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# Subsoil Textural Variations on the ClarionWebster Experimental Farm as Related to the Mankato Glacial Deposit

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# Subsoil Textural Variations on the Clarion-Webster Experimental Farm as Related to the Mankato Glacial Deposit[1]

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The Clarion-Webster Experimental Farm is an 80-acre experimental farm of Iowa State College located 1 mile south of Kanawha, Iowa (W½ SW¼ Sec. 34, T94N, R25W, Hancock County). A detailed soil map was made to determine the uniformity of the soils and the subsoil material. The map was constructed from the results of auger borings, 54 to 60 inches deep, located at the corners of a 50-foot square grid layed out on the tract. Thus, there were more than 1,000 borings made on the 80 acres.

The soils found on the farm are primarily Webster, an outwash phase of Webster and calcareous phases of these soils. The texture of the upper twenty or thirty inches of the area is rather uniform and ranges from a loam to a silty clay loam or clay loam. The subsoil textures vary as is indicated in Figure 1. The sandy subsoil material is stratified and ranges in texture from a fine sandy loam or silt to sand with occasional strata of loam. The less stratified subsoil areas is made up in part of glacial till and in part of a loam material with some pebbles and silt lenses which apparently has undergone some sorting. Approximately 15 or 20 isolated auger borings

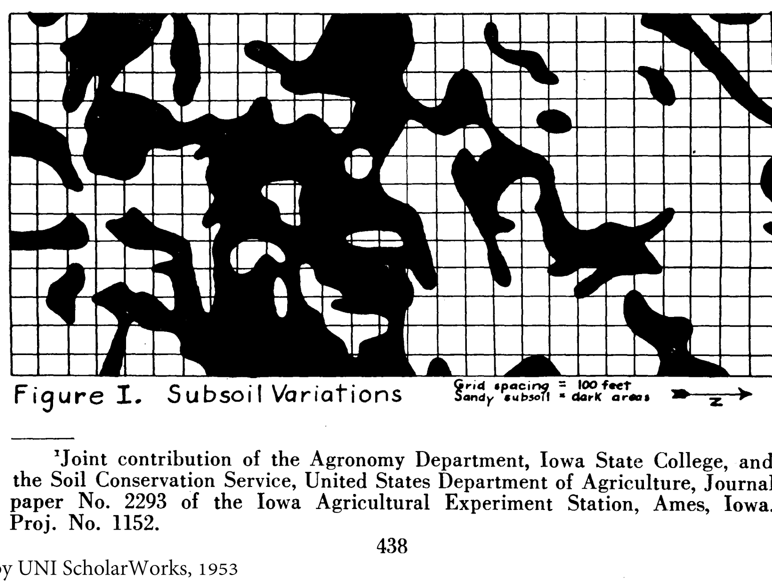

Figure I. Subsoil Variations    Grid spacing = 100 feet
Sandy subsoil = dark areas    N

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of sandy subsoil material were found in the non-sandy subsoil areas.

The orientation of the stratified sandy subsoil material in the northeast-southwest direction is not related to the present topography as shown by a map constructed on a 1-foot contour interval. The maximum relief is 8 feet. The highest point is 500 feet south of the northeast corner, and the lowest occurs along the south side. The slope is to the northwest in the northern one fourth, to slightly north of west in the south one half of the north one half, and to the southwest in the south half of the area. Thus, the areas of subsoil textural variations intersect and cross the contour lines of the present surface. It appears the control necessary for a channeling of water to deposit the stratified sandy subsoil material is not present in the existing surface.

The stratified sandy subsoil material is thought to have resulted from features existing during the recession of the glacier from the area. The orientation of the subsoil variations in the northeast-southwest direction closely parallels the moraine outlined by Ruhe (2) as is shown in Figure II. Goldthwait (1) indicates that drainage streams form in troughs parallel to the ice front in the formation of end moraines. He also states "—that the distinction between these end moraines and the intervening ground moraine is only one of relief and magnitude of the local roughness." Thus, it seems feasible to apply his idea of streams being parallel to the ice front in this area of ground moraine. The ice core moraine formed at the side of the trough opposite the active ice front could act as a control to guide melt water in a manner which is essential to give the oriented, sorted, sandy subsoil material. Such a control is necessary since the present surface is apparently unrelated to the orientation of the subsoil variations. The less oriented nature of the material in the south one half of the area may be related to the escape of water through the ice core moraine to the stream at the southeast or south (Figure III). However, the major trend appears to be the same but with a less definite separation of the sandy subsoil areas by the less sorted subsoil areas. It may be the result of the formation of narrower troughs with correspondingly smaller ice-core moraine.

It seems the partially reworked material which occurs with till in the finer textured subsoil areas could result from a shallow cover of ablation moraine on the ice-core moraine. The relatively uniform surface texture could result from washing of the ablation residue into the troughs. That is, the washing of the poorly sorted finer fractions out of younger troughs into older troughs after the

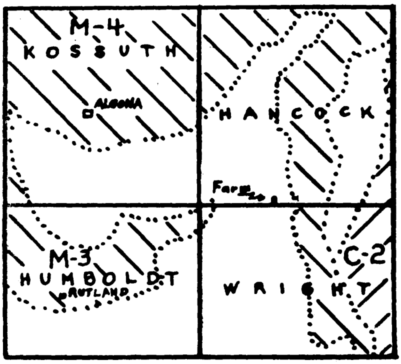


Figure II. Morainal Pattern of Hancock, Humbolt and part of Kossuth and Wright Counties.
••• End moraine margin.
M-3, M-4: Mankato moraines.
C-2: Cary moraines.

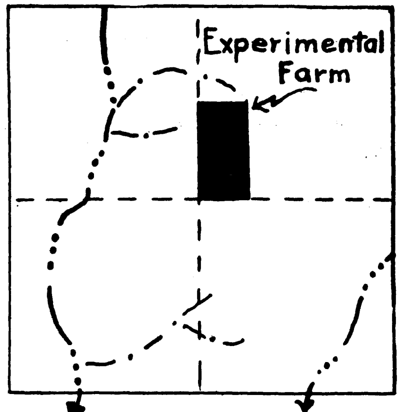


Figure III. Drainage
••• major drainageway
• intermittant drainageway

sandier material was deposited. The possibility of poorly sorted local loess cannot be excluded but it appears the material contains too much clay for this to be feasible. The conditions necessary for the orientation of escaping water could be brought about by a rapidly receding but active glacier. If the glacier were stagnant, there would be no reason for an orientation of the escaping water.

An alternate explanation is that melt water between the marginal moraine, in the middle of Hancock County (Figure II), and the receding ice front did not have well developed outlets so that water flowed across and sorted the till surface material. This explanation does not explain the orientation of the subsoil variations unless one can assume the present surface is entirely different from the surface left by the glacier. It would be possible for a parallel swell and swale topography to orient water but it seems the present surface should have been deposited as a topographic expression of this orientation if this were true. It would also appear that a mass of water would concentrate in the drainageways (Figure III) and not flow across this area unless ice-core morainal systems were present to act as a control. It is not known whether an erosional pebble band exists on the buried till surface. The depth of the till surface from the present surface is not known since in part of the area it was impossible to tell from auger borings whether the material was till or reworked till. In most of the sandy subsoil areas, no till-like material was encountered within the 60-inch depth.

The first explanation of the variations found in the soils and subsoils of this tract seems the best available at this time. The tract investigated is small in comparison to the conclusions which have been made. It would be desirable to have a map of a larger area, but more than 30 man-days of work by soil survey personnel were required to map this 80 acres so that the cost would be prohibitive for a larger area.

## Literature Cited

(1) Goldthwait, R. P. 1951. Development of end moraines in east-central Baffin Island. Jour. Geol. 59: 567-577.
(2) Ruhe, R. V. 1952. Topographic discontinuities of the Des Moines Lobe. Am. Jour. Sci. 250: 46-56.

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