GUIDEBOOK

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FRIENDS OF THE PLEISTOCENE

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LOESS STRATIGRAPHY, WISCONSINAN CLASSIFICATION AND ACCRETION-GLEYS IN CENTRAL WESTERN ILLINOIS

Leaders — John C. Frye and H. B. Willman

Guidebook Series 5

ILLINOIS STATE GEOLOGICAL SURVEY

Urbana, Illinois

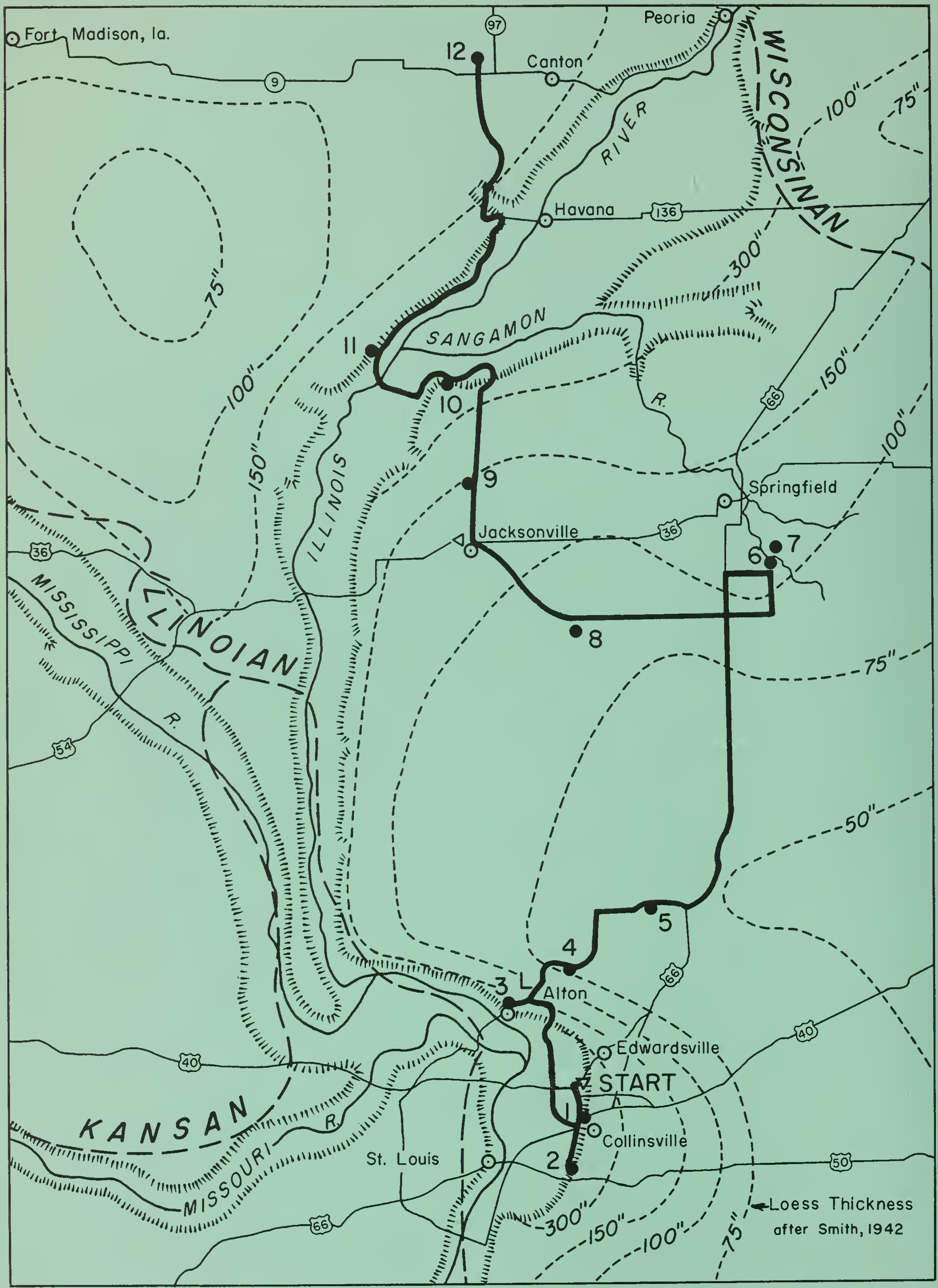


Figure 1. Map showing the route of the trip in central-western Illinois. Numbered Stops 1-8 are the first day's trip, and Stops 9-12 are the second day's trip.

ACKNOWLEDGMENTS

The preparation of this trip has involved work by many persons. Some of these persons will be asked to make special comments at the stops. Previously unpublished X-ray analyses of clay and carbonate minerals presented here were made by H. D. Glass; fossil mollusks were studied and described by A. Byron Leonard; and the data on accretion-gleys is in part from studies in cooperation with Paul R. Shaffer and George E. Ekblaw. Charles A. Ross, John P. Kempton, and Constantine Manos have contributed to the preparation of the trip. Discussions in the field with members of the Departments of Geology and Agronomy of the University of Illinois and with other members of the State Geological Survey staff have been particularly helpful.

INTRODUCTION

The trip starts (fig. 1) along the bluffs of the Mississippi Valley below the mouths of the Missouri and Illinois Rivers and proceeds generally northward across the Illinoian till plain to the Sangamon River Valley. The route is then westward across the Illinois Valley and northward across the till plain between the Mississippi and Illinois Rivers.

The entire region to be traversed was covered by Illinoian glaciers from the Lake Michigan lobe but lies beyond the maximum extent of the Wisconsinan glaciers. All of the major valleys (Illinois, Missouri, Mississippi, and Sangamon) were drainage channels for Wisconsinan outwash and were, therefore, important sources of loess.

The Illinois State Geological Survey adheres to the same stratigraphic principles for the Pleistocene as those generally accepted for all older rocks and recognizes time-stratigraphic, rock-stratigraphic, and biostratigraphic units. Where applicable specialized stratigraphic units, such as soil-stratigraphic and morphostratigraphic units, are also recognized. As provided in the stratigraphic codes of the American Stratigraphic Commission and the Illinois Survey, time-stratigraphic units are distinguished by adjectival endings; rock-stratigraphic, morphostratigraphic, soil-stratigraphic, and biostratigraphic units are distinguished by names written as nouns. It should be understood that the nomenclature of a governmental survey (state or federal) is the product of that organization and, although available for use by anyone, is binding only on that organization's staff. The nomenclature used throughout this guidebook is that currently in use by the Illinois State Geological Survey.

In order to place the major stratigraphic entities pertinent to this trip both temporally and geographically, two diagrams from recent Survey publications are repeated here. The first (fig. 2) shows the time-space relations of stratigraphic units as we now see them, and the second (fig. 3) shows the geographic extent of the several glacial advances in Illinois.

The first two stops show the stratigraphic succession and characteristics of the Wisconsinan loesses where they are thick and well developed, fossiliferous, and dated by radiocarbon methods. Stop 3 illustrates this stratigraphy a short distance back from the bluff line, and Stops 4 to 8 show these loesses in thin, leached sequences farther from the source valleys. Stop 7 displays an accretion-gley overlain by loess and introduces the gumbotil problem.

On the second day, the trip proceeds toward the Illinois Valley, a major loess source area, and Stop 9 contains a section where all the stratigraphic units are thin but identifiable. The route then continues into the Illinois Valley, where at Stops 10 and 11 thick, calcareous, and fossiliferous sections may be seen. This will provide an opportunity to compare the loess sequence of the Illinois Valley with that of the Mississippi Valley examined the first day.

Stop 12 is a road cut which provides an exceptional opportunity to compare and contrast, in continuous exposure, an accretion-gley and an in-situ Sangamon Soil on Illinoian till, both overlain by a thin loess sequence.

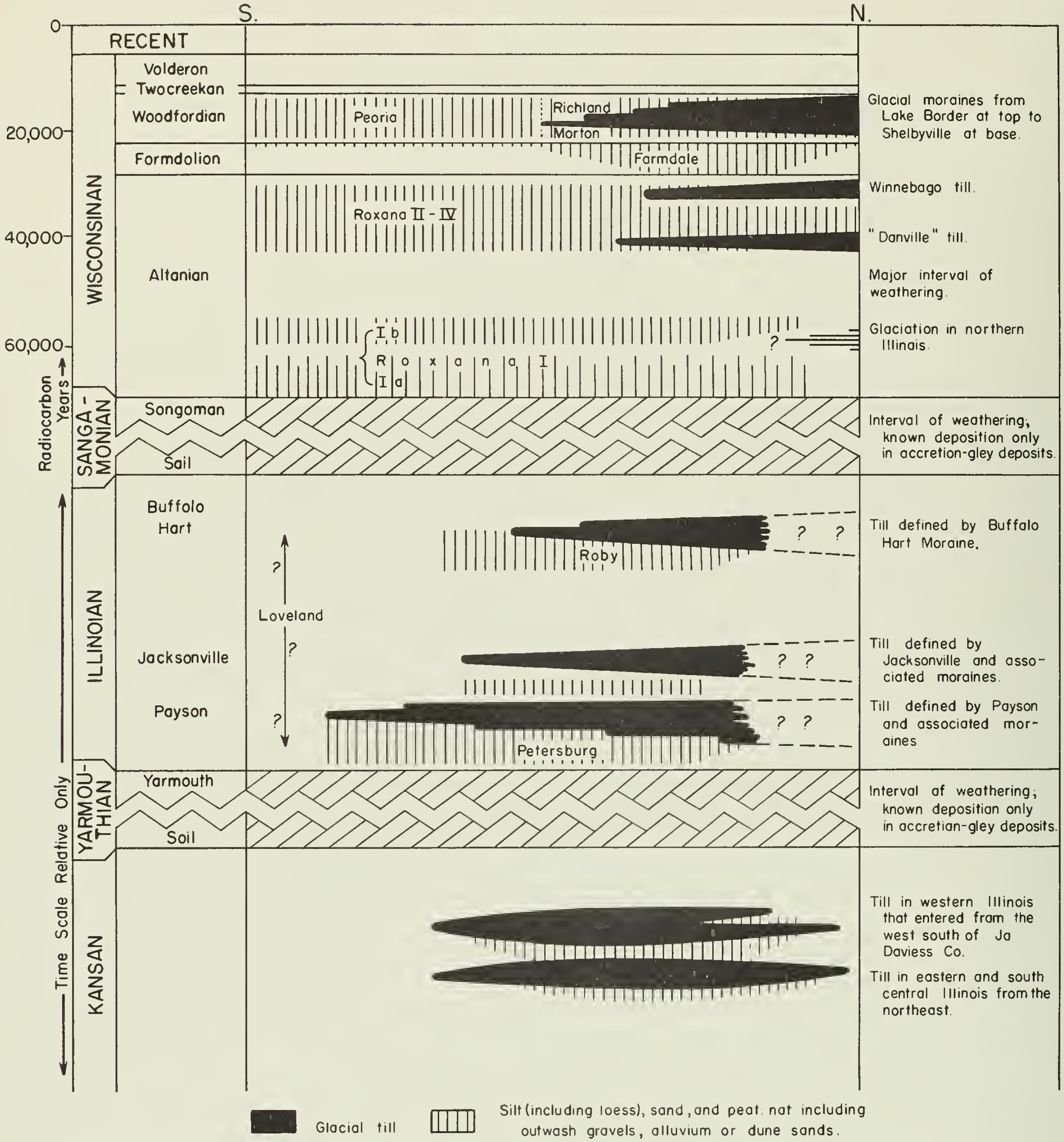


Figure 2. Time-space diagram of glacial tills, sands, and silts in Illinois (excluding outwash gravels, alluvium, and dune sands). The schematic diagram is plotted from north to south but includes the deposits throughout the east-west width of the state. The time scale in the Wisconsinan is based on radiocarbon dates by the Washington Laboratory of the U. S. Geological Survey; the pre-Wisconsinan time scale is relative only. (From Circular 347)

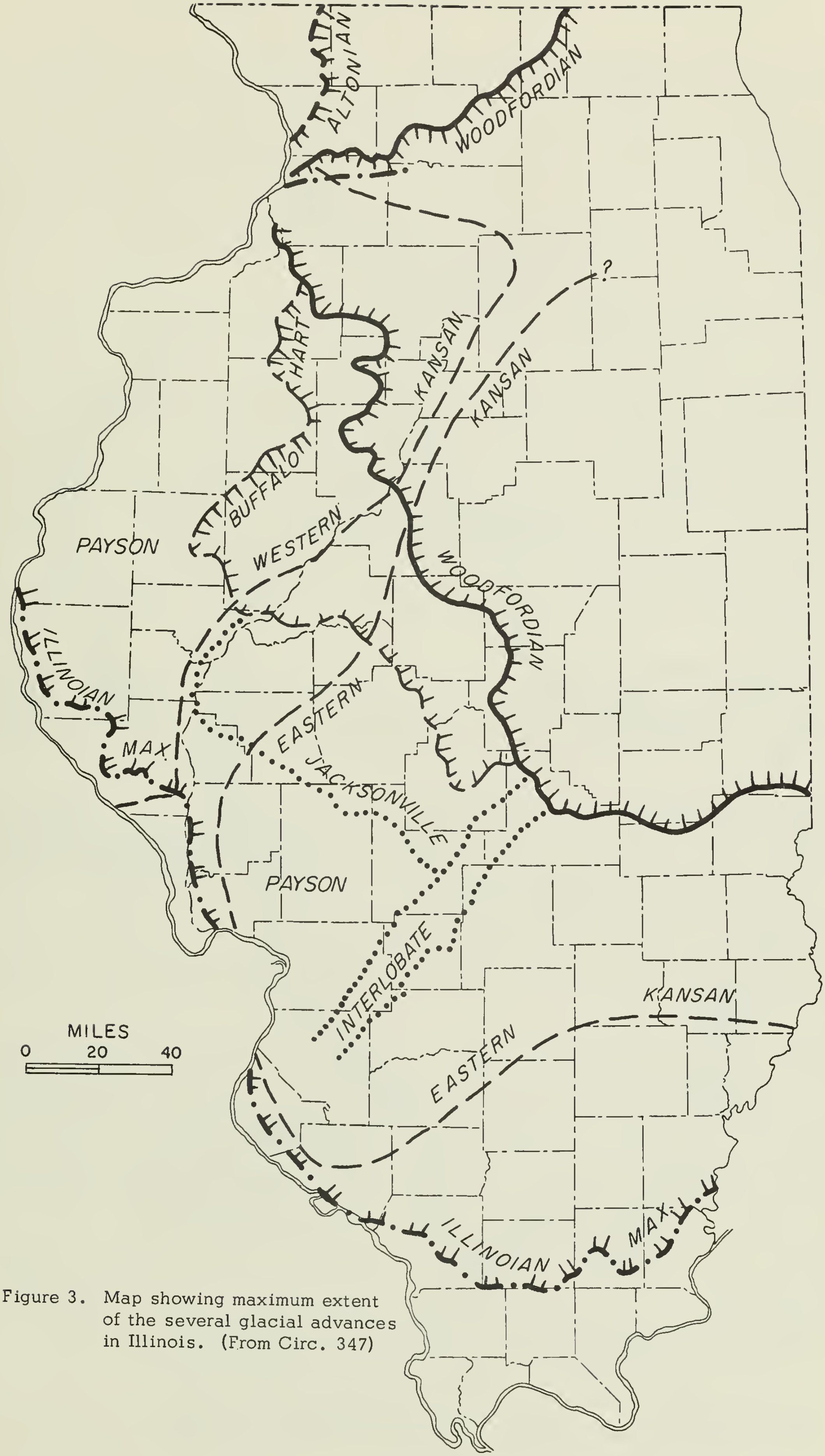


Figure 3. Map showing maximum extent of the several glacial advances in Illinois. (From Circ. 347)

LOESS STRATIGRAPHY AND WISCONSINAN CLASSIFICATION

The classification of the Wisconsinan Stage used by the Illinois Survey (Frye and Willman, 1960) is based on a continuous sequence of deposits related to the advance and retreat of the Lake Michigan glacial lobe. Specifically it is based on the stratigraphic succession and characteristics of the loesses in the lower Illinois Valley and adjacent Mississippi Valley below Illinois Valley, on the succession of loesses, peats, and tills that occur in central and northern Illinois, and on the succession of moraines and associated deposits in northeastern Illinois that extend to the shore of Lake Michigan. Therefore the stratigraphy of the loesses in the region covered, together with radiocarbon dates of shells and wood from the loesses, forms a major basis for the classification.

The genetic relation of the loess deposits of Illinois to the major outwash-carrying valleys has been established for many years, and statewide mineralogical studies have further substantiated this relation (Frye, Glass, and Willman, 1962). During Altonian, Farmdalian, and earliest Woodfordian time, the major source-valleys for the loess in Illinois were the Ancient Mississippi and Ancient Iowa River Valleys in positions shown by figure 4. Along the southeastern and southern margins of the state, the Ohio and Wabash River Valleys were also source areas, and Missouri River was an important contributor to the Ancient Mississippi River Valley south of the St. Louis area. After the Ancient Mississippi River was blocked and diverted to its present course by the advancing Woodfordian glacier (20,000 - 21,000 B.P.), the major outwash-carrying valleys were the present valleys of the Illinois and Mississippi Rivers. As the Ancient Mississippi River was the major avenue for Altonian outwash, it is along this valley that Roxana loess is best developed and thickest. Peoria Loess of Woodfordian age is thick and well developed along all of the major outwash-carrying valleys of the region.

Loess deposits are thickest along the eastern sides of the major valleys, and the stratigraphic subdivisions are based largely on sections along the valley bluffs where the loess is calcareous and fossiliferous. Many of the units recognized in the thick sections have been traced for many miles from the valleys into areas where the loess is leached and relatively thin.

The basis for stratigraphic subdivision within the Roxana Silt, the continuity of the Roxana units, and the distinctions between Roxana and Peoria Loesses will be demonstrated. Of particular significance are the intervals of weathering that separate Roxana Zone I-b from the overlying zones and the interval that separates the generally strongly weathered colluvial Zone I-a from the loess or sand of Zone I-b.

Elsewhere than in the poorly drained areas where peat and organic-rich silts accumulated, Farmdalian time is represented by leaching of the upper part of the Roxana and possibly by a thin zone of slightly calcareous loess resting on top of the leached Roxana and below calcareous and fossiliferous Peoria.

The Roxana Zones II-III contain a snail fauna that is distinctive from the younger Farmdale Silt (in those rare instances where they are fossiliferous) and the younger Peoria Loess and its stratigraphic equivalents, Morton and Richland (Leonard and Frye, 1960).

The mineralogy of loess is indicative of the composition of the outwash discharged to the source valley (Frye, Glass, and Willman, 1962; Willman, Glass, and Frye, 1963). As outwash sources changed, recognizable mineralogical differences were reflected in the loess deposits. X-ray diffraction analyses of clay and carbonate minerals for previously unpublished sections included on this trip are given in an appendix at the end of the log.

The history of the subdivision and classification of the Wisconsinan in Illinois, including the loess deposits, is shown in figure 5. These charts also show the relative placement in time of the units on the basis of available radiocarbon dates. All radiocarbon dates shown for Illinois were determined in the Washington Laboratory of the U. S. Geological Survey.

The revised classification of the early part of the Wisconsinan sequence is based in part on the radiocarbon dates of 37,000 ± 1,500 (W-869) and 35,200 ± 1,000 (W-729) of snail shells from the lower part of Roxana Zone III. The use of these dates has been

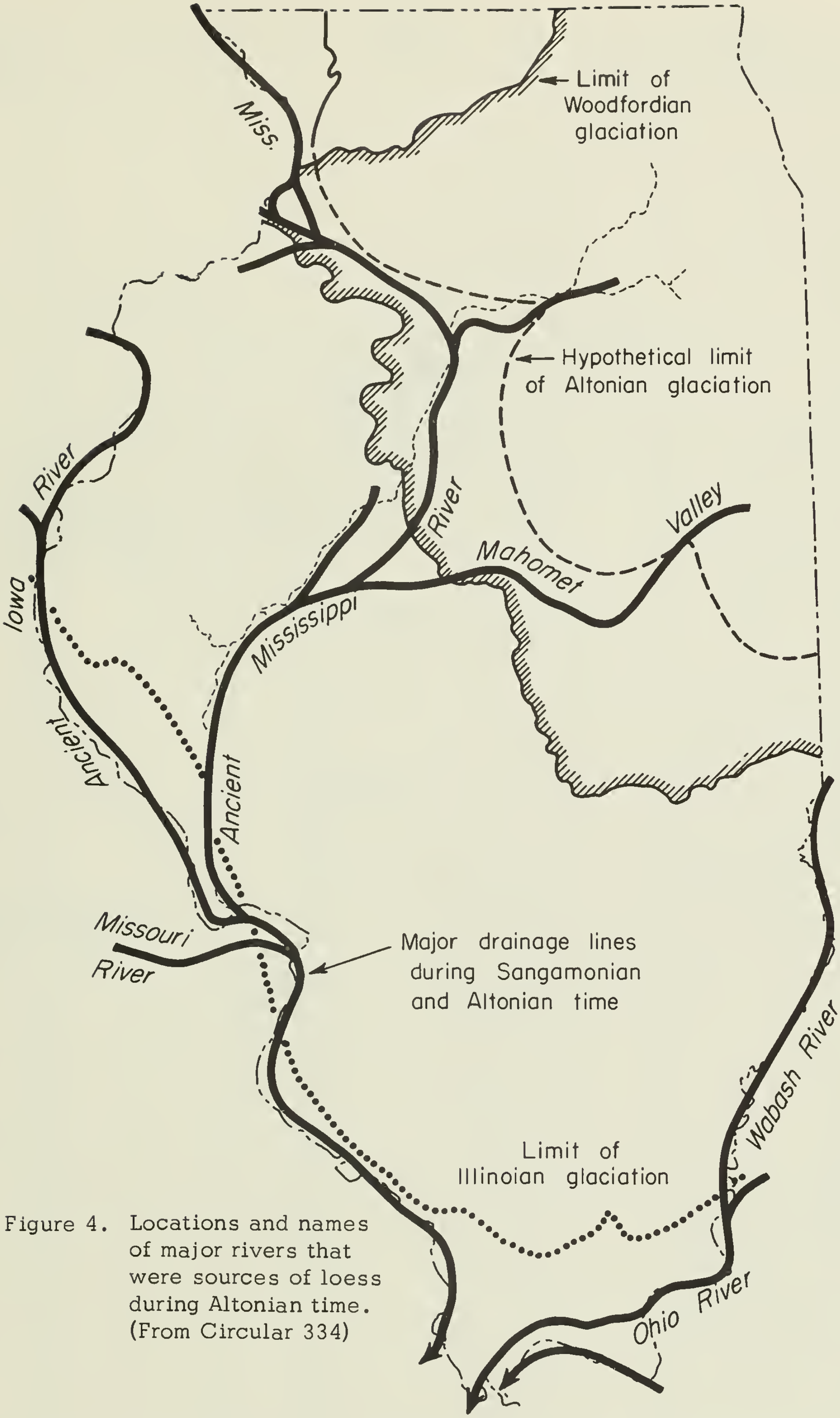
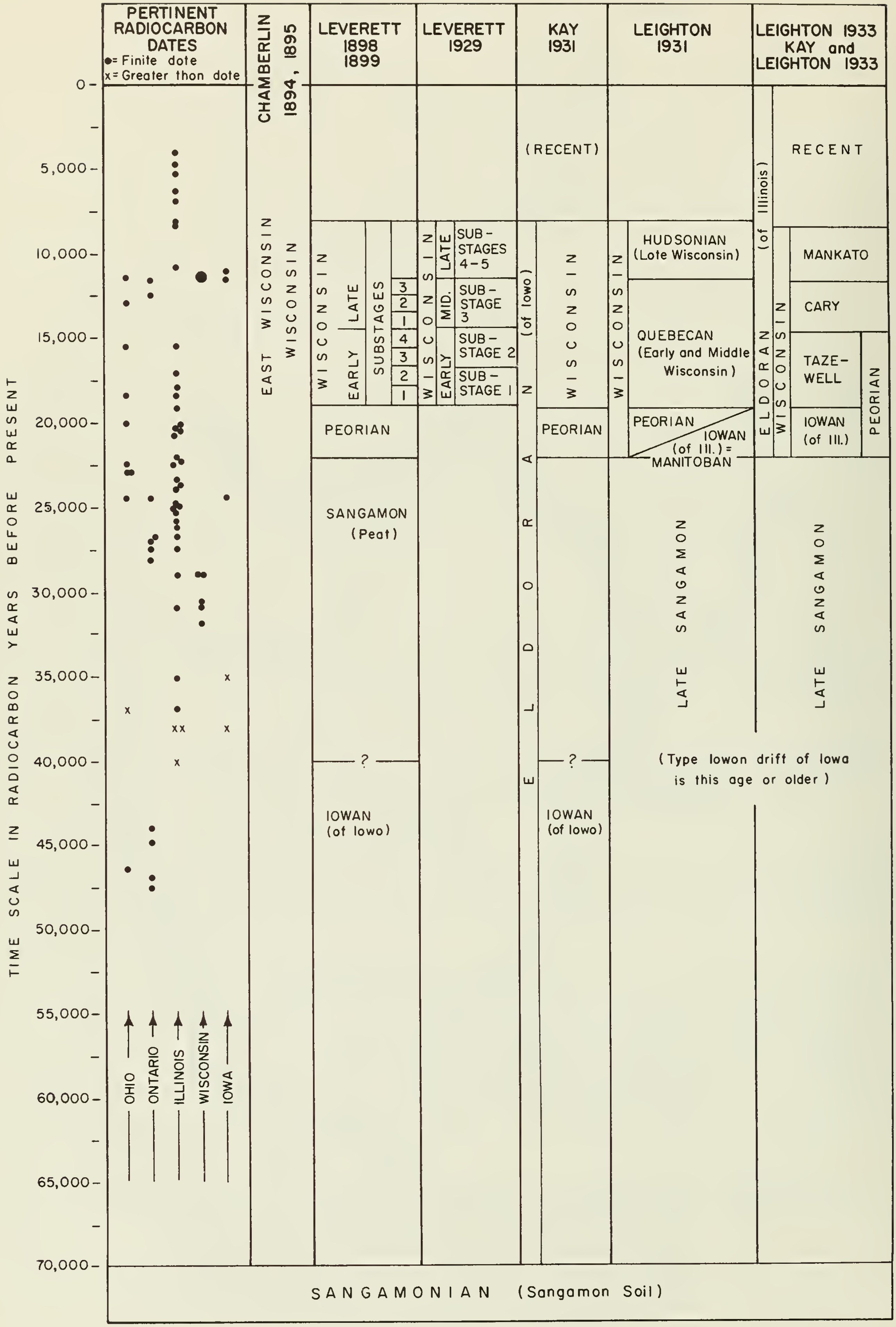
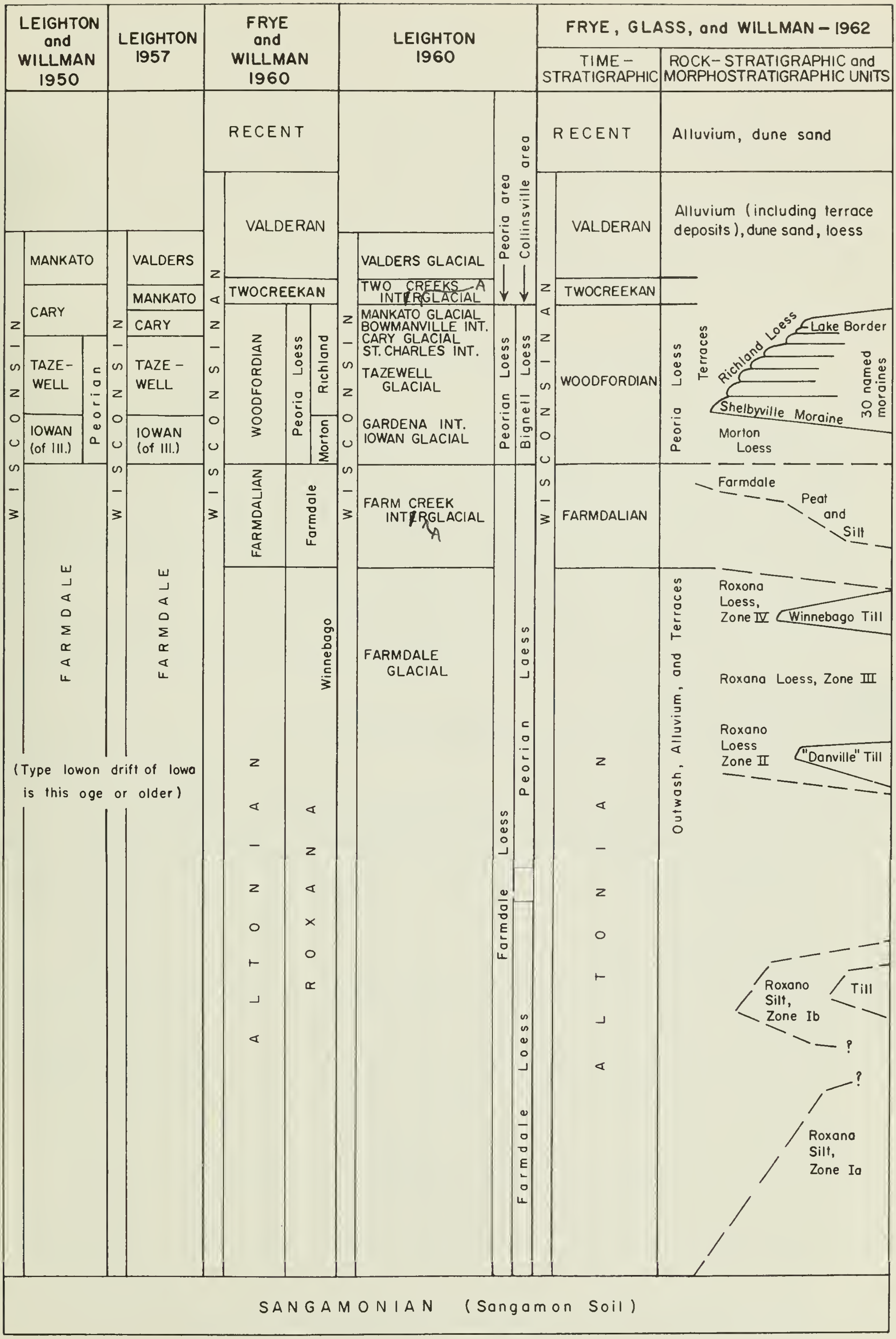


Figure 4. Locations and names of major rivers that were sources of loess during Altonian time. (From Circular 334)

Figure 5. Chart showing the development of the classification and nomenclature of the Wisconsinan Stage in Illinois on a reference time scale of available radiocarbon dates. All radiocarbon dates used for Illinois were determined in the Washington Laboratory of the U. S. Geological Survey. (From Geol. Soc. America Bull., v. 74, 1963)


PERTINENT RADIOCARBON DATES
● = Finite date
x = Greater than date
CHAMBERLIN 1894, 1895
LEVERETT 1898 1899
LEVERETT 1929
KAY 1931
LEIGHTON 1931
LEIGHTON 1933 KAY and LEIGHTON 1933
TIME SCALE IN RADIOCARBON YEARS BEFORE PRESENT
0
5,000
10,000
15,000
20,000
25,000
30,000
35,000
40,000
45,000
50,000
55,000
60,000
65,000
70,000
OHIO
ONTARIO
ILLINOIS
WISCONSIN
IOWA
EAST WISCONSIN
WISCONSIN
WISCONSIN
EARLY
LATE
SUBSTAGES
PEORIAN
SANGAMON (Peat)
IOWAN (of Iowa)
SUB-STAGES 4-5
SUB-STAGE 3
SUB-STAGE 2
SUB-STAGE 1
MID.
(RECENT)
ELDORAN (of Iowa)
IOWAN (of Iowa)
HUDSONIAN (Late Wisconsin)
QUEBECAN (Early and Middle Wisconsin)
PEORIAN
IOWAN (of Ill.) = MANITOBAN
LATE SANGAMON
(Type Iowan drift of Iowa is this age or older)
ELDORAN (of Illinois)
RECENT
MANKATO
CARY
TAZEWELL
IOWAN (of Ill.)
SANGAMONIAN (Sangamon Soil)


LEIGHTON and WILLMAN 1950
LEIGHTON 1957
FRYE and WILLMAN 1960
LEIGHTON 1960
FRYE, GLASS, and WILLMAN – 1962
TIME – STRATIGRAPHIC
ROCK – STRATIGRAPHIC and MORPHOSTRATIGRAPHIC UNITS
RECENT
RECENT
Alluvium, dune sand
Peoria area
Collinsville area
VALDERAN
VALDERAN
Alluvium (including terrace deposits), dune sand, loess
MANKATO
VALDERS
VALDERS GLACIAL
TWOCREEKAN
TWO CREEKS INTERGLACIAL
TWOCREEKAN
MANKATO
CARY
CARY
TAZEWELL
TAZEWELL
Peorian
IOWAN (of Ill.)
IOWAN (of Ill.)
WISCONSIN
WISCONSIN
WISCONSIN
WISCONSIN
WISCONSIN
WOODFORDIAN
Peoria Loess
Richland
Morton
MANKATO GLACIAL
BOWMANVILLE INT.
CARY GLACIAL
ST. CHARLES INT.
TAZEWELL GLACIAL
GARDENA INT.
IOWAN GLACIAL
Peorian Loess
Bignell Loess
WOODFORDIAN
Peoria Loess
Terraces
Richland Loess
Lake Border
30 named moraines
Shelbyville Moraine
Morton Loess
FARMDALIAN
Farmdale
FARM CREEK INTERGLACIAL
FARMDALIAN
Farmdale
Peat and Silt
FARMDALE
FARMDALE
(Type Iowan drift of Iowa is this age or older)
ALTONIAN
ROXANA
Winnebago
FARMDALE GLACIAL
Peorian Loess
Farmdale Loess
Farmdale Loess
ALTONIAN
Outwash, Alluvium, and Terraces
Roxana Loess, Zone IV
Winnebago Till
Roxana Loess, Zone III
Roxana Loess Zone II
"Danville" Till
Roxana Silt, Zone Ib
Till
?
?
Roxana Silt, Zone Ia
SANGAMONIAN (Sangamon Soil)

questioned (Leighton, 1960) on the ground that dead carbonate ingested by the snails would be incorporated in the shells and make the shell dates unreliable. Recent experimental studies by Rubin, Likins, and Berry (1963) demonstrate that the possible error from this cause does not exceed 1,000 years. It is believed by some concerned with this problem that shells are less likely to be contaminated than wood. As the essentially identical dates from Roxana Zone III shells were from localities about 200 miles apart, and as dates of shells from the Peoria Loess [17,100 ± 300 (W-730) and 20,300 ± 400 (W-870)] are consistent with wood dates from Peoria and Morton Loess [17,950 ± 550 (W-1055) to 20,700 ± 650 (W-399)], it appears that the use of these dates as one basis of classification is amply justified.

Revisions in the Wisconsinan classification introduced in 1960 resulted from the cumulative effect of new data and new concepts, including the following:

(1) Changes in dating and correlation

(a) Type Iowan is significantly older, not younger, than type Farmdale (Ruhe, Rubin, and Scholtes, 1957; Ruhe and Scholtes, 1959).

(b) Farmdale Loess of earlier reports includes a sequence of units (Roxana) much older than type Farmdale. It might have been possible to restrict the name Farmdale to the interval of glaciation and introduce a new name for the succeeding interval of ice withdrawal, as was later proposed by Leighton (1960), but our choice was based largely on belief that it was undesirable, and probably impossible, to change the widely accepted use of Farmdale from the interval established by many radiocarbon dates, including dates from the type Farmdale locality. Both alternatives require the restriction of Farmdale. Confusion resulting from three definitions of Farmdale may render the term unusable in the future.

(c) Type Mankato is older, not younger, than Two Creeks. (Wright, 1957; Ruhe and Scholtes, 1959), and therefore can no longer be used as a synonym for Valders.

(2) Changes in classification policy

(a) Need for local rock-stratigraphic terms in place of time terms:

Morton Loess for Iowan loess of Illinois. The Iowan loess of Iowa is essentially equivalent to Peoria Loess.

Richland Loess for Tazewell loess. The Richland Loess is equivalent to only part of the drift called Tazewell and probably includes younger loess.

Winnebago till for Farmdale till. This till has been called Iowan, Illinoian, Farmdale, and Altonian. Winnebago is a meaningful rock-stratigraphic name regardless of age.

(b) Need to recognize substages as time-stratigraphic units differentiated on widely traceable time planes:

Farmdalian and Twocreekan are major substages of ice withdrawal. These peat- and wood-bearing silts are the only regionally traceable units so far recognized.

Altonian as earliest substage of Wisconsinan glaciation. Restriction of Framdalian to the widely recognized and well-dated interval represented by type Farmdale required a new name, Altonian, for the preceding substage of glaciation.

Woodfordian Substage to replace Iowan (of Illinois), Tazewell, and Cary. The end moraines in the Tazewell-Cary sequence do not have enough regional continuity to serve as time planes for substage classification. The generally uniform decrease in depth of weathering across successively younger moraines suggests that there was no interruption in the sequence that merits substage rank. The deposition of 30+ moraines in a time span of about 8,500 radiocarbon years, during a pulsating retreat of over 500 miles, leaves little time for a significant interval of deglaciation within the sequence.

(c) Subdivision within the morainic sequence is best treated by morphostratigraphic classification.

Although it is desirable to have time-stratigraphic classification based on superposition in a representative sequence of deposits, one sequence may not adequately represent all parts of the interval. In the Illinois sequence, the weathered Roxana Zone I becomes more significant as our knowledge of it increases. Perhaps this interval of weathering is equivalent to the Port Talbot interval of ice withdrawal recognized in Ontario by Dreimanis. If this weathering interval becomes widely recognized, it may be desirable to restrict the term Altonian to Roxana II, III, and IV, within which no evidence of weathering has been found, and to introduce a new name for the preceding glacial substage and accept Port Talbot for the intervening ice withdrawal. These potential subdivisions of the Wisconsinan may be as long, or longer, than the younger named substages.

ACCRETION-GLEY (GUMBOTIL) AND THE WEATHERING PROFILE

The undissected upper surfaces of the till sheets in Illinois are marked by two general types of phenomena: (1) profiles of weathering that, in general, fall within the range of the zonal soil profiles but may include some azonal soils or even, in rare cases, intrazonal soils; and (2) accretion-gleys that consist of deposits which accumulated slowly in undrained or poorly drained situations on the till plain and which include some soils that may be classed as humic-gleys and entisols. The accretion-gleys contain much of the material that has been classed as gumbotil and assumed to be an in-situ chemically decomposed residuum of the till. As all of the soils studied by us are buried beneath younger deposits, they are treated as elements of the stratigraphic succession, and no attempt has been made to relate or compare them to formally named soil series or catenas.

Several well developed in-situ Sangamon Soil profiles will be shown, and at two stops (7 and 12) particular attention will be given to accretion-gleys. The mineralogy of the accretion-gleys and of several of the in-situ profiles is described in Circular 295 and only briefly summarized here. Supplemental data on several of the profiles are given in the appendix at the end of this log.

Mineralogical data show that, in the in-situ profiles, the carbonate minerals have been removed to depths of several feet, and calcite is removed to a greater depth than dolomite. A small percentage of feldspars and a somewhat larger percentage of ferromagnesian minerals have been decomposed. Some clay-mineral alteration has extended to depths below the depth of leaching, and pronounced alteration of clay minerals has taken place in the B-zone. Some of the very fine clay has moved downward from the A-zone and accumulated in the B-zone.

The accretion-gleys—in contradiction of formerly stated beliefs—display a lesser degree of mineral alteration than do the in-situ profiles, and they do not even approach a residuum from chemical decomposition. They are generally lacking in carbonate minerals but contain higher percentages of ferromagnesian minerals and of feldspars than do the in-situ profiles, and they contain an assemblage of clay minerals different from that in the in-situ B-zones.

The evidence of partially decomposed grains of silicates observed by Allen (1959; 1962) entirely supports the position that the profiles do not show the extreme degree of silicate decomposition claimed for gumbotil.

When the mineralogical data are added to the field relations of these deposits (such as the general occurrence in slight lows of the microtopography on the till plains) and the physical features (including laminations, humic banding, and local interstratification with sands and silts), the conclusion that they result from slow accumulation on the surface of the till is reached.

The accretion-gleys may have accumulated during the entire time represented by the nearby in-situ profiles. However, they could have been formed largely during a relatively short part of that interval. Some of them rest almost directly on calcareous tills, and it seems likely that deposition at such places started soon, if not immediately, after melting of the ice. Others have a well developed B-zone beneath them; the B-zone may in part have developed during accumulation of the gley, but deposition of the accretion-gley may not have started until after soil formation was well advanced. In places the basal colluvial deposit of the Roxana Silt (Zone I-a) is absent above an accretion-gley, so that some of the accretion-gley at such localities may represent earliest Wisconsinan deposition. Many of the micro-depressions on the till plain surface may have persisted beyond Sangamonian time, and the increase of precipitation accompanying the initiation of Wisconsinan glaciation then produced the puddle conditions favorable for accumulation of accretion-gley.

The question has been raised whether or not the materials that we call accretion-gley were called gumbotil by the original advocates of gumbotil, particularly by Kay in Iowa and Leighton and MacClintock in Illinois.

To our knowledge, the material that we call accretion-gley has been consistently cited, with few exceptions (Krusekopf, 1948), as typical gumbotil, not only by Kay, Leighton, and MacClintock, but by ourselves and others. At every reported exposure that we have recently examined the "gumbotil" is accretion-gley. We also have examined many extensive exposures in strip-coal mines in flat, poorly drained uplands without finding gumbotil, which indicates that gumbotil is not the characteristic soil on the upland surfaces. The distinction between in-situ weathering profiles and "gumbo" on the till surface was pointed out by Leverett (1899, p. 28-33).

Although accretion-gley is common, the presence of such depositional soils was not noted in the writings of either Kay or Leighton and MacClintock. If they had differentiated them from gumbotil, they certainly would have called attention to the possibility of confusing them.

Although only the accretion-gleys come close to meeting the descriptions of the physical properties, color, and pebble content of gumbotils, nearly all the in-situ profiles developed on Illinoian and Kansan till have a relatively high content of plastic clay, and the term gumbotil may have been used by some authors to describe all the soils on the older tills. This is not the case in Illinois where the profiles that we consider in situ were called mesotil and silttil to distinguish them from gumbotil.

The interpretation of the B-zone on the Illinoian and older tills as the product of an advancing front of nearly complete chemical decomposition of silicate minerals, different in process from that which produced modern soil and requiring a different nomenclature (Leighton and MacClintock, 1930; 1962), is not applicable to accretion-gleys which are sediments. Nor does it apply to the in-situ profiles that show only partial decomposition of the most weatherable minerals (particularly soda-lime feldspars and ferromagnesian minerals) and slight loss of some minerals (potash feldspars, epidote, locally garnet) which in cases of very long or very intensive weathering are also eliminated. Furthermore, the degree of decomposition of silicate minerals progressively increases upward through the profile.

The accretion-gleys are primarily water-transported sediments, not tills, and therefore cannot be called gumbotil. The B-zone of the in-situ profiles is not a residuum but was formed like modern profiles of weathering with clay enrichment in the B-zone largely by illuviation from above. Much of the change in properties produced by weathering results from leaching of carbonates and alteration of clay minerals already present in the till. In other words, we have found no soils that fit gumbotil as a genetic term. Continued use of the name gumbotil would require transfer of the name to in-situ profiles, and it would require a greatly modified definition of the character and origin of gumbotil.

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ROAD LOG

Saturday, May 11, 1963

ASSEMBLY POINT: Parking area of Holiday Inn of Edwardsville. (Near SE cor. Alton Quadrangle, NE¼ SE¼ sec. 29, T. 4 N., R. 8 W., Madison County)

STARTING TIME: 7:30 A.M. Central Daylight Time.

NOTE TO DRIVERS: We will not have a police escort. We will have flagmen to direct traffic at certain points for additional safety, but each driver must obey all traffic signs and signals.

There will be a Geological Survey car at the end of the caravan. Wave it down if you need help.

Someone in each car should follow the road log.

FIGURE 6. Shows graphically the stratigraphy to be seen the first day.

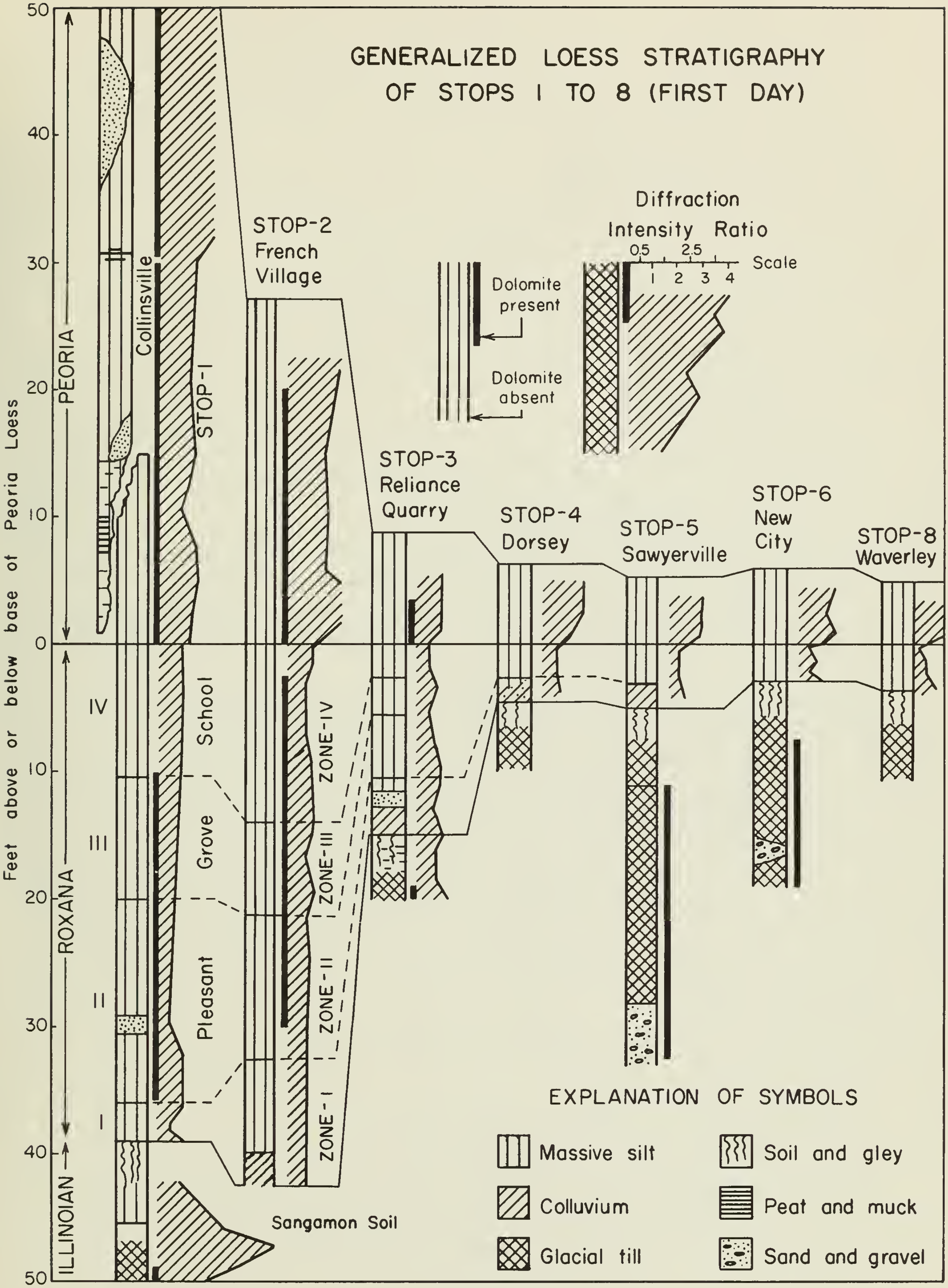
GENERALIZED LOESS STRATIGRAPHY
OF STOPS 1 TO 8 (FIRST DAY)
Feet above or below base of Peoria Loess
PEORIA
ROXANA
ILLINOIAN
IV
III
II
I
Collinsville
STOP-1
School
Grove
Pleasant
STOP-2
French
Village
ZONE-IV
ZONE-III
ZONE-II
ZONE-I
Sangamon Soil
STOP-3
Reliance
Quarry
STOP-4
Dorsey
STOP-5
Sawyerville
STOP-6
New
City
STOP-8
Waverley
Dolomite
present
Dolomite
absent
Diffraction
Intensity Ratio
0.5
2.5
1 2 3 4
Scale
EXPLANATION OF SYMBOLS
Massive silt
Colluvium
Glacial till
Soil and gley
Peat and muck
Sand and gravel

Figure 6

Mileage

0.0 Leaving the parking area turn left (west) on U. S. By-Pass 66.

0.4 Keep left on Illinois 157, leaving U. S. By-Pass 66.

0.5 Stop sign. Continue ahead (south) on Illinois 157 and By-Pass 40.

1.2 Enter Monks Mound Quadrangle.

1.8 Glen Carbon. Railroad crossing.

1.9 Continue ahead on Illinois 157. By-Pass 40 turns left.

2.0 Peters Section on left (east), now largely dug away.

2.3 Burdick Branch Section along road up bluff to left (east). Shells from the Peoria Loess were dated as 17,100 ± 300 (W-730) radiocarbon years B.P.

5.6 STOP 1. - Pleasant Grove School Section (cent. SE$\frac{1}{4}$ sec. 20, T. 3 N., R. 8 W., Madison Co.).

The Pleasant Grove School Section is the type locality for the Roxana Silt (Circulars 285, 304, and 334) and is shown diagrammatically on fig. 7. The Sangamon Soil in Illinoian silt is distinguished by its red-brown color; the overlying Roxana Zone I is brown to dark gray; Zone II is pinkish gray and sparsely fossiliferous; Zone III is light gray-brown, fossiliferous throughout and contains lenses of sand; Zone IV is pinkish gray. Peoria Loess at the top of the section is light yellow-tan, calcareous, and fossiliferous, and it rests on the leached upper part of Roxana Zone IV. This section is in the lower part of the bluff, hence it exposes only the lowermost part of the Peoria. The Collinsville Section high in the bluff to the south exposes the remainder of the Peoria sequence. The position of the 17,950 ± 550 (W-1055) radiocarbon date in the Collinsville Section is at an elevation approximately equal to the top of the Pleasant Grove Section.

The Roxana Loess in this vicinity was formerly called Late Sangamon (Smith, 1942) and later Farmdale (Leighton and Willman, 1950). In the present classification Farmdalian time is represented only by the leaching of Roxana Zone IV. The radiocarbon date 35,200 ± 1,000 (W-729) was determined on large snail shells from the west face—from the uppermost part of Zone II and lower part of Zone III. The minor soil at the top of Zone I in the south face may correlate with Dreimanis' Port Talbot interval of Ontario. The till viewed on last year's trip at Gahanna, Ohio, has been dated (Goldthwait letter of July 24, 1962) at 46,600 ± 2,000 (Grn. 3219), and as the date falls within the range of the Port Talbot dates reported by Dreimanis, it may be inferred that the till at Gahanna is immediately younger than Port Talbot. In this case the till may be equivalent to the basal part of Roxana Zone II of the Illinois sequence.

This section demonstrates the complex sequence of events that took place in this region during Altonian time.

LEAVING STOP 1 continue ahead (south) on Illinois 157.

5.7 Railroad crossing.

5.9 Junction Alternate 40. Continue ahead on Illinois 157.

6.2 Continue ahead on Illinois 157 under Interstate 55-70.

The Collinsville Section is the grassed-over cut of Interstate 55-70 in the bluffs above the overpass on the left (east).

7.6 Continue ahead on Illinois 157. Alternate 40 turns right.

9.1 Caseyville.

9.1 Rough railroad crossing.

10.6 Enter French Village Quadrangle.

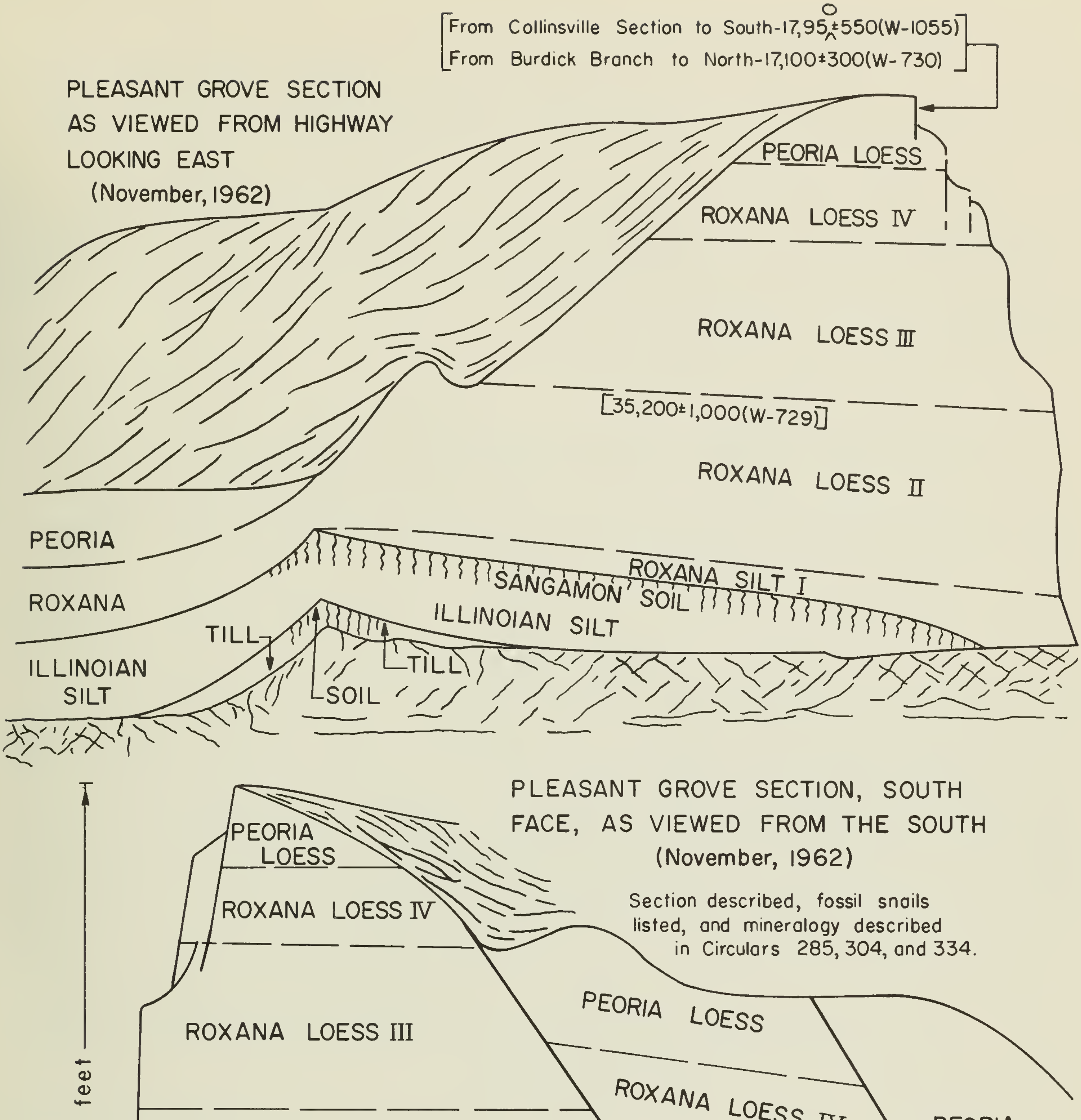

Figure 7. Diagram of two faces of the exposure at Pleasant Grove School Section as they appeared in November, 1962.

12.4 STOP 2. - French Village Section.

This exposure shows the continuity of Roxana units along the valley bluff. It is described in Circular 334 (p. 51) and summarized in figure 6 and below. The Peoria Loess is particularly well exposed. A transitional zone a few inches to a few feet thick, that we now include in the base of the Peoria, may be equivalent in age to type Framdale.

This section contains the relatively coarse, calcareous, fossiliferous loess characteristic of the valley bluff. Less than a mile back from the bluff, the loess is greatly changed in character; the loess units are thinner and finer textured, and largely leached and nonfossiliferous. Roxana Zone I can be distinguished at distances as great as 50 miles from the bluff line, Roxana Zones II, III, and IV for distances of only about 10 miles back from the bluff in this region.

Summary of French Village Section	Thickness (feet)
Peoria Loess, calcareous, fossiliferous, yellow-tan.	25.5
Roxana Loess, Zone IV, calcareous except at top, pinkish gray	14.0
Roxana Loess, Zone III, calcareous, gray-tan, fossiliferous	7.0
Roxana Loess, Zone II, pink, calcareous upper part	12.0
Roxana Silt, Zone I-b, gray-brown	7.0
Roxana Silt, Zone I-a, sandy silt, brown, colluvium.	3.0+

12.5 LEAVING STOP 2 take the road angling left. Do not cross the viaduct. Use caution making this left turn across traffic.

12.7 Make a U-turn just before reaching U. S. 50.

12.8 Return to Illinois 157 and continue ahead (north).

14.8 Enter Monks Mound Quadrangle.

15.9 Railroad crossing in Caseyville.

16.5 Curve left following Illinois 157 at junction with Collinsville road.

17.6 Junction Alternate 40. Continue ahead on Illinois 157.

19.0 Junction Interstate 55-70. Continue ahead on Illinois 157.

19.6 Continue ahead on Illinois 157, leaving Alternate 40.

19.8 Railroad crossing. Turn left (west) on road to Granite City, immediately north of the railroad, leaving Illinois 157.

23.3 Stop sign. Turn right (north) on Illinois 111.

24.4 Stop sign. Continue ahead on Illinois 111.

26.4 Enter Alton Quadrangle.

27.2 Stop light. Junction By-Pass 66, 40. Continue ahead on Illinois 111.

31.5 Low terrace on right. This is the first distinct terrace above the Mississippi River floodplain. It is probably of Valderan age. About 3 miles northwest of here a tree trunk standing erect was collected during construction of a Ranney collector 50 feet below the surface of the floodplain and dated 6,600 ± 200 (IJ-281) radiocarbon years.

32.4 Stop sign. Railroad crossing. Wood River refineries of Shell on right, Sinclair on left, and Standard of Indiana far ahead on left.

33.0 Railroad crossing.

33.2 Rise onto the low terrace.

33.9 Wood River.

34.7 Stop light. Junction with Illinois 159. Continue ahead (north) on Illinois 111.

37.2 Stop light. Continue ahead on Illinois 111.

38.0 Stop light. Turn left (west) on Illinois 140 and Illinois 111.

39.3 East Fork Wood River.

41.4 West Fork Wood River

41.8 Stop light. Continue ahead on Illinois 140. Illinois 111 turns right (north).

42.0 Alton.

42.8 Temporary Southwest Campus of Southern Illinois University (formerly Shurtleff College).

43.0 Stop sign. Continue ahead.

43.1 Stop sign. Continue ahead (west) on College Avenue leaving Illinois 140.

43.5 Entrance Rock Spring Park.

44.3 State House Square. Right around square and continue ahead (west) on College Avenue.

44.6 Railroad crossing.

44.7 STOP 3. - Reliance Whiting Quarry Section.

The type section of the Altonian Substage is $1\frac{1}{4}$ miles west of this point near the bluff of the Mississippi Valley. Although the Roxana in the Altonian type section is similar to the sections observed at Stops 1 and 2, this section shows the character of the Roxana back from the bluff in an area where the loess thins rapidly away from the bluff line. At this section the Roxana is noncalcareous in contrast to the previous sections. The stratigraphic complexities of Roxana Zone I are well illustrated in these exposures. The lower part (Zone I-a) consists of colluvium that was weathered before the deposition of the sand and silt above (Zone I-b). Radiocarbon dates suggest that Zone I is pre-Port Talbot in age and and that the weathering break between I-a and I-b is equivalent in age to a pre-Dunwich break in Dreimanis' Ontario sequence.

Note the exceptionally well developed striated surface on the Mississippian limestone at the east end of the pit.

RELIANCE WHITING QUARRY SECTION, Alton, Illinois, NW$\frac{1}{4}$ SE$\frac{1}{4}$ NE$\frac{1}{4}$ sec. 11, T. 5 N., R. 10 W., Madison Co. (1962).

Pleistocene Series
Wisconsinan Stage
Woodfordian Substage
Peoria Loess

		Thickness (feet)
10.	Loess, tan with some gray and brown mottling, calcareous in lower 3 feet, massive, friable, surface soil in upper part (P-1515*, $\frac{1}{2}$ foot above base). . .	8.0
9.	(Transition zone at base of Peoria Loess). Loess, light tan-brown, slightly calcareous, massive, faint mottling with gray in upper part, gradational contacts (P-1514).	1.0

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* The sample numbers included in the measured sections refer to X-ray analyses given in the table at the end of the guidebook. Mineral analyses have been made for all stops on the trip but are not repeated if they have been published previously.

Altonian Substage

Roxana Loess

Zone IV

8. Loess, coarse, light pinkish brown, leached, massive, gradational contacts (P-1512, ½ foot above base; P-1513, ½ foot below top). 2.5

Zone III

7. Loess, coarse, light tan-brown, leached, massive, mealy (P-1510, ½ foot above base; P-1511, ½ foot below top) 3.0

Zone II

6. Loess, coarse, leached, massive; some very fine sand; light brown in lower part grading upward to light pinkish brown; gradational contacts (P-1507, ½ foot above base; P-1508, 1½ feet above base; P-1509, 1½ feet below top) 5.0

Zone I-b

5. Silt and fine sand with some clay, tan-brown, leached, massive, gradational contacts (P-1506) 1.0

4. Sand, fine, clay and silt, light brown, leached, massive, gradational contacts (P-1505). 1.3

Zone I-a

3. Silt, sandy, with some clay and very few dispersed pebbles in lower part, light pinkish brown, light brown in upper part, leached, massive a few Mn-Fe pellets in lower part, gradational contacts (P-1503, ½ foot above base; P-1504, ½ foot below top). 2.0

Illinoian Stage

Loveland Silt (?)

2. Sangamon Soil. Silt and some sand with dispersed pebbles, red-brown, leached, massive, abundant clay, compact, abundant Mn-Fe pellets in lower part; top B-zone (P-1501, ½ foot above base; P-1502, ½ foot below top). 2.5

Payson Till

1. Sangamon Soil developed in till; upper part red-brown (B-zone) grading downward to yellow-tan (CL-zone), till, clayey, pebbly, leached, massive, compact, Mn-Fe pellets in upper part (P-1499, ½ foot above base; P-1500, ½ foot below top). Laterally the B-zone rises and calcareous till (P-1516) occurs below it, and the Loveland (?) pinches out so that the Sangamon B-zone is in colluvium and till (P-1517). 3.0

Total 29.3

44.7 LEAVING STOP 3 make U-turn at intersection with road from right and head back east on the same street (20th Street).

44.9 Railroad crossing.

45.2 Right around State House Square and continue east on College Avenue.

45.6 Turn left (north) into Rock Spring Park.

45.8 Keep left.

45.9 Turn right to pavilion at second of two close roads.

46.0 LUNCH STOP. Parking area at pavilion. The pavilion provides shelter with rustic facilities. Modern facilities with a smaller shelter are down the slope northeast of the pavilion.

46.1 Turn right leaving the pavilion parking area.

46.4 Lower parking area.

46.6 Stop sign. Turn left (east) on College Avenue.

47.0 Stop sign. Continue ahead (east) on Illinois 140.

47.1 Stop sign. Continue ahead.

47.3 Southern Illinois University - Temporary southwest campus.

48.1 Stop light. Continue ahead (east) on Illinois 140.

48.5 West Fork Wood River.

48.6 Turn left on Fosterburg road leaving Illinois 140.

48.9 Railroad crossing.

53.6 Fosterburg.

53.9 Turn right on black top (Dorsey road).

55.5 Bridge over East Fork.

57.0 Road cut east side of valley at intersection with road from right (south) exposes thin Peoria Loess, Roxana Silt, accretion-gley, and Illinoian till.

57.8 STOP 4. - Dorsey Section.

This section shows the nature of thin Peoria Loess and Roxana Silt at a distance of 10 miles from the bluff line. Note the well developed in-situ Sangamon Soil. Although Zones II, III, and IV of the Roxana are only vaguely discernible at this point, Zone I is clearly defined.

DORSEY SECTION - Cent. sec. 17, T. 6 N., R. 8 W., Madison Co., Ill., (1962).

Pleistocene Series

Wisconsinan Stage

	Thickness (feet)
Woodfordian Substage	
Peoria Loess	
5. Loess, tan, mottled with gray in lower part, leached, surface soil partly truncated at top, (P-1416 base; P-1417 lower)	5.5
4. (Transition zone at base of Peoria Loess). Loess, darker tan than above and less mottled, slightly clayey, gradational top and bottom, leached, Mn-Fe pellets sparse throughout (P-1415)	1.0
Altonian Substage	
Roxana Silt	
Zones II, III, IV	
3. Loess, coarse, reddish tan to reddish brown, a few small pebbles in lower part, leached, massive (P-1413 lower; P-1414 upper)	2.5
Zone I	
2. Sandy silt, clayey, with dispersed pebbles, tan-brown, leached, massive (P-1412 lower)	2.0
Illinoian Stage	
1. Sangamon Soil developed on till; reddish brown, sandy, more dense and compact downward (P-1411 lower)	2.0
Total	13.0

57.8 LEAVING STOP 4 continue ahead (east).

58.2 Dorsey.

58.3 Enter Edwardsville Quadrangle.

58.4 Railroad crossing.

60.1 Turn left (north) on Illinois 112.

63.2 Enter Gillespie Quadrangle.

64.8 Bunker Hill.

65.8 Railroad crossing.

67.4 Turn right (east) on Illinois 138.

69.9 Railroad crossing.

72.6 Wilsonville.

74.6 Continue ahead (east) by turning right, then left, in middle of curve, leaving Illinois 138.

75.2 STOP 5. - Sawyerville Section.

This exposure, like the Dorsey Section at the last stop, shows the thin loesses where Zone I of the Roxana is still distinguishable. The in-situ Sangamon Soil in till is well developed.

SAWYERVILLE SECTION - SW$\frac{1}{4}$ SW$\frac{1}{4}$ NE$\frac{1}{4}$ sec. 1, T. 7 N., R. 7 W., Macoupin Co., Ill. (1962).

Pleistocene Series

Wisconsinan Stage

	Thickness (feet)
Woodfordian Substage	
Peoria Loess	
8. Loess, yellow-tan and gray mottled, massive, leached, a few Mn-Fe pellets; podzolic soil (P-1427 in top: P-1426 middle; P-1425 lower)	4.5
7. (Transition zone at base of Peoria Loess). Loess, yellow-gray, less mottling than above, slightly more clayey, massive, leached (P-1424)	1.0
Altonian Substage	
Roxana Loess	
Zones II, III, IV	
6. Loess, massive, leached, clayey, reddish brown with small mottles of gray and tan, Mn-Fe pellets (P-1422 lower; P-1423 upper)	3.0
Zone I	
5. Silt, with some sand and dispersed small pebbles, tan-brown, mottled, leached, massive (P-1421). (Till is not exposed here, but in cuts 100 yards to east Sangamon Soil developed on Illinoian till is well exposed)	2.0
Illinoian Stage (100 yards east of above)	
4. Sangamon Soil. Soil B-zone developed in till, leached, blocky, some Mn-Fe staining and pellets, clay skins, brown, mottled dark gray and tan	2.0
3. CL-zone of Sangamon Soil. Till, leached, clayey, tan and gray mottled; contains clusters of gypsum crystals throughout but they are abundant in lower 2/3; upper 1/3 contains Mn-Fe pellets and staining; gradational at top, contact at base is sharp	4.0
2. Till, calcareous, tan to gray tan, jointed in upper part with oxidized rinds on joints and some gray joint fillings	17.0
1. Till, calcareous, compact, dark gray, discontinuous lenses and streaks of sand at top	5.0
Total	38.5

75.2 LEAVING STOP 5 continue ahead (east).

75.6 Sawyerville. Continue ahead, crossing Illinois 4.

75.7 Railroad crossing.

75.9 Turn right (south) at end of street, then left (east) at next street (one block) and follow winding road

76.5 Stop sign, Turn right (south) on Illinois 138.

78.7 White City.

79.3 Enter Mount Olive Quadrangle.

79.4 Stop light. Turn left (north) on U. S. 66. North from here the highway crosses the flat Illinoian till plain, thinly mantled with loess, for many miles.

88.6 Railroad crossing.

88.8 Stop light. Litchfield.

93.9 Enter Raymond Quadrangle.

96.1 Junction Illinois 108.

99.1 Stop light. Junction Illinois 48.

106.9 Crown Mine of Freeman Coal Corporation on right.

107.5 Slow. Road intersection.

112.9 Enter Divernon Quadrangle.

120.1 I.C.R.R. overpass.

123.1 Turn right (east) on black-top road leaving U. S. 66. This is the New City road, but the small sign cannot be seen until after you turn off U. S. 66.

123.7 Railroad crossing.

124.1 Stop sign. Continue ahead on pavement.

124.3 Continue ahead on black-top road leaving pavement.

126.6 Road cut east of Brush Creek exposes 4 feet Peoria Loess, on 3 feet Roxana Zones II-IV, on 1½ feet Roxana Zone I, on strongly developed Sangamon Soil in till.

129.2 Stop sign. New City. Turn left (north).

130.6 STOP 6. - New City Section.

This exposure shows the very thin loess at a distance of 50 miles from the source area (Circular 334). Peoria Loess is clearly distinguishable from the Roxana, but within the Roxana only Zone I can be differentiated. Previously unpublished X-ray analyses of Zone I (P-1367 to P-1371; P-1366 top of Sangamon Soil; P-1372 base of Zone II) are given in the appendix. The Sangamon Soil here reflects development under poor drainage conditions, in contrast to several profiles seen previously on the trip, but (with the exception of a thin zone in the upper part) is judged to be an in-situ profile developed in till in contrast to the thick accretion-gley to be seen at the next stop. The following table gives averages of significant mineral constituents in the in-situ Sangamon Soils of Illinois and shows the approximate mineral depletions by weathering in the 62-250 micron fraction of the sand. The clay-mineral assemblage is characterized by abundant illite and heterogeneous swelling material with some kaolinite, in contrast to the vermiculite and abundant montmorillonite, with some kaolinite, typical of the accretion-gleys.

Average Mineral Analyses of Zones of Soil Profiles
on Illinoian Till (62-250 micron fraction)

Zone	Light Minerals %			Heavy Minerals %				
	Number Samples	K felds.	Na-Ca felds.	Number Samples	Tourmaline + Zircon	Garnet	Epidote	Hornblende
A	9	11	5	5	12	14	30	39
B	31	12	6	16	10	18	25	43
CL	19	14	7	16	6	14	19	57
CC	25	12	8	24	6	14	17	52

Approximate Percent of Mineral Depletion by Weathering
Calculated from Above Analyses

Zone	Total feldspars relative to quartz	Na-Ca feldspars relative to K felds.	Garnet relative to Tour. + Zircon	Epidote relative to Tour. + Zircon	Hornblende relative to Tour. + Zircon	All ferro-mag. minerals relative to all others
A	24	31	50	10	62	47
B	12	25	22	10	50	35
CL	0	24	0	0	0	0

130.6 LEAVING STOP 6, continue ahead (north).

130.7 Bridge over South Fork Sangamon River.

131.1 Road cut through sand dune.

131.9 Rochester section in road cut.

132.4 Make U-turn at road intersection.

132.9 STOP 7. - Rochester Section.

Sangamon accretion-gley described in Circular 295. The mineralogy is shown in figure 8. The exposure shows the physical setting of these deposits, formerly called gumbotil, in slight lows on the Illinoian till plain and flanked by in-situ Sangamon Soils at slightly higher topographic positions. This exposure shows the characteristic small pebbles predominantly of quartz and chert but with sparse unweathered granite and greenstone. The lack of intense weathering is shown by the slight depletion of feldspars and ferromagnesian minerals in the following table of mineral analyses of the 62-250 micron sand of accretion-gleys on Illinoian till. The clay minerals also strongly indicate the lack of intense weathering. The presence of chlorite and abundant monmorillonite may be explained best by regrading of the altered clay material brought into a wet, organic rich, acid, reducing environment. It may be that much of Sangamonian time is represented by the deposit.

Comparison of Mineralogy of Accretion-gley and Calcareous Illinoian Till

Zone	Light Minerals %			Heavy Minerals %				
	Number of samples	K felds.	Na-Ca felds.	Number of samples	Tourmaline & Zircon	Garnet	Epidote	Horn-blende
G	22	13	5	22	7	16	26	48
Calcareous till	37	12	8	26	6	15	18	52

Seventy-five yards north of the accretion-gley section is an excellent sequence of the loesses above the Sangamon Soil, and they are described in the following measured section:

ROCHESTER SECTION - Loess Section north of accretion-gley section reported in Circular 295; NE cor., NW$\frac{1}{4}$ sec. 3, T. 14 N., R. 4 W., Sangamon Co., Ill., (1962).

Pleistocene Series

Wisconsinan Stage

Woodfordian Substage — Thickness (feet)

Peoria Loess

8. Loess, tan, mottled light brown, leached, massive; surface soil in top (P-1527, $\frac{1}{2}$ foot above base) 7.0
7. (Transition zone at base of Peoria Loess). Loess, mottled tan and light brown, leached, massive, some streaks of rusty-brown (P-1526) 0.3

Altonian Substage

Roxana Silt

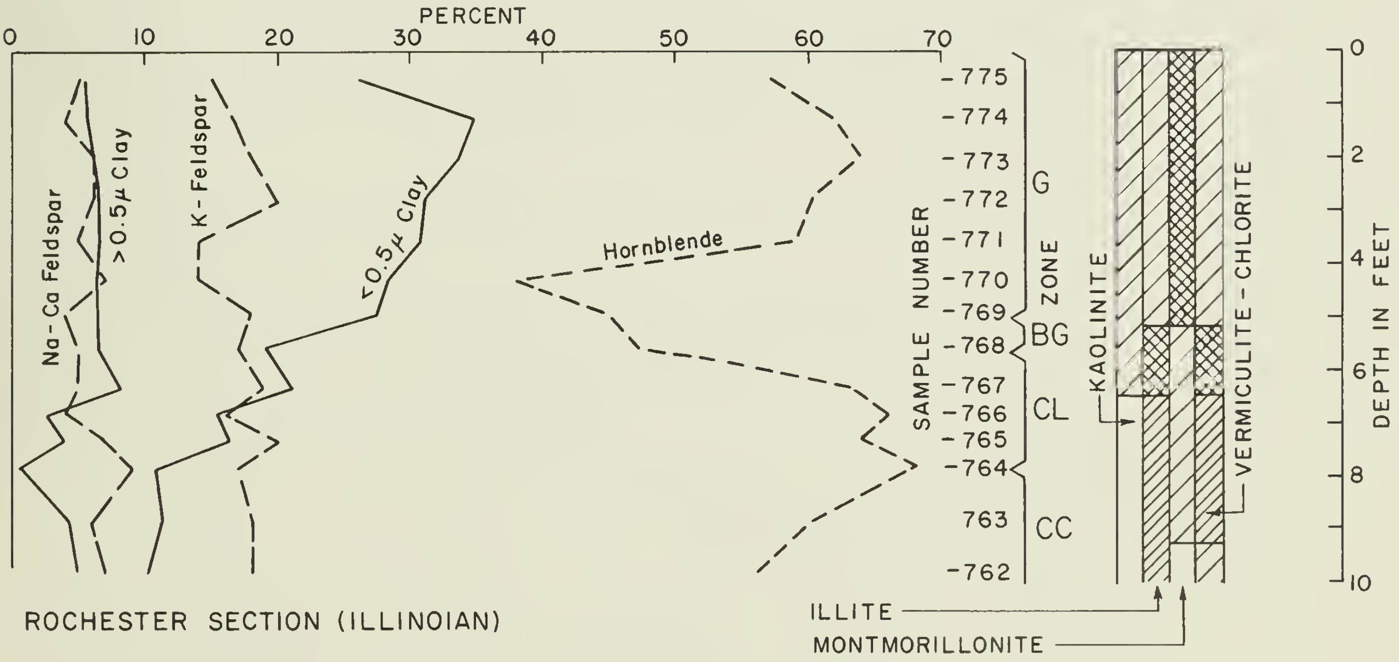

Figure 8. Values of selected mineral constituents and abundance of clay in the Rochester accretion-gley section. (From Circular 295, p. 12)

Zone IV

6. Loess, light pinkish brown, leached, massive, gradational contacts (P-1525). . 0.5

Zone III

5. Loess, light brown, leached, massive, gradational contacts (P-1524) 0.5

Zone II

4. Loess, light pinkish brown, leached, massive, gradational contacts(P-1523) . . 1.0

Zone I-b

3. Sand, fine, and silt, with some clay, light brown, leached, massive, gradational (P-1522) 0.5

Zone I-a

2. Sand and silt with some clay, mottled tan and light brown to light yellow-brown, very few small pebbles, leached, massive, sparse small Mn-Fe pellets (P-1520 base; P-1521 top) 1.5

Illinoian Stage

1. Sangamon Soil. Sand with very few small pebbles, some silt and heavy clay accumulation, yellow-brown, mottled and streaked with gray and rust-brown, leached, massive, tough; contains large Mn-Fe pisolites and streaks; sharp contact at top (P-1518 base; P-1519 top); the top of the Sangamon Soil is continuous with, but 2 feet higher than, the oxidized top of the Sangamon accretion-gley 75 yards to the south (Circular 295) 2.0

Total 13.3

132.9 LEAVING STOP 7, continue ahead (south).

134.1 Bridge over South Fork Sangamon River.

135.7 Stop sign. New City. Continue ahead (south).

139.8 Jog, right then left.

140.9 Jog, right then left.

141.4 Turn right (west) on Illinois 104.

143.6 Pawnee

147.5 U. S. 66 underpass. Continue ahead on Illinois 104.

148.0 Railroad crossing.

152.3 Auburn.

152.8 Railroad crossing.

153.1 Enter Waverly Quadrangle.

153.3 Railroad crossing.

153.6 Stop sign. Junction Illinois 4. Continue ahead on Illinois 104.

154.9 Railroad crossing.

163.8 Waverly.

164.6 Junction Illinois 111. Continue ahead on Illinois 104.

166.2 Turn left (south) on oiled road.

166.7 Turn right.

167.0 Turn left.

167.9 Make U-turn at road intersection.

168.6 STOP 8. - Waverly Section.

A thin sequence of loess on Sangamon Soil is described in the following measured section. Roxana Zone I is strongly weathered and obviously was deposited after the development and truncation of the Sangamon Soil. It represents the earliest element of Wisconsinan deposition, and not the A-zone of the Sangamon profile.

WAVERLY SECTION - SE$\frac{1}{4}$ SE$\frac{1}{4}$ SW$\frac{1}{4}$ sec. 9, T. 13 N., R. 8 W., Morgan Co., Ill., (1962).

	Thickness (feet)
Pleistocene Series	
Wisconsinan Stage	
Woodfordian Substage	
Peoria Loess	
6. Loess, leached, tan, to yellow-tan, mottled with gray, massive with platy structure on weathered surface, surface soil at top, transitional at base (P-1433, 1 foot up)	4.0
5. (Transition zone at base of Peoria Loess). Loess, leached, dark yellow-tan with indistinct mottling, gradational top and bottom, clayey (P-1432)	1.0
Altonian Substage	
Roxana Silt	
Zones II-IV	
4. Loess, with some very fine sand, leached, massive, reddish brown to tan-brown, some indistinct mottling, clayey, dispersed Mn-Fe pellets, gradational top and bottom (P-1431, 4 inches above base)	1.0
Zone I	
3. Sandy silt with pebbles dispersed in lower part, massive, brown with some streaks of tan, some Mn-Fe pellets, gradational at top but sharp contact at base (P-1429 lower; P-1430 upper)	1.5
Illinoian Stage	
2. Sangamon Soil. Soil B-zone developed in till (P-1428), leached, micro-blocky, brown, clay skins, abundant Mn-Fe pellets and staining, sharp contact at top, gradational downward (P-1428); along cut the B-zone is truncated down-slope toward the north, and at the north end of the cut Roxana Zone I rests on the lower part of the Sangamon B-zone	1.5
1. Till, leached in top 2 feet, calcareous below, gray, massive	5.0
Total	14.0

168.6 LEAVING STOP 8 continue ahead (north).

168.7 Turn right.

169.0 Turn left.

169.5 Stop sign. Turn left (west) on Illinois 104.

170.2 Enter Jacksonville Quadrangle.

173.2 Franklin.

179.3 Pisgah.

183.5 Railroad crossing.

184.0 Junction U. S. 36. Turn left (west).

185.0 Jacksonville.

185.7 Stop light. Turn right (north) on U. S. 67 (Main Street).

186.2 Stop light. Turn left (west). Sign points to Dunlap Hotel.

186.3 Turn right (north). One block to hotel.

186.5 NIGHT STOP. Dunlap Hotel. Parking lots will be found east and north of hotel, but overnight parking is permitted on the streets. Dinner in the Dunlap Hotel dining room at 7:00 P.M. The dinner will be followed by informal discussions of problems brought up during the day. We hope that everyone will take part.

SUNDAY MORNING, May 12, 1963

Breakfast will be served in the Dunlap Hotel coffee shop on an individual order basis starting at 6:15 A.M.—please be prompt. In order to arrive at the assembly point (STOP 9) on time, it will be necessary to leave the hotel at 7:30 A.M.

ASSEMBLY POINT: STOP 9 (follow the log).

ARRIVAL TIME: 7:45 A.M.

FIGURE 9. Shows graphically the stratigraphy to be seen the second day.

Mileage

0.0 Dunlap Hotel. Jacksonville Quadrangle. From the northeast corner of the hotel, go east one block on State Street, and turn left (north) on West Street.

0.2 Stop sign. Turn right (east) on Douglas Avenue.

0.3 Stop sign. Turn left (north) on U. S. Highway 67 (Main Street).

0.5 Railroad crossing.

1.0 Stop sign. Continue ahead on U. S. 67.

1.3 Enter Virginia Quadrangle.

6.3 Indian Creek.

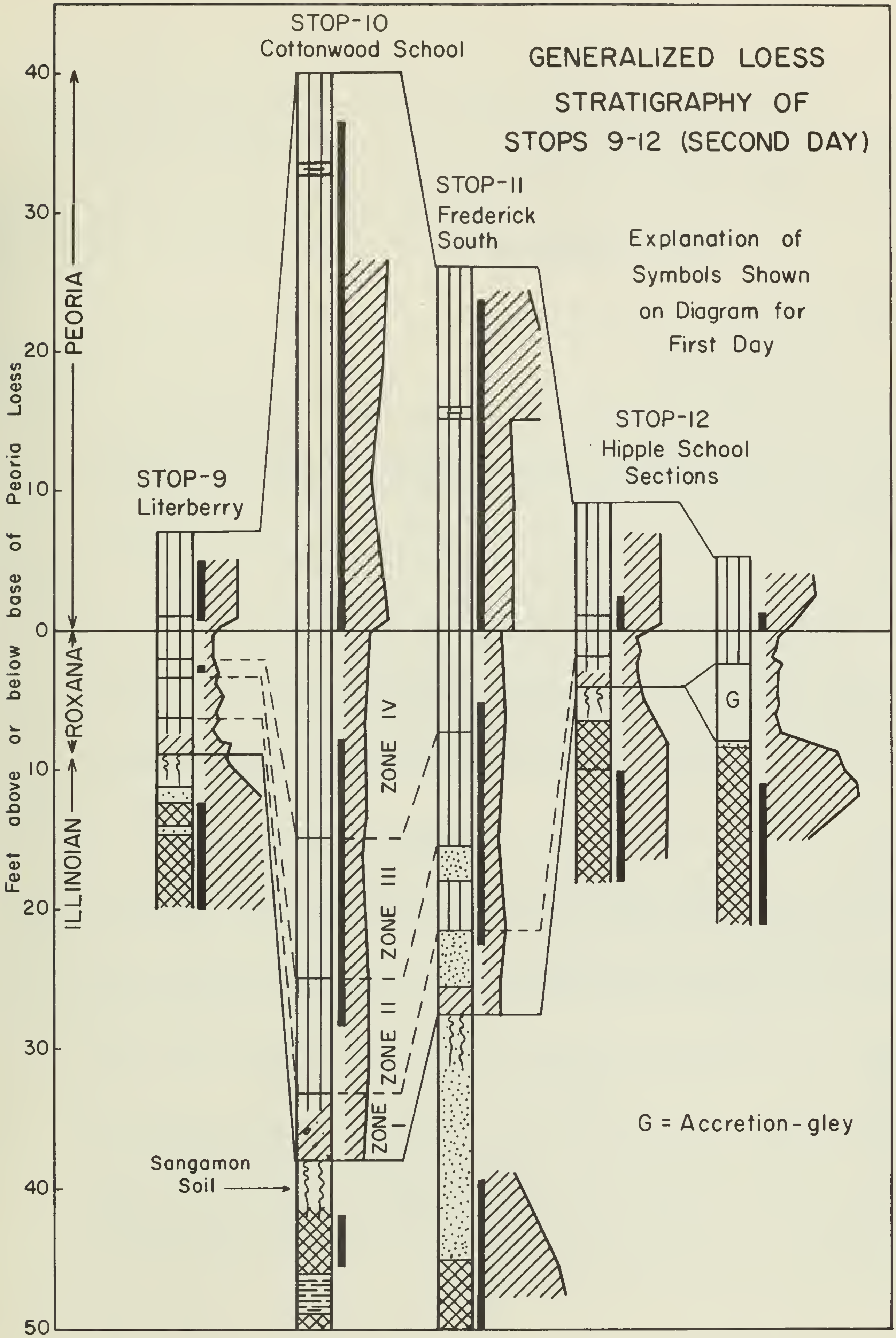
GENERALIZED LOESS STRATIGRAPHY OF STOPS 9-12 (SECOND DAY)
STOP-9 Literberry
STOP-10 Cottonwood School
STOP-11 Frederick South
STOP-12 Hipple School Sections
Explanation of Symbols Shown on Diagram for First Day
G = Accretion-gley
Feet above or below base of Peoria Loess
PEORIA
ROXANA
ILLINOIAN
ZONE IV
ZONE III
ZONE II
ZONE I
Sangamon Soil
G
40
30
20
10
0
10
20
30
40
50

Figure 9

6.7 STOP 9. - Literberry Section.

The loess in this area was derived from Illinois Valley. It has the same sequence of units here as in the Mississippi Valley. During deposition of the Roxana Loess, the Ancient Mississippi River occupied the present Illinois and lower Sangamon Valleys (fig. 4). This section is approximately 10 miles from the bluff line of the Ancient Mississippi. The sequence of deposits is described in the measured section.

LITERBERRY SECTION, NE$\frac{1}{4}$ SW$\frac{1}{4}$ NW$\frac{1}{4}$ sec. 3, T. 16 N., R. 10 W., Morgan Co., Ill. 1 mile NW of Literberry (1962).

Pleistocene Series

Wisconsinan Stage

	Thickness (feet)
Woodfordian Substage	
Peoria Loess	
15. Surface soil in loess; soil profile truncated with weak B-zone and slightly podzolic A-zone, leached, brown to light brown.	2.0
14. Loess, calcareous, massive, gray to tan, some tan mottling in lower part becoming tan to light brown in upper part (P-1452 base; P-1453, 1$\frac{1}{2}$ feet up; P-1454, 3 feet up)	4.0
13. (Transition zone at base of Peoria Loess). Loess, medium, massive, generally calcareous at top, mottled pink-tan and gray-tan (P-1450 lower; P-1451 upper).	1.0
Altonian Substage	
Roxana Loess	
Zone IV	
12. Loess, medium to coarse, massive, some secondary carbonate, pink-brown, gradational at top and bottom (P-1448 lower; P-1449 upper)	2.0
Zone III	
11. Loess, coarse, massive, locally weakly calcareous, tan to light brownish tan (P–1446 lower; P-1447 upper).	1.8
Zone II	
10. Loess, massive, leached, pink-tan to pink-brown (P-1444 lower; P-1445 upper).	2.0
9. Silt with a few sand grains and some clay, brown to pale pinkish brown, some secondary carbonate in upper part, gradational top and bottom (P-1443 lower; P-1442 upper).	1.0
Zone I-b	
8. Sandy silt, with some clay and a few small pebbles, leached, massive, tan to tan-brown with brown mottling, gradational top and bottom P-1441)	1.0
Zone I-a	
7. Sand, silt, and clay with a few small pebbles, leached, massive, brown with tan mottling, few Mn-Fe pellets (P-1439 lower; P-1440 upper)	1.5
Illinoian Stage	
6. Sangamon Soil. Soil B-zone developed in sand and pebbly sand (perhaps a very sandy till), brown, mottled, red-brown and tan, leached, some Mn–Fe staining (P-1438 middle)	2.2
5. Sangamon Soil. Lower part of B-zone, sand, clayey, leached, red-brown and tan mottled; a few flecks of Mn-Fe staining; a very few disseminated pebbles (P-1437)	1.0
4. Till, leached, platy, brown and tan mottled	0.5

3. Till, calcareous, sandy, with a few cobbles but fewer than bed 1, gray, mottled brown and tan (P-1435 lower; P-1436 upper)	1.0
2. Sand, calcareous, friable, tan to dark tan	0.5
1. Till, calcareous, pebbly, friable on weathered surface, sandy, gray and tan, compact; a few joints	5.5
Total	27.0

6.7 LEAVING STOP 9, continue ahead (north).

11.0 Typical view of loess-covered Illinoian till plain.

14.6 Virginia.

15.7 Railroad crossing. Stop sign. Junction with Illinois 125 and 78. Continue ahead on Illinois 78.

19.0 Enter Chandlerville Quadrangle.

21.1 Note dunic hills of sandy loess on left. These are within a mile of the Illinois-Sangamon Valley bluffs.

21.8 Loess hills on lip of valley. Note that these hills of sandy loess on the crest of the valley wall rise 40 feet above the level of the till plain over which we have been traveling.

22.0 Slow. Prepare to turn at bottom of hill.

22.2 Turn left (west) on black top road. The road follows the south bluffs of the joint valley of Illinois and Sangamon Rivers. The far side of the valley, about 10 miles away, can be seen from higher points on the road. This broad valley was the source for some of the thickest accumulations of loess deposits in Illinois. The loess is 50 to 75 feet or more thick in the bluffs and thins southeastward to 8 to 10 feet near Springfield (STOPS 6, 7), about 50 miles from the bluffs. Sand dunes are abundant on the terraces and locally on the bluffs. In places dunes extend onto the uplands. The bluffs are largely composed of loess.

26.5 Enter Beardstown Quadrangle.

29.2 STOP 10. - Cottonwood School Section.

This section has been described in Circulars 304 (p. 27) and 334 and is summarized below and in figure 9. This section displays the zonation of the Roxana as well as any section in the Illinois Valley region. The limonite tubules in Zone III are also present at several other exposures in the region. The upper part of the Peoria is not accessible in this cut, but weakly developed soils can be seen. In other nearby sections, these thin soils show partial leaching and some caliche accumulation.

Summary of Cottonwood School Section	Thickness (feet)
Peoria Loess, calcareous, fossiliferous, gray-tan	40.0
Roxana Loess, Zone IV, pinkish gray	15.0
Roxana Loess, Zone III, calcareous, gray	10.0
Roxana Loess, Zone II, pinkish tan	8.0
Roxana Silt, Zone I, gray, pebbly, colluvium	5.0
Sangamon Soil in Illinoian till; calcareous at base	8.0
Silt, calcareous, gray and tan	3.0
Till, on Pennsylvanian shale and siltstone	5.0

29.2 LEAVING STOP 10, continue ahead (west).

31.7 Turn left (south) at Brick School.

33.3 Enter Arenzville Quadrangle.

33.9 Stop sign. Turn right.

34.0 Stop sign. Turn right (west) on U. S. 67.

34.9 Sand dunes on low terrace (Beardstown Terrace of Bulletin 82).

36.7 Enter Beardstown Quadrangle.

38.9 Junction Illinois 100. Continue ahead on U. S. 67 and Illinois 100. Beardstown on right (north).

39.7 Illinois River.

41.0 Turn right (north) on Illinois 100.

44.1 Frederick. Turn left at DX filling station.

44.7 STOP 11. – Frederick South Section.

This section is described in Circulars 304 (p. 28) and 334 and is summarized below and in figure 9. This is the northernmost locality from which a snail fauna has been described from the Roxana, and the overlying Peoria is also abundantly fossiliferous. At this locality the Sangamon Soil is well-drained and developed in sand. The Roxana is unusually sandy with all zones present and clearly recognizable. The top of the Roxana is truncated at the north end of the pit so that the Peoria Loess rests on Zone III of the Roxana.

Summary of Frederick South Section	Thickness (feet)
Peoria Loess, calcareous, yellow-tan (incipient soil 15 feet up)	26.0
Roxana Loess, Zone IV, pinkish brown	7.5
Roxana Loess, Zone III, silt and fine sand, tan	8.0
Roxana Loess, Zone II, silt, pink, and fine sand	6.0
Roxana Silt, Zone I-b, sand and silt, gray-tan	4.0
Roxana Silt, Zone I-a, silt, sand, and pebbles, tan-brown, noncalcareous, colluvium	2.0
Sangamon Soil in sand, red-brown; calcareous tan sand at base	15.0
Colluvium of sand, silt, and cobbles, calcareous	5.0
Illinoian till, calcareous, on Mississippian (Warsaw) sandstone	4.0

44.7 LEAVING STOP 11, make U-turn and return to Illinois 100.

45.2 Stop sign at junction with Illinois 100. Ahead (north) on Illinois 100.

45.4 Stop sign. Continue ahead on Illinois 100.

50.3 Browning.

58.3 Enter Chandlerville Quadrangle.

59.3 Bluff City.

65.2 Enter Havana Quadrangle.

67.1 Enion.

67.5 Enion Terrace Section in cut along road to left, see figure 10.

70.1 Stop sign. Turn left (west) on Illinois 100 and U. S. 136.

72.6 Turn right following Illinois 100.

74.9 Junction U. S. 136. Continue ahead on Illinois 100.

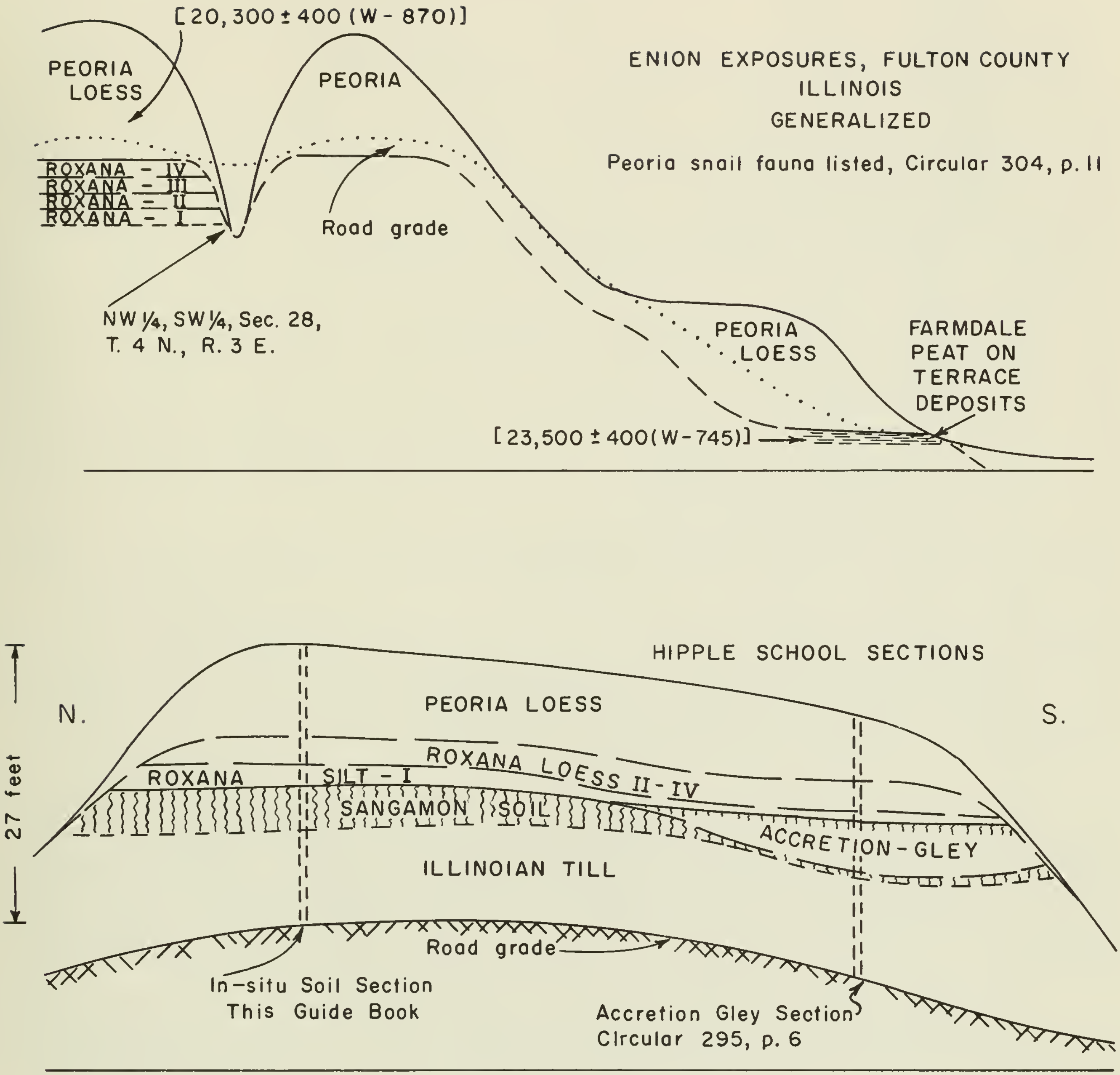

Figure 10. Diagrams showing relation of wood and shell dates to loess stratigraphy and terrace in the Enion area and relation of accretion-gley (gumbotil) to Sangamon Soil at Hipple School sections.

75.2 Spoon River.

76.1 Terrace showing level of fill of Spoon River Valley by Bloomington outwash.

79.1 Lewistown.

79.5 Railroad crossing.

79.6 Junction U. S. 24. Continue ahead on Illinois 100.

80.6 Railroad crossing.

81.1 Turn left (west) on Illinois 97.

84.3 Railroad crossing.

86.6 Junction Illinois 95. Continue ahead on Illinois 97.

87.2 Cuba.

87.5 Stop sign. Turn left (west) following Illinois 97.

87.9 Turn right (north) following Illinois 97.

88.0 Railroad crossing.

88.1 Railroad crossing.

88.4 Enter Canton Quadrangle.

90.0 Put Creek.

91.5 Strip coal mine on right.

92.5 Stop sign. Junction Illinois 9. Continue ahead on gravel road.

92.7 Caution. Strip-mine haulage-road. Crossing.

95.4 STOP 12. - Hipple School Sections.

This exposure is shown diagrammatically in figure 10; the accretion-gley section is described in Circular 295; some aspects of the mineralogy are shown in figure 11; and the sequence is described in the two following measured sections. These exposures admirably demonstrate the relation of accretion-gley deposits (formerly called gumbotil) to the surface of the Illinoian till plain and the in-situ soil profiles on the till. The mineralogical data show that the moderately well drained in-situ profiles have undergone significantly more mineral decomposition than have the accretion-gleys.

The relatively less weathered minerals, together with the absence of Roxana Zone I-a, lead to speculation that the upper part of the accretion-gley may have continued accumulation into earliest Wisconsinan time. Perhaps this sag on the microtopography received little sediment during much of Sangamonian time, and the BG-zone formed as an in-situ Sangamon Soil under marshy conditions, followed by accumulation of the accretion-gley in response to the climatic changes during earliest Wisconsinan time.

On the intermediate slope, in the cut between the high point of the Sangamon Soil surface and the bottom of the sag in which the accretion-gley is found, there is a concentrate of pebbles and cobbles at the surface of the Sangamon Soil. This pebble concentrate probably was produced by the same sheetwash that filled the accretion-gley puddle.

The loess thins westward in this region and was largely derived from the Illinois Valley, which is 15 miles to the east.

HIPPLE SCHOOL SECTION (Accretion-gley). (Reported in Circular 295) (1959-1962). Section near south end of road cut.

Pleistocene Series

Wisconsinan Stage

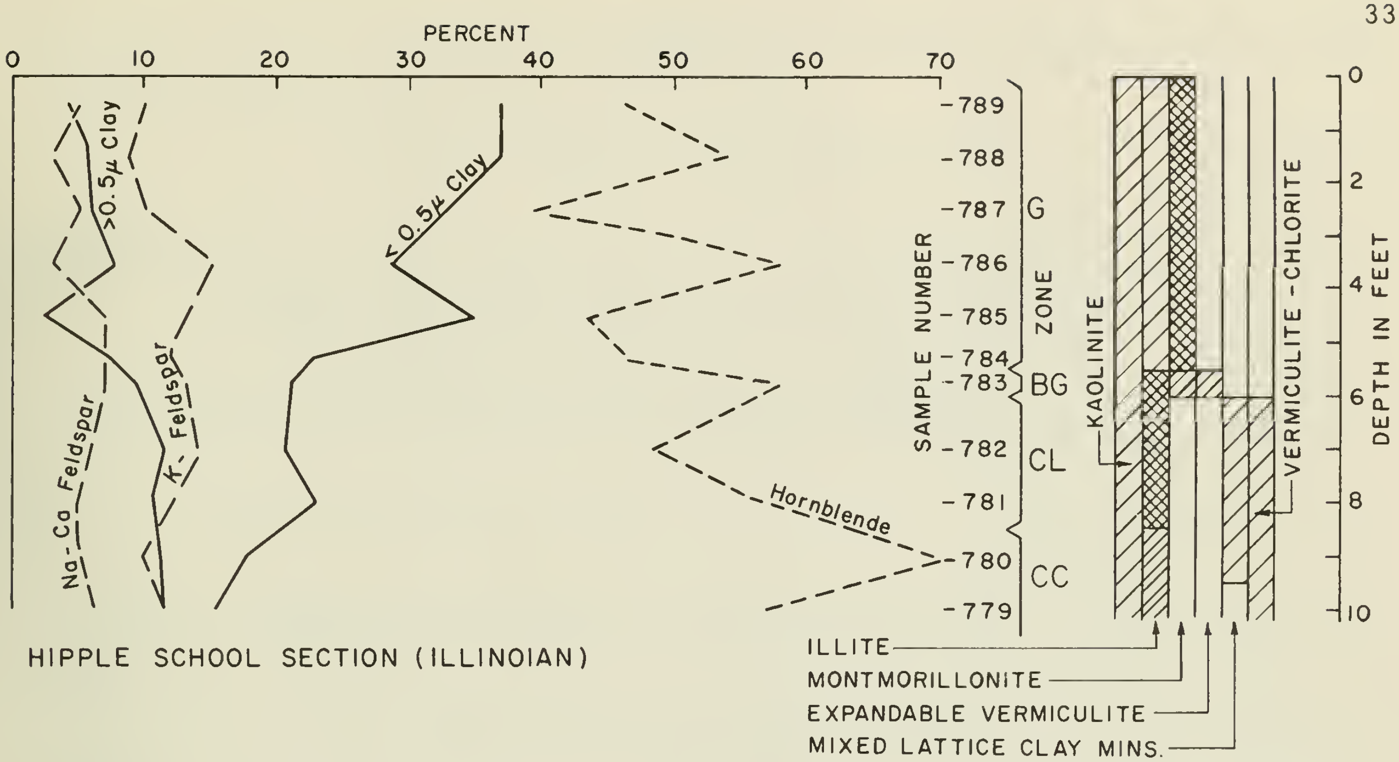

Figure 11. Values of selected mineral constituents and abundance of clay in the Hipple School accretion-gley section. (From Circular 295, p. 12)

	Thickness (feet)
Woodfordian Substage	
Peoria Loess	
7. Loess; basal 1-1½ feet is light gray with fine mottling of tan and light brown, leached, massive (P-1459); gradational upward to tan-brown loess (P-1460) to the B-zone of the surface soil podzolic A-zone at top	5.0
Altonian Substage	
Roxana Loess	
Zones II-IV	
6. Loess, leached, compact, fairly coarse but with abundant clay, massive, weakly zoned, slightly pinkish tan in lower part (P-1456), grading upward into tan-brown (P-1457), grading upward into strongly pink-tan in the top ½ foot (P-1458); sharp contact at top	2.0
Zone I-b	
5. Silt with some sand and clay but no pebbles, leached, brown to tan-brown faintly micro-mottled with tan, weakly micro-blocky (P-1455); gradational at top but sharp contact at base on accretion-gley	0.5
Sangamonian Stage	
4. Sangamon Soil. Accretion-gley, clay with silt and some sand and scattered small pebbles throughout, gray, dark gray at top, noncalcareous, micro-blocky structure (P-784 at base to P-789 at top)	5.5
Illinoian Stage	
3. Sangamon Soil, BG-zone. Till, clayey, leached, gray with some tan mottling (P-783)	0.5
2. Till, leached, mottled tan and gray with some brown in upper part, blocky, bouldery (P-781 lower; P-782 upper)	2.5
1. Till, calcareous, gray with streaks and mottling of tan, cobbly and bouldery, compact (P-778-780); contains lens of sand and gravel in lower part (P-777)	12.0+
Total	28.0

HIPPLE SCHOOL SECTION (NORTH) - NW$\frac{1}{4}$ SW$\frac{1}{4}$ SW$\frac{1}{4}$ sec. 8, T. 7 N., R. 3 E., Fulton Co., Illinois (1962). Section near north end of road cut.

	Thickness (feet)
Pleistocene Series	
Wisconsinan Stage	
Woodfordian Substage	
Peoria Loess	
8. Loess, leached, massive, yellow-tan to medium tan with some indistinct mottling, surface profile at top with weakly podzolized A-zone at top (P-1469, 2$\frac{1}{2}$ feet above base)	8.0
7. Loess, calcareous, light yellow-tan with mottling of gray, massive, friable; sharp contacts (P-1468)	1.0
Altonian Substage	
Roxana Loess	
Zones II-IV	
6. Loess, massive, leached, compact, light tan-brown with a pink cast except in upper $\frac{1}{2}$ foot which is mottled with tan (P-1466 lower; P-1467 upper)	2.0
Zone I-b	
5. Silt with some sand, massive, leached, light brown to tan-brown with only a faint pink cast; lacks pebbles and Mn-Fe pellets (P-1465)	1.0
Zone I-a	
4. Silt and sand with dispersed pebbles of small size, light pinkish brown, leached, massive with crumb structure, sparse Mn-Fe pellets (P-1464)	1.0
Illinoian Stage	
3. Sangamon Soil. Soil (B-zone) developed in till, leached, strongly red-brown in upper part grading downward to red-brown mottled with yellow-tan and light brown, indistinct blocky structure; contains sandy zones and appears to be in part developed in sand lentils in the upper part of the till; no Mn-Fe pellets observed (P-1463 middle)	2.5
2. Sangamon Soil (CL-zone). Till, leached, yellow-tan, mottled and streaked with light brown in upper part, blocky, bouldery, gradational at top (P-1462 middle)	3.5
1. Till, calcareous, massive, bouldery, gray-tan, irregularly blocky (P-1461 top)	8.0
Total	27.0

END OF TRIP

APPENDIX

PREVIOUSLY UNPUBLISHED X-RAY MINERAL ANALYSES
(by H. D. Glass)

Sample number	X-ray diffraction intensity, counts per second — Bulk samples: Calcite	Dolomite	D. I. Ratio	Percent clay minerals in less than 2 micron fraction: Montmorillonite	Illite	Kaolinite and Chlorite
STOP 3. Reliance Whiting Quarry Section						
P-1515	—	30	0.9	71	16	13
P-1514	—	15	0.6	71	14	15
P-1513	—	—	0.6	72	13	15
P-1512	—	—	0.7	80	10	10
P-1511	—	—	0.8	81	10	9
P-1510	—	—	0.5	78	10	12
P-1509	—	—	0.6	73	13	14
P-1508	—	—	0.9	74	14	12
P-1507	—	—	0.9	73	15	12
P-1506	—	—	0.8	71	16	13
P-1505	—	—	0.7	61	20	19
P-1504	—	—	0.8	56	24	20
P-1503	—	—	0.9	48	30	22
P-1502	—	—	0.8	20	44	36
P-1501	—	—	0.8	19	45	36
P-1500	—	—	0.8	28	39	33
P-1499	—	—	1.2	32	43	25
P-1517	—	—	1.8	44	40	16
P-1516	13	195	3.1	30	58	12
STOP 4. Dorsey Section						
P-1417	—	—	1.6	76	17	7
P-1416	—	—	1.2	72	18	10
P-1415	—	—	1.0	71	17	12
P-1414	—	—	0.5	76	11	13
P-1413	—	—	0.5	76	10	14
P-1412	—	—	0.6	70	14	16
P-1411	—	—	*	*	*	*
STOP 5. Sawyerville Section						
P-1427	—	—	0.4	60	16	26
P-1426	—	—	1.2	78	14	8
P-1425	—	—	1.2	77	15	8
P-1424	—	—	1.1	78	14	8
P-1423	—	—	0.4	78	8	14
P-1422	—	—	0.3	71	10	19
P-1421	—	—	0.5	72	12	16

Sample number	X-ray diffraction intensity, counts per second: Bulk samples: Calcite	Dolomite	D. I. Ratio	Percent clay minerals in less than 2 micron fraction: Montmorillonite	Illite	Kaolinite and Chlorite
STOP 6. New City Section						
P-1372	—	—	0.4	80	7	13
P-1371	—	—	0.5	71	10	19
P-1370	—	—	0.5	69	13	18
P-1369	—	—	0.5	71	13	16
P-1368	—	—	0.9	62	22	16
P-1367	—	—	1.4	58	28	14
P-1366	—	—	*	*	*	*
STOP 7. Rochester Section (Loess)						
P-1527	—	—	0.7	79	11	10
P-1526	—	—	0.8	77	12	11
P-1525	—	—	0.5	74	11	15
P-1524	—	—	0.4	73	10	17
P-1528	—	—	0.3	78	7	15
P-1522	—	—	0.4	70	11	19
P-1521	—	—	0.2	71	7	22
P-1520	—	—	0.6	67	15	18
P-1519	—	—	0.6	51	23	26
P-1518	—	—	1.2	39	41	20
STOP 8. Waverly Section						
P-1433	—	—	1.7	59	29	12
P-1432	—	—	0.9	75	14	11
P-1431	—	—	0.2	77	5	18
P-1430	—	—	0.4	71	11	18
P-1429	—	—	0.5	68	14	18
P-1428	—	—	0.9	63	21	16
STOP 9. Literberry Section						
P-1454	18	41	1.0	56	26	18
P-1453	11	55	1.0	66	20	14
P-1452	5	68	1.1	64	23	13
P-1451	—	120	1.0	58	25	17
P-1450	—	—	0.6	49	24	27
P-1449	—	—	0.4	63	14	23
P-1448	—	—	0.4	62	15	23
P-1447	—	—	0.5	78	9	13
P-1446	—	—	0.6	74	12	14
P-1445	—	—	0.6	68	14	18
P-1444	—	—	0.7	58	16	16
P-1443	—	—	0.4	66	12	22
P-1442	—	—	0.5	75	11	14
P-1441	—	—	0.4	58	15	27

Sample number	X-ray diffraction intensity, counts per second — Bulk samples: Calcite	Dolomite	D. I. Ratio	Percent clay minerals in less than 2 micron fraction: Montmoril-lonite	Illite	Kaolinite and Chlorite
STOP 9. (continued)						
P-1440	—	—	0.6	43	28	29
P-1439	—	—	0.8	47	28	25
P-1438	—	—	0.8	49	27	24
P-1437	—	—	2.8	48	42	10
P-1436	—	—	1.3	40	42	18
P-1435	26	110	3.7	34	56	10
STOP 12. Hipple School Section (North)						
P-1469	—	7	1.3	76	16	8
P-1468	—	55	1.3	73	18	9
P-1467	—	—	0.3	73	8	19
P-1466	—	—	0.5	67	14	19
P-1465	—	—	0.3	60	11	29
P-1464	—	—	0.4	60	11	29
P-1463	—	—	0.5	57	17	26
P-1462	—	—	1.8	*	*	*
P-1461	—	—	1.7	14	62	24
STOP 12. Hipple School Section (Accretion-gley)						
P-1460	—	—	1.5	71	20	9
P-1459	—	8	0.9	84	9	7
P-1458	—	—	0.5	70	13	17
P-1457	—	—	0.4	73	11	16
P-1456	—	—	0.2	72	8	20
P-1455	—	—	0.6	65	15	17

* Material sufficiently weathered that a quantitative evaluation of clay mineral composition is impractical.