

Wisconsin Moraines as a Source of Loess in Soil Formation in Fayette and Union Counties¹

H. P. ULRICH, PURDUE UNIVERSITY

The role of glacial melt-water streams such as the Wabash river to loess deposition has long been recognized in several deep silty soils along the Wabash River. These silt deposits, uniformly assorted by wind, occur over several geological materials in southern Indiana. Caldwell has shown 1) that these deposits, thick at the source, thin rapidly initially then gradually over a distance of many miles. They were carried by winds in a southeasterly direction. Further studies made with A. L. Zachary show that loess deposits on the Illinoian till plain of southeastern Indiana are about 30 to 36 inches in thickness. These loess deposits have their sources partly in glacial sluiceways tributary to the Wabash River.

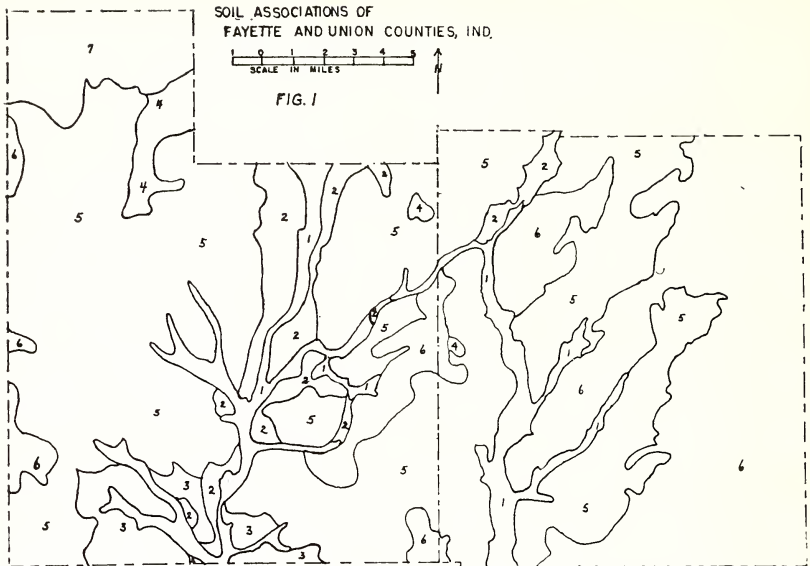
In Parke County, Indiana loess deposits from the Wabash River covered both the Illinoian and the adjoining Wisconsin till plain (Shelbyville moraine). A transect across the Wisconsin and Illinoian till plains from Lyford to New Albany showed that loess deposits decreased from 65 inches adjoining the river valley to 55 inches within a distance of two miles of the valley wall. They increased to 108 inches on the Illinoian till plain, five miles from the escarpment. From this study it was inferred that successive glacial advances may result in a number of loess depositions.

The Fayette and Union County soil surveys presented the opportunity to study the relationship of Wisconsin moraines 2) to loess deposition in an area where glacial melt-water river valleys are narrow and would be expected to contribute little loess.

During the course of the survey the soils were classified and mapped on the basis of their morphological characteristics including the kind or kinds of parent materials from which they were developed. Records were kept of the thickness and reaction or carbonate content of the loess and till. Fig. 1, a generalized map, was prepared from the more detailed field maps. As the probable loess sources consist of either moraines or melt-water stream valleys extending in a north-south direction, we would expect loess deposition to occur east of these features. Legend:

1. Present day flood plains consisting chiefly of Genesee and Eel soils.
2. Alluvial terraces of several levels on which soils of the Ockley, Fox, Nineveh and Martinsville catenas are developed in loamy outwash, chiefly over calcareous gravel and sand.
3. Highly dissected Illinoian till plain on which soils of the Cincinnati catena are developed on nearly level areas in loess ranging from

¹Purdue University, Agricultural Experiment Station, Jour. Paper No. 1358.



40 to 70 inches in thickness overlying glacial till, calcareous at approximately 11 feet.

4. Nearly level ground moraine—Shelbyville stage of the Wisconsin period. Soil chiefly Manlove, Birkbeck and Reesville are developed entirely in silt 35 to 65 inches thick, that often is calcareous near the contact with the underlying calcareous Wisconsin till.

5. Nearly level to rolling area of Shelbyville moraine comprising soils of the Russell catena (Russell, Xenia, Fincastle, Cope, and Brookston series). These soils are developed in 18 to 40 inches of loess overlying till that is calcareous at 42 to 60 inches or more.

6. Nearly level to rolling area of Shelbyville moraine, though less dissected than area No. 5. Soils consist of shallow phases of Russell and Fincastle and of Miami soils undifferentiated. These soils are developed in a thin and variable silt deposit usually varying from 15 to 30 inches and averaging 22.6". Loess overlies till that is calcareous at an average depth of 34.0".

7. Nearly level to undulating till plain of the Champaign morainic system, Wisconsin Period. The soils, members of the Miami, Celina, Crosby, and Brookston Catena, are developed on loam till that is calcareous at an average depth of 24.5". Loess, if present, is limited to the "A" horizon to a depth of about 10 inches.

As noted on the soil map, and legend Fig. 1, loess of varying thickness is recognized on all the groups of soils listed except No. 1, the recent alluvium of streams; No. 2, the older alluvial or terrace deposits of Wisconsin age consisting of gravel, sand and finer materials; and No. 7, the younger till deposits of the Champaign substage of the Wisconsin glacial period.

The following observations and conclusions are centered on Fayette County chiefly because it includes till plains of Illinoian and Wisconsin

Age, the latter including moraines of Shelbyville and Champaign sub-stages.

1. Loess deposits are thicker on nearly level areas, thinner on sloping areas such as occur around drainage ways; and decrease in thickness south eastward from the source.

2. The larger areas and thicker deposits of loess lie adjacent to and southeast of the Champaign substage of the Wisconsin period, Fig. 1 Item 4, on the nearly level divides of the Shelbyville substage.

3. The Illinoian till plain, Fig. 1 Item 3, has been covered in part with loess from the Shelbyville substage of the Wisconsin period. Loess six feet deep occurs on the level Illinoian plain, areas of which occur on or near the Fayette-Franklin County line near the Shelbyville moraine. The Illinoian till plain in Fayette County is so highly stream dissected that few level remnants remain. The average depth of loess observed on smooth area, 48 inches, is a foot thicker than that covering other parts of the Illinoian till plain to the south.

4. Loess deposits three to five feet thick on level areas of the Wisconsin till plain are usually calcareous or neutral in reaction within a depth of three feet. Similar deposits on the Illinoian till plain of Fayette County are strongly acid in reaction and the till is carbonate-free to a depth of 10 feet or more.

5. The Russell catena, Fig. 1 Item 5, is the most extensive group of soils in the area, the one on which more data was collected. Loess depths range from 15 to 40 inches or more in thickness. The loess is thicker southeast of the Champaign moraine and bordering soils of the Manlove Catena, Item 4, which are developed entirely in silts.

Included in Item 6 are many small areas of soils of the Manlove and Russell groups that have either a thicker silt mantle or greater depth of carbonate-free till-derived soil. This mixed soil pattern is especially notable in northeastern Union County and southeastern Wayne County, south of the conspicuous moraine lying parallel to Elkhorn Creek. This area is interpreted to be part of the Shelbyville Moraine.

In order to study the relation of loess depth and glacial streams, the depth of loess and leached till was tabulated by tiers of sections from the Fayette-Rush County line eastward. This data is presented in Fig. 2.

AVERAGE DEPTH OF LOESS AND CARBONATE-FREE TILL IN RUSSELL CATENA BY MILES FROM WEST BOUNDARY OF FAYETTE COUNTY, IND.

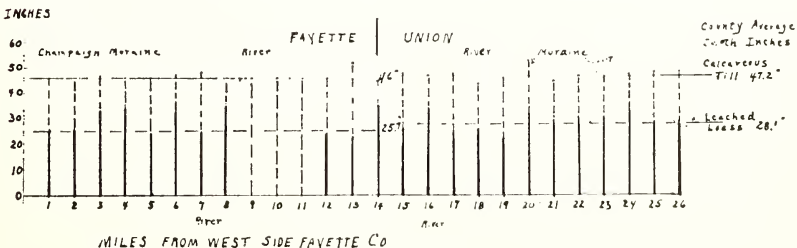


FIG. 2

TABLE 1
 Fayette County, Indiana
 SW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 20 T. 15 N., R. 12E
 Manlove Silt Loam (84B1)
 Manlove Silt Loam (84B1)

Horizon	Depth pH (Inches)	Organic Carbon (Pct)	Very coarse sand 2-1 (Pct)	Coarse sand 1-0.5 (Pct)	Medium sand 0.5-0.25 (Pct)	Fine sand 0.25-0.1 (Pct)	Very fine sand 0.1-0.05 (Pct)	Silt 0.05-0.002 (Pct)	Clay 0.002 (Pct)	0.02-0.002 (Pct)
A ^p	0-5	7.2 1.09	0.3	1.1	2.0	4.4	5.1	70.3	16.8	34.0
A ₂	5-12	7.0 0.78	0.7	1.4	1.9	4.5	5.1	70.0	16.4	33.4
B ₁	12-17	6.4 0.86	0.3	1.0	1.7	4.0	4.5	68.9	19.6	32.5
B ₂	17-32	5.1 0.18	0.1	0.6	1.7	4.2	6.6	59.9	26.9	21.7
B ₃	32-45	5.4 0.16	0.0	0.5	1.5	4.1	6.2	60.1	27.6	24.7
C ₁	45-65	6.1 0.15	0.5	1.0	1.1	2.6	3.0	67.8	24.0	35.3
D	65-	7.6 0.32	3.2	5.8	6.9	15.8	9.8	33.7	24.8	19.8

The average depth of leached loess (solid line) and leached till (dashed line) for soils of the Russell catena in a north south tier of sections is shown by the vertical lines by one mile intervals across the 26 mile width of the two counties. The county average depth of silt and carbonate-free till is indicated by the horizontal lines. The difference in average thickness of the silt, in Fayette county (25.7 inches) and Union County (28.1 inches), is probably not significant. The greater thickness of silt in the northwest part of Fayette County and the northeast part of Union County seems to have its source in the Champaign moraine which crosses Fayette and southern Wayne counties. Local variations in average silt depth is due partly to limitations in the data, variations in topography and the kinds of soils, and the possible source of loess from glacial Whitewater river sluiceways.

A similar variation was found in average silt depth in soils of the Manlove Catena across these counties. Table 1 shows the particle size distribution by soil horizons in Manlove silt loam. The disconformity or abrupt change in the silt versus sand relationship is shown at 65 inches where the loess rests on the glacial till.

In summary, this shows that moraines such as the Champaign and Shelbyville contribute (a) to a relatively thick silt mantle on the eastward side near the moraine, and (b) that they probably contribute to a smaller increment widely distributed over more distant areas.

Literature Cited

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2. WAYNE, WM. J. Thickness of Drift and Bedrock Physiography of Indiana North of the Wisconsin Glacial Boundary. *Geol. Survey Rept. of Progress No. 7*, Indiana Dept. of Conservation.