APPENDIX III

GEOMORPHIC HISTORY OF THE HOCKESSIN VALLEY SITE 7NC-A-17

GEOMORPHIC HISTORY OF THE HOCKESSIN VALLEY SITE 7NC-A-17

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Introduction

A study of the geomorphic history of the Hockessin Valley Site 7NC-A-17 was begun and completed during the fall of 1985. The goal of the study was to describe the physiography of the site during Prehistoric occupation.

Location, Physiography, and Geologic Setting of the Site

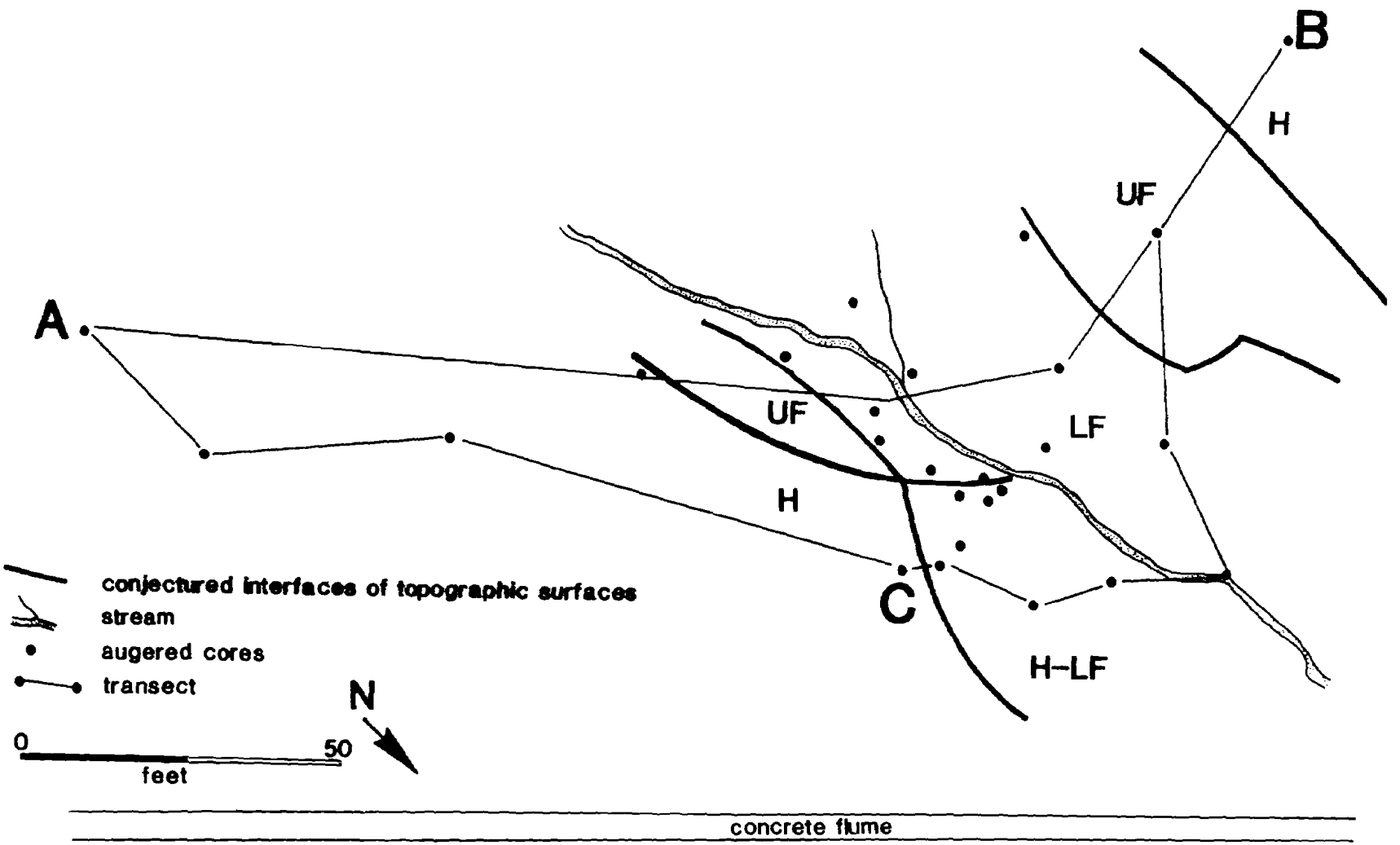
The study area occupied the floodplain and surrounding slopes of a small watershed on the southwestern side of Limestone Road, about 0.5 miles southeast of Hockessin. The stream near the site is a second-order stream. The floodplain at the site is quite narrow and the valley sides join the floodplain without any apparent break in slope. The floodplain itself is composed of 2 surfaces, a lower surface near the stream and an upper surface approximately 3 feet above the lower surface (Figures 71 and 72). Along the northeast part of the site (the area between the east side of the stream and Limestone Road), these two surfaces cannot be distinguished.

The study area is underlain by the Cambro-Ordovician Cockeysville Marble. The site is close to the contact between the Cockeysville Marble and the schists and gneisses of the pelitic facies of the Wissahickon Formation (Woodruff and Thompson, 1972). Fresh bedrock is covered by greater than 80 feet of regolith (Christopher and Woodruff, 1982).

Methods

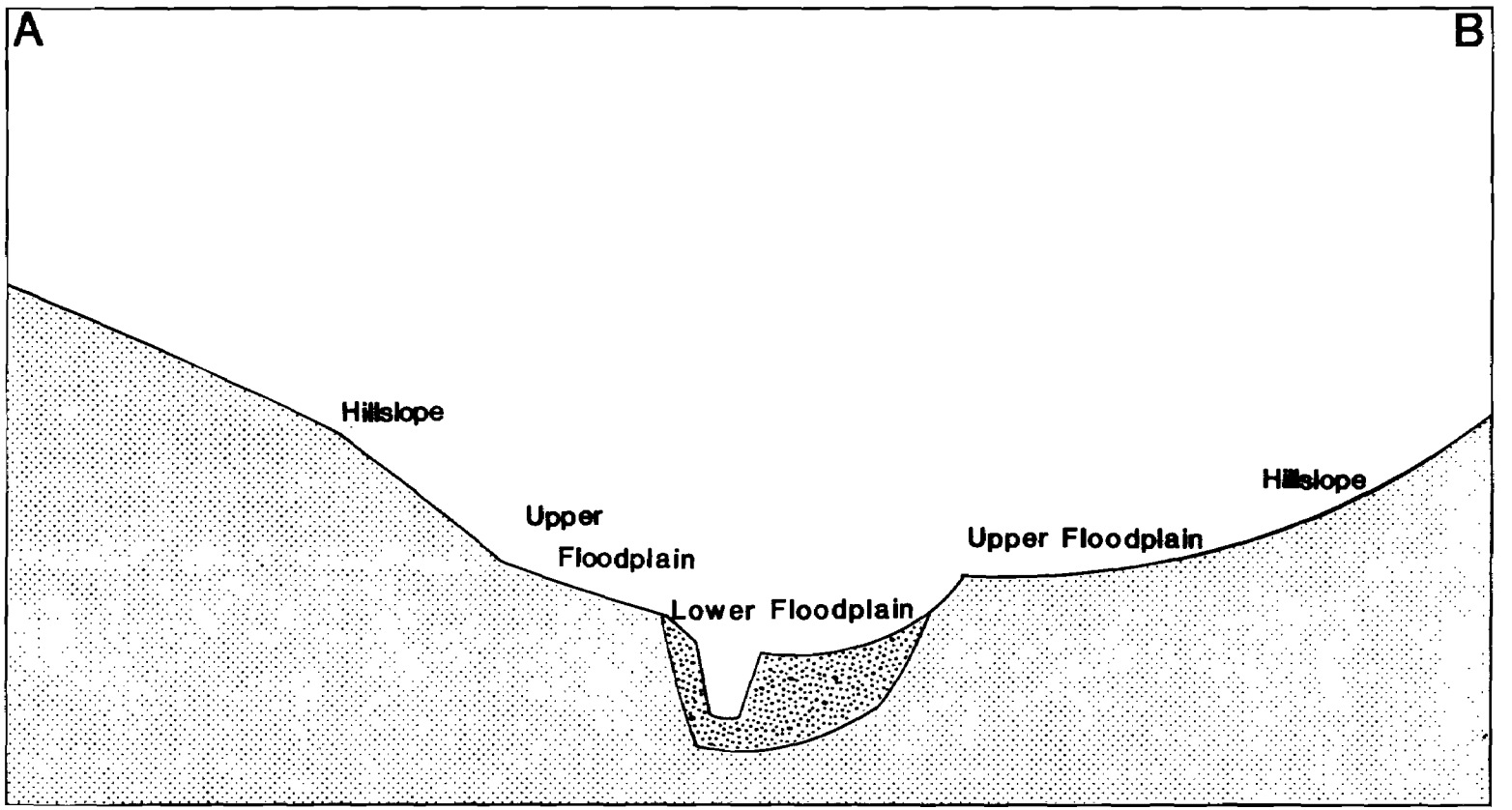
Sediments were excavated with a three-inch diameter soil auger. Samples were obtained at one foot intervals. Each sample was carefully described in the field. Textural descriptions are

FIGURE 71



Locations of cores and topographic surfaces of the study area. Four topographic surfaces are recognized: hillslope (H), lower floodplain (LF), upper floodplain (UF), and hillslope and lower floodplain (H-LF).

FIGURE 72



Geologic cross-section and geomorphic surfaces along A-B (see fig. 1). This cross-section is based on cores shown in figs. 1 and 3 and facies definitions illustrated in fig. 4. Although the cross-section is based on cores, specific cores are not shown (see fig. 6 for a cross-section along A-C-B).

Colluvium

Alluvial Overbank Facies

0 100 horizontal feet

vertical scale exaggeration 10x

based on Folk's (1968) terminology. Colors are described with the Rock Color Chart (Geol. Soc. Am. Rock Color Chart Committee, 1980), a system derived from the Munsell classification.

Each auger hole was located with a Brunton compass and tape measure. A distinctive tree, present on detailed topographic maps of the site, was used as a benchmark. Elevations were measured with a hand level and a stadia rod.

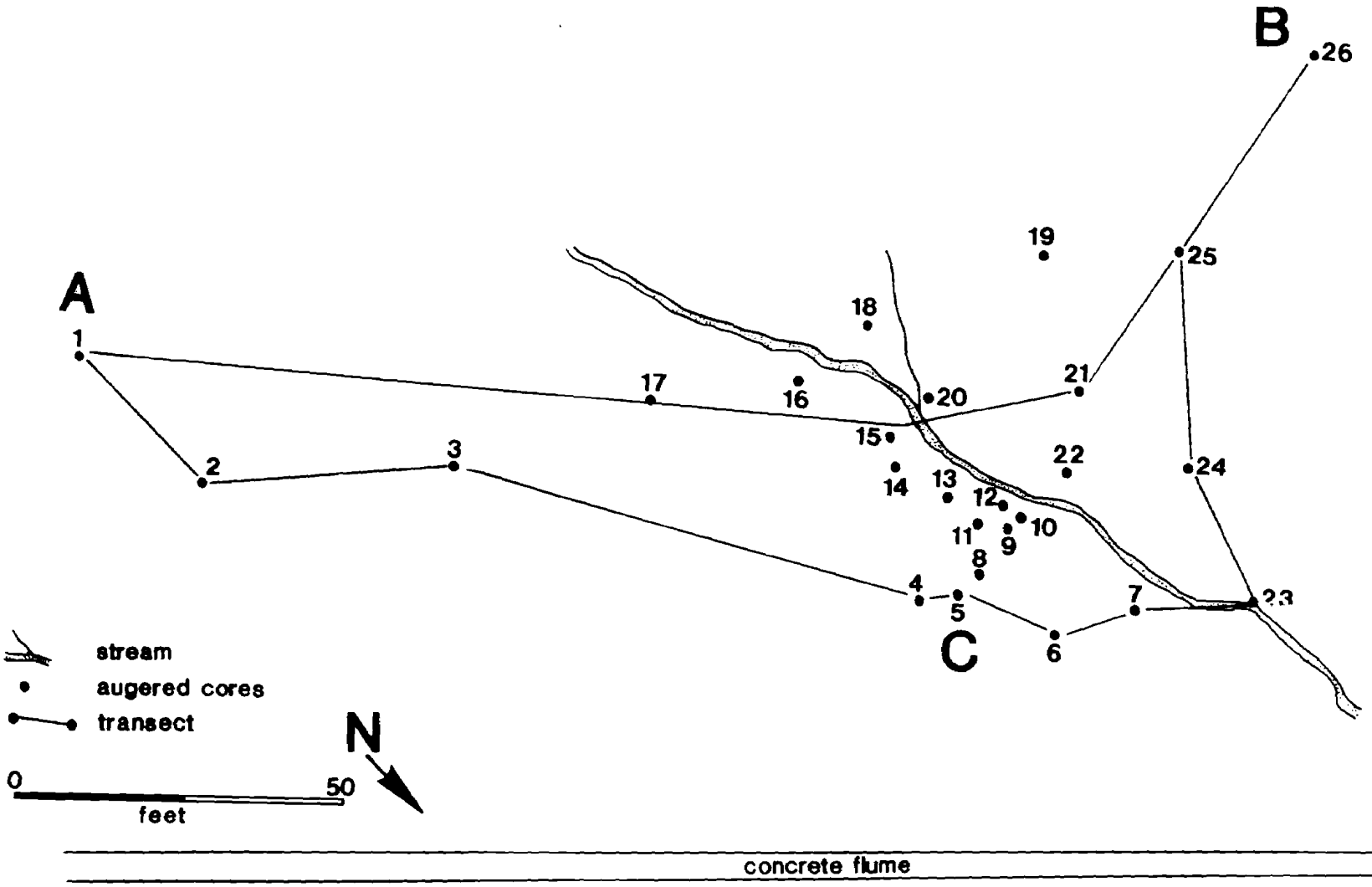
Locations were selected to provide a sample of all potential sedimentary environments at the site. A transect was selected across the entire valley parallel to Limestone Road (Figure73). Other holes were placed closer to the archaeological site to better define the history of sedimentation in this area. A total of 27 auger holes were excavated.

Results

The sediments of the study area may be divided into three different groups. The first group, hereafter referred to as the colluvial facies, consists of an upper unit (10-20 cm thick) of dark yellowish brown clayey silt (Figure74). These silty sediments grade into moderate yellowish brown sandy silts and sandy clayey silts. The lowest unit (typically deeper than 50 cm) is marked by an increase in the number and size of gravel-sized particles of varying lithology. The lowest unit is not sorted, however, and it may frequently exhibit some structures reminiscent of weathered bedrock.

A second group of sediments,hereafter referred to as the alluvial overbank facies, contains an upper layer of moderate brown clayey silt or sandy clayey silt (Figure 74). These silty

FIGURE 73



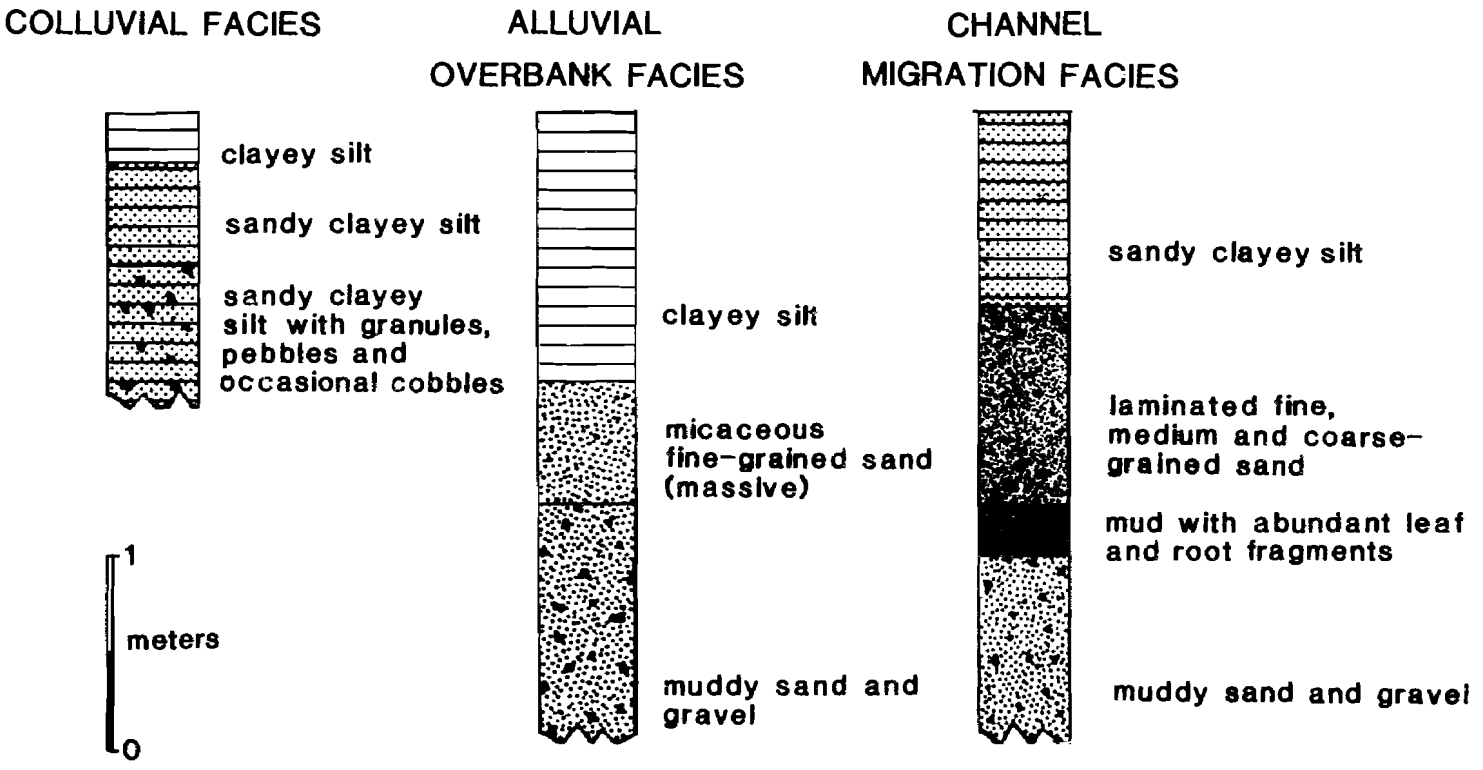
Guide to core numbers. Actual core identification numbers are not listed here because of space limitations. A table on the following page may be used to obtain core identification numbers used in Appendix 1 (see Table 1).

TABLE 1

Guide to Core Identification Numbers

Core # in Figure 73	Core ID #
1	HC10-4-85-6
2	HC10-4-85-5
3	HC10-4-85-4
4	HC10-9-85-2
5	HC10-9-85-3
6	HC10-9-85-1
7	HC10-9-85-6
8	HC10-4-85-7
9	HC10-9-85-5
10	HC10-21-85-1
11	HC10-9-85-4
12	HC10-21-85-2
13	HC10-4-85-1
14	HC10-21-85-4
15	HC10-25-85-5
16	HC10-4-85-2
17	HC10-4-85-3
18	HC10-9-85-8
19	HC10-21-85-6
20	HC10-9-85-1
21	HC9-25-85-1
22	HC9-26-85-1
23	HC10-9-85-7
24	HC10-21-85-7
25	HC9-25-85-2
26	HC9-25-85-3

FIGURE 74



Typical examples of the three facies defined at the study area.

sediments are 30 to 50 cm thick; they typically grade downwards into muddy sands and gravels.

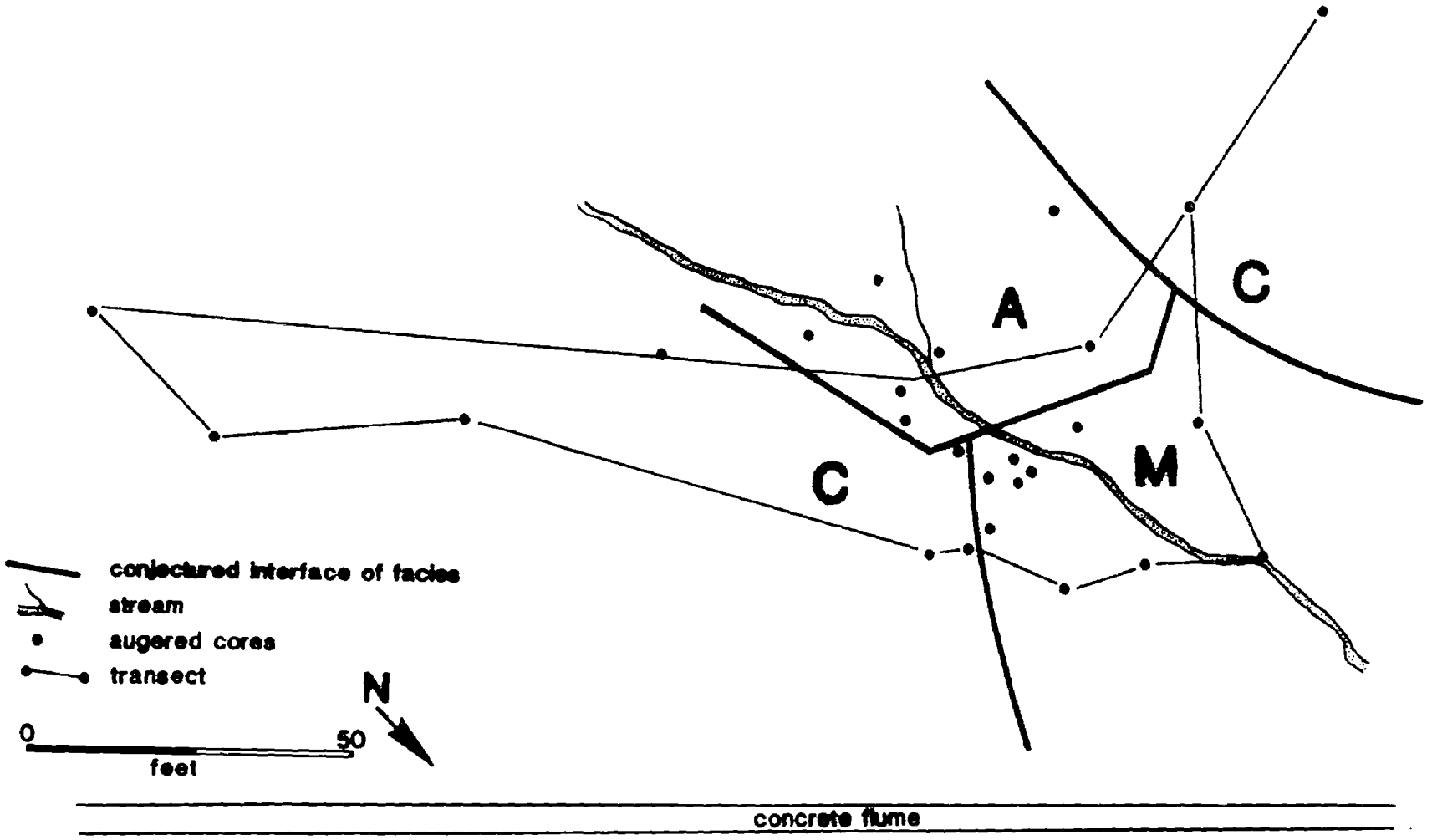
The third group is quite distinctive (Figure 74). These sediments will be referred to as the channel migration facies. The upper 50 cm consists of moderate to dark yellowish brown sandy clayey silt. The next 50 cm typically consists of weakly laminated fine, medium, and coarse sands, silts, and clays. The medium and coarse sandy sediments are frequently weathered to a distinctive rusty orange color. Below a depth of approximately 1 m, a thin layer (typically about 10 cm thick) of black silty clay is often present. These muddy sediments frequently contain many leaf and root fragments. The deepest sediments are muddy sands and gravels (pebbles, granules, and cobbles) (Figure 74).

Discussion

The colluvial facies discussed above is, as the name suggests, probably colluvial. These sediments contain a very wide range in grain sizes, and they are found on valley slopes away from the present floodplain (Figure75). Furthermore, and most importantly, they have no sandy or gravelly sediments which could represent a channel lag facies. Thus, these are typical colluvial deposits.

The alluvial overbank facies discussed above is composed of a relatively thick sequence of silty sediments underlain by sands and gravels. The lower unit has clearly been sorted by water, and it is undoubtedly a channel or point bar deposit. The upper unit is an overbank deposit. These sediments underlie the present floodplain along the southern half of the study area

FIGURE 75



Spatial distribution of the colluvial facies (C), the alluvial overbank facies (A), and the channel migration facies (M).

(Figure 75).

The channel migration facies has a relatively thin upper silty unit underlain by laminated sands. A thin muddy unit with abundant plant fragments underlies the sands, and these organic-rich muddy sediments are underlain by sands and gravels.

The upper silty layer of the channel migration facies is clearly an overbank deposit because of its fine grain size. The laminated sandy unit is probably a point bar deposit. This interpretation is primarily based on the sandy texture of these sediments, although the laminations may also be partly diagnostic (point bar sediments are typically cross-stratified [Walker, 1984]; however, flow depths are quite shallow in the present stream and the bed sediment is fairly coarse. Under these conditions, cross-stratification may not develop [Middleton and Southard, 1984]). Furthermore, similar laminated sandy sediments are found along the insides of bends in the present channel. These laminated sandy sediments are clearly related to lateral migration of the present channel, and therefore it is reasonable to suggest that similar older sediments were also deposited along the insides of laterally migrating bends.

The organic-rich mud which underlies the laminated sands initially appeared to be problematic, for it interrupts a typical fining-upward point bar sequence. However, similar sediments are found along bends of the present channel underneath the laminated sands. These muddy sediments and associated leaves and twigs are probably deposited during waning flood stages or perhaps after small storms.

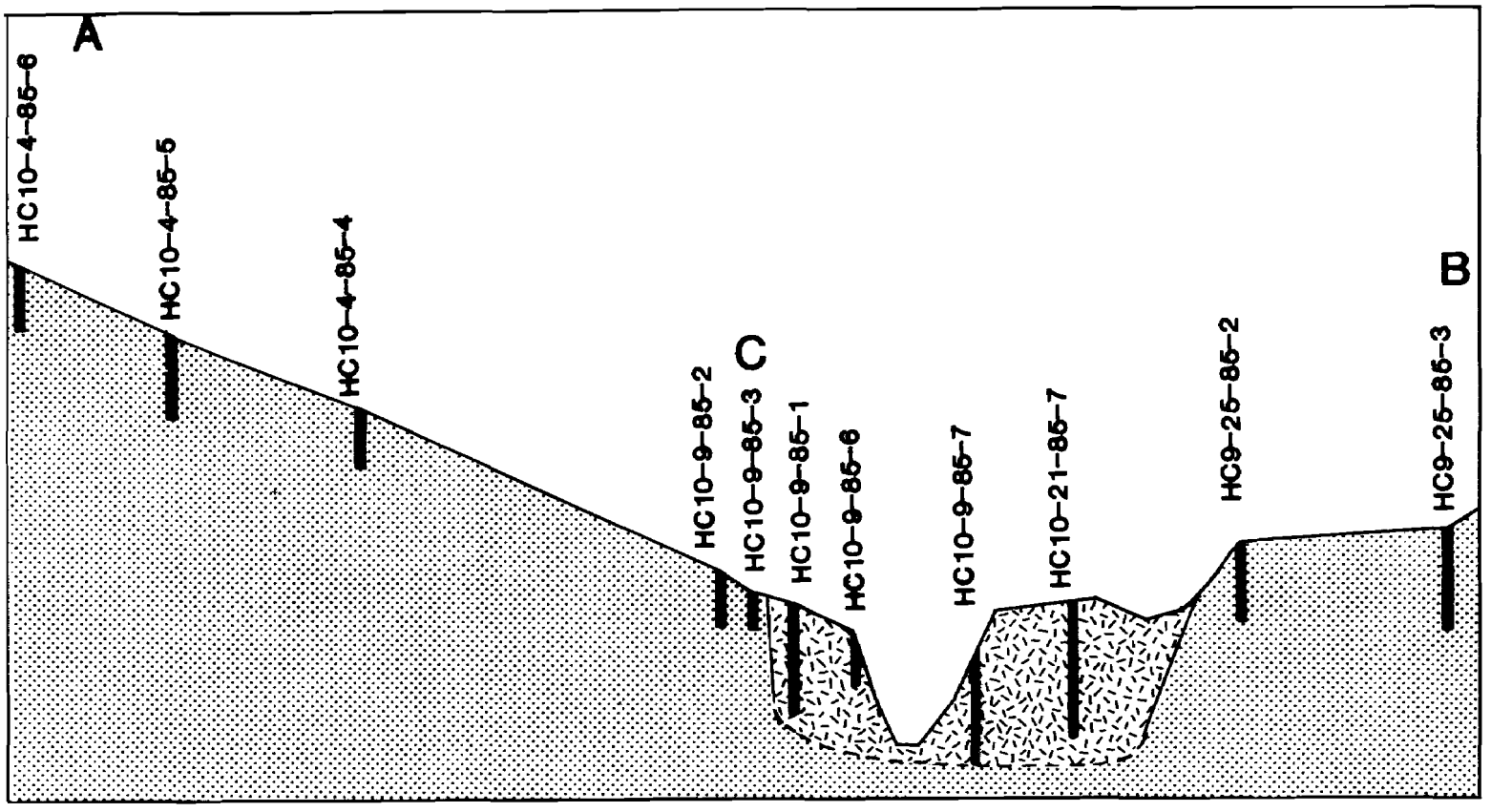
The sands and gravels at the base of the channel migration facies are similar to sediments of the present channel bed. Thus, these are lag deposits associated with the migration of channel bends.

The areal distribution of these three facies is illustrated in Figure 75. The colluvial sediments are found along the valley slopes and on the highest terrace level. The alluvial overbank facies is found close to the stream in the southern part of the study area. It underlies the lowest floodplain surface. The channel migration facies occupies the northern part of the study area, and it also underlies the lowest floodplain surface.

The distribution of these sediments in the subsurface is illustrated in Figure 76. The abrupt contact between the colluvial facies and the channel migration facies on the eastern side of the stream suggests that the channel migrated eastwards into the colluvial sediments, probably creating a high steep bank (Figure 76). The channel then migrated away from the bank, depositing the laminated sands and organic-rich muds presently found underlying this part of the study area.

It is difficult to determine when these events may have occurred. The only clue lies in the intensely orange oxidized crusts deposited on and surrounding the laminated sands of the channel migration facies. This degree of alteration is similar to that found in floodplain sediments of the Brandywine Creek near Chadds Ford, PA (Bolakas, 1984; Pizzuto, in review). The corresponding sediments of the Brandywine floodplain have been dated by carbon-14 at between 2500 and 4000 years B.P. Since the sediments of the Hockessin Valley Site appear to have been

FIGURE 76



Geologic cross-section along A-C-B.

weathered to a similar degree as those of the Brandywine floodplain, the sediments at the Hockessin Valley Site may be generally of equivalent age. This interpretation must be treated with considerable care, as local differences in mineralogy or groundwater flow patterns and chemistry could cause significant differences in weathering rates. Finally, it is important to observe that the age of the channel migration facies could be precisely determined from radiocarbon dating of twigs and leaves from the organic-rich muddy sediments contained within the facies.

The presence at the Hockessin Valley site of flooplain surfaces at several elevations also raises several questions. These different levels could be interpreted to represent some climatic change or tectonic event within the region (Ritter, 1978; Reed, 1981). However, terraces such as these may form without external environmental change if rates of lateral migration and downcutting exceed rates of colluvial sediment supply (Everitt, 1968). Thus, there is no need to posulate a grand event in the history of this region to explain the origin of small terraces such as these.

Conclusion

The sediments of the Hockessin Valley Site 7NC-A-17 may be grouped into three facies, a colluvial facies, an overbank alluvial facies, and a channel migration facies. The colluvial facies is found beneath the highest terrace and slopes of the valley sides. The overbank alluvial facies underlies the lowest floodplain surface in the southern part of the study area while

the channel migration facies underlies the lowest floodplain surface in the northern part of the study area.

The distribution of these facies suggests that the floodplain of the study area has formed by two different mechanisms. In the southern part of the study area, overbank deposition has been the dominant mode of floodplain formation. In the northern part of the study area, lateral accretion has been the dominant mode of floodplain formation.

Laminated sandy sediments of the channel migration facies have been weathered similarly to sediments found beneath the floodplain surface of the Brandywine Creek near Chadds Ford, PA. The sediments of the Brandywine are from 2000 to 4000 years old. Thus, the channel migration facies may be of similar age, perhaps from 1000 to 10,000 years old.

Appendix I - Core Descriptions

Core # HC9-25-85-1

Depth (cm)	Description
0-30	sandy silt, rare quartz pebbles (2 cm diameter), slightly mottled (very small orange mottles), some mica flakes, small black minerals, sand-sized quartz grains, 10% clay; moderate yellowish brown (10 YR 5/4)
30-60	sandy pebbly silt with large (several cm) bright orange mottles (15% clay); dark yellowish orange (10 YR 6/6)
60-90	sandy pebbly silt (10% clay) with abundant bright orange mottles; light brown (5 YR 5/6)

Core # HC9-25-85-2

Depth (cm)	Description
0-30	clayey silt with 15% clay and rare granules, light orange mottles (1 cm or smaller in diameter); greyish orange (10 YR 7/4)
30-60	clayey silt with 20% clay, rare granules and iron concretions, large abundant mottles; light brown (5 YR 5/6)
60-90	clayey pebbly silt with 20% clay, common iron concretions, quartz pebbles and granules of garnet; greyish orange (10 YR 7/4)

Core # HC9-25-85-3

Depth (cm)	Description
0-15	sandy silt with 2% clay, occasiona; granules and pebbles, no mottles; dark yellowish brown (10 YR 4/2)
15-30	clayey pebbly silt with 20% clay, frequent quartz pebbles and cobbles, many mica flakes, heavily mottled (mostly smaller than 1 cm)
30-60	clayey gravelly silt with 25% clay, frequent gold mica flakes, very heavily mottled, frequent granules, rare pebbles and cobbles; moderate yellowish brown (10 YR 5/4)
60-80	clayey sandy silt with 15% clay, frequent granular mica, occasional mottling, a few schist pebbles; moderate brown (10 YR 4/4)

Core # HC9-25-85-4

Depth (cm)	Description
0-15	sandy silt with 2% clay; dark yellowish brown (10 YR 4/2)
15-30	sandy silt with occasional granules, rare mica; dark yellowish brown (10 YR 4/2)
30-60	clayey sandy silt, intensely mottled, frequent coarse sand, schist pebbles, obvious structure of weathered bedrock

Core # HC10-4-85-1

Depth (cm)	Description
0-25	clayey silt, no mottles, 20% clay, rare granules; dark yellowish brown (10 YR 4/2)
>25	clayey sandy silt, some orange mottles and concretions; greyish orange (10 YR 7/4)

Core # HC10-4-85-2

Depth (cm)	Description
0-36	sandy clayey silt with 15% clay, rare granules; dark yellowish brown (10 YR 4/2)
37-73	clayey silt, 20% clay with some sand, occasional dark orange mottles and granules; moderate brown (10 YR 4/4)
73+	clayey silt with 25% clay, intense very small root mottles, abundant mica; dark yellowish brown (10 YR 4/2)

Core # HC10-4-85-3

Depth (cm)	Description
0-7	clayey silt with 20% clay, rare mica; dark yellowish brown (10 YR 4/2)
7-74	sandy silt with 10% clay, occasional granular mica, charcoal (2 mm in diameter) at 65 cm; moderate yellowish brown (10 YR 5/4)
74-100	clayey sandy silt with occasional granules, small orange mottles; grayish orange (10 YR 5/4) - moderate yellowish brown (10 YR 7/4)

Core # HC10-4-85-4

Depth (cm)	Description
0-20	sandy clayey silt with 15% clay; dark yellowish brown (10 YR 4/2)
20-60	sandy clayey silt with 10% clay, rare granules (quartz), dark orange mottles; dark yellowish orange (10 YR 6/6)

Core # HC10-4-85-5

Depth (cm)	Description
0-8	clayey silt with 10% clay; dark yellowish brown (10 YR 4/2)
8-40	sandy clayey silt with 10% clay; dark yellowish brown (10 YR 4/2) - moderate brown (5 YR 3/4)
40-81	sandy clayey silt with 20% clay, orange mottles, occasional granules; moderate yellowish brown (10 YR 5/4)

Core # HC10-4-85-6

Depth (cm)	Description
0-10	clayey silt with 20% clay; yellowish brown (10 YR 4/2)
10-31	sandy clayey silt with 10% clay, some coarse sand; moderate brown (5 YR 3/4)
31-62	clayey sandy silt with granules, small dark orange mottles; moderate yellowish brown (10 YR 5/4)

Core # HC10-4-85-7

Depth (cm)	Description
0-33	sandy clayey silt with 25% clay, rare granules, some mica and coarse sand; moderate brown (5 YR 4/4)
33-100	clayey silty sand (very fine-grained), very high amount of mica (20%?), some weak horizontal laminae
100-146	saprolite

Core # HC10-9-85-1

Depth (cm)	Description
0-8	clayey silt with 15% clay, mica flakes; moderate brown (5 YR 4/4)
8-29	sandy clayey silt with 15% clay, weakly mottled, abundant black mica, very rare granules; moderate brown (4 YR 4/4)
29-64	silty fine and medium grained sand, abundant black mica, rare pods of clayey sandy silt, some coarse sand; moderate yellowish brown (10 YR 5/4)
64-67	finely laminated brown clayey silt and orange micaceous sand

Core # HC10-9-85-2

Depth (cm)	Description
0-24	clayey silt with 10% clay, slightly mottled, some black mica; moderate yellowish brown (10 YR 5/4)
24-52	silty clay, 40% clay, rare coarse sand, mottled; dark yellowish orange (10 YR 6/6) - moderate yellowish brown (10 YR 5/4)

Core # HC10-9-85-3

Depth (cm)	Description
0-25	clayey silt with 15% clay, abundant mica; moderate yellowish brown (10 YR 5/4) - dark yellowish brown (10 YR 4/2)
25-52	clayey silt and silty clay, some lenses of sandy silt, mottles, rare iron concretions; moderate yellowish brown (10 YR 5/4)

Core # HC10-9-85-4

Depth (cm)	Description
0-20	clayey sandy silt with 10% clay; dark yellowish brown (10 YR 4/2)
20-43	clayey sand silt with 15% clay; moderate yellowish brown (10 YR 5/4) - dark yellowish brown (10 YR 4/2)
43-79	clayey sandy silt with 15% clay, occasional granules and coarse sand, mottled, abundant mica, rare iron concretions; moderate yellowish brown (10 YR 5/4)

Core # HC10-9-85-5

Depth (cm)	Description
0-8	clayey silt with 10% clay; dark yellowish brown (10 YR 4/2)
8-43	clayey silt with 15% clay, occasional localized very fine mottles, large biotite flakes; moderate yellowish brown (10 YR 5/4) - dark yellowish brown (10 YR 4/2)
43-55	silty fine sand, abundant biotite, rare granules, local "pods" of sandy silt; moderate brown (5 YR 3/4)

Core # HC10-9-85-6

Depth (cm)	Description
0-8	clayey silt with 10% clay; dark yellowish brown (10 YR 4/2)
8-43	sandy clayey silt with 15% clay; dark yellowish brown (10 YR 4/2)
43-49	silty fine sand, weakly laminated; moderate brown (5 YR 4/4)

Core # HC10-9-85-7

Depth (cm)	Description
0-55	sandy clayey silt
55-115	silty sand, lenses of clayey silt coarsening towards bases, at base unit is very coarse sand and granular; weathered orange color
115-125	silty clay with abundant leaf and root fragment; olive black (5 YR 2/1)
125-155	coarsens downward into sand, bottoms on coarse sand and gravel

Core # HC10-9-85-8

Depth (cm)	Description
0-17	clayey silt with 10% clay, weakly mottled; dark yellowish brown (10 YR 4/2)
17-87	clayey silt with 20% clay, weakly mottled; dark yellowish brown (10 YR 4/2)
87-92	medium - coarse grained oxidized sand

Core # HC10-9-85-9

Depth (cm)	Description
0-8	clayey silt with 10% clay; dark yellowish brown (10 YR 4/2)
8-34	clayey silt with 15% clay; moderate yellowish brown (10 YR 5/4)
34-82	sandy clayey silt with rare granules, weakly mottled; moderate yellowish brown (10 YR 5/4)

Core # HC10-21-85-1

Depth (cm)	Description
0-60	yellowish brown silt
60-140	oxidized fine-grained micaceous sand
140-190	dark grey gravelly sandy mud with twigs, leaves
>190	gravel

Core # HC10-21-85-2

Depth (cm)	Description
0-70	yellowish silt
70-100	oxidized fine sand, micaceous
100-170	orange brown mottled gravelly mud, mostly cobbles

Core # HC10-21-85-3

Depth (cm)	Description
0-30	moderate brown clayey silt
30-120	clayey sandy silt, mottled, gravel at bottom

Core # HC10-21-85-4

Depth (cm)	Description
0-90	clayey sandy silt, moderate brown (10 YR 4/4)
90-120	sandy silt with gravel (boulders) at bottom, mottled; dark yellowish brown (10 YR 5/4)

Core # HC10-21-85-5

Depth (cm)	Description
0-70	moderate brown (10 YR 4/4)
70-150	sandy silt, highly mottled

Core # HC10-21-85-6

Depth (cm)	Description
0-30	sandy clayey silt; moderate yellowish brown (10 YR 5/4) - dark yellowish brown (10 YR 4/2)
30-61	sandy clayey silt, a few small mottles; moderate yellowish brown (10 YR 5/4) - dark yellowish brown (10 YR 4/2)
61-91	sandy clayey silt, mottled, small pieces of charcoal; dark yellowish brown (10 YR 4/2)
91-122	sandy silt - silty sand, rootlets; dusky brown (5 YR 2/2)
122-152	sandy silt, grading down to muddy gravel and coarse sand; dusky yellowish brown (10 YR 2/2)
>152	gravel

Core # HC10-21-85-7

Depth (cm)	Description
0-31	sandy silt, micaceous; moderate yellowish brown (10 YR 4/2) - dark yellowish brown (10 YR 5/4)
31-61	sandy silt, weakly mottled, one granule of charcoal
61-76	clayey sandy silt; dark yellowish brown (10 YR 4/2)
76-91	laminated, silty fine-grained sand and coarse grained sand
91-122	oxidized coarse-grained sand
122-152	intensely mottled sandy silt, some muddy gravel at bottom; moderate yellowish brown (10 YR 5/4), the gravel is olive gray (10 YR 6/1)