

22. GRAIN SIZE OF SEDIMENTS FROM THE WESTERN EQUATORIAL PACIFIC: LEG 7, GLOMAR CHALLENGER

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METHODS

The grain size of sediments collected on Leg 7 was determined on shore at Scripps Institute of Oceanography by standard grain size analysis techniques (c.f., Krumbein and Pettijohn, 1938). Details of the actual procedures used are set forth in Volume IV of the *Initial Reports of the Deep Sea Drilling Project* (1970).

In general, from each core section recovered, one 10-gram sample of fresh sediment was taken in a plastic sampling tube. The samples were sealed in plastic vials and refrigerated until analyzed. In the laboratory, the samples were extruded into beakers, dried, and disaggregated in a dilute Calgon solution. The mixture was sieved through a 0.062-millimeter sieve to remove the sand-sized particles, and the remainder was dispersed in a 1000-milliliter cylinder of water and pipetted to determine the silt and clay-sized fractions. It should be remembered that skeletal debris, Radiolaria skeletons in particular, have a high specific surface area, and their settling velocity is slower than their nominal diameter would indicate. Therefore, determination of the percentage of clay by pipette analysis may yield values that are too large in biogenous sediments.

The percentage of the total weight of the samples having the following equivalent diameters was determined:

Sand:	0.062 millimeter
Silt:	0.062 to 0.004 millimeter
Clay:	0.004 millimeter

A complete list of grain size results from all sites is given in Table 1. Size classifications shown in the table are after Shepard (1954). It should be emphasized that these classifications refer to particle size distribution only and in no way represent mineralogy. For example, in the ooze-chalk sequences, almost all of the sand fractions consist of foraminifera and Radiolaria tests. The clay fraction consists mostly of nannofossils and fragments of foraminifera tests. Triangular diagrams for each site are shown in Figure 1. The percentage of clay, silt and sand are shown plotted as a function of depth on both the core description charts and on the Site Summaries in Chapters 3 through 9.

Analyses of samples from lithified materials which are more difficult to disaggregate should be used with caution, as erroneously large proportions of either large-sized fractions or small-sized fractions may result from treatment. The samples analyzed may consist in part of particles which are aggregates of finer material, and analyses yield erroneously large proportions of the larger sizes. On the other hand, more heroic means are necessary to disperse partially lithified materials (the addition of hydrogen peroxide, agitation with an ultrasonic probe, etc.). This treatment can result in pulverizing some discrete particles, particularly more fragile ones, such as foraminifera and Radiolaria tests, and analyses of these materials will show an erroneously large proportion of finer material.

RESULTS

Site 61

Grain size analysis was made of only one sample of silty clay from Hole 61.1-1-2.

Site 62

Grain size analyses of samples from Site 62 indicate that the calcareous nannofossil ooze-chalk sequence penetrated increases irregularly (Quaternary) in grain size from a silty clay at the surface to a sand-silt-clay at 300 meters (Middle Miocene). Lower Miocene samples from Cores 4 and 5 are somewhat finer grained than the overlying material. Because few aggregates were present in the coarse fraction of the samples, the increase in grain size with depth and age appears to be real. There is some indication that zones of larger grain size may correspond to zones of higher porosity; both may relate to higher content of foraminifera tests.

Site 63

The grain size analyses of samples from Site 63 indicate that the nannofossil marl and chalk-ooze, with few exceptions, consists of silty clay sizes throughout, from Early Oligocene through Quaternary.

As in samples from Site 62, there appears to be a correlation between larger grain size and high porosity, and both may relate to content of foraminifera tests.

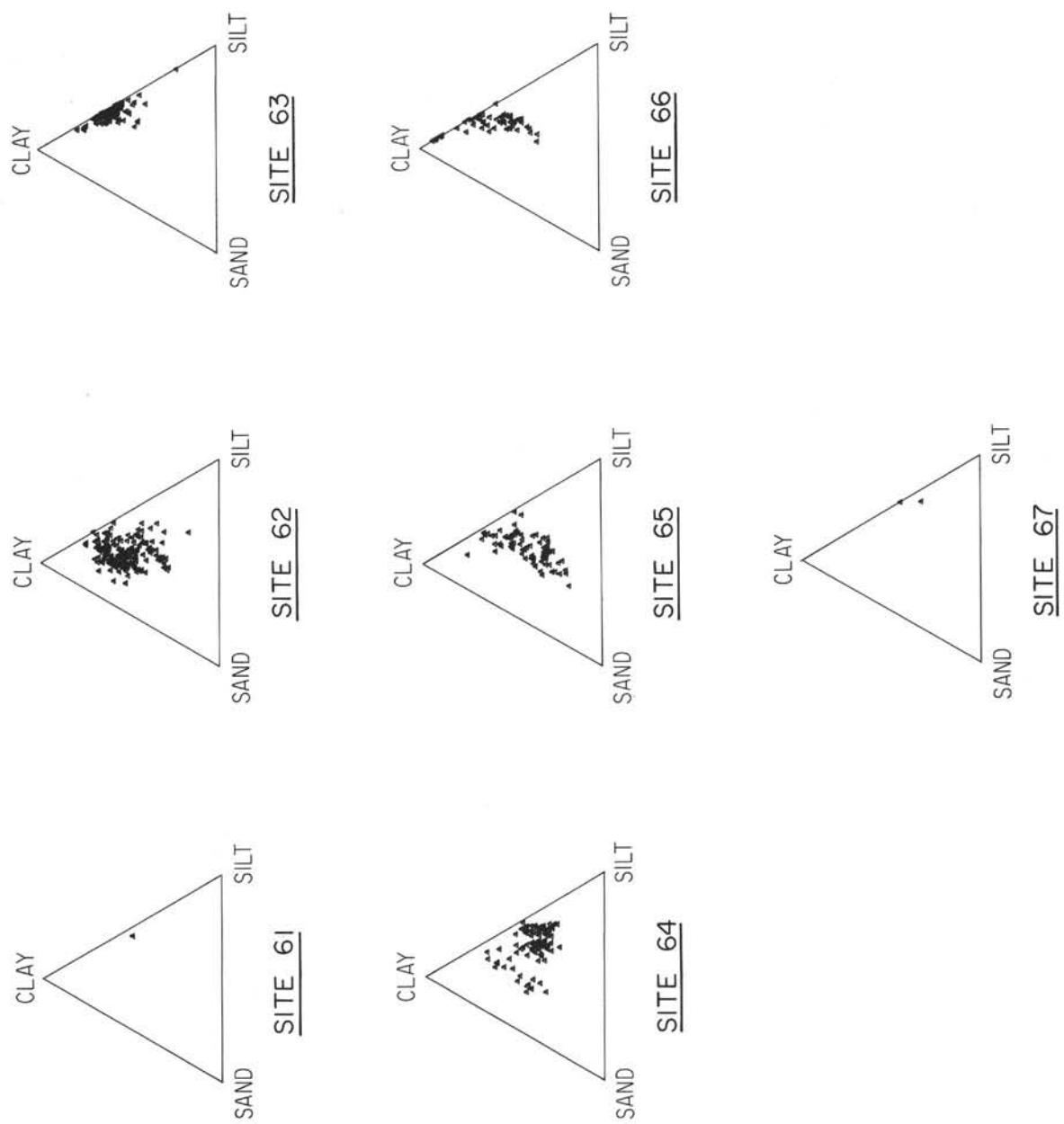


Figure 1. Triangle Diagrams of Grain Size: Leg 7

Site 64

Grain size analyses of samples from Site 64 indicate that the nannofossil ooze-chalk sequence decreases in grain size with depth. There is a marked decrease in grain size from the Quaternary nannofossil ooze (35 per cent sand) near the sea floor to the Late Miocene chalk ooze (12 per cent sand) cored at 200 meters. The grain size of samples recovered between 200 and 600 meters (Late Oligocene) is relatively constant. The grain size decreases with depth in the interval between 600 meters and the Middle Eocene chalk (5 per cent sand) at 910 meters.

Site 65

The Middle Eocene-Quaternary sequence penetrated consists of radiolarian ooze throughout. A consistent increase in grain size with depth from near surface Quaternary oozes to the Late Eocene ooze-chalks at 120 meters is evident in both the proportion of sand-size fraction which increases from less than 10 per cent to 35 per cent, and the proportion of clay-size fraction which decreases from 60 per cent to 20 per cent. There is a slight decrease in grain size in samples between 120 meters and the Middle Eocene oozes at 160 meters (28 per cent sand sizes).

The fact that the increase in grain size with depth between Quaternary and Eocene material is indicated both by a decrease in the proportion of clay sizes and by an increase in the proportion of sand sizes (the latter being determined by sieving) suggests that the increase in clay sizes is largely real, and not an artifact introduced by inferring grain diameter from settling velocity. However, all of the values of the percentage of clay may be somewhat too high. (Size analysis by settling velocity of sediment containing a large proportion of skeletons, Radiolaria in particular, may yield erroneously high proportions of finer fractions.)

That the decrease in grain size from Eocene to Quaternary is not primarily due to increased fragmentation of skeletal material is suggested by the fact that the mean grain density of the ooze increases markedly

between Eocene and Quaternary materials at Site 65. In Chapter 25, it is shown that the proportion of sand sizes increases and the proportion of clay sizes decreases as the measured mean grain density decreases in the Radiolarian ooze at Site 65. This suggests that variations in grain size result primarily from variations in the content of opaline skeletal debris (grain density ~ 2.0), the balance consisting of finer, more dense components.

Site 66

As at Site 65, the Radiolarian ooze sequence shows an increase in grain size from Quaternary samples at 10 meters (less than 1 per cent sand sizes) through Early Miocene samples at 120 meters (22 per cent sand sizes). Like samples from Site 65, samples from this ooze also show a decrease in mean grain density with depth. This fact, together with the increase in grain size, suggests that the percentage of Radiolarian tests increases with depth which may relate to a decrease in productivity and/or an increase in bottom residence time from the Miocene through the Quaternary.

The pelagic clay (Cretaceous) from 165 to 190 meters is very fine-grained. Negligible sand sizes are reported, and the silt content is less than 15 per cent in 11 or 14 sections where samples were taken.

Site 67

Only two samples from Site 67 were analyzed for grain size. Both (67.0-1-1 and 67.1-1-2) were clayey silts and showed negligible sand content.

REFERENCES

- Bader, R. D. *et al.*, 1970. Appendix III. In *Initial Reports of the Deep Sea Drilling Project, Volume IV*. Washington D.C. (U. S. Government Printing Office).
- Krumbein, W. C. and Pettijohn, F. J., 1938. *Manual of Sedimentary Petrography*. New York (Appleton-Century-Crofts, Inc.)
- Shepard, F. P., 1954. Nomenclature based on sand-silt-clay ratios. *J. Sed. Petro.* 24, 151.

TABLE 1
Grainsize of Sediments from the Western Equatorial Pacific

Grainsize ^a						Grainsize ^a					
Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification	Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification
Hole 61.1											
Core 1-2	42.0	4.3	45.9	49.8	Silty Clay	Core 9-2	2.0	9.3	23.2	67.5	Silty Clay
Hole 62.0											
Core 1-1	1.0	11.0	24.3	64.7	Silty Clay	9-3	2.0	19.1	19.2	61.7	Silty Clay
Core 2-2	3.0	3.6	32.4	64.1	Silty Clay	9-4	2.0	23.2	16.0	60.8	Sandy Clay
2-3	8.0	6.3	33.0	60.8	Silty Clay	Core 10-1	2.0	19.8	23.2	57.1	Silty Clay
2-4	3.0	4.2	33.7	62.1	Silty Clay	10-2	22.0	15.6	28.5	55.9	Silty Clay
Core 3-1	2.0	14.6	40.1	45.3	Silty Clay	10-3	10.0	24.7	22.4	52.9	Sand-Silt-Clay
3-2	2.0	11.2	37.9	50.9	Silty Clay	10-4	5.0	22.6	21.0	56.4	Sand-Silt-Clay
3-3	2.0	11.4	43.5	45.1	Silty Clay	10-5	2.0	13.6	19.0	67.4	Silty Clay
3-4	2.0	15.8	40.7	43.4	Silty Clay	10-6	3.0	26.5	21.8	51.6	Sand-Silt-Clay
3-5	2.0	14.3	40.2	45.5	Silty Clay	Core 11-2	2.0	12.6	26.0	61.4	Silty Clay
3-6	2.0	13.1	40.5	46.4	Silty Clay	11-4	3.0	17.8	20.3	61.9	Silty Clay
Core 4-5	2.0	13.6	51.7	34.7	Clayey Silt	11-5	2.0	20.6	33.1	46.3	Sand-Silt-Clay
Core 5-2	14.0	14.2	47.6	38.2	Clayey Silt	11-6	28.0	12.0	24.8	63.2	Silty Clay
5-3	1.0	9.4	47.5	43.1	Clayey Silt	Core 12-1	2.0	18.9	25.8	55.3	Silty Clay
Hole 62.1											
Core 1-2	30.0	2.4	29.3	68.3	Silty Clay	12-2	2.0	19.2	24.4	56.4	Silty Clay
1-3	4.0	2.9	36.6	60.4	Silty Clay	12-3	5.0	29.3	11.7	59.0	Sandy Clay
Core 4-1	2.0	16.5	28.9	54.7	Silty Clay	12-4	2.0	25.8	24.8	49.4	Sand-Silt-Clay
4-3	2.0	6.8	30.9	62.3	Silty Clay	12-5	2.0	11.2	23.6	65.2	Silty Clay
4-4	2.0	5.0	25.5	69.5	Silty Clay	12-6	2.0	22.1	19.8	58.1	Sandy Clay
4-5	4.0	4.3	32.7	63.0	Silty Clay	Core 13-3	91.0	7.9	24.9	67.3	Silty Clay
4-6	2.0	12.0	33.3	54.8	Silty Clay	13-4	5.0	16.4	23.1	60.4	Silty Clay
Core 6-1	10.0	5.3	26.9	67.7	Silty Clay	13-5	2.0	22.0	21.9	56.0	Sand-Silt-Clay
6-2	3.0	11.0	26.8	62.2	Silty Clay	13-6	4.0	21.6	22.5	55.9	Sand-Silt-Clay
6-3	2.0	8.3	22.9	68.8	Silty Clay	Core 14-1	51.0	26.8	21.4	51.9	Sand-Silt-Clay
6-4	2.0	7.4	28.1	64.4	Silty Clay	14-2	5.0	28.1	20.0	51.9	Sand-Silt-Clay
6-5	2.0	10.0	24.1	65.9	Silty Clay	14-3	2.0	30.8	18.3	50.9	Sandy Clay
6-6	2.0	33.5	14.0	52.4	Sandy Clay	14-4	5.0	24.6	22.8	52.6	Sand-Silt-Clay
Core 7-1	4.0	4.1	21.3	74.6	Silty Clay	14-5	6.0	39.0	32.0	29.0	Sand-Silt-Clay
7-2	2.0	20.3	19.4	60.3	Sandy Clay	14-6	12.0	22.6	21.3	56.1	Sand-Silt-Clay
7-3	2.0	9.7	27.5	62.8	Silty Clay	Core 15-1	2.0	31.5	22.5	45.9	Sand-Silt-Clay
7-4	2.0	19.2	20.3	60.5	Silty Clay	16-1	3.0	8.7	24.1	67.2	Silty Clay
7-5	2.0	21.7	21.0	57.3	Sand-Silt-Clay	16-3	4.0	3.2	22.5	74.3	Silty Clay
7-6	2.0	3.5	21.6	74.8	Silty Clay	16-4	2.0	23.5	21.4	55.0	Sand-Silt-Clay
Core 8-3	2.0	10.0	22.9	67.1	Silty Clay	16-6	3.0	14.5	23.3	62.2	Silty Clay
8-4	2.0	13.2	23.8	63.0	Silty Clay	Core 17-1	122.0	15.7	16.2	68.1	Silty Clay
8-5	2.0	13.5	17.0	69.6	Silty Clay	17-2	6.0	17.3	17.5	65.2	Silty Clay
8-6	2.0	11.6	26.2	62.2	Silty Clay	17-4	4.0	10.8	22.5	66.7	Silty Clay
						17-6	2.0	20.9	33.5	45.6	Sand-Silt-Clay
						Core 18-1	2.0	19.1	22.8	58.2	Silty Clay
						18-3	2.0	19.8	20.2	60.0	Silty Clay
						18-4	2.0	20.7	27.3	51.9	Sand-Silt-Clay

^aGrainsize: Sand per cent of total weight greater than .062 millimeter; clay per cent of total weight less than .0039 millimeter; silt remainder of total weight.

TABLE 1 - *Continued*

Grainsize ^a						Grainsize ^a					
Identification	Interval	Sand	Silt	Clay	Classification	Identification	Interval	Sand	Silt	Clay	Classification
	cm	Per Cent	Per Cent	Per Cent			cm	Per Cent	Per Cent	Per Cent	
Hole 62-1 - <i>Continued</i>											
18-5	4.0	21.6	27.0	51.4	Sand-Silt-Clay	25-4	2.0	10.0	30.8	59.3	Silty Clay
18-6	3.0	13.7	34.9	51.4	Silty Clay	25-5	6.0	20.2	25.1	54.7	Sand-Silt-Clay
Core 19-1	78.0	16.9	28.9	54.2	Silty Clay	Core 26-1	7.0	20.1	26.6	53.3	Sand-Silt-Clay
19-2	30.0	26.1	25.3	48.6	Sand-Silt-Clay	26-2	6.0	24.1	28.4	47.5	Sand-Silt-Clay
19-3	3.0	26.4	22.7	50.9	Sand-Silt-Clay	26-3	3.0	18.2	27.0	54.8	Silty Clay
19-4	3.0	23.6	23.8	52.5	Sand-Silt-Clay	26-4	3.0	20.5	25.0	54.5	Sand-Silt-Clay
19-5	2.0	25.8	25.9	48.4	Sand-Silt-Clay	26-6	3.0	19.3	28.5	52.2	Silty Clay
19-6	3.0	18.8	27.8	53.4	Silty Clay	Core 27-1	67.0	18.1	25.4	56.4	Silty Clay
Core 20-1	4.0	31.8	24.1	44.1	Sand-Silt-Clay	27-2	7.0	23.6	28.8	47.6	Sand-Silt-Clay
20-2	2.0	18.7	28.4	52.9	Silty Clay	27-3	2.0	21.1	29.1	49.7	Sand-Silt-Clay
20-3	2.0	29.8	23.5	46.7	Sand-Silt-Clay	27-4	2.0	26.5	26.3	47.2	Sand-Silt-Clay
20-4	2.0	20.4	25.6	54.0	Sand-Silt-Clay	27-5	3.0	21.2	27.9	50.9	Sand-Silt-Clay
20-5	3.0	34.3	24.8	41.0	Sand-Silt-Clay	Core 28-1	3.0	18.9	30.3	50.8	Silty Clay
20-6	4.0	13.1	29.9	57.0	Silty-Clay	28-2	3.0	18.2	31.5	50.3	Silty Clay
Core 21-1	4.0	28.5	24.1	47.4	Sand-Silt-Clay	28-3	2.0	1.2	39.9	58.9	Silty Clay
21-2	11.0	31.9	24.9	43.2	Sand-Silt-Clay	28-4	3.0	22.4	30.9	46.6	Sand-Silt-Clay
21-3	2.0	24.9	24.5	50.6	Sand-Silt-Clay	28-5	2.0	28.5	30.9	40.6	Sand-Silt-Clay
21-4	3.0	24.8	20.7	54.5	Sand-Silt-Clay	Core 29-1	3.0	24.9	32.7	42.4	Sand-Silt-Clay
21-5	3.0	22.6	24.5	52.9	Sand-Silt-Clay	29-2	5.0	18.3	33.0	48.7	Silty Clay
21-6	3.0	21.7	20.8	57.5	Sand-Silt-Clay	29-3	2.0	24.8	28.6	46.6	Sand-Silt-Clay
Core 22-1	3.0	15.7	20.2	64.2	Silty Clay	29-4	2.0	27.0	56.1	16.9	Sandy Silt
22-2	2.0	21.1	20.7	58.3	Sand-Silt-Clay	29-5	2.0	19.9	49.5	30.6	Clayey Silt
22-3	2.0	17.0	22.9	60.1	Silty Clay	29-6	3.0	21.0	31.0	48.0	Sand-Silt-Clay
22-4	3.0	20.2	19.1	60.7	Sandy Clay	Core 30-1	2.0	25.9	27.7	46.5	Sand-Silt-Clay
22-5	3.0	30.7	24.2	45.1	Sand-Silt-Clay	30-2	2.0	15.6	28.4	56.0	Silty Clay
22-6	4.0	11.8	23.3	64.9	Silty Clay	30-3	2.0	23.7	29.6	46.7	Sand-Silt-Clay
Core 23-1	7.0	8.1	29.1	62.8	Silty Clay	30-4	2.0	18.5	27.2	54.4	Silty Clay
23-2	4.0	14.2	21.9	63.9	Silty Clay	30-5	2.0	22.3	27.7	50.0	Sand-Silt-Clay
23-3	2.0	19.1	20.6	60.2	Silty Clay	30-6	2.0	9.8	33.2	57.0	Silty Clay
23-5	6.0	23.5	18.9	57.6	Sandy Clay	Core 31-1	1.0	19.8	31.4	48.8	Silty Clay
23-6	3.0	10.3	25.4	64.3	Silty Clay	31-2	2.0	16.4	36.0	47.6	Silty Clay
Core 24-1	3.0	16.6	18.4	65.0	Silty Clay	31-3	4.0	20.5	33.9	45.6	Sand-Silt-Clay
24-2	13.0	22.7	19.8	57.5	Sandy Clay	31-4	1.0	13.6	37.8	48.6	Silty Clay
24-3	2.0	0.0	29.6	70.4	Silty Clay	31-6	1.0	13.1	44.0	42.9	Clayey Silt
24-4	3.0	18.8	20.7	60.5	Silty Clay	Core 32-1	1.0	23.6	37.5	39.0	Sand-Silt-Clay
24-5	16.0	26.4	17.7	55.9	Sandy Clay	32-2	2.0	25.3	37.4	37.2	Sand-Silt-Clay
24-6	3.0	5.0	27.0	68.0	Silty Clay	32-3	1.0	31.6	37.1	31.4	Sand-Silt-Clay
Core 25-1	6.0	11.5	24.5	63.9	Silty Clay	32-4	1.0	36.9	32.3	30.8	Sand-Silt-Clay
25-2	6.0	11.7	29.4	58.9	Silty Clay	32-5	2.0	28.8	36.1	35.0	Sand-Silt-Clay
25-3	3.0	15.5	28.6	55.8	Silty Clay	32-6	1.0	35.1	34.4	30.5	Sand-Silt-Clay

^aGrainsize: Sand per cent of total weight greater than .062 millimeter; clay per cent of total weight less than .0039 millimeter, silt remainder of total weight.

TABLE I - *Continued*

Grainsize ^a							Grainsize ^a													
Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification		Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification								
Hole 62-1 - <i>Continued</i>																				
Core 33-2	0.0	32.9	35.1	32.0	Sand-Silt-Clay		Core 7-1	1.0	5.0	35.8	59.2	Silty Clay								
33-3	1.0	25.9	35.7	38.4	Sand-Silt-Clay		7-2	2.0	3.8	39.4	56.8	Silty Clay								
Core 34-1	4.0	19.4	36.3	44.3	Silty Clay		7-3	1.0	4.5	38.3	57.2	Silty Clay								
34-4	2.0	19.6	38.8	41.6	Silty Clay		7-4	3.0	2.5	35.7	61.8	Silty Clay								
34-5	4.0	26.3	38.7	35.0	Sand-Silt-Clay		7-5	1.0	3.2	39.3	57.5	Silty Clay								
Core 35-1	30.0	18.7	38.4	42.9	Silty Clay		7-6	4.0	3.6	36.8	59.6	Silty Clay								
35-2	2.0	21.1	41.7	37.2	Sand-Silt-Clay		Core 8-1	50.0	14.7	41.5	43.8	Silty Clay								
35-3	2.0	20.2	39.3	40.5	Sand-Silt-Clay		8-2	3.0	4.9	40.3	54.8	Silty Clay								
35-4	2.0	23.4	38.0	38.6	Sand-Silt-Clay		8-3	2.0	5.0	39.7	55.3	Silty Clay								
35-5	4.0	24.6	43.9	31.5	Sand-Silt-Clay		Core 9-1	18.0	4.5	50.2	45.3	Clayey Silt								
35-6	2.0	38.1	33.6	28.3	Sand-Silt-Clay		9-3	0.0	0.3	77.7	21.9	Silt								
Core 36-2	2.0	33.2	37.2	29.6	Sand-Silt-Clay		9-4	0.0	3.0	34.0	63.1	Silty Clay								
36-3	2.0	24.0	36.7	39.4	Sand-Silt-Clay		Hole 63.1													
36-4	2.0	20.2	12.5	67.3	Sandy Clay		Core 1-1	46.0	6.8	34.1	59.1	Silty Clay								
36-5	2.0	31.6	34.5	33.9	Sand-Silt-Clay		1-2	2.0	3.8	29.3	66.9	Silty Clay								
Core 37-2	2.0	30.8	35.9	33.3	Sand-Silt-Clay		1-3	1.0	3.2	42.4	54.4	Silty Clay								
Hole 63.0																				
Core 1-1	3.0	3.7	22.8	73.5	Silty Clay		Core 3-1	55.0	3.4	34.8	61.8	Silty Clay								
1-2	7.0	0.7	38.4	60.8	Silty Clay		3-2	1.0	9.6	35.8	54.6	Silty Clay								
4,1-4	2.0	1.5	36.6	61.9	Silty Clay		Core 5-3	1.0	0.2	35.9	64.0	Silty Clay								
1-5	10.0	5.3	48.4	46.3	Clayey Silt		5-4	3.0	0.5	33.5	66.0	Silty Clay								
1-6	4.0	4.3	40.4	55.3	Silty Clay		Core 6-1	61.0	0.6	35.1	64.3	Silty Clay								
Core 2-2	2.0	1.8	20.7	77.5	Clay		6-2	1.0	1.3	37.3	61.4	Silty Clay								
2-6	1.0	2.6	23.7	73.7	Silty Clay		6-3	4.0	0.9	39.3	59.8	Silty Clay								
Core 3-1	56.0	2.6	34.1	63.3	Silty Clay		6-4	3.0	2.9	44.5	52.7	Silty Clay								
3-2	4.0	1.7	30.7	67.6	Silty Clay		6-5	3.0	0.6	31.7	67.7	Silty Clay								
3-3	2.0	4.8	40.6	54.6	Silty Clay		6-6	1.0	0.9	30.5	68.6	Silty Clay								
3-4	1.0	2.0	36.2	61.8	Silty Clay		Core 7-2	1.0	2.0	45.7	52.3	Silty Clay								
Core 4-1	7.0	1.0	36.7	62.3	Silty Clay		7-3	1.0	4.5	37.0	58.5	Silty Clay								
4-2	1.0	0.3	43.4	56.3	Silty Clay		Core 8-2	10.0	4.3	34.8	60.9	Silty Clay								
Core 5-1	14.0	2.6	43.6	53.8	Silty Clay		8-3	13.0	2.1	40.8	57.1	Silty Clay								
5-2	4.0	5.1	37.2	57.7	Silty Clay		8-4	1.0	3.9	38.0	58.1	Silty Clay								
Core 6-1	2.0	16.4	38.3	45.3	Silty Clay		8-5	2.0	1.6	42.7	55.7	Silty Clay								
6-2	2.0	10.2	38.4	51.5	Silty Clay		8-6	1.0	1.5	45.9	52.6	Silty Clay								
6-3	2.0	6.4	31.8	61.8	Silty Clay		Core 9-1	10.0	1.0	36.6	62.4	Silty Clay								
6-4	2.0	6.2	33.1	60.8	Silty Clay		9-2	2.0	1.1	39.4	59.5	Silty Clay								
6-5	2.0	7.2	37.3	55.5	Silty Clay		9-3	2.0	1.7	39.0	59.3	Silty Clay								
6-6	1.0	6.3	32.8	60.9	Silty Clay		9-4	6.0	2.1	42.2	55.6	Silty Clay								
							9-5	2.0	1.0	40.4	58.5	Silty Clay								
							9-6	2.0	8.5	37.5	54.0	Silty Clay								

^aGrainsize: Sand per cent of total weight greater than .062 millimeter; clay per cent of total weight less than .0039 millimeter; silt remainder of total weight.

TABLE 1 - *Continued*

Grainsize ^a							Grainsize ^a						
Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification		Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification	
Hole 63.1 - <i>Continued</i>													
Core 10-1	10.0	0.5	45.2	54.2	Silty Clay		1-5	2.0	31.3	23.7	43.2	Sand-Silt-Clay	
10-2	2.0	1.5	45.4	53.2	Silty Clay		1-6	73.0	35.7	23.7	40.6	Sand-Silt-Clay	
10-5	4.0	2.5	55.1	42.5	Clayey Silt		Core 2-2	4.0	31.6	28.6	39.8	Sand-Silt-Clay	
Core 11-1	1.0	5.3	35.2	59.5	Silty Clay		2-3	5.0	20.7	28.3	51.1	Sand-Silt-Clay	
11-2	1.0	1.3	41.9	56.8	Silty Clay		2-4	4.0	26.2	26.8	47.0	Sand-Silt-Clay	
11-3	1.0	1.7	46.2	52.1	Silty Clay		2-6	1.0	28.0	23.5	48.5	Sand-Silt-Clay	
11-4	7.0	7.1	43.6	49.3	Silty Clay		Core 3-1	1.0	13.6	26.8	59.6	Silty Clay	
11-5	1.0	6.4	43.2	50.4	Silty Clay		3-2	4.0	17.4	26.6	56.0	Silty Clay	
11-6	1.0	1.1	39.8	59.1	Silty Clay		3-3	4.0	9.0	26.0	65.0	Silty Clay	
Core 13-1	1.0	0.5	36.6	62.9	Silty Clay		3-4	5.0	13.3	26.5	60.1	Silty Clay	
13-2	2.0	3.4	43.6	53.0	Silty Clay		3-5	2.0	14.9	24.1	61.0	Silty Clay	
13-3	1.0	5.0	39.1	55.9	Silty Clay		3-6	4.0	5.5	29.2	65.3	Silty Clay	
13-4	2.0	1.2	43.5	55.4	Silty Clay		Core 4-1	47.0	16.8	46.8	36.4	Clayey Silt	
13-5	8.0	5.4	37.7	56.9	Silty Clay		4-2	8.0	15.5	47.6	36.9	Clayey Silt	
13-6	3.0	8.5	43.2	48.3	Silty Clay		4-3	8.0	16.6	49.1	34.3	Clayey Silt	
Core 14-1	2.0	1.9	37.4	60.7	Silty Clay		4-4	12.0	14.5	49.3	36.2	Clayey Silt	
14-2	1.0	0.8	46.2	53.0	Silty Clay		4-5	21.0	14.4	54.0	31.6	Clayey Silt	
14-3	3.0	1.7	44.6	53.6	Silty Clay		4-6	4.0	17.4	42.4	40.1	Clayey Silt	
14-4	3.0	3.3	31.9	64.8	Silty Clay		Core 5-1	8.0	15.0	32.1	53.0	Silty Clay	
14-5	0.0	1.8	49.5	48.7	Clayey Silt		5-2	4.0	18.3	38.7	43.0	Silty Clay	
14-6	4.0	8.5	52.4	39.1	Clayey Silt		5-3	8.0	14.1	37.0	48.9	Silty Clay	
Core 14-1	2.0	1.9	37.4	60.7	Silty Clay		5-4	8.0	25.6	41.1	33.3	Sand-Silt-Clay	
14-2	1.0	0.8	46.2	53.0	Silty Clay		5-5	4.0	24.1	39.0	36.9	Sand-Silt-Clay	
14-3	3.0	1.7	44.6	53.6	Silty Clay		Core 5-1	8.0	15.0	32.1	53.0	Silty Clay	
14-4	3.0	3.3	31.9	64.8	Silty Clay		5-2	4.0	18.3	38.7	43.0	Silty Clay	
14-5	0.0	1.8	49.5	48.7	Clayey Silt		5-3	8.0	14.1	37.0	48.9	Silty Clay	
14-6	4.0	8.5	52.4	39.1	Clayey Silt		5-4	8.0	25.6	41.1	33.3	Sand-Silt-Clay	
Hole 63.2													
Core 1-1	2.0	5.9	31.8	62.3	Silty Clay		5-6	5.0	16.2	43.5	40.3	Clayey Silt	
1-2	1.0	14.6	42.0	43.4	Silty Clay		Core 6-1	4.0	12.0	51.9	36.1	Clayey Silt	
1-3	1.0	2.8	42.3	54.9	Silty Clay		6-2	3.0	9.4	60.2	30.4	Clayey Silt	
1-4	5.0	5.3	30.6	64.1	Silty Clay		6-3	4.0	8.4	55.7	35.9	Clayey Silt	
Core 2-1	2.0	1.9	38.7	59.4	Silty Clay		6-4	4.0	13.7	55.9	30.4	Clayey Silt	
2-2	1.0	2.2	40.0	57.8	Silty Clay		6-5	4.0	11.6	56.7	31.7	Clayey Silt	
2-3	1.0	0.9	33.9	65.1	Silty Clay		6-6	3.0	16.6	50.0	33.4	Clayey Silt	
2-4	1.0	1.7	30.6	67.7	Silty Clay		Core 7-1	22.0	18.0	47.1	34.9	Clayey Silt	
2-6	1.0	1.0	38.5	60.5	Silty Clay		7-2	19.0	13.2	41.5	45.4	Silty Clay	
Core 3-1	39.0	1.3	38.1	60.5	Silty Clay		7-3	6.0	13.5	40.1	46.4	Silty Clay	
3-2	1.0	1.1	33.1	65.8	Silty Clay		7-4	17.0	10.4	40.5	49.2	Silty Clay	
3-3	1.0	3.3	22.9	73.9	Silty Clay		7-5	11.0	13.0	43.7	43.2	Clayey Silt	
3-4	2.0	2.3	25.1	72.6	Silty Clay		7-6	7.0	16.8	45.1	38.1	Clayey Silt	
Hole 64.0													
Core 1-1	7.0	35.7	20.8	43.5	Sand-Silt-Clay		Core 8-2	2.0	7.5	33.9	58.6	Silty Clay	
1-2	29.0	35.3	28.8	36.0	Sand-Silt-Clay		8-3	1.0	5.1	51.1	43.8	Clayey Silt	
1-3	2.0	41.3	26.2	32.5	Sand-Silt-Clay		Core 10-1	25.0	6.9	49.8	43.3	Clayey Silt	
1-4	3.0	32.8	25.0	42.2	Sand-Silt-Clay		10-2	2.0	10.1	51.7	38.2	Clayey Silt	

^aGrainsize: Sand per cent of total weight greater than .062 millimeter; clay per cent of total weight less than .0039 millimeter; silt remainder of total weight.

TABLE 1 – *Continued*

Grainsize ^a						Grainsize ^a											
Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification	Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification						
Hole 64.1																	
Core 1-1	19.0	19.1	44.7	36.2	Clayey Silt	9-2	2.0	3.9	49.9	46.3	Clayey Silt						
1-2	2.0	14.5	47.3	38.2	Clayey Silt	9-3	3.0	4.0	52.7	43.3	Clayey Silt						
1-3	5.0	14.4	45.7	39.9	Clayey Silt	Core 10-1	12.0	1.4	53.3	45.3	Clayey Silt						
1-4	4.0	19.0	42.2	38.7	Clayey Silt	10-2	8.0	6.1	55.3	38.6	Clayey Silt						
1-5	4.0	18.4	48.1	33.4	Clayey Silt	Hole 65.0											
1-6	10.0	21.0	47.3	31.7	Sand-Silt-Clay	Core 2-2	2.0	11.0	29.7	59.3	Silty Clay						
Core 2-1	25.0	22.6	42.5	34.9	Sand-Silt-Clay	2-3	18.0	14.7	26.2	59.1	Silty Clay						
2-2	6.0	23.1	47.6	29.3	Sand-Silt-Clay	2-4	19.0	6.3	32.9	60.8	Silty Clay						
2-3	20.0	21.6	42.8	35.6	Sand-Silt-Clay	2-5	42.0	3.9	31.3	64.8	Silty Clay						
2-4	3.0	20.1	47.9	32.0	Sand-Silt-Clay	Core 3-1	15.0	2.5	32.1	65.3	Silty Clay						
2-5	5.0	13.5	46.3	40.2	Clayey Silt	3-2	31.0	12.4	31.0	56.6	Silty Clay						
2-6	3.0	16.0	54.8	29.2	Clayey Silt	3-3	2.0	4.2	32.7	63.1	Silty Clay						
Core 3-1	9.0	23.5	51.7	24.7	Sand-Silt-Clay	3-4	20.0	5.9	37.8	56.3	Silty Clay						
3-2	3.0	10.9	61.7	27.5	Clayey Silt	3-5	2.0	7.2	33.9	58.8	Silty Clay						
3-3	7.0	11.5	59.5	29.0	Clayey Silt	Core 4-2	12.0	13.9	30.5	55.6	Silty Clay						
3-4	20.0	12.3	59.0	28.7	Clayey Silt	4-4	4.0	10.7	36.1	53.2	Silty Clay						
3-5	17.0	8.5	57.7	33.8	Clayey Silt	4-5	4.0	5.0	28.4	66.5	Silty Clay						
3-6	14.0	9.1	55.5	35.5	Clayey Silt	Core 5-2	38.0	12.0	36.4	51.5	Silty Clay						
Core 4-1	10.0	16.9	48.8	34.3	Clayey Silt	5-4	59.0	11.6	38.4	50.0	Silty Clay						
4-2	3.0	13.2	54.0	32.8	Clayey Silt	5-5	1.0	11.8	38.8	49.4	Silty Clay						
4-3	4.0	16.2	49.8	34.0	Clayey Silt	5-6	21.0	11.5	39.3	49.3	Silty Clay						
4-4	3.0	10.1	53.6	36.3	Clayey Silt	Core 6-2	40.0	16.1	35.2	48.7	Silty Clay						
4-5	4.0	9.9	49.4	40.7	Clayey Silt	Core 7-2	82.0	15.4	34.4	50.1	Silty Clay						
4-6	2.0	9.1	54.7	36.2	Clayey Silt	7-3	7.0	10.6	35.8	53.6	Silty Clay						
Core 5-1	25.0	8.1	55.9	36.1	Clayey Silt	7-4	29.0	13.1	36.8	50.1	Silty Clay						
5-2	97.0	6.7	55.0	38.3	Clayey Silt	7-5	16.0	18.4	32.2	49.4	Silty Clay						
5-3	4.0	10.4	56.0	33.6	Clayey Silt	Core 8-1	3.0	21.8	34.3	43.9	Sand-Silt-Clay						
5-4	2.0	11.8	62.2	26.1	Clayey Silt	8-2	53.0	23.5	32.3	44.1	Sand-Silt-Clay						
5-5	2.0	11.2	58.4	30.4	Clayey Silt	8-3	66.0	39.5	27.6	32.9	Sand-Silt-Clay						
5-6	1.0	12.5	54.3	33.2	Clayey Silt	8-4	2.0	18.3	36.5	45.2	Silty Clay						
Core 6-1	3.0	19.2	49.7	31.1	Clayey Silt	8-5	2.0	22.1	38.5	39.4	Sand-Silt-Clay						
6-2	2.0	15.8	51.1	33.1	Clayey Silt	8-6	2.0	28.2	32.7	39.1	Sand-Silt-Clay						
6-3	2.0	19.0	51.5	29.6	Clayey Silt	Core 9-1	21.0	10.7	41.7	47.5	Silty Clay						
6-4	4.0	17.1	44.8	38.1	Clayey Silt	9-2	2.0	16.9	32.7	50.5	Silty Clay						
Core 7-1	99.0	9.9	55.6	34.5	Clayey Silt	9-3	2.0	29.0	33.3	37.6	Sand-Silt-Clay						
7-2	4.0	6.9	49.2	43.9	Clayey Silt	9-4	2.0	33.3	29.9	36.7	Sand-Silt-Clay						
7-3	5.0	8.3	52.1	39.6	Clayey Silt	9-5	88.0	12.2	39.8	48.0	Silty Clay						
7-4	4.0	5.1	54.1	40.8	Clayey Silt	9-6	10.0	14.2	41.3	44.5	Silty Clay						
Core 8-1	100.00	7.4	51.2	41.4	Clayey Silt	Core 10-1	70.0	12.3	41.2	46.5	Silty Clay						
8-2	1.0	5.4	50.5	44.1	Clayey Silt	10-2	2.0	21.8	37.0	41.3	Sand-Silt-Clay						
Core 9-1	9.0	4.7	45.7	49.5	Silty Clay	10-3	53.0	26.7	31.0	42.3	Sand-Silt-Clay						

^aGrainsize: Sand per cent of total weight greater than .062 millimeter; clay per cent of total weight less than .0039 millimeter; silt remainder of total weight.

TABLE 1 - *Continued*

Grainsize ^a						Grainsize ^a					
Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification	Identification	Interval cm	Sand Per Cent	Silt Per Cent	Clay Per Cent	Classification
10-4	2.0	22.2	35.2	42.7	Sand-Silt-Clay	Hole 66.0					
Core 11-2	65.0	27.3	34.2	38.6	Sand-Silt-Clay	Core 2-1	2.0	7.8	38.0	54.2	Silty Clay
11-3	2.0	4.6	50.9	44.5	Clayey Silt	2-2	9.0	14.3	38.6	47.0	Silty Clay
11-4	51.0	17.9	43.9	38.1	Clayey Silt	2-3	4.0	14.5	42.7	42.8	Silty Clay
11-5	41.0	16.8	39.2	44.0	Silty Clay	Core 3-1	20.0	16.4	40.9	42.7	Silty Clay
11-6	2.0	18.5	45.5	36.0	Clayey Silt	3-2	4.0	23.9	38.3	37.8	Sand-Silt-Clay
Core 12-1	4.0	30.4	39.2	30.4	Sand-Silt-Clay	3-3	3.0	21.7	39.9	38.4	Sand-Silt-Clay
12-2	25.0	26.8	43.4	29.8	Sand-Silt-Clay	3-4	12.0	20.1	40.3	39.6	Sand-Silt-Clay
12-3	3.0	8.4	16.9	74.7	Silty Clay	3-5	17.0	29.9	35.6	34.4	Sand-Silt-Clay
12-4	36.0	31.3	30.8	37.9	Sand-Silt-Clay	3-6	3.0	26.6	39.5	33.9	Sand-Silt-Clay
12-5	1.0	31.2	36.4	32.5	Sand-Silt-Clay	Core 6-1	6.0	0.0	11.8	88.2	Clay
12-6	8.0	38.3	37.9	23.8	Sand-Silt-Clay	6-2	2.0	0.0	8.5	91.5	Clay
Core 13-1	30.0	45.5	34.9	19.6	Silty Sand	6-3	2.0	0.0	7.4	92.6	Clay
13-2	14.0	30.3	41.1	28.6	Sand-Silt-Clay	6-4	2.0	0.0	25.7	74.3	Silty Clay
13-3	2.0	31.0	42.0	27.0	Sand-Silt-Clay	Core 7-1	30.0	0.0	12.3	87.7	Clay
13-4	2.0	43.8	36.3	19.9	Silty Sand	7-2	2.0	0.0	12.5	87.5	Clay
13-5	2.0	41.5	32.8	25.7	Sand-Silt-Clay	7-3	2.0	0.0	12.8	87.2	Clay
13-6	9.0	38.3	40.0	21.7	Sand-Silt-Clay	7-4	2.0	0.0	11.9	88.1	Clay
Core 14-1	3.0	29.9	40.0	30.1	Sand-Silt-Clay	Core 8-1	9.0	0.0	9.1	90.9	Clay
14-2	2.0	43.9	33.0	23.1	Sand-Silt-Clay	8-2	10.0	0.0	42.9	57.1	Silty Clay
14-3	2.0	52.3	29.6	18.1	Silty Sand	8-3	3.0	0.0	9.8	90.2	Clay
14-4	14.0	28.8	39.6	31.5	Sand-Silt-Clay	8-4	12.0	0.0	11.6	88.4	Clay
14-5	1.0	30.0	37.9	32.1	Sand-Silt-Clay	8-5	23.0	0.0	9.1	90.9	Clay
14-6	2.0	29.2	32.8	38.0	Sand-Silt-Clay	Core 9-1	117.0	0.0	27.7	72.3	Silty Clay
Core 16-2	43.0	36.5	34.6	28.9	Sand-Silt-Clay	Hole 66.1					
16-3	3.0	40.6	31.9	27.5	Sand-Silt-Clay	Core 2-1	8.0	0.6	33.2	66.2	Silty Clay
16-4	2.0	35.3	33.6	31.1	Sand-Silt-Clay	2-2	49.0	0.8	20.4	78.8	Clay
16-5	2.0	31.7	36.3	32.0	Sand-Silt-Clay	2-3	6.0	1.3	28.4	70.3	Silty Clay
16-6	3.0	37.2	28.9	33.9	Sand-Silt-Clay	2-4	12.0	1.7	30.8	67.5	Silty Clay
Hole 65.1						2-5	2.0	1.5	34.1	64.4	Silty Clay
Core 2-1	97.0	1.1	50.7	48.2	Clayey Silt	2-6	2.0	1.1	31.5	67.4	Silty Clay
Core 4-1	33.0	28.9	39.2	32.0	Sand-Silt-Clay	Core 3-1	33.0	5.3	31.0	63.7	Silty Clay
4-2	2.0	27.8	41.0	31.2	Sand-Silt-Clay	3-2	2.0	11.4	30.6	57.9	Silty Clay
4-3	2.0	32.3	37.0	30.7	Sand-Silt-Clay	3-3	2.0	11.6	27.6	60.8	Silty Clay
4-4	1.0	28.5	41.5	30.1	Sand-Silt-Clay	3-4	2.0	7.7	35.6	56.8	Silty Clay
4-5	13.0	21.9	46.0	32.2	Sand-Silt-Clay	3-5	2.0	4.8	34.6	60.6	Silty Clay
4-6	1.0	7.3	44.3	48.3	Silty Clay	3-6	2.0	5.5	30.3	64.2	Silty Clay
Core 5-1	57.0	23.1	47.0	29.9	Sand-Silt-Clay	Core 4-1	101.0	3.5	30.8	65.7	Silty Clay
5-2	3.0	23.2	42.7	34.1	Sand-Silt-Clay	4-2	2.0	3.8	26.7	69.5	Silty Clay
5-3	2.0	26.7	41.3	32.0	Sand-Silt-Clay	4-3	30.0	5.2	21.1	73.7	Silty Clay
5-4	3.0	32.0	37.5	30.5	Sand-Silt-Clay	4-4	5.0	15.7	35.3	49.0	Silty Clay

^aGrainsize: Sand per cent of total weight greater than .062 millimeter; clay per cent of total weight less than .0039 millimeter; silt remainder of total weight.

TABLE 1 – *Continued*

Identifi- cation	Interval cm	Grainsize ^a			Classification
		Sand Per Cent	Silt Per Cent	Clay Per Cent	
Hole 66.1 – <i>Continued</i>					
4-5	27.0	9.9	35.4	54.7	Silty Clay
4-6	50.0	10.8	40.5	48.7	Silty Clay
Core 5-1	3.0	16.0	34.6	49.4	Silty Clay
5-2	3.0	8.7	40.2	51.1	Silty Clay
5-3	18.0	7.5	39.9	52.6	Silty Clay
5-4	11.0	11.0	36.1	52.9	Silty Clay
5-5	19.0	18.9	36.0	45.1	Silty Clay
5-6	20.0	11.6	36.1	52.3	Silty Clay
Core 6-2	12.0	7.8	27.4	64.8	Silty Clay
6-3	23.0	8.1	30.2	61.6	Silty Clay
6-4	32.0	10.5	35.0	54.5	Silty Clay
6-5	18.0	15.4	37.0	47.6	Silty Clay
6-6	16.0	15.2	33.7	51.1	Silty Clay
Core 7-1	11.0	10.1	40.0	49.9	Silty Clay
7-2	20.0	14.3	41.4	44.3	Silty Clay
7-3	102.0	13.0	38.1	48.9	Silty Clay
7-4	3.0	10.0	40.9	49.1	Silty Clay
7-5	14.0	9.1	0.2	50.7	Silty Clay
7-6	7.0	9.9	41.1	49.0	Silty Clay
Core 8-1	2.0	8.5	38.2	53.2	Silty Clay
8-2	11.0	10.3	40.1	49.6	Silty Clay
8-3	11.0	13.7	39.9	46.3	Silty Clay
8-5	13.0	14.0	41.6	44.4	Silty Clay
8-6	13.0	14.0	41.6	44.4	Silty Clay
Hole 67.0					
Core 1-1	27.0	5.8	61.2	33.0	Clayey Silt
Hole 67.1					
Core 1-1	61.0	0.2	55.2	44.5	Clayey Silt

^aGrainsize: Sand per cent of total weight greater than .062 millimeter; clay per cent of total weight less than .0039 millimeter; silt remainder of total weight.