APPENDIX C

TECHNICAL REPORT ON SOIL MICROMORPHOLOGY

A Micromorphological Evaluation of Pit Features at Augustine Creek, Delaware

Prepared by

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Introduction

As part of the CRM work being done at the site of Augustine Creek, fifteen samples were collected from five features (16, 20, 21, 23, 25), within the excavation area. All five are pit-type features of unknown origin. Although such features have been found at other sites in Delaware such as Lums Pond (Petraglia et al., 1998), and the Gabor Prehistoric Site (Mueller 1995), their cultural or natural origin has been unclear. Two possible explanations for these features have been advanced: tree falls or the preserved "sub-basements" of prehistoric pit houses (Mueller 1995). To date, studies of artifact concentrations and geochemical analysis have been used to determine their origin (Petraglia, 1997, 1998; Mueller 1995), but the results have been inconclusive. The purpose of the present study is to examine the sediment within these features using the technique of micromorphology to help resolve this question.

Methodology

Soils and sediments associated with archaeological sites are typically complex, and interpretations based on field and laboratory data can be of limited value or accuracy. Grain-size analysis of a "grey", "ashy" dump deposit, for example, does not discriminate between the mineral (e.g., quartz sand, silt, etc.; calcareous ash crystals; phytoliths; bone) and non-mineral components (charcoal, or disseminated organic matter). Moreover, most standard laboratory techniques are restricted in their ability to recognize and discern a succession of soil forming (pedological), geological or anthropogenic events that have been superimposed upon the same material or substrate. For example, at the field scale, a dark layer within a Holocene archaeological site context may represent a soil horizon, an occupation layer, or both. Measurement of Munsell color or organic matter in this case, does not really help (Courty et al., 1989). Similarly, measurement of calcium carbonate content may comprise both primary (depositional) or secondary (pedogenic) carbonate.

A technique that is proving increasingly valuable at avoiding many of the above-mentioned limitations is that of micromorphology, the study of undisturbed soils, sediments and other archaeological materials (e.g., ceramics, bricks, mortars) at a microscopic scale. Employing undisturbed, oriented samples in which the original components and their geometrical relationships are conserved, micromorphological analysis allows for the observation of composition (mineral and organic), texture (size, sorting), and most important, fabric - the geometric relationships among the constituents. Within an individual thin section it is therefore possible to observe micro-stratigraphic sequences which reflect temporal changes in depositional and post-depositional processes. An example of such a sequence observed in thin section might hypothetically include 1) layered silt and clay [depositional event(s)], 2) cracks produced by drying, 3) clay filling the cracks as produced by movement through the sediment by soil forming processes; and finally 4) cementation of the above by secondarily precipitated calcium carbonate. Such a sequence would be difficult to monitor using the above-cited more conventional laboratory techniques.

At Augustine Creek it has been suggested that the pit features were created by tree falls, the uprooting of trees by storms or through human agency, or by the intentional excavation of pits, probably within pit houses. Both processes result in features that are similar on a macroscale. The traditional techniques applied to the identification of these features at other sites, geochemical analysis and artifact concentration studies, are limited in that they focus on the nature of the fill and not on the process by which it was deposited. If a prehistoric pit had been dug but refilled in with non-anthropogenic material (from off-site for example), it would not necessarily show higher concentrations of phosphate or artifacts, yet it would still be a cultural feature. A micromorphological examination of these features can avoid this problem by examining not only the composition of the fill, but also its fabric.

The use of micromorphology to identify tree falls has been successfully employed elsewhere (Goldberg and Macphail 1990, Macphail 1986). When tree falls occur, portions of the underlying soil profile remain attached to the roots. The depression created where the tree roots and soil had been, is then refilled by A and B horizon material falling from the exposed roots or from the sides of the depression, fine-grained material that is washed in, and the accumulation of leaf litter or other organic material. There is often a considerable degree of bioturbation within the infilled soil. Although tree falls are often a natural occurrence (Denny and Goodlett, 1956), they can be the result of intentional human activity, especially in the course of forest clearing (Limbrey, 1975). In such a case the exposed root ball is usually removed and the resulting infilling of the depression contains less intermixing of horizons.

Alternatively, it has been suggested that the pit features found at Augustine Creek and elsewhere in Delaware are excavated pits produced by humans, probably within pit houses (making these features "sub-basements" within the residences). If this were the case, we would expect to see less evidence of the re-deposition of different soil horizons within the pit fill. We might also expect to see evidence of anthropogenic activity which might take the form of inclusions such as ash, charcoal, artifacts, etc. There is the possibility that tree throw depressions were utilized by people (as wind breaks, etc.). In this case we might expect characteristics of both tree falls and anthropogenic material to occur.

In order to identify the origin of the five features at Augustine Creek, columns of sediment were collected from each in conjunction with field descriptions (Table 1). The samples were then wrapped tightly in soft paper and plastic tape so as to maintain their integrity. In the laboratory, samples were allowed to air-dry and then were placed in an oven at 60° C for several days. The samples were impregnated with a mixture of unpromoted polyester resin and styrene mixed in a ratio of 7:3. After curing for several days, the samples were placed overnight in an oven at 60° C. The indurated blocks were then processed into thin sections by Spectrum Petrographics in Winston, Oregon. Thin section sectioning entails slicing the blocks with a rock saw to produce 2 x 3 x 1/2" slabs, one face of which is ground, polished and glued to a glass slide. The sediment adhering to the glass is cut with a trim saw, and then ground to a thickness of 30 μm (0.030 mm). Finally, in order to facilitate microscopic observation, the thin section is covered with a cover glass. The thin section is then ready for examination which entailed use of a microfiche viewer, and petrographic microscope under plane polarized (PPL) and cross-polarized light (XPL); magnifications ranged from 15x to 200x.. Terminology follows that of Bullock et al. (1985) and Courty et al. (1989).

Table 1: The samples collected from each feature are give below along with the elevation below the extant surface (after the removal of the plow zone), a description of the feature, and the sample's location within the pit.

Feature	Description of feature	Sample no.	Depth (in cm)	Location of sample within feature
20	Circular pit, ca. 150 cm. Gravelly fill with domains of reddish	AUGS-97-1	0-22	Top of feature
	brown. Irregular contact with underlying sterile soil.	AUGS-97-2	28-54	Base of feature
21	Oval pit, 290 x 75 cm. Sandy, clay-silt. Distinct contact with sterile soil.	AUGS-97-3	0-15	Top of feature
		AUGS-97-4	45-69	Base of feature
		AUGS-97-5	45-69	Base of feature/underlying sterile material
23	D-shape with attached key-hole. D contains charcoal rich, powdery silt. Key-hole has light brown material with mottles of possibly sterile material.	AUGS-97-6	0-28	Upper portion of D shape/lateral contact with sterile sediment
		AUGS-97-7	0-17	Top of key-hole
		AUGS-97-8	17-37	Lower portion of key-hole
		AUGS-97-9	37-48	Base of key-hole/sterile sediment
16	Key-hole shape. SW end contains more compact, organic matter. Irregular contact with	AUGS-97-10	0-20	Upper portion of feature but close to lateral contact with sterile sediment
	underlying soil.	AUGS-97-11	0-18	Upper portion of feature
		AUGS-97-12	18-34	Base of feature
25	D-shape with gradual lateral contacts and irregular basal contact. Extensive orange mottles.	AUGS-97-13A and B	0-10	Top of feature
		AUGS-97-14	10-25	Base of feature

Results

All of the sample are largely composed of the same material, described below. The differences between samples lie largely in the relative abundance or absence of various components.

Matrix

The term matrix denotes the fine fraction of the sediment, and as used in this report, it is synonymous with the term micromass. This material is composed largely of clay and quartz silt, although in some areas it also includes fine organic material, and was deposited largely through natural activities. All of the samples are comprised of a generally silty matrix (figs. 2, 5, and 9–13,), but there are variations in the ratio of the fine components. Some areas are enriched in clay relative to the amount found in other areas of the samples. This type of matrix can be seen in the sterile sediment at the base of sample 5 (fig. 3) and localized, well defined domains/fragments of this type of matrix are found in other samples (figs. 6, 11, and 12). This material is interpreted as being fragments or intact pieces of the Bt horizon, and is referred to as such in the descriptions that follow. Other areas of the matrix contain very little clay and are composed mostly of the silty fraction of the matrix. These areas do not have the distinct boundaries that areas of the clay enriched (Bt) matrix do. This type of matrix is typical of sediment that has been texturally depleted (washed) by percolating water.

Course Fraction

Several categories of coarser particles are found within the silty matrix of the samples. The most common inclusion is quartz grains that range in size from sand to occasional pea gravel (figs. 2 and 4). Occasionally other rock particles such as rounded siliceous gravel are also found (fig. 1). These inclusions, like the matrix, are most likely inherited from the parent material of the soil and are not the results of any anthropogenic activity.

Many of the samples also contain charcoal and other organic matter (figs. 2, 5, 9, and 10). These inclusions can range in size from very fine silt to mm sized pieces. This material is a potential indicator of anthropogenic activity (Courty et al.,1989), although it could have accumulated by natural activities (lightening strikes, etc).

Clay papules, small concentrations of clay, orange to red in color, are another common inclusion (figs. 6 and 8). Layers of clay deposition are sometimes visible within them. These papules are typically detrital grains, indicating reworked fragments of clay coatings and infillings (see description below).

Porosity

While the samples all contain the same general components, they differ in their fabric. Many of the sample are extremely dense and exhibit a low overall porosity, the voids that are present can be categorized into three basic types; large chambers (figs. 6 and 7), channels (fig. 13) and small irregular voids (fig. 9 and 12). Of these, the chambers are probably largely primary in origin, associated with sediment accumulation. The channels and irregular voids could be either depositional or post depositional in nature. Fine channels are commonly associated with modern and fossil roots. In some samples the number and distribution of irregular voids, as well as the occasional presence of fecal pellets, small rounded aggregates of silt produced by invertebrate soil fauna (fig. 13), indicated bioturbation of the sediments.

Secondary Features

Other secondary features are present in addition to the evidence of bioturbation. Brown silty void coatings can be seen in several samples (figs. 7 and 9). These can be formed through natural pedogenic processes, but can also be due to human activities such as trampling or plowing (Courty et al., 1989). Silty intercalations, concentrations of silt unrelated to voids, grains or aggregates, are also present (fig. 5 and 9). Fine yellow/brown clay coatings also occur (fig. 1, 6 and 7), almost always within the clay enriched (Bt) material, and are thus a normal soil forming process. Many of the clay papules (described above) were probably derived from these void coatings.

Descriptions of each sample are given below.

FEATURE 20

AUGS-97-2 (Base of feature/contact with underlying sterile soil. fig. 1)

This sample is characterized by a very compact structure with very few voids, similar to that found in fragipans. It is comprised of silty clay-enriched matrix (Bt horizon) with inclusions of quartz sand in a range of sizes, and occasionally other rock fragments (e.g., chalcedony and glauconite). Clay aggregates and papules are present, as are void coatings composed of well bedded clay. There is little charcoal and recent evidence of biological reworking is absent, although the matrix does show some reworking coeval with the formation of the clay coatings.

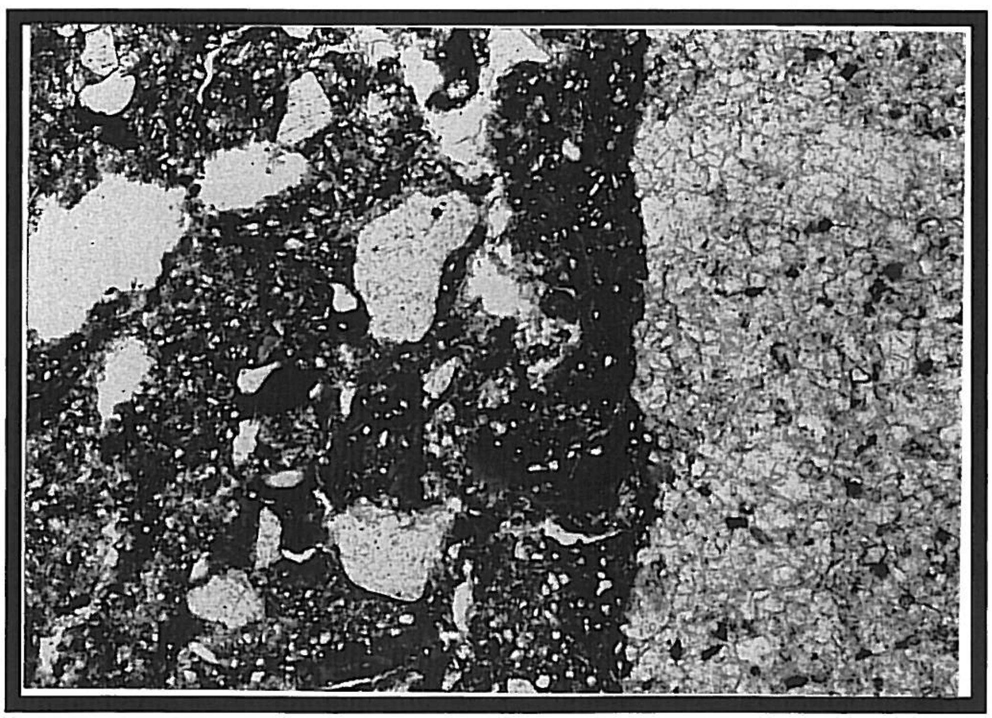

Fig. 1. AUGS 97-2: Shown in this photo is the very dense fabric, although some voids are visible on the left of the photo (white areas). The bright orange material in the center is layered clay coatings. A large siliceous rock particle is visible at right. Plane polarized light (PPL), field of view is 3.1 mm.

AUGS-97-1 (Top of feature fill, fig. 2)

Although the material from the pit fill, including that in this sample, bears a general similarity to the underlying material seen in AUGS-97-2, there are several key differences. Small fragments of organic matter have worked into the silty matrix (A horizon) by biological activity, and there is more charcoal than in the preceding sample. There are also silty intercalations and silty void coatings present. Although the pit fill is dense, it has more and larger voids than AUGS-97-2.

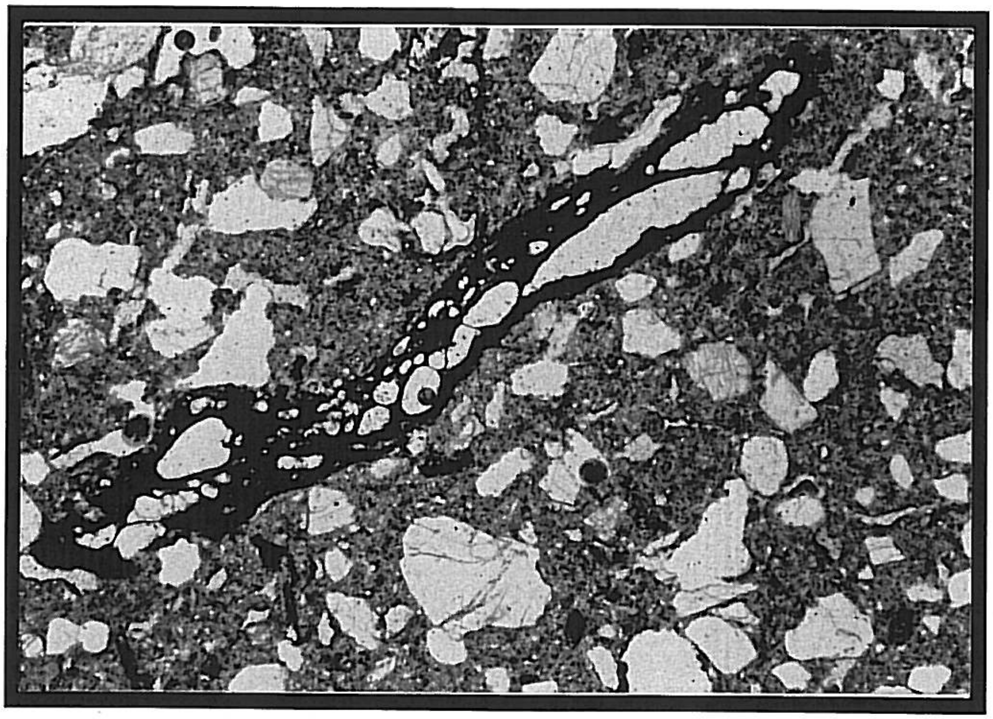

Fig. 2. AUGS-97-1: The dense fabric is visible in this photo. A large, modern root, extends diagonally across the center of the photo. The absence of clay void coatings, clay papules and remnants of the Bt horizon differentiates this material from that seen in fig. 1. PPL, field of view is 6.5 mm.

Interpretation of Feature 20

AUGS-97-2, from the contact between the feature and the underlying sterile material, contains natural, *in situ* soil material from the Bt horizon where clay coatings are typically developed. Moreover, the soil appears to be a fragipan, as suggested by the density and lack of porosity of the matrix. There are localized silty coatings within this material, features which are a typical result of plowing and can probably be attributed to (relatively) recent activity in the area. AUGS-97-1 is similar to AUGS-97-2, but differs in two respects. First, it appears to be derived of material from the A horizon and not the Bt material shown in AUGS-97-2. Secondly, the void structure, and the lack of clay coatings within the voids, indicate reworking of the material. Field photos clearly reveal that the feature cuts into the Bt horizon. Yet this material is almost entirely absent from the pit fill. This indicates that the material was removed from the pit and redeposited, elsewhere, something not likely to be done by natural, non-anthropogenic agents. The pit was later filled in with different material, perhaps A horizon material from the surface around the pit.

FEATURE 21

AUGS-97-5 (Base of feature/Contact with underlying sterile soil. figs. 3 and 4)

This sample is very similar to AUGS-97-2 and is composed of the same clay-enriched matrix (Bt horizon) with sand to gravel sized quartz grains, several clay papules and clay void coatings, although the latter are less abundant in this sample. Two pieces of gravel at the base of the sample display silt cappings, a feature typical of fragipan soils (Fitzpatrick, 1993).

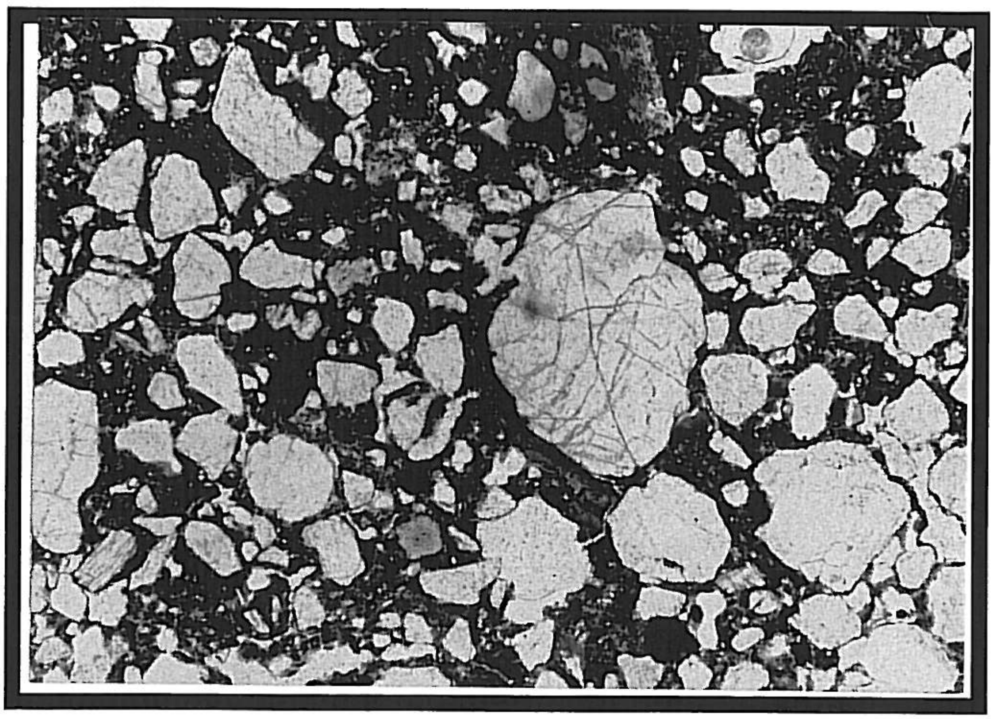

Fig. 3. AUGS-97-5: The dense, clay enriched matrix and abundant quartz sand grains are visible in this photograph. Orange clay coatings are visible in the center. PPL, field of view is 6.5 mm.

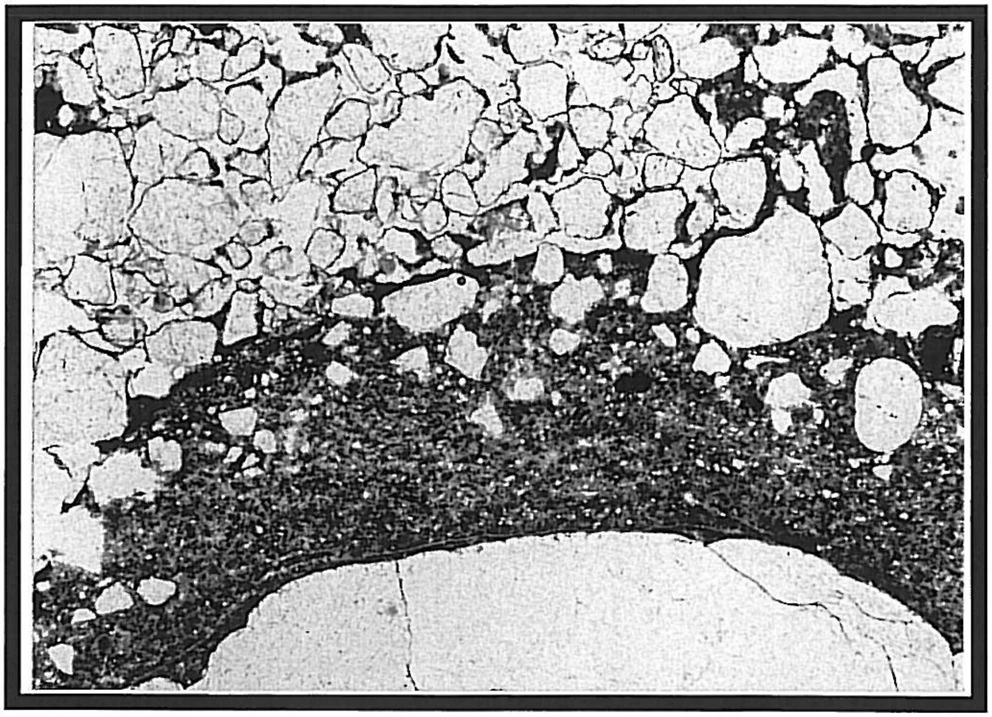

Fig. 4. AUGS-97-5: At the base of the photo is a large (gravel-sized) quartz grain with a silt capping. At the top the fabric is grain supported quartz sand. PPL, field of view is 6.5 mm.

AUGS-97-4 (Base of feature)

Although similar to AUGS-97-5 in its density, the matrix of this sample is comprised of silty (A horizon) material, not the clay-enriched (Bt) material seen in the preceding sample. The matrix also contains more fine-grained organic material worked into the matrix. Clay void coatings are rare, although some clay papules are present.

AUGS-97-3 (Top of feature. fig. 5)

This sample is comprised of material similar to that found in the previous two samples, but post secondary features are more evident. The matrix is comprised largely of silt (A horizon) with organic material and charcoal worked into it, and scattered quartz grains. Clay coatings are relatively rare. Silty void coatings, however, are present, especially near the top of the thin section. In some areas, these are juxtaposed over earlier clay coatings. Chambers are scattered throughout the sample, which is more vughy overall, likely indicating pores produced by roots and microfauna.

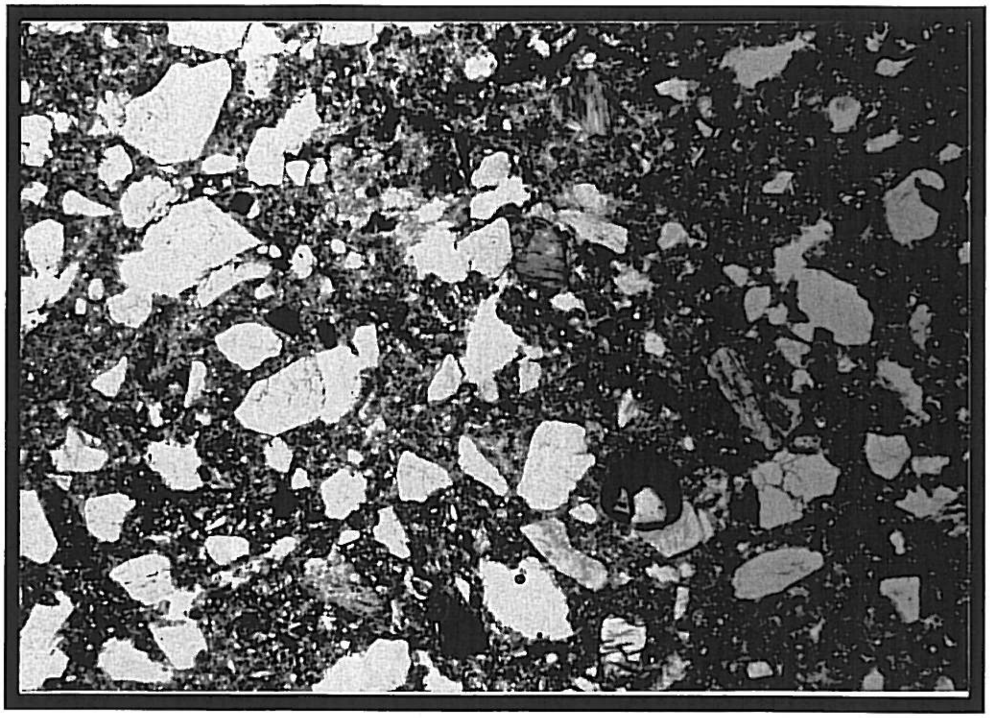

Fig. 5. AUGS-97-3: The compact silt matrix and quartz sand inclusions are visible throughout this photo. The darker grains in the center of the photo are organic matter. Poorly developed silt intercalations can be seen in upper right corner of the photo. PPL, field of view is 6.5 mm.

Interpretation of Feature 21

This feature appears to be similar to Feature 20. A pit was cut into the extant A and Bt horizons and later filled with reworked A horizon with some addition of organic matter and charcoal. Later biological reworking and recent plowing further modified the fill, resulting in silty coatings , as well as greater overall porosity.

FEATURE 23

AUGS-97-9 (Base of feature. figs. 6 and 7)

While this sample is composed of the same silty matrix as the previous two features, it has far less sand. Domains of clay-enriched matrix (Bt horizon) are visible, although they are often locally disturbed. There are some clay papules but many clay void coatings are *in situ.* Silty void coatings are present, and are sometimes superimposed on the clay coatings. There is also more iron staining than was seen in the previous features. Biological reworking of the material is evidenced by the many irregular voids and vughs.

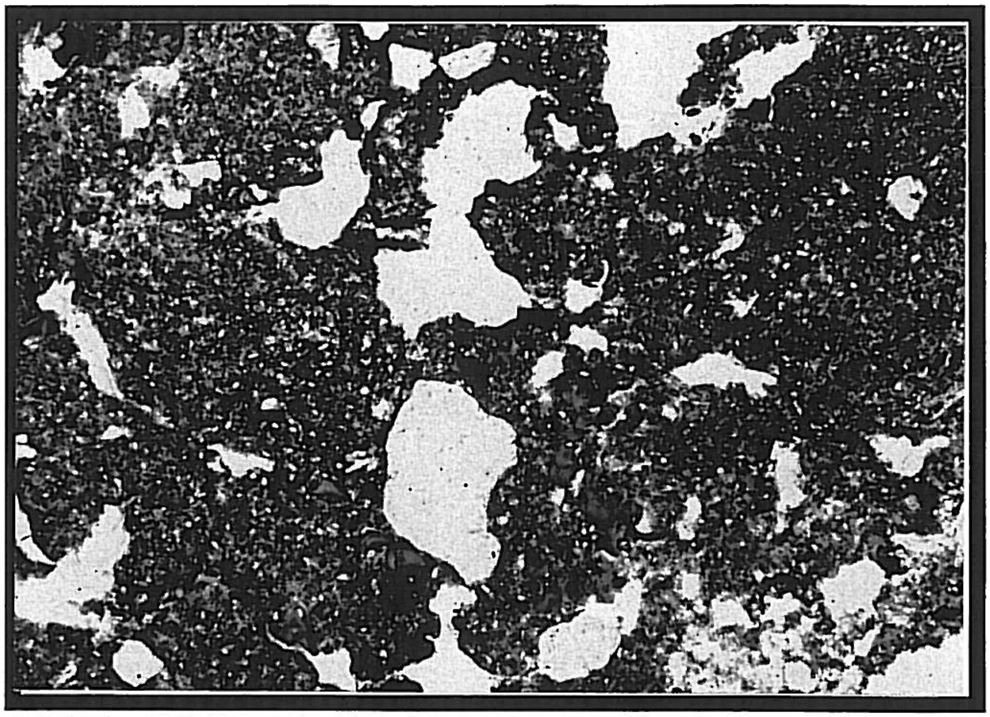

Fig. 6. AUGS-97-9: Clay-enriched (Bt) matrix is visible throughout this photo. The bright orange domains in the center are *in situ* clay void coatings. Poorly developed, darker silt coatings are visible within the chamber in the center. PPL, field of view is 6.5 mm.

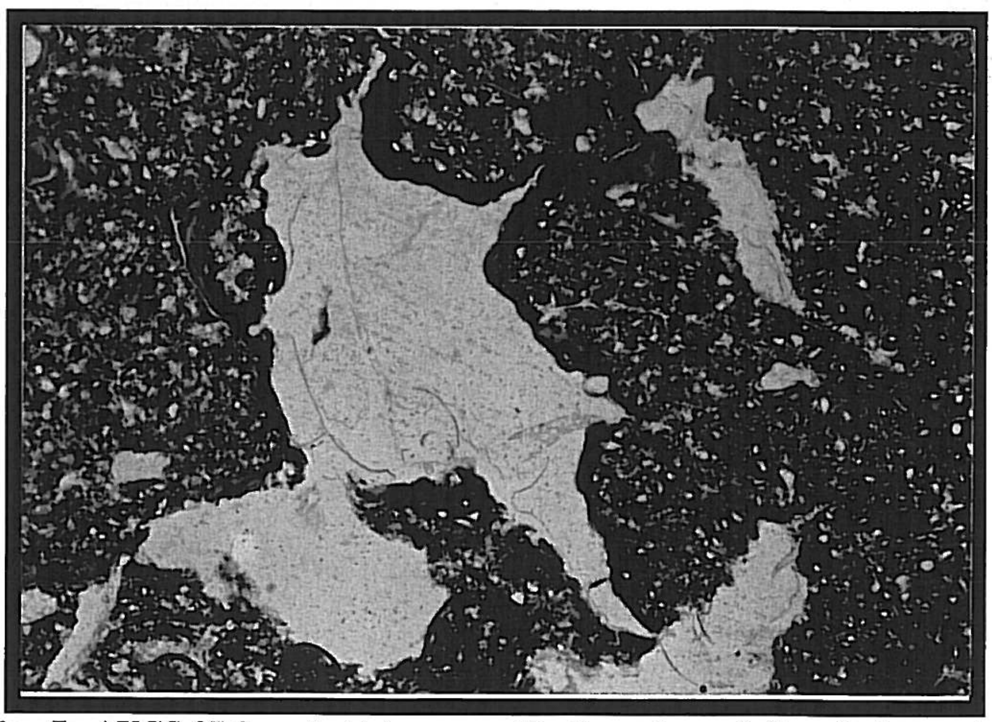

Fig. 7. AUGS-97-9: A higher magnification view of fig. 6 shows the juxtaposition of silt coatings on the clay. The silt coatings are likely the result of relatively recent plowing. PPL, field of view is 3.1 mm.

AUGS-97-8 (Center of feature)

This sample appears to be far more broken up than the material seen in AUGS-97-9. The sample is very disaggregated and contains areas of very dense clay-enriched matrix (Bt material) intermixed with the silty material (A horizon). There are many clay papules scattered throughout. Silty intercalations are also abundant. Both small voids with clay coatings and larger chamber voids with silty coatings occur, indicating a chronological sequence of small void formation, development of clay coatings, chamber void formation, and development of silty coatings.

AUGS-97-7 (Top of feature. fig. 8)

This sample is comprised of silty matrix (A horizon) with many pieces of clay enriched (Bt) material. The sample has a yellowish appearance, possibly due to iron staining. There are areas depleted in fine, clay fraction, leaving behind the coarser material. Charcoal and organic matter are absent. There are very few silty void coatings or intercalations.

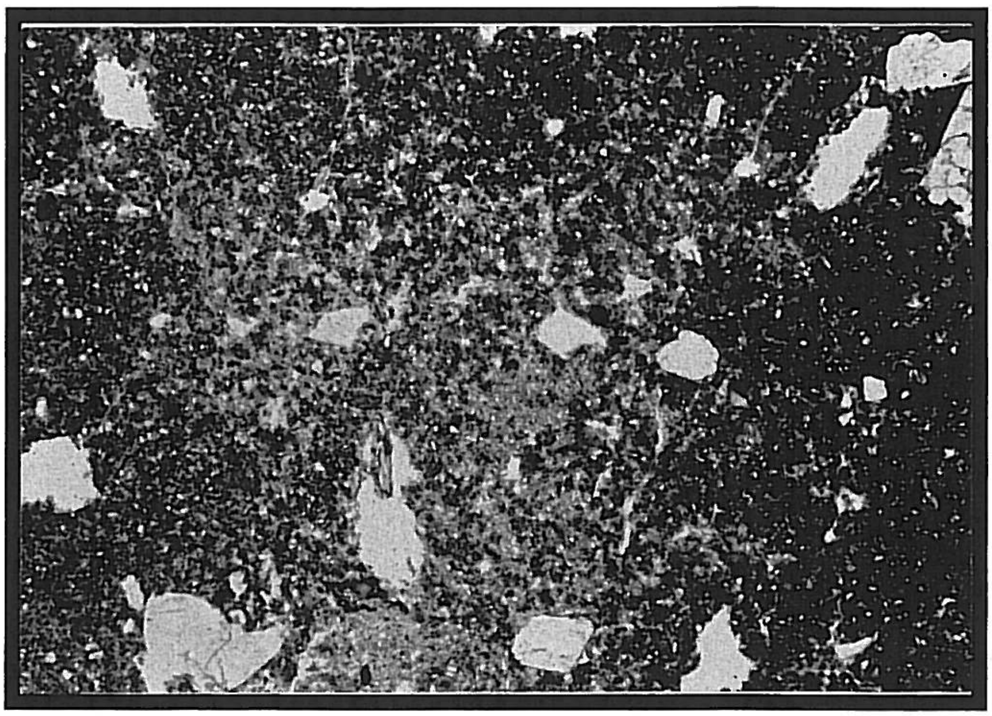

Fig. 8. AUGS-97-7: The lighter area in the center of the photo exhibits silty matrix depleted in fine silt and clay. Small orange clay papules are visible around this center area. PPL, field of view is 6.5 mm.

AUGS-97-6 (Upper portion of attached "D-shaped" feature. fig. 9)

This sample is significantly different from any of the other samples. Although comprised mainly of silt (A horizon), it contains abundant charcoal, both mm sized pieces and silt sized pieces that have been worked into the matrix; possibly burned aggregates are also present. Phytoliths and spores are visible. The sample contains many irregular vughs and voids, indicating extensive biological reworking. Almost all voids contain well developed silty coatings.

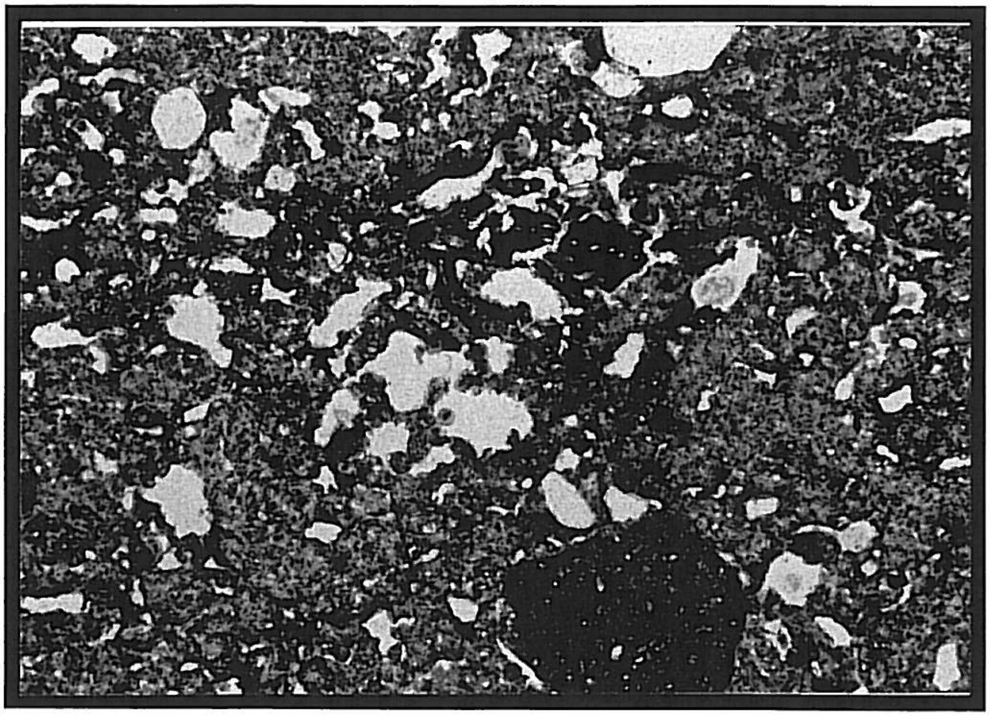

Fig. 9. AUGS-97-6: The distinct characteristics of AUGS-97-6 are visible in this photo, including irregular voids, silt coatings, and relatively abundant charcoal. PPL, field of view is 6.5 mm.

Interpretation of Feature 23

This feature is comprised of two parts; the "key-hole" feature from which samples AUGS-97-9, -8, and -7 were taken, and the "D-shaped" feature from which sample AUGS-97-6 was taken. The three samples from the key-hole feature all contain intermixed Bt and A horizon material, abundant clay papules, and clay void coatings. Later reworking and alteration of the material is indicated by the porosity and the silty void coatings. This portion of the feature is typical of what would be expected of a tree fall. The material from the D-shaped feature is distinctly different: the amount of charcoal and organic material and the absence of intermixed soil horizons indicates that the fill of this portion of the feature was due to anthropogenic activity. While this may be an instance of a tree fall depression being reused, the localized extent and distinctive, well defined shape of the anthropogenic deposit indicated that a pit was excavated into a refilled tree fall depression.

FEATURE 16

AUGS-97-12 (Base of feature- SW end)

As in sample AUGS-97-9, this sample contains traces of intact clay enriched (Bt) material. This sample also contains charcoal and organic material that is worked into the matrix and abundant clay papules. There are very few clay void coatings, although a few *in situ* example are visible. There are few silty void coatings or silty intercalations present. The abundance of irregular voids indicates that this sample has been extensively biologically reworked.

AUGS-97-11 (Upper portion of feature, SW end. fig. 10)

This sample is similar to AUGS-97-6. Like that sample, there are no pieces of Bt horizon present. The material is composed of the silty matrix with extensive silty intercalations, silty void coatings, and charcoal, although these components are not as abundant as in AUGS-97-6. The sample also shows signs of extensive biological reworking.

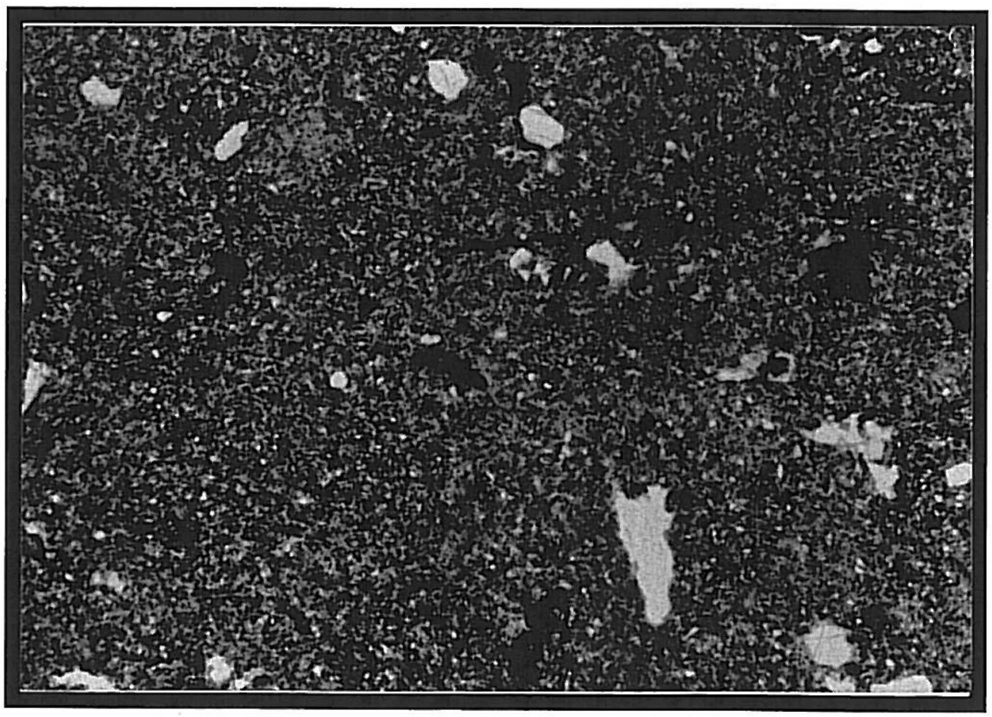

Fig. 10. AUGS-97-11: As in AUGS-97-6, this sample contains abundant charcoal and fine organic material. However, it is more compact and there are fewer silty coatings. PPL, field of view is 6.5 mm.

AUGS-97-10 (Upper portion of feature, NE end, close to lateral contact with sterile sediment. fig. 11)

This sample resemble the material seen in 97-12. Some clay enriched (Bt) material and clay papules are present, although not as abundant as in 97-12. Silty intercalations are common and there is evidence of extensive biological reworking. The matrix appears to be extensively texturally depleted (washed) near the top of the sample.

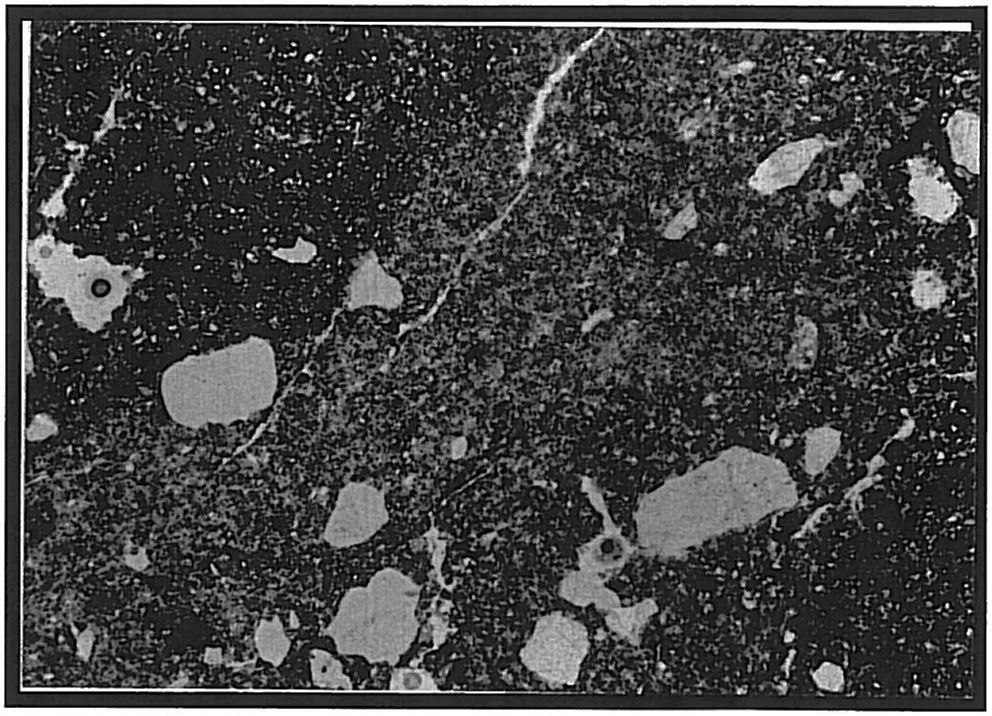

Fig. 11. AUGS-97-10: Bt material is visible in the upper left of the photo (reddish material), as are planar cracks. Washed A horizon material is visible throughout the center. PPL, field of view is 6.5 mm.

Interpretation of Feature 16

Although this feature contains an intermixture of Bt and A horizon material, as seen in Feature 23, the size of the Bt fragments is small and they are not common. There are also fewer *in situ* clay void coatings and fewer silty intercalations. These features, together with the amount of charcoal found throughout the feature would seem to indicate that this is an anthropogenic feature and not a tree throw, although this cannot be definitively stated. It is possible that this was a tree throw that was filled in quickly, hence the lack of silty intercalations. The abundance of charcoal might indicate anthropogenic activity in the tree fall depression that contributed to the rapid infilling.

FEATURE 25

AUGS-97-14 (Base of feature. fig 12)

This sample contains an intermixture of clay enriched (Bt) and silty (A horizon material with frequent large (sand-sized) rounded papules, whose roundness indicates that they were transported prior to deposition. The sample also shows evidence of gleying.

There is little charcoal or organic material present, although unidentified opaque grains are scattered throughout the sample. The sample contains abundant voids.

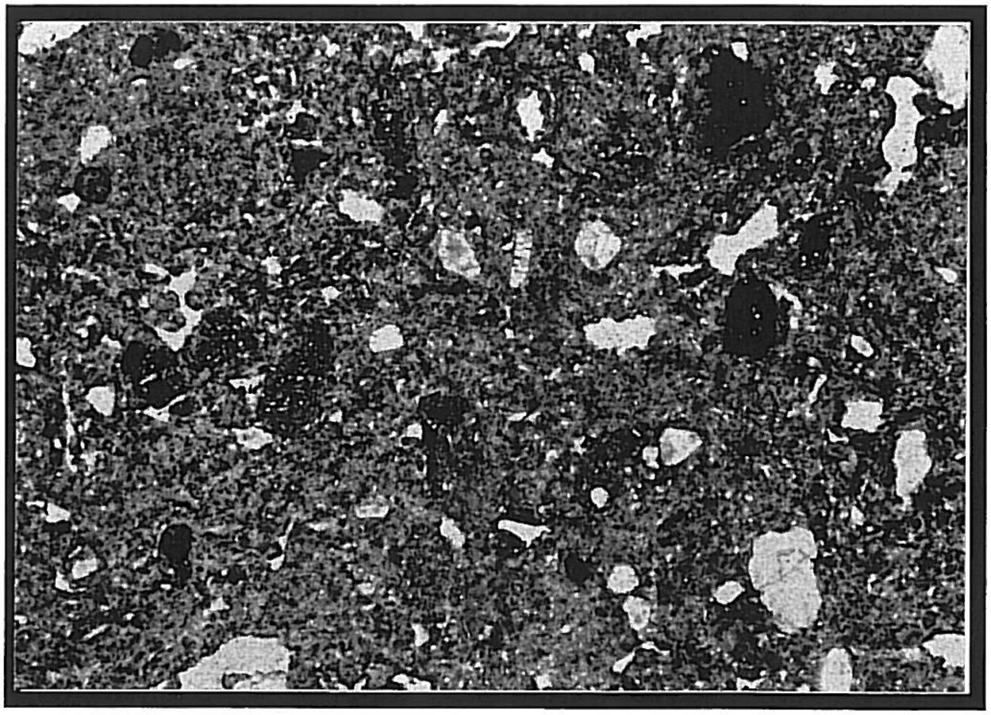

Fig. 12. AUGS-97-14: Bt material, the small reddish domains, is scattered throughout the center of the photo. Small orange clay papules and aggregates, and irregular voids are present. PPL, field of view is 6.5 mm.

AUGS-97-13A and B (Top of feature. fig. 13)

These samples show extensive biological reworking, indicated both by the porosity and by the presence of fecal pellets. There are slaking crusts and micropans, characteristics of sediment reworked by surface water (Courty, et al., 1989). Charcoal is finely disseminated throughout the samples and there are occasional rubified aggregates and papules. Some clay enriched (Bt) material is present, as are clay papules. There is one example of clay coatings, not in a void but in the pores of a piece of charcoal. There is some evidence of localized gleying.

Interpretation of Feature 25

Like Features 20 and 21, Feature 25 appears to be a cultural, not a natural, feature. Although there are some aggregates of Bt material present within the feature fill, they are small and rounded, characteristics inconsistent with material deposited by a tree fall. The rubified aggregates are typical of heat exposed sediments, such as those from hearths. Along with the charcoal, they indicate an anthropogenic origin for this feature.

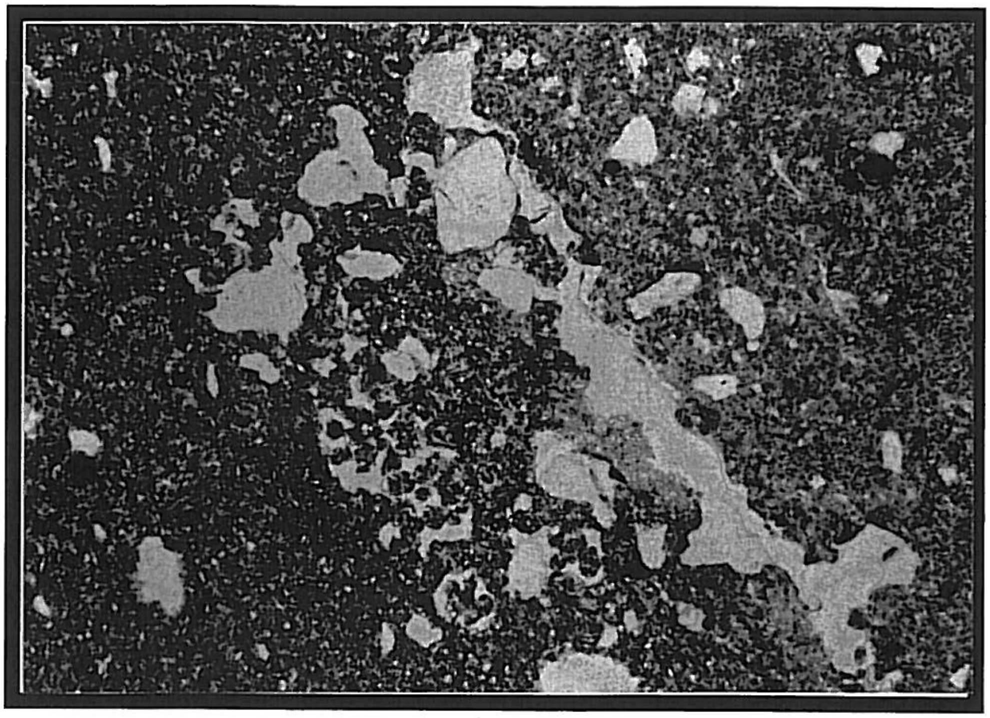

Fig. 13. AUGS-97-13B: The small, rounded silt aggregates in the center of the photo are fecal pellets produced by invertebrate soil fauna. A large channel is visible on the left. PPL, field of view is 6.5 mm.

Summary

There is a range of possible explanations for the features at Augustine Creek. They could be produced by tree falls that were caused by natural events (storms) or pits resulting from anthropogenic activity. If natural tree falls occurred, the resulting depression could have also been exploited by people. Alternatively, the features could be pits dug within houses or elsewhere. There need not be a single explanation for all of the features at the site.

Based on the micromorphological results, it seems clear that of the five features examined at Augustine Creek, four are pit features (20, 21, 16, 25) and one is a tree fall (23), but with an anthropogenic deposit at one end. Feature 20 and 21 are most clearly pits that were dug into the extant soil. There is no evidence of any elaborate preparation of the pits (e.g. any type of lining or compacted earth). Their lack of stratification indicates a rapid infilling, but the source of the fill material is uncertain. The absence of Bt fragments would argue that the material either came form the sides of the existing pit or perhaps were dug or scraped from the upper (A) soil horizon surrounding the pit.

Features 16 and 25 do contain a mixture of Bt and A material within their fill. The Bt fragments are small and not common, and silty intercalations are relatively rare, characteristics inconsistent with tree fall features. The presence of charcoal and organic matter support the identification of this feature as anthropogenic. Additionally, the presence of micropans and slaking crusts indicate loose material that was reworked on a small scale by surface water (Courty, et al., 1989).

Only Feature 23 appears to have been formed, in part, by a tree fall. Samples from the key-hole shaped portion of the feature all contain the intermixed fragments from the Bt and A horizons as well as silt intercalations that are typical of tree fall depressions. The material from the D-shaped feature is clearly anthropogenic in origin. While this material may have been deposited by someone using the depression created by the tree fall, the size and shape of the feature is similar to that seen at other sites (Petraglia et al., 1998) and may have been a pit dug into an earlier tree fall depression; perhaps a tree pulled over in order to make room for the pit/pit house.

Although four of the five features appear entirely cultural in origin, the relative sparsity of cultural materials (bone, shell, charcoal, ash) is difficult to explain. The answer probably relates to the use of the pits, the types and location of activities performed around them, the rate at which the pits were refilled, and the source of that material. For example, at other sites, hearths have been found outside of domiciles, while pits are often located in the interiors. This may account for then the sparcity of ash and charcoal within the pit fill. If food was prepared and consumed outside as well, we would not expect to see considerable food refuse indoors.

Conclusion

The possible origins of the pit features found at Augustine Creek and at other sites in Delaware have been discussed elsewhere, but to date no consensus has developed. Traditional techniques, such as artifact concentration studies and geochemical analysis, used to resolve the question have been unable to produce unequivocal results. By focusing not only on the composition of the fill, but also on its fabric, it has been possible to identify the processes by which the sediments were deposited and to separate those features which are likely cultural in origin (Features 16, 20, 21, and 25) from those which were the result of tree falls. The application of this technique has the potential determine the origin of pit features at other sites in Delaware.

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