUFFALO HART SUBSTAGE

1. Till, upper 18 inches leached, yellow brown (10 YR 5/4), contains a light yellow brown silt streak; remainder calcareous, yellow brown (10 YR 5/4), slightly grayer toward base; secondary $CaCO_3$ concretions common, base not exposed (397-400)............ 20.5

Total 25.0

NO. 11 - TAYLORVILLE DAM SECTION

Measured at the west end of the center line of the dam in SE¼ SW¼ NE¼ sec. 36, T. 13 N., R. 2 W. Christian County, Illinois (1961). This section is no longer exposed.

PLEISTOCENE SERIES
WISCONSINAN STAGE
WOODFORDIAN SUBSTAGE
Peoria Loess

15. Loess, yellow-brown (10 YR 5/4), noncalcareous; contains surface soil profile... 3.3
14. Silty sand, colluvial, mottled yellow-brown and gray; gradational contacts above and below................................ 1.0

SANGAMONIAN STAGE
Sangamon Soil on Buffalo Hart outwash

13. Soil, A-zone, silty sand, dark yellowish brown (10 YR 4/4) mottled with very dark brown (10 YR 2/2) to dark gray (10 YR 4/1), weak platy structure................. 0.8
12. Soil, B-zone, clayey sand, yellow-brown (10 YR 5/4) sandy peds with thick very dark gray (10 YR 3/1) to very dark brown (10 YR 2/2) clay-skins; moderately strong, medium, subangular, blocky structure............. 2.0
11. Soil, CL-zone, sand to silty sand; contains a few pebbles; upper 12 inches is mostly gray (10 YR 5/1), locally light gray (10 YR 7/1), dark gray-brown (10 YR 4/2) with streaks of yellow-brown (10 YR 5/4) and faintly stratified; lower 8 inches is brown (10 YR 5/3) to yellow-brown (10 YR 5/6), massive..... 1.7
10. Soil, CL-zone, clay, pebbly and locally sandy gray (5 Y 6/2), with lower portions mottled gray, yellow-brown, and dark brown; locally contains Mn and Fe concentrations..... 0.8

Thickness (feet)

9. Soil, CL-zone, sandy silt, massive, noncalcareous, slight concentrations of Fe and Mn, lower 6 inches is sand................ 2.0

ILLINOIAN STAGE
JACKSONVILLE SUBSTAGE

8. Till, calcareous except for localized leaching in the upper 2 inches, oxidized, yellow-brown (10 YR 5/4); lower 2 feet is only slightly oxidized and pale brown (10 YR 5/3) to gray-brown (10 YR 5/2) (46 and 47). 6.0
7. Till, calcareous, oxidized, dark brown (10 YR 4/3); upper surface is faceted, striated pebble pavement; thin, sandy, and silty zones in the lower 2 feet (48 and 50)....... 4.0

LIMAN SUBSTAGE
Petersburg (?) Silt

6. Silt, calcareous, dark yellow-brown (10 YR 4/4) with gray streaks; contains a few pebbles (51)............................ 1.0

YARMOUTHIAN STAGE
Yarmouth accretion-gley

5. Soil, G-zone, clayey, noncalcareous except for secondary $CaCO_3$ coatings down veins and around peds, gray (5 Y 5/1) with dark gray (2.5 Y 4/8) and yellow-brown streaks (10 YR 5/4), locally very faintly laminated; contains a few pebbles and some sand; upper surface irregular and distorted by overriding ice... .... 3.0
4. Soil, CL-zone, clay loam, noncalcareous except for local concentrations of secondary $CaCO_3$, yellow-brown (10 YR 5/4-8); contains gray inclusions similar to above unit in the upper 2 feet.......................... 3.0

KANSAN STAGE

3. Till, calcareous, oxidized; upper part is dark yellow-brown (10 YR 4/4); at 5 feet grades down to unoxidized, very dark gray (10 YR 3/1) with a few oxidized sand and gravel pockets and 2-4 inches oxidized along joints; lower 2 feet carbonaceous with abundant wood fragments (58, 60, and 61).. .... 12.0
2. Silt, calcareous; upper 1 foot is dark gray (10 YR 4/1), carbonaceous, fossiliferous; commonly a thin irregular oxidized yellow-brown zone is in the central portion; grades to light gray (10 YR 5-6/1) toward base (63 and 64)............................... 2.0
1. Till, calcareous, upper 1 foot is reddish gray (5 YR 5/2) to gray-brown (10 YR 5/2); lower portion is dark gray (10 YR 4/1); gray streaks of silt common in the upper portion; base covered (65 and 66)............. 2.5

Total 45.1

NO. 12 - TAYLORVILLE DAM-BORROW PIT SECTION

Borrow pit in NW¼ NW¼ SE¼ sec. 36, T. 13 N., R. 2 W., Christian County, Illinois (1961).

Thickness (feet)

PLEISTOCENE SERIES
ILLINOIAN STAGE
JACKSONVILLE SUBSTAGE

6. Till, calcareous, gray; oxidized down joints and along sandy seams; top covered (546).. 3.0
5. Till, silty, calcareous, carbonaceous, dark grayish brown; wood fragments common.. 2-5.0

LIMAN SUBSTAGE
Petersburg (?) Silt

4. Clay, dark gray to black, leached, hackly; slickensided fracture (548).......... 1-1.5
3. Silt, calcareous, dark grayish brown, carbonaceous; contains many wood fragments (549) 1.0
2. Silt, leached, dark blackish gray, carbonaceous; laminated to fissle; contains wood fragments (550)....................... 0.3
1. Silt, calcareous, peaty, and carbonaceous; wood abundant; locally noncalcareous; dark grayish brown in the upper portion grading into dark bluish gray silt which is fossiliferous; base not exposed (551)....... 1-1.5

Total 10.0

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