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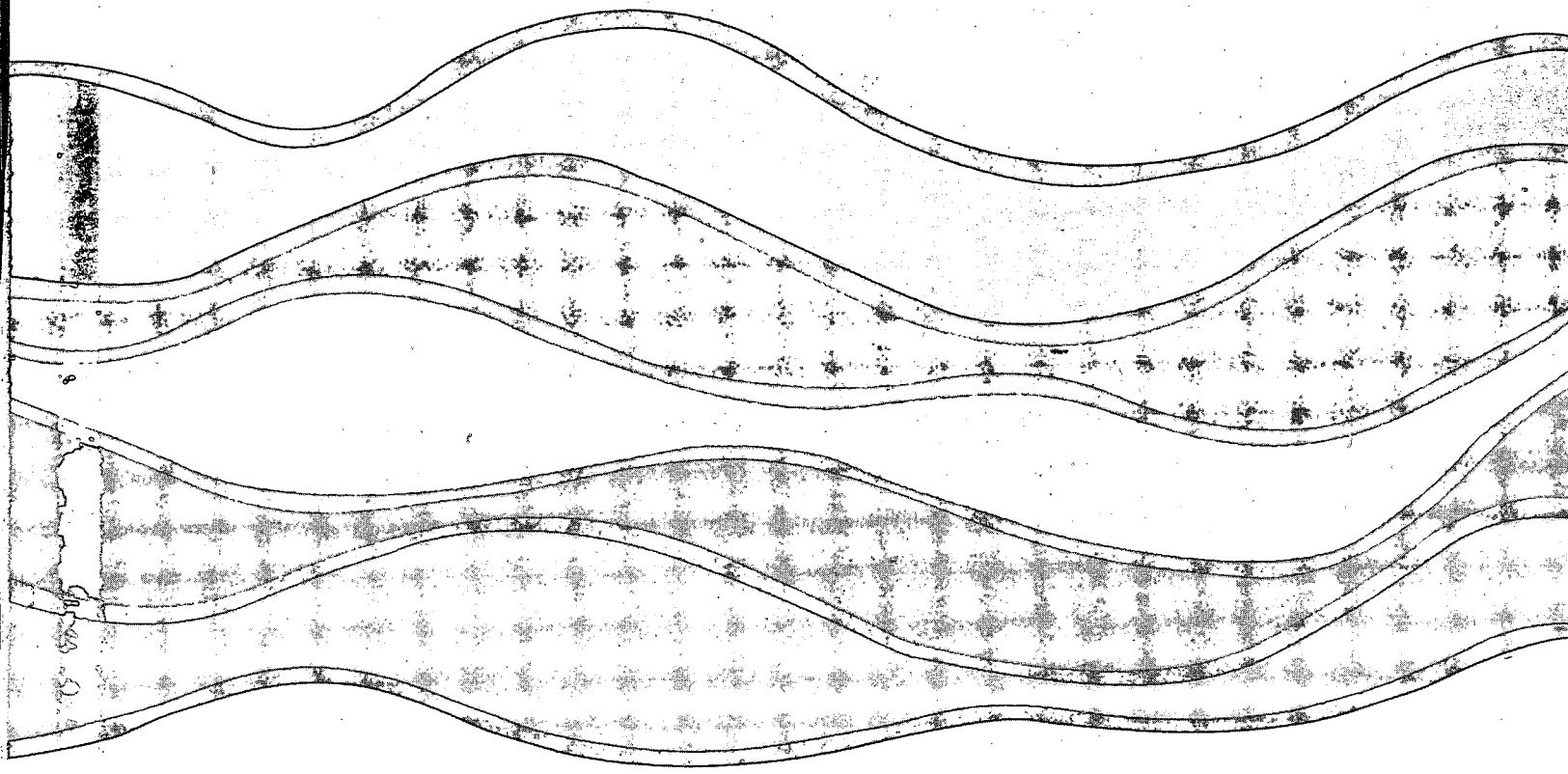

FIELD AND LABORATORY PROCEDURES AND DATA FOR SITE-8 CORES FROM HAMILTON HARBOUR

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NWRI Technical Note LRB-92-TN-07

LAKES RESEARCH BRANCH

TECHNICAL NOTE

DATE: May 1992 **REPORT NO:** LRB-TN-92-07

TITLE: Field and laboratory procedures and data for site-8 cores from Hamilton Harbour

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REASONS FOR REPORT: Requested by the University of Waterloo

STUDY FILE NO: Study 82102

1.0 INTRODUCTION

Sediment cores collected at site 8 in Hamilton Harbour in 1987 (Rukavina 1987) have been used in several studies by NWRI and the University of Waterloo on the sedimentology, paleoenvironments, and chemistry of harbour sediments. This note is a compilation of field and laboratory procedures used to collect and process the cores and of the resulting data. It has been prepared as a source document for studies now in progress.

2.0 FIELD PROCEDURES

Two Benthos cores were collected at site 8 (Figure 1) during the summer of 1987 as part of a survey of Hamilton Harbour bottom sediments (Rukavina 1987; Mawhinney 1987). Navigation was by Motorola Miniranger with an accuracy of about ±5 m and water depth was recorded to the nearest decimetre with a hydrographic sounder. Field data are summarized below:

Core	Date	Depth (IGLD) m	Northing	Easting	Length, cm
8A	87-07-09	9.1	4795235	596207	51
8B	87-07-09	9.0	4795230	596215	54

Upon recovery, cores were photographed through their plastic liners, examined for evidence of layering or disturbance and then placed in cold storage.

3.0 LABORATORY ANALYSES

As the first stage in analysis, cores were x-radiographed (Rukavina 1967) in their plastic liners and radiograph negatives were examined and logged for variations in structure and density and also scanned with a microdensitometer to collect digital film-density data.

Core 8B was then cut longitudinally, photographed and logged for physical properties (Duncan 1982). Appendix 1 lists the core description. Subsamples were taken for geotechnical analysis as channel samples from each of the 5 units identified by logging. Splits of the samples were analysed for grain size (Duncan and LaHaie 1979) and water content (Duncan 1982). Water content was expressed as percent dry weight, the ratio of the weight of water to the weight of dry sediment.

Core 8A was extruded as 1-cm slices and subsamples of the slices were analysed for porosity and particle density (Delorme 1991) and also dated by ^{210}Pb and pollen methods (Harper and Delorme

1988; Turner and Delorme 1988). Density was measured with a Micromeritics density analyser (Micromeritics 1987).

Selected samples of core 8A were also analysed for the metals Zn, Cu, Pb, Cd and Fe (Murphy, NWRI, pers. commun.) and for organochlorine compounds (Fox, NWRI, pers. commun.).

4.0 RESULTS

Grain size and water content for core 8B are summarized in Appendix 2 and plotted as profiles in Figure 2. Size is reported as size-fraction percentages, median size, and modal size(s) (Sandilands and Duncan 1980). Median and modal sizes are in the PHI scale:

$SIZE_{PHI} = -LOG_2 m$ where m is the diameter in mm

Appendix 3 lists corresponding sizes for PHI and metric and English units.

Porosity and particle-density data for core 8A (Turner and Delorme 1988) are tabulated in Appendix 4 and plotted as profiles in Figure 3. The core depth in the profiles is uncompacted mid-depth (Delorme 1991). Delorme uses a number of terms to describe the position of samples from extruded cores. A sample number is assigned sequentially to each extruded sample slice which is nominally 1 cm thick. The "compacted" depth and mid-depth are the depths of the base and middle of an extruded sample slice computed from the slice volume. The "uncompacted" depths are compacted depths expanded to maintain a constant porosity (the surface porosity) throughout the length of the core.

Appendix 4 and Figure 4 show the relationships between sample numbers, compacted and uncompacted depths and the ^{210}Pb ages reported in Turner and Delorme (1988).

The ^{210}Pb data show an uncompacted sedimentation rate of 0.37 cm yr^{-1} and a date of 1828 for the rise in *Ambrosia* pollen (Harper and Delorme 1988).

Figure 5 shows the profiles of x-ray film-density readings for both cores. In this case the depth parameter is measured depth rather than compacted or uncompacted depth.

NWRI data on metals and PCBs for core 8A have not been published. Profiles of content vs uncompacted depth for Zn, Cd, Pb, Cu and Fe show a sharp drop to what appear to be background levels between 19 and 25 cm (Murphy, NWRI, pers. commun.). The profile for total PCBs shows relatively low surface levels, a peak at 4 cm and a drop to background levels at about 9 cm (Fox, NWRI, pers. comm.).

5.0 REFERENCES CITED

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Figures

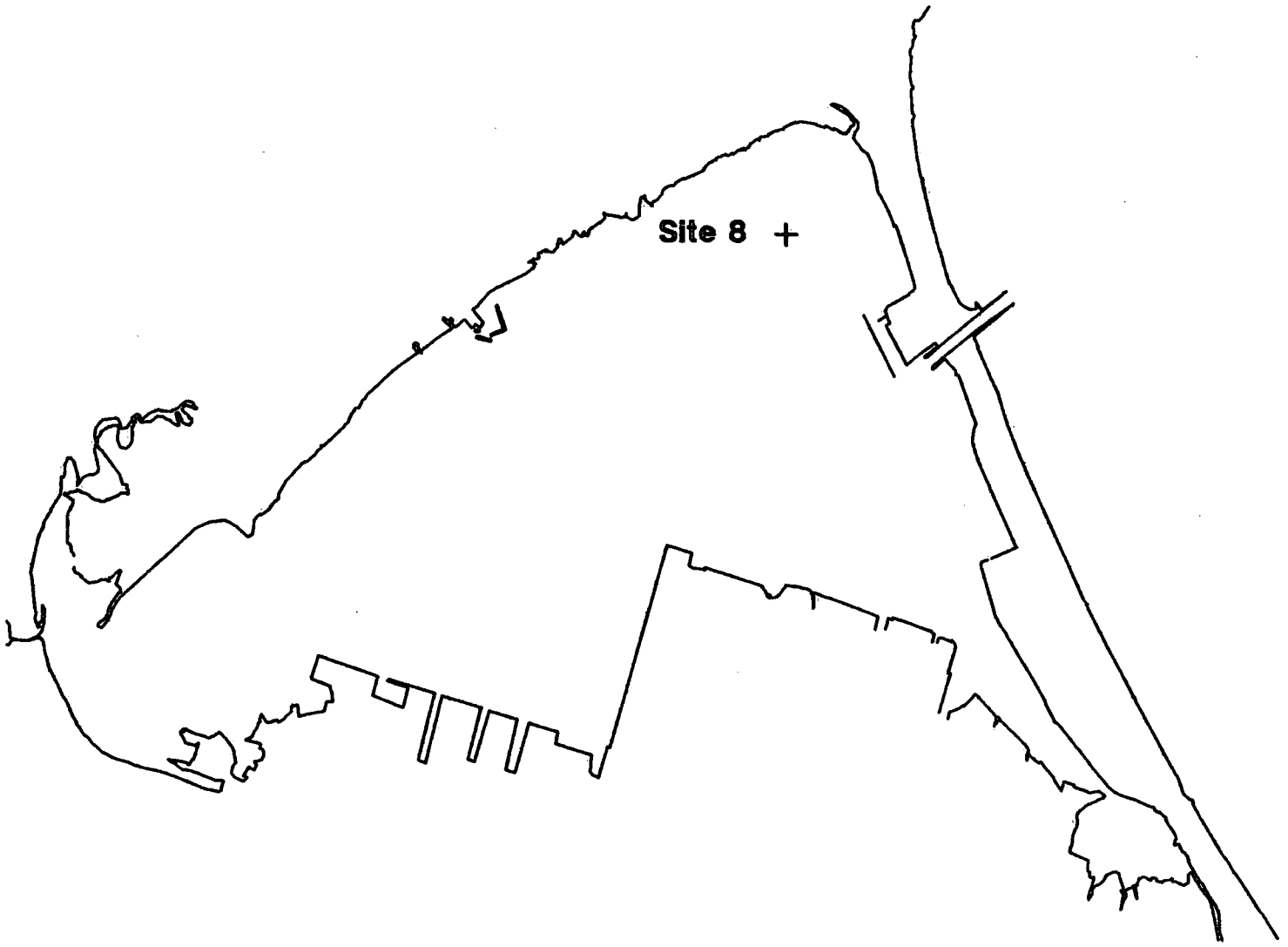

Fig. 1 Site Map

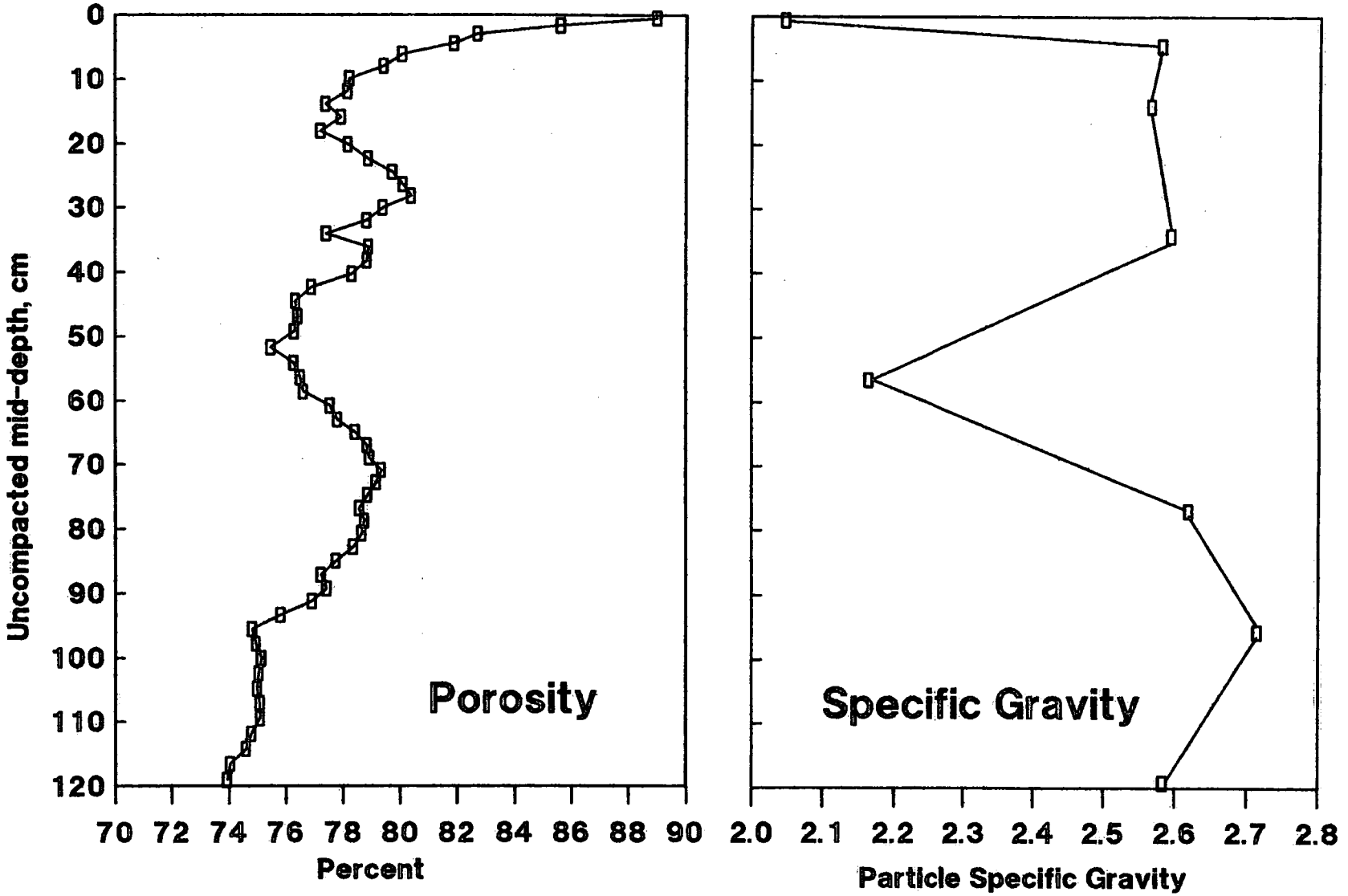

Fig. 3. Core 8A Profiles

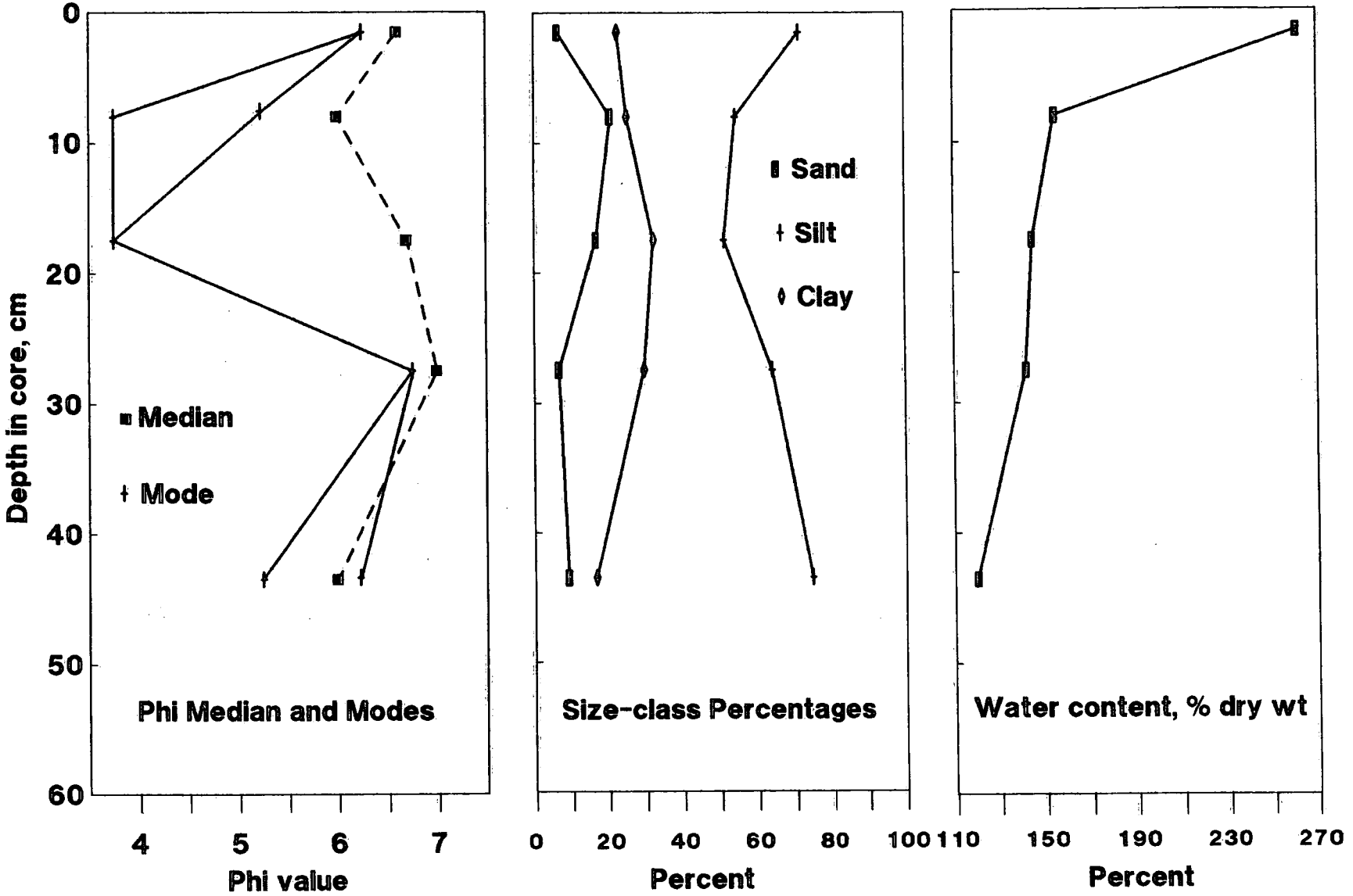

Fig. 2. Core 8B Profiles

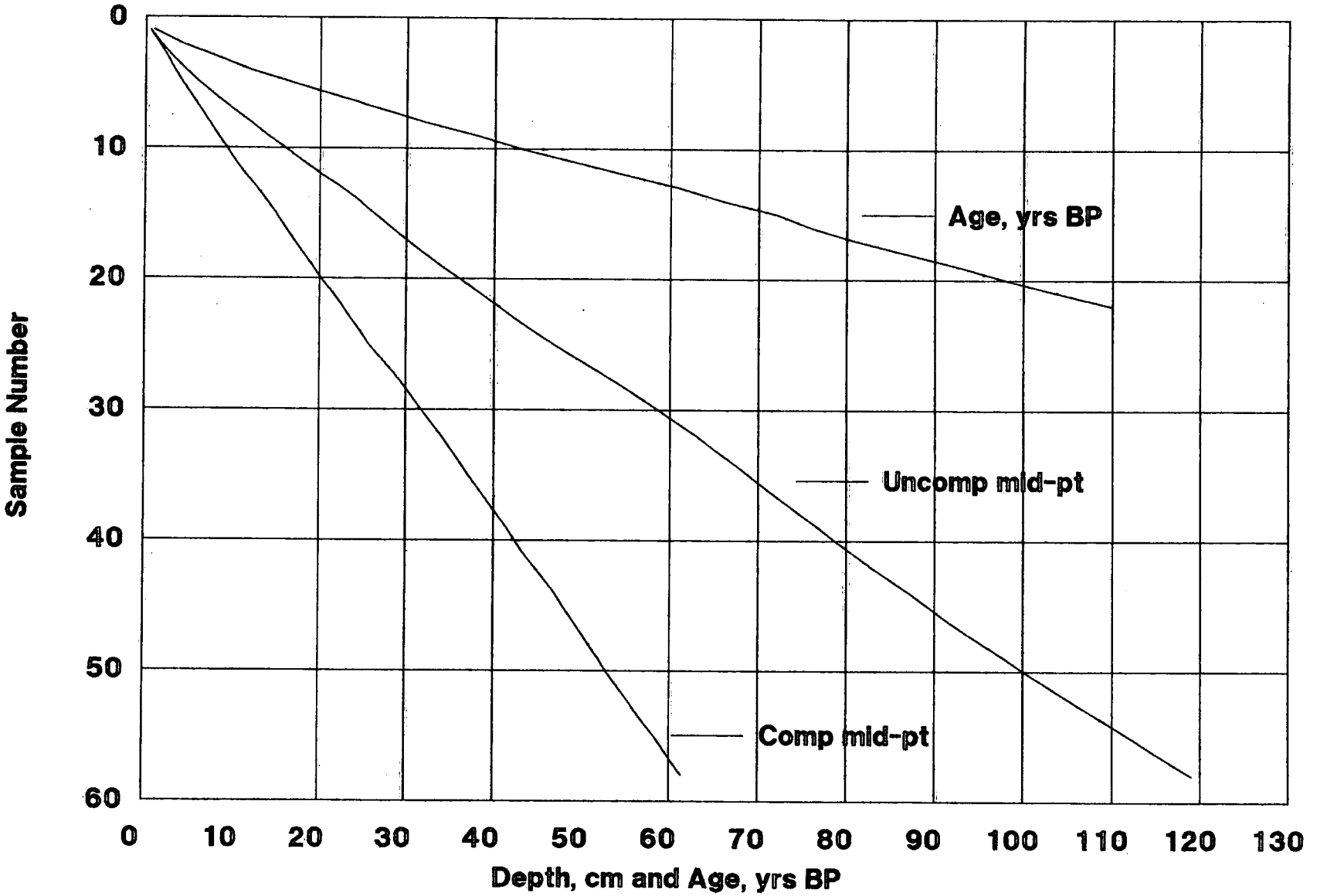

Fig. 4. Age-Depth Relationships

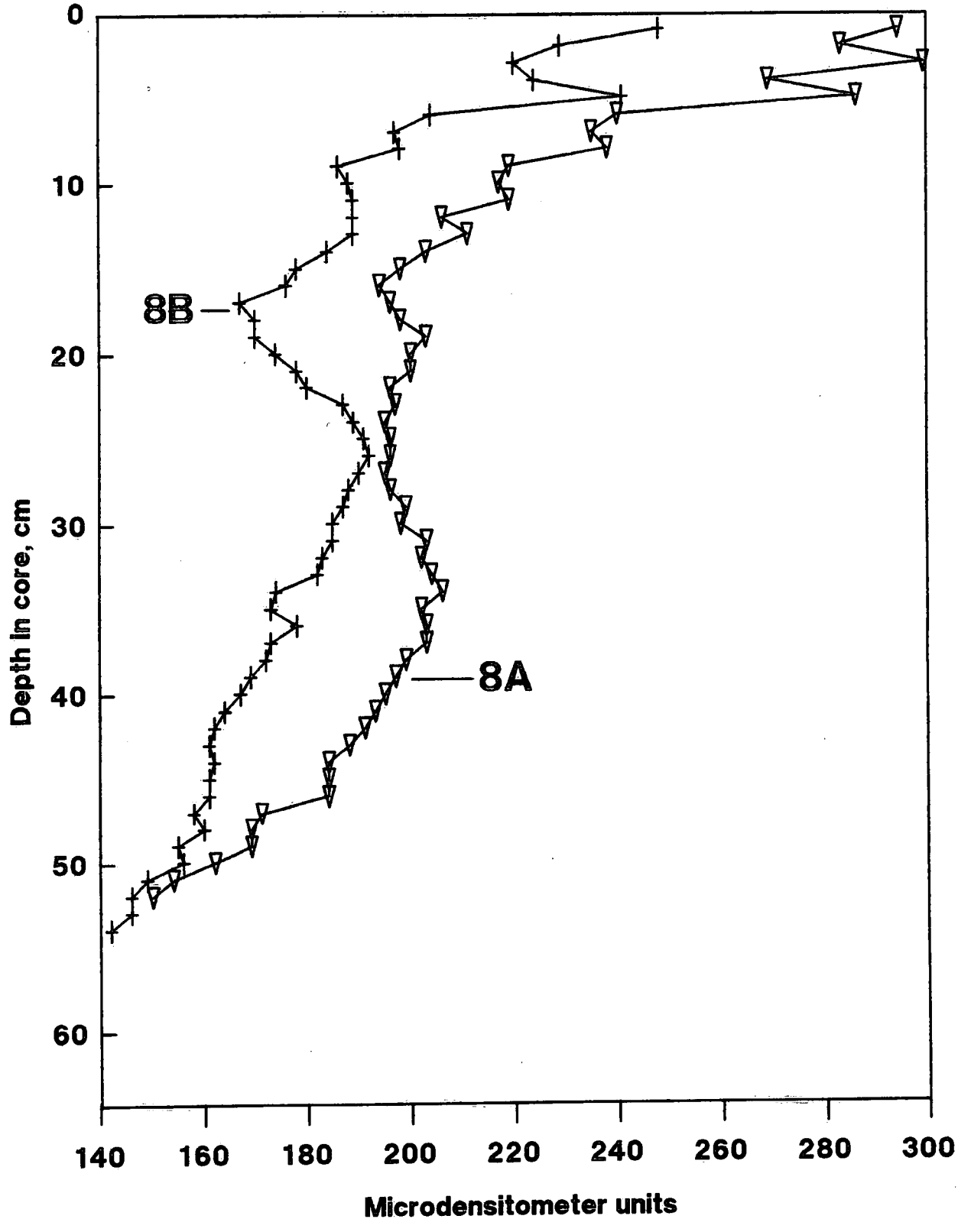

Fig. 5. X-ray Film-density Profiles

Appendix 1

Core log for 8B

HAMILTON HARBOUR CORE NO:8B CORE TYPE: Benthos LENGTH: 54 cm

NORTHING,EASTING: 4795230,596215 IGLD DEPTH: 9.0 m

COLLECTION DATE: 07-08-87

DATE LOGGED: 12-10-87 BY N.A. Rukavina

PHOTOS- SLIDES: Y - X-RAY: Y

UNIT NO: 1 0-3 CM

COLOUR: brown-black
CONSISTENCY: soupy
ODOUR: sewage
TEXTURE: silty clay, minor sand
STRUCTURE: disturbed; massive in X-radiograph
SHELLS: none
PEBBLES: none
HCL REACTION: moderate with H2S odour
WATER CONTENT (% DRY WT): 261.04
SIZE DATA? Y POLLEN DATA? N
COMMENTS: black suspended particles above interface in core tube

UNIT NO: 2 3-13 CM

COLOUR: brown-black
CONSISTENCY: soft
ODOUR:
TEXTURE: sandy mud
STRUCTURE: porous in x-radiograph, massive otherwise. Fine-grained cottage-cheese texture. Porosity decreases downward.
SHELLS: none
PEBBLES: none
HCL REACTION: moderate, slight H2S odour
WATER CONTENT (% DRY WT): 154.76
SIZE DATA? Y POLLEN DATA? N
COMMENTS: fibrous material

UNIT NO: 3 13-22 CM

COLOUR: medium brown with black mottling
CONSISTENCY: medium firm
ODOUR:
TEXTURE: silty clay, minor sand
STRUCTURE: massive, upper portion slightly darker than lower portion in X-radiographs. Lower portion mottled.
SHELLS: none
PEBBLES: none
HCL REACTION: moderate, slight H2S odour
WATER CONTENT (% DRY WT): 145.65
SIZE DATA? Y POLLEN DATA? N

CORE 8B cont'd

UNIT NO: 4 22-33 CM

COLOUR: mottled dark brown and light brown
CONSISTENCY: medium firm
ODOUR:
TEXTURE: silty clay
STRUCTURE: slightly darker in x-radiograph than unit above. Lower porosity than unit above.
SHELLS: none
PEBBLES: none
HCL REACTION: very strong, slight H2S odour
WATER CONTENT (% DRY WT): 142.29
SIZE DATA? Y POLLEN DATA? N

UNIT NO: 5 33-54 CM

COLOUR: medium brown
CONSISTENCY: firm
ODOUR:
TEXTURE: silty clay
STRUCTURE: slightly lighter in X-radiograph than unit above. diffuse laminae in mid third of unit.
SHELLS: none
PEBBLES: none
HCL REACTION: very strong, slight H2S odour
WATER CONTENT (% DRY WT): 120.44
SIZE DATA? Y POLLEN DATA? N
COMMENTS: suspect high organic content because of drier surface

Appendix 2

Grain size and water content, core 8B

CORE 8B

Sample Interval, cm	Mid-depth cm	Ph Median	Phi Mode	% Sand	% Silt	% Clay	Water Content, % dry wt
0-3	1.5	6.6	6.25	6.4	71.1	22.5	261
3-13	8.0	6.0	3.75 5.25	20.6	54.3	25.1	155
13-22	17.5	6.7	----	16.7	51.2	32.1	146
22-33	27.5	7.0	6.75	6.7	63.8	29.5	142
33-54	43.5	6.0	5.25 6.25	9.1	74.4	16.5	120

Appendix 3

Grain-size Terminology

	PHI EQUIVALENTS			
PHI	MM	MICRONS	INCHES	IN. X 1000
-8.0	256.000		100.787	
-7.5	181.019		71.267	
-7.0	128.000		50.394	
-6.5	90.510		35.634	
-6.0	64.000		25.197	
-5.5	45.255		17.817	
-5.0	32.000		12.598	
-4.5	22.627		8.908	
-4.0	16.000		6.299	
-3.5	11.314		4.454	
-3.0	8.000		3.150	
-2.5	5.657		2.227	
-2.0	4.000		1.575	
-1.5	2.828		1.114	
-1.0	2.000	2000.00	0.787	787.40
-0.5	1.414	1414.21	0.557	556.78
0.0	1.000	1000.00	0.394	393.70
0.5	0.707	707.11	0.278	278.39
1.0	0.500	500.00	0.197	196.85
1.5	0.354	353.55	0.139	139.19
2.0	0.250	250.00	0.098	98.43

PHI	MM	MICRONS	INCHES	IN. X 1000
2.5	0.177	176.78	0.070	69.60
3.0	0.125	125.00	0.049	49.21
3.5	0.088	88.39	0.035	34.80
4.0	0.063	62.50	0.025	24.61
4.5	0.044	44.19	0.017	17.40
5.0	0.031	31.25	0.012	12.30
5.5	0.022	22.10	0.009	8.70
6.0	0.016	15.63	0.006	6.15
6.5	0.011	11.05	0.004	4.35
7.0	0.008	7.81	0.003	3.08
7.5	0.006	5.52	0.002	2.17
8.0	0.004	3.91	0.002	1.54
8.5	0.003	2.76	0.001	1.09
9.0	0.002	1.95	0.001	0.77
9.5	0.001	1.38	0.001	0.54
10.0	0.001	0.98	0.000	0.38
10.5	0.001	0.69	0.000	0.27
11.0	0.000	0.49	0.000	0.19
11.5	0.000	0.35	0.000	0.14
12.0	0.000	0.24	0.000	0.10

Appendix 4

Core 8A Data

CORE 8A

Sample number	Comp depth	Comp midpt	Uncomp depth	Uncomp midpt	Porosity percent	Particle S.G.	Years BP
1	1.0	0.5	1.0	0.5	89.0	2.047	1
2	1.9	1.5	2.3	1.6	85.6		4
3	2.9	2.4	3.7	3.0	82.7		8
4	3.7	3.3	5.3	4.5	81.9	2.580	12
5	4.7	4.2	7.0	6.1	80.0		17
6	5.7	5.2	8.9	7.9	79.4		22
7	6.7	6.2	10.9	9.9	78.2		27
8	7.7	7.2	12.9	11.9	78.1		32
9	8.7	8.2	14.9	13.9	77.4	2.566	38
10	9.8	9.2	17.0	16.0	77.9		43
11	10.8	10.3	19.1	18.0	77.2		49
12	12.1	11.4	21.3	20.2	78.1		55
13	13.2	12.6	23.4	22.4	78.9		61
14	14.4	13.8	25.4	24.4	79.7		66
15	15.4	14.9	27.3	26.4	80.1		72
16	16.4	15.9	29.0	28.1	80.4		76
17	17.5	16.9	30.9	30.0	79.4		81
18	18.6	18.0	33.0	32.0	78.8		87
19	19.7	19.1	35.1	34.1	77.4	2.594	93
20	20.8	20.2	37.1	36.1	78.9		98
21	22.0	21.4	39.3	38.2	78.8		104
22	23.1	22.5	41.4	40.3	78.3		110
23	24.0	23.6	43.4	42.4	76.9		
24	25.1	24.6	45.6	44.5	76.3		
25	26.4	25.7	48.0	46.8	76.4		
26	27.7	27.0	50.5	49.2	76.3		
27	29.0	28.4	53.0	51.7	75.4		
28	30.1	29.6	55.3	54.1	76.3		
29	31.3	30.7	57.6	56.4	76.5	2.165	
30	32.2	31.7	59.6	58.6	76.6		
31	33.5	32.9	62.0	60.8	77.5		
32	34.5	34.0	64.0	63.0	77.8		
33	35.5	35.0	66.0	65.0	78.4		
34	36.7	36.1	68.0	67.0	78.8		

CORE 8A

Sample number	Comp depth	Comp midpt	Uncomp depth	Uncomp midpt	Porosity percent	Particle S.G.	Years BP
35	37.6	37.1	69.9	68.9	78.9		
36	38.7	38.1	71.8	70.8	79.3		
37	39.7	39.2	73.7	72.8	79.1		
38	40.8	40.3	75.8	74.7	78.8		
39	41.9	41.4	77.8	76.8	78.6	2.619	
40	42.8	42.4	79.6	78.7	78.7		
41	44.0	43.4	81.7	80.7	78.6		
42	45.1	44.6	83.8	82.8	78.3		
43	46.3	45.7	86.1	84.9	77.7		
44	47.4	46.9	88.2	87.1	77.2		
45	48.4	47.9	90.2	89.2	77.4		
46	49.3	48.8	92.3	91.2	76.9		
47	50.3	49.8	94.5	93.4	75.8		
48	51.3	50.8	96.7	95.6	74.8	2.715	
49	52.2	51.8	98.9	97.8	74.9		
50	53.3	52.8	101.3	100.1	75.1		
51	54.4	53.9	103.6	102.4	75.0		
52	55.5	54.9	106.0	104.8	75.0		
53	56.4	56.0	108.1	107.1	75.1		
54	57.7	57.1	110.7	109.4	75.1		
55	58.7	58.2	113.0	111.8	74.8		
56	59.8	59.3	115.4	114.2	74.6		
57	60.8	60.3	117.8	116.6	74.0		
58	62.0	61.4	120.2	119.0	73.9	2.583	