APPENDIX VI

RESULTS OF ANALYSIS OF POLLEN AND SOIL SAMPLES FROM BAY/BASIN FEATURES

POLLEN ANALYSES FROM BROWN UNIVERSITY

Initial Pollen Scan Results
Basin A and Basin B

Report on pollen analysis of the samples sent by Jay Custer (10 samples from Delaware and 1 from Pennsylvania).

1. Pollen extraction procedure (Paige Newby)
   a. constant volume (2.5 cc) samples taken
   b. 4 tablets of Lycopodium tracers added to each sample (12,000 grains each= 48,000 tracers per sample)
   c. HCl (10%) used to remove carbonates
   d. HF (48%) used to remove silicates (used both "overnight stand" and 30 minute hot HF treatments)
   e. Acetylation procedure employed to remove cellulose
   f. KOH (5%) used to remove organic materials
   g. for the Delaware samples a second HF was necessary to remove remaining silicates
   h. for the Pennsylvania sample more than 30 water washes were required to remove organic residues following KOH
   i. samples washed with TBA to remove water and residues mounted in silicone oil (1000 cs.)

2. Pollen slide scanning (Bob Thompson)
   a. sample residues mounted on microslides and coverslip placed on top
   b. non-overlapping traverses made (at 40X) until at least 20 Lycopodium tracers counted
   c. talleys made of identifiable and unidentifiable pollen.
   d. results presented in tabular form (see attached sheet)

3. Plant macrofossil analysis (Paige Newby and Bob Thompson)
   a. sediment samples disaggregated with Trisodium Phosphate
   b. organic remains in samples "floated" to segregate them from inorganic fraction of samples
   c. organic residues split into different size ranges with nested soil sieves
   d. organic remains dried and examined under 10X magnification

4. Results and Assessment (Bob Thompson)

With the exception of a few rootlets which may be contaminants, no plant macrofossils were recovered from these samples. The sample from Pennsylvania was also devoid of pollen.

The surface samples from the Delaware localities contained abundant pollen, as did the samples from 161 cm below the surface and lower (see table 1). Pine pollen grains were in the majority in the lowermost sample, suggesting that this horizon represents a time in which vegetation was very different from that of today. While it would not be possible to construct a complete Holocene diagram from the samples submitted, it seems that if a site could be found nearby with more permanent and/or deeper water, it should be possible to get a long continuous sequence. Alternatively, the lower materials could be analyzed to provide information on the vegetation and climate of the period of their deposition.

Table 1. The pollen content of the subsurface samples from Delaware. The pollen concentration is in grains/cc.

Horizon	Depth (cm)	Pollen concentration	Percent unidentifiable pollen	Percent *Pinus* pollen
2	38	33,000	76	0
3	56	0	-	-
4	70	0	-	-
4	92	0	-	-
4	112	2,900	33	67
4	141	0	-	-
4	161	11,500	38	38
4	176	11,300	11	89

Initial Field Record from Coring from Basin B

Pollen Laboratory - Brown University

Core Report

Walter's Puddle (Basin B)
Townsend, Delaware 39 24'N 75 41'30"
Dates: 6/4 - Rain: Moderate to Downpour
6/5 Warm and Sunny

Crew: R. Thompson, B. Scharf, R.Webb, P. Newby

Coring Site: 27m diameter basin (of unknown origin); coring done in approx. center. Water depth approx. 1m.

Coring Summary: 4.04m of Holocene and late-glacial (?) sediment. Two cores (A and B) were taken. In both cases clay content in sediment made the process difficult. Core A was abandoned due to extrusion difficulties and rain. An additional surface sample was taken-23.5cm recovery.

Core logs:

Core A: 0 - 90 cm (45cm recovered)

90 - 151 cm (59 cm recovered)

Core B:

Section 1 0 - 40 cm (30cm recovered)
Sandy silt. Visible leaf mold; possible macros.

Section 2 40 - 1.40 (97cm recovered)
Clayey silt. Clean extrusion in the field.

Section 3 1.40 - 233.5 (93.5cm drive, 78cm recovery)
Silty clay. Some exterior discoloration.

Section 4 233.5 - 3.06 (73cm drive, 66cm recovery)
Fine sand/silty clay. Charcoal flecks in lower 10cm of section.

Section 5 3.06 - 3.84 (78cm drive, 79cm recovery)
Silt,sand,clay lenses. Laminae (?) in lower 20 - 25cm of section. Some mottled discoloration also visible.

Section 6 3.84 - 4.04 (20cm drive and recovery)
Clayey silt. Very "blue" appearance in field. Rejection at 20 cm.

Paige Newby

June 25. 1985

Preliminary Report on Pollen and Sediments, Basin B

Preliminary Report: Walter's Puddle, Delaware

Field Operations

At the request of Jay F. Custer, sediment cores for palynological analyses were collected in June, 1985 at a bay/basin feature near Townsend, Delaware as part of the archaeological survey of the Route 13 Corridor in northern Delaware. Previous work done at Brown University indicated the presence of pollen in samples processed from sediments excavated from two selected basins in this area.

Two cores were taken from Basin B (Walter's Puddle); an oval basin approximately 27 meters in diameter. This basin was selected for study at the suggestion of the archaeologists because it contains a permanent pond (85cm water depth at date of coring) and is in proximity to archaeological sites.

The cores were taken with a Livingstone piston corer (2" internal diameter). The individual one-meter-length segments were extruded and wrapped in layers of plastic and aluminum foil, and then placed in aluminum "flashing" and secured with tape. Labels indicating top, bottom and depth were placed in each segment (see Core Report for detailed core information). In addition, botanical samples were taken of the modern vegetation surrounding the pond.

Laboratory Processing

In the laboratory, the core segments were re-measured and photographed. The textures and Munsell colors were described from each sedimentary unit and the cores were examined for evidence of disconformities (see enclosed sediment description and photographs of the lower portion (52 - 79cm) of Section 5). Composite 1 cc samples were taken for pollen and weight loss on

ignition analyses at selected intervals in the core based upon the observed sediment stratigraphy (Table 1).

The processing of the samples for pollen analysis followed the usual procedures for the removal of unwanted organic materials (KOH), carbonates (HCl), and silicates (HF) (Faegri and Iversen, 1975). The samples also were screened to remove large "sand" grains, and treated with sodium pyrophosphate to remove clay size particles (Bates, Coxon and Gibbard, 1978). A series of slides were made at different stages during the processing to monitor the progress of the samples. A known quantity of *Lycopodium* spores (an exotic type) was added to each sample during processing to allow calculation of pollen concentration.

A weight loss technique (Dean, 1974) was used to obtain information on the organic carbon content of the sediments. This technique involves the weighing of the residual material after burning the sample at 550 degrees C, and comparing this weight to the original dry weight of the sample. The percentage of the sample weight lost after ignition is an estimate of the relative organic carbon content of the sample.

Preliminary Results

The preliminary results of the pollen and weight loss analyses are presented in Figure 1. With the exception of intervals in Section 5, the sediment stratigraphy from the core does not indicate any changes with depth. The core is predominantly sand, silt and clay with gradational textural and color boundaries. The sediment grades from a loose, flocculent consistency from 0 - 13cm to a slightly hard, plastic consistency to the bottom of the core. The only abrupt sedimentary changes are in Section 5 (306cm - 384cm) which contains an incoherent, poorly sorted sand lens between 337 - 346cm, a 4cm mottled sandy clay interval from 350cm to 354cm (photograph 1), and rhythmites from 358cm to 374cm (photograph 2). The rhythmites (approx. 1mm wide) have

irregular textures and are defined by different colors. There are also a few small, fine sand lenses in this section.

Gradual changes in texture, color and composition do not suggest any dramatic changes in the depositional regime, although the rhythmites in Section 5 may reflect some short term fluctuations. However, the darker color of the sediments from the surface to 65cm correspond to more organic content in the upper than in the lower portions of the core, probably the result of leaf litter, terrestrial organics and detrital material from in and around the basin. Weight loss analyses indicate a similar change in organic composition with a reduction in % organic carbon from 23.3% to 6.16% between 58.5cm - 6.16cm. Fungal hyphae, perhaps associated with a sub-aereal environment, were observed in the lower sediments, suggesting dry intervals for at least a portion of the basin's history. Terrestrial pollen concentration calculations indicate a substantial decrease from the top (greater than 2 million grains/cc at 58.5cm0) to the bottom (less than 10 thousand grains/cc at 69.5cm) of the core. The quality of the preservation of the pollen follows the same pattern: less than 20% of the grains counted in each of samples 1 - 3 (0 - 69.5cm) were "indeterminates" compared to greater than 50% "indeterminates" in sample 10 (339.5cm). All of this information suggests that the sediments below approx. 65cm may have undergone oxidation during intermittent (seasonal?) dry periods at the basin.

Preliminary pollen counts indicate a negative correlation between *Pinus* and *Quercus*. At 20.5cm, the organic horizon is predominantly *Quercus* species (51%) with *Pinus*, *Liquidambar*, *Carya* and other trees shrubs, herbs and aquatics. Between 58.5cm and 69.5cm, *Pinus* rises steeply to 60%, *Quercus* decreases to 3% and all other types are either degraded or entirely absent. The presence of *Typha* and *Cephalanthus* in the upper and not the lower portion of the core may be the result of differential preservation or the lack of water required for these species.

Discussion

Two hypotheses are proposed from the analyses thus far. The change from *Pinus* to *Quercus* dominance in the pollen spectra may correlate with an early Holocene transition observed at other sites in the Middle Atlantic region (Watts, 1979). This would place the early Holocene horizon at Walter's Puddle between 58.5cm and 69.5cm, with the lower sediments being of either early Holocene or late Pleistocene. The second hypothesis is that the *Pinus* to *Quercus* transition reflects the differential destruction of pollen below 60cm from oxidation and/or other diagenic processes. The stratigraphy from Szabo Pond, N.J. has a similar phenomenon: pollen spectra from the upper section of organic mud were dominated by *Quercus* (70%) while the lower sediments were oxidized and contained poorly preserved pollen (Watts, 1979). This transition post dates 11,950 yrs. BP (Watts, 1979). In any case, it appears that the data from Walter's Puddle provide information on the water levels of this basin and/or changes in the terrestrial vegetation in this area. Additional pollen samples and analyses will increase the resolution of the diagram with more details on aquatics and other taxa and on the transition from *Pinus* to *Quercus* dominance. The presence of *Ambrosia* in the Oswego River, N.J. and Helmetta, N.J. profiles are suggested as related to pre-European forest clearance (Watts, 1979). Closer examination of the upper sediments and the disturbance types profile from Walter's Puddle may provide similar disturbance evidence and/or the historic *Ambrosia* rise. Finally, the radiocarbon dating of the sediment should provide absolute dates necessary to develop a chronostratigraphy for the core and permit comparisons with other Holocene pollen diagrams.

References Cited

Bates, C.D., P. Coxon and P.L. Gibbard (1978). A new method for the preparation of clay-rich clay-rich sediment samples for palynological investigation. *New Phytologist* 81, 459-463.

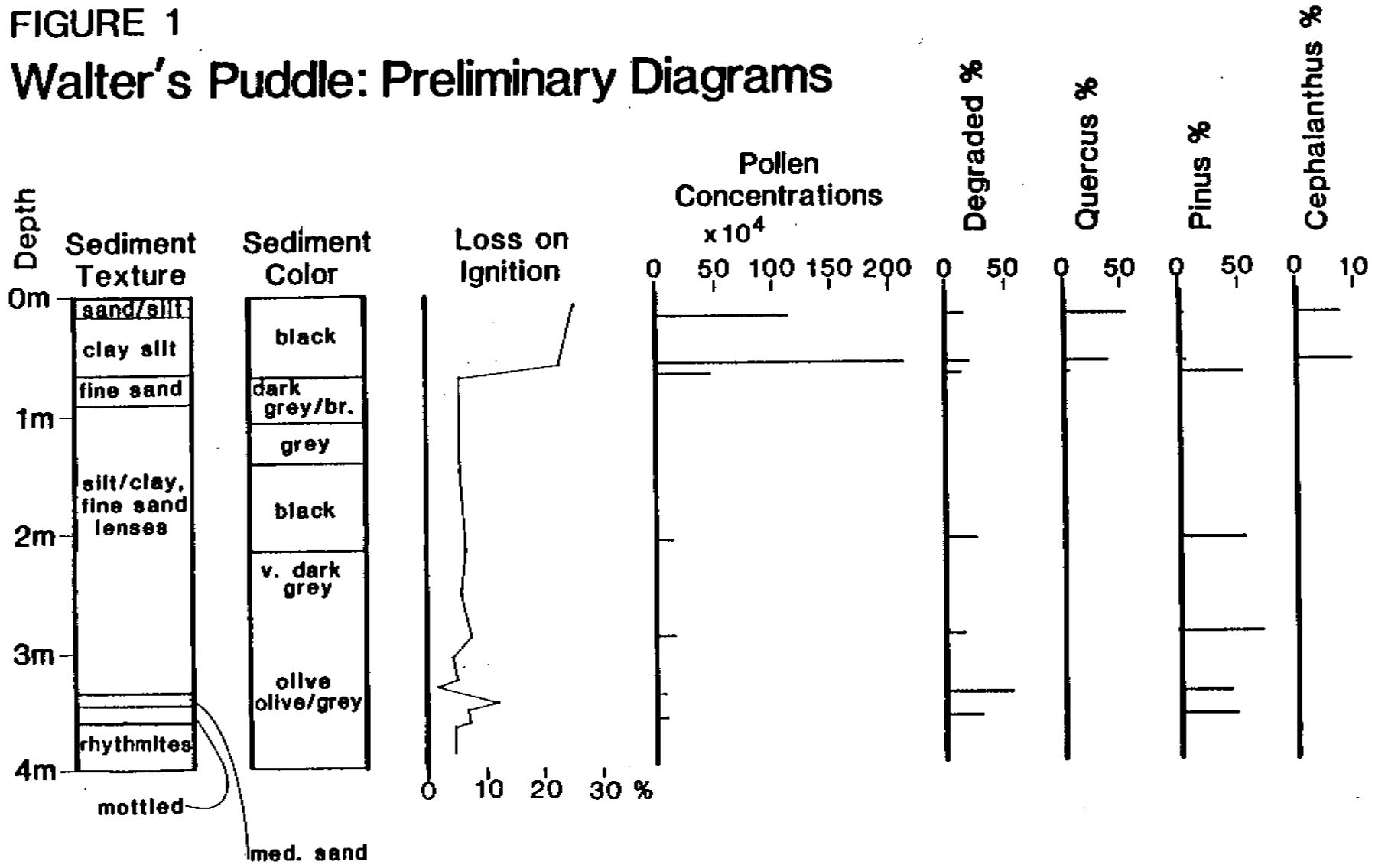
Dean, W.E.,Jr. (1974). Determination of carbonate and organic matter in calcareous sediments and sedimentary rocks by loss on ignition: comparison with other methods. *Journal of Sedimentary Petrology* 44, 242-248.

Faegri, K. and J. Iversen (1975). *Textbook of Pollen Analysis* Hafner Press, New York.

Watts, W.A. (1979). Late Quaternary vegetation of central Appalachia and the New Jersey coastal plain. *Ecological Monographs* 49(4), 427-469.

FIGURE 1

Walter's Puddle: Preliminary Diagrams



Pollen Laboratory -- Brown University
Table 1 -- Sampling Description
Walter's Puddle (Basin B) -- Core B
Townsend, Delaware 39 24'N 75 41'30"W

Sample Number	Section of core	Location of Sample: cm below top of Section	Depth Below Sediment Water Interface	Type of Samples	Processing Status*
#1	1	20-21 cm	20.5 cm	pollen & LOI	A
#2	2	18-19 cm	58.5 cm	pollen & LOI	A
#3	2	29-30 cm	69.5 cm	pollen & LOI	A
#4	3	10-11 cm	150.5 cm	pollen & LOI	B
#5	3	72-73 cm	212.5 cm	pollen & LOI	A
#6	4	20-21 cm	254.0 cm	pollen & LOI	B
#7	4	56-57 cm	290.0 cm	pollen & LOI	A
#8	5	10-11 cm	316.5 cm	pollen & LOI	B
#9	5	26-27 cm	332.5 cm	pollen & LOI	B
#10	5	33-34 cm	339.5 cm	pollen & LOI	A
#11	5	41-42 cm	347.5 cm	pollen & LOI	B
#12	5	45-46 cm	351.5 cm	pollen & LOI	B
#13	5	51-52 cm	357.5 cm	pollen & LOI	A
#14	5	60-61 cm	366.5 cm	pollen & LOI	B
#15	5	71-72 cm	377.5 cm	pollen & LOI	C
#16	5	10-11 cm	394.5 cm	pollen & LOI	C

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* A -- LOI (*Loss on Ignition*) analysis completed. Pollen sample processed and preliminary counts available.
B-- LOI analysis completed. Pollen sample processed but not counted.
C -- LOI analysis completed. Pollen sample taken but not processed.

Pollen Laboratory – Brown University
Sediment Description

Walter's Puddle (Basin B)
Townsend, Delaware 39 24'N 75 41'30"W

Core B
Section 1 – 0-40 cm (30 cm recovered)

00.0-13.0 cm*	
0.00-13.0 cm*	7.5 YR 2/0 Black (moist Munsell color of core rind). Sandy silt, loose and friable. Contains possible macrofossils and leaf mold. The boundary at 13 cm coincides with a break in the sediment core. Exterior (core rind) has leaf fragments adhering to it.
13.0-30.0 cm	
13.0-30.0 cm	10 YR 2/1 Dark black-brown (moist Munsell color of core rind). Slightly clayey silt. Ranges from loose and friable to plastic.

Section 2 – 40-140 cm (97 cm recovered).

0.00-13.0 cm	
40.0-53.0 cm	10 YR 2/1 Black (moist Munsell color of core rind). Slightly clayey silt, slightly sticky, non-plastic. 7-9 cm small fracture.
13.0-23.0 cm	
53.0-63.0 cm	5 Y 2.5/2 Black (Munsell color of moist core rind). Clayey silt, slightly sticky, non-plastic.
23.0-50.0 cm	
63.0-90.0 cm	12.5 Y 3/2 Very dark greyish brown (moist Munsell). Silty fine sand.
50.0-66.0 cm	
20.0-106.0 cm	2.5 Y 3/2 Very dark greyish brown (moist Munsell). Clayey silt, plastic.
66.0-97.0 cm	
106.0-137.0 cm	5 YR 3/1 Very dark grey (Munsell of moist core rind) Silty clay, very plastic.

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* Depth below the top of the section.
** Depth below sediment-water interface.

Section 3 -- 140-233.5 cm (recovery 78 cm)

00.0-78.0 cm
140.0-218.0 cm 5 Y 2.5/2 Black (moist core rind Munsell color). Grades from silty clay (at the top) to slightly silty clay (near 54 cm) plastic, slightly sticky. Extrusion breaks at 54 and 65 cm. Discoloration (darkening) of the exterior of the sediment core, probably due to oxidation.

Section 4 -- 233.5-306 cm (66 cm recovery).

0.00-66.0 cm
233.5-299.5 cm 5 Y 3/1 very dark grey to 5 Y 3/2 dark olive grey. Color grades from very dark grey (top i.e. 0 cm) to dark olive grey (at the bottom). Very fine sandy or possibly silty clay -- very plastic. Possible charcoal flecks in the last 10 cm (56-66 cm) of the sediment core. Extrusion breaks at 37 and 51 cm.

Section 5 -- 306-384 cm (79 cm recovery).

00.0-10.0 cm
306.0-316.0 cm 5 Y 3/2 Dark olive grey. Silt. Extrusion break at 5 cm.

10.0-15.0 cm
316.0-321.0 cm 5 Y 3/2 Dark olive grey silty sand.

15.0-17.0 cm
321.0-323.0 cm 5 Y 3/2 Dark olive grey silt

17.0-21.0 cm
323.0-327.0 cm 5 Y 3/2 Dark olive grey. Silty sand. Break in the sediment at 21 cm.

21.0-25.0 cm
327.0-331.0 cm 5 Y 3/2 Dark olive grey silt.

25.0-27.0 cm
331.0-333.0 cm 5 Y 3/2 Dark olive grey. Silty sand.

27.0-31.0 cm
333.0-337.0 cm 5 Y 3/2 Dark olive grey. Silt. Break in the sediment at 30 cm.

31.0-40.0 cm
337.0-346.0 cm 5 Y 3/1 Very dark grey medium. Sand. Break in the sediment at 37 cm.

40.0-42.0 cm
346.0-348.0 cm 5 Y 4.2 Olive grey silt.

42.0-44.0 cm
348.0-350.0 cm 5 Y 5/3 Olive clay (mottled with some black flecks)

44.0-50.0 cm
350.0-356.0 cm 5 Y 5/3 Olive sandy clay.
Extrusion break at 49 cm.

50.0-53.5 cm
356.0-359.5 cm 5 Y 4/2 Olive grey silty clay.
At 52 cm, rhythmites begin. Rhythmites, which extend from 52 cm to 68 cm, are an average of 1 mm wide of irregularly alternating lighter/darker colors and irregularly alternating lithographies.

53.5-54.5 cm
359.5-360.5 cm 5 Y 4/2 Olive grey sandy lens.

54.5-58.0 cm
360.5-364.0 cm 5 Y 4/2 Olive grey.
Clayey silt with a small amount of sand.

58.0-60.0 cm
364.0-366.0 cm 5 Y 4/2 Olive grey fine sand.
Extrusion break at 59 cm.

60.0-75.0 cm
366.0-381.0 cm 5 Y 4/2 Olive grey clayey silt.
Extrusion break at 70 cm. At 68 cm the rhythmites end.

75.0-79.0 cm
381.0-385.0 cm 5 Y 4/3 Olive with mottles sandy clay.

Section 6 – 384-404 cm (20 cm recovery)

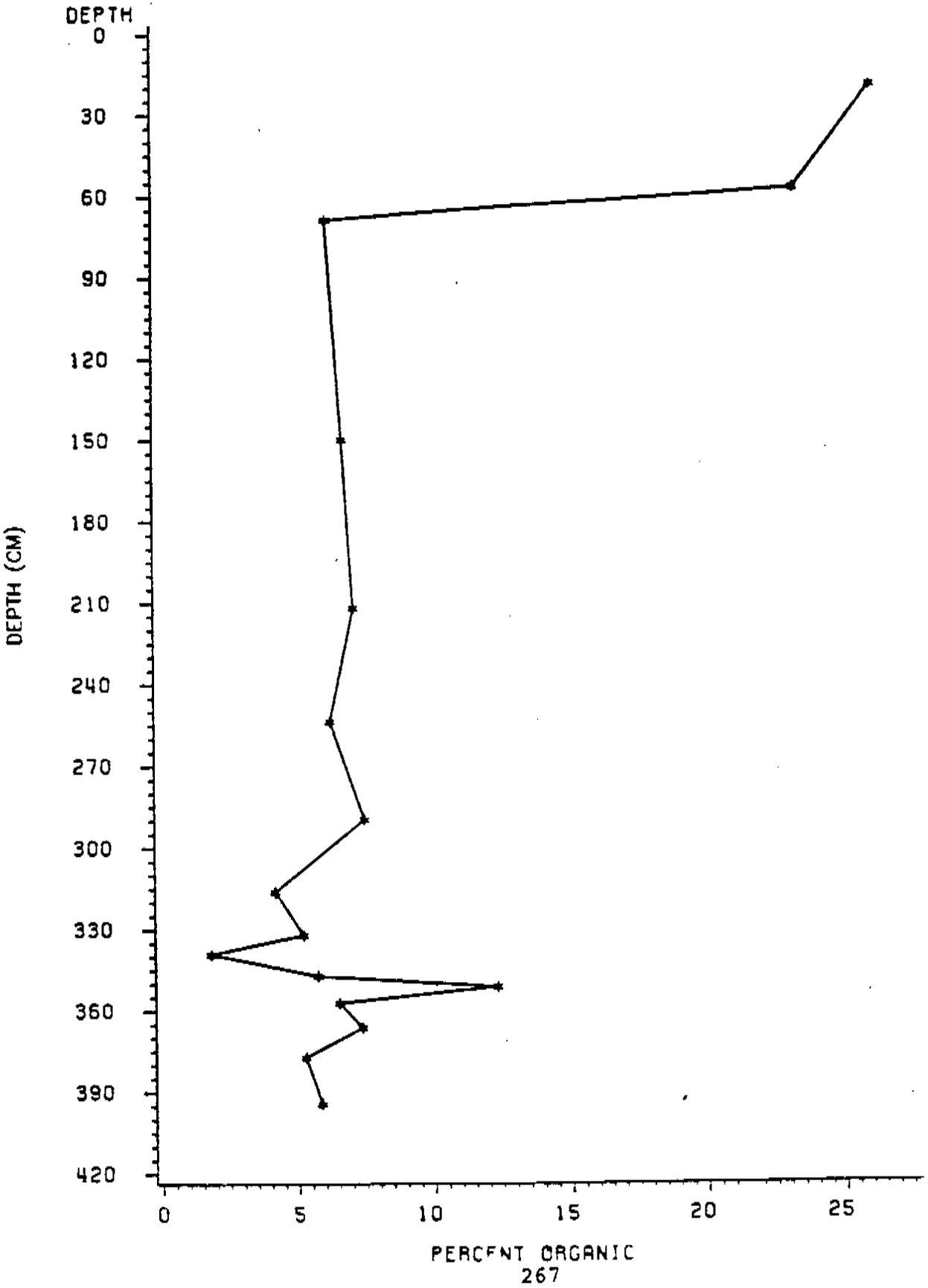
0.00-10.0 cm
384.0-394.0 cm 5 B 5/1 (bluish grey) to 5 B 4/1 (Dark bluish grey) interior (unoxidized) sediment. Core rind 5 Y 5/3 Olive clayey silt.

10.0-11.0 cm
394.0-395.0 cm 2.5 Y 3/0 Very Dark Grey clayey silt, plastic.

11.0-20.0 cm
395.0-404.0 cm 5 Y 5/2 Olive grey silt.

LOSS ON IGNITION

WALTERS PUDDLE



WALTERS PUDDLE: LOSS ON IGNITION, DRY WEIGHT, AND WET WEIGHT DATA

Sample Number	Depth Below Sed-Water Interface (cm)	Wet Weight (gm)	Dry Weight (gm)	Ignited Weight (gm)	Percent Water Content	Percent Organic Matter
1	20.5	.	0.4472	0.3301	.	26.19
2	58.5	.	0.5777	0.4431	.	23.30
3	69.5	.	0.4544	0.4264	.	6.16
4	150.5	.	0.9721	0.9067	.	6.73
5	212.5	.	1.0539	0.9792	.	7.09
6	254.0	.	0.6841	0.6415	.	6.23
7	290.0	.	0.9459	0.8751	.	7.48
8	316.5	.	0.9817	0.9409	.	4.16
9	332.5	.	1.1858	1.1240	.	5.21
10	339.5	.	1.5346	1.5068	.	1.81
11	347.5	.	1.6897	1.5929	.	5.73
12	351.5	.	1.2022	1.0542	.	12.31
13	357.5	.	1.0639	0.9947	.	6.50
14	366.5	.	1.1070	1.0256	.	7.35
15	377.5	.	1.1560	1.0952	.	5.26
16	394.5	.	1.2091	1.1385	.	5.84

Interim Pollen Identifications
Basin B

BROWN UNIVERSITY *Providence, Rhode Island • 02912 - 1846*

DEPARTMENT OF GEOLOGICAL SCIENCES
401-863-3128

October 21, 1985

Dr. Jay Custer
College of Arts and Sciences
University of Delaware
Department of Anthropology
Newark, Delaware 19716

Dear Jay:

Enclosed is an up-date of our pollen work at Walter's Puddle. We were able to improve on the differentiation of conifer grains and found a fair number of spruce (Picea) grains from 60 cm down. We seem to have Pleistocene material below 60 cm and Holocene material above it. An hiatus may exist somewhere between 60 and 90 cm. We have submitted material for C-14 dates at 50 cm and at 100 cm. Those dates will help us tie down our interpretations. Please regard all interpretations with caution. The counts are preliminary and indicate much potential for further work. Paige Newby has done a neat job in completing this work. I can see a publication emerging from this work.

Yours sincerely,

Tom

Thompson Webb III

TW/map
enclosures

Pollen Laboratory -- Brown University
Sampling Description -- Walter's Puddle, Delaware

Sample Number	Section of core	Location of Sample: cm below top of Section	Depth Below Sediment Water Interface	Type of Samples	Processing Status*
#2	poly.	10-11cm	10-11cm	pollen	D
#1	1	20-21 cm	20.5 cm	pollen & LOI	A
#3	1	29-30cm	29-30cm	pollen	D
#4	2	1-2cm	41-42cm	pollen	D
#2	2	18-19 cm	58.5 cm	pollen & LOI	A
#5	2	23-24cm	63-64cm	pollen	D
#3	2	29-30 cm	69.5 cm	pollen & LOI	A
#6	2	82-83cm	122-123cm	pollen	D
#4	3	10-11 cm	150.5 cm	pollen & LOI	A
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Preliminary Pollen Zones

Zone	Zone Name	Depth
WP-1	*Quercus* *Cephalanthus*	0 - 60 cm
WP-2	*Pinus-Picea* *Cyperaceae* *Betula*	60 - 300 cm
WP-3	*Pinus-Quercus* *Cyperaceae*	300 - 400 cm

Notes on Interpretation

Walter's Puddle - 1

The lowest zone (WP-1) may represent a time before the last full glacial period at 18,000 BP.

Walter's Puddle - 2

The middle zone (WP-2) may represent glacial to late-glacial times about 15,000 to 12,000 yrs. BP.

Walter's Puddle - 3

The upper zone (WP-3) represents deposition during the Holocene, perhaps only the late Holocene. No clear *Ambrosia* rise is evident at 10 cm. We have not analyzed any sediments above 10 cm from Core B. In the preliminary diagram the 0 - 2 cm pollen spectra is from a Walter's Puddle Basin B sample processed during the initial phase of the project.
A hiatus may exist between zones WP-2 and WP-3 and may be marked in the sediments by the section of fine sands from 63 to 90 cm. Sediments at 50 to 60 cm and 90 to 137 cm have been submitted for radiocarbon dating.

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Zone	Zone Name	Depth
WP-1	*Quercus* *Cephalanthus*	0 - 60 cm
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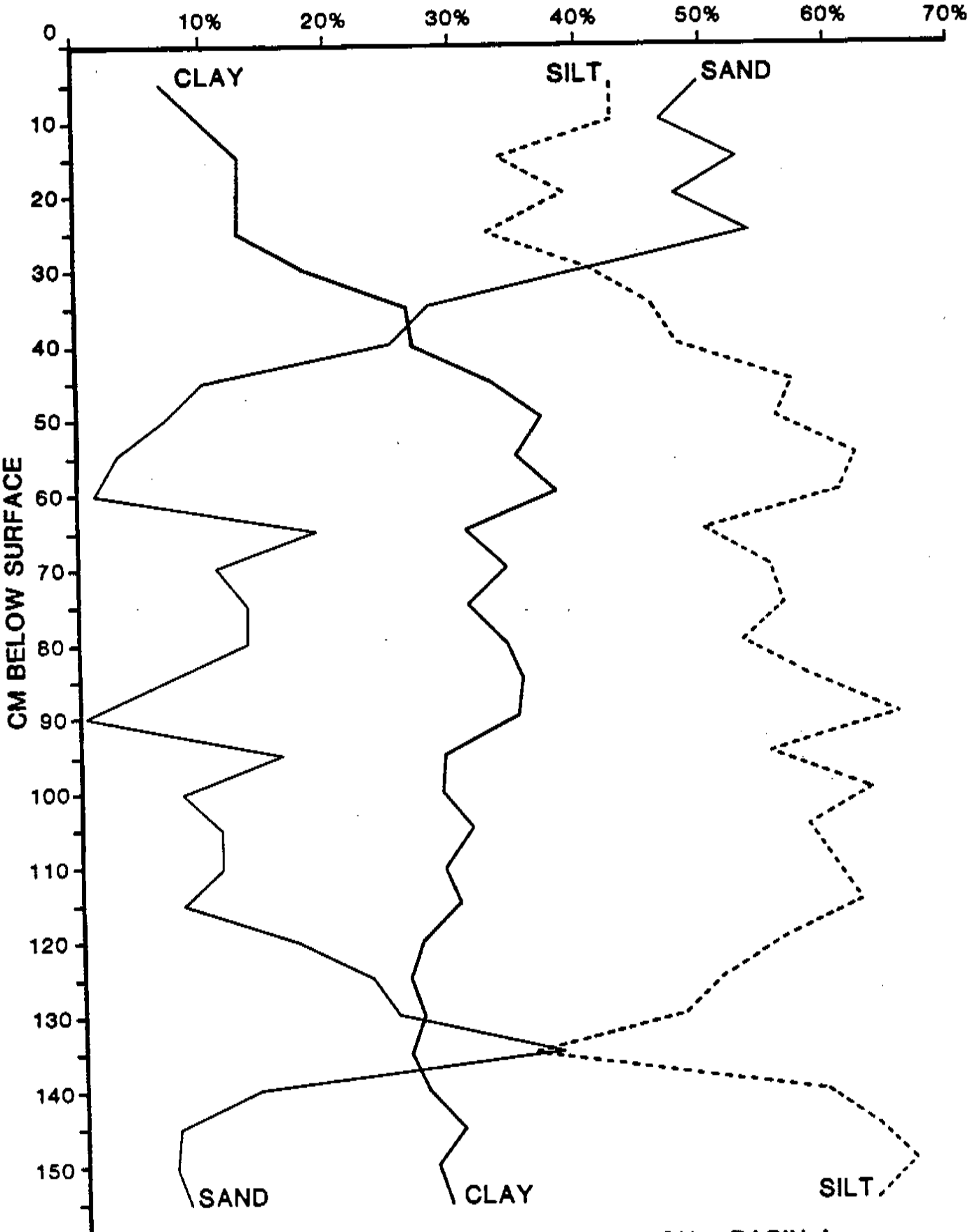
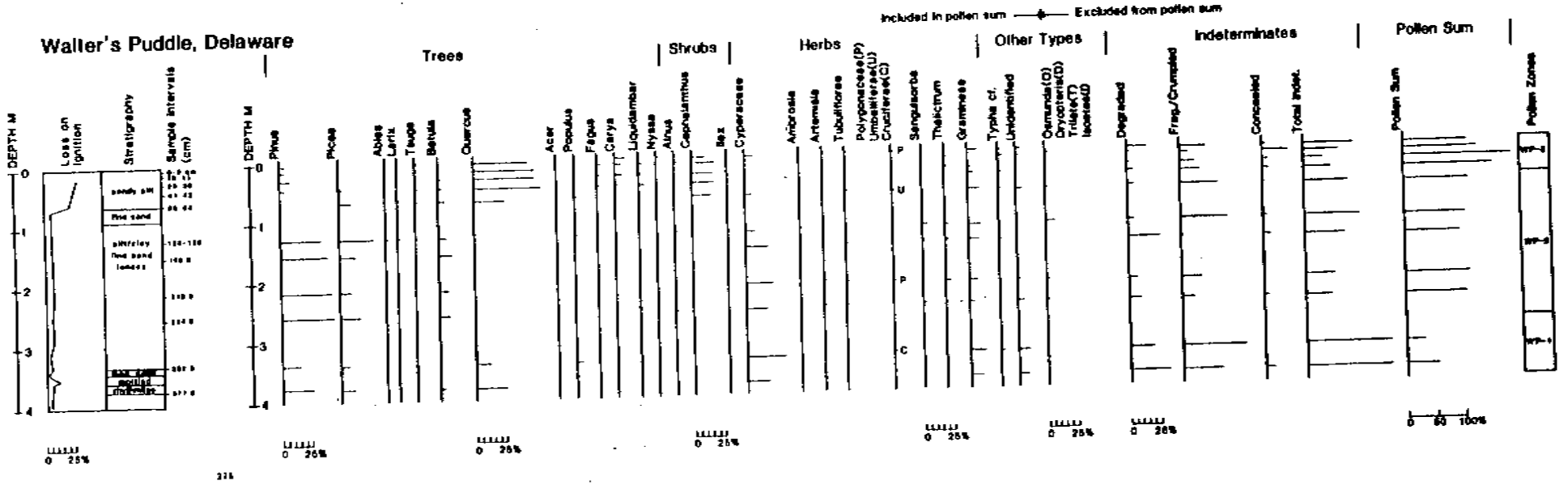
Basin A - Soil Column Analysis Results

DEPTH	CLAY	SILT	SAND	pH	Ph	K	Ca	Mg
0-5	7	43	50	5.2	6	12	24	25
5-10	10	43	47	5.1	3	11	20	18
10-15	13	34	53	5.1	2	14	21	18
15-20	13	39	48	5.1	1	13	18	12
20-25	13	33	54	5.0	1	11	15	20
25-30	18	41	41	4.9	1	13	19	71
30-35	26	46	28	4.9	1	17	27	141
35-40	27	48	25	4.9	1	21	26	150
40-45	33	57	10	4.8	1	27	29	150
45-50	37	56	7	4.8	1	32	31	150
50-55	35	62	3	4.8	1	37	34	160
55-60	38	61	1	4.8	1	40	37	150
60-65	31	50	19	4.9	2	40	35	150
65-70	34	55	11	5.0	5	43	35	150
70-75	31	56	13	5.2	6	46	41	150
75-80	34	53	13	5.2	6	49	42	150
80-85	35	58	7	5.3	3	53	42	150
85-90	35	65	0	5.5	2	55	43	150
90-95	29	55	16	5.4	3	48	40	150
95-100	29	63	8	5.4	4	47	37	150
100-105	31	58	11	5.8	2	42	36	150
105-110	29	60	11	5.9	2	38	36	150
110-115	30	62	8	6.0	2	39	39	150
115-120	27	56	17	6.2	3	38	40	150
120-125	26	51	23	6.3	6	30	36	150
125-130	27	48	25	6.2	5	31	36	150
130-135	26	36	38	6.3	4	30	35	150
135-140	27	59	14	6.1	3	30	35	150
140-145	30	63	7	6.2	3	33	38	150
145-150	28	66	7	6.1	3	30	36	150
150-155	29	63	8	6.2	5	31	36	150



SAND, SILT AND CLAY DISTRIBUTION - BASIN A


Walter's Puddle, Delaware
Included in pollen sum
Excluded from pollen sum
Trees
Shrubs
Herbs
Other Types
Indeterminates
Pollen Sum
DEPTH M
Loss on Ignition
Stratigraphy
Sample intervals (cm)
Pinus
Picea
Abies
Larix
Tsuga
Betula
Quercus
Acer
Populus
Fagus
Carya
Liquidambar
Nyssa
Alnus
Cephalanthus
Ilex
Cyperaceae
Ambrosia
Artemisia
Tubuliflorae
Polygonaceae(P)
Umbelliferae(U)
Cruciferae(C)
Sanguisorba
Thalictrum
Gramineae
Typha cf.
Unidentified
Osmunda(O)
Dryopteris(D)
Trilete(T)
Ipomoea(I)
Degraded
Frag./Crumpled
Concealed
Total indet.
Pollen Sum
Pollen Zones
0 25%
0 50 100%