HYDRAULICS DIVISION
TECHNICAL NOTE

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TITLE: Borehole Stratigraphy of Sediments from the Pelee Shoal Area

AUTHOR: J.P. Coakley

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BOREHOLE STRATIGRAPHY OF SEDIMENTS FROM THE PELEE SHOAL AREA

Introduction

Six cores, 9 cm in diameter and ranging from 4.1 to 12.2 m in length, were collected from the Pelee Shoal (Fig. 1, Table 1) using a Vibracore* apparatus. Because of the inability of other coring techniques to penetrate more than a few centimeters into sand and gravel deposits, these cores represent the first set of long cores taken on the Pelee Shoal.

Background

The Pelee Shoal is a submerged platform of complex bathymetry (average depth - less than 7 m) trending southeast from the tip of Point Pelee for some 12 kilometers (Fig. 1). The dominant surficial sediment type is sand, with glacial sediments (tills and glaciolacustrine deposits) outcropping on the west and northeast borders respectively (Coakley, 1977; St. Jacques and Rukavina, 1976).

Field and Laboratory methods

The technique of collecting cores using the Vibrocore has been already described in Babcock and Miller (1972). In this study, the Vibrocore was deployed from a barge (Fig. 2) manoeuvred by the tug-boat "Argue Martin". The cores were all collected during the period August 6 - 10, 1974. During the coring process, Vibrocore penetration values were recorded as an indication of the *in situ* penetration resistance of the sediments encountered.

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* Leased from Alpine Geophysics Ltd., Norwood, N. J.

Once retrieved, the unextruded cores were cut into 1.5 m sections, sealed, and transported to the Canada Centre for Inland Waters where they were stored at 4°C pending laboratory analysis.

In the laboratory, each core section was X-rayed and an X-radiograph of the core developed prior to opening. This non-destructive process is useful in determining the presence of internal sedimentary structures and objects such as pebbles, shell and wood chips, which may not be visible when the core is opened.

For logging purposes, a longitudinal strip of the core liner was removed from each section and the core material was carefully scraped to produce a clean surface. Qualitative physical properties of the core such as colour, texture, internal structure, aspect of contact planes between units, and fossil content were logged. During the logging of Cores 1 and 2, the undisturbed and remolded shear strength of the cohesive sediments were measured at 30 cm intervals using a Wykeham Farrance laboratory vane. Samples for particle size analysis and natural water content were taken at 30 cm intervals from all cores; those for Atterberg limits every 30 cm in the areas of cohesive sediments. The particle size distribution of the sediment samples was obtained using the combined sieve-pipette-settling tube - Sedigraph procedure outlined by Rukavina and Duncan (1970) and Rukavina and Lahaie (1975). Total and organic carbon content were determined at 90 cm intervals using a Leco IR-12 carbon analyzer after the technique described by Kemp and Lewis (1968). Carbonate percentages were determined at the same interval using the Chittick apparatus procedure developed by Dreimanis (1962). Atterberg limits and natural water content were determined using standard ASTM procedures (D-423/424 and D-2216 respectively). Qualitative X-ray diffraction analyses were carried out on the <2μ fraction of 37 samples representing all sediment types, using a Philips X-ray diffractometer with air-dried

centrifuge-oriented specimens sedimented on glass microslides (Spoljaric, 1971). One-dimensional consolidation tests were performed by the St. Lawrence Seaway Authority Laboratory in St. Catharines, Ontario, on samples taken at two positions in each core. The standard ASTM procedure (D-2435) was used for the tests. The 2.5-in. (6.35-cm) dia. samples were tested in the range of pressure from 24 kN/m^2 to 1530 kNm^2 during the consolidation stage and in the range of pressure from 1530 kN/m^2 to 12 kN/m^2 during the rebound stage. The load increment of twice the previous load and the load decrement of one fourth of the previous load were used during the consolidation and rebound stages respectively. The preconsolidation pressure, P_c, was estimated by Casagrande's graphical construction (Casagrande, 1938).

Five samples of organic material taken from various levels in some of the cores were submitted for radiocarbon dating to the Department of Geological Sciences of Brock University in St. Catharines, Ontario. The dating material consisted of plant detritus and shells.

Gross Lithology

The visual description of the cores is presented in detail in Appendix 1. A brief summary of the sediment units thus identified is presented below, and in Figures 3 to 8.

1. Till

This basal unit encountered in cores 1, 3 and 4 represents the oldest sediments encountered. Dark greyish brown (10YR4/2) with occasional grey mottling and composed of sandy silty clay, the till was characteristically lacking in internal structures, except for abundant subangular to subrounded pebbles and granules.

The pebbles were mainly of grey limestone, buff siltstone, and black shale, with lesser granitic types. In cores 1 and 4, a thin lag gravel layer separated the till from more recent units. The contact between the till and overlying units was sharp in all cases. No evidence of soil formation or plant remains were observed at the contact. The surface elevation of the till appears to be somewhat irregular, ranging from an elevation of around 165 m (a.s.l.) in cores 1 and 3, to less than 156 m (a.s.l.) in cores 2, 5 and 6.

Although it was not possible to determine the age of the till, it appears to be correlative to the clayey silt till mapped by Vagners (1972) throughout Essex county. This till was probably deposited as part of the Port Stanley sheet, about 14,000 years ago (Lewis, 1966). No glaciolacustrine deposits were identified in any of the cores. No fossils were noted in the till.

2. Clay

Predominantly clay units (with significant silt fractions were encountered at the base of cores 2 and 5 (Fig.4,7). Correlation between these two locations is not certain due to significant textural differences. The clay in core 2 is dark olive grey (5YR 5/1) in colour and is uniformly silty and free of pebbles, while that of core 5 grades with depth to a clayey silt and contains numerous scattered pebbles. Likewise, the upper contacts for both units are different - a well-developed lag gravel layer occurs above the unit in core 5 while a gradational transition occurs between the clay unit and the overlying silt in core 2. Apart from the

dark colour, there are other indications of reducing environmental conditions. These are: streaks of black iron sulphide, preserved plant fragments, and generally higher levels of organic carbon than in the upper units.

3. Silt

Units composed predominantly of silt overlie both clayey units (cores 2 and 5) and the lag gravel layer developed on the till surface in core 4 (Fig.4,6,8). Silt also occupies the bottom 5 m in core 6 but the anomalous presence of sand lenses in the lower portion suggests that this unit is not directly correlative with that in the other cores. The silt unit is olive grey (5Y 4/2) in colour and varies in texture from clayey silt in the basal portions to sandy silt in the upper part of the unit. Internal structures, where present, range from laminations (both planar and contorted) to irregular lenses of clay and of sand predominating in the lower and upper sections respectively. Bands of varying thicknesses composed of iron sulphide and plant detritus (especially in core 2) also occur within the silt unit, while wood chips and mollusc shells are scattered throughout.

4. Lower sand

This unit occurs in all cores except core 1. The lower contact with the silt unit where present in the remaining cores is gradational (except in core 2, where a lag gravel layer occurs between them). Interfingering lenses of silt and sand occur in the basal portions of the unit, but sand content gradually increases upward in the unit (Fig.4-8). Colour ranges from olive grey (5Y 3/2) to greyish brown (2.5Y 3/2). This unit can be subdivided into two distinct

types: sand with silt lenses at the base, and laminated sand in the upper portions (for best example see core 2). The contact between these two sub-units is usually gradational, but is sharp in core 4.

The lower sub-unit is characterized by an upward increase in grain size and sand content, and by irregular, random interfingering of sand and clay types, usually in the form of lenses. The upper sub-unit is characterized by slightly inclined, subparallel laminations and cross-bedding, highlighted by linear concentrations of dark-coloured heavy minerals and coarser grains. The laminations are usually less than 0.5 cm in thickness. Shells of pelecypods and gastropods are scattered throughout the sub-unit or occur as random bands of shell hash. The trend toward coarsening upward observed in the lower sub-unit persists.

5. Upper sand

This is the top unit in all the cores, and comprises the dominant surficial sediment on the Pelee Shoal. In thickness, it ranges from 60 cm (core 6) to 2.3 m (core 3). The boundary between this unit and the lower sand is consistently sharp and marked by a distinctive change in the structures present (the top unit is virtually unlaminated) and grain size (top unit is coarser). The colour of the massive sand unit generally grades from brown (2.5Y 4/4) to that of the unit below. In core 1, a lag gravel layer separates the unit from the underlying till. The texture of the massive sand unit is that of a

moderately well sorted, medium-sized sand, but coarser particles ranging from granule to cobble size occur sparsely throughout or are concentrated in sharply defined layers within the unit. Unlike the silty sand unit below, heavy mineral laminae are only minor in occurrence.

Field and Laboratory test results

Radiocarbon Dates

The results of the C^{14} dating of organic matter in some of the cores are presented in Table 2. Of the 5 samples submitted, only 3 were sufficiently large for a standard analysis. Of the remaining 2, one was too small for any analysis to be done, and in the case of the other, no pretreatment was possible.

The 8,100 yr B.P. date was based on shells and returned from the laboratory with the note that, due to possible contamination by "old" carbonates, the date stated might be older than it should be.

Terasmae (1969) determined C^{14} dates for 2 samples of basal gyttja from cores in the Pelee Marsh (Fig. 1). The dates were 3,500 and 3,300 yrs B.P.

Particle Size Distributions

The size analysis results of 151 subsamples representing all stratigraphic units are presented in Figures 3 to 8. The mean phi values of the till range from 6.04 to 7.49 with generally very poor sorting indicated by high standard deviation values from 2.73 to 3.67. The mean phi values of postglacial silts and silty clays range from 4.05 to 7.98 and the spread of standard deviations is from 1.23 to 2.80. The laminated

and massive sand units have mean phi values which range from 0.30 to 3.77, and standard deviations of from 0.54 to 2.49. In other words, they are generally moderately sorted.

The most conspicuous trend in the postglacial sediments is a clear coarsening trend upwards observed in all the cores. This trend is accompanied by a less distinct trend toward better sorting (lower standard deviation values) and higher kurtosis upwards in the cores.

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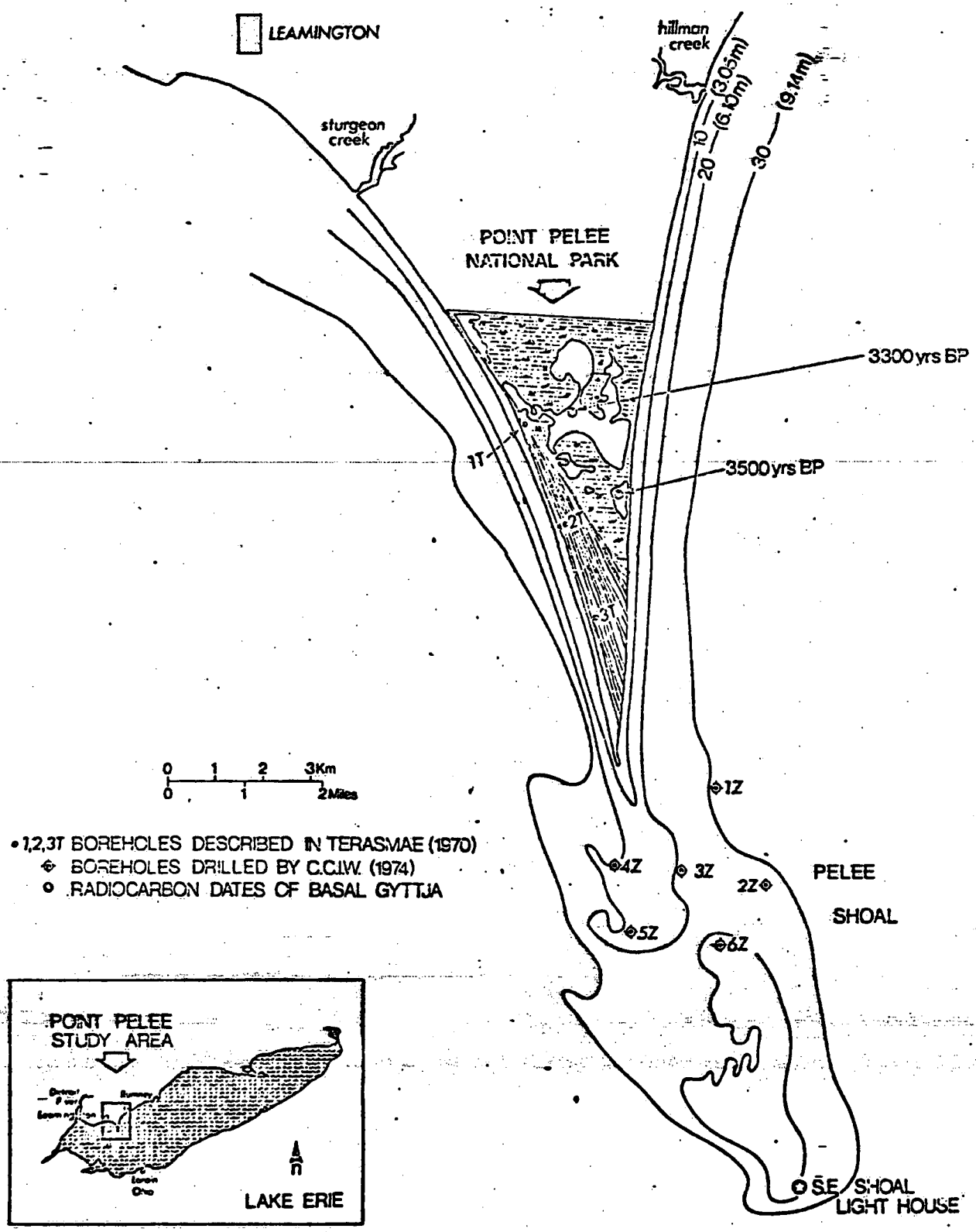


Figure 1 Location map of the Point Pelee - Pelee Shoal area, showing local bathymetry, the positions of 6 vibracore boreholes, and 3 boreholes drilled on Point Pelee by Terasmae (1969).

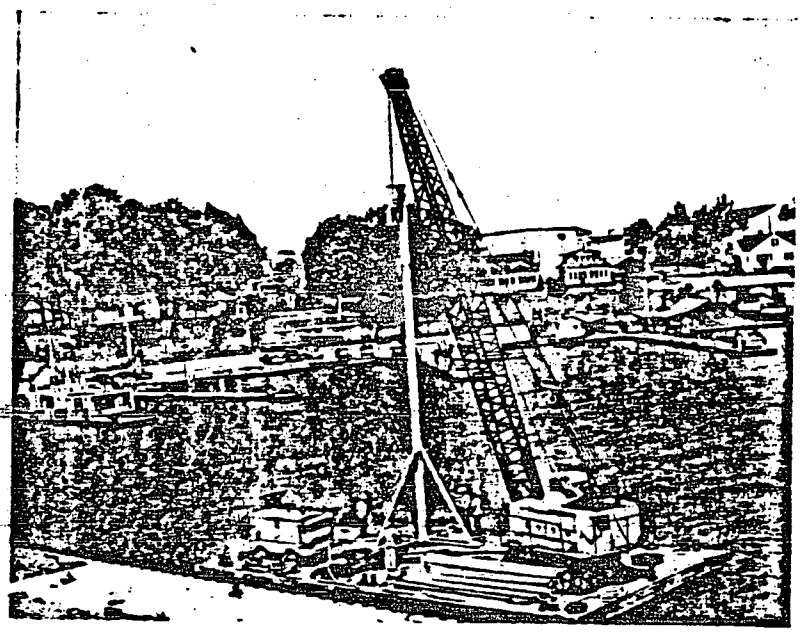


Figure 2 Vibracore apparatus being assembled in Kingsville harbour onto barge used in the coring operations.

Figure 3-8 Plot of various parameters measured at intervals along the length of the 6 cores taken. Core lithological descriptions were based mostly on visual log.

BOREHOLE 1

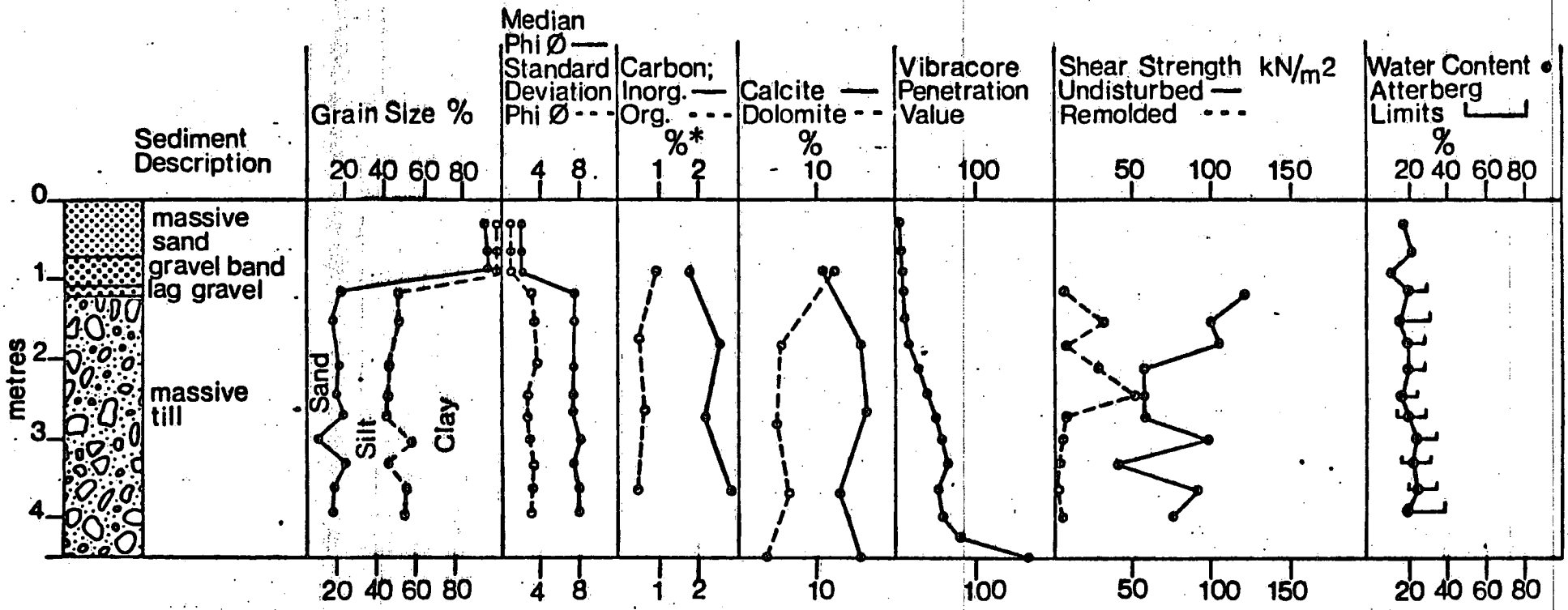


Figure 3

BOREHOLE 2

Figure 4

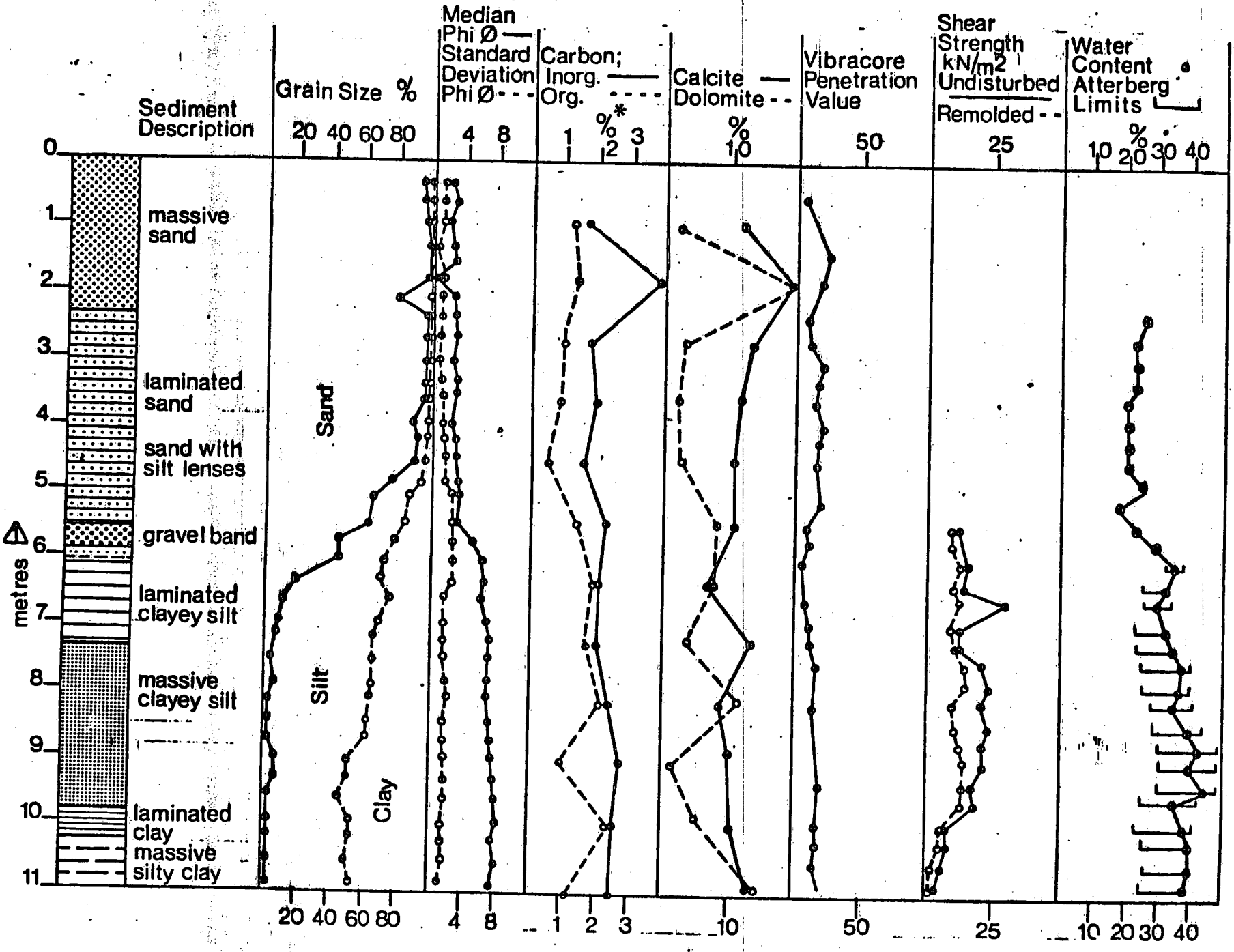


Figure 5

BOREHOLE 3

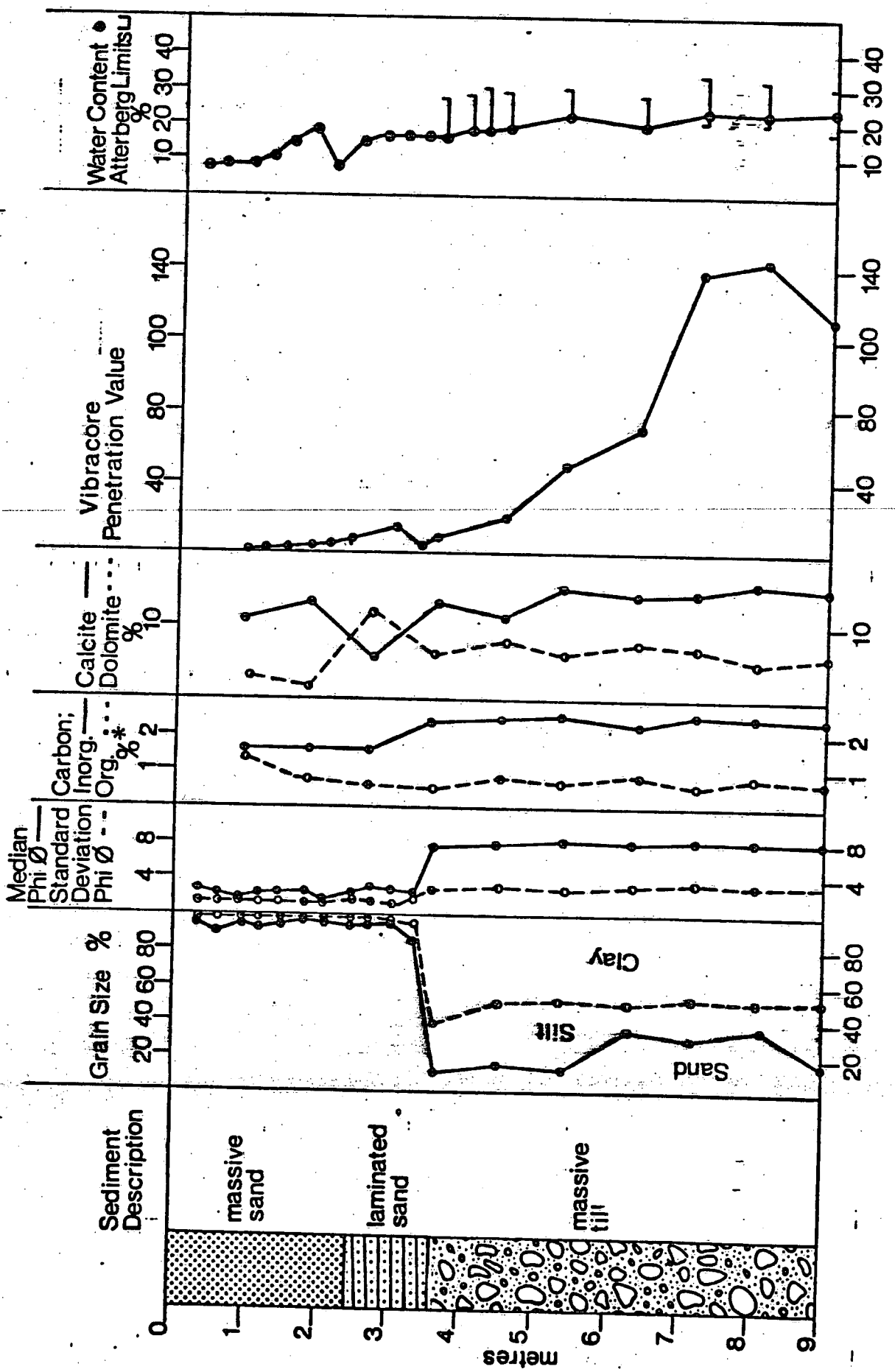


Figure 6

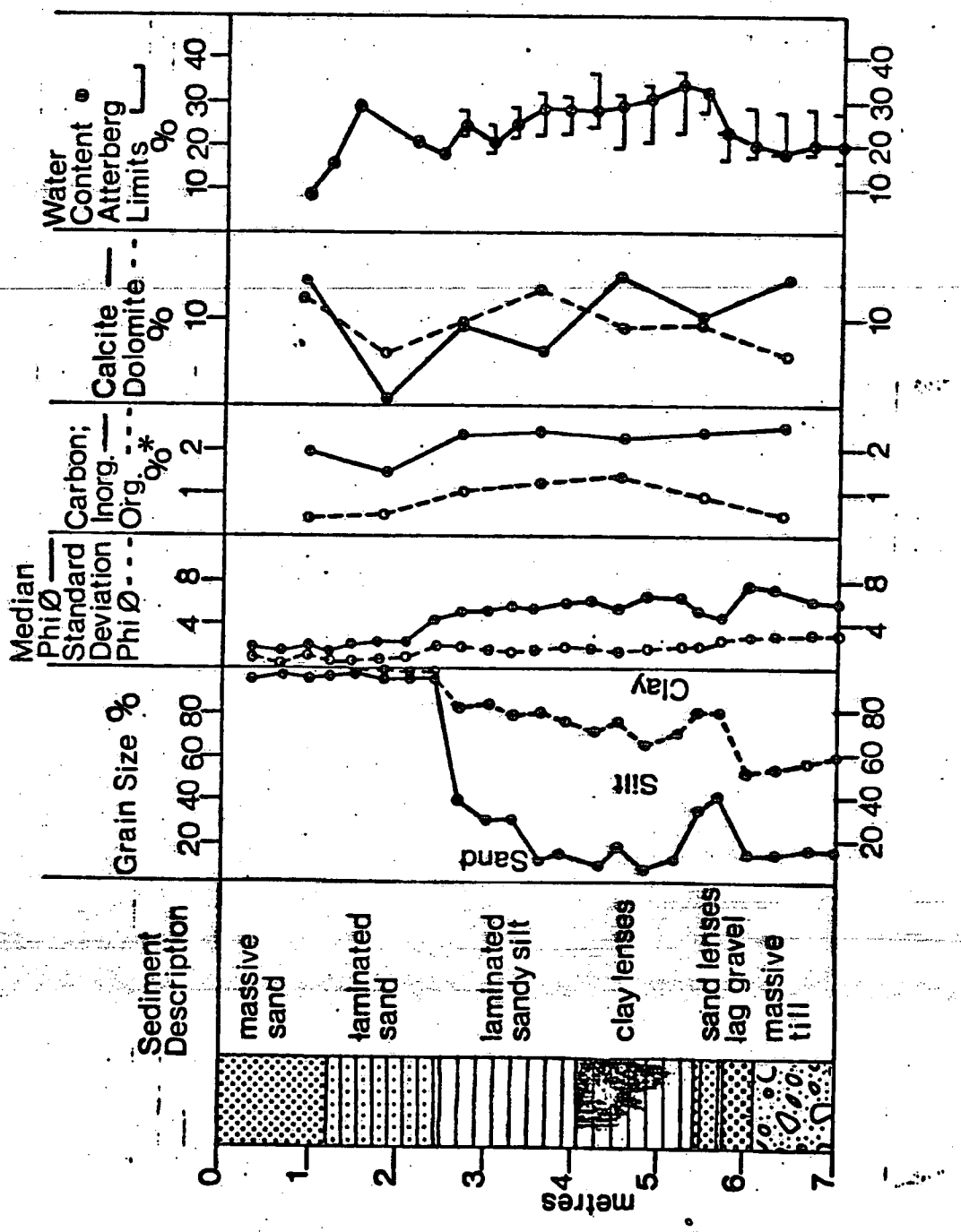
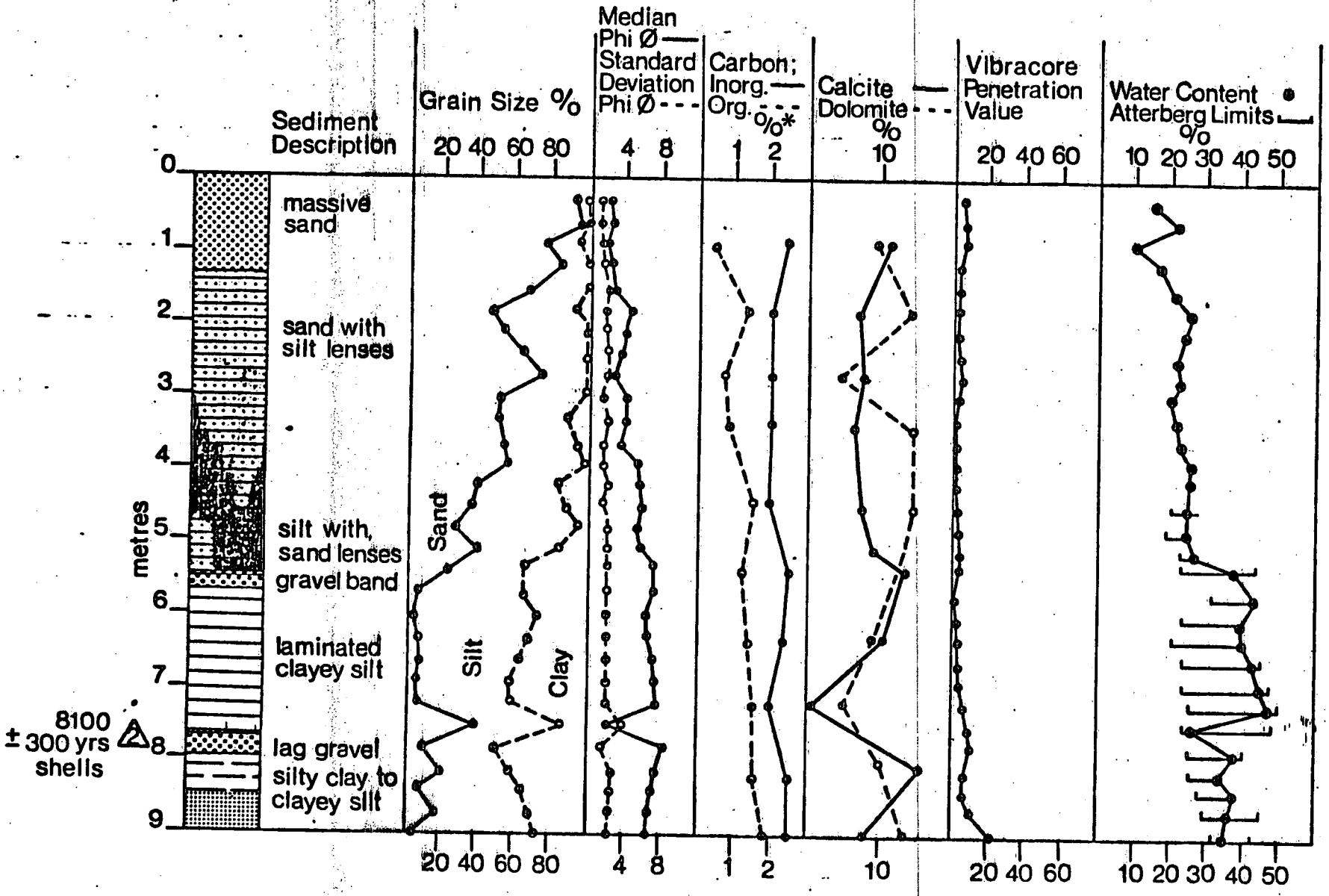

BOREHOLE 4
Sediment Description
massive sand
laminated sand
laminated sandy silt
clay lenses
sand lenses lag gravel
massive till
metres
0
1
2
3
4
5
6
7
Grain Size %
20 40 60 80
Sand
Silt
Clay
Median Phi Ø
Standard Deviation Phi Ø
4 8
Carbon; Inorg. Org. %*
1 2
Calcite Dolomite %
10
Water Content Atterberg Limits %
10 20 30 40

Figure 7

BOREHOLE 5



BOREHOLE 6

Figure 8

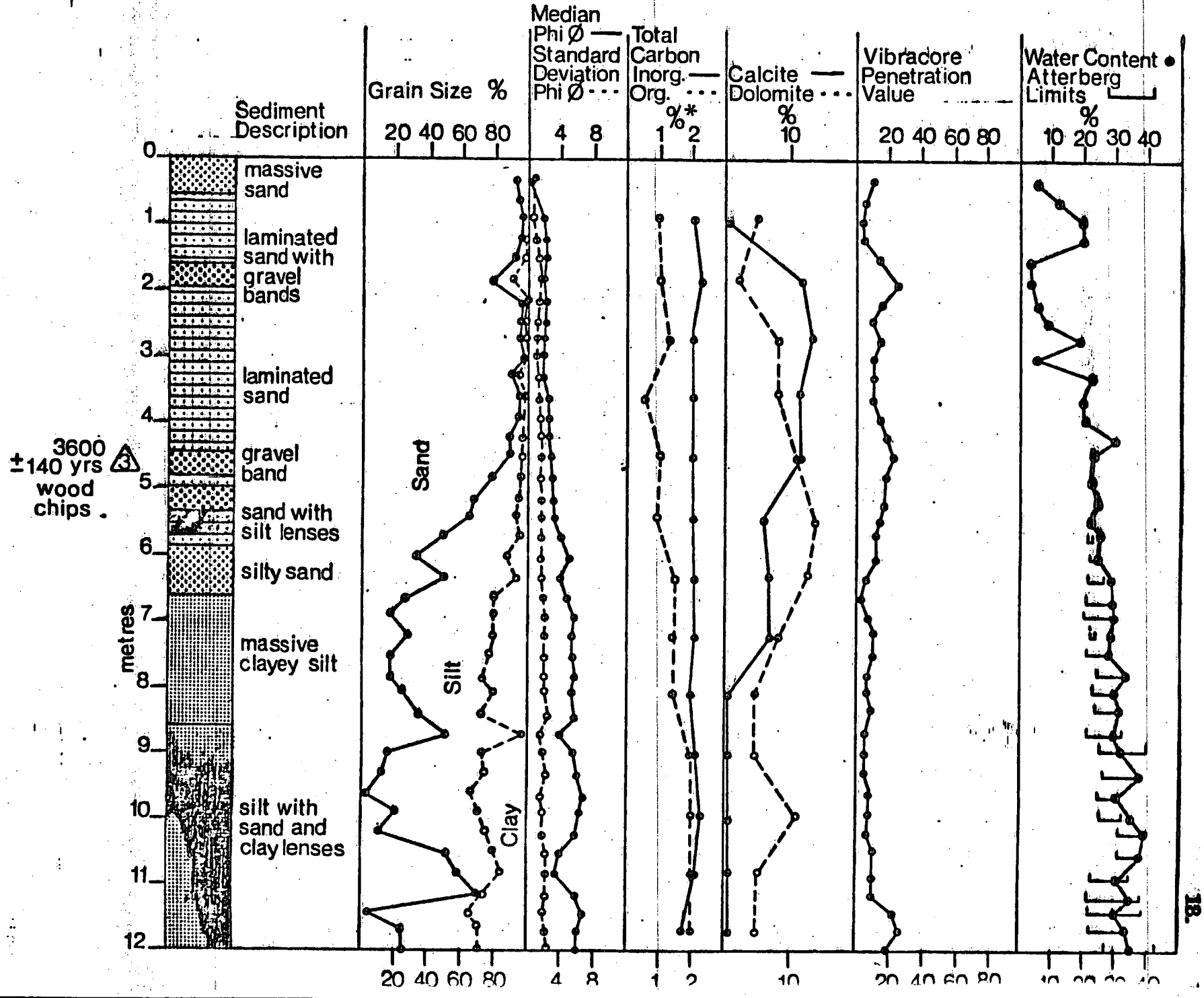


TABLE 1. Location of Cores

Core No.	Date of Coring	Geographic Location* (U.T.M., Zone 17)	Core length (m)	Water Depth (m)** (below IGLD: 173.3 m a.s.l.)
1	Aug. 9/74	N 41° 54'05", W 82° 29'20" (N 4639650, E 376544)	4.11	6.8
2	Aug. 9/74	N 41° 53'00", W 82° 28'25" (N 4637655, E 377755)	11.08	6.8
3	Aug. 9/74	N 41° 53'05", W 82° 29'40" (N 4637871, E 375960)	9.56	5.6
4	Aug. 8/74	N 41° 53'10", W 82° 30'40" (N 4638080, E 374580)	7.16	5.9
5	Aug. 9/74	N 41° 52'25", W 82° 30'30" (N 4636626, E 374831)	9.19	8.4
6	Aug. 9/74	N 41° 52'20", W 82° 29'10" (N 4644030, E 376627)	11.95	5.9

* Positions based on radar fixes. Estimated positional accuracy - 150 m or 2" latitude.

** Depth obtained visually from graduations on Vibrocore apparatus. Estimated error - ±0.1 m (mostly due to waves on surface).

Table 2 Radiocarbon Dates from Pelee Shoal Cores

Core No	Material Used for dating	Elevation of Sample (m a.s.l)**	C^{14} Age (yrs B.P.)
2	plant debris	160.7	10,260 ± 325
5	shells	157.3	8,100 ± 300
5*	wood chips	161.0	6,600 ± 180
6	wood chips	162.8	3,600 ± 140
2	shell frag.	163.3	sample too small

* Sample too small for pre-treatment (net wt. - 4.9 g)

** Metres above sea level, referenced to Lake Erie datum.

APPENDIX 1

The core logs making up this Appendix were transcribed with minimal editing from handwritten logs prepared by G. J. Winter. The units described here are based on visual characteristics alone, and interpretatory comments included do not necessarily reflect those of the authors.

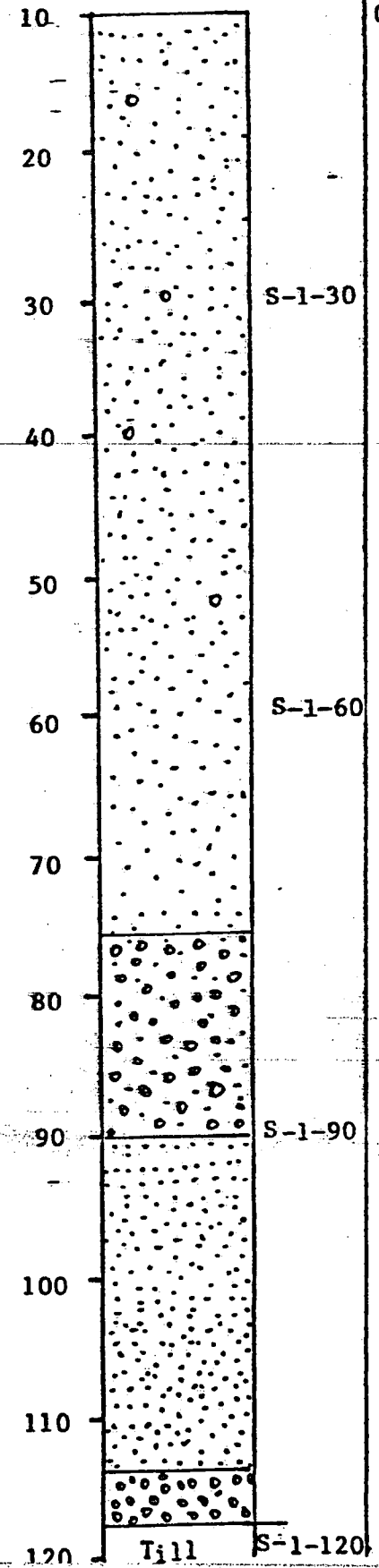
LABORATORY CORE

LOG

Core Location: Pelee Shoal

Core No.: 1 Section:

size anal., X-radio., C-14 date ref.



Sediment Description

0 - 114 cm: (UNIT 1) Colour is 2.5Y, 4/2 dark greyish brown. Texture is sorted fine medium sand with a trace of silt. Structure is predominantly massive with scattered pebbles present. At a depth of 76 cm - 90 cm a gravel layer was noted consisting of subrounded Paleozoic and Precambrian pebbles and granules in a matrix of poorly sorted sand. The upper and lower boundaries of this textural change were sharp. Shell fragments are scattered throughout the unit, reaching maximum concentration in the pebble layer. The X-radiograph shows the pebble layer clearly as an area of generally high shadow but containing shadows of individual pebbles. Immediately below the pebble band to an approximate depth of 97 cm, the X-radiograph shows light and dark subparallel horizontal lamellae each ≈ 0.2 cm thick. These lamellae gradually disappear and may show in the core as very slight concentrations of heavy minerals or sulphides. Sand at the base of the unit from about 100 cm to 114 cm grades very subtly finer until it is predominantly fine sand at the base. The colour is a shade darker, possibly from a general increase in heavy mineral concentration.

114 - 118 cm: Subangular to subrounded carbonate, shale and granitic granules and pebbles in a poorly

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 1 Section:

Depth (cm)	Core	Size anal., X-radio., C-14 date ref.	Sediment Description
120			(Cont'd)
			114 - 118 cm: sorted matrix, probably representative of a lag deposit of gravel. This feature shows well on the X-radiograph as a general shadow zone. The upper contact is sharp.
140			
		S-1-150	
160			
		S-1-180	
180			118 - 411 cm: Colour is 10 YR, 4/2 dark greyish brown.
			(UNIT 2) Texture is very poorly sorted silty clay with numerous pebbles and granules scattered randomly throughout. Structure is very slightly mottled with patches of a grey, predominantly clay phase and a reddish siltier phase scattered randomly throughout the unit. The upper contact is sharp. Pebbles present include shale, sandstone, siltstone, carbonate and granite with Paleozoic rocks predominant. X-radiographs show many pebble shadows present. Colour of the till is becoming slightly more reddish in general and the red and grey mottling caused by the different silt-rich and clay-rich phases is becoming more pronounced. In all other respects, the till is similar to above. At a depth of 270 cm, the colours of the till have subtly changed to predominantly 7.5Y, 4/2 dark brown. - The texture of the til remains the same but the mottling mentioned earlier has become more pronounced with patches of 5Y, 4/3 olive and 5Y, 5/1 grey very
200			
		S-1-210	
220			
240	Till	S-1-240	
260			
		S-1-270	
280			
300		S-1-300	
320			
		S-1-330	

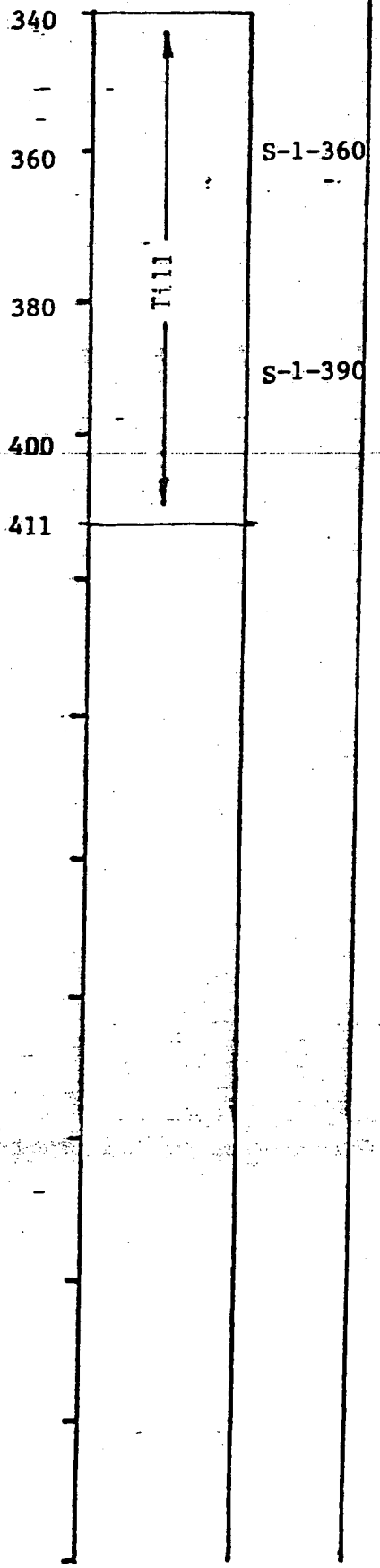
(cont'd)

LABORATORY CORE LOG

Core Location:

Core No.: Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
340		(Cont'd) 118 - 411 cm: common. From 283 to 313 cm the till is predominantly olive in colour. No distinctive textural variation can be associated with this colour change. X-radiographs show no structure in the section but show a uniform distribution of pebbles throughout. From 313 - 335 cm is poorly sorted, pebbly, silty clay till similar in all respects to data from 283 - 313 cm. Section from 335 - 367 cm is mottled predominantly olive in colour. Pebbles remain uniformly distributed throughout. From 367 - 411 cm clay till is similar to previously described section, except that less mottling is evident at the very base of the hole, and the colour is now a more uniform dark brown.
360		
380		
400		
411		411 cm: End of core.

LABORATORY CORE

LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
0		0 - 71 cm : (UNIT 1) Colour is 5Y, 6/2 light olive grey. Texture is moderately well sorted fine medium sand. There are numerous pebbles and a few cobbles scattered randomly throughout the unit - mainly subrounded to subangular carbonates. A few gastropod and mollusc shells and shell fragments can be seen. Structure to 38 cm is massive. Below 38 cm faint subparallel, and subhorizontal laminations appear at uneven intervals on the X-radiograph. These thin lamellae can be interpreted as heavy mineral concentrations in the core.
10		
20		
30	2-S-30	
40		
50		
60	2-S-60	71 - 83 cm : At 71 to 83 cm a textural change occurs in the form of a gravel layer comprised mainly of subrounded granules and pebbles of carbonates and siltstone in a matrix of the previously described sand. The gravel layer may be ascertained on the X-radiograph as a shadow zone with visible clastic fragments. The upper contact is sharp, the lower contact gradational.
70		
80		
90	2-S-90	
100		83 - 130 cm: Below the pebble band is a layer of sand
110		

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

Size anal., X-radio., C-14 date ref.

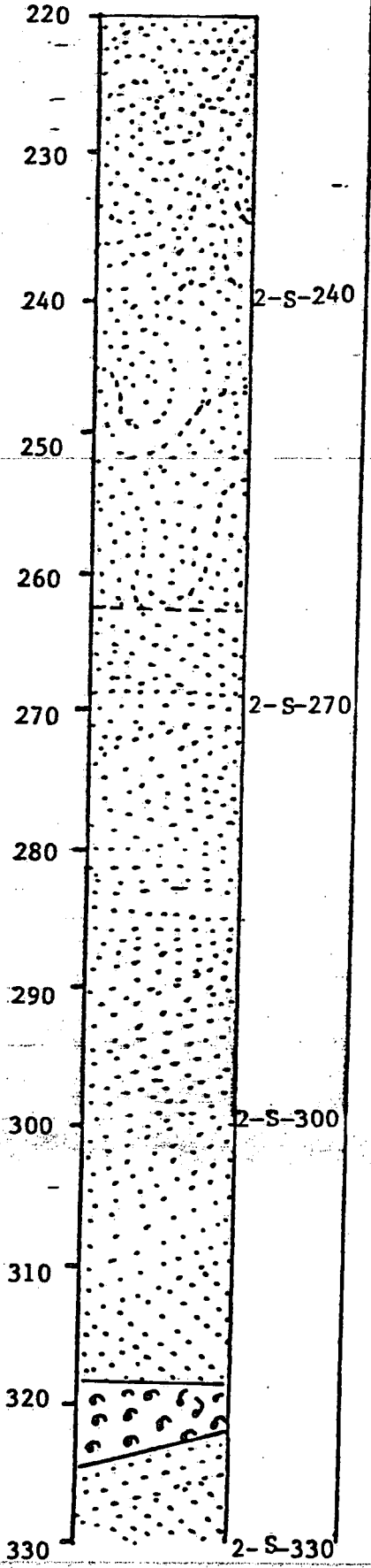
Depth (cm)	Core	Sediment Description
110		(cont'd) 83 - 130 cm: similar to the sand described above, but with a lower density of pebbles than seen in the 0 - 71 cm section. This section of sand is slightly darker (5Y, 4/2 olive grey) than the previous sand because of slightly more heavy minerals. Thin lamellae at random intervals of heavy mineral concentrations can be seen in this section which extends from 83 - 125 cm. Pebble density increases from 125 cm to 130cm where the sharp contact with unit 2 is encountered.
120	2-S-120	
130		
140		
150	2-S-150	
160		130 - 572 cm: (UNIT 2) Colour is 2.5Y, 3/2 very dark greyish brown. Texture is moderately sorted fine and fine medium sand. Notable textural variations will be further outlined below. Structure within each of the textural phases is massive. Numerous gastropod and mollusc shells occur scattered throughout the unit, especially in the coarser phases. The contact with unit 1 is sharp and occurs at 130 cm depth. From 134 - 144 cm a gravel layer consisting of subrounded granules and coarse sand with a carbonate pebble occurs. Upper and lower contacts are sharp. From 144 - 160 cm sand, as described above, occurs. Lower contact is gradational. From 160 - 190 cm a coarse
170		
180	2-S-180	
190		
200		
210	2-S-210	(cont'd)
220		

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
220		(cont'd) 130 - 572 cm: gravel layer consisting of granules, pebbles and cobbles (subrounded) of carbonate and siltstone with a few granitic fragments occurs. Pebble free sand, as described above occurs below this pebble layer. There appears to be organic material present in the sand. When treated with HCl, a distinct H_2S odour could be detected, leading to the speculation that the dark colour of this unit is a result of Fe-sulphides concentrated in the unit. Colour now 2.5Y, 5/2 greyish brown from 200 -.214 cm. Lighter colour is apparently from lack of Fe-sulphides and organic material which were present in sand directly above. Texture is fine to fine medium sand which is notably free of pebbles with the exception of three subrounded pebbles which occur at around 210 cm. Numerous granules are present. Structure to 214 cm is massive. Numerous mollusc shells and shell fragments occur. From 214 - 265 cm the colour is 5Y, 4/2 olive grey, the darker colour being due to a greater concentration of heavy minerals. Texture of the sand from 214 - 265 cm is similar to that described above, perhaps slightly finer in general but with a notable lack of pebbles. Structural features from 214 - 265 cm are dominated by contorted laminations resulting from differential heavy mineral concentrations. The laminations occur at random intervals and appear to be primary
230		
240	2-S-240	
250		
260		
270	2-S-270	
280		
290		
300	2-S-300	
310		
320		
330	2-S-330	

(cont'd)

LABORATORY CORE

LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
330		(cont'd)
340		130 - 572 cm: rather than resulting from sampling process. Scattered fossils appear throughout this unit. From 265 - 341 cm the sand is similar to that described in the 214 - 265 cm section in terms of texture and colour. Structure in the 265 - 341 cm segment is dominated by subhorizontal, subparallel laminations and cross laminations caused mainly by differential heavy mineral concentrations. The laminations are generally <0.5 cm thick and occur at random intervals. Other horizontal structural features seen in this segment include textural variations and a shell hash zone. The textural variations occur in the form of silty horizontal layers <0.5 thick at depths of 289 cm and 293 cm. Other more subtle size variations of the same form may occur near 225 cm. The shell hash occurs at 318 - 324 cm with many mollusc and gastropod shells and shell fragments in a matrix of poorly sorted sand and granules. A clay ball (till pebble ?) ≈1 cm in diameter occurred at a depth of 311 cm Many shell fragments occurred throughout this segment of core. Directly below 341 cm the sand colour became 5Y, 4/3 olive but remained similar to the sand described above in all other respects. This remained the case from 341 - 352 cm. A few subrounded pebble shadows were seen on the X-radiograph at 351 cm. From 352 - 359 cm a wedge shapped block of silt and very fine sand occurs. The block consists
350		
360	2-S-360	
370		
380		
390	2-S-390	
400		
410		
420	2-S-420	
430		
440		

(cont'd)

LABORATORY CORE

LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
440		(cont'd)
450	2-S-450	130 - 572 cm: of a series of textural laminations approximately 1 mm thick. The laminations consist of alternately silt and fine (and very fine) sand. The laminations are approximately parallel and may undulate and dip slightly from the horizontal. The upper contact of the wedge is sharp and inclined. The lower contact is less distinct and undulates. Generally the section from 359 - 510 cm is dominated by several textural regimes which will be outlined in detail now and noted on the log in their area of occurrence.
460		
470		
480	2-S-480	(1) Predominantly Sand Phase These zones are 2.5Y, 4/2 dark greyish brown in colour. Texture is moderately sorted fine sand and silt. Shell fragments can be seen scattered throughout the sand zones. The structure in these zones consists of subparallel, subhorizontal (occasionally contorted) laminations of differential heavy mineral concentrations occurring at irregular intervals.
490		
500		
510	2-S-510	(2) Predominantly Silt Phase These zones are 2.5Y, 4/2 dark greyish brown in colour. Texture is silt with some very fine sand. Structure is generally massive within the zone but the zone of silt itself (which is usually much thinner than the surrounding sand zones) may occur in the form of a contorted or interfingering band.
520		
530		
540	2-S-540	
550		

(cont'd)

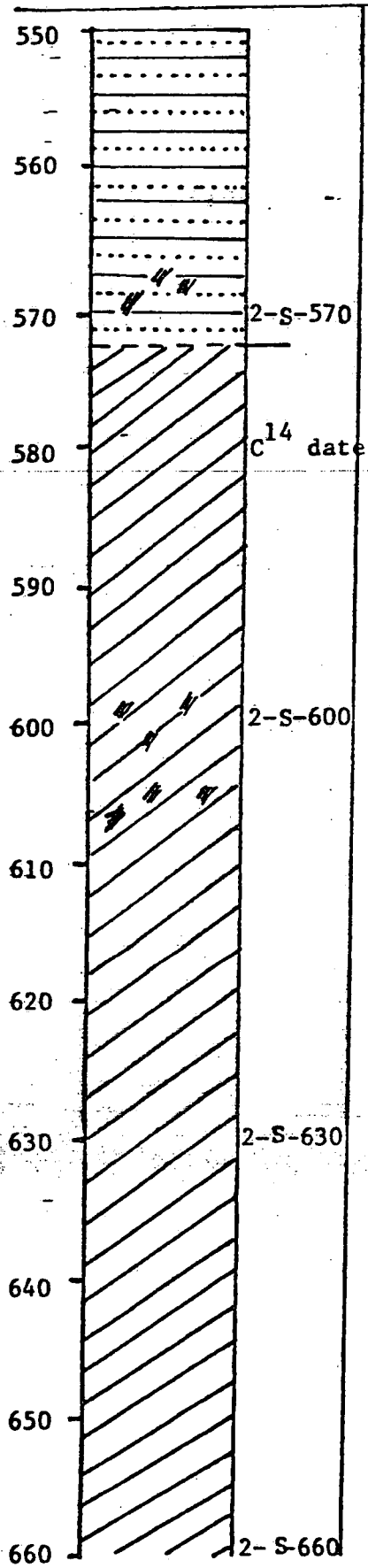
LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm) | Core | Sediment Description



(cont'd)

130 - 572 cm: (3) Shell Hash

Colour is 5Y, 2.5/2 black. Texture is generally a fine medium sand with many shell fragments present. Structure within the zone is massive.

These three general units may interfinger and will be noted if this is the case.

359 - 383 cm predominantly sand as described above.

383 - 390 cm predominantly silt as described above.

390 - 411 cm predominatly sand as above; lower contact horizontal, undulating.

From 411 - 418 cm predominantly silt as described previously occurs. The lower contact represents an interfingering with the underlying unit with a related minor layer of silt occurring just below 420 cm. From 418 - 434 cm predominantly sand as described above occurs; contorted laminations of heavy minerals occur to 427 cm; below that, subhorizontal, subparallel lamellae occur. The lower contact is inclined and slightly undulating. From 434 - 436 cm shell hash as described previously occurs. The lower contact is inclined and undulating. From 436 - 491 cm an interfingering of the predominantly sand phase and predominantly silt phase occurs. From 491 - 510 cm, predominantly sand occurs. It should be noted that generally the sand has undergone a very subtle decrease in grain size and and increase in silt content with increasing depth throughout the section from 359 - 501 cm.

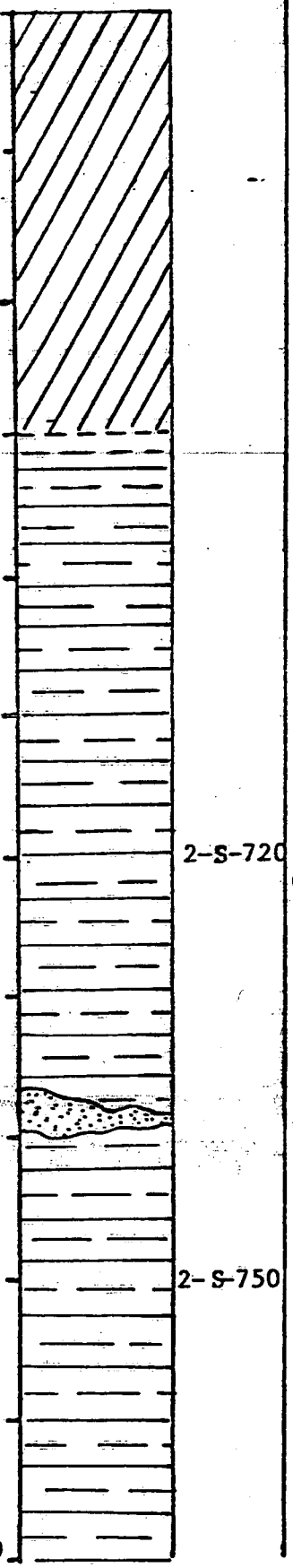
(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
660		(cont'd) 130 - 572 cm: The lower contact is gradational. From 510 - 523 a gravel band occurs. The gravel zone consists of coarse and medium sand, subrounded granules and subrounded pebbles of carbonate and siltstone with a few granitic fragments present. From 523 - 572 cm predominantly sand with silt phases interfingering occur. The sand is now fine with a notable increase in the silt content. The silt percent increases more quickly with depth to form the basis of a gradational contact with the unit below. Near the contact (noted by asterisk in diagram) fragments of wood were recovered.
670		
680		
690		
700		
710		
720	2-S-720	572 - 1108 cm: (UNIT 3) Colour is 5Y, 4/2 olive grey. Texture is mainly silt with some clay and fine sand. Structure is dominated by subhorizontal, subparallel laminations. Two types of laminations are present. In the upper 20 cm, the dominant laminations are caused by a textural change between silt and fine sand. Below this, the dominant banding results from Fe sulphide and organic matter concentrations. The lamellae range in thickness from ≈0.1 cm to 2 cm and show excellently in the X-radiograph as light and dark bands. No visible shell fragments were seen but there
730		
740		
750	2-S-750	
760		
770		

(cont'd)

LABORATORY CORE

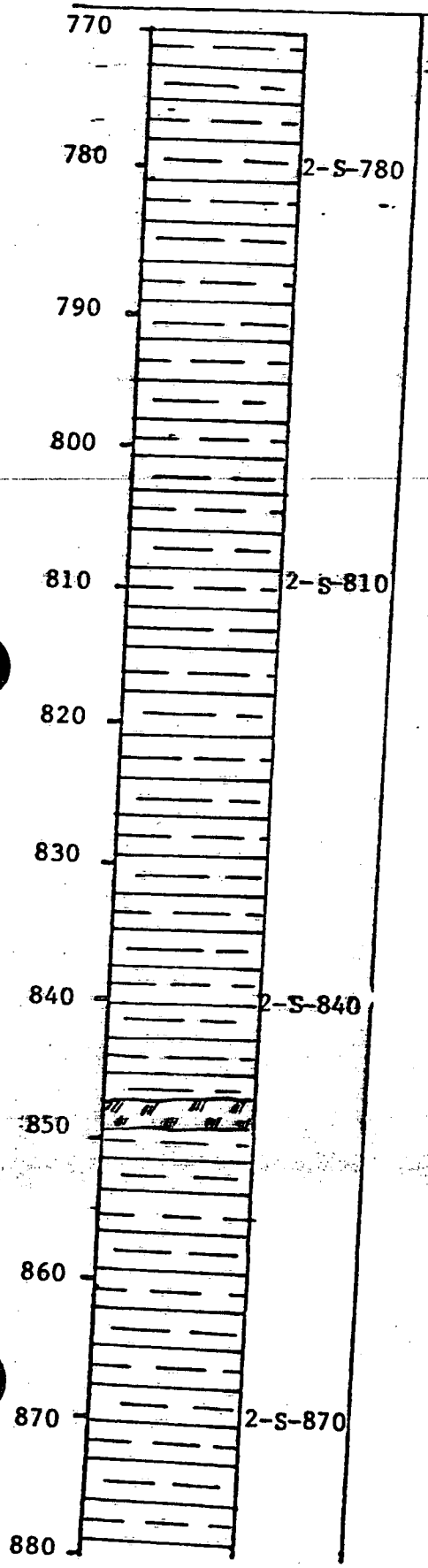
LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm) | Core | Sediment Description



(cont'd)

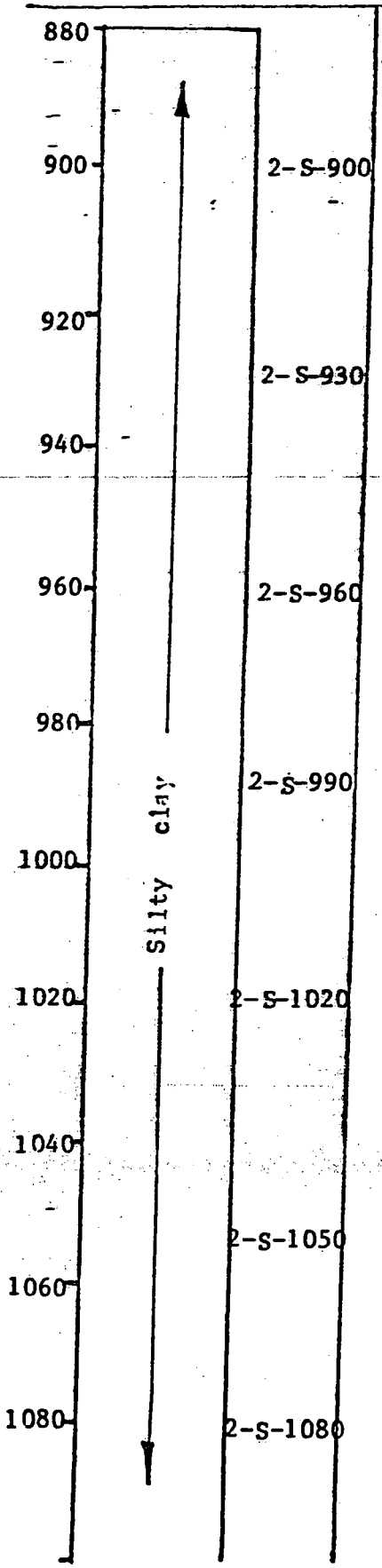
572 - 1108 cm: is much plant matter present (wood chips, stems, etc.) all partially decayed. From 598 - 608 cm a large number of wood chips was recovered. There seems to be a tendency for fewer of the fine sand laminations to occur at greater depth. Clay content increases gradually with depth. From 658 - 690 cm the number of laminations present decreases rapidly. The only laminations which are present in this section are organic concentrations. By 658 cm the colour has gradually become 5Y, 5/1 grey, which it remains to at least 809 cm. Clay content continues to increase with depth until by 690 cm one could call the unit a silty clay. Sand phase has all but disappeared. X-radiograph data shows numerous cracks occurring in this section of the unit. From 690 - 809 cm uniform, massive silty clay occurs. From 737 - 739 cm an irregular lens of very fine sand occurs. There are traces of scattered Fe sulphide streaks occurring sparsely throughout this section. Mollusc shell fragments can be seen scattered sparsely throughout this section. A pebble was recovered from the 808 cm level. It was a weathered, subangular limestone pebble with a black Fe sulphide coating. The coating was assumed to be Fe sulphide because of the strong H_2S odour released upon treatment with HCl. 809 - 915 cm has changed to 5Y, 4/2 olive grey. Texture is a silty clay. Structure is predominantly massive with

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

Depth (cm)	Core	Size anal., X-radio., C-14 date ref.	Sediment Description
880			(Cont'd) 572 - 1108 cm: various layers and blotches which will be outlined specifically later. Gastropod and mollusc shells and shell fragments were seen scattered sparsely throughout the section from 809 to 955 cm. Subrounded granules were present at 818 cm, 890 cm and 895 cm. A subangular black siltstone pebble ≈3 cm x 2 cm x 1.5 cm was recovered from 832 cm. The pebble was partially coated with a white, soft material (calcite). X-radiographs show the presence of many small cracks randomly oriented throughout the section. 847 - 849 cm fragments of wood and other plant detrius occur in a concentrated band. 860 - 867 cm a few sparse sulphide (Fe?) streaks occur. 915 - 955 cm, the colour grades to 5Y, 4/1 dark grey. 923 - 955 cm, very faint sub-horizontal subparallel lamellae begin to appear. The lamellae are <.5 cm thick and reflect a subtle textural change in that the thin bands are slightly siltier. The lamellae are barely discernable on the X-radiograph. 955 - 969 cm, the laminations mentioned above gradually decrease and disappear. Fe sulphide streaks begin to appear at 956 cm, increase to a maximum at 990 cm (at this point they are still rather scarce) and then decrease in frequency with depth, disappearing at 1040 cm. By 990 cm, the colour has graded to 5Y, 5/1 grey which it
900	2-S-900		
920	2-S-930		
940			
960	2-S-960		
980			
1000	2-S-990		
1020	2-S-1020		
1040			
1060	2-S-1050		
1080	2-S-1080		

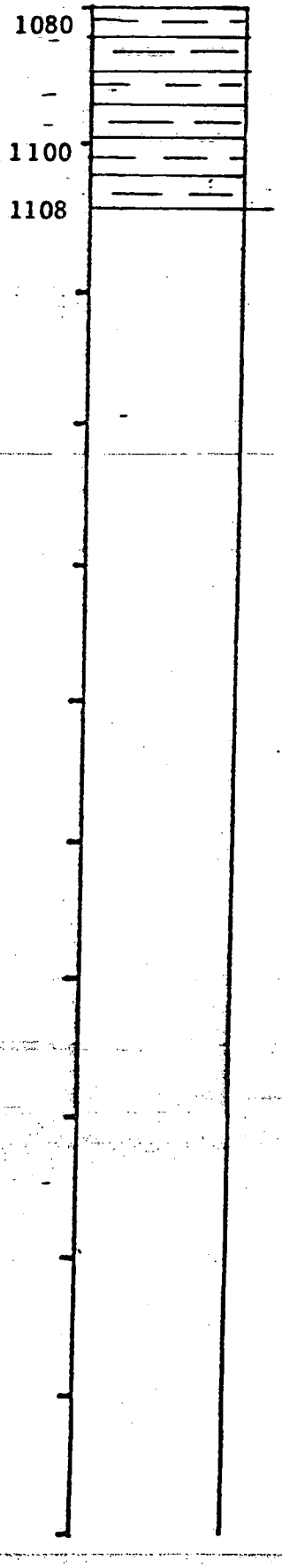
(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 2 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
1080		(cont'd) 572 - 1108 cm: remains to the end of the hole. Mollusc shells are very scarce but are present to the end of the core. Texture remains a silty clay, but the silt content continues to decrease with depth. The sediment below 1040 cm after the disappearance of the sulphide streaks is identical in all respects to the massive silty clay described previously. No pebbles are indicated by the X-radiograph which does show the presence of some randomly oriented fine cracks throughout the section.
1100		
1108		- 1108 cm: End of core.

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 3 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
0		0 - 231 cm : (UNIT 1) Colour is 2.5Y, 4/4 olive brown. Texture is moderately sorted medium sand. Structure is massive with a few sparse zones of heavy mineral concentrations occurring in the form of contorted and disoriented laminations. Fossils are present in the form of mollusc shells and shell fragments scattered sparsely throughout the section 0 - 99 cm. From 0 - 56 cm there are a few rounded granules scattered randomly about. From 56 - 99 cm a large number of subrounded pebbles and granules of mixed composition (carbonates and granitic mainly) are found in a matrix of medium and coarse sand of 2.5Y, 4/4 olive brown colour. The upper contact as seen in the X-radiograph appeared to be gradational over ≈10 cm. There are several minor heavy mineral concentrations scattered randomly throughout this segment. 112 - 118 cm the colour grades to 2.5Y 3/2 very dark greyish brown. Texture is moderately sorted medium sand. Pebbles which were abundant in the 56 - 99 cm section decrease abruptly at 109 cm leaving a few scattered rounded granules in a matrix of medium sand from 109 - 136 cm. Pebbles gradually begin to appear again at 136 cm, become abundant at 155 cm and decrease in abundance abruptly at 167 cm. A few scattered granules occur to 201 cm. The structure remains massive to 201 cm except for minor heavy mineral concentrations occurring at 170 - 187 cm in the form of contorted
20		
40		
60	3-S-60	
80		
100	3-S-90	
120	3-S-120	
140		
160	3-S-150	
180	3-S-180	
200		

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 3 Section:

Depth (cm)	Core	Size anal., X-radio., C-14 date ref.	Sediment Description
200			(cont'd)
		3-S-210	0 - 231 cm : lenses. At 187 cm a coarse medium sand phase with numerous granules occurs and continues at least to 201 cm. Fossils occur as sparsely scattered shell fragments. 200 - 231 cm the colour has subtly graded to 2.5Y, 4/2 dark greyish brown. Texture remains the same as above plus some pebbles and numerous granules. Structure is becoming slightly laminated with heavy mineral bands, more easily discernable on X-radiograph.
220			
240		3-S-240	
260			
		3-S-270	
280			
300		3-S-300	231 - 335 cm: Upper contact is sharp and slightly inclined. (UNIT 2) Colour is 5Y, 3/2 dark olive grey. Texture is mainly medium and fine sand although variations exist which will be further outlined under structure. Structure is laminated with two types of laminations present in several different forms. Heavy mineral laminations are present throughout unit 2 becoming scarce in the 316 - 335 cm section. Silt and clay laminations are most abundant in the 316 - 335 cm section but are also present scattered sparsely throughout unit 2. The laminations are present in subparallel, subhorizontal stratifications (<0.5 cm thick) from 231 - 283 cm (includes some planar X-laminations). Contorted laminations from 283 - 296 cm.
320			
		3-S-330	
340			
360	Till	3-S-360	
380	Pebbly		
400			

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 3 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
400		(cont'd)
420		231 - 335 cm: Convolute X-laminations from 296 - 310 cm, and subparallel, subhorizontal laminations from 310 - 335 cm. These structures are shown well in X-radiographs of the section. Fossils are present in the form of wood and plant fragments as well as several gastropod shells (a large gastropod at 325 cm) scattered throughout the unit. The wood occurs predominantly below 298 cm. Pebbles are very scarce in unit 2. One
440		
460		
480	3-S-450	occurs at 240 cm and a few more at the lower contact (335 cm). The lower contact is sharp.
500	Till	
520	Pebbly	335 - 956 cm: Colour is 7.5 YR, 4/2 dark brown. Texture is poorly sorted silty clay till with numerous granules and pebbles. Structure is predominantly massive but mottling is evident in certain sections. The mottling results from two particular colour changes from that outlined above. A slightly more reddish (Fe_2O_3?) colour occurs in patches from 363 - 440 cm. 464 - 487 cm a 5Y, 4/2 olive grey mottling occurs. The remainder of the core is massive. Generally, the grey coloured fraction has less silt, more clay than the reddish phases. Pebble density is uniform
540	3-S-540	
560		
580		
600		

(cont'd)

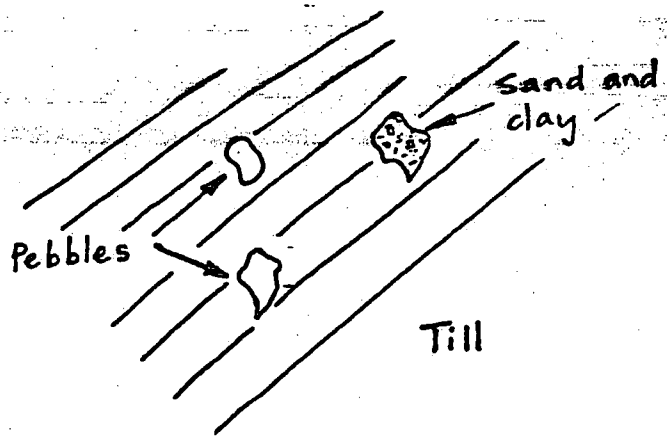
LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 3 Section:

Depth (cm)	Core	Size anal., X-radio., C-14 date ref.	Sediment Description
600			(cont'd)
			335 - 956 cm: throughout the section from 352 - 498 cm. The pebbles are angular to rounded carbonates, siltstones and granitic types with the Paleozoic rocks being dominant. Pebbles were weathered to varying degrees. No fossils were visible in the section. X-radiograph shows the uniformity of this section. (Logger's Note: (See 300 - 400 cm section). The reddish brown mottling is possibly an immature B-horizon representing an incomplete soil profile development on the surface of the till. Such a leaching and precipitation process would indicate a time of subaerial exposure). 498 - 651 cm, the colour has subtly graded to 10 Yr, 4/2 dark greyish brown. The structure is massive. This section is similar in all other respects to that described in the 300 - 400 cm section. Notably, a few partially weathered pebbles occur scattered throughout this section. They usually consist of clay minerals and clastic particles occupying a pebble shaped space in the till.
620		3-S-630	
640			
660			
680			
700	Pebbly Till		
720		3-S-720	
740			
760			
780			
800			

i.e.



(cont'd)

LABORATORY CORE

LOG

Core Location:

Core No.: Section:

size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
800		(cont'd)
	3-S-810	335 - 956 cm: 651 - 804 cm, colour has subtly graded to 7.5 YR, 4/2 dark brown. The till in this section is similar in all other respects to the till previously described. 804 - 956 cm is also similar in all respects to previously described section.
820		
840		
860	Till	
880	Pebbly	
900	3-S-900	
920		
940		
956		- 956 cm: End of core.

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 4 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
0		0 - 116 cm: (UNIT 1) Colour is 2.5 Y 4/4 olive brown. However, this is quite variable with water content. Texture is well sorted medium sand. Well rounded and subrounded granules of siltstone, carbonate and some granitic fragments are scattered frequently throughout the unit at random intervals. Structure is massive with a few very subtle heavy mineral concentrations (lenses) occurring from 60 - 116 cm. Fossils consist of shell fragments scattered throughout the unit. Lower contact is defined as a sharp change in colour; less obvious is a change in structure. The contact is disturbed. X-radiograph shows a good outline of this contact and depicts the structural change much better than in the actual core.
20	4-S-30	
40		
60	4-S-60	
80		
100	4-S-90	
120	4-S-120	
140		116 - 236 cm: (UNIT 2) Colour is 2.5Y, 3/2 very dark greyish brown. Texture is well sorted medium sand with subrounded granules of mixed siltstone and carbonates with a few granitic fragments scattered irregularly throughout the unit. Structure is laminated with thin (<0.5 cm) subparallel heavy mineral laminations and cross-laminations. These laminations are best depicted in the X-radiograph. Fossils consist of shell fragments scattered throughout the
160	4-S-150	
180	4-S-180	
200		

(cont'd)

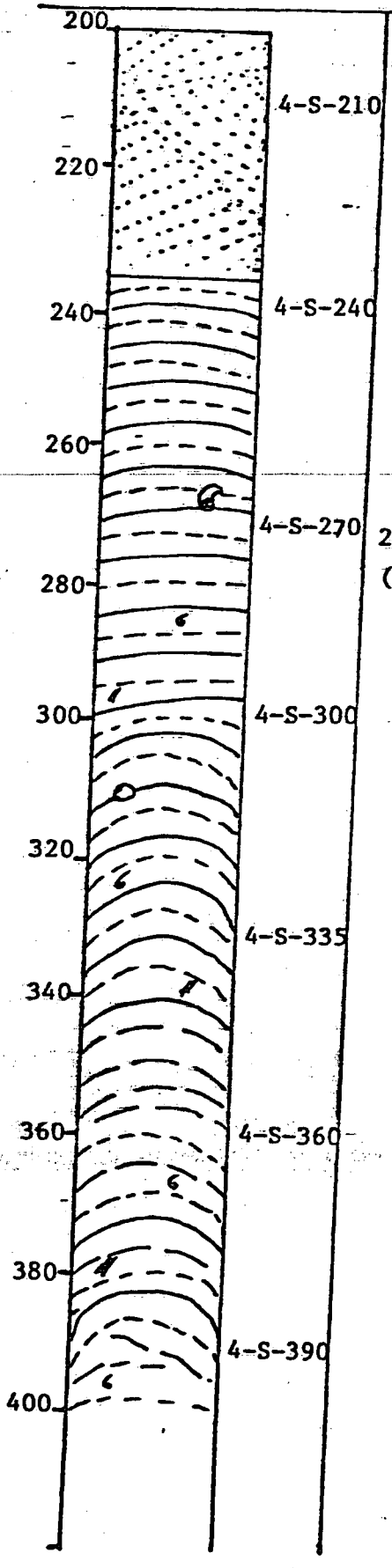
LABORATORY CORE

LOG

Core Location: Pelee Shoal

Core No.: 4 Section:

Depth (cm) | Core | Size anal., X-radio., C-14 date ref. | Sediment Description



(cont'd)

116 - 236 cm: section. An intact gastropod shell occurs at 150 cm. The frequency of occurrence of granules decreases with depth and the granules become scarce by 150 cm. The lower contact of unit 2 is defined as a very sharp textural change from sand to silt and clay.

236 - 550 cm: (UNIT 3) Colour is 5Y, 4/1 dark grey. Texture is predominantly a sandy, clayey silt with lamellae of silty clay (these lamellae are slightly lighter in colour than the sandy clayey silt). Structure is laminated with lamellae of the above-mentioned silty clay (of <0.5 cm) occurring at irregular intervals. Also present are lamellae of Fe sulphides, also thin and occurring at irregular intervals. Both of this type of lamination are subparallel and somewhat contorted (probably as a result of coring). Shell fragments are scattered sparsely throughout this section and at 269 cm, fragments of a large clam shell were found. 300 - 360 cm, similar in all respects to the description of the 236 - 300 cm section. A subrounded limestone pebble was recovered from 312 cm. Generally pebbles in this unit are very scarce. The clay laminations in this unit increase in frequency and

(cont'd)

LABORATORY CORE

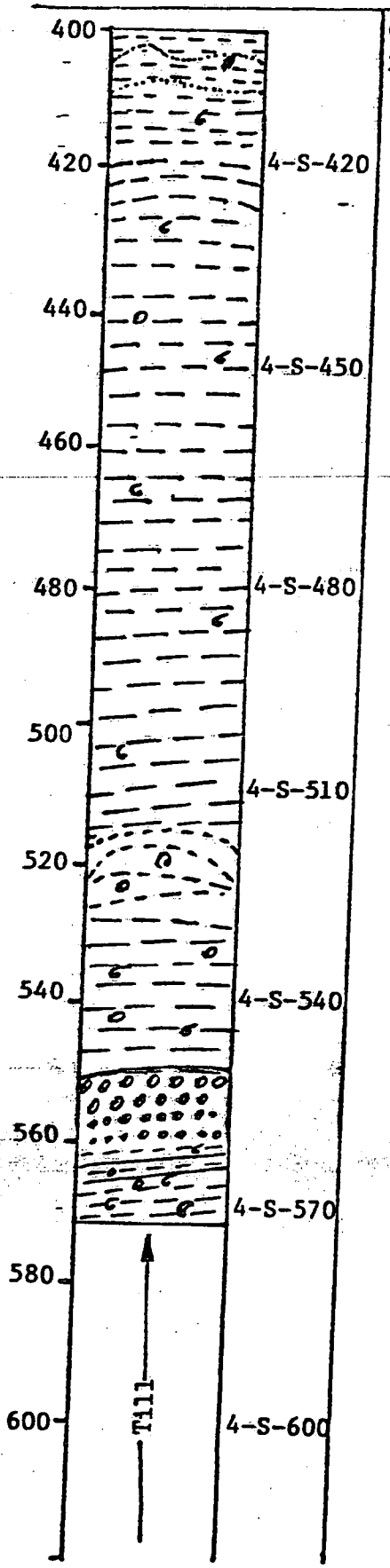
LOG

Core Location: Pelee Shoal

Core No.: 4 Section:

size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description



(cont'd)

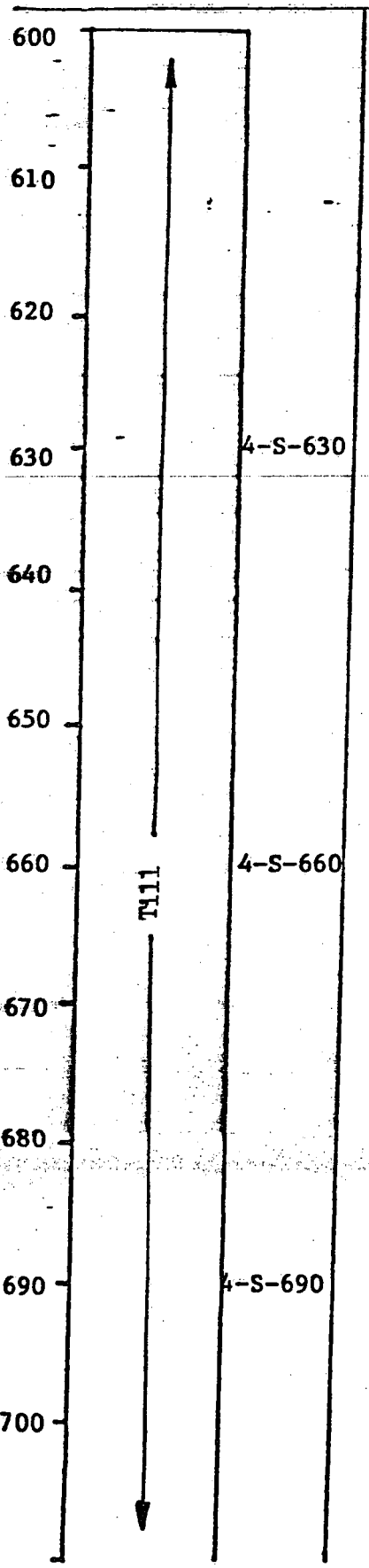
236 - 550 cm: become increasingly contorted with depth until at 360 cm there is ≈ a 50:50 interfingering of sandy clayey silt and silty clay in contorted lenses. At 403 and 408 cm contorted lenses of well sorted fine sand occur. Fossils are present in the form of pelecypod shells, gastropod shells, and shell fragments scattered throughout. Wood chips are also present scattered sparsely throughout. By 500 cm the colour subtly grades to 5Y, 4/2 olive grey. The silty clay phase increases in frequency with depth and by 420 cm it is obviously the predominant phase present. There is a notable increase in clay in the sediment with depth. Pebbles are rare in unit 3, but one was recovered (dark grey siltstone) from 442 cm. Structure is mainly represented by contorted lenses but there is a tendency towards horizontality of the lenses in the 420 - 518 cm section which was not evident in the previous section. Pelecypod shells are scattered sparsely throughout the section. Small black Fe sulphide streaks are common in the 420 - 518 cm section. 518 - 550 cm, the unit consists of three textural phases, present in approximately equal proportions. The silty clay and sandy, clayey silt described previously are still present but appearing at 518 cm are contorted lenses of moderately sorted fine to medium sand. The lenses tend to be subhorizontal. Shell fragments are scattered

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 4 Section:

Depth (cm)	Core	Size anal., X-radio., C-14 date ref.	Sediment Description
600			(cont'd) 236 - 550 cm: throughout this section. Fe sulphide streaks remain common. A few subrounded granules are very sparsely scattered throughout this section. The lower contact of unit 3 is sharp and disturbed by coring and is defined as the upper extent of the underlying gravel band.
610			
620			
630		4-S-630	
640			550 - 572 cm: (Lag gravel?) Lower contact is sharp. Mainly subangular to subrounded siltstones, carbonates with a few granitic fragments in a matrix of poorly sorted coarse sand and granules. The matrix grades finer with depth and by 664 cm is mainly sandy, clayey silt. Small pelecypod shells and shell fragments are present but not common. The unit continues to grade finer with depth and by 571 cm is 5Y, 4/1 dark grey silty clay with very scarce pebbles. At the lower contact, a gastropod (Pleurocera acuta) was recovered; this species being indicative of water warmer than present in Lake Erie, prefers stony bottoms, lacustrine or stream mouth environments.
650			
660	Till	4-S-660	
670			
680			
690		4-S-690	
700			

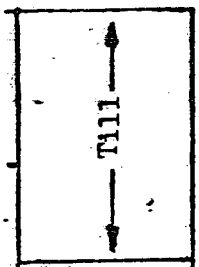
(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 4 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
700		572 - 716 cm: (UNIT 4) Colour is 7.5 YR, 4/2 dark brown. Texture is sandy, silty clay with numerous subangular carbonate, siltstone and granitic pebbles and granules. Some of the pebbles are partially decomposed. Structure is predominately massive. Faint mottling (5Y, 4/1 dark grey) occurs to a depth of 682 cm. Strong grey mottling occurs at a depth of 638 - 658 cm The mottling appears to radiate stratigraphically downwards from a partially decomposed limestone pebble indicating the possibility that the mottling may be the result of leaching The upper contact is sharp and although it is disturbed by coring, it appears to be an erosional surface. This contact is well defined on the X-radiograph. Qualitatively, the upper 30 cm of till feels stiffer and appears to be dessicated (check water content figures).
710		
716		- 716 cm: End of core.

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 5 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
0		0 - 129 cm: (UNIT 1) 0 - 24 cm, colour is 10 YR, 3/3 dark brown. 24 - 80 cm, colour is 2.5Y, 3/2 very dark greyish brown. 80 - 129 cm, colour is 5Y, 3/2 dark olive grey. Texture varies throughout this unit, correlating with the colour changes mentioned above: 0 - 24 cm well sorted medium to coarse sand; 24 - 80 cm, well sorted medium sand; 80 - 129 cm, poorly sorted, silty medium to fine sand. The section 0 - 50 cm has numerous pebbles and granules, mainly subrounded siltstone, shale, and carbonates with minor granitic pebbles and one clay pebble. Structure in the section is massive, lower contact gradational. 50 - 63 cm consists of medium sand (pebble free) with faint, thin (<0.5 cm) heavy mineral laminations and cross-laminations. 63 - 129 cm consists of another zone rich in pebbles and granules. The upper and lower contacts are gradational with the main concentration of pebbles occurring in a gravel layer at 74 - 88 cm. The pebbles are subrounded and subangular siltstones, shales and carbonates with minor granitics. Fossils present are mainly shell fragments scattered throughout the core. These include pieces of large mollusc shells at 14 cm, 70 cm, 96 cm, 110 cm and 125 cm. A gastropod shell was recovered from 123 cm. Lower contact of unit was placed at the point where pebbles from the above pebble band ceased. Numerous gastropod shells were found at 120 cm.
10		
20		
30	5-S-30	
40		
50		
60	5-S-60	
70		
80		
90	5-S-90	
100		

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 5 Section:

Size anal., X-radio., C-14 date ref.

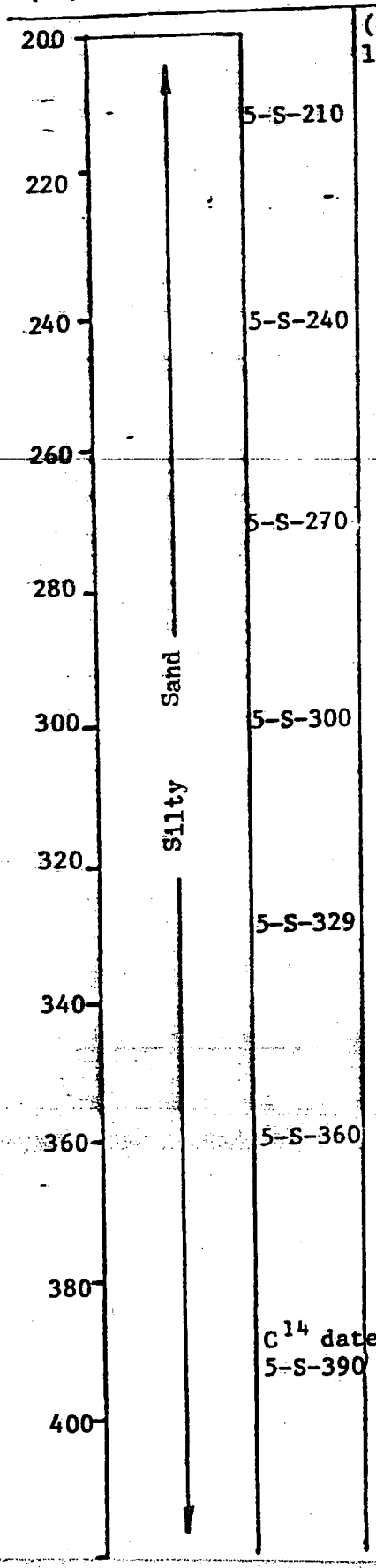
Depth (cm)	Core	Sediment Description
100		129 – 538 cm: (UNIT 2) Colour is 5Y, 3/2 dark olive grey. Texture is silty fine sand. Structure is massive to slightly mottled with the black mottling resulting from varying concentrations of organic matter in the sediment. Fossils include numerous scattered shell fragments and whole gastropod and mollusc shells and numerous fine plant detritus. A shell hash comprised of large mollusc shell fragments occurs at 142 - 144 cm. A fragment of peat-like material was recovered for possible dating at 161 cm. A thin, horizontal lens of silt occurs at 136 cm and others are scattered very sparsely below this horizon. At ≈ 168 cm a network of complexly interfingering lenses of silt and clay appears in the sediment. The predominant sediment type present is still fine and very fine sand, but the interstitial silt and clay content appears to increase gradually with depth. 175 - 180 cm, a band of well sorted, faintly laminated fine sand occurs. 200 - 309 cm, colour is 5Y, 3/2 dark olive grey. Texture is silty, clayey fine sand with complex interfingering of silt/clay lenses. Structure is uniform. Qualitatively, the sorting appears to gradually become poorer with depth and the silt and clay content of the sediment increases. Fossils consist of mollusc (large) and gastropod shells scattered throughout. There is also a minor amount of plant detritus at
110		
120	5-S-120	
130		
140		
150	5-S-150	
160		
170		
180	5-S-180	
190		
200		

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 5 Section:



Sediment Description

(cont'd)

129 - 538 cm: 247 cm. Few granules scattered throughout, in greatest abundance at greater depth (towards 309 cm). Quite generally ≈70% of the sediment is comprised of the silty sand, ≈30% of the silt and clay lenses. 300 - 400 cm, colour has graded subtly to 5Y, 4/2 olive grey. This section is a continuation of the previously described section and is similar to it in all respects. The interstitial silt and clay content of the fine sand phase continues to increase with depth. The number of silt and clay lenses also continues to increase and by the end of this section (≈400 cm) silty sand: silt/clay lenses are ≈60:40. Mollusc shells are scattered sparsely throughout the section; their well preserved nature indicating little transport and low energy environment. A few scattered granules were seen on the X-radiograph to occur around 330 cm. 400 - 500 cm, colour remains 5Y, 4/2 olive grey. This is a continuation of the previous unit, physicall similar to it in all respects. The silt and clay lenses continue to become more numerous and by 450 cm they are in a 50:50 ratio with the silty sand. A few wood chips are seen at 440 - 450 cm, and 493 - 498 cm. By 480 cm the silt and clay lenses have become predominant. The sediment type could now be termed a sandy, clayey silt with complex interfingering of lenses of fine and very fine sand. A contorted lens of medium sand occurs at

(cont'd)

LABORATORY CORE

LOG

Core Location: Pelee Shoal

Core No.: 5 Section:

size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
400		(cont'd)
		129 – 538 cm: 472 – 476 cm. Sorting becomes worse with depth and coarse sand and granule sized particles begin to appear, becoming more common with increased depth. At the base of unit 2, a zone of very poorly sorted granules, coarse sand, medium sand, fine sand, silt and clay occurs. The band is ≈3 cm thick and represents the lower contact of unit 2. The lower contact is sharp and undulating. The undulations, however, may be a result of load casting.
420	5-S-420	
440	5-S-450	
460		
480	5-S-480	
500		538 – 748 cm: (UNIT 3) Colour is 5Y, 3/2 dark olive grey with local variations in some lamellae to 5Y, 4/1 dark grey. Texture is silty clay. Structure is laminated with thin (≥ 0.5 cm) irregularly spaced lamellae of a slightly lighter colour (5Y, 4/1) dark grey. The lamellae are subhorizontal and subparallel, sometimes resembling lenses. Also present are numerous lenses of silt, irregularly spaced, <0.5 cm thick and scattered evenly throughout the unit. A slightly darker, siltier band (with a trace of sand) occurs at 577 – 578 cm. Fossils consist of shell fragments and gastropod shells scattered very sparsely throughout. The shells themselves indicate a warm
510	5-S-510	
520		
540	5-S-540	
560		
570	5-S-570	
580		
600	5-S-600	

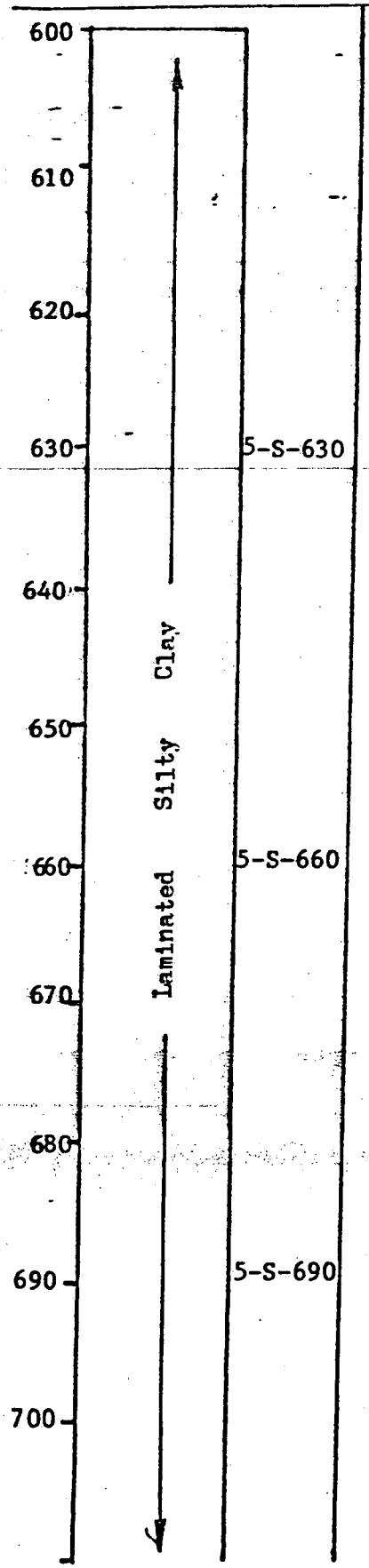
(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 5 Section:

Size anal., X-radio., C-14 date ref.



Sediment Description

(cont'd)

538 – 748 cm: water environment at this time (L. L. Kalas, personal communication). X-radiograph gives a good record of the laminated structure of the unit. A small fragment of wood was seen at 552 cm. Colour remains 5Y, 3/2 dark olive grey with local variations in some lamellae to 5Y, 4/1 dark grey. The section 600 – 700 cm is similar in all respects to the previously described section (538 – 600 cm). Fossils consist of gastropod and pelecypod shells scattered throughout the section. A very small fragment of wood was seen at 648 cm. 700 – 748 cm, similar in all respects to the previously described section. Lower contact is sharp.

748 – 754 cm: (Lag gravel?) Colour is basically 5Y, 3/2 dark olive grey. Texture is a predominantly coarse mixture of the complete size range of sand with silt, minor clay and abundant pebbles and granules. The pebbles are sub-angular to subrounded, mainly Paleozoic rocks (siltstones, carbonates, some chert fragments). Some of the pebbles are coated to varying degrees with calcite concretions. The very soft nature of this coating indicates subaerial exposure with a fluctuating

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 5 Section:

size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
700		(cont'd)
		748 - 754 cm: water table and very low energy conditions. Structure is massive. Upper contact is sharp, the lower is disturbed, probably as a result of coring. Lag gravel zone is well defined in the X-radiograph. Abundant fossils in the lag gravel zone in various states of preservation include a large pelecypod, numerous gastropods, and a wood chip. The shells will be used to ascertain the environment and age of the lag gravel horizon. Directly below the lag gravel was a stiff grey clay which will be described in greater detail in the next section.
710		
720	5-S-720	
730		
740		
750	5-S-750	
760	C^{14} date	754 - 909 cm: (UNIT 4) Colour is 5Y, 5/1 grey in colour at 780 cm grading subtly to 5Y, 4/2 at the base. 754 - 819 cm, texture is slightly silty clay. Subangular pebbles are sparsely scattered randomly throughout. At 819 cm, the silt content of the sediment has increased noticeably. The silt content of the sediment increases gradationally to the end of the hole. The frequency of occurrence and size of the pebbles also begin to increase at this point. The pebbles are mainly carbonates and siltstones with a few granitic fragments present. These erratics may
770		
780	5-S-780	
790		
800		
810	5-S-810	

Laminated Silty Clay

Laminated Silty Clay

(cont'd)

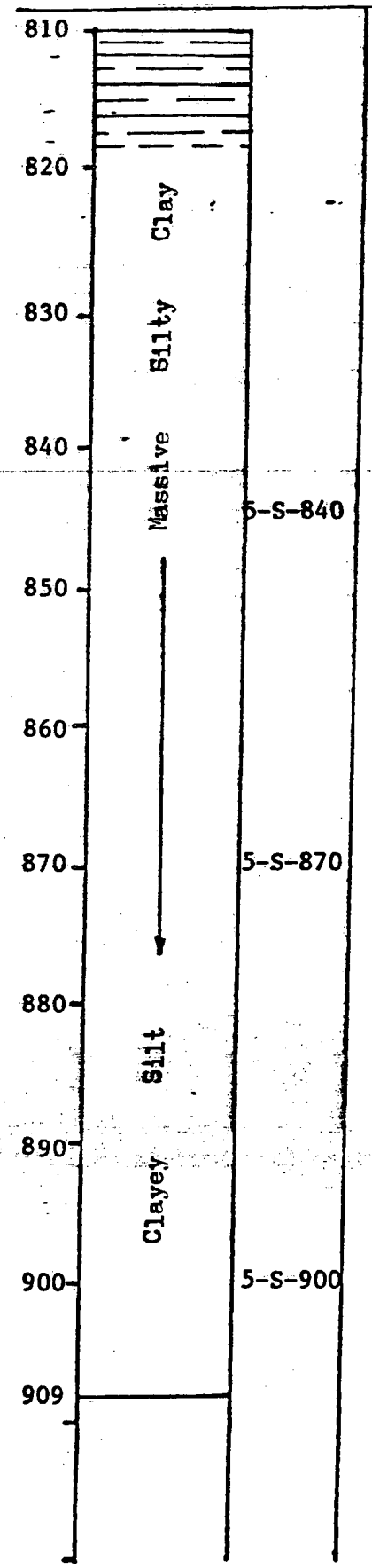
LABORATORY CORE

LOG

Core Location: Pelee Shoal

Core No.: 5 Section:

Size anal., X-radio., C-14 date ref.



Sediment Description

(cont'd)

754 - 909 cm: represent ice rafted particles deposited by melting ice floes in the spring. Structure is faintly laminated with subhorizontal lamellae which have been disturbed by coring. Laminations continue to ≈819 cm where they disappear and the unit becomes massive. Contacts between the two textural and structural phases are gradational near 819 cm. Fossils consist of several species of articulated pelecypods scattered randomly throughout the unit. Some sparse wood fragments are also present. These species of shells indicate temperatures similar to or slightly warmer than present and water depths of ≈<8' in shoreline or creek conditions. X-radiographs show the distribution of erratics throughout the unit. Very minor black Fe sulphide streaking was seen in the clay rich zone.

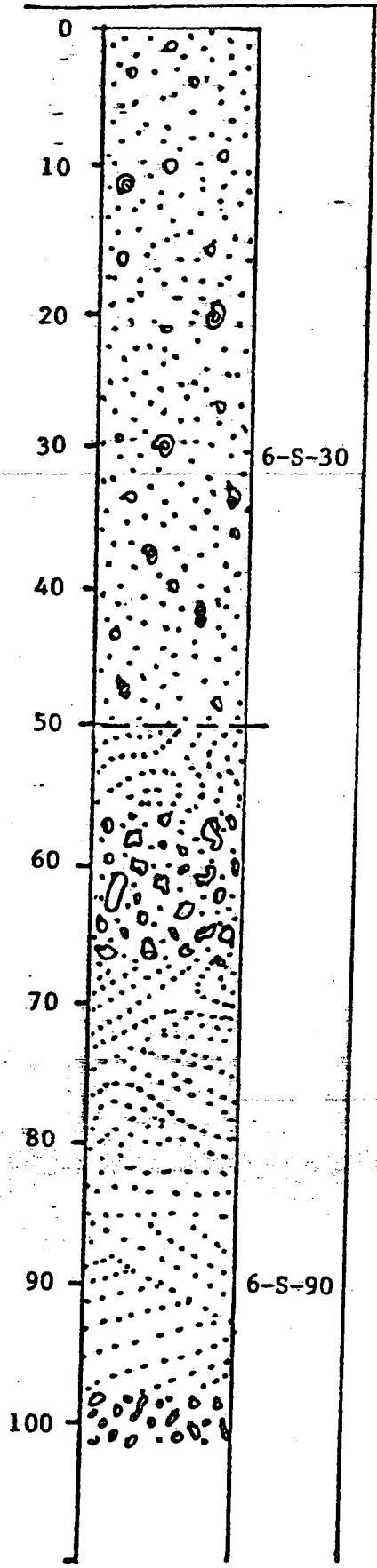
- 909 cm: End of core.

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 6 Section:

size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
0		0 - 50 cm: (UNIT 1) Colour is 2.5Y, 4/4 olive brown. Texture is coarse to medium sand with numerous pebbles and granules. Structure is massive. Pebbles consist mainly of subrounded to rounded Paleozoic (carbonate and siltstone) fragments with some Precambrian granitic fragments. Fossils are present in the form of numerous gastropod shells and shell fragments scattered uniformly throughout the unit. At the lower contact of unit 1, an interlayering of unit 1 and unit 2 takes place over an interval of 18 cm from 36 - 54 cm. The contact was drawn at the point where unit 2 predominates over unit 1.
10		
20		
30	6-S-30	
40		
50		
60		50 - 556 cm: (UNIT 2) Colour is 2.5Y, 3/2 very dark greyish brown. Texture is well sorted medium sand with some variations which will be further outlined. Structure is laminated. Two types of lamination exist: textural variations and heavy mineral concentration variations. Often, combinations of the above forms occur i.e.: heavy minerals are more concentrated in the coarse bands. The heavy mineral bands are thin (<0.5), subparallel, subhorizontal, often convolute and comprise the most common type of lamination in this unit at least to a depth of 133 cm. Coarse bands with coarse
70		
80		
90	6-S-90	
100		

(cont'd)

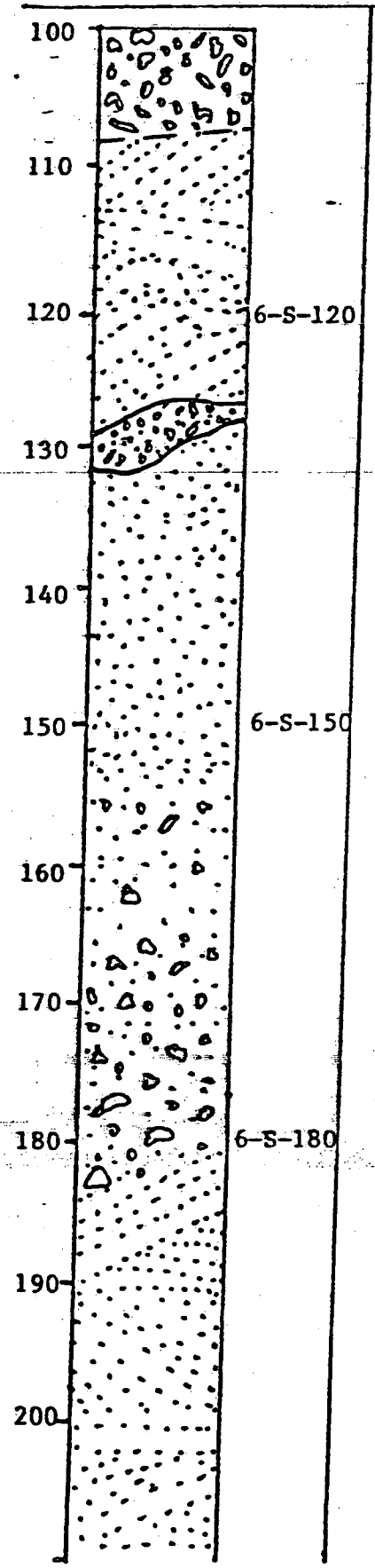
LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 6 Section:

size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description



(cont'd)

50 - 556 cm: sand and numerous granules occur at 98 - 108 cm and 129 - 133 cm. A particularly coarse band with numerous pebbles occurs at 55 - 68 cm (very near the top of the unit). From 133 - 153 cm, the unit is massive, medium sand. Fossils occur in the form of gastropod and mollusc shells and shell fragments which are scattered throughout the section from 50 - 144 cm but which are most concentrated in the coarse bands. X-radiographs of the section give excellent images of the coarse bands but fail to effectively show the heavy mineral laminations. 144 - 294 cm, the upper 2/3 of this section of core is lighter brown in colour while the base of the core returns to the shade originally given for unit 2. This colour variance can be interpreted as an effect of partial dewatering and drying of the core section during storage and has no significance on the interpretation of the core. A coarse pebbly band occurs from 153 - 181 cm. The pebbles are as outlined previously, mainly rounded and subrounded carbonates and siltstones with few granitic fragments. The upper contact of the band is gradational, the lower contact sharp and inclined. 181 - 209 cm, heavy mineral laminations as described previously occur. The form of the laminations in this section, however, is contorted. The remainder of this section of

(cont'd)

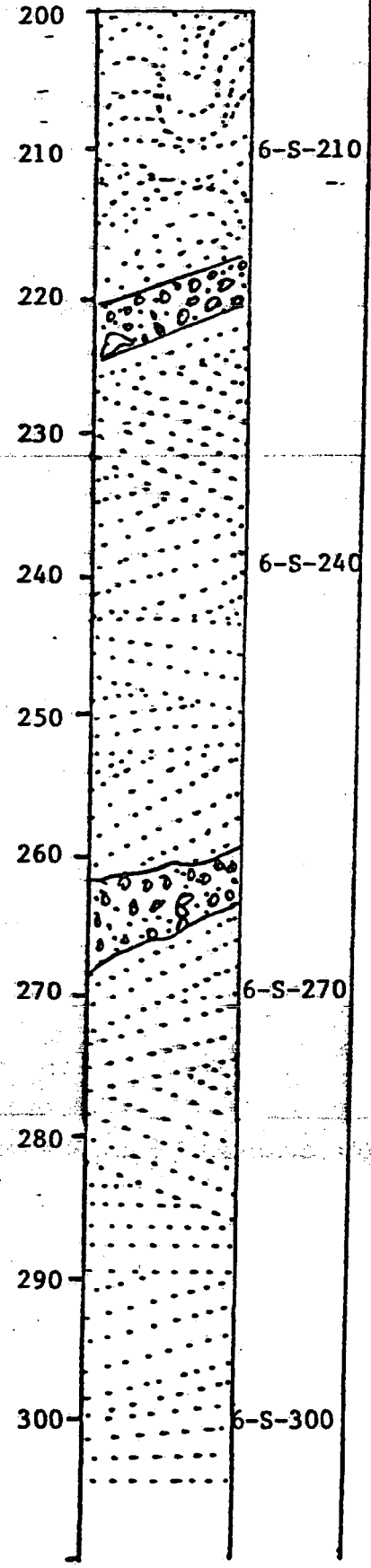
LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 6 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description



(ont'd)

50 - 556 cm: core is strongly laminated, predominantly by heavy mineral laminations. Coarse bands of sand, granules and pebbles also occur at 220 - 225 cm and 260 - 267 cm. Both of these textural bands are inclined and are composed of predominantly subrounded carbonate and siltstone fragments. The heavy mineral laminations found the the 209 - 296 cm section occur in three distinct forms.

(1) Planar cross-laminations in the following intervals: 210 - 220 cm, 225 - 231 cm, 240 - 249 cm and 267 - 326 cm.

(2) Subhorizontal, subparallel laminations occurring at 231 - 240 cm.

(3) Convolute laminations occurring at 249 - 260 cm.

The heavy mineral laminations are generally <0.5 cm thick and are most pronounced between 240 cm and 267 cm. Shell fragments and a few gastropod shells are scattered throughout the 144 - 296 cm section. The laminations described above are discernable on the X-radiograph of this section. Colour remains 2.5Y, 3/2 very dark greyish brown. The banding outlined in the previous section of core continues to be the main point of interest in this core to a depth of 387 cm. 326 - 364 cm, convolute heavy mineral laminations occur. Superimposed on this banding is a layer rich in pebbles at 326 - 343 cm. The pebbles and granules are subrounded and

(cont'd)

LABORATORY CORE

LOG

Core Location: Pelee Shoal

Core No.: 6 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
300		(cont'd)
		50 - 556 cm: are mainly carbonates and siltstones. 364 - 387 cm, a major pebble band occurs. The pebbles and granules are subrounded to subangular siltstones, shales, carbonates, and a few granitics. Some of the pebbles are approaching the cobble size. The interstitial material in this band is a coarse sand. The upper contact is gradational, the lower contact sharp. Notably, a very thin lens of silt occurs at 362 cm, just above the pebble band (<0.5 cm thick). Fossils in the form of gastropod shells and shell fragments are scattered throughout the section to 387 cm, but are most concentrated in the coarse zones. A distinct textural change occurs in the sediment below the coarse pebble band (387 cm). The dominant sand phase now has a texture of fine medium to fine sand and is faintly laminated with heavy mineral zones to massive. The colour remains 2.5Y, 3/2 very dark greyish brown. Variations to the sand described above are:(1) coarse sand and granule phase, (2) predominantly silt phase (silt with some clay and very fine sand 5Y, 4/2 olive grey in colour),(3) shell hash. 397 - 398 cm, shell hash; 401 - 404 cm, medium-coarse sand; 410 - 412 cm, shell hash + bark. The most common textural variation from fine medium-fine sand are the predominantly silt zones. These zones may occur in the form of bands (412 - 417 cm), or lenses interfingering
310		
320		
330	6-S-330	
340		
350		
360	6-S-360	
370		
380		
390	6-S-390	
400		

(cont'd)

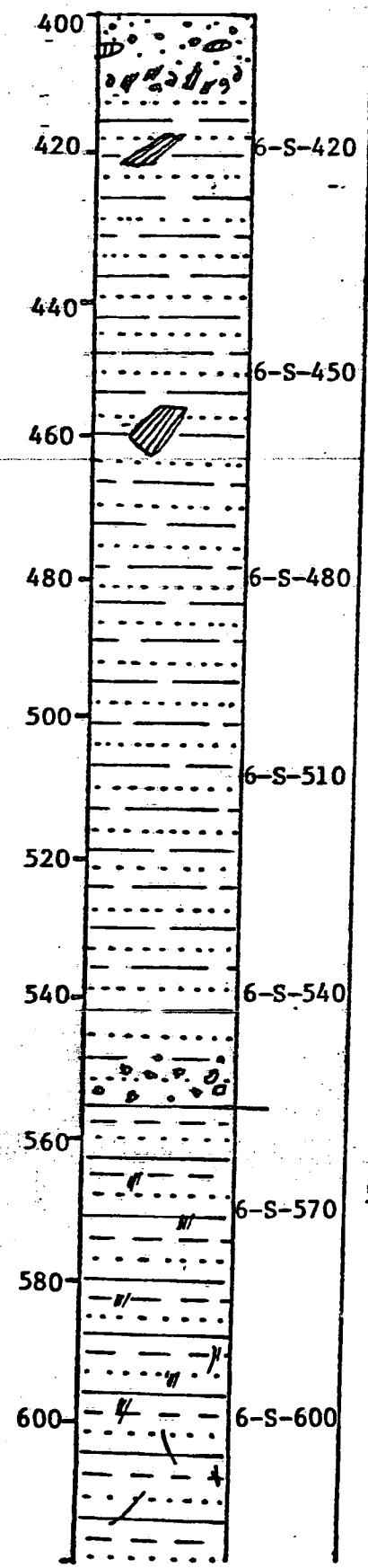
LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 6 Section:

size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description



(cont'd)

50 - 556 cm: with the sand (387 - 388 cm, 405 - 409 cm, 423 - 425 cm, 435 - 447 cm, 475 - 490 cm, 495 - 535 cm). Pebbles and granules are scattered sparsely throughout the section. A fragment of wood 5 cm long was recovered at 420 cm, another large chip from 458 cm. A seed (?) was recovered at 414 cm (and confirmed by T. Anderson later). Colour remains 2.5Y, 3/2 very dark greyish brown (5Y, 4/2 olive grey for the silt lenses). Generally from 495 - 556 cm the silt content of the sand increases and the general grain size of the sand decreases. Structure in this section is dominated by silt lenses interfingering with the sand although massive sections of silty sand do occur (535 - 556 cm). Gastropod shells and shell fragments as well as wood chips are scattered sparsely throughout the 495 - 556 cm section. A few scattered subrounded shale and siltstone pebbles occur at 544 - 556 cm.

556 - 1195 cm: (UNIT 3) 556 - 594 cm section, colour is 5Y, 3/2 dark olive grey. Texture is a sandy, clayey silt. Structure is massive. Upper contact is gradational. Contact was arbitrarily placed since the texture was grading finer

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 6 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core		Sediment Description
600	Massive Sandy Clayey Silt	6-S-630	(cont'd) 556 - 1195 cm: from 390 cm. Contact may be defined as the point where the silt and clay predominate over sand and at this point the contact was qualitatively chosen. Shell fragments are scattered sparsely throughout this section but from the X-radiograph wood chips and plant detritus are seen to be more concentrated than in unit 2. Colour has subtly graded to 5Y, 4/2 olive grey by 600 cm. This slightly lighter colour may coincide with a slight decrease in the amount of visible organic matter. Generally, except for the colour difference, everything said about the sediment of unit 3 in the 556 - 594 cm section is applicable to the 594 - 700 cm section. A wedge of well sorted fine sand occurs in this section at 664 - 673 cm. Pebbles are very scarce in this unit; (670 cm, 693 cm, 721 cm). Shell fragments are scattered throughout the 594 - 759 cm section. Numerous small cracks occur in this section of core possibly as a result of expansion caused by the release of gas from the pore water after the pressure on the water was decreased by taking the core. A very slight H_2S odour could be detected when the sediment was disturbed. At 760 cm, colour remains 5Y, 4/2 olive grey. Structure begins to be dominated by the complex interfingering of three distinct textural types.
620			
640			
660		6-S-660	
680			
700		6-S-690	
720		6-S-720	
740		6-S-750	
760	Complex, interfingering of Sand, Silt, and Clay		
780		6-S-780	
800			

(cont'd)

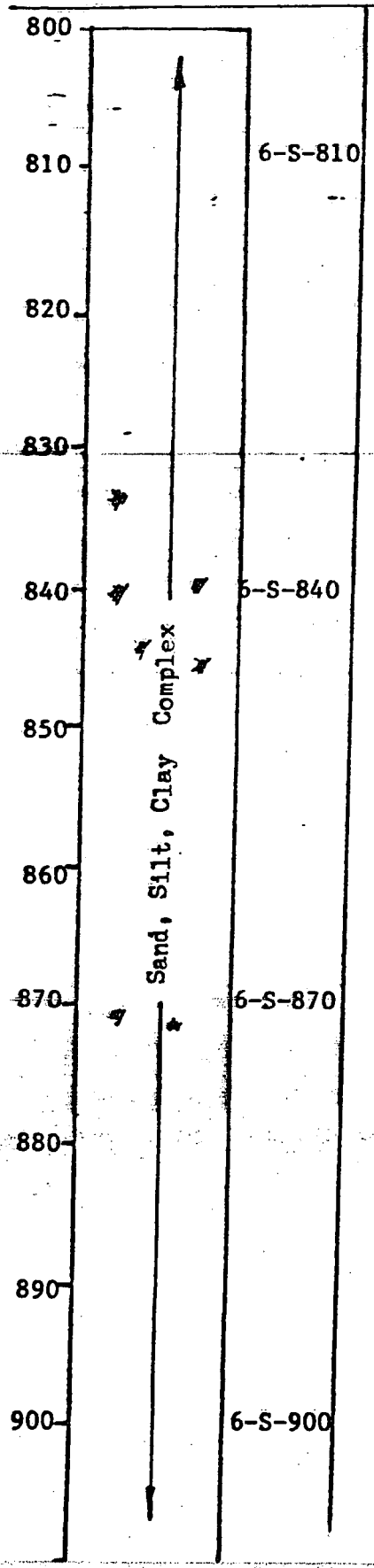
LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 6 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description



(cont'd)

556 - 1195 cm: (1) Predominantly silt: This is a continuation of the sediment type present in the previous sections of this unit. It is mainly silt with fine + very fine sand and clay present in about equal amounts.

(2) Predominantly sand: This mainly fine and very fine sand (well sorted) with some silt and minor clay also present.

(3) Predominantly clay: Mainly clay with some silt also present.

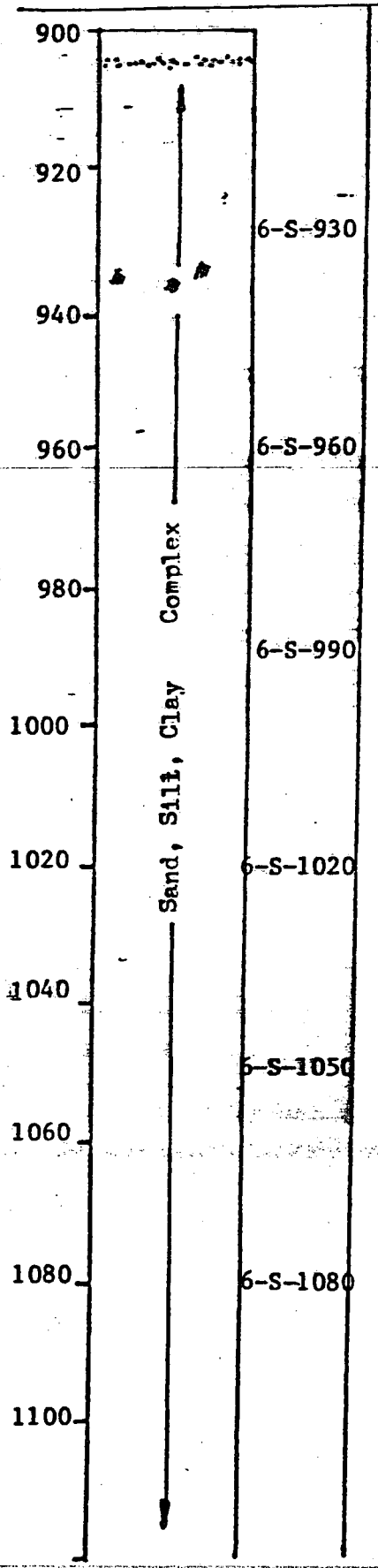
The predominantly silt phase is still the most common sediment type present and provides a background for the lensing of the other two types. Generally speaking the clay lenses are most common in the 810 - 902 cm section of this core while the sand lenses are equally distributed throughout. The lenses themselves are usually contorted, possibly as a result of mobilization of the sediment during compaction although no distinctive features such as flame structures can be observed. Mollusc shells are sparsely scattered throughout the core. Their unbroken character indicates a relatively low energy environment. Wood chips and other plant ditrius are also scattered sparsely throughout the section notably at 828 - 855 cm and at 877 - 881 cm. The sand phase may represent a wind blown sediment which is blown onto the water periodically. Colour is 5Y, 4/2 olive grey.

(cont'd)

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 6 Section:



Sediment Description

(cont'd)

556 - 1195 cm: Complex, contorted lenses of previously described sediments continue. Clay lensing is more abundant in the 810 - 902 cm section. 890 - 902 cm, the lensing becomes slightly more subhorizontal. 862 cm, a sample was taken from a sand lens for size analysis to attempt a determination as to whether it is an eolian sorted deposit. Sample designation will be 6 - S - 862. A granule sized siltstone pebble was recovered from 893 cm (one of the sand lenses). Numerous cracks in the core in this section, slight H_2S odour could be detected. 900 - 1000 cm, colour of the predominantly silt phase is 5Y, 3/2 dark olive grey; clay phase is 5Y, 4/2 olive grey; sand phase is 5Y, 3/2 dark olive grey. The same three textural phases present in the previous section are again dominant here. Generally, subhorizontal clay and sand lenses are much more common in this section than in the previous one. Subhorizontal, subparallel sand and clay lamellae of variable thickness (generally ≈ 0.5 cm) predominate in the following sections: 890 - 910 cm, 933 - 983 cm, while contorted lenses of sand and clay predominate in the 910 - 933 cm and 983 - 1000 cm sections. There is no repetitive arrangement of the different types of bands. Notably, at 904 - 905 cm a horizontal band of fine sand exhibiting normal grading occurs (perhaps indicative of water transported

(cont'd)

23754

LABORATORY CORE LOG

Core Location: Pelee Shoal

Core No.: 6 Section:

Size anal., X-radio., C-14 date ref.

Depth (cm)	Core	Sediment Description
1100		(cont'd)
		556 - 1195 cm: and sorted material). Wood chips are scattered sparsely throughout the section, concentrated at 936 cm. A peat-like band occurs at 972 cm. Mollusc shells (intact) are scattered sparsely throughout the section indicating small transport distances in a low energy environment. The description of the section 900 - 1000 cm applies in all respects to this section, also to at least 1054 cm. Subhorizontal, subparallel sand and clay lenses and lamellae predominate in the following sections: 1000 - 1006 cm, 1025 - 1039 cm, 1054 - 1072 cm, 1094 - 1113 cm. There are numerous cracks in the core (mainly transverse) throughout this section. The description of the section 900 - 1000 cm applies in all respects to this section also. Subhorizontal, subparallel sand and clay lenses and lamellae predominate in the following sections: 1113 - 1122 cm, 1155 - 1174 cm, 1179 - 1195 cm. Contorted lenses of sand and clay predominate in the following sections: 1094 - 1113 cm, 1122 - 1155 cm, 1174 - 1179 cm. Plant ditrius and complete mollusc shells are scattered very sparsely throughout this section. There are numerous transverse cracks throughout this section of core.
1110	6-S-1113	
1120		
1130		
1140	6-S-1140	
1150		
1160		
1170	6-S-1170	
1180		
1190		- 1195 cm: End of core.
1195		

Sand, Silt, Clay Complex