phosphate solution without carrying along phosphate in some manner.

Barton-Wright and McBain also announce in the same article that a crystalline product has been obtained which was free of nitrogen, but contained phosphorus and active virus. In 1928, I obtained several crystalline products,[7] one of which, for instance, was recrystallized three times. The recrystallized product contained virus, as its solutions were infectious, but 358 milligrams of the air-dry crystals contained no Kjeldahl nitrogen. Qualitative tests for reduced sulfur, sulfate, phosphate and chloride were negative. The product charred on heating and contained calcium. It was soon learned, however, that the mother liquor from which the original crystalline product was obtained seemed to contain the major portion of the infectious agent; consequently, the failure to find nitrogen in the sample taken was without particular significance. A dilution of 1 in 100 of our purified virus fractions would make the detection of nitrogen uncertain by the ordinary Kjeldahl method, using ordinary samples.

The virus fraction in most of our preparations is readily precipitated by means of a small amount of $N/_1$ aluminum sulfate solution. This did not hold true for the virus preparations obtained by the amyl alcohol procedure.

Under our conditions purified virus preparations which seemed to contain the major portion of the original virus have not yet been obtained free of nitrogen. This is not stated, however, as argument against the possibility of nitrogen-free preparations having been obtained by others under their conditions.

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## SOIL MINERALS AS A CHECK ON THE LOCATION OF THE WISCONSIN-ILLINOIAN DRIFT BOUNDARY IN NORTH CENTRAL OHIO

As a part of a study of the Pleistocene geology of the region in and around the reentrant angle in the glacial boundary in northeast central Ohio, the outer limits of the Wisconsin and of the Illinoian drift sheets were mapped with considerable care. Fig. 1 shows the location of these boundaries in Knox, Coshocton, Richland and Ashland counties. The Wisconsin boundary farther west, where no older drift lies beyond the younger, has already been described in detail.[1]

The problem of mapping the Wisconsin boundary, where Illinoian drift lies beyond, was more difficult than that of mapping the Wisconsin boundary, where no early drift lies beyond. The boundary between the Wisconsin and Illinoian drifts shown in Fig. 1,[2] was determined by a study of the varying amount of erosion, degree of drainage integration, depth of leaching, et cetera. Its position will be described in detail elsewhere. Incident to a study of the minerals in Wisconsin and Illinoian drifts,[3] it was discovered that the minerals in the soil of the two drifts had different characters. The location of the boundary between the two drifts was then checked by a study of the minerals in the soil. It is the purpose of this note to describe the results so far attained in mapping a boundary between drifts of two ages by means of a study of the soil minerals.

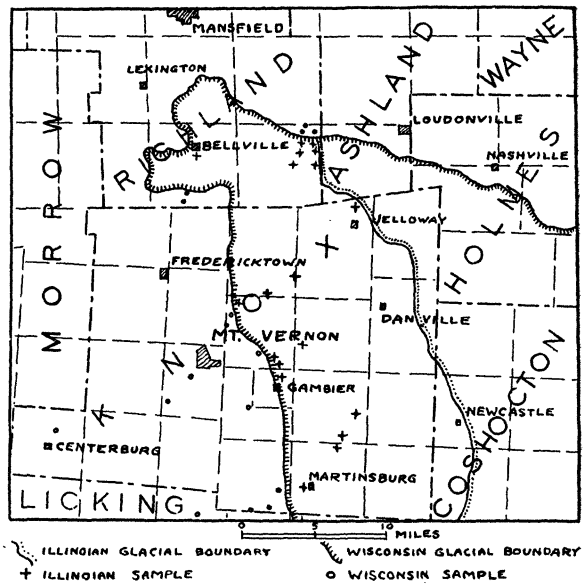


FIG. 1. Map of a portion of north central Ohio, showing areas covered by Wisconsin and Illinoian drift and location of soil samples taken.

Samples of surface soil from reasonably flat areas were collected for laboratory study. Samples were prepared for study as follows: About 25 grams were separated by washing and decantation into sand, silt and clay fractions. After just enough water had been added to wet the sample, it was ground for a few minutes with the ball of the thumb or with the index finger against the inside of a 150 cc beaker. The beaker was then almost filled with water and the silt and clay decanted from the sand. Decantation was repeated until the sand was free from silt and clay. The clay was decanted from the silt and the

[7] C. G. Vinson and A. W. Petre, "Mosaic Disease of Tobacco. II. Activity of the Virus Precipitated by Lead Acetate," *Contr. Boyce Thompson Institute*, 3: 142, 1931.

[1] G. W. White, "Glaciation of Northwestern Holmes County, Ohio," *Ohio Journal Sci.*, 31: pp. 429–53, 1931; "An Area of Glacier Stagnation in Ohio," *Jour. Geol.*, 40: pp. 238–258, 1932.

[2] The names of the townships within the counties shown may be determined from the Geologic Map of Ohio, published by the Geological Survey of Ohio.

[3] The writer is indebted to Professor William J. McCaughey, of the Ohio State University, for advice on methods of separation and examination of soil minerals.

silt and clay saved for possible later examination. The sand was separated into fractions with standard screens having openings of 1, 1/2, 1/4, 1/8, 1/16, 1/32 mm. The 1/2 to 1/4 and the 1/4 to 1/8 mm fractions were found to be best suited for study. These fractions were examined under a binocular microscope in reflected light and under a petrographic microscope in transmitted light.

The Wisconsin sand is fresh appearing and consists dominantly of quartz with small proportions of feldspar and hornblende, of occasional grains of heavy minerals and of a very few rounded iron oxide "pellets." Commonly, several grains of feldspar and hornblende are present in any microscopic field. The average mineral content of several samples is shown in Fig. 2. Many feldspar grains retain their cleavage

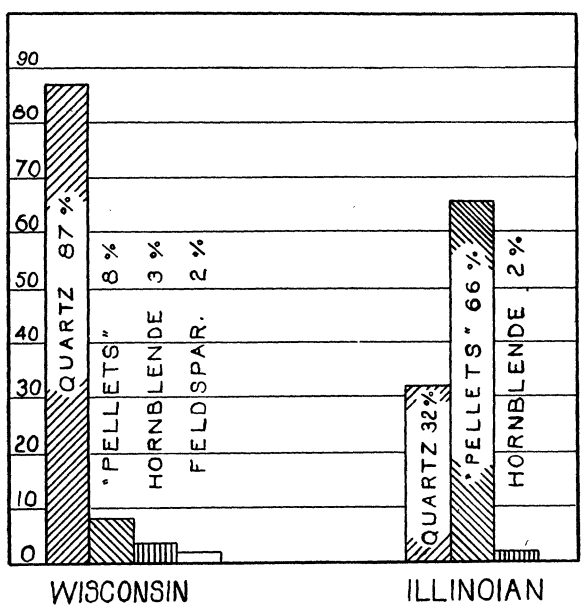


FIG. 2. Chart showing average mineral composition of $\frac{1}{4}$–$\frac{1}{8}$ mm grains washed from soils derived from Wisconsin and Illinoian till.

faces and most grains are very fresh looking. Many grains are only slightly turbid in transmitted light. The hornblende is rarely rusty and has cleavage faces usually as bright and shiny as those of freshly broken material.

The Illinoian sand is weathered and brown and in the washed samples is easily distinguished megascopically from the Wisconsin sand. Under the binocular the sand is seen to consist of about one third quartz and of about two thirds iron oxide "pellets." The average mineral content of Illinoian material is shown in comparison with that of Wisconsin material in Fig. 2. The quartz is sometimes stained with iron oxide. Feldspar is so rare that several microscopic fields may have to be examined to find one grain. The feldspar grains are rounded and pitted, and show no distinct cleavage faces. Most grains are very turbid in transmitted light. The hornblende grains are generally rusted and dull.

The iron oxide "pellets" were examined under the petrographic microscope, both in thin sections and as crushed fragments. The "pellets" are of two types: (1) More than 90 per cent. consist of angular grains of quartz silt in a matrix of brownish iron oxide. (2) A few pellets are small grains of quartz surrounded by a thick coating of iron oxide at least as thick as the radius of the core of quartz. Most of the "pellets" are spherical. Most are quite hard, so that considerable pressure is necessary to crush them —as much in some cases as is necessary to crush a feldspar grain. Their hardness is such that they offer little difficulty in the preparation of thin sections when embedded in balsam.

Surface samples so far studied were collected from the localities indicated in Fig. 1. These samples were definitely either of one type or of the other. The boundary between the two types of samples coincided with the boundary between the Wisconsin and Illinoian previously mapped by the use of other criteria. On either side of the boundary, samples collected within 200 yards of each other were as clearly different from each other as samples collected miles from the boundary.

After this method of distinguishing between Wisconsin and Illinoian drift appeared to be valid, based on examination of samples taken several miles from the boundary and of samples on either side of the boundary where it was quite definite, this method was then used in mapping the Wisconsin boundary in the "Davis Basin," just west of the Ashland-Richland county line, in sections 11, 12, 13 and 14, Worthington Township, Richland County, where the Illinoian drift border passes under the Wisconsin drift (Fig. 1). Using other criteria, the location of the Wisconsin boundary across the "Davis Basin" could not be determined more accurately than being within a belt from 1/2 to 1 mile in width because of puzzling topographic conditions and disturbing variations in depth of leaching. After examination of mineral grains washed from soil samples taken in the basin, a boundary was clearly indicated which is believed to be accurate within 100 yards.

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