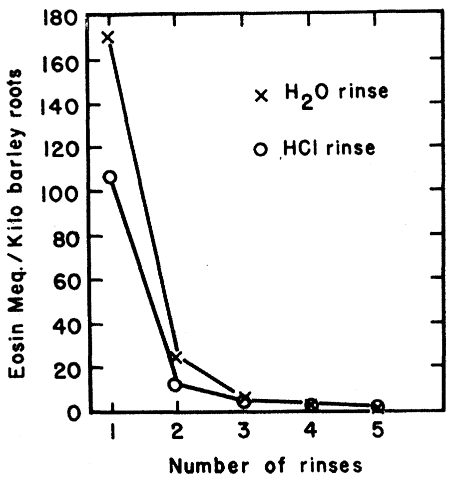

Fig. 3. Amount of eosin released from barley roots by rinsing with H_2O or 0.01*N* HCl.

The data plotted with *o*'s in Fig. 2 were obtained by saturating oat roots with eosin at *p*H values ranging from 2 to 12 and releasing the dye from the roots with 50 ml of 0.1*N* NaOH. The resulting alkaline eosin solution was neutralized with 50 ml of 0.1*N* HCl, and the eosin concentration was determined on the colorimeter. These data substantiate the other data of Fig. 2.

The excess eosin solution which adhered to the root after immersion in the dye solutions was removed by five 10-second rinses in 200 ml of distilled water.

The amount of dye in each succeeding rinse appeared to be too high for mere dilution of excess saturating solution left clinging to the root surface. Calculation showed that released dye was in greater concentration than it should have been and, therefore, the rinse must have contained adsorbed dye released from the root. To minimize the loss of adsorbed dye, roots were washed in HCl at the *p*H of the saturating dye solution. A comparison of the amount of dye removed from root surfaces by HCl (at *p*H 2.0) and by H_2O is found in Fig. 3. In each instance the roots were agitated vigorously for 6 seconds in the wash solutions. An increase in *p*H of the wash solution results in a loss of exchange sites which is the difference in the sum of the milliequivalents of eosin removed from the roots in the first and second rinses. The use of HCl as a rinse has the advantage of maintaining the acidity at the *p*H used in saturating the roots with dye while the excess saturating solutions from the root surface are being removed. From Fig. 1 it is obvious that Cl^- itself has considerable replacing power for removing adsorbed eosin from the root surface. However, of the anions examined, only F^- ion replaced less eosin than did Cl^-.

Lundegårdh (*3*) found that anions had a marked effect on root potentials. He concluded that "potential measurements favor the assumption that anions of neutral salts are adsorbed to the surface layer of the protoplasm by exchange. Hence the surface layer also possesses positive valencies, which in the absence of anions of acids are saturated only by OH^- (and a small amount of HCO_3^-) ions." My results are in agreement with Lundegårdh's conclusion of positive adsorption sites. However, the data in Figs. 1 and 2 are more suggestive of the type of site which amino groups would produce and these groups, rather than being saturated with OH^-, appear to be neutral in alkaline solutions.

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27 July 1962

Particle-Size Analysis of Valders Drift in Eastern Wisconsin

Abstract. Analysis of the fraction of Late Wisconsin deposits less than 2 mm in diameter has shown a wide range in textural composition of glacial tills. Massive lake sediments were high in clay content and contained less sand than the till of the same textural class. Glaciofluvial and eolian deposits were loamy to sandy and sandy, respectively.

Valderan drift of Late Wisconsin age (*1*) constitutes the parent material from which soils in a large area of eastern Wisconsin (see inset, Fig. 1) are formed. This drift was derived in part from pre-existing lake sediments, and as a result has a characteristic reddish-brown hue (*2, 3*). Some of these deposits have been shown previously to be of finer texture than associated Cary (Middle Wisconsin) drift (*2, 3*). The primary objective of our study has been to characterize in more detail the particle-size-distribution of Valderan deposits in this region.

Samples of drift were collected throughout the region at depths ranging from 2 to 15 feet (*4*). Most of them were obtained from C horizons—a layer of relatively unweathered drift below the soil solum believed to be similar to that from which at least part of the overlying soil was formed. When lithologic discontinuities were found below the solum, the significant contrasting layers were sampled. All samples were classified as to genetic origin in the field on the basis of their lithology and the physiographic characteristics of the land forms on which they were found. Care was taken not to sample disturbed or contaminated material.

Bulk samples were air-dried, and gravel was removed with a sieve (No. 10 U.S. Standard). The particle-size distribution of the fraction less than 2 mm in diameter was determined according to the method outlined by Day (*5*); a hydrometer was used to determine the percentage of silt and of clay. Carbonates were not removed before analysis. After the results had been plotted on cumulative curves, percentages of sand (2.0 to 0.05 mm), silt (0.05 to 0.002 mm), and clay ($<$ 0.002-mm diameter) were obtained and plotted on a textural triangle (U.S.D.A.) (*6*) (Fig. 1).

Results of these analyses showed that 169 of 288 samples contained more than 27 percent clay. These were included in four fine or moderately fine textured classes as follows: (i) 67 clay loams, (ii) 60 clays, (iii) 25 silty clays, and (iv) 17 silty clay loams. The high clay content of soils formed from these sediments and the characteristic red color, have resulted in the local designation, "red clays." In a similar manner, the area in which these sediments occur is commonly called the "eastern red clay region."

Of the 119 samples containing less than 27 percent clay, 97 were medium to moderately coarse textured and were included in the following textural classes: (i) 48 sandy loams, (ii) 43 loams, and (iii) 6 silt loams. One sample of sandy clay loam texture containing less than 26 percent clay was also included in this group. The remaining 21 samples were coarse textured and included 7 loamy sands and 14 sands.

An interesting characteristic of most of the samples was their silt content. Out of the 288 samples, 209 contained between 30 and 50 percent silt. Of these 209 samples, 185 consisted of glacial till, mainly of loam texture or finer; 23 were glaciolacustrine sediments; and 1 was a sandy loam glaciofluvial deposit.

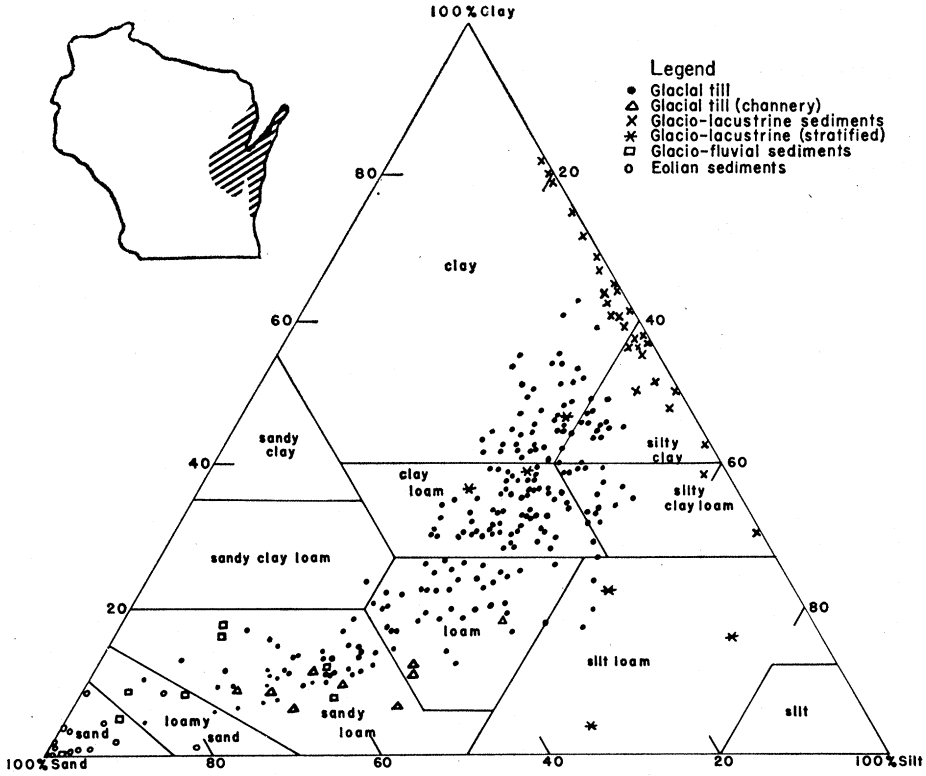

Fig. 1. Textural chart showing percentage of sand, silt, and clay in 288 samples of Late Wisconsin (Valderan) glacial drift from eastern Wisconsin. The hatched area of the small outline map (inset) shows the area studied.

Nine of the till samples were called channery tills because they consisted mainly of angular dolomitic rubble (channer) and flags, in a matrix of rock flour. The fact that the fraction less than 2 mm in diameter, in over half of the channery till samples (five out of nine), included from 30 to 50 percent of highly dolomitic silt-size material suggests that the silty nature of these and other tills in eastern Wisconsin may be due in part to inclusions of rock flour eroded from Silurian or Ordovician dolomite by glacial ice.

According to the field classification, 232 of 288 samples that were studied consisted of glacial till. Thirty-four samples were classified as glaciolacustrine sediments (28 nonbedded or massive, 6 stratified), 14 as eolian or wind-reworked lacustrine sands, and 8 as glacial outwash.

Glacial till samples ranged in texture from clay to loamy sand. The most common till textures were clay loam, clay, loam, and sandy loam, in that order. All till samples contained more than 5 percent sand and all but five contained over 10 percent. Most of the samples contained gravel or channer; field studies of till exposures indicated that coarser clastics, that is, cobbles, flags and boulders, were usually present. Both the gravel, and cobbles and boulders, when present, consisted mainly of dolomite, but the proportion varied with the region (*7*).

Massive glaciolacustrine samples consisted mainly of silt and clay. Of the 28 samples obtained from C horizons of Oshkosh soils and classified in the field as massive or poorly stratified glaciolacustrine sediments, 26 contained less than 2 percent sand. The other two contained only slightly more (5 and 3.5 percent). According to textural classes, there were 15 clays, 11 silty clays, and 2 silty clay loams. Deposits readily identified in situ as being stratified contained somewhat more sand and generally less clay than nonbedded sediments. Three of these samples were silt loams, two were clay loams, and one was a clay.

It should be noted that sandy and loamy lake sediments may also be found in the Valderan drift region. Many of them exist as leached surface deposits overlaying finer textured drift and as such were not sampled during our study. Probably some of the samples classified as eolian deposits were originally sandy lake sediments that had been reworked by wind action. All glaciolacustrine samples were essentially gravel-free; however, gravelly beach deposits can also be found in the region (*3, 7, 8*).

Glaciofluvial and eolian deposits were dominantly moderately coarse to coarse textured. Four glaciofluvial samples were sandy loams (one of these was a fine sandy loam), the other four were loamy sands and sands. These sediments were poorly sorted compared with the eolian deposits which consisted almost entirely of very fine or fine sands. Studies of bulk samples of the same glaciofluvial deposits (*7*) have shown their gravel content ranges from 8 to 67 percent. Most samples fall in the 40 to 50 percent range (*9*).

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