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Sampling procedures and catalogue of samples for eight boreholes
at Clear Lake, Lake County, California

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Swanels

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by

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This report is preliminary and has not
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INTRODUCTION

Clear Lake, California, is situated in an area which has been subject to crustal movement, earthquake-generated ground shaking, volcanic eruptions, and climatic fluctuations during late Quaternary time. The U.S. Geological Survey, in cooperation with Lake County, has undertaken a study of the seismic, volcanic, and environmental history recorded in the late Quaternary sediments beneath the floor of the lake (Sims, 1974). This study is based on continuous core samples measuring 12 cm or 15 cm in diameter that were obtained in August-November, 1973, from 8 boreholes measuring 14-113 m in length (Figure 1). Preliminary description of many of these samples and interpretation of ancient seismic events can be found in Sims and Rymer (1975).

Over 2,000 multiple samples have been taken from these cores in order to study the environmental record preserved in the lacustrine sediments. Samples were taken for pollen, diatoms, cladocera, bulk mineralogy, fine size analysis, macrofossils, and water-content/organic carbon-content at designated depths. In addition, volcanic ash and radiocarbon samples were removed for correlation studies and age determinations.

This report provides a description of the standard sampling procedures designed for sapropelic muds and peat-rich clays, a description of modified sampling procedures developed for sampling sands and coarser sediments, and a catalogue of samples from the Clear Lake cores. Table 2 outlines the steps followed for the standard sampling procedures.

Figure 1. Map showing location of Clear Lake, California and core site locations.

SAMPLING PROCEDURES FOR SAPROPELIC MUDS AND PEAT-RICH CLAYS

Each core segment (or slug) was extruded in the field into a hard plastic casing approximately 85 cm in length. The ends of the casing were covered with plastic film and sealed with wax to retain moisture. Refrigeration of cores during storage was not possible. In the laboratory, slugs were split lengthwise. Each core slug was split into a "voucher half" and a "sample half". One half of each slug (voucher half) was examined for sedimentary structures, photographed, and lithologically described. In addition, a 1 cm-thick radiograph slab was removed from the top of the voucher half and an x-ray radiograph taken. The voucher half was then sealed in polyethylene film and stored for future reference. The remaining half was also stored in polyethylene film and retained for sampling.

Slugs from each core were examined non-sequentially, and each slug was sampled from the stratigraphic top downward. Compaction may have occurred in each slug during drilling and extrusion, or some sediment may have been lost, and therefore the length of the sediment recovered was generally somewhat less than the stratigraphic interval sampled. Each slug represents a separate drive into the borehole. The depth of the top of each slug was defined by the driller's depth for that slug.

Samples were taken from the cores with the devices pictured in Figure 2; descriptions follow:

1 cm diameter cylinder:

Cylinder was made of aluminum tubing cut to length, with a scribe line for volumetric reference. Extruding piston was made of solid aluminum, also with a scribe line for volumetric reference. Volume equals 1.7 cm^3 .

1.5 cm diameter cylinder:

Cylinder was made of aluminum tubing cut to length, with a scribe line for volumetric reference. Extruding piston was made of solid aluminum, also with a scribe line for volumetric reference. Volume equals 4.4 cm^3 .

Macrofossil spoon:

Spoon was made of aluminum; different sizes were made to accomodate different diameter cores. Spoons were designed to remove a $1/4$ section of entire core, 5 cm in thickness, regardless of core diameter. Volume equals 161 cm^3 and 227 cm^3 for 12 and 15 cm diameter core samplers, respectively.

Figure 2. Sampling devices. A. 1 cm diameter cylinder, B. 1.5 cm diameter cylinder C. macrofossil spoon.

These sampling devices and sampling procedures were designed to sample sapropelic muds and peat-rich clays, which are the most common sediments of the cores. In general, pollen, diatom, cladocera, water-content/organic carbon-content, and macrofossil samples were taken at 10 cm intervals. Supplemental samples were taken from layers of special interest, such as peat layers, possible ancient soil horizons, fossiliferous layers, and thinly interbedded sediments. For uniformity, each type of sample was removed from approximately the same area of the slug at each sampling level. A single sample number was assigned to all samples from a given sampled level.

Because of the very large numbers of levels sampled, detailed records were kept at the time of sampling. A separate sampling information sheet was made for each sampled level, and the sheets were organized by sample number in a loose-leaf binder. Each sheet recorded core and slug numbers, the depth at which the sample was taken, the types of samples taken, and any modifications of sampling procedure. An initial examination of each slug half was made before sampling proceeded, and isolated wood and plant fragments, fish parts, and pebbles were removed and stored in polyethylene containers in 95% ethanol. Notes were made to indicate whether the isolated material was found imbedded in undisturbed sediment (and therefore assumed to be in place) or on a cut surface (assumed to be displaced by core slicing). Small samples of concretions were removed with a spatula, dried in an oven at 70-80°C, and mounted on stubs for x-ray analysis. Lithologic changes, degree of post-coring oxidation, mold growth, and the presence of vivianite were noted before samples were removed. Extent and location of

debris, and fractured or disturbed sediment was described. Variations in sampling procedures were described and macrofossil weights were recorded on each record sheet. Water-content/organic carbon-content data was recorded in a separate notebook. Samples were individually labeled and stored by sample type and core number for easy access.

Diatom and Pollen samples

Samples 1 through 22 were exploratory samples taken from the cores before systematic sampling was started. The initial systematic volumetric pollen and diatom samples (#23 through #134) were taken using gelatin capsules to provide a fixed volume, according to the procedure given by Stevenson (1968). This procedure proved to be unsatisfactory for our purposes, so we changed our sampling procedure starting with sample #135.

The remaining diatom and pollen samples were taken with the 1 cm diameter cylinder and sealed in plastic bags with 95% ethanol to prevent growth of unwanted organisms. The pollen sample site was prepared by scraping the cut surface clean in an effort to get relatively fresh pollen samples uncontaminated by laboratory pollen and spores. Volumetric pollen samples were taken; however, the volume of sample for diatoms only needed to be equal to or greater than the pollen sample volumes.

Water-Content/Organic Carbon-Content samples

Volumetric water-content/organic carbon-content samples were taken with a 1.5 cm diameter cylinder, weighed immediately, and dried in an oven at 70-80 °C. Samples were weighed again shortly after they had cooled

completely to avoid absorption of water from the air. The samples were stored dry in sealed plastic bags for future organic content determinations.

Cladocera, Bulk Mineralogy and Fine Size Analysis samples

Cladocera, bulk mineralogy and fine size analysis samples were taken with a 1.5 cm diameter cylinder. All samples were non-volumetric, but equal to or greater than the volume of the water-content/organic carbon-content samples. The samples were sealed in plastic bags with 95% ethanol.

Macrofossil samples

The macrofossil spoon was designed to remove 1/2 of the sediment from the sample half of the core at the level sampled, in a slice 5 cm thick. Excess sediment removed with the samples was scraped off to retain volumetric control. In some instances, driller's mud and, on occasion, plastic casing shavings derived from sawing casings in half, were also scraped from the sample. Each sample was weighed immediately and sealed in a plastic bag with 95% ethanol for later washing and examination for macrofossils.

Radiocarbon samples

Most of the radiocarbon samples were removed from the voucher halves when the core slugs were split. These samples were taken from layers of high organic content, such as peats and carbonaceous muds, and were assigned numbers other than the Clear Lake sample numbers. Additional samples were removed after radiographic examination revealed other desirable sampling

1 Table 1. Radiocarbon samples from Clear Lake, California, Cores 1-8

2 Sample Number	Core/Slug	Sample Depth (cm)	Material	Age in Years B.P.
I-7754	1/22	2103	Sediment	15,510 $\pm$ 340
2364 (W-3347)	1/23	2142-2144	Wood in sediment	14,000
2260	1/23	2145-2155	Sediment	
2264	1/25	2292-2297	Sediment	not returned
2366 (W-3328)	1/25	2342-2344	Wood in sediment	14,300 $\pm$ 450
2367 (W-3327)	1/25	2351-2352	Wood in sediment	13,900 $\pm$ 450
2365 (W-3326)	1/25	2361	Wood	14,800 $\pm$ 700
1984	3/19	1755-1760	Sediment	
1985	3/26	2422-2428	Sediment	
1979 (W-3200)	3/27	2455-2460	Wood in sediment	28,320 $\pm$ 1,000
I-8369	3/35	3039	Wood	24,910 $\pm$ 540
I-8370	3/40	3475	Wood	17,440 $\pm$ 510
1986	3/44	3749-3756	Sediment	
1966 (W-3198)	3/44	3789-3794	Sediment	27,490 $\pm$ 1,000
1980 (W-3205)	3/66	5738-5743	Wood	33,200 $\pm$ 1,000
1045 (W-3206)	3/68	5908	Wood	27,540 $\pm$ 1,000
1806	4/11	960-980	Sediment	
1909	4/19	1680-1700	Sediment	
1877	4/23	2090	Wood	
2371 (W-3217)	4/28	2540-2545	Sediment	15,010 $\pm$ 550
2368	4/40	3566-3581	Sediment	Insufficient material
1934	5/6	508-528	Sediment	
1969	5/11	938-958	Sediment	
1981 (W-3296)	5/12	1082-1097	Sediment	10,400 $\pm$ 350
2373 (W-3220)	5/24	2175-2180	Sediment	24,080 $\pm$ 1,000
2042	5/24	2209-2229	Sediment	
2370 (W-3213)	6/9	813-823	Sediment	13,650 $\pm$ 450
2375 (W-3221)	6/10	878-888	Sediment	13,200 $\pm$ 400

I-7755	6/11	1006	Sediment	13,090 $\pm$ 210
1983 (W-3301)	6/12	1021-1026	Sediment	13,890
2372 (W-3218)	6/19	1618-1631	Sediment	25,890 $\pm$ 1,000
1978 (W-3199)	6/21	1773-1783	Sediment	34,070 $\pm$ 1,000
2377 (W-3226)	6/23	1925-1935	Sediment	32,400 Incomplete analysis
2376 (W-3225)	6/24	1986-1996	Sediment	29,810 $\pm$ 1,000 (not final)
1982	6/25	2052-2057	Sediment	not returned
1987	6/26	2142-2147	Sediment	not returned
I-7719	7/10	763-771	Peat	11,330 $\pm$ 330
(W-3071)	7/11	820-830	Peaty mud	11,780 $\pm$ 250
(W-3072)	7/12	870-880	Peaty mud	12, 20 $\pm$ 250
(W-3073)	7/13	980-1010	Peat	13,160 $\pm$ 300
(W-3063)	7/15	1120-1130	Clayey peat	14,900 $\pm$ 300
I-7756	7/17	1225-1229	Peaty mud	17,660 $\pm$ 330
(W-3064)	7/17	1276-1280	Peaty mud	17,470 $\pm$ 300
(W-3066)	7/18	1320-1330	Peat	18,340 $\pm$ 300
(W-3068)	7/19	1410-1420	Peaty mud	19,110 $\pm$ 300
(W-3069)	7/21	1530-1540	Peat	21,210 $\pm$ 400
(W-3070)	7/22	1670-1676	Peat	26,150 $\pm$ 600
I-7928	7/23	1715-1720	Carbonaceous mud	23,900 $\pm$ 640
I-7932	7/23	1727-1733	Carbonaceous mud	23,300 $\pm$ 600
I-7718	7/36	2731-2737	Peat	>40,000
2369 (W-3214)	8/13	912-927	Sediment	9,850 $\pm$ 250
2374	8/27	1976-1991	Sediment	Insufficient material

¹ Results of the ¹⁴C determinations, where available, are taken from the Open-file reports describing the individual cores (Sims and Rymer, 1975) and from John Sims (personal communication).

² Sample numbers with "I" prefix designate ¹⁴C age determinations by James Buckley, Isotopes, Inc., Westwood, N.J. Sample numbers with "W" prefix designate ¹⁴C determinations by Meyer Rubin, U.S. Geological Survey.

levels. A complete list of all radiocarbon samples removed from voucher halves and sample halves appears in Table 1.

Radiocarbon samples were taken from intervals ranging from 5 cm to 20 cm in thickness. The sample intervals were kept to a minimum to localize age-depth correlations, and the large intervals were removed only to compensate for sediment with lower total organic content. In some cases, all of the sediment in the intervals was removed for dating, and the sample was assigned a number representing this interval. In other cases, only half the sediment in the interval was removed for dating, and pollen, diatoms, cladocera, water-content/organic carbon-content, fine size analysis, and bulk mineralogy samples were taken from the remaining sediment. These radiocarbon samples were assigned the same number as the first sampled level in the interval. No macrofossil samples were taken in either case.

Peat layers and organic-rich zones were removed entirely only if it was thought they would supply enough datable material. In some cores, radiocarbon samples were removed at arbitrarily spaced intervals throughout the core and where significant lithologic changes occurred. All sample surfaces were scraped clean to decrease possible contamination, dried in an oven at 70-80°C, and sealed dry in plastic bags.

Volcanic Ash samples

Where ash and possible ash beds occurred, they were removed to supplement ash samples taken from the voucher half when the cores were split.

Table 2. Steps followed in sampling a core slug.
Departures from the procedure shown here were those
required by the nature of the sediments.

1. Split the core slug in half longitudinally.
2. Take color and black and white photographs of the voucher half of the core slug.
3. Describe the core slug.
4. Remove X-ray radiograph slab from voucher half of core slug.
5. Seal voucher half of core slug in polyethylene bag.
6. Store sampling half of core slug in an unsealed polyethylene bag until sampling. A substantial time sometimes elapsed before the remaining steps were performed.
7. Establish depth scale for sampling half of core slug.
8. Note and describe any irregularities in the sampling half that might affect sampling.
9. Remove and preserve any noteworthy objects from sampling surface of core slug.
10. Remove small-volume cylinder samples:
 - a. Pollen sample (volumetric)
 - b. Diatom sample (non-volumetric)
11. Remove and weigh weight-loss sample (large cylinder, volumetric).
12. Remove fine size analysis, cladocera and bulk mineralogy samples (large cylinder, non-volumetric).
13. Remove and weigh macrofossil sample.
14. Seal sampling half of core slug in polyethylene bag.

MODIFICATIONS OF SAMPLING PROCEDURES

Procedures for sand

The sampling procedure for sapropelic muds and peaty clays described earlier was also followed for silty clays, silts, and sandy silts. As the sediment became increasingly sandy, it caused the 1.5 cm diameter cylinder to jam, preventing extrusion of the sample from the cylinder. In these sandy sediments, cladocera, bulk mineralogy, fine size analysis, and water-content/organic carbon-content samples were then processed in the same manner as the sapropelic muds and peaty clays. The remaining samples were sealed in plastic bags with 95% ethanol. Larger sample volumes were taken, however, to assure adequate sample size. Pollen and diatom samples were taken following the same procedure as for sapropelic muds and peaty clays. Macrofossil samples were usually removed with the macrofossil spoon, but in a few slugs the sediment was too well-consolidated for insertion of the macrofossil spoon, and it was necessary to remove the sediment with a spatula. In a few slugs, only macrofossil, pollen, and diatom samples were taken.

Procedures for gravel

Gravels were sampled at 20 cm intervals, or wherever they occurred in lenses interbedded with sands and silts. Only non-volumetric pollen, fine size analysis and macrofossil samples were removed from the gravels, and again a larger volume of sediment than normally taken was removed for each sample. The pollen and fine size analysis samples were spooned into

plastic bags and sealed with 95% ethanol. A spatula was used to remove a 3 cm thick slice for the macrofossil samples, which were then weighed and wet-sieved through 2 mm and .25 mm screens. Fractions less than .25 mm were not saved. The remaining fractions were dried separately at room temperature. Obsidian was removed from the fraction greater than 2 mm and placed in polyethylene containers for hydration-rate studies. Both fractions were sealed dry in separate plastic bags.

Procedures for mud with high water content

Special attention was given to slugs containing drilling debris and badly fractured or disturbed sediment resulting from coring operations. These anomalies were few and not extensive; however, records were kept on their location and extent. Badly fractured sediment was left unsampled or sampled only for pollen. Disturbed sediment was not sampled. Obvious debris was not sampled, but questionable zones of debris were, and depths within each slug were adjusted to exclude obvious debris. Occasionally, driller's mud filled fractures in the sediment; these areas were avoided in sampling.

Problems with procedures for macrofossil samples

Although volumetric macrofossil samples were desired, they were generally not obtained with the macrofossil spoon because: 1) core halves were cut unequally, 2) the sediment rotated in its casing during storage, or 3) the sediment fell out of the sampler when the sampler was removed. However, the volumes of the macrofossil samples could be calculated using the weight of the macrofossil sample and the known weight and volume of the

water-content/organic carbon-content sample taken at the same depth as each macrofossil sample.

Storing the macrofossil samples in insufficient amounts of ethanol sometimes resulted in growths of mold on the surface of the samples. These growths inhibited the concentration and separation of macrofossils. To process these samples, it was necessary to boil them in water before the samples could be concentrated.

ACKNOWLEDGMENTS

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CLEAR LAKE, CALIFORNIA, CORE 1

DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE
SLUG 1		14.50 SLUG 16	2226
SLUG 2		14.60	2227
SLUG 3	1975	14.70	2228
SLUG 4	1976	14.80	2229
SLUG 5	1977	14.90	2230
SLUG 6	2182	15.00	2231
SLUG 7	2183	15.10	2232
SLUG 8	2184	15.40	2233
SLUG 9	2185	15.50	2234
SLUG 10	2186	15.60	2235
SLUG 11	2187	15.70	2236
SLUG 12	2188	15.80	2237
SLUG 13	2189	15.90	2238
SLUG 14	2190	16.00	2239
SLUG 15	2191	SLUG 17	2240
	2192	SLUG 18	2241
	2193	SLUG 19	2242
	2194	SLUG 20	2243
	2195	SLUG 21	2244
	2196	SLUG 22	2245
	2197	SLUG 23	2246
	2198	SLUG 24	2247
	2199	SLUG 25	2248
	2200	SLUG 26	2249
	2201	SLUG 27	2250
	2202	SLUG 28	2251
	2203	SLUG 29	2252
	2204		2253
	2205		2254
	2206		2255
	2207		2256
	2208		2257
	2209		2258
	2210		2259
	2211		2260
	2212		2261
	2213		2262
	2214		2263
	2215		2264
	2216		2265
	2217		2266
	2218		2267
	2219		2268
	2220		2269
	2221		2270
	2222		2271
	2223		2272
	2224		2273
	2225		2274
			2275
			2276
			2277
			2278

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CLEAR LAKE, CALIFORNIA, CORE 2

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CLEAR LAKE, CALIFORNIA, BOTTOM HALF CORE 4

DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE
59.51		1270		1410		1459		107.10	1179
59.61		1271		1411		1460		107.20	1180
59.71		1272		1412		1461		107.30	1181
59.81		1273		1413		1462		107.40	1182
59.91		1274		1414		1463		107.50	1183
60.01	SLUG 66	1275		1415		1464		107.60	1184
60.11		1276		1416		1465		107.70	1185
60.21		1277				1466		107.80	1186
60.47		1248		1402		1467		107.97	1187
60.57		1249		1403		1468		108.07	1188
60.67	SLUG 67	1250		1404		1469		108.17	1189
60.77		1251		1405		1470		108.27	1190
60.87		1252		1406		1471		108.37	1191
60.97		1253		1407		1472		108.47	1192
61.07		1254		1408		1473		108.57	1193
				1409				108.67	1194
61.40		1578		1395		1315		108.90	1195
61.50		1579		1396		1316			
61.60		1580		1397		1317			
61.70	SLUG 68	1581		1398		1318			
61.80		1582		1399		1319			
61.90		1583		1400		1320			
62.00		1584		1401		1321			
62.30		1585		1322		1308		109.85	1184
62.40		1586		1323		1309			
62.50	SLUG 69	1587		1324		1310		110.00	1185
62.60		1588		1325		1311		110.10	1186
62.70		1589		1326		1312		110.20	1187
62.80		1590		1327		1313			
62.90		1591		1328		1314			
				1329					
63.20		1594		1388		1444		110.71	1195
63.30		1595		1445		1445		110.81	1196
63.40		1596		1389		1446		110.91	1197
63.50	SLUG 70	1597		1390		1447		111.01	1198
63.60		1598		1391		1448		111.11	1199
63.70		1599		1392		1449		111.21	1200
63.80		1600		1393		1450		111.31	1201
		1601		1394		1451		111.41	1202
64.10		1571		1380		1452		111.63	1203
64.20		1572		1381		1453		111.73	1204
64.30	SLUG 71	1573		1382		1454		111.83	1205
64.40		1574		1383		1455		111.93	1206
64.50		1575		1384		1456		112.03	1207
64.60		1576		1385		1457		112.13	1208
64.70		1577		1386		1458		112.23	1209
				1387				112.33	1210
65.00		1600		1373		1429		112.54	1211
65.10		1601		1374		1430		112.64	1212
65.20		1602		1375		1431		112.74	1213
65.30	SLUG 72	1603		1376		1432		112.84	1214
65.40		1604		1377		1433		112.94	1215
65.50		1605		1378		1434		113.04	1216
65.60		1606		1379		1435		113.14	1217
65.70		1607		1380		1436		113.24	1218
65.90		1592		1366		1437		113.51	1219
66.00		1593		1367		1438		113.61	1220
66.10		1594		1368		1439		113.71	1221
66.20	SLUG 73	1595		1369		1440		113.81	1222
66.30		1596		1370		1441		113.91	1223
66.40		1597		1371		1442		114.01	1224
66.50		1598		1372		1443		114.11	1225
66.60		1599							
66.90		1608		1359		1300		102.58	1187
67.00		1609		1360		1301		102.68	1188
67.10	SLUG 74	1610		1361		1302		102.78	1189
67.20		1611		1362		1303		102.88	1190
67.30		1612		1363		1304		102.98	1191
67.40		1613		1364		1305		103.08	1192
67.50		1614		1365		1306		103.18	1193
						1307			
67.76		846		1351		1480		103.50	1194
67.86		847		1352		1481		103.60	1195
67.96		848		1353		1482		103.70	1196
68.06	SLUG 75	849		1354		1483		103.80	1197
68.16		850		1355		1484		103.90	1198
68.26		851		1356		1485		104.00	1199
68.36		852		1357		1486		104.10	1200
68.46		853		1358					
68.73		854		1344		1293		104.36	1201
68.83		855		1345		1294		104.46	1202
68.93	SLUG 76	856		1346		1295		104.56	1203
69.03		857		1347		1296		104.66	1204
69.13		858		1348		1297		104.76	1205
69.23		859		1349		1298		104.86	1206
69.33		860		1350		1299		104.96	1207
69.71		1425		1337		1474		105.28	1208
69.81		1426		1338		1475		105.38	1209
69.91	SLUG 77	1427		1339		1476		105.48	1210
70.01		1428		1340		1477		105.58	1211
				1341		1478		105.68	1212
				1342		1479		105.78	1213
				1343				105.88	1214
70.48		1417		1330		1495		106.14	1215
70.58		1418		1331		1496		106.24	1216
70.68		1419		1332		1497		106.34	1217
70.78	SLUG 78	1420		1333		1498		106.44	1218
70.88		1421		1334		1499		106.54	1219
70.98		1422		1335		1500		106.64	1220
71.08		1423		1336		1501			
71.18		1424		1336					

(200)
R290
100-76-157

CLEAR LAKE, CALIFORNIA, TOP HALF CORE 4

DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE
0.10		11.95		1255		35.75		1728	
0.20		12.05		1256		35.85		1729	
0.30		12.15		1257		35.95		1730	
0.40		12.25		1258		36.05		1731	
0.50		12.35		1259		36.15		1732	
0.60		12.45		1260		36.25		1733	
0.70		12.55		1261		36.35		1734	
		12.65		1262		36.45		1735	
1.00		12.95		1266		36.70		1721	
1.10		13.05		1267		36.80		1722	
1.20		13.15		1268		36.90		1723	
1.30		13.25		1269		37.00		1724	
1.40		13.35		1270		37.10		1725	
1.50		13.45		1271		37.20		1726	
1.60		13.55		1272		37.30		1727	
				1273					
				1274					
				1275					
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				1499					

(200)
R290
no.76-15

CLEAR LAKE, CALIFORNIA, CORE 5

DEPTH (METRES)		SAMPLE			
0.10	0.10	1921	2075		
0.20	0.20	2076	1922		
0.30	0.30	2077	1923		
0.40	0.40	2078	1924		
0.50	0.50	2079	1925		
0.60	0.60	2080	1926		
0.70	0.70	2081	1927		
SLUG 1					
1.00		2082			
1.10		2083			
1.20		2084			
1.30		2085			
1.40		2086			
1.50		2087			
1.60		2088			
1.70		2089			
SLUG 2					
1.90		2090			
2.00		2091			
2.10		2092			
2.20		2093			
2.30		2094			
2.40		2095			
2.50		2096			
2.60		2097			
SLUG 3					
2.90		2098			
3.00		2099			
3.10		2100			
3.20		2101			
3.30		2102			
3.40		2103			
3.50		2104			
SLUG 4					
4.23		1928			
4.33		1929			
SLUG 5					
4.68		1930			
4.78		1931			
4.88		1932			
4.98		1933			
5.08		1934			
5.18		1935			
5.28		1936			
5.38		1937			
SLUG 6					
5.33		1938			
6.03		1939			
6.13		1940			
6.23		1941			
6.48		1942			
6.58		1943			
6.68		1944			
6.78		1945			
6.88		1946			
6.98		1947			
7.08		1948			
7.18		1949			
SLUG 7					
7.33		1950			
7.43		1951			
7.53		1952			
7.63		1953			
7.73		1954			
7.83		1955			
7.93		1956			
8.03		1957			
8.23		1958			
8.33		1959			
8.43		1960			
8.53		1961			
8.63		1962			
8.73		1963			
8.83		1964			
8.93		1965			
SLUG 8					
9.18		1967			
9.28		1968			
9.38		1969			
9.48		1970			
9.58		1971			
9.68		1972			
9.78		1973			
9.88		1974			
SLUG 9					
10.13		2003			
10.23		2004			
10.33		2005			
10.43		2006			
10.53		2007			
10.63		2008			
10.73		2009			
10.82		1981			

10,400 ± 350
W-3296

DEPTH (METRES)		SAMPLE			
11.03		1988			
11.13		1989			
11.23		1990			
11.33		1991			
11.43		1992			
11.53		1993			
11.63		1994			
SLUG 13					
11.93		1995			
12.03		1996			
12.13		1997			
12.23		1998			
12.33		1999			
12.43		2000			
12.53		2001			
12.63		2002			
SLUG 14					
12.83		2010			
12.93		2011			
13.03		2012			
13.13		2013			
13.23		2014			
13.33		2015			
SLUG 15					
14.33		2016			
14.43		2017			
14.53		2018			
14.63		2019			
14.73		2020			
14.83		2021			
14.93		2022			
15.03		2023			
SLUG 16					
15.23		2024			
15.33		2025			
15.43		2026			
15.53		2027			
15.63		2028			
15.73		2029			
15.83		2030			
15.93		2031			
SLUG 17					
16.30		2105			
16.40		2106			
16.50		2107			
16.60		2108			
16.70		2109			
16.80		2110			
SLUG 18					
17.20		2111			
17.30		2112			
17.40		2113			
17.50		2114			
17.60		2115			
17.70		2116			
17.80		2117			
SLUG 19					
18.10		2118			
18.20		2119			
18.30		2120			
18.40		2121			
18.50		2122			
18.60		2123			
18.70		2124			
SLUG 20					
19.00		2125			
19.10		2126			
19.20		2127			
19.30		2128			
19.40		2129			
19.50		2130			
19.60		2131			
SLUG 21					
19.90		2132			
20.00		2133			
20.10		2134			
20.20		2135			
20.30		2136			
20.40		2137			
20.50		2138			
SLUG 22					
20.74		2032			
20.84		2033			
20.94		2034			
21.04		2035			
21.14		2036			
21.24		2037			
SLUG 23					
21.63		2038			
21.73		2039			
21.83		2040			
21.93		2041			
22.03		2042			
22.13		2043			
22.23		2044			
22.33		2045			
SLUG 24					

24,080 ± 1,000
W-3220

CLEAR LAKE, CALIFORNIA, CORE 6

(200)
R290
ms 76-157

DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE
0.10	303	11.78	386
0.20	304	11.91	387
0.30	305	12.01	388
0.40	306	12.11	389
0.50	307	12.21	390
0.60	308	12.31	391
		12.41	392
0.80	309	12.62	393
0.90	310	12.72	394
1.00	311	12.82	395
1.10	312	12.95 12.94	397 396
1.20	313	13.06	398
1.30	314	13.12	399
		13.22	400
1.70	368	13.32	401
1.80	369	13.42	402
1.90	370	13.52	403
2.00	371	13.62	404
2.10	372	13.72	405
2.20	373	13.82	406
2.40	315	14.12	407
2.50	317	14.22	408
2.60	318	14.32	409
2.70	319	14.42	410
2.80	320	14.52	411
2.90	321	14.62	412
3.00	322		
3.10	323		
3.20	324	14.92	413
3.30	325	15.02	414
3.40	326	15.12	415
3.50	327	15.22	416
3.60	328	15.32	417
3.70	329	15.42	418
3.80	330		
3.90	331	15.62	419
4.00	332	15.74	420
4.10	333	15.82	421
4.20	334	15.92	422
4.30	335	16.12	423
4.40	336	16.22	424
4.50	337	16.43	425
		16.53	426
		16.63	427
		16.73	428
		16.83	429
		16.93	430
		17.03	431
		17.15	432
		17.25	433
5.59	338	17.39	434
5.69	339	17.53	435
5.79	340	17.63	436
5.89	341	17.73 17.73	1978 437
5.99	342		
6.09	343		
6.19	344		
		18.01	462
6.50	345	18.11	461
6.61	346	18.21	460
6.71	347	18.31	459
6.81	348	18.41	458
6.91	349	18.51	457
7.01	350		
7.11	351	18.83	463
7.21	352	18.93	464
	353	19.03	465
7.39	354	19.13	466
7.49	355	19.25 19.23	2377 467
7.59	356		
7.69	357	19.43	438
7.79	358	19.53	439
7.89	359	19.63	440
7.99	360	19.71	441
8.13	2370 316	19.86	2376
8.31	361	20.22	442
8.41	362	20.32	443
8.51	363	20.36	444
8.61	364	20.46	445
8.71	2375 365	20.57	446
8.81	366	20.64	447
8.91	367	20.74	448
		20.84	449
		20.96	450
		21.04	451
		21.14	452
		21.24	453
		21.34	454
		21.42	455
		21.48	456
		21.59	457
10.06			
10.21	1983		
10.29	374		
10.39	375		
10.49	376		
10.59	377		
10.69	378		
10.79	379		
11.11	380		
11.21	381		
11.31	382		
11.41	383		
11.51	384		
11.61	385		

25,890 ± 1,000
W-3218

34,070 ± 1,000
W-3199

32,400 (NOT FINAL)
W-3226

29,810 ± 1,000
W-3225

13,090 ± 210
W-7755

13,890
W-3301

13,200 ± 400
W-3221

13,650 ± 450
W-3213

1200
R29
74%

CLEAR LAKE, CALIFORNIA, CORE 7

DEPTH (METRES)	SAMPLE	DEPTH (METRES)	SAMPLE
0.00	102	13.80	55
0.10	103	13.90	56
0.20	104	14.00	57
0.30	105	14.10	58
0.40	106	14.20	59
0.50	107	14.30	60
0.60	108	14.40	61
0.80	109	14.50	62
0.90	110	14.60	63
1.00	111	14.70	64
1.10	112	14.80	65
1.20	113	14.90	66
1.30	114	15.00	67
1.40	115	15.10	68
1.50	116	15.20	69
1.60	117	15.30	70
1.70	118	15.40	71
1.80	119	15.50	72
1.90	120	15.60	73
2.00	121	15.70	74
2.10	122	15.80	75
2.20	123	15.90	76
2.40	124	16.00	77
2.50	125	16.10	78
2.60	126	16.20	79
2.70	127	16.30	80
2.80	128	16.40	81
2.90	129	16.50	82
3.00	130	16.60	83
3.10	131	16.70	84
3.20	132	16.80	85
3.30	133	16.90	86
3.40	134	17.00	87
3.50	135	17.10	88
3.60	136	17.20	89
3.70	137	17.30	90
3.80	138	17.40	91
3.90	139	17.50	92
4.00	140	17.60	93
4.10	141	17.70	94
4.20	142	17.80	95
4.30	143	17.90	96
4.40	144	18.00	97
4.50	145	18.10	98
4.60	146	18.20	99
4.70	147	18.30	100
4.80	148	18.40	101
4.90	149	18.50	202
5.00	150	18.60	203
5.10	151	18.70	204
5.20	152	18.80	205
5.30	153	18.90	206
5.40	154	19.00	207
5.50	155	19.10	208
5.60	156	19.20	209
5.70	157	19.30	210
5.80	158	19.40	211
5.90	159	19.50	212
6.00	160	19.60	213
6.20	161	19.70	214
6.30	162	19.80	215
6.40	163	19.90	216
6.50	164	20.00	217
6.60	165	20.10	218
6.70	166	20.20	219
6.80	167	20.30	220
6.90	168	20.40	221
7.00	169	20.50	222
7.10	170	20.60	223
7.20	171	20.70	224
7.30	172	20.80	225
7.40	173	20.90	226
7.50	174	21.00	227
7.60	175	21.10	228
7.70	176	21.20	229
7.80	177	21.30	230
7.90	178	21.40	231
8.00	179	21.50	232
8.10	180	21.60	233
8.20	181	21.70	234
8.30	182	21.80	235
8.40	183	21.90	236
8.50	184	22.00	237
8.60	185	22.10	238
8.70	186	22.20	239
8.80	187	22.30	240
8.90	188	22.40	241
9.00	189	22.50	242
9.10	190	22.60	243
9.20	191	22.70	244
9.30	192	22.80	245
9.40	193	22.90	246
9.50	194	23.00	247
9.60	195	23.10	248
9.70	196	23.20	249
9.80	197	23.30	250
10.00	198	23.40	251
10.10	199	23.50	252
10.20	200	23.60	253
10.30	201	23.70	254
10.40	202	23.80	255
10.50	203	23.90	256
10.60	204	24.00	257
10.70	205	24.10	258
10.80	206	24.20	259
10.90	207	24.30	260
11.00	208	24.40	261
11.10	209	24.50	262
11.20	210	24.60	263
11.30	211	24.70	264
11.40	212	24.80	265
11.50	213	24.90	266
11.60	214	25.00	267
11.70	215	25.10	268
11.80	216	25.20	269
11.90	217	25.30	270
12.00	218	25.40	271
12.10	219	25.50	272
12.20	220	25.60	273
12.30	221	25.70	274
12.40	222	25.80	275
12.50	223	25.90	276
12.60	224	26.00	277
12.70	225	26.10	278
12.80	226	26.20	279
12.90	227	26.30	280
13.00	228	26.40	281
13.10	229	26.50	282
13.20	230	26.60	283
13.30	231	26.70	284
13.40	232	26.80	285
13.50	233	26.90	286
13.60	234	27.00	287
13.70	235	27.10	288
13.80	236	27.20	289
13.90	237	27.30	290
14.00	238	27.40	291
14.10	239	27.50	292
14.20	240	27.60	293
14.30	241	27.70	294
14.40	242	27.80	295
14.50	243	27.90	296
14.60	244	28.00	297
14.70	245	28.10	298
14.80	246	28.20	299
14.90	247	28.30	300
15.00	248	28.40	301
15.10	249	28.50	302
15.20	250	28.60	303
15.30	251	28.70	304
15.40	252	28.80	305
15.50	253	28.90	306
15.60	254	29.00	307
15.70	255	29.10	308
15.80	256	29.20	309
15.90	257	29.30	310
16.00	258	29.40	311
16.10	259	29.50	312
16.20	260	29.60	313
16.30	261	29.70	314
16.40	262	29.80	315
16.50	263	29.90	316
16.60	264	30.00	317
16.70	265	30.10	318
16.80	266	30.20	319
16.90	267	30.30	320
17.00	268	30.40	321
17.10	269	30.50	322
17.20	270	30.60	323
17.30	271	30.70	324
17.40	272	30.80	325
17.50	273	30.90	326
17.60	274	31.00	327
17.70	275	31.10	328
17.80	276	31.20	329
17.90	277	31.30	330
18.00	278	31.40	331
18.10	279	31.50	332
18.20	280	31.60	333
18.30	281	31.70	334
18.40	282	31.80	335
18.50	283	31.90	336
18.60	284	32.00	337
18.70	285	32.10	338
18.80	286	32.20	339
18.90	287	32.30	340
19.00	288	32.40	341
19.10	289	32.50	342
19.20	290	32.60	343
19.30	291	32.70	344
19.40	292	32.80	345
19.50	293	32.90	346
19.60	294	33.00	347
19.70	295	33.10	348
19.80	296	33.20	349
19.90	297	33.30	350
20.00	298	33.40	351
20.10	299	33.50	352
20.20	300	33.60	353
20.30	301	33.70	354
20.40	302	33.80	355
20.50	303	33.90	356
20.60	304	34.00	357
20.70	305	34.10	358
20.80	306	34.20	359
20.90	307	34.30	360
21.00	308	34.40	361
21.10	309	34.50	362
21.20	310	34.60	363
21.30	311	34.70	364
21.40	312	34.80	365
21.50	313	34.90	366
21.60	314	35.00	367
21.70	315	35.10	368
21.80	316	35.20	369
21.90	317	35.30	370
22.00	318	35.40	371
22.10	319	35.50	372
22.20	320	35.60	373
22.30	321	35.70	374
22.40	322	35.80	375
22.50	323	35.90	376
22.60	324	36.00	377
22.70	325	36.10	378
22.80	326	36.20	379
22.90	327	36.30	380
23.00	328	36.40	381
23.10	329	36.50	382
23.20	330	36.60	383
23.30	331	36.70	384
23.40	332	36.80	385
23.50	333	36.90	386
23.60	334	37.00	387
23.70	335	37.10	388
23.80	336	37.20	389
23.90	337	37.30	390
24.00	338	37.40	391
24.10	339	37.50	392
24.20	340	37.60	393
24.30	341	37.70	394
24.40	342	37.80	395
24.50	343	37.90	396
24.60	344	38.00	397
24.70	345	38.10	398
24.80	346	38.20	399
24.90	347	38.30	400
25.00	348	38.40	401
25.10	349	38.50	402
25.20	350	38.60	403
25.30	351	38.70	404
25.40	352	38.80	405
25.50	353	38.90	406
25.60	354	39.00	407
25.70	355	39.10	408
25.80	356	39.20	409
25.90	357	39.30	410
26.00	358	39.40	411
26.10	359	39.50	412
26.20	360	39.60	413
26.30	361	39.70	414
26.40	362	39.80	415
26.50	363	39.90	416
26.60	364	40.00	417
26.70	365	40.10	418
26.80	366	40.20	419
26.90	367	40.30	420
27.00	368	40.40	421
27.10	369	40.50	422
27.20	370	40.60	423
27.30	371	40.70	424
27.40	372	40.80	425
27.50	373	40.90	426
27.60	374	41.00	427
27.70	375	41.10	428
27.80	376	41.20	429
27.90	377	41.30	430
28.00	378	41.40	431
28.10	379	41.50	432
28.20	380	41.60	433
28.30	381	41.70	434
28.40	382	41.80	435
28.50	383	41.90	436
28.60	384	42.00	437
28.70	385	42.10	438
28.80	386	42.20	439
28.90	387	42.30	440
29.00	388	42.40	441
29.10	389	42.50	442
29.20	390	42.60	443
29.30	391	42.70	444
29.40	392	42.80	445
29.50	393	42.90	446
29.60	394	43.00	447
29.70	395	43.10	448
29.80	396	43.20	449
29.90	397	43.30	450
30.00	398	43.40	451
30.10	399	43.50	452
30.20	400	43.60	453
30.30	401	43.70	454
30.40	402	43.80	455
30.50	403	43.90	456
30.60	404	44.00	457
30.70	405	44.10	458
30.80	406	44.20	459
30.90	407	44.30	460
31.00	408	44.40	461
31.10	409	44.50	462
31.20	410	44.60	463
31.30			

(200)
R290
72.76-157

CLEAR LAKE, CALIFORNIA, CORE 8

DEPTH (METRES)		SAMPLE		DEPTH (METRES)		SAMPLE	
0.10	SLUG 1	468		10.70	SLUG 15	564	
0.30		469		10.80		565	
0.40		470		10.90		566	
0.50		471		11.00		567	
0.60		472		11.10		568	
0.70	SLUG 2	473		11.20	SLUG 16	569	
0.80		474		11.30		570	
0.90		475		11.50		571	
1.00		476		11.60		572	
1.10		477		11.70		573	
1.20	SLUG 3	478		11.80		574	
1.30		479		11.90	SLUG 17	575	
1.40		480		12.00		576	
1.60		481		12.20		577	
1.70		482		12.30		578	
1.80	SLUG 4	483		12.40	SLUG 18	579	
1.90		484		12.50		580	
2.00		485		12.60		581	
2.10		486		12.70		582	
2.20		487		12.80		583	
2.40	SLUG 5	488		13.00	SLUG 19	584	
2.50		489		13.10		585	
2.60		490		13.20		586	
2.70		491		13.30		587	
2.80		492		13.40	SLUG 20	588	
2.90	SLUG 6	493		13.50		589	
3.00		494		13.60		590	
3.10		495		13.80		591	
3.20		496		13.90	SLUG 21	592	
3.30	SLUG 7	497		14.00		593	
3.40		498		14.10		594	
3.50		499		14.20		595	
3.60		500		14.30		596	
3.70		501		14.40	SLUG 22	597	
3.90	SLUG 8	502		14.75		598	
4.00		503		14.85		599	
4.10		504		14.95		600	
4.20		505		15.05		601	
4.30	SLUG 9	506		15.15	SLUG 23	602	
4.40		507		15.45		603	
4.50		508		15.55		604	
4.60		509		15.65		605	
4.70		510		15.75		606	
4.80	SLUG 10	511		15.85	SLUG 24	607	
4.90		512		16.10		608	
5.00		513		16.20		609	
5.10		514		16.30		610	
5.20		515		16.40	SLUG 25	611	
5.40	SLUG 11	516		16.50		612	
5.50		517		16.60		613	
5.60		518		16.70		614	
5.70		519		16.90	SLUG 26	615	
5.80	SLUG 12	520		17.00		616	
5.90		521		17.10		617	
6.00		522		17.20		618	
6.20		523		17.30		619	
6.30	SLUG 13	524		17.40	SLUG 27	620	
6.40		525		17.60		621	
6.50		526		17.70		622	
6.60		527		17.80		623	
6.70		528		17.90		624	
6.80	SLUG 14	529		18.00		625	
6.90		530		18.10		626	
7.00		531		18.40	SLUG 28	627	
7.10		532		18.50		628	
7.20		533		18.60		629	
7.30	SLUG 15	534		18.70		630	
7.40		535		18.80		631	
7.50		536		18.90		632	
7.70	SLUG 16	537		19.10	SLUG 29	633	
7.80		538		19.20		634	
7.90		539		19.30		635	
8.00		540		19.40		636	
8.10		541		19.50		637	
8.20	SLUG 17	542		19.60	SLUG 30	638	
8.30		543		19.70		639	
8.40		544		19.76		639	
8.50		545		19.90		640	
8.60		546		20.00		641	
8.70	SLUG 18	547		20.10	SLUG 31	642	
8.80		548		20.20		643	
8.90		549		20.30		644	
9.00		550		20.40		645	
9.12		2369					
9.30	SLUG 19	551					
9.40		552					
9.50		553					
9.60		554					
9.70		555					
9.80	SLUG 20	556					
10.00		557					
10.10		558					
10.20		559					
10.30		560					
10.40	SLUG 21	561					
10.50		562					
10.60		563					

9,850 ± 250
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