GEOTECHNICAL PROPERTIES OF SEDIMENTS OBTAINED DURING HUDSON 86Ø13 AT NARWHAL F-99 WELLSITE

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This Open File describes lithology, water content, bulk density and vane shear strength in three piston cores from the Narwhal F-99 well site, on the S.W. Grand Banks slope.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (continued)

LIST OF TABLES

1.Ø SUMMARY

Detailed geotechnical testing and sampling has been performed on sediments collected in two piston cores obtained near the Narwhal F-99 wellsite and a third piston core taken upslope from the wellsite. Geological description and biostratigraphical subsampling were also performed on these three cores and an additional two cores obtained on the slope above the wellsite.

The sediments in the two cores obtained near the wellsite consist of olive gray silt and clayey silt with alternating layers of sandy silt. Anomalies are noted in the water content and shear strength profiles in the upper few meters of these two cores. The observed trend of increasing water content and decreasing shear strength with increasing depth is not the behavior associated with a normally consolidating sequence, and perhaps indicates sediment that has been deposited at the site in a rapid deposition process, such as a slump. A sudden increase in sand content at 2.5 - 3 m in these two cores is reflected in sudden changes observed in the profiles of geotechnical data, and variations in the properties below this depth are generally ruled by the fluctuations of sand content at the test or sample sites.

The sediments collected in three cores further upslope are dark gray clayey silt, with increasing stiffness and bioturbation with increasing depth in the cores. These three cores were very gaseous and analyses of gas samples may indicate a source at depth. Surprisingly, the data from the trigger weight core exhibit similar behavior to the anomolous trends in the cores obtained near the wellsite.

2.Ø INTRODUCTION

Three piston cores were obtained near the proposed NARWHAL F-99 wellsite in May 1986, using the Benthos split piston corer aboard C.S.S. Hudson, Cruise 86-Ø13. Three additional cores were collected at successively shallower water depths as the ship moved up the slope from the wellsite area. Table 2-1 lists the cores with their locations, approximate water depths, and quantity of sediment recovered by the piston corer.

TABLE 2-1.
Cores obtained near NARWHAL F-99 wellsite, Hudson 86-Ø13

Core	Approximate Location	Water Depth	Piston Core Recovery
86-Ø13-ØØ1	44°18.23'N 53°44.96'W	1614 m	11.24 m
86-Ø13-ØØ2	44°18.38'N 53°44.6Ø'W	1578 m	11.62 m
86-Ø13-ØØ3	44°18.36'N 53°44.29'W	1574 m	11.32 m
86-Ø13-ØØ4	44°24.3Ø'N 53°41.5Ø'W	12ØØ m	9.86 m
86-Ø13-ØØ5	44°25.3Ø'N 53°39.9Ø'W	9ØØ m	11.34 m
86-Ø13-ØØ6	44°25.7Ø'N 53°38.1Ø'W	6ØØ m	9.98 m

Core ØØ1 was partially analyzed onboard and the remainder of that core was analyzed at the NORDCO office in St. John's, Nfld. The results of this analysis are summarized in the NORDCO draft report entitled "1986 Piston Core Program at Narwhal F-99 Wellsite", dated May 1986, NORDCO File No. 8Ø8-86I.

Cores ØØ2, ØØ3, and ØØ5 were extensively tested and subsampled for geotechnical analysis in January 1987, at Bedford Institute of Oceanography (BIO). Samples for micropaleontological analyses were collected from all six cores at this time.

Cores ØØ4 and ØØ6 were considered to be inappropriate for geotechnical testing due to the degree of disturbance they had experienced. The liners of many of the sections had imploded, and in some cases the liners had to be hammered out of the barrel. In both cores the bottom three meters were gas-charged and the sediment had undergone considerable disturbance as a result of gas expansion.

This report contains the index properties, shear strength, grain

size, and Atterberg limit data for Cores ØØ2, ØØ3, and ØØ5. This data is correlated with the described lithologies where possible. The results from Cores ØØ2 and ØØ3 are compared with the data from Core ØØ1, analyzed in the the NORDCO report, as the three cores are located in the same setting.

3.Ø SAMPLING PROGRAM

3.1 Core Processing

Following recovery, all cores were cut into 1.5 m lengths and then labelled following AGC standards. The ends were capped and taped, and sealed with wax to prevent moisture loss in the sediments. The cores were stored upright in a refrigerated core storage facility aboard the Hudson, and then stored upright in the refrigerated storage facility at B.I.O.

The following steps were followed during processing of the cores at B.I.O. Whole round samples were taken from cores ØØ2, ØØ3, and ØØ5 for consolidation testing, as detailed in Table A-1 of the Appendix. These samples have not been tested as yet. Three whole round samples were taken for gas analysis; one from Core ØØ4 (5.32-5.41 m) and two from Core ØØ6 (5.42-5.55 m and 7.94-8.Ø4 m). These samples are also awaiting analyses.

The next step would usually be to split the cores for testing and subsampling. However, the cores had been collected in liners that imploded when split. The degree of disturbance caused by this implosion was considered to render the sediment unacceptable for any undisturbed geotechnical analyses. Thus the cores were cut into Ø.5 m sections, and extruded into previously split acceptable liners. The cores were then split, described, and photographed.

Cores ØØ2, ØØ3, and ØØ5 were extensively tested and subsampled for geotechnical analysis. Vane shear tests (BS1377), using the AGC modified Wykham-Farrance minivane, were performed at an interval of one every 1Ø cm where possible. Much of Cores ØØ2 and ØØ3 consisted of sandy muds with layers of sand and mud. Care was taken in selecting test sites that contained minimal sand, but it may be possible that the sandy silt drained during some of the tests. Hand-held torvane (Sibley and Yamane, 1965) measurements were also performed at regular, although less frequent, intervals to provide a basis of comparison with the previously processed strength data obtained with a Torvane from core ØØ1 (NORDCO draft report).

Subsamples for water content and bulk density determinations were obtained at a frequency of one every 1Ø cm where possible. Samples were collected for grain size (Table A-2, Appendix) and Atterberg limits (Table A-3, Appendix) analyses at an approximate interval of one each per section. Frequent samples were taken in all six cores by D. Bonifay for a study of the biostratigraphy. This work is not completed as yet. Notes taken during the processing of cores are presented in the Appendix, in Tables A-4a, A-4b, A-5a, A-5b, and A-6.

3.2 Core Disturbance

Cores ØØ4 and ØØ6 were considered too disturbed for geotechnical testing. The liners of many of the sections had imploded during coring and had to be hammered out of the barrel. There was also considerable gas expansion evident in these two cores. Both cores were split, described, and photographed, with a few samples taken for gas analyses.

Some degree of disturbance likely occurred as a result of extruding each core section. As much care as possible was taken to reduce the effects of this procedure, by extruding short sections (5Ø cm) to reduce the drag imposed by friction between the extruding mud and the liner. However, ease of extrusion was dependent on the nature of the sediment. Stiffer, predominantly silty and clayey mud extruded fairly easily, with no apparent change in length of core. Zones of high sand content or soupy mud proved more difficult to extrude, and thus, in some cases, undisturbed tests could not be performed.

An undeterminable amount of disturbance appears to have occurred during the coring operation itself. The shipboard log sheets for these cores all indicate an apparent penetration up to several meters greater than the total length of recovered sediment. It has been suggested that this was the result of the piston moving up inside of the barrel as the corer is lowered through the water column. With the piston not at the mudline when the freefall of the corer begins, some of the soft upper sediment may be displaced by water trapped between the piston and the sediment as the corer falls rapidly toward the sediment surface.

These problems may also be compounded if the surface sediments are particularly soft and do not cause the trigger arm of the small gravity corer to trip as soon as this corer contacts the sediment surface. This action would result in the piston corer still moving downward, possibly through the sediment, until the trigger arm is released and the piston core barrel falls. In addition to displacing some of the upper sediments, any of these possible behaviors of the coring system may also compress collected soft sediments.

The results of the consolidation tests may indicate whether any sediment is missing from the top of the core, as may a comparison of the lithologies of the sediments in the trigger weight core and the piston core at each site. The measured physical properties should assist in this determination.

4.Ø RESULTS

4.1 Calculations

The water content and bulk density samples were processed at BIO. Because the soil was saturated with salt water, a correction for the salt content was applied in calculating the water content. The following equation (Noorany, 1984) was used to calculate water content, which Noorany calls fluid content:

$$w = \frac{Wt - Ws}{Ws - r\,Wt} \times 1ØØ$$

where Wt = weight of wet soil, Ws = weight of dry soil, and r = salinity, assumed to be Ø.Ø35. The bulk density was calculated as Wt/Vt, where Wt = weight of wet soil and Vt = volume of wet soil.

Shear strength measurements were performed using AGC's modified Wykham-Farrance minivane, and calculated using the program 'SHEARN'. All plots and charts have been plotted at the same depth scale (Ø-12 m) to allow for easy comparison of data trends from different cores.

4.2 Core ØØ2

Summary descriptions of Piston Core ØØ2 and trigger weight core ØØ2 are shown in Figure 4-1 and 4-2, respectively. The core is very similar in lithology to Core ØØ1 (NORDCO draft report, May 1986). The piston core contains a zone of slightly bioturbated, olive gray clayey silt in the upper Ø.7 m corresponding to the same clayey silt in the upper 1.1 m of the trigger weight core. Below this zone is a layer of highly bioturbated, softer, silty clay, which extends to a depth of 1.8 m in the piston core and to the bottom of the collected trigger weight core. The third zone extends from 1.8 m to the bottom of the piston core and is made up of alternating sequences of clayey silt, sandy silt, silty sand and sand. These alternations in grain size are the only apparent structure. The sand layers appear to have been deposited by turbidite currents.

Figure 4-3 shows the bulk density, water content, and peak undrained shear strength data plotted against depth in the core for Piston Core ØØ2. The same data is plotted for Trigger Weight Core ØØ2 in Figure 4-4. Figure 4-5 presents plots of minivane peak and remoulded, and torvane peak undrained shear strength data versus depth in the core for Piston Core ØØ2. The data for

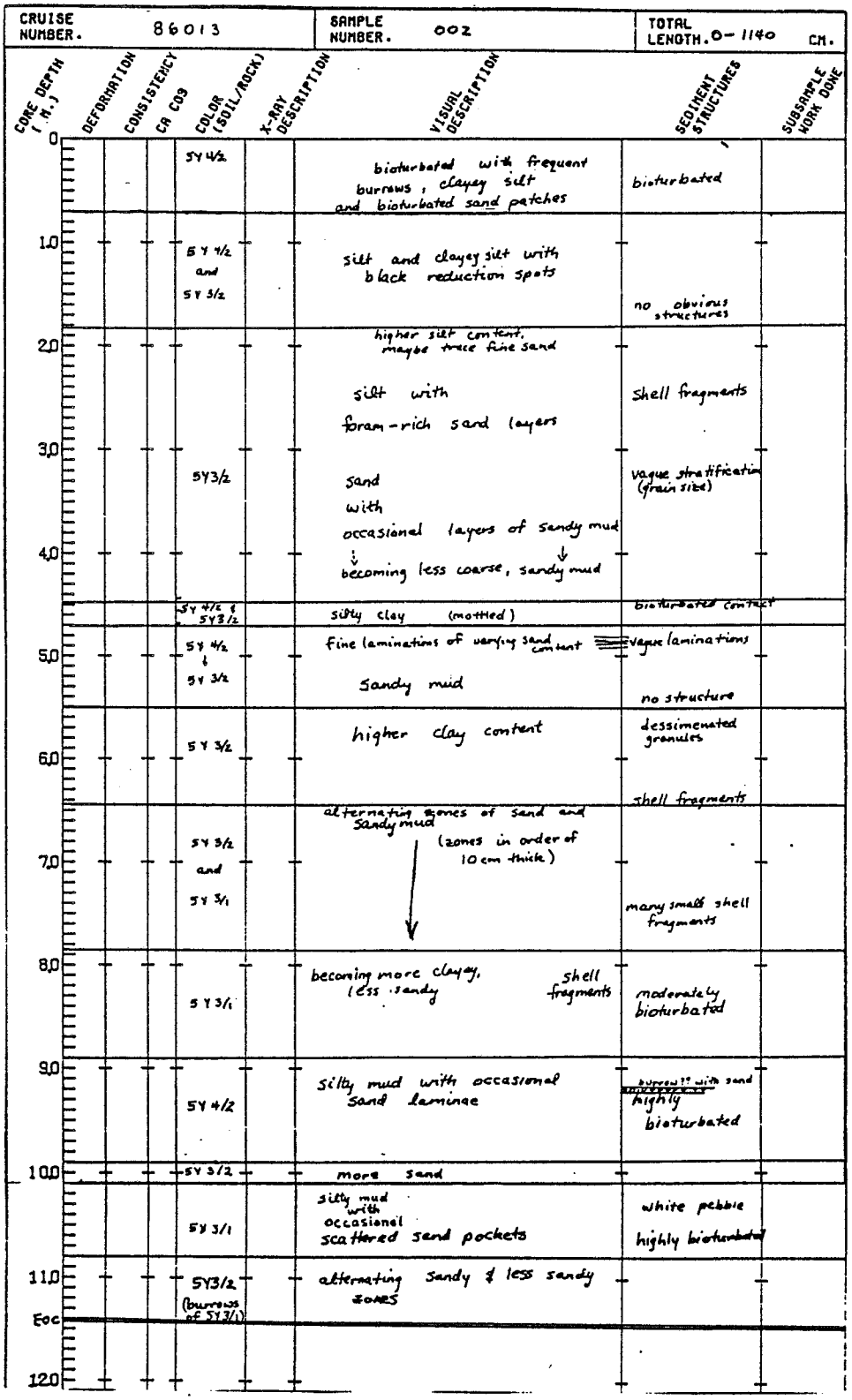

FIGURE 4-1

Summary Description of Piston Core 86Ø13-ØØ2

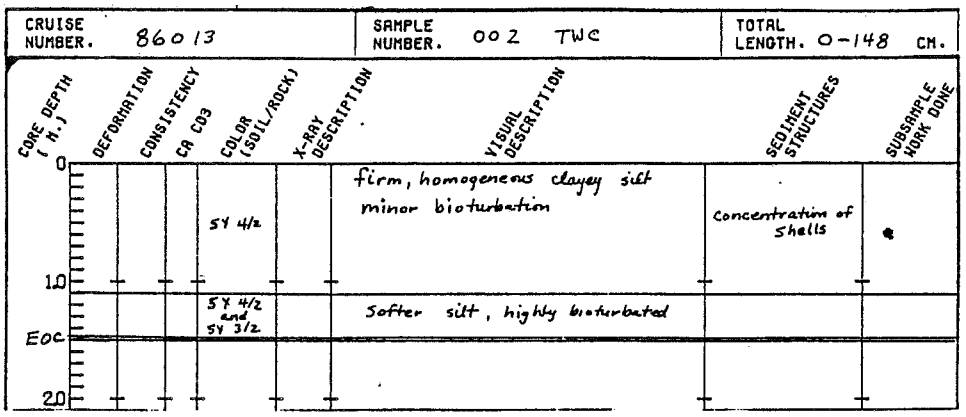

FIGURE 4-2

Summary Description of Trigger Weight Core 86Ø13-ØØ2

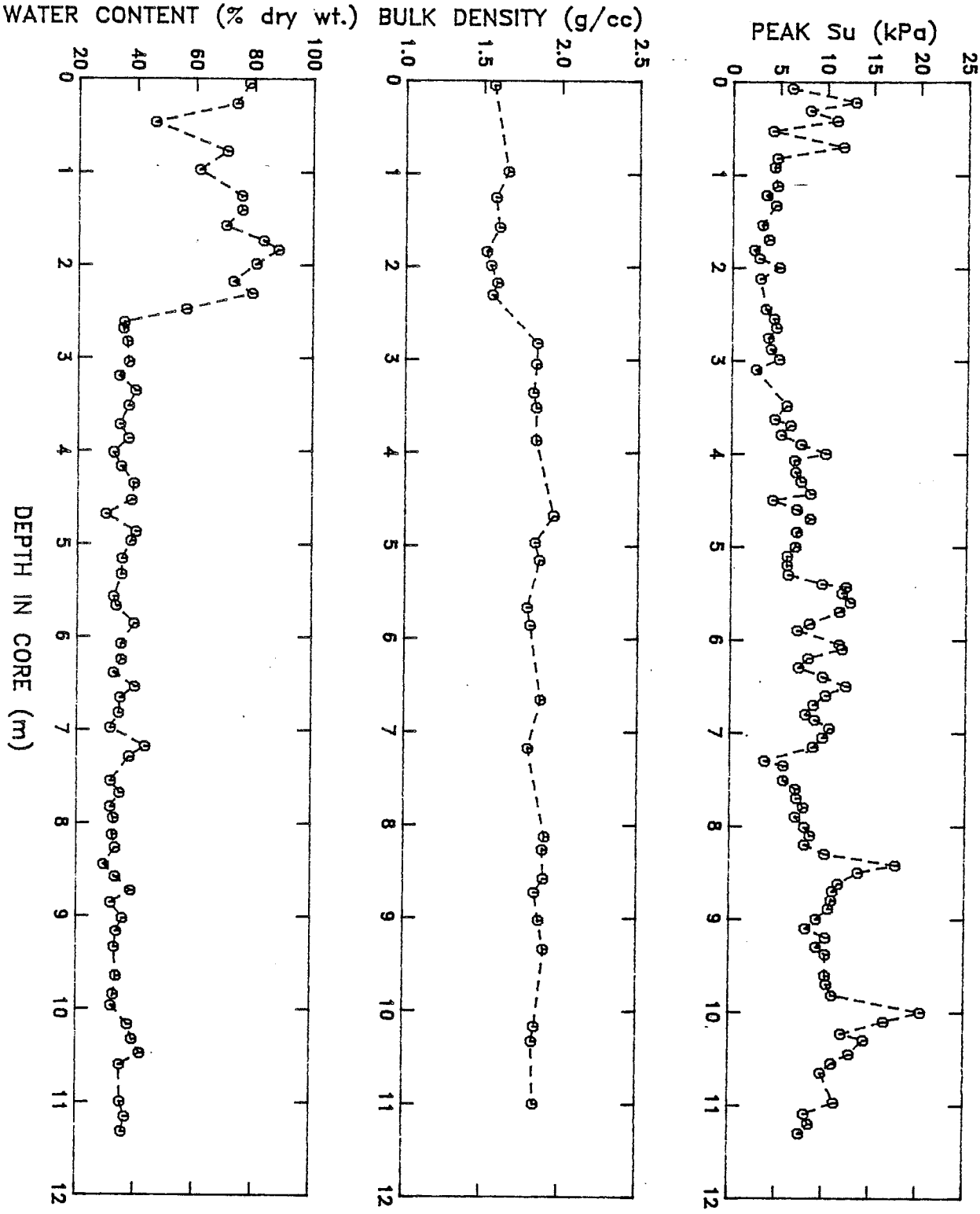

FIGURE 4-3

Geotechnical Data for Piston Core 86Ø13-ØØ2

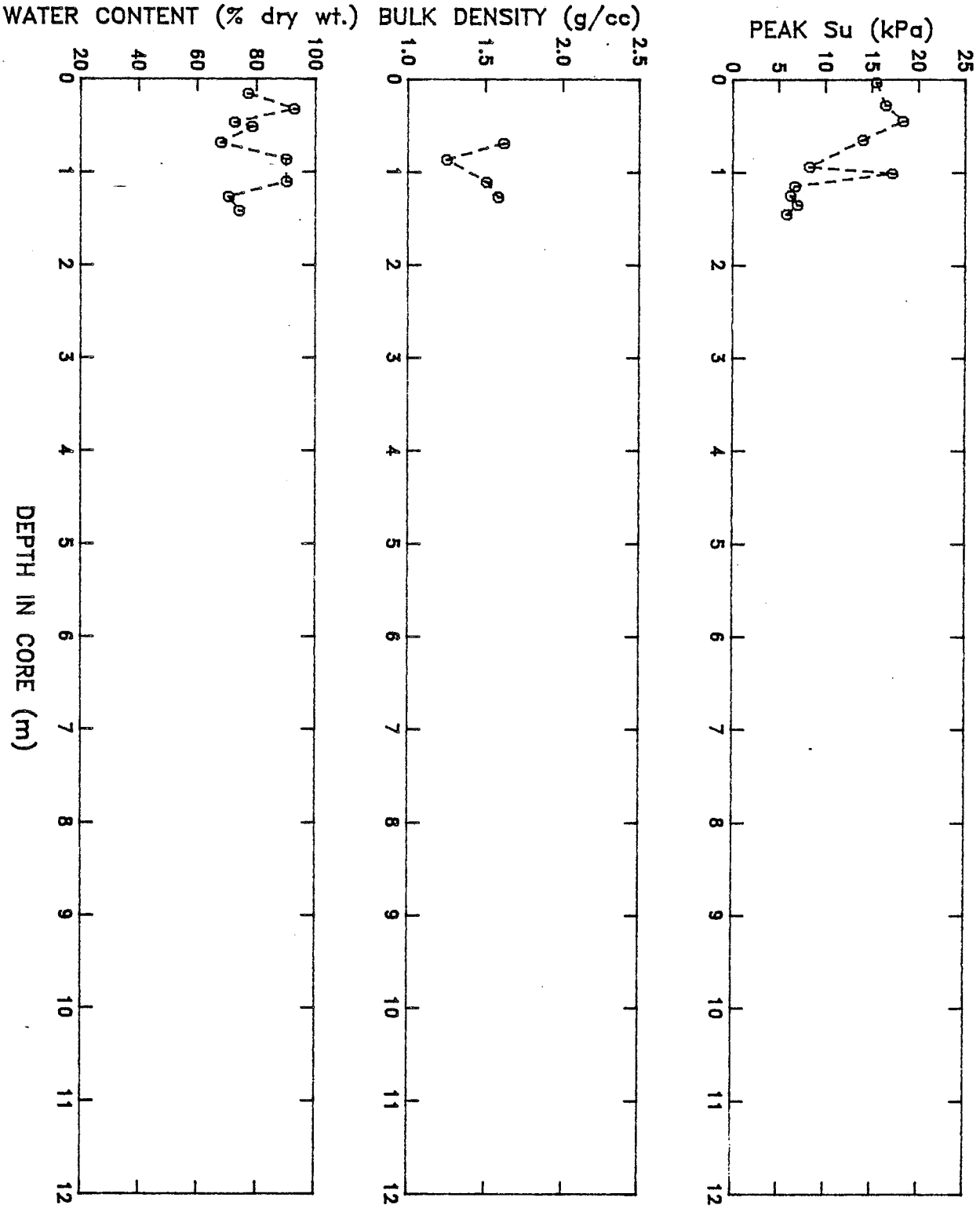

FIGURE 4-4

Geotechnical Data for Trigger Weight Core 86Ø13-ØØ2

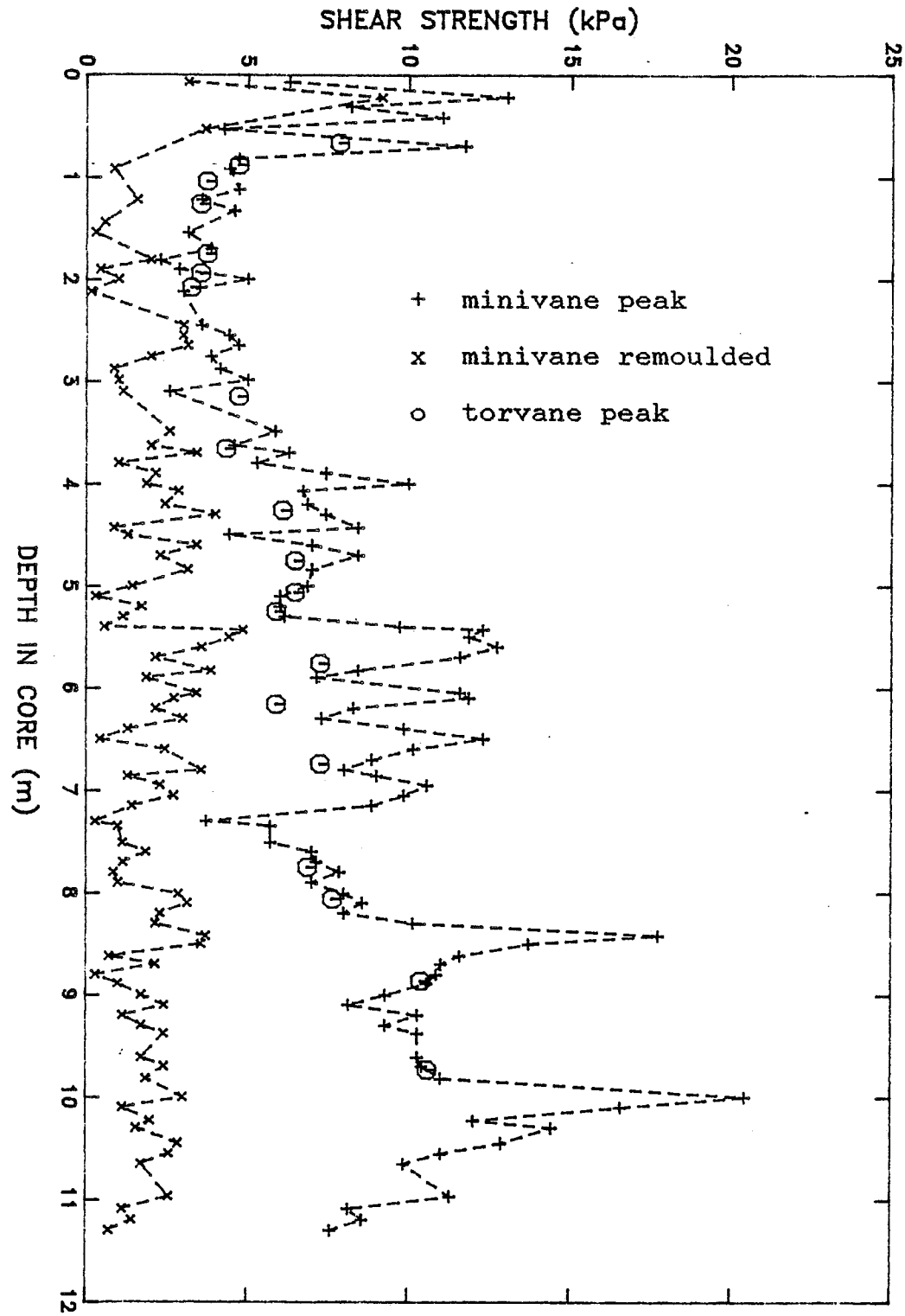

FIGURE 4-5

Undrained Shear Strength for Piston Core 86Ø13-ØØ2

these plots are given in tabular form in Table A-7 and A-8 of the Appendix. The following references to depths in the core are to depths in the piston cores.

The water content and bulk density data indicate a major change in the sediment properties in the piston core at an approximate depth of 2.4 m (see Figure 4-3). The water content decreases from a value of 78% near the surface to 61% at Ø.98 m depth (excluding the value of 46% at Ø.47 m). The trend in water content then changes to an increasing one (although some fluctuations are observed) to a value of 79% at a depth of 2.31 m. At this point an abrupt change occurs, and the water content drops to a value of 36% at 2.62 m. The water content remains in the 34-38% range through to the bottom of the core, with some small-scale fluctuations that likely reflect the variations in grain size.

The bulk density data reflect the trends observed in the water content data. The bulk density near the surface was measured as 1.57 g/cm^3. The values gradually decrease from 1.66 g/cm^3 at Ø.98 m to 1.56 g/cm^3 at 2.31 m. The bulk density then jumps to a value of 1.85 g/cm^3 at 2.83 m depth, where it remains constant, with some slight variation, to the bottom of the core.

The peak undrained minivane shear strength profile appears to reflect the changes in sediment facies to a greater degree than the index properties data, particularly below approximately 2.8 m where the water content and bulk density data remains fairly constant despite the changes in lithology. In the upper 2.8 m the shear strength profile is consistant with the trends observed in the water content data. There is considerable scatter in the strength profile in the upper meter of sediment, with values ranging between 13.Ø kPa at Ø.22 m and 4.7 kPa at Ø.8 m. The shear strength profile then remains fairly linear, with values decreasing slightly to 3.Ø kPa at a depth of 2.12 m.

There is another distinct zone in the peak shear strength profile (Figure 4-3) between approximately 2.5 and 4.8 m depth. There is an increase in sand content in the sediment in this interval, and the variations observed in the shear strength profile likely reflect the changes in grain size rather than actual variations in shear strength. The values of shear strength gradually increase in this depth range, with some slight cyclic variation in the fairly linear profile. The peak strength generally ranges from 4 to 6 kPa, with a few more extreme values.

At approximately 5.5 m, the shear strength profile reflects a change in lithology to a sediment with higher clay content. The increased variation (which is present to a depth of 7.3 m) in the profile is likely caused by varying ratios of silt and clay in the previously described alternating layers. The trend in this

zone is of slightly decreasing shear strength, with the values generally ranging between 6 and 11 kPa.

In the next section of the peak shear strength profile, between 7.3 m and 9.82 m, the trend reverts again to increasing strength with increasing depth. This portion of the profile is fairly linear, ranging from a value of 3.7 kPa at 7.3 m to 11.Ø kPa at 9.82 m. The exception to the linear trend is a sharp jump in shear strength to 17.7 kPa at 8.4 m depth. It is possible that this test location was in a zone of higher sand content, and that draining occurred during the test, resulting in an improper measurement of the shear strength.

A similar increase in the strength profile is observed at 1Ø.Ø m, where the peak strength reaches a high of 2Ø.4 kPa, corresponding to a known strata of higher sand content as noted in the core description. The shear strength values then decrease, again with some variation due to alternating zones of sediment with different grain sizes, to a value of 7.6 kPa at 11.3 m depth.

Torvane peak strength data is also plotted in Figure 4-5. In general, the torvane data agree closely with data obtained using the minivane. Thus there is confidence in comparing the values of peak strength between Core ØØ1 (measured with torvane) and Cores ØØ2 and ØØ3 (measured with minivane).

The grain size data (Table A-2) is depicted in Figure 4-6. The MIT engineering classification (Glossop and Skempton, 1945) was used in the analysis, with grains smaller than Ø.ØØ2 mm classified as clay, grains Ø.ØØ2 to Ø.Ø6 mm classified as silt, grains Ø.Ø6 to 2 mm classified as sand, and grains larger than 2 mm classified as gravel. A plasticity chart has been constructed for the Atterberg limit data (Table A-3) from Cores ØØ2, ØØ3, and ØØ5, and is shown in Figure 4-7. Most of the samples were non-plastic, as a result of the high silt and sand content.

The sediment in the upper 1.4 m of Piston Core ØØ2 is clayey silt (55-58% silt, 37% clay) with trace sand. The sand content increases slightly between 1.4 and 2.5 m depth. Using the Unified Soil Classification System (Wagner, 1957), the sediments in the upper 2.5 m of Core ØØ2 can be described as inorganic silts or clayey silts with slight plasticity (ML).

At approximately 2.5 m depth there is a marked change in grain size. Below this depth, the sediment varies between sandy silt and silty sand (35-57% sand, 34-47% silt and 15-2Ø% clay). These sediments can be classified as silty sands (SM) or inorganic silts or clayey silts of low plasticity (ML). At 8.5 m depth, where the description notes a higher clay content, the sediment is classified as inorganic silty clay of low plasticity (CL).

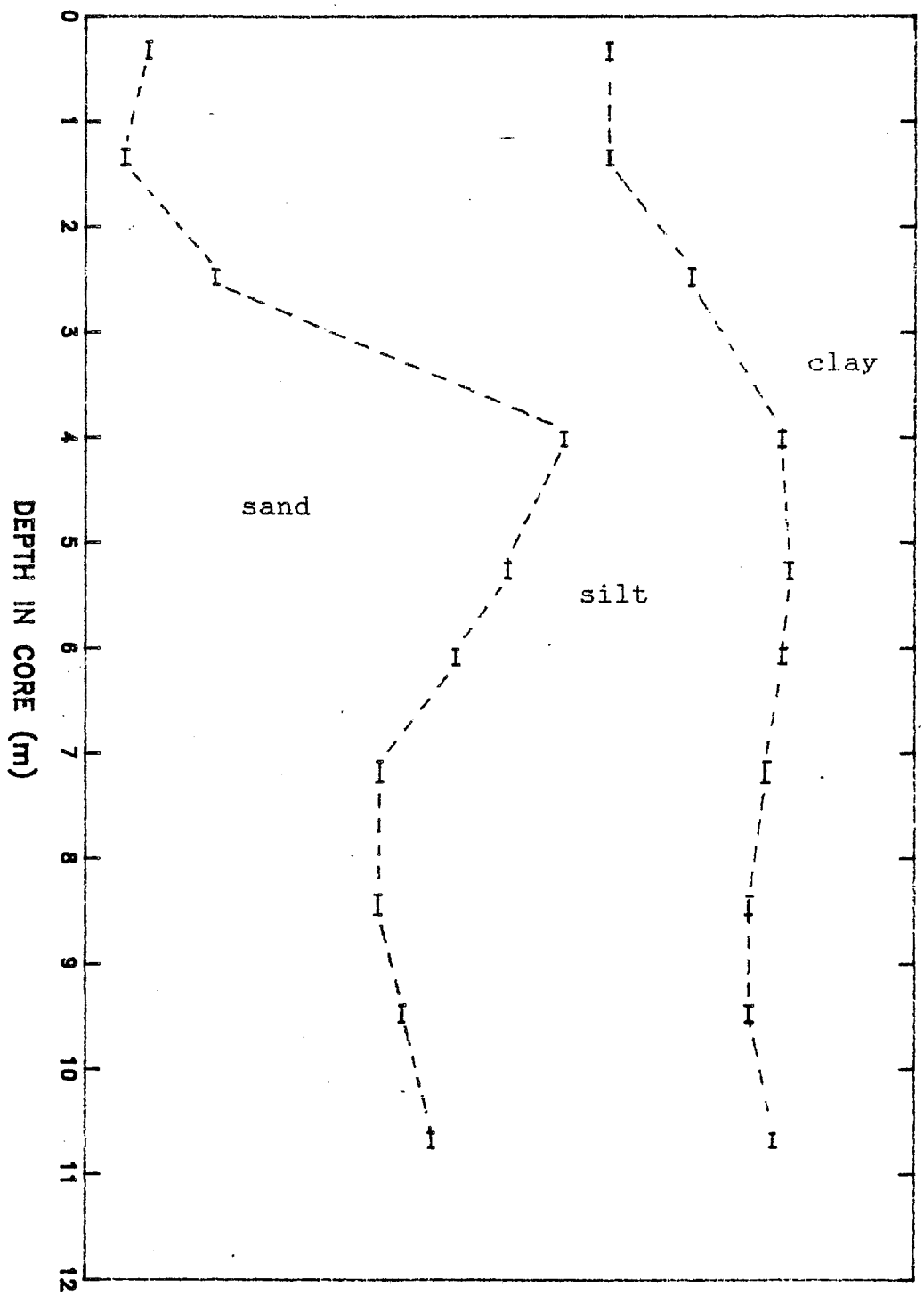

FIGURE 4-6

Grain Size for Piston Core 86Ø13-ØØ2

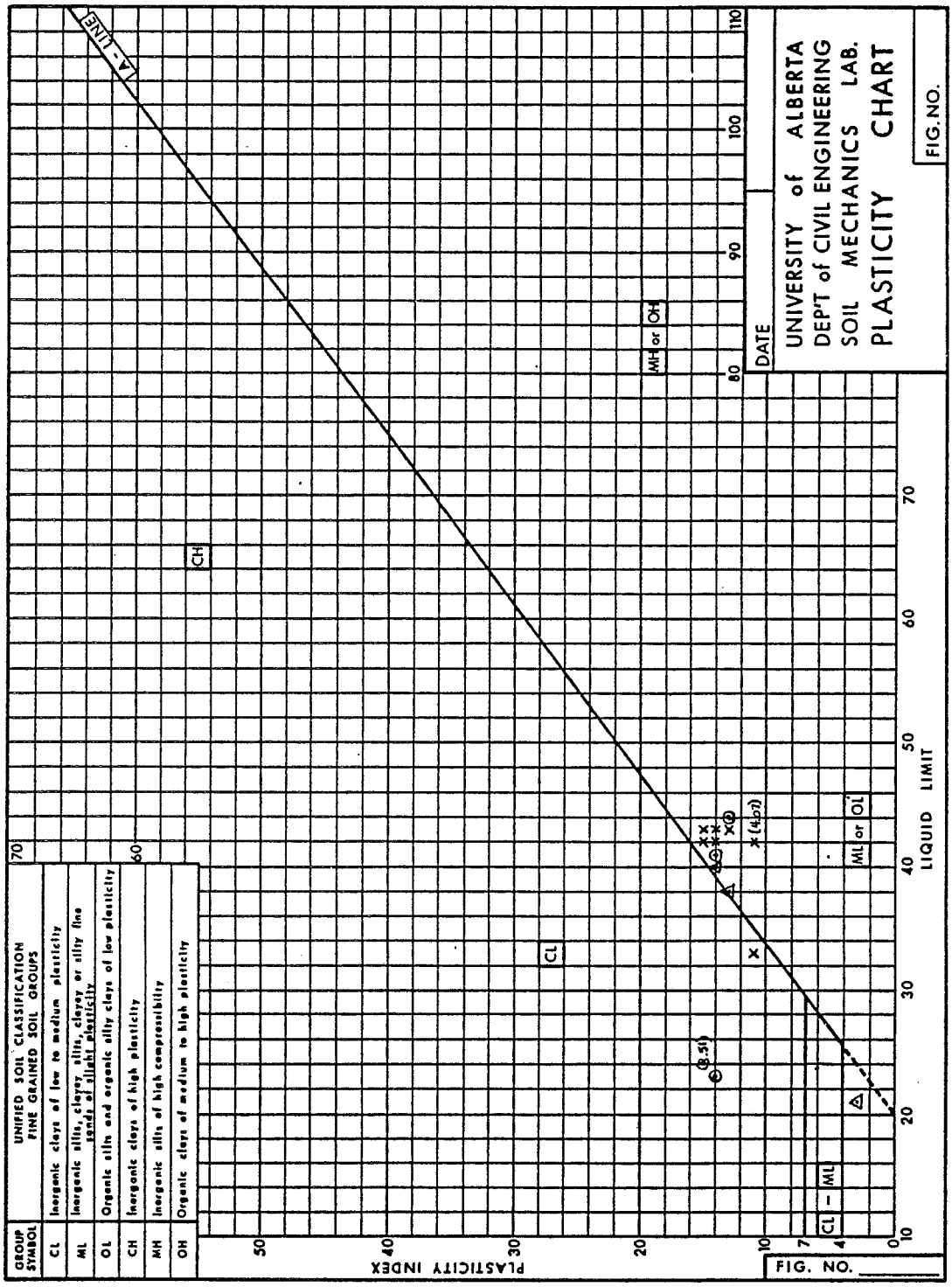

FIGURE 4-7

Plasticity Chart with Data from Piston Cores Ø02, Ø03, and Ø05

4.3 Core ØØ3

Summary descriptions of Piston Core ØØ3 and trigger weight core ØØ3 are shown in Figure 4-8 and 4-9, respectively. This core is from the same setting as Cores ØØ1 and ØØ2 and is similar in lithology.

Figure 4-1Ø shows the bulk density, water content, and peak undrained shear strength data plotted against depth in the core for Piston Core ØØ3. The same data is plotted for trigger weight core ØØ3 in Figure 4-11. Plots of minivane peak and remoulded, and torvane peak undrained shear strength data versus depth in the core for Piston Core ØØ3 are presented in Figure 4-12. The data for these plots are given in tabular form in Table A-9 and A-1Ø of the Appendix. The following references to depths in the core are to depths in the piston core.

The water content and bulk density profiles (Figure 4-8) show that a major change occurs in the sediment properties that can be correlated with the similar occurrence in Piston Core ØØ2 and ØØ1. In piston core ØØ3, this change occurs at an approximate depth of 2.8 m.(see Figure 4-3). In general, other trends observed in Core ØØ3 data are similar to those in Core ØØ2.

Grain size tests also provided similar results to those from Core ØØ2 (Table A-2). Figure 4-15 is a sketch of the grain size data, and the good correlation between Core ØØ3 and Core ØØ2 (see Figure 4-6) is apparent, with the exception of the test at 4.95-5.2Ø m. This interval corresponds to a 3Ø-cm interval of mottled silty clay observed in the description. This material was not subsampled for grain size in Core ØØ2, where it occurs at approximately 4.45-4.72 m) and this accounts for the difference in grain size profiles between the two cores.

Atterberg limit samples from Piston Core ØØ3 were tested (Table A-3), with much the same results as for Core ØØ2. Most of the samples were non-plastic, but the remaining data is plotted on the plasticity chart in Figure 4-7.

Using the Unified Soil Classification System, the sediments in the upper 2 m of Core ØØ3 can be classified as silts or clayey silts with slight plasticity (ML). The sample at 4.95-5.2Ø is an inorganic silty clay of low plasticity (CL). The remaining sediments in the core alternate between silty sands (SM) and inorganic silts with slight plasticity (ML).

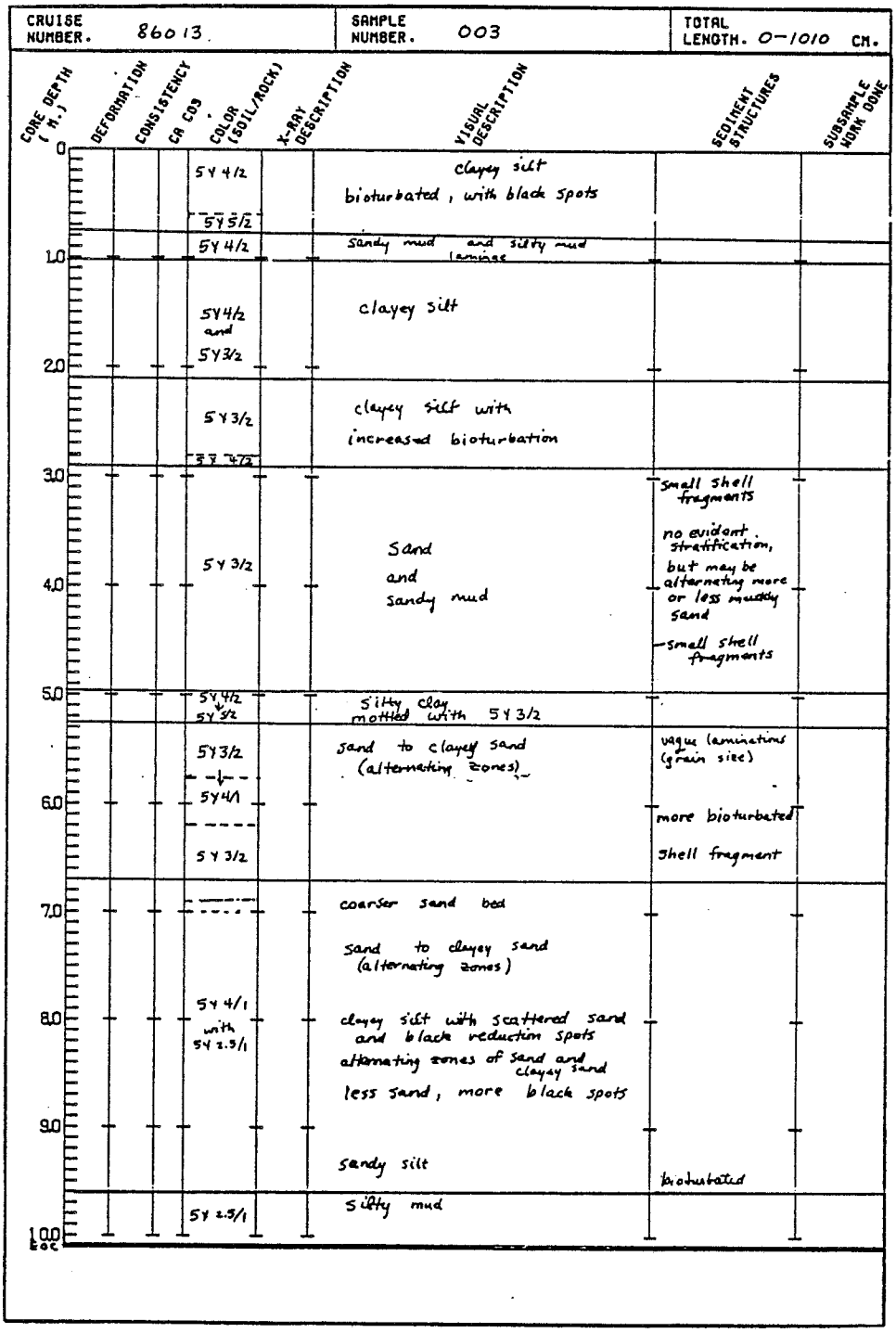

FIGURE 4-8

Summary Description of Piston Core 86Ø13-ØØ3

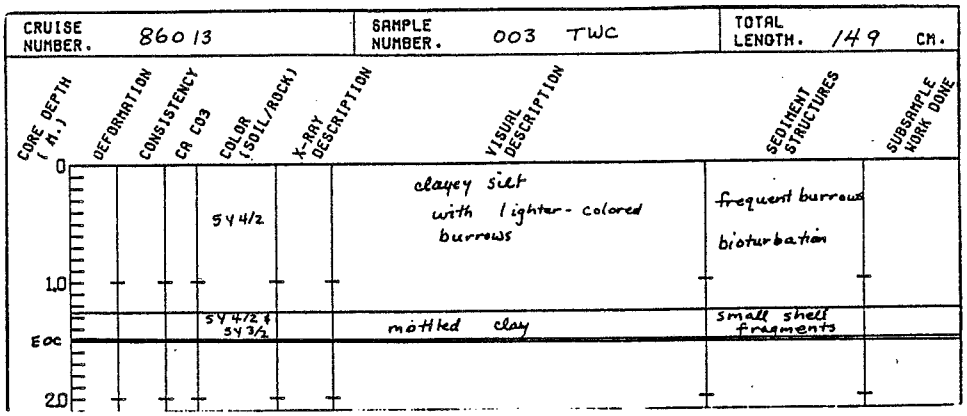

FIGURE 4-9

Summary Description of Trigger Weight Core 86Ø13-ØØ3

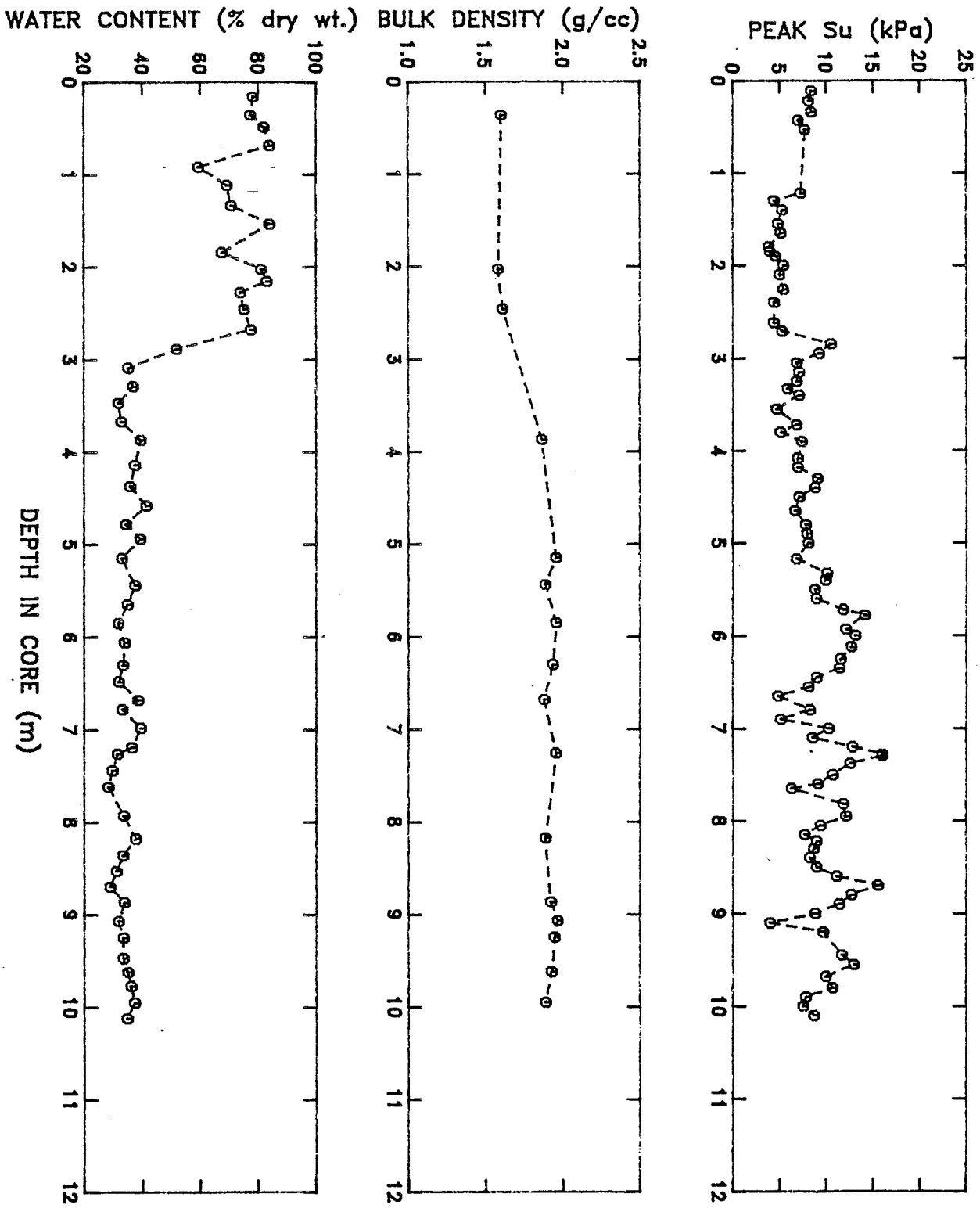

FIGURE 4-10

Geotechnical Data for Piston Core 86Ø13-ØØ3

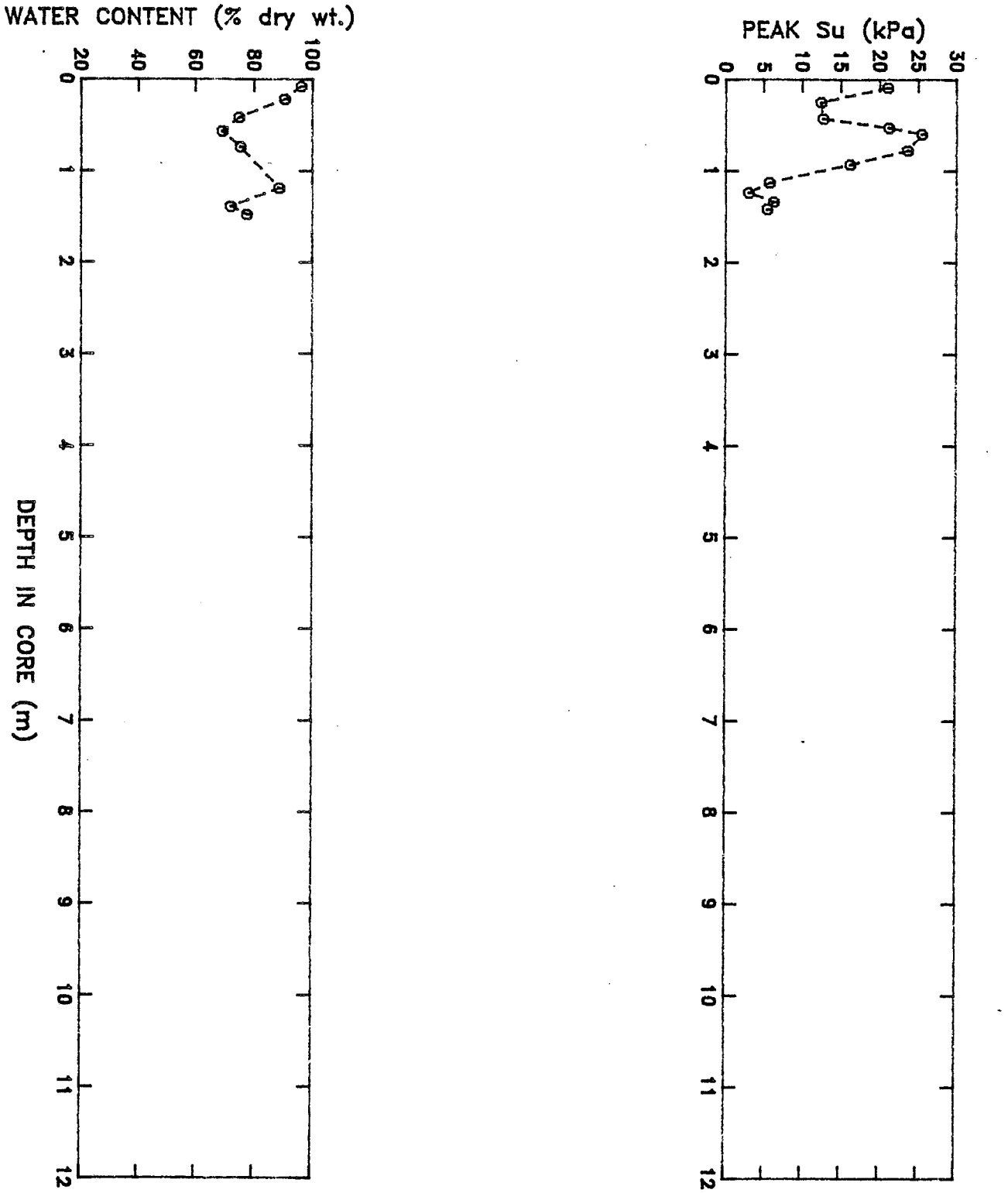

FIGURE 4-11

Geotechnical Data for Trigger Weight Core 86Ø13-ØØ3

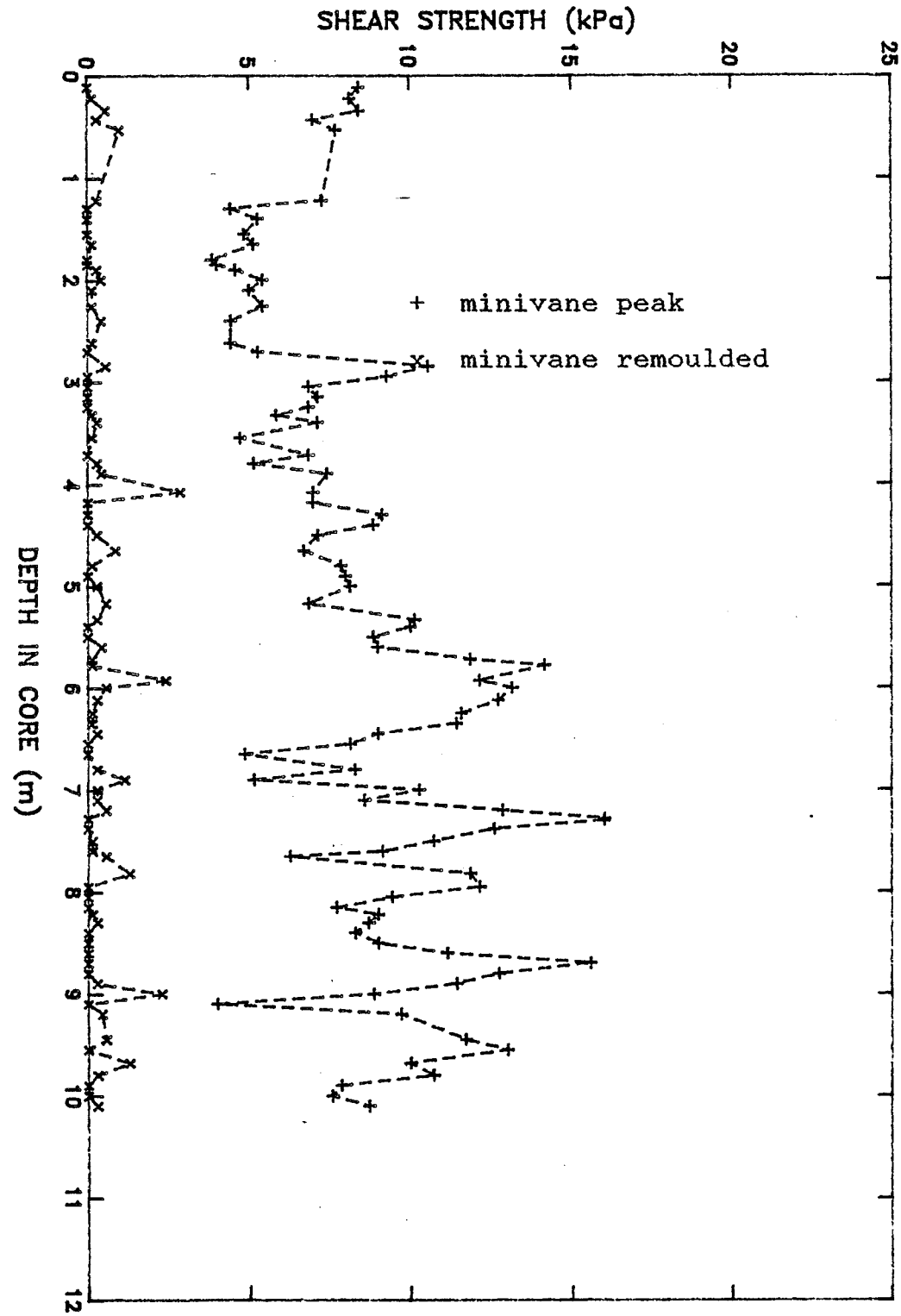

FIGURE 4-12

Undrained Shear Strength for Piston Core 86Ø13-ØØ3

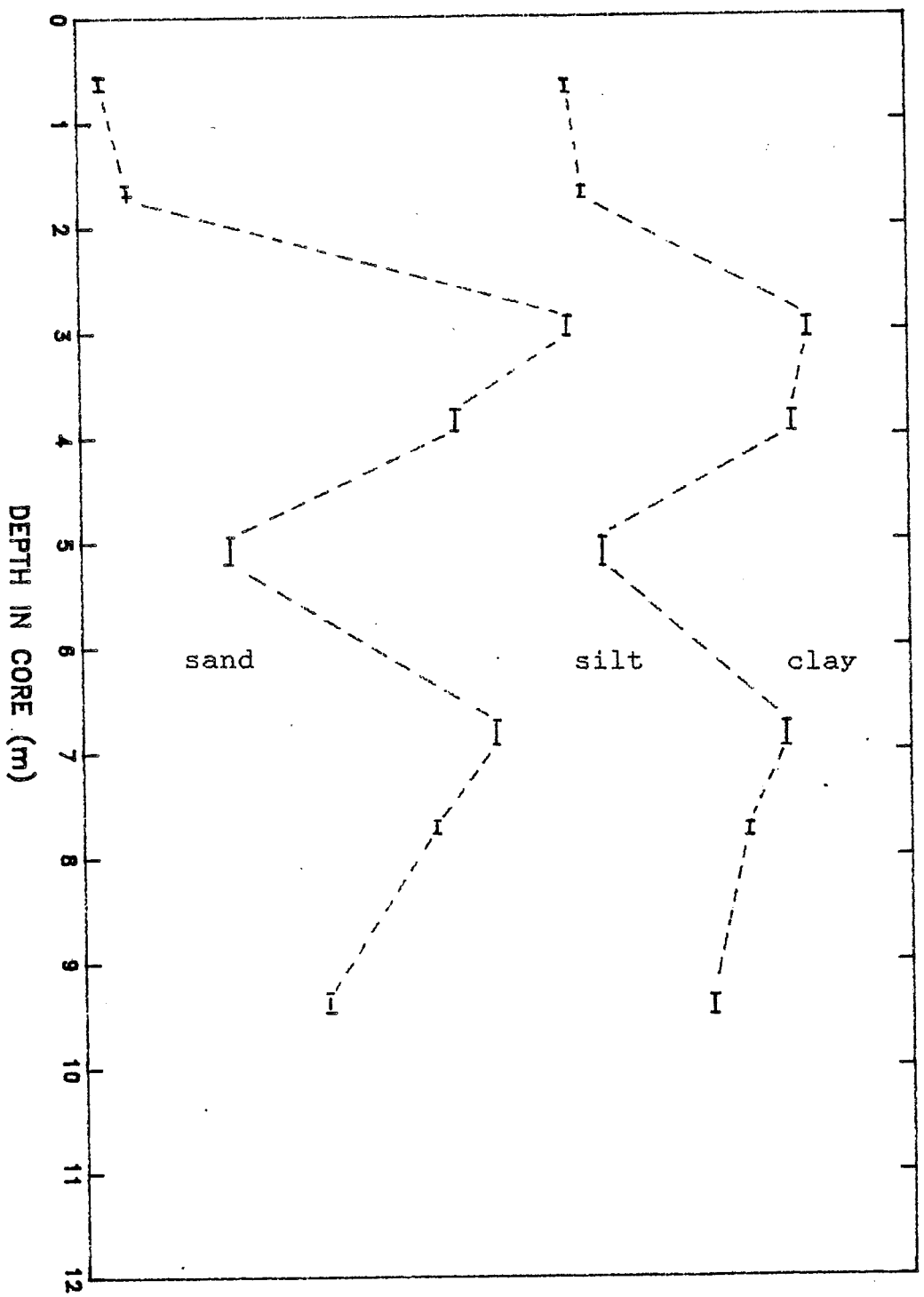

FIGURE 4-13

Grain Size for Piston Core 86Ø13-ØØ3

4.4 Core ØØ5

A summary description of Piston Core ØØ5 is shown in Figure 4-14 and of Trigger Weight Core ØØ5 in Figure 4-16. This core was taken further upslope (in approximately 9ØØ m water depth) than Cores ØØ1, ØØ2, and ØØ3 (in approximately 16ØØ m water depth), and thus it would be expected that the lithology would be somewhat different from that already noted in those cores. In general, the core consists of silty clay with varying degrees of bioturbation downcore. The high sand content evident throughout Cores ØØ1, ØØ2 and ØØ3 is not present in Core ØØ5. However, alternating silt and sand laminae are present below a depth of 9.2 m in Core ØØ5.

Figures 4-16 and 4-17 show the bulk density, water content, and peak undrained shear strength data plotted against depth in the core for Piston Core ØØ5 and Trigger Weight Core ØØ5. Plots of minivane peak and remoulded, and torvane peak undrained shear strength data versus depth in the core for Piston Core ØØ5 are presented in Figure 4-18. The data for these plots are presented in Tables A-11 and A-12 of the Appendix. The following references to depths in the core are to depths in the piston core.

The water contents have a peak value of 144% near the top of the piston core at a depth of Ø.19 m (Figure 4-16). The profile decreases sharply to a value of 89% at a depth of Ø.67 m. The water content profile changes slope abruptly at this depth, and decreases fairly linearly to a value of 58% at a depth of 8.24 m. There is a jump in the water content values that reaches a maximum of 85% at a depth of 8.84 m, corresponding to a layer with increased clay content and bioturbation. A zone of varying water contents occurs from 9.2 to 1Ø.3 m, corresponding to alternating laminae of silt and silty clay and sand. The profile returns to a linear trend below 1Ø.3 m, where the sediment consists of bioturbated clay.

The peak undrained shear strength (Figure 4-16 and Figure 4-18) increases fairly linearly from a value of 4.4 kPa near the surface of the piston core to a value of 7.15 kPa at 1.Ø6 m depth. A shift occurs in the profile at this depth, with a sudden drop in peak strength to 3.3 kPa at 1.22 m depth, where a foram-rich layer occurs. The strength increases downcore with variations in the profile caused by alternating sequences with different degrees of bioturbation and different grain sizes. A clay layer between 8.5 and 9.2 m is particularly evident in the peak strength plot.

It is worthwhile to note that although the sediments in the piston core exhibit the behavior usually associated with a normally consolidating sequence (i.e. decreasing water content and increasing shear strength with increasing depth in the core),

TABLE A-5a Observations during Sampling - Piston Core 86Ø13-ØØ3

Depth	Comments
Ø.57- 1.19	Liner imploded (no vane shear or bulk density tests).
8.74- 9.3Ø	2 cm of sediment lost during extrusion, due to compression of sample.

TABLE A-5b Observations during Sampling - Trigger Core 86Ø13-ØØ3

Depth	Comments
Ø.28- Ø.39	Sediment broken up by cracks and fissures.

TABLE A-6 Observations during Sampling - Piston Core 86Ø13-ØØ5

Depth	Comments
Ø.ØØ- 1.Ø2	Sediment is fractured and not intact (can find sites for vane shear tests, but not for consolidation samples).
3.72- 3.98	Cores have very gassy smell.
6.75- 7.25	Upon removal from storage, observed that core appears to be dried out. Visual examination before extrusion shows sediment is heavily cracked and bottom of 1.5 m section has dry mud visible against core liner. Core smells gassy. Sediment is too fractured for consolidation samples.
6.78- 7.ØØ	No vane shear test because sediment is too fractured.
7.25- 7.75	Sediment is more dried out and cracked than above section. Test results will be questionable.
7.93- 8.Ø7	Sediment fractured.
8.26- 8.76	Entire length of core is dried out, and heavily cracked. The mud has actually dried against the liner. The top of the core has not been sealed properly. There was insufficient tape, and it was not waxed properly. This section of core is not suitable for testing.
9.8Ø-1Ø.33	Sediment is still heavily cracked over entire length of core section, and is not suitable for consolidation tests. The sediment has not dried as much against the core liner as in the previous sections. Some vane shear tests tried where cracking allows a test location.
1Ø.33-1Ø.45	Sediment badly cracked.

TABLE A-7. Test Results for Piston Core 86Ø13-ØØ2

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
Ø.Ø5	78.18	1.568	*****	*****	*****
Ø.Ø7	*****	*****	6.29	3.15	*****
Ø.22	*****	*****	13.Ø2	9.16	*****
Ø.27	73.82	*****	*****	*****	*****
Ø.31	*****	*****	8.2Ø	*****	*****
Ø.42	*****	*****	11.Ø3	*****	*****
Ø.47	46.15	*****	*****	*****	*****
Ø.53	*****	*****	4.26	3.68	*****
Ø.66	*****	*****	*****	*****	7.84
Ø.7Ø	*****	*****	11.73	*****	*****
Ø.78	7Ø.63	*****	*****	*****	*****
Ø.82	*****	*****	4.72	*****	*****
Ø.88	*****	*****	*****	*****	4.71
Ø.92	*****	*****	4.43	Ø.86	*****
Ø.98	61.31	1.658	*****	*****	*****
1.Ø4	*****	*****	*****	*****	3.73
1.12	*****	*****	4.72	*****	*****
1.22	*****	*****	3.58	1.57	*****
1.26	75.6Ø	1.58Ø	*****	*****	3.53
1.33	*****	*****	4.58	4.86	*****
1.41	75.73	*****	*****	*****	*****
1.54	*****	*****	3.15	Ø.29.	*****
1.58	7Ø.2Ø	1.6Ø3	*****	*****	*****
1.7Ø	*****	*****	3.86	Ø.ØØ	*****
1.74	83.14	*****	*****	*****	*****
1.75	*****	*****	*****	*****	3.73
1.81	*****	*****	2.29	2.ØØ	*****
1.84	88.23	1.521	*****	*****	*****
1.9Ø	*****	*****	2.87	Ø.43	*****
1.94	*****	*****	*****	*****	3.53
1.99	8Ø.61	1.548	*****	*****	*****
2.ØØ	*****	*****	5.Ø1	1.ØØ	*****
2.Ø8	*****	*****	*****	*****	3.24
2.12	*****	*****	3.ØØ	Ø.14	*****
2.18	72.78	1.591	*****	*****	*****
2.25	*****	*****	4.15	4.3Ø	*****
2.31	79.3Ø	1.559	*****	*****	*****
2.45	*****	*****	3.58	3.Ø1	*****
2.48	56.91	*****	*****	*****	*****
2.55	*****	*****	4.43	3.ØØ	*****
2.62	35.7Ø	*****	*****	*****	*****
2.65	*****	*****	4.72	3.15	*****
2.69	35.37	*****	*****	*****	*****
2.76	*****	*****	3.86	2.ØØ	*****
2.83	36.82	1.848	*****	*****	*****

Table A-7 (continued)

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
2.88	*****	*****	4.15	Ø.86	*****
2.99	*****	*****	5.Ø1	1.ØØ	*****
3.Ø5	37.38	1.843	*****	*****	*****
3.1Ø	*****	*****	2.57	1.14	*****
3.15	*****	*****	*****	*****	4.71
3.2Ø	34.Ø6	*****	*****	*****	*****
3.3Ø	*****	*****	Ø.86	2.43	*****
3.36	39.72	1.824	*****	*****	*****
3.49	*****	*****	5.86	2.58	*****
3.52	37.3Ø	1.843	*****	*****	*****
3.63	*****	*****	4.58	2.Ø1	*****
3.66	*****	*****	*****	*****	4.32
3.7Ø	*****	*****	6.29	3.43	*****
3.72	34.38	*****	*****	*****	*****
3.8Ø	*****	*****	5.29	1.ØØ	*****
3.87	37.37	1.844	*****	*****	*****
3.9Ø	*****	*****	7.44	2.15	*****
4.ØØ	*****	*****	1Ø.Ø1	1.86	*****
4.Ø2	32.26	*****	*****	*****	*****
4.Ø7	*****	*****	6.73	2.86	*****
4.17	34.91	*****	*****	*****	*****
4.2Ø	*****	*****	6.87	2.44	*****
4.26	*****	*****	*****	*****	6.Ø8
4.3Ø	*****	*****	7.44	4.ØØ	*****
4.35	39.28	*****	*****	*****	*****
4.43	*****	*****	8.44	Ø.86	*****
4.5Ø	*****	*****	4.43	1.29	*****
4.53	38.44	*****	*****	*****	*****
4.6Ø	*****	*****	7.Ø1	3.43	*****
4.68	29.71	1.958	*****	*****	*****
4.7Ø	*****	*****	8.44	2.29	*****
4.75	*****	*****	*****	*****	6.47
4.84	*****	*****	7.Ø1	3.15	*****
4.87	4Ø.Ø3	*****	*****	*****	*****
4.97	38.28	1.839	*****	*****	*****
5.ØØ	*****	*****	6.87	1.43	*****
5.Ø6	*****	*****	*****	*****	6.47
5.1Ø	*****	*****	6.Ø1	Ø.29	*****
5.16	35.29	1.868	*****	*****	*****
5.2Ø	*****	*****	6.Ø1	1.72	*****
5.25	*****	*****	*****	*****	5.88
5.3Ø	*****	*****	6.15	1.14	*****
5.33	35.Ø9	*****	*****	*****	*****
5.4Ø	*****	*****	9.73	Ø.57	*****
5.43	*****	*****	12.3Ø	4.86	*****

Table A-7 (continued)

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
5.50	*****	*****	11.87	4.43	*****
5.57	32.50	*****	*****	*****	*****
5.60	*****	*****	12.74	3.58	*****
5.67	33.28	1.790	*****	*****	*****
5.70	*****	*****	11.59	2.15	*****
5.76	*****	*****	*****	*****	7.26
5.83	*****	*****	8.44	3.87	*****
5.86	39.57	1.810	*****	*****	*****
5.90	*****	*****	7.15	1.86	*****
6.05	*****	*****	11.59	3.43	*****
6.08	35.07	*****	*****	*****	*****
6.10	*****	*****	11.87	2.72	*****
6.16	*****	*****	*****	*****	5.88
6.20	*****	*****	8.30	2.15	*****
6.25	35.13	*****	*****	*****	*****
6.30	*****	*****	7.30	3.00	*****
6.39	32.51	*****	*****	*****	*****
6.40	*****	*****	9.87	1.29	*****
6.50	*****	*****	12.31	0.43	*****
6.54	39.81	*****	*****	*****	*****
6.60	*****	*****	10.16	2.44	*****
6.66	34.86	1.879	*****	*****	*****
6.70	*****	*****	8.87	*****	*****
6.74	*****	*****	*****	*****	7.26
6.80	*****	*****	8.01	3.58	*****
6.82	34.32	*****	*****	*****	*****
6.86	*****	*****	9.02	1.29	*****
6.95	*****	*****	10.58	2.29	*****
6.98	31.51	*****	*****	*****	*****
7.05	*****	*****	9.87	2.72	*****
7.15	*****	*****	8.87	1.43	*****
7.18	43.48	1.798	*****	*****	*****
7.29	38.03	*****	*****	*****	*****
7.30	*****	*****	3.73	0.29	*****
7.35	*****	*****	5.72	0.99	*****
7.51	*****	*****	5.72	1.14	*****
7.55	31.69	*****	*****	*****	*****
7.60	*****	*****	7.01	1.86	*****
7.68	34.76	*****	*****	*****	*****
7.70	*****	*****	7.15	1.15	*****
7.75	*****	*****	*****	*****	6.87
7.80	*****	*****	7.87	0.86	*****
7.83	31.61	*****	*****	*****	*****
7.90	*****	*****	7.01	1.00	*****
7.95	32.69	*****	*****	*****	*****

Table A-7 (continued)

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
8.Ø1	*****	*****	8.Ø1	2.87	*****
8.Ø6	*****	*****	*****	*****	7.65
8.1Ø	*****	*****	8.58	3.15	*****
8.13	32.31	1.9Ø9	*****	*****	*****
8.2Ø	*****	*****	8.Ø1	2.29	*****
8.27	33.31	1.896	*****	*****	*****
8.3Ø	*****	*****	1Ø.16	2.15	*****
8.42	*****	*****	17.74	3.72	*****
8.45	29.41	*****	*****	*****	*****
8.5Ø	*****	*****	13.73	3.58	*****
8.58	33.36	1.9Ø3	*****	*****	*****
8.62	*****	*****	11.59	Ø.72	*****
8.7Ø	*****	*****	11.Ø1	2.15	*****
8.73	38.72	1.845	*****	*****	*****
8.8Ø	*****	*****	1Ø.87	Ø.99	*****
8.86	31.84	*****	*****	*****	1Ø.4Ø
8.89	*****	*****	1Ø.58	1.ØØ	*****
9.ØØ	*****	*****	9.3Ø	1.72	*****
9.Ø3	35.96	1.873	*****	*****	*****
9.1Ø	*****	*****	8.15	2.43	*****
9.17	33.84	*****	*****	*****	*****
9.2Ø	*****	*****	1Ø.3Ø	1.14	*****
9.3Ø	*****	*****	9.3Ø	1.72	*****
9.34	33.13	1.9Ø5	*****	*****	*****
9.38	*****	*****	1Ø.3Ø	2.42	*****
9.61	*****	*****	1Ø.3Ø	1.72	*****
9.65	33.78	*****	*****	*****	*****
9.7Ø	*****	*****	1Ø.44	2.43	*****
9.73	*****	*****	*****	*****	1Ø.59
9.82	*****	*****	11.Ø1	1.86	*****
9.85	32.85	*****	*****	*****	*****
9.97	32.15	*****	*****	*****	*****
1Ø.ØØ	*****	*****	2Ø.45	3.Ø1	*****
1Ø.1Ø	*****	*****	16.59	1.14	*****
1Ø.17	37.87	1.848	*****	*****	*****
1Ø.23	*****	*****	12.Ø2	2.ØØ	*****
1Ø.3Ø	*****	*****	14.45	1.57	*****
1Ø.33	39.43	1.833	*****	*****	*****
1Ø.45	*****	*****	12.88	2.86	*****
1Ø.48	42.15	*****	*****	*****	*****
1Ø.55	*****	*****	11.Ø1	2.58	*****
1Ø.6Ø	35.19	*****	*****	*****	*****
1Ø.65	*****	*****	9.87	1.72	*****
1Ø.97	*****	*****	11.3Ø	2.57	*****
11.ØØ	35.41	1.845	*****	*****	*****

Table A-7 (continued)

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
11.Ø9	*****	*****	8.15	1.14	*****
11.16	37.Ø4	*****	*****	*****	*****
11.2Ø	*****	*****	8.58	1.43	*****
11.3Ø	*****	*****	7.59	Ø.72	*****
11.32	35.87	*****	*****	*****	*****

TABLE A-8. Test Results for Trigger Weight Core 86Ø13-ØØ2

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
Ø.Ø3	*****	*****	15.45	Ø.86	*****
Ø.16	77.25	*****	*****	*****	*****
Ø.28	*****	*****	16.45	Ø.57	*****
Ø.33	92.76	*****	*****	*****	*****
Ø.45	*****	*****	18.31	Ø.29	*****
Ø.47	72.62	*****	*****	*****	*****
Ø.52	78.57	*****	*****	*****	*****
Ø.65	*****	*****	14.Ø2	Ø.72	*****
Ø.69	68.ØØ	1.618	*****	*****	*****
Ø.87	9Ø.1Ø	*****	*****	*****	*****
Ø.94	*****	*****	8.3Ø	Ø.43	*****
1.Ø1	*****	*****	17.16	Ø.15	*****
1.11	9Ø.23	1.5Ø8	*****	*****	*****
1.15	*****	*****	6.73	Ø.72	*****
1.25	*****	*****	6.29	1.44	*****
1.27	7Ø.62	1.583	*****	*****	*****
1.35	*****	*****	7.Ø1	Ø.57	*****
1.42	74.19	*****	*****	*****	*****
1.45	*****	*****	5.86	Ø.15	*****

TABLE A-9. Test Results for Piston Core 86Ø13-ØØ3

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
Ø.11	*****	*****	8.44	Ø.ØØ	*****
Ø.16	78.38	*****	*****	*****	*****
Ø.22	*****	*****	8.15	Ø.14	*****
Ø.34	*****	*****	8.44	Ø.57	*****
Ø.36	77.44	1.6Ø5	*****	*****	*****
Ø.43	*****	*****	7.Ø1	Ø.29	*****
Ø.49	82.Ø4	*****	*****	*****	*****
Ø.53	*****	*****	7.72	1.ØØ	*****
Ø.69	83.92	*****	*****	*****	*****
Ø.92	59.5Ø	*****	*****	*****	*****
1.12	69.27	*****	*****	*****	*****
1.22	*****	*****	7.29	Ø.29	*****
1.3Ø	*****	*****	4.43	Ø.ØØ	*****
1.34	7Ø.78	*****	*****	*****	*****
1.4Ø	*****	*****	5.29	Ø.ØØ	*****
1.54	83.99	*****	*****	*****	*****
1.55	*****	*****	4.86	Ø.ØØ	*****
1.65	*****	*****	5.15	Ø.14	*****
1.8Ø	*****	*****	3.87	Ø.ØØ	*****
1.85	67.55	*****	4.ØØ	Ø.ØØ	*****
1.9Ø	*****	*****	4.58	Ø.29	*****
2.ØØ	*****	*****	5.44	Ø.43	*****
2.Ø3	81.19	1.584	*****	*****	*****
2.1Ø	*****	*****	5.Ø1	Ø.14	*****
2.16	83.ØØ	*****	*****	*****	*****
2.24	*****	*****	5.44	Ø.14	*****
2.28	73.88	*****	*****	*****	*****
2.4Ø	*****	*****	4.44	Ø.43	*****
2.46	75.19	1.614	*****	*****	*****
2.62	*****	*****	4.43	Ø.14	*****
2.68	77.57	*****	*****	*****	*****
2.71	*****	*****	5.29	Ø.ØØ	*****
2.85	*****	*****	1Ø.58	Ø.57	*****
2.89	51.89	*****	*****	*****	*****
2.95	*****	*****	9.3Ø	Ø.ØØ	*****
3.Ø5	*****	*****	6.87	Ø.ØØ	*****
3.Ø9	35.27	*****	*****	*****	*****
3.15	*****	*****	7.15	Ø.ØØ	*****
3.25	*****	*****	6.87	Ø.ØØ	*****
3.29	36.85	*****	*****	*****	*****
3.33	*****	*****	5.86	Ø.14	*****
3.4Ø	*****	*****	7.15	Ø.29	*****
3.47	31.89	*****	*****	*****	*****
3.55	*****	*****	4.72	Ø.14	*****
3.67	32.9Ø	*****	*****	*****	*****
3.72	*****	*****	6.87	Ø.ØØ	*****

TABLE A-9 (continued)

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
3.80	*****	*****	5.15	0.29	*****
3.87	39.52	1.866	*****	*****	*****
3.90	*****	*****	7.44	0.43	*****
4.08	*****	*****	7.01	2.87	*****
4.14	37.58	*****	*****	*****	*****
4.18	*****	*****	7.01	0.00	*****
4.30	*****	*****	9.15	0.00	*****
4.37	35.89	*****	*****	*****	*****
4.40	*****	*****	8.87	0.00	*****
4.50	*****	*****	7.16	0.29	*****
4.58	41.54	*****	*****	*****	*****
4.65	*****	*****	6.72	0.86	*****
4.78	34.44	*****	*****	*****	*****
4.80	*****	*****	7.87	0.14	*****
4.90	*****	*****	8.01	0.00	*****
4.94	39.42	*****	*****	*****	*****
5.00	*****	*****	8.16	0.29	*****
5.15	33.08	1.958	*****	*****	*****
5.17	*****	*****	6.87	0.57	*****
5.33	*****	*****	10.16	0.29	*****
5.40	*****	*****	10.02	0.00	*****
5.44	37.64	1.888	*****	*****	*****
5.50	*****	*****	8.87	0.00	*****
5.60	*****	*****	9.01	0.43	*****
5.65	35.02	*****	*****	*****	*****
5.72	*****	*****	11.87	0.14	*****
5.78	*****	*****	14.17	0.14	*****
5.85	31.86	1.957	*****	*****	*****
5.93	*****	*****	12.16	2.43	*****
6.00	*****	*****	13.17	0.57	*****
6.06	33.99	*****	*****	*****	*****
6.12	*****	*****	12.73	0.29	*****
6.25	*****	*****	11.59	0.14	*****
6.30	33.44	1.936	*****	*****	*****
6.35	*****	*****	11.44	0.14	*****
6.45	*****	*****	9.01	0.29	*****
6.48	31.98	*****	*****	*****	*****
6.55	*****	*****	8.15	0.00	*****
6.65	*****	*****	4.86	0.00	*****
6.68	38.64	1.880	*****	*****	*****
6.78	33.15	*****	*****	*****	*****
6.80	*****	*****	8.30	0.29	*****
6.90	*****	*****	5.15	1.15	*****
6.98	39.50	*****	*****	*****	*****
7.00	*****	*****	10.30	0.29	*****
7.10	*****	*****	8.59	0.29	*****

TABLE A-9 (continued)

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
7.19	36.41	*****	*****	*****	*****
7.2Ø	*****	*****	12.87	Ø.57	*****
7.26	31.46	1.956	*****	*****	*****
7.28	*****	*****	16.Ø3	Ø.ØØ	*****
7.3Ø	*****	*****	16.Ø2	*****	*****
7.38	*****	*****	12.59	Ø.ØØ	*****
7.44	29.7Ø	*****	*****	*****	*****
7.5Ø	*****	*****	1Ø.73	Ø.14	*****
7.6Ø	*****	*****	9.15	Ø.14	*****
7.62	28.29	*****	*****	*****	*****
7.65	*****	*****	6.29	Ø.57	*****
7.82	*****	*****	11.87	1.29	*****
7.93	33.67	*****	*****	*****	*****
7.95	*****	*****	12.16	Ø.ØØ	*****
8.Ø5	*****	*****	9.44	Ø.ØØ	*****
8.15	*****	*****	7.72	Ø.ØØ	*****
8.18	37.79	1.888	*****	*****	*****
8.22	*****	*****	9.Ø2	Ø.14	*****
8.3Ø	*****	*****	8.72	Ø.29	*****
8.36	33.4Ø	*****	*****	*****	*****
8.4Ø	*****	*****	8.3Ø	Ø.ØØ	*****
8.5Ø	*****	*****	9.Ø2	Ø.ØØ	*****
8.53	31.1Ø	*****	*****	*****	*****
8.6Ø	*****	*****	11.16	Ø.ØØ	*****
8.7Ø	28.89	*****	15.59	Ø.ØØ	*****
8.8Ø	*****	*****	12.74	Ø.ØØ	*****
8.87	33.9Ø	1.922	*****	*****	*****
8.9Ø	*****	*****	11.44	Ø.29	*****
9.ØØ	*****	*****	8.87	2.29	*****
9.Ø7	31.87	1.966	*****	*****	*****
9.1Ø	*****	*****	4.ØØ	Ø.ØØ	*****
9.2Ø	*****	*****	9.73	Ø.43	*****
9.25	33.58	1.946	*****	*****	*****
9.45	*****	*****	11.73	Ø.57	*****
9.47	33.54	*****	*****	*****	*****
9.55	*****	*****	13.Ø2	Ø.ØØ	*****
9.62	35.12	1.927	*****	*****	*****
9.68	*****	*****	1Ø.Ø2	1.29	*****
9.77	36.13	*****	*****	*****	*****
9.8Ø	*****	*****	1Ø.73	Ø.29	*****
9.9Ø	*****	*****	7.87	Ø.ØØ	*****
9.95	37.38	1.889	*****	*****	*****
1Ø.ØØ	*****	*****	7.58	Ø.ØØ	*****
1Ø.1Ø	*****	*****	8.73	Ø.29	*****
1Ø.12	34.86	*****	*****	*****	*****

TABLE A-1Ø. Test Results for Trigger Weight Core 86Ø13-ØØ3

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
Ø.Ø8	96.21	*****	*****	*****	*****
Ø.Ø9	*****	*****	21.Ø3	Ø.14	*****
Ø.22	9Ø.5Ø	*****	*****	*****	*****
Ø.25	*****	*****	12.44	Ø.57	*****
Ø.42	74.85	*****	*****	*****	*****
Ø.43	*****	*****	12.73	Ø.43	*****
Ø.53	*****	*****	21.17	*****	*****
Ø.57	69.1Ø	*****	*****	*****	*****
Ø.6Ø	*****	*****	25.47	Ø.86	*****
Ø.74	75.33	*****	*****	*****	*****
Ø.78	*****	*****	23.61	Ø.72	*****
Ø.93	*****	*****	16.17	Ø.ØØ	*****
1.13	*****	*****	5.72	Ø.ØØ	*****
1.19	88.61	*****	*****	*****	*****
1.24	*****	*****	3.Ø1	Ø.ØØ	*****
1.34	*****	*****	6.29	Ø:29	*****
1.39	72.Ø1	*****	*****	*****	*****
1.42	*****	*****	5.44	Ø.ØØ	*****
1.48	77.59	*****	*****	*****	*****

TABLE A-11. Test Results for Piston Core 86Ø13-ØØ5

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
Ø.1Ø	14Ø.55	*****	*****	*****	*****
Ø.11	*****	*****	4.43	Ø.29	*****
Ø.19	144.25	1.345	*****	*****	*****
Ø.21	*****	*****	4.86	Ø.86	*****
Ø.26	*****	*****	*****	*****	2.94
Ø.3Ø	*****	*****	4.87	Ø.57	*****
Ø.34	115.56	*****	*****	*****	*****
Ø.37	*****	*****	4.72	Ø.43	*****
Ø.57	*****	*****	5.58	Ø.14	*****
Ø.65	*****	*****	7.15	Ø.42	*****
Ø.67	89.Ø8	1.5Ø9	*****	*****	*****
Ø.75	*****	*****	5.73	Ø.29	*****
Ø.81	*****	*****	*****	*****	5.1Ø
Ø.85	*****	*****	6.Ø1	Ø.43	*****
Ø.87	84.31	1.533	*****	*****	*****
Ø.95	*****	*****	6.44	Ø.14	*****
1.Ø6	*****	*****	7.15	Ø.57	*****
1.Ø9	81.88	*****	*****	*****	*****
1.22	*****	*****	3.29	Ø.ØØ	*****
1.3Ø	*****	*****	4.73	Ø.14	*****
1.34	85.31	1.525	*****	*****	*****
1.4Ø	*****	*****	4.86	Ø.42	*****
1.5Ø	*****	*****	4.44	Ø.14	*****
1.53	75.54	*****	*****	*****	*****
1.65	*****	*****	6.44	Ø.72	*****
1.72	73.Ø2	*****	*****	*****	*****
1.8Ø	*****	*****	6.87	Ø.72	*****
1.87	69.Ø4	*****	*****	*****	*****
2.ØØ	*****	*****	8.15	1.ØØ	*****
2.Ø5	75.2Ø	*****	*****	*****	*****
2.1Ø	*****	*****	8.44	Ø.43	*****
2.19	71.32	*****	*****	*****	*****
2.22	*****	*****	7.72	Ø.29	*****
2.4Ø	*****	*****	9.15	1.29	*****
2.43	73.93	1.575	*****	*****	*****
2.5Ø	*****	*****	7.Ø1	1.72	*****
2.56	*****	*****	*****	*****	8.43
2.6Ø	*****	*****	7.87	Ø.86	*****
2.63	71.91	1.587	*****	*****	*****
2.91	*****	*****	9.44	Ø.29	*****
2.97	72.97	*****	*****	*****	*****
3.ØØ	*****	*****	7.15	Ø.ØØ	*****
3.1Ø	*****	*****	9.Ø1	Ø.ØØ	*****
3.13	81.ØØ	1.544	*****	*****	*****
3.19	*****	*****	8.72	Ø.ØØ	*****

TABLE A-11 (continued)

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
3.30	*****	*****	11.30	0.15	*****
3.34	75.43	*****	*****	*****	*****
3.40	*****	*****	13.87	0.14	*****
3.45	*****	*****	*****	*****	10.59
3.50	*****	*****	12.02	0.43	*****
3.57	74.07	1.580	*****	*****	*****
3.65	*****	*****	11.16	0.29	*****
3.75	*****	*****	12.02	0.14	*****
3.81	74.59	1.574	*****	*****	*****
3.85	*****	*****	11.44	0.14	*****
3.93	75.26	*****	*****	*****	*****
3.95	*****	*****	10.44	0.57	*****
4.10	*****	*****	8.73	0.72	*****
4.20	*****	*****	12.01	0.14	*****
4.23	81.41	1.545	*****	*****	*****
4.30	*****	*****	12.16	0.57	*****
4.40	*****	*****	10.88	0.72	*****
4.44	78.45	1.558	*****	*****	*****
4.50	*****	*****	11.73	0.14	*****
4.58	75.28	1.571	*****	*****	*****
4.60	*****	*****	11.73	0.00	*****
4.70	*****	*****	13.59	0.57	*****
4.75	80.79	*****	*****	*****	*****
4.80	*****	*****	11.59	0.00	*****
4.85	*****	*****	*****	*****	10.20
4.90	*****	*****	10.30	0.00	*****
4.93	84.52	1.507	*****	*****	*****
5.02	*****	*****	12.59	0.00	*****
5.15	*****	*****	11.44	0.29	*****
5.17	76.63	*****	*****	*****	*****
5.25	*****	*****	15.31	0.14	*****
5.33	77.26	*****	*****	*****	*****
5.40	*****	*****	15.73	0.29	*****
5.50	*****	*****	15.31	0.43	*****
5.53	66.65	*****	*****	*****	*****
5.60	*****	*****	15.16	0.43	*****
5.65	*****	*****	*****	*****	11.77
5.70	*****	*****	13.59	0.00	*****
5.77	70.65	1.607	*****	*****	*****
5.80	*****	*****	11.59	0.29	*****
5.93	73.70	*****	*****	*****	*****
6.00	*****	*****	14.88	0.00	*****
6.10	*****	*****	14.73	*****	*****
6.14	71.51	1.630	*****	*****	*****
6.23	*****	*****	12.02	0.14	*****

TABLE A-11 (continued)

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
6.40	*****	*****	13.59	0.00	*****
6.45	73.41	1.614	*****	*****	*****
6.50	*****	*****	15.30	0.29	*****
6.60	*****	*****	12.16	0.29	*****
6.64	69.74	1.635	*****	*****	*****
6.70	*****	*****	11.87	0.00	*****
6.78	*****	*****	15.30	*****	*****
6.84	67.37	*****	*****	*****	*****
7.00	*****	*****	15.45	0.00	*****
7.02	70.05	*****	*****	*****	*****
7.10	*****	*****	14.31	0.14	*****
7.17	*****	*****	*****	*****	12.95
7.20	*****	*****	13.02	0.00	*****
7.27	69.56	*****	*****	*****	*****
7.30	*****	*****	16.45	0.14	*****
7.36	67.98	*****	*****	*****	*****
7.40	*****	*****	15.88	0.00	*****
7.50	*****	*****	14.88	0.44	*****
7.56	70.81	*****	*****	*****	*****
7.59	*****	*****	7.58	0.14	*****
7.70	*****	*****	12.02	0.00	*****
7.78	62.79	*****	*****	*****	*****
7.80	*****	*****	14.45	0.15	*****
7.90	*****	*****	14.88	0.14	*****
8.10	*****	*****	11.59	0.14	*****
8.14	58.66	*****	*****	*****	*****
8.21	*****	*****	13.59	0.29	*****
8.24	58.31	1.700	*****	*****	*****
8.46	61.22	*****	*****	*****	*****
8.48	*****	*****	18.59	0.14	*****
8.66	79.35	*****	*****	*****	*****
8.69	*****	*****	19.32	0.00	*****
8.84	84.91	*****	*****	*****	*****
8.89	*****	*****	19.03	0.14	*****
9.08	*****	*****	13.30	0.00	*****
9.12	79.47	*****	*****	*****	*****
9.37	*****	*****	13.44	0.14	*****
9.45	47.10	*****	*****	*****	*****
9.50	*****	*****	10.88	0.14	*****
9.65	*****	*****	12.16	0.14	*****
9.67	62.14	*****	*****	*****	*****
9.93	37.20	*****	*****	*****	*****
10.00	*****	*****	13.30	0.28	*****
10.10	*****	*****	17.46	0.00	*****
10.18	58.42	1.706	*****	*****	*****

TABLE A-11 (continued)

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
10.22	*****	*****	15.02	*****	*****
10.44	60.10	*****	*****	*****	*****
10.45	*****	*****	14.45	0.57	*****
10.56	58.15	*****	*****	*****	*****
10.70	*****	*****	14.74	0.14	*****
10.73	54.15	*****	*****	*****	*****
10.81	*****	*****	15.88	0.00	*****
10.89	52.91	*****	*****	*****	*****
10.95	*****	*****	15.16	0.14	*****
11.05	46.30	*****	*****	*****	*****
11.07	*****	*****	16.73	0.00	*****
11.22	*****	*****	14.73	0.14	*****
11.24	61.84	*****	*****	*****	*****

TABLE A-12. Results for Trigger Weight Core 86Ø13-ØØ5

Subbottom Depth (m)	Water Content (% dry wt)	Bulk Density (g/cc)	Peak Vane Strength (kPa)	Res. Vane Strength (kPa)	Torvane Strength (kPa)
Ø.15	*****	*****	2Ø.17	Ø.57	*****
Ø.16	115.99	*****	*****	*****	*****
Ø.25	*****	*****	1Ø.3Ø	Ø.14	*****
Ø.33	121.2Ø	1.438	*****	*****	*****
Ø.35	*****	*****	1Ø.3Ø	Ø.29	*****
Ø.46	*****	*****	8.59	3.Ø3	*****
Ø.5Ø	123.Ø8	*****	*****	*****	*****
Ø.53	*****	*****	8.15	Ø.86	*****
Ø.68	*****	*****	1Ø.44	6.Ø6	*****
Ø.74	139.32	1.399	*****	*****	*****
Ø.78	*****	*****	8.16	Ø.14	*****
Ø.9Ø	*****	*****	7.29	Ø.29	*****
Ø.97	143.17	*****	*****	*****	*****
1.ØØ	*****	*****	5.3Ø	Ø.ØØ	*****
1.1Ø	*****	*****	4.43	Ø.43	*****
1.12	136.28	*****	*****	*****	*****

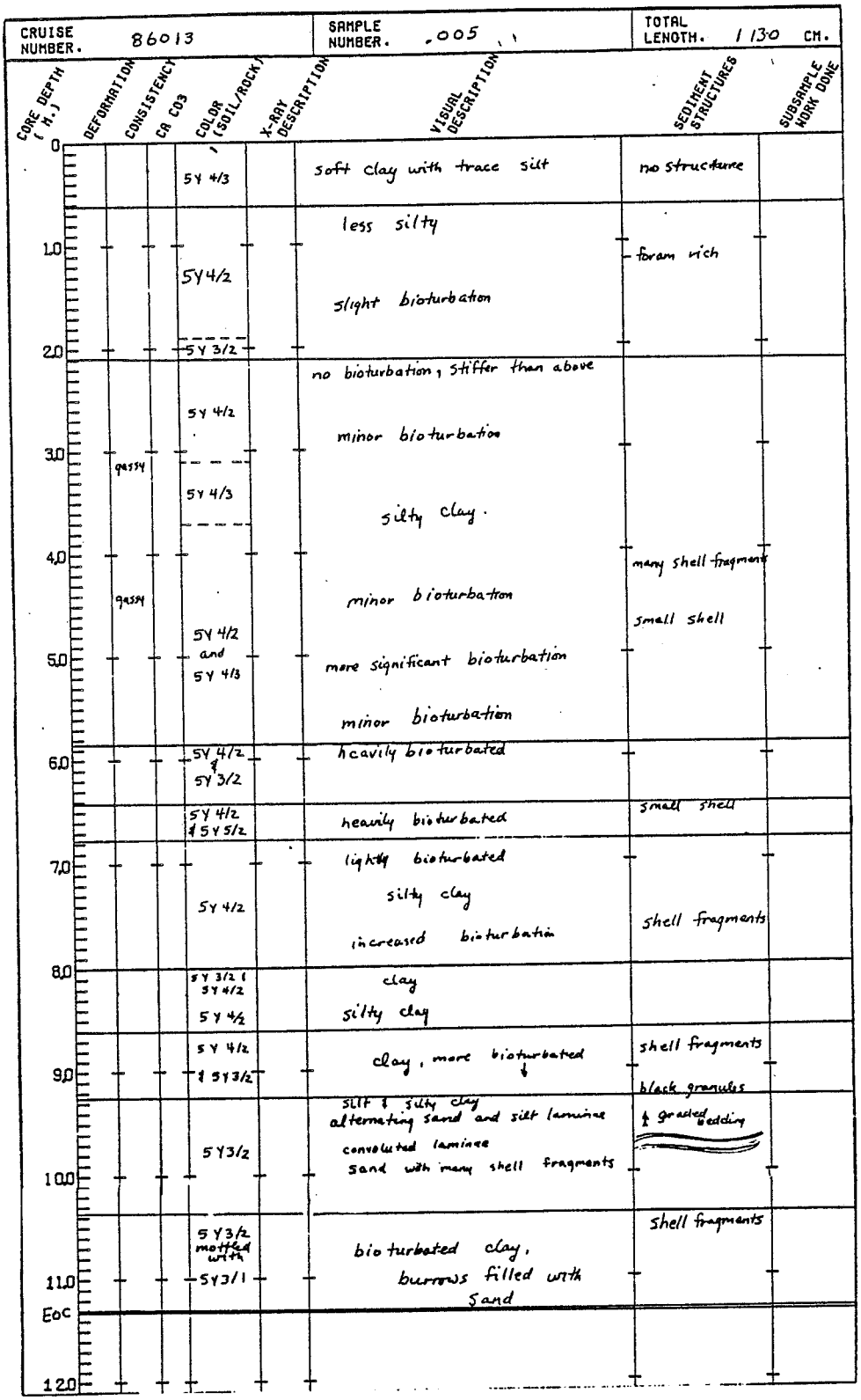

FIGURE 4-14

Summary Description of Piston Core 86Ø13-ØØ5

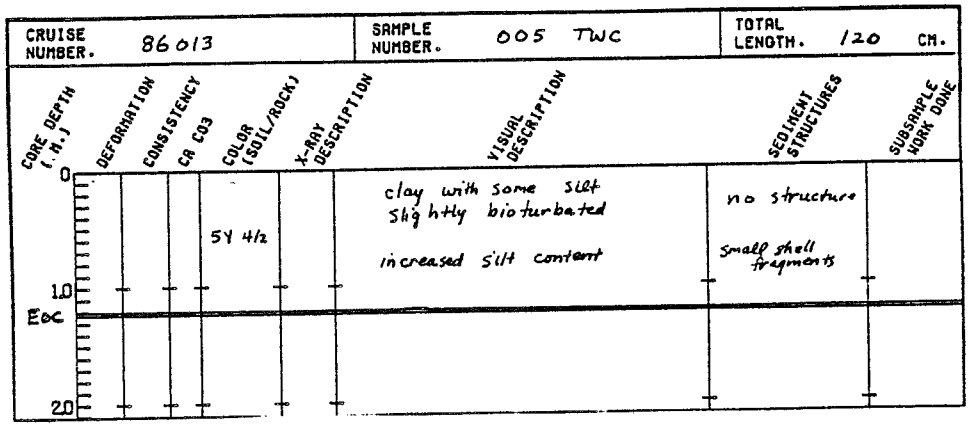

FIGURE 4-15

Summary Description of Trigger Weight Core 86Ø13-ØØ5

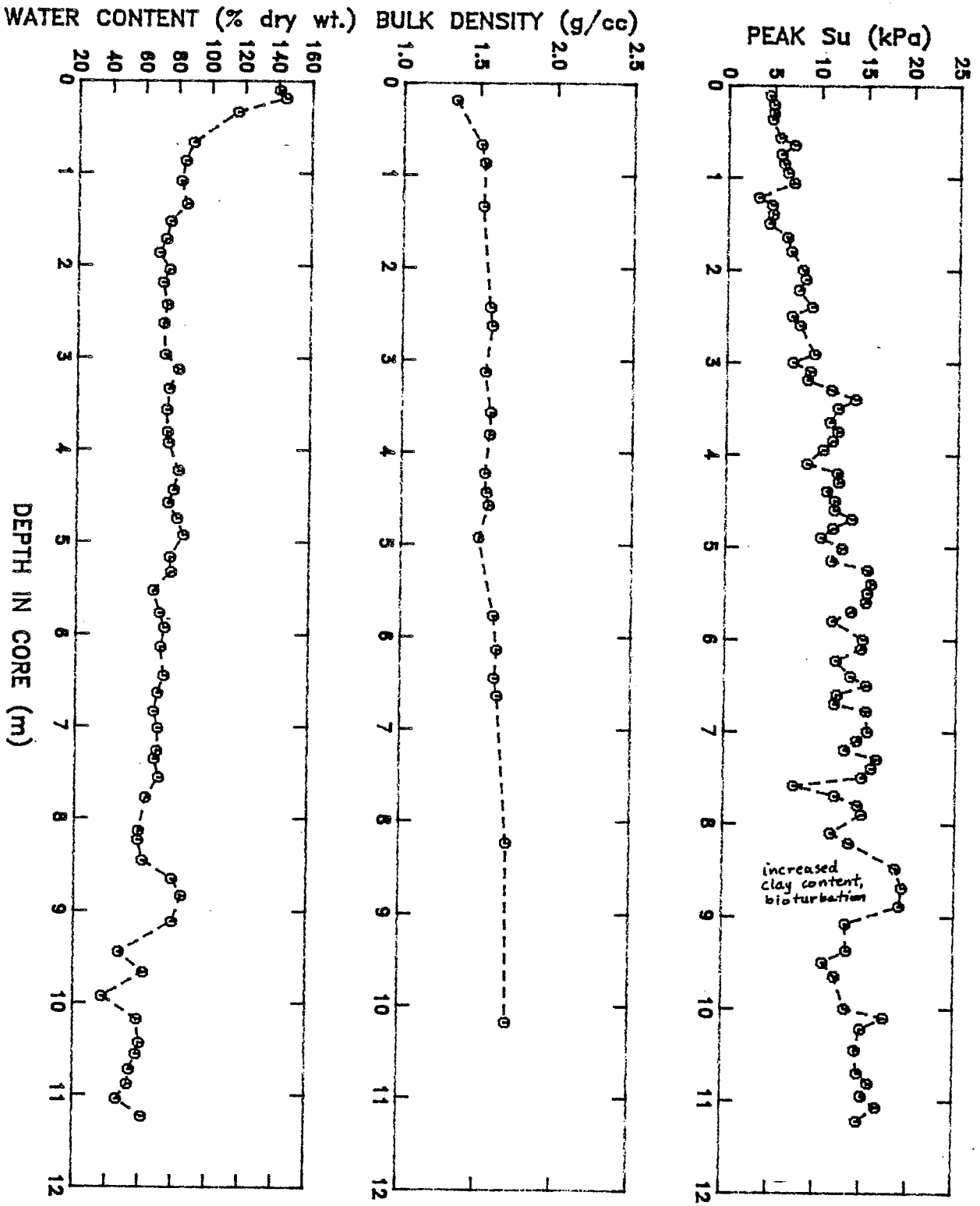

FIGURE 4-16

Geotechnical Data for Piston Core 86Ø13-ØØ5

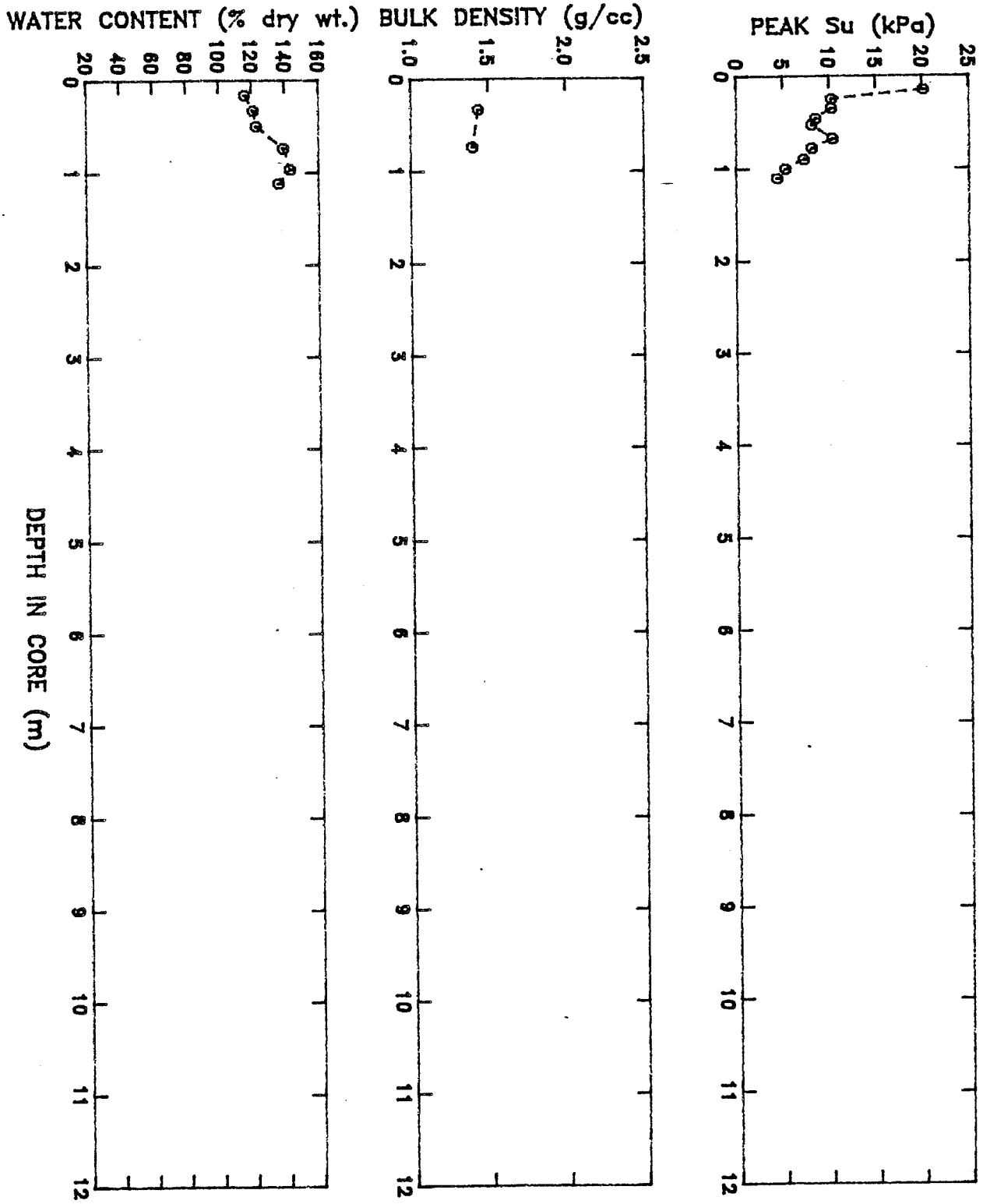

FIGURE 4-17

Geotechnical Data for Trigger Weight Core 86Ø13-ØØ5

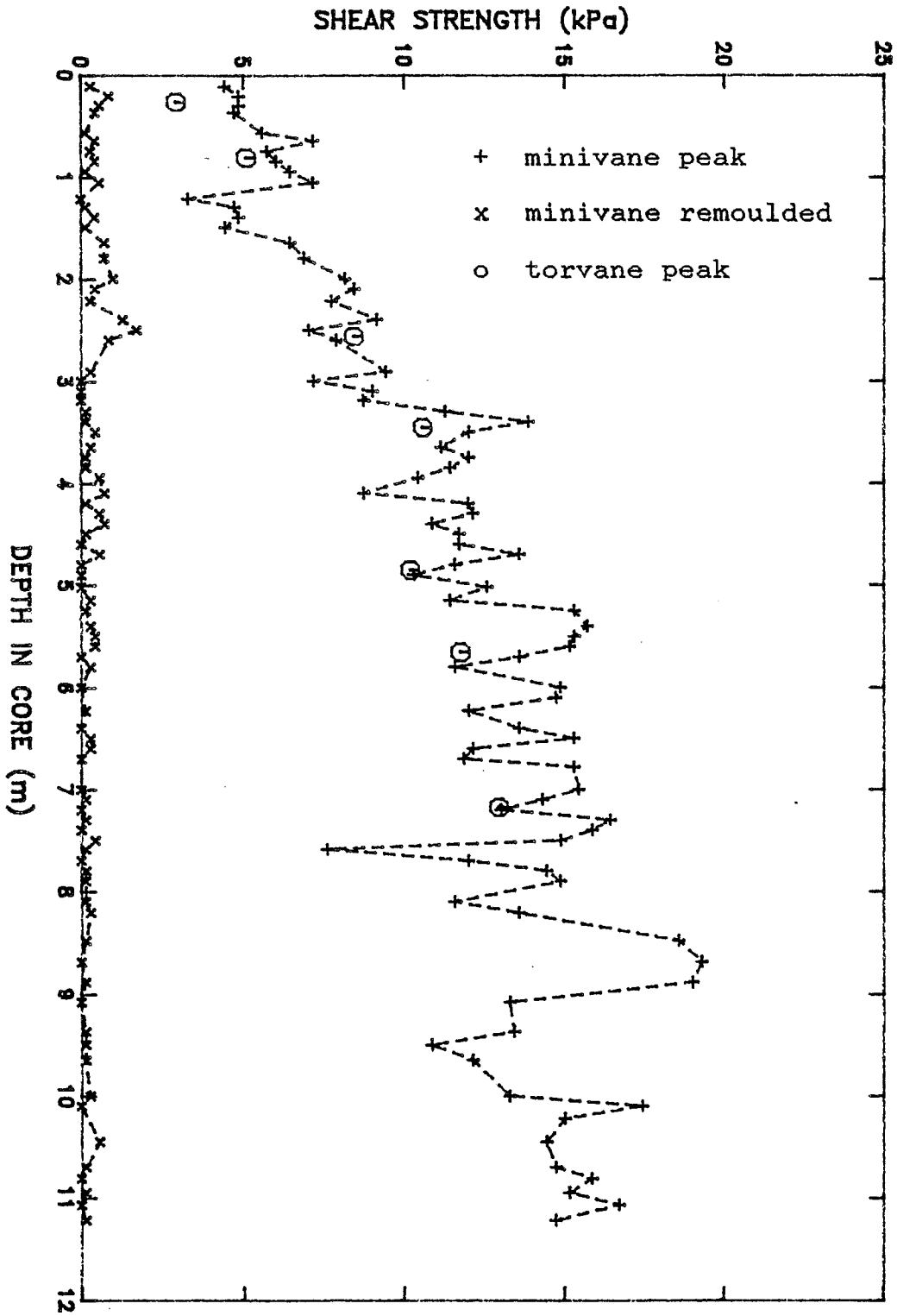

FIGURE 4-18

Undrained Shear Strength for Piston Core 86Ø13-ØØ5

the sediments in the trigger weight core display different behavior. The trigger weight core apparently collected the top meter of sediments at this site that were not obtained in the piston core. The trigger weight core sediments exhibit increasing water content and decreasing shear strength with increasing depth in the core, as has been seen in the profiles of the data from Cores ØØ2 and ØØ3.

The resul ts of the grain size tests for Core ØØ5 are given in Table A-2 and are depicted in Figure 4-19. The Atterberg limit test results are presented in Table A-3 and Figure 4-7. The sediment generally consists of clayey silt, with varying ratios of silt (49-68%) and clay (23-38%), and with small amounts of sand (4-17%). Using the Unified Soil Classification System, the sediments are classified as inorganic silts of low plasticity.

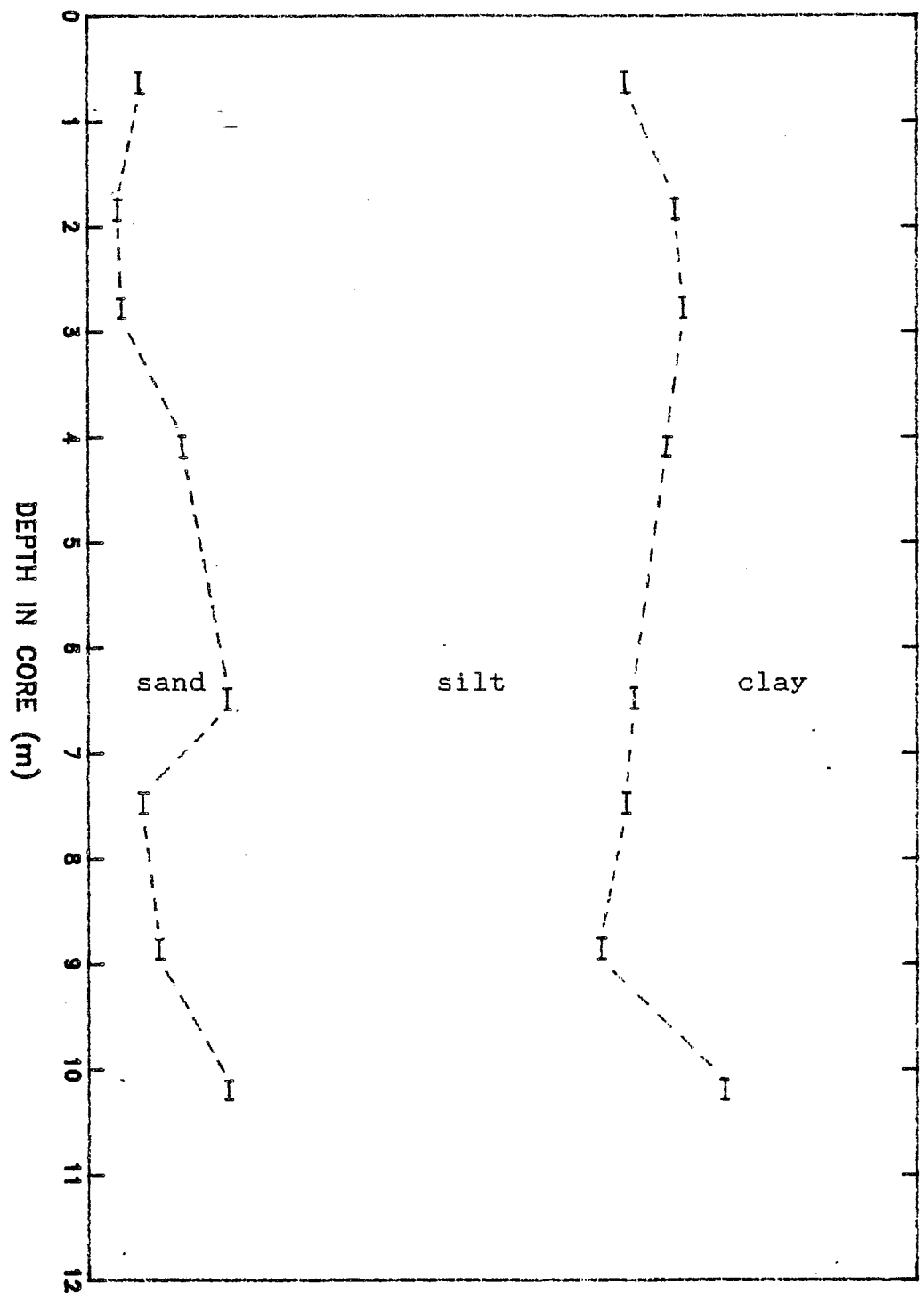

FIGURE 4-19

Grain Size for Piston Core 86Ø13-ØØ5

4.5 Cores ØØ4 and ØØ6

Figures 4-2Ø and 4-21 are sketches of the lithologies of Piston Core ØØ4 and Trigger Weight Core ØØ2, respectively. Similar sketches are shown in Figures 4-22 and 4-23 for Piston Core ØØ6 and Trigger Weight Core ØØ6.

Unfortunately, due to the high degree of disturbance in Cores ØØ4 and ØØ6, geotechnical testing or sampling were not performed. This lack of information causes difficulty in categorizing the sediments at these two sites. However, samples were taken for biostratigraphy, and some samples were taken for gas analysis. These samples have not been processed as yet, but should provide more information regarding the nature of the sediments in the two cores.

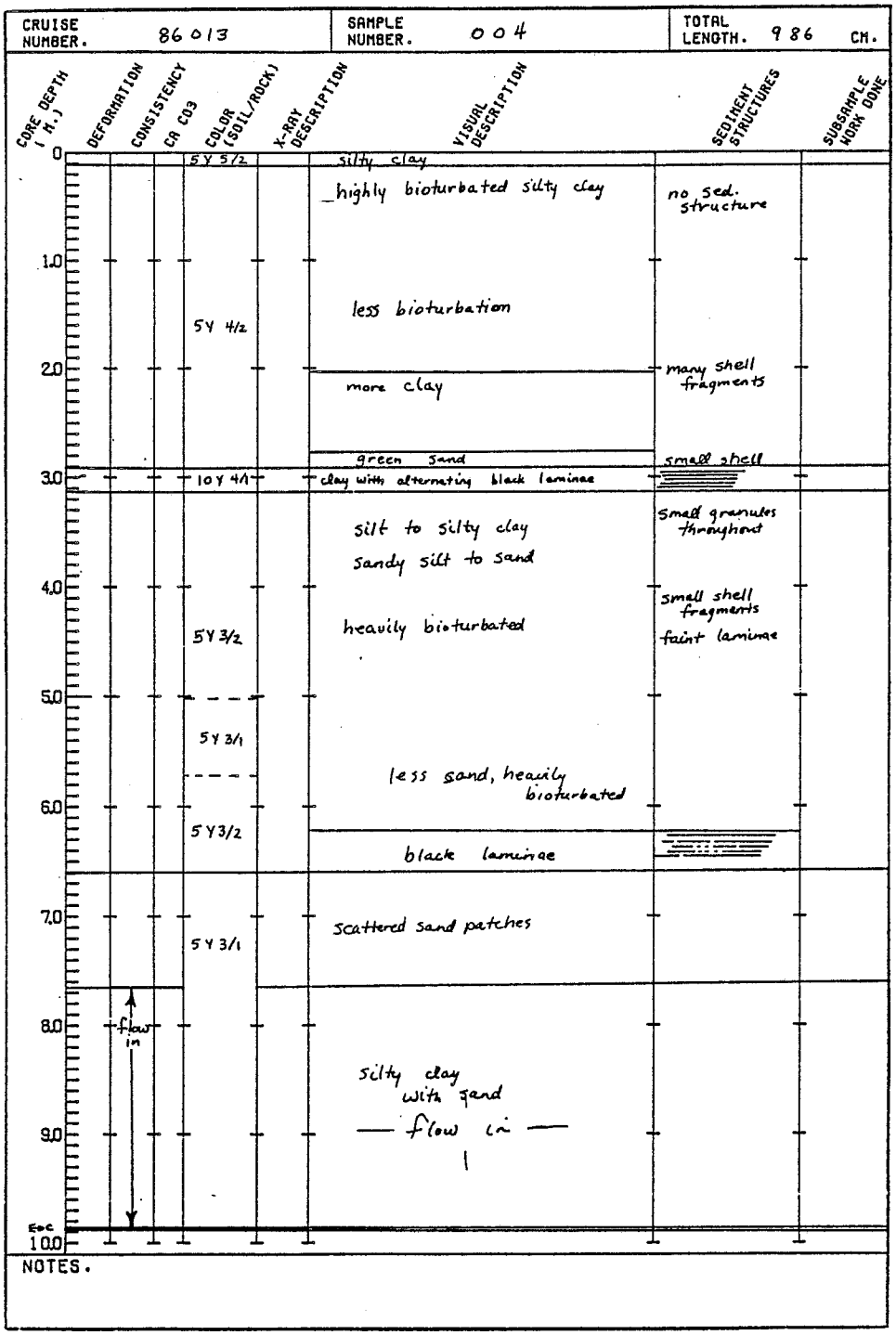

FIGURE 4-20

Summary Description of Piston Core 004

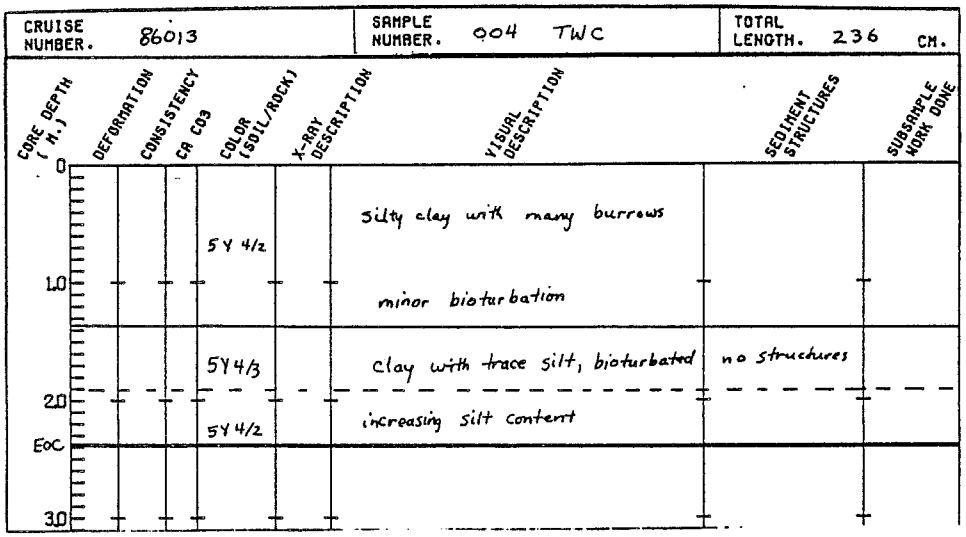

FIGURE 4-21

Summary Description of Trigger Weight Core ØØ4

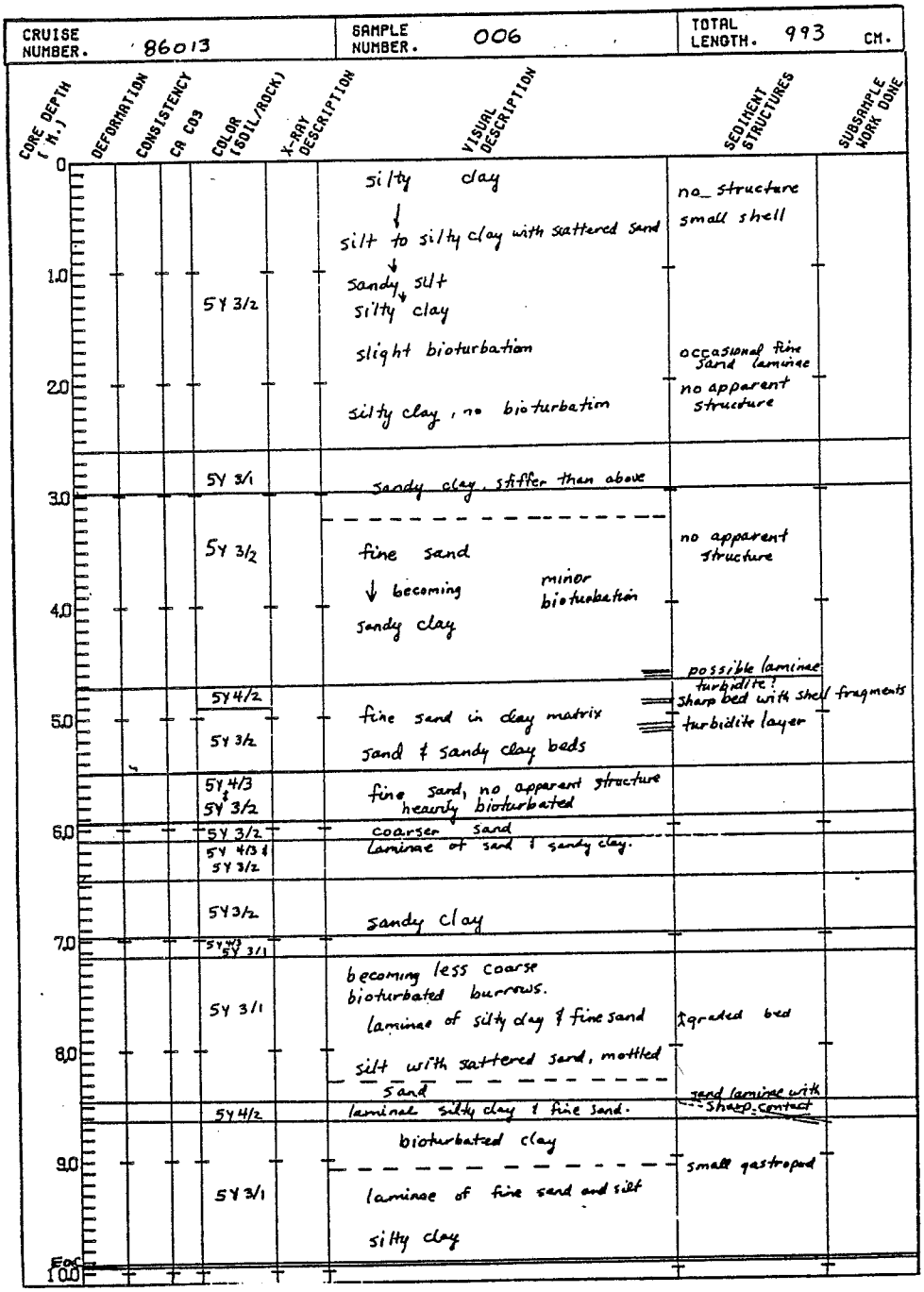

FIGURE 4-22

Summary Description of Piston Core ØØ6

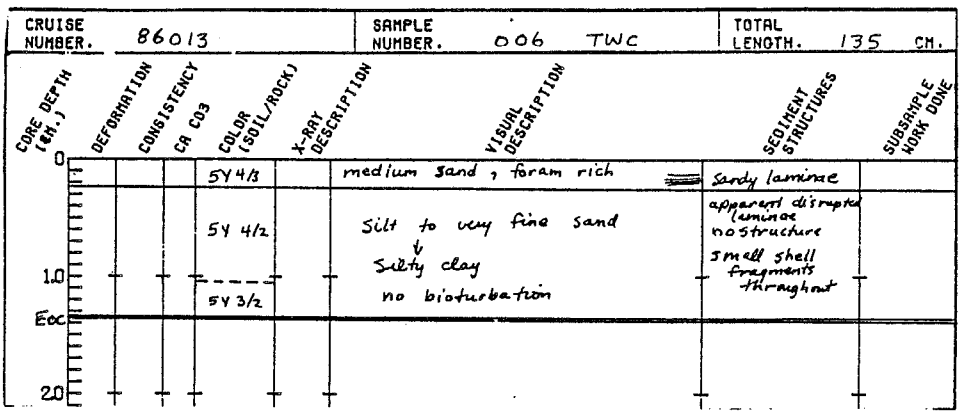

FIGURE 4-23

Summary Description of Trigger Weight Core ØØ6

5.Ø Discussion

Figure 5-1 shows a schematic of Cores ØØ1 through ØØ6, including piston and trigger weight cores. The top of the trigger weight cores are assumed to correspond with the mudline. The piston cores were placed in the sediment column by considering the core descriptions and the geotechnical data, and attempting to match the data from the top of the piston core to the data from the trigger weight core at each site.

The data for Trigger Weight Core ØØ1 was not available, so Piston Core ØØ1 (analyzed by NORDCO) was placed with the most distinct marker, the change in water content near 2.5 m matching the corresponding change in Core ØØ2 near 2.5 m. This assumption may provide a slight error due to variability in local sedimentation, but was considered the best choice. The markers deeper in the cores are estimated from trends that occur in the profiles at each site. Figure 5-2 shows water content, bulk density, and shear strength profiles constructed from the data presented in Nordco's draft report (1986). Many of the trends observed in the profiles of data from Cores ØØ2 and ØØ3 can be seen in the profiles of Figure 5-2. They are more noticeable in the water content profile than in the shear strength profile, where some variation is likely due to the different test methods and high sand content.

The results of the biostratigraphical sampling should provide a basis of comparison between the trigger weight and piston cores. The results of the consolidation tests may provide an idea of stress history that could be compared to the assumed overburden stresses (assuming a normally consolidated sediment), perhaps resulting in a closer estimate of the location of the cores in the sediment column. However, because the sediments are so silty, the change in slope of the void ratio vs. log stress curves are likely to occur very gradually, making the range of possible preconsolidation pressures large. If the assumed overburden stress fall within this range, no assumptions of the location of the cores in the sediment can be made on the basis of these tests.

It is apparent that the effort of placing the piston cores in the sediment column with the information currently available is difficult at best, and emphasizes the need for a closer study of the seismic data in the area. A further study of the seismic data may also allow the tracing of reflectors from the sites on the slope to deeper sediments at the sites near the wellsite, thus allowing some assumptions to be made about the expected physical behavior of some of the deeper sediments at those sites.

The cores from 86Ø13 can be divided into two groups based on description and physical properties. The sediments obtained

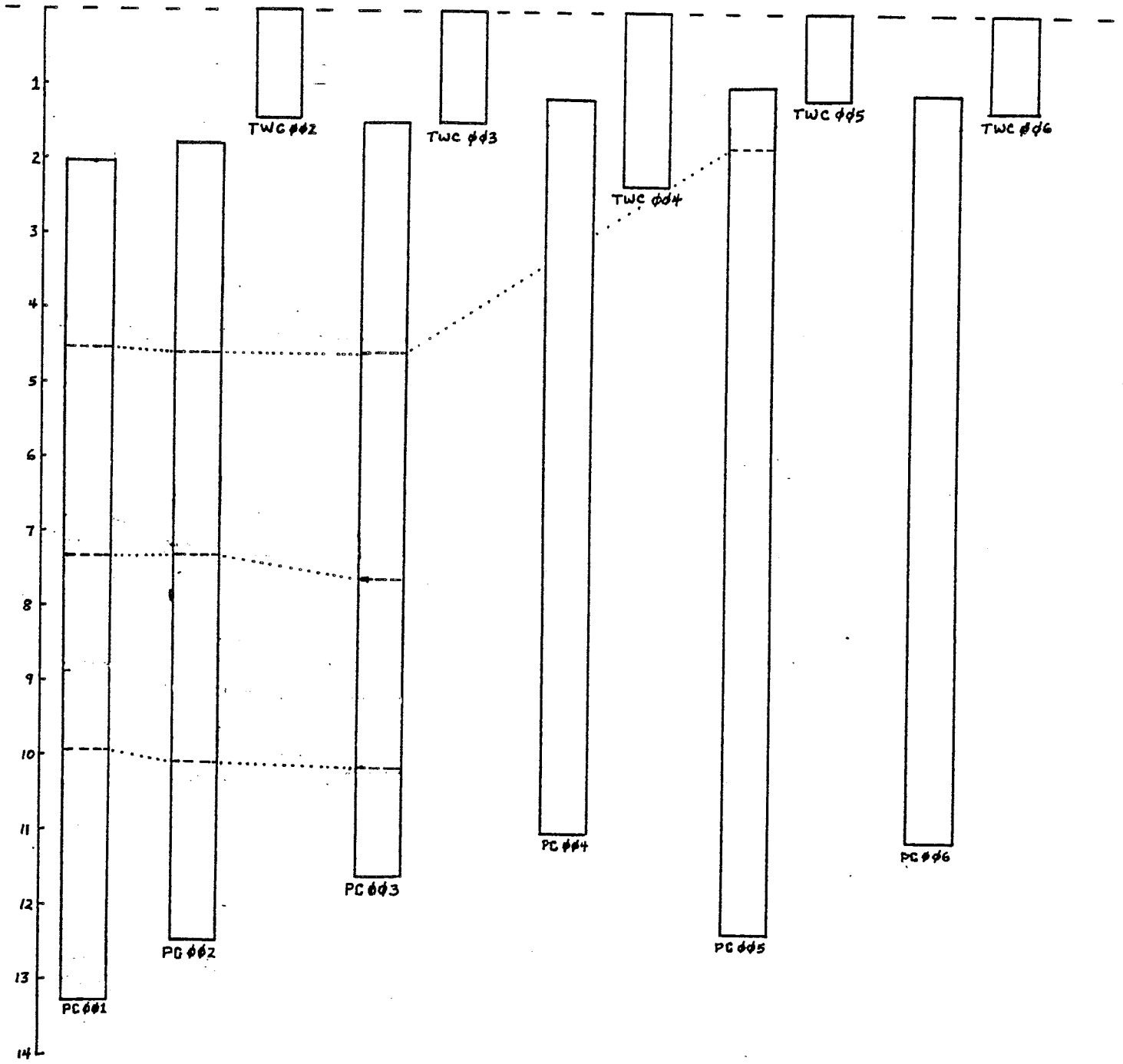

FIGURE 5-1

Schematic of Six Cores Obtained near Narwhal F-99 Wellsite

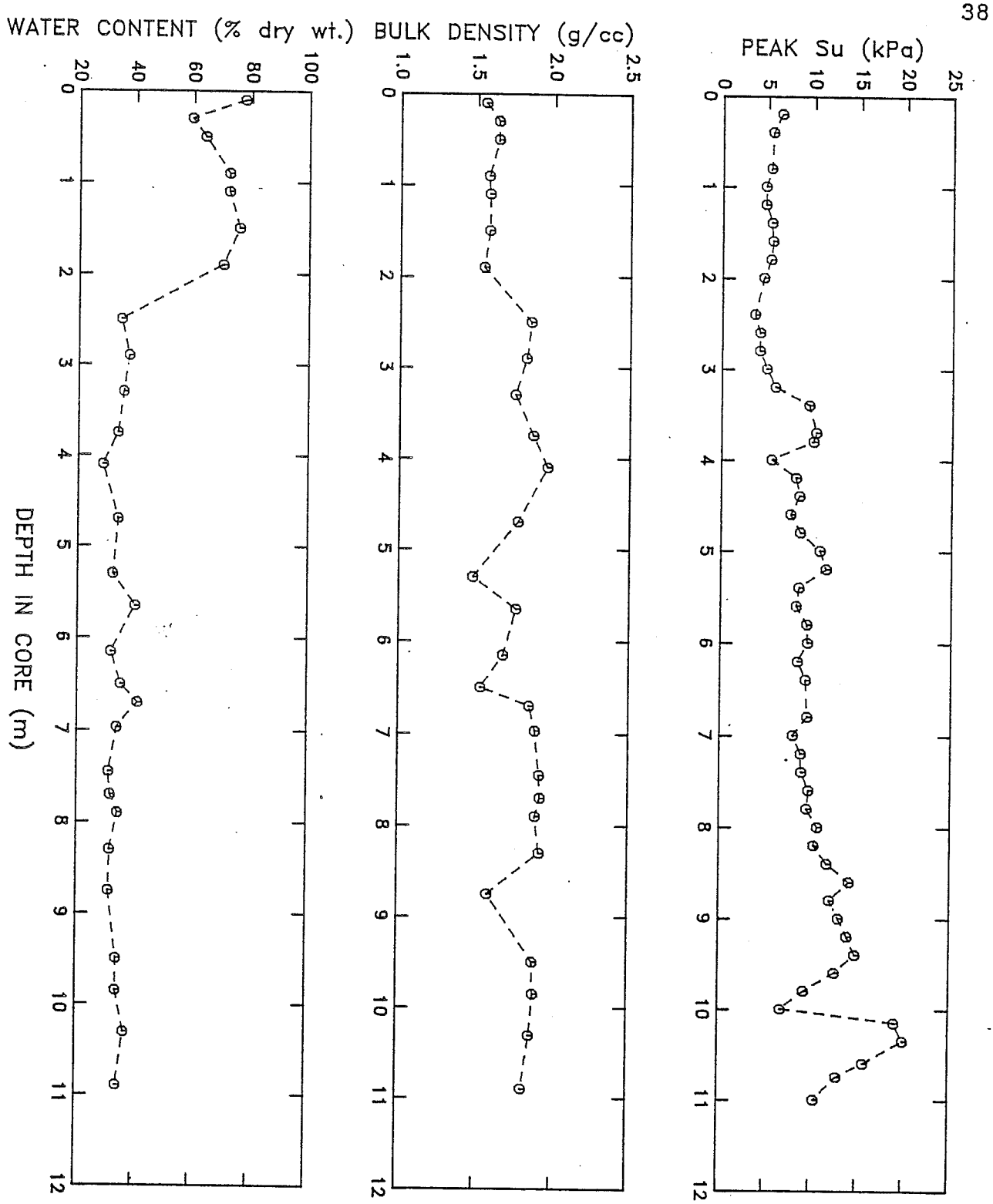

FIGURE 5-2

Geotechnical Data for Trigger Weight Core 86Ø13-ØØ1

upslope of the Narwhal F-99 wellsite (Cores ØØ4, ØØ5 and ØØ6) are distinctly different from those collected near the wellsite (Cores ØØ1, ØØ2, and ØØ3).

The visual analyses of Cores ØØ2 and ØØ3 show these cores to consist of olive gray clayey silt alternating with zones of sandy silt. Varying degrees of bioturbation are evident. The obtained geotechnical data show an abrupt change in water content and bulk density at 2.5 to 3 m in Cores ØØ2 and ØØ3 which is also evident in Core ØØ1 (NORDCO draft report). This change corresponds to the sharp increase in sand content at this depth in the cores. The relatively constant trends of water content and bulk density below approximately 3 m in the cores are likely influenced by the sampling procedure, reflecting the difficulty in obtaining true values of water content and bulk density in sediments with such high sand contents. The values of shear strength are also likely affected by the high sand content.

The values of shear strength obtained in the sandy silts are probably not indicative of the real shear strength, as previously stated, because of the inaccuracy of the vane test in sediments with high sand content. However, the trends in test results do allow a comparison between cores in determining if Cores ØØ1, ØØ2, and ØØ3 were obtained in the same stratigraphic sequence.

Cores ØØ4, ØØ5 and ØØ6 consist of dark gray gaseous clay and silty clay. Analysis of gas samples should indicate whether the gas is from a source at depth or from local bioturbation. It is likely that these cores sample a lower stratigraphic horizon than the three cores at the wellsite. Thus the geotechnical, micropaleontological, and gas chemistry sample information may be used to predict the behavior of the sediments deeper in Cores ØØ1, ØØ2 and ØØ3. Closer study of the seismic reflectors may prove whether this assumption is viable.

Cores ØØ4 and ØØ5 contain occasional sand laminae near the bottom of the core, but consist predominantly of silty clay, becoming stiffer and more bioturbated with increasing depth in the core. Core ØØ6 appears to contain more sand, with possible turbidite layers throughout.

Oddly, the trend in the remoulded data for Core ØØ3 is noticeably different than that for Core ØØ2. It could not be determined why many of the remoulded tests for Core ØØ3 gave values of zero or close to zero when this was not the case for Core ØØ2, but it may result from some difference in test procedure between the cores. Data from Core ØØ5 shows similar behavior to Core ØØ3. Neither of the sets of results can be disclaimed, but a further look at the stress-strain curves from the tests in each core may provide a clue to this strange behavior, and determine if it is real, or some remnant of test procedures.

One of the most interesting observations concerning the data in this study is the trend of increasing water content and decreasing shear strength with increasing depth in the core in all cores for which this data is available. In Cores ØØ1, ØØ2, and ØØ3, these anomalous trend occurs down to a depth in the piston core of approximately 2.5 m, where dramatic changes in physical properties occur. In Core ØØ5, these trends are seen in the trigger weight core, which apparently samples the upper meter of sediment that was not collected in the piston core.

The occurrence of these trends, opposite to those expected for a normally consolidating sediment sequence, in core in different settings, imply that a similar process has caused the anomalies. It is possible that these sediments have been deposited rapidly, in a slump or slide situation. The anomalies in the data might reflect the consolidation of this zone, with drainage occurring at both boundaries of the layer (the water/sediment interface and the boundary between the anomalous clayey sediments and the underlying sand sediments).

Another possibility is that the anomalies are due to the effects of bioturbation. This was suggested by Mosher (1987) in discussing a similar phenomenon in Verrill Canyon cores. There is apparent bioturbation in Cores ØØ2 and ØØ3, but only slight bioturbation in Trigger Weight Core ØØ5, where the anomalies also occur. This appears to disclaim bioturbation as the cause of the anomalies at this site. Results of the consolidation testing may provide information which can allow a more confident explanation.

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APPENDIX

TABLE A-1 CONSOLIDATION SAMPLES

Core	Sample No.	Depth (m)
86-Ø13-ØØ2	2-1	5.98- 6.Ø3
86-Ø13-ØØ2	2-2	7.43- 7.48
86-Ø13-ØØ2	2-3	9.53- 9.58
86-Ø13-ØØ2	2-4	1Ø.74-1Ø.79
86-Ø13-ØØ3	3-1	1.73- 1.78
86-Ø13-ØØ3	3-2	4.ØØ- 4.Ø5
86-Ø13-ØØ3	3-3	5.24- 5.29
86-Ø13-ØØ3	3-4	7.74- 7.79
86-Ø13-ØØ3	3-5	9.37- 9.42
86-Ø13-ØØ5	5-1	2.83- 2.88
86-Ø13-ØØ5	5-2	4.Ø2- 4.Ø7
86-Ø13-ØØ5	5-3	6.31- 6.36

TABLE A-2 GRAIN SIZE DATA

Core	Interval (mbsf)	% Gravel	% Sand	% Silt	% Clay
86-013-002	0.18- 0.28	0.0	7.7	55.3	37.0
86-013-002	1.26- 1.40	0.0	4.7	58.3	37.0
86-013-002	2.39- 2.54	0.0	15.5	57.5	27.0
86-013-002	3.93- 4.06	0.6	57.0	42.4	16.0
86-013-002	5.15- 5.34	0.0	50.6	34.4	15.0
86-013-002	6.02- 6.16	0.1	44.3	39.6	16.0
86-013-002	7.08- 7.28	0.0	35.4	46.6	18.0
86-013-002	8.39- 8.51	0.0	35.2	44.8	20.0
86-013-002	9.40- 9.47	0.0	38.1	41.9	20.0
86-013-002	10.61-10.74	0.1	41.6	41.3	17.0
86-013-003	0.37- 0.57	0.0	2.6	56.4	41.0
86-013-003	1.68- 1.73	0.0	6.0	55.0	39.0
86-013-003	2.86- 3.05	0.0	59.0	29.0	12.0
86-013-003	3.75- 3.95	0.0	45.4	40.6	14.0
86-013-003	4.95- 5.20	0.8	17.2	45.0	37.0
86-013-003	6.71- 6.94	0.1	49.9	35.0	15.0
86-013-003	7.70- 9.38	0.0	42.8	37.7	19.5
86-013-003	9.34- 9.38	0.0	29.5	46.5	24.0
86-013-005	0.48- 0.69	0.0	6.4	58.6	35.0
86-013-005	1.73- 1.90	0.0	3.6	67.4	29.0
86-013-005	2.75- 2.88	0.0	4.1	67.9	28.0
86-013-005	3.98- 4.07	0.0	11.3	58.7	30.0
86-013-005	6.36- 6.58	0.0	16.8	49.2	34.0
86-013-005	7.38- 7.57	0.0	6.6	58.4	35.0
86-013-005	8.76- 8.96	0.0	8.6	53.4	38.0
86-013-005	10.10-10.28	0.2	16.7	60.1	23.0

TABLE A-3 ATTERBERG LIMIT DATA

Core	Interval (mbsf)	Liquid Limit	Plastic Limit	Specific Gravity
86-013-002	0.08- 0.18	44	31	----
86-013-002	1.15- 1.26	41	27	----
86-013-002	5.93- 5.98	nonplastic		2.68
86-013-002	7.25- 7.39	nonplastic		2.69
86-013-002	8.51- 8.63	23	19	2.70
86-013-002	9.47- 9.53	nonplastic		2.69
86-013-002	10.79-10.89			
86-013-003	0.57- 0.81	40	26	2.70
86-013-003	1.78- 2.03	38	25	2.75
86-013-003	3.05- 3.33	18	nonplastic	2.68
86-013-003	3.95- 4.00	19	nonplastic	2.70
86-013-003	5.20- 5.25	21	18	2.73
86-013-003	6.48- 6.71	20	nonplastic	2.70
86-013-003	7.79- 8.01	20	nonplastic	2.71
86-013-003	9.30- 9.34	24	nonplastic	2.70
86-013-005	0.30- 0.48	nonplastic		2.67
86-013-005	1.58- 1.73	43	30	2.71
86-013-005	2.68- 2.75	43	28	2.66
86-013-005	4.07- 4.25	42	31	2.66
86-013-005	6.26- 6.31	42	27	2.65
86-013-005	7.25- 7.38	42	28	2.67
86-013-005	8.57- 8.76	43	29	2.67
86-013-005	10.28-10.47	33	22	2.72

TABLE A-4a Observations during Sampling - Piston Core 86Ø13-ØØ2

Depth	Comments
Ø.ØØ- 1.15	Sediment is too disturbed (cracks) or sandy for consolidation testing.
1.15- 1.4Ø	Study of core upon removal from storage shows large sand zone in approx. half of core (therefore, no consolidation samples).
2.5Ø- 2.91	Liner imploded.
2.5Ø- 5.5Ø	Very sandy (no Atterberg limits or consolidation samples taken).
5.45- 5.9Ø	Liner imploded.
5.93- 5.98	Sediment more intact here (no seams or fissures).

TABLE A-4b Observations during Sampling - Trigger Core 86Ø13-ØØ2

Depth	Comments
Ø.48- Ø.98	Sediment has been cracked during coring process and is not intact. It is difficult to find locations for tests and impossible to obtain bulk density samples.
1.15- 1.3Ø	Sediment is noticeably softer.
1.3Ø- 1.45	Sediment very soupy.