GENESIS OF THREE SOILS DEVELOPED FROM MATERIALS RESIDUAL FROM LIMESTONE

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The close relationship between the productivity of soils developed over limestone and the underlying rock formation suggests a profile study as a guide to characterizing the various soils developed from limestone material.

Previous to the mapping of soils in some of the southwest Virginia counties, it was generally felt that the Hagerstown soils were the most fertile of those developed over limestone. Soon after mapping was started in southwest Virginia, interest was expressed by farmers and agricultural specialists in specific areas of soils which had been mapped previously as Hagerstown soils but which were considered to be of much higher agricultural value than other areas of the soils mapped in the Hagerstown series. Since there were sufficient morphological differences between the two soils for them to be definitely separated and since they occurred over different rock formations, they were separated, and the soil of greatest agricultural value has been correlated recently as Pisgah silt loam.

In an attempt to find the significant properties which are responsible for the agricultural differences between the two soils and also the influence of the parent rocks which furnished their materials, total analyses were made of samples from each horizon of the soils and their underlying rocks. As a guide to interpretation, a similar study was made of a profile sample of Clarksville cherty silt loam, which is considered to have the least agricultural value of the soils developed over limestone in the same area.

MATERIALS AND METHODS

MATERIALS

The profile samples for this investigation were taken in the fall of 1936 at the conclusion of the soil survey of Russell County, Va. The parent rock samples were taken in the fall of 1940. One sample of rock was taken for each corresponding soil type.

Three soil types, all occurring within the Gray-Brown Podzolic region, were investigated. These included the Hagerstown silt loam, Pisgah silt loam, and Clarksville cherty silt loam.

The Hagerstown silt loam profile sample was taken in a clover field in Russell County, Va., 1 mile east of Lebanon. It is underlain by a highly calcareous limestone belonging to the Lenoir formation (9), which in places contains a small amount of chert. Both internal and external drainage are good. As a result, erosion is not noticeable on slopes below 15%.

The Pisgah silt loam profile sample was taken in Russell County, Va., 3/4 mile south of Hansonville. It is underlain by a dolomitic limestone known as the Nittany dolomite, which is a member of the Copper Ridge formation (9), and it contains a considerable quantity of chert. In places chert comprises 35 to 40% of the soil mass. It occurs on the steeper slopes and ridges of the county. As a result, erosion is not noticeable on slopes below 15%.

The Clarksville cherty silt loam sample was taken in Russell County, Va., 1 mile northeast of Hansonville in virgin ground. It is underlain by a dolomitic limestone known as the Maryville formation (9), which in places contains a small amount of chert. Both internal and external drainage are good; as a result, erosion is not noticeable on slopes below 15%.

A detailed description of the soils used in this study can be found in the Russell County, Va., soil survey report.

METHODS

In the field sampling of these soils, duplicate samples of each horizon and subhorizon were taken according to the procedure followed in the sampling of profiles by the Soil Survey Division of the Bureau of Plant Industry.

One set of the samples was sent to the U. S. Department of Agriculture, Bureau of Plant Industry, where mechanical analyses were made according to the standard pipette method.

The other set of samples was brought to Blacksburg for the chemical analyses were made by the investigating to the methods described by the Association of Official Agricultural Chemists (2), with the exception of the nesia determination which was made according to the methods as described by Handy (4). The pH determinations were made by means of the glass electrode, using 25 grams of soil mixture had been thoroughly stirred and allowed for 30 minutes.

DISCUSSION OF RESULTS

MECHANICAL COMPOSITION

The mechanical analyses of the soils investigated are given in Table 1 and are graphically represented in Figs. 1, 2, and 3. The data show that both Hagerstown silt loam and Clarksville cherty silt loam are classified as a clay according to standards set up by Black (3). The analyses were made according to the methods described by Handy (4). The pH determinations were made by means of the glass electrode, using 25 grams of soil mixture had been thoroughly stirred and allowed for 30 minutes.