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Station Locations and Grain-size Analysis of Surficial Sediment Samples collected on the Continental Shelf, Gulf of the Farallones during Cruise F2-89-NC, January 1989

by

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INTRODUCTION

The U.S. Geological Survey began a major geologic and oceanographic study of the Gulf of the Farallones in 1989. This investigation, the first of several planned adjacent to major population centers, was designed to establish a good scientific data base on a segment of continental shelf adjacent to the San Francisco Bay area so as to evaluate and monitor human impact on the marine environment. Two cruises were conducted in January 1989 on the continental shelf between Cordell Bank and Half Moon Bay east of the Farallon Islands (Chin et al., 1989). Reconnaissance side-scan sonar and high-resolution seismic-reflection surveys were conducted along a rectilinear grid of tracks spaced nominally 4 km apart. This report describes the collection and analysis of 268 surficial sediment samples collected during the second cruise, F2-89-NC.

DATA COLLECTION

A regional grid of 97 samples of surficial sediment was collected with a Soutar Van Veen sampler at the intersections of the reconnaissance tracklines and, at other sites of interest, at intervals of about 4 km (Fig. 1). A denser grid of 171 samples spaced nominally 1 km apart was collected just east of the Farallon Islands (Figs. 1 and 2).

Three systems were used to navigate the ship during the sampling: (1) Global Positioning System (GPS), (2) LORAN-C, and (3) a shore-based transponder net. The primary system used for real-time positioning was chosen either manually by the navigator or automatically by the computer. Positional accuracy varied from about 100 m using GPS and LORAN-C to a few meters using the shore-based transponder net.

LABORATORY ANALYSIS

Grain -Size Analysis

The following procedures used to determine grain-size distribution of the sediment samples were standardized by the U.S. Geological Survey Marine Geology laboratory, Menlo Park. Similar methods are described in Carver (1971) and Theide and others (1976).

Oxidation of of organic matter

5-10 g portions of sample were placed in a beaker with 200 ml of distilled water and 5 ml of 30% hydrogen peroxide. The samples were stirred to fully disaggregate the sample and heated overnight at 70-80^{o} C to drive off excess H_2O_2 following oxidation of organic matter.

Removal of soluble salts

Following oxidation, the samples were washed into plastic 250 ml bottles and centrifuged at about 1700 rpm for 45 minutes. The water and soluble salts were decanted, replaced with distilled water, centrifuged a second time, and again decanted.

Size segregation

After removal of soluble salts, the samples were wet sieved with distilled water into three size fractions: Gravel (>2 mm), sand (63 μ - 2 mm), and mud (silt + clay) (<63 μ). The gravel and sand fractions were transferred to pre-weighed evaporating dishes, dried, and reweighed. The weight of the sample was then calculated by subtracting the weight of the dish. The silt + clay fractions were transferred into graduated cylinders and filled to the 1

liter mark with distilled water. Five ml of 10% sodium hexametaphosphate solution was added to disperse clay and clay size particles and prevent flocculation.

Determining the weight and size distribution of the silt + clay (<63 μ) fraction

A representative 20 ml aliquot was pipetted from each 1 liter graduated cylinder, transferred to a preweighed aluminum weighing boat, oven dried and reweighed. The total weight of the <63 fraction was calculated by multiplying that weight by 50 and subtracting out the sodium hexametaphosphate weight. Weight percents for half-phi intervals from 4.0 to 9.0ϕ (phi sizes are converted to millimeters as explained below; see also Table 1) were determined using a hydrophotometer (Jordan et al., 1977).

Determining the size distribution of the sand fraction

A Rapid Sediment Analyzer (RSA), commonly known as a settling tube, was used to measure weight percents for half-phi intervals from -1.0 to 4.5 phi. In the RSA, the sand grains are released at the top of a 2 m water column and settle to a weighing platform . The cumulative weight vs time is recorded on a chart recorder from which the size distribution can be measured using a calibrated overlay. Theory, equipment, and techniques employed are described in detail by Theide and others (1976).

Calculation of grain-size statistics and parameters

Statistics of the grain-size distribution were computer calculated with a U.S. Geological Survey Marine Geology grain-size program (Mckendrie 1988). Grain-size statistical parameters and graphic representations are given in phi units. The phi unit (ϕ) is a logarithmic transformation of millimeters into whole integers, according to the formula:

$$\phi = -\mathrm{Log}_2\ d$$

where d = grain diameter in millimeters.

The parameters calculated for these analyses include:

1) "median" - corresponds to the 50 percentile on a cumulative curve, where half the particles by weight are larger and half are smaller than the median. This parameter is measured in phi units.

2) "mean" - is the average grain-size. Several formulas are used in calculating the mean. The most inclusive graphically derived value is that given by Folk (1968):

$$M_Z = \frac{\phi 16 + \phi 50 - \phi 84}{3}$$

where $\phi 16$, $\phi 50$, and $\phi 84$ represent the size at 16, 50, and 84 percent of the sample by weight. Mean is also measured in phi units and is the most widely compared parameter.

3) "sorting" - is a method of measuring the grain-size variation of a sample by encompassing the largest parts of the size distribution as measured from a cumulative curve. Folk (1968) introduced the "inclusive graphic standard deviation", that is calculated as follows:

$$\sigma_1 = \frac{\phi 84 - \phi 16}{4} + \frac{\phi 95 - \phi 5}{6.6}$$

where $\phi 84$, $\phi 16$, $\phi 95$, and $\phi 5$ represent the phi values at 84, 16, 95, and 5 percentiles. Folk (1968) presented a verbal classification scale for sorting (Table 2): σ_1 <0.350: very well sorted; 0.35-0.500: well sorted; 0.5-0.710: moderately well sorted; 0.71-1.00: moderately sorted; 1.00-2.00: poorly sorted; 2.00-4.00: very poorly sorted; and, >4.00: extremely poorly sorted.

4) "skewness" - measures the degree to which a cumulative curve approaches symmetry. Two samples may have the same average grain size and sorting but may be quite different

to their degrees of symmetry. Folk's "inclusive graphic skewness" (1968) is determined by the equation:

$$sk_1 = \frac{\phi 16 + \phi 84 - 2\phi 50}{2(\phi 84 - \phi 16)} + \frac{\phi 5 + \phi 95 - 2\phi 50}{2(\phi 95 - \phi 5)}$$

where the phi values represent the same percentages as those for sorting. This formula includes a measure of the "tails" of the cumulative curve as well as the central portion. Other methods for determining skewness, notably those by Inman (1952) and Trask (1950), do not measure the tails of the curve. Symmetrical curves have a skewness equal to 0.00; those with a large proportion of fine material are positively skewed; those with a large proportion of coarse material are negatively skewed. A verbal classification for skewness suggested by Folk (1968) includes(Table 2): sk_1 from +0.10 to -0.10 as nearly symmetrical; -0.10 to -0.30 as coarse-skewed; and, -0.30 to -1.00 as strongly coarse-skewed.

5) "kurtosis" - is a measure of "peakedness" in a curve. Folk's (1968) formula for kurtosis is:

$$k_g = \frac{\phi 95 - \phi 5}{2.44(\phi 75 - \phi 25)}$$

where the phi values represent the same percentages as those for sorting. A normal Gaussian distribution has a kurtosis of 1.00 which is a curve with the sorting in the tails equal to the sorting in the central portion. If a sample curve is better sorted in the central part than in the tails, the curve is said to be excessively peaked, or leptokurtic; if the sample curve is better sorted in the tails than in the central portion, the curve is flat peaked or

platykurtic. For normal curves k_g = 1.00, leptokurtic curves have k_g >1.00, and platykurtic curves have k_g <1.00.

Method of Moments

All of the above statistical parameters can be calculated using the method of moments. This method gives a more rigorous treatment of the sediment characteristics. The computer program used for the sample analyses in this study performed the necessary calculations for parameter determination. The first moment measure corresponds to the mean, the second to the standard deviation, the third to the skewness, and the fourth to the kurtosis.

All data derived from these analysis are shown in Appendix I and II. Grain-size parameters calculated using the method of moments and graphically derived values are both reported.

PRELIMINARY RESULTS AND INTERPRETATION

The distribution of surficial sediment textures based on the regional grid of 97 stations suggests that depositional processes in the Gulf of the Farallones are complex. A 20-km wide corridor of sand extends westerly from the Golden Gate to the Farallon Islands (Fig. 3). Sediment textures in fig. 3 are grouped according to the classification of Shepard (1954). Silty sand and sandy silt bound the corridor to the northwest and southeast and a tongue of silt from the north extends around Pt. Reyes (Fig. 3). More detailed analysis of the sediment texture reveals a slightly more complex regional distribution as shown, for example, by a plot of mean grain size (Fig. 4). The increased complexity is well illustrated by examining the cross-shelf corridor of sand defined in Figure 3. Plotting the mean grain size at 1-phi intervals shows that patches of medium and coarse sand exist within a field of fine sand and that sediment texture becomes coarser closer to the Farallon Islands (Fig. 4). Increased sampling density reveals an even more complex pattern of sediment texture.

Note the area of dense stations (171 spaced 1 km apart) on Figures 1 and 2. Sediment in this area, based solely on analysis of samples from the regional grid of stations, is uniformly fine sand (Fig. 4). However, data from the 171 sample grid of stations (also plotted at a 1-phi interval) shows that the area actually consists of a complex pattern of mean grain sizes that range from fine to very coarse sand (Fig. 5). This level of sampling density provides data important to interpretation of the modern day depositional and oceanographic processes operating in the Gulf of the Farallones.

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LIST OF FIGURES

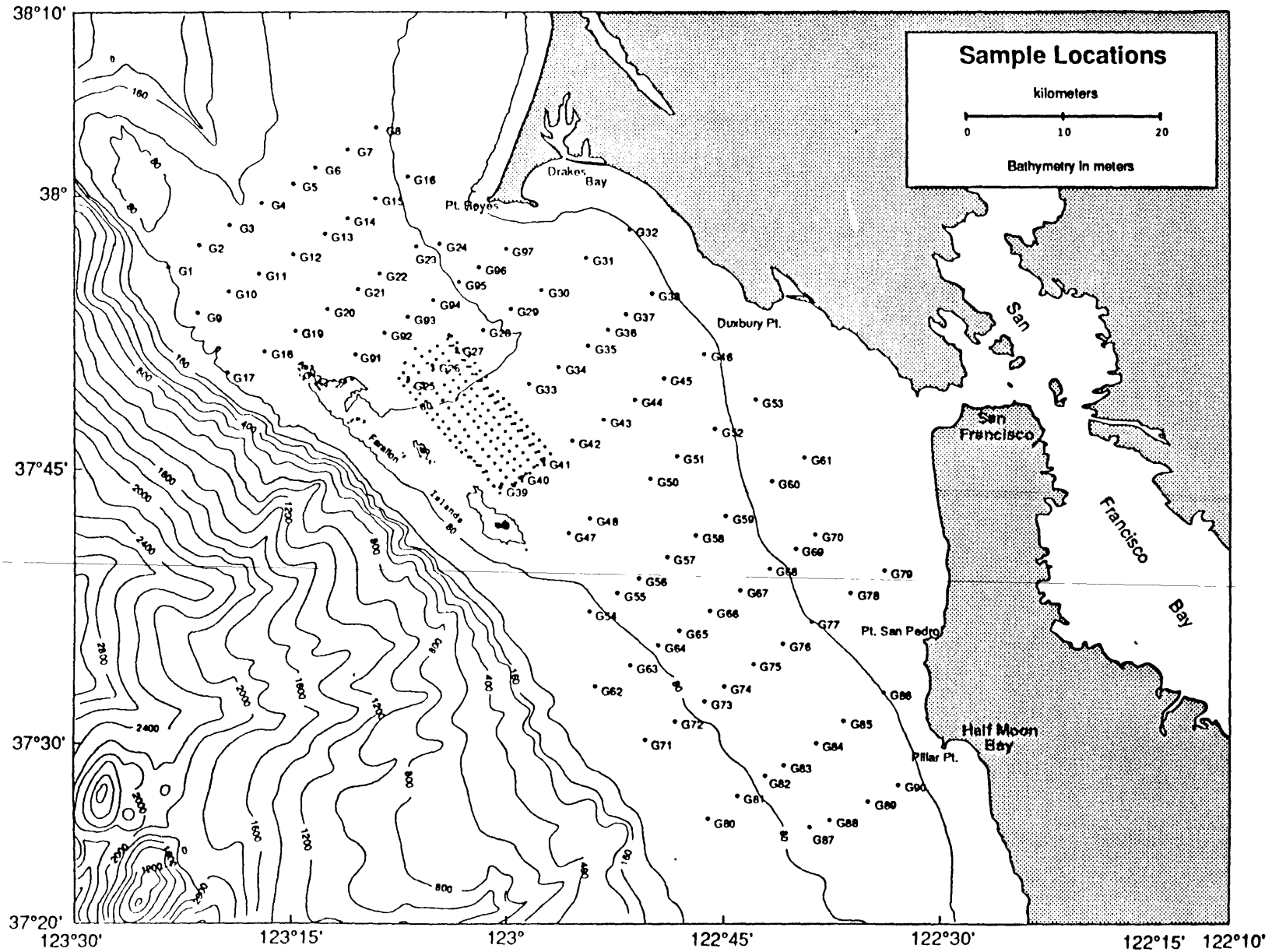
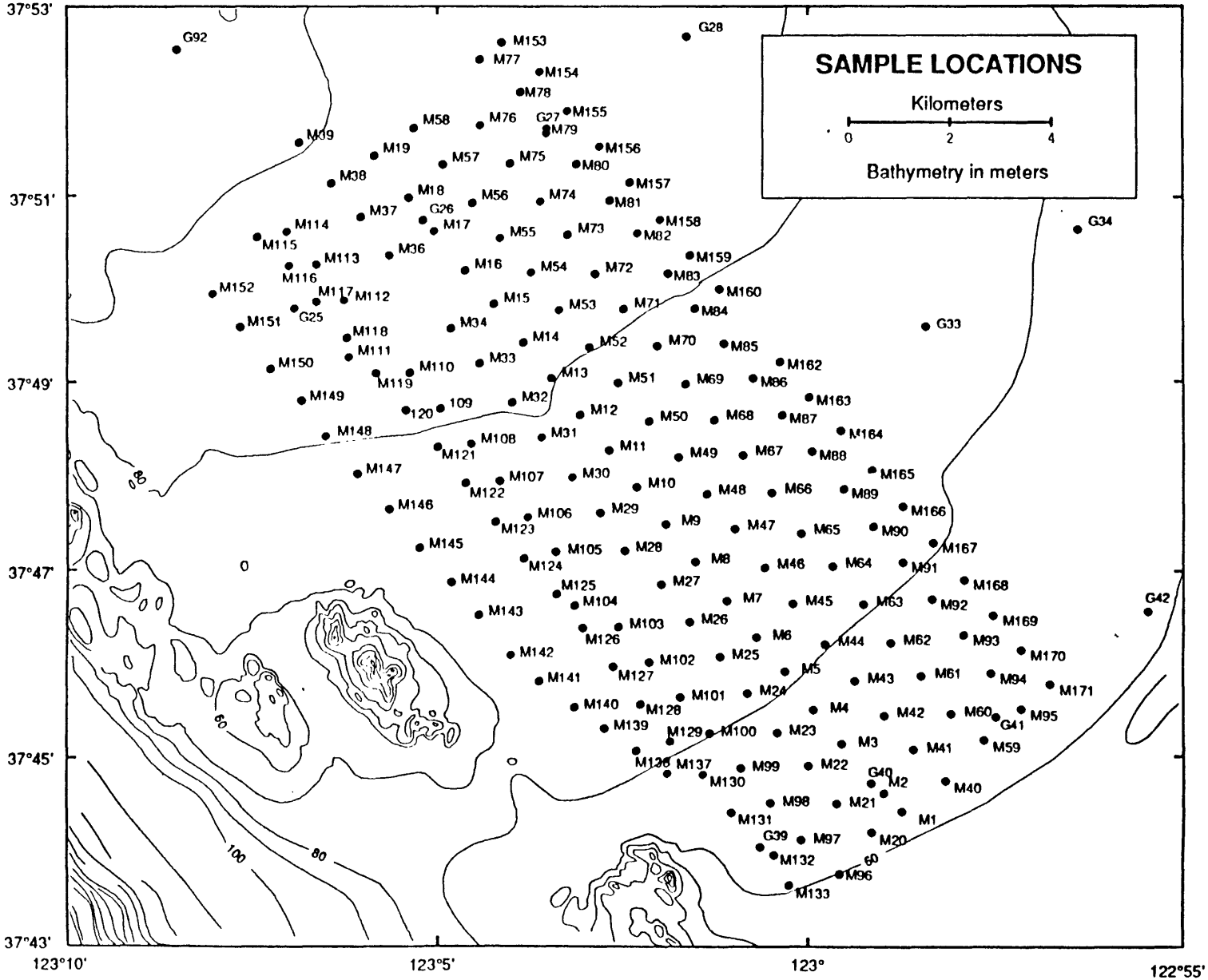

Sample Locations
kilometers
0
10
20
Bathymetry in meters
38°10'
38°
37°45'
37°30'
37°20'
123°30'
123°15'
123°
122°45'
122°30'
122°15'
122°10'
Drakes Bay
Pt. Reyes
Duxbury Pt.
San Francisco
Francisco Bay
Pt. San Pedro
Half Moon Bay
Pillar Pt.
Farallon Islands

Figure 1


SAMPLE LOCATIONS
Kilometers
0
2
4
Bathymetry in meters
37°53'
37°51'
37°49'
37°47'
37°45'
37°43'
123°10'
123°5'
123°
122°55'
G92
G28
G34
G33
G42
G41
G40
G39
M153
M77
M154
M78
M155
M58
M76
G27
M79
M59
M19
M57
M75
M156
M80
M38
M157
M18
M56
M74
M81
M37
G26
M17
M158
M114
M55
M73
M82
M115
M36
M159
M113
M16
M54
M72
M83
M116
M152
M117
M112
M15
M53
M71
M160
M84
M151
G25
M118
M34
M14
M52
M70
M85
M111
M150
M110
M33
M162
M119
M13
M51
M69
M86
M149
120
109
M32
M163
M12
M50
M68
M87
M148
M108
M31
M164
M121
M11
M49
M67
M88
M147
M107
M30
M165
M122
M10
M48
M66
M89
M146
M106
M29
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M28
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M64
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M103
M26
M169
M126
M6
M44
M62
M93
M142
M102
M25
M170
M5
M141
M127
M43
M61
M94
M171
M140
M101
M24
M128
M4
M42
M60
M95
M139
M129
M100
M23
M3
M41
M136
M137
M99
M22
M2
M40
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M21
M131
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M97
M20
M132
M96
M133
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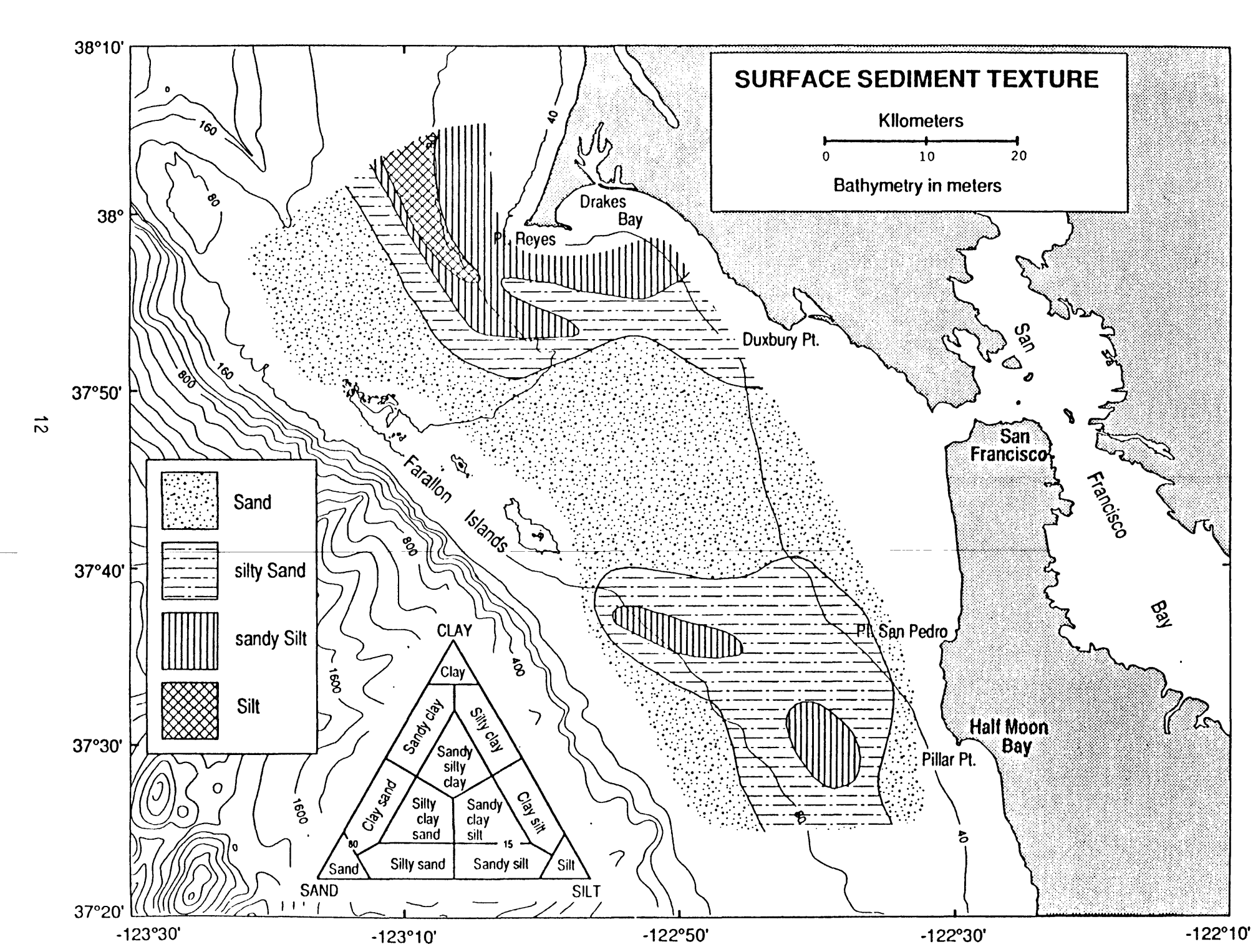
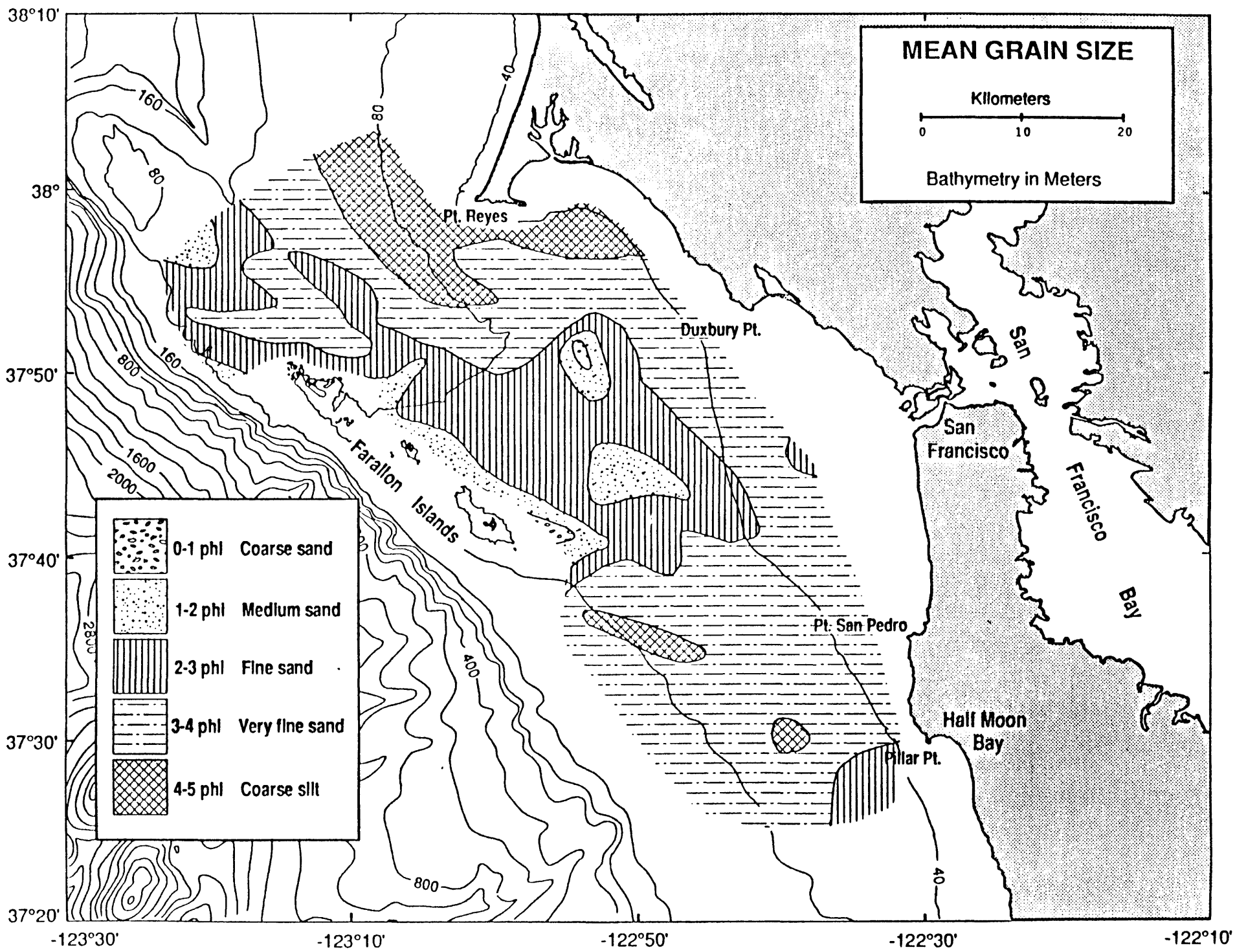
60
100
0

Figure 2


SURFACE SEDIMENT TEXTURE
Kilometers
0
10
20
Bathymetry in meters
Sand
silty Sand
sandy Silt
Silt
CLAY
Clay
Sandy clay
Silty clay
Sandy silty clay
Clay sand
Silty clay sand
Sandy clay silt
Clay silt
Sand
Silty sand
Sandy silt
Silt
SAND
SILT
Drakes Bay
Pt. Reyes
Duxbury Pt.
Farallon Islands
San Francisco
Pt. San Pedro
Half Moon Bay
Pillar Pt.
San Francisco Bay
38°10'
38°
37°50'
37°40'
37°30'
37°20'
-123°30'
-123°10'
-122°50'
-122°30'
-122°10'


MEAN GRAIN SIZE
Kilometers
0
10
20
Bathymetry in Meters
0-1 phi Coarse sand
1-2 phi Medium sand
2-3 phi Fine sand
3-4 phi Very fine sand
4-5 phi Coarse silt
Pt. Reyes
Duxbury Pt.
Farallon Islands
Pt. San Pedro
Pillar Pt.
San Francisco
San Francisco Bay
Half Moon Bay
38°10'
38°
37°50'
37°40'
37°30'
37°20'
-123°30'
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-122°10'
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80
160
800
1600
2000
2800
400

Figure 4

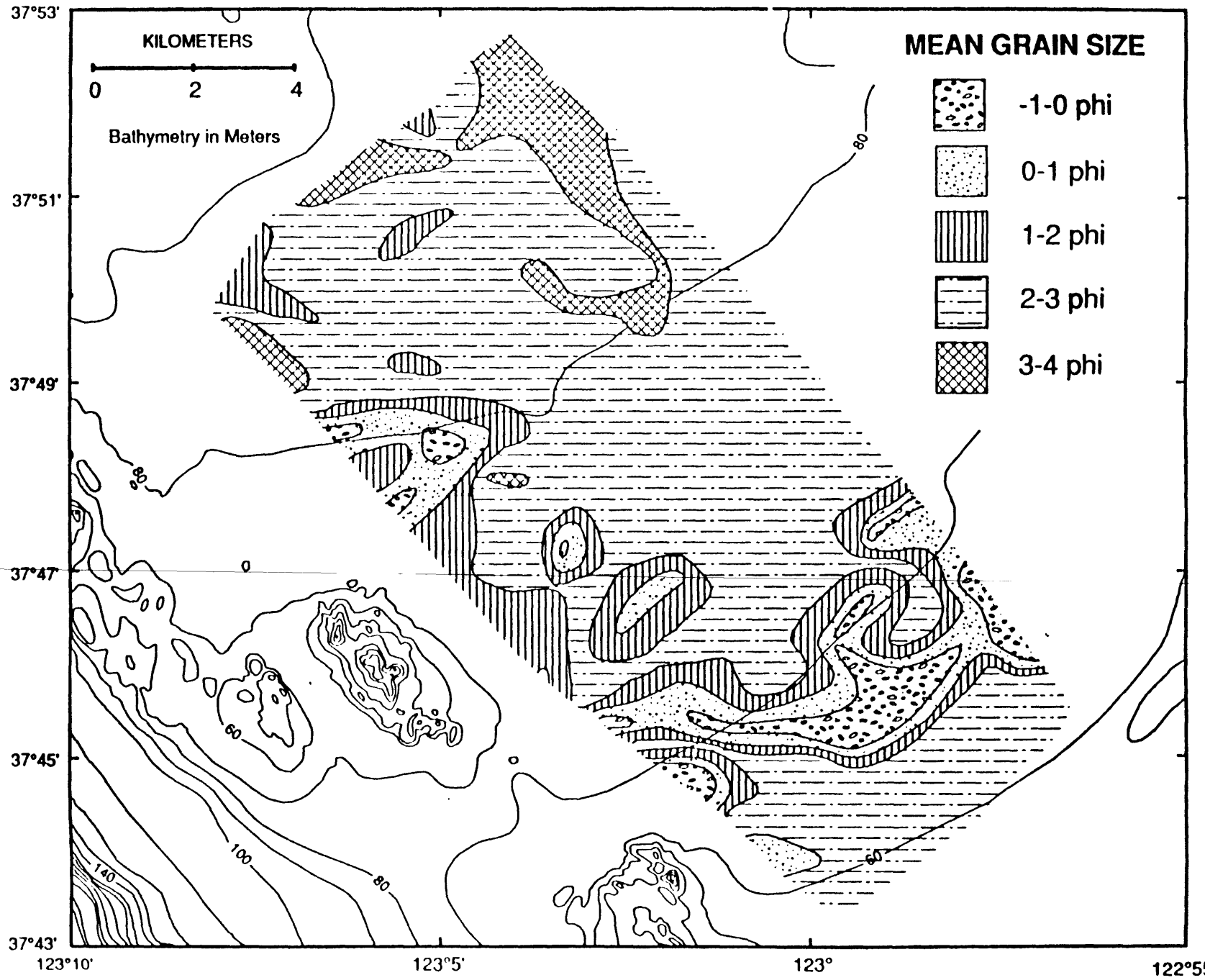
37°53'
37°51'
37°49'
37°47'
37°45'
37°43'
123°10'
123°5'
123°
122°55'
KILOMETERS
0 2 4
Bathymetry in Meters
MEAN GRAIN SIZE
-1-0 phi
0-1 phi
1-2 phi
2-3 phi
3-4 phi
80
0
60
100
140

Figure 5

LIST OF TABLES

Table 1

GRAIN-SIZE COMPARISON CHART

Millimeters	Phi (ϕ)	Wentworth Size Class
>2.00	< -1.0	Gravel
1.00 - 2.00	1.00 to -1.00	Very Coarse Sand
0.50 - 1.00	0.50 - 1.00	Coarse Sand
0.25 - 0.50	2.00 - 1.00	Medium Sand
0.125 - 0.25	3.00 - 2.00	Fine Sand
0.0625 - 0.125	4.00 - 3.00	Very Fine Sand
0.031 - 0.0625	5.00 - 4.00	Coarse Silt
0.0156 - 0.031	6.00 - 5.00	Medium Silt
0.0078 - 0.0156	7.00 - 6.00	Fine Silt
0.0039 - 0.0078	8.00 - 7.00	Very Fine Silt
<0.0039	>8.00	Clay

Table 2

Verbal classifications for graphically calculated sorting, skewness and kurtosis:

SORTING

0.35ϕ	very well sorted
0.35 - 0.50ϕ	well sorted
0.50 - 0.71ϕ	moderately well sorted
0.71 - 1.0ϕ	moderately sorted
1.0 - 2.0ϕ	poorly sorted
2.0 - 4.0ϕ	very poorly sorted
over 4.0ϕ	extremely poorly sorted

SKEWNESS

+1.00 to +0.30	strongly fine-skewed
+0.30 to +0.10	fine-skewed
+1.0 to -0.10	near symmetrical
-0.10 to -0.30	coarse-skewed
-0.30 to -1.00	strongly coarse-skewed

KURTOSIS

under 0.67	very platykurtic
0.67 - 0.90	platykurtic
0.90 - 1.11	mesokurtic
1.11 - 1.50	leptokurtic
1.50 - 3.00	very leptokurtic
over 3.00	extremely leptokurtic

APPENDICES

Appendix I. Location, depth, and grain-size parameters for the 97 regional samples.

Appendix II. Location, depth, and grain-size parameters for the 171 sample grid.

APPENDIX I

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
G1	37.93494	-123.38916	119	0.00	93.72	5.67	0.61	6.28	14.93	1.69
G2	37.95555	-123.35440	104	4.66	93.70	0.66	0.98	1.64	57.10	1.26
G3	37.97375	-123.31955	108	0.00	98.75	0.50	0.75	1.25	78.85	0.94
G4	37.99467	-123.28257	113	0.00	97.06	2.47	0.47	2.94	32.96	0.64
G5	38.01173	-123.24715	110	0.00	89.55	9.62	0.83	10.45	8.57	1.03
G6	38.02652	-123.22030	108	0.00	77.58	21.22	1.20	22.42	3.46	1.39
G7	38.04293	-123.18358	99	0.00	7.06	87.78	5.16	92.94	0.08	1.42
G8	38.06244	-123.15092	84	0.00	13.59	83.28	3.13	86.41	0.16	1.32
G9	37.89164	-123.35657	113	0.00	94.95	4.06	0.99	5.05	18.82	1.15
G10	37.91335	-123.31981	106	0.00	93.10	5.61	1.28	6.90	13.49	1.24
G11	37.92994	-123.28522	106	0.00	92.25	4.65	3.10	7.75	11.90	1.44
G12	37.94736	-123.24631	102	0.00	96.99	1.20	1.81	3.01	32.20	1.26
G13	37.96555	-123.20976	102	0.00	91.57	7.74	0.69	8.43	10.86	0.93
G14	37.97964	-123.18377	102	0.00	57.32	39.77	2.91	42.68	1.34	1.61
G15	37.99833	-123.15191	90	0.00	9.21	86.61	4.18	90.79	0.10	1.33
G16	38.01821	-123.11442	73	0.00	27.84	69.48	2.68	72.16	0.39	1.38
G17	37.83702	-123.32305	117	0.00	96.30	2.83	0.87	3.70	26.02	1.55
G18	37.85830	-123.27953	102	0.00	91.20	7.01	1.80	8.80	10.36	1.42
G19	37.87700	-123.24419	99	0.00	90.91	8.26	0.84	9.09	10.00	0.95
G20	37.89647	-123.20708	95	0.00	95.08	4.40	0.52	4.92	19.33	0.73
G21	37.91470	-123.17167	95	0.00	91.97	7.25	0.77	8.03	11.46	1.45
G22	37.92921	-123.14709	95	0.00	65.83	31.83	2.34	34.17	1.93	1.58
G23	37.95396	-123.10461	82	0.00	14.71	82.14	3.15	85.29	0.17	1.36
G24	37.95589	-123.07693	76	0.00	23.29	73.07	3.64	76.71	0.30	1.58

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
G1	2.32	2.84	0.28	4.73	3.01	2.20	1.50	-0.61	0.60
G2	1.25	1.58	3.65	24.36	1.11	1.18	0.72	0.07	2.55
G3	2.12	0.88	4.92	36.78	1.93	2.11	0.41	0.55	1.12
G4	3.30	0.42	7.57	80.49	3.24	3.22	0.28	-0.06	2.75
G5	3.33	1.06	3.45	24.71	3.17	3.22	0.60	0.18	1.64
G6	3.50	1.94	2.00	11.67	3.15	3.44	0.99	0.55	1.30
G7	5.33	2.02	2.24	9.41	4.93	5.22	1.15	0.45	1.56
G8	4.88	1.75	2.30	11.75	4.57	4.75	0.97	0.38	1.92
G9	3.03	1.31	2.09	16.12	3.02	3.02	0.80	-0.20	1.92
G10	3.10	1.53	2.78	18.48	3.01	2.81	0.89	-0.20	2.53
G11	3.36	2.06	3.26	14.10	3.04	3.16	0.58	0.33	1.68
G12	3.10	1.59	2.60	15.38	3.01	3.05	0.61	-0.09	1.71
G13	3.42	0.86	5.17	36.85	3.25	3.25	0.43	0.22	3.61
G14	4.13	2.58	1.82	8.08	3.58	3.91	1.30	0.49	1.01
G15	5.05	1.77	2.26	10.65	4.69	4.91	0.99	0.47	1.92
G16	4.57	1.89	1.89	9.45	4.46	4.41	1.19	0.08	1.62
G17	1.62	2.41	2.34	11.93	1.04	1.51	1.22	0.49	0.75
G18	3.17	2.02	2.77	15.33	3.00	2.96	0.95	0.10	2.20
G19	3.36	0.90	4.45	34.54	3.23	3.22	0.46	0.13	2.67
G20	3.30	0.53	6.53	61.49	3.22	3.15	0.30	-0.19	30.51
G21	2.63	2.11	1.17	8.14	3.13	2.49	1.23	-0.68	1.50
G22	3.78	2.51	1.74	8.31	3.21	3.63	1.28	0.56	1.18
G23	4.96	1.85	2.24	10.62	4.67	4.82	1.07	0.31	1.96
G24	4.67	2.50	1.37	7.51	4.44	4.46	1.37	0.15	1.99

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
G25	37.82920	-123.11513	86	0.04	99.39	0.46	0.11	0.57	173.27	0.83
G26	37.84536	-123.08605	88	34.24	55.38	9.02	1.36	10.37	5.34	2.38
G27	37.86065	-123.05816	88	0.00	76.05	21.28	2.67	23.95	3.18	1.73
G28	37.87759	-123.02689	84	0.00	57.96	40.42	1.62	42.04	1.38	1.27
G29	37.89687	-122.99469	73	0.00	43.53	54.58	1.88	56.47	0.77	1.33
G30	37.91418	-122.95872	64	0.00	56.92	42.25	0.82	43.08	1.32	1.01
G31	37.94329	-122.90724	46	0.00	39.18	59.91	0.91	60.82	0.64	0.89
G32	37.96941	-122.85798	38	0.00	23.68	74.68	1.63	76.32	0.31	1.07
G33	37.82592	-122.97384	74	0.00	95.04	4.42	0.55	4.96	19.14	0.90
G34	37.84363	-122.93931	68	0.00	95.38	1.85	2.77	4.62	20.64	1.50
G35	37.86269	-122.90486	60	19.92	77.08	1.20	1.80	3.01	25.65	1.76
G36	37.87762	-122.88200	59	0.00	96.23	1.51	2.26	3.77	25.55	1.43
G37	37.89175	-122.86136	53	0.00	65.06	33.78	1.16	34.94	1.86	1.12
G38	37.91101	-122.83202	40	0.00	77.45	21.98	0.57	22.55	3.43	0.76
G39	37.73207	-123.00782	56	1.00	98.78	0.09	0.13	0.22	448.87	0.79
G40	37.74343	-122.98278	58	0.00	99.81	0.07	0.11	0.19	538.30	0.67
G41	37.75718	-122.95761	58	0.00	99.56	0.18	0.26	0.44	226.81	0.66
G42	37.77592	-122.92386	59	0.00	99.12	0.35	0.53	0.88	112.89	0.82
G43	37.79525	-122.88777	55	0.00	99.26	0.30	0.44	0.74	134.52	0.84
G44	37.81380	-122.85199	53	0.00	98.34	0.67	1.00	1.66	59.10	0.94
G45	37.83346	-122.81878	48	0.00	86.47	12.99	0.53	13.53	6.39	0.93
G46	37.85575	-122.77229	40	0.00	72.35	26.96	0.69	27.65	2.62	1.05
G47	37.69082	-122.92862	55	13.00	86.99	0.00	0.00	0.01	9999.90	0.97
G48	37.70578	-122.90347	57	0.00	99.68	0.13	0.19	0.32	313.04	0.73

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
G25	1.67	0.69	1.90	18.71	1.48	1.72	0.65	0.46	1.15
G26	1.79	5.69	0.51	3.70	2.94	1.70	1.99	-0.57	0.61
G27	3.45	2.99	1.92	8.70	2.98	3.40	1.42	0.51	2.24
G28	3.97	1.62	2.38	11.97	3.48	3.78	1.02	0.52	1.02
G29	4.11	1.78	1.76	11.01	4.14	3.99	1.01	-0.03	1.17
G30	3.90	1.03	2.39	17.97	3.81	3.83	0.72	0.08	1.09
G31	4.17	0.79	3.67	26.61	4.07	4.01	0.59	-0.02	1.23
G32	4.51	1.15	2.97	18.21	4.39	4.38	0.76	0.10	1.89
G33	3.00	0.81	3.26	30.99	2.92	2.89	0.35	0.04	1.69
G34	2.99	2.26	2.71	12.26	2.85	2.78	0.67	-0.18	0.99
G35	0.44	3.09	3.45	17.15	0.25	0.07	1.06	0.03	1.23
G36	2.48	2.06	3.36	16.41	2.29	2.32	0.59	0.04	1.33
G37	3.66	1.25	2.42	16.56	3.47	3.52	0.77	0.18	0.90
G38	3.71	0.58	4.58	37.92	3.54	3.62	0.50	0.28	0.87
G39	1.74	0.62	1.02	19.64	1.72	1.74	0.63	0.01	1.42
G40	2.33	0.45	0.80	22.36	2.41	2.31	0.47	-0.20	1.38
G41	2.51	0.43	3.64	44.21	2.51	2.49	0.43	-0.07	1.90
G42	2.30	0.67	4.54	40.68	2.31	2.33	0.45	-0.08	0.90
G43	2.36	0.70	2.93	31.29	2.47	2.40	0.50	-0.38	1.05
G44	2.72	0.88	4.80	34.13	2.53	2.57	0.41	0.20	1.19
G45	3.26	0.86	2.90	24.94	3.02	3.20	0.62	0.35	1.89
G46	3.50	1.09	1.62	14.80	3.36	3.40	0.66	0.17	0.79
G47	0.67	0.95	-0.22	2.67	0.93	0.70	0.97	-0.32	0.86
G48	2.16	0.54	1.14	29.68	2.21	2.19	0.46	-0.26	1.53

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
G50	37.74153	-122.83417	53	0.00	99.58	0.17	0.25	0.42	238.54	0.72
G51	37.76215	-122.80375	53	0.00	99.06	0.37	0.56	0.94	105.94	0.85
G52	37.78643	-122.75986	42	0.00	96.77	1.29	1.94	3.23	29.98	1.13
G53	37.81364	-122.71266	31	0.00	86.30	13.27	0.42	13.70	6.30	0.74
G54	37.61967	-122.90467	82	0.00	41.02	56.94	2.04	58.98	0.70	1.21
G55	37.63793	-122.87154	69	0.00	62.18	36.17	1.65	37.82	1.64	1.28
G56	37.65117	-122.84738	62	0.00	73.96	25.10	0.94	26.04	2.84	1.11
G57	37.67056	-122.81462	53	0.00	93.90	5.76	0.34	6.10	15.39	0.76
G58	37.69041	-122.78189	51	0.00	86.48	13.07	0.44	13.52	6.40	0.89
G59	37.70798	-122.74751	42	0.00	96.21	1.52	2.27	3.79	25.38	1.38
G60	37.73940	-122.69398	33	0.00	86.36	13.33	0.32	13.64	6.33	0.62
G61	37.76096	-122.65620	22	0.00	95.98	1.61	2.41	4.02	23.87	1.34
G62	37.55080	-122.89766	99	0.00	89.27	9.72	1.00	10.73	8.32	1.30
G63	37.57167	-122.85699	86	0.00	70.21	28.60	1.19	29.79	2.36	1.22
G64	37.59038	-122.82450	73	0.00	41.61	56.03	2.36	58.39	0.71	1.26
G65	37.60342	-122.80027	64	0.00	47.63	50.91	1.46	52.37	0.91	1.03
G66	37.62208	-122.76494	53	0.00	57.42	41.77	0.82	42.58	1.35	0.99
G67	37.64075	-122.73024	46	0.00	65.25	34.28	0.47	34.75	1.88	0.72
G68	37.66003	-122.69633	38	0.00	63.18	35.88	0.94	36.82	1.72	0.93
G69	37.67802	-122.66647	33	0.00	90.91	8.90	0.19	9.09	10.00	0.57
G70	37.69143	-122.64354	29	0.00	84.97	14.73	0.29	15.03	5.66	0.65
G71	37.50130	-122.84047	91	0.00	92.00	7.40	0.60	8.00	11.50	0.79
G72	37.52028	-122.80540	86	0.00	88.24	10.96	0.79	11.76	7.51	0.88
G73	37.53859	-122.77157	73	0.00	59.80	39.03	1.17	40.20	1.49	1.09

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
G50	1.58	0.51	4.38	45.78	1.43	1.53	0.48	0.36	0.87
G51	2.26	0.72	4.22	39.01	2.28	2.30	0.40	-0.14	1.25
G52	3.36	1.27	3.74	20.70	3.22	3.22	0.40	0.06	1.21
G53	3.51	0.54	4.50	42.33	3.37	3.49	0.42	0.41	2.18
G54	4.19	1.47	2.85	15.83	4.07	3.99	0.86	0.04	1.53
G55	3.70	1.64	2.51	14.15	3.31	3.53	0.90	0.42	0.82
G56	3.38	1.24	2.51	17.04	2.97	3.30	0.74	0.60	0.61
G57	2.73	0.58	5.07	43.76	2.64	2.61	0.54	0.18	2.03
G58	3.04	0.80	3.08	23.47	2.80	3.01	0.70	0.44	1.41
G59	2.58	1.89	3.76	18.06	2.37	2.23	0.50	-0.10	1.11
G60	3.52	0.39	5.44	55.77	3.27	3.43	0.39	0.58	0.77
G61	3.13	1.78	3.20	15.33	3.03	2.94	0.60	-0.20	1.46
G62	3.23	1.70	1.12	11.55	3.39	3.34	0.85	-0.32	3.61
G63	3.65	1.49	1.73	15.61	3.56	3.65	0.76	0.02	1.51
G64	4.37	1.58	3.02	16.70	4.26	4.14	0.72	0.01	1.10
G65	4.07	1.07	3.40	23.92	4.02	3.95	0.62	-0.03	0.96
G66	3.85	0.99	1.96	21.28	3.86	3.81	0.53	-0.07	0.91
G67	3.82	0.52	4.37	40.17	3.74	3.68	0.48	0.00	0.81
G68	3.82	0.87	3.52	25.21	3.61	3.66	0.52	0.32	0.88
G69	3.41	0.32	4.41	56.31	3.33	3.41	0.33	0.33	2.97
G70	3.55	0.42	4.70	46.75	3.43	3.54	0.41	0.33	1.78
G71	3.27	0.62	5.50	49.72	3.17	3.15	0.48	0.13	1.81
G72	3.40	0.77	4.61	36.55	3.14	3.27	0.51	0.43	1.62
G73	3.87	1.18	2.57	19.18	3.72	3.73	0.66	0.18	0.85

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
G74	37.55270	-122.74916	66	0.00	52.76	45.93	1.31	47.24	1.12	1.05
G75	37.57315	-122.71492	55	0.00	51.28	48.00	0.72	48.72	1.05	0.85
G76	37.59166	-122.68055	66	0.00	64.15	35.43	0.42	35.85	1.79	0.80
G77	37.61192	-122.64777	38	0.00	74.79	24.56	0.65	25.21	2.97	0.83
G78	37.63853	-122.60244	29	0.00	89.29	10.39	0.32	10.71	8.34	0.93
G79	37.65847	-122.56403	25	0.00	92.91	6.82	0.26	7.09	13.11	0.65
G80	37.42887	-122.76807	88	0.00	92.11	6.46	1.42	7.89	11.68	1.01
G81	37.45164	-122.73332	81	0.00	78.12	21.04	0.85	21.88	3.57	1.16
G82	37.47010	-122.70071	73	0.00	56.47	42.53	0.99	43.53	1.30	0.95
G83	37.48016	-122.67931	68	0.00	40.07	58.64	1.29	59.93	0.67	1.03
G84	37.49995	-122.64224	59	0.00	37.38	61.86	0.76	62.62	0.60	0.91
G85	37.52064	-122.60995	51	0.00	64.20	35.16	0.64	35.80	1.79	1.12
G86	37.54711	-122.56464	35	0.00	90.17	9.47	0.36	9.83	9.18	0.68
G87	37.42068	-122.64998	82	0.00	50.36	47.72	1.92	49.64	1.01	1.16
G88	37.42939	-122.62628	69	0.00	70.14	28.98	0.88	29.86	2.35	1.22
G89	37.44613	-122.58218	58	0.00	93.56	6.03	0.40	6.44	14.53	1.03
G90	37.46227	-122.54769	45	0.00	94.34	5.29	0.37	5.66	16.67	1.06
G91	37.85476	-123.17690	95	0.00	93.86	5.36	0.78	6.14	15.29	0.86
G92	37.87502	-123.14165	93	0.00	92.85	6.34	0.81	7.15	12.98	0.93
G93	37.88958	-123.11449	91	0.00	79.60	18.70	1.69	20.40	3.90	1.37
G94	37.90495	-123.08521	88	0.00	45.16	52.13	2.71	54.84	0.82	1.56
G95	37.92123	-123.05503	77	0.00	26.14	70.40	3.47	73.86	0.35	1.43
G96	37.93472	-123.03178	66	0.00	72.59	26.10	1.31	27.41	2.65	1.28
G97	37.95161	-123.00029	58	0.00	45.79	51.77	2.44	54.21	0.84	1.64

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
G74	4.08	1.10	3.38	22.41	3.92	3.88	0.67	0.04	0.71
G75	3.99	0.72	3.36	28.11	3.97	3.89	0.57	-0.10	0.99
G76	3.78	0.64	2.14	24.03	3.68	3.67	0.51	0.07	0.83
G77	3.73	0.69	4.29	33.07	3.49	3.61	0.52	0.41	0.92
G78	3.28	0.87	0.43	15.09	3.33	3.40	0.63	-0.08	2.71
G79	3.33	0.42	3.92	48.04	3.26	3.27	0.38	0.06	1.31
G80	3.45	1.02	5.50	39.39	3.16	3.26	0.47	0.51	2.18
G81	3.47	1.35	1.57	15.48	3.39	3.49	0.73	0.04	1.78
G82	3.94	0.91	3.08	23.87	3.86	3.81	0.57	0.00	0.97
G83	4.22	1.06	3.19	21.46	4.24	3.99	0.69	-0.30	0.77
G84	4.11	0.82	2.31	21.11	4.15	4.02	0.65	-0.18	0.93
G85	3.69	1.25	0.94	11.87	3.49	3.68	0.78	0.25	1.19
G86	3.45	0.46	6.11	59.96	3.31	3.44	0.32	0.77	1.75
G87	4.11	1.34	3.70	22.17	3.99	3.90	0.66	-0.06	0.74
G88	3.43	1.49	1.47	12.17	3.24	3.38	0.82	0.23	1.00
G89	2.40	1.05	2.36	18.48	2.33	2.32	0.70	0.07	1.62
G90	2.73	1.12	2.37	20.19	2.83	2.65	0.89	-0.19	1.15
G91	3.29	0.73	4.85	42.39	3.21	3.14	0.37	-0.10	6.55
G92	3.16	0.87	4.29	33.81	2.99	2.96	0.42	0.15	1.25
G93	3.57	1.88	2.90	14.26	3.19	3.46	1.02	0.56	2.53
G94	4.19	2.43	1.73	8.26	4.25	4.04	1.33	-0.01	0.93
G95	4.62	2.05	1.79	9.13	4.49	4.42	1.20	0.07	1.71
G96	3.49	1.63	2.48	12.55	2.95	3.45	0.89	0.81	0.93
G97	4.07	2.69	1.36	6.73	4.15	3.96	1.45	-0.03	1.04

APPENDIX II

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
M1	37.73977	-122.97913	57	0.00	97.97	0.81	1.22	2.03	48.24	1.02
M2	37.74647	-122.98581	60	0.00	99.25	0.30	0.45	0.75	132.26	0.74
M3	37.75352	-122.99245	62	60.47	39.41	0.05	0.07	0.12	320.37	0.94
M4	37.75959	-122.99883	66	0.99	98.04	0.39	0.58	0.97	101.04	1.16
M5	37.76637	-123.00511	66	0.00	99.54	0.18	0.28	0.46	216.88	0.70
M6	37.77243	-123.01165	67	0.00	97.57	0.97	1.46	2.43	40.20	1.11
M7	37.77885	-123.01817	71	0.00	98.68	0.53	0.79	1.32	74.72	0.90
M8	37.78578	-123.02514	71	0.00	98.86	0.45	0.68	1.14	86.93	0.85
M9	37.79248	-123.03179	73	0.00	98.85	0.46	0.69	1.15	86.16	0.84
M10	37.79900	-123.03822	73	0.00	98.77	0.49	0.74	1.23	80.58	0.91
M11	37.80547	-123.04437	75	0.00	98.39	0.64	0.97	1.61	61.13	0.97
M12	37.81195	-123.05087	79	0.00	99.12	0.35	0.53	0.88	112.89	0.81
M13	37.81843	-123.05725	79	0.00	98.30	0.68	1.02	1.70	57.88	0.95
M14	37.82471	-123.06387	81	0.00	96.67	1.53	1.80	3.33	29.01	1.11
M15	37.83165	-123.07044	84	0.00	96.69	1.33	1.99	3.31	29.18	1.19
M16	37.83760	-123.07692	88	0.00	95.05	3.68	1.27	4.95	19.20	1.26
M17	37.84463	-123.08382	88	0.00	94.01	5.18	0.82	5.99	15.68	1.16
M18	37.85062	-123.08957	88	3.31	90.08	5.54	1.07	6.61	13.63	1.48
M19	37.85804	-123.09723	88	0.00	84.23	13.75	2.02	15.77	5.34	1.45
M20	37.73621	-122.98692	59	0.00	98.68	0.53	0.79	1.32	74.57	0.91
M21	37.74282	-122.99354	62	0.00	99.22	0.31	0.47	0.78	127.31	0.82
M22	37.74960	-122.99992	64	0.00	99.38	0.25	0.37	0.62	160.35	0.76
M23	37.75554	-123.00695	64	41.50	57.80	0.28	0.42	0.70	82.69	1.23
M24	37.76254	-123.01357	66	0.00	99.10	0.36	0.54	0.90	110.33	0.80

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
M1	2.47	1.04	4.76	30.80	2.45	2.43	0.38	-0.19	1.02
M2	2.45	0.55	4.02	42.98	2.45	2.52	0.31	0.02	1.82
M3	-0.37	0.88	2.20	14.63	-1.00	-0.44	0.73	1.00	0.61
M4	0.42	1.34	4.22	28.38	0.13	0.22	0.72	0.42	1.75
M5	2.35	0.49	3.32	40.61	2.41	2.37	0.47	-0.18	0.99
M6	2.70	1.23	4.23	25.46	2.51	2.60	0.43	0.26	2.33
M7	2.55	0.80	4.60	36.20	2.53	2.47	0.36	-0.09	2.84
M8	2.56	0.72	4.52	39.05	2.54	2.51	0.40	-0.10	3.00
M9	2.70	0.71	4.46	37.61	2.59	2.61	0.42	0.05	0.99
M10	2.52	0.83	3.95	32.90	2.53	2.46	0.43	-0.19	2.53
M11	2.54	0.94	4.55	32.29	2.55	2.43	0.47	-0.34	2.34
M12	2.59	0.65	3.68	36.37	2.67	2.55	0.48	-0.53	4.12
M13	2.71	0.90	4.15	29.86	2.56	2.59	0.44	-0.01	2.51
M14	3.01	1.23	5.05	28.54	2.81	2.89	0.31	0.31	2.90
M15	3.02	1.41	4.03	21.71	2.83	2.95	0.31	0.36	4.74
M16	2.91	1.59	2.90	19.77	2.89	2.86	0.64	-0.14	1.71
M17	2.68	1.36	2.79	19.40	2.72	2.52	0.90	-0.15	1.02
M18	2.83	2.19	0.93	10.43	3.00	2.75	1.15	-0.33	1.85
M19	3.43	2.10	2.46	13.60	3.11	3.31	0.94	0.47	2.40
M20	2.33	0.84	4.90	38.01	2.30	2.28	0.45	-0.17	0.77
M21	2.41	0.68	3.38	33.82	2.46	2.34	0.47	-0.26	1.07
M22	2.23	0.58	4.12	39.91	2.20	2.28	0.46	0.14	0.83
M23	0.02	1.52	2.92	19.71	-0.04	-0.07	0.95	0.18	0.79
M24	2.39	0.64	4.34	39.69	2.44	2.30	0.36	-0.42	1.08

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
M25	37.76897	-123.01968	69	0.00	98.83	0.47	0.70	1.17	84.65	0.96
M26	37.77523	-123.02645	69	0.00	99.05	0.38	0.57	0.95	103.95	0.84
M27	37.78188	-123.03277	69	40.87	58.83	0.12	0.18	0.31	192.20	1.04
M28	37.78785	-123.04100	69	0.00	99.11	0.35	0.53	0.89	111.88	0.83
M29	37.79452	-123.04626	71	0.00	98.71	0.52	0.77	1.29	76.61	0.90
M30	37.80078	-123.05265	73	0.00	99.72	0.11	0.17	0.28	354.61	0.75
M31	37.80783	-123.05965	75	0.00	98.71	0.52	0.77	1.29	76.56	0.85
M32	37.81423	-123.06643	77	0.00	98.65	0.54	0.81	1.35	73.23	0.89
M33	37.82104	-123.07362	78	0.00	98.35	0.66	0.99	1.65	59.74	0.91
M34	37.82729	-123.08014	80	0.00	96.58	1.37	2.05	3.42	28.26	1.24
M36	37.84032	-123.09381	88	0.84	96.47	1.08	1.61	2.69	35.87	1.36
M37	37.84709	-123.10013	88	2.27	92.12	4.64	0.97	5.61	16.44	1.44
M38	37.85326	-123.10671	88	0.56	78.78	16.79	3.87	20.66	3.81	1.93
M39	37.86035	-123.11401	89	0.00	87.83	10.53	1.64	12.17	7.21	1.25
M40	37.74540	-122.97028	59	0.00	98.38	0.65	0.97	1.62	60.74	0.93
M41	37.75245	-122.97640	62	0.00	99.33	0.27	0.40	0.67	148.24	0.75
M42	37.75871	-122.98301	64	64.79	34.14	0.43	0.64	1.07	31.99	1.36
M43	37.76471	-122.98957	66	48.65	50.09	0.50	0.75	1.25	39.93	1.35
M44	37.77126	-122.99625	68	23.55	76.18	0.11	0.16	0.27	285.79	0.94
M45	37.77840	-123.00341	68	0.00	98.50	0.60	0.90	1.50	65.59	0.95
M46	37.78487	-123.00970	71	0.00	98.88	0.45	0.67	1.12	88.52	0.89
M47	37.79161	-123.01635	73	0.00	98.99	0.41	0.61	1.01	97.72	0.88
M48	37.79785	-123.02263	73	0.00	98.71	0.52	0.78	1.29	76.35	0.91
M49	37.80427	-123.02895	73	0.20	98.71	0.44	0.65	1.09	90.51	0.86

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
M25	2.12	0.93	3.44	28.46	2.07	2.08	0.51	-0.20	1.51
M26	2.16	0.71	4.56	38.00	2.10	2.14	0.50	0.01	1.08
M27	-0.01	1.08	2.25	18.03	0.40	0.07	0.75	-0.49	0.48
M28	2.48	0.69	4.00	35.03	2.47	2.43	0.49	-0.09	1.24
M29	2.50	0.81	4.44	35.78	2.47	2.41	0.39	-0.15	1.23
M30	2.31	0.56	1.00	19.09	2.47	2.33	0.59	-0.43	2.01
M31	2.67	0.73	4.51	35.95	2.55	2.59	0.39	0.10	2.02
M32	2.72	0.79	4.31	34.57	2.75	2.69	0.44	-0.27	1.84
M33	2.74	0.83	5.17	36.99	2.63	2.63	0.42	-0.05	1.84
M34	2.94	1.53	3.76	20.01	2.87	2.86	0.39	-0.06	1.70
M36	1.87	1.84	3.51	19.02	1.64	1.79	0.66	0.31	1.20
M37	2.36	2.07	1.89	13.38	2.67	2.32	1.00	-0.36	1.14
M38	3.57	3.73	1.73	7.90	3.07	3.55	1.57	0.50	2.95
M39	3.34	1.56	3.48	21.04	3.12	3.09	0.62	0.24	1.93
M40	2.64	0.86	5.01	36.45	2.59	2.57	0.37	-0.08	3.33
M41	2.19	0.56	4.85	47.69	2.14	2.19	0.45	0.09	1.46
M42	-0.43	1.84	4.29	26.60	-1.00	-0.69	0.74	1.00	2.27
M43	-0.24	1.83	4.23	26.62	-0.84	-0.48	0.83	0.83	1.21
M44	0.13	0.89	2.48	21.86	0.27	0.02	0.81	-0.24	0.86
M45	2.58	0.90	4.49	31.99	2.50	2.50	0.45	0.08	0.93
M46	2.53	0.78	4.07	32.78	2.51	2.46	0.50	-0.08	1.42
M47	2.47	0.78	3.77	31.64	2.45	2.40	0.50	-0.05	1.00
M48	2.51	0.83	4.18	35.06	2.52	2.50	0.36	-0.08	0.91
M49	2.52	0.74	4.04	36.94	2.56	2.41	0.32	-0.66	1.35

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
M50	37.81074	-123.03548	77	0.00	98.82	0.47	0.71	1.18	83.96	0.84
M51	37.81752	-123.04235	77	0.00	98.20	0.72	1.08	1.80	54.51	0.96
M52	37.82389	-123.04875	77	0.00	97.68	0.93	1.39	2.32	42.11	0.99
M53	37.83042	-123.05550	81	0.00	93.96	4.78	1.25	6.04	15.57	1.07
M54	37.83718	-123.06201	84	0.00	95.38	1.85	2.77	4.62	20.63	1.33
M55	37.84338	-123.06905	86	0.00	94.36	5.22	0.42	5.64	16.74	1.12
M56	37.84977	-123.07536	88	2.67	87.92	8.71	0.70	9.41	9.34	1.38
M57	37.85645	-123.08190	88	1.58	75.75	20.23	2.43	22.67	3.34	2.08
M58	37.86295	-123.08837	88	42.62	44.28	11.92	1.19	13.10	3.38	2.50
M59	37.75269	-122.96169	58	0.00	99.66	0.14	0.20	0.34	292.91	0.71
M60	37.75892	-122.96803	60	0.00	99.45	0.22	0.33	0.55	180.05	0.79
M61	37.76564	-122.97456	64	51.18	48.41	0.17	0.25	0.42	116.55	1.02
M62	37.77156	-122.98165	64	0.00	98.72	0.51	0.77	1.28	76.97	1.00
M63	37.77832	-122.98769	68	25.09	74.91	0.00	0.00	0.00	0.00	0.88
M64	37.78504	-122.99464	69	0.00	98.86	0.46	0.69	1.14	86.43	0.87
M65	37.79089	-123.00172	71	0.00	98.57	0.57	0.86	1.43	68.80	0.85
M66	37.79802	-123.00810	71	0.25	97.94	0.72	1.09	1.81	54.08	1.01
M67	37.80461	-123.01463	73	0.00	97.68	0.93	1.39	2.32	42.04	1.10
M68	37.81096	-123.02092	73	0.00	97.89	0.84	1.26	2.11	46.46	1.05
M69	37.81741	-123.02737	75	0.00	97.35	1.06	1.59	2.65	36.69	1.10
M70	37.82407	-123.03362	60	0.00	96.78	1.29	1.93	3.22	30.02	1.17
M71	37.83073	-123.04110	78	0.00	96.36	1.46	2.18	3.64	26.47	1.21
M72	37.83700	-123.04748	82	0.00	92.96	6.62	0.42	7.04	13.20	0.93
M73	37.84397	-123.05358	84	0.00	94.57	4.93	0.50	5.43	17.43	0.88

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
M50	2.59	0.71	4.35	35.91	2.62	2.54	0.39	-0.32	4.32
M51	2.76	0.92	4.72	32.91	2.69	2.66	0.44	-0.17	1.92
M52	2.92	0.98	5.29	33.15	2.79	2.85	0.32	0.20	2.81
M53	3.08	1.14	5.42	38.46	2.86	3.01	0.47	0.74	1.85
M54	3.31	1.76	3.51	15.85	3.01	3.05	0.39	0.16	0.91
M55	2.64	1.26	1.30	12.77	2.68	2.75	0.78	0.04	2.39
M56	2.46	1.92	1.22	9.24	2.66	2.39	1.01	-0.22	1.11
M57	3.12	4.32	0.82	4.99	2.98	3.02	2.06	0.07	2.24
M58	1.31	6.23	0.90	3.54	0.93	1.07	2.10	0.27	0.71
M59	2.34	0.50	1.46	28.03	2.47	2.42	0.43	-0.30	0.99
M60	2.21	0.63	2.55	29.20	2.26	2.26	0.52	-0.13	1.08
M61	-0.28	1.04	3.47	26.91	-1.00	-0.51	0.66	1.00	0.60
M62	2.42	1.01	2.67	23.06	2.45	2.42	0.53	-0.18	3.00
M63	-0.03	0.77	1.19	5.12	-0.14	-0.13	0.80	0.15	0.69
M64	2.58	0.75	4.14	35.84	2.60	2.56	0.41	-0.17	2.55
M65	2.68	0.72	5.78	44.34	2.63	2.56	0.37	-0.09	1.34
M66	2.59	1.03	3.79	27.36	2.58	2.52	0.33	-0.27	1.05
M67	2.72	1.22	4.09	24.99	2.55	2.64	0.45	0.21	1.82
M68	2.79	1.11	4.00	26.17	2.68	2.75	0.45	0.12	1.24
M69	2.98	1.21	4.10	24.35	2.97	2.88	0.36	-0.18	1.40
M70	3.11	1.36	3.98	21.51	2.91	2.98	0.33	0.39	1.88
M71	3.21	1.47	3.78	19.35	3.04	3.10	0.34	0.30	1.58
M72	2.99	0.87	2.50	20.72	2.77	2.88	0.52	0.57	1.32
M73	3.04	0.77	3.20	25.50	2.97	2.96	0.55	0.07	1.51

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
M74	37.84990	-123.05996	86	0.00	85.67	12.20	2.13	14.33	5.98	1.49
M75	37.85664	-123.06689	88	0.00	88.20	10.40	1.40	11.80	7.47	1.53
M76	37.86336	-123.07355	88	0.00	86.15	12.61	1.24	13.85	6.22	1.34
M77	37.87444	-123.07310	88	5.61	63.25	28.17	2.97	31.14	2.03	2.21
M78	37.86769	-123.06566	88	7.70	62.85	26.55	2.91	29.46	2.13	2.15
M79	37.86127	-123.05954	88	0.35	81.44	16.31	1.91	18.22	4.47	1.49
M80	37.85501	-123.05265	86	2.06	78.39	17.60	1.96	19.55	4.01	1.58
M81	37.84851	-123.04539	86	0.00	91.31	7.62	1.07	8.69	10.51	1.08
M82	37.84270	-123.03903	81	0.00	94.23	4.88	0.89	5.77	16.33	0.97
M83	37.83552	-123.03249	79	0.00	95.88	1.65	2.47	4.12	23.27	1.25
M84	37.82928	-123.02636	77	0.00	96.35	1.46	2.19	3.65	26.42	1.21
M85	37.82297	-123.01988	77	0.00	97.02	1.19	1.79	2.98	32.57	1.30
M86	37.81684	-123.01341	77	0.00	97.95	0.82	1.23	2.05	47.83	0.99
M87	37.81028	-123.00696	73	0.00	98.08	0.77	1.15	1.92	51.01	1.01
M88	37.80381	-123.00038	73	0.00	98.19	0.72	1.09	1.81	54.24	0.99
M89	37.79713	-122.99324	73	0.00	98.01	0.80	1.20	1.99	49.13	0.98
M90	37.79062	-122.98660	71	8.19	91.37	0.18	0.26	0.44	206.89	0.87
M91	37.78419	-122.97991	70	0.00	98.57	0.83	0.60	1.43	69.01	0.87
M92	37.77776	-122.97336	68	0.00	99.16	0.34	0.51	0.84	117.38	0.78
M93	37.77150	-122.96625	66	20.12	79.88	0.00	0.00	0.00	0.00	0.86
M94	37.76468	-122.96018	64	0.00	98.47	0.87	0.66	1.53	64.48	0.86
M95	37.75822	-122.95344	62	0.00	99.84	0.06	0.10	0.16	626.89	0.57
M96	37.73001	-122.99454	55	0.00	99.86	0.06	0.08	0.14	722.71	0.67
M97	37.73637	-123.00163	59	0.00	99.52	0.19	0.29	0.48	208.60	0.77

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
M74	3.21	2.22	2.82	13.76	2.89	2.99	0.98	0.39	2.46
M75	2.91	2.33	1.98	10.62	2.90	2.68	1.22	-0.04	1.14
M76	3.07	1.80	2.03	14.18	2.86	3.12	0.80	0.59	3.60
M77	3.26	4.90	0.62	4.91	2.95	3.13	2.16	0.09	1.66
M78	3.24	4.62	0.69	5.45	2.90	3.16	2.03	0.14	1.80
M79	3.26	2.23	2.21	11.98	2.98	3.25	1.09	0.41	2.13
M80	3.36	2.50	1.63	10.62	3.02	3.36	1.14	0.46	2.22
M81	3.22	1.17	3.87	26.54	3.00	3.05	0.54	0.38	1.61
M82	3.14	0.95	4.36	33.23	2.98	3.06	0.47	0.32	2.83
M83	3.22	1.57	3.95	18.92	3.02	3.01	0.36	0.02	0.80
M84	3.02	1.47	4.27	21.76	2.80	2.90	0.28	0.47	14.05
M85	2.80	1.70	2.62	16.61	2.76	2.79	0.56	-0.21	3.85
M86	2.82	0.98	4.78	31.83	2.68	2.72	0.32	0.07	1.36
M87	2.84	1.02	4.02	27.40	2.81	2.79	0.47	-0.07	1.41
M88	2.84	0.98	3.98	28.27	2.76	2.73	0.43	0.04	1.35
M89	2.77	0.96	4.90	32.98	2.56	2.60	0.37	0.21	1.42
M90	0.02	0.76	5.39	49.67	-0.10	-0.03	0.39	0.34	1.35
M91	2.43	0.76	4.36	36.44	2.46	2.38	0.49	-0.17	1.19
M92	2.26	0.61	4.94	43.68	2.23	2.27	0.43	-0.04	0.80
M93	0.21	0.73	0.49	3.92	0.29	0.08	0.84	-0.22	1.01
M94	2.53	0.74	4.51	39.92	2.53	2.42	0.32	-0.50	1.47
M95	2.47	0.33	0.41	32.43	2.57	2.60	0.33	-0.19	0.93
M96	2.17	0.44	0.29	19.79	2.24	2.22	0.48	-0.26	0.90
M97	2.32	0.59	1.89	28.41	2.46	2.40	0.50	-0.36	1.11

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
M98	37.74298	-123.00840	62	0.00	98.93	0.43	0.64	1.07	92.79	0.91
M99	37.74916	-123.01518	66	0.00	98.16	0.74	1.11	1.84	53.23	1.03
M100	37.75539	-123.02197	68	26.47	73.08	0.18	0.27	0.45	161.57	0.87
M101	37.76178	-123.02854	68	3.20	96.49	0.13	0.19	0.31	307.76	0.95
M102	37.76801	-123.03545	69	0.00	98.56	0.58	0.87	1.44	68.34	0.98
M103	37.77439	-123.04227	69	24.21	73.13	1.06	1.59	2.65	27.55	1.66
M104	37.77833	-123.05249	69	0.00	98.20	0.72	1.08	1.80	54.44	1.05
M105	37.78743	-123.05600	71	31.57	68.03	0.16	0.24	0.40	169.71	1.17
M106	37.79374	-123.06281	73	0.00	97.95	1.52	0.53	2.05	47.88	0.85
M107	37.80009	-123.06927	73	0.00	98.93	0.89	0.18	1.07	92.23	0.40
M108	37.80674	-123.07553	75	1.24	98.64	0.10	0.02	0.12	800.96	0.88
M109	37.81309	-123.08259	77	0.00	97.64	2.11	0.25	2.36	41.41	0.65
M110	37.81942	-123.08922	78	0.00	98.76	0.50	0.74	1.24	79.63	1.04
M111	37.82227	-123.10357	80	0.00	98.32	0.67	1.01	1.68	58.66	1.05
M112	37.83187	-123.10341	84	0.00	96.52	1.58	1.90	3.48	27.76	1.27
M113	37.83869	-123.11003	86	0.00	96.26	1.50	2.25	3.74	25.73	1.35
M114	37.84460	-123.11671	88	0.00	95.78	1.69	2.53	4.22	22.69	1.52
M115	37.84365	-123.12442	87	2.48	95.04	0.99	1.49	2.48	38.37	1.39
M116	37.83691	-123.11749	84	0.00	96.04	1.59	2.38	3.96	24.22	1.30
M117	37.83057	-123.11121	82	0.00	96.75	1.50	1.75	3.25	29.81	1.19
M118	37.82409	-123.10444	80	0.00	97.04	1.18	1.78	2.96	32.80	1.15
M119	37.81774	-123.09783	78	0.00	97.75	0.90	1.35	2.25	43.37	1.05
M120	37.81123	-123.09129	77	3.43	95.43	0.46	0.68	1.14	83.69	1.17
M121	37.80470	-123.08424	77	81.27	18.01	0.29	0.43	0.71	25.23	1.03

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
M98	2.26	0.82	4.00	33.89	2.24	2.26	0.46	0.03	1.04
M99	2.42	1.07	4.51	30.79	2.37	2.36	0.46	-0.06	0.98
M100	-0.32	0.75	5.91	58.96	-0.38	-0.38	0.52	0.05	0.56
M101	0.32	0.90	3.03	22.55	0.05	0.31	0.83	0.49	1.58
M102	2.37	0.96	4.18	31.06	2.33	2.24	0.45	-0.17	1.07
M103	0.60	2.74	3.18	16.67	0.62	0.21	1.01	-0.29	1.20
M104	2.43	1.10	4.20	28.66	2.40	2.30	0.48	-0.21	1.12
M105	-0.12	1.38	2.74	16.10	-0.44	-0.34	0.87	0.44	1.17
M106	2.64	0.72	5.19	48.10	2.62	2.59	0.32	-0.20	3.32
M107	3.28	0.16	12.82	223.72	3.25	3.25	0.19	0.10	0.93
M108	0.48	0.78	1.02	7.58	0.36	0.39	0.82	0.12	1.05
M109	3.07	0.42	5.63	65.17	3.04	2.91	0.28	-0.38	0.84
M110	1.64	1.09	4.18	28.61	1.41	1.64	0.70	0.41	1.19
M111	2.54	1.10	3.59	24.77	2.57	2.42	0.63	-0.30	1.11
M112	2.95	1.61	3.33	18.88	2.86	2.86	0.54	-0.09	1.54
M113	2.91	1.83	3.18	15.75	2.83	2.74	0.64	-0.18	0.98
M114	2.88	2.32	2.36	11.54	2.99	2.63	0.84	-0.56	1.11
M115	1.64	1.93	3.36	18.51	1.35	1.60	0.62	0.66	2.88
M116	3.01	1.69	3.71	18.04	2.89	2.85	0.41	-0.28	0.82
M117	2.91	1.43	3.89	22.63	2.93	2.87	0.46	-0.29	1.55
M118	2.96	1.33	4.02	22.57	2.84	2.91	0.42	0.04	2.78
M119	2.87	1.09	4.25	27.36	2.96	2.88	0.42	-0.35	1.89
M120	0.90	1.38	3.65	26.54	0.92	0.67	0.73	-0.45	1.96
M121	-0.73	1.06	6.97	60.49	-1.00	-0.83	0.27	1.00	-99.99

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
M122	37.79842	-123.07792	73	0.00	98.37	0.65	0.98	1.63	60.51	0.93
M123	37.79155	-123.07111	73	0.00	99.25	0.30	0.45	0.75	133.17	0.87
M124	37.78500	-123.06486	71	0.00	98.64	0.54	0.81	1.36	72.67	0.94
M125	37.77864	-123.05720	71	0.00	99.24	0.30	0.45	0.76	131.33	0.82
M126	37.77265	-123.05141	69	0.00	98.69	0.52	0.79	1.31	75.39	0.97
M127	37.76577	-123.04459	69	0.00	98.58	0.57	0.85	1.42	69.26	0.95
M128	37.75920	-123.03851	69	0.22	99.23	0.22	0.33	0.55	180.84	0.90
M129	37.75245	-123.03179	70	0.00	98.73	0.51	0.76	1.27	77.47	0.90
M130	37.74644	-123.02449	66	63.23	36.41	0.14	0.22	0.36	101.30	0.96
M131	37.73973	-123.01824	62	0.00	98.77	0.49	0.74	1.23	80.23	0.95
M132	37.73360	-123.01172	59	0.00	99.72	0.11	0.17	0.28	351.25	0.64
M133	37.72684	-123.00549	55	0.00	99.25	0.30	0.45	0.75	133.08	0.78
M137	37.74834	-123.03144	62	25.88	73.69	0.17	0.26	0.43	172.69	1.01
M138	37.75241	-123.03857	68	0.00	98.41	0.64	0.95	1.59	61.84	0.98
M139	37.75647	-123.04569	71	44.94	51.08	1.59	2.39	3.98	12.83	2.04
M140	37.76023	-123.05231	68	0.00	97.64	1.17	1.19	2.36	41.30	1.08
M141	37.76487	-123.06045	70	0.73	98.88	0.15	0.23	0.39	255.59	0.87
M142	37.76942	-123.06683	70	0.00	99.61	0.16	0.23	0.39	256.86	0.71
M143	37.77653	-123.07382	71	0.00	99.23	0.31	0.46	0.77	128.48	0.86
M144	37.78223	-123.08001	73	0.00	99.07	0.37	0.56	0.93	106.82	0.94
M145	37.78841	-123.08717	73	0.00	98.90	0.44	0.66	1.10	90.16	0.95
M146	37.79523	-123.09396	75	25.95	73.46	0.24	0.35	0.59	124.27	1.09
M147	37.80145	-123.10092	75	0.00	98.74	0.50	0.75	1.26	78.49	1.03
M148	37.80808	-123.10803	77	12.88	86.39	0.29	0.44	0.73	119.05	1.03

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
M122	2.69	0.86	4.85	35.92	2.65	2.58	0.39	-0.14	1.48
M123	2.28	0.76	2.50	26.14	2.37	2.23	0.50	-0.38	1.06
M124	2.43	0.88	4.33	33.15	2.45	2.32	0.45	-0.37	1.08
M125	1.97	0.66	4.80	42.47	1.90	1.91	0.51	0.18	0.85
M126	2.25	0.94	4.23	31.40	2.21	2.10	0.53	-0.21	0.95
M127	2.45	0.91	4.35	32.76	2.42	2.37	0.45	-0.08	1.69
M128	0.63	0.80	4.79	40.36	0.43	0.43	0.47	0.27	1.37
M129	2.36	0.82	4.75	38.09	2.33	2.32	0.43	0.03	0.96
M130	-0.50	0.92	4.26	35.14	-1.00	-0.58	0.63	1.00	0.94
M131	2.46	0.90	3.53	28.91	2.49	2.43	0.49	-0.19	1.69
M132	1.67	0.41	4.15	45.82	1.54	1.60	0.50	0.30	1.01
M133	2.40	0.61	3.97	39.18	2.44	2.32	0.43	-0.30	1.04
M137	-0.15	1.02	3.97	31.75	-0.38	-0.28	0.63	0.21	0.53
M138	2.29	0.96	4.99	35.71	2.17	2.20	0.44	0.13	0.77
M139	0.10	4.15	3.35	14.69	-0.45	-0.16	1.02	0.56	1.22
M140	2.39	1.17	4.73	31.00	2.24	2.20	0.44	0.04	0.96
M141	0.87	0.77	2.97	28.32	0.84	0.88	0.67	0.04	1.24
M142	1.40	0.50	4.71	48.49	1.33	1.31	0.50	0.06	1.52
M143	1.79	0.74	4.46	39.34	1.69	1.78	0.51	0.23	1.19
M144	1.93	0.88	3.31	28.61	1.90	1.96	0.56	-0.07	1.66
M145	1.72	0.90	5.13	38.90	1.48	1.59	0.54	0.38	1.00
M146	0.02	1.19	3.37	26.41	-0.12	-0.11	0.79	0.13	0.59
M147	2.29	1.05	2.97	24.17	2.35	2.30	0.63	-0.24	1.17
M148	-0.02	1.07	5.05	40.90	-0.02	-0.14	0.64	-0.09	1.48

Sample ID	Latitude	Longitude	Depth (meters)	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	Percent Mud	Sand/Mud Ratio	Standard Deviation
M149	37.81436	-123.11349	81	0.00	97.57	0.97	1.46	2.43	40.22	1.04
M150	37.82019	-123.12032	84	0.00	96.64	1.35	2.02	3.36	28.73	1.26
M151	37.82748	-123.12728	84	0.00	96.39	1.44	2.17	3.61	26.69	1.27
M152	37.83351	-123.13344	88	2.23	95.72	0.82	1.23	2.05	46.63	1.33
M153	37.87666	-123.06830	88	0.00	68.43	29.46	2.11	31.57	2.17	1.49
M154	37.87112	-123.06100	88	0.00	69.11	28.45	2.44	30.89	2.24	1.67
M155	37.86434	-123.05476	86	0.00	80.89	17.54	1.57	19.11	4.23	1.40
M156	37.85799	-123.04746	84	0.00	86.91	11.69	1.40	13.09	6.64	1.24
M157	37.85182	-123.04079	84	0.00	91.27	8.20	0.53	8.73	10.46	0.86
M158	37.84517	-123.03418	82	0.00	93.58	6.09	0.33	6.42	14.58	0.79
M159	37.83881	-123.02741	81	0.00	93.46	5.92	0.62	6.54	14.29	0.88
M160	37.83273	-123.02087	79	0.00	95.60	1.76	2.64	4.40	21.73	1.30
M162	37.81982	-123.00745	77	0.00	96.15	1.54	2.31	3.85	24.96	1.33
M163	37.81353	-123.00098	75	0.00	97.19	1.12	1.69	2.81	34.59	1.16
M164	37.80756	-122.99384	73	0.00	97.74	0.91	1.36	2.26	43.18	1.06
M165	37.80053	-122.98695	71	0.00	95.11	1.96	2.94	4.89	19.43	1.44
M166	37.79414	-122.98003	70	7.97	92.03	0.00	0.00	0.00	0.00	0.71
M167	37.78762	-122.97306	70	0.00	0.00	0.00	0.00	0.00	0.00	0.50
M168	37.78119	-122.96618	66	28.26	70.92	0.33	0.49	0.82	86.46	1.10
M169	37.77491	-122.95961	62	46.27	53.41	0.13	0.19	0.32	168.02	1.13
M170	37.76875	-122.95348	62	14.91	85.09	0.00	0.00	0.00	0.00	0.75
M171	37.76263	-122.94707	60	0.00	99.51	0.49	0.00	0.49	203.06	0.48

Sample ID	First Moment	Second Moment	Third Moment	Fourth Moment	Median	Mean	Sorting	Skewness	Kurtosis
M149	3.08	1.08	4.16	26.27	2.97	2.99	0.36	0.13	0.82
M150	3.03	1.60	3.16	17.47	2.92	3.09	0.45	0.50	1.67
M151	3.08	1.61	3.41	17.74	2.94	3.06	0.44	0.27	1.42
M152	1.22	1.77	4.03	24.37	1.01	1.11	0.68	0.32	2.11
M153	3.71	2.21	2.25	10.34	3.15	3.56	1.17	0.63	1.00
M154	3.75	2.79	1.86	8.40	3.15	3.61	1.24	0.70	0.93
M155	3.40	1.95	2.69	13.22	2.94	3.36	1.04	0.72	2.75
M156	3.26	1.53	3.43	19.00	2.90	3.01	0.67	0.59	1.96
M157	3.16	0.74	3.91	27.98	2.97	2.91	0.42	0.14	1.38
M158	3.00	0.62	3.68	31.18	2.67	2.76	0.36	0.76	1.55
M159	3.00	0.77	4.40	32.81	2.82	2.89	0.46	0.50	2.72
M160	3.13	1.69	3.96	18.38	2.84	2.91	0.34	0.42	1.07
M162	2.88	1.77	3.56	17.66	2.71	2.71	0.48	-0.03	1.65
M163	2.75	1.35	4.19	23.95	2.51	2.60	0.40	0.28	1.40
M164	2.75	1.12	4.42	28.09	2.52	2.62	0.33	0.21	1.39
M165	2.93	2.09	3.51	15.43	2.52	2.59	0.48	0.35	2.05
M166	0.02	0.50	1.88	9.24	-0.04	-0.06	0.50	-0.08	1.46
M167	0.99	0.25	2.32	12.53	0.82	0.90	0.39	0.41	0.87
M168	-0.09	1.20	4.78	37.59	-0.08	-0.29	0.58	-0.27	0.60
M169	-0.09	1.29	2.24	15.12	-0.58	-0.24	0.90	0.63	0.73
M170	-0.12	0.56	1.74	8.09	-0.22	-0.25	0.63	0.03	0.69
M171	2.48	0.23	-1.82	11.22	2.56	2.56	0.32	-0.28	1.24