SOIL MINERALOGY OF AN UPPER COASTAL PLAIN LANDSCAPE IN VIRGINIA

by

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(ABSTRACT)

A heavy mineral mining company (RGC Inc.) faces challenging mining and reclamation practices for its proposed operation in the Upper Coastal Plain of Virginia due to the high clay content of the deposit. The original intent of this study was to identify the mineralogy present in the proposed mining area and to determine similarities and differences among sampled pedons. Twenty eight typical pedons were sampled throughout the profile and these samples were prepared for mineralogical analysis. The pedon comparisons were performed to determine differences due to location and geomorphic surface, and due to drainage. Statistical results were then used to relate mineralogy, together with data on pH, CEC, and particle size distribution to pedogenesis in the area. Coastal Plain soils had sandier subsurface horizons than Piedmont soils. The above-scarp soils (> 75 meters) were the most mature Coastal Plain soils and approached the kaolinitic Piedmont soils reasonably well in mineralogy and particle size distribution. Coastal Plain soils were dominated by kaolinite, HIV and gibbsite. Wet soils were less mature in mineralogy due to the lack of weathering activity. All but the Piedmont soils contained a surface mica enrichment, believed to be eolian additions. Well drained and moderately well drained soils had a more mature mineralogy than somewhat poorly and poorly drained soils. Kaolinite contents increased with depth whereas

HIV contents tended to be concentrated in the A horizon. Despite the large clay content, the low charge nature of all soils should limit problems associated with clay dispersion practices during the mining. The low charge nature of the soils is reinforced by low ECEC data.

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INTRODUCTION

Renison Goldfields Consolidated Limited (RGC) is a large, diversified mining company based in Sydney, Australia, with operations in base metals, precious metals, oil, gas and mineral sands. The RGC Mineral Sands Division has been mining heavy minerals in Western Australia and Florida for many years. The most important commercial heavy minerals are zircon and the titanium-dioxide-bearing rutile, ilmenite and leucoxene. Since these heavy metals are used for many purposes and in such a wide variety of end products, RGC is constantly increasing its knowledge of other potential mineralized areas through intensive exploration efforts.

In 1988, high concentrations of surficial heavy minerals were reported in a large area of the Virginia Upper Coastal Plain, about 97 km south of Richmond. Evaluation of this potential mineral sands deposit - the Old Hickory Project - confirmed its commercial viability. This was the beginning of the development of an integrated mining and restoration program. Since a surface-mining operation has such a big impact on the environment, the company must explore all possibilities to minimize this impact. Furthermore, the ultimate goal of the program is to mine and reclaim the area in such a way as to return it as closely as possible to its original form and land use.

Although RGC has developed great expertise in mineral sands mining operations and their successive reclamation programs in Australia and Florida, it may encounter new problems in Virginia. The proposed mining area in the Coastal Plain of Virginia is dominantly prime farmland and, to date, little research has been conducted regarding the return of mineral sands mining areas to rowcrop production. Additionally, the climatic and biotic factors, as well as geological and geographic features are quite different. The vegetation in Florida is adapted to a subtropical climate and grown mainly on sandy soils. The landscape and soils of the Florida deposit are much younger and less complex than in the Coastal Plain of Virginia. The high amount and the specific characteristics of clay minerals can also create a major problem in the mining and restoration operation. During the mining process, dispersed clay can interfere with mineral separation and material handling procedures. Flocculation characteristics of the clay fraction can make the de-watering of the slime ponds very difficult. Wetlands in the Old Hickory area also attract special concern because of their importance to water quality, wildlife- and plant species- conservation.

Twenty eight typical pedons were sampled throughout the profile and these samples were submitted for mineralogical analysis. The original intent for this work was to identify the mineralogy present in the Old Hickory area and to determine if there were significant differences in mineralogy among the pedons. These comparisons were performed to assess variability by location and geomorphic surface and by drainage. Statistical results were then used to relate mineralogy, together with data from pH, cation exchange capacity, base saturation, iron and particle size distribution to pedogenesis in the area and to evaluate the possibility of eolian additions. The data also were useful to predict the possibility of problems with the mining and reclamation activities.

LITERATURE REVIEW

1.1. Coastal Plain characteristics

1.1.1. Geomorphology - Geology

The Atlantic Coastal Plain region stretches over 2,200 km from southeastern New York and New Jersey to the Florida Keys and is as much as 320 km wide from the Piedmont to the present sea level. It is divided into three physiographic units that parallel the Atlantic Coast: the Upper (Inner), Middle, and Lower (Outer) Coastal Plains. Commonly, these subdivisions are separated by escarpments and each belt has distinctive topography and surficial stratigraphy (Colquhoun et al., 1991).

The Coastal Plain is a sequence of gentle seaward-sloping depositional plains, composed of unconsolidated fluvial, marine and eolian deposits that range in age from Pleistocene to Cretaceous (Daniels and Gamble, 1978). The highest plains are the oldest and the scarps mark major or minor differences in ages of the adjacent plains. The Coastal Plain laps westward onto the crystalline basement of the Piedmont province.

The Atlantic Coastal Plain terraces and related alloformations are most likely produced by mechanisms such as: increase in ice volume through late Neogene and Quaternary time, increase in oceanic-basin volume, and intra-plate upwarping of the eastern United States (Colquhoun et. al, 1991). The erosional scarps in the Coastal Plain mark different ancient shorelines. The Fall Zone Scarp at about 90 m above sea level marks the eastern limit of exposed Piedmont bedrock with cappings of Coastal Plain sediments; the Surry Scarp at about 33 m elevation marks the eastern limit of the inner Coastal Plain; and the Suffolk Scarp at about 17 m above sea level delineates the boundary between the middle and outer Coastal

Plain (Howard et al., 1992).

Several studies suggest that the Pliocene was characterized by a climate that was significantly warmer than the present (Dowsett and Cronin, 1990; Sarnthein and Fenner, 1987), thus causing glaciers to melt and the sea to transgress as far inland as the Fall Line. Pleistocene climates included significantly colder glacial episodes that alternated with warm, humid interglacials (Markewich et. al, 1990). This resulted in cyclic transgressive/regressive events which, together with a slow uplift of the area, gave the Coastal Plain a stair-stepped surface with depositional terraces and erosional wave-cut scarps. Bailey (1987) proposed the following depositional model: (1) initial rapid transgression and accumulation of a reworked sand sheet; (2) brief regression and/or stillstand; (3) renewed transgression and deposition of silty shelf sands and (4) progradation (regression) of a shelf, lagoonal, and possibly deltaic mud blanket.

The Upper Coastal Plain is underlain by Cretaceous and Tertiary sediments that unconformably overlap Mesozoic to Precambrian rocks of the Piedmont Section (Colquhoun et al., 1991). It is strongly dissected into irregular-sized remnants of a once more extensive plain. The Middle and Lower Coastal Plains have a stair-stepped topography whereby the degree of dissection of the plains (terraces) decreases from Middle to Lower Plains. Indeed, surface drainage by streams and their hydraulic gradient from the interfluve to the streams is much greater in the Upper and Middle than in the Lower Coastal Plain (Daniels and Gamble, 1978). The Middle Coastal Plain is underlain by Pliocene sediments with local overlays of Quaternary eolian, lacustrine, colluvial or alluvial deposits. The Lower Coastal Plain is of Quaternary age (Colquhoun et al., 1991).

Hack (1955), who studied the origin of the upland gravels of the inner Atlantic Coastal Plain, suggested that these gravels are of fluvial origin. This is in accordance with the statement of Daniels and Gamble (1978) that, in the Neuse drainage of North Carolina, most of the Middle and Upper Coastal Plain is of fluvial origin although there possibly are local marine elements present (see also Fig.1.1.). Sediments of fluvial origin show a typical textural sequence of coarse basal beds grading upward into finer beds. Considerable horizontal textural variability, however, can exist due to slightly different energy environments during deposition. The latter may result in the local occurrence of many soil series on a given surface (Daniels and Gamble, 1978).

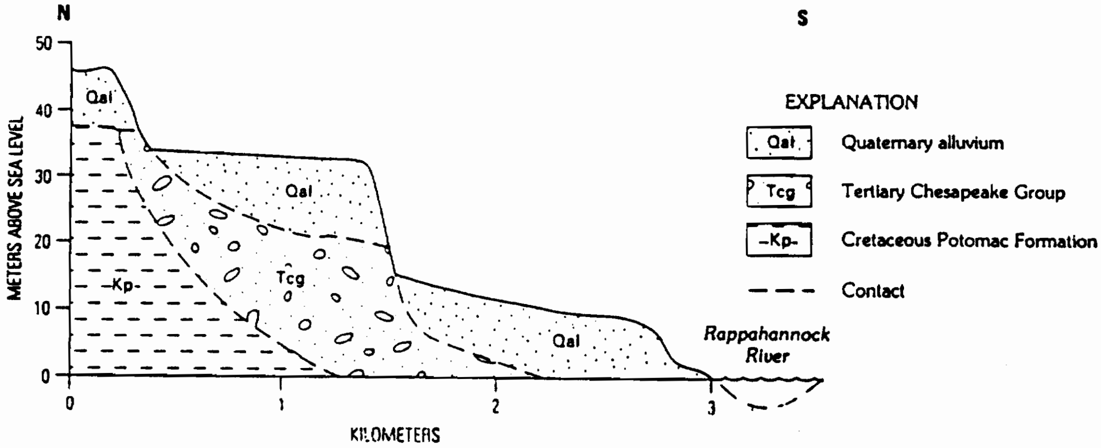


Figure 1.1. Cross-section showing series of alluvial terraces on the inner Coastal Plain in Virginia, from Markewich et al. (1987).

The Middle and Lower Coastal Plain surficial sediments are largely marine or lagoon deposits. The coastal terraces are believed to be former marine shore/nearshore platforms although they merge into, or are cut by, fluvial terraces along the transverse rivers (Colquhoun et al., 1991). These sediments have contrasting particle size distributions in almost any vertical or horizontal sequence (Daniels and Gamble, 1978). Although several authors mention eolian depositions (Murray, 1961; Daniels and Gamble, 1972), there seems to be a lack of clear-cut evidence for those kinds of additions.

The Piedmont and Coastal Plain regions are adjacent and meet each other in the Fall Zone, commonly known as the Fall Line. This physiographic boundary is generally marked by rapids or falls in the major drainages. The Piedmont and Coastal Plain provinces have similar long-term climatic histories and slow uplift rates (e.g., 10 to 20 m/Ma, Markewich et al., 1990) but have fundamentally different soil parent materials. Soils in both provinces reach maximum maturity near the Fall Zone (Markewich et al., 1990).

1.1.2. Soils

The dominant controls on upland soil development in the Piedmont and Coastal Plain are parent material and time. Parent material is generally the more important because it strongly influences near-surface soil texture and permeability, which in turn, influences soil residence time.

The distribution of soils on a local or regional landscape, under udic moisture regime, however, is controlled by the interaction of time, parent material and soil moisture regime. The first two factors on constructional Coastal Plain surfaces are set by the sedimentation history of the area. The soil moisture regime, however, can be modified by anything that affects the retention or movement of water on a regional or local landscape. Because water movement is mainly influenced by landscape dissection, the latter is thought to be one of the major driving forces in weathering and soil development in Coastal Plain areas with a humid climate (Daniels et al., 1975b; Daniels and Gamble, 1978).

The Piedmont is commonly characterized by low infiltration rates (0.5 to 14 cm/h, Markewich et al., 1990), relatively high runoff/precipitation ratios and intense chemical weathering. Near the Blue Ridge, where relief is relatively high and slopes are steep, Inceptisols and thin Hapludults are common. Near the Fall Zone, progressively thicker Hapludults and Paleudults occur. In the Coastal Plain, pedogenesis generally begins in silicious sedimentary parent material (alluvium, marine sands and clays, or dune sands) that is texturally more coarse-grained and mineralogically more mature (e.g., significantly less feldspar, K-mica, iron silicates and iron sulfides; Markewich et al., 1986) than the Piedmont regolith. Coastal Plain soils typically have higher infiltration rates (13-28 cm/h, Markewich et al., 1990) and a lower runoff/precipitation ratio. Near the Fall Zone of the Coastal Plain, extremely thick (pedon thickness 5-10 m) mineralogically mature soils (Paleudults) are most common. In the central part of the Coastal Plain, 2 to 5 m thick Hapludults and Paleudults have developed. Near the coast, where the degree of dissection is minimal, Spodosols, Spodosols with argillic horizons and Ultisols with spodic horizons are most common (Markewich et al., 1990).

Because of the great age of some of the Coastal Plain surfaces and the similar composition of the sediments, especially in the upper and middle Coastal Plain, the same soil or group of soils can occur on more than one surface. However, such soil features as solum thickness, depth to water table, depth to and thickness of plinthite, and percentage of gibbsite show distinct and measurable decreases from older (upper) to younger (middle) surfaces (Daniels and Gamble, 1978). In addition, there are changes in the mineralogy of the original sediment that are related to the geomorphic surface.

1.1.3. Mineralogy

Changes in soil mineralogy are consistent with the idea of increased mineral weathering with time. Indeed, there is a shift from a siliceous - kaolinitic mineralogy in the upper and middle Coastal Plain to a mixed-montmorillonitic mineralogy in the lower Coastal Plain (Daniels and Gamble, 1978).

The mineralogy of the clay fraction changes from a more complex mixed mineralogy (kaolinite, vermiculite and gibbsite) to a simpler, kaolinitic mineralogy through time (Markewich et al., 1989). In the surficial sediments, quartz usually dominates the sand fraction, with minor amounts (< 10%) of feldspar and resistant heavy minerals. The clay fraction is largely kaolinite with less than 2% mica (Daniels et al., 1971). The increase of hue (or rubification) through time also indicates the continuous formation and accumulation of iron oxides and oxyhydroxides in the solum (Markewich et al., 1989), as suggested by the Al_2O_3 + Fe_2O_3 / SiO_2 ratio which appears to increase at a constant rate with time.

1.1.4. Climate

The Coastal Plain of the Eastern United States has a humid subtropical to humid temperate climate. The soil temperature regime in the Coastal Plain south of Maryland is thermic where the mean annual soil temperature ranges from 15 to 22 °C at a depth of 50 cm and the difference between mean summer and mean winter soil temperatures is greater than 5 °C. The soil moisture regime in the Coastal Plain is udic where, in most years, the soil moisture control section is not dry in any part for as long as 90 cumulative days (Soil Survey Staff, 1990). Annual precipitation for Dinwiddie and Sussex Counties is 1.14 meters with peak rainfall occurring during the months of July and August; average snowfall is 0.23 meter. Average temperatures are 5° C in winter and 26° C in summer, and average relative humidity is 50 %.

1.2. The Old Hickory Project

The Old Hickory project area is located in the Upper (Inner) Coastal Plain, just east of the Fall Line. An eastward facing scarp divides the area into a high and a low depositional level. Heavy minerals occur in both levels and the deposits merge together as a continuous orebody. The Old Hickory deposit was depicted by Carpenter and Carpenter (1991) and drawn by Mallard as seen in Figure 1.2. Carpenter and Carpenter (1991) recognized two lithologic units within sediments

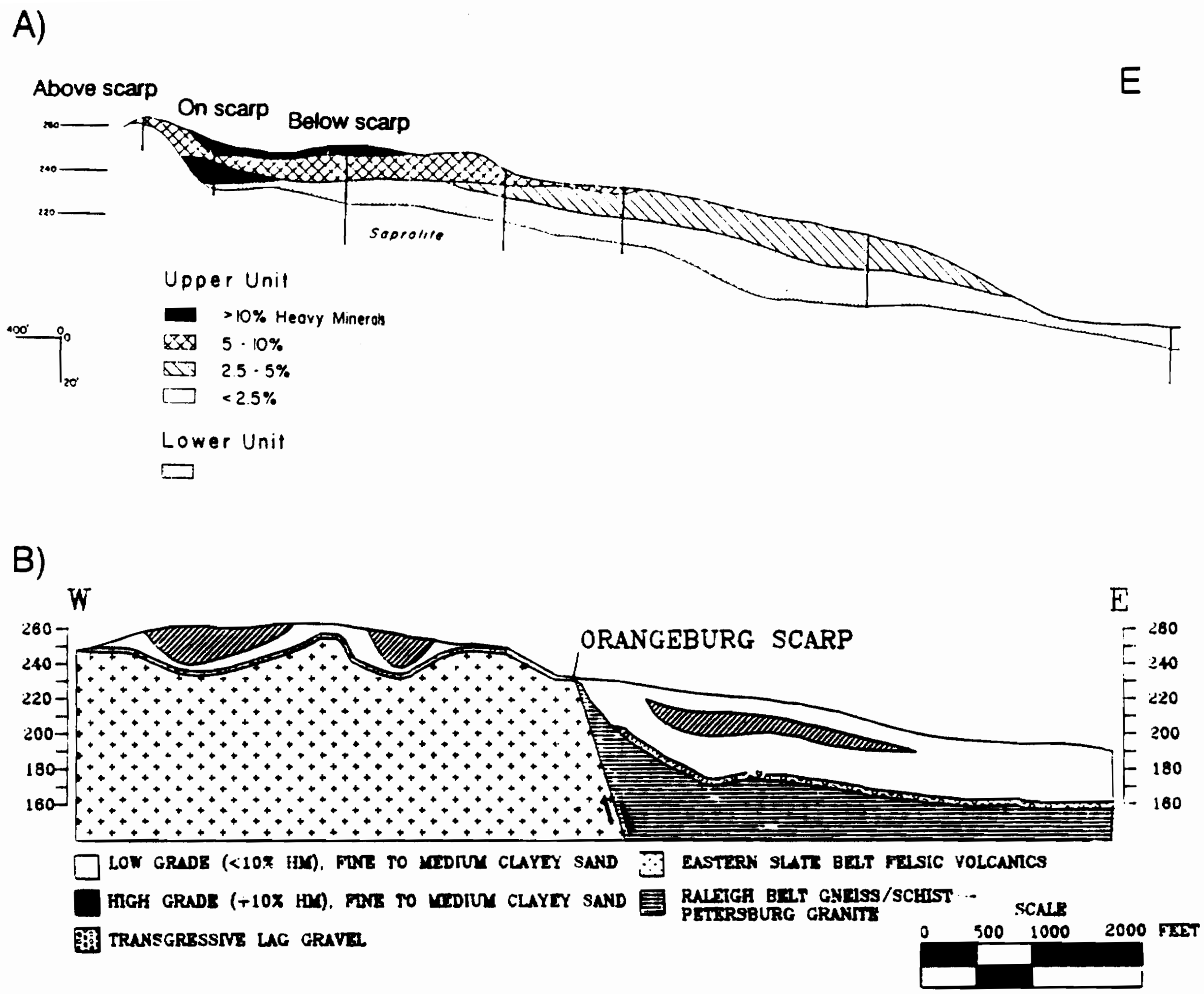


Figure 1.2. Geologic cross section through the Old Hickory heavy mineral deposit A) by Carpenter and Carpenter (1991) and B) drawn by E. Mallard.

of the upper Coastal Plain in the study area: the lower and the upper unit. The lower unit consists mainly of poorly sorted sands, gravelly sands and dispersed clay, and is not well exposed in outcrops. The upper unit is a fine, clayey sand in which the sand fraction is well sorted. Heavy mineral deposits of economic interest are confined mainly to the upper unit. Both units lie on top of crystalline basement Piedmont rocks. These Piedmont rocks are exposed at the surface, mainly as saprolite, to the west of the Old Hickory area in the upper level deposit.

The heavy minerals have supposedly been deposited during a very active sea-event such as a major storm or major successive storms. These storms should have had enough energy to displace quantities of heavy minerals from the seabottom and rework them to the beach.

A striking paradox is the rather uniform occurrence of widely distributed clay in all of the terrace sands. The origin of this clay is not currently known. It seems unlikely that substantial amounts of clay could have been co-deposited with sand rich in heavy minerals. Therefore, two alternative origins for the clay are considered. The clay could have formed by weathering of sand-size feldspar grains deposited with quartz and heavy minerals, or the clay was introduced into the sands after deposition (Carpenter and Carpenter, 1991).

The lower and upper units are interpreted to be updip, near-shore equivalents of the Yorktown Formation, which represents a major transgressive-regressive sequence in the Pliocene (Carpenter and Carpenter, 1991).

1.3. Soil minerals in short

There are far too many minerals to describe them all, but it is important to know some major characteristics of the most prominent species.

Kaolinite is a 1:1 phyllosilicate that stands almost at the end of the weathering sequence. It is therefore a good indicator of long-term weathering in soils. Kaolinite has a low surface area, very low charge and low CEC, as seen in Table 1.1. Vermiculite is a 2:1 phyllosilicate with a high surface area, high charge, high CEC and limited expansion. The charge of this mineral is in most soils partly neutralized by aluminum hydroxides, by which a stable hydroxy-interlayered vermiculite (HIV) is formed. Smectites are 2:1 phyllosilicates that are responsible for the shrink-swell properties of a soil. With their very high surface area, medium charge, high CEC and unlimited expansion, these minerals are mainly present in

Table 1.1. Charge, CEC and Surface Area of some minerals (White and Zelazny, 1986)

Mineral	Charge	CEC (cmol/kg)	Surface Area (m2/g)
Kaolinite	0	0.2-15	5-30 (EGME)
Vermiculite	1.2-1.8	100-210	50-800 (EGME)
Montmorrillonite	0.4-1.2	57-200	309-859 (EGME)
Mica	1.2-2.0	< 1	-
Gibbsite	-	2-4	0.385-7.51 (N2)

young soils. They originate primarily by: (i) inheritance from parent materials, (ii) synthesis, and (iii) alteration of other phyllosilicates (Allen and Hajek, 1989). Mica's are primary clay minerals from which many secondary clay minerals form. These minerals have very high charge but due to the perfect fit of potassium in the interlayers, the surface area and CEC are extremely low. Feldspars are, next to quartz, the most widespread primary minerals in soils. These minerals (i.e., $KAlSi_3O_8$) occur usually in the coarser soil fractions, but they can be a minor component in coarse clay. Although the feldspar content tends to increase with depth, they sometimes persist throughout the profiles of strongly weathered soils, perhaps because they are protected from weathering by slowly permeable, fine-textured horizons (Allen and Hajek, 1989).

Gibbsite is an aluminum hydroxide that is known to form mainly in well drained soils from which most of the silica has been leached out. The mineral is most often an indicator of long-term weathering, but could sometimes be present in younger soils, having the proper conditions for its formation. There seems to be a negative correlation between gibbsite and vermiculite present in soils. The presence of vermiculite promotes the formation of Al-hydroxy-interlayered vermiculite rather than gibbsite. This principle is better known as the "anti-gibbsite-effect" (Jackson, 1963). Gibbsite has a low CEC and a low surface area. The amount of gibbsite has most often been described as decreasing with proximity to the surface. This was attributed to retention of aluminum in the interlayers of vermiculite, resulting in the formation of HIV, under the more acidic conditions in the upper horizons. Another proposal was given by Calvert et al. (1980a,b) who explained this trend by resilication of gibbsite to halloysite and subsequent transformation into kaolinite higher in the profile.

Quartz is a major constituent of most soils because (i) it is the second most common mineral, after feldspars, in the earth crust, and (ii) it is highly resistant to weathering (Allen and Hajek, 1989). Despite this stability, it can be solubilized under intensive weathering, especially when the grain sizes have become very small (Senkayi et al., 1985).

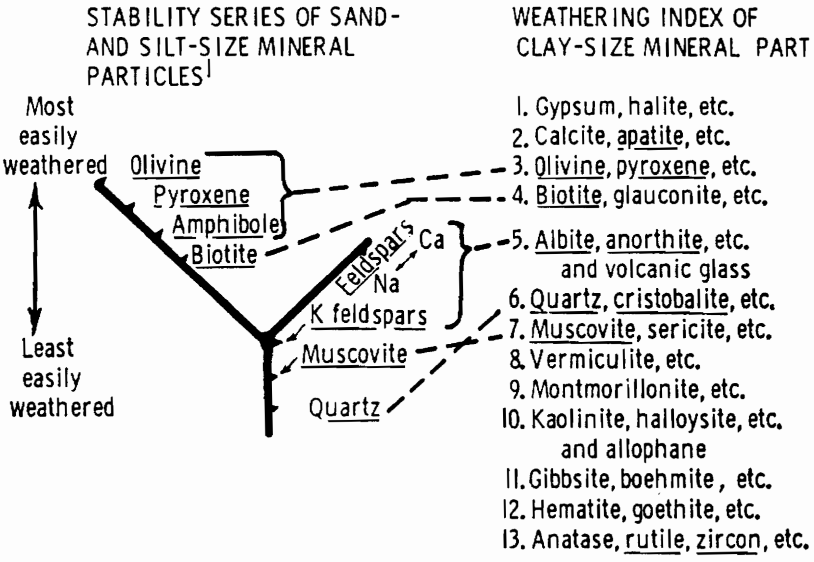
Titanium oxides such as rutile (TiO_2) and ilmenite ($FeTiO_3$) often occur in the sand fractions of soils as primary minerals inherited from igneous and metamorphic rocks. Rutile has a very pronounced stability in soil environments and is therefore sometimes used as an index mineral in soil-genesis studies. Ilmenite is less stable and tends to weather to anatase and leucoxene, which have been described as a mixture of Ti oxides (Anand and Gilkes, 1984). Another sand sized silicate is zircon ($ZrSiO_4$), which is an inherited mineral, tending to increase with weathering intensity. It is very stable and is therefore used as an index mineral in pedogenic studies or in determining the provenance of sediments. Kyanite (Al_2SiO_5), staurolite [$Fe_2Al_9O_6(SiO_4)_4(O,OH)_2$] and tourmaline [$(Na,Ca)(Li,Mg,Al)(Al,Fe,Mn)_6(BO_3)_3(Si_6O_{18})(OH)_4$] are silicate minerals that occur in minor quantities in the sand fractions of soils.

1.4. Weathering and weathering sequences

Weathering is a complex process of physical and chemical "changes" of a parent material as a soil forms and matures. Physical weathering is caused by mechanical processes and results in the production of smaller particles without a change in particle composition. Chemical weathering at the other hand attacks the particle composition through oxidation-reduction, hydrolysis and chelation reactions. The chemical weathering products depend on a variety of factors including time. Kittrick (1986) writes: "Weathering of minerals in soils is the transformation of constituents of minerals into forms that are more stable under current conditions". It can involve both the transformation of primary to secondary minerals and transformation of secondary to other secondary minerals. These mineral transformations are generally accompanied by a decrease in permanent charge, a decrease in Si/Al ratio, a major removal of bases, oxidation of Fe^{2+} to Fe^{3+} and a decrease of potassium (K) in phyllosilicate interlayers. Weathering stages tend to advance with increasing proximity to the surface (Jackson et al., 1948). The rate of weathering of soil particles is dependent on (1) temperature, (2) leaching and internal soil drainage, (3) soil reaction, (4) redox potential (5) biotic factors, (6) particle size and specific surface effects (7) specific weatherability of minerals, (8) chemical kinetics, (9) topography and (10) anthropogenic effects (White et al., 1990).

Three processes are considered to take place simultaneously in the weathering environment: (1) breakdown of parent materials with release of cations and Si, (2) removal in solution of some of the released constituents, and (3) reconstitution of the constituents to form new minerals which are stable or metastable in the environment (White et al., 1990; Loughnan, 1969).

Primary minerals of crystalline rocks are known to weather at different rates and secondary minerals tend to appear from these primary minerals in well established sequences (Tardy et al., 1973). Many articles have been written on weathering sequences and mineral stabilities, based on thermodynamics and stability approaches (Garrels, 1957; Kittrick, 1969; Kittrick, 1982). An important reflection is that soil mineral weathering is an attempt to reach equilibrium with the soil solution. Figure 1.3. demonstrates a comparison between stability series of sand- and silt-size mineral particles and the weathering index series of clay-size mineral particles after Goldich (1938) and Jackson (1968).



[1] Goldich 1938. Primary minerals are underlined in this figure.

[2] Jackson 1968.

Figure 1.3. A comparison between the stability series of sand- and silt-size mineral particles and the weathering index series of clay-size mineral particles, from Buol et al., 1980.

Several weathering sequences are known to exist depending on the local weathering environment as pictured in Figure 1.4.

The weathering sequences, studied in this work are :

Na-feldspar -> montmorillonite -> kaolinite ->* gibbsite

K-feldspar -> K-mica -> kaolinite ->* gibbsite

Mica (di) -> vermiculite -> smectite -> kaolinite ->* gibbsite

Mica (di) -> vermiculite -> HIV

* These transformations will only be possible in well drained conditions.

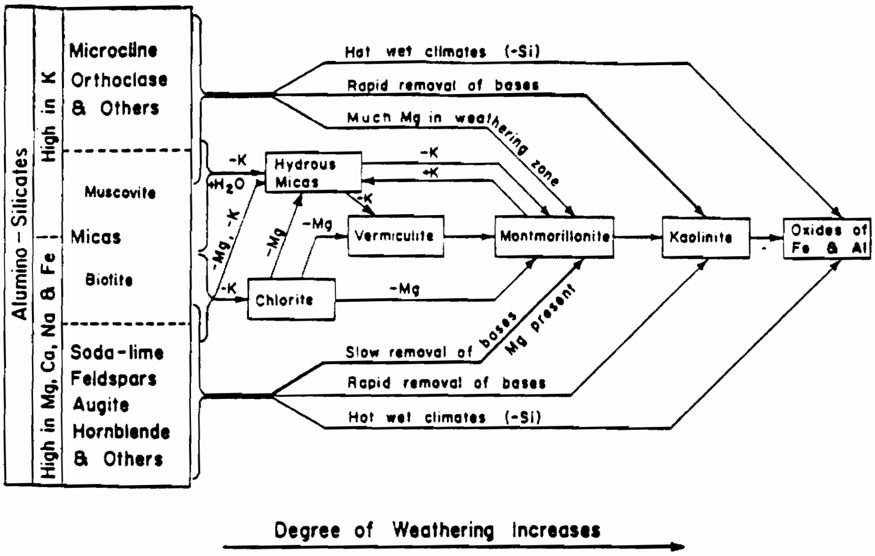


Figure 1.4. Diagram showing the general conditions for the formation of the various silicate clays and oxides of iron and aluminum, from Buckman and Brady, 1969.

MATERIALS AND METHODS

2.1. Soil samples

The Old Hickory Deposit is located 97 km south of Richmond, VA and 177 km inland from the Atlantic Coast (Fig. 2.1.). It is approximately 11.3 km long, between 800 and 2400 meters wide, and covers 22.3 km^2 of northwestern Sussex and southwestern Dinwiddie Counties, VA. Most of this area consists of highly productive farmland with tobacco and peanuts, rotated with corn and soybeans, as main crops.

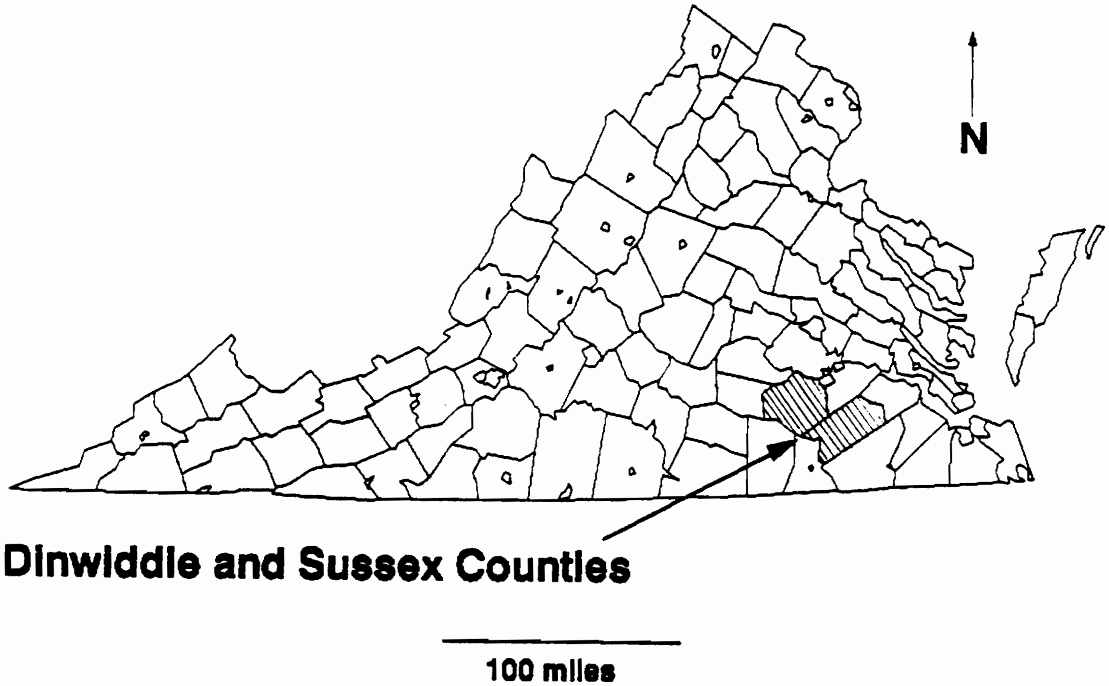


Figure 2.1. Location of the Old Hickory project, Virginia

The soils and landscapes of the Old Hickory area were mapped extensively during the 1989-1991 period. For each major soil type or soil series within the mining area, a "typical pedon" was selected and sampled throughout the profile. A "typical pedon" is representative for a soil type in the whole mapping area and is selected by experienced soil surveyors after considerable augering and correlation with existing soil series data. Samples from the A, B, and C horizons of twenty eight typical pedons were submitted for mineralogical analysis.

2.2. Pretreatments and measurements

Several pretreatments for mineralogical analyses were performed on all samples in order to remove the cementing agents and to fractionate the samples into various ranges of particle sizes.

Organic matter was removed by oxidation with H_2O_2 after buffering of the soil with 1 N NaOAc (pH 5.0) (Zelazny and Qureshi, 1972). Free iron oxides were removed by the dithionate-citrate-bicarbonate (DCB) method (Mehra and Jackson, 1960; Holmgren, 1967). The sand fraction (> 50 µm) was removed by wet sieving and the silt fraction was separated from the clay fraction (< 2 µm) by centrifugation (Day, 1965). Oriented mounts of the clay fraction were made using the suction-on-ceramic method (Gibbs, 1965). Samples were K-saturated and x-rayed at room temperature, 110°C, 300°C and 550°C; and Mg-saturated, glycerol solvated and x-rayed at room temperature and 110°C. The x-ray equipment consists of a Diano XRD-8300 diffractometer, employing Cu-Kα x-radiation and a graphite monochromator.

Clay-sized gibbsite and kaolinite were quantitatively measured by differential scanning calorimetry (DSC) using a Dupont 2910 thermal analyzer. The amount of kaolinite, calculated from DSC, could then be used as an internal standard to quantify the other minerals in the x-ray diffractogram.

Silt mounts (2-50 µm), prepared using the pipette-on-glass technique were x-rayed at room temperature. Grain mounts were prepared from the sand fraction (50 µm-2 mm) with Canada balsam as a mounting agent. The mineral suite was determined via optical petrography observing 200 grain counts per slide.

The quantity of each mineral was expressed as a weight percent (amount of mineral per 100 grams of clay, silt or sand). This was also recalculated into a mass percent (amount of mineral per 100 grams of soil-horizon). For that reason, the following calculation was performed: $(\text{mass \% mineral} = (\text{weight \% mineral} * \text{\% particle size of interest})/100)_{\text{horizon}}$. For the calculation of mass percentages for the clay fraction, however, we had to take into account the % iron, assuming that it was all present in this fraction. Indeed, the clay mineralogy was determined on an iron-free basis because we removed iron. The iron is not present as free iron, though, but rather as mainly coatings of an iron mineral on the clay minerals. Not knowing for sure the iron mineral species, we assume it to be hematite-like (Fe_2O_3). We then obtained $(\text{mass \% mineral} = (\text{weight \% mineral} * (\text{\% clay} - \text{\% } Fe_2O_3))/100)_{\text{horizon}}$.

Free iron oxides were extracted by DCB (Mehra and Jackson, 1960; Holmgren, 1967) and iron was measured by atomic absorption analysis (AAS) using a Perkin-Elmer atomic absorption spectrometer. Results were expressed as % free iron (elemental Fe per 100 grams of soil), as grams of Fe_2O_3 per 100 grams of soil and as gram Fe_2O_3 per 100 grams of clay. For the latter, the amount of Fe_2O_3 per 100 grams of soil was divided by the percentage clay, measured by the hydrometer technique (thus not iron-free).

Additional information determined for each sample were pH, exchangeable cations and acidity and cation exchange capacity (CEC). Soil pH was measured using a 1:1 soil:water slurry on a weight basis (McLean, 1982). Extractable Ca, Mg, and K were determined by AAS after extraction with N NH_4OAc buffered at pH 7 (Thomas, 1982). Exchangeable Al was extracted with N KCl (Barnhisel and Bertsch, 1982) and determined by AAS. Cation exchange capacity was determined by the summation of extractable Ca, Mg, K and exchangeable aluminum. Percent base saturation was calculated by dividing the sum of the basic cations by the total CEC.

2.3. General set-up and grouping of the data

The original intent for this work was to identify the mineralogy present in the Old Hickory area and to determine if there were significant differences in mineralogy among the pedons. Significant differences could impact the mining and especially the reclamation operation. To compare these pedons, I needed some kind of grouping to examine the mineralogy of the groups. Two groupings were chosen: one according to location relative to the scarp and another according to drainage. Both of these factors can have a major influence on soil formation.

Soil location in relation to the "scarp" which bisects the Old Hickory deposit was determined from a combination of field notes, elevation, and interpretation of the various topographic maps and geological information provided by RGC (see Fig. 1.2.). Soils "above the scarp" are mainly highly weathered, red soils formed in older fluvio-marine sediments occurring above 75 meters. Soils "on the scarp" are formed in exposed pre-weathered clayey materials and re-worked sediments. Soils "below the scarp" (<69 meters) are younger than those above the scarp and are formed in a mixture of re-worked sediments from higher elevations and more recent marine sediments.

Soils occurring in wetland areas and those forming in Piedmont outcrops were further grouped separately because of their unique characteristics (Daniels et al., 1992). Piedmont soils have higher silt and clay contents than the Coastal Plain soils due to their underlying saprolites, which constitute their parent material. Wetland soils are poorly drained and thus are not submitted to as intense weathering activity because of the lack of water, flushing the reaction products. They are generally less mature soils with coarser particle sizes. The sample sizes in the below-scarp, on-scarp, above-scarp, wet soils and Piedmont soils are 8, 6, 4, 6 and 4, respectively.

Considering the formation of the scarp, one can assume that the soils below the scarp must be younger than those above the scarp. Indeed, the scarp is a feature that was cut out of the older deposits by the sea, which through transgression left younger deposits on the foot of the scarp. Studying differences with location relative to the scarp can therefore be viewed as looking at the effect of time on mineralogy.

These same soils were also grouped according to drainage with the help of soils classification data. Four different drainage classes were used: well drained, moderately well drained, somewhat poorly drained and poorly drained. Sample sizes in well drained, moderately well drained, somewhat poorly drained and poorly drained classes are 19, 3, 2 and 4, respectively.

2.4. Mineralogical data

X-ray diffraction analysis is a very sensitive and accurate method for determining the mineralogy of a soil. Mineralogical interpretations, though, are very subjective and prone to human error. Thermal patterns (DSC) can help the interpreter to verify and support x-ray results, but even here, different persons will generate different quantitative estimates. It is estimated that a well trained x-ray diffraction analyst can determine a mineral percentage with a 5 % error-rate, but no precise values are known. As technology improves, computers will take over the role of the interpreter, which will largely eliminate human error.

2.5. Mass percentages versus weight percentages

A weight percentage is the amount of a mineral in the particle size of interest (sand, silt or clay). It is especially useful when looking at soil genesis and weathering sequences. From a mining standpoint, though, we are more interested in the amount of minerals that are present in the whole soil rather than in a particle size fraction. We therefore calculated mass percentages. Both data sets reveal important information on different points of interest.

2.6. Statistical analysis

After the samples were grouped, comparisons could be made to test significant differences among groups. Several comparisons were made:

a. mineralogy of all soils below the scarp, on the scarp, above the scarp, in wetlands and in Piedmont outcrops, both in weight and mass %.

b. mineralogy of only the well and moderately well drained soils below the scarp, on the scarp, above the scarp and in Piedmont outcrops in weight %.

c. mineralogy of all soils below the scarp, on the scarp and above the scarp, both in weight % and mass %.

d. mineralogy of all soils below and above the scarp, both in weight % and mass %.

e. mineralogy of all soils in well, moderately well, somewhat poorly and poorly drainage classes, both in weight % and mass %.

f. mineralogy of all A horizons versus B horizons and B horizons versus C horizons, grouped per location and geomorphic surface in weight %.

Two important facts had to be accounted for :

a. Visuals such as box-plots revealed a possible non-Gaussian-like distribution of the data.

b. The sample sizes per group were relatively high (19) to extremely low (2).

Boxplots of percentages clay in surface and subsurface horizons of the 5 different groups are given in Figure 2.2. The center line of the box marks the median or middle of the data. The box represents the middle 50%-range of the data. The "whiskers" go from the box to the furthest data value within the inner fences. The inner fences are calculated by adding 1.5 times the box-length at either side of the box. Outer fences are calculated by adding 3 times the box-length at either side of the box. The asterix * is a moderate outlier between the inner and outer fences. The dot o is an extreme outlier beyond the outer fences.

For these reasons, non-Gaussian-like distribution and uneven sample sizes, we decided to use nonparametric procedures. Nonparametric statistics are equivalent or only slightly less conservative for normal data than parametric procedures. For non-Gaussian data, however, the efficiency of nonparametric statistics is much higher than parametric statistics. This is especially true with this kind of data set for which it is safer to use nonparametric statistical procedures, based on their distribution-free assumptions and higher power with unequal sample sizes.

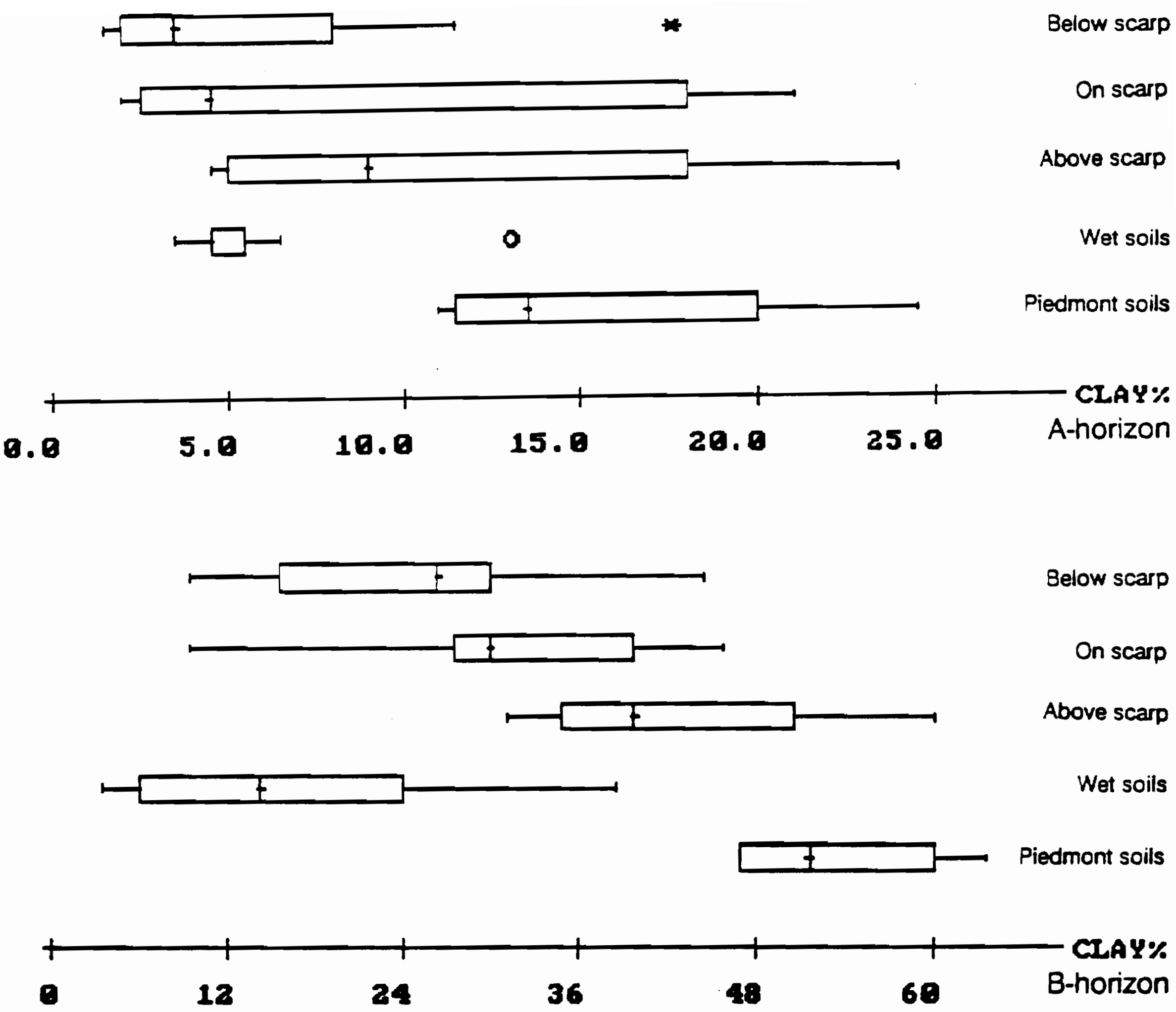


Figure 2.2. Boxplots of percentages clay in surface and subsurface horizons of the five different groups.

For the comparisons of soils as a function of location or as a function of drainage, the 1-way ANOVA by ranks, -better known as Kruskal-Wallis test- was performed. The model for this test is :

$$X_{ij} = \mu + \tau_i + e_{ij}$$

where :

X_{ij} = the j'th observation of group i

μ = the overall measure of location of the pooled groups

τ_i = the difference in location from μ for the i'th group

e_{ij} = random variability in the j'th observation from the i'th group

The null and alternative hypothesis can be formulated as such :

H_0: $\tau_1 = \tau_2 = ... = \tau_k = 0$ where k = the number of groups

H_A: $\tau_i \neq \tau_h$ for at least one pair of groups i and h

Thus, the Kruskal-Wallis test reveals whether or not differences exist among groups, at a significance level α. Given the small sample sizes, a significance level of 0.1 was used. The Kruskal-Wallis test will not indicate which groups differ from each other. Therefore, additional distribution-free multiple comparisons based on Kruskal-Wallis rank sums had to be performed. An approximation, valid for unequal sample sizes, was introduced by Dunn (1964). The decision is as such: $\tau_i \neq \tau_h$ if

$$|R_{.i} - R_{.h}| \geq z_{(\alpha/[k(k-1)])} \left[\frac{N(N+1)}{12}\right]^{1/2} \left(\frac{1}{n_i} + \frac{1}{n_h}\right)^{1/2}$$

where :

$R_{.i}$ = the mean of the ranks of the i'th group

$R_{.h}$ = the mean of the ranks of the h'th group

k = the number of groups involved

It is a common practice to use a slightly higher experimentwise error rate (decision level α) for the multiple comparisons than those customarily encountered in single-comparison inference procedures. The choice of α is determined in part by k, the number of groups involved, and is larger for larger k. Alpha levels for multiple comparisons can be 0.15, 0.20 or 0.25, depending on k (Daniel, 1990).

For the comparison of only two groups, the Kruskal-Wallis Chi-square distribution approximation was used.

For the comparison of the groups with depth, paired sample procedures had to be employed. Indeed, because the different horizons have supposedly been formed from the same parent material, there is a co-dependence in the mineralogy. All the soils were grouped according to location and geomorphic surface and in each group, the mineralogy of the horizons was compared to each other. The nonparametric tool for this test is the Sign test, with :

$$X_i = b_i + e_{1i}$$
$$Y_i = b_i + M + e_{2i}$$
$$Z_i = Y_i - X_i = M + (e_{2i} - e_{1i}) = M + e_i$$

where :

X_i = the X-group observation on the i'th pair

Y_i = the Y-group observation on the i'th pair

b_i = a blocking factor specific to the i'th pair

e_{1i} and e_{2i} = random variability in X_i and Y_i for i'th pair

e_i = random variability in Z_i, the i'th paired difference

Z_i = excess in Y_i over X_i

M = distribution median of Z_i

The null and alternative hypothesis can be formulated as such :

H_0: $M = 0$

H_A: $M > 0$ $M < 0$ $M \neq 0$

Given the small sample sizes within the groups, the Sign test was most appropriate. A one sided test is most powerful when one is aware a priori about a certain direction of the results. When no ad hoc direction is known, one is better off using the two sided test. The p-values of the tests were taken from Table A.2 (pages 259 to 263) in Hollander and Wolfe's nonparametric statistical methods book (1973). This table gives the upper tail probabilities for binomial distributions. The binomial distribution with $p = 0.5$ was used. In the case of equality in pairs, a standard solution is to delete the obtained zeros and to reduce the sample size. This has the disadvantage of making the test conditional on the non-zero pairs. An unconditional test was introduced by Lehman (1975), using a large sample approximation of the normal distribution with adapted mean and variance. Both of these test have limitations, however: if more than one third of the paired observations are equal, one cannot give any statistical conclusions. Most of the tests were performed two sided; the particle size analysis and some of the clay mineralogy were one sided tests. A decision level of 0.15 was used in these cases.

2.7. Important statistical analysis concerns

The groupings of the data (via location or drainage) gave only a small to very small number of soils per group. This is mainly due to the fact that there was no initial design for these kinds of comparisons. The soil samples were selected and analyzed in order to obtain knowledge of the mineralogy of the Old Hickory area. Only after sampling was there an interest to compare some of those groupings of soils. These small sample sizes are unsatisfactory for good statistical results. Normality tests, for instance, are insignificant when one has only three samples. Although nonparametric statistical procedures are more resistant against this sample size problem than Gaussian procedures, a greater number of soils per grouping would definitely enhance the efficiency of the tests.

Soils are formed by the influence of five soil forming factors: time, climate, vegetation, parent material and topography. It is statistically important to compare groups of soils that have varied by only one of these factors. This comparison necessitates that you have to keep the four other factors constant or nearly constant. This task is very difficult and not always practicable. If one compares soils for the influence of one factor and another factor has also an impact, an unknown part of the systematic variability (τ_i) of the group comparison will be occupied by that second factor. So, it is very important to always inquire into the influences of these soil forming factors on the systematic variability of the comparison.

RESULTS

Because of the presence of a very extensive data-set, it was decided to separate the results from the discussion. Doing so enables the reader as well as the writer to see the woods for the trees. It is indeed possible to get too preoccupied with statistical results so that important conclusions get lost in a corner of a page. One goal of this results-chapter is to present the data in graphical form and show the most prominent differences and trends. All tables with the base data are contained in Appendix I. Another purpose is to report the most important statistical results as seen in the tables from Appendix II. Answers on why these trends and statistical significances exist will be provided in the discussion chapter.

It was preferred to depict the data means as a function of landscape position and geomorphic surface instead of a function of drainage. There was not only a higher interest in the former grouping but also the sample sizes were more appropriate to make valid comparisons.

3.1. Soil pedon map and classification

The typical pedons and their location in the Old Hickory area are shown in Figure 3.1. (Hodges et al., 1992). Classifications of these pedons as determined by soil surveyors is included (Table 3.1)(Hodges et al., 1992).

3.2. Particle Size Distribution

The A horizon is dominated by sand in all groups and the highest percentage clay was found in the Piedmont soils (16 %)(Fig. 3.2). B horizons of all but the wet soils contain between 20 and 55 % clay. The Piedmont soils have much

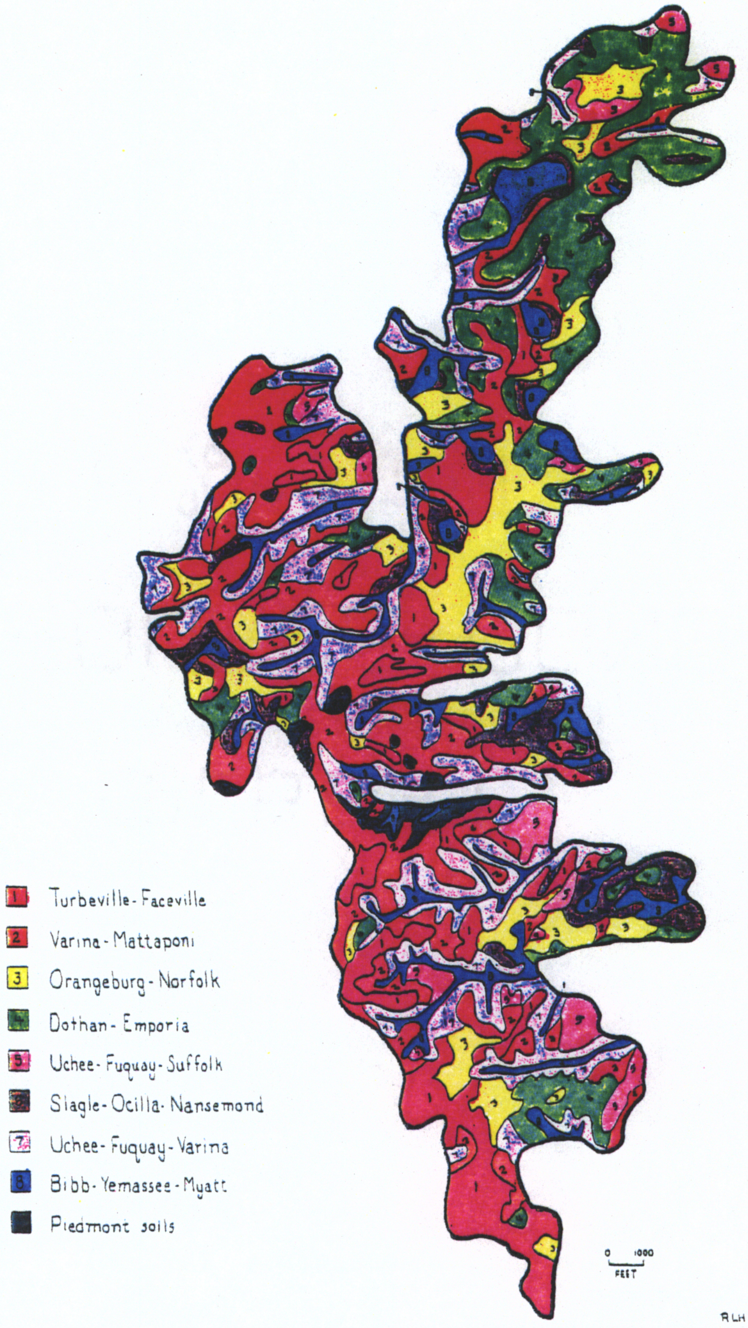


Figure 3.1. General soils map of the Old Hickory project, Virginia (Hodges et al., 1992).

Table 3.1. Classification of the soils in the Old Hickory project, Virginia (Hodges et al., 1992)

Soil name	Family or higher taxonomic class
Bibb	coarse-loamy, siliceous, acid, thermic Typic Fluvaquents
Dothan	fine-loamy, siliceous, thermic Plinthic Kandiudults
Dragston	coarse-loamy, mixed, thermic Aeric Ochraquults
Emporia	fine-loamy, siliceous, thermic Typic Hapludults
Faceville	clayey, kaolinitic, thermic Typic Kandiudults
Fuquay	loamy, siliceous, thermic Plinthic Paleudults
Georgeville	clayey, kaolinitic, thermic Typic Hapludults
Helena	clayey, mixed, thermic Aquic Hapludults
Herndon	clayey, kaolinitic, thermic Typic Hapludults
Masada	clayey, mixed, thermic Typic Hapludults
Myatt	fine-loamy, siliceous, thermic Typic Ochraquults
Nansemond	coarse-loamy, siliceous, thermic Aquic Hapludults
Norfolk	fine-loamy, siliceous, thermic Typic Kandiudults
Ocilla	loamy, siliceous, thermic Aquic Arenic Paleudults
Orangeburg	fine-loamy, siliceous, thermic Typic Kandiudults
Pickney	coarse-loamy, siliceous, acid, thermic Cumulic Humaquepts
Roanoke	clayey, mixed, thermic Typic Ochraquults
Slagle	fine-loamy, siliceous, thermic Aquic Hapludults
Suffolk	fine-loamy, siliceous, thermic Typic Hapludults
Turbeville	clayey, mixed, thermic Typic Kandiudults
Uchee	loamy, siliceous, thermic Arenic Hapludults
Vance	clayey, mixed, thermic Typic Hapludults
Varina	clayey, kaolinitic, thermic Plinthic Paleudults
Yemassee	fine-loamy, siliceous, thermic Aeric Ochraquults

less sand than the Coastal Plain soils where the sand fraction dominates the particle sizes, except in the above-scarp soils. The C horizon of all groups also contains more than 20 % clay. Piedmont soils are dominated by the silt fraction in their lowest horizon whereas Coastal Plain soils mainly are formed out of sands. In the above-scarp soils, the sand fraction does not dominate the particle size but has been weathered down to smaller particle sizes.

3.3. Clay mineralogy

The amount of kaolinite on a clay basis increases with depth for all groupings and dominates the clay mineralogy (Fig. 3.3.a). The Piedmont soils differ especially from the wet soils and the below-scarp soils in their percentage of kaolinite. Hydroxy-interlayered vermiculite (HIV) seems to be most stable in the A horizon and follows the same trends on a clay basis in all groupings (Fig. 3.3.a). Smectites are common in the clay fraction in the wet soils and appear highest on a soil basis in the C horizon of the wet soils and the B horizon of the Piedmont soils (Fig. 3.3.b). Percentage quartz is highest in the A horizon on a clay basis (Fig. 3.3.b). On a soil basis, all groupings contain less than 1 % clay sized quartz, with the highest amounts in the wet soils. When we examine mica on a clay basis, its content is highest in the clays and silts of the A horizon but on a soil basis, B horizons contain the highest quantities (Fig. 3.3.c). Piedmont soils contain less mica than Coastal Plain soils. Only traces of feldspars were found and those occurred mainly in the A and B horizons of the Coastal Plain soils (Fig. 3.3.c). Gibbsite occupies a fair quantity of the clay fraction of the Coastal Plain soils, except for the wet soils (Fig. 3.3.d). It appears to have a bulge in B horizons. The Piedmont soils contain surprisingly low amounts of gibbsite. Iron oxides tend to be high in Piedmont soils and in the above-scarp soils and comparably low in wet soils (Fig. 3.3.d).

3.4. Silt mineralogy

As in the clay fraction, the amount of kaolinite on a silt basis increases with depth for all groupings (Fig. 3.4.a). Especially the Piedmont soils contain a very high percent kaolinite. Hydroxy-interlayered vermiculite is mainly present in the below-scarp, on-scarp and wet soils, but constitutes less than 1.8 % on a soil basis

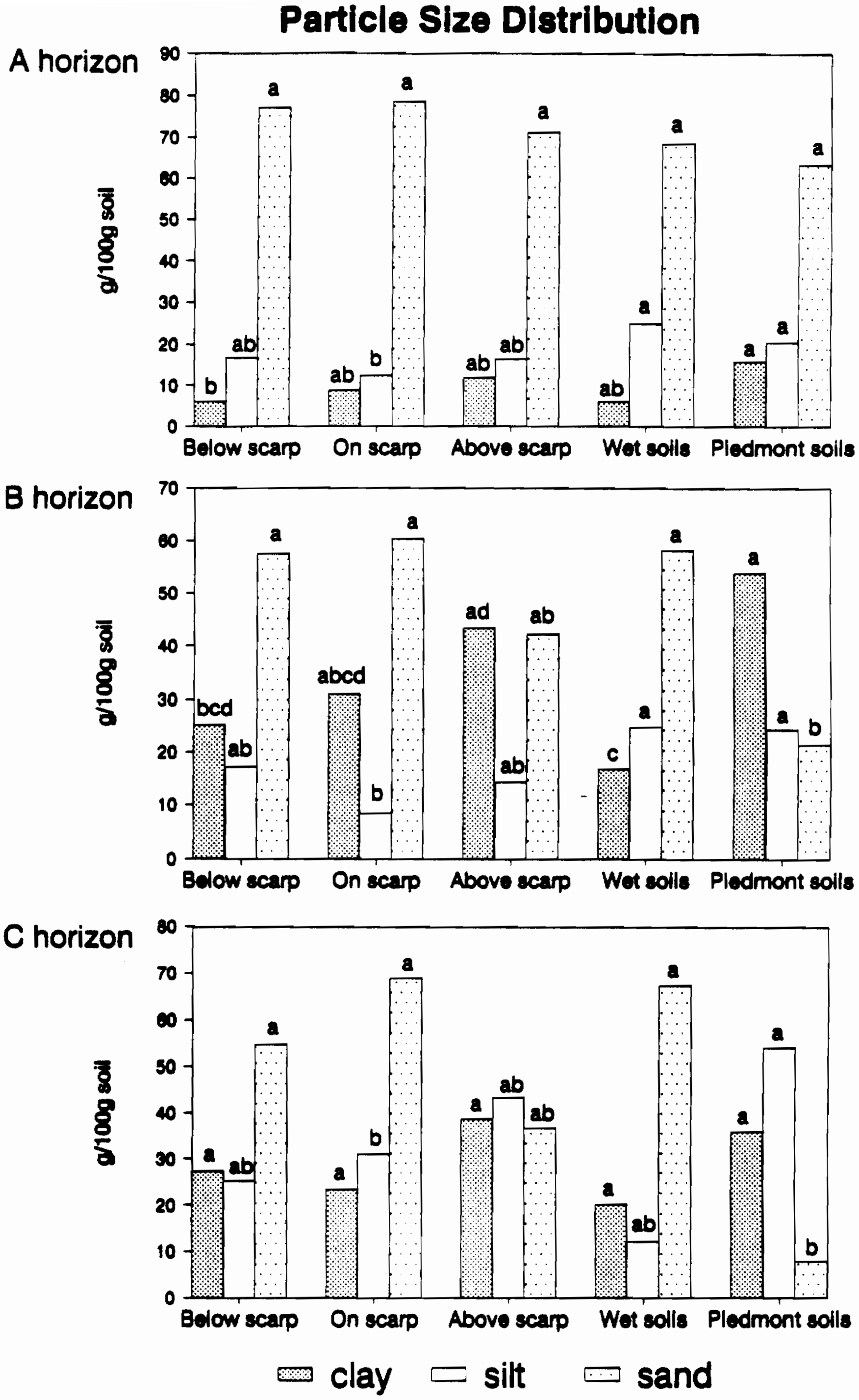


Figure 3.2. Comparison of the particle size distributions as a function of location and geomorphic surface. Lower case letters are for comparisons of one particle size among groups, where same letters in one horizon indicate no differences in that horizon.

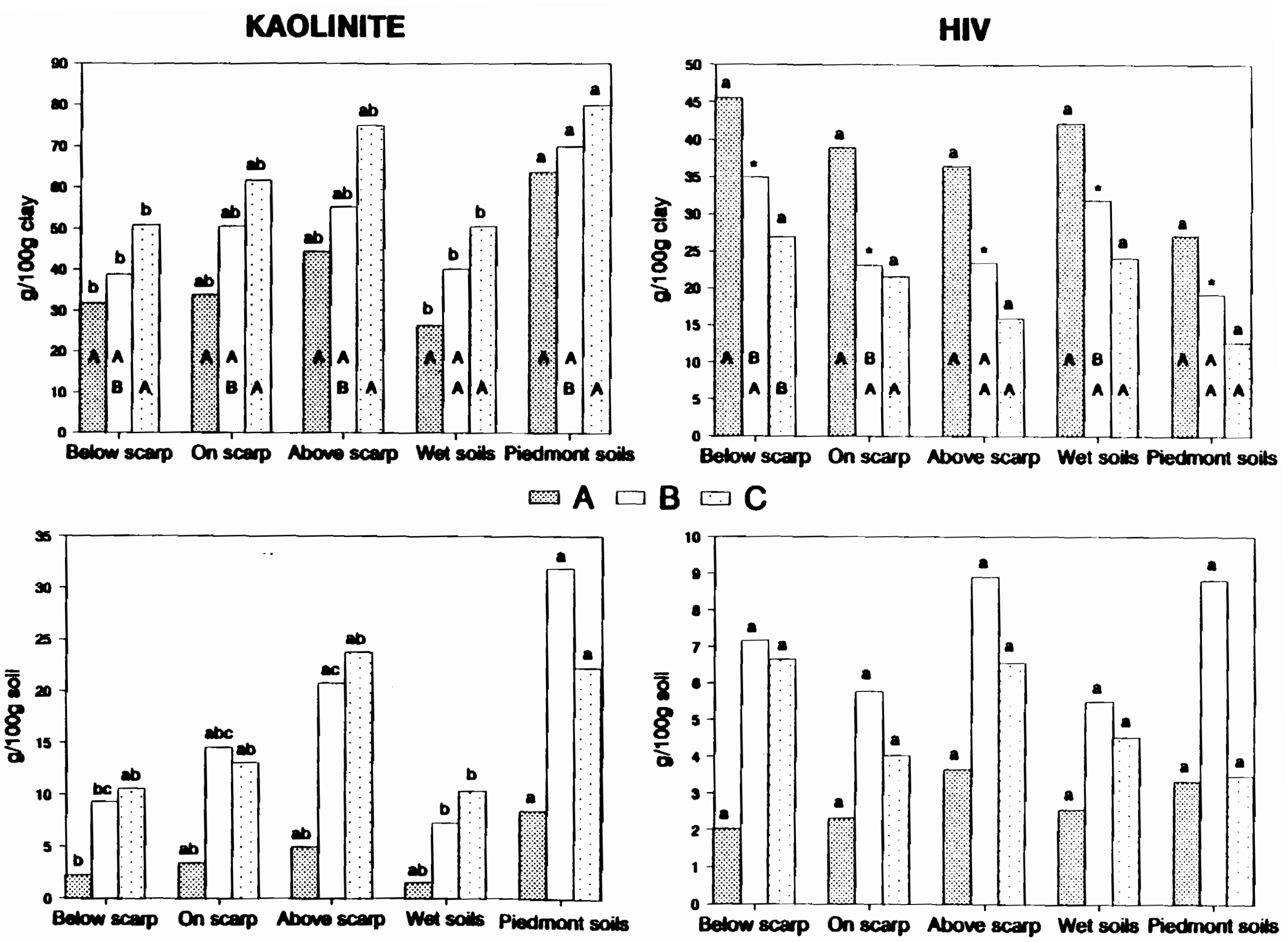


Figure 3.3.a Comparison of clay sized kaolinite and HIV as a function of location and geomorphic surface, both in weight % and mass %. Lower case letters are for comparisons of one horizon among groups. Upper case letters are for comparisons between A and B, and between B and C horizons within each group. Same letters indicate no differences. * experimentwise alpha-level too high

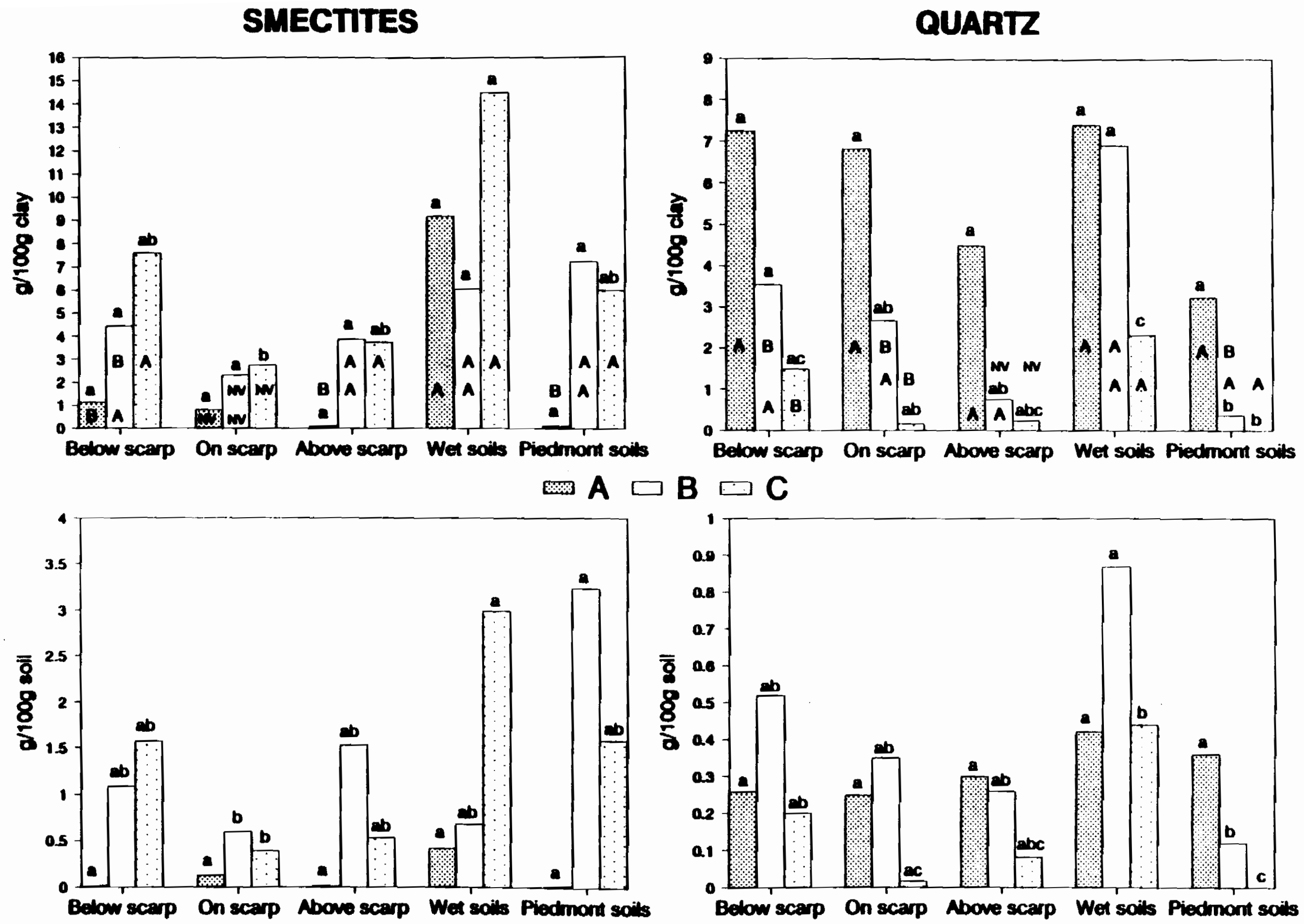


Figure 3.3.b Comparison of clay sized smectites and quartz as a function of location and geomorphic surface, both in weight % and mass %. Lower case letters are for comparisons of one horizon among groups. Upper case letters are for comparisons between A and B, and between B and C horizons within each group. Same letters indicate no differences. NV = no valid comparison

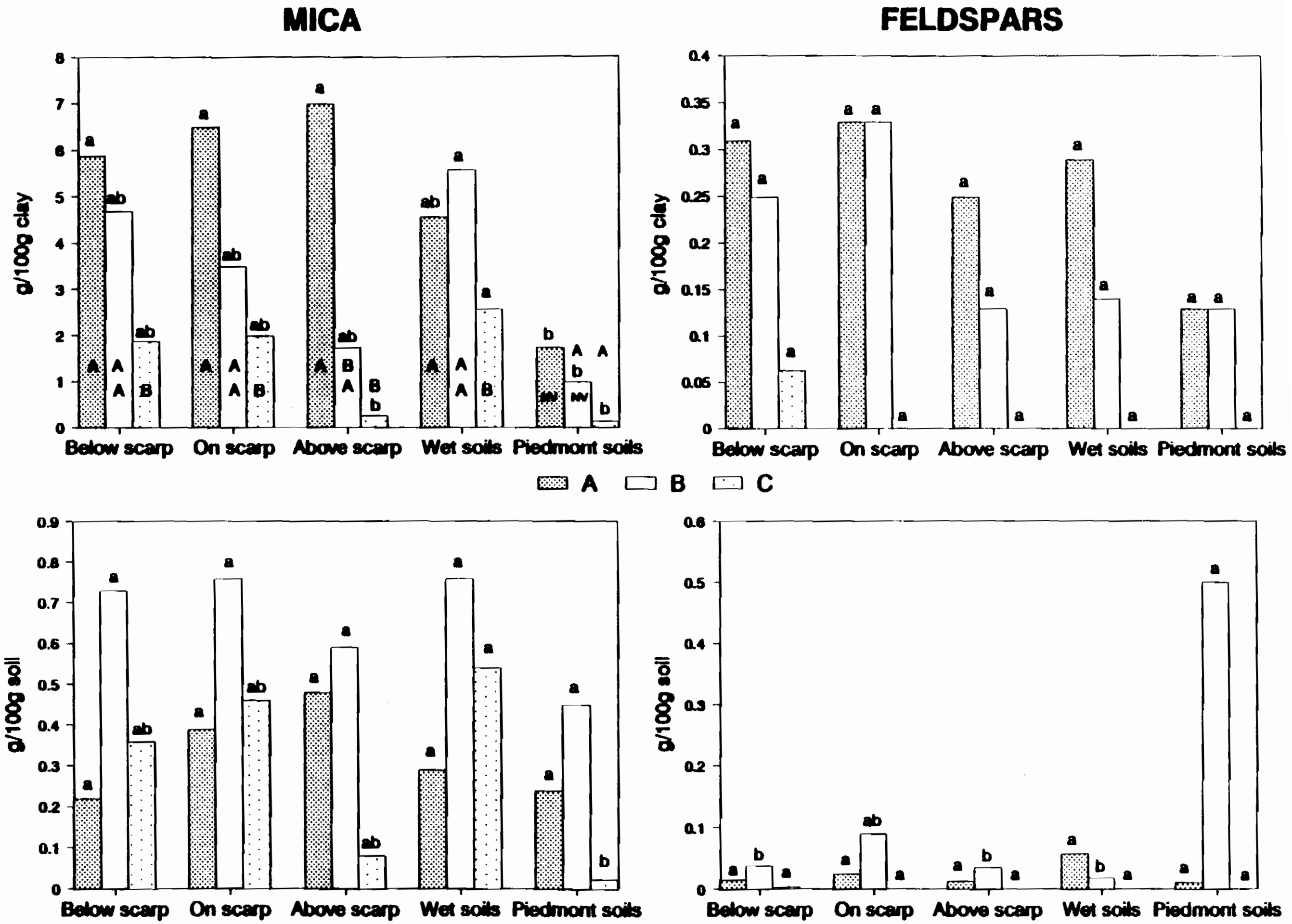


Figure 3.3.c Comparison of clay sized mica and feldspars as a function of location and geomorphic surface, both in weight % and mass %. Lower case letters are for comparisons of one horizon among groups. Upper case letters are for comparisons between A and B, and between B and C horizons within each group. Same letters indicate no differences. NV = no valid comparison

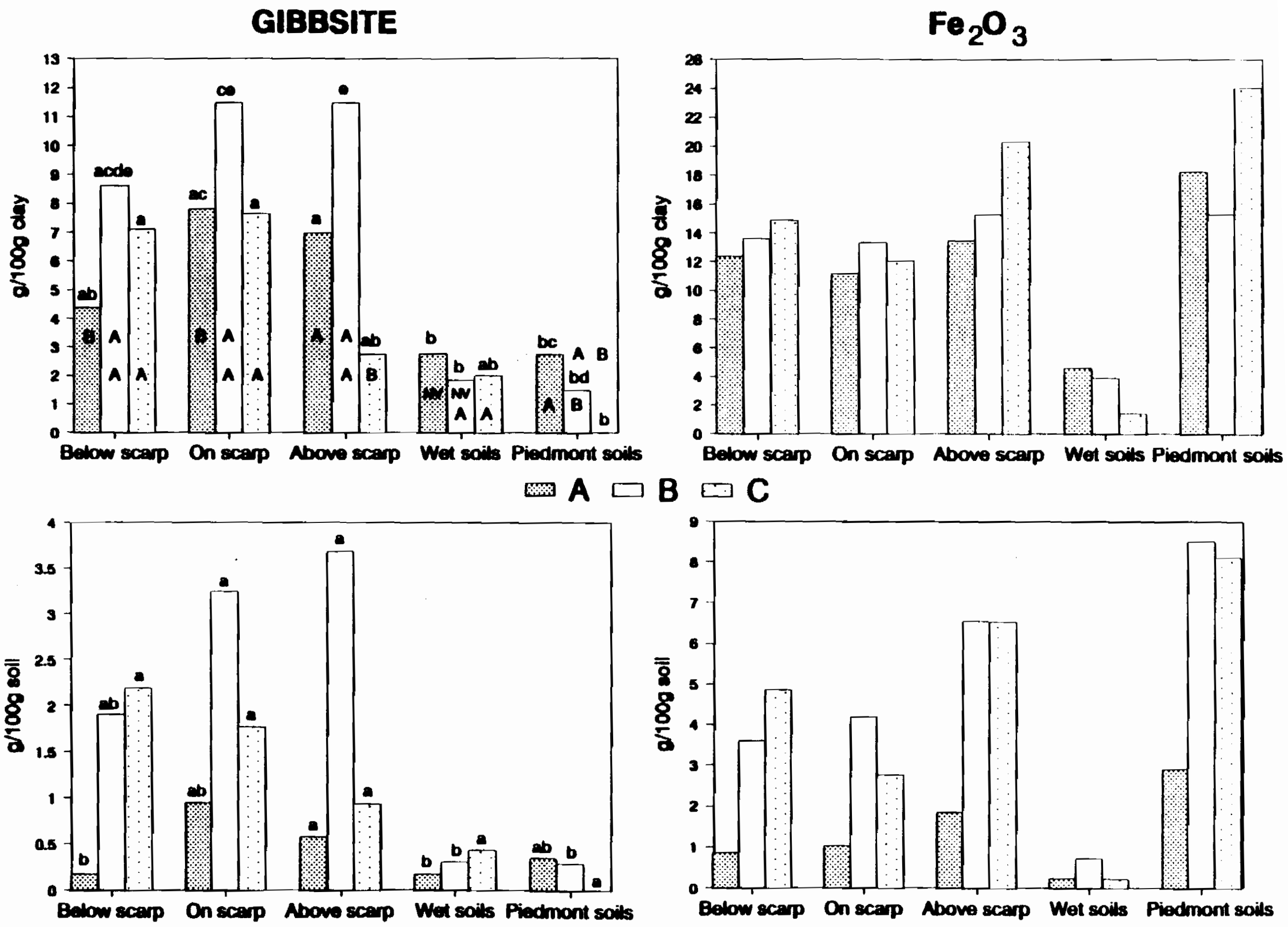


Figure 3.3.d Comparison of clay sized gibbsite and Fe-oxide as a function of location and geomorphic surface, both in weight % and mass %. Lower case letters are for comparisons of one horizon among groups. Upper case letters are for comparisons between A and B, and between B and C horizons within each group. Same letters indicate no differences. NV = no valid comparison

(Fig. 3.4.a). Mica occupies a fair amount of the silt fraction and seems to be highestin the surface horizons of the Coastal Plain soils (Fig. 3.4.b). Feldspars tend to be mostly present in the A and B horizons, but constitute only maximally 0.4 % on a soil basis (Fig. 3.4.b). Quartz dominates the silt fraction and has large quantities on a soil basis (up to 21 %) in the wet soils (Fig. 3.4.c).

3.5. Sand mineralogy

Quartz dominates the sand fraction and is fairly constant in all horizons throughout all groupings (Fig. 3.5.a). On a whole soil basis, the Piedmont soils contain much less quartz in the subsurface horizons than the Coastal Plain soils. Ilmenite occupies between 6 and 15 % of the sand fraction for all groupings and is lowest in B horizons of the wet soils (Fig. 3.5.a). Not many differences appear in the zircon distribution throughout the horizons and among the groupings (Fig. 3.5.b). The same is true for leucoxene, but this mineral tends to be concentrated in the subsurface horizon of below-scarp and wet soils (Fig. 3.5.b).

3.6. Physicochemical characteristics and pH

Effective CEC for all groupings was maximally 5 cmol/kg soil (Fig. 3.6.). Effective BS was high (> 80 %) in A and B horizons of below-scarp, on-scarp and above-scarp soils but lower for wet and Piedmont soils (Fig. 3.6.). Measurements of pH averaged around 5 with the pH of the A and B horizon being slightly higher (Fig. 3.6.).

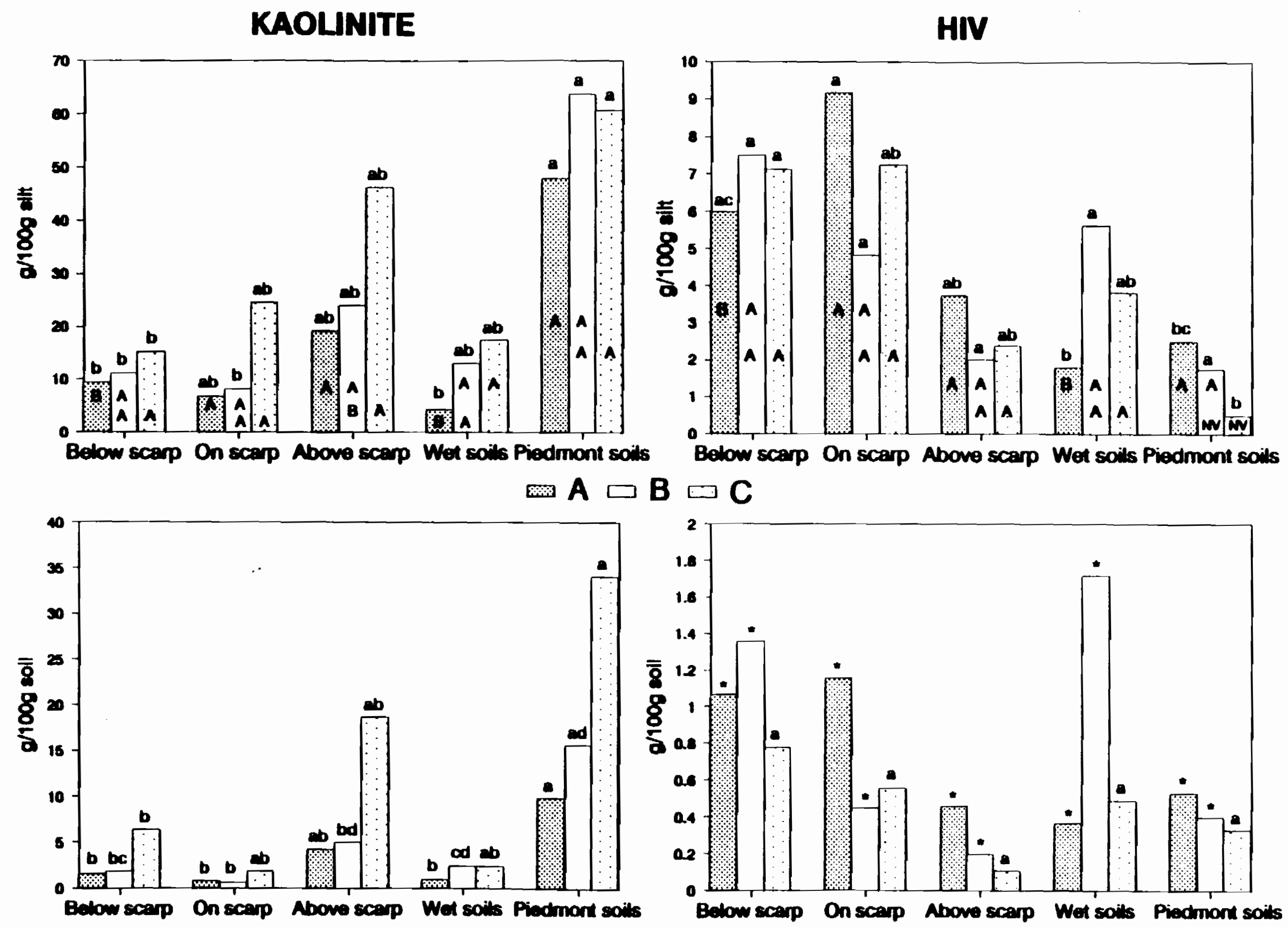


Figure 3.4.a Comparison of silt sized kaolinite and HIV as a function of location and geomorphic surface, both in weight % and mass %. Lower case letters are for comparisons of one horizon among groups. Upper case letters are for comparisons between A and B, and between B and C horizons within each group. Same letters indicate no differences. NV = no valid comparison * experimentwise alpha-level too high

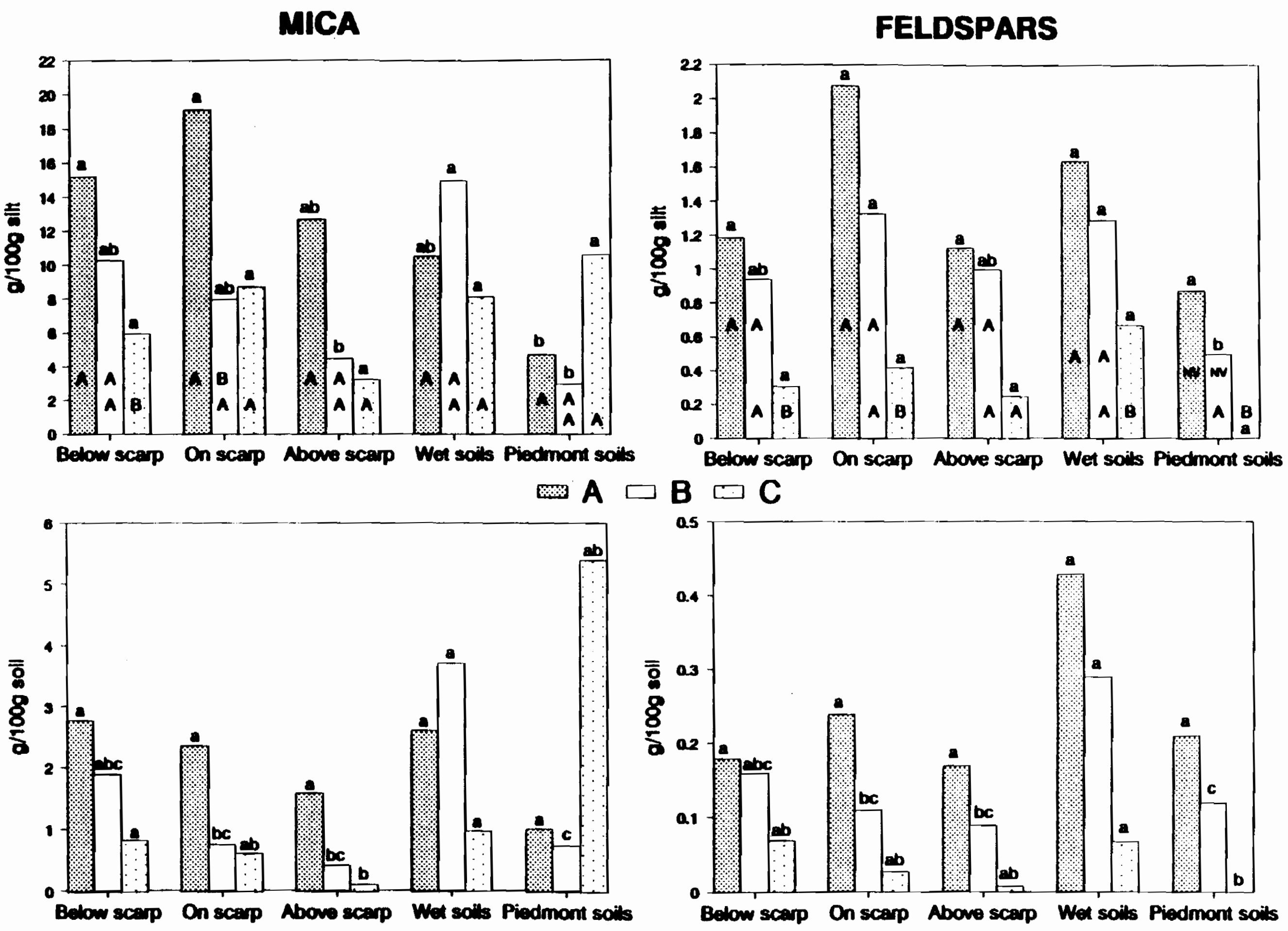


Figure 3.4.b Comparison of silt sized mica and feldspars as a function of location and geomorphic surface, both in weight % and mass %. Lower case letters are for comparisons of one horizon among groups. Upper case letters are for comparisons between A and B, and between B and C horizons within each group. Same letters indicate no differences. NV = no valid comparison

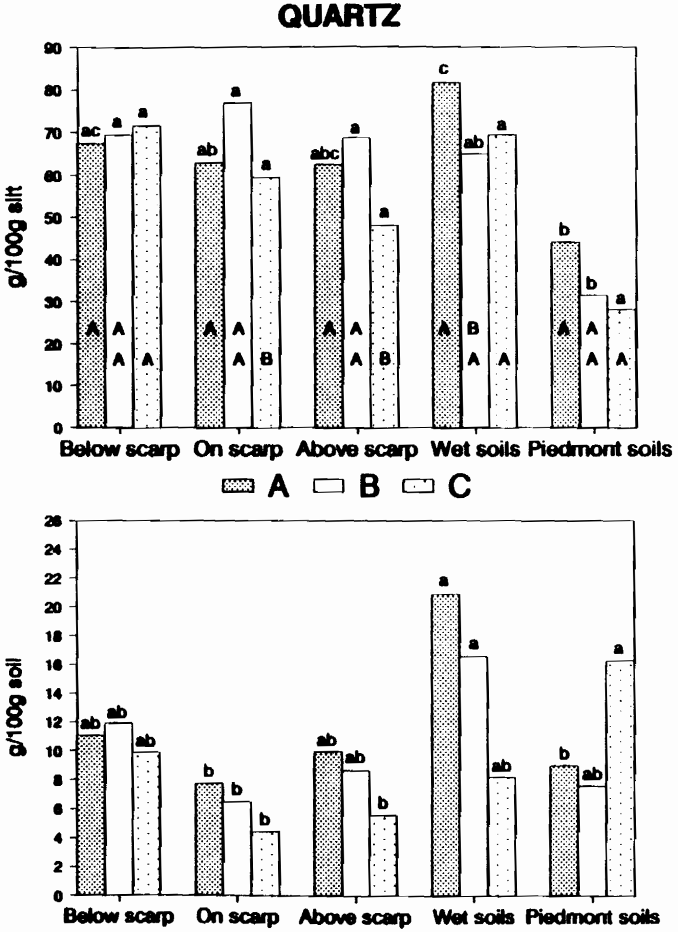


Figure 3.4.c Comparison of silt sized quartz as a function of location and geomorphic surface, both in weight % and mass %. Lower case letters are for comparisons of one horizon among groups. Upper case letters are for comparisons between A and B, and between B and C horizons within each group. Same letters indicate no differences.

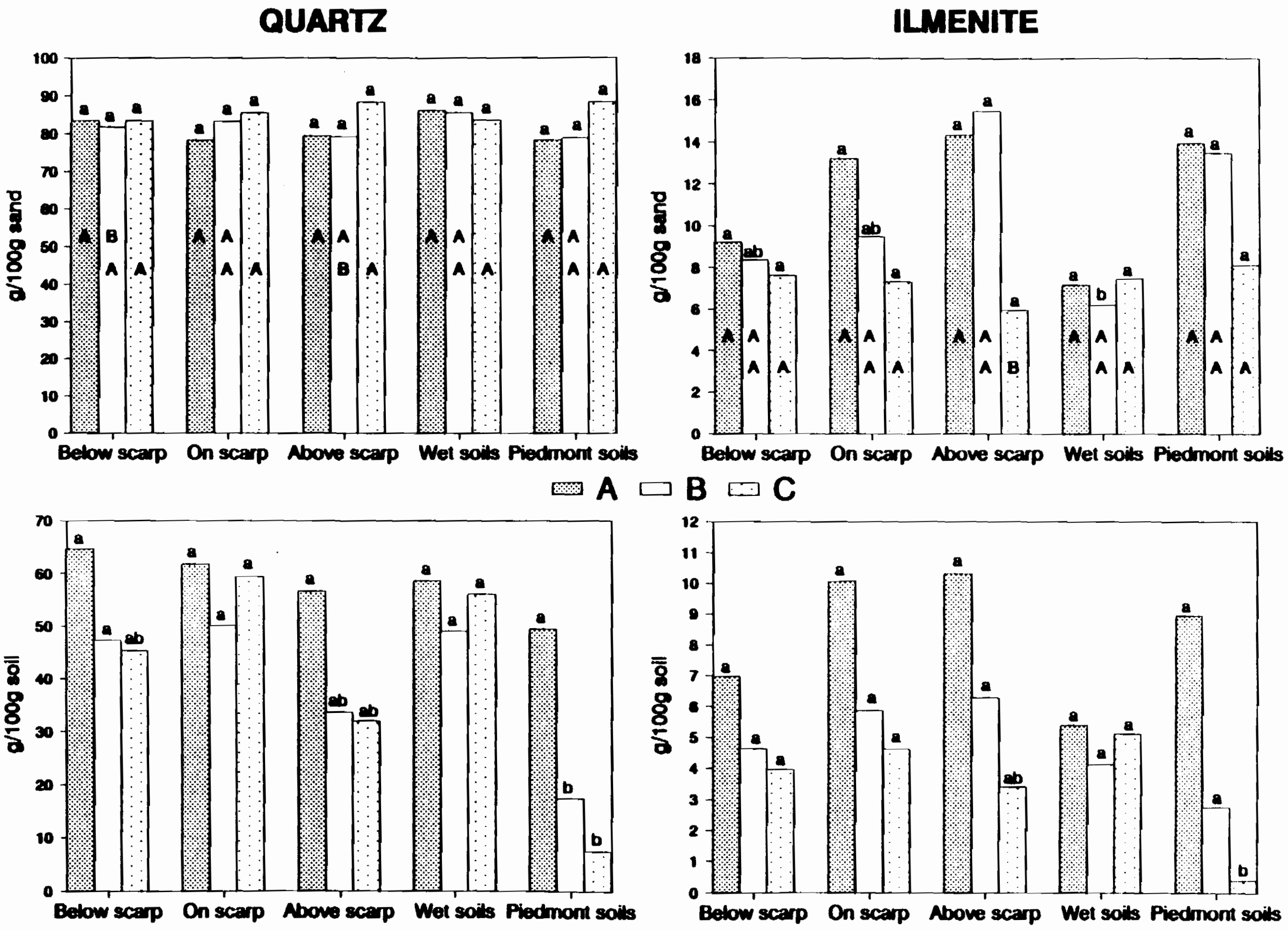


Figure 3.5.a Comparison of sand sized quartz and ilmenite as a function of location and geomorphic surface, both in weight % and mass %. Lower case letters are for comparisons of one horizon among groups. Upper case letters are for comparisons between A and B, and between B and C horizons within each group.
Same letters indicate no differences.

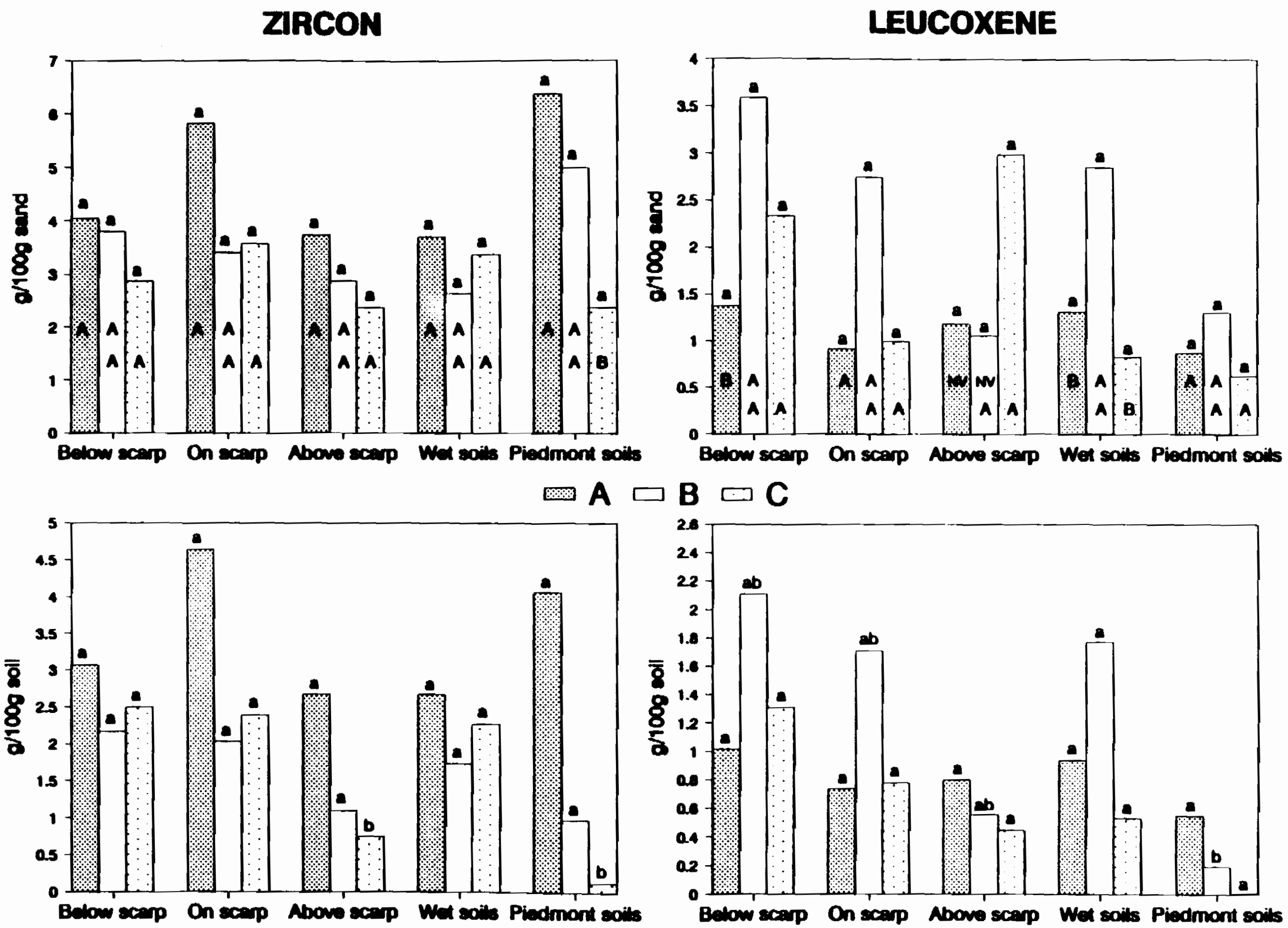


Figure 3.5.b Comparison of sand sized zircon and leucoxene as a function of location and geomorphic surface, both in weight % and mass %. Lower case letters are for comparisons of one horizon among groups. Upper case letters are for comparisons between A and B, and between B and C horizons within each group. Same letters indicate no differences. NV = no valid comparison

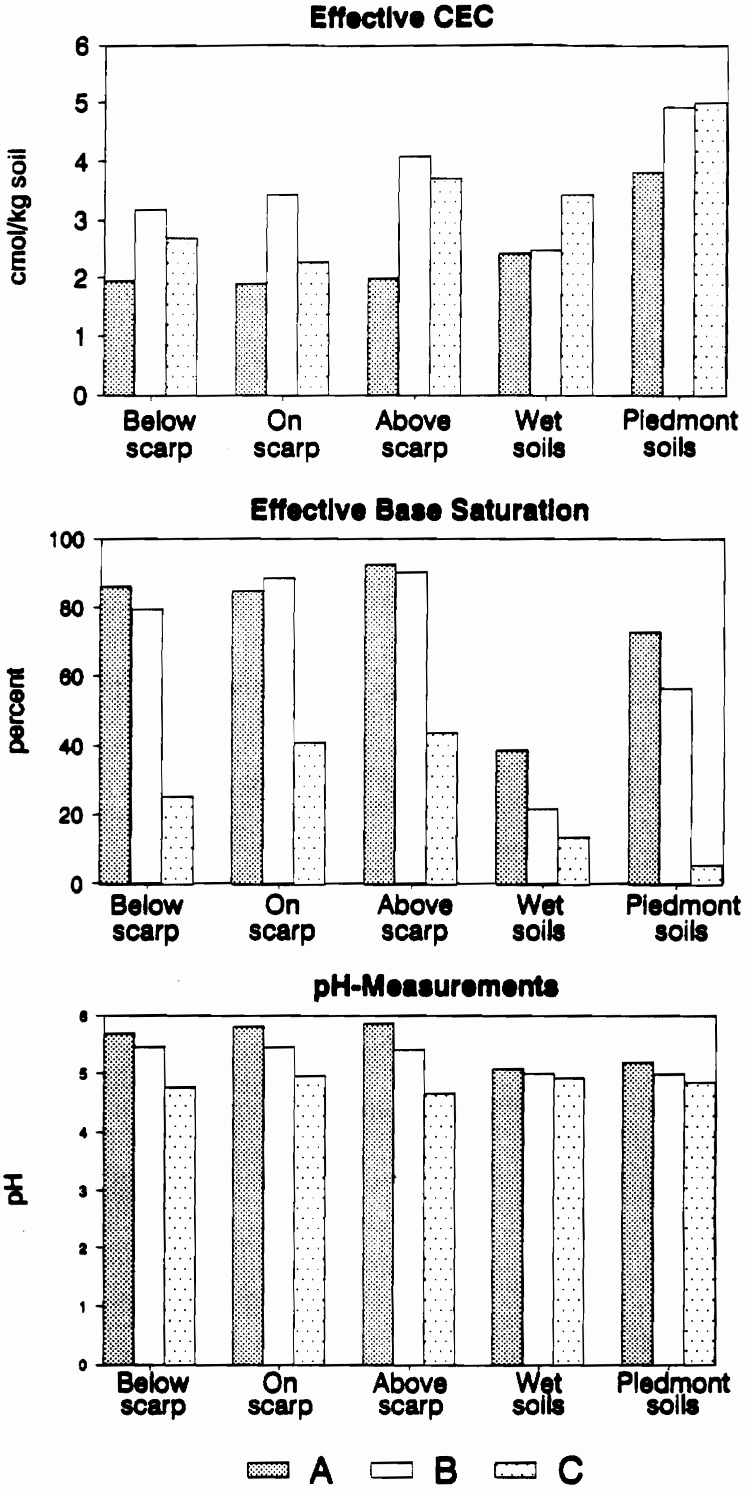


Figure 3.6. Effective CEC, effective base saturation and pH as a function of location and geomorphic surface.

3.7. Statistical comparisons

It was difficult to present the statistical results in a pleasant and easy-to-read manner, mainly because of the many different factors involved (3 different horizons, mass and weight %, and clay, silt, and sand fractions). My goal was to point out differences and trends of interest. I decided to write my results in these somewhat mechanical sections in order to decrease verbiage and repetition.

Several multiple comparisons turned out to be seemingly illogical. This, however, does not mean that the statistics are invalid. It is simply due to 1) the approximate equation used, 2) the very unequal sample sizes and 3) the extreme variability in the results.

3.7.1. Comparison of all soils with regard to location and geomorphic surface

Statistical justification

This comparison of locations can be viewed as an inquiry into the influence of time on soils formed from Coastal Plain sediments. A significant problem with this comparison is that several other known factors influence the mineralogy of the various groups. A soil is formed through the impact of five soil forming factors: climate, parent material, vegetation, topography and time. For the Old Hickory area, climate can be assumed to be constant and vegetation should be very similar for all locations. All soils formed originally under mixed hardwoods and are presently used for agricultural purposes and cultivated in a similar manner. For this comparison, though, Piedmont soils have a different parent material than the other soil groups (which are all Coastal Plain soils). The wet soils also result in a very different grouping than the other groups because of the lack of sufficient drainage. Both parent material and drainage (which is a part of the topographic factor) can control a significant portion of the systematic variability. We therefore cannot examine the impact of "only" time on the mineralogy with this grouping.

Results

Weight % (Tables II.1a, II.1b and II.1c)

The particle size distribution of soils can reflect parent material types and weathering intensity through time. These comparisons are especially important to indicate parent material differences between Piedmont and Coastal Plain soils. Piedmont A horizons contain more ($p=0.15$) clay and silt than below-scarp and on-scarp soils, respectively. Piedmont B horizons contain less ($p=0.15$) sand than all but the above-scarp Coastal Plain soils and more ($p=0.15$) clay than below-scarp and wet soils. The most important observation for the C horizon is that the Piedmont soils have a much lower ($p=0.25$) percentage sand than below-scarp, on-scarp and wet soils and a higher ($p=0.15$) percentage silt than on-scarp soils.

Piedmont soils contain more ($p=0.15$) clay- and silt-sized kaolinite in all horizons than below-scarp soils and wet soils. Clay-sized gibbsite of the A horizon is lower ($p=0.2$) in Piedmont soils than above-scarp soils; in the B horizon, clay-sized gibbsite of the Piedmont and wet soils is lower ($p=0.15$) as compared to the other groupings. Clay- and silt-sized mica is lower ($p=0.2$) in Piedmont A horizons than in below-, on- and above-scarp soils; wet soils have a higher ($p=0.15$) amount of clay-sized mica than above-scarp and Piedmont soils. Much less ($p=0.15$) silt-sized quartz is found in Piedmont A horizons as compared to below-scarp and wet soils. Below-scarp soils and wet soils contain more ($p=0.15$) clay-sized quartz in the B horizon than Piedmont soils, indicating less weathering activity.

Smectites occur in higher ($p=0.15$) amounts in the wet soils than in the on-scarp soils.

Mass % (Tables II.2a, II.2b and II.2c)

From a mining standpoint, the dominance of kaolinite, especially in Piedmont and above-scarp soils, should give minimal chemical and physical problems for the reclamation program. The amount of high charge smectites in the Piedmont B horizons is higher ($p=0.15$) than in the on-scarp soils. However, this constitutes maximally 3.25 % of the soil and Piedmont soils will probably be minimally subject to mining. Smectites of the C horizon occur in higher ($p=0.15$) amounts in the wet soils than in the on-scarp soils but they too constitute only about 3 % of the soil.

3.7.2. Comparison of well and medium well drained soils with regard to location and geomorphic surface

Statistical justification

This comparison of locations can also be viewed as an inquiry into the influence of time on soils formed from Coastal Plain sediments. We can eliminate the drainage influence by choosing only the well and medium well drained soils. The somewhat poorly and poorly drained soils are all contained in the group of wet soils. Therefore, we have only 4 groups to compare. There is, however, still a problem with different parent materials present because of comparisons of Coastal Plain with Piedmont soils. Because of this interaction and its effect on the systematic variability, only minor attention will be given to these comparisons.

Results

Weight % (Tables II.3a, II.3b and II.3c)

Particle size analysis reveals that Piedmont soils especially differ from the soils below- and on- the scarp: Piedmont soils contain 1) a higher ($p=0.15$)

percentage silt in the A and C horizons, 2) a higher (p=0.2) percentage clay in the A and B horizons and 3) a lower (p=0.15) percentage sand in the B and C horizons. Also the mineralogy indicates that Piedmont soils especially differ from below- and on-scarp soils: Piedmont soils have more clay- (p=0.2) and silt- (p=0.15) sized kaolinite, a lower (p=0.25) percentage clay- and silt-sized mica, a lower (p=0.2) percentage gibbsite of clay size, a lower percentage silt-sized HIV in B and C horizons and a lower (p=0.2) percentage clay- and silt-sized quartz. Piedmont and above-scarp soils are fairly similar, both in particle size distribution and mineralogy.

3.7.3. Comparison of all soils with regard to location

Statistical justification

No major influences other than time has an impact on the systematic variability in this study. All soils in the comparisons are well and medium well drained and have presumably formed from the same parent material. Only topographic factors such as microclimate, slope and face can have a supplementary impact on the systematic variability. But these influences are assumed to be minimal as compared to the influence of time on mineralogy.

Results

Weight % (Tables II.4a, II.4b and II.4c)

The most important particle size observations are that above-scarp B horizons contain a higher (p=0.1) percentage clay and a lower (p=0.15) percentage sand than the other soils. This difference would indicate time or duration of weathering activity. The clay- and silt-fractions also reveal a more mature mineralogy in the above-scarp soils: higher ($p=0.25$) % kaolinite in B and C horizons and lower ($p=0.25$) % clay-sized quartz in B horizons.

Mass % (Tables II.5a, II.5b and II.5c)

The low charge nature of the minerals, especially in the above-scarp soils, should again pose minimal chemical and physical problems for the reclamation process. The B horizon clay mineralogy reveals a higher ($p=0.15$) percentage kaolinite and gibbsite for the above-scarp soils than for the below-scarp soils. The percentage HIV in the silt fraction is lower ($p=0.15$) above than below the scarp. The percentage smectites in C horizons below the scarp is higher ($p=0.15$) than on the scarp. This amount, however, is low and should not cause too many problems in the reclamation of the below-scarp area.

3.7.4. Comparison of soils below and above the scarp

Statistical justification

The on-scarp soils have been reworked and stripped extensively. They therefore are not a very good indicator of on-site weathering through time. Leaving these samples out for the comparisons may give the best view of the impact of time on the mineralogy in the area.

Results

Weight % (Tables II.6a, II.6b and II.6c)

All comparisons reveal a higher maturity for the above-scarp soils. For the A horizon, the percentage clay is higher ($p=0.0617$), clay- and silt-sized kaolinite is higher ($p=0.0889$ and $p=0.0735$, resp.), gibbsite is higher ($p=0.0827$), clay-sized

HIV and quartz are lower (p=0.0740 and p=0.0861, resp.). For the B horizon, the above-scarp soils contain less (p=0.0894) sand and more (p=0.0272) clay, more clay-sized kaolinite (p=0.0872), less clay- (p=0.0408) and silt- (p=0.1054) sized HIV, and less clay-sized quartz (p=0.0373). For the C horizon, the above-scarp soils contain more clay- (p=0.0214) and silt- (p=0.1704) sized kaolinite, less clay- (p=0.1060) and silt- (p=0.0883) sized HIV and less clay-sized quartz (p=0.1).

Mass % (Tables II.7a, II.7b and II.7c)

The same trends were found as in the weight % comparisons: higher clay percentages kaolinite (p=0.0617), mica (p=0.0735) and gibbsite (p=0.0066) for the above-scarp A horizons.

3.7.5. Comparison of the Coastal Plain soils with regard to drainage

Statistical justification

The Piedmont soils were omitted from the statistical analysis based on their difference in parent material from the remaining soils. The differences with location and thus with time, however, are inevitable and must be considered. As we have seen in the previous sections, this time influence is substantial and especially represented between the subsurface horizons of the soils above and below the scarp. Again, the same important problem exists of very unequal sample sizes among the groups: the well drained, moderately well drained, somewhat poorly drained and poorly drained groups contain 16, 2, 2 and 4 soils, respectively. This makes the statistical tests doubtful and impractical.

Weight % (Tables II.8a, II.8b and II.8c)

The mineralogy shows that the well drained soils are more developed and mature than the other drainage classes. They contain a lower percentage smectites in the A horizon ($p=0.1987$) and in the C horizon ($p=0.1104$), a higher percentage clay-sized gibbsite in the A and B horizons ($p=0.15$), higher ($p=0.0136$) % silt-sized HIV and lower ($p=0.0035$) % silt-sized quartz in the A and C horizons, than in the poorly drained soils. The particle size distribution of the B horizon provides evidence that a great part of the silt and sand has converted to clay size components in the well drained soils. The sand mineralogy of the A horizon displays a more mature assemblage of minerals for the well drained and medium well drained soils: higher % rutile ($p=0.1601$), ilmenite ($p=0.2607$) and zircon ($p=0.2381$).

Mass % (Tables II.9a, II.9b and II.9c)

The low charge nature of especially the well drained soils is expressed in a much higher amount of kaolinite ($p>0.25$) and gibbsite ($p=0.15$) in the clay fraction of the B horizons. Smectites in the well drained and medium well drained soils are low for the A horizon ($p=0.1926$) and the C horizon ($p=0.1885$), indicating the potential for a successful reclamation of these soils.

3.7.6. Comparison of the mineralogy between A and B horizons and B and C horizons

Statistical justification

Pairing samples and analyzing for differences with depth can result in much less interference from such effects as climate, vegetation, topography and time. Time can indeed be assumed constant since we are comparing only one grouping of soils with regard to location and geomorphic surface. The largest assumption is that the parent material of all layers is the same. These comparisons also allows us to infer weathering sequences assuming limited additions have taken place.

Results

Comparisons between A and B horizons (Table II.10a)

A one sided test was performed for the sand and clay fraction. Indeed, I would assume more sand and less clay in the A than in the B horizon. Our reasoning is that water passing through the profile transports clay from the A horizon or solubilizes silica and aluminum that then can reprecipitate as secondary clay minerals in the B horizon. In all groupings, this assumption was proven correct.

One sided tests were also performed on the % kaolinite, % HIV, % smectite and % quartz in the clay fraction. One would indeed assume to find more kaolinite, HIV and quartz and less smectite in the A horizon than in the B horizon because of longer or greater weathering action. For kaolinite, this assumption was not valid and, although not significant, the opposite trend was true. The % HIV and % quartz, are higher in the A than in the B horizon of most of the groupings. The amount of smectites is lower in the A than in the B horizon. Unexpected is the higher ($p=0.0947$) % mica in the clay fraction of the surface horizons above the scarp. Less ($p=0.0350$) gibbsite was found in surface horizons of below-scarp and on-scarp soils, but higher ($p= 0.0947$) percentages gibbsite were found in this horizon in the Piedmont soils.

Also in the silt fraction, more kaolinite was found in the B horizon than in the A horizon, especially in the below-scarp ($p=0.1250$) and wet soils ($p=0.0312$).

Strangely enough, in these groups, the % HIV was also lower in the A horizon (p=0.1250) than in the B horizon (p=0.0626). The wet soils have a higher (p=0.0626) % quartz in their A horizon.

There is a trend that more of the heavy minerals are found in the surface horizon than in the subsurface horizon.

Comparisons between B and C horizons (Table II.10b)

One sided tests were also performed on the sand and clay particle size analyses. One would assume more clay and less sand in the B horizon than in the C horizon. Indeed, the C horizon is the zone of least weathering activity and furthermore, the Coastal Plain soils should have formed out of sandy sedimentary materials. This assumption was found to be true for on-scarp (p=0.0156) and Piedmont soils.

For the clay-, silt-, and sand-mineralogy, two sided tests were performed. Higher (p from 0.0156 to 0.2188) percentages of clay sized kaolinite were found in the C horizons of almost all groupings. One observes especially a lower (p from 0.0156 to 0.25) percentage feldspar in the C horizon of the silt fraction. The soils below the scarp contain more clay sized HIV (p=0.1250), mica (p=0.0626) and quartz (p=0.0078) and less (p=0.1250) smectites in the B horizon than in the C horizon. Also the other groupings contain more (p=0.1250) clay sized mica in the B horizon than in the C horizon. For the below-scarp and wet soils, also more (p=0.1250 and p=0.2188, resp.) silt sized mica was found in the B horizon than in the C horizon. In the above-scarp soils, more (p=0.1250) kaolinite of silt size was observed in the C horizon than in the B horizon. The percentage smectites is higher (p=0.1250) in the C horizon of below-scarp soils.

note on the statistical analyses: Whenever less or equal than one third of the pairs were tied, the Lehman unconditional approach was used. A "no valid" (nv) statement was used whenever more than one third tied pairs was encountered.

DISCUSSION

4.1. **Particle size distribution** (Fig.3.2.)

Physical weathering processes decrease particle size by breakdown of particles through time. Chemical weathering processes will solubilize mineral constituents and reprecipitate secondary clay minerals. Both processes are significantly controlled by water movement through the solum. One would expect the highest physical and chemical breakdown where drainage was best. Besides the prevailing drainage class, the particle size distribution of a given soil is also dependent on the particle size and characteristics of the parent material and age of the soil.

The parent materials from the Piedmont and Coastal Plain soils studied have vastly different particle size distribution: Coastal Plain soils have developed out of sandy sediments while Piedmont soils form from silty granitic and schist saprolites.

My results indicate that the A horizon is dominated by sand in all groups. Although the A horizon has been weathering for the longest amount of time and under the greatest intensity and thus should have the highest percentage clay, -assuming conservation of mass-, much of that clay has been moved to the subsurface horizons where it accumulates. The Piedmont soils contained the highest percentage clay ($p=0.15$ Table II.1b) and low amount of sand ($p=0.15$ Table II.1b) in their subsurface horizons as compared to the Coastal Plain soils. This occurs partly because of their silty parent material but also because long-term weathering has decreased particle sizes. The more silty parent material can especially be observed in the C horizon of the Piedmont soils ($p=0.15$ Table II.1c). The above-scarp soils, although developed from another parent material, come close to the Piedmont soils in terms of the amount of clay: they have almost as much clay as sand in their B horizons and therefore would be more indicative of highly developed and older soils than the below- and on-scarp soil. Also the C horizon of the above-scarp soils displays trends of having a finer particle size distribution as compared to the other Coastal Plain soils: less sand ($p>0.25$), more silt ($p>0.15$) and more clay ($p=0.25$). The wet soils are dominated by sand in all horizons and are quite different from especially Piedmont soils in this aspect ($p=0.15$ Table II.1b and $p=0.25$ Table II.1c). This observation is primarily due to the lack of water movement and thus weathering activity through the solum. Wet soils probably also have had frequent additions of surficial sandy materials over time.

4.2. Mineralogy (Fig. 3.3., Fig. 3.4., and Fig. 3.5.)

The clay- and silt-fractions are dominated by kaolinite and HIV in all groupings. Both minerals are stable in their environment and are indicators of long-term weathering. Kaolinite increases with depth (Tables II.10a and II.10b) which can be explained by several processes: some kaolinite will have formed in place out of feldspar weathering which tend to be concentrated in the C horizon. Another process is the dissolution of silica and aluminum from surface horizons and subsequently movement and reprecipitation of these components into the lower horizons to form kaolinite. There can also be some movement of clay particles without dissolution, but this would be mainly for fine clay sized kaolinite. These processes were also considered to take place by Lougnan (1969) and White et al. (1990). Kaolinite quantities are highest in the Piedmont soils (Tables II.3a, II.3b and II.3c), partly due to their higher feldspar content of the parent material as compared to Coastal Plain soils. Another explanation is that the weathering of Piedmont soils has reached a "kaolinite stage" whereas kaolinite in the upper Coastal Plain soils weathers further to gibbsite. Birkeland (1984) writes that if weathering products accumulate on the surface of weathering minerals, they can decrease the weathering rate with time. Another justification would be a resilication of gibbsite to kaolinite when ground water silica rises from freshly decomposing silicates (Harrison, 1933). This was also the view of Jackson et al. (1948) who claimed that sediments represent a certain amount of reversal of the weathering sequence, particularly in conditions of little leaching and a lowered oxidation potential. The amount of kaolinite is lowest in the wet soils, due to a lack of weathering activity. Based on the percent kaolinite in the soil, I observe that those soils with the highest percentage clay also contain the highest percentage kaolinite. Piedmont soils as well as the above-scarp soils can thus be assumed to be fairly old soils.

Clay sized HIV tends to be most stable in surface horizons (Table II.10a). A somewhat higher pH in the surface horizon from frequent liming of these soils could provide the Al in a precipitated form which would then favor the formation of HIV. This differs somewhat with the findings of Rich (1968) who concluded that chloritized vermiculite would form under soils conditions of (1) moderate weathering to remove Ca, Mg and K ions and make Al ions available, (2) moderately acid soil pH (near 5.0), (3) low organic matter content, (4) frequent wetting and drying cycles, and (5) oxidizing conditions. Piedmont soils tend to have a somewhat lower percentage HIV than Coastal Plain soils, probably because of the somewhat lower pH or the greater transformation of HIV to silt- and clay sized kaolinite. Part of the clay sized HIV could also occur from the physical breakdown of silt sized HIV, which may be the case in the below-scarp soils. The percentage HIV on a soil basis is highest in the B horizon because of the higher percentage clay in that horizon.

Except for the wet soils, smectites constitute only a small part of the clay minerals. Smectites are mainly present in young, undeveloped soils and occur in this area in the wet soils (Table II.1c). These soils have limited weathering activity and are thus immature in mineralogy. The same relationship was observed by

Jackson et al. (1948) who associated montmorillonite with impeded drainage, making longer contact times between solution and unstable soil minerals possible. The latter resulted in higher H_4SiO_4 activities which are required for montmorillonite stability. In the other groupings, smectites are almost absent in the A horizon and show a maximum of only 3 % on a soil basis in the B horizon of Piedmont soils. This finding is again due to the very high clay content in that horizon.

Quartz is always seen as the most stable sand sized mineral in soils. Clay sized quartz, however, is fairly easily solubilized because of the large surface area on which weathering activity can take place. We therefore find the lowest amount of clay sized quartz in the Piedmont and above-scarp soils (Tables II.3b and II.3c), due to their long-term weathering impact. Silt sized quartz should be fairly stable and dominates the fraction. The Piedmont soils also contain the lowest amount of silt sized quartz (Tables II.3a, II.3b and II.3c), showing the strong weathering activity in these soils. The wet soils tend to have a somewhat higher clay- and silt sized quartz percentage than the other Coastal Plain soils, demonstrating again the low weathering activity trend of these soils. Clay sized quartz in all but the wet soils is higher in the surface horizon than in the subsurface horizons (Table II.10a). Knowing that the A horizon has been weathering for the longest period of time and greatest intensity, we would expect the opposite trend. This clay sized quartz is therefore probably coming from the breakdown of silt- and sand sized quartz.

Mica and feldspar are primary minerals and thus are found in the beginning of the weathering "scale". They should not be too prevalent in very old soils, but should instead be weathered into secondary minerals. Large quantities of these minerals, especially in the surface horizons, could mean some kind of addition of a younger material to or on top of the original soil. We indeed see a trend of the highest percentages clay- and silt sized mica occurring in the A horizon, except for the wet soils (Table II.10a). The wet soils contained the highest amount of mica in the B horizon. On close observation, however, one extreme outlier seemed to produce the high mica content (Dragston 74A, Appendix I). The amount of mica is fairly high in all Coastal Plain soils. Apart from the concept of perhaps eolian additions, another explanation could be that mica is actually formed by frequent potassium-fertilization. This, however, cannot explain the comparative low percentages mica in Piedmont soils. The wet soils do not have much mica turnover due to their lack of weathering activity. The high percentage of clay in B horizons explains the trends on a soil basis. For feldspars, similar trends as with mica's are found, except that they occur in very small percentages in the clay fraction (<0.35 %) and silt fraction (<2.2 %).

Gibbsite is a stable endproduct of long-term weathering and is generally a good indicator of very old soils. The gibbsite graph (Fig. 3.3.d) is somewhat startling because of the differences observed between Piedmont and Coastal Plain soils. Piedmont soils contain very low amounts of gibbsite as compared to the soils below-, on- and above- the scarp (Tables II.3a, II.3b and II.3c). Several explanations could be offered based on time differences and parent material differences (and related soil physical characteristics). A first explanation is that the Coastal Plain soils in the Fall Zone region, are actually older than the Piedmont soils and thus more weathered. This is indeed the concept of Markewich et al., (1990), who claims that the age of a soil is consistent with its residence time. Since the Piedmont soils are submitted to more erosion, the residence time of these soils are shorter. Markewich et al., (1990) hypothesizes a Piedmont soil age of maximally 1 Ma years old whereas Coastal Plain soils can be between 2 and 5 Ma years old. Observing the weathering sequences (later Fig. 4.1.e) and the amount of Fe_2O_3 present in the soils (Fig. 3.3.d), however, the Piedmont soils still tend to be more weathered overall. The existing sand cappings on the Piedmont soils also inhibit strong erosion.

A second explanation is based in the fact that gibbsite is known to form mainly in well drained soils. Coastal Plain soils have formed from sandy parent materials and are thus coarser in texture than Piedmont soils. This implies a more rapid flushing into the former profiles, creating a better leaching environment and thus a low silica activity from the dissolution of unstable silicates, necessary for gibbsite formation (Jackson et al., 1948). A problem with this explanation is that many Piedmont soils have been truncated into their saprolite and have been capped with Coastal Plain sediments. Indeed, especially the above-scarp soils come close to the Piedmont soils in terms of particle size distribution. It could, however, be possible that the slightly higher percentages clay in the B horizon and silt in the C horizon of Piedmont soils, comparative with above-scarp Coastal Plain soils, tend to build up silica rather than to leach it out. The latter would simply imply that kaolinite never desilicates and gibbsite never forms. This condition would also make a resilication of gibbsite into kaolinite possible. Another source of silica would otherwise have to play a role in this resilication process. Harrison (1933) mentioned the possibility of resilication processes with higher ground water silica contents from freshly decomposing silicates. Similarly, Jackson (1965) writes about the formation of new montmorillonite layers by silication of hydroxy sesquioxide layers tactile to mineral surfaces. In our case, the silica could come from mica in eolian additions. This would explain all three observations: lower mica and gibbsite and higher kaolinite contents in Piedmont soils. The question then becomes why mica in surface horizons of Piedmont soils would weather faster than in Coastal Plain soils. Perhaps it is the slightly lower pH (about a half pH lower) or greater erosion or a combination of both.

The fact that gibbsite tends to concentrate in the B horizon could be due to what is called "the anti-gibbsite effect" (Jackson, 1963). This effect suggests that gibbsite cannot be formed as long as 2:1 minerals are present that can host aluminum-hydroxides in their interlayers, forming HIV. Observing my HIV graph, though, I would expect a higher percentage gibbsite in the C horizon than in the B horizon in that case. On the other hand is the C horizon not subjected to as much weathering activity and time as are the A and B horizons.

The sand fraction is dominated by quartz and ilmenite, and has lower amounts of zircon and leucoxene. Quartz, ilmenite and zircon tend to be concentrated in the A horizon, especially on a soils basis. This is due to the very high percentages of sand in this horizon, the resistance of these minerals to long term weathering, and the concentration of these minerals when clay moves out or solubilizes from the A horizon.

4.3. Physicochemical characteristics and pH

The effective cation exchange capacity shows a maximum of 5 cmol/kg soil (Fig. 3.6.), which is about the ECEC of kaolinite. These data thus support the low charge nature of all soils. The ECEC of the below-scarp, on-scarp and above-scarp soils is higher in the B horizon due to the higher percentage of clay in the latter.

The effective base saturation (Fig. 3.6) is high in both A and B horizons of especially below-, on- and above-scarp soils because of the organic matter in the surface horizons and their frequency of liming. Wet soils are not cultivated and thus not limed which creates their much lower effective base saturation.

The pH of all soils fluctuates around 5, with the pH of the surface horizon slightly higher due to frequent liming (Fig. 3.6).

4.4. Weathering trends

Weathering is an ongoing process through time by which several weathering processes alter the chemical composition of soil minerals. There are some trends that dominate weathering sequences as indicated in the literature review. The most important weathering trends of the clay- and silt-fractions, applied on our data, are graphed in Figures 4.1.a through 4.1.e. In all these graphs, the degree of weathering increases from left to right. They furthermore can indicate something about the weathering stage of the soils. Because so many possible chemical alterations can take place and some weathering reactions can proceed in opposite directions, it is very difficult to determine which mineral has formed out of another mineral. Many observations can therefore only be explained in a hypothesized manner.

What we can observe from the graphs is that all Coastal Plain soils tend to have the highest concentrations of clay minerals at the end of the weathering sequence, showing their very mature nature. Kaolinite and HIV dominate the clay fraction and a fair amount of gibbsite is found in all Coastal Plain soils except the wet soils. The wet soils do not have much weathering activity impact and therefore are still in a somewhat earlier stage of maturity. The clay fraction of the Piedmont soils contains almost solely kaolinite and HIV. Much less gibbsite is found than in the below-, on-, and above-scarp soils, leading to a question on whether the Piedmont soils could be younger than the Coastal Plain soils in the Fall Zone region. We can, however, observe that more alterations of primary minerals towards kaolinite seem to have taken place in Piedmont soils, based on the low contents of these primary minerals. Piedmont soils could furthermore still be assumed to be older soils with possible resilication of gibbsite into kaolinite (Harrison, 1933; Jackson et al., 1948). A problem is that we don't know yet the original amount of mica's in the parent material. It would therefore be interesting to have some deep boring samples and determine their mineral suite and content.

The silt fraction of all soils indicates a high amount of mica's, especially in the surface horizon. This could be mainly due to eolian additions which indeed have silty textures. Besides mica, the silt fraction is dominated by kaolinite, but in much lower quantities than in the clay fraction.

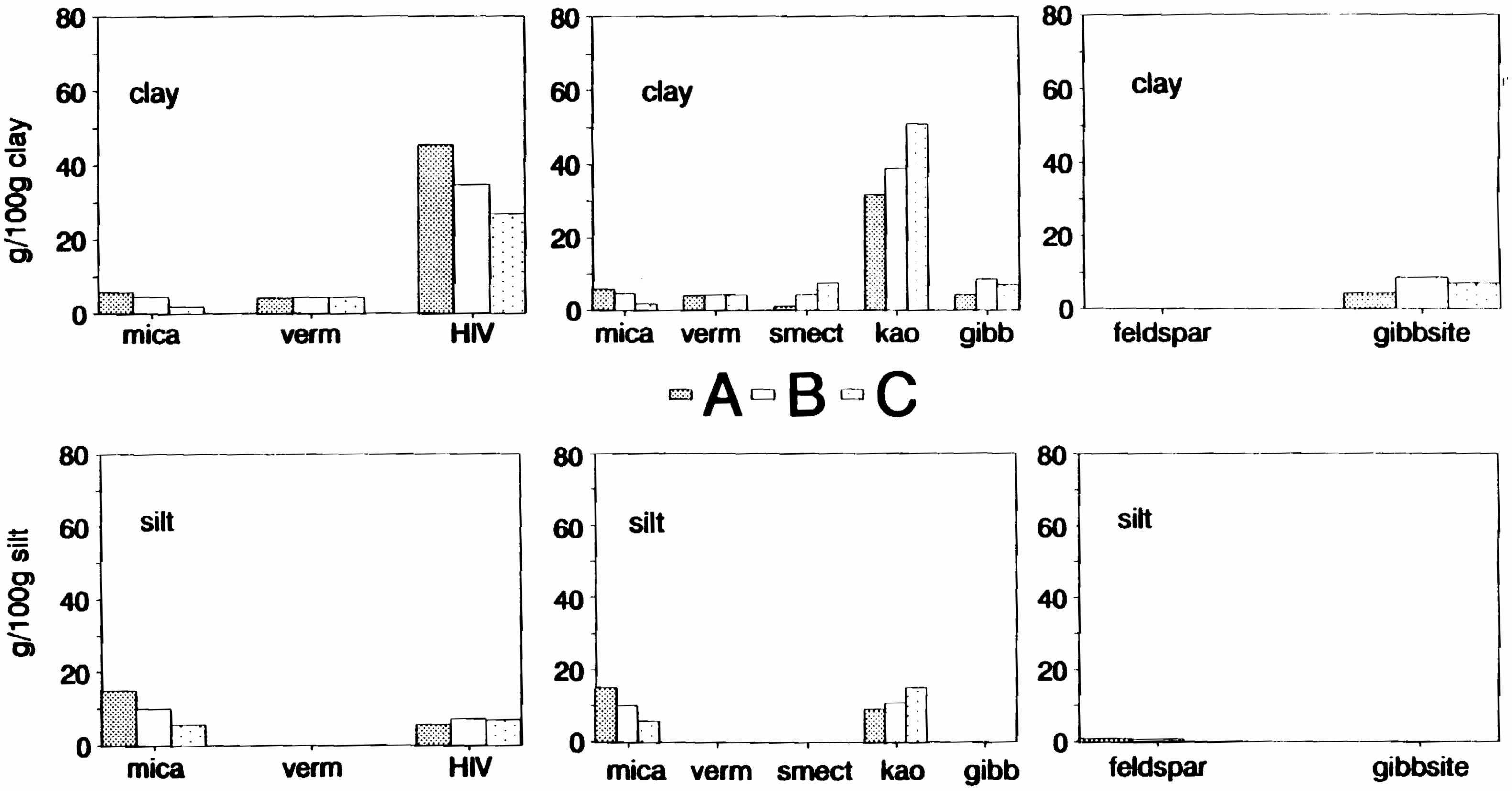


Figure 4.1.a Weathering sequences for the clay and silt fractions of soils below the scarp.

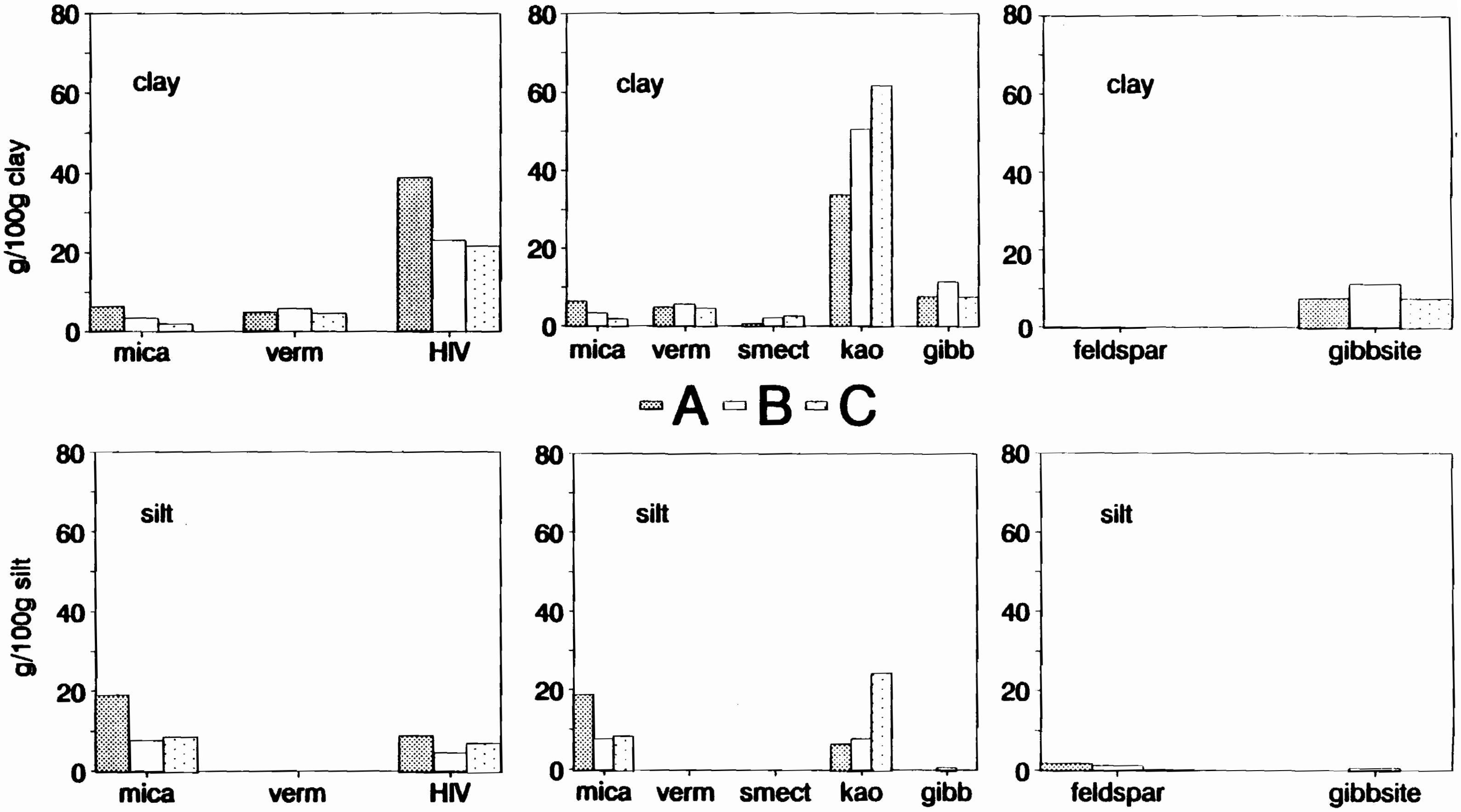


Figure 4.1.b Weathering sequences for the clay and silt fractions of soils on the scarp

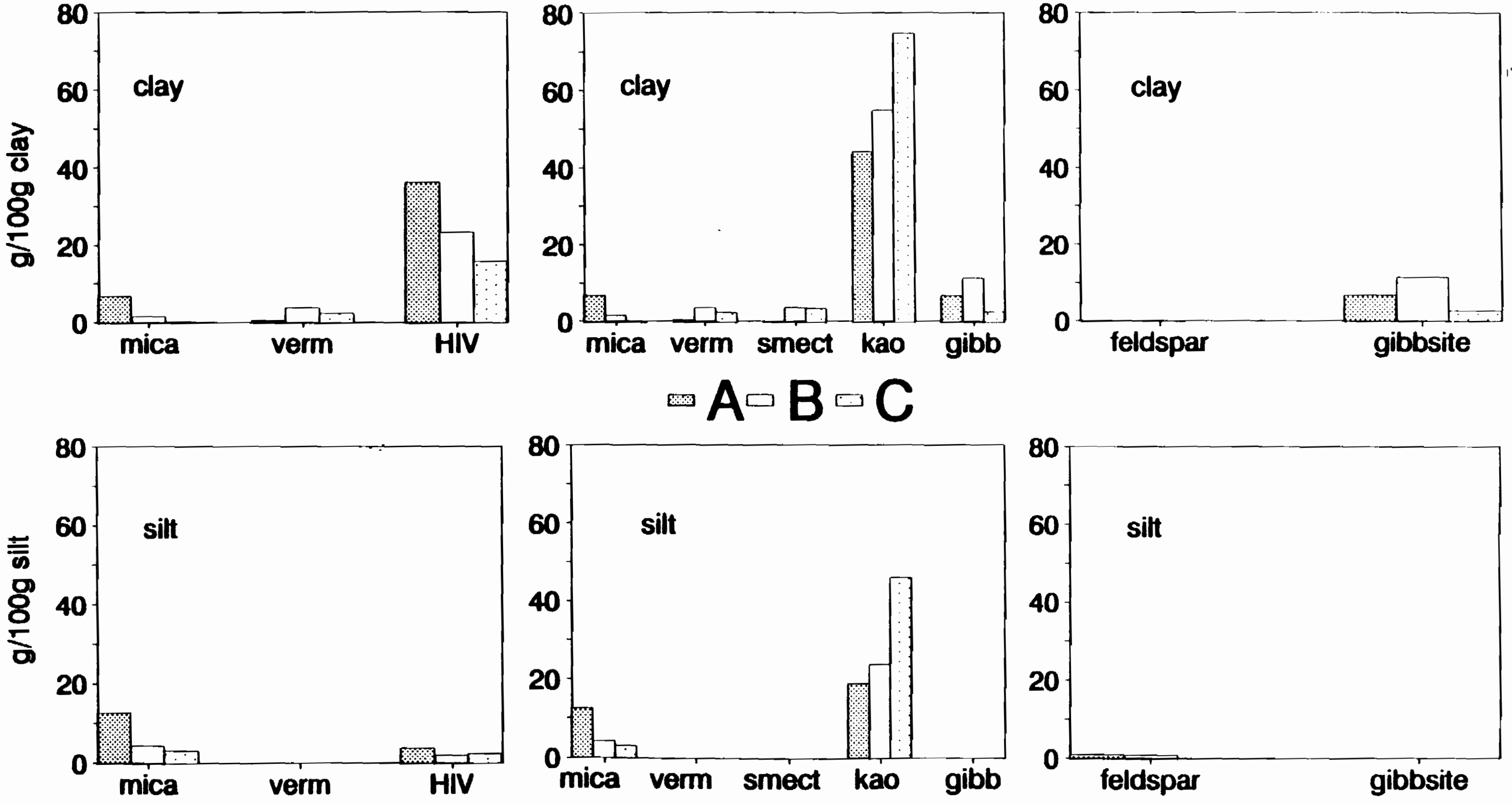


Figure 4.1.c Weathering sequences for the clay and silt fractions of soils above the scarp

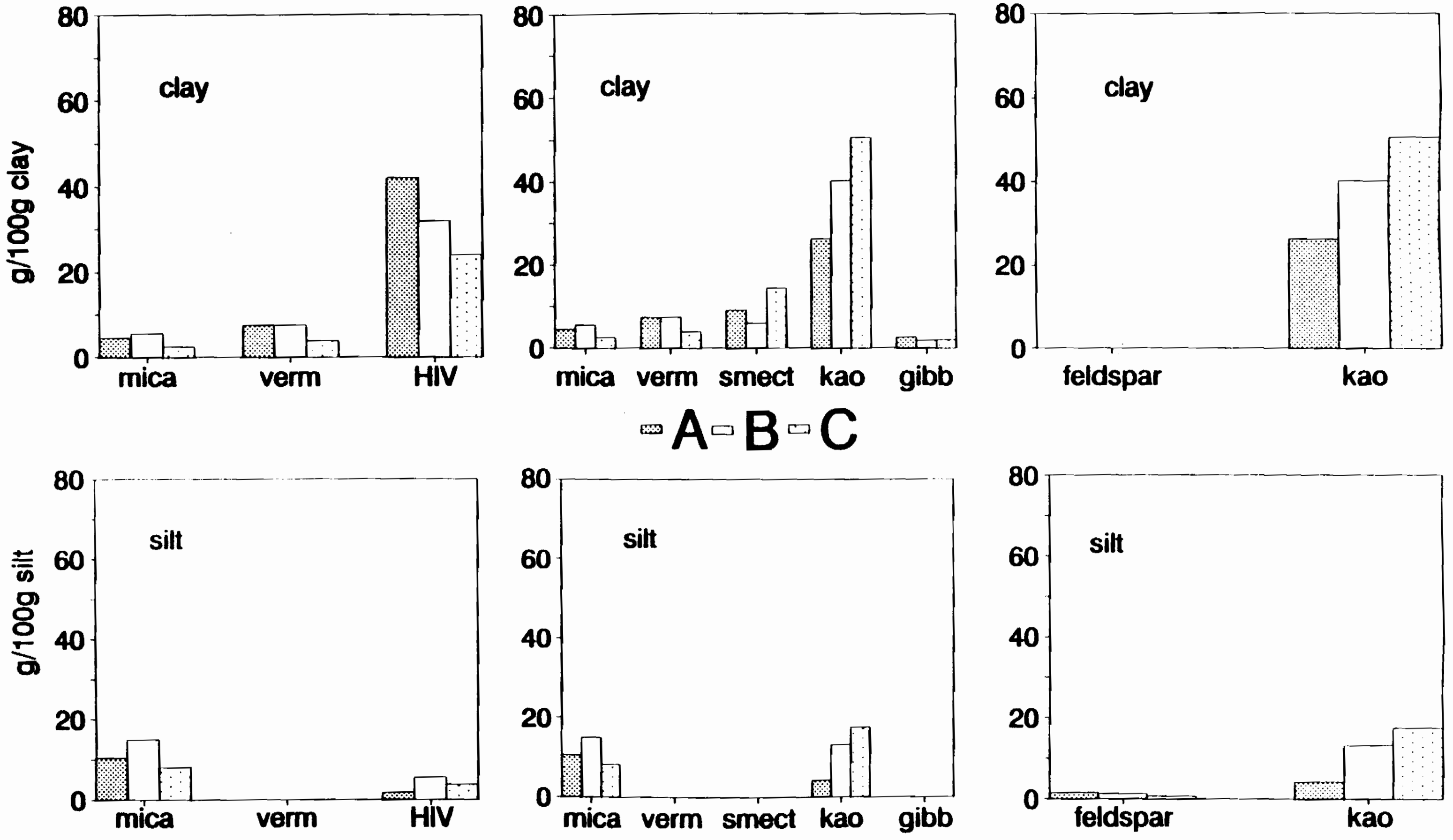


Figure 4.1.d Weathering sequences for the clay and silt fractions of wet soils

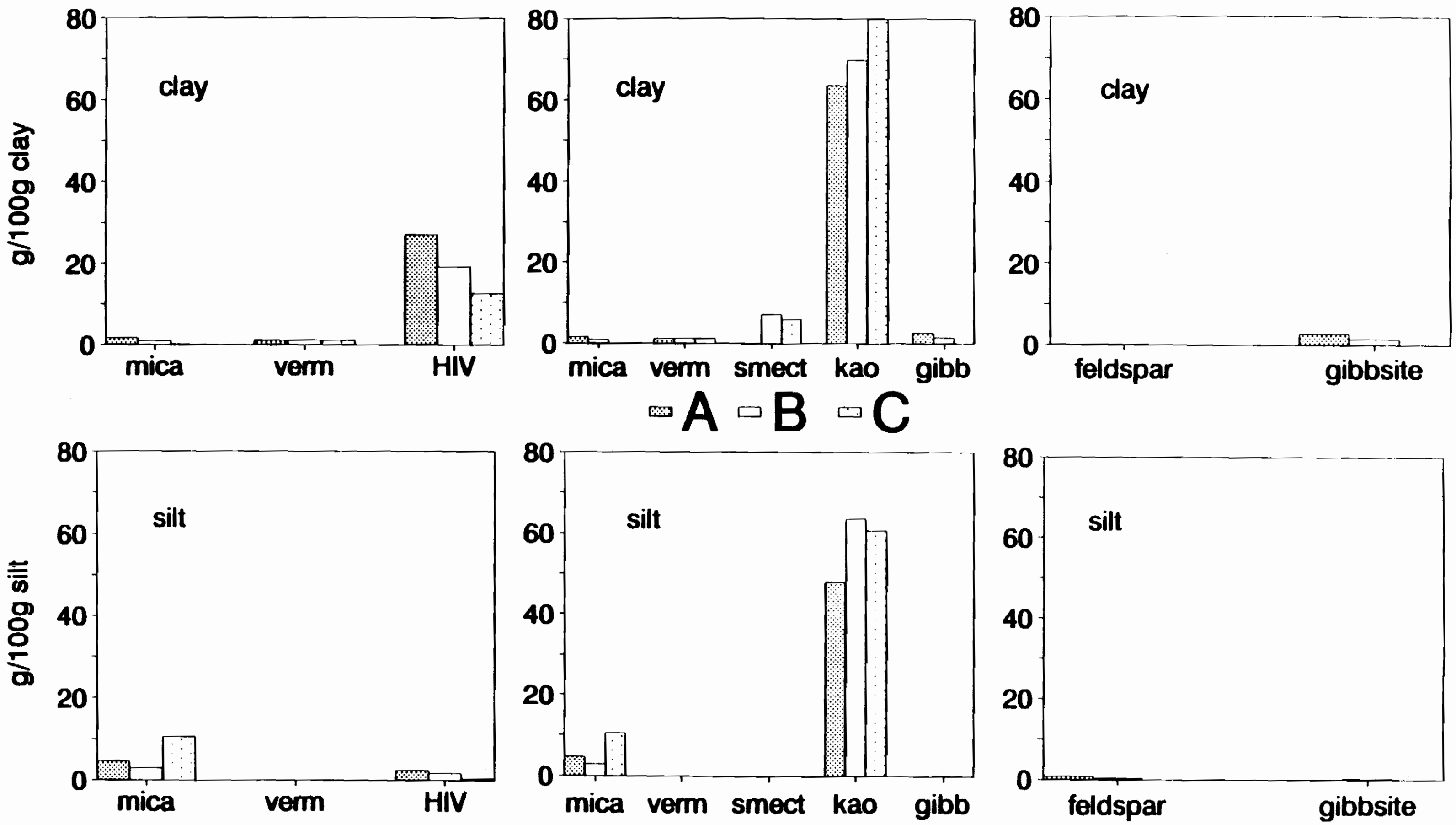


Figure 4.1.e Weathering sequences for the clay and silt fractions of Piedmont soils.

4.5. Conclusions for groupings according to location and according to drainage.

Both time (and thus location in this case) and drainage can have major impacts on the formation of soils and their mineralogical suite distribution. Important trends were observed with my data. When the soils were ordered according to location, I observed a consequent trend of having the mineralogically older and more mature soils "above the scarp". This is in agreement with some literature (Daniels and Gamble, 1978) which indicates that the highest Coastal Plain surfaces are the oldest and that scarps mark major or minor differences in ages of the adjacent plains. When the soils are ordered according to drainage, I found the more weathered and mineralogically more mature soils in the "well drained and moderately well drained" drainage classes. "Mineralogically more mature" indicates that minerals from the end of the weathering sequence dominate the mineralogical suite. These minerals include kaolinite and gibbsite in clay- and silt-fractions. For the sand fraction, it indicates that there is a more mature assemblage of heavy minerals: more zircon, rutile and tourmaline. This maturation-process of the mineralogy inevitably accompanies a physical breakdown of soil particles because weathering processes always decrease particle sizes. So, we find more clay and less sand in the above-scarp soils and in the well drained and moderately well drained soils. Smaller particle sizes have larger surface areas which increases the impact of weathering agents. There was consistently less clay sized quartz found in these high weathering activity locations.

It was justified to remove the wet soils as a separate group. These soils differ from all other groups in many ways, based on their lack of weathering activity. They contain significant lower percentages of clay and mature clay minerals (kaolinite, HIV, gibbsite and Fe_2O_3) than the other groupings. They have the highest percentage clay- and silt-sized quartz and reveal the highest smectites percentages.

The Piedmont soils were also removed as a separate group based on their very different parent material as compared with the Coastal Plain soils. Long-term weathering, however, has removed most of the parent material influence on the mineralogy in this Fall Zone region. I indeed observed that the mineralogy of the Piedmont soils and above-scarp soils was quite similar. This agrees with literature (Markewich et al., 1990) which indicates that Piedmont and Coastal Plain soils reach maximum maturity near the Fall Zone. A big difference, though, was the percentage clay-sized gibbsite which was significantly lower in Piedmont than in above-scarp soils. But when I observed that both clay- and silt-sized kaolinite in Piedmont soils are higher, I assume that resilication of gibbsite to kaolinite takes place (Harrison, 1933; Jackson et al., 1948). A requirement for the resilication process to take place would be the accumulation of finer particle sizes of the Piedmont soils, thus preventing the leaching of silica. Also clay sized mica in surface horizons of above-scarp soils is higher than in Piedmont soils, which could indicate that mica from eolian additions in Piedmont soils weathers faster than in above-scarp soils. An indicator of different parent materials is observed in the particle size distribution: Coastal Plain soils are much more sandier, especially in B and C horizons, than Piedmont soils. This is accompanied by a lower percentage silt-sized quartz in Piedmont soils.

4.6. Mineralogical influences on the proposed mining operation

Much concern has been indicated with regard to the mining operation method. The originally proposed mining operation would use a dredge floating in a pond. Because this wet method involves almost 70 percent water, it is distinguished from the dry method, which uses only about 30 percent water. The dredge digs across the face of the mineral sands and pumps slurry to a concentrator, which is also floating on the pond. On the concentrator, the heavy mineral bearing sands are separated from the silt- and clay fraction and are pumped into spirals. These spirals are used as segregators to separate the heavy minerals from the host sands. After this separation, tailings (separated sands) are piled up behind the concentrator and slimes (clay and silt fraction) would probably be pumped to large slime de-watering ponds.

This reclamation, however cannot start until the slime ponds are de-watered. A problem with this de-watering would result from the large quantity and physicochemical characteristics of the clay fraction. Because clay is much smaller than silt or sand, it may not flocculate readily and this can prevent a good textural mixture. Physicochemical characteristics of interest are cation exchange capacity, surface charge and specific surface area. High charge clays, accompanied by high cation exchange capacities (CEC) and high specific surface area tend to stay in suspension rather than to flocculate. Indeed, high charge clays tend to repel each other unless they are completely saturated with cations which neutralize the negative charges. The amount of water that can fit in the interlayer of clay minerals also influences the flocculation characteristics. Smectites for instance, although they have a relative low charge as compared to many other clay minerals, can have so much water in the interlayers that the plates repel each other. Also Fe-oxide coatings and exchangeable Al saturation can have a major influence on the clay behavior. Coatings neutralize the negative charges of clay minerals and can be seen as "big cations". Coatings will lower the charge and CEC and thus enhance flocculation. It is important for the mining company to have an estimation of the clay behavior and especially to know where the potential problem sites are. When they have this information, they can adapt and plan the mining operation accordingly.

There is indeed a very high percentage clay to deal with. All Coastal Plain soils contain between 17 and 43 percent clay in both B and C horizons. Piedmont soils contain even more clay but should not been considered here because little of the solum or only the surface horizon will be mined for heavy minerals. Soils in the above-scarp location could pose a potential problem because they would generate slimes with very high clay content.

Despite the large quantities of clay, the prevailing clay minerals belong to a group that is fairly easy to flocculate out. All groups are dominated by the low charged kaolinite and HIV. Smectites, which would be the most troublesome to flocculate out, are only present in a maximum amount of 3.4 present. Also, the effective CEC data show the low charge nature of the soils. The highest ECEC is 5 cmol/kg soil, which is about the ECEC of kaolinite.

The mineralogy therefore partially offsets the potential problems posed by having such a large quantity of clay. It should furthermore be relatively easy to flocculate out the low charge clays. Adding relatively small amounts of flocculating cations, pH-adjustment of the process water, and adequate flocculation time should be appropriate practices to manipulate the settling characteristics and to successfully de-water the slime ponds.

CONCLUSIONS

I observed influences of parent material, time and drainage on the mineralogy of the soils within the proposed mining operation area. Coastal Plain soils and Piedmont soils have a different parent material, as observed in their particle size distribution. Above-scarp soils, however, have developed for a long enough time period to approach Piedmont characteristics. Indeed, not only the particle size distribution but also the mineralogy of the above-scarp soils come close to that of the Piedmont soils. All Coastal Plain soils, except wet soils, are dominated by kaolinite, HIV, quartz and gibbsite, which indicates their fairly old nature. The wet soils lack the weathering activity produced by drainage and therefore have a somewhat younger mineralogy with the highest percentage smectites. Piedmont soils are especially dominated by kaolinite and do not contain the large gibbsite contents of the Coastal Plain soils. The most appealing theory for this is that the decomposing mica from eolian additions provide the silica, necessary for the resilication of gibbsite into kaolinite. We indeed saw a fair amount of mica in the surface horizons of Coastal Plain soils and not in the Piedmont soils. This mica is believed to be due to eolian additions.

Grouping the soils according to location with regard to the scarp shows that the above-scarp soils are more mature than the soils below the scarp. Grouping the soils according to drainage shows that the well drained and moderately well drained soils have a more mature mineralogy and particle size distribution than somewhat poorly drained and poorly drained soils.

The low charge nature of all soils in the Old Hickory Project was reinforced by the low ECEC data. This low charge nature is a welcome feature for the reclamation process of this area with such high clay contents. It should be relatively easy to flocculate these clay minerals by adequate flocculation techniques.

SUMMARY

Renison Goldfields Consolidated Limited (RGC) is known to have much expertise in mineral sands mining operations and successive reclamation programs in Coastal Plain areas of Australia and Florida. Mining in the Upper Coastal Plain of Virginia, however, will be a challenging project because of the large amount of clay. The original intent of this study was to identify the mineralogy present in the proposed mining area and to determine if differences among pedons existed. Twenty eight typical pedons of the mining area were sampled throughout the profile and these samples were submitted for mineralogical analysis. The pedon comparisons were performed as a function of their location and geomorphic surface and as a function of drainage. Statistical results were then used to relate mineralogy, together with data on pH, CEC, base saturation and particle size distribution to pedogenesis in the area.

I found that Coastal Plain soils had sandier subsurface horizons than Piedmont soils, showing their different parent material. The above-scarp soils were the oldest and most mature Coastal Plain soils and approached the Piedmont mineralogy and characteristics quite well. Coastal Plain soils were dominated by kaolinite, HIV and gibbsite; Piedmont soils by mainly kaolinite. All but the Piedmont soils contained a surface mica enrichment, believed to be eolian additions. In the case of Piedmont soils, we theorized that surface mica from eolian additions decomposed very quick, forming a silica source for resilication of gibbsite into kaolinite. Wet soils were less mature in mineralogy due to the lack of weathering activity. Well drained and moderately well drained soils had a more mature mineralogy than somewhat poorly and poorly drained soils.

Despite the large clay content, the low charge nature of all soils should not cause too much trouble in flocculation processes after the mining.

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APPENDIX I

BASE DATA FOR PARTICLE SIZE DISTRIBUTION, MINERALOGY, CHEMICAL DATA AND PH

TABLE I.1a Depth, elevation, drainage class and particle size distribution of the A horizon

BELOW SCARP

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
69-053-1	Nansemond 69B	Ap	0-11	195	MW	88.3	9.5	2.2
52-053-1	Ocilla 52B	Ap	0-9	220	WD	81.2	14.3	4.5
8-053-1	Masada 8C3	Ap	0-6	220	WD	65.6	16.6	17.8
45-053-2	Orangeburg 45A	Ap	0-10	220	WD	80.9	17.3	1.8
63-053-1	Norfolk 63A	Ap	0-12	220	WD	82.8	14.5	2.7
7-053-1	Emporia 7B	Ap	0-10	200	WD	81.4	15.2	3.5
246-W-5	Dothan 246	Ap	0-8	215	WD	75.3	20.6	4.1
10-053-1	Slagle 10A	Ap	0-10	195	MW	61.1	27.1	11.9
Mean						77.10	16.89	6.06

ON SCARP

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
12-183-1	Uchee 12B	Ap	0-10	185	WD	85.9	11.3	2.8
46-183-3	Turbeville 46B3	Ap	0-6	230	WD	63.4	15.3	21.3
112-183-1	Fuquay 112B	Ap	0-10	230	WD	86.9	11.0	2.1
60-183-1	Fuquay 60C	Ap	0-8	230	WD	79.5	14.4	6.0
11-183-1	Suffolk 11B	Ap	0-9	215	WD	88.1	8.5	3.4
8-053-2	Masada 8B	Ap	0-9	220	WD	68.3	13.7	18.0
Mean						78.68	12.37	8.93

ABOVE SCARP

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
346-183-1	Faceville 346B	Ap	0-10	260	WD	82.2	13.1	4.6
46-183-2	Turbeville 46B	Ap	0-10	250	WD	83.1	10.8	6.1
146-053-1	Varina 146B	Ap	0-8	265	WD	73.4	14.1	12.5
146-053-3	Varina 146B3	Ap	0-4	265	WD	47.3	28.3	24.4
Mean						71.50	16.58	11.90

WET SOILS

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
29-053-1	Roanoke 29A	Ap	0-8	210	PD	47.8	47.9	4.2
82-053-1	Yemassee 82A	Ap	0-10	185	SP	69.1	24.2	6.8
26-053-1	Myatt 26A	A	0-5	215	PD	46.8	40	13.3
74-053-1	Dragston 74A	Ap1	0-5	215	SP	78.5	16.6	4.9
74-053-1	Dragston 74A	Ap2	5-11	215	SP	76.6	18.6	4.8
VT-4	Pickney 90A	Ag	0-24	220	PD	84.3	11.9	3.8
VT2-10	Bibb 92A	Ag1	0-8	210	PD	77.5	17.6	4.9
Mean						68.66	25.26	6.10

PIEDMONT SOILS

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
16-053-1	Herndon 16D3	Ap	0-4	220	WD	69.8	18.8	11.3
20-053-1	Georgeville 20B2	Ap	0-8	260	WD	60.6	14.9	24.5
17-053-1	Helena 17B2	Ap	0-5	260	MW	63.7	20.7	15.5
14-053-1	Vance 14C3	A+E	0-4	260	WD	59.7	27.9	12.4
Mean						63.45	20.58	15.93

TABLE I.1b Depth, elevation, drainage class and particle size distribution of the B horizon

BELOW SCARP

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
69-053-1	Nansemond 69B	Bt	19-31	195	MW	78.9	11.2	9.9
52-053-1	Ocilla 52B	Bt	35-46	220	WD	54.4	33.3	12.3
8-053-1	Masada 8C3	Bt1	6-20	220	WD	40.8	14.6	44.6
45-053-2	Orangeburg 45A	Bt1	20-29	220	WD	54.9	14.5	30.6
63-053-1	Norfolk 63A	Bt1	17-32	220	WD	64.0	16.0	20.0
7-053-1	Emporia 7B	Bt1	14-30	200	WD	59.6	15.7	24.7
246-W-5	Dothan 246	Bt	17-52	215	WD	57.2	12.6	30.2
10-053-1	Slagle 10A	Bt1	10-22	195	MW	50.6	20.4	29.1
Mean						57.55	17.29	25.18

ON SCARP

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
12-183-1	Uchee 12B	Bt1	23-35	185	WD	61.5	6.9	31.6
46-183-3	Turbeville 46B3	Bt1	6-40	230	WD	45.5	8.9	45.6
112-183-1	Fuquay 112B	Bt	33-42	230	WD	78.3	11.3	10.4
60-183-1	Fuquay 60C	Bt1	19-26	230	WD	55.0	4.6	40.4
11-183-1	Suffolk 11B	Bt1	26-50	215	WD	63.8	8.1	28.1
8-053-2	Masada 8B	Bt	9-42	220	WD	58.2	11.2	30.6
Mean						60.38	8.50	31.12

ABOVE SCARP

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
346-183-1	Faceville 346B	Bt1	10-24	260	WD	53.1	15.0	31.9
46-183-2	Turbeville 46B	Bt1	10-22	250	WD	52.1	9.2	38.7
146-053-1	Varina 146B	Bt	8-17	265	WD	51.9	6.0	42.1
146-053-3	Varina 146B3	Btv1	4-24	265	WD	12.0	27.1	60.9
Mean						42.28	14.33	43.40

WET SOILS

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
29-053-1	Roanoke 29A	Btg1	8-14	210	PD	42.2	42.7	15.1
29-053-1	Roanoke 29A	Btg2	14-28	210	PD	33.3	37.6	29.1
82-053-1	Yemassee 82A	Bt	10-25	185	SP	58.0	23.1	18.9
74-053-1	Dragston 74A	Bt	19-34	215	SP	72.2	19.6	8.2
26-053-1	Myatt 26A	Btg	10-30	215	PD	35.4	25.4	39.2
VT-4	Pickney 90A	CS	10-40	220	PD	83.7	12.3	4.0
VT2-10	Bibb 92A	Ag2	8-15	210	PD	82.9	12.8	4.3
Mean						58.24	24.79	16.97

PIEDMONT SOILS

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
16-053-1	Herndon 16D3	Bt1	4-37	220	WD	22.6	21.1	56.3
20-053-1	Georgeville 20B2	Bt1	8-42	260	WD	5.6	30.0	64.4
17-053-1	Helena 17B2	Bt1	5-23	260	MW	28.0	24.2	47.8
14-053-1	Vance 14C3	Bt1	4-33	260	WD	30.0	22.3	47.7
Mean						21.55	24.40	54.05

TABLE I.1c Depth, elevation, drainage class and particle size distribution of the C horizon

BELOW SCARP

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
69-053-1	Nansemond 69B	Cg	31-66	195	MW	67.5	26.4	6.1
52-053-1	Ocilla 52B	BC	46-60	220	WD	75.4	14.6	10.0
8-053-1	Masada 8C3	2C2	65-80+	220	WD	12.6	54.0	33.4
45-053-2	Orangeburg 45A	Bt4	60-79	220	WD	46.3	6.4	47.3
63-053-1	Norfolk 63A	Btv	67-74	220	WD	54.6	8.8	36.5
7-053-1	Emporia 7B	Cg	53-73	200	WD	74.7	11.0	14.3
246-W-5	Dothan 246	Btv	52-74	215	WD	48.7	9.1	42.2
10-053-1	Slagle 10A	BC	36-60+	195	MW	58.0	13.0	28.9
Mean						54.73	17.91	27.34

ON SCARP

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
12-183-1	Uchee 12B	Cg	60-70	185	WD	69.8	6.1	24.1
46-183-3	Turbeville 46B3	Bt2	40-72	230	WD	52.4	6.3	41.2
112-183-1	Fuquay 112B	Btv	50-72	230	WD	57.8	11.0	31.3
60-183-1	Fuquay 60C	C	45-60	230	WD	71.0	8.4	20.6
11-183-1	Suffolk 11B	BC	65-75	215	WD	86.7	3.2	10.1
8-053-2	Masada 8B	C	53-70	220	WD	76.7	10.3	13.0
Mean						69.07	7.55	23.38

ABOVE SCARP

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
346-183-1	Faceville 346B	Bt4	64-72	260	WD	41.8	4.0	54.2
46-183-2	Turbeville 46B	BC	65-89+	250	WD	76.9	2.6	20.6
146-053-1	Varina 146B	Cv	33-70	265	WD	19.5	21.6	59.0
146-053-3	Varina 146B3	C	62-72	265	WD	9.0	69.8	21.3
Mean						36.80	24.50	38.78

WET SOILS

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
29-053-1	Roanoke 29A	Cg	62-70	210	PD	66.0	16.0	18.0
82-053-1	Yemassee 82A	Cg	43-60	185	SP	62.9	17.3	19.7
26-053-1	Myatt 26A	2Cg	44-60+	215	PD	54.3	9.0	36.7
74-053-1	Dragston 74A	2Cg	41-64	215	SP	69.4	9.3	21.4
VT-4	Pickney 90A	Cg3	48-60	220	PD	70.5	14.8	14.8
VT2-10	Bibb 92A	Cg	15-60	210	PD	81.7	7.3	11.0
Mean						67.47	12.28	20.27

PIEDMONT SOILS

Lab #	Series Name	horizon	depth (inches)	elevation (ft)	drainage class	% total sand	% total silt	% clay
16-053-1	Herndon 16D3	BC	49-64	220	WD	8.7	57.5	33.8
20-053-1	Georgeville 20B2	BC	66-72	260	WD	1.6	52.0	46.4
17-053-1	Helena 17B2	C	52-72	260	MW	8.3	65.7	26.0
14-053-1	Vance 14C3	Cg	42-72	260	WD	13.6	48.9	37.6
Mean						8.05	56.03	35.95

TABLE I.2a Clay mineralogy of the A horizon in weight % (g/100 g clay)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
69-053-1	Nansemond 69B	26	53	5	-	4	9	3	tr	tr
52-053-1	Ocilla 52B	29	45	8	tr	6	8	4	tr	-
8-053-1	Masada 8C3	71	24	tr	-	2	1	2	-	-
45-053-2	Orangeburg 45A	19	44	5	8	6	9	9	-	-
63-053-1	Norfolk 63A	21	57	-	-	8	10	4	tr	-
7-053-1	Emporia 7B	24	48	5	-	11	9	3	-	-
246-W-5	Dothan 246	19	54	5	-	8	7	7	tr	tr
10-053-1	Slagle 10A	45	40	5	tr	2	5	3	tr	-
Mean		31.75	45.63	4.19	1.13	5.88	7.25	4.38	0.31	0.13

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
12-183-1	Uchee 12B	33	37	5	-	13	9	3	tr	tr
46-183-3	Turbeville 46B3	46	28	5	-	3	1	17	tr	tr
112-183-1	Fuquay 112B	18	54	5	-	7	12	4	tr	tr
60-183-1	Fuquay 60C	30	46	5	-	7	6	6	tr	-
11-183-1	Suffolk 11B	23	51	5	-	4	12	5	-	tr
8-053-2	Masada 8B	54	18	5	5	5	1	12	-	-
Mean		34.00	39.00	5.00	0.83	6.50	6.83	7.83	0.33	0.33

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
346-183-1	Faceville 346B	33	41	tr	-	10	7	9	tr	tr
46-183-2	Turbeville 46B	37	37	2	-	10	5	9	tr	tr
146-053-1	Varina 146B	53	28	-	tr	7	6	6	-	tr
146-053-3	Varina 146B3	55	40	-	-	1	-	4	-	-
Mean		44.50	36.50	0.63	0.13	7.00	4.50	7.00	0.25	0.38

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
29-053-1	Roanoke 29A	15	5	30	41	5	4	tr	-	-
82-053-1	Yemassee 82A	30	45	tr	8	6	8	3	tr	tr
74-053-1	Dragston 74A Ap1	29	48	5	-	5	10	3	tr	tr
74-053-1	Dragston 74A Ap2	23	49	7	-	5	9	7	tr	-
26-053-1	Myatt 26A	30	49	5	tr	6	6	4	-	tr
VT2-10	Bibb 92A	26	47	tr	15	2	10	-	tr	tr
VT-4	Pickney 90A	32	53	5	-	3	5	2	-	tr
Mean		26.43	42.29	7.57	9.21	4.57	7.43	2.79	0.29	0.36

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
16-053-1	Herndon 16D3	65	26	-	-	1	5	3	tr	tr
20-053-1	Georgeville 20B2	75	19	-	-	2	1	3	-	-
17-053-1	Helena 17B2	70	18	5	-	2	2	3	-	tr
14-053-1	Vance 14C3	45	46	-	tr	2	5	2	-	tr
Mean		63.75	27.25	1.25	0.13	1.75	3.25	2.75	0.13	0.38

Kao = kaolinite; Ch.V = chloritized vermiculite; Verm = vermiculite; Smec = smectite;
Qz = quartz; Gibb = gibbsite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Tr = trace.

TABLE I.2b Clay mineralogy of the B horizon in weight % (g/100 g clay)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
69-053-1	Nansemond 69B	30	30	10	tr	10	11	9	tr	-
52-053-1	Ocilla 52B	25	35	5	5	13	7	5	tr(k,p)	5
8-053-1	Masada 8C3	74	16	-	5	tr	tr	5	-	-
45-053-2	Orangeburg 45A	32	25	5	15	5	2	16	-	-
63-053-1	Norfolk 63A	28	58	-	-	2	3	9	tr	-
7-053-1	Emporia 7B	55	33	5	-	2	2	3	-	-
246-W-5	Dothan 246	29	48	-	-	2	1	20	-	-
10-053-1	Slagle 10A	38	35	10	10	3	2	2	tr(k,p)	-
Mean		38.88	35.00	4.38	4.44	4.69	3.56	8.63	0.25	0.63

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
12-183-1	Uchee 12B	57	19	10	-	5	tr	9	-	-
46-183-3	Turbeville 46B3	58	18	5	-	1	tr	18	tr(k,p)	-
112-183-1	Fuquay 112B	38	27	5	-	8	13	9	tr	-
60-183-1	Fuquay 60C	71	13	5	-	3	tr	8	tr	-
11-183-1	Suffolk 11B	35	40	2	4	2	tr	13	tr(k,p)	5
8-053-2	Masada 8B	45	22	8	10	2	1	12	-	-
Mean		50.67	23.17	5.83	2.33	3.50	2.67	11.50	0.33	0.83

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
346-183-1	Faceville 346B	55	17	5	tr	3	1	19	tr	-
46-183-2	Turbeville 46B	46	21	10	5	2	1	15	-	-
146-053-1	Varina 146B	55	30	tr	5	1	tr	9	-	-
146-053-3	Varina 146B3	65	26	-	5	1	tr	3	-	-
Mean		55.25	23.50	3.88	3.88	1.75	0.75	11.50	0.13	-

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
29-053-1	Roanoke 29A Btg1	30	47	8	-	5	10	tr	-	-
29-053-1	Roanoke 29A Btg2	52	35	5	-	4	4	tr	-	-
82-053-1	Yemassee 82A	44	25	10	10	5	4	2	tr	-
74-053-1	Dragston 74A	15	30	10	tr	15	25	5	tr(k,p)	-
26-053-1	Myatt 26A	52	35	-	5	3	2	3	-	-
VT2-10	Bibb 92A	50	19	15	12	4	tr	-	-	-
VT-4	Pickney 90A	39	33	5	15	3	3	2	-	-
Mean		40.29	32.00	7.57	6.07	5.57	6.93	1.86	0.14	-

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
16-053-1	Herndon 16D3	58	33	-	5	1	1	2	tr	-
20-053-1	Georgeville 20B2	80	15	-	5	tr	tr	tr	-	-
17-053-1	Helena 17B2	84	9	-	4	tr	-	3	-	-
14-053-1	Vance 14C3	58	20	5	15	2	-	tr	-	-
Mean		70.00	19.25	1.25	7.25	1.00	0.38	1.50	0.13	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Verm = vermiculite; Smec = smectite;
Qz = quartz; Gibb = gibbsite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Tr = trace.

TABLE I.2c Clay mineralogy of the C horizon in weight % (g/100 g clay)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Int
69-053-1	Nansemond 69B	55	26	5	5	-	5	4	-
52-053-1	Ocilla 52B	41	27	5	8	8	4	7	-
8-053-1	Masada 8C3	74	16	-	10	tr	-	-	-
45-053-2	Orangeburg 45A	40	29	5	8	2	tr	16	-
63-053-1	Norfolk 63A	41	45	-	5	tr	1	8	-
7-053-1	Emporia 7B	61	20	5	10	2	tr	2	-
246-W-5	Dothan 246	35	38	5	-	2	tr	20	-
10-053-1	Slagle 10A	60	15	10	15	-	tr	-	-
Mean		50.88	27.00	4.38	7.63	1.88	1.50	7.13	-

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Int
12-183-1	Uchee 12B	90	5	5	-	tr	-	-	-
46-183-3	Turbeville 46B3	60	20	5	tr	tr	-	15	-
112-183-1	Fuquay 112B	45	28	8	-	8	-	11	-
60-183-1	Fuquay 60C	80	10	-	6	tr	-	4	-
11-183-1	Suffolk 11B	40	38	5	5	tr	tr	12	-
8-053-2	Masada 8B	55	29	5	5	2	tr	4	-
Mean		61.67	21.67	4.67	2.75	2.00	0.17	7.67	-

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Int
346-183-1	Faceville 346B	60	34	-	-	tr	tr	6	-
46-183-2	Turbeville 46B	75	10	5	5	-	-	5	-
146-053-1	Varina 146B	85	15	-	-	-	-	-	-
146-053-3	Varina 146B3	80	5	5	10	tr	tr	-	-
Mean		75.00	16.00	2.50	3.75	0.25	0.25	2.75	-

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Int
29-053-1	Roanoke 29A	45	5	14	32	2	2	-	-
82-053-1	Yemassee 82A	49	29	-	20	tr	2	tr	-
74-053-1	Dragston 74A	45	34	5	5	5	3	3	tr
26-053-1	Myatt 26A	60	17	-	15	3	2	3	tr
VT2-10	Bibb 92A	45	38	-	10	2	5	tr	-
VT-4	Pickney 90A	60	22	5	5	3	-	5	-
Mean		50.67	24.17	4.00	14.50	2.58	2.33	2.00	0.17

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Int
16-053-1	Herndon 16D3	70	22	-	8	-	-	-	-
20-053-1	Georgeville 20B2	85	15	-	-	-	-	-	-
17-053-1	Helena 17B2	85	9	-	6	tr	-	-	-
14-053-1	Vance 14C3	80	5	5	10	-	-	-	-
Mean		80.00	12.75	1.25	6.00	0.13	-	-	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz; Gibb = gibbsite; Int = interstratified 2:1 phyllosilicates; Tr = trace.

TABLE I.3a Clay mineralogy of the A horizon in mass % (g/100 g soil)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
69-053-1	Nansemond 69B	0.53	1.08	0.10	-	0.08	0.18	0.06	tr	tr
52-053-1	Ocilla 52B	1.24	1.93	0.34	tr	0.26	0.34	0.17	tr	-
8-053-1	Masada 8C3	9.93	3.36	tr	-	0.28	0.14	0.28	-	-
45-053-2	Orangeburg 45A	0.26	0.60	0.07	0.11	0.08	0.12	0.12	-	-
63-053-1	Norfolk 63A	0.52	1.42	-	-	0.20	0.25	0.10	tr	-
7-053-1	Emporia 7B	0.74	1.48	0.15	-	0.34	0.28	0.09	-	-
246-W-5	Dothan 246	0.70	2.00	0.19	-	0.30	0.26	0.26	tr	tr
10-053-1	Slagle 10A	4.73	4.20	0.53	tr	0.21	0.53	0.32	tr	-
Mean		2.33	2.04	0.18	0.02	0.22	0.26	0.18	0.02	-

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
12-183-1	Uchee 12B	0.84	0.94	0.13	-	0.33	0.23	0.08	tr	tr
46-183-3	Turbeville 46B3	8.58	5.22	0.93	-	0.56	0.19	3.17	tr	tr
112-183-1	Fuquay 112B	0.33	0.99	0.09	-	0.13	0.22	0.07	tr	tr
60-183-1	Fuquay 60C	1.64	2.52	0.27	-	0.38	0.33	0.33	tr	-
11-183-1	Suffolk 11B	0.68	1.51	0.15	-	0.12	0.36	0.15	-	tr
8-053-2	Masada 8B	8.55	2.85	0.79	0.79	0.79	0.16	1.90	-	-
Mean		3.44	2.34	0.39	0.13	0.39	0.25	0.95	0.10	0.02

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
346-183-1	Faceville 346B	1.38	1.71	tr	-	0.42	0.29	0.38	tr	tr
46-183-2	Turbeville 46B	1.99	1.99	0.11	-	0.54	0.27	0.48	tr	tr
146-053-1	Varina 146B	5.64	2.98	-	tr	0.74	0.64	0.64	-	tr
146-053-3	Varina 146B3	10.98	7.99	-	-	0.20	-	0.80	-	-
Mean		5.00	3.67	0.03	-	0.48	0.30	0.58	0.01	0.03

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
29-053-1	Roanoke 29A	0.60	0.20	1.21	1.65	0.20	0.16	tr	-	-
82-053-1	Yemassee 82A	1.93	2.89	tr	0.51	0.39	0.51	0.19	tr	tr
74-053-1	Dragston 74A Ap1	1.32	2.18	0.23	-	0.23	0.45	0.14	tr	tr
74-053-1	Dragston 74A Ap2	1.03	2.19	0.31	-	0.22	0.40	0.31	tr	-
26-053-1	Myatt 26A	3.92	6.40	0.65	tr	0.78	0.78	0.52	-	tr
VT2-10	Bibb 92A	1.20	2.16	tr	0.69	0.09	0.46	-	tr	tr
VT-4	Pickney 90A	1.21	2.00	0.19	-	0.11	0.19	0.08	-	tr
Mean		1.60	2.57	0.38	0.42	0.29	0.42	0.18	0.06	0.07

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
16-053-1	Herndon 16D3	5.17	2.07	-	-	0.08	0.40	0.24	tr	tr
20-053-1	Georgeville 20B2	14.51	3.68	-	-	0.39	0.19	0.58	-	-
17-053-1	Helena 17B2	9.37	2.41	0.67	-	0.27	0.27	0.40	-	tr
14-053-1	Vance 14C3	5.08	5.19	-	tr	0.23	0.56	0.23	-	tr
Mean		8.53	3.34	0.17	0.02	0.24	0.36	0.36	0.01	0.04

Kao = kaolinite; Ch.V = chloritized vermiculite; Verm = vermiculite; Smec = smectite;
Qz = quartz; Gibb = gibbsite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; tr = trace.

TABLE I.3b Clay mineralogy of the B horizon in mass % (g/100 g soil)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
69-053-1	Nansemond 69B	2.55	2.55	0.85	tr	0.85	0.94	0.77	tr	-
52-053-1	Ocilla 52B	2.81	3.93	0.56	0.56	1.46	0.79	0.56	tr(k,p)	0.56
8-053-1	Masada 8C3	27.11	5.86	-	1.83	tr	tr	1.83	-	-
45-053-2	Orangeburg 45A	8.19	6.40	1.28	3.84	1.28	0.51	4.09	-	-
63-053-1	Norfolk 63A	4.84	10.02	-	-	0.35	0.52	1.56	tr	-
7-053-1	Emporia 7B	11.94	7.16	1.09	-	0.43	0.43	0.65	-	-
246-W-5	Dothan 246	7.77	12.87	-	-	0.54	0.27	5.36	-	-
10-053-1	Slagle 10A	9.39	8.65	2.47	2.47	0.74	0.49	0.49	tr(k,p)	-
Mean		9.33	7.18	0.78	1.09	0.73	0.52	1.91	0.04	0.07

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
12-183-1	Uchee 12B	15.56	5.19	2.73	-	1.37	tr	2.46	-	-
46-183-3	Turbeville 46B3	23.15	7.18	2.00	-	0.40	tr	7.18	tr(k,p)	-
112-183-1	Fuquay 112B	3.52	2.50	0.46	-	0.74	1.20	0.83	tr	-
60-183-1	Fuquay 60C	25.00	4.58	1.76	-	1.06	tr	2.82	tr	-
11-183-1	Suffolk 11B	8.26	9.44	0.47	0.94	0.47	tr	3.07	tr(k,p)	1.18
8-053-2	Masada 8B	11.81	5.78	2.10	2.63	0.53	0.26	3.15	-	-
Mean		14.55	5.78	1.59	0.60	0.76	0.35	3.25	0.09	0.20

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
346-183-1	Faceville 346B	14.78	4.57	1.34	tr	0.81	0.27	5.11	tr	-
46-183-2	Turbeville 46B	14.91	6.81	3.24	1.62	0.65	0.32	4.86	-	-
146-053-1	Varina 146B	19.51	10.64	tr	1.77	0.35	tr	3.19	-	-
146-053-3	Varina 146B3	34.18	13.67	-	2.63	0.53	tr	1.58	-	-
Mean		20.85	8.92	1.19	1.54	0.59	0.26	3.69	0.04	-

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
29-053-1	Roanoke 29A Btg1	4.37	6.85	1.17	-	0.73	1.46	tr	-	-
29-053-1	Roanoke 29A Btg2	14.44	9.72	1.39	-	1.11	1.11	tr	-	-
82-053-1	Yemassee 82A	7.64	4.34	1.74	1.74	0.87	0.69	0.35	tr	-
74-053-1	Dragston 74A	1.16	2.33	0.78	tr	1.16	1.94	0.39	tr(k,p)	-
26-053-1	Myatt 26A	19.74	13.29	-	1.90	1.14	0.76	1.14	-	-
VT2-10	Bibb 92A	2.10	0.80	0.63	0.50	0.17	tr	-	-	-
VT-4	Pickney 90A	1.56	1.32	0.20	0.60	0.12	0.12	0.08	-	-
Mean		7.29	5.52	0.84	0.68	0.76	0.87	0.31	0.02	-

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb	Fd	Int
16-053-1	Herndon 16D3	26.85	15.28	-	2.31	0.46	0.46	0.93	tr	-
20-053-1	Georgeville 20B2	41.38	7.76	-	2.59	tr	tr	tr	-	-
17-053-1	Helena 17B2	34.74	3.72	-	1.65	tr	-	1.24	-	-
14-053-1	Vance 14C3	24.77	8.54	2.14	6.41	0.85	-	tr	-	-
Mean		31.94	8.83	0.54	3.24	0.45	0.12	0.30	0.50	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Verm = vermiculite; Smec = smectite;
Qz = quartz; Gibb = gibbsite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; tr = trace.

TABLE I.3c Clay mineralogy of the C horizon in mass % (g/100 g soil)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb
69-053-1	Nansemond 69B	3.28	1.55	0.30	0.30	-	0.30	0.24
52-053-1	Ocilla 52B	3.85	2.54	0.47	0.75	0.75	0.38	0.66
8-053-1	Masada 8C3	12.23	2.64	-	1.65	tr	-	-
45-053-2	Orangeburg 45A	16.39	11.88	2.05	3.28	0.82	tr	6.56
63-053-1	Norfolk 63A	13.12	14.40	-	1.60	tr	0.32	2.56
7-053-1	Emporia 7B	7.97	2.61	0.65	1.31	0.26	tr	0.26
246-W-5	Dothan 246	12.83	13.93	1.83	-	0.73	tr	7.33
10-053-1	Slagle 10A	15.11	3.78	2.52	3.78	-	tr	-
Mean		10.60	6.67	0.98	1.58	0.36	0.20	2.20

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb
12-183-1	Uchee 12B	19.94	1.11	1.11	-	tr	-	-
46-183-3	Turbeville 46B3	21.92	7.31	1.83	tr	tr	-	5.48
112-183-1	Fuquay 112B	11.83	7.36	2.10	-	2.10	-	2.89
60-183-1	Fuquay 60C	15.09	1.89	-	1.13	tr	-	0.75
11-183-1	Suffolk 11B	3.50	3.33	0.44	0.44	tr	tr	1.05
8-053-2	Masada 8B	6.06	3.19	0.55	0.55	0.22	tr	0.44
Mean		13.06	4.03	1.01	0.39	0.46	0.02	1.77

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb
346-183-1	Faceville 346B	28.58	16.20	-	-	tr	tr	2.86
46-183-2	Turbeville 46B	13.34	1.78	0.89	0.89	-	-	0.89
146-053-1	Varina 146B	43.51	7.68	-	-	-	-	-
146-053-3	Varina 146B3	9.83	0.61	0.61	1.23	tr	tr	-
Mean		23.82	6.57	0.38	0.53	0.08	0.08	0.94

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb
29-053-1	Roanoke 29A	8.06	0.90	2.51	5.73	0.36	0.36	-
82-053-1	Yemassee 82A	9.38	5.55	-	3.83	tr	0.38	tr
74-053-1	Dragston 74A	9.45	7.14	1.05	1.05	1.05	0.63	0.63
26-053-1	Myatt 26A	21.96	6.22	-	5.49	1.10	0.73	1.10
VT2-10	Bibb 92A	4.80	4.05	-	1.07	0.21	0.53	tr
VT-4	Pickney 90A	8.86	3.25	0.74	0.74	0.44	-	0.74
Mean		10.42	4.52	0.72	2.99	0.54	0.44	0.44

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Verm	Smec	Mica	Qz	Gibb
16-053-1	Herndon 16D3	16.72	5.26	-	1.91	-	-	-
20-053-1	Georgeville 20B2	31.05	5.48	-	-	-	-	-
17-053-1	Helena 17B2	13.54	1.43	-	0.96	tr	-	-
14-053-1	Vance 14C3	27.94	1.75	1.75	3.49	-	-	-
Mean		22.31	3.48	0.44	1.59	0.02	-	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Verm = vermiculite; Smec = smectite;
Qz = quartz; Gibb = gibbsite; tr = trace.

TABLE I.4a Silt mineralogy of the A horizon in weight % (g/100 g silt)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
69-053-1	Nansemond 69B	tr	3	8	88	1	-	-
52-053-1	Ocilla 52B	5	7	10	77	1	-	-
8-053-1	Masada 8C3	44	3	3	50	tr	-	-
45-053-2	Orangeburg 45A	3	5	25	65	2	-	**
63-053-1	Norfolk 63A	4	5	19	70	2	-	**
7-053-1	Emporia 7B	6	7	15	70	2	-	**
246-W-5	Dothan 246	8	12	19	55	1	5	*
10-053-1	Slagle 10A	5	6	23	66	-	-	**
Mean		9.44	6.00	15.25	67.63	1.19	0.63	-

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
12-183-1	Uchee 12B	9	11	23	55	2	-	**
46-183-3	Turbeville 46B3	6	18	24	52	tr	tr	**
112-183-1	Fuquay 112B	3	5	19	70	3	-	*
60-183-1	Fuquay 60C	10	4	12	72	2	-	-
11-183-1	Suffolk 11B	7	10	18	63	3	-	**
8-053-2	Masada 8B	6	7	19	66	2	-	**
Mean		6.83	9.17	19.17	63.00	2.08	0.08	-

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
346-183-1	Faceville 346B	6	4	13	73	1	3	**
46-183-2	Turbeville 46B	7	7	20	65	1	tr	**
146-053-1	Varina 146B	18	4	18	58	2	-	**
146-053-3	Varina 146B3	46	-	-	54	tr	-	-
Mean		19.25	3.75	12.75	62.5	1.13	0.88	-

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
29-053-1	Roanoke 29A	-	-	10	88	2	-	-
82-053-1	Yemassee 82A	4	4	14	77	1	-	*
74-053-1	Dragston 74A Ap1	4	4	17	73	2	-	-
74-053-1	Dragston 74A Ap2	4	4	17	73	2	-	-
26-053-1	Myatt 26A	8	tr	8	82	2	-	*
VT2-10	Bibb 92A	-	-	-	100	tr	-	-
VT-4	Pickney 90A	10	-	8	80	2	-	-
Mean		4.29	1.79	10.57	81.86	1.64	-	-

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
16-053-1	Herndon 16D3	50	-	-	50	tr	-	-
20-053-1	Georgeville 20B2	48	3	6	43	tr	-	*
17-053-1	Helena 17B2	45	4	6	45	tr	-	*
14-053-1	Vance 14C3	49	3	7	39	2	tr	-
Means		48.00	2.50	4.75	44.25	0.88	0.13	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Qz = quartz; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Misc = miscellaneous; tr = trace; Ch.V. denotes a 14 A component which may be Ch.V., Verm, Smec, or Int; * and ** denote surface horizon silt fractions enriched (1x) or highly enriched (2x), resp. with regard to mica, feldspars, kaolinite, and 14 A component relative to B horizon silt fractions.

TABLE I.4b Silt mineralogy of the B horizon in weight % (g/100 g silt)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
69-053-1	Nansemond 69B	3	4	3	89	-	1	-
52-053-1	Ocilla 52B	10	11	15	63	-	1	-
8-053-1	Masada 8C3	47	-	tr	53	-	tr	-
45-053-2	Orangeburg 45A	3	6	11	79	tr	1	-
63-053-1	Norfolk 63A	7	5	13	74	-	1	-
7-053-1	Emporia 7B	3	8	8	80	-	1	-
246-W-5	Dothan 246	10	19	22	43	-	1	5
10-053-1	Slagle 10A	6	7	10	76	tr	1	-
Mean		11.13	7.50	10.31	69.63	0.13	0.94	0.63

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
12-183-1	Uchee 12B	8	3	3	85	-	1	-
46-183-3	Turbeville 46B3	9	11	11	68	-	1	tr
112-183-1	Fuquay 112B	7	7	15	69	-	2	tr
60-183-1	Fuquay 60C	14	-	5	75	4	2	-
11-183-1	Suffolk 11B	3	6	5	85	tr	1	-
8-053-2	Masada 8B	8	2	9	80	tr	1	-
Mean		8.17	4.83	8.00	77.00	0.83	1.33	0.17

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
346-183-1	Faceville 346B	4	3	5	88	-	1	-
46-183-2	Turbeville 46B	4	1	5	89	-	1	-
146-053-1	Varina 146B	23	4	8	63	-	2	-
146-053-3	Varina 146B3	65	-	-	35	-	-	-
Mean		24.00	2.00	4.50	68.75	-	1.00	-

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
29-053-1	Roanoke 29A Btg1	5	3	14	77	-	1	-
29-053-1	Roanoke 29A Btg2	7	17	15	60	-	1	-
82-053-1	Yemassee 82A	6	6	10	77	-	1	-
74-053-1	Dragston 74A	7	4	22	66	-	1	tr
26-053-1	Myatt 26A	11	8	17	63	tr	1	-
VT2-10	Bibb 92A	36	1	15	46	-	2	-
VT-4	Pickney 90A	20	tr	12	66	-	2	-
Mean		13.14	5.64	15.00	65.00	0.07	1.29	0.07

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
16-053-1	Herndon 16D3	65	-	-	35	-	tr	-
20-053-1	Georgeville 20B2	74	-	3	23	tr	tr	-
17-053-1	Helena 17B2	45	2	3	50	tr	tr	-
14-053-1	Vance 14C3	71	5	6	18	-	tr	-
Mean		63.75	1.75	3.00	31.50	0.25	0.50	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Qz = quartz; Gibb = gibbsite;
Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Tr = trace.
Ch.V. denotes a 14 A component which may be Ch.V., Verm, Smec, or Int.

TABLE I.4c Silt mineralogy of the C horizon in weight % (g/100 g silt)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
69-053-1	Nansemond 69B	3	4	3	90	tr	-
52-053-1	Ocilla 52B	5	5	8	82	tr	-
8-053-1	Masada 8C3	87	-	3	10	tr	-
45-053-2	Orangeburg 45A	6	12	10	72	tr	-
63-053-1	Norfolk 63A	7	11	7	75	tr	-
7-053-1	Emporia 7B	2	6	4	88	-	-
246-W-5	Dothan 246	5	10	8	77	-	-
10-053-1	Slagle 10A	7	9	5	79	-	-
Mean		15.25	7.13	6.00	71.63	0.31	-

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
12-183-1	Uchee 12B	40	tr	15	45	1	-
46-183-3	Turbeville 46B3	8	16	18	58	tr	-
112-183-1	Fuquay 112B	13	13	5	69	tr	-
60-183-1	Fuquay 60C	70	-	tr	30	-	-
11-183-1	Suffolk 11B	6	8	6	80	tr	-
8-053-2	Masada 8B	11	6	8	75	-	-
Mean		24.67	7.25	8.75	59.50	0.42	-

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
346-183-1	Faceville 346B	15	6	8	71	tr	-
46-183-2	Turbeville 46B	5	3	5	87	tr	-
146-053-1	Varina 146B	85	tr	-	15	-	-
146-053-3	Varina 146B3	80	-	-	20	-	-
Mean		46.25	2.38	3.25	48.25	0.25	-

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
29-053-1	Roanoke 29A	8	-	6	81	tr	5
82-053-1	Yemassee 82A	10	10	3	77	tr	-
74-053-1	Dragston 74A	8	10	10	72	tr	-
26-053-1	Myatt 26A	7	2	12	79	tr	-
VT2-10	Bibb 92A	3	tr	4	91	2	-
VT-4	Pickney 90A	69	tr	14	17	-	-
Mean		17.50	3.83	8.17	69.50	0.67	0.83

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
16-053-1	Herndon 16D3	75	-	-	25	-	-
20-053-1	Georgeville 20B	70	-	tr	30	-	-
17-053-1	Helena 17B2	53	2	5	40	-	-
14-053-1	Vance 14C3	45	-	37	18	-	-
Mean		60.75	0.50	10.63	28.25	-	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Qz = quartz;
Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Tr = trace.
Ch.V. denotes a 14 A component which may be Ch.V., Verm, Smec, or Int.

TABLE I.5a Silt mineralogy of the A horizon in mass % (g/100 g soil)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
69-053-1	Nansemond 69B	tr	0.29	0.76	8.36	0.10	-	-
52-053-1	Ocilla 52B	0.72	1.00	1.43	11.01	0.14	-	-
8-053-1	Masada 8C3	7.30	0.50	0.50	8.30	tr	-	-
45-053-2	Orangeburg 45A	0.52	0.87	4.33	11.25	0.35	-	**
63-053-1	Norfolk 63A	0.58	0.73	2.76	10.15	0.29	-	**
7-053-1	Emporia 7B	0.91	1.06	2.28	10.64	0.30	-	**
246-W-5	Dothan 246	1.65	2.47	3.91	11.33	0.21	1.03	*
10-053-1	Slagle 10A	1.36	1.63	6.23	17.89	-	-	**
Mean		1.64	1.07	2.78	11.12	0.18	0.13	-

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
12-183-1	Uchee 12B	1.02	1.24	2.60	6.22	0.23	-	**
46-183-3	Turbeville 46B3	0.92	2.75	3.67	7.96	tr	tr	**
112-183-1	Fuquay 112B	0.33	0.55	2.09	7.70	0.33	-	*
60-183-1	Fuquay 60C	1.44	0.58	1.73	10.37	0.29	-	-
11-183-1	Suffolk 11B	0.60	0.85	1.53	5.36	0.26	-	**
8-053-2	Masada 8B	0.82	0.96	2.60	9.04	0.27	-	**
Mean		0.86	1.16	2.37	7.78	0.24	0.03	-

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
346-183-1	Faceville 346B	0.79	0.52	1.70	9.56	0.13	0.39	**
46-183-2	Turbeville 46B	0.76	0.76	2.16	7.02	0.11	tr	**
146-053-1	Varina 146B	2.54	0.56	2.54	8.18	0.28	-	**
146-053-3	Varina 146B3	13.02	-	-	15.28	tr	-	-
Mean		4.28	0.46	1.60	10.00	0.17	0.11	-

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
29-053-1	Roanoke 29A	-	-	4.79	42.15	0.96	-	-
82-053-1	Yemassee 82A	0.97	0.97	3.39	18.63	0.24	-	*
74-053-1	Dragston 74A Ap1	0.66	0.66	2.82	12.12	0.33	-	-
74-053-1	Dragston 74A Ap2	0.74	0.74	3.16	13.58	0.37	-	-
26-053-1	Myatt 26A	3.20	tr	3.20	32.80	0.80	-	*
VT2-10	Bibb 92A	-	-	-	17.60	tr	-	-
VT-4	Pickney 90A	1.19	-	0.95	9.52	0.24	-	-
Mean		0.97	0.37	2.62	20.91	0.43	-	-

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int	Misc
16-053-1	Herndon 16D3	9.40	-	-	9.40	tr	-	-
20-053-1	Georgeville 20B2	7.15	0.45	0.89	6.41	tr	-	*
17-053-1	Helena 17B2	9.32	0.83	1.24	9.32	tr	-	*
14-053-1	Vance 14C3	13.67	0.84	1.95	10.88	0.56	tr	-
Mean		9.89	0.53	1.02	9.00	0.21	0.04	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Qz = quartz; Fd = feldspars
Int = interstratified 2:1 phyllosilicates; Misc = miscellaneous; tr = trace.
Ch.V. denotes a 14 A component which may be Ch.V., Verm, Smec, or Int.
* and ** denote surface horizon silt fractions enriched (1x) or highly enriched (2x), resp. with regard to mica, feldspars, kaolinite, and 14 A component

TABLE I.5b Silt mineralogy of the B horizon in mass % (g/100 g soil)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
69-053-1	Nansemond 69B	0.34	0.45	0.34	9.97	-	0.11	-
52-053-1	Ocilla 52B	3.33	3.66	5.00	20.98	-	0.33	-
8-053-1	Masada 8C3	6.86	-	tr	7.74	-	tr	-
45-053-2	Orangeburg 45A	0.44	0.87	1.60	11.46	tr	0.15	-
63-053-1	Norfolk 63A	1.12	0.80	2.08	11.84	-	0.16	-
7-053-1	Emporia 7B	0.47	1.26	1.26	12.56	-	0.16	-
246-W-5	Dothan 246	1.26	2.39	2.77	5.42	-	0.13	0.63
10-053-1	Slagle 10A	1.22	1.43	2.04	15.50	tr	0.20	-
Mean		1.88	1.36	1.90	11.93	0.02	0.16	0.08

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
12-183-1	Uchee 12B	0.55	0.21	0.21	5.87	-	0.07	-
46-183-3	Turbeville 46B3	0.80	0.98	0.98	6.05	-	0.09	tr
112-183-1	Fuquay 112B	0.79	0.79	1.70	7.80	-	0.23	tr
60-183-1	Fuquay 60C	0.64	-	0.23	3.45	0.18	0.09	-
11-183-1	Suffolk 11B	0.24	0.49	0.41	6.89	tr	0.08	-
8-053-2	Masada 8B	0.90	0.22	1.01	8.96	tr	0.11	-
Mean		0.65	0.45	0.76	6.50	0.05	0.11	0.02

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
346-183-1	Faceville 346B	0.60	0.45	0.75	13.20	-	0.15	-
46-183-2	Turbeville 46B	0.37	0.09	0.46	8.19	-	0.09	-
146-053-1	Varina 146B	1.38	0.24	0.48	3.78	-	0.12	-
146-053-3	Varina 146B3	17.62	-	-	9.49	-	-	-
Mean		4.99	0.20	0.42	8.67	-	0.09	-

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
29-053-1	Roanoke 29A Btg1	2.14	1.28	5.98	32.88	-	0.43	-
29-053-1	Roanoke 29A Btg2	2.63	6.39	5.64	22.56	-	0.38	-
82-053-1	Yemassee 82A	1.39	1.39	2.31	17.79	-	0.23	-
74-053-1	Dragston 74A	1.37	0.78	4.31	12.94	-	0.20	tr
26-053-1	Myatt 26A	2.79	2.03	4.32	16.00	tr	0.25	-
VT2-10	Bibb 92A	4.61	0.13	1.92	5.89	-	0.26	-
VT-4	Pickney 90A	2.46	tr	1.48	8.12	-	0.25	-
Mean		2.48	1.72	3.71	16.60	0.02	0.29	0.01

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Gibb	Fd	Int
16-053-1	Herndon 16D3	13.72	-	-	7.39	-	tr	-
20-053-1	Georgeville 20B2	22.20	-	0.90	6.90	tr	tr	-
17-053-1	Helena 17B2	10.89	0.48	0.73	12.10	tr	tr	-
14-053-1	Vance 14C3	15.83	1.12	1.34	4.01	-	tr	-
Mean		15.66	0.40	0.74	7.60	0.07	0.12	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Qz = quartz; Gibb = gibbsite;
Fd = feldspars; Int = interstratified 2:1 phyllosilicates; tr = trace.
Ch.V. denotes a 14 A component which may be Ch.V., Verm, Smec, or Int.

TABLE I.5c Silt mineralogy of the C horizon in mass % (g/100 g soil)

BELOW SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
69-053-1	Nansemond 69B	0.79	1.06	0.79	23.76	tr	-
52-053-1	Ocilla 52B	0.73	0.73	1.17	11.97	tr	-
8-053-1	Masada 8C3	46.98	-	1.62	5.40	tr	-
45-053-2	Orangeburg 45A	0.38	0.77	0.64	4.61	tr	-
63-053-1	Norfolk 63A	0.62	0.97	0.62	6.60	tr	-
7-053-1	Emporia 7B	0.22	0.66	0.44	9.68	-	-
246-W-5	Dothan 246	0.46	0.91	0.73	7.01	-	-
10-053-1	Slagle 10A	0.91	1.17	0.65	10.27	-	-
Mean		6.39	0.78	0.83	9.91	0.069	-

ON SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
12-183-1	Uchee 12B	2.44	tr	0.92	2.75	0.06	-
46-183-3	Turbeville 46B3	0.50	1.01	1.13	3.65	tr	-
112-183-1	Fuquay 112B	1.43	1.43	0.55	7.59	tr	-
60-183-1	Fuquay 60C	5.88	-	tr	2.52	-	-
11-183-1	Suffolk 11B	0.19	0.26	0.19	2.56	tr	-
8-053-2	Masada 8B	1.13	0.62	0.82	7.73	-	-
Mean		1.93	0.56	0.61	4.47	0.03	-

ABOVE SCARP

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
346-183-1	Faceville 346B	0.60	0.24	0.32	2.84	tr	-
46-183-2	Turbeville 46B	0.13	0.08	0.13	2.26	tr	-
146-053-1	Varina 146B	18.36	tr	-	3.24	-	-
146-053-3	Varina 146B3	55.84	-	-	13.96	-	-
Mean		18.73	0.11	0.11	5.58	0.01	-

WET SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
29-053-1	Roanoke 29A	1.28	-	0.96	12.96	tr	0.80
82-053-1	Yemassee 82A	1.73	1.73	0.52	13.32	tr	-
74-053-1	Dragston 74A	0.74	0.93	0.93	6.70	tr	-
26-053-1	Myatt 26A	0.63	0.18	1.08	7.11	tr	-
VT2-10	Bibb 92A	0.22	tr	0.29	6.64	0.15	-
VT-4	Pickney 90A	10.21	tr	2.07	2.52	-	-
Mean		2.47	0.49	0.98	8.21	0.068	0.13

PIEDMONT SOILS

Lab #	Series Name	Kao	Ch.V.	Mica	Qz	Fd	Int
16-053-1	Herndon 16D3	43.13	-	-	14.38	-	-
20-053-1	Georgeville 20B	36.40	-	tr	15.60	-	-
17-053-1	Helena 17B2	34.82	1.31	3.29	26.28	-	-
14-053-1	Vance 14C3	22.01	-	18.09	8.80	-	-
Mean		34.09	0.33	5.41	16.27	-	-

Kao = kaolinite; Ch.V = chloritized vermiculite; Qz = quartz;
Fd = feldspars; Int = interstratified 2:1 phyllosilicates; tr = trace.
Ch.V. denotes a 14 A component which may be Ch.V., Verm, Smec, or Int.

TABLE I.6a Sand mineralogy of the A horizon in weight % (g/100 g sand)

BELOW SCARP

Lab #	Series Name	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
69-053-1	Nansemond 69B	80.0 (1.1)	-	13 (1.15)	-	-	7.0 (0.85)	tr	-
52-053-1	Ocilla 52B	87.0 (1.1)	-	5.0 (0.8)	1.5 (0.4)	0.5	5.0 (0.8)	-	1.0 (0.35)
8-053-1	Masada 8C3	79.0 (1.4)	-	13.0 (1.25)	1.0 (0.35)	-	4.0 (0.6)	2.0 (0.55)	1.0 (0.35)
45-053-2	Orangeburg 45A	88.0 (1.1)	-	7.5 (0.95)	0.5	1.0 (0.35)	1.0 (0.35)	tr	2.0 (0.4)
63-053-1	Norfolk 63A	92.0 (1.0)	-	4.0 (0.7)	1.0 (0.35)	-	2.0 (0.4)	tr	tr
7-053-1	Emporia 7B	78.5 (1.4)	-	13.0 (1.25)	2.5 (0.4)	0.5	3.5 (0.6)	tr	2.0 (0.4)
246-W-5	Dothan 246	90.0 (1.0)	-	4.0 (0.6)	2.0 (0.55)	-	2.0 (0.55)	1.0 (0.35)	1.0 (0.35)
10-053-1	Slagle 10A	74.5 (1.55)	-	14.5 (1.2)	2.5 (0.4)	0.5	8.0 (0.65)	tr	tr
Mean		83.63	-	9.25	1.38	0.31	4.06	0.53	0.94

ON SCARP

Lab #	Series Name	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
12-183-1	Uchee 12B	88.0 (1.1)	1.0 (0.35)	6.0 (0.85)	1.0 (0.35)	1.0 (0.35)	2.0 (0.45)	-	1.0 (0.35)
46-183-3	Turbeville 46B3	66.0 (1.7)	-	26.0 (1.8)	1.0 (0.35)	-	6.0 (0.6)	-	tr
112-183-1	Fuquay 112B	77.0 (1.45)	-	9.0 (0.9)	2.0 (0.55)	2.0 (0.55)	10.0 (1.15)	tr	-
60-183-1	Fuquay 60C	78.0 (1.4)	-	15.0 (1.25)	-	2.0 (0.55)	5.0 (0.8)	-	-
11-183-1	Suffolk 11B	74.0 (1.55)	0.5	15.5 (1.55)	1.0 (0.35)	0.5	7.5 (0.95)	tr	1.0 (0.35)
8-053-2	Masada 8B	86.5 (1.1)	-	8.0 (0.95)	0.5	0.5	4.5 (0.7)	tr	-
Mean		78.25	0.25	13.25	0.92	1.00	5.83	0.13	0.38

ABOVE SCARP

Lab #	Series Name	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
346-183-1	Faceville 346B	84.0 (1.25)	-	11.0 (1.1)	2.0 (0.7)	0.5	2.0 (0.55)	0.5	-
46-183-2	Turbeville 46B	73.0 (1.55)	0.5	18.5 (1.4)	0.5	1.5 (0.4)	6.0 (0.85)	tr	tr
146-053-1	Varina 146B	81.0 (1.05)	-	14.0 (1.25)	tr	1.0 (0.35)	3.0 (0.55)	-	1.0 (0.35)
146-053-3	Varina 146B3	80.0 (1.1)	-	14.0 (1.2)	2.0 (0.45)	-	4.0 (0.6)	tr	tr
Mean		79.5	0.13	14.38	1.19	0.75	3.75	0.25	0.38

WET SOILS

Lab #	Series Name	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
29-053-1	Roanoke 29A	92.0 (1.0)	-	2.0 (0.55)	1.0 (0.35)	-	3.0 (0.45)	-	2.0 (0.55)
82-053-1	Yemassee 82A	80.0 (1.1)	-	10.0 (1.05)	3.0 (0.5)	-	5.0 (0.8)	-	2.0 (0.55)
74-053-1	Dragston 74A Ap1	96.0 (0.75)	-	2.5 (0.5)	tr	-	1.5 (0.4)	tr	tr
74-053-1	Dragston 74A Ap2	85.5 (1.15)	-	5.0 (0.8)	2.5 (0.4)	tr	5.0 (0.8)	-	2.0 (0.55)
26-053-1	Myatt 26A	92.5 (1.0)	0.5	4.0 (0.7)	0.5	0.5	1.5 (0.4)	0.5	1.5 (0.4)
VT2-10	Bibb 92A	85.0 (1.15)	1.0 (0.35)	8.0 (0.95)	-	-	5.0 (0.8)	-	1.0 (0.35)
VT-4	Pickney 90A	73.0 (1.55)	tr	19.0 (1.55)	2.0 (0.55)	-	5.0 (0.8)	-	1.0 (0.35)
Mean		86.29	0.25	7.21	1.32	0.11	3.71	0.11	1.39

PIEDMONT SOILS

Lab #	Series Name	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
16-053-1	Herndon 16D3	74.0 (1.55)	-	16.5 (1.55)	0.5	tr	7.0 (0.85)	-	2.0 (0.55)
20-053-1	Georgeville 20B2	65.0 (1.75)	-	22.0 (1.2)	1.0 (0.35)	-	10.0 (1.05)	-	2.0 (0.55)
17-053-1	Helena 17B2	80.0 (1.15)	tr	13.0 (1.15)	1.0 (0.35)	-	6.0 (0.85)	-	-
14-053-1	Vance 14C3	94.0 (0.8)	0.5	4.5 (0.7)	1.0 (0.35)	tr	2.5 (0.4)	tr	tr
Mean		78.25	0.19	14.00	0.88	0.13	6.38	0.06	1.06

Qz = quartz; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = kyanite; Stau = staurolite; Tr = trace; ( ) = standard deviation.

TABLE I.6b Sand mineralogy of the B horizon in weight % (g/100 g sand)

BELOW SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
69-053-1	Nansemond 69B	81.5 (1.3)	-	-	7.0 (0.85)	6.0 (0.85)	0.5	5.0 (0.8)	-	-	-
52-053-1	Ocilla 52B	85.5 (1.15)	-	-	5.5 (0.8)	3.5 (0.6)	-	4.0 (0.7)	tr	1.5 (0.4)	-
8-053-1	Masada 8C3	77.5 (1.4)	1.0 (0.35)	-	12.5 (1.15)	2.5 (0.5)	1.0 (0.35)	5.0 (0.8)	-	1.0	-
45-053-2	Orangeburg 45A	86.5 (1.15)	-	-	8.0 (0.95)	2.5 (0.5)	1.0 (0.35)	1.5 (0.5)	tr	0.5	-
63-053-1	Norfolk 63A	89.0 (1.1)	0.5	-	4.5 (0.7)	2.5 (0.5)	-	2.0 (0.45)	tr	1.0 (0.35)	0.5
7-053-1	Emporia 7B	81.5 (1.3)	-	-	10.0 (1.05)	tr	0.5	4.0 (0.7)	-	1.0 (0.35)	-
246-W-5	Dothan 246	83.0 (1.0)	2.0 (0.55)	-	6.0 (0.85)	4.0 (0.6)	-	2.0 (0.55)	1.0 (0.35)	1.0 (0.35)	-
10-053-1	Slagle 10A	70.0 (1.6)	-	-	13.5 (1.25)	7.5 (0.85)	2.0 (0.45)	7.0 (0.85)	-	-	-
Mean		81.81	0.44	-	8.38	3.59	0.63	3.81	0.22	0.75	0.06

ON SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
12-183-1	Uchee 12B	90.0 (1.05)	3.0 (0.55)	-	4.5 (0.7)	1.0 (0.35)	-	1.0 (0.35)	0.5	-	-
46-183-3	Turbeville 46B3	80.0 (1.1)	0.5	-	13.0 (1.1)	1.5 (0.4)	1.0 (0.35)	5.5 (0.8)	-	-	-
112-183-1	Fuquay 112B	84.0 (1.3)	tr	-	12.5 (1.15)	1.5(0.4)	tr	2.0 (0.45)	-	-	-
60-183-1	Fuquay 60C	96.0 (0.7)	-	-	3.0 (0.55)	0.5	-	0.5	-	tr	-
11-183-1	Suffolk 11B	57.5 (1.75)	-	-	21.0 (1.5)	9.5 (0.95)	1.5 (0.4)	9.5 (0.95)	0.5	0.5	-
8-053-2	Masada 8B	92.0 (0.85)	-	-	3.0 (0.55)	2.5 (0.5)	-	2.0 (0.45)	0.5	tr	-
Mean		83.25	0.63	-	9.50	2.75	0.46	3.42	0.25	0.21	-

ABOVE SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
346-183-1	Faceville 346B	88.0 (1.1)	-	-	7.0 (0.85)	3.5 (0.6)	-	1.5 (0.4)	-	-	-
46-183-2	Turbeville 46B	68.0 (1.65)	-	-	25.5 (1.5)	0.5	1.5 (0.4)	3.5 (0.6)	0.5	0.5	-
146-053-1	Varina 146B	83.5 (1.2)	-	-	11.5 (1.1)	tr	-	2.5 (0.5)	1.0 (0.35)	1.5 (0.4)	-
146-053-3	Varina 146B3	77.0 (1.4)	-	-	18.0 (1.4)	-	-	4.0 (0.6)	-	-	1.0 (0.35)
Mean		79.13	-	-	15.50	1.06	0.38	2.88	0.38	0.50	0.25

WET SOILS

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
29-053-1	Roanoke 29A Btg1	92.5 (0.85)	0.5	-	3.5 (0.6)	1.0 (0.35)	-	2.0 (0.45)	-	0.5	-
29-053-1	Roanoke 29A Btg2	91.0 (0.95)	1.0 (0.35)	-	4.0 (0.6)	1.0 (0.35)	-	1.0 (0.35)	-	2.0 (0.55)	-
82-053-1	Yemassee 82A	85.0 (1.2)	-	-	4.0 (0.65)	7.5 (0.85)	0.5	2.5 (0.5)	-	0.5	-
74-053-1	Dragston 74A	86.0 (1.15)	tr	-	5.0 (0.8)	4.5 (0.7)	0.5	3.0 (0.55)	0.5	-	0.5
26-053-1	Myatt 26A	85.5 (1.15)	2.5 (0.5)	1.0 (0.35)	5.0 (0.8)	2.0 (0.45)	0.5	2.0 (0.45)	-	1.5 (0.4)	-
VT2-10	Bibb 92A	80.0 (1.5)	1.0 (0.5)	-	10.0 (1.05)	1.0 (0.5)	3.0 (0.6)	5.0 (0.8)	-	-	-
VT-4	Pickney 90A	79.0 (1.3)	2.0 (0.55)	-	12.0 (1.15)	3.0 (0.55)	-	3.0 (0.55)	1.0 (0.35)	tr	-
Mean		85.57	1.04	0.14	6.21	2.86	0.64	2.64	0.21	0.68	0.07

PIEDMONT SOILS

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
16-053-1	Herndon 16D3	71.0 (1.55)	-	-	18.0 (1.4)	-	1.0 (0.35)	9.0 (0.95)		1.0 (0.35)	-
20-053-1	Georgeville 20B2	74.0 (1.5)	-	-	15.0 (1.25)	3.5 (0.6)	0.5	5.5 (0.8)	0.5	1.0 (0.35)	-
17-053-1	Helena 17B2	80.5 (1.1)	tr	-	14.5 (1.25)	1.5 (0.4)	-	3.5 (0.6)	tr	-	-
14-053-1	Vance 14C3	90.0 (1.05)	0.5	0.5	6.5 (0.8)	tr	tr	2.0 (0.45)	-	0.5	-
Mean		78.88	0.19	0.13	13.50	1.31	0.44	5.00	0.19	0.63	-

Qz = quartz; Al Fd = alkali (K and/or Na) feldspars; Musc = muscovite; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = kyanite; Stau = staurolite; Tour = tourmaline; Tr = trace; ( ) = standard deviation.

TABLE I.6c Sand mineralogy of the C horizon in weight % (g/100 g sand)

BELOW SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
69-053-1	Nansemond 69B	84.0 (1.25)	-	-	6.0 (0.75)	4.0 (0.70)	1.0 (0.5)	4.0 (0.7)	1.0 (0.5)	-	-
52-053-1	Ocilla 52B	92.0 (0.95)	tr	-	2.0 (0.45)	2.0 (0.45)	-	4.0 (0.7)	tr	tr	-
8-053-1	Masada 8C3	84.0 (1.25)	-	-	12.0 (1.15)	4.0 (0.7)	-	-	-	-	-
45-053-2	Orangeburg 45A	82.5 (1.3)	-	-	6.0 (0.75)	2.5 (0.55)	1.0 (0.5)	8.0 (0.9)	-	-	-
63-053-1	Norfolk 63A	85.0 (1.05)	-	-	3.5 (0.6)	tr	-	1.5 (0.55)	-	-	-
7-053-1	Emporia 7B	68.0 (1.65)	-	-	13.0 (1.15)	6.0 (0.75)	3.0 (0.6)	9.0 (0.9)	1.0	tr	-
246-W-5	Dothan 246	93.0 (0.95)	-	-	4.5 (0.7)	-	1.0 (0.5)	1.5 (0.55)	tr	-	-
10-053-1	Slagle 10A	79.0 (1.5)	-	-	14.0 (1.2)	-	-	4.0 (0.7)	3.0 (0.6)	-	-
Mean		83.44	0.03	-	7.63	2.34	0.75	2.88	0.69	0.06	-

ON SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
12-183-1	Uchee 12B	84.0 (1.25)	12.0 (1.15)	-	2.0 (0.45)	-	-	3.0 (0.6)	-	-	-
46-183-3	Turbeville 46B3	72.0 (1.6)	-	-	21.0 (1.15)	-	-	7.0 (0.85)	-	tr	-
112-183-1	Fuquay 112B	89.0 (1.1)	-	-	7.0 (0.85)	-	-	3.0 (0.6)	tr	1.0 (0.5)	-
60-183-1	Fuquay 60C	95.0 (1.05)	tr	tr	2.0 (0.45)	1.0 (0.5)	-	2.0 (0.45)	-	-	-
11-183-1	Suffolk 11B	86.0 (1.2)	-	-	7.0 (0.85)	1.0 (0.5)	-	4.0 (0.7)	-	2.0 (0.45)	-
8-053-2	Masada 8B	87.5 (1.15)	-	-	5.0 (0.8)	4.0 (0.7)	1.0 (0.5)	2.5 (0.55)	-	-	-
Mean		85.58	2.04	0.04	7.33	1.00	0.17	3.58	0.04	0.54	-

ABOVE SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
346-183-1	Faceville 346B	92.0 (0.95)	-	-	5.0 (0.8)	1.5 (0.55)	-	1.5 (0.55)	-	-	-
46-183-2	Turbeville 46B	83.0 (1.25)	-	-	14.0 (1.2)	-	-	2.0 (0.45)	1.0 (0.5)	-	-
146-053-1	Varina 146B	92.5 (0.95)	-	-	3.0 (0.6)	2.0 (0.45)	-	2.5 (0.55)	-	-	-
146-053-3	Varina 146B3	86.0 (1.2)	-	-	2.0 (0.45)	8.5 (0.9)	-	3.5 (0.6)	-	-	-
Mean		88.38	-	-	6.00	3.00	-	2.38	0.25	-	-

WET SOILS

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
29-053-1	Roanoke 29A	86.0 (1.2)	-	-	8.0 (0.9)	-	-	4.0 (0.7)	-	2.0 (0.45)	-
82-053-1	Yemassee 82A	79.5 (1.5)	-	-	14.0 (1.2)	-	1.5 (0.55)	4.0 (0.7)	-	1.0 (0.5)	-
74-053-1	Dragston 74A	82.0 (1.3)	-	-	5.0 (0.8)	3.0 (0.6)	1.0 (0.5)	8.0 (0.9)	-	-	1.0 (0.5)
26-053-1	Myatt 26A	93.0 (0.95)	-	-	4.0 (0.7)	2.0 (0.45)	-	2.0 (0.45)	-	2.0 (0.45)	-
VT2-10	Bibb 92A	81.0 (1.05)	6.0 (0.85)	-	10.0 (0.95)	-	-	2.0 (0.55)	-	1.0 (0.35)	-
VT-4	Pickney 90A	80.5 (1.5)	12.5 (1.15)	3.0 (0.6)	4.0 (0.7)	-	-	tr	-	-	-
Mean		83.67	3.08	0.50	7.50	0.83	0.42	3.38	-	1.00	0.17

PIEDMONT SOILS

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
16-053-1	Herndon 16D3	93.0 (0.95)	1.0 (0.5)	-	4.0 (0.7)	-	-	2.0 (0.45)		-	-
20-053-1	Georgeville 20B2	71.5 (1.6)	-	-	20.0 (1.4)	2.5 (0.55)	1.0 (0.5)	5.0 (0.8)	-	-	-
17-053-1	Helena 17B2	93.0 (0.95)	-	-	5.5 (0.75)	-	-	1.5 (0.55)	tr	-	-
14-053-1	Vance 14C3	96.0 (1.05)	-	-	3.0 (0.6)	-	-	1.0 (0.5)	-	-	-
Mean		88.38	0.25	-	8.13	0.63	0.25	2.38	0.06	-	-

Qz = quartz; Al Fd = alkali (K and/or Na) feldspars; Musc = muscovite; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = kyanite; Stau = staurolite; Tour = tourmaline; Tr = trace; ( ) = standard deviation.

TABLE I.7a Sand mineralogy of the A horizon in mass % (g/100 g soil)

BELOW SCARP

Lab #	Series Name	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
69-053-1	Nansemond 69B	70.64 (0.97)	-	11.48 (1.02)	-	-	6.18 (0.75)	tr	-
52-053-1	Ocilla 52B	70.64 (0.89)	-	4.06 (0.65)	1.22 (0.32)	0.41	4.06 (0.65)	-	0.81 (0.28)
8-053-1	Masada 8C3	51.82 (0.92)	-	8.52 (0.82)	0.66 (0.23)	-	2.62 (0.39)	1.31 (0.36)	0.66 (0.23)
45-053-2	Orangeburg 45A	71.19 (0.89)	-	6.07 (0.77)	0.40	0.81 (0.28)	0.81 (0.28)	tr	1.62 (0.32)
63-053-1	Norfolk 63A	76.18 (0.83)	-	3.31 (0.58)	0.83 (0.29)	-	1.66 (0.33)	tr	tr
7-053-1	Emporia 7B	63.89 (1.14)	-	10.58 (1.02)	2.04 (0.33)	0.41	2.85 (0.49)	tr	1.63 (0.33)
246-W-5	Dothan 246	67.77 (0.75)	-	3.01 (0.45)	1.51 (0.41)	-	1.51 (0.41)	0.75 (0.26)	0.75 (0.26)
10-053-1	Slagle 10A	45.52 (0.95)	-	8.86 (0.73)	1.53 (0.24)	0.31	4.89 (0.52)	tr	tr
Mean		64.70	-	6.99	1.02	0.24	3.07	0.38	0.73

ON SCARP

Lab #	Series Name	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
12-183-1	Uchee 12B	75.59 (0.94)	0.86 (0.3)	5.15 (0.73)	0.86 (0.3)	0.86 (0.3)	1.72 (0.39)	-	0.86 (0.3)
46-183-3	Turbeville 46B3	41.84 (1.06)	-	16.48 (1.14)	0.63 (0.22)	-	3.8 (0.38)	-	tr
112-183-1	Fuquay 112B	66.91 (1.26)	-	7.82 (0.78)	1.74 (0.48)	1.74 (0.48)	8.69 (0.99)	tr	-
60-183-1	Fuquay 60C	62.01 (1.11)	-	11.93 (0.99)	-	1.59 (0.44)	3.98 (0.64)	-	-
11-183-1	Suffolk 11B	65.19 (1.36)	0.44	13.65 (1.36)	0.88 (0.31)	0.44	6.61 (0.84)	tr	0.88 (0.31)
8-053-2	Masada 8B	59.06 (0.75)	-	5.46 (0.65)	0.34	0.34	3.07 (0.48)	tr	-
Mean		61.77	0.22	10.08	0.74	0.38	4.65	0.10	0.32

ABOVE SCARP

Lab #	Series Name.	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
346-183-1	Faceville 346B	69.05 (1.03)	-	9.04 (0.9)	1.64 (0.9)	0.41	1.64 (0.45)	0.41	-
46-183-2	Turbeville 46B	60.66 (1.29)	0.42	15.37 (1.16)	0.42	1.25 (0.33)	4.99 (0.71)	tr	tr
146-053-1	Varina 146B	59.45 (0.77)	-	10.28 (0.92)	tr	0.73 (0.26)	2.2 (0.4)	-	0.73 (0.26)
146-053-3	Varina 146B3	37.84 (0.52)	-	6.62 (0.57)	0.95 (0.21)	-	1.89 (0.28)	tr	tr
Mean		56.75	0.11	10.33	0.80	0.60	2.68	0.19	0.27

WET SOILS

Lab #	Series Name	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
29-053-1	Roanoke 29A	43.98 (0.48)	-	0.96 (0.26)	0.48 (0.17)	-	1.43 (0.22)	-	0.96 (0.26)
82-053-1	Yemassee 82A	55.28 (0.76)	-	6.91 (0.72)	2.07 (0.35)	-	3.45 (0.55)	-	1.38 (0.38)
74-053-1	Dragston 74A Ap1	75.36 (0.59)	-	1.96 (0.39)	tr	-	1.18 (0.31)	tr	tr
74-053-1	Dragston 74A Ap2	65.49 (0.86)	-	3.83 (0.61)	1.92 (0.31)	tr	3.83 (0.61)	-	1.53 (0.42)
26-053-1	Myatt 26A	43.29 (0.47)	0.23	1.87 (0.33)	0.23	0.23	0.7 (0.19)	0.23	0.7 (0.19)
VT2-10	Bibb 92A	65.88 (0.89)	0.78 (0.27)	6.2 (0.74)	-	-	3.88 (0.62)	-	0.78 (0.27)
VT-4	Pickey 90A	61.54 (1.31)	tr	16.02 (1.31)	1.69 (0.46)	-	4.22 (0.67)	-	0.84 (0.30)
Mean		58.69	0.17	5.39	0.94	0.06	2.67	0.06	0.91

PIEDMONT SOILS

Lab #	Series Name	Qz	Al Fd	Ilm	Leuc	Rut	Zir	Ky	Stau
16-053-1	Herndon 16D3	51.65 (1.08)	-	11.52 (1.08)	0.35	tr	4.89 (0.59)	-	1.4 (0.38)
20-053-1	Georgeville 20B2	39.39 (1.06)	-	13.33 (0.73)	0.61 (0.21)	-	6.06 (0.64)	-	1.21 (0.33)
17-053-1	Helena 17B2	50.96 (0.73)	tr	8.28 (0.73)	0.64 (0.22)	-	3.82 (0.54)	-	-
14-053-1	Vance 14C3	56.12 (0.48)	0.30	2.69 (0.42)	0.6 (0.21)	tr	1.49 (0.24)	tr	tr
Mean		49.53	0.12	8.96	0.55	0.08	4.07	-	0.69

Qz = quartz; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = kyanite; Stau = staurolite; Tr = trace; ( ) = standard deviation.

TABLE I.7b Sand mineralogy of the B horizon in mass % (g/100 g soil)

BELOW SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
69-053-1	Nansemond 69B	64.3 (1.03)	-	-	5.52 (0.67)	4.73 (0.67)	0.39	3.95 (0.63)	-	-	-
52-053-1	Ocilla 52B	46.51 (0.63)	-	-	2.99 (0.44)	1.9 (0.33)	-	2.18 (0.38)	tr	0.82 (0.22)	-
8-053-1	Masada 8C3	31.62 (0.57)	0.41 (0.14)	-	5.1 (0.47)	1.02 (0.2)	0.41 (0.14)	2.04 (0.33)	-	0.41	-
45-053-2	Orangeburg 45A	47.49 (0.63)	-	-	4.39 (0.52)	1.37 (0.27)	0.55 (0.19)	0.82 (0.27)	tr	0.27	-
63-053-1	Norfolk 63A	56.96 (0.70)	0.32	-	2.88 (0.45)	1.6 (0.32)	-	1.28 (0.29)	tr	0.64 90.22)	0.32
7-053-1	Emporia 7B	48.57 (0.77)	-	-	5.96 (0.63)	tr	0.30	2.38 (0.42)	-	0.60 (0.21)	-
246-W-5	Dothan 246	47.48 (0.57)	1.14 (0.31)	-	3.43 (0.49)	2.29 (0.34)	-	1.14 (0.31)	0.57 (0.2)	0.57 (0.2)	-
10-053-1	Slagle 10A	35.42 (0.81)	-	-	6.83 (0.63)	3.80 (0.43)	1.01 (0.23)	3.54 (0.43)	-	-	-
Mean		47.29	0.23	-	4.64	2.11	0.33	2.17	0.13	0.41	0.04

ON SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
12-183-1	Uchee 12B	55.35 (0.65)	1.85 (0.34)	-	2.77 (0.43)	0.62 (0.22)	-	0.62 (0.22)	0.31	-	-
46-183-3	Turbeville 46B3	36.40 (0.50)	0.23	-	5.92 (0.50)	0.68 (0.18)	0.45 (0.16)	2.50 (0.36)	-	-	-
112-183-1	Fuquay 112B	65.77 (1.02)	tr	-	9.79 (0.9)	1.17 (0.31)	tr	1.57 (0.35)	-	-	-
60-183-1	Fuquay 60C	52.80 (0.39)	-	-	1.65 (0.30)	0.28	-	0.28	-	tr	-
11-183-1	Suffolk 11B	36.69 (1.12)	-	-	13.40 (0.96)	6.06 (0.61)	0.96 (0.26)	6.06 (0.61)	0.32	0.32	-
8-053-2	Masada 8B	53.54 (0.49)	-	-	1.75 (0.32)	1.45 (0.29)	-	1.16 (0.26)	0.29	tr	-
Mean		50.09	0.38	-	5.88	1.71	0.27	2.03	0.15	0.10	-

ABOVE SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
346-183-1	Faceville 346B	46.73 (0.58)	-	-	3.72 (0.45)	1.86 (0.32)	-	0.80 (0.21)	-	-	-
46-183-2	Turbeville 46B	35.43 (0.86)	-	-	13.29 (0.78)	0.26	0.78 (0.21)	1.82 (0.31)	0.26	0.26	-
146-053-1	Varina 146B	43.34 (0.62)	-	-	5.97 (0.57)	tr	-	1.30 (0.26)	0.52 (0.18)	0.78 (0.21)	-
146-053-3	Varina 146B3	9.24 (0.17)	-	-	2.16 (0.17)	-	-	0.48 (0.07)	-	-	0.12 (0.04)
Mean		33.69	-	-	6.29	0.56	0.20	1.10	0.20	0.26	0.03

WET SOILS

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
29-053-1	Roanoke 29A Btg1	39.04 (0.36)	0.21	-	1.46 (0.25)	0.42 (0.15)	-	0.84 (0.19)	-	0.21	-
29-053-1	Roanoke 29A Btg2	30.30 (0.32)	0.33 (0.12)	-	1.33 (0.20)	0.33 (0.12)	-	0.33 (0.12)	-	0.67 (0.18)	-
82-053-1	Yemassee 82A	49.30 (0.70)	-	-	2.32 (0.38)	4.35 (0.49)	0.29	1.45 (0.29)	-	0.29	-
74-053-1	Dragston 74A	62.09 (0.83)	tr	-	3.61 (0.58)	3.25 (0.51)	0.36	2.17 (0.40)	0.36	-	0.36
26-053-1	Myatt 26A	30.27 (0.41)	0.89 (0.18)	0.35 (0.12)	1.77 (0.28)	0.71 (0.16)	0.18	0.71 (0.16)	-	0.53 (0.14)	-
VT2-10	Bibb 92A	66.32 (1.2)	0.83 (0.42)	-	8.29 (0.87)	0.83 (0.42)	2.49 (0.50)	4.15 (0.66)	-	-	-
VT-4	Pickney 90A	66.12 (1.09)	1.67 (0.46)	-	10.04 (0.96)	2.51 (0.46)	-	2.51 (0.46)	0.84 (0.29)	tr	-
Mean		49.10	0.59	0.05	4.12	1.77	0.48	1.74	0.17	0.27	0.05

PIEDMONT SOILS

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
16-053-1	Herndon 16D3	16.05 (0.35)	-	-	4.07 (0.32)	-	0.23 (0.08)	2.03 (0.21)	-	0.23 (0.08)	-
20-053-1	Georgeville 20B2	4.14 (0.08)	-	-	0.84 (0.07)	0.20 (0.03)	0.028	0.31 (0.045)	0.028	0.056 (0.02)	-
17-053-1	Helena 17B2	22.54 (0.31)	tr	-	4.06 (0.35)	0.42 (0.11)	-	0.98 (0.17)	tr	-	-
14-053-1	Vance 14C3	27.0 (0.32)	0.15	0.15	1.95 (0.24)	tr	tr	0.60 (0.14)	-	0.15	-
Mean		17.43	0.08	0.04	2.73	0.19	0.10	0.98	0.02	0.11	-

Qz = quartz; Al Fd = alkali (K and/or Na) feldspars; Musc = muscovite; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = kyanite; Stau = staurolite; Tour = tourmaline; Tr = trace; ( ) = standard deviation.

TABLE I.7c Sand mineralogy of the C horizon in mass % (g/100 g soil)

BELOW SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
69-053-1	Nansemond 69B	56.7 (0.84)	-	-	4.05 (0.51)	2.7 (0.47)	0.68 (0.34)	2.7 (0.47)	0.68 (0.34)	-	-
52-053-1	Ocilla 52B	69.4 (0.72)	tr	-	1.51 (0.34)	1.51 (0.34)	-	3.02 (0.53)	tr	tr	-
8-053-1	Masada 8C3	10.58 (0.16)	-	-	1.51 (0.15)	0.5 (0.09)	-	-	-	-	-
45-053-2	Orangeburg 45A	38.2 (0.6)	-	-	2.8 (0.35)	1.16 (0.25)	0.46 (0.23)	3.7 (0.42)	-	-	-
63-053-1	Norfolk 63A	46.4 (0.57)	-	-	1.91 (0.33)	tr	-	0.82 (0.3)	-	-	-
7-053-1	Emporia 7B	50.8 (1.23)	-	-	9.7 (0.86)	4.5 (0.56)	2.24 (0.45)	6.7 (0.67)	0.8	tr	-
246-W-5	Dothan 246	45.3 (0.46)	-	-	2.19 (0.34)	-	0.49 (0.24)	0.73 (0.27)	tr	-	-
10-053-1	Slagle 10A	45.8 (0.87)	-	-	8.12 (0.7)	-	-	2.32 (0.41)	1.74 (0.35)	-	-
Mean		45.40	0.02	-	3.97	1.31	0.48	2.50	0.43	0.05	-

ON SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
12-183-1	Uchee 12B	58.63 (0.87)	8.38 (0.8)	-	1.4 (0.31)	-	-	2.1 (0.42)	-	-	-
46-183-3	Turbeville 46B3	37.7 (0.84)	-	-	11.0 (0.6)	-	-	3.67 (0.45)	-	tr	-
112-183-1	Fuquay 112B	51.44 (0.64)	-	-	4.0 (0.49)	-	-	1.7 (0.35)	tr	0.6 (0.29)	-
60-183-1	Fuquay 60C	67.45 (0.75)	tr	tr	1.42 (0.32)	0.71 (0.36)	-	1.42 (0.32)	-	-	-
11-183-1	Suffolk 11B	74.56 (1.04)	-	-	6.1 (0.74)	0.87 (0.43)	-	3.5 (0.61)	-	1.73 (0.39)	-
8-053-2	Masada 8B	67.1 (0.88)	-	-	3.84 (0.61)	3.1 (0.54)	0.77 (0.38)	1.92 (0.42)	-	-	-
Mean		59.49	1.43	0.03	4.63	0.78	0.13	2.39	0.02	0.41	-

ABOVE SCARP

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
346-183-1	Faceville 346B	38.5 (0.4)	-	-	2.1 (0.33)	0.63 (0.23)	-	0.63 (0.23)	-	-	-
46-183-2	Turbeville 46B	63.83 (0.96)	-	-	10.77 (0.92)	-	-	1.54 (0.35)	0.77 (0.38)	-	-
146-053-1	Varina 146B	18.0 (0.19)	-	-	0.59 (0.12)	0.39 (0.09)	-	0.5 (0.11)	-	-	-
146-053-3	Varina 146B3	7.7 (0.1)	-	-	0.18 (0.04)	0.77 (0.08)	-	0.32 (0.05)	-	-	-
Mean		32.01	-	-	3.41	0.45	-	0.75	0.19	-	-

WET SOILS

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
29-053-1	Roanoke 29A	56.76 (0.79)	-	-	5.3 (0.59)	-	-	2.64 (0.46)	-	1.32 (0.3)	-
82-053-1	Yemassee 82A	50.0 (0.94)	-	-	8.81 (0.75)	-	0.94 (0.35)	2.52 (0.44)	-	0.63 (0.31)	-
74-053-1	Dragston 74A	56.9 (0.9)	-	-	3.47 (0.55)	2.1 (0.42)	0.69 (0.35)	5.55 (0.62)	-	-	0.69 (0.35
26-053-1	Myatt 26A	50.5 (0.52)	-	-	2.17 (0.38)	1.1 (0.24)	-	1.1 (0.24)	-	1.1 (0.24)	-
VT2-10	Bibb 92A	66.2 (0.86)	4.9 (0.69)	-	8.17 (0.78)	-	-	1.63 (0.45)	-	0.82 (0.29)	-
VT-4	Pickney 90A	56.75 (1.06)	8.81 (0.81)	2.12 (0.42)	2.82 (0.49)	-	-	tr	-	-	-
Mean		56.19	2.29	0.35	5.12	0.53	0.27	2.27	-	0.65	0.12

PIEDMONT SOILS

Lab #	Series Name	Qz	Al Fd	Musc	Ilm	Leuc	Rut	Zir	Ky	Stau	Tour
16-053-1	Herndon 16D3	8.1 (0.08)	0.09 (0.04)	-	0.35 (0.06)	-	-	0.18 (0.04)	-	-	-
20-053-1	Georgeville 20B2	1.14 (0.03)	-	-	0.32 (0.02)	0.04 (0.01)	0.02 (0.01)	0.08 (0.013)	-	-	-
17-053-1	Helena 17B2	7.72 (0.08)	-	-	0.46 (0.06)	-	-	0.12 (0.05)	tr	-	-
14-053-1	Vance 14C3	13.1 (0.14)	-	-	0.41 (0.08)	-	-	0.14 (0.07)	-	-	-
Mean		7.52	0.02	-	0.39	0.01	0.004	0.13	0.005	-	-

Qz = quartz; Al Fd = alkali (K and/or Na) feldspars; Musc = muscovite; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = kyanite; Stau = staurolite; Tour = tourmaline; Tr = trace; ( ) = standard deviation.

TABLE I.8. Chemical data for Old Hickory Project Typical Pedons

PEDON	MAP UNIT	TAXONOMIC UNIT	HORIZON	DEPTH	pH	Ca	Mg	K	H	Al	CEC	ECEC	BASE SATURATION	EFFECTIVE BASE SAT'N
				(cm)		cmol(+)/kg soil							(%)	(%)
7-053-1	7B	Emporia	Ap	0-25	5.57	0.30	0.09	0.17	4.60	0.05	5.16	0.61	10.85	91.80
	7B	Emporia	Bt1	36-76	5.20	1.76	0.58	0.46	6.60	0.85	9.40	3.65	29.79	76.71
	7B	Emporia	Cg	135-185	4.50	0.33	0.05	0.02	7.60	1.65	8.00	2.05	5.00	19.51
8-053-1	8C3	Masada	Ap	0-15	6.30	2.88	1.22	0.09	3.40	0.10	7.59	4.29	55.20	97.67
	8C3	Masada	Bt1	15-51	5.84	2.23	1.00	0.04	11.20	0.15	14.47	3.42	22.60	95.61
	8C3	Masada	2C2	165-203	5.04	0.04	0.24	0.02	11.60	3.45	11.90	3.75	2.52	8.00
8-053-2	8B	Masada	Ap	0-23	5.60	2.41	0.52	0.43	2.00	0.05	5.36	3.41	62.69	98.53
	8B	Masada	Bt	23-107	5.50	2.89	0.73	0.16	6.80	0.15	10.38	3.73	34.49	95.98
	8B	Masada	C	135-178	4.80	0.06	0.34	0.02	3.80	1.05	4.22	1.47	9.95	28.57
10-053-1	10A	Slagle	Ap	0-25	5.60	2.46	0.49	0.21	4.00	0.05	7.16	3.21	44.13	98.44
	10A	Slagle	Bt1	25-56	5.42	2.78	1.05	0.30	6.60	0.65	10.73	4.78	38.49	86.40
	10A	Slagle	BC	91-152	4.76	0.94	0.36	0.06	8.20	2.65	9.56	4.01	14.23	33.92
11-183-1	11B	Suffolk	Ap	0-23	5.88	0.55	0.02	0.04	1.40	0.05	2.01	0.66	30.35	92.42
	11B	Suffolk	Bt1	66-127	5.04	2.43	0.61	0.28	7.60	0.05	10.92	3.37	30.40	98.52
	11B	Suffolk	CB	165-191	5.12	0.69	0.12	0.02	2.60	0.15	3.43	0.96	24.20	84.69
12-183-1	12B	Uchee	Ap	0-25	5.94	0.57	0.04	0.09	2.60	0.10	3.30	0.80	21.21	87.50
	12B	Uchee	Bt1	58-89	5.58	2.95	0.92	0.40	2.60	0.05	6.87	4.32	62.15	98.84
	12B	Uchee	Cg	152-178	4.80	0.90	0.33	0.05	7.20	2.15	8.48	3.43	15.09	37.32
14-053-1	14C3	Vance	A/E	0-10	4.90	0.18	0.08	0.18	11.00	2.25	11.44	2.69	3.85	16.36
	14C3	Vance	Bt1	10-84	4.92	0.09	0.51	0.13	13.40	3.75	14.13	4.48	5.17	16.29
	14C3	Vance	Cg	107-183	4.70	0.04	0.13	0.03	11.60	7.85	11.80	8.05	1.69	2.48
16-053-1	16D3	Herndon	Ap	0-10	5.30	4.65	0.75	0.24	5.20	0.05	10.84	5.69	52.03	99.12
	16D3	Herndon	Bt1	10-94	5.30	0.64	1.62	0.19	13.80	1.65	16.25	4.10	15.08	59.76
	16D3	Herndon	BC	125-163	5.12	0.04	0.14	0.03	11.20	2.45	11.41	2.66	1.84	7.89
17-053-1	17B2	Helena	Ap	0-13	5.50	2.08	0.62	0.39	1.00	0.85	4.09	3.94	75.55	78.43
	17B2	Helena	Bt1	13-58	4.92	2.42	0.96	0.17	6.40	3.15	9.95	6.70	35.68	52.99
	17B2	Helena	C	132-183	4.80	0.14	0.31	0.02	10.40	5.15	10.87	5.62	4.32	8.36
20-053-1	20B2	Georgeville	Ap	0-20	5.10	2.17	0.58	0.20	2.40	0.05	5.35	3.00	55.14	98.33
	20B2	Georgeville	Bt1	20-107	4.90	3.36	0.89	0.07	11.80	0.10	16.12	4.42	26.80	97.74
	20B2	Georgeville	BC	168-183	4.80	0.03	0.07	0.02	10.00	3.65	10.12	3.77	1.19	3.18
26-053-1	26A	Myatt	A	0-13	4.70	0.25	0.03	0.07	10.80	1.75	11.15	2.10	3.14	16.67
	26A	Myatt	Btg	25-76	4.92	0.30	0.22	0.13	15.20	5.75	15.85	6.40	4.10	10.16
	26A	Myatt	2Cg	112-152	5.02	0.33	0.22	0.06	8.20	3.65	8.81	4.26	6.92	14.32

TABLE I.8. Chemical data for Old Hickory Project Typical Pedons (cont'd)

PEDON	MAP UNIT	TAXONOMIC UNIT	HORIZON	DEPTH	pH	Ca	Mg	K	H	Al	CEC	ECEC	BASE SATURATION	EFFECTIVE BASE SAT'N
				(cm)		cmol(+)/kg soil							(%)	(%)
29-053-1	29A	Roanoke	Ap	0-20	5.68	4.31	1.09	0.05	6.40	0.15	11.85	5.60	45.99	97.32
	29A	Roanoke	Btg1	20-36	5.00	0.31	0.12	0.02	7.80	1.95	8.25	2.40	5.45	18.75
	29A	Roanoke	Btg2	36-71	4.80	0.28	0.22	0.07	5.80	4.85	6.37	5.42	8.95	10.52
	29A	Roanoke	Cg	157-178	4.95	0.04	0.13	0.04	8.20	4.15	8.41	4.36	2.50	4.82
45-053-2	45A	Orangeburg	Ap	0-25	5.78	1.07	0.07	0.09	0.60	0.05	1.83	1.28	67.21	96.09
	45A	Orangeburg	Bt1	50-74	5.60	2.75	0.41	0.29	4.60	0.05	8.05	3.50	42.86	98.57
	45A	Orangeburg	Bt4	152-183	4.52	0.87	0.27	0.07	9.20	1.65	10.41	2.86	11.62	42.31
46-183-2	46B	Turbeville	Ap	0-25	5.90	0.79	0.12	0.09	1.40	0.05	2.40	1.05	41.67	95.24
	46B	Turbeville	Bt1	25-56	5.40	2.52	0.58	0.24	10.80	0.20	14.14	3.54	23.62	94.35
	46B	Turbeville	BC	165-226	4.73	0.13	0.18	0.03	8.60	0.65	8.94	0.99	3.80	34.34
46-183-3	46B3	Turbeville	Ap	0-15	5.80	2.49	0.65	0.34	5.40	0.10	8.88	3.58	39.19	97.21
	46B3	Turbeville	Bt1	15-102	5.50	2.17	0.70	0.14	8.20	1.25	11.21	4.26	26.85	70.66
	46B3	Turbeville	Bt2	102-183	4.90	0.12	0.19	0.09	6.00	1.95	6.40	2.35	6.25	17.02
52-053-1	52B	Ocilla	Ap	0-23	5.18	0.15	0.04	0.07	6.20	0.95	6.46	1.21	4.02	21.49
	52B	Ocilla	Bt	89-117	4.88	0.05	0.02	0.05	4.80	2.05	4.92	2.17	2.44	5.53
	52B	Ocilla	BC	117-152	5.05	0.05	0.03	0.03	4.20	1.65	4.31	1.76	2.55	6.25
60-183-1	60C	Fuquay	Ap	0-20	5.88	1.34	0.47	0.10	3.80	0.10	5.71	2.01	33.45	95.02
	60C	Fuquay	Bt1	48-66	5.80	2.22	1.02	0.16	6.60	0.05	10.00	3.45	34.00	98.55
	60C	Fuquay	C	114-152	5.10	0.11	0.14	0.10	5.40	1.15	5.75	1.50	6.09	23.33
63-053-1	63A	Norfolk	Ap	0-30	5.90	1.01	0.12	0.13	8.40	0.05	9.66	1.31	13.04	96.18
	63A	Norfolk	Bt1	43-81	5.66	1.97	0.73	0.39	4.20	0.05	7.29	3.14	42.39	98.41
	63A	Norfolk	Btv	170-188	4.54	0.46	0.26	0.12	8.40	2.45	9.24	3.29	9.09	25.53
69-053-1	69B	Nansemond	Ap	0-28	5.48	1.02	0.22	0.05	2.00	0.05	3.29	1.34	39.21	96.27
	69B	Nansemond	Bt	48-78	5.68	0.79	0.61	0.17	2.20	0.05	3.77	1.62	41.64	96.91
	69B	Nansemond	Cg	78-168	5.05	0.24	0.20	0.03	3.20	0.65	3.67	1.12	12.81	41.96
74-053-1	74A	Dragston	Ap1	0-13	4.62	0.17	0.06	0.11	8.00	1.45	8.34	1.79	4.08	18.99
	74A	Dragston	Ap2	13-28	4.90	0.03	0.02	0.03	3.40	0.55	3.48	0.63	2.30	12.70
	74A	Dragston	Bt	48-86	4.80	0.09	0.01	0.02	3.00	0.45	3.12	0.57	3.85	21.05
	74A	Dragston	2Cg	104-163	4.92	0.02	0.16	0.05	6.80	3.05	7.03	3.28	3.27	7.01

TABLE I.8. Chemical data for Old Hickory Project Typical Pedons (cont'd)

PEDON	MAP UNIT	TAXONOMIC UNIT	HORIZON	DEPTH	pH	Ca	Mg	K	H	Al	CEC	ECEC	BASE SATURATION	EFFECTIVE BASE SAT'N
				(cm)		cmol(+)/kg soil							(%)	(%)
82-053-1	82A	Yemassee	Ap	0-25	6.28	2.19	0.62	0.25	4.40	0.10	7.48	3.16	41.02	96.84
	82A	Yemassee	Bt	25-63	5.50	1.08	0.97	0.17	3.80	1.25	6.02	3.47	36.88	63.98
	82A	Yemassee	Cg	109-152	4.80	0.40	0.25	0.04	4.60	3.15	5.29	3.84	13.04	17.97
90-183-2	90A	Pickney	Ag	0-61	4.60	0.07	0.03	0.02	5.00	1.75	5.12	1.87	2.34	6.42
	90A	Pickney	CS	10-40	5.19	0.03	0.03	0.03	4.40	1.00	4.49	1.09	2.00	8.26
	90A	Pickney	Cg3	122-152	4.92	0.07	0.29	0.03	2.80	1.85	3.19	2.24	12.23	17.41
VT2-10	92A	Bibb	Ag1	0-20	4.95	0.30	0.08	0.05	7.00	1.45	7.43	1.88	5.79	22.87
	92A	Bibb	Ag2	20-38	4.90	0.14	0.04	0.02	1.00	0.75	1.20	0.95	16.67	21.05
	92A	Bibb	Cg	38-152	5.00	0.28	0.23	0.02	1.20	2.15	1.73	2.68	30.64	19.78
112-183-1	112B	Fuquay	Ap	0-10	5.60	0.72	0.11	0.06	1.40	0.10	2.29	0.99	38.86	89.90
	112B	Fuquay	Bt1	84-107	5.41	0.70	0.25	0.11	2.20	0.45	3.26	1.51	32.52	70.20
	112B	Fuquay	Btv	127-183	5.14	1.56	0.49	0.16	10.80	1.75	13.01	3.96	16.99	55.81
146-053-1	146B	Varina	Ap	0-20	6.20	1.93	0.31	0.23	3.00	0.10	5.47	2.57	45.16	96.11
	146B	Varina	Bt	20-43	5.58	2.71	0.62	0.29	8.20	0.10	11.82	3.72	30.63	97.31
	146B	Varina	Cv	84-178	4.70	2.52	0.73	0.09	8.80	2.15	12.14	5.49	27.51	60.84
146-053-3	146B3	Varina	Ap	0-10	5.20	1.53	0.42	0.60	8.60	0.15	11.15	2.70	22.87	94.44
	146B3	Varina	Btv1	10-61	4.88	2.37	1.00	0.31	12.40	1.45	16.08	5.13	22.89	71.73
	146B3	Varina	C	157-183	4.58	0.22	0.33	0.06	8.60	4.25	9.21	4.86	6.62	12.55
246-W-5	246	Dothan	Ap	0-20	5.76	1.75	0.23	0.23	4.40	0.15	6.61	2.36	33.43	93.64
	246	Dothan	Bt	43-132	-	-	-	-	-	-	-	-	-	-
	246	Dothan	Btv	132-186	4.54	0.10	0.51	0.17	6.60	1.75	7.38	2.53	10.57	30.83
346-183-1	346B	Faceville	Ap	0-25	6.20	1.21	0.13	0.12	1.80	0.25	3.26	1.71	44.79	85.38
	346B	Faceville	Bt1	25-61	5.87	2.67	0.83	0.44	5.40	0.05	9.34	3.99	42.18	96.75
	346B	Faceville	Bt4	163-183	4.70	1.73	0.61	0.05	6.00	1.15	10.39	3.54	23.00	67.51

TABLE I.9 Percentages iron on a clay- and soil-basis for all horizons

BELOW SCARP

Lab #	Series Name	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay
69-053-1	Nansemond 69B	Ap	0-11	0.12	0.17	7.80	Bt	19-31	0.98	1.40	14.16	Cg	31-66	0.10	0.14	2.34
52-053-1	Ocilla 52B	Ap	0-9	0.15	0.21	4.77	Bt	35-46	0.74	1.06	8.60	BC	46-60	0.42	0.60	6.01
8-053-1	Masada 8C3	Ap	0-6	2.67	3.82	21.45	Bt1	6-20	5.57	7.97	17.86	2C2	65-80	11.80	16.87	50.52
45-053-2	Orangeburg 45A	Ap	0-11	0.30	0.43	23.83	Bt1	20-29	3.51	5.02	16.40	Bt4	60-79	4.42	6.32	13.36
63-053-1	Norfolk 63A	Ap	0-12	0.15	0.21	7.94	Bt1	17-32	1.90	2.72	13.58	Btv	67-74	3.14	4.49	12.30
7-053-1	Emporia 7B	Ap	0-10	0.29	0.41	11.85	Bt1	14-30	2.10	3.00	12.16	Cg	53-70	0.87	1.24	8.70
246-W-5	Dothan 246	Ap	0-8	0.28	0.40	9.77	Bt	17-52	2.37	3.39	11.22	Btv	52-74	3.87	5.53	13.11
10-053-1	Slagle 10A	Ap	0-10	0.98	1.40	11.78	Bt1	10-22	3.07	4.39	15.09	BC	36-60	2.60	3.72	12.87
Mean				0.62	0.88	12.40			2.53	3.62	13.63			3.40	4.87	14.90

ON SCARP

Lab #	Series Name	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay
12-183-1	Uchee 12B	Ap	0-10	0.18	0.26	9.19	Bt1	23-35	3.01	4.30	13.62	C	60-70+	1.36	1.94	8.07
46-183-3	Turbeville 46B3	Ap	0-6	1.85	2.65	12.42	Bt1	6-40	3.98	5.69	12.48	Bt2	40-72	3.26	4.66	11.32
112-183-1	Fuquay 112B	Ap	0-10	0.18	0.26	12.26	Bt	33-42	0.80	1.14	11.00	Btv	50-72	3.51	5.02	16.04
60-183-1	Fuquay 60C	Ap	0-8	0.37	0.53	8.82	Bt1	19-26	3.63	5.19	12.85	C	45-60	1.22	1.74	8.47
11-183-1	Suffolk 11B	Ap	0-9	0.30	0.43	12.62	Bt1	26-50	3.15	4.50	16.03	BC	65-75	0.94	1.34	13.31
8-053-2	Masada 8B	Ap	0-9	1.51	2.16	12.00	Bt	9-42	3.04	4.35	14.21	C	53-70	1.39	1.99	15.29
Mean				0.73	1.05	11.22			2.94	4.20	13.36			1.95	2.78	12.08

ABOVE SCARP

Lab #	Series Name	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay
346-183-1	Faceville 346B	Ap	0-10	0.30	0.43	9.33	Bt1	10-24	3.52	5.03	15.78	Bt4	64-72	4.59	6.56	12.11
46-183-2	Turbeville 46B	Ap	0-10	0.50	0.72	11.72	Bt1	10-22	4.39	6.28	16.22	BC	65-89+	1.97	2.82	13.68
146-053-1	Varina 146B	Ap	0-8	1.30	1.86	14.67	Bt	8-17	4.63	6.62	15.73	Cg	33-70	5.46	7.81	13.23
146-053-3	Varina 146B3	Ap	0-4	3.1[illegible]	4.43	18.17	Btv1	4-24	5.81	8.31	13.64	C	62-72	6.30	9.01	42.30
Mean				1.3[illegible]	1.86	13.52			4.59	6.56	15.34			4.58	6.55	20.33

WET SOILS

Lab #	Series Name	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay
29-053-1	Roanoke 29A	Ap	0-8	0.12	0.17	4.09	Btg1	8-14	0.37	0.53	3.50	Cg	62-70	0.07	0.10	0.56
29-053-1	Roanoke 29A	-	-	-	-	-	Btg2	14-28	0.94	1.34	4.62	-	-	-	-	-
26-053-1	Myatt 26A	A	0-5	0.17	0.24	1.83	Btg	10-30	0.87	1.24	3.17	Cg	44-60	0.07	0.10	0.27
82-053-1	Yemassee 82A	Ap	0-10	0.26	0.37	5.47	Bt	10-25	1.07	1.53	8.10	Cg	43-60	0.39	0.56	2.83
74-053-1	Dragston 74A	Ap1	0-5	0.25	0.36	7.30	Bt	19-34	0.31	0.44	5.41	Cg	41-64	0.27	0.39	1.80
74-053-1	Dragston 74A	Ap2	5-11	0.23	0.33	6.85	-	-	-	-	-	-	-	-	-	-
VT-4	Pickney 90A	Ag	0-24	0.02	0.03	0.72	CS	10-40	0.00	0.01	0.14	Cg3	46-60	0.02	0.03	0.19
VT2-10	Bibb 92A	Ag1	0-8	0.21	0.30	6.13	Ag2	8-15	0.08	0.11	2.66	Cg	15-60	0.24	0.34	3.12
Mean				0.19	0.26	4.63			0.52	0.74	3.94			0.18	0.25	1.46

PIEDMONT SOILS

Lab #	Series Name	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay	Horizon	Depth	% Fe	g Fe2O3/ 100 g soil	g Fe2O3/ 100 g clay
16-053-1	Herndon 16D3	Ap	0-4	2.34	3.35	29.61	Bt1	4-37	7.00	10.01	17.78	BC	49-64	6.93	9.91	29.32
20-053-1	Georgeville 20B2	Ap	0-8	3.60	5.15	21.01	Bt1	8-42	8.87	12.68	19.70	BC	66-72	6.90	9.87	21.27
17-053-1	Helena 17B2	Ap	0-5	1.48	2.12	13.65	Bt1	5-23	4.50	6.44	13.46	C	52-72	7.04	10.07	38.72
14-053-1	Vance 14C3	A+E	0-4	0.78	1.12	9.00	Bt1	4-33	3.49	4.99	10.46	Cg	42-72	1.87	2.67	7.11
Mean				2.05	2.93	18.32			5.97	8.53	15.35			5.69	8.13	24.10

APPENDIX II

TABLES WITH STATISTICAL COMPARISONS, P-VALUES OF KRUSKAL-WALLIS TESTS AND α-LEVELS FOR MULTIPLE COMPARISONS

TABLE II.1a COMPARISON OF A-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION AND GEOMORPHIC SURFACE IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means					experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Sand	0.1846	77.10 a	78.68 a	71.50 a	68.66 a	63.45 a	
Silt	0.0382	16.89 ab	12.37 b	16.58 ab	25.26 a	20.58 a	0.15
Clay	0.0938	6.06 b	8.93 ab	11.90 ab	6.1 ab	15.93 a	0.15

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Kao	0.0170	31.75 b	34.0 ab	44.50 ab	26.43 b	63.75 a	0.15
HIV	0.1576	45.63 a	39.0 a	36.5 a	42.29 a	27.25 a	
Verm	0.0191	4.19 ab	5.0 ab	0.63 b	7.57 a	1.25 ab	0.25
Smec	0.4183	1.13 a	0.83 a	0.13 a	9.21 a	0.13 a	
Mica	0.0722	5.88 a	6.5 a	7.0 a	4.57 ab	1.75 b	0.2
Chl	0.4290	0 a	0.083 a	0 a	0 a	0 a	
Qz	0.1912	7.25 a	6.83 a	4.50 a	7.43 a	3.25 a	
Gibb	0.0202	4.38 ab	7.83 ac	7.0 a	2.79 b	2.75 bc	0.2
Goet	0.6786	0.063 a	0.083 a	0 a	0 a	0 a	
Fd	0.7447	0.31 a	0.33 a	0.25 a	0.29 a	0.13 a	
Int	0.2807	0.13 a	0.33 a	0.38 a	0.36 a	0.38 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Kao	0.0072	9.44 b	6.83 ab	19.25 ab	4.29 b	48.0 a	0.15
HIV	0.0061	6.0 ac	9.17 a	3.75 ab	1.79 b	2.5 bc	0.15
Mica	0.0216	15.25 a	19.17 a	12.75 ab	10.57 ab	4.75 b	0.2
Qz	0.0010	67.63 ac	63.0 ab	62.5 abc	81.86 c	44.25 b	0.15
Gibb	0.1812	0 a	0 a	0 a	0 a	0.13 a	
Fd	0.1352	1.19 a	2.08 a	1.13 a	1.64 a	0.88 a	
Int	0.3507	0.63 a	0.083 a	0.88 a	0 a	0.13 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Qz	0.3710	83.63 a	78.25 a	79.5 a	86.29 a	78.25 a	
Al Fd	0.3505	0 a	0.25 a	0.13 a	0.25 a	0.19 a	
Ilm	0.1335	9.25 a	13.25 a	14.38 a	7.21 a	14.0 a	
Leuc	0.8982	1.38 a	0.92 a	1.19 a	1.32 a	0.88 a	
Rut	0.0591	0.31 ab	1.0 a	0.75 ab	0.11 b	0.13 ab	0.15
Zir	0.3107	4.06 a	5.83 a	3.75 a	3.71 a	6.38 a	
Ky	0.1165	0.53 a	0.13 a	0.25 a	0.11 a	0.063 a	
Stau	0.0995	0.94 ab	0.38 b	0.38 ab	1.39 a	1.06 ab	0.2

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz;
Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite;
Stau = staurolite

TABLE II.1b COMPARISON OF B-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION AND GEOMORPHIC SURFACE IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means					experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Sand	0.0174	57.55 a	60.38 a	42.28 ab	58.24 a	21.55 b	0.15
Silt	0.0049	17.29 ab	8.5 b	14.33 ab	24.79 a	24.40 a	0.15
Clay	0.0024	25.18 acd	31.12 abcd	43.40 bd	16.97 c	54.05 b	0.15

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Kao	0.0150	38.88 b	50.67 ab	55.25 ab	40.29 b	70.0 a	0.15
HIV	0.0862	35.0	23.17	23.5	32.0	19.25	too high
Verm	0.1682	4.38 a	5.83 a	3.88 a	7.57 a	1.25 a	
Smec	0.3623	4.44 a	2.33 a	3.88 a	6.07 a	7.25 a	
Mica	0.0207	4.69 ab	3.5 ab	1.75 ab	5.57 a	1.0 b	0.15
Qz	0.0150	3.56 a	2.67 ab	0.75 ab	6.93 a	0.38 b	0.15
Gibb	0.0018	8.63 acde	11.5 ce	11.5 e	1.86 b	1.5 bd	0.15
Fd	0.5453	0.25 a	0.33 a	0.13 a	0.14 a	0.13 a	
Int	0.6786	0.63 a	0.83 a	0 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Kao	0.0410	11.13 b	8.17 b	24.0 ab	13.14 ab	63.75 a	0.15
HIV	0.1375	7.50 a	4.83 a	2.0 a	5.64 a	1.75 a	
Mica	0.0081	10.31 ab	8.0 ab	4.5 b	15.0 a	3.0 b	0.15
Qz	0.0267	69.63 a	77.0 a	68.75 a	65.0 ab	31.50 b	0.2
Gibb	0.3098	0.13 a	0.83 a	0 a	0.07 a	0.25 a	
Fd	0.0116	0.94 ab	1.33 a	1.0 ab	1.29 a	0.5 b	0.15
Int	0.5488	0.63 a	0.17 a	0 a	0.07 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Qz	0.5010	81.81 a	83.25 a	79.13 a	85.57 a	78.88 a	
Al Fd	0.1017	0.44 ab	0.63 ab	0 ab	1.04 a	0.19 b	0.15
Ilm	0.0711	8.38 ab	9.5 ab	15.5 a	6.21 b	13.5 a	0.2
Leuc	0.1866	3.59 a	2.75 a	1.06 a	2.86 a	1.31 a	
Rut	0.9063	0.63 a	0.46 a	0.38 a	0.64 a	0.44 a	
Zr	0.5689	3.81 a	3.42 a	2.88 a	2.64 a	5.0 a	
Ky	0.9498	0.22 a	0.25 a	0.38 a	0.21 a	0.19 a	
Stau	0.4592	0.75 a	0.21 a	0.5 a	0.68 a	0.63 a	
Musc	0.4446	0 a	0 a	0 a	0.14 a	0.13 a	
Tour	0.6741	0.063 a	0 a	0.25 a	0.07 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz;
Gibb = gibbsite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zr = zircon; Ky = kyanite;
Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.1c COMPARISON OF C-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION AND GEOMORPHIC SURFACE IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α - level mult. comp.
Sand	0.0130	54.73 a	69.07 a	36.8 ab	67.47 a	8.05 b	0.25
Silt	0.0302	17.91 ab	7.55 b	24.5 ab	12.28 ab	56.03 a	0.15
Clay	0.2455	27.34 a	23.38 a	38.78 a	20.27 a	35.95 a	

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α - level mult. comp.
Kao	0.0181	50.88 b	61.67 ab	75.0 ab	50.67 b	80.0 a	0.15
HIV	0.2493	27.0 a	21.67 a	16.0 a	24.17 a	12.75 a	
Verm	0.3867	4.38 a	4.67 a	2.5 a	4.0 a	1.25 a	
Smec	0.0763	7.63 ab	2.75 b	3.75 ab	14.5 a	6.0 ab	0.15
Mica	0.0181	1.88 ab	2.0 ab	0.25 b	2.58 a	0.13 b	0.15
Chl	0.4530	0 a	0.083 a	0 a	0 a	0 a	
Qz	0.0089	1.5 ac	0.17 ab	0.25 abc	2.33 c	0 b	0.2
Gibb	0.0715	7.13 a	7.67 a	2.75 ab	2.0 ab	0 b	0.2
Goet	0.1991	0 a	0 a	0.13 a	0 a	0 a	
Fd	0.6446	0.063 a	0 a	0 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α - level mult. comp.
Kao	0.0496	15.25 b	24.67 ab	46.25 ab	17.5 ab	60.75 a	0.15
HIV	0.0997	7.13 a	7.25 ab	2.38 ab	3.83 ab	0.5 b	0.15
Mica	0.4422	6.0 a	8.75 a	3.25 a	8.17 a	10.63 a	
Qz	0.1169	71.63 a	59.5 a	48.25 a	69.5 a	28.25 a	
Fd	0.1193	0.31 a	0.42 a	0.25 a	0.67 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α - level mult. comp.
Qz	0.4174	83.44 a	85.58 a	88.38 a	83.67 a	88.38 a	
Al Fd	0.5909	0.031 a	2.04 a	0 a	3.08 a	0.25 a	
Ilm	0.9193	7.63 a	7.33 a	6.0 a	7.5 a	8.13 a	
Leuc	0.3375	2.34 a	1.0 a	3.0 a	0.83 a	0.63 a	
Rut	0.4159	0.75 a	0.17 a	0 a	0.42 a	0.25 a	
Zir	0.7455	2.88 a	3.58 a	2.38 a	3.38 a	2.38 a	
Ky	0.1035	0.69	0.04	0.25	0	0.06	too high
Stau	0.0553	0.063	0.54	0	1.0	0	too high
Musc	0.5967	0 a	0.04 a	0 a	0.5 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz;
Gibb = gibbsite; Goet = goethite; Fd = feldspars;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite;
Stau = staurolite; Musc = muscovite

TABLE II.2a. COMPARISON OF A-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION AND AND GEOMORPHIC SURFACE IN MASS %

CLAY MINERALOGY

	Kruskall-Wallis p-value	Means					experimentwise α-level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Kao	0.0397	2.33 b	3.44 ab	5.0 ab	1.60 ab	8.53 a	0.15
HIV	0.4290	2.04 a	2.34 a	3.67 a	2.57 a	3.34 a	
Verm	0.0636	0.18 a	0.39 a	0.033 b	0.38 ab	0.17 ab	0.2
Smec	0.4520	0.023 a	0.13 a	0.014 a	0.42 a	0.015 a	
Mica	0.3498	0.22 a	0.39 a	0.48 a	0.29 a	0.24 a	
Chl	0.4290	0a	0.0016 a	0a	0 a	0 a	
Qz	0.4039	0.26 a	0.25 a	0.3 a	0.42 a	0.36 a	
Gibb	0.0577	0.18 b	0.95 ab	0.58 a	0.18 b	0.36 ab	0.15
Goet	0.6704	0.0009 a	0.002 a	0 a	0 a	0 a	
Fd	0.9007	0.015 a	0.025 a	0.013 a	0.057 a	0.011 a	
Int	0.0993	0.004	0.023	0.027	0.066	0.043	too high

SILT MINERALOGY

	Kruskall-Wallis p-value	Means					experimentwise α-level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Kao	0.0353	1.64 b	0.86 b	4.28 ab	0.97 b	9.89 a	0.15
HIV	0.0663	1.07	1.16	0.46	0.37	0.53	too high
Mica	0.2278	2.78 a	2.37 a	1.6 a	2.62 a	1.02 a	
Qz	0.0047	11.12 ab	7.78 b	10.0 ab	20.91 a	9.0 b	0.2
Gibb	0.1812	0 a	0 a	0 a	0 a	0.025 a	
Fd	0.3738	0.18 a	0.24 a	0.17 a	0.43 a	0.21 a	
Int	0.3808	0.13 a	0.03 a	0.11 a	0 a	0.04 a	

SAND MINERALOGY

	Kruskall-Wallis p-value	Means					experimentwise α-level mult. comp.
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	
Qz	0.1649	64.7 a	61.77 a	56.75	58.69 a	49.53 a	0.15
Al Fd	0.3679	0 a	0.22 a	0.11 a	0.17 a	0.12 a	
Ilm	0.2166	6.99 a	10.08 a	10.33 a	5.39 a	8.96 a	
Leuc	0.8932	1.02 a	0.74 a	0.80 a	0.94 a	0.55 a	
Rut	0.0407	0.24 ab	0.83 a	0.60 ab	0.06 b	0.08 ab	
Zir	0.5059	3.07 a	4.65 a	2.68 a	2.67 a	4.07 a	
Ky	0.1186	0.38 a	0.10 a	0.19 a	0.06 a	0.004 a	
Stau	0.2221	0.73 a	0.32 a	0.27 a	0.91 a	0.69 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz;
Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite;
Stau = staurolite

TABLE II.2b COMPARISON OF B-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION AND GEOMORPHIC SURFACE IN MASS %

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α - level mult. comp.
Kao	0.0064	9.33 bc	14.55 abc	20.85 ac	7.29 b	31.94 a	0.2
HIV	0.4968	7.18 a	5.78 a	8.92 a	5.52 a	8.83 a	
Verm	0.3511	0.78 a	1.59 a	1.19 a	0.84 a	0.54 a	
Smec	0.1071	1.09 ab	0.60 b	1.54 ab	0.68 ab	3.24 a	0.15
Mica	0.7061	0.73 a	0.76 a	0.59 a	0.76 a	0.45 a	
Qz	0.0618	0.52 ab	0.35 ab	0.26 ab	0.87 a	0.12 b	0.15
Gibb	0.0005	1.91 ab	3.25 a	3.69 a	0.31 b	0.30 b	0.15
Fd	0.0146	0.038 b	0.09 ab	0.035 b	0.02 b	0.50 a	0.15
Int	0.6704	0.07 a	0.20 a	0 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α - level mult. comp.
Kao	0.0048	1.88 bc	0.65 b	4.99 bd	2.48 cd	15.66 ad	0.15
HIV	0.0998	1.36	0.45	0.20	1.72	0.4	too high
Mica	0.0053	1.90 abc	0.76 bc	0.42 bc	3.71 a	0.74 c	0.15
Qz	0.0433	11.93 ab	6.5 b	8.67 ab	16.60 a	7.6 ab	0.15
Gibb	0.3496	0.022 a	0.046 a	0 a	0.019 a	0.068 a	
Fd	0.0029	0.16 abc	0.11 bc	0.09 bc	0.29 a	0.12 c	0.15
Int	0.6143	0.079 a	0.017 a	0 a	0.014 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α - level mult. comp.
Qz	0.0191	47.29 a	50.09 a	33.69 ab	49.1 a	17.43 b	0.15
Al Fd	0.0927	0.23 ab	0.38 ab	0 b	0.59 a	0.06 ab	0.15
Musc	0.4446	0 a	0 a	0 a	0.05 a	0.04 a	
Ilm	0.5070	4.64 a	5.88 a	6.29 a	4.12 a	2.73 a	
Leuc	0.0291	2.11 ab	1.71 ab	0.56 ab	1.77 a	0.19 b	0.25
Rut	0.8328	0.33 a	0.27 a	0.20 a	0.48 a	0.10 a	
Zir	0.3394	2.17 a	2.03 a	1.1 a	1.74 a	0.98 a	
Ky	0.9499	0.13 a	0.15 a	0.20 a	0.17 a	0.02 a	
Stau	0.3064	0.41 a	0.10 a	0.26 a	0.27 a	0.11 a	
Tour	0.7323	0.04 a	0 a	0.03 a	0.05 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.2c COMPARISON OF C-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION AND GEOMORPHIC SURFACE IN MASS %

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α-level mult. comp.
Kao	0.0751	10.6 ab	13.06 ab	23.82 ab	10.42 b	22.31 a	0.25
HIV	0.9089	6.67 a	4.03 a	6.57 a	4.52 a	3.48 a	
Verm	0.5467	0.98 a	1.01 a	0.38 a	0.72 a	0.44 a	
Smec	0.0696	1.58 ab	0.39 b	0.53 ab	2.99 a	1.59 ab	0.15
Mica	0.0307	0.36 ab	0.46 ab	0.08 ab	0.54 a	0.024 b	0.15
Chl	0.4530	0 a	0.023 a	0 a	0 a	0 a	
Qz	0.0044	0.20 ab	0.017 ac	0.08 abc	0.44 b	0 c	0.25
Gibb	0.1270	2.20 a	1.77 a	0.94 a	0.44 a	0 a	
Goet	0.1991	0 a	0 a	0.068 a	0 a	0 a	
Fd	0.6446	0.0038 a	0 a	0 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α-level mult. comp.
Kao	0.1100	6.39 b	1.93 ab	18.73 ab	2.47 ab	34.09 a	0.15
HIV	0.3163	0.78 a	0.56 a	0.11 a	0.49 a	0.33 a	
Mica	0.0992	0.83 a	0.61 ab	0.11 b	0.98 a	5.41 ab	0.15
Qz	0.0335	9.91 ab	4.47 b	5.58 b	8.21 ab	16.27 a	0.15
Fd	0.0637	0.069 ab	0.027 ab	0.008 ab	0.068 a	0 b	0.15
Int	0.4530	0 a	0 a	0 a	0.13 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means					experimentwise
		Below scarp	On scarp	Above scarp	Wet soils	Piedmont soils	α-level mult. comp.
Qz	0.0088	45.40 ab	59.49 a	32.01 ab	56.19 a	7.52 b	0.15
Al Fd	0.6066	0.024 a	1.43 a	0 a	2.29 a	0.022 a	
Musc	0.5967	0 a	0.03 a	0 a	0.35 a	0 a	
Ilm	0.0317	3.97 a	4.63 a	3.41 ab	5.12 a	0.39 b	0.15
Leuc	0.3336	1.31 a	0.78 a	0.45 a	0.53 a	0.01 a	
Rut	0.4527	0.48 a	0.13 a	0 b	0.27 a	0.004 a	
Zir	0.0186	2.50 a	2.39 a	0.75 b	2.27 a	0.13 b	0.15
Ky	0.1039	0.43	0.023	0.19	0	0.005	too high
Stau	0.0606	0.047	0.41	0	0.65	0	too high
Tour	0.4530	0 a	0 a	0 a	0.12 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz;
Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite;
Stau = staurolite; Musc = muscovite; Tour = tourmaline

TABLE II.3a COMPARISON OF A-HORIZON MINERALOGY OF WELL AND MODERATELY WELL DRAINED SOILS AS A FUNCTION OF LOCATION AND GEOMORPHIC SURFACE IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Sand	0.1457	77.10 a	78.68 a	71.50 a	63.45 a	
Silt	0.0734	16.89 ab	12.37 b	16.58 ab	20.58 a	0.15
Clay	0.1076	6.06 b	8.93 ab	11.90 ab	15.93 a	0.2

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Kao	0.0412	31.75 b	34.0 b	44.50 ab	63.75 a	0.2
HIV	0.1451	45.63 a	39.0 a	36.5 a	27.25 a	
Verm	0.0142	4.19 ab	5.0 a	0.63 b	1.25 b	0.2
Smec	0.8704	1.13 a	0.83 a	0.13 a	0.13 a	
Mica	0.0882	5.88 ab	6.5 a	7.0 a	1.75 b	0.2
Chl	0.4459	0 a	0.083 a	0 a	0 a	
Qz	0.1846	7.25 a	6.83 a	4.50 a	3.25 a	
Gibb	0.0299	4.38 ab	7.83 a	7.0 a	2.75 b	0.15
Goet	0.7366	0.063 a	0.083 a	0 a	0 a	
Fd	0.5912	0.31 a	0.33 a	0.25 a	0.13 a	
Int	0.2292	0.13 a	0.33 a	0.38 a	0.38 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Kao	0.0082	9.44 b	6.83 b	19.25 ab	48.0 a	0.15
HIV	0.0324	6.0 ab	9.17 a	3.75 ab	2.5 b	0.15
Mica	0.0490	15.25 a	19.17 a	12.75 ab	4.75 b	0.2
Qz	0.0219	67.63 a	63.0 a	62.5 a	44.25 b	0.2
Gibb	0.2123	0 a	0 a	0 a	0.13 a	
Fd	0.1491	1.19 a	2.08 a	1.13 a	0.88 a	
Int	0.5632	0.63 a	0.083 a	0.88 a	0.13 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Qz	0.5086	83.63 a	78.25 a	79.5 a	78.25 a	
Al Fd	0.2703	0 a	0.25 a	0.13 a	0.19 a	
Ilm	0.2647	9.25 a	13.25 a	14.38 a	14.0 a	
Leuc	0.7228	1.38 a	0.92 a	1.19 a	0.88 a	
Rut	0.1207	0.31 a	1.0 a	0.75 a	0.13 a	
Zir	0.3284	4.06 a	5.83 a	3.75 a	6.38 a	
Ky	0.1141	0.53 a	0.13 a	0.25 a	0.063 a	
Stau	0.3606	0.94 a	0.38 a	0.38 a	1.06 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite

TABLE II.3b COMPARISON OF B-HORIZON MINERALOGY OF WELL AND MODERATELY WELL DRAINED SOILS AS A FUNCTION OF LOCATION AND GEOMORPHIC SURFACE IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means				experimentwise α- level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Sand	0.0089	57.55 a	60.38 a	42.28 ab	21.55 b	0.15
Silt	0.0073	17.29 a	8.5 b	14.33 ab	24.40 a	0.15
Clay	0.0057	25.18 b	31.12 b	43.40 ab	54.05 a	0.15

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α- level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Kao	0.0240	38.88 b	50.67 ab	55.25 ab	70.0 a	0.15
HIV	0.1161	35.0 a	23.17 a	23.5 a	19.25 a	
Verm	0.2320	4.38 a	5.83 a	3.88 a	1.25 a	
Smec	0.2387	4.44 a	2.33 a	3.88 a	7.25 a	
Mica	0.0929	4.69 a	3.5 ab	1.75 ab	1.0 b	0.15
Qz	0.0328	3.56 a	2.67 ab	0.75 ab	0.38 b	0.15
Gibb	0.0263	8.63 a	11.5 a	11.5 a	1.5 b	0.2
Fd	0.4952	0.25 a	0.33 a	0.13 a	0.13 a	
Int	0.7366	0.63 a	0.83 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Kao	0.0316	11.13 b	8.17 b	24.0 ab	63.75 a	0.15
HIV	0.0859	7.50 a	4.83 ab	2.0 ab	1.75 b	0.2
Mica	0.1212	10.31 a	8.0 a	4.5 a	3.0 a	
Qz	0.0362	69.63 a	77.0 a	68.75 a	31.50 b	0.15
Gibb	0.3114	0.13 a	0.83 a	0 a	0.25 a	
Fd	0.0181	0.94 ab	1.33 a	1.0 ab	0.5 b	0.15
Int	0.4235	0.63 a	0.17 a	0 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Qz	0.5964	81.81 a	83.25 a	79.13 a	78.88 a	
Al Fd	0.4550	0.44 a	0.63 a	0 a	0.19 a	
Ilm	0.2003	8.38 a	9.5 a	15.5 a	13.5 a	
Leuc	0.1416	3.59 a	2.75 a	1.06 a	1.31 a	
Rut	0.8221	0.63 a	0.46 a	0.38 a	0.44 a	
Zir	0.6104	3.81 a	3.42 a	2.88 a	5.0 a	
Ky	0.9365	0.22 a	0.25 a	0.38 a	0.19 a	
Stau	0.2840	0.75 a	0.21 a	0.5 a	0.63 a	
Musc	0.2123	0 a	0 a	0 a	0.13 a	
Tour	0.5000	0.063 a	0 a	0.25 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz;
Gibb = gibbsite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite;
Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.3c COMPARISON OF C-HORIZON MINERALOGY OF WELL AND MODERATELY WELL DRAINED SOILS AS A FUNCTION OF LOCATION AND GEOMORPHIC SURFACE IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Sand	0.0122	54.73 a	69.07 a	36.8 ab	8.05 b	0.15
Silt	0.0294	17.91 ab	7.55 b	24.5 ab	56.03 a	0.15
Clay	0.3700	27.34 a	23.38 a	38.78 a	35.95 a	

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Kao	0.0305	50.88 b	61.67 ab	75.0 a	80.0 a	0.2
HIV	0.1643	27.0 a	21.67 a	16.0 a	12.75 a	
Verm	0.2164	4.38 a	4.67 a	2.5 a	1.25 a	
Smec	0.2059	7.63 a	2.75 a	3.75 a	6.0 a	
Mica	0.0700	1.88 ab	2.0 a	0.25 ab	0.13 b	0.25
Chl	0.4459	0 a	0.083 a	0 a	0 a	
Qz	0.0194	1.5 a	0.17 ab	0.25 ab	0 b	0.15
Gibb	0.0833	7.13 a	7.67 a	2.75 ab	0 b	0.2
Goet	0.2123	0 a	0 a	0.13 a	0 a	
Fd	0.6259	0.063 a	0 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α- level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Kao	0.0609	15.25 b	24.67 ab	46.25 ab	60.75 a	0.15
HIV	0.0591	7.13 a	7.25 a	2.38 ab	0.5 b	0.2
Mica	0.4183	6.0 a	8.75 a	3.25 a	10.63 a	
Qz	0.0857	71.63 a	59.5 ab	48.25 ab	28.25 b	0.15
Fd	0.1711	0.31 a	0.42 a	0.25 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	Piedmont soils	
Qz	0.3903	83.44 a	85.58 a	88.38 a	88.38 a	
Al Fd	0.5322	0.031 a	2.04 a	0 a	0.25 a	
Ilm	0.9018	7.63 a	7.33 a	6.0 a	8.13 a	
Leuc	0.3270	2.34 a	1.0 a	3.0 a	0.63 a	
Rut	0.2655	0.75 a	0.17 a	0 a	0.25 a	
Zir	0.6188	2.88 a	3.58 a	2.38 a	2.38 a	
Ky	0.2284	0.69 a	0.04 a	0.25 a	0.06 a	
Stau	0.1610	0.063 a	0.54 a	0 a	0 a	
Musc	0.4459	0 a	0.04 a	0 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.4a COMPARISON OF A-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Sand	0.7697	77.08 a	78.68 a	71.5 a	
Silt	0.1718	16.89 a	12.37 a	16.58 a	
Clay	0.1856	6.06 a	8.93 a	11.90 a	

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.1831	31.75 a	34.0 a	44.5 a	
HIV	0.2506	45.63 a	39.0 a	36.5 a	
Verm	0.0147	4.19 a	5.0 a	0.63 b	0.15
Smec	0.7266	1.13 a	0.83 a	0.13 a	
Mica	0.8554	5.88 a	6.5 a	7.0 a	
Chl	0.3679	0 a	0.083 a	0 a	
Qz	0.2965	7.25 a	6.83 a	4.5 a	
Gibb	0.1472	4.38 a	7.83 a	7.0 a	
Goet	0.7175	0.063 a	0.083 a	0 a	
Fd	0.8711	0.31 a	0.33 a	0.25 a	
Int	0.1770	0.13 a	0.33 a	0.38 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.1399	9.44 a	6.83 a	19.25 a	
HIV	0.1535	6.0 a	9.17 a	3.75 a	
Mica	0.4610	15.25 a	19.17 a	12.75 a	
Qz	0.6960	67.63 a	63.0 a	62.50 a	
Fd	0.1456	1.19 a	2.08 a	1.13 a	
Int	0.3824	0.63 a	0.083 a	0.88 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Qz	0.2944	83.63 a	78.25 a	79.5 a	
Al Fd	0.2365	0 a	0.25 a	0.13 a	
Ilm	0.1577	9.25 a	13.25 a	14.38 a	
Leuc	0.6198	1.38 a	0.92 a	1.19 a	
Rut	0.1847	0.31 a	1.0 a	0.75 a	
Zir	0.3396	4.06 a	5.83 a	3.75 a	
Ky	0.2069	0.53 a	0.13 a	0.25 a	
Stau	0.2243	0.94 a	0.38 a	0.38 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite

TABLE II.4b COMPARISON OF B-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Sand	0.1059	57.55 a	60.38 a	42.28 b	0.15
Silt	0.0156	17.29 a	8.5 b	14.33 ab	0.1
Clay	0.0558	25.18 b	31.12 ab	43.4 a	0.1

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.1064	38.88 b	50.67 ab	55.25 a	0.25
HIV	0.1348	35.0 a	23.17 a	23.5 a	
Verm	0.6476	4.38 a	5.83 a	3.88 a	
Smec	0.3139	4.38 a	2.33 a	3.88 a	
Mica	0.3900	4.69 a	3.5 a	1.75 a	
Qz	0.0769	3.56 a	2.67 b	0.75 b	0.25
Gibb	0.5310	8.63 a	11.5 a	11.5 a	
Fd	0.4552	0.25 a	0.33 a	0.13 a	
Int	0.7175	0.625 a	0.83 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.6635	11.13 a	8.17 a	24.0 a	
HIV	0.1236	7.5 a	4.83 a	2.0 a	
Mica	0.2535	10.31 a	8.0 a	4.5 a	
Qz	0.7770	69.63 a	77.0 a	68.75 a	
Gibb	0.212	0.13 a	0.83 a	0 a	
Fd	0.2857	0.94 a	1.33 a	1.0 a	
Int	0.4316	0.63 a	0.17 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Qz	0.4783	81.81 a	83.25 a	79.13 a	
Al Fd	0.2973	0.44 a	0.63 a	0 a	
Ilm	0.3031	8.38 a	9.5 a	15.5 a	
Leuc	0.1244	3.59 a	2.75 a	1.06 a	
Rut	0.6826	0.63 a	0.46 a	0.38 a	
Zir	0.6401	3.81 a	3.42 a	2.88 a	
Ky	0.8468	0.22 a	0.25 a	0.38 a	
Stau	0.2011	0.75 a	0.21 a	0.5 a	
Tour	0.4495	0.063 a	0 a	0.25 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz;
Gibb = gibbsite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = Kyanite; Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.4c COMPARISON OF C-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Sand	0.1749	54.73 a	69.07 a	38.8 a	
Silt	0.1916	17.91 a	7.55 a	24.5 a	
Clay	0.4259	27.34 a	23.38 a	38.78 a	

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.0815	50.88 b	61.67 ab	75.0 a	0.1
HIV	0.3235	27.0 a	21.67 a	16.0 a	
Verm	0.4495	4.38 a	4.67 a	2.5 a	
Smec	0.1315	7.63 a	2.75 a	3.75 a	
Mica	0.1929	1.88 a	2.0 a	0.25 a	
Chl	0.3679	0 a	0.083 a	0 a	
Qz	0.0518	1.5 a	0.17 b	0.25 ab	0.15
Gibb	0.4833	7.13 a	7.67 a	2.75 a	
Goet	0.1738	0 a	0 a	0.13 a	
Fd	0.5353	0.063 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.1061	15.25 b	24.67 ab	46.25 a	0.25
HIV	0.2547	7.13 a	7.25 a	2.38 a	
Mica	0.2782	6.0 a	8.75 a	3.25 a	
Qz	0.2202	71.63 a	59.5 a	48.25 a	
Fd	0.7346	0.32 a	0.42 a	0.25 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Qz	0.4613	83.44 a	85.58 a	88.38 a	
Al Fd	0.3445	0.031 a	2.04 a	0 a	
Musc	0.3679	0 a	0.042 a	0 a	
Ilm	0.8062	7.63 a	7.33 a	6.0 a	
Leuc	0.3817	2.34 a	1.0 a	3.0 a	
Rut	0.1514	0.75 a	0.17 a	0 a	
Zir	0.5628	2.88 a	3.58 a	2.38 a	
Ky	0.1703	0.69 a	0.042 a	0.25 a	
Stau	0.1849	0.063 a	0.54 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite;
Qz = quartz; Gibb = gibbsite; Fd = feldspars;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = kyanite; Stau = staurolite; Musc = muscovite

TABLE II.5a COMPARISON OF A-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION IN MASS %

CLAY MINERALOGY

	Kruskall-Wallis p-value	Means			experimentwise α-level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.1856	2.33 a	3.44 a	5.0 a	
HIV	0.4336	2.04 a	2.34 a	3.67 a	
Verm	0.0416	0.18 ab	0.39 a	0.033 b	0.15
Smec	0.8439	0.023 a	0.13 a	0.014 a	
Mica	0.1348	0.22 a	0.39 a	0.48 a	
Chl	0.3679	0a	0.0016 a	0a	
Qz	0.8684	0.26 a	0.25 a	0.3 a	
Gibb	0.0592	0.18 b	0.95 ab	0.58 a	0.15
Goet	0.6996	0.0009 a	0.002 a	0 a	
Fd	0.9572	0.015 a	0.025 a	0.013 a	
Int	0.0953	0.004 b	0.023 ab	0.027 a	0.2

SILT MINERALOGY

	Kruskall-Wallis p-value	Means			experimentwise α-level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.5041	1.64 a	0.86 a	4.28 a	
HIV	0.1566	1.07 a	1.16 a	0.46 a	
Mica	0.4975	2.78 a	2.37 a	1.6 a	
Qz	0.0414	11.12 a	7.78 b	10.0 ab	0.15
Fd	0.6251	0.18 a	0.24 a	0.17 a	
Int	0.4222	0.13 a	0.03 a	0.11 a	

SAND MINERALOGY

	Kruskall-Wallis p-value	Means			experimentwise α-level mult. comp.
		Below scarp	On scarp	Above scarp	
Qz	0.3423	64.7 a	61.77 a	56.75	
Al Fd	0.2271	0 a	0.22 a	0.11 a	
Ilm	0.2718	6.99 a	10.08 a	10.33 a	
Leuc	0.7776	1.02 a	0.74 a	0.80 a	
Rut	0.1452	0.24 a	0.83 a	0.60 a	
Zir	0.3195	3.07 a	4.65 a	2.68 a	
Ky	0.4259	0.38 a	0.10 a	0.19 a	
Stau	0.3314	0.73 a	0.32 a	0.27 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite

TABLE II.5b COMPARISON OF B-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION IN MASS %

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.0794	9.33 b	14.55 ab	20.85 a	0.15
HIV	0.4196	7.18 a	5.78 a	8.92 a	
Verm	0.3225	0.78 a	1.59 a	1.19 a	
Smec	0.2734	1.09 a	0.60 a	1.54 a	
Mica	0.8529	0.73 a	0.76 a	0.59 a	
Qz	0.6219	0.42 a	0.35 a	0.26 a	
Gibb	0.0040	0.83 b	3.25 a	3.69 a	0.15
Fd	0.4120	1.22 a	0.09 a	0.035 a	
Int	0.6996	0.07 a	0.20 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.5283	1.88 a	0.65 a	4.99 a	
HIV	0.0566	1.36 a	0.45 ab	0.20 b	0.15
Mica	0.1301	1.90 a	0.76 a	0.42 a	
Qz	0.0667	11.93 a	6.5 b	8.67 ab	0.15
Gibb	0.2801	0.022 a	0.046 a	0 a	
Fd	0.1459	0.16 a	0.11 a	0.09 a	
Int	0.4325	0.079 a	0.017 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α - level mult. comp.
		Below scarp	On scarp	Above scarp	
Qz	0.1556	47.29 a	50.09 a	33.69 a	
Al Fd	0.3035	0.23 a	0.38 a	0 a	
Ilm	0.8896	4.64 a	5.88 a	6.29 a	
Leuc	0.1091	2.11 a	1.71 ab	0.56 b	0.15
Rut	0.6644	0.33 a	0.27 a	0.20 a	
Zir	0.3162	2.17 a	2.03 a	1.1 a	
Ky	0.8934	0.13 a	0.15 a	0.20 a	
Stau	0.1870	0.41 a	0.10 a	0.26 a	
Tour	0.5131	0.04 a	0 a	0.03 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz;
Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = kyanite; Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.5c COMPARISON OF C-HORIZON MINERALOGY OF ALL SOILS AS A FUNCTION OF LOCATION IN MASS %

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α-level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.2914	10.6 a	13.06 a	23.82 a	
HIV	0.8048	6.67 a	4.03 a	6.57 a	
Verm	0.5477	0.98 a	1.01 a	0.38 a	
Smec	0.0963	1.58 a	0.39 b	0.53 ab	0.15
Mica	0.3232	0.36 a	0.46 a	0.08 a	
Chl	0.3679	0 a	0.023 a	0 a	
Qz	0.0251	0.20 a	0.017 b	0.08 ab	0.15
Gibb	0.6937	2.20 a	1.77 a	0.94 a	
Goet	0.1738	0 a	0 a	0.068 a	
Fd	0.5353	0.0038 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α-level mult. comp.
		Below scarp	On scarp	Above scarp	
Kao	0.7255	6.39 a	1.93 a	18.73 a	
HIV	0.1081	0.78 a	0.56 ab	0.11 b	0.15
Mica	0.0233	0.83 a	0.61 a	0.11 b	0.15
Qz	0.0842	9.91 a	4.47 b	5.58 ab	0.15
Fd	0.3753	0.069 a	0.027 a	0.008 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means			experimentwise α-level mult. comp.
		Below scarp	On scarp	Above scarp	
Qz	0.1215	45.40 a	59.49 a	32.01 a	
Al Fd	0.3746	0.024 a	1.43 a	0 a	
Musc	0.3679	0 a	0.03 a	0 a	
Ilm	0.5672	3.97 a	4.63 a	3.41 a	
Leuc	0.6627	1.31 a	0.78 a	0.45 a	
Rut	0.1999	0.48 a	0.13 a	0 b	
Zir	0.0815	2.50 a	2.39 a	0.75 b	0.15
Ky	0.1994	0.43 a	0.023 a	0.19 a	
Stau	0.2175	0.047 a	0.41 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz; Chl = chlorite; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.6a COMPARISON OF A-HORIZON MINERALOGY OF SOILS BELOW AND ABOVE THE SCARP IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Sand	0.8651	77.08 a	71.5 a
Silt	0.3958	16.89 a	16.58 a
Clay	0.0617	6.06 b	11.90 a

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.0889	31.75 b	44.5 a
HIV	0.0740	45.63 a	36.5 b
Verm	0.0409	4.19 a	0.63 b
Smec	0.6098	1.13 a	0.13 a
Mica	0.6079	5.88 a	7.0 a
Qz	0.0861	7.25 a	4.5 b
Gibb	0.0827	4.38 b	7.0 a
Goet	0.4795	0.063 a	0 a
Fd	0.6918	0.31 a	0.25 a
Int	0.1128	0.13 a	0.38 a

SILT MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.0735	9.44 b	19.25 a
HIV	0.3022	6.0 a	3.75 a
Mica	0.6098	15.25 a	12.75 a
Qz	0.4431	67.63 a	62.50 a
Fd	0.8573	1.19 a	1.13 a
Int	0.3373	0.63 a	0.88 a

SAND MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Qz	0.4439	83.63 a	79.5 a
Al Fd	0.1573	0 a	0.13 a
Ilm	0.0861	9.25 b	14.38 a
Leuc	0.6673	1.38 a	1.19 a
Rut	0.2080	0.31 a	0.75 a
Zir	0.9317	4.06 a	3.75 a
Ky	0.6351	0.53 a	0.25 a
Stau	0.2159	0.94 a	0.38 a

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite;
Smec = smectite; Qz = quartz; Gibb = gibbsite; Goet = goethite;
Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene;
Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite

TABLE II.6b COMPARISON OF B-HORIZON MINERALOGY OF SOILS BELOW AND ABOVE THE SCARP IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Sand	0.0894	57.55 a	42.28 b
Silt	0.3958	17.29 a	14.33 a
Clay	0.0272	25.18 b	43.4 a

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.0872	38.88 b	55.25 a
HIV	0.1054	35.0 a	23.5 b
Verm	0.9999	4.38 a	3.88 a
Smec	0.6567	4.38 a	3.88 a
Mica	0.2245	4.69 a	1.75 a
Qz	0.0373	3.56 a	0.75 b
Gibb	0.5480	8.63 a	11.5 a
Fd	0.4279	0.25 a	0.13 a
Int	0.4795	0.625 a	0 a

SILT MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.3907	11.13 a	24.0 a
HIV	0.0408	7.5 a	2.0 b
Mica	0.1054	10.31 a	4.5 b
Qz	0.8647	69.63 a	68.75 a
Gibb	0.2943	0.13 a	0 a
Fd	0.8236	0.94 a	1.0 a
Int	0.4795	0.63 a	0 a

SAND MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Qz	0.6098	81.81 a	79.13 a
Al Fd	0.1810	0.44 a	0 a
Ilm	0.1060	8.38 b	15.5 a
Leuc	0.0861	3.59 a	1.06 b
Rut	0.4127	0.63 a	0.38 a
Zir	0.3443	3.81 a	2.88 a
Ky	0.6471	0.22 a	0.38 a
Stau	0.4795	0.75 a	0.5 a
Tour	0.5139	0.063 a	0.25 a

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite;
Smec = smectite; Qz = quartz; Gibb = gibbsite;
Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene;
Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite; Tour = tourmaline

TABLE II.6c COMPARISON OF C-HORIZON MINERALOGY OF SOILS BELOW AND ABOVE THE SCARP IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Sand	0.3082	54.73 a	38.8 a
Silt	0.7341	17.91 a	24.5 a
Clay	0.3082	27.34 a	38.78 a

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.0214	50.88 b	75.0 a
HIV	0.1060	27.0 a	16.0 b
Verm	0.3329	4.38 a	2.5 a
Smec	0.2237	7.63 a	3.75 a
Mica	0.1557	1.88 a	0.25 a
Qz	0.1000	1.5 a	0.25 b
Gibb	0.2996	7.13 a	2.75 a
Goet	0.1573	0 a	0.13 a
Fd	0.4795	0.063 a	0 a

SILT MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.1704	15.25 a	46.25 a
HIV	0.0883	7.13 a	2.38 b
Mica	0.2637	6.0 a	3.25 a
Qz	0.2345	71.63 a	48.25 a
Fd	0.6918	0.32 a	0.25 a

SAND MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Qz	0.2679	83.44 a	88.38 a
Al Fd	0.4795	0.031 a	0 a
Ilm	0.4946	7.63 a	6.0 a
Leuc	0.9316	2.34 a	3.0 a
Rut	0.1025	0.75 a	0 b
Zir	0.8630	2.88 a	2.38 a
Ky	0.3138	0.69 a	0.25 a
Stau	0.2943	0.063 a	0 a

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite;
Smec = smectite; Qz = quartz; Gibb = gibbsite; Goet = goethite;
Fd = feldspars; AlFd = alkali (K and/or Na) feldspars;
Ilm = ilmenite; Leuc = leucoxene;
Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite

TABLE II.7a COMPARISON OF A-HORIZON MINERALOGY OF SOILS ABOVE AND BELOW THE SCARP IN MASS %

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.0617	2.33 b	5.0 a
HIV	0.2345	2.04 a	3.67 a
Verm	0.0872	0.18 a	0.033 b
Smec	0.7618	0.023 a	0.014 a
Mica	0.0735	0.22 b	0.48 a
Qz	0.6104	0.26 a	0.3 a
Gibb	0.0066	0.18 b	0.58 a
Goet	0.4795	0.0009 a	0 a
Fd	0.8602	0.015 a	0.013 a
Int	0.0372	0.004 b	0.027 a

SILT MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.2345	1.64 a	4.28 a
HIV	0.1264	1.07 a	0.46 a
Mica	0.3082	2.78 a	1.6 a
Qz	0.2345	11.12 a	10.01 a
Fd	0.7986	0.18 a	0.17 a
Int	0.2650	0.13 a	0.11 a

SAND MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Qz	0.1735	64.7 a	56.75 a
Al Fd	0.1573	0 a	0.11 a
Ilm	0.1742	6.99 a	10.33 a
Leuc	0.7341	1.02 a	0.80 a
Rut	0.2142	0.24 a	0.60 a
Zir	0.8651	3.07 a	2.68 a
Ky	0.4946	0.38 a	0.19 a
Stau	0.1727	0.73 a	0.27 a

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite;
Smec = smectite; Qz = quartz; Gibb = gibbsite; Goet = goethite;
Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene;
Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite

TABLE II.7b COMPARISON OF B-HORIZON MINERALOGY OF SOILS ABOVE AND ABOVE THE SCARP IN MASS %

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.0272	9.33 b	20.85 a
HIV	0.3958	7.18 a	8.92 a
Verm	0.5451	0.78 a	1.19 a
Smec	0.3924	1.09 a	1.54 a
Mica	0.6706	0.73 a	0.59 a
Qz	0.3949	0.42 a	0.26 a
Gibb	0.0108	0.83 b	3.69 a
Fd	0.2177	1.22 a	0.035 a
Int	0.4795	0.07 a	0 a

SILT MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.7341	1.88 a	4.99 a
HIV	0.0408	1.36 a	0.20 b
Mica	0.0894	1.90 a	0.42 b
Qz	0.3082	11.93 a	8.67 a
Gibb	0.2963	0.022 a	0 a
Fd	0.1054	0.16 a	0.09 b
Int	0.4795	0.079 a	0 a

SAND MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Qz	0.1264	47.29 a	33.69 a
Al Fd	0.1810	0.23 a	0 a
Ilm	0.7341	4.64 a	6.29 a
Leuc	0.0617	2.11 a	0.56 b
Rut	0.4146	0.33 a	0.20 a
Zir	0.0894	2.17 a	1.1 b
Ky	0.7164	0.13 a	0.20 a
Stau	0.3873	0.41 a	0.26 a
Tour	0.6953	0.04 a	0.03 a

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite;
Smec = smectite; Qz = quartz; Gibb = gibbsite;
Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene;
Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite; Tour = tourmaline

TABLE II.7c COMPARISON OF C-HORIZON MINERALOGY OF SOILS ABOVE AND BELOW THE SCARP IN MASS %

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.1264	10.6 a	23.82 a
HIV	0.7341	6.67 a	6.57 a
Verm	0.3873	0.98 a	0.38 a
Smec	0.1237	1.58 a	0.53 a
Mica	0.1666	0.36 a	0.08 a
Qz	0.1712	0.20 a	0.08 a
Gibb	0.6040	2.20 a	0.94 a
Goet	0.1573	0 a	0.068 a
Fd	0.4795	0.0038 a	0 a

SILT MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Kao	0.7341	6.39 a	18.73 a
HIV	0.0334	0.78 a	0.11 b
Mica	0.0065	0.83 a	0.11 b
Qz	0.1264	9.91 a	5.58 a
Fd	0.2177	0.069 a	0.008 a

SAND MINERALOGY

	Kruskal-Wallis p-value	Means	
		Below scarp	Above scarp
Qz	0.3082	45.40 a	32.01 a
Al Fd	0.4795	0.024 a	0 a
Ilm	0.3949	3.97 a	3.41 a
Leuc	0.4939	1.31 a	0.45 a
Rut	0.1059	0.48 a	0 b
Zir	0.0894	2.50 a	0.75 b
Ky	0.4146	0.43 a	0.19 a
Stau	0.2963	0.047 a	0 a

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite;
Smec = smectite; Qz = quartz; Gibb = gibbsite; Goet = goethite;
Fd = feldspars; AlFd = alkali (K and/or Na) feldspars;
Ilm = ilmenite; Leuc = leucoxene;
Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite

TABLE II.8a COMPARISON OF A-HORIZON MINERALOGY OF ALL COASTAL PLAIN SOILS AS A FUNCTION OF DRAINAGE IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Sand	0.6064	76.58 a	74.7 a	74.73 a	64.1 a	
Silt	0.1575	14.94 a	18.3 a	19.8 a	29.35 a	
Clay	0.9326	8.48 a	7.1 a	5.5 a	6.55 a	

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Kao	0.7317	35.31 a	35.5 a	27.33 a	25.75 a	
HIV	0.8053	40.75 a	46.5 a	47.33 a	38.50 a	
Verm	0.6793	3.5 a	5.0 a	4.17 a	10.13 a	
Smec	0.1987	0.88 a	0.25 a	2.67 a	14.13 a	
Mica	0.1349	6.75 a	3.0 a	5.33 a	4.0 a	
Chl	0.9050	0.031 a	0 a	0 a	0 a	
Qz	0.6020	6.44 a	7.0 a	9.0 a	6.25 a	
Gibb	0.0294	6.5 a	3.0 ab	4.33 ab	1.63 b	0.15
Goet	0.7593	0.063 a	0 a	0 a	0 a	
Fd	0.1544	0.28 a	0.5 a	0.5 a	0.13 a	
Int	0.8138	0.25 a	0.25 a	0.33 a	0.38 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Kao	0.1571	11.75 a	2.75 a	4.0 a	4.5 a	
HIV	0.0136	6.81 a	4.5 ab	4.0 ab	0.13 b	0.15
Mica	0.0971	16.06 a	15.5 ab	16.0 ab	6.5 b	0.15
Qz	0.0035	63.44 b	77.0 ab	74.33 ab	87.5 a	0.15
Fd	0.3628	1.59 a	0.5 a	1.67 a	1.63 a	
Int	0.4664	0.56 a	0 a	0 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Qz	0.4081	81.38 a	77.25 a	87.17 a	85.63 a	
Al Fd	0.0850	0.13	0	0	0.44	too high
Ilm	0.2607	11.47 a	13.75 a	5.83 a	8.25 a	
Leuc	0.6278	1.17 a	1.25 a	1.92 a	0.88 a	
Rut	0.1601	0.69 a	0.25 a	0.083 a	0.13 a	
Zir	0.2381	4.22 a	7.5 a	3.83 a	3.63 a	
Ky	0.4176	0.34 a	0.25 a	0.083 a	0.13 a	
Stau	0.0831	0.69	0.13	1.42	1.38	too high

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite;
Stau = staurolite

TABLE II.8b COMPARISON OF B-HORIZON MINERALOGY OF ALL COASTAL PLAIN SOILS AS A FUNCTION OF DRAINAGE IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Sand	0.7345	53.89 a	64.75 a	65.10 a	55.5 a	
Silt	0.1204	13.44 a	15.8 a	21.35 a	26.16 a	
Clay	0.0620	32.67	19.5	13.55	18.34	too high

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Kao	0.3367	48.0 a	34.0 a	29.50 a	44.6 a	
HIV	0.4590	28.0 a	32.5 a	27.50 a	33.8 a	
Verm	0.0541	4.1 a	10.0 a	10.0 a	6.6 a	
Smec	0.6658	3.41 a	5.25 a	5.25 a	6.4 a	
Mica	0.0726	3.28 b	6.5 ab	10.0 a	3.8 ab	0.2
Qz	0.0591	2.16 b	6.5 ab	14.50 a	3.9 ab	0.2
Gibb	0.0038	10.81 a	5.5 ab	3.50 ab	1.2 b	0.15
Fd	0.0342	0.22	0.5	0.5	0	too high
Int	0.7593	0.63 a	0 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Kao	0.3247	14.1 a	4.5 a	6.5 a	15.8 a	
HIV	0.9666	5.38 a	5.5 a	5.0 a	5.9 a	
Mica	0.0584	8.47 b	6.5 b	16.0 ab	14.6 a	0.15
Qz	0.2669	70.56 a	82.5 a	71.50 a	62.4 a	
Gibb	0.7342	0.34 a	0.25 a	0 a	0.1 a	
Fd	0.6003	1.1 a	1.0 a	1.0 a	1.4 a	
Int	0.4187	0.38 a	0 a	0.25 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Qz	0.5149	82.44 a	75.75 a	85.5 a	85.6 a	
Al Fd	0.0318	0.45 b	0 ab	0.13 ab	1.4 a	0.15
Musc	0.2615	0 a	0 a	0 a	0.2 a	
Ilm	0.3099	10.34 a	10.25 a	4.5 a	6.9 a	
Leuc	0.0437	2.25 b	6.75 a	6.0 ab	1.6 ab	0.25
Rut	0.4182	0.42 a	1.25 a	0.5 a	0.7 a	
Zir	0.2728	3.16 a	6.0 a	2.75 a	2.6 a	
Ky	0.4678	0.3 a	0 a	0.25 a	0.2 a	
Stau	0.2928	0.58 a	0 a	0.25 a	0.85 a	
Tour	0.3520	0.094 a	0 a	0.25 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz;
Gibb = gibbsite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon;
Ky = kyanite; Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.8c COMPARISON OF C-HORIZON MINERALOGY OF ALL COASTAL PLAIN SOILS AS A FUNCTION OF DRAINAGE IN WEIGHT %

PARTICLE SIZE DISTRIBUTION

	Kruskal-	Means				experimentwise
	Wallis p-value	WD	MD	SP	PD	α - level mult. comp.
Sand	0.8360	47.25 a	44.6 a	66.15 a	68.13 a	
Silt	0.3945	21.35 a	35.03 a	13.30 a	11.78 a	
Clay	0.5047	31.42 a	20.33 a	20.55 a	20.13 a	

CLAY MINERALOGY

	Kruskal-	Means				experimentwise
	Wallis p-value	WD	MD	SP	PD	α - level mult. comp.
Kao	0.8317	63.0 a	66.67 a	47.0 a	52.5 a	
HIV	0.6229	21.63 a	16.67 a	31.5 a	20.5 a	
Verm	0.4670	3.32 a	5.0 a	2.5 a	4.75 a	
Smec	0.1104	4.76 a	8.67 a	12.5 a	15.5 a	
Mica	0.0472	1.47 ab	0.17 b	2.75 ab	2.5 a	0.15
Chl	0.9189	0.026 a	0 a	0 a	0 a	
Qz	0.0573	0.45	1.83	2.5	2.25	too high
Gibb	0.3720	5.79 a	1.33 a	1.75 a	2.13 a	
Goet	0.9189	0.026 a	0 a	0 a	0 a	
Fd	0.0117	0	0.17	0	0	too high
Int	0.0624	0	0	0.25	0.13	too high

SILT MINERALOGY

	Kruskal-	Means				experimentwise
	Wallis p-value	WD	MD	SP	PD	α - level mult. comp.
Kao	0.5701	33.42 a	21.0 a	9.0 a	21.75 a	
HIV	0.1572	5.11 a	5.0 a	10.0 a	0.75 a	
Mica	0.5991	7.53 a	4.33 a	6.5 a	9.0 a	
Qz	0.2837	54.05 a	69.67 a	74.5 a	67.0 a	
Fd	0.6671	0.29 a	0.17 a	0.5 a	0.75 a	
Int	0.1718	0 a	0 a	0 a	1.25 a	

SAND MINERALOGY

	Kruskal-	Means				experimentwise
	Wallis p-value	WD	MD	SP	PD	α - level mult. comp.
Qz	0.2533	85.72 a	81.5 a	80.75 a	85.13 a	
Al Fd	0.3053	0.78 a	0 a	0 a	4.63 a	
Musc	0.5665	0.016 a	0 a	0 a	0.75 a	
Ilm	0.5339	6.81 a	10.0 a	9.5 a	6.5 a	
Leuc	0.5617	2.05 a	2.0 a	1.5 a	0.5 a	
Rut	0.0717	0.38 ab	0.5 ab	1.25 a	0 b	0.25
Zir	0.1386	2.88 a	4.0 a	6.0 a	2.06 a	
Ky	0.0272	0.17 ab	2.0 a	0 b	0 b	0.25
Stau	0.1345	0.23	0	0.5	1.25	too high
Tour	0.0117	0	0	0.5	0	too high

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.9a COMPARISON OF A-HORIZON MINERALOGY OF ALL COASTAL PLAIN SOILS AS A FUNCTION OF DRAINAGE IN MASS %

CLAY MINERALOGY

	Kruskal-	Means				experimentwise
	Wallis p-value	WD	MD	SP	PD	α - level mult. comp.
Kao	0.9767	3.38 a	2.63 a	1.43 a	1.73 a	
HIV	0.8235	2.49 a	2.64 a	2.42 a	2.69 a	
Verm	0.5648	0.21 a	0.32 a	0.19 a	0.52 a	
Smec	0.1926	0.06 a	0.028 a	0.17 a	0.60 a	
Mica	0.3240	0.35 a	0.15 a	0.28 a	0.30 a	
Chl	0.9050	0.0006 a	0 a	0 a	0 a	
Qz	0.2270	0.26 a	0.36 a	0.45 a	0.40 a	
Gibb	0.3071	0.56 a	0.19 a	0.21 a	0.16 a	
Goet	0.7598	0.001 a	0 a	0 a	0 a	
Fd	0.0989	0.016 ab	0.033 ab	0.13 a	0.006 b	0.2
Int	0.4534	0.016 a	0.01 a	0.12 a	0.03 a	

SILT MINERALOGY

	Kruskal-	Means				experimentwise
	Wallis p-value	WD	MD	SP	PD	α - level mult. comp.
Kao	0.8180	2.12 a	0.70 a	0.79 a	1.10 a	
HIV	0.0349	0.96 a	0.96 ab	0.79 ab	0.05 b	0.15
Mica	0.5718	2.24 a	3.50 a	3.12 a	2.24 a	
Qz	0.0211	9.34 b	13.1 ab	14.78 a	25.52 a	0.15
Fd	0.0917	0.22 ab	0.05 b	0.31 a	0.52 ab	0.15
Int	0.4668	0.097 a	0 a	0 a	0 a	

SAND MINERALOGY

	Kruskal-	Means				experimentwise
	Wallis p-value	WD	MD	SP	PD	α - level mult. comp.
Qz	0.5934	62.44 a	58.1 a	65.38 a	53.67 a	
Al Fd	0.1136	0.11 a	0 a	0 a	0.31 a	
Ilm	0.2493	8.58 a	10.17 a	4.23 a	6.26 a	
Leuc	0.5243	0.89 a	0.77 a	1.40 a	0.60 a	
Rut	0.0965	0.56	0.16	0.063	0.06	too high
Zir	0.2983	3.26 a	5.54 a	2.82 a	2.56 a	
Ky	0.4086	0.25 a	0.19 a	0.067 a	0.06 a	
Stau	0.1556	0.54 a	0.015 a	1.04 a	0.82 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates; Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite

TABLE II.9b COMPARISON OF B-HORIZON MINERALOGY OF ALL COASTAL PLAIN SOILS AS A FUNCTION OF DRAINAGE IN MASS %

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Kao	0.1118	14.58	5.97	4.4	8.44	too high
HIV	0.3858	7.23 a	5.6 a	3.33 a	6.4 a	
Verm	0.6522	1.08 a	1.66 a	1.26 a	0.68 a	
Smec	0.8818	1.0 a	1.26 a	0.89 a	0.6 a	
Mica	0.4789	0.7 a	0.8 a	1.02 a	0.65 a	
Qz	0.1459	0.32 a	0.72 a	1.32 a	0.69 a	
Gibb	0.0066	2.48 a	0.63 ab	0.37 ab	0.29 b	0.15
Fd	0.1241	0.64 a	0.09 a	0.064 a	0 a	
Int	0.7598	0.11 a	0 a	0 a	0 a	

SILT MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Kao	0.0617	2.34 b	0.78 ab	1.38 ab	2.93 a	0.15
HIV	0.6108	0.78 a	0.94 a	1.09 a	1.98 a	
Mica	0.0318	1.19 b	1.19 ab	3.31 ab	3.87 a	0.15
Qz	0.1160	8.98 a	12.74 a	15.37 a	17.09 a	
Gibb	0.7046	0.022 a	0.05 a	0 a	0.026 a	
Fd	0.0060	0.13 b	0.16 ab	0.22 ab	0.31 a	0.15
Int	0.3658	0.046 a	0 a	0.049 a	0 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Qz	0.7395	44.62 a	49.86 a	55.70 a	46.41 a	
Al Fd	0.0415	0.26 ab	0 b	0.09 ab	0.79 a	0.2
Musc	0.2615	0 a	0 a	0 a	0.07 a	
Ilm	0.5489	5.32 a	6.18 a	2.97 a	4.58 a	
Leuc	0.0466	1.3 b	4.27 a	3.8 ab	0.96 ab	0.2
Rut	0.3163	0.23 a	0.7 a	0.33 a	0.54 a	
Zir	0.2673	1.65 a	3.75 a	1.81 a	1.71 a	
Ky	0.4996	0.17 a	0 a	0.18 a	0.17 a	
Stau	0.3695	0.31 a	0 a	0.15 a	0.32 a	
Tour	0.2505	0.03 a	0 a	0.18 a	0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz; Gibb = gibbsite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.9c COMPARISON OF C-HORIZON MINERALOGY OF ALL COASTAL PLAIN SOILS AS A FUNCTION OF DRAINAGE IN MASS %

CLAY MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Kao	0.6422	15.0 a	9.20 a	9.42 a	10.92 a	
HIV	0.6927	6.15 a	2.67 a	6.35 a	3.61 a	
Verm	0.8395	0.78 a	1.41 a	0.53 a	0.81 a	
Smec	0.1885	0.81 a	2.04 a	2.44 a	3.26 a	
Mica	0.0905	0.37 ab	0 b	0.58 ab	0.53 a	0.15
Chl	0.9189	0.0088 a	0 a	0 a	0 a	
Qz	0.0423	0.1 b	0.22 ab	0.51 a	0.41 ab	0.15
Gibb	0.4042	1.98 a	0.12 a	0.36 a	0.47 a	
Goet	0.9189	0.017 a	0 a	0 a	0 a	
Fd	0.0117	0	0.015	0	0	too high

SILT MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Kao	0.9480	8.5 a	0.85 a	1.24 a	3.09 a	
HIV	0.0254	0.49 ab	1.12 a	1.33 a	0.073 b	0.15
Mica	0.4477	0.58 a	0.72 a	0.73 a	1.10 a	
Qz	0.1538	5.9 a	17.1 a	10.01 a	7.31 a	
Fd	0.3608	0.038 a	0.065 a	0.067 a	0.069 a	
Int	0.1718	0 a	0 a	0 a	0.2 a	

SAND MINERALOGY

	Kruskal-Wallis p-value	Means				experimentwise α - level mult. comp.
		WD	MD	SP	PD	
Qz	0.8008	46.6 a	51.25 a	53.46 a	57.56 a	
Al Fd	0.3057	0.55 a	0 a	0 a	3.43 a	
Musc	0.5665	0.011 a	0 a	0 a	0.53 a	
Ilm	0.3851	3.81 a	6.09 a	6.14 a	4.62 a	
Leuc	0.6676	0.89 a	1.35 a	1.05 a	0.28 a	
Rut	0.0571	0.25 ab	0.34 ab	0.82 a	0 b	0.2
Zir	0.3280	2.02 a	2.51 a	4.04 a	1.39 a	
Ky	0.0371	0.12 ab	1.21 a	0 b	0 b	0.2
Stau	0.1367	0.18 a	0 a	0.32 a	0.81 a	
Tour	0.0117	0	0	0.35	0	too high

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Chl = chlorite; Qz = quartz; Gibb = gibbsite; Goet = goethite; Fd = feldspars; Int = interstratified 2:1 phyllosilicates;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite; Tour = tourmaline; Musc = muscovite

TABLE II.10a COMPARISON OF THE MINERALOGY BETWEEN A- AND B-HORIZONS IN WEIGHT %

Particle size Distr		Below scarp		On scarp		Above scarp		Wet soils		Piedmont soils	
			p-value		p-value		p-value		p-value		p-value
% sand	A-hor.	77.08 a	0.0039	78.68 a	0.0156	71.5 a	0.0625	68.66 a	0.1094	63.45 a	0.0625
	B-hor.	57.55 b		60.38 b		42.29 b		58.24 b		21.55 b	
% silt	A-hor.	16.89 a	1.0000	12.37 a	0.2188	16.58 a	0.6250	25.26 a	0.6876	20.58 a	0.6250
	B-hor.	17.29 a		8.5 a		14.33 a		24.79 a		24.40 a	
% clay	A-hor.	6.06 b	0.0039	8.93 b	0.0156	11.9 b	0.0625	6.1 b	0.1094	15.93 b	0.0625
	B-hor.	25.16 a		31.12 a		43.4 a		16.97 a		54.05 a	

Clay mineralogy		Below scarp		On scarp		Above scarp		Wet soils		Piedmont soils	
			p-value		p-value		p-value		p-value		p-value
% Kao	A-hor.	31.75 a	>0.6367	34.0 a	> 0.6563	44.5 a	> 0.6875	26.43 a	> 0.6563	63.75 a	> 0.6875
	B-hor.	38.88 a		50.67 a		55.25 a		40.29 a		70.0 a	
% HIV	A-hor.	45.63 a	0.0352	39.0 a	0.1094	36.5 a	0.3125	42.29 a	0.1094	27.25 a	0.3125
	B-hor.	35.0 b		23.17 b		23.5 a		32.0 b		19.25 a	
% Verm	A-hor.	4.19 a	0.8840	5.0 a	0.4927	0.63 b	0.0947	7.57 a	0.8330	1.25	nv
	B-hor.	4.38 a		5.83 a		3.88 a		7.57 a		1.25	
% Smec	A-hor.	1.13 b	0.0295	0.83	nv	0.13 b	0.0625	9.21 a	0.3438	0.13 b	0.0625
	B-hor.	4.38 a		2.33		3.88 a		6.07 a		6.25 a	
% Mica	A-hor.	5.88 a	0.7266	6.5 a	0.2188	7.0 b	0.0947	4.57 a	0.8293	1.75	nv
	B-hor.	4.69 a		3.5 a		1.75 a		5.57 a		1.00	
% Qz	A-hor.	7.25 a	0.0352	6.83 a	0.0700	4.5 a	0.3125	7.43 a	0.3438	2.75 a	0.0625
	B-hor.	3.56 b		2.67 b		0.75 a		6.93 a		1.50 b	
% Gibb	A-hor.	4.38 b	0.0350	7.83 b	0.0350	7.0 a	0.6250	2.79	nv	2.0 a	0.0947
	B-hor.	8.63 a		11.5 a		11.5 a		1.86		1.5 b	

Silt mineralogy		Below scarp		On scarp		Above scarp		Wet soils		Piedmont soils	
			p-value		p-value		p-value		p-value		p-value
% Kao	A-hor.	9.44 b	0.1250	6.83 a	0.6876	19.25 a	1.0000	4.29 b	0.0312	40.5 a	0.2500
	B-hor.	11.13 a		8.17 a		24.0 a		13.14 a		63.75 a	
% HIV	A-hor.	6.0 b	0.1250	9.17 a	0.2188	3.75 a	0.5000	1.79 b	0.0626	2.5 a	1.0000
	B-hor.	7.5 a		4.83 a		2.0 a		5.64 a		1.75 a	
% Mica	A-hor.	15.25 a	0.2890	19.17 a	0.0312	12.75 a	0.2500	10.57 a	0.2188	4.75 a	0.2500
	B-hor.	10.31 a		8.0 b		4.5 a		15.0 a		3.0 a	
% Qz	A-hor.	67.63 a	0.2890	63.0 a	0.2188	46.25 a	0.6250	81.86 a	0.0626	44.25 a	0.6250
	B-hor.	69.63 a		77.0 a		68.75 a		65.0 b		31.5 a	
% Fd	A-hor.	1.19 a	0.2500	2.09 a	0.6876	1.0 a	1.0000	1.64 a	0.3750	0.88	nv
	B-hor.	0.94 a		1.33 a		1.0 a		1.29 a		0.50	

Sand mineralogy		Below scarp		On scarp		Above scarp		Wet soils		Piedmont soils	
			p-value		p-value		p-value		p-value		p-value
% Qz	A-hor.	83.63 a	0.0704	78.25 a	0.2188	79.5 a	1.0000	86.29 a	0.6876	78.25 a	1.0000
	B-hor.	81.81 b		83.25 a		79.13 a		85.57 a		78.88 a	
% AlFd	A-hor.	0	nv	0.25 a	0.6250	0.13	nv	0.25 b	0.1250	0.19	nv
	B-hor.	0.44		0.63 a		0		1.04 a		0.19	
% Ilm	A-hor.	9.25 a	1.0000	13.25 a	0.6876	14.38 a	1.0000	7.21 a	0.6876	14.0 a	0.6250
	B-hor.	8.38 a		9.5 a		15.5 a		6.21 a		13.5 a	
% Leuc	A-hor.	1.38 b	0.0704	0.92 a	0.3750	1.19	nv	1.32 b	0.0626	0.88 a	1.0000
	B-hor.	3.59 a		2.75 a		1.06		2.86 a		1.31 a	
% Rut	A-hor.	0.31 a	0.6250	1.0 a	0.6876	0.75	nv	0.11 a	0.2500	0.13 a	0.5000
	B-hor.	0.63 a		0.46 a		0.38		0.64 a		0.44 a	
% Zir	A-hor.	4.06 a	1.0000	5.83 a	0.2188	3.75 a	0.2500	3.71 a	0.3750	6.38 a	0.6250
	B-hor.	3.81 a		3.42 a		2.88 a		2.64 a		5.0 a	
% Ky	A-hor.	0.53 a	0.3750	0.13 a	0.6250	0.25 a	1.0000	0.11	nv	0.06	1.0000
	B-hor.	0.22 a		0.25 a		0.38 a		0.21		0.19	
% Stau	A-hor.	0.94 a	1.0000	0.38 a	1.0000	0.38 a	1.0000	1.39 a	0.0626	1.06 a	1.0000
	B-hor.	0.75 a		0.21 a		0.5 a		0.86 b		0.63 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz; Gibb = gibbsite; Fd = feldspars;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zir = zircon; Ky = kyanite; Stau = staurolite; nv = not valid.

TABLE II.10b COMPARISONS OF THE MINERALOGY BETWEEN B- AND C-HORIZONS IN WEIGHT %

Particle size Distr		Below scarp		On scarp		Above scarp		Wet soils		Piedmont soils	
			p-value		p-value		p-value		p-value		p-value
% sand	B-hor.	57.55 a	> 0.636	60.38 b	0.1094	42.29 a	> 0.687	58.24 a	0.6563	21.55 a	> 0.687
	C-hor.	54.73 a		69.07 a		38.80 a		67.47 a		8.05 a	
% silt	B-hor.	17.29 a	0.2890	8.5 a	0.2188	14.33 a	1.0000	24.79 a	0.2188	24.40 b	0.1250
	C-hor.	17.91 a		7.55 a		24.50 a		12.28 a		56.03 a	
% clay	B-hor.	25.18 a	0.3633	31.12 a	0.1094	43.40 a	0.6875	18.87 a	> 0.656	54.05 a	0.0625
	C-hor.	27.34 a		23.38 b		38.78 a		20.27 a		35.95 b	

Clay mineralogy		Below scarp		On scarp		Above scarp		Wet soils		Piedmont soils	
			p-value		p-value		p-value		p-value		p-value
% Kao	B-hor.	38.88 b	0.0780	50.87 b	0.0156	55.25 b	0.1250	40.29 a	0.2188	70.0 b	> 0.6875
	C-hor.	50.88 a		61.87 a		75.0 a		50.87 a		80.0 a	
% HIV	B-hor.	35.0 a	0.1250	23.17 a	1.0000	23.5 a	0.6250	32.0 a	1.0000	19.25 a	0.3125
	C-hor.	27.0 b		21.67 a		16.0 a		24.17 a		12.75 a	
% Verm	B-hor.	4.38	nv	5.83 a	1.0000	3.88 a	0.6250	7.57 a	0.6250	1.25	nv
	C-hor.	4.38		4.67 a		2.50 a		4.0 a		1.25	
% Smec	B-hor.	4.38 b	0.1250	2.33	nv	3.88 a	0.2500	8.07 a	0.6876	6.25 a	1.0000
	C-hor.	7.63 a		2.75		3.75 a		14.5 a		6 a	
% Mica	B-hor.	4.69 a	0.0626	3.5 a	0.1250	1.75 a	0.1250	5.57 a	0.1250	1 a	0.2500
	C-hor.	1.88 b		2.0 b		0.25 b		2.58 b		0.13 a	
% Qz	B-hor.	3.56 a	0.0078	2.67 a	0.0626	0.75	nv	6.93 a	0.3750	1.5 a	0.5000
	C-hor.	1.50 b		0.17 b		0.25		2.33 a		0 a	
% Gibb	B-hor.	8.63 a	0.2188	11.5 a	0.2188	11.5 a	0.1250	1.88 a	1.0000	1.5 a	0.1250
	C-hor.	7.13 a		7.67 a		2.75 b		2.0 a		0 b	

Silt mineralogy		Below scarp		On scarp		Above scarp		Wet soils		Piedmont soils	
			p-value		p-value		p-value		p-value		p-value
% Kao	B-hor.	11.13 a	1.0000	8.17 a	0.2188	24.0 b	0.1250	13.14 a	0.6876	63.75 a	1.0000
	C-hor.	15.25 a		24.67 a		46.25 a		17.50 a		60.75 a	
% HIV	B-hor.	7.5 a	1.0000	4.83 a	0.3750	2.0 a	1.0000	5.64 a	1.0000	1.75	nv
	C-hor.	7.13 a		7.25 a		2.38 a		3.63 a		0.5	
% Mica	B-hor.	10.31 a	0.1250	8.0 a	1.0000	4.5 a	1.0000	15.0 a	0.2188	3.0 a	1.0000
	C-hor.	6.0 b		8.75 a		3.25 a		8.17 a		10.63 a	
% Qz	B-hor.	69.63 a	0.2890	77.0 a	0.0626	68.75 a	0.1250	65.0 a	0.3750	31.5 a	1.0000
	C-hor.	71.63 a		59.5 b		48.25 b		69.5 a		28.25 a	
% Fd	B-hor.	0.94 a	0.0156	1.33 a	0.0626	1.0 a	0.2500	1.29 a	0.0626	0.5 a	0.1250
	C-hor.	0.32 b		0.42 b		0.25 a		0.67 b		0 b	

Sand mineralogy		Below scarp		On scarp		Above scarp		Wet soils		Piedmont soils	
			p-value		p-value		p-value		p-value		p-value
% Qz	B-hor.	81.81 a	0.7266	83.25 a	0.6876	79.13 b	0.1250	85.57 a	1.0000	78.88 a	0.6250
	C-hor.	83.44 a		85.60 a		88.38 a		83.67 a		88.38 a	
% AlFd	B-hor.	0.44	nv	0.63 a	1.0000	0	nv	1.04 a	1.0000	0.19 a	1.0000
	C-hor.	0.03		2.04 a		0		3.08 a		0.25 a	
% Ilm	B-hor.	8.38 a	0.2890	9.5 a	0.6876	15.5 a	0.1250	6.21 a	1.0000	13.5 a	0.6250
	C-hor.	7.63 a		7.33 a		6.0 b		7.5 a		8.13 a	
% Leuc	B-hor.	3.59 a	0.4532	2.75 a	0.6876	1.08 a	1.0000	2.86 a	0.0626	1.31 a	0.2500
	C-hor.	2.34 a		1.0 a		3.0 a		0.63 a		0.63 a	
% Rut	B-hor.	0.63 a	1.0000	0.46 a	0.6250	0.38	nv	0.64 a	1.0000	0.44 a	1.0000
	C-hor.	0.75 a		0.17 a		0.00		0.42 a		0.25 a	
% Zlr	B-hor.	3.81 a	0.4532	3.42 a	0.2188	2.88 a	0.5000	2.64 a	1.0000	5.0 a	0.1250
	C-hor.	4.0 a		3.58 a		2.38 a		3.38 a		2.38 b	
% Ky	B-hor.	0.22 a	1.0000	0.25 a	0.6250	0.38 a	1.0000	0.21	nv	0.19	nv
	C-hor.	0.69 a		0.04 a		0.25 a		0		0.06	
% Stau	B-hor.	0.75 a	0.0312	0.21 a	1.0000	0.5 a	0.5000	0.88 a	0.3750	0.63 a	0.2500
	C-hor.	0.06 b		0.54 a		0 a		1.0 a		0 a	

Kao = kaolinite; HIV = chloritized vermiculite; Verm = vermiculite; Smec = smectite; Qz = quartz; Gibb = gibbsite; Fd = feldspars;
Al Fd = alkali (K and/or Na) feldspars; Ilm = ilmenite; Leuc = leucoxene; Rut = rutile; Zlr = zircon; Ky = kyanite; Stau = staurolite; nv = not valid.

VITA

An Vanwormhoudt was born, june 10th 1968 in Ghent, Belgium. She attained Sint-Bavo Humaniora in Ghent, wearing "happily" a dark green uniform for nine years. Not ready to give up the "green" and loving nature, physics and mathematics, she started a five year program in agronomical engineering at the State University of Ghent in 1985. She choose the chemistry division of that program which made her graduate as "Engineer in Chemistry and Agronomical Industries" in september 1990. She came to VPI & SU in january, 1991 to work with Dr. L.W. Zelazny in a Master of Science program. She will graduate in May 1993.

Vanwormhoudt