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I am submitting herewith a dissertation written by Janice L. Branson entitled "Soil Genesis and Classification in the Whiteoak Mountain Fault Block in East Tennessee." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Plant and Soil Science.

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SOIL GENESIS AND CLASSIFICATION IN THE WHITEOAK MOUNTAIN FAULT BLOCK IN EAST TENNESSEE

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Janice Branson

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DEDICATION

This work is dedicated to my parents, Beulah and James H. Branson, Jr., and my sister, Sharon Beeler, without whose support it would not have been possible.

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ABSTRACT

Geological processes have forged an atypical region of geomorphic and stratigraphic diversity in the Ridge and Valley physiographic region of East Tennessee. Soils developing in the mélange of parent materials reflect this heterogeneity. Objectives of this study were 1) to better understand the geological stratigraphy of the Ridge and Valley area, 2) to determine the genesis of soils forming in a variety of parent materials, 3) to examine soils forming in specific parent materials to discern properties uniquely characteristic to those soils, 4) to identify specific properties utilizable for field recognition of these soils, and 5) to classify these soils to the family level.

Within the Whiteoak Mountain fault block, geologies range from the Cambrian Rome Formation to the Ordovician Moccasin Formation. Properties of each rock unit vary to some extent. This complexity has induced a great diversity in soil genesis.

Sixty-one pedons from the Whiteoak Mountain thrust block were sampled for soil genesis and classification. A transect of thirteen soils was examined over a sequence of Cambrian to Ordovician aged geological units including the Rome Formation, Knox Group, and the Chickamauga Group. Soil genesis of forty-eight pedons directly related to the Copper Ridge Formation and the Maryville Formations were studied in Roane and Anderson Counties, Tennessee.

Soil morphology was described for each site. Horizonization, texture, structure, consistency, redoximorphic features, and any other observable property was noted during excavation. Laboratory analyses for soil characterization included pH, total carbon, particle size, free iron oxides, cation exchange capacity, percent base saturation, total acidity, KCl extractable aluminum, and hydroxylamine-HCl extractable manganese.

Parent materials in the thirteen soil transect included alluvium, colluvium, and residuum. Soils evolved from Chickamauga Group geologies were classified as Typic Paleudults and Typic Hapludalfs. Classification of soils developing in materials from members of the Knox Group

included Typic Paleudults, Typic Fragiudults, Typic Kandiudults, Typic Hapludalfs and Typic Hapludults. The Rome Formation had weathered to form soils classified as Ultic Hapludalfs and Typic Hapludults. Soils derived from fault breccia and an alluvial/colluvial deposition were classified as a Typic Hapludalf and Typic Hapludult, respectively. The primary differences among these pedons resulted from the influences of geological parent material, site position, slope, and erosion.

Soil formation in Copper Ridge parent materials resulted in development of low activity clays with kandic horizonization. Of the 24 pedons examined, 54% had developed kandic horizons. Kandic horizons with hues of 5YR and 2.5YR had average clay contents of 49 and 68%, respectively. Non-kandic argillic horizons averaged 34 and 55% clay in the 5YR and 2.5YR horizons. Kandic horizons had developed in both colluvial and residual materials. For field identification, intense redness of soil matrix color along with high clay content in soils forming in Copper Ridge colluvium/residuum would present a greater than 54% possibility that kandic horizonization had occurred.

Soil evolution in Maryville parent materials was very consistent over the twenty-four pedons examined. These soils were not very deeply weathered. Paralithic contact occurred at less than 100 cm in 75% of the pedons. Particle size class was predominantly clayey. Classification varied primarily due to thickness of the argillic horizon. Forty-two percent were Ochreptic Hapludults, while the remaining 58% were Typic Hapludults.

Weathering of the diversity of rock units in the Ridge and Valley physiographic region has resulted formation of a variety of soils. Soils properties were directly related to the geological parent material with variations primarily resulting from differences in site position. Knowledge of the geological lithologies of a region is a valuable tool in the examination of soil genesis and classification.

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CHAPTER 1 OBJECTIVES

This study embraces five objectives: 1) to better understand the geological stratigraphy of the Whiteoak Mountain fault block, 2) to determine the genesis of soils forming over different rock units, 3) to examine soils forming in specific parent materials to discern properties uniquely characteristic to those soils, 4) to identigy specific properties utilizable for field recognition of thiese soils, and 5) to classify these soils to the family level.

The Whiteoak Mountain fault block encompasses an area bounded by the Whiteoak Mountain fault to the northwest and the Copper Creek fault to the southeast. Demarcation of the Whiteoak Mountain fault occurs where the Wallen Valley fault merges with or disappears under the Hunter Creek fault (Fig. 1) (Rodgers, 1970). Much of Roane and Anderson Counties in East Tennessee lie within this unit (Fig. 2). Rock units deposited during the Cambrian and Ordovician geological periods comprise the stratigraphic units underlying the ridges and valleys of this fault block (Fig. 3). Weathering of these diverse lithologies have had a major impact on the formation of soils in this section of the Ridge and Valley physiographic province in East Tennessee.

Chapter 2 contains a literature review of the major geological units found within the Whiteoak Mountain fault block. Detailed geologic investigations have provided data related to the depositional environments, biological relationships, and structural fabrics of these rock units, but most often in terms unfamiliar to non-geologists. Nomenclature applied to a specific rock unit often varies by location. In chapter 2, basic information on the major rock units in the Whiteoak Mountain fault block is presented to assist in recognition of these units in the field.

Chapter 3 involves a discussion of soils sampled along a transect across rock units of the Whiteoak Mountain fault block. These soils are diverse and represent the influence of the five soil forming factors (Jenny, 1941). Comparisons of soils developing in similar rock units will show properties shared by these soils and those in contrast due to factors, such as site position, slope,

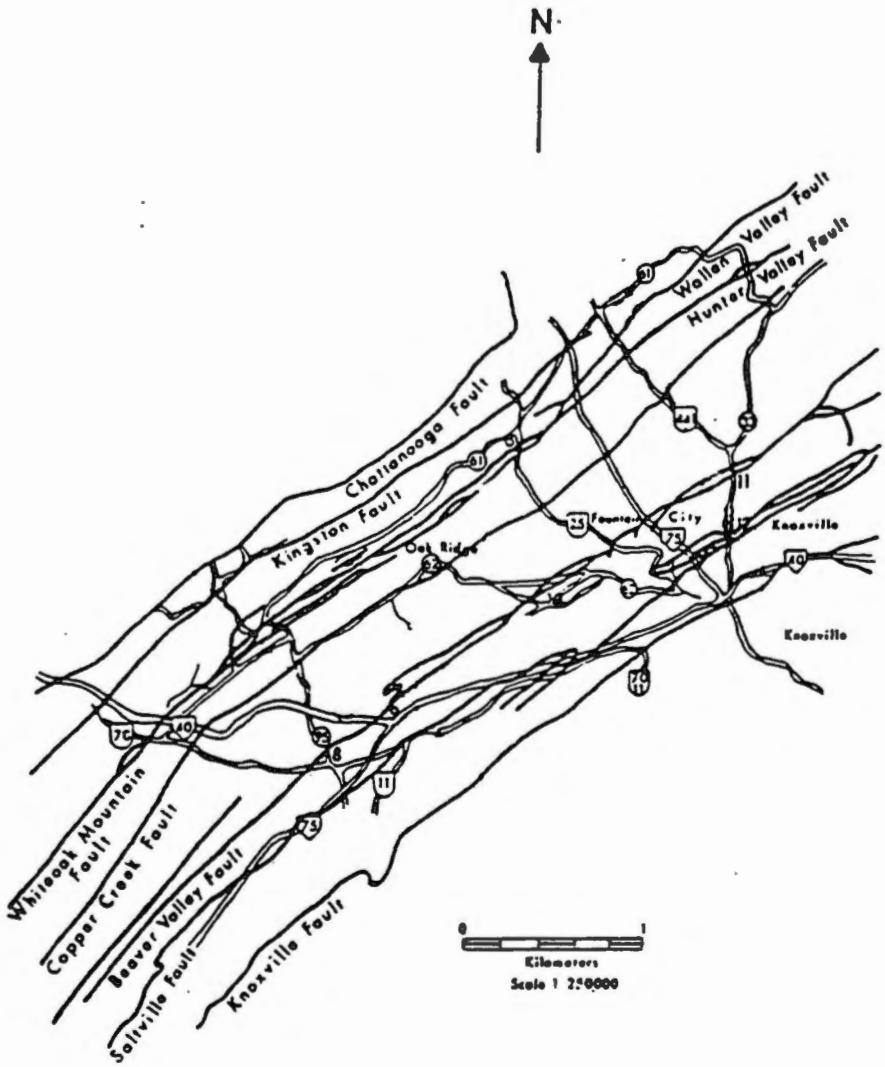
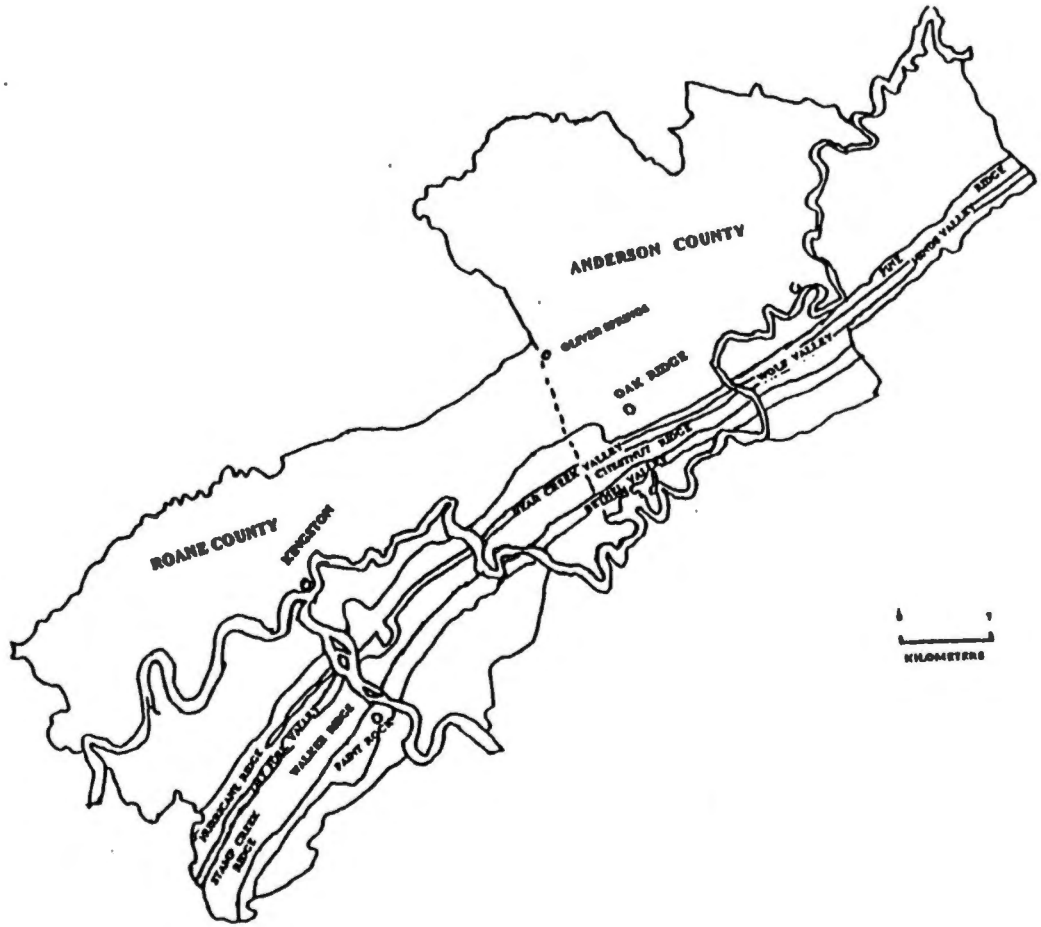


Figure 1. Major thrust faults of the western portion of the Ridge and Valley. The study area is located between the Whiteoak Mountain fault and the Copper Creek fault (modified from Ossi, 1979).



.Figure 2. Location of the major ridges and valleys in Roane and Anderson Counties in the Whiteoak Mountain fault block.

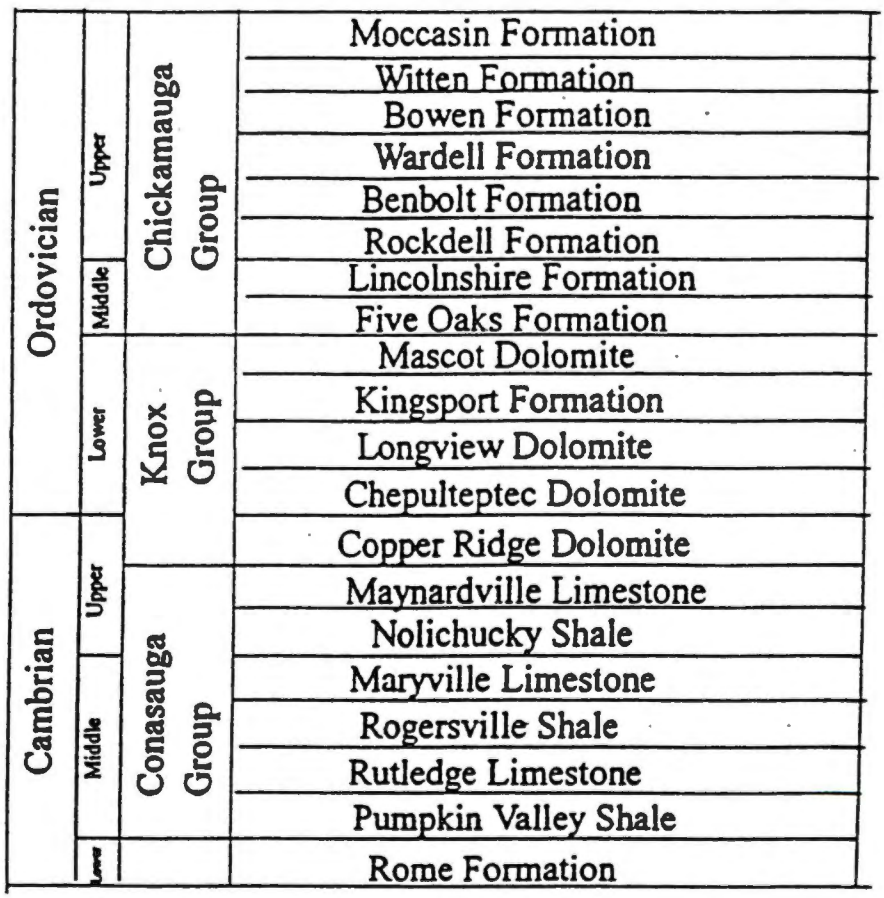


Figure 3. Cambrian-Ordovician geological units of the Whiteoak Mountain thrust block.

and aspect. Logically, properties of soils formed in contrasting rock units should differ, but often will have shared characteristics.

Chapter 4 is an in-depth study of twenty-four soil pedons which had developed from the Copper Ridge formation. Many soils of the southeast have been deeply weathered and highly oxidized similar to those of the present day tropics. These soils contain low activity clays (kandic horizons) having management requirements which differ from other soils. Identification of the kandic horizon is based on laboratory criteria. Recognition of kandic horizons in the field is difficult due to variances in soil physical properties, i. e. soil color, structure, and soil texture. In this chapter, an investigation of soils specifically related to the Copper Ridge Formation will determine if kandic horizons are present and if there are any identification properties utilizable in field studies.

In chapter 5, soils related to the Maryville Limestone will be examined for continuity of chemical and physical properties. Soil pedons formed on continuous landscapes will be examined for differences and similarities as related to landscape position. Transported parent material has been a major influence in the genesis of the soils for this study. Each soil will be examined for evidence of alluvial, colluvial, and/or loessial influences.

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CHAPTER 2. CAMBRIAN-ORDOVICIAN GEOLOGY AND SOILS OF THE WHITEOAK MOUNTAIN THRUST BLOCK

Folding and faulting have exposed many different rock units across the Ridge and Valley physiographic region. When weathered these rock units produce a diversity of soil materials. Fault blocks, the area between major faults, generally contain similar stratigraphic units. However, specific units may be missing due to nondeposition, occlusion by faulting, or erosional processes.

The objective of the aspect of this study was to review the available literature to 1) identify the Cambrian-Ordovician rock units of the Whiteoak Mountain fault block in Roane and Anderson Counties, Tennessee, 2) discern the character and properties of those units, and 3) identify soil taxons which typically form in the parent materials related to those units.

LOCATION OF THE STUDY AREA

The White Oak Mountain thrust block is located in the strike-belt bordered to the northwest by the White Oak Mountain fault and to the southeast by the Copper Creek fault (Belvin, 1975) (Fig 1). North of Clinton, Tennessee (Anderson County), the Wallen Valley fault merges with or disappears under the Hunter Valley fault to form the Whiteoak Mountain fault, which persists southwestward across Tennessee into Georgia. The Copper Creek fault first appears southeast of Big A Mountain and continues across the state with little change. (Rodgers, 1970).

Geographically, a large area of the fault block is located in Roane County and Anderson County, Tennessee. Specific areas of interest included Pine Ridge, Hurricane Ridge, Wolf Valley, Bethel Valley, Bear Creek Valley, Dry Fork Valley, Chestnut Ridge, Stamp Creek Ridge, and Walker Ridge (Fig. 2). Nomenclature often differs by locality, but actually identifies the same ridge or valley over linear distance. For instance, in Roane County, Walker Ridge and Stamp Creek Ridge indicate the same ridge with only a water gap between them.

GEOLOGICAL STRATIGRAPHY

Stratigraphy of the Whiteoak Mountain fault block ranges in age from Cambrian to Ordovician (Fig. 3). Cambrian units include the Rome Formation, Conasauga Group, and Copper Ridge Dolomite of the Knox Group. Remaining formations of the Knox, as well as the Chickamauga Group, represent the Ordovician. To the west, the Whiteoak Mountain Fault marks the location where the Rome Formation has been thrust over the Chickamauga Group of the Kingston fault block. Similarly, the eastern boundary is marked by the thrusting of the Rome of the Copper Creek fault over the Chickamauga of the Whiteoak Mountain fault block (Fig. 4).

Rome Formation

In the Whiteoak Mountain fault block, the Rome Formation occupies the upper third of the south side of Pine Ridge and continues on the north side of Pine Ridge to the fault zone near the base of the northwest facing slope. Several outstanding features distinguish the Rome from other formations. The comby or cockscomb topography of the ridges it underlies, the variegated colors of the rocks, and the primary structural features, including ripple marks, and mudcracks are all characteristic of the Rome Formation.

The Rome Formation is well know for its colorful expression. During the Cambrian period, the area which would become East Tennessee lay approximately 15 degrees south of the paleoequator (Bambach et al., 1980) (Wicander and Monroe, 1989). Red colors are derived from iron oxides which originated under tropical to subtropical environments in both the original source area and the depositional area (Byerly et al, 1986). These hues are primarily evident in the lower and middle beds. Greens and grays are a result of the glauconite common in the Rome. Carbonates of this unit commonly produce a brownish-yellow color.

A variety of lithological units may be found in the Rome Formation as a result of the unit's

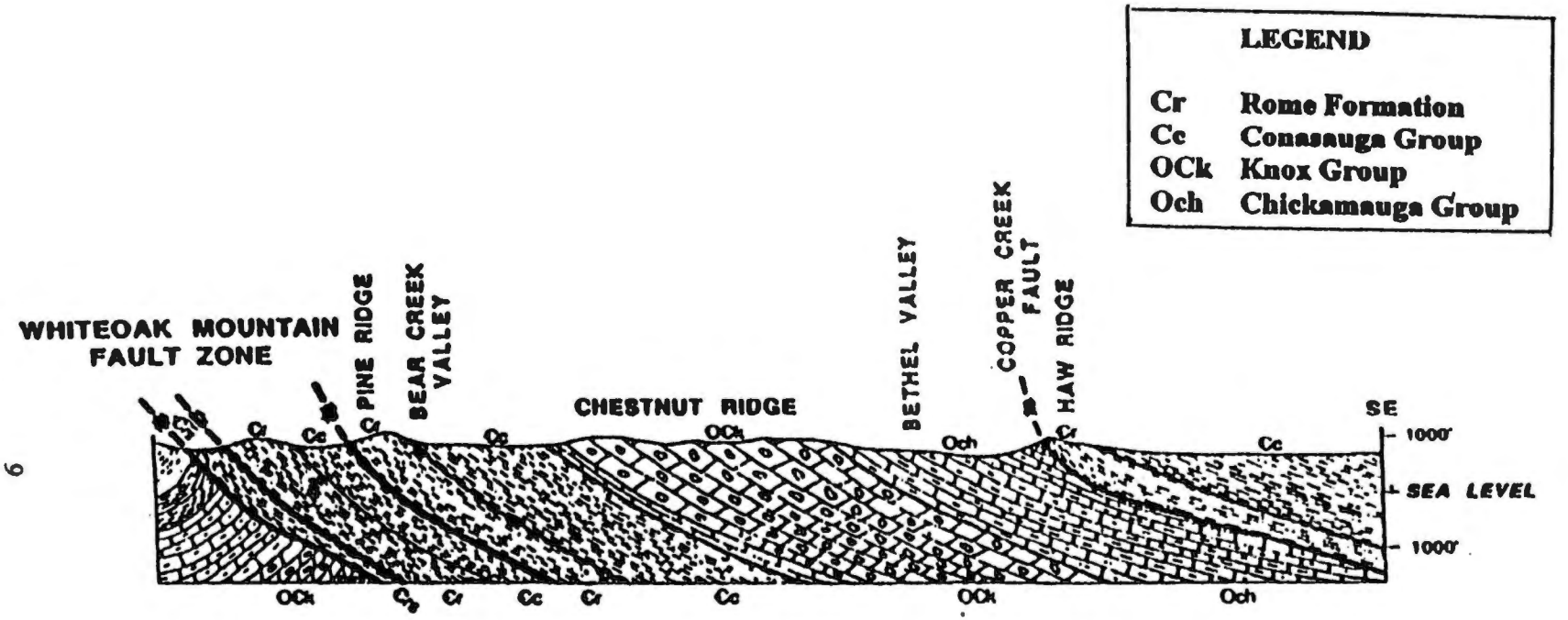


Figure 4. General cross section of the topography and geology of the Whiteoak Mountain thrust block (Lee et al, 1988).

tidal flat depositional environment. Mudstone with red bed sediments, shale, and dolomite often occur, with sandstone and siltstone the predominant rock units of the Rome (Samman, 1975)

Sandstone and shale of the Rome Formation underlie Pine Ridge and tend to form thin, sandy, residual and colluvial soils that overlie fractured and weathered bedrock. Slopes on Pine Ridge are steep (Lee et al, 1988). The unit weathers into soil containing shale and siltstone fragments and small sandstone blocks. Bluish-white, tan, brown, and chalcedonic chert are common to weathered dolomite and limestone members (Lemiszki, 1992).

In the Whiteoak Mountain thrust block, soils forming in sandstone containing feldspar and siltstone of the Rome Formation contain strong brown clay enriched subsoil horizons (Typic and Ochreptic Hapludults). Typic Dystrochrepts are the characteristic soil taxon found in the hard pinkish fine-grained sandstone that is mostly cemented by iron oxides. Red and dark red mudstones have developed into soils classified as Typic Dystrochrepts or Ochreptic Hapludults depending on slope gradient. Colluvial soils are classified as Typic Hapludults (Lee et al, 1988).

Conasauga Group

Six formations of alternating shales and limestones comprise the Conasauga Group including the Pumpkin Valley Shale (oldest), Rutledge Limestone, Rogersville Shale, Maryville Limestone, Nolichucky Shale, and Maynardville Limestone (youngest) (Fig. 3). On the Oak Ridge Reservation, the Rutledge and Maryville Formations, due to lithological differences from the type localities of these formations, have been designated as the Friendship and Dismal Gap, respectively (Lemiszki, 1992). To prevent confusion, the designations Rutledge and Maryville will be used in this review since they have been more prevalently used across the Ridge and Valley region.

The Conasauga Group typically occurs in outcrop bands of varying widths (Lee et al, 1988). Transitional boundary zones between each formation can extend from 50 to 100 ft. (15.2-30.4 m) wide while others may be less than 25 to 50 ft. (7.6-15.2 m) (Lee et al, 1988) In the Whiteoak

Mountain fault block, the Conasauga Group underlies Wolf Valley, Bear Creek Valley, and Dry Fork Valley (Fig. 2).

Pumpkin Valley Formation. Soils related to the Pumpkin Valley Formation vary due to the diversity of rock types in this unit. Ruptic-Ultic Dystrochrepts develop in the upper rock unit of interbedded claystone and siltstone. Lower Pumpkin Valley lithology is dominated by more permeable siltstone and very fine-grained glauconitic sandstone. Soils are Typic Hapludults with some Ochreptic Hapludults. Typic Dystrochrepts are found on slopes steeper than 45° (Lee et al, 1988).

Rutledge Formation. Thin bedded shale and siltstone divide the limestone of the Rutledge Formation into an upper and lower member. Limestone is light gray in color, while shale and siltstone are reddish-brown and gray (Haase et al., 1985). Topography of the Rutledge Formation is a generally linear depression underlying flowing streams or which have been largely filled with colluvium derived from the Rome and Pumpkin Valley formations. Ruptic-Ultic Dystrochrepts often develop in Rutledge materials (Lee et al, 1988).

Rogersville Formation. Shale of the Rogersville Formation is very thin to thin bedded, gray, green and red. Siltstone lenses , some containing glauconite, can be present (Lemiszki, 1992). In some areas, the Craig Limestone unit may divide the unit (Haase et al, 1985). However, in mapping within the Bethel Quadrangle of the Oak Ridge Reservation area, Lemiszki (1992) did not observe this limestone unit. On slopes less than 6%, soils have evolved with a yellowish brown to yellowish red clayey subsoil and are Typic Hapludults. Ruptic-Ultic Dystrochrepts form in soils of steeper slopes (Lee et al, 1988).

Maryville Formation. Maryville lithology consists of calcareous siltstone, argillaceous limestone, and a thin strata of very fine grained calcareous sandstone. Glauconitic materials occur in the lowermost part of the formation. Saprolite, chemically "rotted" rock *in situ*, has a relatively

high iron oxide and manganese content as reflected by thick bright red or dark red iron oxide coatings or fragments often underlain by thick black manganese oxide coatings or fragments. Dominant Maryville soils are Ruptic-Ultic Dystrochrepts. However, Typic Hapludults generally form in soils on stable landforms with red or yellowish red subsoils evolved from saprolite. Typic Dystrochrepts occur only on the steepest sideslopes. (Lee et al, 1988)

Nolichucky shales. Nolichucky shale is medium to massive bedded, gray, green, maroon, calcareous, and interbedded with micritic and oolitic limestone (Lemiszki, 1992). Compared to the Maryville Formation below and the Maynardville Formation above, the Nolichucky has a relatively low calcium carbonate content. The dominant soils on the Nolichucky are Ruptic-Ultic Dystrochrepts with Typic Dystrochrepts on very steep slopes. Soils forming on stable landforms with yellow brown to strong brown clay enriched subsoils are classified as Typic Hapludults (Lee et al, 1988).

Maynardville Formation. The Maynardville Formation consists of high carbonate content limestone containing clay and silt, but little iron. When weathered, saprolite does not form. Topographically, the formation occupies floodplains and low terrace positions. Soils are shallow and rock outcrops are common. The lowermost part of the Maynardville Formation is a clay rich or argillaceous limestone with interbeds of claystone in the transition zone where the Maynardville merges with the uppermost Nolichucky Formation. Soils are either Hapludalfs or Hapludults depending on depth to rock and amount of leaching (Lee et al, 1988)

The transition between the Maynardville Formation and the Copper Ridge member of the Knox Group is a low chert content dolomite or dolomitic limestone that contains impurities of silt and clay sized particles and iron oxide. This transition zone may be covered by thin to thick Knox colluvium or Pleistocene to modern aged alluvium and colluvium. (Lee et al, 1988)

Knox Group

The most widespread rock unit in East Tennessee (Hershey and Maher, 1963) is the Knox Group. Lithology of the Knox varies greatly across the Ridge and Valley physiographic region. In the Whiteoak Mountain thrust block, the Knox is dominated by thick bedded siliceous dolomite that produces much chert (Rodgers, 1953). Formations in the Knox Group commonly contain karst features dominated by dolines of differing size (Ketelle and Huff, 1984).

In the East Chestnut Ridge area of the Whiteoak fault block, the Knox Group is composed of five members: Copper Ridge (oldest), Chepultepec, Longview, Kingsport, and Mascot (youngest) (Fig. 3).

Copper Ridge Formation. An abundance of chert is characteristic of the Copper Ridge Formation. Much of the chert developed from oolites and cryptozoans in which the original calcium carbonate was replaced with silica (Haney, 1966) . Silicified ooids are gray, white, or concentrically banded in a matrix of white chert. Spherical, oval, tabular, or onion shaped ooids may be present (Lemiszki, 1992).

Lower Copper Ridge dolomite is dark gray and brown, massively bedded, and medium to coarsely crystalline. A strong petroliferous odor emanates from freshly broken rocks. Oolitic beds that have been replaced by chert are very distinctive, but in unweathered rock these beds are difficult to identify (Lemiszki, 1992).

The upper part of the Copper Ridge is light gray, medium crystalline dolomite. However, this lithology is often intercalated through the lower part. White and gray chert is very common often forming beds and lenses. Chert of the upper unit is commonly oolitic. Occasionally, dark gray, petroliferous beds also occur in the upper part (Lemiszki, 1992).

Because of its chert, the Copper Ridge Dolomite occupies persistent broad ridges which are slightly asymmetrical, the steeper northwest slope adjacent to the Conasauga and the more gentle

side forming a dip slope to the Chepultepec unit (Fig. 4). Pinnacles and ledges are a common feature as are surface depressions (Lietzke et al, 1989).

High silt plus clay content and variable chert volume are typical of soils forming in Copper Ridge residuum. The upper 40 to 80 cm are very cherty. Underlying subsurface horizons vary from greater than 35% chert to those almost chert free (Lietzke et al, 1989). Lower Copper Ridge residuum usually produces a deep-red soil (Lemiszki, 1992). Copper Ridge soils have been classified most often as clayey, kaolinitic, thermic Typic Paleudults (Lietzke et al, 1989).

Chepultepec Formation. Bordered by a ridge of Copper Ridge dolomite to the northwest and a ridge of Longview dolomite on the southeast, the Chepultepec Formation occurs in broad, shallow swales (Lemiszki, 1992). This topography is related to a lower chert content when compared to the two adjacent rock units (Milici, 1973). Chepultepc chert is distinctly light weight and porous (Swingle, 1959) (Crider, 1981). It occurs in variable masses at the base and top of the unit. Oolitic cherts occur only in the lower third of the Chepultepec (Swingle, 1959). Colors vary from white to yellowish gray or yellowish brown and lack the banded character of those commonly found in the Copper Ridge (Crider, 1981).

Soils forming in Chepultepec residuum have been classified as clayey, kaolinitic, thermic Typic Paleudults. Erosion has truncated many of the original A and E horizons, but when present these horizon have higher chert contents than subordinate horizons. Horizons in the upper portion of the argillic have a 10YR or 7.5 YR hue with a clay loam texture, but the lower clayey horizons become redder with hues of 5YR and 2.5 YR (Lietzke et al, 1989). Saprolite in this unit is predominately yellow in hue (Lee et al, 1988).

Longview Dolomite. Symmetrical ridges typify the topography underlain by Longview sediments (Crider, 1981). Abundant large white angular chert denotes basal contact of this unit. Distinctive sets of gashes on the chert faces generate a cross hatched or grid iron appearance

(Haney, 1966; Crider, 1981). Massive chert blocks occur in the upper Longview (Crider, 1981).

Longview soils often are very cherty with thick (60-80 cm) E horizons and red (2.5YR), clayey argillic horizons. Soils are generally classified as clayey-skeletal, kaolinitic, thermic Typic Paleudults. Colluvial footslope soils forming in Longview materials normally are in the loamy-skeletal particle size family (Lietzke et al, 1989)

Kingsport Formation. Limestone and two textural varieties of dolomite constitute the Kingsport Formation. The lower unit consists of a light gray brown, medium to thick bedded, fine to coarsely crystalline dolomite which may contain laminae of quartz sand grains. The upper dolomite is fine grained and often pinkish gray. Some bedded, white to gray, fine grained, sandy chert is present (Lemiszki, 1992). Although the Kingsport produces less chert than other Knox units (Lemiszki, 1992), flattened, light gray chert parallels the bedding of some layers and appears as small white blocks in residual soils. Sandstone is present only in small amounts (Oder and Ricketts, 1961) (Milici, 1973). The formation usually underlies gentle slopes or valleys downdip from ridges developed on the Longview Dolomite (Lemiszki, 1992).

Soils of the Kingsport Formation are highly eroded with thin surface horizons. Upper Bt material has a hue of 2.5YR and the lower subsoil stays redder with depth than most other Knox Group soils. Subsoil chert is soft and chalky and content is greater than 15%. Kingsport saprolite contains pea and gravel sized weathered chert which has turned to light gray or white. Bright red (2.5 YR) hues are characteristic of this saprolitic material (Lietzke et al, 1989).

Mascot Formation. Chert matrix sandstone found as float in residuum distinguishes the basal unit of the Mascot Formation from the underlying Kingsport. Massive beds of fine grained light gray dolomite with pinkish streaks and patches are the main constituent of this formation. Lithologically, thick beds of coarse grained dolomite with scattered quartz sand grains, white, gray, red, and tan chert nodules and pods, and medium to thick, white chert beds occur in the lower

Mascot (Lemiszki, 1992). Ledges, pinnacles, and depressions characterize the weathered or erosional surface of the Mascot Formation. Ledges tend to give rise to narrow benches on steep sideslopes (Lietzke et al, 1989)

Mascot soils tend to be more shallow than other Knox soils and have a more intense red upper subsoil than Kingsport soils. Sandstone fragments and chert matrix sandstone are common as float in Mascot residuum. Soil surface textures are loam or fine sandy loam. Saprolite is a duller red than that of the underlying Kingsport Formation, while the clays of the saprolite and soil horizons are stickier and more plastic. Typical soils of the Mascot Formation are classified as fine, mixed, thermic Typic Hapludalfs, Ultic Hapludalfs, and Typic Hapludults (Lietzke et al, 1989).

The Kingsport and Mascot Formations have been combined as the Newala Formation in areas where separation of these units is difficult (Cattermole, 1958, 1966; Rodgers, 1953).

Chickamauga Group

Stratigraphic units of the Chickamauga Group have been both lumped together and subdivided numerous times. In the Whiteoak Mountain fault block, the dominant Chickamauga formations include: Five Oakes, Lincolnshire, Rockdell, Benbolt, Wardell, Bowen, Witten, Moccasin, and Martinsburg.

Five Oaks. Composition of the Five Oaks is highly variable and includes lime mudstone with thin parallel lamination, dolomite, and occasional chert (Ruppel, 1979). Describing exposures in Bethel Valley, Lee and Ketelle (1988) described the Five Oaks as purplish-maroon and pale olive limestone containing angular dolomitic clasts.

In some areas, the Five Oaks has been divided into the Blackford and Tumbez Members. In Bethel Valley, Robertson (1994) described the Blackford subdivision as comprised of gray or beige

dolostone, burgundy limestone, and burgundy/beige packstone. Overlying the Blackford are red and brown shale interbedded with gray dolostone and burgundy/gray packstone of the Tumbez Member.

Weiss (1981) divided an exposure of the Blackford at Solway Bridge in Anderson County, TN, into three distinct units: 1)a brownish to dark gray, fine to coarse grained wackestone with nodular beds of chert (2 to 4 cm in diameter), 2) a dark red, fine grained, silty and shaley dolomitic mudstone, and 3) a reddish brown to red and greenish gray, fine-grained, silty and shaley dolomitic mudstone interbedded with grainstone.

Lincolnshire. Three members comprise the Lincolnshire Formation: the Eidson, Fleanor, and Hogskin. Eidson facies consists of calcareous, gray-maroon , shaley siltstone interbedded with light gray limestone (Lemiszki, 1992). Black chert nodules 1.5 to 13 cm in diameter are a distinctive characteristic. Fossils include crinoid columns, gastropods, trilobite fragments, echinoderms, bryozoans, and coral debris (Weiss, 1981). Soils are usually classified as Hapludalfs with some Hapludults being present (Lee et al, 1988).

The Fleanor of Bethel Valley has been described as calcareous, maroon and sometimes olive gray siltstone interbedded with maroon, calcareous shale and fine to medium-grained limestone (Lemiszki, 1992). In Raccoon Valley, Union County, TN, tan and yellow shale were also prevalent in the unit (Ashworth, 1982).

Hogskin rock units contain medium gray to yellowish brown, fine to coarse-grained, argillaceous wackestone-packstone with scattered shale laminae (Weiss, 1981). In the Whiteoak fault block, the Fleanor and Hogskin members underlie a narrow valley between Chestnut Ridge and low hills held up by the Rockdell Formation (Lemiszki, 1992).

Rockdell Formation. Topographically, the Rockdell Formation is represented by a chain of low hills. Lower facies in the Rockdell Formation consist of a mixture of micritic and fine to coarse grained limestone. Dark gray, calcareous siltstone and patches of nodular chert are also present. Upper Rockdell units are composed of thin to massive, gray to olive gray limestones that are in part nodular and argillaceous. Thin even bands of chert present in the unit weather into angular fragments (Lemiszki, 1992). Soils developing in the upper unit of the Rockdell have been classified as Hapludults or Paleudults (Lee et al, 1988).

Benbolt. Weiss (1981) divided the Benbolt into 7 units. Facies represented included 1) dark gray to yellowish green, fine to coarse grained, argillaceous wackestone-packstone, 2) brownish dark gray medium bedded, very fine-grained wackestone, 3) a dark gray to yellowish green, fine to coarse grained, argillaceous wackestone interbedded with brownish yellow shale, 4) dark gray medium to coarse grained wackestones, 5) dark brownish yellow, thinly laminated to laminated, very fine grained, argillaceous and dolomitic shale and mudstone interbedded with brownish yellow, thin bedded, very fine-grained, dolomitic grainstone, 6) thin bedded, dark greenish gray, very fine to fine-grained mudstone-wackestone, and 7) greenish gray and reddish to yellowish brown very fine to fine -grained, dolomitic mudstone interbedded with reddish to greenish gray, very fine-grained, dolomitic grainstone.

Wardell Formation. Characterized by an even higher overall terrigenous clay content than the Benbolt (Ruppel, 1979), the Wardell Formation contains biosparites and intercalate shale (Weiss, 1981). Biosparite is limestone consisting of bioclasts together with a sparry calcite cement (Allaby and Allaby, 1990).

Lower Wardell lithologies are characterized by bluish gray, fine-grained mudstone, fine to

coarse-grained wackestone, packstone, and grainstone. Thin greenish gray shale beds are present throughout the section. A layer of chert nodules (4 to 8 cm long and 2 cm thick) is present near the base of the unit. These rock units are overlain by greenish brown to yellowish green, very fine to fine-grained, dolomitic and argillaceous mudstone. The upper portion is a dove to brownish gray and orangish-brown, very fine-grained mudstone and dove gray, fine to coarse-grained wackestone, packstone, and grainstone. Greenish gray shale laminae are present throughout the upper section. Dolomite becomes more common toward the top (Weiss, 1981).

Bowen Formation. Descriptions of the Bowen Formation have varied by location. On Melton Lake Drive, the Bowen was described as light tan to dark gray, fine-grained, fissile, thinly bedded (2.5 to 5 cm) shales randomly intercalated with thin (2.5 to 5 cm) dark red to reddish brown cherts and light gray, thin bedded (0.5 to 1 cm) fine-grained limestone (Belvin, 1975).

Exposures of the Bowen at Solway in Anderson County, TN were characterized as dark reddish-brown and greenish-brown, very fine to fine-grained mudstone interbedded with reddish brown to greenish brown, very fine to fine grainstone (Weiss, 1981).

Lemiszke (1992) delineated the Bowen as a maroon, calcareous, shaley siltstone containing thin beds of light gray to olive gray argillaceous limestone. Upper extent of the formation occurred at the uppermost occurrence of maroon siltstone.

Witten Formation. When the Bowen is absent, the Witten Formation is hard to distinguish from the underlying Wardell. The major difference between the two is a greater content of terrigenous clay shale in the Witten. Ruppel (1979) described this formation as alternating medium to coarse, bioclastic grainstone, lime mudstone, and shale.

Weiss (1981) described an array of lithologies at a site in Solway. Brownish to greenish gray wackestone, packstone, and grainstone interbedded with yellowish brown shale/mudstone comprised the lower section. This was overlain by dove to brownish gray mudstone and wackestone. The upper section was a brownish green, shaley mudstone interbedded with greenish gray, grainstone. Mudcrack polygons (13 by 16 cm in diameter) were evident in the basal portion of the unit with abundant horizontal burrows and few vertical burrows in the upper section.

Lemiszki (1992) divided the formation into three sections with dominantly limestone components. A basal unit consisted of light gray, fine to medium grained, fossiliferous, nodular limestone that graded upward to ribbon limestone. The middle section is a light gray fine grained, poorly fossiliferous limestone. Upper depositions were composed of thin interbedded, dark gray siltstone and light gray limestone which graded upward to light gray, nodular and ribbon limestone. Upper contact with the overlying Moccasin began with the presence of maroon colors and an increase in shale and siltstone (Lemiszki, 1992).

Moccasin Formation. According to Ruppel (1979), the Moccasin Formation is composed of alternating blue gray limestone, and red, yellow weathering, clay shale containing common ripple marks and mudcracks.

Weiss (1981) described the Moccasin as being composed of reddish brown to greenish gray grainstone, mudstone, and shaley wackestone. In contrast, Lemiszki (1992) characterized the formation as olive to light gray and maroon calcareous siltstone interbedded with thin bedded, light gray and maroon argillaceous limestone with commonly occurring mudcracks.

CONCLUDING REMARKS

The geology of the Ridge and Valley physiographic province is diverse. Weathering of the contrasting rock units has provided a variety of material from which soils have formed. As a soil scientist, it is difficult to comprehend the evolution of a soil without having some understanding of the nature of the source material from which it has formed.

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CHAPTER 3. CLASSIFICATION AND FORMATION OF SOILS ON A CAMBRIAN/ORDOVICIAN GEOLOGICAL SEQUENCE IN EAST TENNESSEE

ABSTRACT

Thirteen soil pedons associated with the Rome, Knox, and Chickamauga Formations in East Tennessee were examined. The study sites are located in the Ridge and Valley physiographic region on the Oak Ridge Reservation in Roane County. Geological age of the formations ranged from Cambrian (Rome) to Ordovician (Knox and Chickamauga). The objective of this study was to compare and contrast the properties of soils in which the primary variables were parent material and site position. Soil morphology was recorded for each site. Laboratory analysis included pH, total carbon, particle size, free iron oxides, cation exchange capacity, percent base saturation, and hydroxylamine-HCl manganese. Parent materials included alluvium, colluvium, and residuum. Soils evolved from bedrock lithologies of the Chickamauga Group were classified as Typic Paleudults and Typic Hapludalfs. Classification of soils developing in materials from members of the Knox Group included Typic Paleudults, Typic Fragiudults, Typic Kandiudults, Typic Hapludalfs and Typic Hapludults. The Rome Formation had weathered to form soils classified as Ultic Hapludalfs and Typic Hapludults. Soils derived from fault breccia from the Rome Formation and from an alluvial/colluvial deposition were classified as Typic Hapludalfs and Typic Hapludults, respectively. The primary differences among these pedons resulted from the influences of geological parent material, site position, slope, and erosion.

INTRODUCTION

Soil genesis is a complex process in the Valley and Ridge physiographic province of East Tennessee. Many soil differences are the result of some combination of microclimate, pedogenesis, erosion, and geological surficial processes (Birkeland, 1984). For any one soil, the importance of the five soil forming factors (Jenny, 1941) and the internal generalized processes (Simonson, 1959)

varies in degree of influence. The objective of this study was to compare and contrast the properties of soils in which the primary variables were parent material and site position.

NATURE AND GEOLOGY OF THE AREA

Bounded by the Whiteoak Mountain thrust fault (northwest) and the Copper Creek thrust fault (southeast) (Fig. 1), the Whiteoak Mountain thrust block is characterized by a pattern of parallel ridges and valleys composed primarily of Cambrian and Ordovician geological units (Fig. 3 and Fig. 5). Cambrian units include the Rome Formation, Conasauga Group, and Copper Ridge Dolomite of the Knox Group. Remaining formations of the Knox, as well as the Chickamauga Group, represent the Ordovician. Across the Oak Ridge Reservation in Roane County, Tennessee, the Rome Formation underlies Pine Ridge (Fig. 4). Bear Creek Valley has developed over Conasauga rock units. Chestnut Ridge overlies formations of the Knox Group. Bedrock lithologies of the Chickamauga Group underlie Bethel Valley. Only those rock units specifically related to a soil sampled for this study will be discussed.

Whiteoak Mountain fault marks the location where the Rome Formation has been thrust over the Chickamauga Formation (Fig. 4). This fault zone can be identified by the presence of fault breccia in which soils with fairly thick clayey subsoils have formed over saprolite (Lee et al, 1988).

The Rome Formation occupies the upper third of the south side of Pine Ridge and continues on the north side of Pine Ridge to the fault zone. Slopes on Pine Ridge are steep (Lee et al, 1988). Complete exposed sections of the Rome are rare due to occlusion of the lower Rome along the fault (Frazier and Schwimmer, 1987).

The Rome Formation contains several lithologies that occur between the crest of Pine Ridge and the Whiteoak Mountain fault. One rock unit is a sandstone containing feldspar and siltstone which weathers to a yellowish saprolite. Soils forming on this material contain strong brown clay enriched subsoil horizons and are classified as Typic and Ochreptic Hapludults. Typic

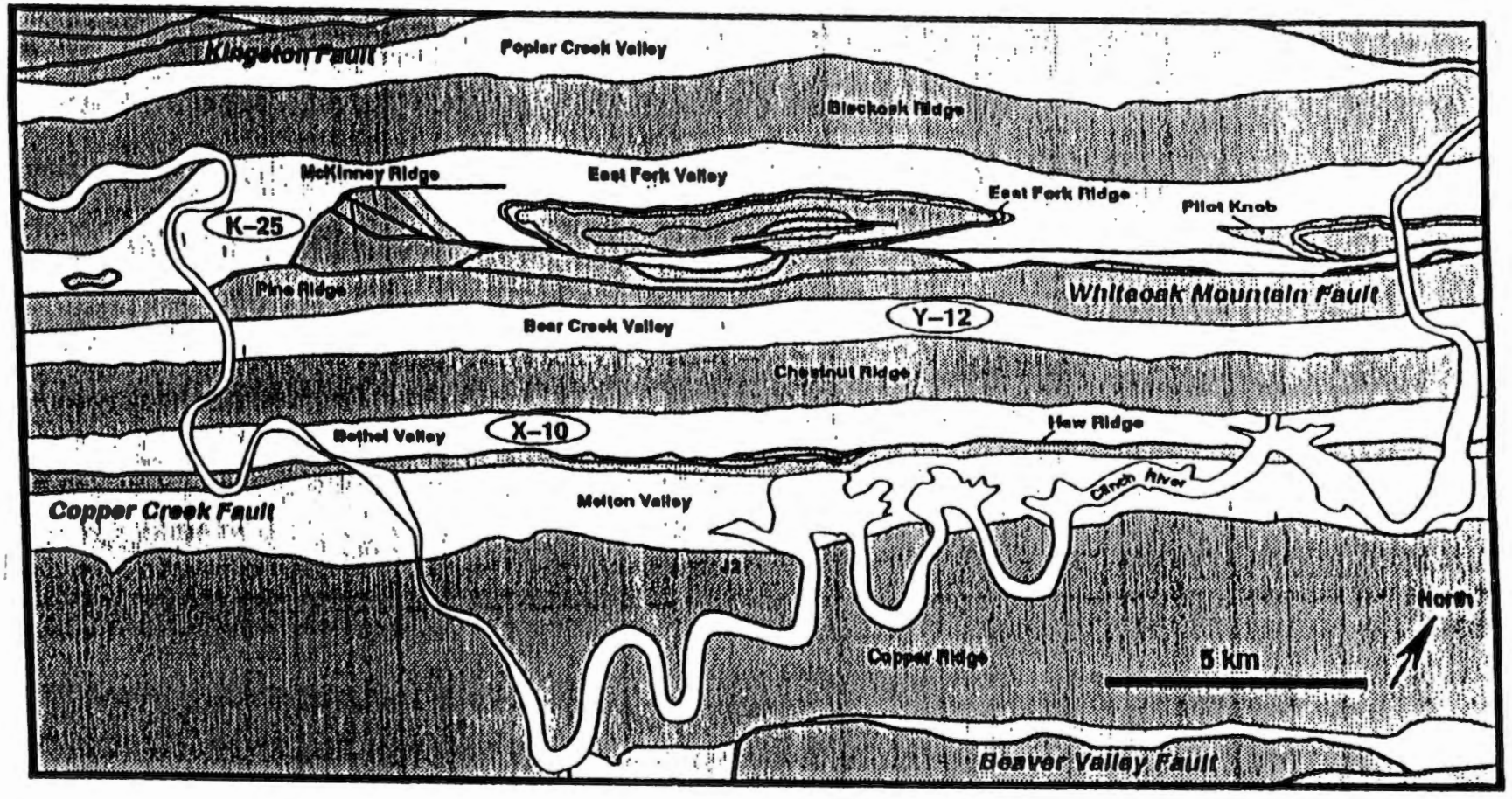


Figure 5. Location of major ridges and valleys in the Oak Ridge Reservation section of the Whiteoak Mountain fault block (Lemiski, 1992).

Dystrochrepts form in a hard, pinkish, fine-grained sandstone unit that is mostly cemented by iron oxides. Red and dark red mudstones weather to form Typic Dystrochrepts or Ochreptic Hapludults depending on slope gradient. Rome colluvial soils are Typic Hapludults. However, most soils on the Rome are thin and do not have argillic horizons (Lee et al, 1988). The Knox Group of the Whiteoak Mountain thrust block is composed of several dolomite rock units. Beds of shale and occasionally sandstone are also present (Lee et al, 1984). Formations in the Knox Group commonly contain karst features dominated by dolines of differing size (Ketelle and Huff, 1984).

In the East Chestnut Ridge area, the Knox Group is composed of five members: Copper Ridge (oldest), Chepultepec, Longview, Kingsport, and Mascot (youngest)(Fig. 3). Kingsport and Mascot Formations have been mapped separately in many places, but have been combined as the Newala Formation in others (Cattermole, 1958, 1966; Rodgers, 1953).

An abundance of chert is characteristic of the Copper Ridge Formation. Many cherts developed from oolites and cryptozoans in which the original calcium carbonate was replaced with silica (Haney, 1966) . Silicified ooids are gray, white, or concentrically banded in a matrix of white chert. Spherical, oval, tabular, or onion shaped ooids may be present (Lemiszki, 1992).

Lower Copper Ridge dolomite is dark gray and brown, massively bedded, and medium to coarsely crystalline. A strong petroliferous odor emanates from freshly broken rocks. Oolitic beds that have been replaced by chert are very distinctive, but in unweathered rock these beds are difficult to identify (Lemiszki, 1992).

Light gray, medium crystalline dolomite typifies the upper part of the Copper Ridge and is often intermingled through the lower part. White and gray chert is very common often forming beds and lenses. Chert of the upper unit is commonly oolitic. Occasionally, dark gray,

petroliferous beds also occur in the upper part (Lemiszki, 1992).

Because of its chert, Copper Ridge dolomite occupies broad ridges which are slightly asymmetrical, the steeper side next to the Conasauga and the more gentle side forming a dip slope. Pinnacles and ledges are a common feature as are surface depressions (Lietzke et al, 1989).

High silt plus clay content and variable chert volume are typical of soils forming in Copper Ridge residuum. The upper 40 to 80 cm are very cherty. Underlying subsurface horizons vary from greater than 35% chert to those almost chert free (Lietzke et al, 1989). Lower Copper Ridge residuum usually produces a deep-red soil (Lemiszki, 1992). Copper Ridge soils have been classified most often as clayey, kaolinitic, thermic Typic Paleudults (Lietzke et al, 1989).

The Chepultepec Formation occurs in broad, shallow swales (Lemiszki, 1992). This topography is related to a lower chert content when compared to the two adjacent geological formations (Copper Ridge and Longview) (Milici, 1973). Chepultepec chert is distinctly light weight and porous (Swingle, 1959; Crider, 1981). It occurs in variable masses at the base and top of the unit. Oolitic cherts occur only in the lower third of the Chepultepec (Swingle, 1959). Colors vary from white to yellowish-gray or yellowish- brown and lack the banded character of those commonly found in the Copper Ridge (Crider, 1981).

Soils forming in Chepultepec residuum have been classified as clayey, kaolinitic, thermic Typic Paleudults. Erosion has truncated many of the original A and E horizons, but when present these horizons have higher chert contents than subordinate horizons. Horizons in the upper portion of the argillic have a 10YR or 7.5 YR hue with a clay loam texture, but the lower clayey horizons become redder with hues of 5YR and 2.5 YR (Lietzke et al, 1989). Saprolite in this unit was predominately yellow in hue (Lee et al, 1988).

Symmetrical ridges typify the topography underlain by Longview sediments (Crider, 1981). On the eastern portion of Chestnut Ridge, a thin seam of Longview Dolomite is situated between Chelpultepec and Kingsport rock units (Lietzke et al, 1989). Often, the Longview can be identified by thick chert ledges (Lietzke et al, 1989).

Abundant large white angular chert are common in the Longview Dolomite. Distinctive sets of gashes generate a cross hatched or grid iron appearance on the chert block faces (Haney, 1966; Crider, 1981) . Massive chert blocks (over 2 m.) occur the upper Longview (Crider, 1981).

Longview soils often are very cherty with thick (60-80 cm) E horizons and red (2.5YR), clayey argillic horizons. Soils are generally classified as clayey-skeletal, kaolinitic, thermic Typic Paleudults. Colluvial footslope soils forming in Longview materials normally are in the loamy-skeletal particle size family (Lietzke et al, 1989).

Limestone and two types of dolomite constitute the Kingsport Formation. The lower unit consists of a light gray-brown, medium to thick bedded, fine to coarsely crystalline dolomite which may contain laminae of quartz sand grains. Upper dolomite is fine grained and often pinkish gray. Some bedded, white to gray, fine grained, sandy chert occurs (Lemiszki, 1992). Algal stromatolites constitute as much as 35% of the formation (Harris, 1969). Although the Kingsport produces less chert than other Knox members (Lemiszki, 1992), flattened, light gray, nodular cherts parallel the bedding of some layers and appear as small white blocks in residual soils. Sandstones occur only in small amounts (Oder and Ricketts, 1961; Milici, 1973). The formation usually underlies gentle slopes or valleys downdip from ridges developed on the Longview Dolomite (Lemiszki, 1992).

Soils of the Kingsport are highly eroded with thin surface horizons. Upper Bt material has a hue of 2.5YR and the lower subsoil stays redder with depth than most other Knox Group soils.

Subsoil chert is soft and chalky and content is greater than 15%. Kingsport saprolite contains pea and gravel sized weathered chert which has turned to light gray or white. Bright red (2.5 YR) hues are characteristic of this saprolitic material (Lietzke et al, 1989).

Sandstone with a chert matrix distinguishes the basal unit of the Mascot Formation from the underlying Kingsport. Massive beds of fine grained light gray dolomite with pinkish streaks and patches are the main constituent of this formation. Thick beds of coarse grained dolomite with scattered quartz sand grains occasionally occur in the unit. White, gray, red, and tan chert nodules and pods are scattered throughout. Medium to thick, white chert beds occur in the lower Mascot (Lemiszki, 1992). Ledges, pinnacles, and depressions characterize the Mascot Formation. Ledges tend to give rise to narrow benches on steep sideslopes (Lietzke et al, 1989)

Soils of the Mascot Formation generally are not as thick as those of the other Knox Formations and have a more intense red upper subsoil than soils formed in the adjoining Kingsport rock units. Sandstone fragments and chert matrix sandstones are common. Surface textures are loam or fine sandy loam. Saprolite is a duller red than that of the underlying Kingsport Formation, while the clays of the saprolite and soil horizons are stickier and more plastic. Typical soils of the Mascot Formation are classified as fine, mixed, thermic Typic Hapludalfs, Ultic Hapludalfs, and Typic Hapludults (Lietzke et al, 1989).

In general, soils forming in Knox Group residuum on slopes of 25° or less have clay-enriched subsoils with sufficient solum thicknesses to be classified as Paleudults. Those on slopes exceeding 25° are mostly Hapludults (Lietzke et al, 1989).

Due to topographic inversion, many of the highest elevations on Chestnut Ridge are covered with a blanket of colluvium. Saddles, concave footslopes, and toeslopes are also sites of colluvial

deposition. Many of these deposits have more than one time discontinuity indicating more than one major episode of geomorphic instability. Chert is a common component in most Knox colluvium. Colluvial soils with fragipans occur primarily on concave landscapes and sporadically in low toeslope positions. Fragipans or subsoil layers with fragic properties are never found in residual soils (Lietzke et al, 1989).

Nomenclature related to the Chickamauga supergroup has varied over time and location (Lemiszki, 1992). On the Oak Ridge Reservation, Stockdale (1951) labeled these units alphabetically from A to H. Five distinctive geologic units, A through E, represent the Chickamauga Group in the area of interest. Of these, only the Chickamauga A and D will be discussed in relation to this study.

Unit A, the oldest unit, is a combination of the Five Oakes Formation and the Eidson Member of the Lincolnshire Formation. The term Five Oakes has been used to describe the mixture of materials filling depressions in the Knox disconformity (Bridge, 1955). In the Bethel Valley area, purplish-marroon and pale olive limestones containing angular dolomitic clasts are in abrupt contact with underlying Mascot dolomites (Lee and Ketelle, 1988). The Edison member consists of calcareous, gray-maroon , shaly siltstone interbedded with light gray limestones. Nodular to bedded chert is present in the lower two thirds. The upper section of the unit is a medium grained light to dark gray limestone containing abundant nodular and bedded chert (Lemiszki, 1992) . Soils are usually classified as Hapludalfs with some Hapludults being present (Lee et al, 1988).

Unit D is composed of cherty limestones from the upper Rockdell Formation (Lee et al, 1988). Thin to massive, gray to olive gray, the limestone is in part nodular and argillaceous. Thin

even bands of chert in this unit weather into angular fragments (Lemiszki, 1992). Soils of Unit D have been classified as Hapludults or Paleudults (Lee et al, 1988).

MATERIALS AND METHODS

Site Location

All study sites were located on the Oak Ridge Reservation in Roane County, Tennessee (Fig. 6). Some sites were observed and described in the field, but not sampled for soil characterization. Only those sampled will be discussed. Moving in a northward direction, pedons 2, 3, and 4 were located in Bethel Valley on the Chickamauga Frm.(Fig. 7). Pedons 6, 7, 9, 10, 11, and 13 werelocated on West Chestnut Ridge on the Knox Frm. Pedons 15 and 16 were located on Pine Ridge on the Rome Formation. An old stream channel infilled by colluvium was the position for pedon 12, while pedon 14 had developed in fault breccia.

Field Methods

Soil morphology was completed according to National Cooperative Soil Survey Standards (Soil Survey Staff, 1981). Field descriptions included: horizon designation, depth, boundary distinctness, texture, color, consistence, and structure.

The presence of cutans, manganese concretions, fossils, and other observations were noted. Elevation, aspect, vegetation, slope, and other site characteristics were also recorded.

Laboratory Methods

Each sample was air dried, sieved to remove coarse fragments (≥ 2mm), and mixed thoroughly. Total carbon analysis was performed with a Leco CR-12 Carbon System. Soil pH was measured using a 1:1 ratio of water and soil (Olsen and Ellis, 1982a). Mineralogy was

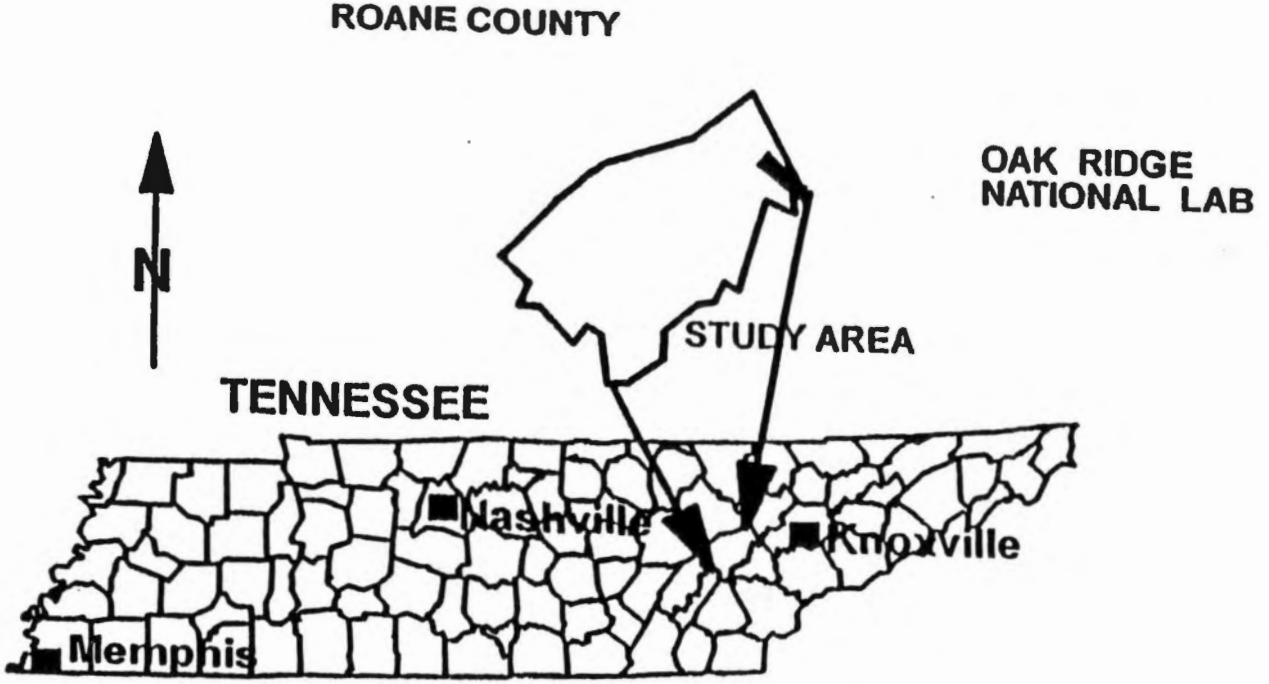


Figure 6. Location of study area in Roane County, Tennessee.

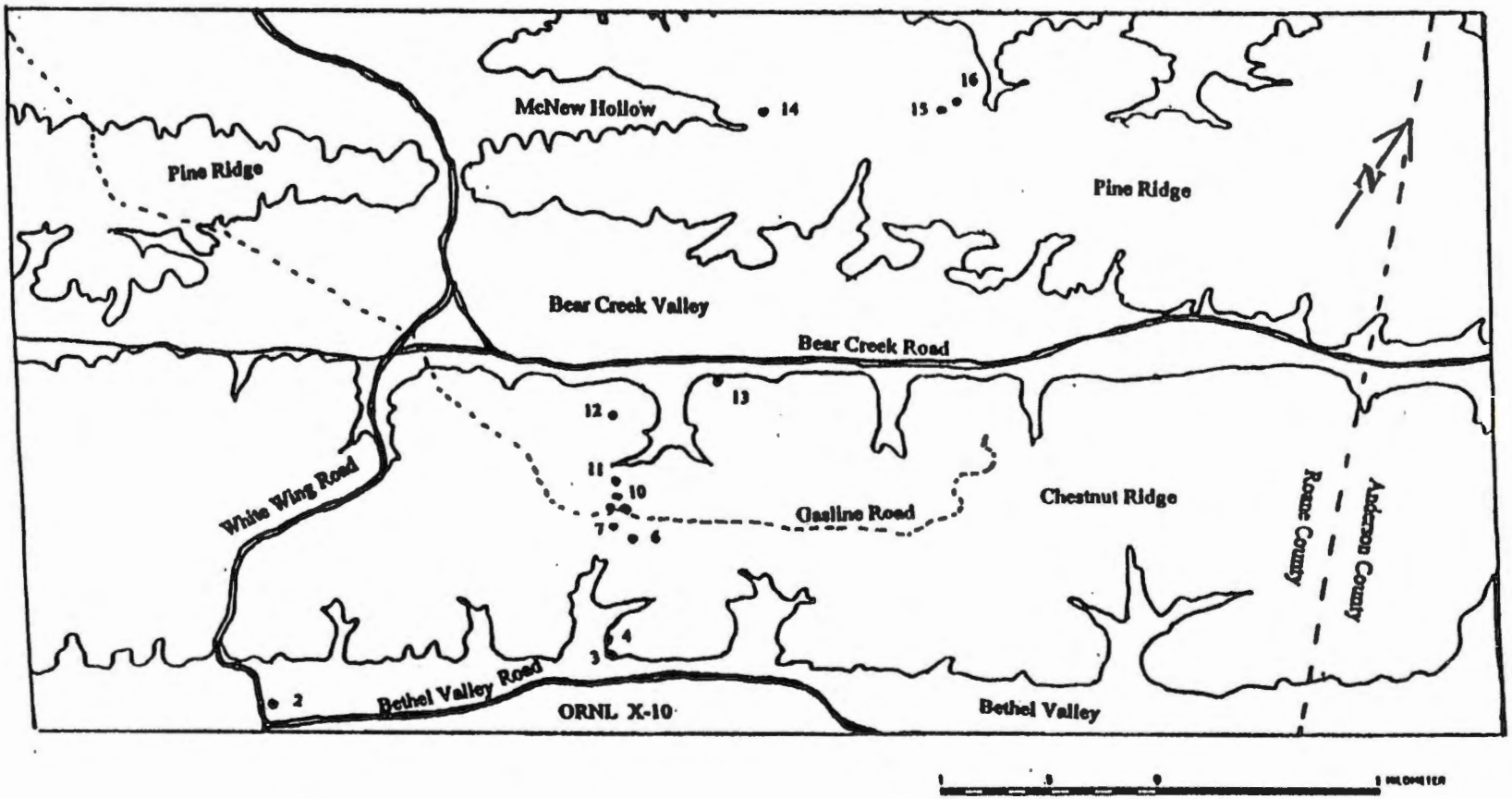


Figure 7. Location of the thirteen soil pedons examined from the Oak Ridge Reservation in Roane County, Tennessee.

determined on the control section of each pedon using CEC to clay ratios (Soil Survey Laboratory, 1995).

The pipette method was used for particle size analysis (Kilmer and Alexander, 1949). Sands were fractionated into very coarse sand (vcos), coarse sand (cos), medium sand (ms), fine sand (fs), and very fine sand (vfs) (Gee and Bauder, 1986).

Percent base saturation and cation exchange capacity were determined by the ammonium acetate saturation method (Jackson, 1958; Chapman, 1965). A hydroxylamine hydrochloride method was employed to extract manganese oxides (Gambrell and Patrick, 1982). Iron oxides were extracted by the citrate-dithionite (CD) method (Olsen and Ellis, 1982b). KCl extraction was used to determine total acidity and aluminum content (Lin and Coleman, 1960). Elemental concentrations in extracts for bases, iron, and manganese were determined with a Perkin-Elmer 5000 Atomic Absorption Spectrophotometer.

RESULTS AND DISCUSSION

Ten sites, pedons 2, 6, 7, 9, 10, 11, 12, 14, 15, and 16, were classified as Ultisols. Laboratory data confirmed pedons 3, 4, and 13 were Alfisols (Table 1[1]). Eight of the pedons studied were located in upland site positions. Only pedons 2 and 16 had formed in residuum, while the remaining pedons had developed in varying thicknesses of colluvial material overlying residuum or in alluvium. Generally, colluvium was found in sites positioned on slopes of 12% or greater, with pedon 16 on a 24% slope being the exception (Tables 1 and 2).

When compared to underlying residual horizons, silt content was predominantly higher in the colluvial horizons of many of the pedons examined (Table 3). This observation was particularly

[1]All tables are located in Appendix F

evident in pedons 2, 3, 9, and 13. Silt content in pedons 2, 3, 9, and 13, respectively, averaged 73, 66, 46, and 61% in the colluvial horizons. Average silt content for the residual horizons was 44, 43, 17, and 32%. Since this feature was prevalent over a variety of geologies and space, the probable source for this silt was from localized loess.

Pedon 2 was located on the upper portion of a sideslope. Coarse fragment content increased in the upper 20 cm as a result of soil creep (Table 2). An albic E horizon had developed in the upper 7 cm (Table 2). Residual parent material was Unit D of the Chickamauga Formation. Clay illuviation has been a major process in this profile. The 2.5YR coatings in the Bt1 masked any remnant 10YR colors in ped interiors. Even with thick red (2.5YR 4/8) clay films covering the peds, the yellowish brown ped interiors of the Bt2 were more visible than those in the overlying horizon.. Pedogenesis is evident to some extent to a depth of 310 cm. Weak structure, light gray flow streaks, and clay coatings were observable in the lower horizons.

Both pedon 3 and 4 had developed in colluvial material over a paleosol of Chickamauga A residuum. Positioned on a midslope, the colluvium in pedon 3 was relatively thin (44 cm) compared with 110 cm in the gully fill position of pedon 4 (Table 2). Both pedons contained large volumes of coarse fragments and bridging voids were observed in the Bt2 of pedon 4. With hues of 10YR and 7.5YR, the colluvial material was not highly weathered and had total clay content of less than 30% (Table 3). Rubification was evident in the 2.5YR and 10R colors of the residual material (Table 2). These horizons reflected the character of the carbonate parent material with high exchangeable calcium, low total acidity, and high clay content (> 50%) (Tables 3, 4, and 5). Fragic materials with 40% brittleness and vertical streaks were present in the Bt2 of pedon 4 (Table 2).

The soils of pedons 6,7, 9, 10, and 11 formed over members of the Knox Group. Residual parent material of pedons 6 and 7 was the Newala Formation. Pedon 9 had developed in Longview

dolomite, while pedons 10, and 11 formed over the Chelpultepec Formation (Table 1).

Pedon 6 had formed on an upper sideslope and had a mantle of colluvium (74 cm) Both pedon 3 and 4 had developed in colluvial material over a paleosol of Chickamauga A residuum. Positioned on a midslope, the colluvium in pedon 3 was relatively thin (44 cm) compared with 110 cm in the gully fill position of pedon 4 (Table 2). Both pedons contained large volumes of coarse fragments and bridging voids were observed in the Bt2 of pedon 4. With hues of 10YR and 7.5YR, the colluvial material was not highly weathered and had total clay content of less than 30% (Table 3). Rubification was evident in the 2.5YR and 10R colors of the residual material (Table 2). These horizons reflected the character of the carbonate parent material with high exchangeable calcium, low total acidity, and high clay content (> 50%) (Tables 3, 4, and 5). Fragic materials with 40% brittleness and vertical streaks were present in the Bt2 of pedon 4 (Table 2).

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Pedon 6 had formed on an upper sideslope and had a mantle of colluvium (74 cm) over a clayey paleosol. Pedon 7 was located on the crest of a ridge near the lip of a depression. This pedon had developed in colluvium over residuum with a lithologic discontinuity occurring at 180 cm. Both profiles had thin A horizons over E horizons. The E1 of pedon 6 was albic (Table 2).

Clay content was similar in both profiles. Colluvial material had less than 21% clay while residual horizons contained between 46 and 51% clay. The chert was highly weathered and soft Chert content in residuum was greater than 35% (Table 3). Iron stains had penetrated into the interiors of some chert fragments. Red coloration (2.5YR) implied intensive weathering in the residual material. Yellowish-brown (10YR 6/8) mottles or saprolitic colors were intermingled in this matrix probably as remnants of decomposing coarse fragments (Table 2). Coarse fragment content in the A horizon of pedon 7 indicated some surface creep had occurred (Table 3). Fragic properties were also observed in the Bt horizon.

Soil development in pedon 9 had occurred on a ridge crest in a thin layer of colluvium (56 cm) over residuum (Table 2). Soil creep had generated an extremely cherty A horizon. Influence of the Longview parent material was evidenced by a major increase in coarse fragments at 56 cm (Table 3).

Highly weathered soils having low activity clays (LAC's) are characterized by low CEC values, accumulations of sesquioxides, an absence of weatherable minerals, and the presence of large amounts of kaolinite, goethite, hematite, and gibbsite (Goenadi and Tan, 1988). The CEC and ECEC in the paleosol (56-200 cm) of pedon 9 were sufficiently low to comply with criteria for a kandic horizon (Table 5). Dithionite iron oxide and KCl aluminum values serve as evidence of substantial illuviation of these elements within the soil profile (Table 6).

Degree of redness is related to the proportion of iron present as hematite and goethite. Little or no hematite is present in soil material having hues of 7.5YR or 10YR. Hues of 5R indicate a dominance of hematite (Bigham et al., 1978). In pedon 9, the 10R hues would signify a predominance of hematite (Table 2). A kaolinitic mineralogy class was indicated by the CEC to clay ratios.

Pedon 9 was not the only soil profile containing horizons with soil hues of 10R. Pedon 3 (96-120 cm) and pedon 4 (110-129 cm) contained paleosols with argillic horizons having 10 R hues (Table 2). Clay content was similar in all three pedons (> 50%) (Table 3). In comparison to pedon 9, percent iron oxides and KCl aluminum were generally lower (Table 6) and CEC's were higher in pedons 3 and 4 (Table 4). Deep red soil hues (Table 2) indicated environmental factors favoring hematite formation i. e. high temperatures, low water activity, and low organic carbon content (Kampf and Schwertmann, 1983). The overriding difference between these three pedons was parent material (Table 1). Composition of the original Longview sediments was more conducive to the formation of low activity clays than that of the Chickamauga A unit.

Both pedons 10 and 11 had formed on the same sideslope in Chepultepec parent material (Table 1). Pedon 10 was located on a middle sideslope (25-45% slope) above a bench. The upper

40 cm of the soil profile had developed in soil creep (Table 3). Pedon 11 formed on a sideslope (12-25% slope) below this bench at the upper end of a hollow. Soil color, particle size, and coarse fragment content indicated two depositions of colluvium at 26 and 66 cm. A stone lag line was present in the 2E3 (Table 3). Thickness of colluvial material was a reflection of site position and percent slope.

Silt contents greater than 50% in the colluvial depositions of both pedon 10 and 11 reflected the presence of loess material from the ridge crest above these sites (Table 3). Each pedon had developed albic E horizons in the colluvial material (Table 2). A 22 cm fragipan had formed in the 2Btx of pedon 11. Argillic horizon thickness in the paleosols was 99 and 82 cm in pedons 10 and 11, respectively. Both had similar clay contents (Table 3). Soil formation within these paleosols was probably similar. Down cutting at the head of the hollow may have eroded the paleosol of pedon 11 and generated a deeper receiving area for colluvial deposition.

Soil genesis in pedon 12 was diverse. Presently in a toeslope position, the pedon was a colluvial deposition. A stream channel had cut through the colluvium depositing alluvial sediments. Morphology of this soil indicated the alluvial deposition was not that of a permanent stream, but more likely the result of major flooding in the area (Table 2). This deposition was later covered by more colluvium. Redoximorphic depletions were evident in the old colluvial paleosol beginning at 150 cm. The light gray (10YR 7/2) matrix of the Btg (203 cm) denoted a prolonged reducing environment.

Properties of the BC horizon did not correlate well to any adjacent horizon. There were marked changes in coarse fragment content, extractable manganese, and total sand, especially in the very coarse and very fine sand fractions (Tables 3 and 6). However, this horizon did contain stream gravels reflecting alluvial origin. Smaller sized particles comprised the overlying BE, Bt1, and Bt2 horizons. A plausible scenario involved deposition of the BC material when a high energy force of water cut into the old surface. As water movement slowed, a slack water environment allowed for deposition of smaller sized particles in the overlying horizons. The Ap represented still

another deposition of colluvium. Coarse fragment content and sand fractions at 30 cm (Table 3) indicated little relation to the BE horizon immediately below.

A bench of lower Copper Ridge sediments was the foundation for pedon 13. Laboratory and field data indicated an erratic morphology in this soil profile. Depth to rock within the excavated pit ranged from 25 cm to greater than 2 meters. The upper 77 cm constitutes the youngest colluvial deposition. The Bt/E horizon contained E horizon material similar in color to the overlying E horizon (Table 2) but a much higher coarse fragment content (69%)(Table 3). The B horizon material did increase in clay (36%) and had redder hues, but fine clay and free iron percentages did not indicate illuviation (Tables 2, 3, and 5). Deposition of the B horizon material may have occurred a short time prior to the overlying material in order for E horizon material to have been incorporated into this horizon.

Particle size, sand and silt fractions, coarse fragments, CEC, and free iron in the 2Bw horizon indicated this horizon was probably a separate deposition, since there is little relationship to adjacent horizons other than color (Tables 3, 4, and 6). The 3Bt1 and 3Bt2 had pressure faces indicating force of movement between peds. A dolomite rock too large for excavation occupied the 114 to 139 cm area of the 3Bt2. Red hues at 63 cm were indicative of intense weathering (Table 2). The 4Cr and weathered dolomite of the R layer were the only residual material in this pedon.

Pedon 14 had formed in fault breccia of the Rome Formation at the base of a sideslope. The soil profile developed in colluvial material over saprolite (Table 1). Soil materials present prior to colluvial deposition appeared to have been truncated. Only the red color (2.5YR 4/8) mixed with strong browns (7.5YR 5/8) of the Bt2 indicated influence of saprolitic material (2.5YR 4/6) in the underlying 2BC horizon (Table 2). Weathering of the 2BC was heavily influenced by the overlying colluvial material. Free iron, clay, and fine clay percentages indicate illuviation had occurred throughout the soil profile and into the 2BC (Tables 3 and 6). The variety of colors and textures in the saprolitic material of this pedon exemplified major differences in parent material resulting from faulting of the original geologic bedding. This also demonstrated some of the difficulty in

determining genesis of soils forming in residual material with frequent lithologic changes in the original geology.

The soils of pedons 15 and 16 represented pedogenic development on two different aspects and slopes of the Rome Frm. (Table 1). Pedon 15 was located on a middle sideslope having a slope of 50% with an eastern aspect. The top 38 cm had developed in colluvial material. Coarse fragments of sandstone were greater by volume in the upper 38 cm than in the underlying residual material (Table 3).

Pedon 16 was situated on a 24% slope in a midslope position. With its southern aspect, total carbon and cation exchange capacity in the surface horizons of pedon 16 were much lower than pedon 15 (Tables 4 and 6). Iron oxide content was greater in the argillic horizon of pedon 16. Base saturation was also lower.

As noted by Lee et al (1988), soils of the Rome Frm. tended to be shallow. Slope percentage was an integral factor in soil depth and the thickness of argillic horizons. Pedon 15 with a 50% slope (Table 1) had developed a weak argillic horizon 15 cm thick (Table 3). Pedon 16 was in a more stable position, 24% slope, and had an argillic horizon 29 cm thick.

Iron oxide concentrations have often been utilized as indicators of weathering in soil profiles (Arduino, et al, 1986; Robertus and Buol, 1985). Soils of the Knox Group were more deeply weathered than those of the Chickamauga and Rome Formations. The highest concentrations of free iron were in the highly weathered soil of pedon 9, a Typic Kandiudult (Table 1 and 6). In contrast, the Ultic Halpudalf of pedon 15 had the lowest concentrations of free iron, was on a 50% slope, and had the least amount of development (Table 1 and 6).

Manganese concentrations, in all soil profiles, were generally higher in surface horizons (Table 6). Saprolitic material varied in manganese content with pedons 10 and 14 having very high concentrations. Soils formed over the Chickamauga A limestone (pedons 3 and 4) had higher levels of base cations, especially calcium, than those formed over Knox or Rome parent material (Table 4).

Parent material was a major factor in the development and character of each of these soils. In many cases, the properties of soils developed in residual materials were very different from those developing in colluvium or alluvium. These differences were especially pronounced in the type of horizonization, soil color, particle size, and cation exchange capacity. Site position played an integral role in development of several pedons especially in regard to soil depth and argillic thickness. Of the five soil forming factors (Jenny, 1941), topography and parent material were the most influential in formation of these thirteen pedons.

CONCLUSIONS

1. Parent material and topographical position were major factors in soil
2. Soils of the Knox Group were deeper than those of the Chickamauga and Rome Formations.
3. Nine out of 10 sites having slopes of 12% or greater had colluvial depositions.
4. Kandic horizon formation in pedon 9 was indicative of low activity clays (LAC's). Parent material rather than the pedogenic processes was probably the overriding factor in LAC formation, since the intensely rubified argillic horizons of pedons 3 and 4 had no kandic properties.
5. Pedons 12 and 13 were characteristic of soils whose development have been influenced by repeated depositions of material. Both are in receiving positions and had multiple additions. Pedogenesis throughout the profile was very slow due to a repeating cycle of returning to "time zero".
6. Slope and aspect were major components influencing total carbon levels and thickness of the argillic horizon in pedons 15 and 16 of the Rome Formation.

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CHAPTER 4. KANDIC HORIZON IDENTIFICATION IN SOILS FORMING IN COPPER RIDGE COLLUVIUM/RESIDUUM IN EAST TENNESSEE

ABSTRACT

Soils which have developed kandic horizons characterized by low activity clays require specific soil management methods. Identification of kandic horizons is difficult in the absence of laboratory data. Several geological formations in the Ridge and Valley physiographic region have weathered to produce horizons with properties similar to kandics found in tropical soils. The objective of this study was to determine the presence or absence of kandic horizons in soils forming in association with the Copper Ridge Formation and if any physical properties would be viable as tools in field identification. Total carbon, CEC, ECEC, particle size, total acidity, citrate-dithionite iron, and pH were determined on samples from 24 pedons. Soil morphology was completed on each soil profile. Of the 24 pedons examined, 54% had developed kandic horizons. Kandic horizons with hues of 5YR and 2.5YR had average clay contents of 49 and 68%, respectively. Non-kandic argillic horizons averaged 34 and 55% clay in the 5YR and 2.5YR horizons. Kandic horizons had developed in both colluvial and residual materials. Intense redness of soil matrix color along with high clay content in soils forming in Copper Ridge colluvium/residuum would present a greater than 50% possibility that kandic horizonation had occurred.

INTRODUCTION

Highly weathered soils are often characterized by low CEC values, accumulations of sesquioxides, an absence of weatherable minerals, and the presence of large amounts of kaolinite, goethite, hematite, and gibbsite. A predominance of 1:1 lattice-type and sesquioxided clays contribute to low CEC values. These clays are often termed low-activity clays (LACs) (Goenadi and Tan, 1988).

Soils containing LACs undergo greater cation leaching, increased anion and heavy metal adsorption, and greater phosphate fixation. These distinctive properties govern soil management and are of concern for proper recognition and classification of such soils. Proficiency in determining the presence of LAC as defined by kandic horizon requirements would facilitate classification and mapping of these soils (Kleiss, 1994).

In East Tennessee, soils developing in certain geologic parent materials display intense weathering characteristics. Deep red soils forming over dolomites and limestones often exhibit properties similar to kandic horizons. This study was undertaken to 1) determine the presence or absence of kandic horizons in soils developing on the Cambrian-aged Copper Ridge geological formation and 2) identify morphological properties which could be used to identify kandic horizons in the absence of laboratory data.

Soils of temperate humid areas have dominantly yellowish colors with hues seldom redder than 5YR (Kampf and Schwertmann, 1983). Well drained soils formed under humid, warm climates usually are relatively low in cation exchange capacity, exchangeable bases, and have red or yellow colored subsoils (Buol and Sanchez, 1986). Degree of redness is related to the proportion of the iron present as hematite and goethite. Little or no hematite is present in soil material with 7.5YR or 10YR colors. Colors of 5 R indicate a dominance of hematite (Bigham et al., 1978).

In studying the relationship of iron oxide mineralogy to soil and climatic factors in Brazil, Kampf and Schwertmann (1983) found higher temperatures favored hematite, whereas high excess moisture (excess of rainfall over evapotranspiration) and lower pH favor goethite. Higher organic carbon content (>3% organic C) resulted in no hematite being formed. At < 15°C, goethite was the only Fe oxide mineral found. Between 15.5 and 17.5 °C, the hematite/hematite + goethite ratio increased rapidly. Factors favoring hematite formation were low water activity, higher temperature, and low organic matter content.

Curi and Franzmeier (1984) examined a toposequence in which reddish soils, dominated by

hematite, occurred in the upper well drained positions. Yellowish soils, dominated by goethite, were found in lower landscape positions where soil environments were more moist.

NATURE OF THE AREA

Faulting and folding of geologic beds have produced the distinct northeast to southwest parallel topography of the Ridge and Valley physiographic province of East Tennessee. Many of the distinctive ridges are underlain with dolomites from the Cambrian aged Copper Ridge Formation (Knox Group). This includes a series of ridges within the White Oak Mountain imbricate thrust sheet known as Chestnut Ridge (northeast), Stamp Creek Ridge, and Walker Ridge (southwest) (Fig. 2).

Copper Ridge dolomite underlies long, broad asymmetrical ridges with the steeper side next to the Conasauga (Cambrian) and the more gentle side forming a dip slope (Lemiszki, 1992). Pinnacles, ledges, and surface depressions are a common feature (Lietzke et al, 1989).

Large, stable dolines are situated on ridge crests or at relatively high elevations (Lietzke et al, 1989). Doline size on Chestnut Ridge ranges from 0.03 to > 1 ha (Crownover et al., 1994) Active dolines seem to occur primarily on lower sideslopes where surface and subsurface flow from higher landforms have been concentrated (Lietzke et al, 1989). Density and size of dolines depend on the rate of karstification as controlled by bedrock lithology (White and White, 1979). Sinkholes of the Copper Ridge are probably a direct influence of variations in chert content (Crider, 1981).

Lower Copper Ridge rock materials are dark gray and brown, massively bedded, medium to coarse crystalline dolomites. Freshly broken pieces yield a strong petroliferous odor. Light gray, medium crystalline dolomite is typical of the upper section of the Copper Ridge and may be interbedded through the lower part (Lemiszki, 1992). Cherts are light colored, concentrically banded, or oolitic (Crider, 1981). Much of the chert has developed as siliceous oolites and silicified cryptozoans in which silica has replaced the original calcium carbonate (Haney, 1966). Beds and

lenses of white or gray chert have formed in the upper Copper Ridge (Lemiszki, 1992).

Soils forming in Copper Ridge residuum have high silt plus clay content and a highly variable chert content. The upper 40 to 80 cm are very cherty. Underlying subsurface horizons vary from greater than 35% chert to those almost chert free (Lietzke et al, 1989). Crownover et al. (1994) described residual Copper Ridge soils on Chestnut Ridge as having yellowish-red (5YR 5/8) silty clay loam upper horizons (30-60 cm) with redder (2.5YR) subsoils having clay textures. Soils occurring along the narrow crest and steep sideslopes of Chestnut Ridge were classified as clayey, kaolinitic, thermic Typic Paleudults on slopes generally <25% and Hapludults on slopes > 25%. (Lietzke et al, 1989).

MATERIALS AND METHODS

Site Selection

Site selection was based on three primary requirements: 1) all soils must have developed over residuum from the Copper Ridge geological formation, 2) soils should be under forest vegetation, and 3) human influence should have been minimal for 40 years or more (Watkins et al, 1993). The presence of Copper Ridge residuum was determined by examining soil color, chert content, and stratigraphic relationships of available geological exposures. Time since major human influence was discerned through coring of trees and personal communications with landowners.

Field Methods

Twenty-four pedons in Roane and Anderson Counties, TN, were sampled and described according to National Cooperative Soil Survey standards (Soil Survey Staff, 1995) (Fig. 8, 9, and 10). All pits were hand dug. Descriptions included horizonization, depth, color, structure, consistency, texture, and redoximorphic features.

Laboratory Methods

Each sample was air dried, sieved to remove coarse fragments (≥ 2mm), and mixed thoroughly. Total carbon analysis was determined with a Leco CR-12 Carbon System. Soil pH

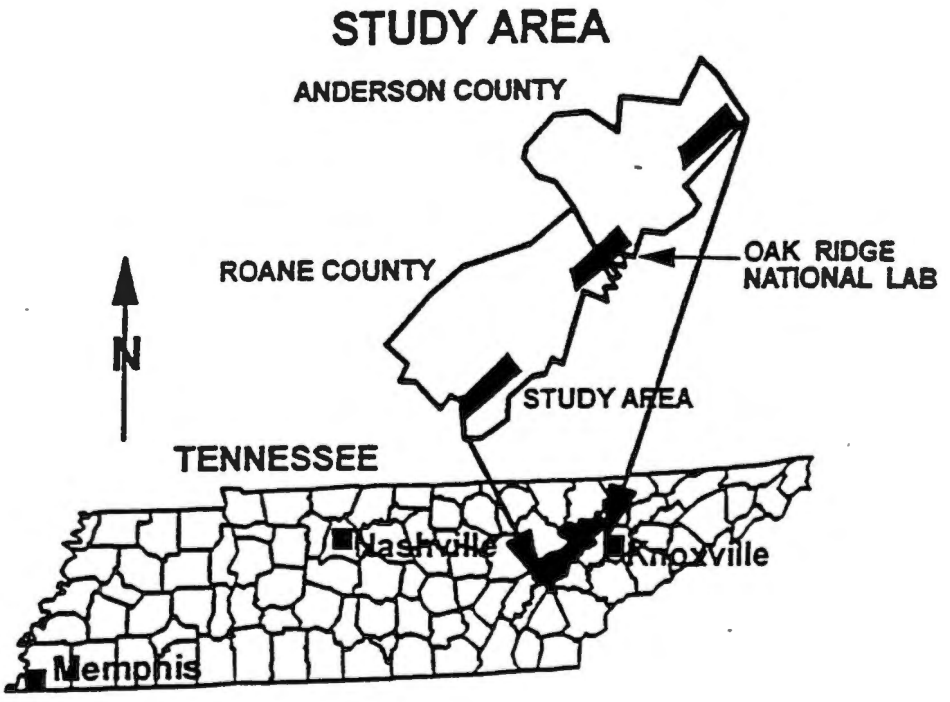


Figure 8. General location of the study areas in Roane and Anderson Counties, Tennessee.

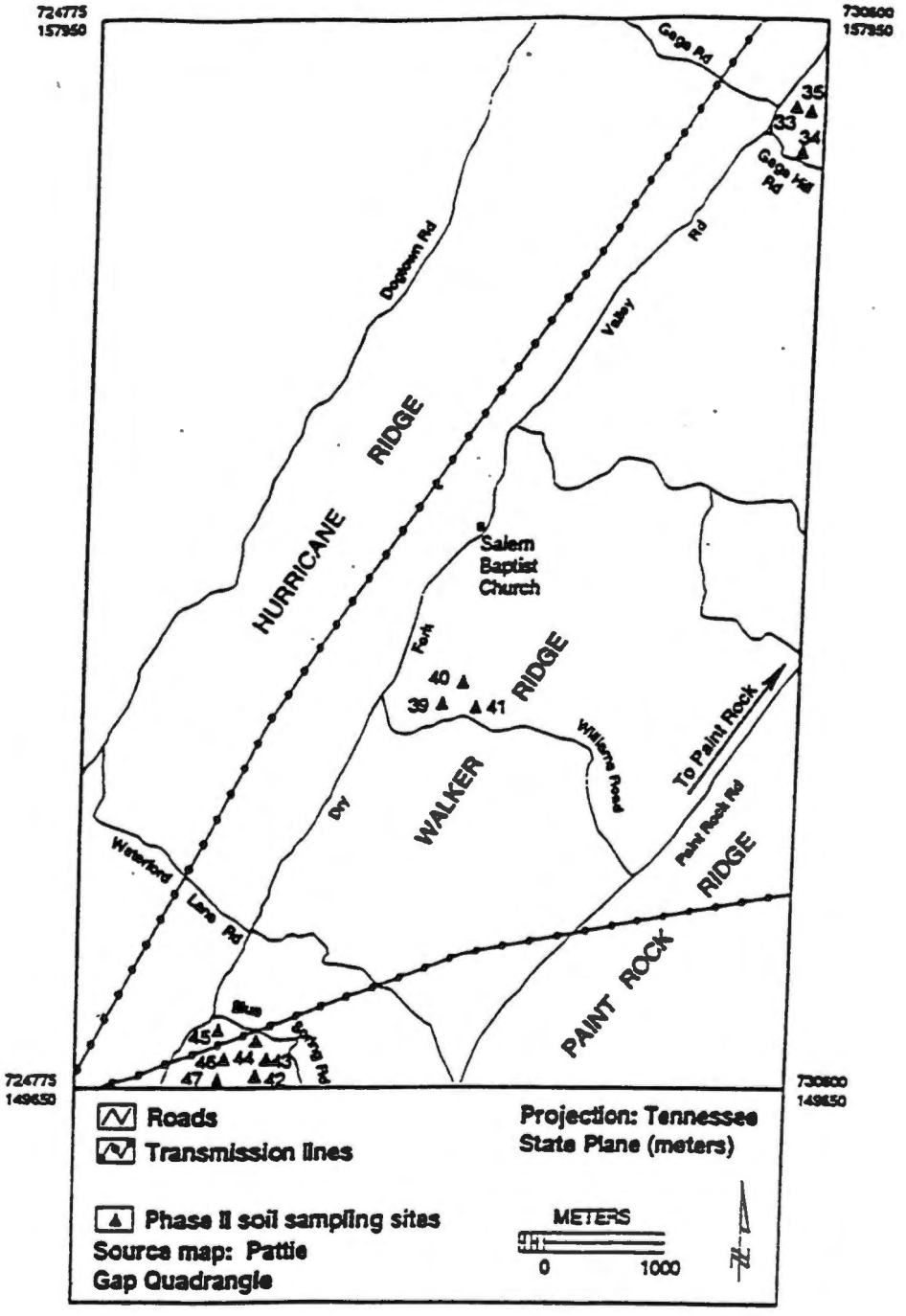


Figure 9. Location of pedons in Roane County, Tennessee on the Copper Ridge Formation. Sites are listed as Phase II soil sampling sites (modified from Watkins et al., 1993).

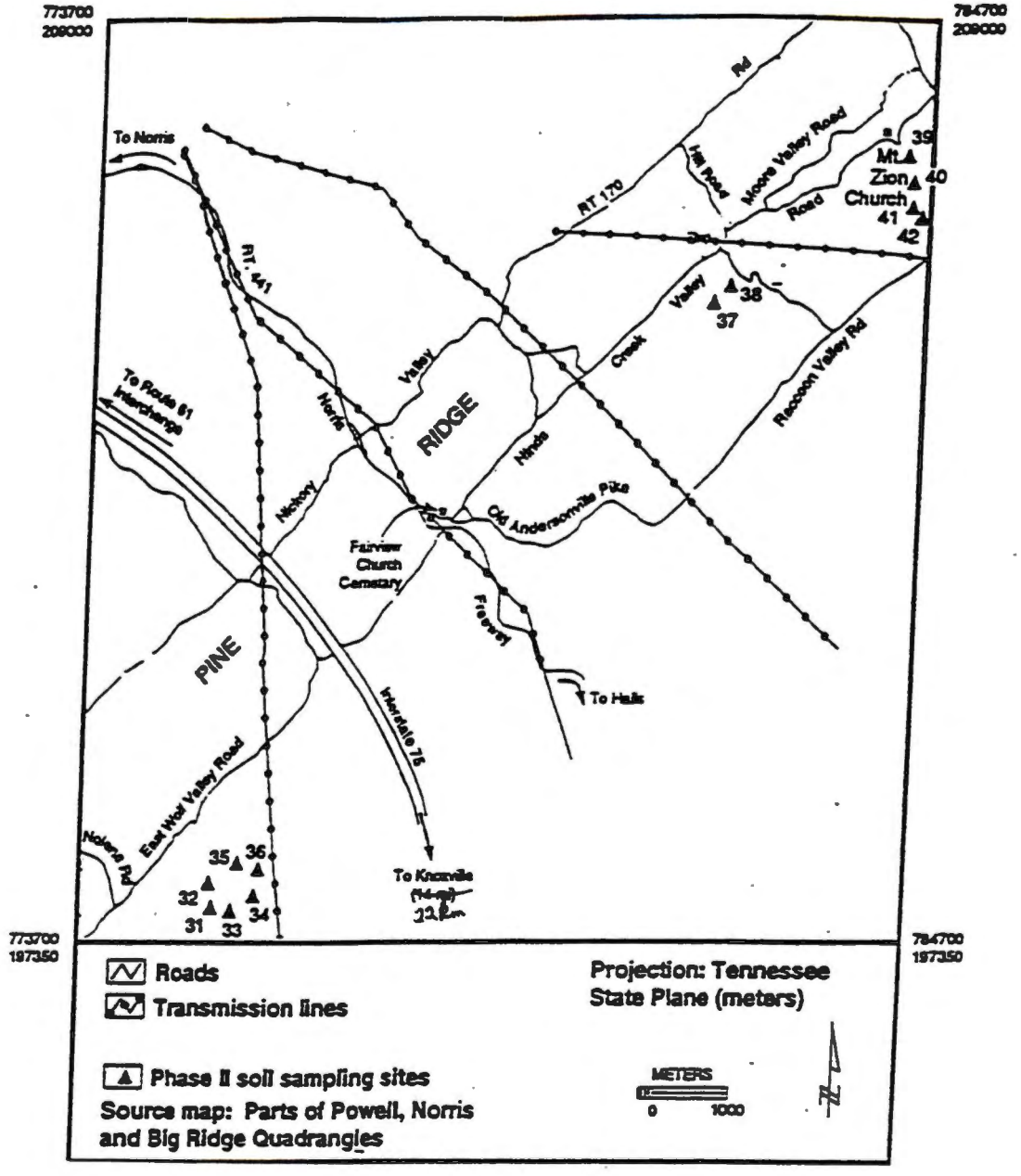


Figure 10. Location of pedons in Anderson County, Tennessee on the Copper Ridge Formation. Sites are listed as Phase II soil sampling sites (modified from Watkins et al., 1993).

was measured using a 1:1 ratio of water and soil (Olsen and Ellis, 1982a).

Particle size analysis was determined by the pipette method (Kilmer and Alexander, 1949). Sands were fractionated into very coarse sand (vcos), coarse sand (cos), medium sand (ms), fine sand (fs), and very fine sand (vfs) (Gee and Bauder, 1986). Ammonium acetate saturation (pH 7) was used to measure percent base saturation (Jackson, 1958). Cation exchange capacities were measured by displacement and distillation (Chapman, 1965). Total acidity and aluminum content were determined by the KCl extraction procedure (Lin and Coleman, 1960).

A hydroxylamine hydrochloride method was utilized to extract manganese oxides (Gambrell and Patrick, 1982). Iron oxides were extracted by the citrate-dithionite (CD) method (Olsen and Ellis, 1982b). Mineralogical class was determined by CEC to clay ratio (Soil Survey Laboratory, 1995).

RESULTS AND DISCUSSION

Since the Copper Ridge Formation characteristically underlies broad ridges, topography has been an integral part in soil development. All sites in this study were well drained soils located on steep sideslopes (10 to 39%) between the contact with the Maynardville Formation of the Conasauga Group and the ridge crest (Tables 7 and 8).

None were examined on the gently rolling slope overlying upper Copper Ridge sediments. In general, the present vegetative cover was composed of Southern red oak (*Quercus falcata*), chestnut oak (*Quercus prinus*), dogwood (*Cornus florida*), red maple (*Acer rubrum*), Virginia pine (*Pinus virginiana*), and hickory (*Carya*). Tree corings and personal communications with landowners established age since major human influence at 40 to 80 years before present (b. p.).

Parent material in general consisted of colluvium over Copper Ridge residuum (Tables 7 and 8). The residual soil observed in most profiles was a clayey paleosol. Dark red (2.5YR 4/6 and 2.5YR 4/8) colors were predominant (Table 9 and 10). Percent free iron and CEC were higher compared with the overlying colluvial material (Table 11 and 12).

Colluvial influence was observed in all soil profiles. In some pedons, only a shallow

colluvial veneer was present (Roane 33) (Table 9). In others, the entire soil profile had developed in colluvium i. e. Anderson 31, 32, 40, and 41, and Roane 43 and 44. In several soil profiles, there was evidence of more than one deposition of colluvium. For example, coarse fragment content and percentage of fine clay in Roane 35 indicated changes in deposition at 23 cm and 73 cm (Table 11). Similar results were observed in Roane 42 at 15 cm and 55 cm (Table 11).

Many pedons had much higher amounts of coarse fragments in the surface than in horizons immediately underneath them. As heavy rains washed material down slope, larger fragments may have moved only short distances or remained stable while smaller sized particles continued to move into lower receiving positions. This resulted in surface materials having a higher concentration of coarse fragments. Evidence of this occurred in Anderson 31, 32, 33, and Roane 33, 39, 44, 45, 46, 47 (Tables 9 and 10).

Chert has been a major factor in soil development on Copper Ridge material. A majority of coarse fragments were chert; however, there were also many gravels and cobbles composed of dolomite. Sizes of coarse fragments were variable within many profiles. Some were greater than 15 cm in diameter (Roane 42) (Table 9). Overall, the profiles in Anderson County tended to have greater coarse fragment content than those in Roane County.

Colluvial horizons were characterized by hues in the 10YR and 7.5YR range (Tables 9 and 10). Horizons having colors of 5YR were primarily colluvial, but often displayed transitional properties between the colluvium and residual paleosol. The red hues (2.5YR) of the paleosol indicated an older soil that had undergone intense rubification. Clay content also was positively related to soil color. This would be logical since clays and iron (Fe2+) both move with the soil solution. Averaging over the thickness of each horizon by color, clay percentage increased as soil color became redder. In Anderson County, 10YR, 7.5YR, 5YR, and 2.5YR horizons had average clay contents of 19, 26, 41, and 55 percent, respectively. For Roane County, averages were 21, 25, 38, and 54 percent with increasing redness.

Forest vegetation had a stabilizing effect on the soil. Recent colluvial events would probably

produce an irregularity in organic carbon content with depth. While many of these soils did have chemical and physical evidence of colluvial deposition , only in Anderson 33, Roane 40, and Roane 43 at 46 cm, 52 cm, and 72 cm, respectively, did percent total carbon fluctuate with depth (Tables 11 and 12).

Further evidence of soil stability was indicated by the presence of argillans. Illuviated clays often adhere to the faces of soil peds forming a coating. As more coatings are applied, the thicker the argillan (clay skin) becomes. This process requires both time and ped stability (Sleeman, 1963). Daniels et al. (1983) found argillans to be thicker and more continuous on ped faces from subsoils under forest vegetation when compared to pasture vegetation. Argillans (clay skins) were present in all twenty-four soil profiles and varied in thickness and continuity (Tables 9 and 10).

Under present day vegetation, A horizons ranged in depth from 3 to 27 cm (Tables 9 and 10). Pine vegetation grew over the thickest A horizons in Anderson 41(27 cm) and 42 (24 cm). E horizons had formed in numerous pedons (Table 3). All or portions of the E horizons in Roane 35, 40, 42, 43, and 44 met the color criteria to be albic (Table 9). These horizons were all colluvial in origin and have probably developed within 40 years when the last major disturbance occurred.

Higher clay contents tend to produce smaller peds with blocky structure (Harper,1937). Soils of the study area are in agreement with this axiom. Argillic horizons were predominately subangular blocky in structure with peds of fine to medium size (Tables 9 and 10).

Of the 24 pedons examined, 13 (54%) had developed horizons which met kandic criteria. Roane 46 and Anderson 38 had horizons containing 9 cm and 11 cm, respectively, of kandic material, but did not comprise 50% of the argillic (Tables 11 and 12). In many of the pedons that had no kandic diagnostic horizons, the CEC/ECEC criteria was only slightly higher than accepted parameters for a kandic .

Kandic horizons had developed in both transported and residual materials. Dominant matrix color in the argillic/kandic horizons was yellowish-red (5YR 5/8) to dark red (2.5YR 4/8). Hues of 2.5YR were more representative of paleosol color, while 5YR colors were more common in

colluvial or transitional horizons. Of the Bt horizons having 2.5YR matrices, 60% (15 of 25) were kandic. With 5YR matrices, 62% (18 of 29) of the Bt horizons were kandic (Tables 9,10,11, and 12).

Clay content was higher in horizons which met kandic criteria. Kandic horizons with hues of 5YR and 2.5YR had averaged clay percentages of 49 and 68, respectively. Non-kandic argillic horizons averaged 34 and 55 percent clay in the 5YR and 2.5YR hued horizons. As always, there were exceptions. One horizon having 86% clay (Roane 33) (Table 11) did not meet kandic criteria while another with 27% clay did (Anderson 39)(Table 12). Development or nondevelopment of kandic horizonization may have been related to micro environmental factors, such as organic carbon content and moisture content, affecting these landscapes over time. Even with these exception, hue color and clay content have been shown to be viable field tools to identify kandic horizons on these Copper Ridge landscapes.

Thirteen pedons were classified as Typic Kandiudults (Tables 13 and 14). Ten were classified as Typic Paleudults and one was a Typic Fragiudult. CEC to clay ratios indicated the predominance of kaolinitic clays in these soils.

CONCLUSIONS

1. Soils forming on steep slopes over the basal members of the Copper Ridge Formation have developed in colluvium or colluvium/residuum parent material.

2. E horizons had developed within 40 to 80 years.

3.The paleosol was characterized by a high clay content and 2.5YR soil matrix hues.

4. In soils forming in the residuum of the basal units of the Copper Ridge Formation, kandic horizons can be reasonably identified in the field through determination of clay content and the presence of 5YR to 2.5YR matrix colors.

5. Forest vegetation has provided stability for soils forming on steep slopes. E horizon development, a normally decreasing total carbon content, and argillan formation are evidence of soil stability.

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CHAPTER 5. SOIL FORMATION IN THE CAMBRIAN MARYVILLE FORMATION (DISMAL GAP) OF THE WHITEOAK MOUNTAIN THRUST FAULT BLOCK

ABSTRACT

Variation in soil formation has often been noted in parent materials which have been transported. Residual parent materials from the same geological formation produce spatial variation as well. The focus of this study was to determine the genesis of soils forming in residuum of the Maryville Formation (Cambrian age), examine the basis of soil differences and similarities, discern specific properties unique to these soils, identify properties useable in field identification, and classify each soil pedon to the family level. In Roane and Anderson Counties, Tennessee, twenty-four soil pedons forming at least in part in residuum of the Maryville Formation were described and sampled for complete soil characterization according to National Cooperative Soil Survey Methods. In 17 of 24 pedons, the upper portion of the solum was composed of either alluvial or colluvial material. Influence of wind blown silt occurred in 71% of the pedons. In Roane County, soils overlying Maryville geology were primarily located in terrace positions. In Anderson County, knobs and sideslopes were the main site positions. Argillic horizons in the soils from Roane County were primarily 7.5 YR in hue, while those in Anderson County were 5 YR. Family particle size class was dominantly fine. Thickness of the argillic horizon was the major determinant in classifying each pedon as either a Typic (14 pedons) or Ochreptic (10 pedons) Hapludult.

INTRODUCTION

Spatial variability in soils is a function of many different factors (Campbell, 1977) (Wilding and Drees, 1983). Site position, slope, anthropogenic influences, and vegetation are only a few of the factors influencing soil diversity. A major contributor to spacial variability is parent material. Primary emphasis of studies in this realm has been placed on soils forming in transported materials (Wilding and Drees, 1983). However, residual parent materials exhibit definite spatial variabilities.

Residual parent materials are often described as belonging to a specific geological unit or group. However, differences as well as similarities in soils are tied to the lithologies of the original geology. Logically, geological units bearing the same nomenclature, just like soil units, share many major characteristics no matter the distance between them, but vary in other properties over short intervals.

In this study, twenty-four soil pedons forming in the residuum of the Maryville Formation (Cambrian) were described and sampled. The objectives of this work were to 1) determine the genesis of soils forming in residuum of the Maryville Formation, 2) examine the basis for soil differences and similarities, 3) discern specific properties unique to these soils, 4) identify properties useable in field identification, and 5) classify each soil profile to the family level.

NATURE OF THE AREA

Composed of units of alternating shales and limestones, the Conasauga Group (Cambrian) underlies many major valleys in the Ridge and Valley physiographic province of East Tennessee (Fig. 3). The Conasauga conformably overlies the Rome Formation (Cambrian) and is in turn overlain conformably by the Knox Group (Cambrian/ Ordovician) (Rodgers and Kent, 1948). In the study area, Conasauga members underlie Dry Fork Valley (Roane County) , Wolf Valley (Anderson County), and Hinds Valley (Anderson County) (Fig. 2).

In this region, the Conasauga Group is comprised of six major units of alternating shales and limestones including the: Pumpkin Valley Shale (oldest), Rutledge Limestone, Rogersville Shale, Maryville Limestone, Nolichucky Shale, and Maynardville Limestone (youngest) (Fig. 3).

Across the expanse of the Ridge and Valley, the character of the Maryville Limestone, in particular, has exhibited major differences in character. In southeastern depositions, peritidal and subtidal carbonates were the predominant sediments. A central section consisted of shallow and deep water subtidal carbonates interbedded with increasing amounts of shale. To the northwest,

shales became dominant (Rodgers, 1953; Srinivasan, 1993). The study area lies in the transition zone between the central and northwestern phases.

Due to facies differences in the Anderson County section, the name Dismal Gap Formation has been applied in describing Maryville stratigraphy. In this area, the limestone has weathered leaving only an identifiable shale member. The name is derived from a well exposed section along Dismal Gap Road in the Wolf Valley area of Anderson County, Tennessee (Lemiszki, 1992). For continuity throughout this work, Maryville nomenclature will be used to describe this geology.

Maryville limestones are typically light to medium gray, and thin to medium bedded. Flat-pebble conglomerate, oolitic packstone, wackestone, and micrite have been observed in these limestones. Shale and siltstone are typically calcareous and siltstones often contain glauconite. Relatively high iron oxide and manganese contents in the Maryville are reflected by thick bright red or dark red iron oxide coatings or fragments in the upper saprolite and thick black manganese oxide coatings or fragments below the zone of iron oxide coatings (Lemiszki, 1992)

Maryville limestone represents deposition along a rimmed shelf edge-to basin transition (Srinivasan, 1993). Facies distribution of the Maryville Formation reflects a change in depositional mode through time from a gently sloping ramp (Kozar, 1986) to a rimmed platform (Srinivasan, 1993). Carbonate sedimentation on the shallow subtidal ramp occurred at a relatively constant rate. Offshore, deposition rate did not keep pace with that of the ramp area. Slope increased (2-3°) with a change in topography to a rimmed platform. Rising sea levels decreased carbonate productivity and sedimentation rate. Lithofacies of deeper environments contained a high amount of quartz silt, terrigenous clay, and carbonate mud which evolved into packstones and shales (Srinivasan, 1993).

Dominant Maryville soils are Ruptic-Ultic Dystrochrepts. However, Typic Hapludults with red or yellowish-red clay enriched subsoils have developed from saprolites on stable landforms. Typic Dystrochrepts occur only on the steepest sideslopes (Lee et al, 1988).

MATERIALS AND METHODS

Site Selection

Twenty-four pedons developing on the Maryville Formation were selected for extensive examination. Twelve pedons were located in Dry Gap Valley, Roane County, Tennessee (Fig. 11) and twelve were in East Wolf Valley and Hind Valley, Anderson County, Tennessee (Fig. 12). Specific requirements for site selection were: 1) soils must have developed in residuum of the Maryville Limestone and 2) the soils should not have been disturbed by man for at least 40-50 years (Watkins et al, 1993). Geologic conditions were met by taking transects across possible site areas and correlating the underlying residuum with descriptions from previous work on the geology and soils of the Conasauga Formation. To deduce a timeline for the sites, personal communication with private landowners and tree corings were the best evidence for age since the last major disturbance.

Field Methods

Each pedon was excavated through manual digging. Soil morphology was completed according to National Cooperative Soil Survey Standards (Soil Survey Staff, 1995). Field descriptions included: horizon designation, depth, boundary distinctness, texture, color, consistence, and structure.

The presence of cutans, manganese concretions, fossils, and other observations were noted. Elevation, aspect, vegetation, slope, and other site characteristics were also recorded.

Laboratory Methods

Each sample was air dried, sieved to remove coarse fragments ($\geq$ 2mm), and mixed thoroughly. Total carbon analyses was determined with a Leco CR-12 System. Soil pH was measured using a 1:1 ratio of water and soil (Olsen and Ellis, 1982a). Particle size analysis was determined by the pipette method (Kilmer and Alexander, 1949). Sands were fractionated into

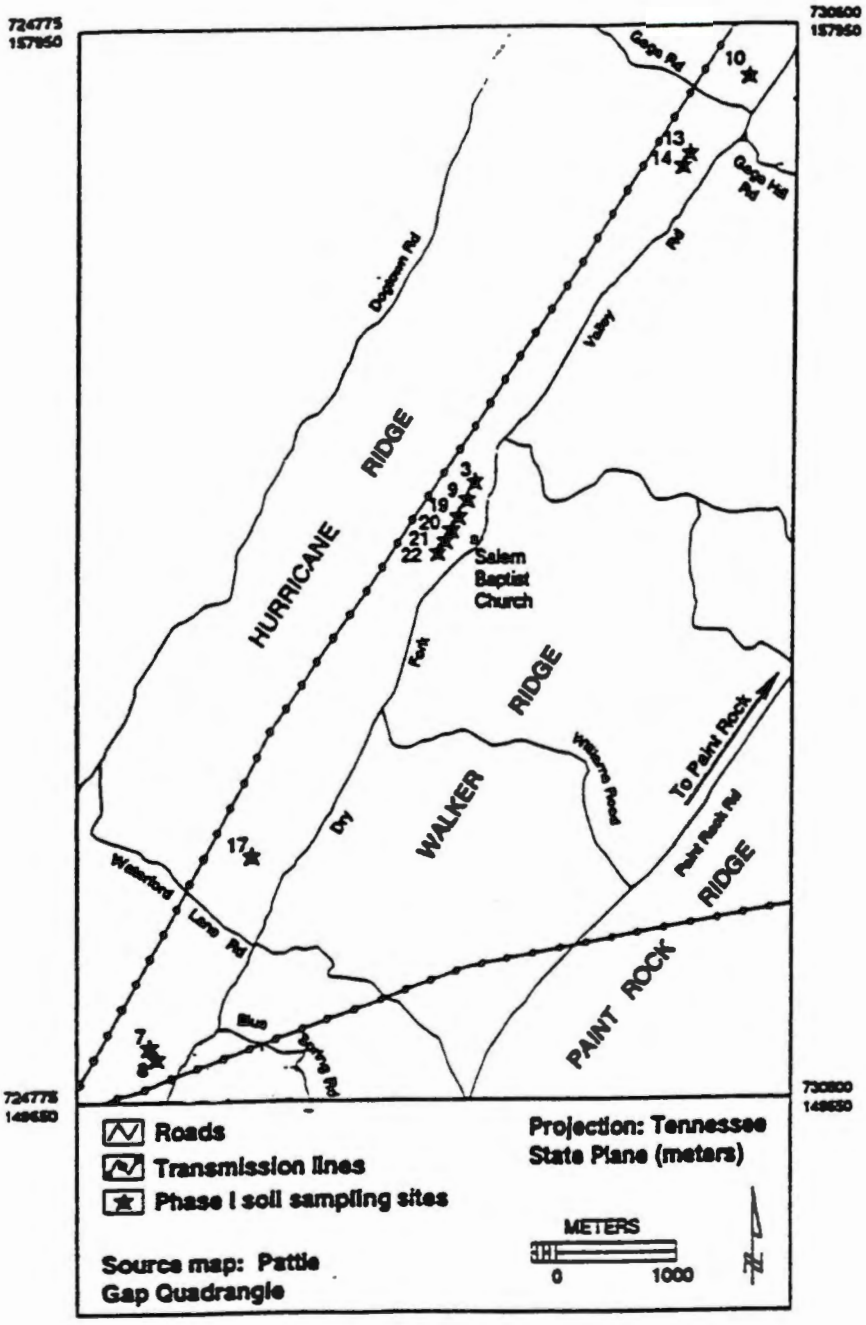


Figure 11. Location of soil pedons formed in residuum of the Maryville Formation in Roane County, Tennessee (modified from Watkins et al, 1993).

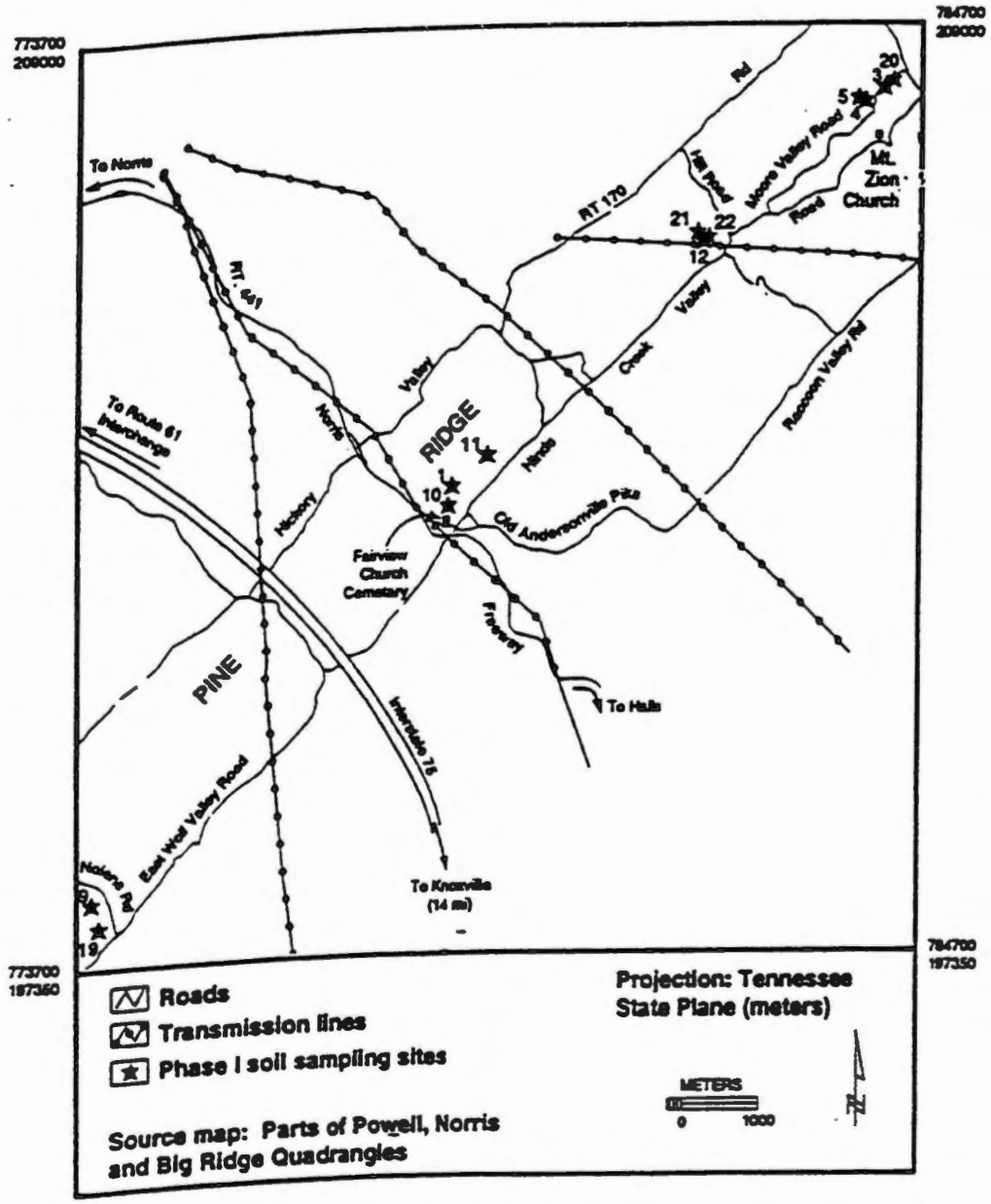


Figure 12. Location of soil pedons formed in residuum of the Maryville Formation in Anderson County, Tennessee (modified from Watkins et al, 1993).

very coarse sand (vcos), coarse sand (cos), medium sand (ms), fine sand (fs), and very fine sand (vfs) (Gee and Bauder, 1986).

Percent base saturation and cation exchange capacity were determined by an ammonium acetate saturation method (Jackson, 1958; Chapman, 1965). Total acidity and aluminum were measured using the KCl method (Lin and Coleman, 1960). Hydroxylamine hydrochloride was utilized in extractions for manganese determinations (Gambrell and Patrick, 1982). Iron oxides were extracted using the citrate-dithionite (CD) method (Olsen and Ellis, 1982b). Elemental concentrations in extracts for bases, aluminum, iron, and manganese were determined with a Perkin-Elmer 5000 Atomic Absorption Spectrophotometer. Mineralogy class was determined using CEC to clay ratios (Soil Survey Laboratory, 1995).

RESULTS AND DISCUSSION

Sites in Anderson County were at elevations slightly greater than 1000 ft (304 m) above mean sea level, while those in Roane County were between 900 and 1000 ft (274-304 m) above mean sea level. Conasauga geomorphology in Roane County was that of a wide valley having been cut down by alluvial forces to produce wide, gentle benches and terraces. Maryville geology was present under the first bench/terrace areas above the valley floor. In contrast, the area underlain by the Conasauga Group in Anderson County was a narrow valley area with knobs and hills. Wide slopes and shoulders of these knobs and hills were underlain by Maryville shales. Conasauga rock units in Anderson County may have been more resistant to erosive forces than that of Roane County. This was probably due to a combination of factors including differences in composition of the original sediments, drainage patterns, and angle of tectonic folding.

All, or a portion, of each pedon had formed in residuum from the Maryville Formation. Many pedons had definite discontinuities where a thin layer of alluvium and/or colluvium had been deposited over the residual soil (Tables 15 and 16). Discontinuities were especially prevalent in soils of Roane County. Of the 12 pedons examined, four pedons (33%) had formed in

alluvium/residuum, six pedons (50%) in colluvium/ residuum, and two pedons (17%) in residuum.

Soils in Roane County with upper solums of colluvium occurred on slopes of 10% or greater, while those with alluvial deposits were found on less steep slopes (Table 15). Horizons forming in colluvium or alluvium were generally yellowish brown with hues of 10YR and 7.5YR. The underlying paleosols were more red with hues of 5YR. In the two residual soils, coloration was generally more of the 10YR to 7.5YR hue (Table 17). Some differences in color may be due to the amount of limestone present in the original parent material. Humic substances are highly influential in the dissolution of hematite, the primary oxide source of deep red hues in soils (Schwertmann and Taylor, 1989). Calcium and magnesium tend to bind with organic matter and remove it from solution (Jackson et al, 1978).

Alluvial horizons contained greater than 50% silt and less than 17% sand. Colluvial horizons had less than 58% silt and 16% or more sand sized particles (Table 18). No E horizonization occurred in any of the alluvial soils (Table 17). Roane 9, 20, and 22 (colluvium) and Roane 13 (residuum) had developed weakly structured E horizons with colors of 10YR 5/4 or lighter. Soils with colluvial horizons (Roane 9, 20, and 22) in which E or AE horizons had developed ranged from 30 to 53 cm in thickness above the discontinuity. Roane 14 and 21 had thinner depositions of colluvium (19 and 18 cm, respectively) and had no E horizonization. The lack of depth to the discontinuity may have restricted movement of clays and irons from the colluvium of Roane 14 and 21 decreasing the possibility of developing an E horizon. Discontinuities tend to slow the rate of water movement from material of one parent material into that of another (Ross, 1990) and therfore, may have impeded movement of clays and irons moving from the colluvial horizons into the residual horizons.

Investigations in Anderson County revealed no evidence of alluvial deposition over the residual soils of the Maryville parent material. Seven pedons were comprised of colluvium over residuum, while the remaining five had residuum as the sole parent material (Table 16 and 19). These residual soils contained an average of 39% clay and 36% silt. In soils with discontinuities,

clay and silt contents in residual materials averaged 50 and 25 percent, respectively. Colluvial materials contained 30% clay and 45% silt. Interestingly, sand content averaged 25% no matter which parent material was predominant (Table 20).

In the Ridge and Valley MLRA (Major Land Resource Area), investigations of dolines have revealed the presence of loess deposits (Lietzke et al, 1989; Crownover et al, 1994). Loessial influences were also noted in the soils of this investigation. When compared to the silt content of horizons lower in the soil profile, higher surficial silt content indicated the presence of wind blown silts. These depositions would have been predominantly of local origin from major flood events in the valleys. Normally, A and/or E horizons will have a higher amount of silt than an underlying Bt horizon as this is the nature of the argillic horizon with its clay accumulation. However, in 17 of the 24 pedons, a decrease in silt levels of 27% or more occurred between the upper two or three horizons of these soils compared with the horizons beneath them. A decrease of 40 to 62% was measured in 10 of the 24 pedons.

This particle size change was most pronounced in the soils of Anderson County (Fig.13). Silt fractions decreased by 27% or more from the upper horizons to the horizons beneath them 11 of the 12 pedons. In eight of the soils, the silt content decreased by 40 to 62%. Average silt content in the upper horizons of the Anderson County soils was 47%, while the lower horizons had an average of 27% silt.

In Roane County, this abrupt change in silt content occurred in only 50% of the 12 pedons (Fig. 14). Five of the sites maintained a >40% silt content throughout the soil profile (Roane 3, 8, 9, 19, and 21) indicating a high silt content in the residuum. In the remainder, the residual material contained lower silt contents similar to those of Anderson County. Geomorphic position may have been another major factor in these regional differences. Positioned closer to the floodplain, the benches and terraces of Roane County may have been subjected to more erosive loss of loessial material by alluvial actions than the hillslopes of Anderson County. Surface levels of silt were consistently higher throughout the area. Since the residual parent material was predominantly

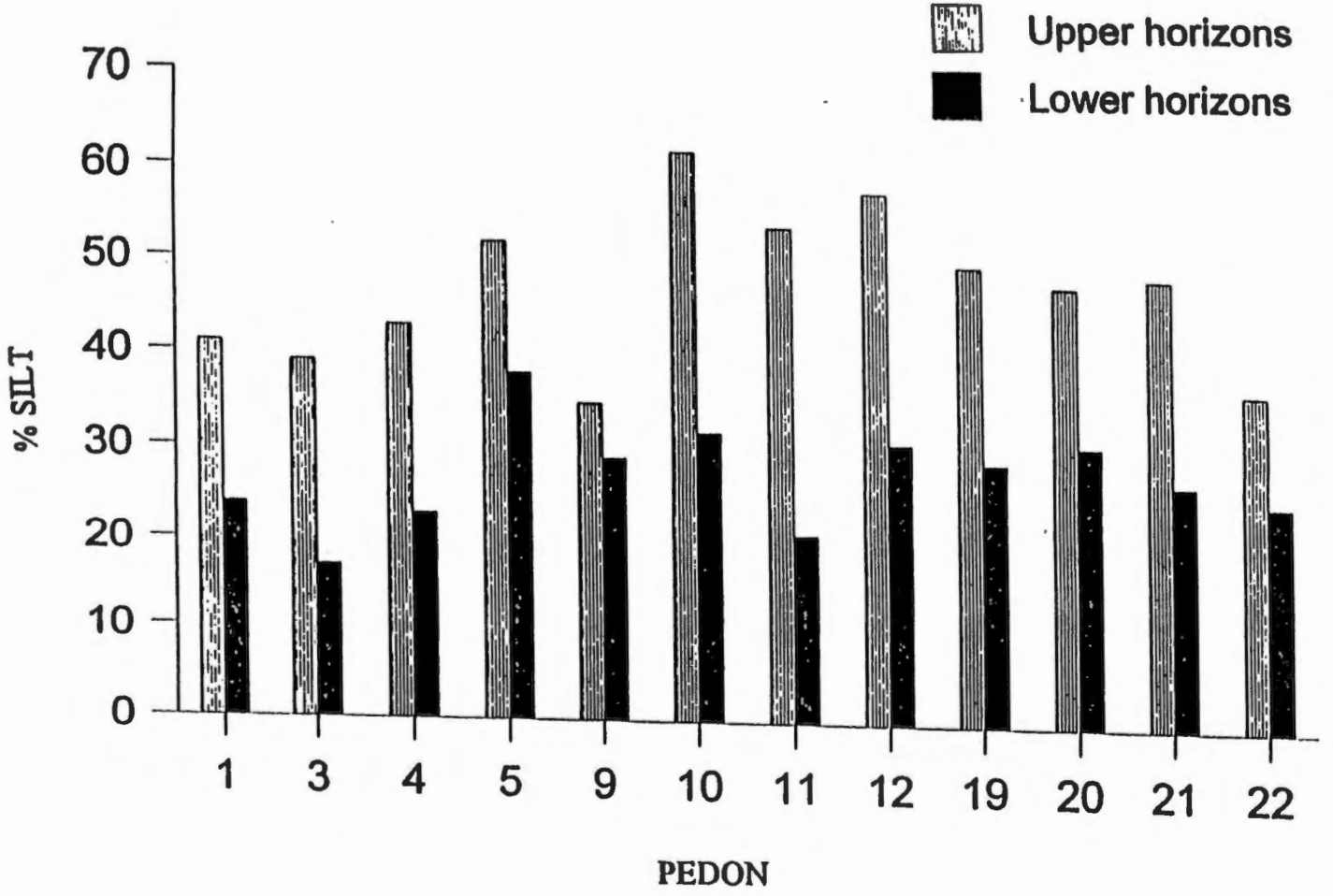


Figure 13. In Anderson County, silt content in the lower horizons of the soil pedons decreased measurably from that in the overlying horizons indicating loessial influences in surface horizons.

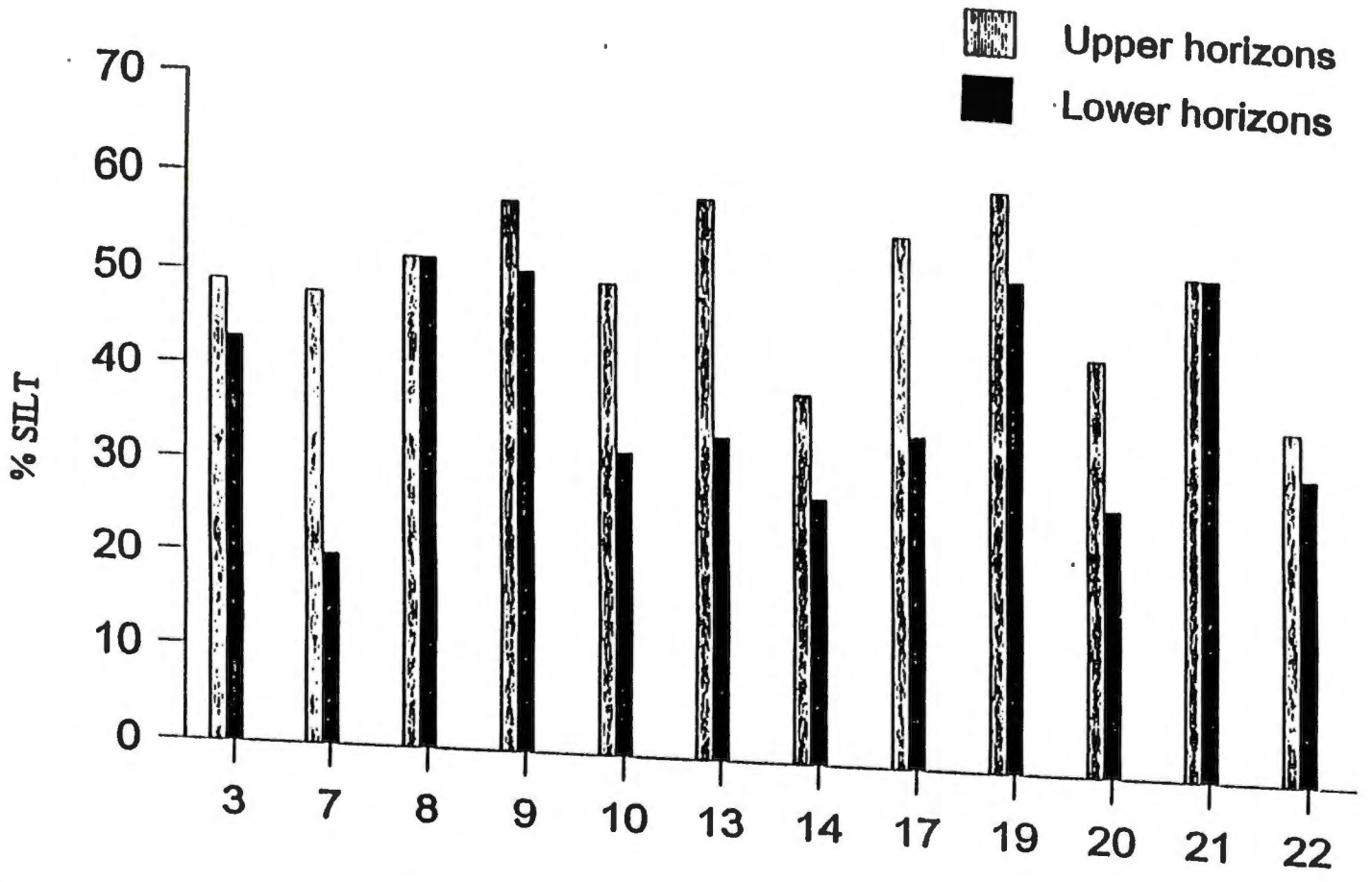


Figure 14. In Roane County, silt content in the lower horizons of several soil pedons decreased measurably from that in the overlying horizons, but in pedons 3, 8, 9, 19, and 21 this relationship did not hold true.

lower in silt, compelling evidence indicated wind-blown silt as the reason for the higher content of the surficial silt fraction.

It might be logical to assume these particle size breaks always occurred at the same depth as the discontinuity. This was not always the case. In several pedons with upper horizons of transported parent material, the lower alluvial/colluvial horizons contained silt contents similar to the underlying residuum (Roane 10, 14, 22, and Anderson 11). Colluvial/alluvial deposition in those lower horizons probably occurred prior to deposition of the wind blown silts.

Roane County soils had very little KCl extractable aluminum (< 2 cmol/kg) in the system. Soil pH was a reflection of the pH of its parent material. Soil material had an average pH of 4.8, while the parent material represented by Cr horizons ranged from 4.7 to 5.3 in pH (Table 15). All soils having alluvial material also contained manganese concentrations or stains (Table 17). These were probably a remnant of the once fluctuating aquic conditions of these depositions.

Much of the alluvium was deposited during periods of lower energy such as that occurring in backwater environments (Lambert, 1988). Horizons with alluvial influence had much higher silt content than those in residuum, which were predominantly clayey. Surface horizons on all terrace soils (Roane 7, 8, 10, and 17) contained greater than 60% silt. This may be the result of both slack water deposition as well as loessial influence. Both physical and chemical criteria were used to determine the presence or absence of discontinuities. Color, particle size, base saturation, and cation exchange capacity were major factors indicating changes between parent materials. Even though loessial influence was evident in many soils, there was difficulty in discerning definite breaks from other types of parent material.

Most Maryville soils investigated in this study had formed on a south/southeast aspect (Tables 15 and 16). These soils were not very deeply weathered. In eighteen profiles, paralithic contact occurred at less than 100 cm, with the shallowest profiles at 28 cm (Anderson 21 and 22) (Tables 19 and 20). Thickness of argillic horizons varied from 10 cm (Roane 10) to 71 cm (Anderson 20).

Rubification of the argillic horizon was more pronounced in soils of Anderson County. Eight pedons, Anderson 1, 3, 4, 12, 19, 20, 21, and 22, had at least one horizon in the argillic with a hue of 5YR or redder (Table 19). In Roane County, only sites 9, 17, 20, and 22 had at least one horizon in the argillic with a matrix color of 5YR or redder. Predominant hues were in the range of 7.5YR (Table 17).

Roane 7 and 8 were located on the same landform within 100 meters of each other. Both soils had formed in alluvial material over an older residual paleosol. Contact depth of the discontinuity was 44 cm in both pedons (Table 17). Under unsaturated conditions, subtle textural changes can act as local barriers to water flow (Kung, 1990 a, b) (Ross, 1990). Manganese concentrations and stains observed in horizons superior to contact with the paleosol were indicative of fluctuations in water content. Major influence most probably followed deposition of the alluvium, since all four of the alluvium/residuum soils contained evidence of manganese oxidation within the area of their discontinuities (Tables 17 and 18).

Differences in the original residual rock material of Roane 7 and 8 were reflected in soil horizons of their respective paleosols. Major deviations occurred in both CEC's and particle sizes, especially in clay content (Table 18). A more homogenous relationship occurred in the alluvial horizons above these paleosols. Similar particle size contents and CEC's were a reflection of the sedimentary environment during deposition after shared flooding events.

In one section of Roane County, six soil pedons, Roane 3, 9, 19. 20, 21, and 22, were excavated within close proximity to each other. The sloping landscape was sharply dissected by erosional gullies. Four pedons (Roane 9, 19, 20, and 21) situated on sideslopes (Table 15) were relatively shallow with contact to Cr ranging from 47 to 74 cm (Table 17). Variations in depth were a result of differences in colluvial material available during deposition and/or erosional processes. Conventional tillage probably was a major instigator of transformation of this landscape. In the soil profile of Roane 21, a newly formed A horizon had developed over an older plowed horizon (Ap). Major changes in sand fractions and coarse fragment contents indicated the

presence of a paleosol under the Ap (Table 18). Annual plowing of the upper portion of this profile had allowed for more intensified movement of material overlying the more stable paleosol.

Roane 3 and 22 extended to a greater depth than the four pedons discussed previously. Roane 3 was located on a sideslope, but the position was concave rather than convex allowing for greater retainment of materials. Similarly, Roane 22 was located on a midslope bench in a receiving position (Table 15).

Within these six profiles, pH's ranged from 4.4 to 5.0. Total acidity increased with depth, but very little was measurable as KCl extractable aluminum. With the exception of Roane 19, exchangeable magnesium also increased with depth in each pedon. Corresponding Cr materials exhibited similarly high levels of magnesium. Calcium tended to decrease in each profile, except Roane 9 and 19 (Table 18).

Differences between these pedons were evident in the soil textures of horizons formed in residual materials. Clay averages ranged from 32% (Roane 19 and 21) to 61% (Roane 20). Thickness of the argillic horizons measured from 22 cm (Roane 9) to 70 cm (Roane 3). Colors varied from yellow-brown hues (7.5 YR) to yellow-red hues (2.5 YR) (Table 17). Site position, composition of the original parent material, and erosional influences were primary contributors to the differences between these soil profiles as well as their similarities.

Anderson 12, 21 and 22 were adjacent pedons. Anderson 22 was on a wide convex slope and Anderson 12 was on the upper side shoulder of a hill. Between these two pedons was a deep drain. At the head of the drain between the two pedons was a small saddle. This was the site location of Anderson 21. These pedons shared similar horizon colors (Table 19), and particle sizes (Table 20). The absence of an E horizon in Anderson 22 was probably a consequence of the steeper slope (18%) in comparison to Anderson 12 and 21 (Table 19). Another factor influencing Anderson 22 to a greater extent than the other two pedons involved management practices in the area adjacent to the site. While Anderson 22 was located in a wooded area, it was 15 m from a pasture area traversed by a power line. The extent of clearing practices utilized in maintenance of the power

lines was unknown. This may have increased erosional pressures affecting Anderson 22 which was only 28 cm thick to paralithic contact (Cr).

Influences from management practices were evident in the chemistry of Anderson 22. Exchangeable Ca, Mg, and K were much higher throughout the profile of site 22 compared with sites 12 and 21 (Table 20). Additions of lime and/or fertilizer to the pasture adjacent to this pedon may have been the source of airborne depositions on site 22.

Although Cr horizons are not normally analyzed for characterization, the Cr shales were sufficiently friable to be prepared for laboratory analyses. Similar particle size was common to the Cr's in all three pedons. Clay content ranged from 36 to 43%. Exchangeable bases were similar in pedon 12 and 21. High exchangeable Mg content in Anderson 22 was most likely the result of dolomitic lime additions in adjacent fields (Table 20).

Anderson 21 was also a shallow soil with the Cr occurring at 28 cm (Table 19). Colluvial or alluvial depositions are commonly found in soils situated in saddle positions. However, Anderson 21 was also at the head of a deep drainageway. Movement of loose materials was probably down through the drain bypassing the main portion of the remaining saddle. The presence of an E horizon indicated stability of the site but additions and losses of soil material seemed to have attained an equilibrium at present.

Slope was a major factor in soil formation in pedons 9 and 19 of Anderson County. Positioned on the same convex slope, Anderson 9 was located 70 m above Anderson 19. With a slope of 15%, site 9 had formed an argillic horizon 34 cm thick and was only 62 cm deep to paralithic contact. Slope on site 19 was only 6% (Table 16). A thicker argillic had formed (49 cm) and depth to Cr was 95 cm (Table 19). Several properties were common to both pedons including CEC in the argillic horizons, pH, free iron, and KCl extractable aluminum (Table 20). Anderson 19 did have redder hue coloration and the Cr horizons did not show much similarity either with particle size or base content. This may have been due to microenvironmental differences in the original sedimentary depositions.

Anderson 1 and 10 were also situated on the same landscape. Site 10 was on an upland summit, while site 1 had developed on the shoulder just off the summit. Both pedons had weaklly developed E horizons with similar coarse fragment content (Table 19) and the particle size in the Cr horizons was similar. Greater erosional activity due to the 6% slope in pedon 1 resulted in a shallower solum than that of pedon 10 (Table 16 and 19).

Another set of paired pedons was sampled on a steep hill covered with thick hardwoods, pines, and heavy understory vegetation. Anderson 5, at 90 meters upslope, shared many common properties with Anderson 4. Solum thickness in both pedons was 70 cm (Table 19). Colluvial deposits had resulted in discontinuities occurring at 53 cm in Anderson 4 and 45 cm in Anderson 5. Transitional and E horizons had developed in this colluvium (Table 19). Differences in the deposits was reflected in the lower cation exchange capacity and KCl extractable aluminum of site 5. In the residual argillic (Bt) horizons, KCl aluminum values were similar (Table 20). In each profile, very fine sands (vfs) dominated the sand fraction. Using very fine sand to total sand plus silt ratios, the position of the discontinuities was well illustrated (Fig. 15).

All things being equal, it would be expected that pedons on steepslopes would be more subject to stringent erosional processes than those of lesser slopes. However, the opposite occurred in pedons, Anderson 3 and 20. Anderson 20 was positioned on a 12 % slope 70 m from Anderson 3 (7% slope). Both had colluvial upper horizons, though site 3's was thinner (16 cm) (Table 20). Human influences most likely had a greater impact on the present day morphology of these two profiles than did differences in slope. Approximately, 50 m from Anderson 3 was evidence of a former homestead. The slope containing the two subject pedons was probably cleared and farmed for crops at one time. Site 3 on a lesser slope probably lost much of its topsoil to erosion. Higher on the slope there were many small gullies and rills present. While less resistant sections were subject to greater erosional pressures, Anderson 20 may have been more protected by position, vegetation, or some other factor. Greater depth to Cr and the presence of E material (BE) (Table 20) validate stability within this pedon.

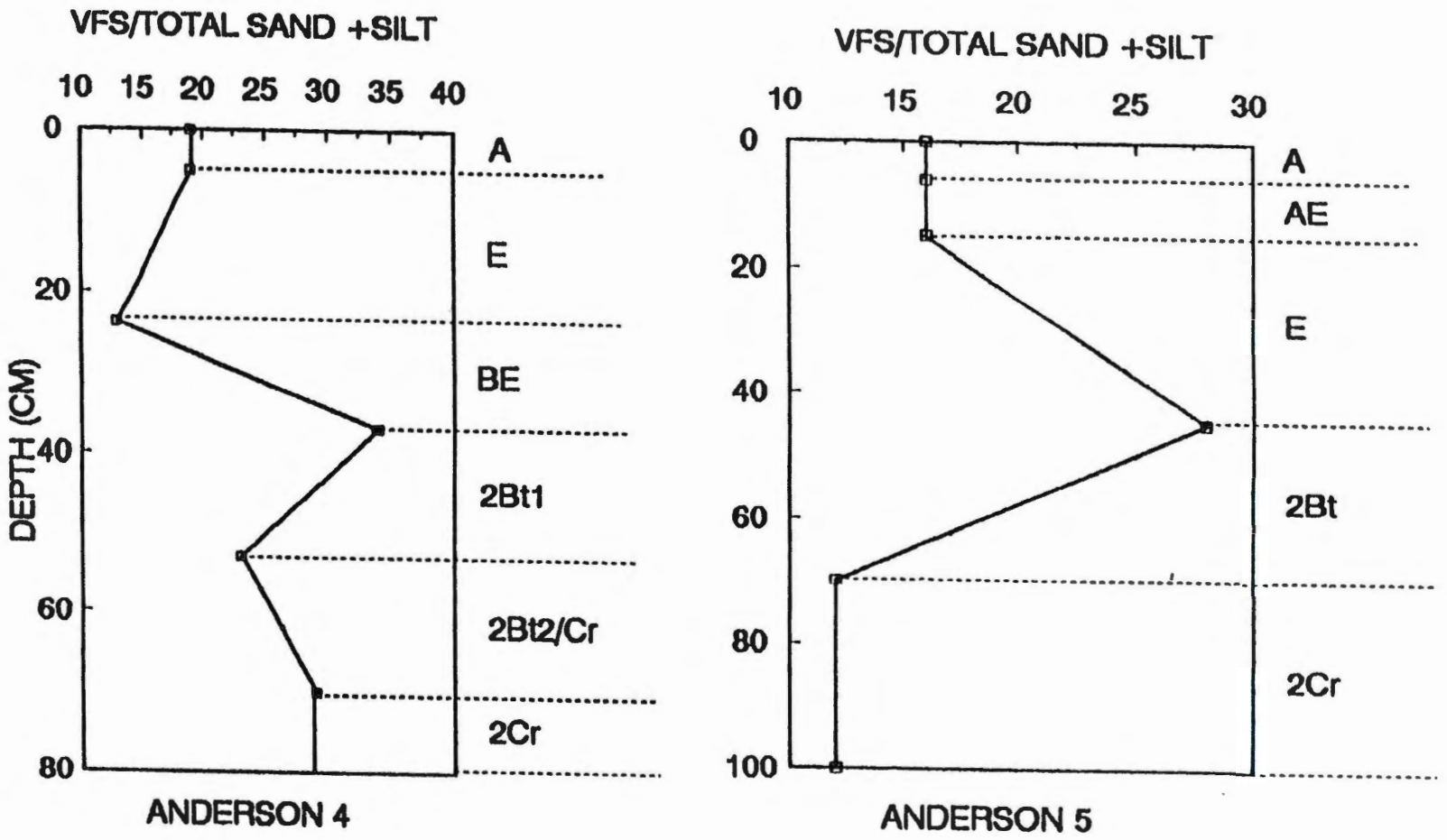


Figure 15. Very fine sand to total sand plus silt ratios graphically illustrate the position of discontinuities in Anderson 4 and Anderson 5.

Many of the soils sampled in Anderson County contained E horizons. Elluviated horizons are normally thought of as being lighter in coloration compared with the overlying horizons. These horizons were still relatively dark, 10YR 5/4 to 10YR 5/6, though they were still lighter than the horizon above (Table 19). However, a decrease in clay content (Anderson 4, 5, and 10) and CEC (Anderson 1,4,5,9,10,11,12,21, and 22) indicated there had been movement of materials out of the E horizons (Table 20).

All twenty-four pedons were classified as Hapludults. Depending on the thickness of the argillic horizon, eight were Ochreptic Hapludults and the remaining sixteen were Typic Hapludults (Table 21 and 22).

CONCLUSIONS

1. In Roane County, site location, for soils associated with the Maryville Formation, was primarily on terraces, while knobs and hills were the primary setting in Anderson County. Geological composition, tectonic influence, and environmental conditions were the most probable factors attributing to these differences.
2. In 17 of 24 soil pedons, the upper horizons were composed of transported materials.
3. Alluvium was only present in the surface horizons of four pedons in Roane County. None were found in Anderson County due to site position.
4. Consistently high silt content in the surficial horizons when compared to the underlying horizons indicted the presence of wind blown silt materials in 71% of the soil pedons..
5. Clayey particle size class was dominant in horizons developed from Maryville residuum.
6. Argillic horizons in Roane County were primarily 7.5YR in hue, while those in Anderson County were a redder 5 YR color.
7. Maryville soils were not very deeply weathered. Paralithic contact occurred at less than 100 cm in 18 of 24 soils examined.
8. All of the Maryville pedons were classified as Hapludults. Thickness of the argillic horizon determined whether the subgroup was Ochreptic (8 pedons) or Typic (16 pedons).

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CHAPTER 6. EPILOGUE

Soil genesis in the Ridge and Valley physiographic province is complex, yet compelling. Each pedon has a unique evolutionary history. The underlying basis in soil formation rests on parent material. Geological differentiation produces a cornucopia of soils. Yet, within each individual geological unit, a stability exists in the properties of the soils developing from the residuum.

Examination of soils of the Copper Ridge Formation revealed characteristics uniquely shared by each pedon (Chapter 4). Horizon development, color, and clay content were only a few properties common to these soils. The same type of relationship was observed in soils of the Maryville Formation (Chapter 5).

Differences between soils of the Copper Ridge and the Maryville were primarily a function of parent material and topography. Copper Ridge dolomites weathered deeply to produce cherty, red soils of low activity clays. Brown soils of the Maryville limestones were of mixed mineralogy and shallow in comparison to those of the Copper Ridge. Over time, Copper Ridge soils developed on stable broad ridgetops. Less resistant Maryville soils were and continue to be subjected to downcutting actions of erosive forces. This is not to say erosion was not a factor on Copper Ridge soils. On the contrary, erosion had resulted in colluvial depositions covering the residual portions of these soils. However, topography has had an instrumental role in establishing the differing types of development occurring in these soils.

Parent material and topographic influence was even more evident in the transect of soils on the Oak Ridge Reservation (Chapter 3). Differing geologies had weathered to produce uniquely distinctive soils. Slope, aspect, and site position all contributed to this uniqueness. Yet, these soils were woven together to produce the topographical tapestry of the Whiteoak allochthon.

One of the main tenants presented in this dissertation concerned the possibility of kandic horizon development in Copper Ridge soils. This theory has proved to be true. It is this author's opinion that field identifiable properties may be found in relation to other specific geological units.

Vast areas of the Ridge and Valley are underlain by singular rock units. The Rome occupies many acres in the form of knobby ridges. Maynardville and Moccasin geologies cover wide expanses in the valleys. Beneficial information would be gained by in-depth examination of these and other major units of the region. The data should then be field tested to assure continuity across the physiographic province.

While soil has long been an essential component for life on earth, much about soil genesis is unknown and yet to be explored. This dissertation is the culmination of much time and effort on the part of many people. Even so, sixty-one pedons constitute only a modest glimpse of the panoramic sculpture etched by the ridges and valleys of East Tennessee.

APPENDICES

APPENDIX A

Morphology of all pedons from the Oak Ridge Reservation transect

Pedon 2

Lab numbers: 88195-88203
Location: Oak Ridge Reservation. Corner of Bethel Valley Road and Route 95.
Classification: Fine, Mixed, Thermic, Semiactive Typic Paleudult
Physiography: upland
Geomorphic Position: upper sideslope
Slope and Aspect: 5 to 12% southwest
Parent Material (s): Group D residuum of Chickamauga
Vegetation: old field successional pines

Soil Description

Oi 4-0 cm; leaf litter and pine needles

E 0-7 cm; grayish brown (10YR 5/2) cherty silt loam; very friable; common fine roots; many pores; 33% chert fragments; clear wavy boundary.

E/B 7-20 cm; light yellowish brown (10YR 6/4) E portion and strong brown (7.5YR 5/6) B portion; silt loam; weak fine subangular blocky structure; very friable; common fine and medium roots; many pores; 10% chert fragments; abrupt wavy boundary (old plow layer base).

2Bt1 20-58 cm; red (2.5 YR 4/8) silty clay; moderate medium subangular blocky structure; friable; few yellowish-brown remnant saprolite colors in ped interiors; peds coated with red (2.5 YR 4/6) clay; few fine and medium roots; 2% chert fragments; gradual wavy boundary.

2Bt2 58-91 cm; yellowish brown (10YR 5/6) ped interiors with thick red (2.5YR 4/8) clay films; silty clay; moderate medium subangular blocky structure; firm; few fine roots; many pores; 1% chert fragments; diffuse wavy boundary.

2BC1 91-158 cm; mixed olive yellow (2.5 Y 6/6) and light yellowish brown (2.5Y 6/4) matrix with red (2.5 YR 4/8) streaks; silty clay; moderate medium and coarse subangular blocky structure; firm thin red (2.5YR 4/8) clay films on most ped faces; few fine roots; many pores; 6% chert fragments; diffuse wavy boundary.

2BC2 158-207 cm; mixed olive yellow (2.4 Y 6/6) and red (2.5 YR 4/8); cherty clay; moderate coarse and medium subangular blocky structure; firm; thin yellowish red (5YR 5/8) clay films on most ped faces; few fine roots; many pores; 31% chert fragments; diffuse wavy boundary.

2CB 207-280 cm; mixed olive yellow (2.5Y 6/6) and red (2.5 YR 4/8); silty clay; weak coarse subangular blocky structure; very firm; thin yellowish red (5YR 5/8) clay films on some ped faces; light gray (10YR 7/2) in flow streaks; few fine roots; many tubular pores to 260 cm; 1% chert fragments; diffuse wavy boundary.
2C 280-310 cm; mixed red (2.5 YR 4/8); and yellowish red (5YR 5/6) saprolite that easily crushes to clay; very firm; thin yellowish red (5YR 5/8) clay films in some faces and pores; light gray (10YR 7/2) flow zones in the saprolite; 2% chert fragments.

NOTE: BC1 was subdivided into two sections at 91-124 cm and 124-158 cm for sampling purposes.

Pedon 3

Lab numbers: 88187-88194
Location: Oak Ridge Reservation. Chestnut Ridge telephone line transect. Third pit north of Bethel Valley Road
Classification: Fine, Mixed, Thermic, Superactive Typic Hapludalf
Physiography: upland
Geomorphic Position: mid sideslope
Slope and Aspect: 12 to 25% southwest
Parent Material (s): Group A of the Chickamauga Formation
Vegetation: oaks and white pine

Soil Description

Oi 5-0 cm; leaf litter.

A 0-15 cm; dark brown (10YR 3/3) cherty silt loam; strong fine granular structure; very friable; many fine and medium roots; 35% chert fragments; clear wavy boundary.

E 15-23 cm; brown (7.5YR 5.4) cherty silt loam; moderate fine granular structure; very friable; common medium roots; 31% chert fragments; clear wavy boundary.

Bt/E 23-44 cm; strong brown (7.5 YR 5/6) B portion and light brown (7.5YR 6/4) E portion; very cherty silt loam; moderate fine subangular blocky structure; very friable; common medium roots; 50% chert fragments; clear wavy boundary.

2Bt1 44-80 cm; red (2.5 YR 4/6) silty clay/clay; strong coarse subangular blocky structure parting to strong medium and fine subangular blocky structure; friable; light brown (7.5 YR 6/4) skeletans along some ped faces in upper part; common fine and medium roots; 12% chert fragments; clear wavy boundary.

2Bt2 80-96 cm; dark reddish brown (2.5YR 3/4) silty clay/clay; strong coarse prismatic parting to moderate coarse subangular blocky structure; very firm; light brown (7.5YR 6/4) pressure faces on prisms; black manganese specks on ped interiors; few fine and medium roots; 3% chert fragments; clear wavy boundary.

2Bt3 96-120 cm; dusky red (10R 3/2) silty clay; weak medium prismatic structure; very firm; few fine roots; abrupt wavy boundary.

2CB 120-150 cm; dark reddish brown (5YR 3/4) saprolite that easily crushes to silty clay; very firm; many tubular pores; few fine roots; gradual wavy boundary.

2C 150-158 cm; reddish brown (5YR 4/3) saprolite that easily crushes to silty clay; very firm; few fine roots; common tubular pores.

2R 158 cm; light gray and maroon limestone.

NOTE: Depth to rock in pit is 96 to 158 cm in pedon and highly irregular. Lower part of pit has colluvium over residuum. Some areas in the pit have a thin Cr horizon over rock.

Pedon 4

Lab numbers: 88178-88186
Location: Oak Ridge Reservation. Chestnut Ridge transect. Second pit north of Bethel Valley Road
Classification: Fine-loamy, Mixed Thermic, Semiactive Typic Hapludalf
Physiography: sideslope
Geomorphic Position: old gully fill
Slope and Aspect: 12 to 25% southwest
Parent Material (s): colluvium from Group A of Chickamauga
Vegetation: edge of woods with pines, oaks, and a few poplars

Soil Description

Oi 4-0 cm; leaf litter and root mat.

A 0-2 cm; very dark grayish brown (10YR 3/2) extremely cherty silt loam; moderate fine granular structure; very friable; many fine and medium roots; 60% chert fragments; clear wavy boundary.

E1 2-23 cm; brown (10YR 5/3); extremely cherty silt loam; weak fine granular structure; very friable; many fine and medium roots; 60% chert fragments; gradual wavy boundary.

E2 23-40 cm; pale brown (10YR 6/3); very cherty silt loam; weak fine granular structure; very friable; many fine and medium roots; 58% chert fragments; gradual wavy boundary.

Bt1 40-80 cm; strong brown (7.5 YR 4/6); extremely cherty silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; 66% chert fragments; gradual wavy boundary.

Bt2 80-110 cm; strong brown (7.5 YR 4/6); extremely cherty silt loam; moderate fine subangular blocky structure; friable with about 40% firm and brittle areas; brown (7.5 YR 4/4) clay films on ped faces, fragment surfaces, and bridges between fragments; light yellowish brown (10YR 6/4) skeletans as vertical streaks; common fine roots; 70% chert fragments; abrupt wavy boundary.

2Bt3 110-129 cm; dusky red (10R 3/3); clay; moderate medium prismatic structure; very firm; few fine roots; clear wavy boundary.

2BC 129-170 cm; reddish black (10R 2/1) to very dusky red (10R 2/2) clay; weak coarse prismatic structure; very firm; few fine roots; abrupt wavy boundary.

2CB 170-189 cm; strong brown (7.5 YR 4/6) and dusky red (10R 3/2) saprolite that easily crushes to clay; very firm; few fine roots; abrupt wavy boundary.

2C1 189-220 cm; olive brown (2.5Y 4/4) saprolite that easily crushes to clay; very firm; few fine roots; abrupt wavy boundary.

2C2 220-248 cm; weak red (2.5 YR 4/2) saprolite with olive yellow and dusky red streaks that easily crush to silty clay; very firm; few fine roots.

2Cr 248-252 cm; dark reddish gray hard oxidized and partially leached saprolite; slight

effervescence with acid.

NOTE: The pit cuts across an old colluvium filled gully. Thickness of colluvium ranges from 50 cm to 130 cm around pit.

Pedon 6

Lab numbers: 88204-88210
Location: Oak Ridge Reservation Chestnut Ridge transect pit number 4 from Bethel Valley road.
Classification: Fine, Mixed, Thermic, Subactive Typic Paleudult
Physiography: upland
Geomorphic Position: upper sideslope (once lower sideslope of ancient Tertiary landform before Pleistocene topographic inversion)
Slope and Aspect: 12 to 25% southwest
Parent Material (s): thin ancient colluvium over lowermost Newala residuum
Vegetation: pines, chestnut oak, sourwood, black gum

Soil Description

O 5-0 cm; leaf litter and root mat

E1 0-15cm; grayish brown (2.5Y 5/2) cherty loam; weak fine granular structure; very friable; common medium and fine roots; 28% chert fragments; gradual wavy boundary.

E2 15-43 cm; light yellowish brown (2.5Y 6/4) cherty silt loam; weak fine granular structure; very friable; common medium and fine roots; 25% chert fragments; gradual wavy boundary.

Bt/E 43-74 cm; strong brown (7.5 YR 5/8) B portion and brownish yellow (10YR 6/6) E portion; silt loam/loam; moderate fine subangular blocky structure; very friable; few fine and medium roots; 12 % chert fragments; gradual wavy boundary.

2Bt1 74-130 cm; red (2.5YR 4/8) with brownish yellow (10YR 6/8) saprolite colors increasing in the lower part; clay; moderate medium and fine subangular blocky structure; firm; yellowish red (5YR 5/8) clay films on ped faces; few fine roots; 15% chert fragments; gradual wavy boundary.

2Bt2 130-170 cm; red (2.5YR 4/6) and brownish yellow (10YR 6/8) saprolite colors; very cherty clay; moderate medium subangular blocky structure; very firm; yellowish red (5YR 5/8) clay films on ped faces; few fine roots; 48% chert fragments; gradual wavy boundary.

2Bt3 170-180 cm; brownish yellow (10YR 6/8) and red (2.5 YR 4/6) saprolite colors; very cherty clay; weak medium subangular blocky structure; very firm; yellowish red (5YR 5/8) clay films on ped faces; few fine roots; 59% chert fragments; large chert fragments precluded deeper investigation.

NOTE: The Bt1 horizon was subdivided into two sections for sampling purposes. Divisions were 74-94 cm and 94-130 cm. This soil contained much oolitic chert which was highly weathered and quite soft. There was a very thin A horizon less than 2 cm thick that was not sampled.

Pedon 7

Lab numbers: 88211-88217
Location: Oak Ridge Reservation. Chestnut Ridge telephone line transect. Pit number 5 from Bethel Valley
Classification: Loamy-skeletal, Mixed, Thermic Semiactive Typic Paleudult
Physiography: upland
Geomorphic Position: crest of broad ridge into which a depression has formed. Ancient toeslope colluvium.
Slope and Aspect: 12 to 25% southwest
Parent Material (s): ancient Tertiary colluvium over lowermost Newala residuum. Considerable chert in upper profile is dolomitic.
Vegetation: pines, oak, with scattered poplar

Soil Description

O 4-0 cm; leaf litter and root mat

A 0-6 cm; dark grayish brown (2.5Y 4/2) very cherty silt loam; moderate fine granular structure; very friable; many fine and medium roots; many pores; 36% chert fragments; clear wavy boundary.

E1 6-20 cm; brown (10YR 5/3); cherty silt loam; weak fine granular structure; very friable; common fine and medium roots; many pores; 18% chert fragments; gradual wavy boundary.

E2 20-60 cm; yellowish brown (10 YR 5/4); very cherty silt loam; weak fine subangular blocky structure; very friable; few fine and medium roots; many medium and large pores; 31% chert fragments; gradual wavy boundary.

Bt 60-170 cm; strong brown (7.5 YR 5/6) cherty loam; weak medium subangular blocky structure; friable; clay bridging between fragments and some brittle areas with pale brown (10YR 6/3) skeletans; few fine roots; many large and medium pores from ants, termites, and roots; 56-62% chert fragments; clear wavy boundary.

CB 170-180 cm; strong brown (7.5YR 5/8) extremely cherty very coarse sandy loam; structureless massive; very friable; some clay bridging between fragments; few fine roots; many pores; 68% chert fragments 2-20 mm in size; abrupt irregular boundary.

2Bt 180-210 cm; red (2.5YR 4/8) with brownish yellow (10YR 6/8) mottles; very cherty clay; moderate medium subangular blocky structure; very firm; few fine roots; 35% chert fragments. (large fragments prevented deeper investigation).

NOTE: The Bt was subdivided and sampled at 60-110 cm and 110-170 cm. Part of the pedon consists of an old groundhog hole. Old stump filling is present in part of pit wall, which was once a termite colony given the large open pores.

Most chert in colluvium is from the Copper Ridge, Chepultepec, and Longview Formations. Chert is mostly highly weathered and can be easily broken without too much effort. May chert faces are coated with red iron stains. Iron stains have penetrated oolitic chert.

Pedon 9

Lab numbers: 88218-88224
Location: Oak Ridge Reservation. Telephone line transect. Pit at intersection of gasline road and telephone row.
Classification: Fine, Kaolinitic, Thermic Typic Kandiudult
Physiography: upland
Geomorphic Position: crest of middle ridge of Chestnut Ridge.
Slope and Aspect: 12 to 25% west
Parent Material (s): uppermost Chepultepec fragmented residuum
Vegetation: oaks

Soil Description

O 5-0 cm; leaf litter and root mat, large tree roots

A 0-4 cm; very dark grayish brown (10YR 3/2); extremely cherty sandy loam; moderate fine granular structure; very friable; many fine and medium roots; 62% chert fragments; clear wavy boundary.

E 4-28 cm; very pale brown (10YR 7/4); silt loam; weak fine granular structure; very friable; common fine and medium roots; 8% chert fragments; clear wavy boundary.

Bt1 28-56 cm; yellowish red (5YR 5/8); clay; moderate medium subangular blocky structure; firm; yellowish red (5YR 5/8) clay films on ped faces; common fine and medium roots; 7% chert fragments; gradual wavy boundary.

2Bt2 56-160 cm; mottled red (10R 4/8) and brownish yellow (10YR 6/8); very cherty clay; weak coarse subangular blocky structure; very firm; yellowish red (5YR 5/8) clay films on ped faces; few fine roots; 40% chert fragments, fragments had thick clay coatings; gradual wavy boundary. Most of the primary colors were inherited from the saprolite.

2Bt3 160-200 cm; red (10YR 4/8); mottles of brownish yellow (10YR 6/8) and light gray (10YR 7/2) flow zones; clay; weak coarse subangular blocky structure; very firm; yellowish brown (10YR 5/8) clay films on ped faces; few fine roots; 12% chert fragments; gradual wavy boundary. Most of the primary colors were inherited from the saprolite.

NOTE: The 2Bt2 was subdivided for sampling purposes into three sections as follows: 56-92 cm; 92-130 cm; and 130-160 cm.

Pedon 10

Lab numbers: 88225-88232
Location: Oak Ridge Reservation telephone row transect across Chestnut Ridge. Second pit north of gas line road and telephone line intersection
Classification: Fine, Kaolinitic, Thermic, Typic Hapludult
Physiography: upland
Geomorphic Position: mid sideslope
Slope and Aspect: 25 to 45% west-northwest
Parent Material (s): Chelpultepec residuum
Vegetation: Chestnut, red oak, white oak

Soil Description

Oi 5-0 cm; leaf litter and root mat

E 0-17 cm; pale olive (5Y 6/3); silt loam; weak fine granular structure; very friable; many fine and medium roots; many pores; 5% chert fragments; gradual wavy boundary

E/B 17-40 cm; olive yellow (2.5Y 6/6) E portion and yellowish brown (10YR 5/6) B portion; cherty silt loam; weak fine granular structure; very friable; many fine and medium roots; many pores; 21 % chert fragments; gradual wavy boundary.

2Bt1 40-69 cm; yellowish red (5 YR 5/8); clay; moderate fine subangular blocky structure; friable; common medium and fine roots; many pores; 6% chert fragments; gradual wavy boundary;

2Bt2 69-99 cm; yellowish red (5 YR 5/8) with red (2.5YR 4/8) and yellowish brown (10YR 5/6) saprolite colors; clay; moderate fine subangular blocky structure; firm; yellowish red (5YR 5/8) clay films on all ped faces; common medium and fine roots; many pores; 1% chert fragments; gradual wavy boundary.

2Bt3 99-139 cm; brownish yellow (10YR 6/6) and red (2.5YR 4/8) saprolite colors; silty clay; weak coarse subangular and angular blocky structure; very firm; red (2.5 YR 4/8) clay films on many ped faces and coating large pores; few fine roots; many pores; 2% chert fragments; gradual wavy boundary.

2CB 139-187 cm; yellowish brown (10YR 5/8) saprolite that easily crushes to silty clay; angular blocks from fractured saprolite; very firm; strong brown (7.5 YR 5/6) clay flows on most faces; water flow zones with light gray (10 YR 7/1) interiors and olive yellow (2.5Y 6/8) exteriors; few fine roots; many pores; clear wavy boundary.

2C1 187-231 cm; strong brown (7.5 YR 5/8) and brownish yellow (10YR 6/8) saprolite that easily crushes to clay loam; angular blocks from fractured saprolite; very firm; yellowish red (5YR 5/8) clay flows on some faces; red (2.5YR 4/8) iron staining in pores and coating some faces; few fine roots; many pores; clear wavy boundary; a zone of manganese concentration marks the base of this horizon.

2C2 231-276 cm; yellowish red (5YR 5/6) and brownish yellow (10YR 6/8) multi-colored saprolite with thin strata of disoriented highly weathered grayish and reddish very fine grained sandstone that crushes to silty clay; very firm; water flow zones light gray (10YR 7/2) interiors and Yellowish iron depleted exteriors; few fine roots; common to many manganese concentrations; 2% chert fragments.

Pedon 11
Lab numbers: 88233-88240
Location: Oak Ridge Reservation. Pit number 9 along Chestnut Ridge transect from Bethel Valley Road. (Third pit north of gasline and telephone line intersection)
Classification: Fine-loamy, Mixed, Thermic, Semiactive Typic Fragiudult
Physiography: upland
Geomorphic Position: sideslope below bench at the upper end of a hollow
Slope and Aspect: 12 to 25% northwest
Parent Material (s): colluvium over Chepultepec residuum
Vegetation: red oak, white oak, red maple, a few tulip poplar

Soil Description

O 10-0 cm; leaf litter and root mat

E1 0-10 cm; pale olive (5Y 6/3); cherty silt loam; weak fine granular structure; very friable; many fine roots and pores; 21% chert fragments; gradual wavy boundary.

E2 10-26 cm; pale olive (5Y 6/4); cherty silt loam; weak fine granular structure; very friable; common fine and medium roots; many pores; 38% chert fragments; with a gradual increase in fragment content in the lower part; gradual wavy boundary.

2E3 26-44 cm; yellowish brown (10YR 6/4) extremely cherty silt loam; moderate fine subangular blocky structure; very friable; few fine roots; many pores; 64% chert fragments, stone lag line; gradual wavy boundary.

2Btx 44-66 cm; yellowish brown (10YR 5/6) extremely cherty silty clay loam; weak fine subangular blocky structure; firm with very firm brittle areas; few fine roots; many pores; 73% chert fragments; abrupt wavy boundary.

3Bt1 66-120 cm; yellowish red (5YR 5/8) and red (2.5YR 4/8); cherty silty clay loam or clay; moderate medium subangular blocky structure; firm; pink (7.5YR 7/4) streaks of E material in the upper part; strong brown (7.5YR 5/6) clay films on most ped faces, and some dark red iron stains in pores; few fine roots; many pores; 21% chert fragments; gradual wavy boundary.

3Bt2 120-148 cm; red (2.5 YR 4/8) and brownish yellow (10YR 6/8) clay; weak medium and coarse subangular blocky structure; very firm; yellowish red (5YR 5/8) clay films on most ped faces, and some dark red iron stains in pores; light gray (10YR 7/1 and 7/2) gray water flow streaks; few fine roots; many pores; 12% chert fragments; gradual wavy boundary.

3BC 148-184 cm; brownish yellow (10YR 6/6 and 6/8) with red (2.5YR 4/8) mottles; silty clay or silty clay loam saprolite; angular blocks; very firm; yellowish red (5YR 5/8) clay films on most block faces; light gray (10YR 7/1-7/2) gray water flow streaks; few fine roots; many pores; 14% chert fragments; gradual wavy boundary.

3CB 184-203 cm; brownish yellow (10YR 6/8) and red (2.5 YR 4/8) silty clay loam saprolite; angular blocky; very firm; yellowish red (5YR 5/8) clay films on many block faces; olive yellow (2.5Y 6/6) water flow streaks; white bodies from soft chert and some black manganese concentrations; few fine roots; common pores; 11% chert fragments; gradual wavy boundary.

NOTE: A thin A horizon of less than 2 cm was not sampled.

Pedon 12
Lab numbers: 88241-88249
Soil Type No. 94
Location: Oak Ridge Reservation
Classification: Fine-loamy, Siliceous, Thermic, Subactive Typic Hapludult
Physiography: toeslope
Parent material: alluvium over cherty colluvium
Additional notes: Old colluvium - paleosol
Loess mantle (old A horizon)
stream alluvium - one stream channel cuts into old colluvium and is covered by slack water alluvium, one stream channel cuts into slack water alluvium and is backfilled by cherty alluvium. Slack water alluvium and thin lag chert colluvium on surface.

Soil Description

O 2 to 0 cm; leaf litter.

Ap 0 to 30 cm; brown (10YR 4/3); cherty loam; moderate fine grandular structure; very friable; abrupt wavy boundary; many fine roots; 30% coarse fragments.

BE 30 to 44 cm; strong brown (7.5YR 5/6); loam; moderate fine subangular blocky structure; very friable; clear wavy boundary; common medium and fine roots; 9% coarse fragments.

Bt1 44 to 80 cm; yellowish red (5YR 5/6); loam; moderate fine and medium subangular blocky structure; very friable; gradual wavy boundary; few fine roots; 7% coarse fragments.

Bt2 80 to 114 cm; yellowish red (5YR 4/6); loam; moderate fine and medium subangular blocky structure; very friable; abrupt wavy boundary; few fine roots; 5% coarse fragments; gravel bed at base.

2BC 114 to 150 cm; yellowish red (5YR 5/6) and red (2.5YR 4/8); extremely gravelly clay loam texture; massive structure, placic at lower contact; firm; abrupt wavy boundary; 46% coarse fragments; stream gravels.

3Eg1 150 to 168 cm; light reddish brown (2.5Y 6/4) with light reddish brown mottles (5Y 6/3) ; silt loam; massive structure; firm; clear wavy boundary; 28% coarse fragments.

3Eg2 168 to 186 cm; light reddish brown (2.5Y 6/4) with pale red (2.5Y 6/2) and yellowish brown (10YR 5/6) mottles; cherty silt loam; massive structure; firm; clear wavy boundary; 28% coarse fragments.

4Eg3 186 to 203 cm; yellowish brown (10YR 5/4) with pinkish gray mottles (7.5YR 7/2); extremely cherty silty clay loam; massive structure; very firm; gradual wavy boundary; 46% coarse fragments; black Mn bodies.

4Btg 203-230 cm; light gray (10YR 7/2); extremely cherty silty clay loam; weak, medium subangular blocky structure; very firm; 51% coarse fragments.

Pedon 13

Lab numbers: 88250-88255
Soil Series No: 61
Area: Oak Ridge Reservation, Telephone transit across Chestnut Ridge.
Classification: Fine, Mixed, Thermic, Semiactive Typic Hapludalf
Location: pit 7 next to Bear Creek Road
Parent material: lower Copper Ridge
Physiography: Bench with colluvium
Slope and Aspect: 12 to 25% northwest
Vegetation: hardwoods and cedars

Soil Description

Oi 4 to 0 cm; leaf litter

Ap 0 to 22 cm; brown (10YR 4/3); very cherty silt loam; strong fine grandular structure; very friable; abrupt wavy boundary; many fine and medium roots; 42% chert fragments.

E 22 to 47 cm; brown (7.5YR 5/4); very cherty silt loam; moderate fine grandular structure; very friable; clear wavy boundary; common fine roots; 40% chert fragments.

Bt/E 47 to 63 cm; extremely cherty silty clay loam; yellowish brown (5YR 4/6) B portion and strong brown (7.5YR 5/6) E portion; very cherty silt loam or silty clay loam; moderate fine subangular blocky structure; friable; clear wavy; common fine roots; 69% chert fragments.

BC 63 to 77 cm; red (2.5YR 4/8); silty loam; moderate medium and fine subangular blocky; friable; gradual wavy boundary; few fine roots; 13% chert fragments; yellowish red (5YR 5/6) clay films; Mn coatings.

2Bt1 77 to 109 cm; red (2.5YR 4/6); clay films same color; clay; strong medium subangular and angular blocky structure; pressure faces common; friable; gradual wavy boundary; few fine roots; 2% chert fragments.

2Bt2 109 to 185 cm; red (2.5YR 4/6) and yellowish red (5YR 5/8) zones; clay; strong fine angular blocky structure; friable; abrupt irregular; few fine roots; 6% coarse fragments-chert and dolomite; pressure faces; dolomite floater at 114-139 cm.

3Cr 185 to 190 cm; pale brown (10YR 6/3); rock controlled structure; abrupt irregular boundary.

3R 190 cm; weathered dolomite.

Depth to rock in pit is >2 m to as shallow as 25 cm.

Pedon 14
Lab numbers: 88257-88266
Soil Type: 601 D3 R
Area: Oak Ridge Reservation
Classification: Fine, Mixed, Thermic, Active Typic Hapludalf
Native Vegetation.: pines, poplars and few red maples
Parent material: fault breccia from the Rome formation
Physiography: base of side slope in fault zone
Slope and Aspect: 27% southeast
Vegetation: pines, poplars, few red maples

Soil Description

O/A 4 to 0 cm; leaf litter; clear wavy boundary; many fine and medium roots.

E 0 to 10 cm; yellowish brown (10YR 5/4); very fine sandy loam or silt loam; moderate fine grandular structure; very friable; gradual wavy boundary; common medium roots, 6% coarse fragments.

E/B 10 to 20 cm; yellowish brown (10YR 5/4) E portion and yellowish brown (10YR 5/8) B portion; very fine sandy loam or silt loam; moderate medium subangular block; very friable; gradual wavy boundary; common medium roots, 2% coarse fragments.

Bt1 20 to 32 cm; strong brown (7.5YR 5/6); silty clay loam; moderate medium subangular blocky structure; very friable; gradual wavy boundary; common fine roots; 20% soft coarse fragments.

Bt2 32 to 70 cm; strong brown (7.5YR 5/8) and red (2.5YR 4/8); silty clay or clay; moderate medium subangular blocky structure; friable; common fine roots; 40% soft coarse fragments.

Bt3 70 to 90 cm; red (2.5YR 4/6); silty clay loam; saprolite structure; very friable; common fine roots; 75% soft coarse fragments.

CB 90 to 126 cm; strong brown (7.5YR 5/8); loam or very fine silt loam; saprolite structure; very friable; common fine roots, 75% soft fragments.

C1 126 to 150 cm; (5YR 5/4); siltstone breccia; saprolite structure; firm fragments; few fine roots; 85% soft coarse fragments.

C2 150 to 200 cm; brownish yellow (10YR 6/8) saprolite; very fine siltstone; few fine roots; 85% soft coarse fragments.

C3 200 to 255 cm; (5YR 4/4) siltstone; very fine fragments; saprolite; very firm fragments; few fine roots; 90% soft coarse fragments.

C4 255 to 300 cm; yellowish brown (5YR 4/6); clay siltstone soft few fine roots; 0% soft fragments.

NOTE: There were no hard fragments.

Pedon 15

Lab numbers: 88267-88275
Location: Roane County, Oak Ridge Reservation. East of Gum Branch Road, in uppermost Gum Branch watershed.
Classification: Fine-silty, Mixed, Thermic, Active Ultic Hapludalf
Physiography: upland
Geomorphic Position: mid sideslope
Slope and Aspect: 50% northeast
Parent Material (s): dusky red Rome mudstone surficial creep and residuum
Vegetation: pines and hardwoods

Soil Description

O 5-0 cm; leaves, needles, and twigs

A 0-2 cm; dark brown (10YR 3/3) gravelly loam; moderate fine granular structure; very friable; many fine and medium roots; many pores; 20% sandstone fragments; clear wavy boundary.

E1 2-7 cm; reddish brown (5YR 4/3); loam; weak fine granular structure; very friable; few fine and medium roots; many pores; 14% sandstone fragments; clear wavy boundary.

E2 7-15 cm; reddish brown (5YR 5/4); silt loam; weak medium subangular blocky structure; very friable; light reddish brown (5YR 6/3) skeletans on many ped faces; few fine and medium roots; many pores; 14% sandstone fragments; clear wavy boundary.

Bt1 15-23 cm; reddish brown (5YR 4/4); silt loam; weak medium subangular blocky structure; friable; light reddish brown (5YR 6/3) skeletans on many ped faces; few fine and medium roots; many pores; 14% sandstone fragments; clear wavy boundary.

Bt2 23-38 cm; reddish brown (5YR 4/3); silt loam; moderate medium subangular blocky structure; friable; reddish brown (5YR 5/3) skeletans on many ped faces; few fine and medium roots; many pores; 4% sandstone fragments; abrupt wavy boundary.

2CB 38-92 cm; dark reddish brown (5 YR 3/3), strong brown (7.5YR 5/8) and pinkish gray (7.5YR 6/2); loam; massive; friable; dark reddish brown (5YR 3/4) clay films on many fragment faces; common dine roots; many pores; 8% sandstone fragments; abrupt wavy boundary.

2Cr1 92-135 cm; light olive brown (2.5Y 5/6) and brown (10YR 4/3) arkosic sandstone saprolite stratum; very firm; dusky red (2.5YR 3/4) iron coatings on most fragment faces; few fine roots; common pores.

2Cr2 135-160 cm; reddish brown (5YR 5/3) and dusky red (2.5YR 3/2) mudstone saprolite; extremely firm; no roots.

2Cr3 160-180 cm; (5GY 5/1) interbedded siltstone and dusky red (10R 2/1) mudstone. Some fragment surfaces bright red (10R 4/6) iron stains.

NOTE: The upper 30 cm formed in creep. E1 and E2 were sampled together. 2CB was split at 38-63 cm and 63-92 cm.

Pedon 16

Lab numbers: 88276-88281
Location: Oak Ridge Reservation. Roane County. Upper sub-watershed basin of Gum Branch. First watershed south of Pin Hook Branch on west side of Gum Branch Road.
Classification: Fine, Mixed, Thermic, Active Typic Hapludult
Physiography: upland
Geomorphic Position: mid-sideslope
Slope and Aspect:24% south
Parent Material (s): Rome arkosic fine grained sandstone and siltstone
Vegetation: pines and hardwoods

Soil Description

Oi 4-0 cm; needles and leaves, root mat

A 0-2 cm; dark grayish brown (10YR 4/2); gravelly very fine sandy loam; weak fine granular structure; very friable; common medium and fine roots; many pores; 18% coarse fragments; clear wavy boundary.

E1 2-13 cm; brown (10YR 5/3); gravelly very fine sandy loam; weak fine granular structure; very friable; few medium and fine roots; many pores; 18% coarse fragments; clear wavy boundary.

E2 13-25 cm; pale brown (10YR 6/3); silt loam; weak fine granular structure; very friable; light gray (10YR 7/2) skeletans on some ped faces and in streaks; few medium and fine roots; many pores; 11% coarse fragments, clear wavy boundary.

B/E 25-36 cm; strong brown (7.5YR 4/6) B portion and yellowish brown (10YR 5/4) E portion; loam; moderate medium subangular blocky structure; friable; common fine roots; many pores; 3% coarse fragments; clear wavy boundary.

Bt 36-65 cm; strong brown (7.5YR 4/6) clay loam; moderate medium subangular blocky structure; firm; thin continuous brown (7.5YR 5/4) clay films on ped faces; common fine roots; many pores; 4% coarse fragments; clear wavy boundary.

BC 65-71 cm; strong brown (7.5YR 4/6); clay loam; moderate medium subangular blocky structure; firm; thin continuous reddish brown (5YR 5/4) clay films on ped faces; few fine roots; many pores; 3% coarse fragments; gradual irregular boundary.

BC2 71-100 cm; yellowish red (5YR 5/6); clay loam; weak coarse subangular blocky structure tending towards massive in the lower part; firm; thick continuous reddish brown (5YR 5/4) clay films on ped faces and lining old root channels and cracks; red (2.5 YR 4/6) iron stains on rock fragment faces; few fine roots; many pores; 3% sandstone fragments; gradual irregular boundary.

Cr 100-110 cm; soft reddish gray (5YR 5/2) and yellowish brown (10YR 5/6) saprolite fro Rome arkosic sandstone that crushes to gravelly very fine sandy loam; firm; thick continuous reddish brown (5YR 5/4) clay films in cracks and coating fragment faces in upper most part; few fine roots in cracks; common pores; 18% sandstone fragments.

NOTE: BC1 and BC2 were sampled and mixed together.

APPENDIX B

Morphology of Roane County pedons of the Copper Ridge Formation

Pedon Roane 33

Lab numbers: 92253-92257
Classification: very fine, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 35° 44' 25" N 84° 33' 33" W
Geomorphic Position: double convex sideslope
Slope and Aspect: 30 %, 265° W
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: redbud, scarlet oak, hickory, dogwood, blackjack oak.
Note: evidence of burning was visible on the tree trunks. Burning was not recent.

Soil Description

Oi\Oa 5-0 cm; leaf litter, twigs, roots, intermitton

E 0-10 cm; 7.5YR 5/6; silty clay loam; weak, coarse subangular blocky structure; firm; many fine and very fine roots, few coarse and medium roots; 19% coarse fragments; clear, smooth boundary.

2Bt1 10-20 cm; 2.5YR 4/8; silty clay; strong, medium, subangular blocky structure; firm to very firm; 1% coarse fragments; few, fine, distinct mottles (5YR 7/4); silt coatings (5YR 6/6 and 6/4); common coarse and medium roots, many fine and very fine roots; many moderate, thick, continuous clay skins; clear, smooth boundary.

2Bt2 20-110 cm; 2.5YR 4/6; clay; moderate, medium subangular blocky structure; firm; few, fine, distinct mottles (5YR 6/6); many, moderately thick, discontinuous clay skins on ped faces not in pores; few coarse roots, common medium and fine roots; 1% coarse fragments; gradual, smooth boundary.

2Bt3 110-147 cm; 2.5YR 4/6; clay; moderate, medium subangular blocky structure; friable;few, thin, distinct mottles (5YR 6/6); 1% coarse fragments;common, thick, discontinuous clay skins; gradual, smooth boundary.

2Bt4 147-180+ cm; 2.5YR 4/8: clay; moderate, medium subangular blocky structure; friable; 1 % coarse fragments; common, thick, discontinuous clay skins.

Pedon Roane 34

Lab numbers: 92315-92320
Classification: very fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 35° 44' 30" N 84° 33' 30" W
Geomorphic Position: Upland, just below the break on the ridge crest
Slope and Aspect: N.W. 380° 10%
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: chestnut oak, blackjack, black oak, southern red oak, Virginia pine

Soil Description

Oi 5-0 cm; leaf litter and roots

A 0-4 cm; 10YR 3/2,4/2; gravelly loam; moderate, fine granular structure; very friable; many fine and very fine roots; 31% coarse fragments; clear, smooth boundary.

E 4-16 cm; 10YR 4/6; gravelly loam; weak, medium subangular blocky structure; friable; 32% coarse fragments; common medium roots, many fine and very fine roots; few medium pores; clear smooth boundary.

Bt1 16-27 cm; 5YR 5/8; SiCL; weak, medium subangular blocky structure; friable; few coarse and very coarse roots, common medium, fine, and very fine roots; 7 % coarse fragments; clear, smooth boundary.

Bt2 27-48 cm; 5YR 5/8; gravelly clay; moderate, medium subangular blocky structure; firm; common thin discontinuous clay skins; few medium roots, common fine and very fine roots; 52 % coarse fragments; clear, smooth boundary.

Bt3 48-75 cm; matrix; 2.5YR 4/8; clay; moderate, medium angular blocky structure; firm; many medium prominent lithochromic mottles (2.5Y 7/6); common medium thick continuous clay skins (2.5YR 4/6); few fine roots; 10 % coarse fragments; gradual, smooth boundary.

2BC 76-105 cm; mottled color 2.5YR 5/8, 10R 4/8, 2.5Y 7/6; gravelly clay; structureless massive; friable; 42% coarse fragments over 6 inches in diameter.

Pedon Roane 35

Lab numbers: 92296-92304
Classification: fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 35° 44' 33" N 84° 33' 26" W
Geomorphic Position: Upland, just below crest of ridge
Slope and Aspect: 340° N 19%
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: Dogwood, chestnut oak, blackjack, scarlet oak, hickory, sassafras

Soil Description

Oi 5-0 cm; leaf litter, roots and twigs, many fine and medium roots.

A 0-10 cm; 10YR 4/3; silt loam; moderate, fine granular structure; very friable; common fine, medium, and coarse roots; 20% coarse fragments; clear smooth boundary.

Ap 10-16 cm; 10YR 4/3; gravelly silt loam; weak, fine subangular blocky structure; friable;; many, medium, distinct mottles (7.5YR 5/6); common fine, medium, and coarse roots; 32% coarse fragments; clear smooth boundary.

Bt1 16-23 cm; 7.5YR 5/6; clay loam; weak, fine subangular blocky structure; friable; few fine roots; 9% coarse fragments; clear smooth boundary.

Bt2 23-46 cm; 5YR 5/6; clay; moderate, fine subangular blocky structure; friable; 19% coarse fragments; silt coating on ped faces (7.5YR 5/4); few fine roots; few, patchy, faint clay skins; gradual smooth boundary.

Bt3 46-73 cm; 2.5YR 4/6; clay; moderate, medium angular blocky structure; firm; 22% coarse fragments 5- 12 cm in diameter; few fine roots; common, continuous, dinstinct clay skins; gradual, smooth boundary.

2Bt4 73-110 cm; 2.5YR 4/6; clay; moderate, medium angular blocky structure; firm; many, thick continuous clay skins; 6% coarse fragments; gradual, smooth boundary.

2Bt5 110-135; 2.5YR 5/8; clay; moderate, medium angular blocky structure; firm; many, thick, continuous, clay skins; 1% coarse fragments; gradual, smooth boundary.

2Bt6 135-180; 2.5YR 5/8; clay; moderate, medium subangular blocky structure; firm; many, thick discontinuous clay skins; 9% coarse fragments; gradual, smooth boundary.

2Bt7 180-192; 2.5YR 5/8; clay; weak, medium subangular blocky structure; friable; few prominent mottles (2.5Y 7/6); 2% coarse fragments.

Pedon Roane 39

Lab numbers: 92326-92331
Classification: fine-loamy, kaolinitic, thermic Typic Fragiudult
Latitude/Longitude: 35° 42' 00" N 84° 35' 30" W
Geomorphic Position: foot slope
Slope and Aspect: SW 220o 14%
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: Chestnut oak, scarlet oak, black jack oak, dogwood

Soil Description

Oi 5-0 cm; roots, leaf litter

A 0-7 cm; 10YR 5/3; gravelly silt loam; weak, medium granular; very friable; 46% coarse fragments less than 1/2 inch diameter; many, fine and very fine roots, common medium roots, few coarse roots; abrupt, smooth boundary.

E 7-34 cm; 10YR 6/6; gravelly silt loam; weak, moderate, subangular blocky structure; very friable; many, fine and very fine roots, common medium roots;. common, fine and medium pores; 31% coarse fragments; clear, smooth boundary.

Bt1 34-61 cm; 7.5YR 5/6; gravelly silt loam; weak, medium subangular blocky structure; friable; common fine and medium pores; few, fine and medium roots; few, thin, patchy clay skins; 56 % coarse fragments; clear, smooth boundary.

Bt2 61-95 cm; 5YR 5/8: gravelly clay loam; moderate, medium angular blocky structure; firm; large pocket of Btx material in Bt; thin, discontinuous, clay films; common, medium, distinct mottles (2.5YR 5/8); few, medium roots; 49% coarse fragments less than 1/2 inch diameter; clear, smooth boundary..

2C 95-146 cm; 2.5YR 4/8; gravelly clay; structureless massisve; firm; many small chert pieces. 38% coarse fragments.

Pedon Roane 40

Lab numbers: 92286-92290
Classification: fine, kaolinitic, thermic Typic Kandiudult:
Latitude/Longitude: 35° 41' 59" N 84° 35' 30" W
Geomorphic Position: Upland
Slope and Aspect: 320° N.W. 7%
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: Chestnut oak, white oak, hickory, Virginia pine

Soil Description

Oi 4-0 cm; leaf litter, roots

E 0-18 cm; 10YR 6/3; loam; weak, fine granular structure; friable; many fine and very fine roots, common medium roots; 10% coarse fragments; clear, smooth boundary.

BE 18-29 cm; 7.5YR 7/6; silt loam; weak, fine, subangular blocky structure; friable; many fine and very fine roots, common medium roots; 20% coarse fragments; common medium pores; gradual, smooth boundary.

Bt1 29-52 cm; 5YR 5/8; gravelly clay; weak, medium, subangular blocky structure; firm; silt coatings on ped faces; many coarse pores; common fine roots; common, fine, faint mottles (2.5YR 5/8); few, patchy clay skins; 25% coarse fragments; clear, smooth boundary.

2Bt2 52-75 cm; 2.5YR 4/8: gravelly clay; weak, medium, subangular blocky structure; friable; 25% coarse fragments primarily chert; few, fine roots; few, discontinuous clay skins; silt coatings on ped faces; comon coarse pores; clear, smooth boundary.

2BC 75-102 cm; 2.5YR 4/8; gravelly clay; weak, fine and medium, subangular blocky structure; friable; 25% chert fragments.

Pedon Roane 41

Lab numbers: 92321-92325
Classification: fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 35° 42' 00" N 84° 35' 28" W
Geomorphic Position: midslope
Slope and Aspect: 160° S 18%
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: White oak, scarlet, chestnut oak

Soil Description

Oi 5-0 cm; leaf litter

A/O 0-2 cm; leaf litter and some mineral matter, many fine & very fine roots

E 2-17 cm; 10YR 4/4; loam; weak, medium granular structure; friable; many fine and very fine roots, many large pores; 39% coarse fragments; clear, smooth boundary..

BE 17-33 cm; 7.5YR 6/4; silt loam; weak, medium subangular blocky structure; friable; common, very fine roots; 48% coarse fragments; clear, smooth boundary.

Bt1 33-58 cm; 2.5YR 5/8; very gravelly clay; moderate, medium subangular blocky structure; friable; few very fine roots; thin, continuous clay skins; 62% coarse fragments, four fragments greater than 3 inches in diameter; clear, smooth boundary.

2Bt2 58-74 cm; 2.5YR 4/8; very gravelly clay; weak, coarse subangular blocky structure; firm; thin, continuous clay skins; 59% coarse fragments; clear, smooth boundary.

2CB 74-102 cm; 2.5YR 4/8; gravelly clay loam; structureless massive; friable; 62% coarse fragments.

Pedon Roane 42

Lab numbers: 92291-92295
Classification: fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 35° 40' 14" N 84° 36' 42" W
Geomorphic Position: Long slope - upper portion of midslope
Slope and Aspect: 19% 100° E
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: Chestnut oak, blackjack oak, red maple, red sumac

Soil Description

Oi 5-0 cm; root mat; leaf litter

E1 0-15 cm; 10YR 6/2; gravelly silt loam; weak, fine, granular structure; very friable; many fine, very fine, and medium roots, few coarse roots; 52% coarse fragments; clear, smooth boundary.

E2 15-35 cm; 10YR 7/3; cobbly silt loam; weak, medium subangular blocky structure; very friable; many fine and very fine roots, common medium roots; many coarse pores visible without a hand lens; 47% coarse fragments, 30% greater than 3 inches in diameter; clear, smooth boundary.

BE 35-55 cm; 5YR 5/8; cobbly clay loam; weak, coarse subangular blocky structure; friable; few medium roots, many fine and very fine roots;. silt coatings on outside of peds; 46% coarse fragments, 30% greater than 3 inches in diameter; few, thin, discontinuous clay films (5YR 4/6); clear, smooth boundary.

2Bt 55-80 cm; 2.5YR 5/8; gravelly clay; moderate, medium subangular blocky structure; firm; common, moderately thin, discontinuous clay skins (2.5YR 4/8); few fine roots; 45% coarse fragments, 30% greater than 6 inches in diameter; clear, smooth boundary..

2Bt2 80-125 cm; 2.5YR 4/8; cobbly clay; moderate, medium subangular blocky structure; firm; 30% coarse fragments greater than 6 inches in diameter.

Pedon Roane 43

Lab numbers: 92243-92247
Classification: fine, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 35° 40' 16" N 84° 36' 44" W
Geomorphic Position: midslope
Slope and Aspect: 23% 120° E
Parent Material (s): colluvium
Vegetation: chestnut oak, dogwood, sumac, sassafras

Soil Description

Oi 5-0 cm; thick root mat, leaf litter

E 0-18 cm; 10YR 6/2; gravelly silt loam; weak, medium granular; very friable; many fine and very fine roots, common medium roots; 30% coarse fragments; clear, smooth boundary.

EB 18-48 cm; 10YR 6/4; gravelly silt loam; weak, medium subangular blocky structure; friable; many fine and very fine roots, common medium roots; many large pores, visible without lens; 30% coarse fragments; clear, smooth boundary.

Bt1 48-72 cm; 7.5YR 5/8; gravelly silty clay loam; weak, medium subangular blocky structure; friable; few coarse and medium roots, many fine and very fine roots; common medium pores; 25% coarse fragments; clear, smooth boundary.

Bt2 72-90 cm; 5YR 5/8; gravelly clay; weak, medium subangular blocky structure; friable; common, thin, discontinuous clay skins; common fine and very fine roots; 35% coarse fragments; clear, smooth boundary.

BC 90-110 cm; 5YR 5/8; gravelly clay; structureless massive; friable; 30% coarse fragments.

Pedon Roane 44

Lab numbers: 92248-92252
Classification: fine-loamy, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 35° 40' 16" N 84° 36' 48" W
Geomorphic Position: lower sideslope
Slope and Aspect: 23% SE 140°
Parent Material (s): colluvium
Vegetation: Dogwood, maple, blackjack oak, chestnut oak, yellow poplar

Soil Description

Oi 5-0 cm; leaf litter, roots, twigs

EI 0-14 cm; 10YR 5/3; gravelly silt loam; weak, fine, granular; very friable; 39% coarse fragments; common medium roots, few coarse roots, many fine and very fine roots; clear, smooth boundary.

E2 14-34 cm; 10YR 7/3; silt loam; weak, medium subangular blocky structure; very friable; common medium roots, many-fine and very fine roots; 14% coarse fragments; clear, wavy boundary.

EB 34-47 cm; 10YR 7/4; loam; moderate, medium subangular blocky structure; friable; 21% coarse fragments; common fine roots, few, fine, faint lithochromic mottles (10YR 7/8); clear, wavy boundary.

Bt1 47-88 cm; 7.5YR 6/6; gravelly loam; moderate, medium subangular blocky structure; friable; 36% coarse fragments; silt coatings(10YR 7/3), few fine faint mottles (7.5YR 5/8); few, faint, patchy clay skins; gradual, wavy boundary.

Bt2 88-115 cm; 7.5YR 5/8; clay loam; moderate, medium subangular blocky structure; friable; 10% coarse fragments; few, medium, discontinuous clay skins; clear, irregular boundary.

2R 115+ cm. Hard limestone.

Pedon 45

Lab numbers:92262-92267
Classification: fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 35° 40' 12" N 84° 36' 50" W
Geomorphic Position: Midslope just above break
Slope and Aspect: 23% 120° SW
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: Sassafras, chestnut oak, hickory, dogwood

Soil Description

Oi 5-0 cm; leaf litter, twigs, roots

A 0-6 cm; 10YR 5/3; silt loam; weak, medium, granular structure; very friable; 16% chert fragments; many fine and medium roots; abrupt smooth boundary..

E 6-23 cm; 10YR 6/4; silt loam; weak, fine, subangular blocky structure; friable; common fine and medium roots, few coarse roots; 2% chert; clear, smooth boundary.

BE 23-33 cm; 7.5YR 5/6; silt loam; weak, fine, subangular blocky structure; friable; many, coarse, distinct mottles (10YR 5/4), 3% coarse fragments; common, fine and medium roots; clear, wavy boundary.

2Bt1 33-61 cm; 5YR 5/8; silty clay loam; moderate, medium angular and subangular blocky structure; friable; 10% chert; common fine roots; few, distinct, patchy clay skins; clear, wavy boundary.

2Bt2 61-94 cm; 5YR 5/6; clay; weak, medium angular and subangular blocky structure; friable; common, discontinuous, distinct clay skins (2.5YR 4/6); 10% coarse fragments; few fine and very fine roots; clear, wavy boundary.

2CB 94-109 cm; 2.5YR 4/8; clay; structureless massive; friable; 10% coarse fragments.

Pedon Roane 46

Lab numbers: 92268-92273
Classification: fine, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 35° 40' 09" N 84° 36' 54" W
Geomorphic Position: mid slope of a doubly convex slope
Slope and Aspect: 23%, SW 240
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: Maple, dogwood

Soil Description

Oi 5-0 cm, leaf litter.

A 0-12 cm; 10YR 4/4; loam; weak, fine and medium granular structure; friable; common, medium roots, many fine and very fine roots; 9% coarse fragments; clear, smooth boundary.

AB 12-19 cm; 7.5YR 4/6; clay loam; weak, fine subangular blocky structure; friable; few, fine, prominent mottles(2.5YR 5/8); common, medium roots, . many, fine and very fine roots; 2 % coarse fragments; clear, smooth boundary.

Bt1 19-28 cm; 5YR 4/8; silty clay loam; weak, medium subangular blocky structure; friable; mottles-common, medium, distinct mottles (7.5YR 4/6); few fine pores;common, medium and fine roots; 3 % coarse fragments; clear, smooth boundary.

2Bt2 28-43 cm; 2.5YR 4/8; clay; moderate, medium subangular blocky structure; friable; common, medium and fine roots; 2% coarse fragments; many, continuous distinct clay skins; clear, smooth boundary.

2Bt3 43-64 cm; 2.5YR 4/8; clay; moderate, medium subangular blocky structure; friable; common medium roots, few fine roots, 13% coarse fragments, primarily chert; many, thick, continuous, prominent clay skins; gradual smooth boundary.

2C 64-104 cm; 2.5YR 4/8; clay; structureless massive; friable; 6% coarse. fragments.

Pedon Roane 47

Lab numbers: 92305-92309
Classification: fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 35° 40' 06" N 84° 36' 58" W
Geomorphic Position: Midslope just above a slope break, upland
Slope and Aspect: 25% 20° N
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: Poplar, dogwood, red maple understory

Soil Description

Oi 5-0 cm; leaf litter, twigs, roots

A1 0-13 cm; 10YR 4/4; silt loam; moderate, medium granular structure; very friable; many fine and very fine roots, common medium roots; 8% coarse fragments; few, small Mn concretions; clear, smooth boundary.

A2 13-22 cm; 10YR 4/4; silt loam; weak, moderate subangular blocky structure; very friable; few medium roots; few small Mn concretions; 1% coarse fragments; few fine and very fine pores; clear, smooth boundary.

BE 22-43 cm; 7.5YR 5/6; silt loam; weak, moderate subangular blocky structure; friable; many fine and very fine pores; few very fine and fine roots; few, fine,faint mottles (5YR 5/8); 6% coarse fragments; clear, smooth boundary..

2Bt 43.61 cm; 5YR 5/8; clay/silty clay; weak, medium and coarse subangular blocky structure; friable to firm; many silt coatings; common, discontinuous clay films; few very fine and fine roots; 6% coarse fragments primarily chert; clear, smooth boundary.

2BC 61-89 cm; 2.5YR 4/8; clay; moderate, medium subangular blocky structure; very firm; many, continuous, distinct clay skins; 12% coarse fragments; few, fine, very fine, and medium roots.

APPENDIX C

Morphology of the Anderson County pedons of the Copper Ridge Formation

SITE No. AND 31

Lab numbers: 92332-92338
Classification: fine-loamy, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 36° 06' 19" N 84° 02' 55" W
Geomorphic Position: upland-lower slope
Slope and Aspect: 18% 240° SW
Parent Material (s): colluvium
Vegetation: pine, sassafras, southern red oak, chestnut oak

Soil Description

Oi 5-0 cm; partially decomposed leaves and twigs;

A 0-11 cm; 10YR3/2 & 10YR 4/2; extremely gravelly silt loam; 68% coarse fragments; weak, medium, subangular blocky structure; very friable; common medium roots, many fine and very fine roots; clear, smooth boundary.

E1 11-20 cm; 10YR5/3; silt loam; 26 % coarse fragments; weak, medium, subangular blocky structure; very friable; common, medium roots, many fine and very fine roots; clear smooth boundary.

Bt1 20-49 cm; 10YR6/4; loam; 44 % coarse fragments; weak, medium subangular blocky structure; very friable; common fine and very fine roots, few, medium roots; few, medium, faint mottles (10YR 7/3); common, fine pores; clear, smooth boundary.

Bt2 49-61 cm; 7.5YR 5/4; 50% coarse fragments; silt loam; moderate, medium subangular blocky structure; friable; few, medium roots, common fine and very fine roots; common, medium, distinct mottles (10YR 7/4 & 10YR 6/4); common, patchy clay skins; common, smooth boundary.

Bt3 61-87 cm; 5YR 5/8; clay loam; 50% coarse fragments; moderate, medium subangular blocky structure; few medium roots, common fine and very fine roots; common, continuous clay skins; few, fine, faint mottles (5YR 6/6); clear, smooth boundary.

Bt4 87-100 cm; 5yr5/8; clay loam; 35 % coarse fragments; moderate, medium and fine subangular blocky structure; friable; few fine and very fine roots; common distinct mottles (7.5YR 7/4); common, continuous clay skins; gradual, smooth boundary.

C 100-132 cm; 5YR 5/8 and 2.5Y 6/4; clay loam; % coarse fragments; structureless massive; friable.

SITE No. AND 32

Lab numbers: 92339-92344
Classification: fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 36° 06' 21" N 84° 02' 54" W
Geomorphic Position: slide slope bench 25 feet from a slight depression
Slope and Aspect: 13% 270° W
Parent Material (s): colluvium over residuum of Copper Ridge Formation
Vegetation: chestnut oak, hickory, sassafras, red oak

Soil Description

Oi 10-2 cm; hardwood litter

Oa 2-0 cm; highly decomposed leaves, twigs, roots

A 0-7 cm; 10YR 3/3; silty clay loam; 72% coarse fragments, 2% cobbles; weak, fine granular structure; very friable; many fine, medium, and coarse roots; clear, smooth boundary.

E 7-38 cm; 10YR 6/4; silt loam; 40% coarse fragments; weak, fine subangular blocky structure; very friable; common fine, medium, and coarse roots; clear, smooth boundary.

Bt1 38-45 cm; 7.5 YR 5/8; clay loam; 57 % coarse fragments; moderate, fine subangular blocky structure; friable; few, medium and coarse roots; common, medium prominent mottles (10YR 6/4); clear, wavy boundary.

Bt2 45-91 cm; 5YR 5/8; clay; 39% coarse fragments; moderate, medium subangular blocky structure; friable; common, discontinuous clay films; few fine roots; gradual, smooth boundary.

Bt3 91-120 cm; 5YR 5/8; clay; 43% coarse fragments; moderate, medium subangular blocky structure; firm; common, medium, distinct mottles (7.5 YR 5/6); common, discontinuous clay skins; clear, wavy boundary.

BC 120-144 cm; 5YR 5/8; clay; 52% coarse fragments; moderate, medium subangular blocky structure; friable; few discontinuous clay skins.

SITE No. AND 33

Lab numbers: 92345-92351
Classification: fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 36° 06' 19" N 84° 02' 50" W
Geomorphic Position: Upland - upper part of slope
Slope and Aspect: 10% SW 240°
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: red oak, chestnut oak, sassafras, dogwood, hickory

Oi 7-2cm; leaf litter

Oa 2-0cm; decomposed leaves - undistinguishable

A 0-3cm; 10YR 3/2; loam; 70% coarse fragments; weak, fine granular; very friable; many very fine, fine, and medium roots; abrupt, smooth boundary.

E1 3-21cm; 7.5YR 6/4; silt loam; 50 % coarse fragments; weak, medium subangular blocky structure; very friable; many, fine pores; many very fine, fine, and medium roots; clear, smooth boundary.

E2 21-36cm; 10YR 6/6; silt loam; 48% coarse fragments; weak, medium subangular blocky structure; common, medium and fine pores; many very fine, fine, and medium roots; gradual smooth boundary.

Bt1 36-46 cm; 7.5YR 6/8; silty clay; 48% coarse fragments, 10% > 3 inches; moderate, medium subangular blocky structure; friable; common, fine, prominent mottles (2.5YR 4/8); many, thin, continuous, clay skins; clear, smooth boundary.

2Bt2 46-62 cm; 5YR 5/8; clay; 69% coarse fragments; moderate, medium subangular blocky structure; friable; many, medium, prominent mottles (10YR 6/6); many, medium, prominent mottles (10YR 6/6), few, fine, distinct mottles (2.5YR 4/8); few very fine and fine roots; many, coarse, continuous clay skins; clear, smooth boundary.

2Bt3 62-75 cm; 5YR 5/8; clay; 58% coarse fragments; moderate, medium subangular blocky structure; firm; few very fine roots; many, continuous clay skins; gradual, wavy boundary.

2Bt4 75-117cm; 5YR 5/8; clay; 67% coarse fragments; moderate, medium subangular blocky structure; firm; common, medium, discontinuous clay skins; few, faint mottles (2.5yr 7/6)

SITE No. AND 34

Lab numbers: 92352-92357
Classification: fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 36° 06' 20" N 84° 02' 47" W
Geomorphic Position: Upland, mid slope - gentle slope
Slope and Aspect: 14% 290° W
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: chestnut oak, sassafrass, dogwood, red maple

Oi 5-0 cm; leaf litter

A 0-7 cm; 10YR 4/3; silt loam; 38% coarse fragments; weak, medium granular structure; very friable; abrupt, smooth boundary.

E 7-27 cm; 10YR 5/4; silt loam; 35% coarse fragments; weak, medium subangular blocky structure; very friable; common, medium and fine roots; few, fine pores; clear, smooth boundary.

Bt1 27-38 cm; 10YR 6/8; clay loam; 48% coarse fragments; weak, medium subangular blocky structure; friable; common, medium, fine, and very fine roots; few, fine and medium pores; clear, wavy boundary.

Bt2 38-52 cm; 7.5YR 6/8; silty clay loam; 49% coarse fragments; moderate, medium subangular blocky structure; friable; few, coarse, fine, and medium roots; common, continuous clay skins; clear, smooth boundary.

2Bt3 52-94 cm; 5YR 6/8; clay; 53% coarse fragments; moderate, medium subangular blocky structure; friable; common, medium, distinct mottles (2.5YR 4/8); many, continuous clay skins; few, medium and fine roots; gradual, smooth boundary.

2Bt4 94-140 cm; 5YR 5/8 clay; 41% coarse fragments; weak, medium subangular blocky structure; firm.

SITE NO. AND 35

Lab numbers: 92358-363
Classification: fine-loamy, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 36° 06' 25" N 84° 02' 51" W
Geomorphic Position: Upper portion of gentle slope
Slope and Aspect: 8% 20° N
Parent Material (s): colluvium over Copper ridge residuum
Vegetation: chestnut oak, sassafras, scarlet oak, white oak, red maple

Oi 5-0 cm; leaf litter

A 0-12 cm; 10YR 4/3; silt loam; 35% coarse fragments; weak, medium subangular blocky structure; very friable; many, medium, fine, and very fine roots; clear, smooth boundary.

Bt1 12-27 cm; 10YR 4/6; clay loam; 42% coarse fragments; weak, medium subangular blocky structure; very friable; common, fine pores; common Mn; common, medium, fine, and very fine roots; clear, smooth boundary.

Bt2 27-46 cm; 7.5YR 5/6; clay loam; 57% coarse fragments; moderate, medium subangular blocky structure; friable; few, medium and common, fine roots; Common Mn; common, discontinuous clay skins; clear, smooth boundary.

Bt3 46-62 cm; 7.5YR 5/8; clay loam; 57% coarse fragments; moderate, medium subangular blocky structure; friable; few, fine and medium roots; common Mn; common, continuous clay skins; clear, smooth boundary.

BC 62-85 cm; 5YR 5/8; silt loam; 59% coarse fragments; moderate, medium subangular blocky structure; friable; common Mn concretions; few, fine roots; common, continusous clay skins; gradual, smooth boundary.

2C 85-125 cm; 2.5YR 4/8; clay; 39% coarse fragments; structureless massive; friable.

SITE No. AND 36

Lab numbers: 92364-92368
Classification: fine-loamy, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 36° 06' 24" N 84° 02' 15" W
Geomorphic Position: side slope/shoulder
Slope and Aspect: 32 % 350° N
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: yellow poplar, white oak, hickory, red oak

O1 7-2 cm; Hardwood litter

Oa 2-0 cm; Highly decomposed leaves, twigs & roots

A 0-8 cm; 10YR 3/4; silt loam; 31% coarse fragments; weak, medium granular structure; very friable; many, fine and medium roots; clear, smooth boundary.

Bt1 8-26 cm; 10YR 5/3; silty clay loam; 34% coarse fragments; weak, medium subangular blocky structure; very friable; common, very fine, fine, and medium roots; clear, smooth boundary.

Bt2 26-42 cm; 10YR 5/4; clay loam; 53% coarse fragments, 2% cobbles; weak, medium subangular blocky structure; friable; common, medium, prominent mottles (7.5YR 5/8); few, faint clay skins; common, medium roots; clear, smooth boundary.

Bt3 42-75 cm; 5YR 5/8; silty clay; 56% coarse fragments, 2% cobbles; moderate, medium subangular blocky structure; friable; common, medium, distinct mottles (7.5YR 5/8); common, distinct clay skins; few, fine and medium roots; clear, smooth boundary.

2Bt4 75-90 cm; 5YR 5/8; clay; 77% coarse fragments; moderate, medium subangular blocky structure; firm; few, continuous clay films.

SITE No. AND 37

Lab numbers: 92369-92373
Classification: fine, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 36° 10' 18" N 83° 58' 36" W
Geomorphic Position: upland, upper slope
Slope and Aspect: 16% 280° W
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: red maple, oak, cedar

Oi 5-0 cm; leaf litter

A 0-19 cm; 10YR 4/4; silt loam; 21% coarse fragments; moderate, medium subangular blocky structure; friable; many medium, fine, and very fine roots, few, coarse roots; clear, smooth boundary.

Bt1 19-33 cm; 5YR 5/8; silt loam; 11% coarse fragments; moderate, medium subangular blocky structure; friable; common medium, fine, and very fine roots, few coarse roots; many. thin, continuous clay skins; clear, smooth boundary.

Bt2 33-80 cm; 5YR 5/8; clay; 8% coarse fragments; strong, medium subangular blocky structure; firm; many continuous clay skins; few coarse, medium, fine, and very fine roots; clear, smooth boundary.

Bt3 80-100 cm; 2.5YR 4/6; clay; 36% coarse fragments; strong, medium subangular blocky structure; firm; many thick continuous clay skins; clear, smooth boundary.

Bt4 100-123 cm; 2.5YR 4/6; clay; 48% coarse fragments; moderate, medium subangular blocky structure; firm.

SITE No. AND 38

Lab numbers: 92374-92378
Classification: fine, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 36° 10' 20" N 83° 58' 34" W
Geomorphic Position: Upper slope
Slope and Aspect: 13% N 20°
Parent material (s): colluvium over Copper Ridge residuum
Vegetation: privet, red cedar, red maple, black oak, red oak

Oi 5-0 cm; leaf litter, roots

A 0-12 cm; 10YR 4/4; silt loam; 36% coarse fragments; moderate, medium granular structure; very friable; many, medium, fine and very fine roots, few coarse roots; clear, smooth boundary.

E 12-29 cm; 10YR 5/4; silt loam; 52% coarse fragments; weak, medium subangular blocky structure; very friable; common, small pores; common, medium, fine, and very fine roots; clear, smooth boundary.

Bt1 29-40 cm; 5YR 5/6; silt loam; 49% coarse fragments; weak, fine subangular blocky structure; friable; thin, discontinuous clay skins; few, medium, fine, and very fine roots; clear, smooth boundary.

2Bt2 40-80 cm; 2.5YR 4/6; clay; 49% coarse fragments; moderate, medium subangular blocky structure; firm; many, thick, continuous clay skins; few very fine roots; common, prominent mottles (7.5YR 6/6); gradual, smooth boundary.

2Bt3 80-120 cm; 2.5YR 4/6; clay; 50% coarse fragments; moderate, medium subangular blocky structure; firm; many, thick, discontinuous clay skins; few, prominent mottles (10YR 6/3).

SITE No. AND 39

Lab numbers: 92379-92383
Classification: fine-loamy, kaolinitic, thermic Typic Kandiudult
Latitude/Longitude: 36° 11' 04" N 83° 57' 06" W
Geomorphic Position: Mid slope on a short bench
Slope and Aspect: 5% 310° NW
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: red oak, hickory, red maple

Oi 6-0 cm; leaves

A 0-8 cm; 10YR 3/4; loam; 23% coarse fragments; moderate, medium granular structure; very friable; many fine and very fine roots, common, medium roots; clear, smooth boundary.

BA 8-22 cm; 7.5YR 4/6; silt loam; 34% coarse fragments; weak, medium subangular blocky structure; very friable; many, fine and very fineroots, few medium roots; few discontinuous clay skins; clear, smooth boundary.

Bt1 22-34 cm; 5YR 5/6; silt loam; 60% coarse fragments; weak, medium subangular blocky structure; friable; common fine and very fine roots, few medium roots; few, thin, continuous clay skins; clear, smooth boundary.

Bt2 34-84 cm; 5YR 4/6; loam/clay loam; 63% coarse fragments; moderate, medium subangular blocky structure; firm; thick, continuous clay skins; common fine and very fine roots, few medium roots; gradual, smooth boundary.

2Bt3 84-114 cm; 2.5YR 4/6; clay; 51% coarse fragments; weak, medium subangular blocky structure; firm.

SITE No. AND 40

Lab numbers: 92384-92387
Classification: fine-loamy, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 36° 11' 01" N 83° 57' 04" W
Geomorphic Position: above a footslope
Slope and Aspect: 21% N 10°
Parent Material (s): colluvium
Vegetation: Va pine, ferns, red maple

Oi 5-0 cm; leaves, pine needles

A 0-19 cm; 10YR 4/4; silt loam; 55 % coarse fragments; weak, medium subangular blocky structure; very friable; many, fine, very fine, and medium roots, few coarse roots; few, fine Mn; clear, smooth boundary.

Bt1 19-36 cm; 7.5YR 4/6; silty clay loam; 50% coarse fragments; moderate, medium subangular blocky structure; firm; common, small Mn; many, continuous, medium clay skins; few fine and very fine roots; gradual, smooth boundary.

Bt2 36-72 cm; 5YR 4/6; silty clay loam; 49% coarse fragments; moderate, medium subangular blocky structure; firm; common, fine Mn; many continuous clay skins; few, fine and very fine roots; gradual, smooth boundary.

BC 72-104 cm; 5YR 5/6; silt loam; 55% coarse fragments; weak, medium subangular blocky structure and structureless massive; firm.

SITE No. AND 41

Lab numbers: 92388-92392
Classification: fine-loamy, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 36° 10' 58" N 83° 57' 01" W
Geomorphic Position: Mid slope
Slope and Aspect: 18% N 0.5°
Parent Material (s): colluvium
Vegetation: red maple, ferns, dogwood, Virginia pine

Oi 5-0 cm; leaf litter, pine needles

A1 0-11 cm; 10YR 3/4; silt loam; 43% coarse fragments; moderate, medium granular structure; very friable; many medium, fine, and very fine roots, few coarse roots; clear, smooth boundary.

A2 11-27 cm; 7.5YR 4/4; silt loam; 44% coarse fragments; weak, medium subangular blocky structure; friable; common, medium, and many fine and very fine roots; common Mn nodules; clear, smooth boundary.

BA 27-38 cm; 7.5YR 4/6; silt loam; 49% coarse fragments; moderate, medium subangular blocky structure; friable; common, fine Mn; common medium, fine, and very fine roots; many, continuous, fine clay skins; clear, smooth boundary.

Bt1 38-70 cm; 5YR 4/6; silty clay loam; 47% coarse fragments; moderate, coarse subangular blocky structure; firm; common, fine Mn; many, continuous clay skins; few, fine and very fine roots; gradual, smooth boundary.

Bt2 70-125 cm; 5YR 5/6; silty clay loam; 45% coarse fragments; weak, medium subangular blocky structure; friable; common, discontinuous clay skins.

SITE No. AND 42

Lab numbers: 92393-92397
Classification: fine, kaolinitic, thermic Typic Paleudult
Latitude/Longitude: 36° 11' 01" N 83° 56' 57" W
Geomorphic Position: Upper part of slope
Slope and Aspect: 19% N 0.5°
Parent Material (s): colluvium over Copper Ridge residuum
Vegetation: Va pine, red maple, ferns

Oi 5-0 cm; leaved,pine needles; 20% coarse frags

A 0-24 cm; 10YR 3/3; silt loam; 44% coarse fragments; weak, medium subangular blocky structure; very friable; many medium, fine, and very fine roots; clear, smooth boundary.

Bt1 24-39 cm; 7.5YR 4/6; silty clay loam; 51% coarse fragments; weak, medium subangular blocky structure; friable; common, fine and very fine roots, few medium roots; common, continuous, thin clay skins; clear, smooth boundary.

Bt2 39-53 cm; 7.5YR 5/6; silty clay loam; 63% coarse fragments, 10% > 3 inches; moderate, medium subangular blocky structure; friable; many, continuous, thin clay skins; few fine and very fine roots; clear, smooth boundary.

Bt3 53-81 cm; 5YR 5/6; silty clay; 44% coarse fragments; moderate, medium subangular blocky structure; firm; many, continuous, thick clay skins; few fine and very fine roots; clear, smooth boundary.

2Bt4 81-93 cm; 2.5YR 4/6; clay; 78% coarse fragments; weak, medium subangular blocky structure; firm.

APPENDIX D

Morphology of the Roane County pedons of the Maryville Formation

SITE No. Roane 3

Location: 35° 43' 2" N 84° 35' 7" W
Classification: Fine, mixed, thermic, active, Typic Hapludult
Geomorphic Position: Lower slope
Slope and Aspect: SE 11%
Parent Material: Colluvium
Vegetation: Oaks, maples, sweetgum

Oi 4-0 cm; leaves and pine needles

AE 0-15 cm; 10YR 4/4; gravelly clay loam/silty clay loam; moderate, medium granular structure; friable; common medium roots, many fine and very fine roots; 18% coarse fragments; clear, wavy boundary.

Bt1 15-31 cm; 7.5YR 5/6; 10YR 4/4; gravelly silty clay loam; moderate, medium subangular blocky structure; friable; moderate, medium subangular blocky structure; common medium roots, many fine and very fine roots; 20% coarse fragments; clear wavy boundary.

2Bt2 31-53 cm; 10YR 5/6; gravelly clay loam; weak, coarse subangular blocky structure; firm; few medium Mn concentration; few, faint discontinuous clayskins; many fine and very fine roots; common, fine, prominent mottles (2.5YR 3/6); 21% coarse fragments; gradual, wavy boundary.

2Bt3 53-85 cm; gravelly clay or silty clay; mottled color 2.5YR 4/6 and 2.5Y 6/4; moderate, medium subangular blocky structure; firm; common fine and very fine roots; few, medium Mn concentrations; many distinct continuous clayskins; 25% coarse fragments; gradual smooth boundary.

2C 85-95+ cm; gravelly silty clay loam; mottled color 2.5YR 3/6, 2.5Y 6/2, and 10YR 5/6; structureless massive; firm; few medium Mn concretions; 20% coarse fragments.

SITE No. Roane 7

Location: 35° 40' 41" N 84° 36' 55" W
Classification: Fine, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position: Stream terrace
Slope and Aspect: 4% S
Parent Material: Maryville Formation
Vegetation: Red maple, dogwood, poplar, Va pine

Ap 0-6 cm; 10YR 3/2; silt loam; moderate, fine granular structure; friable; many fine and medium roots; 2% coarse fragments; abrupt, smooth boundary.

BA 6-16 cm; 10YR 5/4; silt loam; weak, fine subangular blocky structure; friable; common and medium roots; 5% coarse fragments; clear smooth boundary.

Bt1 16-44 cm; 10YR 5/6; Silty clay; moderate, medium subangular blocky structure; friable; few, fine roots; common, distinct, discontiuous clayskins; 3% coarse fragments; clear, smooth boundary.

2Bt2 44-56 cm; mottled color 2.5YR 4/6, 7.5YR 4/6, and 2.5YR 6/3; clay; weak, medium subangular blocky structure; firm; many, prominent, continuous clay skins; few MN stains; 5% coarse fragments; gradual smooth boundary.

2C 56-93 cm; mottled color 7.5YR 5/6, 2.5YR 4/6, and 2.5Y 6/2; clay; structureless massive; firm; 9% coarse fragments; clear wavy boundary.

2Cr 93+ cm shale

SITE No. Roane 8

Location: 35° 40' 38" N 84° 36' 53" W
Classification: Fine, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position: Stream terrace
Slope and Aspect: 6% S
Parent Material: Alluvium over Maryville residuum
Vegetation: Va. Pines, sweetgum, sugar maple

Ap 0-5 cm; 10YR 3/2; silt loam; moderate, fine granular structure; very friable; common fine and medium roots; 10% sandstone fragments; abrupt smooth boundary.

BA 5-17 cm; 10YR 5/6; silty clay loam; moderate, fine subangular blocky structure; very friable; 7%; coarse fragments; fine and medium roots; few, medium Mn concretions; clear smooth boundary.

Bt1 17-44 cm; 7.5YR 5/6; silty clay; moderate, medium, subangular blocky structure; friable; few,fine and medium roots; 2% coarse fragments; few, medium Mn concretions; few,faint, discontinuous clay skins; gradual smooth boundary.

2Bt2 44-80 cm; 7.5 4/6; silty clay loam; moderate, medium angular blocky structure; firm; many, prominent, contiuous clay skins; common, fine, prominent (2.5Y 6/4) and few, fine, prominent (2.5YR 4/8) mottles; few, fine Mn concretions; few, fine roots along ped faces; 1% coarse fragments; clear smooth boundary.

2C 80-95+ cm; mottled color 5YR 4/6, 2.5YR 6/4, and 2.5YR 4/6; silty clay loam; moderate, coarse platy structure;, rock controlled; very firm; 10% sandstone and shale fragments.

SITE No. Roane 9

Location: 35° 42' 53" N 84° 35' 14" W
Classification: Fine, mixed, thermic, semi-active, Ochreptic Hapludult
Geomorphic Position: Footslope
Slope and Aspect: 10% South
Parent Material: Colluvium over Maryville residuum
Vegetation: Oak, hardwoods, pines

Oi 2-0cm; leaves and twigs

A 0-9 cm; 10YR 4/2; gravelly silt loam; moderate, medium subangular blocky structure; very friable; few coarse roots, common medium roots, and many fine and very fine roots; 18% coarse fragments; clear, wavy boundary.

E 9-16; 10YR 5/3; gravelly silt loam; moderate, fine and medium subangular blocky structure; friable; few, faint mottles (10YR 6/4); 19% coarse fragments; few, medium roots, many fine and very fine roots; clear, wavy boundary.

BE 16-30 cm; 10YR 5/6; gravelly silt loam; moderate, fine and weak, medium subangular blocky structure; friable; few coarse and medium roots, common fine roots,17% coarse fragments; clear wavy boundary.

2Bt 30-52 cm; 5YR 5/6; gravelly silty clay loam; weak, medium subangular blocky structure; friable; few, thin, discontinuous clay skins, 19% coarse fragments; few, medium roots, common, fine roots; clear, wavy boundary.

2Cr 52+ cm

SITE No. Roane 10

Location: 35° 44' 41" N 84° 33' 37" W
Classification: Fine, mixed, thermic, semi-active, Ochreptic Hapludult
Geomorphic Position: bench, terrace smear on top
Slope and Aspect: 3% 150° SE
Parent Material: alluvium over Maryville residuum
Vegetation: maple, oak, short leaf pine

Oi 7-5 cm; leaf; litter
Oa 5-0 cm; decomposed plant material

Ap 0-18 cm; 10YR 4/4; gravelly silty clay loam; weak, medium subangular blocky structure; friable; common fine, very fine, and medium roots; few, medium mottles (10YR 5/8); 18% coarse fragments; clear, irregular boundary.

Bt 18-28 cm; 10YR 5/4; silty clay; 10YR 5/8; moderate, medium subangular blocky structure; firm; common, thin, discontinuous clay skins; 15% shale fragments, some remnant structure from shale, common fine and very fine roots, few medium roots; common Mn concretions; common, coarse, faint mottles (10YR 5/8); 13% coarse fragments; clear smooth boundary.

Bt2 28-40 cm; 7.5YR 4/6; gravelly clay; moderate, medium angular blocky structure; firm; 15% coarse fragments; many, thick, continuous clay skins; common, coarse, distinct mottles (10YR 6/8), reflecting the color of weathered shale; few, fine and medium roots; clear, smooth boundary.

2BC 40-62 cm; 7.5YR 4/6; gravelly clay loam; moderate, medium angular blocky structure; firm, many, thick, continuous clay skins; common, medium, distinct (5YR 4/6) and common, medium, prominent (10YR 6/6) mottles; few,fine and very fine roots; 50% coarse fragments predominantly shale; clear, smooth boundary.

2Cr1 62-83 cm; red,green, and yellow shale
2Cr2 83-108 cm; green shale, many coarse Mn concretions and pockets

SITE No. Roane #13

Location: 35° 44' 22" N 84° 33' 57" W
Classification: Fine, mixed, thermic, active, Typic Hapludult
Geomorphic Position: bench
Slope and Aspect:3% 100° E
Parent Material: Colluvium
Vegetation: Dogwoods, red maple, Va. pine, chesnut oak

A 0-2.5 cm; 10YR 2/2; silt loam; weak, fine, subangular blocky structure; friable; common, medium roots, many fine and very fine roots; 12% coarse fragments; abrupt smooth boundary.

E 2.5-13 cm; 10 YR 5/4; silt loam; weak, medium subangular blocky structure; friable; 10% chert; common medium roots, many fine and very fine roots; clear, wavy boundary.

Bt1 13-30 cm; 7.5YR 5/6; silty clay; moderate, medium subangular blocky structure; firm; many continuous clay films (7.5YR 4/6); few medium roots, many fine and very fine roots; few coarse roots; 5% chert; clear wavy boundary.

Bt2 30-50 cm; 7.5YR 4/6; gravelly silty clay; moderate, medium subangular blocky structure; firm; many continuous clay films (7.5YR 4/6); few medium roots, many fine and very fine roots; few coarse roots; 15% chert; clear wavy boundary.

Bt3 50-78 cm; 7.5YR 4/6; clay; weak, medium subangular blocky structure; firm; many, thin, continuous clay skins (5YR 5/6), few, fine and very fine roots, 12% chert, some pieces of green shale; clear wavy boundary.

BC 78-88 cm; 7.5YR 4/6; clay; structureless massive; friable; 2% coarse fragments; clear wavy boundary.

C 88-98+; 7.5YR 4/6; gravelly clay loam; structureless massive; friable; 22% chert

SITE No. Roane 14

Location: 35° 44' 19" N 84° 33' 59" W
Classification: Fine, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position: upland-sideslope
Slope and Aspect: 13% N 355°
Parent Material: Colluvium over Maryville residuum
Vegetation: Poison ivy, dogwood, poplar

A 0-8 cm; 10YR 2/2; silty clay loam; weak, medium granular structure;very friable; many fine and very fine roots, few medium roots; 6% coarse fragments, clear, smooth boundary.

Bt1 8-19 cm; 10YR 4/3; gravelly clay; moderate, medium subangular blocky structure; friable; few, faint mottles (10YR 5/6); 22% coarse fragments-shale; common, fine roots, few, medium and coarse roots; shale layer at bottom of the Bt1; clear wavy boundary.

2Bt2 19-41 cm; 7.5YR 4/6; clay; weak, medium subangular blocky structure; firm; common, faint mottles (10YR 4/4); common, thin, discontinuous clay skins; common, fine and very fine roots, few medium roots; 8% coarse fragments; clear, wavy boundary.

2Bt3 41-58 cm; mottled color 2.5YR 4/6, 10YR 5/2, and 2.5Y 4/4; gravelly clay; moderate, medium subangular blocky structure; firm; 32% shale fragments; common, thick, discontinuous clay skins; few coarse, medium, and fine roots; gradual wavy boundary.

2Cr 58-104+ cm

SITE No. Roane 17

Location: 35° 41' 31" N 84° 36' 21" W
Classification: Fine, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position: Stream terrace
Slope and Aspect: 2% E 110°
Parent Material: Alluvium over Maryville residuum
Vegetation: Va Pine thicket, red cedar, sweet gum

Oi 2-0 cm; pine needles, twigs, few leaves

A 0-15 cm; 10YR 5/4; silt loam; weak, fine granular structure; friable; few, fine Mn concretions; 12% coarse fragments; common fine roots, few medium roots; clear smooth boundary.

Bt1 15-28 cm; 10YR 4/6; gravelly silty clay loam; moderate, fine, subangular blocky structure; friable; few, fine and medium roots; few, fine Mn concretions; 19% coarse fragments; clear, smooth boundary.

2Bt2 28-60 cm; 5YR 4/6; gravelly clay; moderate, medium subangular blocky structure; friable; 18% soft green shale fragments; few fine roots; few, distinct clay skins; gradual smooth boundary.

2Bt3 60-80 cm; 5YR 4/6; gravelly clay; moderate, medium subangular blocky structure; friable; few, medium faint mottles (5YR 4/4); common, distinct clay skins; 15% channers; clear, smooth boundary.

2C 80-104 cm; mottled color 5YR 4/6, 7.5YR 4/6, and 2.5Y 5/3; clay; structureless massive; friable; few Mn stains; 4% coarse fragments.

SITE No. Roane #19

Location: 35° 42' 50" N 84° 35' 16" W
Classification: Fine-silty, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position: upland sideslope
Slope and Aspect: 15% SE 150
Parent Material: Maryville residuum
Vegetation: Red maple, oak, dogwood, cedar, hickory

Oe 2-0 cm; decomposing leaves

A 0-6 cm; 10YR 3/2; gravelly silt loam; weak, fine, granular structure; very friable; 23% coarse fragments; abrupt, smooth boundary.

AE 6-18 cm; 10YR 4/4; gravelly silty clay loam; weak, medium, subangular blocky structure; very friable; 17% coarse fragments; clear smooth boundary.

Bt 18-47 cm; 7.5YR 4/6; silty clay loam; moderate, medium subangular blocky structure; friable; common, medium Mn concretions; 9% coarse fragments; clear wavy boundary.

Cr 47-98+ cm; yellow and red shale

SITE No. Roane #20

Location: 35° 42' 47" N 84° 35' 19" W
Classification: Fine, mixed, thermic, semi-active, Ochreptic Hapludult
Geomorphic Position: Upland - side slope - eroded
Slope and Aspect: 12% 140° SE
Parent Material: colluvium over Maryville residuum
Vegetation: Chestnut, oak, sweet gum, dogwood

Oi 2-0 cm; leaves and pine needles

E 0-12 cm; 10YR5/4; gravelly clay loam; weak, medium subangular blocky structure; friable; common, fine and medium roots, few coarse roots; 16% coarse fragments; clear smooth boundary.

Bt1 12-35 cm; 5YR 4/6; clay/silty clay; strong, medium, subangular structure; firm; few, medium, prominent (2.5Y 6/6 and 2.5YR 3/6) mottles; few, medium and fine roots; many, thick, continuous clay skins; 7% coarse fragments; gradual smooth boundary.

2Bt2 35-52 cm; 2.5YR 3/6; gravelly clay; weak, coarse, subangular blocky structure; firm; common, medium,prominent mottles (2.5Y 5/4); few, very fine roots; 25% coarse fragments; clear smooth boundary.

2Cr 52-72+ cm; red and green shale.

SITE No. Roane 21

Location: 35° 42' 44" N 84° 35' 22" W
Classification: Fine-silty, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position: Mid slope
Slope and Aspect: 13% SE 130°
Parent Material: Colluvium over Maryville residuum
Vegetation: Oak,sweetgum, maple, poplar, Va pine, ground pine

Oi 3-0 cm; leaves, moss, pine needles

A 0-5 cm; 10YR 4/3; loam; moderate, medium granular structure; very friable; common, medium roots, many fine and very fine roots; 13% coarse fragments; clear smooth boundary.

Ap 5-18 cm; 10YR 4/2; silt loam; weak, medium subangular blocky structure; friable; many, fine roots; common, medium, distinct mottles (7.5YR 4/6); 13% coarse fragments; clear wavy boundary.

2Bt1 18-36 cm; 7.5YR 4/6; silty clay loam; moderate, medium subangular blocky structure; firm; common, distinct, continuous clay skins; few, medium and fine Mn concretions; common,fine and medium roots; 7% coarse fragments; clear smooth boundary.

2Bt2 36-64 cm; 7.5YR 5/6; silty clay loam; moderate, coarse subangular blocky structure; firm; many, medium, discontinuous clay skins; few, fine and medium roots; common fine and medium Mn and iron concretions; 12% coarse fragments; clear smooth boundary.

2BC 64-74 cm; 7.5YR 5/4; gravelly silty clay loam; weak, medium subangulr blocky structure; friable; few, faint, patchy clay skins; common fine and medium iron and Mn concretions; few, fine roots; few, fine, prominent mottles (2.5Y 7/4); 19% coarse fragments; gradual smooth boundary.

2Cr 74-112+ cm.

SITE No. Roane #22

Location: 35° 42' 40" N 84° 35' 26" W
Classification: Fine, mixed, thermic, active, Typic Hapludult
Geomorphic Position: Footslope
Slope and Aspect: 13% SE 140°
Parent Material: Colluvium over Maryville residuum
Vegetation: Cedar, oak, poplar, ground pine, Va Pine

Oi 3-0 cm; pine needles, some leaves

E 0-19 cm; 10YR 5/6; silt loam; moderate, medium granular structure; friable;common, medium and fine roots; 9% coarse fragments; clear, smooth boundary.

Bt1 19-29 cm; 7.5YR 5/8; clay; moderate, medium subangular blocky structure; firm; few, medium and fine roots; many,thick, continuous clay skins; 5% coarse fragments; clear, smooth boundary.

Bt2 29-45 cm; 7.5YR 4/6; clay; moderate, medium subangular blocky structure; firm; few, fine and medium roots; common, thick, discontinous clay skins; 5% coarse fragments; clear, smooth boundary.

2Bt3 45-56 cm; 2.5YR 4/6 and 2.54Y 5/4; clay; weak, coarse, subangular blocky structure; firm; few, fine roots; common, thin, discontinuous clay skins; 4% coarse fragments; clear, smooth boundary.

2C 56-100+ cm; mottled color 7.5YR 5/8, 2.5Y 6/4, and 2.5YR 4/6; clay; structureless massive; firm; 6% coarse fragments.

APPENDIX E

Morphology of the Anderson County pedons of the Maryville Formation

Pedon Anderson 1

Location: 36° 11' 48" N 83° 56' 57" W
Classification: Fine, mixed, thermic, semi-active, Ochreptic Hapludult
Geomorphic Position: Upland
Slope and Aspect: 6% SE
Parent Material: Maryville residuum
Vegetation: Tulip poplar, dogwood, red maple, Virginia pine

Soil Description

A 0-10 cm; (10YR 3/3); loam/clay loam; weak, medium, granular strucutre; very friable; many fine and medium roots; common medium distinct mottles (10YR 5/4); 2 % coarse fragments; clear, smooth boundary.

E 10-28 cm; (10YR 5/6); clay loam; weak, medium subangular blocky structure; friable; few medium distinct mottles (7.5YR 5/6); 13 % coarse fragments; clear, wavy boundary.

Bt 28-44 cm; (5YR 5/6); clay; moderate, medium subangular structure; friable; few fine roots common, medium prominent mottles (10YR 5/3 and 10YR 5/4); 6% shale fragments; common distinct clay films on ped faces; clear, wavy boundary.

Cr 44-104 cm; yellow and brown shale, 20% Bt material

Pedon Anderson 3

Location: 36° 11' 40" N 83° 57' 05" W
Classification: Fine, mixed, thermic, subactive, Typic Hapludult
Geomorphic Position: upland midslope
Slope and Aspect: 7%, 160 S/SE
Parent Material: Colluvium over Maryville residuum
Vegetation: Pine, dogwood, red maple, moss, poison ivy, sumack , cedar, some oak

Soil Description

Oi 2-0 cm; moss and pine needles

A 0-4 cm; (10YR3/4); clay loam; moderate, medium granular structure; friable; few-coarse and medium roots, many-fine and very fine roots; 7 % coarse fragments; abrupt smooth boundary.

Bt1 4-16 cm; (10YR5/4); clay; moderate, fine subangular blocky structure; friable; few medium roots, common fine and very fine roots; 6 % coarse fragments; clear, smooth boundary.

2Bt2 16-40 cm; (5YR4/6); clay; moderate, medium angular blocky structure; firm; few medium roots, lithochromic mottles, common medium distinct (7.5YR6/8),common thick continuous clay skins; few medium roots; 1 % coarse fragments; clear, wavy boundary.

2Bt3 40-53 cm; (5YR4/6); clay; moderate, medium angular blocky structure; firm; lithochromic mottles- many medium distinct (7.5YR6/8) and (2.5YR4/8), few-fine roots; many thick continuous clay skins on ped faces and pores; 1 % coarse fragments; clear, wavy boundary.

2Cr 53-90+ cm; shale

Pedon Anderson 4

Location: 36° 06' 28" N 83° 57' 18" W
Classification: Fine, mixed, thermic, semi-active, Ochreptic Hapludult
Geomorphic Position: Midslope, Upland
Slope and Aspect: 24% 103° SE
Parent Material: Colluvium over Maryville residuum
Vegetation: poison ivy, Virginia pine, dogwood, sourwood, red maple, elm, cherry

Soil Description

Oi 3-0 cm; leaf litter, roots, pine needles

A 0-5 cm; (10YR5/4); loam; weak, medium granular structure; very friable; 8% channers, common, fine and medium roots; abrubt smooth boundary.

E 5-24 cm; (10YR5/6); loam/silt loam; weak, fine, subangular blocky structure; friable; 8% channers, few fine roots; abrupt, smooth boundary.

BE 24-37 cm; (7.5YR5/6); clay loam; moderate, fine, subangular blocky structure; friable; common, medium prominent lithochromic mottles (2.5Y 5/4); 14% shale channers, few fine roots, few patchy faint clay skins; clear, smooth boundary.

2Bt1 37-53 cm; (5YR5/6); clay; moderate, medium subangular blocky; friable; 2% channers, common, medium distinct mottles (7.5YR5/6), common discontinuous clay skins, few-fine mica flakes, few-fine roots; clear, wavy boundary.

2Bt2/Cr 53-70 cm; Bt: (5YR5/6); clay; moderate, medium subangular blocky structure; friable; common discontinuous clay skins; Cr: (2.5YR5/4) soft fractured shale; few fine roots along fracture planes, few Mn stains, abrupt, wavy boundary.

2Cr 70-100 cm; soft light olive brown shale, some red and yellow shales; a few small pockets of Bt material

Pedon Anderson 5

Location: 36° 11' 29" N 83° 57' 22" W
Classification: Fine-loamy, mixed, thermic, semi-active, Ochreptic Hapludult
Geomorphic Position: Midslope - Upland
Slope and Aspect: 120° SE, 25%
Parent Material: Colluvium over Maryville residuum
Vegetation: Poison ivy, Virginia pine, Dogwood, Oak

Soil Description

Oi 2-0 cm; leaf; litter; pine needles roots-branches

A 0-6 cm; (10YR4/4); loam; fine, medium granular structure; very friable; many very fine and fine roots, common medium roots; 18% channers; clear, smooth boundary.

AE 6-15 cm; (10YR 4/6); loam; fine, medium subangular blocky structure; friable; common fine and medium roots, 23% channers; clear, smooth boundary.

E 15-45 cm; (10YR 5/6); clay loam; moderate, medium subangular blocky structure; friable; common medium prominant mottles (7.5YR 5/8), 13% channers; few fine roots, few fine discontinuous clay skins; clear, smooth boundary.

2Bt 45-70 cm; (7.5YR 5/8); clay loam; moderate, medium subangular blocky structure; friable; common medium prominent mottles (2.5Y 5/4), few-fine roots, 19% channers, common distinct continuous clay skins; clear, smooth boundary.

2Cr 70-122 cm; red, yellow, and brown shales.

Pedon Anderson 9

Location: 36° 06' 00" N 84° 03' 42" W
Classification: Fine, mixed, thermic, active, Typic Hapludult
Geomorphic Position: midslope on a convex slope
Slope and Aspect: 160° S.E. 15% slope
Parent Material: Colluvium over Maryville residuum
Vegetation: Virginia pine, understory yellow poplar, red maple, dogwood

Soil Description

Oi 2-0 cm; pine needles and leaves

A 0-5 cm; dry (10YR 4/4), moist (10 YR 3/3); loam; moderate, fine, subangular blocky structure; friable; many fine and very-fine roots, few coarse roots, common medium roots, 15% fragments; clear smooth boundary.

E 5-12 cm; dry(2.5YR 5/4), moist (10YR 5/4); loam; fine, medium subangular blocky structure; friable; 9% fragments, few medium and many fine and very-fine roots; clear, smooth boundary.

2Bt1 12-35 cm; (7.5YR 5/6) clay; moderate, medium and coarse subangular blocky structure; firm; lithochromic mottles, common, fine, prominent (2.5Y 6/6), many, thick, continuous clay skins on ped faces, few fine Mn concentrations: few coarse and medium roots, common fine and very fine roots; 4 % coarse fragments; clear, wavy boundary.

2Bt2 35-50 cm; (7.5YR 4/6) clay; weak, medium subangular blocky structure (some rock controlled structure); firm; many medium prominent mottles (2.5Y 6/6), common thin discontinuous clay skins; few medium roots, common fine and very fine roots; 5 % coarse fragments; clear, wavy boundary.

2BC 50-62 cm; (7.5YR 5/6); clay; weak, fine, subangular blocky structure (rock controlled structure); firm; common, medium, prominent mottles (2.5Y 6/6); common Mn concentrations; few medium thick discontinuous clay skins; 10% fragments; clear wavy boundary.

2Cr 62-105 cm; shale

Pedon Anderson 10

Location: 36° 08' 47" N 84° 00' 58" W
Classification: Fine, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position: Upland
Slope and Aspect: NE 20°, 1%
Parent Material: Colluvium over Maryville residuum
Vegetation: Poplar, Red maple, Virginia pine

Soil Description

Oi roots leaf litter

A 0-10 cm; 10YR 3/2; silt loam; weak, medium subangular blocky structure; fraible; common medium roots, many fine and very fine roots; 4 % coarse fragments; clear, wavy boundary.

E 10-21 cm; 10YR5/3; silt loam; weak, medium subangular blocky structure; friable; common, fine, faint mottles (10YR 6/6), common, medium roots, many fine and very fine roots, several root channels had a mix of A and E materials; 12 % coarse fragments; clear, smooth boundary.

Bt1 21-40 cm; 7.5YR 5/6 and 10YR 5/4; silty clay loam; weak, medium subangular blocky structure; friable; 10% fragments; few medium roots, common fine and very fine roots; clear, smooth boundary.

Bt2 40-77 cm; 7.5YR 5/6; clay; moderate, medium subangular blocky structure; friable; few coarse and medium roots, common fine and very fine roots; 9 % coarse fragments; clear, smooth boundary.

Cr 77-136 cm; shale.

Pedon Anderson 11

Location: 36° 09' 10" N 84° 00' 36" W
Classification: Fine, mixed, thermic, subactive, Typic Hapludult
Geomorphic Position: Upland shoulder of a knob
Slope and Aspect: SE 145° 12% slope
Parent Material: Colluvium over Maryville residuum
Vegetation: Hickory, poplar, beech, maple, may apples

Soil Description

Oa 2-0 cm; crumbly, organic matter

A 0-6 cm; silt loam; 10YR 4/3; weak, medium subangular blocky structure to moderate, fine granular; very fraible; many fine and very fine roots, common medium roots, few coarse roots; 13% shale fragments, clear, wavy boundary.

E 6-12 cm; gravelly silt loam; 10YR 5/4; weak, fine, subangular blocky structure; friable;common fine and very fine roots; 19% coarse fragments; clear wavy boundary.

Bt1 12-18 cm; 7.5YR 5/6 and 7.5YR 5/4; silty clay loam; weak, fine subangular blocky structure; friable; common fine and very fine roots, few medium roots; few, fine, distinct mottles (10YR 5/2); 5 % coarse fragments; clear, wavy boundary.

Bt2 18-30 cm; 7.5YR 5/4; clay; weak, medium and moderate, fine subangular blocky structure; firm; common, thin, discontinuous clay skins (5YR 5/6); few, fine Mn concentrations, common fine and very fine roots, few medium roots; 10 % coarse fragments; clear, irregular boundary.

2Bt3 30-56 cm; 7.5YR 5/6; clay; weak, medium subangular blocky structure; friable; common, discontinuous clay skins (5YR 5/6 and 4/6); common fine and very fine roots, few medium roots, common, fine to medium Mn concentrations; 4 % coarse fragments; clear, irregular boundary.

2BC 56-92 cm; 7.5Y 5/4; clay; weak, medium subangular blocky structure; friable to firm; common, discontinuous clay skins (5YR 5/6); common fine and very fine roots; common, fine Mn concentrations; 15 % coarse fragments; gradual, wavy boundary.

2Cr 92-140 cm; shale (2.5Y 5/4)

Pedon Anderson 12

Location: 36° 10' 32" N 83° 58' 45" W
Classification: Fine, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position:
Slope and Aspect: S, SE 160°, 15%
Parent Material: Maryville residuum
Vegetation: Sweetgum, pine, dogwood, hickory

Soil Description

Oi 2-0 cm; pine needles, grass, leaves

A 0-7 cm; 10YR 3/3; silt loam; moderate, fine, granular strucutre; friable; many fine roots, common very fine roots; 4 % coarse fragments; abrupt, smooth boundary.

E 7-16 cm; 10YR 5/4; silt loam; weak, moderate subangular blocky structure; friable; common, medium, faint mottles (10YR 5/8), few fine, medium, and coarse roots; 6 % coarse fragments; clear, wavy boundary.

Bt1 16-41 cm; 7.5YR4/6; clay; moderate, coarse, subangular blocky structure; firm; common medium distinct mottles (2.5Y 5/4) , lithochromic from rotton shale; common, thin, discontinuous clay skins; few fine and medium roots;2 % coarse fragments; clear, wavy boundary.

Bt2 41-56 cm; 5YR 5/6; clay ; moderate, coarse, subangular blocky structure; firm; common medium distinct mottles (2.5Y 5/4) , lithochromic from rotton shale; many, thick, continuous clay skins; 6 % coarse fragments; clear, wavy boundary.

Cr1 56-90 cm; red and yellow shales

Cr2 90-122+ cm; red, yellow, and brown shales.

Pedon Anderson 19

Location: 36° 11' 01" N 83° 58' 14" W
Classification: Fine, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position: Lower part of slope, upland
Slope and Aspect: 6% 160° S.E.
Parent Material: Colluvium over Maryville residuum
Vegetation: Virginia pine, red maple, poplar, sassafras, moss

Soil Description

Oi 4-0 cm; moss, pine needles, roots

A 0-13 cm; 10YR 3/2; silt loam; moderate, medium subangular blocky structure; friable; common fine and very fine roots, few medium roots; 9 % coarse fragments; abrupt, smooth boundary.

E 13-23 cm; 10YR 5/6; gravelly loam; moderate, medium and fine, subangular blocky structure; friable; 16% channers,common fine and medium roots; abrupt, smooth boundary.

2Bt1 23-39 cm; 5YR 5/6; clay; moderate, medium subangular blocky structure; firm;few fine and medium roots; many, thin, discontinuous clay skins; 4% coarse fragments; abrupt, smooth boundary.

2Bt2 39-72 cm; 5YR 5/8; clay; moderate, medium subangular blocky structure; firm; 7% coarse fragments; many, continuous, thick, clay skins; few, fine roots; common, medium, distinct lithochromic mottles (2.5Y 5/6) from decomposed shale; clear, wavy boundary.

2BC 72-95 cm; 5YR 5/8; clay; weak, medium subangular blocky structure; friable; common, discontinuous clay films, few, fine roots; 8 % coarse fragments; gradual wavy boundary.

2CR 95-135 cm; shale.

Pedon Anderson 20

Location: 36° 11' 32" N 83° 57' 14" W
Classification: Fine, mixed, thermic, semi-active, Typic Hapludult
Geomorphic Position: Upland
Slope and Aspect: SW 200° 12% slope
Parent Material: Colluvium over Maryville residuum
Vegetation: Moss, tulip poplar, Virginia pine

Soil Description

Oi 2-0 cm; moss, leaf litter

A 0-5 cm ; 7.5YR 4/4; silt loam; moderate, medium granular structure; friable; common, fine roots; 3 % coarse fragments; clear, smooth boundary.

BE 5-13 cm; 10YR 5/6; silty clay loam; weak, fine, subangular blocky structure; friable; 3% channers; common, fine and medium roots; gradual, smooth boundary.

Bt1 13-21 cm; 7.5YR 5/6; silty clay loam; moderate, medium subangular blocky structure;friable; 3% channers, few fine roots; few, patchy, faint clay skins; abrupt, smooth boundary.

2Bt2 21-42 cm; 5YR 5/6; clay; moderate, medium subangular blocky structure; firm; few, fine roots; many, continuous clay skins; common, fine, prominent, lithochromic mottles (2.5Y 5/6); clear, wavy boundary.

2Bt3 42-84 cm; 2.5YR 4/8; clay; strong, medium subangular blocky structure; friable; many, fine 2.5Y 5/6 mottles; 3% channers; many, continuous clay skins; clear, wavy boundary.

Cr 84+ cm; soft light olive, yellowish brown shale

Pedon Anderson 21

Location: 36° 11' 36" N 83° 57' 14" W
Classification: Fine, mixed, thermic, semi-active, Ochreptic Hapludult
Geomorphic Position: In a saddle at the head of a drain
Slope and Aspect: 11%, SE 140°
Parent Material: Maryville residuum
Vegetation: Tulip poplar, dogwood

Soil Description

Oi 2-0 cm; pine needles, leaves

A 0-6 cm; 10YR 3/3; silt loam; weak, fine and medium granular structure; friable; many fine and very fine roots, common medium roots; 2 % coarse fragments; abrupt, smooth boundary..

E 6-12 cm; 10YR 5/4; clay loam; moderate, medium subangular blocky structure; friable; common, medium, distinct mottles (7.5YR 5/8); common medium roots, few fine roots; 5 % coarse fragments; clear, smooth boundary.

Bt 12-28 cm; 5YR 4/6; clay; strong, moderate subangular blocky structure; firm; many, medium, prominent mottles (2.5YR 5/4); many, thick,continuous clay skins; 2 % coarse fragments; clear, wavy boundary.

Cr 26-87+ cm;

Pedon Anderson 22

Location: 36° 10' 34" N 83° 58' 14" W
Classification: Fine, mixed, thermic, semi-active, Ochreptic Hapludult
Geomorphic Position: upland
Slope and Aspect: 18%, SE 130°
Parent Material: Maryville residuum
Vegetation: Poplar, cedar, Virginia pine, dogwood

Soil Description

Oi 2-0 cm; roots and leaf litter, pine needles

A 0-4 cm; 10YR 4/3; loam; weak, fine, subangular blocky structure; friable; many fine and very fine roots; 10% channers; few coarse and medium roots; abrupt, smooth boundary.

Bt1 4-14 cm; 10YR 5/4; clay; weak, medium subangular blocky structure; friable; 10% channers; common, moderate, thick, discontinuous clay skins (7.5YR 5/6); common, medium roots, many, fine and very fine roots; clear, wavy boundary.

Bt2 14-28 cm; 5YR 5/6; clay; moderate, medium subangular blocky structure; firm; many moderate, thick, continuous clay skins; common ,fine and very fine roots, few medium roots; common Mn concentrations and stains; 8% channers primarily green shale fragments; clear, irregular boundary..

Cr 28-98 cm; greenish gray shale; a water seep occurred at 50 cm.

APPENDIX F

Tables

Table 1. Relationship of site position and geologic formation to soil taxonomy on the Rome, Knox, and Chickamauga Formations.

PEDON NUMBER	ASPECT	PERCENT SLOPE	GEOLOGICAL FORMATION	PARENT MATERIAL	SOIL CLASSIFICATION
2	SW	5-12	CHICKAMAUGA D	COLLUVIUM/ RESIDUUM	FINE, MIXED, THERMIC, SEMIACTIVE TYPIC PALEUDULT
3	SW	12-25	CHICKAMAUGA A	COLLUVIUM/ RESIDUUM	FINE, MIXED, THERMIC, SUPERACTIVE TYPIC HAPLUDALF
4	SW	12-25	CHICKAMAUGA A	COLLUVIUM	FINE-LOAMY, MIXED THERMIC, SEMIACTIVE TYPIC HAPLUDALF
6	SW	12-25	NEWALA	COLLUVIUM/ RESIDUUM	FINE, MIXED, THERMIC, SUBACTIVE TYPIC PALEUDULT
7	SW	12-25	NEWALA	COLLUVIUM/ RESIDUUM	LOAMY-SKELETAL, MIXED, THERMIC SEMIACTIVE TYPIC PALEUDULT
9	W	12-25	LONGVIEW	COLLUVIUM/	FINE, KAOLINITIC, THERMIC TYPIC KANDIUDULT
10	W/NW	25-45	CHELPULTEPEC	COLLUVIUM/ RESIDUUM	FINE, KAOLINITIC, THERMIC, TYPIC HAPLUDULT

Table 1. continued.

PEDON NUMBER	ASPECT	PERCENT SLOPE	GEOLOGICAL FORMATION	PARENT MATERIAL	SOIL CLASSIFICATION
11	NW	12-25	CHELPULTEPEC	COLLUVIUM/ RESIDUUM	FINE-LOAMY, MIXED, THERMIC, SEMIACTIVE TYPIC FRAGIUDULT
12				ALLUVIUM/ COLLUVIUM	FINE-LOAMY, SILICEOUS, THERMIC SUBACTIVE TYPIC HAPLUDULT
13	NW	27	LOWER COPPER RIDGE	COLLUVIUM/ RESIDUUM	FINE, MIXED, THERMIC, SEMIACTIVE TYPIC HAPLUDALF
14	NW	12-25	FAULT BRECCIA OF THE ROME	COLLUVIUM/ RESIDUUM	FINE, MIXED, THERMIC, ACTIVE TYPIC HAPLUDALF
15	E	50	ROME	COLLUVIUM/ RESIDUUM	FINE-SILTY, MIXED, THERMIC, ACTIVE ULTIC HAPLUDALF
16	S	24	ROME	RESIDUUM	FINE, MIXED, THERMIC, ACTIVE TYPIC HAPLUDULT

Table 2. Soil morphology for study sites on the Rome, Knox, and Chickamauga Formations.

PEDON 2					
HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
E	0-7	GRSIL	10YR 5/2		VFR
E/Bt	7-20	SIL	10YR 6/4 7.5YR 5/6	1FSBK	VFR
Bt1	20-58	SIC	2.5YR 4/8	2MSBK	FR
Bt2	58-91	SIC	10YR 5/6	2MSBK	FI
BC1	91-124	SIC	2.5YR 6/6 2.5YR 6/4	2MSBK	FI
BC2	124-158	GRVSIC	2.5YR 6/6 2.5YR 6/4	2MSBK	FI
BC3	158-207	GRC	2.5YR 6/6 2.5YR 4/8	2CSBK	FI
DB	207-280	SIC	2.5Y 6/6 2.5YR 4/8	1CSBK	VFI
C	280-310	C	2.5YR 4/8 5YR 5/6	OMASL	VFI
* Oi	4-0	LEAF LITTER AND PINE NEEDLES			

Table 2 continued.

PEDON 3

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
A	0-15	GRSIL	10YR 3/3	3FGR	VFR
E	15-23	GRSIL	7.5YR 5/4	2FGR	VFR
Bt/E	23-44	GRVSIL	7.5YR 5/6 7.5YR 6/4	2FSBK	VFR
2Bt1	44-80	SIC	2.5YR4/6	3CSBK	FR
2Bt2	80-98	C	2.5YR 3/4	2CSBK 3CPR	VFRI
2BC	98-120	SIC	10YR 3/2	2MPR	VFR
2CB	120-150	SIC	5YR 3/4	OMASL	VFR
2C	150-158	SIC	5YR 4/3	OMASL	VFR
2R	158+	LIGHT GRAY AND MAROON LIMESTONE			
* Oi	5-0	LEAF LITTER			

Table 2 continued.

PEDON 4

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
A	0-2	GRXSIL	10YR 3/2	2FGR	VFR
E1	2-23	GRXSIL	10YR 5/3	1FGR	VFR
E2	23-40	GRVSIL	10YR 6/3	1FGR	VFR
Bt1	40-80	GRXSICL	7.5YR 4/6	2FSBK	FR
Bt2	80-110	GRXSIL	7.5YR 4/6	2FSBK	FR
2Bt3	110-129	C	10R 3/3	2MPR	VFI
2BC	129-170	C	10R 2/1 10R 2/2	1CPR	VFI
2CB	170-189	C	10R 3/2 7.5 YR 4/6		VFI
2C1	189-220	C	2.5Y 4/4		VFI
2C2	220-248	SIC	2.5YR 4/2		VFI
2Cr	248-252	SAPROLITE			

Table 2 continued.

PEDON 6

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
E1	0-15	GRL	2.5 Y 5/2	1FGR	VFR
E2	15-43	GRSIL	2.5Y 6/4	1FGR	VFR
Bt/E	43-74	SIL/L	7.5YR 5/8 10YR 6/6	2FSBK	VFR
2Bt1	74-130	C	2.5YR4/8 10 YR 6/8	2MSBK 2FSBK	FI
2Bt2	130-170	GRVC	2.5YR 4/6 10 YR 6/8	2MSBK	VFI
2Bt3	170-180	GRVC	10YR 6/8 2.5 YR 4/6	1MSBK	VFI
* Oi	5-0	LEAF LITTER			

Table 2 continued.

PEDON 7

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
A	0-6	GRSIL	2.5YR 4/2	2FGR	VFR
E	6-20	GRSIL	10YR 5/3	1FGR	VFR
BE	20-60	GRSIL	10YR 5/4	1FSBK	VFR
Bt1	60-110	GRVL	7.5YR 5/6	1MSBK	FR
Bt2	110-170	GRXL	7.5YR 5/6	1MSBK	FR
E′	170-180	GRX	7.5YR 5/8	0MASL	VFR
		VCOSSL			
2Bt	180-210	GRC	2.5YR 4/8	2MSBK	VFI
*Oi	4-0	LEAF LITTER AND ROOT MAT			

* Some fragic properties in the Bt horizons.

Table 2 continued.

PEDON 9					
HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
A	0-4	GRXL	10YR 3/2	2FGR	VFR
BE	4-28	SIL	10YR 7/4	1FGR	VFR
Bt1	28-56	C	5YR 5/8	2MSBK	F1
2Bt2	56-92	GRVC	10YR 4/8 10YR 6/8	1CSBK	VFI
2Bt3	92-130	GRVC	10YR 4/8 10YR 6/8	1CSBK	VFI
2Bt4	130-160	GRC	10R 4/8 10YR 6/8	1CSBK	VFI
2Bt5	160-200	C	MOTTLED 10R 4/8 10YR 6/8 10YR 7/2	1CSBK	VFI
*Oi	5-0	LEAF LITTER AND ROOT MAT			

Table 2 continued.

PEDON 10

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
E	0-17	SIL	5Y 6/3	1FGR	VFR
E/B	17-40	GRSIL	2.5Y 6/6 10YR 5/6	1FGR	VFR
Bt1	40-69	C	5YR 5/8	2FSBK	FR
2Bt2	69-99	C	5YR 5/8	2FSBK	FI
2BC	99-139	SIC	10YR 6/6 2.5YR 4/8	1CSBK 1CABK	VFI
2CB	139-187	SIC	10YR 5/8	0MASL	VFI
2C1	187-231	C	7.5YR 5/6 10YR 6/8	0MASL	VFI
2C2	231-276	SIC	5YR 5/6 10YR 6/8	0MASL	VFI
*Oi	5-0	LEAF LITTER AND ROOT MAT			

Table 2 continued.

PEDON 11					
HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
E1	0-10	GRSIL	5Y 6/3	1FGR	VFR
E2	10-26	GRSIL	5Y 6/4	1FGR	VFR
2E3	26-44	GRXSIL	10YR 6/4	2FSBK	VFR
2Btx	44-66	GRXSICL	10YR 5/6	1FSBK	FI
3Bt1	66-120	GRSICL/C	MOTTLED 5YR 5/8 2.5YR 4/8	2MSBK	FI
3Bt2	120-148	C	2.5YR 4/8 10 YR 6/8	1MSBK 1CSBK	VFI
3BC	148-184	SICL/SIC	10YR 6/6 10 YR 6/8	ABK	VFI
3CB	184-203	SICL	10YR 6/8 2.5 YR 4/8	ABK	VFI

A thin A horizon of less than 2 cm was not sampled.

Table 2 continued.

PEDON 12

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
Ap	0-30	GRL	10YR 4/3	2FGR	VFR
BE	30-44	L	7.5YR 5/6	2FSBK	VFR
Bt1	44-80	L	5YR 5/6	2F & MSBK	VFR
Bt2[1]	80-114	L	5YR 4/6	2F & MSBK	VFR
2BC	114-150	GRXCL	5YR 5/6 2.5 YR 4/8	0MASL	FI
3Eg1	150-168	SIL	2.5YR 6/4	0MASL	FI
3Eg2	168-186	GRSIL	2.5YR 6/4	0MASL	FI
4Eg3	186-203	GRXSICL	10YR 5/4	0MASL	FI
4Btg	203-230	GRXSICL	10YR 7/2	0MASL	FI

Table 2 continued.

PEDON 13

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
AP	0-22	GRVSIL	10YR 4/3	3FGR	VFR
E	22-47	GRVSIL	7.5YR 5/4	2FGR	VFR
Bt/E	47-63	GRXSICL	5YR 4/6 7.5 YR 5/6	2MSBK	FR
BC	63-77	SIL	2.5YR 4/8	2M & FSBK	FR
2Bt1	77-109	C	2.5YR 4/6	3MABK 3MSBK	FR
2Bt2	109-185	C	2.5YR 4/6 5 YR 5/8	3FABK	FR
3Cr	185-190		10 YR 6/3		
3R	190+	WEATHERED DOLOMITE			
*Oi	4-0		LEAF LITTER		

Table 2 continued.

PEDON 14

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
E	0-10	VFSL/SIL	10YR 5/4	2FGR	VFR
E/B	10-20	VFSL/SIL	10YR 5/4 10YR 5/8	2MSBK	VFR
Bt1	20-32	SICL	7.5YR 5/6	2MSBK	VFR
Bt2	32-70	SIC/C	7.5YR 5/8 2.5 YR 4/8	2MSBK	FR
Bt3	70-90	SICL	2.5YR 4/6	SAPROLITE	VFR
CB	90-126	L/SIL	7.5YR 5/8	SAPROLITE	VFR
C1	126-150		5 YR 5/4 SILTSTONE BRECCIA/SAPROLITE		
C2	150-200		10 YR 6/8 SILTSTONE/SAPROLITE		
C3	200-255		5 YR 4/4 SILTSTONE/SAPROLITE		
C4	255-300		5 YR 4/6 SILTSTONE		

Table 2 continued.

PEDON 15

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
A	0-2	GRL	10YR 3/3	2FGR	VFR
E	2-15	L	5YR 4/3	1FGR	VFR
BE	15-23	SIL	5YR 4/4	1MSBK	FR
Bt	23-38	SIL	5YR 4/3	2MSBK	FR
2CB	38-92	L	MOTTLED 5YR 3/3 7.5YR 5/8 7.5YR 6/2	0MASL	FR
2Cr1	92-135	SICL	ARKOSIC SANDSTONE SAPROLITE		
2Cr2	135-160	SICL	MUDSTONE SAPROLITE		
2Cr3	160-180	SIL	INTERBEDDED SILTSTONE		
*Oi	5-0		LEAVES, NEEDLES, TWIGS		

Table 2 continued.

PEDON 16

HORIZON	DEPTH (cm)	USDA TEXTURE	COLOR	STRUCTURE	CONSISTENCE
A	0-2	GRSL	10YR 4/2	1FGR	VFR
E1	2-13	GRSL	10YR 5/3	1FGR	VFR
E2	13-25	SIL	10YR 6/3	1FGR	VFR
Bt/E[1]	25-36	L	7.5YR 4/6 10YR 5/4	2MSBK	FR
Bt	36-65	CL	7.5YR 4/6	2MSBK	FI
BC	65-100	CL	5YR 5/6 7.5YR4/6	1CSBK 2MSBK	FI
Cr	100-110	SL	SAPROLITE FROM ARKOSIC SANDSTONE		
*Oi	4-0	NEEDLES AND LEAVES, ROOT MAT			

[1] E was not sampled

Table 3. Particle size analyses for pedons 2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15, and 16.

Horizon	Depth (cm)	Coarse Fragments (volume)	VCOS	COS	MS	FS	VFS	Total Sand	Total Silt	Total Clay	Fine Clay	Texture Class
			percent									
Pedon 2												
E	0-7	33	7	2	1	2	4	17	74	9	NA	Cherty silt loam
E/B	7-20	10	3	1	1	1	2	8	72	20	NA	Silt loam
2Bt1	20-58	2	1	0	0	0	1	2	47	51	NA	Silty clay
2Bt2	58-91	1	1	1	0	0	0	2	46	52	NA	Silty clay
2BC1	91-158	6	1	1	0	1	1	4	43	53	NA	Silty clay
2BC2	158-207	31	1	0	0	0	1	2	37	61	NA	Cherty clay
2CB	207-280	1	1	0	0	1	5	7	50	43	NA	Silty clay
2C	280-310	2	1	0	0	0	1	1	35	64	NA	Clay
Pedon 3												
A	0-15	35	3	4	2	2	5	16	72	12	NA	Cherty silt loam
E	15-23	31	13	3	1	1	4	23	64	13	NA	Cherty silt loam
B/E	23-44	50	11	2	1	1	4	19	61	20	NA	Very cherty silt loam
2Bt1	44-80	12	1	0	0	0	1	2	40	58	NA	Silty clay/clay
2Bt2	80-96	3	0	0	0	1	4	5	39	56	NA	Silty clay/clay
2Bt3	96-120	0	0	0	0	0	2	3	47	50	NA	Silty clay
2CB	120-150	0	0	0	0	0	2	3	45	52	NA	Silty clay
2C	150-158	0	0	0	0	0	3	4	49	47	NA	Silty clay
2R	158+											

Table 3 continued.

Pedon 4

Horizon	Depth (cm)	Coarse Fragments (volume)	VCOS	COS	MS	FS	VFS	Total Sand	Total Silt	Total Clay	Fine Clay	Texture Class
			percent									
E1	2-23	60	10	5	2	3	5	25	60	15	35	Extremely cherty silt loam
E2	23-40	58	8	5	2	3	5	22	60	18	32	Very cherty silt loam
Bt1	40-80	66	7	4	2	2	4	19	52	29	44	Extremely cherty clay loam
Bt2	80-110	69	12	5	2	2	7	26	52	22	52	Extremely cherty silt loam
2Bt3	110-129	0	1	0	0	1	0	3	36	61	39	Clay
2BC	129-170	0	0	0	0	1	2	2	31	67	31	Clay
2C1	189-220	0	0	0	0	0	4	1	30	69	27	Clay
2C2	220-248	4	1	1	1	2	3	8	42	50	22	Silty clay

*There were no samples from: A (0-2cm), 2CB (170-189 cm), 2Cr (248-252 cm)

Pedon 6

E1	0-15	28	7	8	5	8	6	35	46	19	20	Cherty loam
E2	15-43	25	7	6	5	6	5	29	53	18	18	Cherty silt loam
B/E	43-74	12	7	3	2	4	14	29	50	21	31	Loam/silt loam
2Bt1	74-130	15	3	4	2	3	3	15	37	45	47	Clay
2Bt2	130-170	48	5	7	3	4	2	21	33	46	46	Very cherty clay
2Bt3	170-180	59	5	6	3	4	3	20	29	51	52	Very cherty clay

Table 3 continued.

Pedon 7

Horizon	Depth (cm)	Coarse Fragments (volume)	VCOS	COS	MS	FS	VFS	Total Sand	Total Silt	Total Clay	Fine Clay	Texture Class
			percent									
A	0-6	36	16	8	4	6	5	38	52	10	NA	Very cherty silt loam
E1	6-20	18	8	3	4	6	5	30	60	10	NA	Cherty silt loam
E2	20-60	31	10	7	5	6	4	33	54	14	NA	Very cherty silt loam
Bt1	60-110	56	10	8	5	7	4	33	48	19	NA	Very cherty loam
Bt2	110-170	62	18	10	5	6	3	42	41	17	NA	Extremely cherty loam
CB	170-180	68	33	12	5	5	3	57	28	15	NA	Extremely cherty sandy loam
2Bt	180-210	35	21	12	5	6	2	46	9	45	NA	Very cherty clay

Pedon 9

A	0-4	62	22	7	4	6	5	44	49	7	NA	Extremely cherty sandy loam
E	4-28	8	7	7	6	7	5	32	56	12	NA	Silt loam
Bt1	28-56	7	4	4	4	7	5	23	37	40	NA	Clay
2Bt2	56-92	41	5	5	5	6	3	25	13	62	NA	Very cherty clay
2Bt3	92-130	40	6	5	5	6	3	24	19	57	NA	Very cherty clay
2Bt4	130-160	29	6	7	5	8	4	29	17	55	NA	Cherty clay
2Bt5	160-200	12	5	7	6	7	4	29	19	52	NA	Clay

Table 3 continued.

Horizon	Depth (cm)	Coarse Fragments (volume)	VCOS	COS	MS	FS	VFS	Total Sand	Total Silt	Total Clay	Fine Clay	Texture Class
			percent									
Pedon 10												
E	0-17	5	3	5	6	11	7	32	58	10	NA	Silt loam
E/B	17-40	21	4	5	6	9	6	31	55	14	NA	Cherty silt loam
2Bt1	40-69	6	2	2	3	6	4	18	39	44	NA	Clay
2Bt2	69-99	1	0	1	2	4	2	9	34	57	NA	Clay
2Bt3	99-139	2	0	0	0	1	1	3	41	57	NA	Silty clay
CB	139-187	0	0	0	0	0	1	2	42	56	NA	Silty clay
C1	187-231	0	0	0	0	1	4	5	35	60	NA	Clay
C2	231-276	2	0	0	0	1	6	9	40	52	NA	Silty clay
Pedon 11												
E1	0-10	21	3	3	3	4	8	21	65	14	38	Cherty silt loam
E2	10-26	38	4	4	4	4	9	23	62	15	41	Very cherty silt loam
2E3	26-44	64	8	4	4	7	6	29	56	15	46	Extremely cherty silt loam
2Btx	44-66	73	6	4	4	8	6	28	51	21	44	Extremely cherty silt loam
3Bt1	66-120	21	3	2	1	4	4	13	44	43	50	Cherty silty clay
3Bt2	120-148	12	1	1	1	3	3	8	28	64	47	Clay
3BC	148-184	14	1	1	1	3	4	10	26	64	45	Clay
3CB	184-203	11	1	2	4	8	4	19	21	60	41	Clay

Table 3 continued.

Pedon 12

Horizon	Depth (cm)	Coarse Fragments (volume)	VCOS	COS	MS	FS	VFS	Total Sand	Total Silt	Total Clay	Fine Clay	Texture Class
			percent									
Ap	0-30	30	3	4	4	13	11	36	48	15	40	Cherty loam
BE	30-44	9	1	1	2	6	13	23	54	23	45	Silt loam
Bt1	44-80	7	1	1	2	9	12	26	47	27	44	Loam
Bt2	80-114	5	2	4	5	15	11	37	40	23	46	Loam
2BC	114-150	46	5	4	7	17	8	41	36	23	42	Very cherty loam
3E1	150-168	28	1	1	2	11	13	29	50	21	45	Cherty loam/silt loam
3E2	168-186	27	3	2	7	6	6	24	49	27	35	Cherty silt loam
4E3	186-203	46	4	4	2	5	5	20	55	25	29	Very cherty silt loam
4Btg	203-230	51	7	4	4	6	5	26	45	29	26	Very cherty clay loam

Pedon 13

Ap	0-22	42	8	4	2	4	6	26	65	9	46	Very cherty silt loam
E	22-47	40	10	3	3	3	4	23	63	14	47	Very cherty silt loam
B/E	47-63	69	3	1	1	1	3	9	55	36	49	Extremely cherty silty clay loam
2Bw	63-77	13	11	4	2	3	5	26	58	16	41	Silt loam
3Bt	77-109	2	0	0	0	0	1	2	24	74	49	Clay
BC	109-185	6	1	0	0	1	1	3	35	62	49	Clay

Table 3 continued.

Pedon 14

Horizon	Depth (cm)	Coarse Fragments (volume)	VCOS	COS	MS	FS	VFS	Total Sand	Total Silt	Total Clay	Fine Clay	Texture Class
			percent									
E	0-10	6	1	1	0	4	30	37	44	19	30	Loam
E/B	10-20	2	2	1	1	5	23	32	38	30	44	Clay loam
Bt1	20-32	20	1	1	1	4	17	24	32	44	49	Cherty clay
Bt2	32-70	40	0	1	1	3	22	28	25	47	52	Very cherty clay
BC	70-90	75	1	2	1	5	15	26	29	45	51	Extremely cherty clay
CB	90-126	75	3	3	1	9	24	42	30	28	54	Extremely cherty clay loam
C1	126-150	85	3	3	1	6	17	29	33	38	47	Extremely cherty clay loam
C2	150-200	85	2	2	1	1	3	10	52	38	49	Extremely cherty silty clay loam
C3	200-255	90	4	2	1	1	4	13	40	47	44	Extremely cherty silty clay
C4	255-300	1	2	2	1	2	7	15	37	48	50	Clay

Table 3 continued.

Pedon 15

Horizon	Depth (cm)	Coarse Fragments (volume)	VCOS	COS	MS	FS	VFS	Total Sand	Total Silt	Total Clay	Fine Clay	Texture Class
			percent									
A	0-2	20	6	1	1	5	30	43	45	12	NA	Gravelly loam
E	2-15	14	5	1	0	4	30	40	48	12	NA	Loam
Bt1	15-23	14	2	1	0	3	26	32	53	15	NA	Silt loam
Bt2	23-38	4	1	0	0	1	25	28	54	18	NA	Silt loam
2CB1	38-63	8	0	1	1	3	31	35	48	17	NA	Loam
2CB2	63-92	6	1	1	1	3	27	33	47	20	NA	Loam
2Cr1	92-135	2	1	1	0	2	5	9	56	35	NA	Silty clay loam
2Cr2	135-160	2	8	6	1	2	2	20	48	32	NA	Clay loam
2Cr3	160-180	1	8	6	2	3	5	24	49	27	NA	Loam

Pedon 16

A & E1	0-13	18	3	1	1	7	34	46	48	6	NA	Gravelly sandy loam
E2	13-25	11	3	1	1	6	31	41	51	8	NA	Silt loam
B/E	25-36	3	2	1	0	4	23	30	48	22	NA	Loam
Bt	36-65	4	4	1	0	2	14	21	44	35	NA	Clay loam
BC	65-100	3	2	1	1	6	24	33	36	31	NA	Clay loam
Cr	100-110	18	8	4	2	10	31	54	31	15	NA	Gravelly sandy loam

Table 4 . Cation exchange capacity and base saturation data for pedons 2, 3, 4, 6, 7, 10, 11, 12, 13, 14, 15, and 16.

Horizon	Depth (cm)	Ca	Mg	Na	K	CEC	Base Sat.
		$cmol^{(+)}\ kg^{-1}$				%	
Pedon 2							
E	0-7	0.54	0.09	0.35	0.13	3.3	34
E/B	7-20	0.63	0.13	0.44	0.10	4.7	28
2Bt1	20-58	1.39	0.24	0.46	0.15	15.1	15
2Bt2	58-91	0.71	0.17	0.49	0.14	15.9	10
2BC1	91-158	0.42	0.12	0.44	0.14	12.4	9
2BC2	158-207	0.31	0.09	0.47	0.14	25.3	4
2CB	207-280	0.29	0.06	0.41	0.11	11.1	8
2C	280-310	0.35	0.10	0.47	0.19	17.2	7
Pedon 3							
A	0-15	7.93	0.76	0.51	0.50	9.8	99
E	15-23	1.45	0.20	0.42	0.18	4.3	52
B/E	23-44	1.79	0.18	0.42	0.10	5.1	49
2Bt1	44-80	9.75	0.85	0.40	0.25	42.1	27
2Bt2	80-96	23.36	1.47	0.47	0.26	28.9	88
2Bt3	96-120	21.32	1.24	0.15	0.24	25.6	90
2CB	120-150	24.65	1.12	0.14	0.20	29.8	88
2C	150-158	30.48	0.95	0.47	0.20	38.6	83
2R	158+						
Pedon 4							
E1	2-23	1.09	0.30	0.10	0.35	5.75	32
E2	23-40	1.02	0.27	0.12	0.36	3.48	51
Bt1	40-80	1.67	0.65	0.05	0.14	9.42	27
Bt2	80-110	2.04	0.81	0.05	0.07	9.18	32
2Bt3	110-129	8.04	1.85	0.06	0.23	23.90	43
2BC	129-170	9.32	1.57	0.06	0.24	27.10	41
2C1	189-220	23.49	2.97	0.06	0.26	22.53	119
2C2	220-248	51.06	2.57	0.08	0.31	29.14	185

*There were no samples from: A (0-2cm), 2CB (170-189 cm), 2Cr (248-252 cm)

Table 4 continued.

Horizon	Depth (cm)	Ca	Mg	Na	K	CEC	Base Sat.
		$cmol^{(+)}\ kg^{-1}$					%
Pedon 6							
E1	0-15	1.03	0.25	0.04	0.05	2.60	52
E2	15-43	1.05	0.27	0.04	0.05	2.65	53
B/E	43-74	1.11	0.67	0.05	0.07	6.60	29
2Bt1	74-130	1.11	0.51	0.05	0.07	10.37	17
2Bt2	130-170	1.01	0.40	0.04	0.08	10.24	15
2Bt3	170-180	1.00	0.40	0.05	0.11	11.25	14
Pedon 7							
A	0-6	1.03	0.20	0.40	0.23	5.5	34
E1	6-20	0.35	0.09	0.39	0.16	2.9	34
E2	20-60	0.30	0.06	0.39	0.12	2.9	30
Bt1	60-110	0.72	0.18	0.44	0.14	4.7	32
Bt2	110-170	0.75	0.01	0.53	0.12	3.7	44
CB	170-180	0.54	0.16	0.41	0.11	2.3	53
2Bt	180-210	0.60	0.38	0.41	0.09	8.8	17
Pedon 10							
E	0-17	0.36	0.07	0.37	0.15	2.5	39
E/B	17-40	0.27	0.06	0.38	0.14	2.7	32
2Bt1	40-69	0.29	0.07	0.38	0.13	11.7	8
2Bt2	69-99	0.42	0.54	0.41	0.15	14.3	11
2Bt3	99-139	0.28	0.24	0.44	0.12	14.7	7
CB	139-187	0.28	0.15	0.46	0.12	13.0	8
C1	187-231	0.27	0.11	0.43	0.11	12.2	8
C2	231-276	0.28	0.12	0.46	0.14	12.8	8

Table 4 continued.

Horizon	Depth (cm)	Ca	Mg	Na	K	CEC	Base Sat.
		$cmol^{(+)}\ kg^{-1}$					%
Pedon 11							
E1	0-10	1.11	0.23	0.07	0.12	5.65	27
E2	10-26	1.15	0.23	0.05	0.10	4.41	35
2E3	26-44	1.03	0.21	0.05	0.11	4.76	29
2Btx	44-66	1.08	0.26	0.04	0.12	6.22	24
3Bt1	66-120	1.10	0.79	0.04	0.19	10.33	20
3Bt2	120-148	1.05	0.47	0.03	0.20	17.51	10
3BC	148-184	1.01	0.29	0.03	0.14	14.80	10
3CB	184-203	0.97	0.24	0.04	0.13	12.02	11
Pedon 12							
Ap	0-30	1.51	0.31	0.05	0.19	6.32	33
BE	30-44	0.80	0.17	0.04	0.05	4.65	23
Bt1	44-80	1.32	0.38	0.04	0.06	5.01	36
Bt2	80-114	0.77	0.34	0.04	0.06	6.02	20
2BC	114-150	0.30	0.19	0.03	0.06	5.99	10
3E1	150-168	0.29	0.17	0.04	0.07	5.66	10
3E2	168-186	0.45	0.18	0.05	0.09	6.51	12
4E3	186-203	0.27	0.15	0.03	0.08	5.85	9
4Btg	203-230	0.39	0.13	0.03	0.08	5.18	12
Pedon 13							
Ap	0-22	2.53	0.52	0.05	0.15	7.89	41
E	22-47	1.27	0.29	0.03	0.15	3.11	56
B/E	47-63	1.65	0.27	0.04	0.17	3.56	60
2Bw	63-77	4.40	0.92	0.05	0.10	8.48	64
3Bt	77-109	6.94	2.90	0.04	0.11	15.03	66
BC	109-185	8.75	3.91	0.04	2.37	16.27	93

Table 4 continued.

Horizon	Depth (cm)	Ca	Mg	Na	K	CEC	Base Sat.
		cmol(+) kg-1				%	
Pedon 14							
E	0-10	4.03	1.38	0.05	0.26	10.83	53
E/B	10-20	3.61	1.72	0.04	0.53	11.72	50
Bt1	20-32	3.91	2.26	0.04	0.54	18.87	36
Bt2	32-70	1.81	1.69	0.04	0.26	18.52	20
BC	70-90	0.56	1.03	0.07	0.01	20.75	8
CB	90-126	0.28	0.54	0.05	0.20	11.33	9
C1	126-150	0.24	0.53	0.07	0.23	17.32	6
C2	150-200	0.16	0.47	0.06	0.07	20.92	4
C3	200-255	0.10	0.41	0.06	0.39	21.68	4
C4	255-300	0.10	0.40	0.08	0.38	21.60	4
Pedon 15							
A	0-2	1.88	0.42	0.42	0.29	8.5	35
E	2-15	0.65	0.23	0.43	0.17	4.0	37
Bt1	15-23	1.46	0.72	0.42	0.23	6.2	46
Bt2	23-38	2.14	1.88	0.41	0.31	8.6	55
2CB1	38-63	2.01	3.07	0.43	0.36	9.4	62
2CB2	63-92	1.61	3.30	0.42	0.41	11.2	51
2Cr1	92-135	0.69	2.19	0.44	0.47	11.9	32
2Cr2	135-160	0.99	2.55	0.45	0.79	14.5	34
2Cr3	160-180	1.03	2.69	0.44	0.73	13.4	37
Pedon 16							
A & E1	0-13	0.40	0.07	0.42	0.12	2.9	35
E2	13-25	0.38	0.06	0.46	0.11	1.4	72
B/E	25-36	2.34	0.73	0.45	0.21	7.8	48
Bt	36-65	3.38	0.21	0.44	0.35	15.4	28
BC	65-100	0.99	1.41	0.43	0.44	16.7	20
Cr	100-110	0.42	0.72	0.41	0.23	10.2	18

Table 5. Cation exchange capacity, ECEC, and base saturation data for pedon 9

Pedon 9									
Horizon	Depth (cm)	Ca	Mg	Na	K	CEC	Base Sat. %	CEC $cmol^{(+)}\ kg^{-1}$ clay	ECEC
		$cmol^{(+)}\ kg^{-1}$							
A	0-4	0.70	0.23	0.46	0.26	11.6	14	--	--
E	4-28	0.26	0.05	0.39	0.10	1.8	44	--	--
Bt1	28-56	0.28	0.05	0.39	0.15	7.2	12	18	12
2Bt2	56-92	0.29	0.42	0.42	0.14	9.5	13	15	9
2Bt3	92-130	0.26	0.21	0.41	0.11	7.8	13	14	10
2Bt4	130-160	0.28	0.17	0.41	0.11	7.9	12	14	10
2Bt5	160-200	0.29	0.17	0.47	0.11	7.7	14	15	12

Table 6. Chemical data for pedons 2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15, and 16.

Horizon	Depth (cm)	Total Carbon %	pH	Mn mg kg^{-1}	Fe_2O_3 %	KCl-Al	Total Acidity
						--$cmol^{(+)}$ kg^{-1}—	
Pedon 2							
E	0-7	0.99	4.10	21	0.39	1.76	2.39
E/B	7-20	0.38	4.15	3	0.88	4.03	5.05
2Bt1	20-58	0.35	4.25	2	4.03	9.85	11.65
2Bt2	58-91	0.21	4.30	2	3.89	10.95	13.88
2BC1	91-158	0.12	4.40	2	3.66	8.71	11.77
2BC2	158-207	0.19	4.30	1	4.58	12.76	15.90
2CB	207-280	0.11	4.45	2	3.30	8.11	10.50
2C	280-310	0.16	4.50	2	4.15	11.00	15.16
Pedon 3							
A	0-15	2.88	5.90	1061.73	0.74	0.01	0.22
E	15-23	0.56	4.60	332.74	0.49	1.50	2.11
B/E	23-44	0.24	4.50	116.74	0.75	2.17	3.02
2Bt1	44-80	0.23	4.45	16.35	2.54	7.21	9.95
2Bt2	80-96	0.23	6.25	731.61	2.08	<0.01	<0.01
2Bt3	96-120	0.18	6.75	582.54	2.22	<0.01	<0.01
2CB	120-150	0.18	7.35	679.00	1.84	<0.01	<0.01
2C	150-158	0.21	7.60	756.69	1.63	<0.01	<0.01
2R	158+						
Pedon 4							
E1	2-23	1.32	4.30	317	0.62	0.50	0.11
E2	23-40	0.23	4.30	35	0.96	0.74	0.10
Bt1	40-80	0.23	4.60	84	6.51	1.95	0.31
Bt2	80-110	0.12	4.70	242	4.79	0.95	0.20
2Bt3	110-129	0.06	4.85	12	7.72	4.19	0.77
2BC	129-170	0.06	5.00	1027	3.15	0.55	0.10
2C1	189-220	0.08	7.00	913	2.54	<.03	0.01
2C2	220-248	0.44	7.50	879	1.39	<.03	0.01

*There were no samples from: A (0-2cm), 2CB (170-189 cm), 2Cr (248-252 cm)

Table 6 continued.

Horizon	Depth (cm)	Total Carbon %	pH	Mn mg kg^{-1}	Fe_2O_3 %	KCl-Al --$cmol^{(+)}$ kg^{-1}--	Total Acidity
Pedon 6							
E1	0-15	1.26	4.55	4.24	2.50	0.29	0.21
E2	15-43	0.30	4.40	89	1.69	0.35	0.15
B/E	43-74	0.10	4.55	19	3.28	1.08	0.24
2Bt1	74-130	0.07	4.75	10	4.49	2.25	0.39
2Bt2	130-170	0.02	4.60	19	4.53	2.05	0.44
2Bt3	170-180	0.08	4.60	20	0.87	2.66	0.57
Pedon 7							
A	0-6	3.05	4.20	167	0.45	1.20	1.69
E1	6-20	1.15	4.25	124	0.45	1.00	1.30
E2	20-60	0.64	4.20	86	0.55	1.06	1.28
Bt1	60-110	0.26	3.70	5	1.14	2.11	2.72
Bt2	110-170	0.14	4.00	2	1.33	1.95	3.01
CB	170-180	0.05	4.00	2	1.51	1.43	1.92
2Bt	180-210	0.08	4.35	2	3.09	4.19	4.54
Pedon 9							
A	0-4	6.04	3.50	29	0.65	2.90	5.46
E	4-28	0.72	4.05	41	0.67	1.14	1.67
Bt1	28-56	0.33	3.75	3	3.63	4.07	5.27
2Bt2	56-92	0.14	4.35	2	9.30	4.44	5.43
2Bt3	92-130	0.08	4.35	1	6.26	4.58	5.94
2Bt4	130-160	0.08	4.40	1	5.08	4.60	5.50
2Bt5	160-200	0.10	4.30	1	4.47	5.22	6.37
Pedon 10							
E	0-17	1.23	4.30	74	0.44	0.99	1.42
E/B	17-40	0.51	4.15	13	0.60	1.52	2.03
2Bt1	40-69	0.24	3.90	7	2.05	5.48	8.14
2Bt2	69-99	0.23	4.00	4	2.75	8.75	11.63
2Bt3	99-139	0.09	4.30	15	2.95	8.51	12.53
CB	139-187	0.07	4.40	497	3.65	8.84	11.64
C1	187-231	0.04	4.20	3	2.75	6.27	8.32
C2	231-276	0.04	4.40	888	2.00	6.69	9.24

Table 6 continued.

Horizon	Depth (cm)	Total Carbon %	pH	Mn mg kg^{-1}	Fe_2O_3 %	Kcl-Al --$cmol^{(+)}$ kg^{-1}--	Total Acidity
Pedon 11							
E1	0-10	0.80	4.45	153	0.86	0.52	0.11
E2	10-26	0.65	4.50	60	1.02	0.47	0.13
2E3	26-44	0.38	4.65	26	1.69	0.91	0.19
2Btx	44-66	0.12	4.50	27	1.81	1.12	0.25
3Bt1	66-120	0.99	4.60	16	3.77	2.57	0.46
3Bt2	120-148	0.16	4.60	80	5.37	2.93	0.65
3BC	148-184	0.12	4.65	30	5.05	3.54	0.61
3CB	184-203	0.10	4.70	234	7.39	2.71	0.51
Pedon 12							
Ap	0-30	1.34	4.80	2624	1.44	0.10	0.04
BE	30-44	0.34	4.75	747	0.70	0.34	0.07
Bt1	44-80	0.13	4.80	402	2.69	0.42	0.13
Bt2	80-114	0.10	4.80	655	2.20	0.96	0.17
2BC	114-150	0.10	5.00	2043	1.83	0.67	0.16
3E1	150-168	0.09	4.75	119	1.81	0.80	0.20
3E2	168-186	0.15	4.90	289	2.69	0.78	0.20
4E3	186-203	0.11	5.10	1028	2.43	0.56	0.15
4Btg	203-230	0.10	5.05	1851	0.43	0.48	0.13
Pedon 13							
Ap	0-22	1.79	5.05	1707	0.93	<.03	0.03
E	22-47	0.40	5.30	636	1.49	<.03	0.01
B/E	47-63	0.23	5.50	177	0.67	<.03	0.01
2Bw	63-77	0.23	5.45	521	2.00	<.03	0.01
3Bt	77-109	0.29	5.60	156	1.71	<.03	0.01
BC	109-185	0.36	6.65	569	2.12	<.03	0.01

Table 6 continued.

Horizon	Depth (cm)	Total Carbon %	pH	Mn mg kg^{-1}	Fe_2O_3 %	Kcl-Al	Total Acidity
						---$cmol^{(+)}$ kg^{-1}---	
Pedon 14							
E	0-10	2.23	5.05	1589	0.74	0.06	0.02
E/B	10-20	0.78	5.00	622	1.13	0.65	1.16
Bt1	20-32	0.61	4.70	152	7.01	1.91	0.44
Bt2	32-70	0.27	4.80	92	6.15	3.27	0.66
BC	70-90	0.19	5.00	36	4.24	4.59	0.97
CB	90-126	0.12	5.00	60	2.85	3.37	0.73
C1	126-150	0.16	4.85	71	2.88	4.32	0.90
C2	150-200	0.11	5.05	462	4.57	5.25	1.13
C3	200-255	0.04	5.00	5406	3.27	4.78	0.99
C4	255-300	0.08	5.20	17928	4.34	2.48	0.38
Pedon 15							
A	0-2	2.77	4.25	329	0.41	1.46	2.62
E	2-15	0.45	4.40	134	0.46	2.08	3.08
Bt1	15-23	0.24	4.55	23	0.68	2.41	3.17
Bt2	23-38	0.16	4.65	11	0.87	2.68	3.56
2CB1	38-63	0.08	4.70	10	0.84	3.14	4.23
2CB2	63-92	0.06	4.60	54	0.80	3.71	9.64
2Cr1	92-135	0.10	4.40	189	2.81	6.10	9.96
2Cr2	135-160	0.03	4.65	78	2.35	6.86	9.11
2Cr3	160-180	0.04	4.60	66	0.77	6.34	7.81
Pedon 16							
A & E1	0-13	0.75	4.40	46	0.38	1.42	2.14
E2	13-25	0.20	4.30	19	0.48	1.22	2.00
B/E	25-36	0.26	4.60	3	1.52	2.53	3.55
Bt	36-65	0.32	4.75	1	3.15	4.56	5.67
BC	65-100	0.12	4.60	0	2.17	10.24	7.68
Cr	100-110	0.05	4.80	0	1.71	5.88	7.79

Table 7. Site characteristics and parent materials of the pedons in Roane County.

Pedon	Slope	Aspect	Site Position	Parent Material
33	10	NW	below ridge crest	colluvium/residuum
34	10	NW	below ridge crest	colluvium/residuum
35	19	N	below ridge crest	colluvium/residuum
39	14	SW	foot slope	colluvium/residuum
40`	7	NW	upper slope	colluvium/residuum
41	18	S	midslope	colluvium/residuum
42	19	E	midslope	colluvium/residuum
43	23	E	midslope	colluvium
44	23	SE	lower slope	colluvium
45	23	SW	midslope	colluvium/residuum
46	23	SW	midslope	colluvium/residuum
47	25	N	midslope	colluvium

Table 8. Site characteristics and parent materials of the pedons in Anderson County.

Pedon	Slope	Aspect	Site Position	Parent Material
31	18	SW	lower slope	colluvium
32	13	W	midslope bench	colluvium
33	10	SW	upper slope	colluvium/residuum
34	14	W	midslope	colluvium/residuum
35	8	N	upper slope	colluvium/residuum
36	32	N	shoulder	colluvium/residuum
37	16	W	upper slope	colluvium/residuum
38	13	N	upper slope	colluvium/residuum
39	5	NW	midslope bench	colluvium/residuum
40	21	N	above foot slope	colluvium
41	18	N	midslope	colluvium
42	19	N	upper slope	colluvium/residuum

Table 9. Soil morphology of Roane County pedons developing over Copper Ridge residuum. *Structure abbreviation are defined at the end of the table.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 33							
E	0-10	Silty clay loam	1 c sbk	firm	7.5YR 5/6	19	
2Bt1	10-20	Silty clay	3 m sbk	firm/very firm	2.5YR 4/8	1	many, thick continuous clay skins
2Bt2	20-110	Clay	2 m sbk	firm	2.5YR 4/6	1	many, thick, discontinuous clay skins
2Bt3	110-147	Clay	2 m sbk	friable	2.5YR 4/6	1	common, thick, discontinuous clay skins
2Bt4	147-180+	Clay	2 m sbk	friable	2.5YR 4/8	1	common, thick, discontinuous clay skins
Roane County 34							
A	0-4	gravelly loam	2 f gr	very friable	10YR 3/2	31	
E	4-16	gravelly loam	1 m sbk	friable	10YR 4/6	32	
Bt1	16-27	silty clay	1 m sbk	friable	5YR 5/8	7	
Bt2	27-48	gravelly clay	2 m sbk	firm	5YR 5/8	52	common, thin discontinuous clay skins
Bt3	48-75	clay	2 m abk	firm	2.5YR 4/8	12	common, medium, continuous clay skins
2BC	75-105+	very cobbly clay	sl ma	friable	2.5YR 5/8 10R 4/8 2.5Y 7/6	42	most coarse fragments > 6 inches

Table 9 continued.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 35							
A	0-10	silt loam	2 f gr	very friable	10YR 4/3	20	
Ap	10-16	gravelly silt loam	1 f sbk	friable	10YR 4/3	32	
Bt1	16-23	clay loam	1 f sbk	friable	7.5YR 5/6	9	
Bt2	23-46	clay	2 f sbk	friable	5YR 5/6	19	few, faint, patchy clay skins
Bt3	46-73	clay	2 m abk	firm	2.5YR 4/6	22	common, continuous clay skins
2Bt4	73-110	clay	2 m abk	firm	2.5YR 4/6	6	many, thick, continuous clay skins
2Bt5	110-135	clay	2 m abk	firm	2.5YR 5/8	1	many, thick, continuous clay skins
2Bt6	135-180	clay	2 m sbk	firm	2.5YR 5/8	9	many, thick, discontinuous clay skins
2Bt7	180-192+	clay	1 m sbk	friable	2.5YR 5/8	2	
Roane County 39							
A	0-7	gravelly silt loam	1 m gr	very friable	10YR 5/3	46	
E	7-34	gravelly silt loam	1 m sbk	very friable	10YR 6/6	31	
Bt1	34-61	very gravelly silt loam	1 m sbk	friable	7.5YR 5/6	56	few, thin, patchy clay skins
Bt2	61-95	gravelly clay loam	2 m sbk	firm	5YR 5/8	49	pocket of Btx material was sampled separately few, thin, discontinuous clay skins
2C	95-146+	gravelly clay	sl ma	firm	2.5YR 4/8	38	

Table 9 continued.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 40							
E	0-18	loam	1 f gr	friable	10YR 6/3	10	
BE	18-29	silt loam	1 f sbk	friable	7.5YR 7/6	20	
Bt1	29-52	gravelly clay	1 m sbk	firm	5YR 5/8	25	few, patchy clay skins
2Bt2	52-75	gravelly clay	1 m sbk	friable	2.5YR 4/8	25	few, discontinuous clay skins
2BC	75-102+	gravelly clay	1 f&m sbk	friable	2.5YR 4/8	25	
Roane County 41							
O/A	0-2	leaf litter and some mineral material mixed, unable to sample separately					
E	2-17	gravelly loam	1 m gr	friable	10YR 4/4	39	
BE	17-33	gravelly loam	1 m sbk	friable	7.5YR 6/4	48	
Bt1	33-58	very gravelly clay loam	2 m sbk	friable	2.5YR 5/8	62	thin, continuous clay skins
2Bt2	58-74	very gravelly clay	1 c sbk	firm	2.5YR 4/8	59	thin, continuous clay skins
2C	74-102+	very gravelly clay loam	sl ma	friable	2.5YR 4/8	62	

Table 9 continued.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 42							
E1	0-15	gravelly silt loam	1 f gr	very friable	10YR 6/2	52	
E2	15-35	cobbly silt loam	1 m sbk	very friable	10YR 7/3	47	30% fragment > 3 inches in diameter
BE	35-55	cobbly clay loam	1 c sbk	friable	5YR 5/8	46	30%fragments > 3 inches in diameter few, thin discontinuous clay skins
2Bt1	55-80	cobbly clay	2 m sbk	firm	2.5YR 5/8	45	30% fragments > 6 inches in diameter common, thin, discontinuous clay skins
2Bt2	80-125+	cobbly clay	2 m sbk	firm	2.5YR 4/8	30	25% fragments > 6 inches in diameter
Roane County 43							
E	0-18	gravelly silt loam	1 m gr	very friable	10YR 6/2	30	
EB	18-48	gravelly silt loam	1 m sbk	friable	10YR 6/4	30	
Bt1	48-72	gravelly silty clay loam	1 m sbk	friable	7.5YR 5/8	25	
Bt2	72-90	gravelly clay	1 m sbk	friable	5YR 5/8	35	common, thin, discontinuous clay skins
CB	90-110+	gravelly clay	sl ma	friable	5YR 5/8	30	

Table 9 continued.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 44							
E1	0-14	gravelly silt loam	1 f gr	very friable	10YR 5/3	39	
E2	14-34	silt loam	1 m sbk	very friable	10YR 7/3	14	
EB	34-47	loam	2 m sbk	friable	10YR 7/4	21	
Bt1	47-88	gravelly loam	2 m sbk	friable	7.5YR 6/6	36	few, faint, patchy clay skins
Bt2	88-115	clay loam	2 m sbk	friable	7.5YR 5/8	10	few, medium, discontinuous clay skins
2R	115+	hard limestone					
Roane County 45							
A	0-6	silt loam	1 m gr	very friable	10YR 5/3	16	
E	6-23	silt loam	1 f sbk	friable	10YR 6/4	2	
BE	23-33	silt loam	1 f sbk	friable	7.5YR 5/6	3	
2Bt1	33-61	silty clay loam	2 m abk	friable	5YR 5/8	10	few, distinct, patchy clay skins
2Bt2	61-94	clay	1 m abk	friable	5YR 5/6	10	common, distinct, discontinuous clay skins
2CB	94-109+	clay	sl ma	friable	2.5YR 4/8	10	

Table 9 continued.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 46							
A	0-12	loam	1 f gr	friable	10YR 4/4	9	
AB	12-19	clay loam	1 f sbk	friable	7.5YR 4/6	2	
Bt1	19-28	silty clay loam	1 m sbk	friable	5YR 4/8	3	
2Bt2	28-43	clay	2 m sbk	friable	2.5YR 4/8	2	many, distinct, continuous clay skins
2Bt3	43-64	clay	2 m sbk	friable	2.5YR 4/8	13	many, prominent, continuous clay skins
2C	64-104+	clay	sl ma	friable	2.5YR 4/8	6	
Roane County 47							
A1	0-13	silt loam	2 m gr	very friable	10YR 4/4	8	
A2	13-22	silt loam	2 m sbk	very friable	10YR 4/4	1	
E	22-43	silt loam	1 m sbk	friable	7.5YR 5/6	6	
2Bt	43-61	clay/silty clay	1 m&c sbk	friable/firm	5YR 5/8	6	common, discontinuous clay skins
2BC	61-89+	clay	2 m sbk	very firm	2.5YR 4/8	12	many, continuous clay skins

*structure: 1=weak, 2=moderate, 3=strong; f=fine, m=medium, c=coarse; gr=granular, sbk=subangular blocky, abk=angular blocky, sl ma= structureless massive

Table 10 . Soil morphology for soil profiles in Anderson County, Tennessee forming over Copper Ridge residuum. *Structure abbreviations are defined at the end of the table.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Anderson County 31							
A	0-11	Silt loam	1 m sbk 2 f gr	very friable	10YR 3/2 10YR 4/2	68	
E	11-20	Silt loam	1 m sbk	very friable	10YR 5/3	26	
Bt1	20-49	Loam	1 m sbk	very friable	10YR 6/4	44	
Bt2	49-61	Silt loam	2 m sbk	friable	7.5YR 5/4	50	common, patchy clay skins
Bt3	61-87	Clay loam	2 m sbk	friable	5YR 5/6	50	common, continuous clay skins
Bt4	87-100	Clay loam	2 m & f sbk	friable	5YR 5/8	35	common, continuous clay skins
C	100-132	Clay loam	ma sl	friable	5YR 5/8 2.5Y 6/4	54	
Anderson County 32							
A	0-7	Silty clay loam	1 f gr	very friable	10YR 3/3	72	
E	7-38	Silt loam	1 f sbk	very friable	10YR 6/4	40	
Bt1	38-45	Clay loam	2 f sbk	friable	7.5YR 5/8	57	
Bt2	45-91	Clay	2 m sbk	friable	5YR 5/8	39	common, discontinuous clay skins
Bt3	91-120	Clay	2 m sbk	firm	5 YR 5/8	43	common, discontinuous clay skins
BC	120-144	Clay	2 m sbk	friable	5 YR 5/8	52	

Table 10 continued

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Anderson County 33							
A	0-3	Loam	1 f gr	very friable	10YR 3/2	70	
E1	3-21	Silt loam	1 m sbk	very friable	7.5YR 6/4	50	many fine pores
E2	21-36	Silt loam	1 m sbk	friable	10YR 6/6	48	common medium & fine pores
Bt1	36-46	Silty clay	2 m sbk	friable	7.5YR 6/8	48	many, continuous clay skins
2Bt2	46-62	Clay	2 m sbk	friable	5 YR 5/8	69	many, continuous clay skins
2Bt3	62-75	Clay	2 m sbk	firm	5 YR 5/8	58	many, continuous clay skins
2Bt4	75-117	Clay	2 m sbk	firm	5 YR 5/8	67	common, discontinuous clay skins
Anderson County 34							
A	0-7	Silt loam	1 m gr	very friable	10YR 4/3	38	
E1	7-27	Silt loam	1 m sbk	very friable	10YR 5/4	35	few fine pores
Bt1	27-38	Clay loam	1 m sbk	friable	10YR 6/8	48	few fine & medium pores
Bt2	38-52	Silty clay loam	2 m sbk	friable	7.5YR 6/8	49	common, continuous clay skins
2Bt3	52-94	Clay	2 m sbk	friable	5 YR 6/8	53	many, continuous clay skins
2Bt4	94-140	Clay	1 m sbk	firm	5 YR 5/8	41	

Table 10 continued.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Anderson County 35							
A	0-12	Silt loam	1 m sbk	very friable	10YR 4/3	35	
Bt1	12-27	Clay loam	1 m sbk	very friable	10YR 4/6	42	common, fine pores
Bt2	27-46	Clay loam	2 m sbk	friable	7.5YR 5/6	57	common, discontinuous clay skins
Bt3	46-62	Clay loam	2 m sbk	friable	7.5YR 5/8	57	common, continuous clay skins
BC	62-85	Silt loam	2 m sbk	friable	5 YR 5/8	59	common, continuous clay skins
2C	85-125	Clay	sl ma	friable	2.5YR 4/8	39	
Anderson County 36							
A	0-8	Silt loam	1 m gr	very friable	10YR 3/4	31	
Bt1	8-26	Silty clay loam		1 m sbk	very friable	10YR 5/3	
	34						
Bt2	26-42	Clay loam	1 m sbk	friable	10YR 5/4	53	few, patchy clay skins
Bt3	42-75	Silty clay	2 m sbk	friable	5 YR 5/8	56	common, continuous clay skins
2Bt4	75-90	Clay	2 m sbk	firm	5 YR 5/8	77	few, continuous clay skins

Table 10 continued.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Anderson County 37							
A	0-19	Silt loam	2 m sbk	friable	10YR 4/4	21	
Bt1	19-33	Silt loam	2 m sbk	friable	5 YR 5/8	11	many, continuous clay skins
Bt2	33-80	Clay	3 m sbk	firm	5 YR 5/8	8	many, continuous clay skins
Bt3	80-100	Clay	3 m sbk	firm	2.5YR 4/6	36	many, continuous clay skins
2Bt4	100-123	Clay	2 m sbk	firm	2.5YR 4/6	48	
Anderson County 38							
A	0-12	Silt loam	2 m gr	very friable	10YR 4/4	36	
E	12-29	Silt loam	1 m sbk	very friable	10YR 5/4	52	common, fine pores
Bt1	29-40	Silt loam	1 f sbk	friable	5 YR 5/6	49	few, discontinuous clay skins
2Bt2	40-80	Clay	2 m sbk	firm	2.5 YR 4/6	49	many, continuous clay skins
2Bt3	80-120	Clay	2 m sbk	firm	2.5YR 4/6	50	many, discontinuous clay skins

Table 10 continued.

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
Anderson County 39							
A	0-8	Loam	2 m sbk	very friable	10YR 3/4	23	
BA	8-22	Silt loam	1 m sbk	very friable	7.5YR 4/6	24	few, discontinuous clay skins
Bt1	22-34	Silt loam	1 m sbk	friable	5 YR 5/6	60	common, continuous clay skins
Bt2	34-84	Loam/Clay loam	2 m sbk	firm	5YR 4/6	63	many, continuous clay skins
2Bt3	84-114	Clay	1 m sbk	firm	2.5YR 4/6	51	
Anderson County 40							
A	0-19	Silt loam	1 m sbk	very friable	10YR 4/4	55	
Bt1	19-36	Silty clay loam	1 m sbk	friable	7.5YR 4/6	50	many, continuous clay skins
Bt2	36-72	Silty clay loam	2 m sbk	firm	5 YR 4/6	49	many, continuous clay skins
CB	72-104	Silt loam	sl ma 1 m sbk	firm	5 YR 5/6	55	
Anderson County 41							
A1	0-11	Silt loam	2 m gr	very friable	10YR 3/4	43	
A2	11-27	Silt loam	1 m sbk	friable	7.5YR 4/4	44	
BA	27-38	Silt loam	2 m sbk	friable	7.5YR 4/6	49	many, continuous clay skins
Bt1	38-70	Silty clay loam	2 c sbk	firm	5 YR 4/6	47	many, continuous clay skins
Bt2	70-125	Silty clay loam	1 m sbk	friable	5 YR 5/6	45	common, discontinuous clay skins

Table 10 continued.

Anderson County 42

Horizon	Lower Depth (cm)	Texture	Structure*	Consistency	Color	Coarse Fragments %	Additional Remarks
A	0-24	Silt loam	1 m sbk	very friable	10YR 3/3	44	
Bt1	24-39	Silty clay loam	1 m sbk	friable	7.5YR 4/6	51	common, continuous clay skins
Bt2	39-53	Silty clay loam	2 m sbk	friable	7.5YR 5/6	63	many, continuous clay skins 10% coarse frag. > 3 inches
Bt3	53-81	Silty clay	2 m sbk	firm	5 YR 5/6	44	many continuous clay skins
2Bt4	81-93	Clay	1 m sbk	firm	2.5 YR 4/6	78	

*structure: 1=weak, 2=moderate, 3=strong; f=fine, m=medium, c=coarse; gr=granular, sbk=subangular block, abk=angular blocky, sl ma= structureless massive

Table 11. Chemical and laboratory data for all pedons in Roane County on the Copper Ridge Formaiton.

Roane County 33

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
92253	E	0-10	1.166	4.4	192	0.38	2.35	2.28
92254	2Bt1	10-20	0.811	4.4	66	0.43	2.75	2.30
92255	2Bt2	20-110	0.377	4.7	26	0.42	5.07	2.33
92256	2Bt3	110-147	0.138	4.8	36	0.48	5.21	2.32
92257	2Bt4	147-180+	0.105	5.0	23	0.56	3.26	2.33

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92253	E	0-10	3.43	1.11	1.01	2.32	2.32	10	56	34	40	Silty clay loam
92254	2Bt1	10-20	1.43	0.41	0.51	1.12	1.43	5	46	49	47	Silty clay
92255	2Bt2	20-110	0.00	0.10	0.10	0.41	0.41	1	13	86	47	Clay
92256	2Bt3	110-147	1.75	1.03	0.21	0.51	0.10	4	19	78	51	Clay
92257	2Bt4	147-180+	0.00	0.41	0.00	0.31	0.10	1	18	81	48	Clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC	ECEC
			cmol (+) kg^{-1}					%	cmol(+) kg clay $^{-1}$	
92253	E	0-10	0.610	0.293	0.217	0.048	7	16	21	10
92254	2Bt1	10-20	0.616	0.516	0.269	0.024	9	15	19	9
92255	2Bt2	20-110	1.053	1.863	0.260	0.061	14	23	17	10
92256	2Bt3	110-147	0.878	0.720	0.273	0.033	13	14	27	10
92257	2Bt4	147-180+	3.641	1.253	0.259	0.038	22	24	81	49

Table 11 continued.

Roane County 34

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-------cmol$^{(+)}$ kg^{-1}-------	
92315	A	0-4	7.430	4.6	18	0.74	1.94	1.57
92316	E	4-16	1.264	4.9	175	2.29	1.14	1.02
92317	Bt1	16-27	0.492	4.5	99	3.54	2.75	2.36
92318	Bt2	27-48	0.386	4.6	16	5.36	4.31	3.62
92319	Bt3	48-76	0.165	4.7	2	6.31	5.10	4.58
92320	2BC	76-105+	0.036	4.7	1	5.76	5.56	4.81

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92315	A	0-4	4.73	4.84	3.50	8.02	8.33	29	47	24	17	Gravelly loam
92316	E	4-16	2.81	3.51	3.08	7.64	7.64	25	49	27	22	Gravelly loam
92317	Bt1	16-27	0.48	1.93	2.12	5.51	5.89	16	44	40	31	Silty clay
92318	Bt2	27-48	1.23	1.14	1.14	3.25	3.77	11	25	65	33	Gravelly clay
92319	Bt3	48-76	0.20	0.92	0.51	1.32	1.83	5	13	82	39	Clay
92320	2BC	76-105+	1.21	2.12	1.81	4.13	2.52	12	18	70	38	Very cobbly clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}						%	
92315	A	0-4	3.037	0.618	0.565	0.067	18	23	76	26
92316	E	4-16	0.675	0.181	0.140	0.036	5	19	20	8
92317	Bt1	16-27	0.195	0.210	0.115	0.032	5	11	13	8
92318	Bt2	27-48	0.189	1.088	0.159	0.040	8	18	13	9
92319	Bt3	48-76	0.054	1.355	0.146	0.038	10	15	13	8
92320	2BC	76-105+	<0.001	0.175	0.070	0.038	8	3	12	8

Table 11 continued.

Roane County 35

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-------cmol$^{(+)}$ kg^{-1}-------	
92296	A	0-10	3.266	5.2	180	1.68	0.15	0.28
92297	Ap	10-16	1.356	5.2	216	2.42	0.36	0.42
92298	Bt1	16-23	0.441	4.9	328	2.51	0.61	0.64
92299	Bt2	23-46	0.391	5.0	204	2.84	0.59	0.62
92300	Bt3	46-73	0.212	4.9	80	3.56	1.22	1.29
92301	2Bt4	73-110	0.109	5.1	2	6.56	2.24	2.53
92302	2Bt5	110-135	0.099	5.1	2	7.29	1.33	1.52
92303	2Bt6	135-180	0.083	5.3	1	7.07	1.54	1.80
92304	2Bt7	180-192+	0.034	5.1	1	8.39	4.14	3.21

Table 11 continued.

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			%									
92296	A	0-10	9.25	4.62	2.88	5.34	6.37	28	52	20	30	Gravelly silt loam
92297	Ap	10-16	9.43	4.26	2.59	12.25	0.00	26	52	22	37	Silt loam
92298	Bt1	16-23	4.16	3.07	2.47	4.95	5.34	20	51	29	39	Clay loam
92299	Bt2	23-46	6.44	3.53	2.70	12.99	0.00	26	33	41	35	Clay
92300	Bt3	46-73	6.11	2.72	1.55	4.56	4.08	19	29	52	40	Clay
92301	2Bt4	73-110	3.13	1.84	1.01	2.49	2.03	11	14	75	47	Clay
92302	2Bt5	110-135	0.95	0.86	0.95	1.43	1.72	6	12	82	43	Clay
92303	2Bt6	135-180	1.23	1.70	0.94	1.32	1.41	7	11	82	43	Clay
92304	2Bt7	180-192+	1.25	1.44	1.05	1.25	1.53	7	14	79	53	Clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC	ECEC
			cmol (+) kg^{-1}					%	cmol(+) kg clay $^{-1}$	
92296	A	0-10	2.836	0.670	0.284	0.039	10	38	51	20
92297	Ap	10-16	1.402	0.467	0.180	0.180	6	37	26	11
92298	Bt1	16-23	0.980	0.495	0.086	0.034	4	38	14	8
92299	Bt2	23-46	1.409	0.062	0.102	0.252	5	37	12	6
92300	Bt3	46-73	1.372	0.183	0.184	0.346	6	35	11	6
92301	2Bt4	73-110	0.858	1.066	0.223	0.084	8	27	11	6
92302	2Bt5	110-135	1.327	0.915	0.194	0.091	7	34	9	5
92303	2Bt6	135-180	1.298	1.305	0.198	0.266	8	40	9	6
92304	2Bt7	180-192+	1.332	1.004	0.248	0.210	11	26	13	9

Table 11 continued.

Roane County 39

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							cmol$^{(+)}$ kg^{-1}	
92326	A	0-7	7.972	4.3	243	0.66	2.35	2.12
92327	E	7-34	0.941	4.6	12	0.72	0.96	0.86
92328	Bt1	34-61	0.296	3.8	17	1.38	2.45	2.41
92329	Bt2	61-95	0.169	4.1	4	1.90	3.34	3.23
92330	Btx	61-95	0.094	4.2	1	2.16	2.10	2.00
92331	2C	95-146+	0.040	4.3	>1	5.89	3.73	3.71

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			%									
92326	A	0-7	8.84	6.25	3.77	7.87	8.51	35	56	9	37	Gravelly silt loam
92327	E	7-34	3.58	4.52	4.05	8.20	7.73	28	57	15	33	Gravelly silt loam
92328	Bt1	34-61	2.76	3.35	2.76	6.22	6.41	21	53	26	40	Very gravelly silt loam
92329	Bt2	61-95	3.55	3.35	2.33	5.07	5.58	20	49	31	46	Gravelly clay loam
92330	Btx	61-95	4.26	5.05	4.55	9.30	8.21	31	42	27	42	Loam/Clay loam
92331	2C	95-146+	4.25	3.74	2.12	4.05	3.74	18	32	50	48	Gravelly clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}					%		
92326	A	0-7	<0.001	0.036	0.454	0.069	18	3	224	36
92327	E	7-34	<0.001	0.006	0.092	0.034	3	4	22	7
92328	Bt1	34-61	<0.001	0.010	0.082	0.031	4	3	17	10
92329	Bt2	61-95	0.002	0.038	0.093	0.044	8	2	26	11
92330	Btx	61-95	0.198	0.420	0.079	0.305	7	14	27	12
92331	2C	95-146+	0.008	0.085	0.051	0.038	10	2	21	8

Table 11 continued.

Roane County 40

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al ----cmol$^{(+)}$	Total Acidity kg^{-1}---
92286	E	0-18	1.473	4.5	324	0.24	0.71	0.96
92287	BE	18-29	0.385	4.5	42	0.22	1.02	1.26
92288	Bt1	29-52	0.329	4.2	>1	0.09	2.70	3.29
92289	2Bt2	52-75	0.360	4.2	>1	0.25	3.31	3.92
92290	2BC	75-102+	0.111	4.5	5	0.45	2.61	3.03

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92286	E	0-18	7.65	5.71	4.49	9.59	8.67	36	48	16	36	Loam
92287	BE	18-29	4.51	5.32	4.41	9.73	4.61	29	56	15	51	Silt loam
92288	Bt1	29-52	4.46	4.86	3.47	12.59	0.10	25	32	43	40	Gravelly clay
92289	2Bt2	52-75	6.28	5.02	3.19	5.89	4.25	25	25	50	46	Gravellly clay
92290	2BC	75-102+	9.74	7.86	3.66	7.42	5.27	34	22	44	44	Gravelly clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}						%	
92286	E	0-18	0.379	0.110	0.059	0.034	5	12	29	8
92287	BE	18-29	1.835	0.457	0.151	0.227	16	17	104	25
92288	Bt1	29-52	0.409	0.129	0.042	0.047	6	11	13	8
92289	2Bt2	52-75	0.460	0.267	0.048	0.064	7	12	14	8
92290	2BC	75-102+	0.565	0.826	0.048	0.042	6	25	14	9

Table 11 continued.

Roane County 41

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}---	
92321	E	0-17	3.400	4.8	5	0.99	1.20	0.88
92322	BE	17-33	0.591	4.5	51	1.39	1.27	1.02
92323	Bt1	33-58	0.223	4.5	22	3.68	3.02	2.60
92324	2Bt2	58-74	0.072	4.8	2	3.83	2.69	2.33
92325	2C	74-102+	0.078	4.7	1	3.17	2.07	1.87

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92321	E	0-17	6.77	6.87	4.44	9.59	8.48	36	48	16	23	Gravelly loam
92322	BE	17-33	3.44	5.05	4.65	10.51	10.21	34	47	19	31	Gravelly loam
92323	Bt1	33-58	4.11	3.73	2.43	4.95	4.48	20	52	28	36	Very gravelly clay loam
92324	2Bt2	58-74	8.31	7.41	3.80	8.31	5.31	33	23	44	40	Very gravelly clay
92325	2C	74-102+	8.04	6.84	4.32	9.75	8.35	37	24	39	33	Very gravelly clay loam

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}						%	
92321	E	0-17	1.151	0.189	0.230	0.045	8	21	47	18
92322	BE	17-33	<0.001	0.021	0.038	0.053	3	4	17	7
92323	Bt1	33-58	0.430	0.447	0.079	0.035	6	17	20	14
92324	2Bt2	58-74	0.040	0.067	0.072	0.036	6	4	13	7
92325	2C	74-102+	0.006	0.035	0.027	0.034	3	3	8	6

Table 11 continued.

Roane County 42

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}---	
92291	E1	0-15	4.866	4.4	151	1.23	1.68	1.94
92292	E2	15-35	0.357	4.4	34	0.79	1.17	1.33
92293	BE	35-55	0.175	4.3	4	2.12	3.03	3.39
92294	2Bt1	55-80	0.134	4.4	3	2.71	3.35	4.11
92295	2Bt2	80-125+	0.032	4.8	1	1.36	3.88	4.26

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92291	E1	0-15	6.10	5.26	4.31	15.78	0.21	32	56	12	38	Gravelly silt loam
92292	E2	15-35	5.85	3.32	3.41	6.83	6.24	26	54	20	36	Cobbly silt loam
92293	BE	35-55	3.38	3.57	2.61	6.08	5.31	21	46	33	45	Cobbly clay loam
92294	2Bt1	55-80	3.71	2.97	2.14	9.10	0.00	18	34	48	39	Cobbly clay
92295	2Bt2	80-125+	2.92	3.22	2.63	5.46	3.70	18	23	59	41	Cobbly clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
92291	E1	0-15	0.783	0.235	0.212	0.050	11	12
92292	E2	15-35	0.338	0.078	0.542	0.036	3	16
92293	BE	35-55	0.065	<0.001	0.079	0.039	5	3
92294	2Bt1	55-80	0.257	0.134	0.086	0.041	6	8
92295	2Bt2	80-125+	<0.001	0.144	0.057	0.037	4	7

Table 11 continued.

Roane County 43

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}---	
92243	E	0-18	1.725	4.4	133	0.22	1.38	1.40
92244	EB	18-48	0.412	4.4	38	0.37	2.19	2.91
92245	Bt1	48-72	0.265	4.5	31	0.57	4.42	4.36
92246	Bt2	72-90	0.307	4.5	27	0.72	4.74	4.81
92247	BC	90-110+	0.097	4.6	30	0.51	5.03	5.09

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92243	E	0-18	4.82	3.62	3.92	8.24	6.83	27	64	9	56	Gravelly silt loam
92244	EB	18-48	7.58	2.83	2.32	5.36	5.66	24	53	23	48	Gravelly silt loam
92245	Bt1	48-72	4.28	2.55	2.04	4.69	4.79	18	44	38	50	Gravelly silty clay loam
92246	Bt2	72-90	4.51	3.21	2.31	4.72	5.02	20	39	41	50	Gravelly clay
92247	BC	90-110+	5.14	8.06	2.82	5.95	4.94	27	32	41	51	Gravelly clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}					%		
92243	E	0-18	0.247	0.114	0.093	0.030	5	10	59	23
92244	EB	18-48	0.068	0.198	0.117	0.028	6	7	26	11
92245	Bt1	48-72	0.228	0.792	0.173	0.044	9	14	24	15
92246	Bt2	72-90	0.310	1.063	0.188	0.028	11	15	26	15
92247	BC	90-110+	0.133	0.860	0.170	0.027	10	12	26	15

Table 11 continued.

Roane County 44

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al ---cmol$^{(+)}$	Total Acidity kg^{-1}---
92248	E1	0-14	2.339	4.9	223	0.23	0.82	0.77
92249	E2	14-34	0.814	4.7	72	0.20	1.04	1.01
92250	EB	34-47	0.241	4.6	81	0.34	1.81	2.28
92251	Bt1	47-88	0.094	4.7	47	0.40	2.56	2.28
92252	Bt2	88-115	0.065	4.6	32	0.31	3.30	2.28
	2R	115+						

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92248	E1	0-14	10.09	5.75	3.94	7.27	5.45	32	59	9	58	Gravelly silt loam
92249	E2	14-34	4.34	5.04	3.33	8.17	7.06	28	61	11	54	Silt loam
92250	EB	34-47	8.99	4.59	3.30	7.29	6.39	31	48	21	41	Loam
92251	Bt1	47-88	10.97	5.29	3.69	7.98	7.18	35	40	25	39	Gravelly loam
92252	Bt2	88-115	4.05	4.66	3.04	8.51	7.70	28	34	38	40	Clay loam
	2R	115+										

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC	ECEC
			cmol (+) kg^{-1}					%	cmol(+) kg clay $^{-1}$	
92248	E1	0-14	0.734	0.210	0.167	0.033	6	19	75	25
92249	E2	14-34	0.097	0.085	0.108	0.024	3	9	31	12
92250	EB	34-47	<0.001	0.061	0.110	0.029	4	5	19	10
92251	Bt1	47-88	0.273	0.355	0.138	0.028	5	15	22	13
92252	Bt2	88-115	<0.001	0.439	0.147	0.027	6	10	17	10
	2R	115+								

Table 11 continued.

Roane County 45

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al $cmol^{(+)}$ kg^{-1}	Total Acidity $cmol^{(+)}$ kg^{-1}
92262	A	0-6	2.149	4.5	249	0.24	1.11	2.27
92263	E	6-23	0.434	4.5	130	0.19	0.69	2.26
92264	BE	23-33	0.218	4.4	64	0.29	1.52	2.27
92265	2Bt1	33-61	0.158	4.6	31	0.16	2.61	2.29
92266	2Bt2	61-94	0.124	4.8	25	0.38	3.39	2.31
92267	2CB	94+	0.018	4.8	28	0.29	3.23	2.29

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			%									
92262	A	0-6	8.74	4.81	3.73	7.27	7.46	32	51	17	34	Silt loam
92263	E	6-23	4.29	4.48	2.99	6.98	6.98	26	55	19	32	Silt loam
92264	BE	23-33	5.82	3.49	2.52	7.08	6.30	25	53	22	38	Silt loam
92265	2Bt1	33-61	3.11	2.43	2.24	5.64	5.05	18	43	39	39	Silty clay loam
92266	2Bt2	61-94	2.08	2.47	2.08	5.04	4.15	16	30	54	47	Clay
B92267	2CB	94+	4.18	3.68	3.68	8.06	6.47	26	27	47	44	Clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}							
92262	A	0-6	0.227	0.089	0.129	0.040	7	7	39	9
92263	E	6-23	0.384	0.071	0.056	0.168	2	28	13	7
92264	BE	23-33	0.449	0.098	0.070	0.117	4	19	17	10
92265	2Bt1	33-61	0.731	0.895	0.111	1.080	7	39	18	14
92266	2Bt2	61-94	0.900	1.531	0.159	1.018	7	49	14	13
92267	2CB	94+	0.351	0.314	0.069	0.137	7	13	14	9

Table 11 continued.

Roane County 46

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
92268	A	0-12	3.461	5.0	918	0.26	0.58	2.28
92269	AB	12-19	0.977	4.8	501	0.28	0.91	1.11
92270	Bt1	19-28	0.553	4.5	181	0.36	1.97	2.54
92271	2Bt2	28-43	0.344	4.3	37	0.23	4.34	5.66
92272	2Bt3	43-64	0.174	4.5	30	0.14	4.42	5.75
92273	2C	64-104+	0.096	4.6	29	0.18	3.22	4.37

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92268	A	0-12	4.11	4.01	3.50	7.82	8.02	27	48	25	34	Loam
92269	AB	12-19	2.26	2.85	2.85	6.39	7.27	21	51	28	38	Clay loam
92270	Bt1	19-28	2.23	1.94	2.32	5.90	6.48	19	44	37	41	Silty clay loam
92271	2Bt2	28-43	1.83	1.83	1.54	3.66	4.53	13	37	49	52	Clay
92272	2Bt3	43-64	2.36	2.46	2.08	4.54	4.91	17	36	47	61	Clay
92273	2C	64-104+	4.34	3.67	2.41	4.63	5.50	21	39	40	52	Clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC cmol(+) kg clay $^{-1}$	ECEC
			cmol (+) kg^{-1}					%		
92268	A	0-12	1.225	0.341	0.166	0.055	7	26	27	9
92269	AB	12-19	0.589	0.189	0.137	0.053	4	24	14	7
92270	Bt1	19-28	0.504	0.167	0.104	0.050	6	15	15	8
92271	2Bt2	28-43	0.607	0.275	0.105	0.054	10	10	21	11
92272	2Bt3	43-64	0.653	0.776	0.095	0.063	11	15	23	13
92273	2C	64-104+	0.427	0.508	0.088	0.053	8	14	19	11

Table 11 continued.

Roane County 47

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity cmol$^{(+)}$ kg^{-1}
92305	A1	0-13	2.581	5.3	279	1.94	0.22	0.19
92306	A2	13-22	1.562	5.1	120	1.46	0.64	0.55
92307	BE	22-43	0.458	4.8	626	2.32	1.38	1.13
92308	2Bt	43-61	0.279	4.8	65	2.69	2.30	1.87
92309	2C	61-89+	0.186	5.0	3	3.78	1.97	1.65

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			%									
92305	A1	0-13	6.45	3.54	2.70	13.00	0.00	26	55	19	32	Silt loam
92306	A2	13-22	3.16	3.36	2.76	13.43	0.00	23	57	20	37	Silt loam
92307	BE	22-43	3.78	3.58	2.49	6.27	6.27	23	54	23	42	Silt loam
92308	2Bt	43-61	4.28	2.82	1.85	4.57	5.15	18	40	42	36	Clay/Silty clay
92309	2C	61-89+	3.75	2.53	1.88	3.47	4.41	16	29	55	43	Clay

Table 11 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}							
92305	A1	0-13	2.134	0.514	0.238	0.051	8	36	43	17
92306	A2	13-22	0.912	0.247	0.139	0.115	5	26	27	10
92307	BE	22-43	0.149	0.067	0.026	0.060	2	12	11	7
92308	2Bt	43-61	1.047	1.177	0.069	0.049	6	40	14	11
92309	2C	61-89+	2.061	0.158	0.099	0.038	7	31	14	8

Table 12. Chemical and laboratory data for all pedons in Anderson County on the Copper Ridge Formation.

Anderson County 31

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}---	
92332	A	0-11	4.776	4.2	244	1.06	1.75	1.68
92333	E	11-20	1.281	4.4	1	0.84	1.01	0.94
92334	Bt1	20-49	0.459	4.2	16	1.14	1.41	1.41
92335	Bt2	49-61	0.171	4.1	6	1.72	2.78	2.88
92336	Bt3	61-87	0.085	4.4	1	2.71	3.29	3.25
92337	Bt4	87-100	0.090	4.4	<1	2.74	3.16	3.16
92338	C	100-132+	0.072	4.4	<1	2.16	3.05	2.98

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92332	A	0-11	8.88	5.12	6.58	12.98	7.63	41	49	10	36	Silt loam
92333	E	11-20	4.99	4.50	6.16	12.03	7.33	35	51	14	35	Silt loam
92334	Bt1	20-49	4.91	3.99	6.04	11.36	6.65	33	47	20	34	Loam
92335	Bt2	49-61	4.87	3.08	4.17	8.74	5.86	27	52	21	47	Silt loam
92336	Bt3	61-87	2.94	2.55	4.22	9.32	6.18	25	44	31	29	Clay loam
92337	Bt4	87-100	3.29	2.29	3.99	8.77	5.88	25	42	33	38	Clay loam
92338	C	100-132+	3.75	2.76	4.63	9.26	6.11	26	45	29	42	Clay loam

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+)	ECEC kg clay^{-1}
			cmol (+) kg^{-1}							
92332	A	0-11	0.957	0.217	0.279	0.056	7	21	71	33
92333	E	11-20	0.035	0.047	0.136	0.049	4	7	27	9
92334	Bt1	20-49	<0.001	0.004	0.003	0.017	3	1	17	7
92335	Bt2	49-61	<0.001	0.008	0.005	0.010	5	1	24	13
92336	Bt3	61-87	0.035	0.038	0.007	0.007	6	2	18	11
92337	Bt4	87-100	0.035	0.074	0.007	0.009	6	2	18	10
92338	C	100-132+	0.017	0.086	0.009	0.010	7	2	24	11

Table 12 continued.

Anderson County 32

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}---	
92339	A	0-7	3.279	4.4	635	1.85	1.45	1.35
92340	E	7-38	0.985	4.4	294	0.87	1.28	1.20
92341	Bt1	38-45	0.250	4.0	13	1.48	2.86	2.87
92342	Bt2	45-91	0.153	4.2	17	2.61	4.10	4.16
92343	Bt3	91-120	0.086	4.2	5	2.72	4.34	4.44
92344	BC	120-144+	0.090	4.2	2	3.24	3.94	3.80

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92339	A	0-7	2.02	0.71	0.20	1.71	4.53	9	59	32	39	Silty clay loam
92340	E	7-38	3.26	3.06	5.33	9.87	6.32	27	53	20	35	Silt loam
92341	Bt1	38-45	3.17	2.77	5.75	9.81	4.16	26	45	29	40	Clay loam
92342	Bt2	45-91	1.66	1.56	7.12	10.83	3.51	25	30	45	42	Clay
92343	Bt3	91-120	1.42	1.21	5.36	9.30	3.23	20	25	55	41	Clay
92344	BC	120-144+	2.31	2.12	5.11	12.91	4.53	27	21	52	41	Clay

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+) kg clay $^{-1}$	ECEC
			cmol (+) kg^{-1}							
92339	A	0-7	0.015	0.017	0.018	0.010	8	1	25	5
92340	E	7-38	0.003	0.006	<0.001	0.014	4	1	16	5
92341	Bt1	38-45	0.510	0.071	0.079	0.118	4	19	14	13
92342	Bt2	45-91	0.600	0.113	0.116	0.086	7	13	15	11
92343	Bt3	91-120	0.716	0.563	0.168	0.052	8	19	14	11
92344	BC	120-144+	0.617	0.452	0.178	0.060	7	18	14	10

Table 12 continued.

Anderson County 33

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----mol$^{(+)}$ kg^{-1}-----	Total Acidity
92345	A	0- 3	9.581	3.7	1	0.97	2.97	3.24
92346	E1	3-21	1.083	4.5	331	1.03	0.89	0.79
92347	E2	21-36	0.517	4.4	155	0.92	0.74	0.71
92348	Bt1	36-46	0.253	4.1	2	2.66	3.50	3.42
92349	2Bt2	46-62	0.269	4.1	2	3.26	4.35	4.40
92350	2Bt3	62-75	0.211	4.3	12	4.30	4.11	4.38
92351	2Bt4	75-117	0.171	4.8	7	4.34	3.95	3.96

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%					----------%				
92345	A	0- 3	13.79	4.40	4.17	8.58	7.65	38	48	14	36	Loam
92346	E1	3-21	4.56	3.07	3.96	8.22	7.53	28	53	19	29	Silt loam
92347	E2	21-36	4.28	3.04	3.71	7.70	6.46	26	54	20	29	Silt loam
92348	Bt1	36-46	3.30	1.80	2.20	4.70	4.00	16	42	42	35	Silty clay
92349	2Bt2	46-62	4.50	2.68	2.30	4.12	3.26	16	28	56	36	Clay
92350	2Bt3	62-75	3.15	1.91	1.53	2.77	2.10	12	20	68	37	Clay
92351	2Bt4	75-117	1.89	1.09	1.19	2.89	2.29	10	19	71	37	Clay

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC	ECEC
			cmol (+) kg^{-1}					%		cmol(+) kg clay $^{-1}$
92345	A	0- 3	1.458	0.400	0.240	0.098	27	8	191	37
92346	E1	3-21	0.441	0.039	0.066	0.069	4	16	21	8
92347	E2	21-36	0.422	0.034	0.047	0.078	3	19	16	7
92348	Bt1	36-46	0.495	0.036	0.085	0.110	7	11	15	10
92349	2Bt2	46-62	0.556	0.067	0.108	0.101	8	11	14	9
92350	2Bt3	62-75	0.958	0.522	0.135	0.047	11	15	16	8
92351	2Bt4	75-117	0.712	1.324	0.122	0.084	12	18	17	9

Table 12 continued.

Anderson County 34

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}-----	
92352	A	0-7	3.607	5.0	1	1.32	0.20	0.16
92353	E	7-27	1.226	4.6	740	1.14	0.87	0.83
92354	Bt1	27-38	0.431	4.3	242	1.30	0.87	1.39
92355	Bt2	38-52	0.193	4.1	20	1.76	1.93	2.74
92356	2Bt3	52-94	0.120	4.4	11	1.34	2.00	3.16
92357	2Bt4	94-140+	0.142	4.4	8	3.88	2.54	3.41

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92352	A	0-7	9.03	3.75	3.35	6.29	6.80	29	52	19	19	Silt loam
92353	E	7-27	2.44	3.26	3.87	6.62	6.01	22	54	24	24	Silt loam
92354	Bt1	27-38	4.08	4.56	4.66	8.54	9.61	32	39	29	29	Clay loam
92355	Bt2	38-52	2.43	2.23	2.23	5.67	6.68	20	43	37	37	Silty clay loam
92356	2Bt3	52-94	1.01	1.22	1.52	7.49	9.82	21	28	51	51	Clay
92357	2Bt4	94-140+	1.20	0.90	0.90	2.61	4.71	10	32	58	58	Clay

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}							
92352	A	0-7	4.250	0.559	0.302	0.061	9	55	50	28
92353	E	7-27	0.304	0.081	0.098	0.089	5	13	19	6
92354	Bt1	27-38	0.160	0.042	0.065	0.076	4	8	15	4
92355	Bt2	38-52	0.296	0.107	0.086	0.095	5	11	14	7
92356	2Bt3	52-94	0.628	1.006	0.135	0.094	8	24	15	8
92357	2Bt4	94-140+	0.389	0.649	0.106	0.258	7	19	13	7

Table 12 continued.

Anderson County 35

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}-----	
92358	A	0-12	2.854	4.8	3	1.44	0.14	0.39
92359	Bt1	12-27	0.866	4.7	10	1.30	1.09	1.41
92360	Bt2	27-46	0.305	4.8	4	1.96	0.98	1.46
92361	Bt3	46-62	0.258	4.7	1	2.20	1.43	2.00
92362	BC	62-85	0.172	4.6	1	1.99	1.33	1.93
92363	2C	85-125+	0.058	4.8	15	2.84	0.79	1.32

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92358	A	0-12	4.52	3.37	4.84	8.31	4.52	26	52	22	28	Silt loam
92359	Bt1	12-27	2.33	3.34	4.56	7.80	4.15	22	49	29	36	Clay loam
92360	Bt2	27-46	3.44	3.65	4.46	7.49	4.15	23	45	32	41	Clay loam
92361	Bt3	46-62	2.13	3.24	4.46	7.50	4.26	22	49	29	42	Clay loam
92362	BC	62-85	4.11	3.60	4.51	7.41	4.81	25	51	24	50	Silt loam
92363	2C	85-125+	3.54	2.93	2.83	5.26	3.94	18	38	44	41	Clay

Table 12 continued.

Lab	Horizon Number	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC	ECEC
			cmol (+) kg^{-1}					%	cmol(+)	kg clay $^{-1}$
92358	A	0-12	2.144	0.639	0.269	0.230	10	34	44	16
92359	Bt1	12-27	0.463	0.235	0.131	0.087	7	14	23	7
92360	Bt2	27-46	1.276	1.004	0.124	0.108	7	34	23	11
92361	Bt3	46-62	0.885	0.777	0.111	0.095	7	28	23	11
92362	BC	62-85	0.831	0.698	0.101	0.092	6	28	26	13
92363	2C	85-125+	2.098	0.709	0.109	0.083	7	46	15	9

Table 12 continued.

Anderson County 36

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}-----	
92364	A	0-8	3.635	5.0	21	1.43	0.01	0.16
92365	Bt1	8-26	1.366	4.6	44	1.29	0.58	1.13
92366	Bt2	26-42	0.487	4.2	16	1.60	0.96	1.67
92367	Bt3	42-75	0.307	4.5	25	2.70	1.23	2.15
92368	2Bt4	75-90+	0.186	4.3	7	4.01	1.81	2.84

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92364	A	0-8	5.68	4.21	3.89	6.52	5.57	26	57	17	32	Silt loam
92365	Bt1	8-26	2.34	3.45	4.16	6.70	3.45	20	53	27	27	Silty clay loam
92366	Bt2	26-42	2.52	3.42	3.42	6.44	5.33	21	50	29	29	Clay loam
92367	Bt3	42-75	2.55	2.25	1.86	4.90	5.58	17	41	42	30	Silty clay
92368	2Bt4	75-90+	8.24	3.82	1.91	3.42	2.81	20	19	61	35	Clay

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+) kg clay $^{-1}$	ECEC
			cmol (+) kg^{-1}							
92364	A	0-8	2.228	0.718	0.322	0.115	9	37	54	20
92365	Bt1	8-26	0.172	0.087	0.109	0.085	5	8	20	4
92366	Bt2	26-42	0.069	0.049	0.065	0.092	4	7	13	4
92367	Bt3	42-75	0.766	0.421	0.050	0.076	5	24	13	6
92368	2Bt4	75-90+	0.108	0.062	<0.001	0.020	8	2	13	3

Table 12 continued.

Anderson County 37

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}-----	
92369	A	0-19	2.645	4.6	8	1.92	0.57	1.18
92370	Bt1	19-33	0.472	4.3	5	3.56	0.95	1.88
92371	Bt2	33-80	0.400	4.3	2	4.57	1.34	2.59
92372	Bt3	80-100	0.288	4.4	13	5.45	1.77	3.22
92373	2Bt4	100-123+	0.159	4.4	1	2.25	1.24	2.34

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92369	A	0-19	8.06	3.77	2.86	6.02	5.81	26	57	17	31	Silt loam
92370	Bt1	19-33	6.21	3.61	1.70	3.31	3.21	18	59	23	44	Silt loam
92371	Bt2	33-80	2.49	1.70	0.80	1.30	1.10	8	38	54	45	Clay
92372	Bt3	80-100	1.32	0.71	0.41	0.51	0.41	3	19	78	48	Clay
92373	2Bt4	100-123+	5.10	2.70	1.10	1.60	1.10	11	21	68	39	Clay

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}							
92369	A	0-19	0.184	0.021	0.023	0.018	11	2	63	5
92370	Bt1	19-33	0.026	0.001	0.008	0.015	5	1	21	4
92371	Bt2	33-80	0.209	0.059	0.025	0.009	9	3	16	3
92372	Bt3	80-100	0.340	0.133	0.010	0.006	12	4	16	3
92373	2Bt4	100-123+	0.198	0.091	0.007	0.007	9	3	14	2

Table 12 continued.

Anderson County 38

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}-----	
92374	A	0-12	7.595	5.3	1016	1.15	0.00	0.13
92375	E	12-29	0.923	4.8	10	1.57	0.24	0.57
92376	Bt1	29-40	0.346	4.7	23	1.84	0.27	0.60
92377	2Bt2	40-80	0.274	4.9	5	4.30	0.05	0.20
92378	2Bt3	80-120+	0.260	4.7	1	4.06	0.19	0.42

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92374	A	0-12	2.53	3.74	1.42	2.53	3.24	14	60	26	26	Silt loam
92375	E	12-29	4.64	2.57	1.19	2.47	4.25	16	67	17	37	Silt loam
92376	Bt1	29-40	2.49	1.79	0.90	2.29	4.19	12	61	27	29	Silt loam
92377	2Bt2	40-80	0.80	0.50	0.30	0.80	1.80	4	42	54	40	Clay
92378	2Bt3	80-120+	1.29	0.79	0.20	0.69	0.99	4	41	55	47	Clay

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+) kg clay $^{-1}$	ECEC
			cmol (+) kg^{-1}							
92374	A	0-12	1.670	0.244	0.062	0.012	24	8	93	8
92375	E	12-29	0.086	0.019	0.004	0.005	6	2	33	2
92376	Bt1	29-40	0.081	0.023	0.002	0.005	4	2	16	1
92377	2Bt2	40-80	0.428	0.106	0.027	0.005	9	6	17	1
92378	2Bt3	80-120+	0.402	0.124	0.007	0.006	10	6	18	1

Table 12 continued.

Anderson County 39

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}-----	Total Acidity
92379	A	0-8	2.312	5.1	1	1.49	0.13	0.12
92380	BA	8-22	1.276	4.8	1298	1.39	0.28	0.75
92381	Bt1	22-34	0.494	5.0	25	1.58	0.15	0.37
92382	Bt2	34-84	0.292	4.5	9	2.55	0.77	1.83
92383	2Bt3	84-114+	0.108	4.6	22	4.00	1.83	3.84

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92379	A	0-8	4.93	3.26	6.71	11.94	6.12	33	48	19	30	Loam
92380	BA	8-22	2.74	3.13	7.62	13.59	6.55	34	62	4	99	Silt loam
92381	Bt1	22-34	3.12	3.32	6.83	12.29	5.85	31	51	18	45	Silt loam
92382	Bt2	34-84	3.22	3.01	5.73	9.34	4.82	26	47	27	55	Loam/Clay loam
92383	2Bt3	84-114+	3.43	3.23	5.75	9.18	4.24	26	31	43	67	Clay

Table 12 continued.

Lab	Horizon Number	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	CEC	ECEC
			cmol (+) kg^{-1}					%	cmol(+) kg clay $^{-1}$	
92379	A	0-8	0.247	0.041	0.021	0.006	7	4	45	2
92380	BA	8-22	0.036	0.013	0.002	0.014	6	1	140	9
92381	Bt1	22-34	0.080	0.024	<0.001	0.007	4	3	24	1
92382	Bt2	34-84	0.081	0.029	0.001	0.006	2	5	8	3
92383	2Bt3	84-114+	0.064	0.073	0.004	0.006	10	1	24	5

Table 12 continued.

Anderson County 40

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}-----	
92384	A	0-19	2.504	5.3	1	2.38	0.15	0.07
92385	Bt1	19-36	0.441	4.9	1	2.32	0.07	0.20
92386	Bt2	36-72	0.340	4.9	1	2.57	0.44	0.92
92387	BC	72-104+	0.144	5.0	7	2.56	0.40	0.94

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92384	A	0-19	4.82	3.69	3.69	5.75	4.92	23	57	20	38	Silt loam
92385	Bt1	19-36	2.97	3.17	2.97	4.86	4.86	19	53	28	52	Silty clay loam
92386	Bt2	36-72	2.72	2.82	3.12	5.23	4.53	18	51	31	55	Silty clay loam
92387	BC	72-104+	3.85	3.14	3.45	5.68	4.87	21	52	27	56	Silt loam

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol (+) kg^{-1} clay	ECEC
			cmol (+) kg^{-1}							
92384	A	0-19	0.485	0.067	0.047	0.009	11	6	54	4
92385	Bt1	19-36	0.215	0.048	0.019	0.006	9	3	31	1
92386	Bt2	36-72	0.287	0.135	0.009	0.010	9	5	29	3
92387	BC	72-104+	0.227	0.138	0.007	0.015	7	6	25	3

Table 12 continued.

Anderson County 41

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}-----	
92388	A1	0-11	2.381	5.4	13	1.91	0.00	0.08
92389	A2	11-27	0.909	5.1	6	1.95	0.12	0.12
92390	BA	27-38	0.357	5.2	2	1.95	0.09	0.20
92391	Bt1	38-70	0.209	5.4	2	2.14	0.21	0.20
92392	Bt2	70-125+	0.102	4.3	2	2.86	0.82	1.58

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92388	A1	0-11	3.14	3.25	3.14	5.45	5.45	21	57	22	25	Silt loam
92389	A2	11-27	2.73	3.03	3.12	5.17	4.98	19	58	23	26	Silt loam
92390	BA	27-38	2.31	2.51	2.31	4.41	4.71	17	61	22	53	Silt loam
92391	Bt1	38-70	3.13	2.83	2.53	4.14	4.35	17	53	30	37	Silty clay loam
92392	Bt2	70-125+	3.02	2.61	2.51	4.42	4.42	17	55	28	49	Silty clay loam

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}							
92388	A1	0-11	0.544	0.135	0.024	0.013	11	7	48	3
92389	A2	11-27	0.197	0.066	0.007	0.013	7	4	30	2
92390	BA	27-38	0.296	0.046	0.006	0.012	6	6	28	2
92391	Bt1	38-70	0.339	0.098	0.002	0.021	6	7	21	2
92392	Bt2	70-125+	0.097	0.080	<0.001	0.014	7	3	24	4

Table 12 continued.

Anderson County 42

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}-----	
92393	A	0-24	1.857	5.0	1	1.96	0.59	1.01
92394	Bt1	24-39	0.370	5.1	1	2.36	0.32	0.20
92395	Bt2	39-53	0.241	5.4	788	3.09	0.11	0.05
92396	Bt3	53-81	0.234	5.4	501	3.50	0.20	0.10
92397	2BC	81-93+	0.192	5.2	27	4.31	0.13	0.08

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92393	A	0-24	2.98	3.18	2.69	4.67	5.17	19	62	19	41	Silt loam
92394	Bt1	24-39	2.58	2.28	1.98	3.37	4.36	15	58	27	43	Silty clay loam
92395	Bt2	39-53	2.01	2.01	1.91	3.42	4.12	14	53	33	46	Silty clay loam
92396	Bt3	53-81	1.51	1.51	1.71	2.92	3.62	12	47	41	44	Silty clay
92397	2BC	81-93+	4.02	1.81	0.90	2.01	1.91	11	24	65	41	Clay

Table 12 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation %	CEC cmol(+)	ECEC kg clay $^{-1}$
			cmol (+) kg^{-1}							
92393	A	0-24	0.254	0.065	0.024	0.011	6	6	32	5
92394	Bt1	24-39	0.269	0.066	<0.001	0.010	6	6	22	5
92395	Bt2	39-53	0.409	0.126	0.003	0.009	7	8	20	2
92396	Bt3	53-81	0.435	0.097	0.005	0.010	7	7	18	2
92397	2BC	81-93+	0.549	0.149	0.010	0.011	9	8	13	1

Table 13. Classification of the twelve pedons forming on the Copper Ridge Formation in Anderson County, Tennessee.

PEDON	CLASSIFICATION
31	fine-loamy, kaolinitic, thermic Typic Paleudult
32	clayey, kaolinitic, thermic Typic Kandiudult
33	fine-loamy, kaolinitic, thermic Typic Kandiudult
34	clayey, kaolinitic, thermic Typic Kandiudult
35	fine-loamy, kaolinitic, thermic Typic Paleudult
36	clayey, kaolinitic, thermic Typic Kandiudult
37	clayey, kaolinitic, thermic Typic Kandiudult
38	clayey, kaolinitic, thermic Typic Paleudult
39	fine-loamy, kaolinitic, thermic Typic Kandiudult
40	fine-loamy, kaolinitic, thermic Typic Paleudult
41	fine-loamy, kaolinitic, thermic Typic Paleudult
42	clayey, kaolinitic, thermic Typic Paleudult

Table 14. Classification of the twelve pedons forming on the Copper Ridge formation in Roane County, Tennessee.

PEDON	CLASSIFICATION
33	clayey, kaolinitic, thermic Typic Paleudult
34	clayey, kaolinitic, thermic Typic Kandiudult
35	clayey, kaolinitic, thermic Typic Kandiudult
39	fine-loamy, kaolinitic, thermic Typic Fragiudult
40	clayey, kaolinitic, thermic Typic Kandiudult
41	fine-loamy, kaolinitic, thermic Typic Kandiudult
42	clayey, kaolinitic, thermic Typic Kandiudult
43	fine-loamy, kaolinitic, thermic Typic Paleudult
44	fine-loamy, kaolinitic, thermic Typic Paleudult
45	clayey, kaolinitic, thermic Typic Kandiudult
46	clayey, kaolinitic, thermic Typic Paleudult
47	clayey, kaolinitic, thermic Typic Kandiudult

Table 15. Site position, parent material, slope and aspect of soil profiles of the Maryville Formation in Roane County.

Pedon	Slope	Aspect	Site Position	Parent Material
3	11	SE	Concave sideslope	Colluvium/Residuum
7	4	S	Terrace	Alluvium/Residuum
8	6	S	Terrace	Alluvium/Residuum
9	10	S	Convex sideslope	Colluvium/Residuum
10	3	SE	Knob w/terrace smear	Alluvium/Residuum
13	3	E	Bench	Residuum
14	13	N	Upland/sideslope	Colluvium/Residuum
17	2	E	Terrace	Alluvium/Residuum
19	15	SE	Convex sideslope	Residuum
20	12	SE	Convex sideslope	Colluvium/Residuum
21	13	SE	Midslope	Colluvium/Residuum
22	13	SE	Midslope bench	Colluvium/Residuum

Table 16. Site position, parent material, slope and aspect of soil profiles of the Maryville Formation in Anderson County.

Pedon	Slope	Aspect	Site Position	Parent Material
1	6	SE	Upland shoulder	Residuum
3	7	SE	Upland midslope	Colluvium/Residuum
4	24	SE	Upland midslope	Colluvium/Residuum
5	25	SE	Upland midslope	Colluvium/Residuum
9	15	SE	Upland midslope	Colluvium/Residuum
10	1	NE	Upland	Residuum
11	12	SE	Upland shoulder	Colluvium/Residuum
12	15	SE	Upper slope	Residuum
19	6	SE	Convex midslope	Colluvium/Residuum
20	12	SW	Upland midslope	Colluvium/Residuum
21	11	SE	Saddle	Residuum
22	18	SE	Convex midslope	Residuum

Table 17. Soil morphology of all pedons on the Maryville Formation in Roane County.

Horizon	Lower Depth (cm)	Texture	Structure	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 3							
AE	0-15	Gr CL/SiCL	2 m gr	friable	10YR 4/4	18	
Bt1	15-31	Gr SiCL	2 m sbk	friable	7.5YR 5/6	20	
2Bt2	31-53	Gr CL	1 c sbk	firm	10YR 5/6	21	few, faint, continuous clay skins few, medium manganese conc.
2Bt3	53-85	Gr C/SiC	2 m sbk	firm	2.5YR 4/6 2.5Y 6/4	25	many, distinct, continuous clay skins few, medium manganese conc.
2C	85-95+	Gr SiCL	sl ma	firm	2.5YR 3/6 2.5Y 6/2 10YR 5/6	20	few, medium manganese conc.
Roane County 7							
Ap	0-6	SiL	2 f gr	friable	10YR 3/2	2	
BA	6-16	SiL	1 f sbk	friable	10YR 5/4	5	
Bt1	16-44	SiC	2 2 sbk	friable	10YR 5/6	3	common, distinct, discontinuous clay skins
2Bt2	44-56	C	1 m sbk	firm	2.5YR 4/6 7.5YR 4/6 2.5YR 6/3	5	many, prominent, continuous clay skins few, medium manganese stains
2C	56-93	C	1 m sbk	firm	7.5YR 5/6 2.5YR 4/6 2.5Y 6/2	9	
2Cr	93+	shales					

Table 17 continued.

Roane County 8

Horizon	Lower Depth (cm)	Texture	Structure	Consistency	Color	Coarse Fragments %	Additional Remarks
Ap	0-5	SiL	2 f gr	very friable	10YR 3/2	10	
BA	5-17	SiCL	2 f sbk	very friable	10YR 5/6	7	few, medium manganese conc.
Bt1	17-44	SiC	2 m sbk	friable	7.5YR 5/6	2	common, distinct, discontinuous clay skins few, medium manganese conc.
2Bt2	44-80	SiCL	2 m abk	firm	7.5YR 4/6	1	many, prominent, continuous clay skins few, fine manganese conc.
2C	80-95+	SiCL	2 c pl	very firm	5YR 4/6 2.5YR 6/4 2.5YR 4/6	10	

Roane County 9

A	0-9	Gr SiL	2 m sbk	very friable	10YR 4/2	18	
E	9-16	Gr SiL	2 f/m sbk	friable	10YR 5/3	19	
BE	16-30	Gr SiL	2 m &1 f sbk	friable	10YR 5/6	17	
2Bt	30-52	Gr SiCL	1 m sbk	friable	5YR 5/6	19	few, thin, discontinuous clay skins
2Cr	52+						

Table 17 continued.

Roane County 10

Horizon	Lower Depth (cm)	Texture	Structure	Consistency	Color	Coarse Fragments %	Additional Remarks
Ap	0-18	Gr SiCL	1 m sbk	friable	10YR 4/4	18	
Bt1	18-28	SiC	2 m sbk	firm	10YR 5/4	13	common, thin, discontinuous clay skins common manganese conc.
Bt2	28-40	Gr C	2 m abk	firm	7.5YR 4/6	15	many, thick, continuous clay skins common manganese conc.
2BC	40-62	Gr CL	2 m abk	firm	7.5YR 4/6	50	many, thick, continuous clay skins
2Cr1	62-83	red, yellow, and green shale					
2Cr2	83-108	green shale, many coarse Mn concretions and pockets					

Roane County 13

A	0-2.5	SiL	1 f sbk	friable	10YR 2/2	12	
E	2.5-13	SiL	1 m sbk	friable	10YR 5/4	10	
Bt1	13-30	SiC	2 m sbk	firm	7.5YR 5/6	5	many, thin,continuous clay skins
Bt2	30-50	Gr C	2 m sbk	firm	7.5YR 4/6	15	many, thin,continuous clay skins
Bt3	50-78	C	1 m sbk	firm	7.5YR 4/6	12	many, thin,continuous clay skins
BC	78-88	C	sl ma	friable	7.5YR 4/6	2	
C	88-98+	Gr CL	sl ma	friable	7.5YR 4/6	22	

Table 17 continued.

Horizon	Lower Depth (cm)	Texture	Structure	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 14							
A	0-8	SiCL	1 m gr	very friable	10YR 2/2	6	
Bt1	8-19	Gr C	2 m sbk	friable	10YR 4/3	22	layer of shale at base of horizon
2Bt2	19-41	C	1 m sbk	firm	7.5YR 4/6	8	common, thin, discontinuous clay skins
2Bt3	41-58	Gr C	2 m sbk	firm	2.5YR 4/6 10YR 5/2 2.5Y 4/4	32	common, thick, discontinuous clay skins
2Cr	58-104+						
Roane County 17							
A	0-15	SiL	1 f gr	friable	10YR 5/4	12	few, fine manganese conc.
Bt1	15-28	Gr SiCL	2 f sbk	friable	10YR 4/6	19	few, fine manganese conc.
2Bt2	28-60	Gr C	2 m sbk	friable	5YR 4/6	18	few, distinct clay skins
2Bt3	60-80	Gr C	2 m sbk	friable	5YR 4/6	15	common, distinct clay skins
2C	80-104+	C	sl ma	friable	5YR 4/6	4	few manganese conc.

Table 17 continued.

Horizon	Lower Depth (cm)	Texture	Structure	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 19							
A	0-6	Gr SiL	1 f gr	very friable	10YR 3/2	23	
AE	6-18	Gr SiCL	1 m sbk	very friable	10YR 4/4	17	
Bt	18-47	SiCL	2 m sbk	friable	7.5YR 4/6	9	common, medium manganese
Cr	47-98+	red and yellow shales					
Roane County 20							
E	0-12	GR CL	1 m sbk	friable	10YR 5/4	16	
Bt1	12-35	C/SiC	3 m sbk	firm	5YR 4/6	7	many, thick, continuous clay skins
2Bt2	35-52	Gr C	1 c sbk	firm	2.5YR 3/6	25	
2Cr	52-72+	red and green shale					

Table 17 continued.

Horizon	Lower Depth (cm)	Texture	Structure	Consistency	Color	Coarse Fragments %	Additional Remarks
Roane County 21							
A	0-5	L	2 m gr	very friable	10YR 4/3	13	
Ap	5-18	SiL	1 m sbk	friable	10YR 4/2	13	
2Bt1	18-36	SiCL	2 m sbk	firm	7.5YR 4/6	7	common, distinct continuous clay skins few, fine and medium manganese conc.
2Bt2	36-64	SiCL	2 c sbk	firm	7.5YR 5/6	12	many, medium, discontinuous clay skins common, fine & medium manganese & iron conc.
2BC	64-74	Gr SiCL	1 m sbk	friable	7.5YR 5/4	19	few, faint, patchy clay skins common, fine and medium manganese conc.
2Cr	74-112+						
Roane County 22							
E	0-19	SiL	2 m gr	friable	10YR 5/6	9	
Bt1	19-29	C	2 m sbk	firm	7.5YR 5/8	5	many, thick, continuous clay skins
Bt2	29-45	C	2 m sbk	firm	7.5YR 4/6	5	common, thin, discontinuous clay skins
2Bt3	45-56	C	1 c sbk	firm	2.5YR 4/6 2.5Y 5/4	4	common, thin, discontinuous clay skins
2C	56-100+	C	sl ma	firm	7.5YR 5/8 2.5Y 6/4 2.5YR 4/6	6	

Table 18. Chemical and physical data for all pedons on the Maryville Formation in Roane County, Tennessee.

Roane County 3

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}-----	
9259	AE	0-15	1.562	4.7	1293	2.12	0.52	5.37
9260	Bt1	15-31	0.626	4.7	806	2.25	0.53	5.74
9261	2Bt2	31-53	0.308	5.0	164	3.25	0.61	6.50
9262	2Bt3	53-85	0.213	4.9	106	3.67	0.04	6.47
9263	2C	85-95+	0.361	5.0	180	2.99	0.71	7.72

Table 18 continued.

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			%									
9259	AE	0-15	3.83	2.24	1.21	2.15	10.83	20	51	29	37	Gravelly clay loam/ Silty clay loam
9260	Bt1	15-31	2.64	2.36	0.28	1.61	9.82	17	48	35	40	Gravelly silty clay loam
9261	2Bt2	31-53	3.68	2.96	0.72	3.32	10.87	22	42	36	43	Gravelly clay loam
9262	2Bt3	53-85	4.05	2.61	0.99	3.06	8.90	20	40	40	45	Gravelly clay/Silty clay
9263	2C	85-95+	3.10	2.09	0.64	2.46	10.02	18	46	36	48	Gravelly silty clay loam

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
9259	AE	0-15	0.083	0.441	0.210	0.034	15	5
9260	Bt1	15-31	0.301	0.615	0.185	0.035	13	9
9261	2Bt2	31-53	0.381	1.754	0.186	0.032	20	12
9262	2Bt3	53-85	0.189	2.067	0.279	0.049	21	12
9263	2C	85-95+	0.186	1.278	0.196	0.057	15	11

Table 18 continued.

Roane County 7

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al ------cmol$^{(+)}$	Total Acidity kg^{-1}------
9264	Ap	0-6	8.061	4.5	751	1.97	0.02	0.79
9265	BA	6-16	0.785	4.9	345	2.88	0.01	3.02
9266	Bt1	16-44	0.337	5.0	24	3.70	0.72	7.63
9267	2Bt2	44-56	0.292	4.8	5	4.74	1.77	17.75
9268	2C	56-93	0.186	4.7	24	2.61	1.79	18.11
9269	2Cr	93+	0.471	4.7	168	3.07	1.24	12.29

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
9264	Ap	0-6	1.18	1.62	1.29	3.02	8.51	16	66	18	24	Silt loam
9265	BA	6-16	1.62	2.70	1.08	2.34	7.11	15	63	22	54	Silt loam
9266	Bt1	16-44	1.85	1.66	0.78	0.78	3.41	8	51	41	52	Silty clay
9267	2Bt2	44-56	0.10	0.51	0.20	1.11	1.82	4	23	73	63	Clay
9268	2C	56-93	1.57	1.96	0.88	2.05	1.96	8	19	73	68	Clay
9269	2Cr	93+	4.52	9.65	2.61	3.42	6.93	27	42	31	49	Clay loam

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
9264	Ap	0-6	10.333	2.274	0.578	0.062	28	47
9265	BA	6-16	0.562	0.582	0.388	0.039	22	7
9266	Bt1	16-44	0.527	0.911	0.654	0.046	15	14
9267	2Bt2	44-56	0.050	1.098	0.586	0.074	27	7
9268	2C	56-93	0.146	0.988	0.574	0.101	27	7
9269	2Cr	93+	0.012	0.579	0.292	1.098	18	11

Table 18 continued.

Roane County 8

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}	Total Acidity ---------
9285	Ap	0-5	7.567	4.2	413	1.53	0.21	2.77
9286	BA	5-17	0.360	4.2	41	2.27	0.38	4.49
9287	Bt1	17-44	0.104	4.5	10	3.00	0.01	0.10
9288	2Bt2	44-80	0.200	4.8	18	4.41	0.64	7.21
9289	2C	80-95+	0.076	4.6	10	0.52	0.84	9.38

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%									
9285	Ap	0-5	1.83	1.71	0.91	3.88	11.31	20	64	16	34	Silt loam
9286	BA	5-17	1.53	1.33	0.82	2.65	8.77	15	56	29	56	Silty clay loam
9287	Bt1	17-44	1.13	0.92	0.82	1.74	5.93	11	48	41	56	Silty clay
9288	2Bt2	44-80	0.82	0.72	0.20	1.74	6.54	10	53	37	59	Silty clay loam
9289	2C	80-95+	0.00	1.42	0.31	2.34	8.14	12	52	36	58	Silty clay loam

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
9285	Ap	0-5	0.620	1.681	0.644	1.162	26	16
9286	BA	5-17	0.073	0.466	0.517	1.123	22	10
9287	Bt1	17-44	0.024	0.541	0.408	1.120	15	14
9288	2Bt2	44-80	0.430	0.490	1.156	0.400	11	24
9289	2C	80-95+	<0.001	0.370	0.195	0.303	11	8

Table 18 continued.

Roane County 9

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
9249	A	0-9	2.636	4.7	1326	2.02	0.23	1.70
9250	E	9-16	1.521	4.8	1156	2.19	0.21	2.52
9251	BE	16-30	0.603	4.7	611	1.77	0.23	2.54
9252	2Bt	30-52	0.296	4.8	160	2.19	0.42	4.35
9253	2Cr	52+	0.185	4.8	172	2.51	0.55	5.55

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%									
9249	A	0-9	5.74	2.47	0.71	2.56	7.42	19	58	23	27	Gravelly Silt loam
9250	E	9-16	8.96	1.87	0.47	0.93	10.64	23	55	22	40	Gravelly Silt loam
9251	BE	16-30	2.71	1.10	0.80	1.00	9.82	15	59	26	43	Gravelly Silt loam
9252	2Bt	30-52	2.72	1.55	0.58	0.78	6.41	12	51	37	44	Gravelly Silty clay loam
9253	2Cr	52+	4.35	2.65	0.76	1.04	5.77	15	48	37	42	Gravelly Silty clay loam

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
9249	A	0-9	0.349	0.246	0.239	0.048	13	7
9250	E	9-16	0.705	0.376	0.144	0.050	11	12
9251	BE	16-30	0.724	0.343	0.149	0.055	9	14
9252	2Bt	30-52	0.876	1.129	0.223	0.045	12	20
9253	2Cr	52+	0.887	1.595	0.213	0.052	14	20

Table 18 continued.

Roane County 10

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -------cmol$^{(+)}$ kg^{-1}--------	Total Acidity
9295	Ap	0-18	0.783	4.5	882	2.52	0.21	2.75
9296	Bt1	18-28	0.514	4.4	169	3.19	0.38	4.36
9297	Bt2	28-40	0.384	4.4	82	4.11	0.51	5.70
9298	2BC	40-62	0.253	4.3	182	3.49	0.58	6.62
9299	2Cr1	62-83	0.095	4.2	89	2.88	1.05	1.07
92100	2Cr2	83-108+	0.012	4.2	107	2.68	1.38	15.70

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
9295	Ap	0-18	3.27	2.56	0.51	1.94	5.01	13	65	22	34	Gravelly Silty clay loam
9296	Bt1	18-28	3.97	3.54	0.86	2.47	3.22	14	44	42	43	Silty clay
9297	Bt2	28-40	5.27	4.61	1.60	2.73	3.29	18	30	52	48	Gravelly Clay
9298	2BC	40-62	13.32	10.97	2.44	2.96	3.74	33	32	35	47	Gravelly Clay loam
9299	2Cr1	62-83	21.07	15.73	4.61	5.97	3.53	51	22	27	39	Sandy clay loam
92100	2Cr2	83-108+	13.89	14.97	5.02	6.63	3.67	44	24	32	35	Clay loam

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
9295	Ap	0-18	1.008	0.612	0.983	0.338	9	33
9296	Bt1	18-28	4.089	0.605	1.025	0.291	16	37
9297	Bt2	28-40	5.442	3.202	0.448	0.420	19	49
9298	2BC	40-62	3.887	2.574	0.509	0.387	18	41
9299	2Cr1	62-83	2.070	2.033	0.543	0.463	20	25
92100	2Cr2	83-108+	1.019	2.157	0.365	0.323	24	16

Table 18 continued.

Roane County 13

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
92101	A	0-2.5	4.784	5.2	1781	2.50	0.01	0.13
92102	E	2.5-13	0.996	5.4	1037	3.07	0.05	0.94
92103	Bt1	13-30	0.495	4.9	85	4.08	0.69	7.68
92104	Bt2	30-50	0.258	4.8	37	4.11	1.34	14.03
92105	Bt3	50-78	0.134	5.0	25	4.66	1.43	15.12
92106	BC	78-88	0.096	4.9	67	4.30	1.18	12.62
92107	C	88-98+	0.076	5.0	2753	3.27	1.05	11.63

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92101	A	0-2.5	3.48	2.36	1.12	3.14	12.12	22	60	18	27	Silt loam
92102	E	2.5-13	3.02	1.77	0.83	2.40	10.63	19	58	23	41	Silt loam
92103	Bt1	13-30	1.34	1.16	0.72	2.06	5.82	11	45	44	43	Silty clay
92104	Bt2	30-50	2.96	2.26	1.04	2.78	4.61	14	32	54	43	Gravelly Clay
92105	Bt3	50-78	3.69	3.98	1.80	4.17	5.21	19	29	52	41	Clay
92106	BC	78-88	1.73	1.64	0.96	2.69	5.97	13	36	51	38	Clay
92107	C	88-98+	7.02	6.06	2.90	8.16	9.65	34	30	36	37	Gravelly Clay loam

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
92101	A	0-2.5	6.976	0.910	0.264	0.383	12	73
92102	E	2.5-13	2.304	0.482	0.073	0.331	7	49
92103	Bt1	13-30	2.347	0.642	0.104	0.292	19	18
92104	Bt2	30-50	1.410	1.052	0.286	0.434	22	14
92105	Bt3	50-78	0.434	0.978	0.208	0.414	21	10
92106	BC	78-88	0.338	1.341	0.193	0.465	20	12
92107	C	88-98+	0.280	0.504	0.040	0.201	9	12

Table 18 continued.

Roane County 14

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
9290	A	0-8	4.899	5.0	2036	2.66	0.05	0.90
9291	Bt1	8-19	0.912	5.1	270	3.15	0.64	7.30
9292	2Bt2	19-41	0.445	4.6	52	4.84	1.17	12.90
9293	2Bt3	41-58	0.269	4.6	33	4.84	1.44	15.70
9294	2Cr	58-104+	0.039	5.3	76	3.03	0.77	8.60

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
9290	A	0-8	3.61	2.73	1.20	2.84	7.44	18	52	30	19	Silty clay loam
9291	Bt1	8-19	7.73	8.57	2.51	4.07	3.76	27	30	43	30	Gravelly Clay
9292	2Bt2	19-41	1.68	1.05	0.74	1.89	5.46	11	29	60	48	Clay
9293	2Bt3	41-58	7.55	4.51	1.26	1.47	1.47	16	27	57	42	Gravelly Clay
9294	2Cr	58-104+	12.79	10.71	3.12	3.85	2.91	33	35	32	33	Clay loam

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
9290	A	0-8	9.788	2.428	0.477	0.292	24	53
9291	Bt1	8-19	3.828	3.615	0.572	0.354	20	41
9292	2Bt2	19-41	1.227	1.887	0.276	0.257	20	18
9293	2Bt3	41-58	1.192	2.622	0.390	0.391	24	19
9294	2Cr	58-104+	5.380	5.577	0.389	0.473	24	49

Table 18 continued.

Roane County 17

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al ---cmol$^{(+)}$ kg^{-1}---	Total Acidity
9254	A	0-15	0.913	4.2	789	1.80	0.30	3.51
9255	Bt1	15-28	0.479	4.9	164	2.57	0.50	5.35
9256	2Bt2	28-60	0.231	4.9	17	3.50	0.78	7.75
9257	2Bt3	60-80	0.158	5.0	59	3.69	1.04	9.56
9258	2C	80-104+	0.49	4.9	323	4.56	1.37	11.31

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			---%									
9254	A	0-15	2.11	1.69	0.85	1.69	7.89	14	62	24	45	Silt loam
9255	Bt1	15-28	2.82	2.41	0.91	2.41	6.44	15	48	37	41	Gravelly Silty clay loam
9256	2Bt2	28-60	3.32	3.71	1.17	3.22	4.40	16	35	49	41	Gravelly Clay
9257	2Bt3	60-80	3.33	3.60	0.55	3.60	5.54	16	32	52	45	Gravelly Clay
9258	2C	80-104+	4.74	5.71	1.65	4.94	7.16	24	36	40	42	Clay

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
9254	A	0-15	0.137	0.077	0.119	0.039	8.43	4
9255	Bt1	15-28	0.581	0.523	0.220	0.039	12.38	11
9256	2Bt2	28-60	2.124	1.376	0.279	0.043	18.87	20
9257	2Bt3	60-80	1.349	1.650	0.352	0.054	24.86	14
9258	2C	80-104+	0.478	1.112	0.320	0.054	20.18	10

Table 18 continued.

Roane County 19

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	%	Free Iron	Al	Total Acidity cmol$^{(+)}$ kg^{-1}
9245	A	0-6	2.535	4.6	898		0.01	0.13	1.75
9247	AE	6-18	0.715	4.5	498		0.01	0.29	3.10
9246	Bt	18-47	0.278	4.7	557		0.56	0.82	8.33
9248	Cr	47-98+	0.112	4.8	541		4.24	1.00	10.77

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			%									
9245	A	0-6	5.38	2.03	0.62	1.15	6.44	16	61	23	29	Gravelly Silt loam
9247	AE	6-18	2.60	1.80	0.60	1.20	5.00	11	61	28	43	Gravelly Silty clay loam
9246	Bt	18-47	3.82	1.81	0.70	1.61	4.62	13	52	35	39	Silty clay loam
9248	Cr	47-98+	14.07	6.58	1.52	2.73	3.74	29	25	46	37	Gravelly Clay

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation	ECEC
			cmol (+) kg^{-1}					%	cmol (+) kg^{-1}
9245	A	0-6	0.759	0.347	0.312	0.108	9.99	15	
9247	AE	6-18	0.703	0.688	0.154	0.109	11.42	14	
9246	Bt	18-47	0.707	0.267	0.215	0.044	9.72	13	
9248	Cr	47-98+	0.268	1.905	0.297	0.086	21.32	12	

Table 18 continued.

Roane County 20

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
9281	E	0-12	1.187	4.6	244	1.92	0.43	5.05
9282	Bt1	12-35	0.325	4.9	21	3.14	0.58	6.72
9283	2Bt2	35-52	0.189	4.9	8	3.76	1.23	13.59
9284	2Cr	52-72+	0.032	5.2	96	2.96	1.12	12.40

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%									
9281	E	0-12	2.91	1.45	0.83	2.18	15.68	23	53	24	43	Gravelly clay loam
9282	Bt1	12-35	2.47	1.23	0.62	1.54	7.51	13	40	47	46	Clay/silty clay
9283	2Bt2	35-52	3.25	3.66	1.15	1.57	1.26	11	28	61	38	Gravelly clay
9284	2Cr	52-72+	14.35	10.71	3.02	3.02	1.14	32	27	41	32	Clay

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			----------cmol (+) kg^{-1}----------					%
9281	E	0-12	0.098	0.438	0.165	1.004	11	15
9282	Bt1	12-35	0.275	2.548	0.366	1.367	16	28
9283	2Bt2	35-52	0.180	2.967	0.495	1.008	25	19
9284	2Cr	52-72+	0.200	4.480	0.494	1.199	25	25

Table 18 continued.

Roane County 21

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$	Total Acidity kg^{-1}---
9275	A	0-5	1.319	4.4	501	3.82	0.61	6.50
9276	Ap	5-18	0.887	5.0	683	2.13	0.20	2.23
9277	2Bt1	18-36	0.321	4.8	167	2.53	0.38	4.14
9278	2Bt2	36-64	0.260	4.8	76	2.98	0.52	5.58
9279	2BC	64-74	0.223	4.9	98	2.65	0.64	6.81
9280	2Cr	74-112+	0.135	5.0	18	3.66	1.32	14.69

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%									
9275	A	0-5	4.86	2.64	1.06	4.01	11.61	24	49	27	42	Loam
9276	Ap	5-18	3.78	2.03	0.64	2.21	12.06	21	54	25	39	Silt loam
9277	2Bt1	18-36	2.91	1.50	0.56	1.50	7.89	14	56	30	49	Silty clay loam
9278	2Bt2	36-64	3.40	1.89	0.66	1.61	7.46	15	52	33	43	Silty clay loam
9279	2BC	64-74	3.27	1.64	0.77	2.12	8.37	16	54	30	43	Gravelly Silty clay loam
9280	2Cr	74-112+	4.48	3.75	1.46	2.08	1.98	14	30	56	36	Gravelly clay

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
9275	A	0-5	0.057	0.562	0.352	1.160	15	14
9276	Ap	5-18	0.143	0.824	0.185	1.149	10	22
9277	2Bt1	18-36	0.159	1.009	0.280	1.023	11	23
9278	2Bt2	36-64	0.117	1.266	0.173	1.223	13	22
9279	2BC	64-74	0.058	1.241	0.227	1.119	13	21
9280	2Cr	74-112+	0.106	3.797	1.101	1.253	26	24

Table 18 continued.

Roane County 22

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
9270	E	0-19	1.294	4.8	490	1.98	0.48	5.08
9271	Bt1	19-29	0.557	5.0	11	4.13	1.23	12.28
9272	Bt2	29-45	0.330	5.0	4	3.71	1.31	13.68
9273	2Bt3	45-56	0.243	4.9	28	1.99	1.38	14.42
9274	2C	56-100+	0.258	4.9	9	4.28	1.52	15.57

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
9270	E	0-19	3.50	1.50	0.60	2.90	14.11	23	50	27	45	Silt loam
9271	Bt1	19-29	2.73	2.02	0.91	3.84	9.71	19	25	56	50	Clay
9272	Bt2	29-45	3.26	3.46	1.58	4.55	7.31	21	28	51	53	Clay
9273	2Bt3	45-56	5.22	4.53	1.77	5.32	7.88	24	31	45	39	Clay
9274	2C	56-100+	3.80	3.20	1.70	4.49	9.39	22	32	46	48	Clay

Table 18 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
9270	E	0-19	0.078	0.522	0.172	1.104	12	16
9271	Bt1	19-29	0.214	2.289	0.579	1.231	24	18
9272	Bt2	29-45	0.150	2.414	1.072	1.665	25	22
9273	2Bt3	45-56	0.099	2.232	0.348	1.032	24	15
9274	2C	56-100+	0.065	2.606	0.314	1.015	24	16

Table 19. Soil morphology of all pedons on the Maryville Formation in Anderson County, Tennessee.

Horizon	Depth (cm)	Texture	Structure	Consistency	Color	% Coarse Fragments	Additional Remarks
Anderson County 1							
A	0-10	L/CL	1 m gr	very friable	10YR 3/3	2	
E	10-28	CL	1msbk	friable	10YR 5/6	13	
Bt	28-44	C	2msbk	friable	5YR 5/6	6	common, distinct clay skins
Cr	44-104+	yellow and brown shales					
Anderson County 3							
A	0-4	CL	2 m gr	friable	10YR 3/4	7	
Bt1	4-16	C	2 f sbk	friable	10YR 5/4	6	
2Bt2	16-40	C	2 m abk	firm	5YR 4/6	1	common, thick, continuous clay skins
2Bt3	40-53	C	2 m abk	firm	5YR 4/6	1	many, thick, continuous clay skins
2Cr	53-94+	shale					
Anderson County 4							
A	0-5	L	1 m gr	very friable	10YR 5/4	8	
E	5-24	L/SiL	1 f sbk	friable	10YR 5/6	8	
BE	24-37	CL	2 f sbk	friable	7.5YR 5/6	14	few, faint, patchy clay skins
2Bt1	37-53	C	2 m sbk	friable	5YR 5/6	2	common, discontinuous clay skins
2Bt2/Cr	53-70	C	2 m sbk	friable	5YR 5/6	2	common, discontinuous clay skins
2Cr	70-100+	soft light olive brown shale, some red and yellow shales; a few small pockets of Bt material					

Table 19 continued.

Anderson County 5

Horizon	Depth (cm)	Texture	Structure	Consistency	Color	%Coarse Fragments	Additional Remarks
A	0-6	L	1 m gr	very friable	10YR 4/4	18	
AE	6-15	L	1 m sbk	friable	10YR 4/6	23	
E	15-45	CL	2 m sbk	friable	10YR 5/6	13	
2Bt	45-70	CL	2 m sbk	friable	7.5YR 5/8	19	common, distinct, continuous clay skins
2Cr	70+	red, yellow, and brown shales					

Anderson County 9

A	0-5	L	2 f sbk	friable	10YR 4/4	15	
E	5-12	L	1 m sbk	friable	10YR 5/4	9	
2Bt1	12-35	C	2 m&c sbk	firm	7.5YR 5/6	4	many, thick, continuous clay skins
2Bt2	35-50	C	1 m sbk	firm	7.5YR 4/6	5	common, thin, discontinuous clay skins
2BC	50-62	C	1 f sbk	firm	7.5YR 5/6	10	
2Cr	62-105+	shales					

Table 19 continued.

Horizon	Depth (cm)	Texture	Structure	Consistency	Color	% Coarse Fragments	Additional Remarks
Anderson County 10							
A	0-10	SiL	1 m sbk	friable	10YR 3/2	4	
E	10-21	SiL	1 m sbk	friable	10YR 5/3	12	
Bt1	21-40	SiCL	1 m sbk	friable	7.5YR 5/6 10YR 5/4	10	
Bt2	40-77	C	2 m sbk	friable	7.5YR 5/6	9	
Cr	77-136+	shales					
Anderson County 11							
A	0-6	SiL	1 m sbk	very friable	10YR 4/3	13	
E	6-12	Gr SiL	1 f sbk	friable	10YR 5/4	19	
Bt1	12-18	SiCL	1 f sbk	friable	7.5YR 5/6	5	
Bt2	18-30	C	1 m sbk	firm	7.5YR 5/4	10	common, thin, discontinuous clay skins few, fine manganese conc.
2Bt3	30-56	C	1 m sbk	friable	7.5YR 5/6	4	common, discontinuous clay skins common, fine and medium manganese conc.
2BC	56-92	C	1 m sbk	friable/firm	7.5YR 5/4 2.5Y 5/4	15	common, discontinuous clay skins common, fine manganese conc.
2Cr	92-140+	shale					

Table 19 continued.

Anderson County 12

Horizon	Depth (cm)	Texture	Structure	Consistency	Color	%Coarse Fragments	Additional Remarks
A	0-7	SiL	2 f gr	friable	10YR 3/3	4	
E	7-16	SiL	1 m sbk	friable	10YR 5/4	6	
Bt1	16-41	C	2 c sbk	firm	7.5YR 4/6	2	common, thin, discontinuous clay skins
Bt2	41-56	C	2 c sbk	firm	5 YR 5/6	6	many, thick, continuous clay skins
Cr1	56-90	red and yellow shales					
Cr2	90-122+	red, yellow, and brown shales					

Anderson County 19

A	0-13	SiL	2 m sbk	friable	10YR 3/2	9	
E	13-23	Gr L	2 f&m sbk	friable	10YR 5/6	16	
2Bt1	23-39	C	2 m sbk	firm	5 YR 5/6	4	many, thin, discontinuous clay skins
2Bt2	39-72	C	2 m sbk	firm	5 YR 5/8	7	many, thick, continuous clay skins
2BC	72-95	C	1 m sbk	friable	5 YR 5/8	8	common, discontinuous clay skins
2Cr	95-135+	shale					

Table 19 continued.

Horizon	Depth (cm)	Texture	Structure	Consistency	Color	%Coarse Fragments	Additional Remarks
Anderson County 20							
A	0-5	SiL	2 m gr	friable	7.5YR 4/4	3	
BE	5-13	SiCL	1 f sbk	friable	10YR 5/6	3	
Bt1	13-21	SiCL	2 m sbk	friable	7.5YR 5/6	3	few, faint, patch clay skins
2Bt2	21-42	C	2 m sbk	firm	5 YR 5/6	2	many, continuous clay skins
2Bt3	42-84	C	3 m sbk	friable	2.5YR 4/8	3	many, continuous clay skins
2Cr	84+	soft light olive, yellowish brown shale					
Anderson County 21							
A	0-6	SiL	1 f&m gr	friable	10YR 3/3	2	
E	6-12	CL	2 m sbk	friable	10YR 5/4	5	
Bt	12-28	C	3 m sbk	firm	5YR 4/6	2	many, thick, continuous clay skins
Cr	28-87+						
Anderson County 22							
A	0-4	L	1 f sbk	friable	10YR 4/3	10	
Bt1	4-10	C	1 m sbk	friable	10YR 5/4	10	common, thick, discontinuous clay skins
Bt2	10-28	C	2 m sbk	firm	5 YR 5/6	8	many, thick, continuous clay skins
Cr	28-98+	greenish gray shale					

Table 20. Chemical and physical data for all pedons on the Maryville Formation in Anderson County.

Anderson County 1

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Al Iron %	Total Acidity ------cmol$^{(+)}$ kg^{-1}--------
92258	A	0-10	4.803	4.5	1210	0.19	0.18 2.15
92259	E	10-28	0.788	4.8	309	0.33	2.49 2.31
92260	Bt	28-44	0.444	4.4	48	0.29	4.84 2.33
92261	Cr	44-104+	0.163	4.6	220	0.50	3.66 2.33

Lab Number	Horizon (cm)	Depth	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%									
92258	A	0-10	6.29	3.14	1.12	2.69	12.57	25	47	28	30	Loam/Clay loam
92259	E	10-28	9.27	5.41	1.67	3.23	11.87	31	37	32	34	Clay loam
92260	Bt	28-44	3.65	4.36	1.62	4.77	15.73	30	24	46	46	Clay
92261	Cr	44-104+	18.62	9.36	2.26	4.11	9.77	44	26	30	38	Gravelly Clay loam

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
92258	A	0-10	9.810	2.976	0.720	0.077	23	60
92259	E	10-28	2.217	1.140	0.599	0.048	12	32
92260	Bt	28-44	2.280	1.329	0.642	0.047	17	26
92261	Cr	44-104+	2.461	1.395	0.400	0.051	17	26

Table 20 continued.

Anderson County 3

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al --cmol$^{(+)}$ kg^{-1}---	Total Acidity
92122	A	0-4	5.562	5.0	498	2.78	0.13	1.72
92123	Bt1	4-16	1.061	5.1	160	3.06	0.24	2.90
92124	2Bt2	16-40	0.424	4.9	>1	3.37	1.12	12.05
92125	2Bt3	40-53	0.158	5.0	>1	4.25	1.37	14.78
92126	2Cr	53-94+	0.198	5.1	>1	3.70	1.26	13.00

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------	----------	----------	%----------	----------	----------	----------	----------		
92122	A	0-4	2.14	3.20	1.42	5.93	11.39	24	45	31	36	Clay loam
92123	Bt1	4-16	1.77	1.88	0.77	3.32	13.17	21	37	42	42	Clay
92124	2Bt2	16-40	0.42	0.74	0.74	4.43	9.50	16	19	65	57	Clay
92125	2Bt3	40-53	0.93	1.86	1.86	7.85	14.98	27	15	58	59	Clay
92126	2Cr	53-94+	3.22	2.70	2.08	10.92	18.62	38	14	48	60	Clay

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			----------cmol (+) kg^{-1}----------					%
92122	A	0-4 1.656	0.372	0.127	0.171	8	28	
92123	Bt1	4-16	0.775	0.271	0.072	0.167	4	31
92124	2Bt2	16-40	0.595	0.265	0.067	0.135	8	13
92125	2Bt3	40-53	0.063	0.127	0.017	0.130	8	4
92126	2Cr	53-94+	0.021	0.098	0.005	0.117	6	4

Table 20 continued.

Anderson County 4

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$	Total Acidity kg^{-1}---
92132	A	0-5 2.202	4.7	228	2.70	5.55	3.04	
92133	E	5-24	0.526	5.5	227	2.61	5.41	1.12
92134	BE	24-37	0.367	5.6	42	3.96	5.64	1.68
92135	2Bt1	37-53	0.259	5.3	27	3.83	5.59	1.75
92136	2Bt2/Cr	53-70	0.210	5.3	29	3.70	5.57	2.18
92137	2Cr	70-100+	0.117	5.5	115	5.64	5.36	5.94

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%									
92132	A	0-5	6.06	5.32	1.60	4.04	14.57	32	43	25	33	Loam
92133	E	5-24	3.37	3.28	0.99	2.78	14.49	25	50	25	37	Loam/silt loam
92134	BE	24-37	8.17	8.47	2.12	4.84	9.38	33	38	29	38	Clay loam
92135	2Bt1	37-53	1.52	3.46	2.03	10.16	19.61	37	21	42	49	Clay
92136	2Bt2/Cr	53-70	8.60	6.96	1.74	3.79	13.11	34	24	42	55	Clay
92137	2Cr	70-100+	0.92	1.54	1.23	4.20	16.80	25	33	42	45	Clay

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
92132	A	0-5	0.384	0.133	0.032	0.016	15	4
92133	E	5-24	0.354	0.163	0.026	0.006	10	5
92134	BE	24-37	0.500	0.271	0.041	0.065	14	6
92135	2Bt1	37-53	0.511	0.355	0.048	0.010	14	7
92136	2Bt2/Cr	53-70	0.371	0.345	0.048	0.003	14	6
92137	2Cr	70-100+	0.046	0.137	0.044	0.053	14	2

Table 20 continued.

Anderson County 5

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al cmol$^{(+)}$ kg^{-1}	Total Acidity cmol$^{(+)}$ kg^{-1}
92127	A	0-6	1.676	4.7	186	2.21	0.42	4.65
92128	AE	6-15	0.590	5.8	161	2.84	0.13	1.82
92129	E	15-45	0.399	5.7	156	2.94	0.13	1.71
92130	2Bt	45-70	0.238	5.4	159	3.62	5.60	2.05
92131	2Cr	70+	0.087	5.2	305	3.14	5.61	5.03

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			%									
92127	A	0-6	4.64	3.69	0.74	2.21	10.55	22	46	32	30	Clay loam
92128	AE	6-15	5.05	5.56	1.41	3.33	10.61	26	41	33	30	Clay loam
92129	E	15-45	4.23	4.33	1.21	3.22	13.28	26	57	17	60	Silt loam
92130	2Bt	45-70	2.34	3.66	0.92	2.85	18.22	28	38	34	42	Clay loam
92131	2Cr	70+	11.38	9.06	3.02	6.95	8.66	39	36	25	47	Loam

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
92127	A	0-6	0.723	0.360	0.051	0.160	6	23
92128	AE	6-15	0.984	0.591	0.062	0.212	5	35
92129	E	15-45	0.916	0.726	0.067	0.257	5	42
92130	2Bt	45-70	0.276	0.291	0.042	0.008	14	5
92131	2Cr	70+	0.149	0.352	0.041	0.095	15	4

Table 20 continued.

Anderson County 9

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al ---cmol$^{(+)}$ kg^{-1}---	Total Acidity
92158	A	0-5	3.462	4.0	320	2.67	5.64	6.35
92159	E	5-12	0.216	4.3	203	2.77	5.48	5.18
92160	2Bt1	12-35	0.573	4.4	138	4.59	5.74	7.01
92161	2Bt2	35-50	0.304	4.5	70	4.61	5.67	8.31
92162	2BC	50-62	0.161	4.5	150	4.59	5.64	8.08
92163	2Cr	62-105+	0.199	4.5	515	5.81	5.67	9.10

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------	----------	----------	----------	%----------	----------	----------	----------	----------	
92158	A	0-5	14.05	9.74	2.66	4.98	12.06	43	33	22	29	Loam
92159	E	5-12	11.30	7.85	2.20	4.71	12.03	38	36	26	39	Loam
92160	2Bt1	12-35	1.47	2.93	4.09	3.56	9.95	22	29	49	50	Clay
92161	2Bt2	35-50	3.95	5.47	1.72	4.35	9.52	25	30	45	55	Clay
92162	2BC	50-62	5.71	6.32	1.84	4.79	11.12	30	29	41	54	Clay
92163	2Cr	62-105+	1.02	2.34	0.92	2.24	5.80	12	35	53	55	Clay

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
92158	A	0-5	1.573	1.128	0.324	0.046	21	15
92159	E	5-12	1.427	1.211	0.296	0.100	14	22
92160	2Bt1	12-35	1.692	2.988	0.472	0.062	19	28
92161	2Bt2	35-50	0.630	3.997	0.479	0.051	19	27
92162	2BC	50-62	0.371	3.517	0.423	0.057	18	25
92163	2Cr	62-105+	0.247	3.423	0.423	0.156	15	24

Table 20 continued.

Anderson County 10

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al	Total Acidity
							-----cmol$^{(+)}$ kg^{-1}---	
92310	A	0-10	4.416	4.1	180	2.06	1.29	1.12
92311	E	10-21	0.955	4.6	106	1.96	2.15	1.93
92312	Bt1	21-40	0.334	4.9	45	2.58	2.91	2.46
92313	Bt2	40-77	0.223	4.8	4	4.08	5.12	4.39
92314	Cr	77-136+	0.105	5.1	1	4.98	2.45	2.02

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92310	A	0-10	4.80	2.34	0.56	11.26	0.11	19	62	19	36	Silt loam
92311	E	10-21	4.89	2.55	0.61	1.84	9.38	19	63	18	44	Silt loam
92312	Bt1	21-40	3.15	1.57	1.08	1.48	9.15	16	46	38	46	Silty clay loam
92313	Bt2	40-77	2.83	2.33	1.01	2.53	11.54	20	26	54	54	Clay
92314	Cr	77-136+	17.01	10.99	3.84	6.95	5.50	44	18	38	41	Gravelly Clay loam

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
92310	A	0-10	4.986	1.193	0.584	0.084	17	41
92311	E	10-21	1.109	0.296	0.453	0.054	8	24
92312	Bt1	21-40	2.407	1.772	0.479	0.046	12	39
92313	Bt2	40-77	2.545	0.510	0.761	0.044	17	23
92314	Cr	77-136+	4.096	3.374	0.603	0.064	16	51

Table 20 continued.

Anderson County 11

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al cmol$^{(+)}$ kg^{-1}	Total Acidity
92108	A	0-6	4.026	4.8	1640	4.00	0.17	2.20
92109	E	6-12	1.344	5.0	1019	2.22	0.23	2.93
92110	Bt1	12-18	0.713	5.1	415	3.47	0.32	3.90
92111	Bt2	18-30	0.838	5.0	513	5.03	0.49	5.85
92112	2Bt3	30-56	0.353	5.1	1333	6.30	0.79	9.12
92113	2BC	56-92	0.136	5.1	942	5.32	0.90	10.38
92114	2Cr	92-140+	0.066	5.2	203	2.80	0.85	10.13

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			%									
92108	A	0-6	3.03	1.62	0.76	2.27	9.63	17	64	19	31	Silt loam
92109	E	6-12	4.25	3.01	0.93	3.42	11.41	23	55	22	40	Gravelly silt loam
92110	Bt1	12-18	2.26	2.06	0.82	2.78	9.36	17	44	39	37	Silty clay loam
92111	Bt2	18-30	1.72	1.94	1.08	3.12	5.70	14	27	59	49	Clay
92112	2Bt3	30-56	0.52	1.15	0.84	2.09	4.39	9	20	71	54	Clay
92113	2BC	56-92	7.92	5.04	1.23	2.57	4.22	21	19	60	54	Clay
92114	2Cr	92-140+	10.27	7.32	1.63	11.08	0.00	30	61	9	84	Silt loam

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			----------cmol (+) kg^{-1}----------				%	
92108	A	0-6	0.758	0.256	0.064	0.156	6	21
92109	E	6-12	0.293	0.164	0.024	0.151	4	18
92110	Bt1	12-18	0.332	0.330	0.039	0.144	4	22
92111	Bt2	18-30	0.478	0.852	0.085	0.149	6	25
92112	2Bt3	30-56	0.433	1.087	0.115	0.171	9	20
92113	2BC	56-92	0.152	0.410	0.062	0.147	6	14
92114	2Cr	92-140+	0.012	0.535	0.055	0.161	10	7

Table 20 continued.

Anderson County 12

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al ----cmol$^{(+)}$ kg^{-1}---	Total Acidity
92138	A	0-7	5.201	4.4	146	1.75	5.53	0.24
92139	E	7-16	0.914	4.9	280	1.89	5.30	1.66
92140	Bt1	16-41	0.545	5.1	67	3.90	5.62	3.39
92141	Bt2	41-56	0.322	5.0	46	5.26	5.63	6.26
92142	Cr1	56-90	0.211	5.0	1079	4.02	5.81	4.45
92143	Cr2	90-122+	0.172	5.1	58	4.88	5.71	7.05

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92138	A	0-7	2.98	2.18	0.80	2.29	13.51	22	59	19	24	Silt loam
92139	E	7-16	2.22	1.61	0.81	2.22	14.41	21	58	21	38	Silt loam
92140	Bt1	16-41	2.24	4.05	2.02	3.73	10.55	23	34	43	46	Clay
92141	Bt2	41-56	1.24	2.17	0.93	2.17	16.09	23	26	51	49	Clay
92142	Cr1	56-90	2.95	2.70	1.89	4.45	16.35	28	30	42	41	Clay
92143	Cr2	90-122+	1.35	2.28	1.04	4.04	22.91	32	31	37	52	Clay loam

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			----------cmol (+) kg^{-1}----------					%
92138	A	0-7	0.551	0.120	0.033	0.007	24	3
92139	E	7-16	0.316	0.090	0.033	0.005	10	5
92140	Bt1	16-41	0.419	0.211	0.083	0.007	14	5
92141	Bt2	41-56	0.378	0.272	0.114	0.025	19	4
92142	Cr1	56-90	0.311	0.246	0.094	0.009	17	4
92143	Cr2	90-122+	0.046	0.185	0.061	0.006	16	2

Table 20 continued.

Anderson County 19

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
92164	A	0-13	3.255	4.4	643	2.02	5.51	1.15
92165	E	13-23	0.662	4.6	186	2.62	5.40	2.37
92166	2Bt1	23-39	0.482	4.5	35	4.24	5.71	6.76
92167	2Bt2	39-72	0.187	4.5	33	4.62	5.72	8.75
92168	2BC	72-95	0.220	4.4	40	4.79	5.66	9.80
92169	2Cr	95-135+	0.092	4.5	873	4.20	5.62	9.25

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%									
92164	A	0-13	5.34	3.03	0.94	2.51	12.55	24	53	23	28	Silt loam
92165	E	13-23	5.15	3.63	1.11	2.93	13.12	26	47	27	40	Gravelly loam
92166	2Bt1	23-39	2.25	2.36	1.13	3.07	6.35	15	32	53	51	Clay
92167	2Bt2	39-72	4.38	3.67	1.12	3.26	6.02	18	27	55	53	Clay
92168	2BC	72-95	4.58	4.79	2.04	5.60	7.33	24	31	45	51	Clay
92169	2Cr	95-135+	3.14	4.66	2.23	8.91	18.02	37	32	31	49	Clay loam

Table 20 continued.

Lab Number	Horizon (cm)	Depth	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			----------cmol (+) kg^{-1}----------					%
92164	A	0-13	1.736	0.547	0.225	0.048	10	27
92165	E	13-23	2.259	1.053	0.285	0.045	10	35
92166	2Bt1	23-39	2.846	2.507	0.438	0.047	18	32
92167	2Bt2	39-72	1.369	2.498	0.452	0.038	19	23
92168	2BC	72-95	0.073	1.913	0.350	0.068	19	13
92169	2Cr	95-135+	<0.001	1.914	0.199	0.066	17	13

Table 20 continued.

Anderson County 20

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
92148	A	0-5	3.284	4.4	570	2.65	5.51	1.40
92149	BE	5-13	0.799	4.4	95	3.16	5.66	2.95
92150	Bt1	13-21	0.750	4.4	78	3.62	5.71	3.02
92151	2Bt2	21-42	0.402	4.5	34	4.94	5.92	4.64
92152	2Bt3	42-84	0.221	4.5	31	5.44	5.88	6.21
92153	2Cr	84+	0.626	4.4	80	3.85	5.68	5.25

Lab Number	Horizon (cm)	Depth	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%									
92148	A	0-5	2.66	1.43	0.51	2.15	11.26	18	56	26	24	Silt loam
92149	BE	5-13	1.63	1.63	0.71	2.44	11.50	18	47	35	38	Silty clay loam
92150	Bt1	13-21	2.30	1.67	0.52	2.20	10.46	17	45	38	46	Silty clay loam
92151	2Bt2	21-42	2.76	2.35	1.02	2.45	6.85	15	32	53	50	Clay
92152	2Bt3	42-84	1.93	2.95	1.02	2.75	8.04	17	31	52	50	Clay
92153	2Cr	84+	0.74	1.90	1.16	3.59	10.67	18	41	41	48	Silty clay

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}				%	
92148	A	0-5	0.535	0.110	0.030	0.001	15	4
92149	BE	5-13	0.255	0.095	0.027	0.008	11	4
92150	Bt1	13-21	0.275	0.131	0.031	0.004	12	4
92151	2Bt2	21-42	3.607	2.604	0.506	0.344	17	43
92152	2Bt3	42-84	2.050	1.939	0.435	0.066	16	28
92153	2Cr	84+	1.148	1.154	0.353	0.061	14	20

Table 20 continued.

Anderson County 21

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al -----cmol$^{(+)}$ kg^{-1}---	Total Acidity
92144	A	0-6	7.515	4.8	275	2.07	5.91	0.24
92145	E	6-12	1.098	4.9	50	2.67	5.62	2.78
92146	Bt	12-28	0.501	4.8	38	3.91	5.66	5.77
92147	Cr	28-87+	0.319	4.4	55	3.76	5.66	7.12

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			----------%----------									
92144	A	0-6	2.53	3.14	0.97	2.90	12.18	22	52	26	21	Silt loam
92145	E	6-12	5.84	3.96	1.46	4.07	12.72	28	44	28	38	Clay loam
92146	Bt	12-28	1.06	1.79	0.95	8.13	21.22	33	27	40	60	Clay
92147	Cr	28-87+	3.41	3.51	1.24	5.99	20.67	35	29	36	52	Clay loam

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}				%	
92144	A	0-6	1.646	0.282	0.059	0.043	32	6
92145	E	6-12	0.500	0.159	0.051	0.002	14	5
92146	Bt	12-28	0.249	0.137	0.066	0.000	15	3
92147	Cr	28-87+	0.093	0.175	0.078	0.027	16	3

Table 20 continued.

Anderson County 22

Lab Number	Horizon	Depth (cm)	Total Carbon %	pH	Manganese mg kg^{-1}	Free Iron %	Al $cmol^{(+)}$ kg^{-1}	Total Acidity
92154	A	0-4	6.757	5.1	537	2.44	5.94	0.19
92155	Bt1	4-10	0.963	4.4	131	3.81	5.79	5.06
92156	Bt2	10-28	0.341	4.5	428	5.69	5.63	7.93
92157	Cr	28-98	0.85	4.7	196	4.50	5.73	8.32

Lab Number	Horizon	Depth (cm)	VCOS	COS	MS	FS	VFS	SAND	SILT	CLAY	FINE CLAY	TEXTURE
			%									
92154	A	0-4	6.70	7.61	1.62	5.28	14.41	36	37	27	32	Loam
92155	Bt1	4-10	3.09	3.95	1.07	2.99	11.52	23	32	45	42	Clay
92156	Bt2	10-28	7.94	4.95	1.55	4.23	10.62	29	22	49	52	Clay
92157	Cr	28-98+	3.26	2.95	1.12	2.75	18.33	28	29	43	50	Clay

Table 20 continued.

Lab Number	Horizon	Depth (cm)	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	CEC	Base Saturation
			cmol (+) kg^{-1}					%
92154	A	0-4	15.618	4.548	0.991	0.065	31	69
92155	Bt1	4-10	2.513	2.228	0.500	0.062	14	38
92156	Bt2	10-28	0.360	2.922	0.494	0.051	19	21
92157	Cr	28-98+	0.089	3.142	0.283	0.091	18	20

Table 21. Soil classification of pedons on the Maryville Formation located in Roane County, Tennessee.

Pedon	Classification
3	Fine, mixed, thermic, active, Typic Hapludult
7	Fine, mixed, thermic, semi-active, Typic Hapludult
8	Fine, mixed, thermic, semi-active, Typic Hapludult
9	Fine, mixed, thermic, semi-active, Ochreptic Hapludult
10	Fine, mixed, thermic, semi-active, Ochreptic Hapludult
13	Fine, mixed, thermic, active, Typic Hapludult
14	Fine, mixed, thermic, semi-active, Typic Hapludult
17	Fine, mixed, thermic, semi-active, Typic Hapludult
19	Fine-silty, mixed, thermic, semi-active, Typic Hapludult
20	Fine, mixed, thermic, semi-active, Ochreptic Hapludult
21	Fine-silty, mixed, thermic, semi-active, Typic Hapludult
22	Fine, mixed, thermic, active, Typic Hapludult

Table 22. Soil classification of pedons on the Maryville Formation located in Anderson County, Tennessee.

Pedon	Classification
1	Fine, mixed, thermic, semi-active, Ochreptic Hapludult
3	Fine, mixed, thermic, subactive, Typic Hapludult
4	Fine, mixed, thermic, semi-active, Ochreptic Hapludult
5	Fine-loamy, mixed, thermic, semi-active, Ochreptic Hapludult
9	Fine, mixed, thermic, active, Typic Hapludult
10	Fine, mixed, thermic, semi-active, Typic Hapludult
11	Fine, mixed, thermic, subactive, Typic Hapludult
12	Fine, mixed, thermic, semi-active, Typic Hapludult
19	Fine, mixed, thermic, semi-active, Typic Hapludult
20	Fine, mixed, thermic, semi-active, Typic Hapludult
21	Fine, mixed, thermic, semi-active, Ochreptic Hapludult
22	Fine, mixed, thermic, semi-active, Ochreptic Hapludult

VITAE

Janice Branson has lived most of her life in Corryton, Tennessee. She was raise on a farm where the primary products were beef cattle and tobacco. This has given her a deep love for the land and for animal which have been carried throughout her life. After graduation from Gibbs High School, Janice was awarded a four-year academic scholarship to Carson-Newman College where she earned a B. S. degree in physical education. She went to work at Robertshaw Controls as a factory worker for thirteen years. During this time, Janice realized she needed to return to agriculture if she was to find employment she could truly enjoy and from which to learn. Janice obtained a second B.S. degree from the University of Tennessee in plant and soil science. At the urging of Dr. Tom Ammons, she continued her education and obtained a M. S. degree from the University of Tennessee. In the interim, she became a staff member at UT working on a contract from Oak Ridge National Laboratory. This was a major undertaking in soil background characterization which became the basis for the dissertation presented in this volume. Janice plans to continue working in some aspect of agriculture whether it be in academics, soil survey, agricultural extension, or as a consultant. As Dr. Tom Ammons is fond of saying after a Ph. D. is earned "Now the real learning begins".

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