APPENDIX III

PEDOLOGY AND GEOMORPHOLOGY OF SITES 7K-C-382 AND 7K-C-431 AT DELAWARE AIRPARK, CHESWOLD, KENT COUNTY, DELAWARE

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AT DELAWARE AIRPARK

CHESWOLD, KENT COUNY, DELAWARE

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Introduction

This report addresses pedological and geomorphological interpretations of the soils and landscapes at Sites 7K-C-382 and 7K-C-431 located in expansion areas for Delaware Airpark near Cheswold in Kent County, Delaware. The investigation was intended to develop a paleogeographic interpretation of the site to assess the framework of soil and landscape conditions with which prehistoric inhabitants of the site would have been familiar. Such assessments are based on considerations of landscape type, relative deposit ages, degrees of disturbance, and environmental conditions relating to human utilization of a landscape.

Methods

Field investigations were carried out during two separate visits made on June 6 and August 5, 2006. Efforts entailed pedestrian traversal of the project area landscapes together with examinations of soils exposed in numerous archaeological test units and supplementary hand auger borings. Detailed descriptions were compiled for soil profiles considered representative of the major soil types in accordance with standard techniques and nomenclature for the field description of soil (Schoeneberger, et al., 1998). These descriptions are contained in Appendix A.

Several of the representative profiles were also sampled for laboratory analyses of soil particle-size distributions. These analyses entailed determination of silt and clay fractions by the hydrometer method (Gee and Bauder, 1986), and measurements of sand by sieve fractionation. Particle size data are provided in Appendix B.

Geologic Setting

The central Delmarva Peninsula location of the site is within the Coastal Plain Physiographic Province that comprises all of Delaware generally south of Newark and Wilmington. Geologic materials of the Coastal Plain consist of variously textured unconsolidated sediments derived both from marine and fluvial sedimentation. In the project area marine deposits are restricted to fairly deep depths, and the surficial geology in which regional uplands are formed is considered to be of fluvial origin. Specifically, Jordan (1964) has identified the regional sediments as major channel phase deposits of the fluvial facies of the Pleistocene age Columbia Formation. Groot and Jordan (1999) further describe the Columbia as coarse to medium sand with variable but lesser amounts of gravel and also occasional thin layers of light gray silt that tend to be of limited areal extent. The same deposit types are interpreted by Owens and Denny (1979) as the Pensauken and Beaverdam Sand Formations, which span late Miocene through Pliocene ages. Whatever their designation, it is clear that Coastal Plain sediments of the regional

uplands were emplaced many tens of thousands of years before human occupation of the Delmarva Peninsula.

Despite the great age of the regional geologic sediments, few if any of the existing land surfaces formed in them would be of similar antiquity. Rather, most of the region's landscapes and surfaces should be viewed as considerably younger, with origins largely attributable to processes acting well after sediment deposition. Erosional actions, directed by such forces as climate, vegetational changes, alterations in stream base levels in response to varying sea levels, and probably even tectonic movements of land masses, have acted on the sediments through multiple subsequent periods of the Pleistocene as well as the Holocene. Gross erosional processes together with stream valley alluviation and near-surface soil reworking by a host of pedoturbational agents have combined to generally limit the ages for most of the region's landscapes to a late Pleistocene through Holocene time frame.

In addition to the multiplicity of Holocene erosional and depositional processes, Quaternary fluctuations in sea level and climate have been paramount both in shaping Coastal Plain landforms, as well as triggering correlative responses in environmental conditions. What is now the broad estuary of Delaware Bay was during the late Pleistocene and early Holocene no more than an inland stretch of a strictly freshwater Delaware River many tens of kilometers removed from marine conditions. Perhaps as much as 80 m lower than present at the close of the Pleistocene, by around 4,000 YBP the expanding sea was within about 5 m of its modern level and by 2,000 YBP within less than 2 m (Fletcher, 1988). The drowned valley that has become Delaware Bay is therefore unlikely to have resembled its current form much before about the middle of the Holocene, and rather than the present 12-km distance from the site to the bay, early in the Holocene the distance to the Delaware channel and even early stage tidal conditions was over 20 km. With the Holocene sea level rise brackish conditions also encroached up the nearby Leipsic River, and perhaps by about 2,000 years ago eventually reached their present inland limit near Rt. 13 roughly 3 km northeast of the project area.

Pedological Considerations

Interpretations of soil profile development are fundamental to paleogeographic analyses of archeological sites. Derived from the progressive climate-dependent, weathering of geologic parent materials over time, soil profile characteristics provide tangible records of the past. Because mature soils owe many of their properties to weathering processes acting during extended intervals of relative landscape stability, the degree of soil profile development may be related to duration of deposit stability, and where sufficient subsoil development has occurred, can suggest approximate ages for deposits. When most of the main factors of soil genesis are at least roughly definable, the tendency for soil formation to follow pathways normally culminating in predictable horizonation sequences provides a means for establishing chrono-stratigraphic markers even in situations where only truncated remnants of soil profiles remain in the

stratigraphic column. Hence, within the context of soil-landscape relationships, soil profiles may be interpreted as indicators of depositional histories, erosional intervals, land surface ages, and environmental conditions.

Given the very sandy composition of most of the project area soils, special considerations of the possible origins and archaeological implications for sandy soils are in order. Instability of upper soil horizons during the Holocene is of particular interest for sandy soils of the Delmarva Peninsula. Sandy soils are among the most susceptible to pedoturbational disturbance, and relative to more loamy-textured soils are subject to greater frequencies of reworking due to such landscape-wide agents as eolian mobilization of sand or the more localized mixing of pedoturbation. Eolian sand deposits are extensive on the Delmarva Peninsula and are principally derived from the winnowing of previously water-lain Coastal Plain sediments. Wind-blown sand is, of course, found along modern coastlines, but it is also abundant over inland positions of the central Delmarva Peninsula where it may occur as sheet deposits or exhibit dunal forms marking relic dune fields or former Pleistocene beach lines (Denny and Owens, 1979).

Echoing the abundance of eolian sand on the Delmarva Peninsula, interior deposits of Holocene age eolian sand have also been recognized at a number of locations throughout the southeastern Coastal Plain (Markewich and Markewich, 1994). It is likely that several widespread droughty periods as well as more localized intervals of instability perhaps exacerbated by other contributing agents such as fire or plant disease have given rise to eolian activity at many locations during the Holocene. Thus, where sandy soils are present the possibility of multiple eolian impacts on landscapes and environmental settings should be considered both in assessing not only prehistoric settlement patterns but also the post-depositional disposition of artifacts. Where deposits of eolian sand are present, they can be recognized based on stratigraphic or pedogenic discontinuities within soil profiles as well as by a very distinct particle size tendency skewed toward the finer sand fractions (Leigh, 2001). Pebbles and coarser sand fractions too large for wind transport are not normally present in deposits that have undergone significant eolian sorting.

The degree of soil development exhibited by very sandy Coastal Plain soils is usually no more than weak to moderate, even given a prolonged weathering age. The reasons for this are two-fold. First, very sandy soils are normally highly siliceous, and with only meager amounts of weatherable minerals, the most common soil genetic pathways are retarded within a fabric heavily dominated by relatively inert quartz mineralogy. Second, the higher rates of pedoturbational destructive actions in very sandy soils are more able to overwhelm or neutralize the progressive development of horizons that in finer-textured, more stable soils would otherwise proceed to more advanced stages. Recognizing reworked surficial zones as a trait variably characteristic of all soils, Johnson (1993) has applied the concept of biomantle to the upper zone of a soil profile in which regressive pedoturbational processes tend toward profile simplification. In many medium to fine-textured soils this zone might be only a few centimeters thick, but in sandy soils biomantle zones tens of centimeters in thickness are often more typical. Thus, with comparatively resistant mineralogies and thick biomantles, sandy soils seldom

exhibit advanced soil development even when parent materials were originally derived as long ago as the Pleistocene.

Soils and Geomorphology

The two site areas are distributed across Coastal Plain upland positions situated adjacent to or in relatively close proximity to the headwaters of three streams that respectively drain north, east and south from the site areas. The system most intimately associated with the sites is that of an unnamed tributary to Willis Branch, itself a tributary to the Leipsic River. Wetland headwaters for this unnamed stream all but surround Site 7K-C-382, and also abut the western side of Site 7K-C-431. Draining northward from the sites area, the stream converges with Willis Branch about 1.5 km away, and from this point their combined flow then intercepts the Leipsic River nearly another 2 km distant. The headwaters of two other streams also occur nearby but not in direct contact with the sites. Ashton Branch, also a tributary to the Leipsic River, reaches its landward limit about 750 m east of Site 7K-C-431, and an unnamed tributary to Fork Branch approaches the sites from the south. Ranging to the south side of Rt. 42, the headwater area for this stream is no more than about 500 m from the sites. Via Fork Branch this southern drainage ultimately feeds to the Silver Lake impoundment of the St. Jones River about 5 km away. A major tributary to Delaware Bay, the St. Jones River is tidally influenced well into Dover.

Soils occupying the sites are well representative of those common to Central Delaware, and are formed in mostly coarse-textured coastal Plain sediments of compositions typical of the widespread Columbia Formation. Other than in the artificially filled wetland at the west end of the existing runway where the buried swamp soil is silty in texture, all other examined soils are formed in sandy deposits with variable gravel contents. Occupying footslopes and low ridges rising only a meter or so above the nearby very poorly drained wetlands, soils of both sites are somewhat down-drainage, with most classified within the moderately well drained class. Such soils are subject to seasonal saturation of lower subsoil levels, but this minor degree of impeded drainage is not restrictive for human occupation. Soils of the two site areas are discussed below.

Site 7K-C-382

This site, bordered by wetlands to the north, south and west is not only of wider areal extent than Site 7K-C-431, but its more variable landscapes also support a somewhat more changing complex of soils. Most of the soils are quite sandy and usually contain at least small amounts of pebbles and gravel, which also tend to have an increasing presence on higher landscape positions such as that occupied by most of the Block C test units. The principal areas of difference to this pattern are in the vicinity of Block A where soils are more loamy in texture, as well as a wetland soil examined south of Block B, where a silty composition is completely dissimilar to the coarse soils of the site.

Degree of soil development ranges from relatively well expressed where some fines are present to very weak where sand textures prevail throughout the profile. The profile of Block B Test Unit 140 is a good example of the site's more strongly developed soils. Like the loamier soil of Test Unit 82 of Block A (Appendix A), subsoil development has achieved that of an argillic horizon (Bt), but the coarser Block B soil is much more representative of the mostly sandy textural composition prevailing over the majority of the site. As shown in Figure 1, the sandy soil exhibits a subsoil increase in clay barely sufficient to recognize an argillic horizon. Elsewhere even this degree of subsoil formation has not occurred, and as an example within the same Block B excavation, just 6 m to the south at the location of Test Unit 16, an argillic horizon was not recognized in the field (Appendix A). Subsoil formation in this very sandy soil is limited to color-B (Bw) horizons without appreciable clay enrichment. Such short-distance variability is not unusual for sandy Coastal Plain soils, and the two closely spaced profiles also typify much of the range in soil characteristics across the site. Only some of more strongly developed and loamier soils of Block A fall outside of the otherwise encompassing bracket offered by the two Block B profiles.

The wetland soil examined south of Block B is also unique, but although only several tens of meters away, the location is not included within the occupied site area. The setting would have been far too poorly drained to support occupation, and in addition to the severely impeded drainage, soil composition also sharply sets the nearby wetland soil apart. The silty textures shown in Figure 2 demonstrate the wetland soil to be so markedly different from the sandy and gravelly soils of the site, that no compositional connection between the two can be made. This is even largely the case for the uppermost surface horizons that might be expected to have some components derived from accelerated erosion of the adjacent sandy soils subsequent to the introduction of European agriculture. Although slightly higher sand contents in the first two of three stacked surface horizons are possibly attributable to minor historic or even late prehistoric contributions of slope wash, the textural shift is meager at best, and the horizons remain distinctively silty.

The textural dichotomy that segregates the wetland soil from those of the site has profound implications both for site formation processes as well as artifact distributions. Chief among these is the strong indication of essential landscape stability for a prolonged period of time probably encompassing the entire occupational history of the site. With any significant amount of soil erosion, cross-landscape migration, or other form of sediment mobilization such as by wind activation, a registration of the site soils should be apparent in the lower lying wetland position by sandy strata unrelated to the wetland silts. Given the overwhelmingly coarse textures of the site soils, it is not possible for the silts to have been derived as deposits eroded from them; and lithologic variation in the Columbia

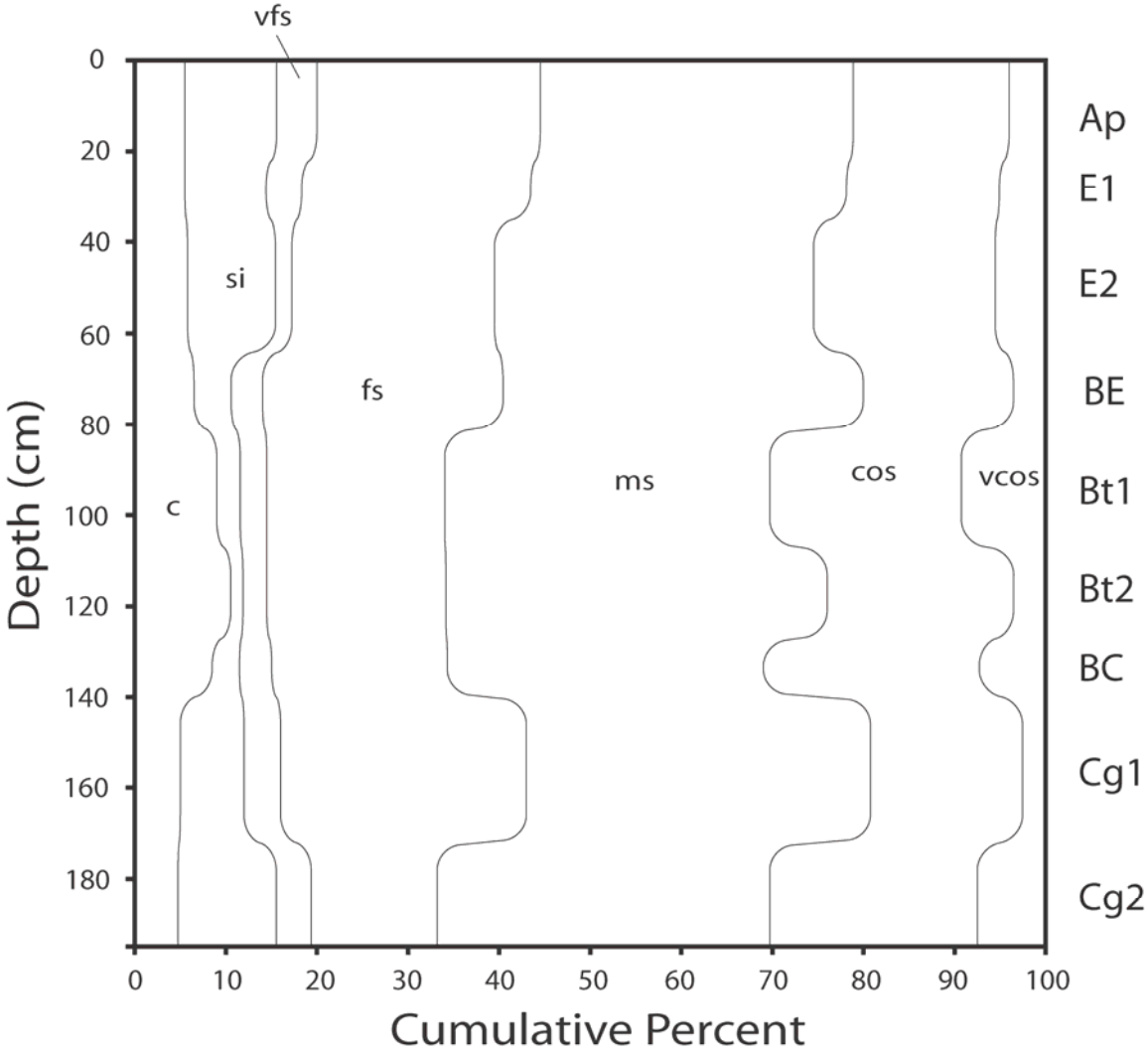

Figure 1. Distributions of soil particle size fractions in the soil profile of Test Unit 140 showing the predominance of medium and coarse sand fractions as well as relatively minor increase in subsoil clay content. (c = clay, si = silt, fs = fine sand, ms = medium sand, cos = coarse sand, and vcos = very coarse sand)

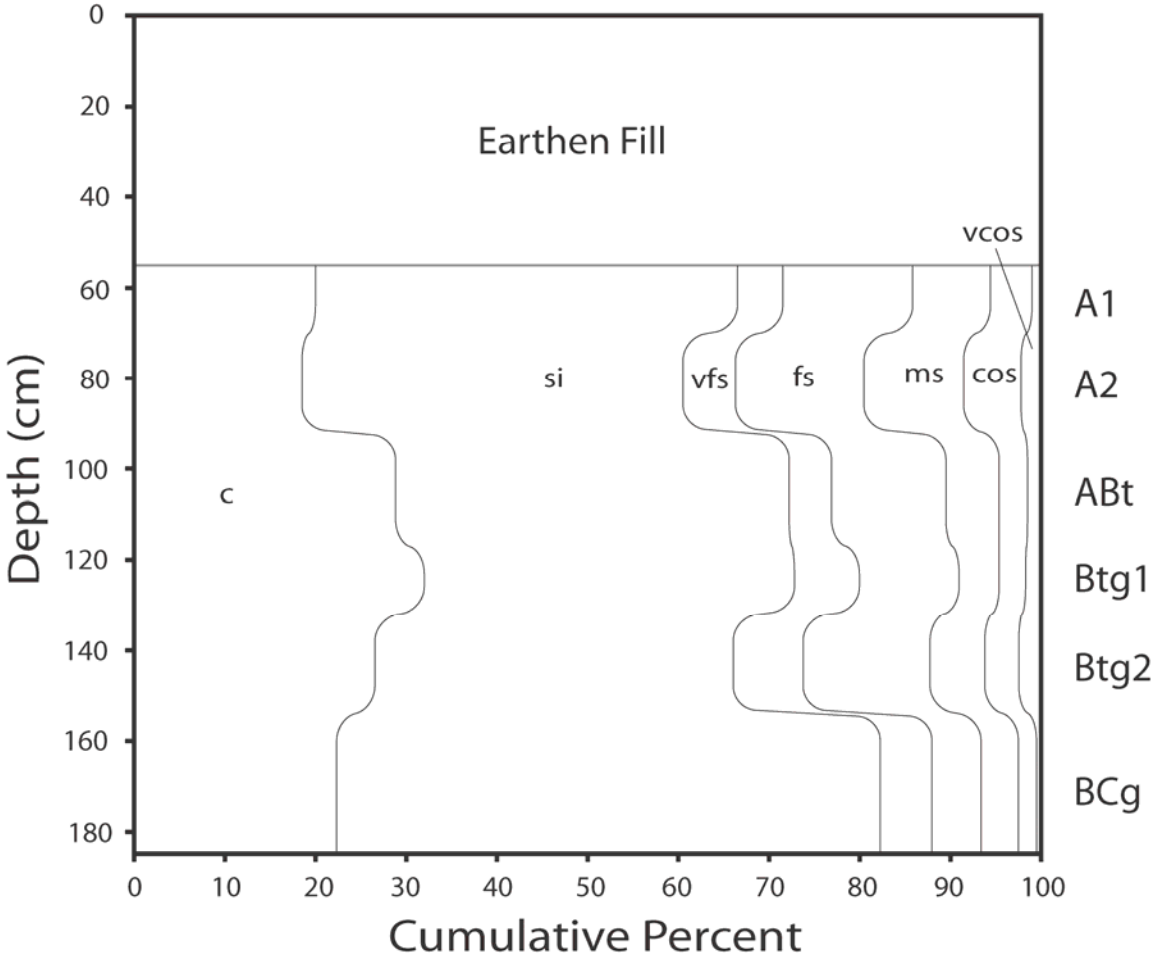

Figure 2. Distributions of soil particle size fractions in the silty wetland soil profile examined south of Block B. The original surface is beneath 55 cm of introduced fill. (c = clay, si = silt, fs = fine sand, ms = medium sand, cos = coarse sand, and vcos = very coarse sand)

Formation sediments or some ancient reworking of the original materials greatly predating human occupation is apparent. It is even noteworthy that tillage-induced erosion also appears to have had minimal impact. Although readily recognizable plow zones are present throughout the site, the absence of identifiable historic wash deposits in the wetland suggests that for much of the historic period the farming regimen must have been relatively low intensity, and perhaps mainly in the form of pasturage. This could possibly be attributable to the comparative isolation and irregular shape of the site with nearly surrounding wetlands on three sides.

Without discernible evidence of appreciable soil mobilization, few options remain to account for artifact burial across this old, largely stable Coastal Plain upland. Clearly, episodes of landscape wide eolian activity were not a significant player. In addition to the lack of sandy deposits in the wetland, which surely would exist if widespread movement of eolian sand had occurred, the prevalence of excessively coarse sand fractions shown in Figure 1, together with the presence of pebbles and gravel across the site all but negate prospects for appreciable eolian reworking. A slight tendency for sand fractions to undergo some fining in upper horizons is possibly consistent with highly localized eolian sorting; however, this would still likely have generated some detectable sedimentation in the wetland, and other factors such as original lithologic variability in the parent material or partial segregation of particle sizes by biomantle processes are the more likely. Specifically, upward transport of soil particles by ants and other insects would tend to favor concentration of finer sizes. As previously discussed biomantle mixing in very sandy soils is often significant, and for this site the principal pedoturbational agents in addition to insects are likely to have been burrowing rodents and tree fall. Such actions also account for the redistribution of artifacts.

Given the apparent overall stability of the site topography as well as scant evidence of either appreciable soil erosion or sedimentation, biomantle processes therefore loom as the principal mechanisms for introducing artifacts to subsurface levels. For the most part artifacts should mainly be confined to upper subsoil eluvial horizons (E) and underlying transitional horizons (BE) lying atop the more stable lower subsoil horizons. For more weakly developed soils in which subsoil development has achieved only color-B horizon (Bw) formation, these lower horizons could also have some artifact potential. More strongly developed argillic subsoil horizons (Bt) typically mark levels of prolonged stability and hence are usually cultural sterile. Due to the sandy composition of the site soils as well as the relatively weak degree of argillic horizon expression which is not reliably indicative of age in such soils, some limited potential for cultural deposits even rests within argillic horizons. For the most part, however, the greatest potential should be assigned to surface and upper subsoil horizons which together comprise biomantle zones typically extending to depths of 60 to as much as 80 cm.

Consistent with the apparent antiquity of the overall site landscape is the stronger soil development of the Block A soils, which unlike the very sandy soils prevalent over most of the site can be more reliably interpreted for soil and landscape age. As exposed in Test Unit 82 subsoil formation in the more loamy soils in this portion of the site has achieved that of an advanced argillic horizon with moderate structural development and

nearly continuous clay coatings on most ped faces. Such advanced development is indicative of a lengthy and stable period of soil weathering likely encompassing most of the Holocene and probably ranging into the late Pleistocene. Even here, though the upper biomantle zone is still quite sandy and thick, upper subsoil horizons (E, BE) with some cultural potential extend to the depth of 60 cm.

Site 7K-C-431

Examinations of soil profiles exposed in multiple archaeological test units revealed compositionally similar soils across this gently sloping site. Soils are uniformly very sandy and as would be expected and indeed almost dictated by the coarse parent material, field characterizations documented weak soil development throughout the site. Subsoil horizons have achieved development no more advanced than color-B horizons. These horizons (Bw) have no little or pedological structure, and their only subsoil traits are brownish colorations (7.5YR 4/6, 10YR 4/6) derived from weathering releases of free iron oxides. As shown in Figure 3 there clearly is no subsoil increase in clay content, and similar to Site 7K-C-382, sand fractions skew toward coarser sizes. The coarse sands again all but eliminate prospects for appreciable eolian mobilization, so that biomantle mixing should also again be considered the most likely mechanism for introducing artifacts to subsurface levels.

Unlike Site 7K-C-382, the soils and landscapes of this site exhibit noticeable modifications attributable to agricultural tillage. This site is not so isolated, and abutting a wetland only on its western side the area is in continuum with a broad eastern expanse of arable land. Consequently, it could well have a history of much more intensive farming, a probability supported by observed soil modifications. Among these are downslope accumulations of soil in the form of thickening plow zones as the wooded wetland is approached, as well as the absence of upper subsoil horizons on higher landscape positions. The profile of Test Unit 143 is a good example of both cases. Since the plow zone rests directly atop the subsoil Bw horizon, it is likely the soil has suffered enough deflation to cause downward migration of the surface and ensuing interception and destruction of upper subsoil levels (E horizons) as they are progressively incorporated into the plow zone. However, the higher silt content of the surface horizon is also conspicuously suggestive of slope wash additions, so that even though the location has likely suffered a net loss of soil, it has also been a recipient. Deflational action is especially noteworthy for this site, since very sandy soils tend to have E horizons of sufficient thickness that total destruction is often not accomplished by plowing. The profile of Test Unit 150 is an example of E horizon persistence as are the many profiles of Site 7K-C-382. In tandem with the tillage-induced loss of soil from higher positions is accumulation of the eroded soil as wash deposits on lower positions. In addition to a tendency for a slight increase in surface silt content as shown in Figure 3, slope wash contributions are also evinced by over-thickened plow zones often in excess of 30 cm or more compared to more common thicknesses of 20 to 25 cm.

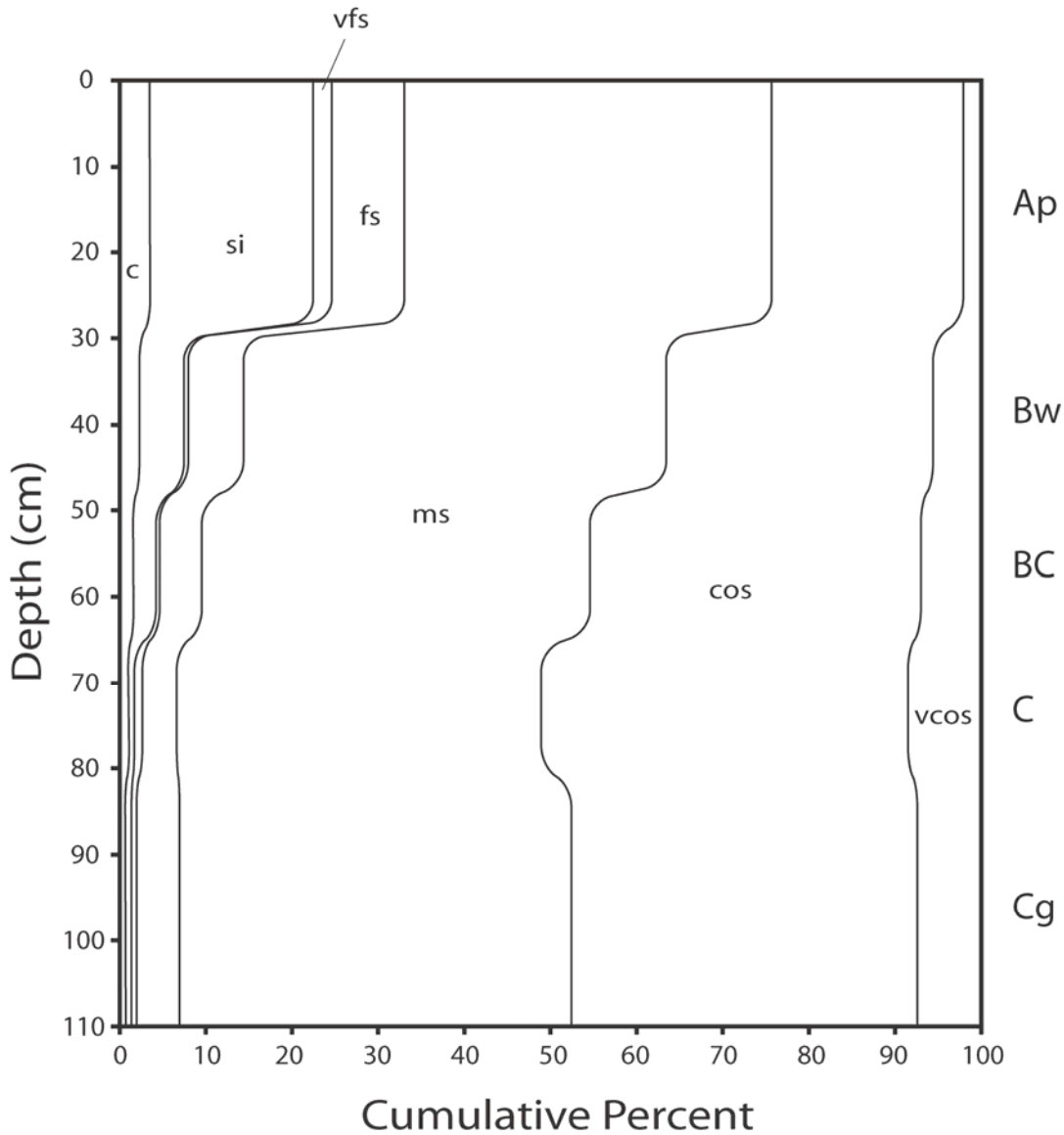

Figure 3. Distributions of soil particle size fractions in the soil profile of Test Unit 143. With the exception of a surface increase in silt likely attributable to slope wash, the soil is mostly coarse-sandy. (c = clay, si = silt, fs = fine sand, ms = medium sand, cos = coarse sand, and vcos = very coarse sand)

Beyond the greater farming impact, the soils of this site are generally similar to the sandy soils of Site 7K-C-382, and have comparable archaeological interpretations related to apparent landscape age and artifact distributions. Localized biomantle mixing is probably the most important landscape wide process to have affected the site area over the course of the Holocene. Despite the likely landscape age, soil development is unable to advance, and together with the regressive mixing, cultural materials can be moved to subsurface levels. Such mixing also tends to work against stratification of cultural materials, although artifacts of later groups are more likely to be concentrated near the surface since they have not been subject to biomantle disturbances for as long a period. Artifacts predating the Woodland period could potentially be distributed across a depth range from the surface to as much as 60 or 70 cm below.

Summary

Both sites can be characterized as Coastal Plain upland landscapes formed mainly in coarse-textured sediments derived from native geologic materials of the Columbia Formation. Each is also closely situated to the wetland headwaters of streams that eventually feed to Delaware Bay some 12 km distant. Although nearly surrounded by (Site 7K-C-382) or abutting the wetlands (Site 7K-C-431), the site areas are themselves favorably drained and well suited for human occupation.

Very sandy soils encompass all of Site 7K-C-431 as well as the great majority of Site 7K-C-382. As would be expected with sand textures, soil development is not advanced and is mostly limited to color-B or occasionally weakly formed argillic (Bt) subsoil horizons. Weak development in sandy soils does not necessarily infer young landscape age, and can be attributed to resistance of the deposits to soil weathering as well as active biomantle processes. These mixing processes appear to have been the main natural actions affecting both sites during the Holocene. Despite the predominance of sandy soils little evidence exists to indicate appreciable eolian movement of sand. Indeed, arguing against eolian impacts are the coarseness of sand fractions at both sites, pebbles and gravel throughout most of the soils of Site 7K-C-382, and the absence of sand deposits in the distinctively silty soil of the nearby wetland.

Historic farming has impacted each of the sites differently. At Site 7K-C-431 tillage-induced erosion has resulted in soil deflation at higher positions with attending deposition of slope wash deposits in lower areas approaching the wetland. This type of soil movement is typical for fields with long histories of cultivation. In contrast, there is little evidence of accelerated soil erosion due to farming at Site 7K-C-382. Although the entire site area has been plowed, most upper subsoil horizons are still intact, and sandy slope wash deposits have not accumulated in the adjacent wetland. Compared to Site 7K-C-431 which is at the edge of a large arable field, the relative isolation of Site 7K-C-382 surrounded by wetlands on three sides possibly accounts for a less intense farming history.

With no indications of appreciable eolian activity, biomantle processes should be considered the most likely means for introducing artifacts to subsurface levels at both sites. For the most part, potential cultural zones correspond to the surface and upper subsoil horizons that are most susceptible to biomantle pedoturbation. These typically extend to depths of 50 to 60 cm, but due to relatively meager subsoil formation in even the most strongly developed soils, the possibility of deep disturbances long ago also offers some prospects for artifacts in lower subsoil horizons as deep as 80 cm. Biomantle processes on uplands tend to limit opportunities for stratification of cultural deposits; however, artifacts of more recent cultures should be concentrated within surface horizons simply because of the shorter time available for these processes to have operated.

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APPENDIX A

Soil Profile Descriptions

Site 7K-C-382, Block A TU82

Horizon	Depth (cm)	Properties
Ap	0-27	Dark brown (10YR 3/3) loamy sand; weak, medium granular structure; very friable consistence; abrupt smooth boundary
E	27-52	Yellowish brown (10YR 5/4) loamy fine sand; weak, medium platy structure; very friable consistence; clear smooth boundary
BE	52-60	Dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) fine sandy loam; weak, medium subangular blocky structure; friable consistence; clear smooth boundary
Bt	60-81	Dark yellowish brown (10YR 4/6) fine sandy loam; moderate, medium subangular blocky structure; nearly continuous clay films on most ped faces; friable consistence; clear smooth boundary
BC1	81-108	Yellowish brown (10YR 5/6) fine sandy loam; common, medium distinct mottles of strong brown (7.5YR 4/6) and light brownish gray (10YR 6/2); friable consistence
BC2	108-126	Strong brown (7.5YR 4/6) fine sandy loam; many, coarse prominent mottles of light gray (2.5Y 7/2); very friable consistence
C	126-137+	Light olive brown (2.5Y 5/6) sand; common, medium prominent mottles of gray (5Y 6/1); loose consistence

Other comments: Coastal Plain upland backslope; 4% slope; moderately well drained; examination by auger below 94 cm; described 6/12/06

Site 7K-C-382, Block B TU140

Horizon	Depth (cm)	Properties
Ap	0-22	Dark brown (10YR 3/3) loamy sand; weak, medium granular structure; very friable consistence; abrupt smooth boundary
E1	22-36	Dark yellowish brown (10YR 4/4) sand; structureless, single grain; loose consistence; clear smooth boundary
E1	26-64	Brown (7.5YR 4/4) to dark yellowish brown (10YR 4/4) sand; few lamellae 2-3 mm thick; structureless, single grain; loose consistence; clear smooth boundary
BE	64-81	Strong brown (7.5YR 5/6) sand; structureless, single grain; loose consistence; clear smooth boundary
Bt1	81-107	Strong brown (7.5YR 4/6) loamy sand; moderate, coarse subangular blocky structure; continuous clay films of dark reddish brown (5YR 3/4) on most ped faces; friable consistence; clear smooth boundary
Bt2	107-127	Yellowish brown (10YR 5/6) loamy sand; moderate, coarse subangular blocky structure; continuous clay films of strong brown (7.5YR 4/6) on most ped faces; friable consistence
BC	127-140	Yellowish brown (10YR 5/4) loamy to sand; common, medium distinct mottles of light yellowish brown (2.5Y 6/3) and strong brown (7.5YR 4/6); very friable consistence
Cg1	140-152	Light brownish gray (2.5Y 6/2) sand; many, coarse distinct mottles of light olive brown (2.5Y 5/4); loose consistence
Cg2	152-195	Gray (2.5Y 6/1) sand; common, coarse prominent mottles of light strong brown (7.5YR 4/6); loose consistence
C	195-215+	Strong brown (7.5YR 5/8) and yellowish brown (10YR 5/6) loamy sand; very friable consistence

Other comments: Coastal Plain upland; 5% slope; well drained; few fine (3-5 mm) pebbles throughout, with larger gravel (1-2 cm) below 175 cm; increasing gravel in higher test units near slope summit; examination by auger below 120 cm; described 6/12/06

Site 7K-C-382, Block B TU167

Horizon	Depth (cm)	Properties
Ap	0-26	Dark brown (10YR 3/3) loamy sand to sand; weak, medium granular structure; very friable consistence; abrupt smooth boundary
Bw1	26-48	Dark yellowish brown (10YR 4/4) sand; structureless, single grain; loose consistence; clear smooth boundary
Bw2	48-59	Dark yellowish brown (10YR 4/4) sand; common, medium distinct mottles of light olive brown (2.5Y 5/3) structureless, single grain; loose consistence; clear smooth boundary
C	59-78	Yellowish brown (10YR 5/4) sand; many, medium distinct mottles of grayish brown (2.5Y 5/2); structureless, single grain; loose consistence; clear smooth boundary
Cg1	78-100	Light brownish gray (2.5Y 6/2) sand; common, medium distinct of dark yellowish brown (10YR 4/4); loose consistence; clear smooth boundary
Cg2	100-118+	Grayish brown (2.5Y 5/2) sand; common, coarse prominent mottles of dark brown (7.5YR 3/4); loose consistence

Other comments: Coastal Plain footslope; 2% slope; moderately well drained; pebbles and gravel throughout; described 6/12/06

Site 7K-C-382, Wetland Boring

Horizon	Depth (cm)	Properties
C1	0-30	Mixed earthen fill
C2	30-55	Mixed earthen fill with wood
A1	55-70	Very dark gray (5Y 3/1) silt loam; friable consistence
A2	70-92	Black (5Y 2.5/1) silt loam; friable consistence
ABt	92-117	Dark Olive gray (5Y 3/1) silt loam; friable consistence
Btg1	117-132	Greenish gray (10Y 6/1) silty clay loam; firm consistence
Btg2	132-154	Greenish gray (5GY 5/1) silt loam to loam; firm consistence
BCg	154-185+	Greenish gray (5GY 6/1) heavy silt loam; common, medium prominent mottles of yellowish brown (10YR 5/6); firm consistence

Other comments: Filled wetland; 0 % slope; very poorly drained; described 6/12/06

Site 7K-C-431, Block D TU143

Horizon	Depth (cm)	Properties
Ap	0-29	Dark brown (10YR 3/3) loamy sand to sandy loam; weak, fine granular structure; very friable consistence; abrupt smooth boundary
Bw	29-48	Dark yellowish brown (10YR 4/6) sand; structureless, single grain; loose consistence; clear smooth boundary
BC	48-65	Yellowish brown (10YR 5/6) sand; structureless, single grain; loose consistence; clear smooth boundary
C	65-81	Yellowish brown (10YR 5/6) sand; common, medium distinct mottles of brown (10YR 5/3); structureless, single grain; loose consistence; clear smooth boundary
Cg	81-110+	Light yellowish brown (2.5Y 6/3) sand; many, medium distinct mottles of yellowish brown (10YR 5/6); loose consistence

Other comments: Coastal Plain footslope; 3% slope; moderately well drained; water table at 105 cm; described 8/5/06

Site 7K-C-431, Block F TU150

Horizon	Depth (cm)	Properties
Ap	0-32	Very dark grayish brown (10YR 3/2) sandy loam to loamy sand; weak, fine granular structure; friable consistence; abrupt smooth boundary
E	32-45	Dark yellowish brown (10YR 4/4) sand; structureless, single grain; loose consistence; clear smooth boundary
Bw	45-66	Strong brown (7.5YR 4/6) sand to loamy sand; ~10 to 15% cemented Bt bodies of dark reddish brown (2.5YR 3/3) loamy sand; weak, coarse subangular blocky structure; very friable consistence; clear smooth boundary
C	66-77	Dark yellowish brown (10YR 4/6) sand; common, medium distinct mottles of brown (10YR 5/3); structureless, single grain; loose consistence; clear smooth boundary
Cg	77-115+	Brown (10YR 5/3) to grayish brown (10YR 5/2) sand; many, coarse distinct mottles of yellowish brown (10YR 5/6); loose consistence

Other comments: Coastal Plain footslope; 2% slope; moderately well drained; water table at 110 cm; cemented Bt bodies in Bw are in some places ironstone lumps; sand coarsens with depth through C and Cg; described 8/5/06

Appendix B

Distributions of Soil Particle Size Fractions with Depth

Site 7K-C-382, Block B TU140

		Total (<2 mm)			Sand Fractions (2-0.05 mm)				
Horizon	Depth (cm)	clay	silt	sand	vcos	cos	ms	fs	vfs
		- - - - - - - - - - - -			% - - - - - - - - - - - - - -				
Ap	0-22	5.6	9.6	84.4	4.0	17.2	34.3	24.5	4.4
E1	22-36	5.6	8.7	85.7	4.9	16.9	34.7	25.2	4.0
E2	36-64	5.8	9.6	84.6	5.5	20.1	34.9	22.3	1.8
BE	64-81	6.4	4.2	89.4	3.6	16.5	39.6	26.4	3.3
Bt1	81-107	9.0	2.5	88.5	9.2	21.1	35.6	19.7	2.9
Bt2	107-127	10.4	1.4	88.2	3.5	20.4	41.9	19.7	2.7
BC	127-140	8.4	3.0	88.6	7.3	23.6	34.8	19.3	3.6
Cg1	140-152	5.0	6.9	88.1	2.6	16.7	37.7	26.9	4.2
Cg2	152-195	4.8	10.8	84.4	7.6	32.7	26.5	13.9	3.7

Site 7K-C-382, Wetland Boring

		Total (<2 mm)			Sand Fractions (2-0.05 mm)				
Horizon	Depth (cm)	clay	silt	sand	vcos	cos	ms	fs	vfs
		- - - - - - - - - - - -			% - - - - - - - - - - - - - -				
A1	55-70	20.1	46.3	33.6	1.0	4.6	8.6	14.2	5.2
A2	70-92	18.4	42.2	39.4	2.2	6.4	11.0	14.1	5.7
ABt	92-117	28.8	43.4	27.8	0.9	3.8	5.9	12.6	4.6
Btg1	117-132	32.0	40.7	27.3	1.2	3.4	4.4	11.1	7.2
Btg2	132-154	26.5	39.6	33.9	1.9	4.3	6.0	14.0	7.7
BCg	154-185	22.3	54.9	17.8	0.6	2.0	4.1	5.2	5.9

Site 7K-C-382, Block A TU82

		Total (<2 mm)			Sand Fractions (2-0.05 mm)				
Horizon	Depth (cm)	clay	silt	sand	vcos	cos	ms	fs	vfs
		- - - - - - - - - - - -			% - - - - - - - - - - - - - -				
Ap	0-27	3.6	14.2	82.2	2.6	17.8	32.8	24.4	4.6
E	27-52	4.2	20.6	75.2	4.0	13.4	23.8	27.9	6.1
BE	52-60	6.8	20.4	72.8	4.8	12.3	20.1	28.7	6.9
Bt	60-81	14.0	21.1	64.9	3.1	6.8	11.8	34.0	9.2
BC1	81-108	12.0	22.5	65.5	0.8	2.6	8.7	39.8	13.6
BC2	108-126	10.2	17.0	72.8	1.2	2.5	8.8	53.3	7.0
C	126-137	5.8	4.9	89.3	3.0	18.7	38.6	26.2	2.8

Site 7K-C-431, Block D TU143

Horizon	Depth (cm)	Total (<2 mm) clay	silt	sand	Sand Fractions (2-0.05 mm) vcos	cos	ms	fs	Vfs
		- - - - - - - - - - - - % - - - - - - - - - - - - - -							
Ap	0-29	3.5	18.9	77.6	2.0	22.2	42.8	8.4	2.2
Bw	29-48	2.2	5.2	92.6	5.4	31.3	48.8	6.6	0.5
BC	48-65	1.8	2.4	95.8	7.0	38.4	45.0	4.9	0.5
C	65-81	1.0	0.8	98.2	8.4	42.5	42.4	4.4	0.5
Cg	81-110+	0.4	1.2	98.4	7.6	39.9	45.5	4.9	0.5

vcos = 2-1 mm, cos = 1-0.5 mm, ms = 0.5-0.25 mm, fs = 0.25-0.1 mm, vfs = 0.1-0.05 mm, silt = 0.05-0.002 mm, clay = <0.002 mm