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# Data report: grain size distribution of the late Cenozoic hemipelagic mud from Site C0011<sup>1</sup>

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## Abstract

We performed grain size analyses of late Cenozoic hemipelagic mud samples from Holes C0011C and C0011D recovered during Integrated Ocean Drilling Program Expedition 333 (December 2010–January 2011). Hemipelagic mud grains are coarsest in the uppermost 94 m interval; the median diameter is ~7.2  $\phi$ , although frequency distributions in the interval from 42 to 94 meters below seafloor (mbsf) are exceptionally broadened and flattened relative to the other horizons. Grain size fines downhole with fluctuations in the interval between 94 and 165 mbsf, where median grain size diameter fines downcore from 7 to 8  $\phi$ . Hemipelagic mud grains are finest in the interval from 165 to 380 mbsf. In this interval, median grain size diameter is consistently ~8  $\phi$ , although coarsening excursions are present between 214 and 254 mbsf and between 351 and 363 mbsf.

## Introduction

The purpose of this study is to provide information about grain sizes of hemipelagic mud in Holes C0011C and C0011D. Grain size distribution is one of the most important properties of sediment and is fundamental data used in studies of many fields.

Grain size distribution provides information about the origin and formative processes of sediment, including provenance, depositional environment, type and intensity of transport mechanisms, and depositional processes (e.g., Visher, 1969; McLaren, 1981; MacLaren and Bowles, 1985; Rea and Hovan, 1995; Holz et al., 2004). Therefore, grain size distribution can be a useful proxy in paleoenvironmental studies, especially when combined with other proxies.

Furthermore, physical properties of mud or mudstone are strongly influenced by grain size (Aplin and Macquaker, 2011). Hence, grain size distribution of the sediment deposited on the Philippine Sea plate at the Nankai Trough in Holes C0011C and C0011D will be an important data set when interpreting the downhole variation of several physical properties and the subsequent evolution of these properties during subduction (see the “Site C0011” chapter [Expedition 333 Scientists, 2012]).

<sup>1</sup>Saitoh, Y., 2014. Data report: grain size distribution of the late Cenozoic hemipelagic mud from Site C0011. In Henry, P., Kanamatsu, T., Moe, K., and the Expedition 333 Scientists, *Proc. IODP, 333*: Tokyo (Integrated Ocean Drilling Program Management International, Inc.).  
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## Methods and materials

### Materials

During Expedition 333, an ocean-floor sediment succession, mostly hemipelagic mud with intercalated ash layers, was sampled from the surface to 379.93 meters below seafloor (mbsf). A total of 277 samples (~10 mL, covering a depth interval of 2 cm) were collected from almost every 150 cm core section. Sand and volcanic ash layers were avoided during sampling; however, a few samples accidentally contain a significant amount of ash. A total of 276 samples were analyzed in this study. The average depth interval between samples is 1.38 m.

### Sample preparation

About 50 mg of each sediment sample, which was not dried or crushed, was soaked with 12 mL of 5.5 g/L sodium hexametaphosphate dispersant for >24 h and then was sonicated and well dispersed by hand shaking. Stiff lumps were gently crushed with a thin wood stick within the dispersant. To check for errors originating from nonhomogeneity of the samples, three aliquots using a different part of each sample block were made for 27 samples, selected from each consecutive 10 samples (Table T1).

### Grain size analysis

Grain size analysis was carried out using a Malvern Mastersizer 2000 laser diffractometer with an automated sample dispersion unit (Hydro 2000S) installed at the Kochi Core Center (Japan). Principles of the instrument are described in Sperazza et al. (2004). We adopted the procedure and analytical setting proposed by Sperazza et al. (2004) with some modification. In this study, samples dispersed in advance were poured into the dispersion unit, with pump speed and intensity of sonication set to 2000 rpm and 20%, respectively. The input amount of the samples was controlled so that obscuration fell within the 15%–20% range. The grain reflectance index and dispersant were set to 1.555 and 1.33, respectively. Particle absorption was set to 1. Each measurement run was set for 12 s, or 12,000 snaps, and repeated five times. Grain size analyses reported in this paper are the fifth result of the repetition series. Prior to accepting an analysis, we visually inspected the output from each of the five runs for consistency.

Results were compiled with Malvern's Mastersizer 2000 software as the volume frequency of 100 size

classes. The boundaries between classes are set as a geometric series from 0.02 to 2000  $\mu\text{m}$ . For convenience, we used the phi ( $\phi$ ) scale in the following text, table, and figures. The grain size unit  $\phi$  is derived as follows:

$$\phi = -\log_2(d/d_0),$$

where  $d$  (in millimeters) is the diameter of a particle and  $d_0$  is a reference diameter equal to 1 mm.

## Results

Results are shown in Figures F1 and F2 and in Table T1. Raw data of frequency distribution is provided in GRAINSIZ in "Supplementary material."

Errors derived from nonhomogeneity of samples were mostly <0.2  $\phi$ , except for mode diameter, in terms of standard deviation of each representative value derived from measurements of three different aliquots from each of 27 selected samples (Fig. F3). Correlation of standard deviation to 10-percentile and median diameter is a nonzero value by >0.99 probability, and that to mean diameter is >0.98 probability (Fig. F4). Smaller diameters tend to show smaller standard deviation values. Thus, a difference of ~0.2  $\phi$  in median diameter between different samples can be regarded significant if the median diameter is <7  $\phi$ .

Hemipelagic mud grains are coarsest in the uppermost 94 m interval, with median diameters of ~7.2  $\phi$ . However, the 42–94 mbsf interval is characterized by a broadened grain size frequency distribution. In contrast, median and 10-percentile diameters differ little from the uppermost 42 m interval; 90-percentile diameter is obviously coarser between 42 and 94 mbsf than in the uppermost interval. Frequency distributions are also flattened because of the low frequency of modal grain size (Fig. F1).

Grain size generally fines downcore with fluctuations in the 94 to 165 mbsf interval. Median and 90-percentile diameters fine from 7 to 8  $\phi$  and from 5 to 6  $\phi$ , respectively, whereas 10-percentile diameter fines slightly from 9.6 to 10  $\phi$  (Fig. F2A).

Hemipelagic mud grains are finest from 165 to 380 mbsf (Figs. F1, F2). In this interval, grain size shows narrow, sharp frequency distribution, and median diameter is almost steady at ~8  $\phi$ . A few excursions were observed between 254 and 214 mbsf, where median diameter coarsens to 6.5  $\phi$ , and between 351 and 363 mbsf, where median diameter coarsens to 5.3  $\phi$ .

## Acknowledgments

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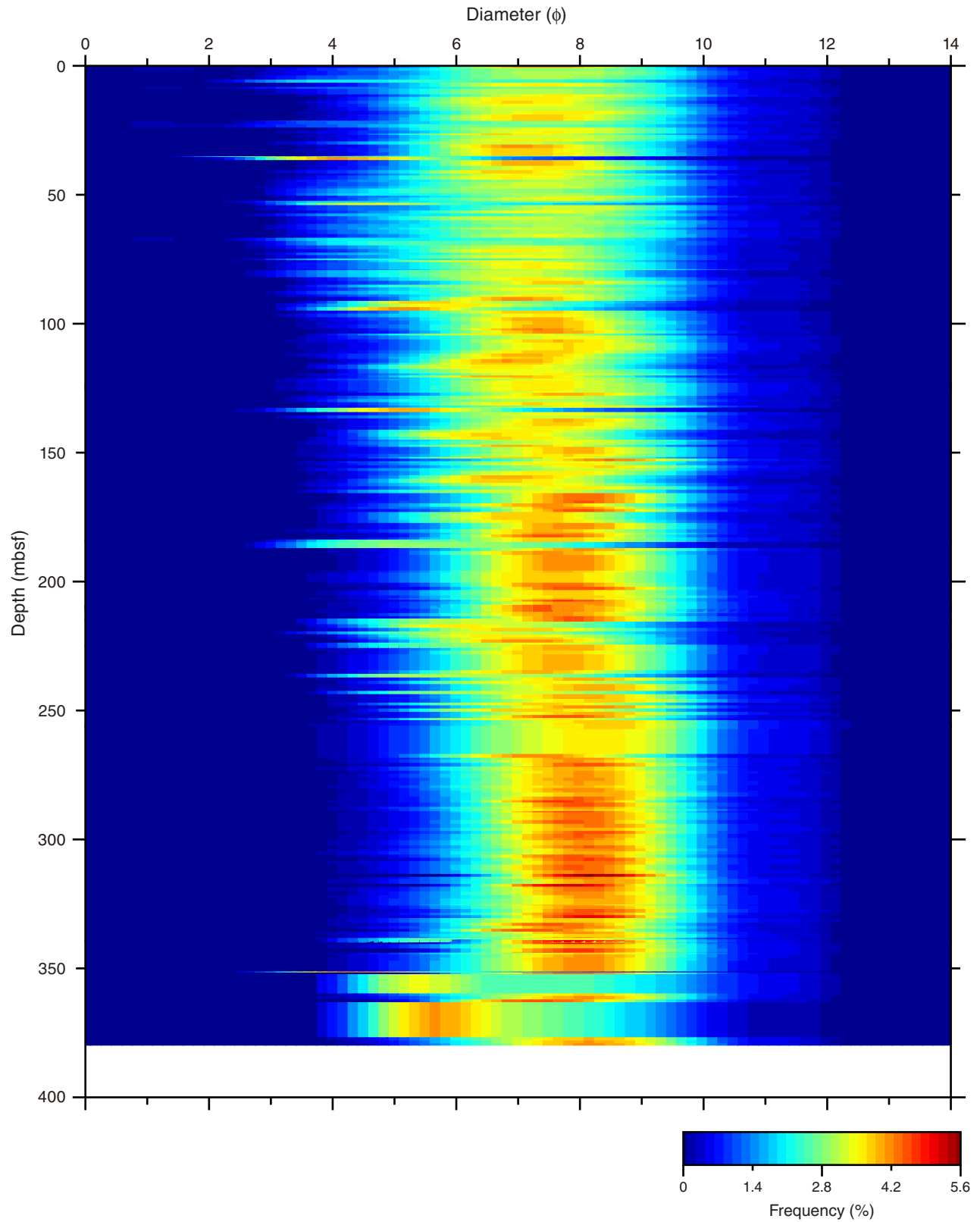
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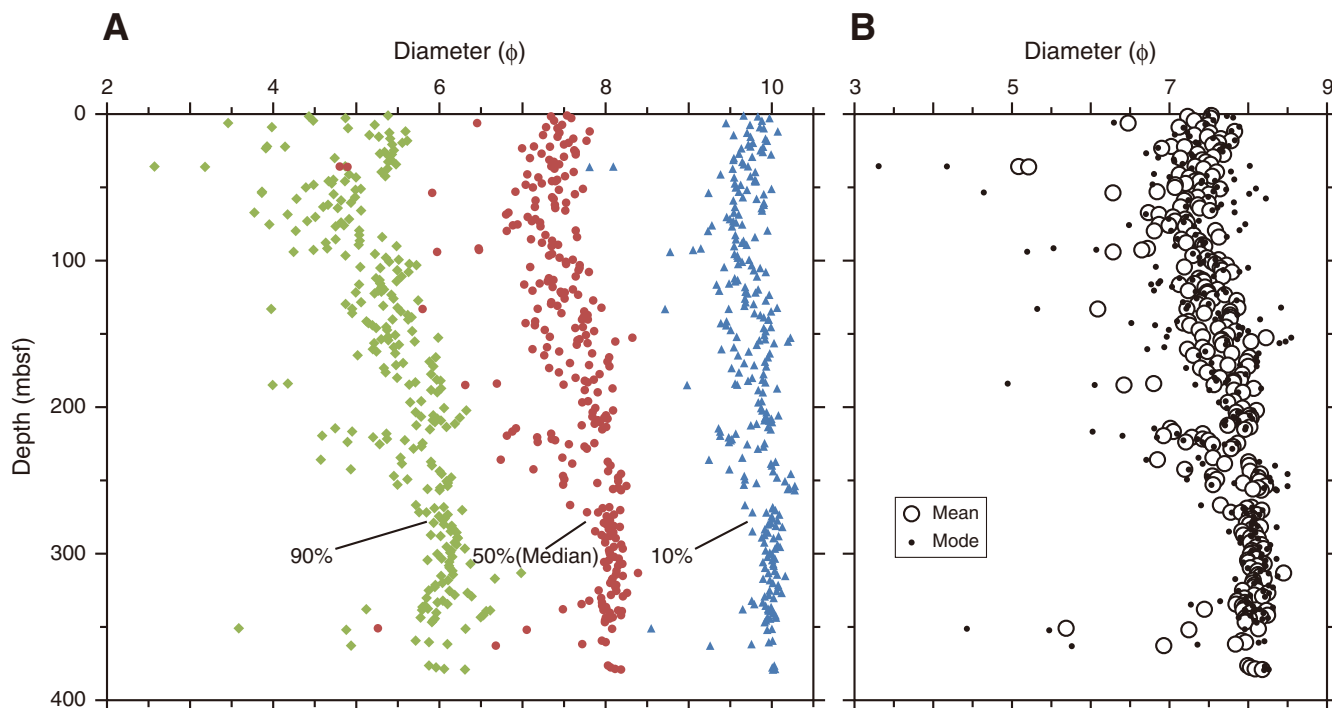
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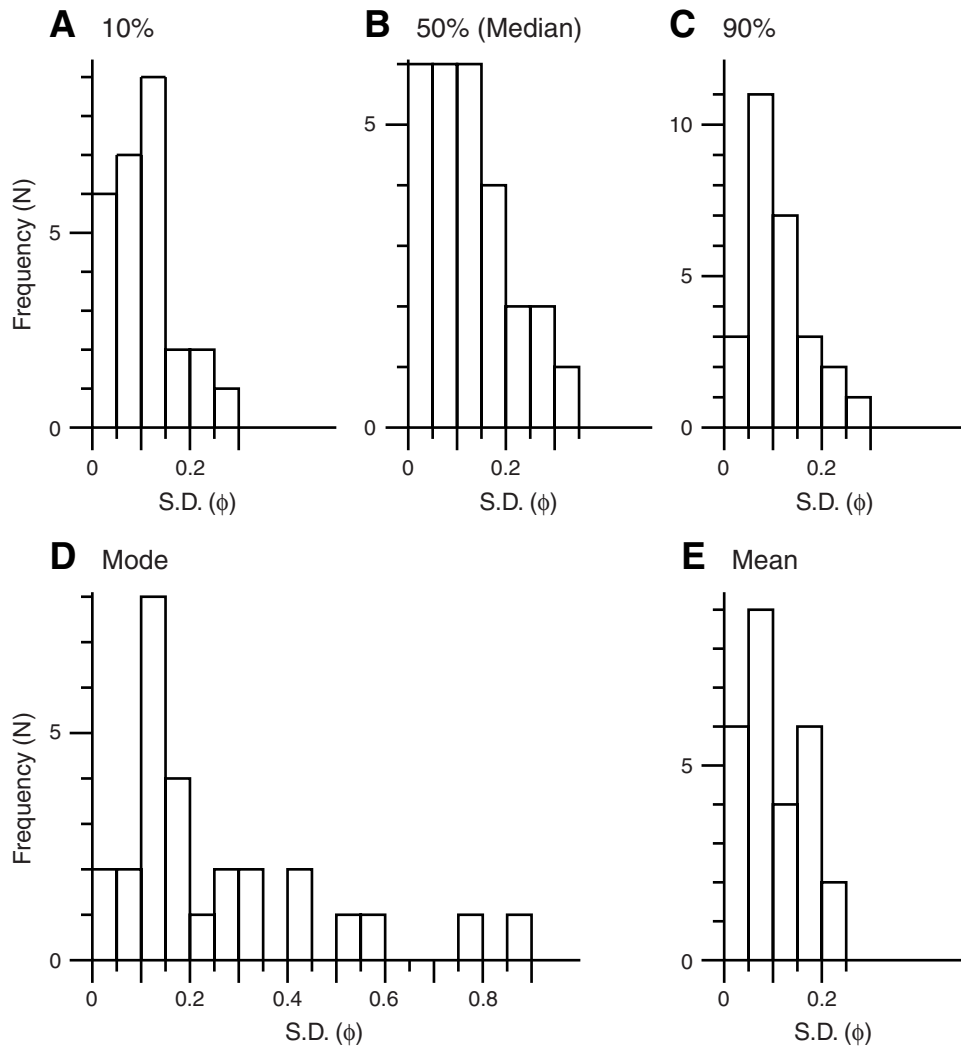
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**Figure F1.** Downcore variation of frequency distribution of grain size, Site C0011.

**Figure F2.** Downcore variation of representative values of grain size distributions, Site C0011. **A.** 10-, 50- (median), and 90-percentile diameter. **B.** Mode and mean diameter.



**Figure F3.** Histogram of standard deviation (S.D.) of representative values derived from measured values of three different aliquots from 27 selected samples, Site C0011. **A.** 10-percentile diameter. **B.** 50-percentile (median) diameter. **C.** 90-percentile diameter. **D.** Modal diameter. **E.** Mean diameter.



**Figure F4.** Correlation between average of each representative value and its standard deviation (S.D.) derived from measured values of three different aliquots from 27 selected samples, Site C0011. A. 10-percentile diameter. B. 50-percentile (median) diameter. C. 90-percentile diameter. D. Modal diameter. E. Mean diameter.

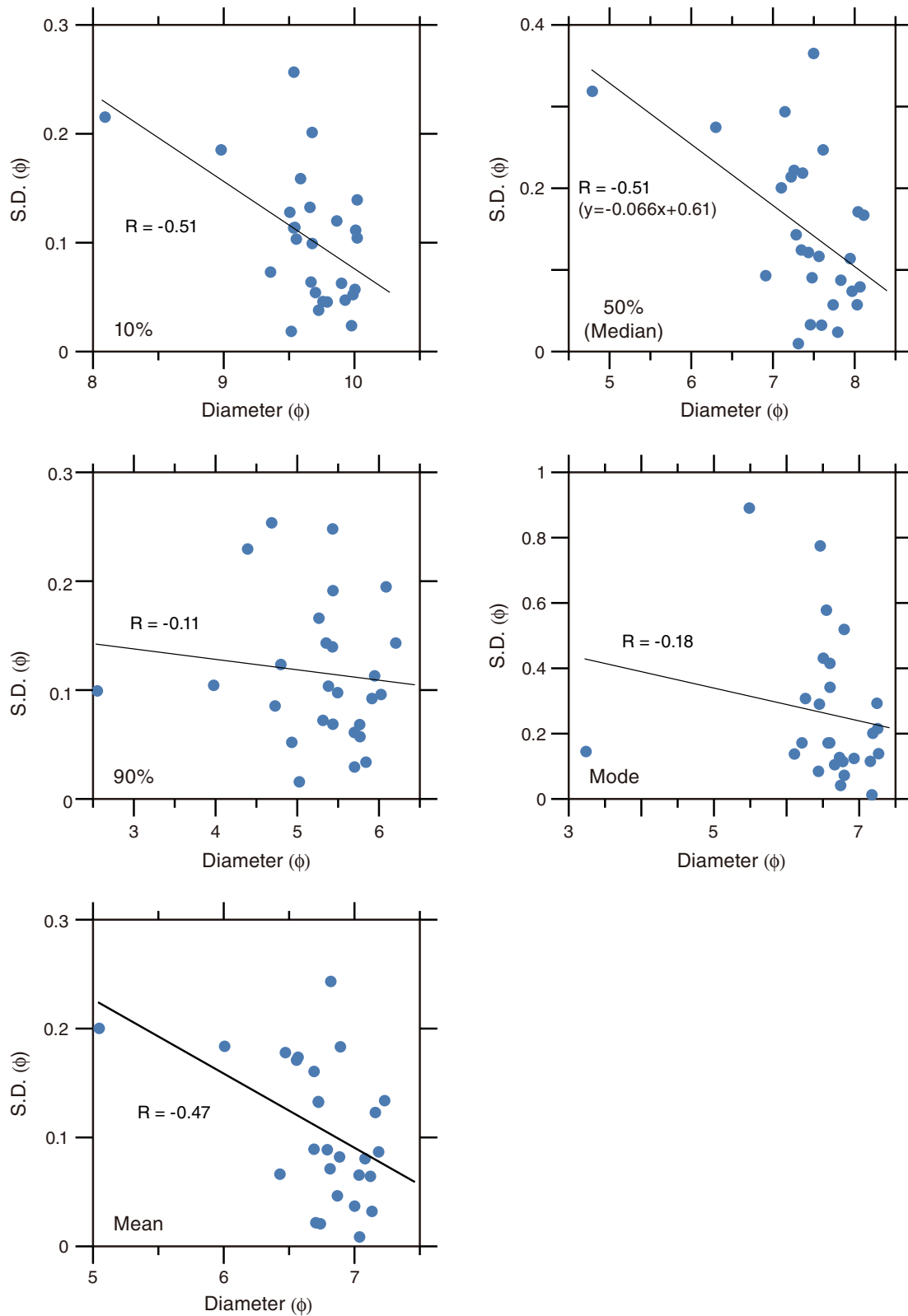


Table T1. Representative values of grain size distribution, Site C0011. (Continued on next five pages.)

Sample	Hole, core, section, interval (cm)	Core depth CSF-B (m)		10-percentile	50-percentile	90-percentile	Mean	Mode
		Top	Bottom					
333-								
1	C0011C-1H-1W, 44–46	0.422	0.441	9.66	7.53	5.37	7.53	7.49
2	C0011C-1H-3W, 24–26	1.040	1.060	9.84	7.34	4.41	7.23	7.73
3	C0011C-1H-5W, 20–22	2.181	2.201	9.98	7.58	4.86	7.52	7.81
4	C0011C-2H-1W, 49–51	3.971	3.990	9.88	7.37	4.47	7.31	7.56
5	C0011C-2H-3W, 81–83	5.613	5.633	9.45	6.45	3.44	6.46	6.29
6	C0011C-2H-4W, 60–62	6.775	6.795	9.74	7.47	5.21	7.48	7.46
7	C0011C-2H-6W, 88–90	8.413	8.432	9.86	7.28	3.97	7.12	7.89
8	C0011C-2H-7W, 22–24	9.134	9.153	9.91	7.41	4.89	7.42	7.18
9	C0011C-2H-9W, 109–111	11.324	11.343	10.08	7.80	5.58	7.83	7.79
10	C0011C-2H-11W, 62–64	12.236	12.256	9.64	7.32	5.27	7.41	6.96
10 rep.				9.73	7.46	5.43	7.54	7.19
10 rep.				9.74	7.53	5.45	7.58	7.53
10 average				9.70	7.44	5.39	7.51	7.22
10 S.D.				0.05	0.11	0.10	0.09	0.29
11	C0011C-3H-1W, 86–88	13.808	13.827	9.54	7.24	5.14	7.31	7.07
12	C0011C-3H-2W, 67–69	14.955	14.973	9.75	7.42	5.26	7.48	7.26
13	C0011C-3H-3W, 62–64	16.232	16.251	9.93	7.61	5.39	7.65	7.55
14	C0011C-3H-6W, 74–76	17.712	17.731	9.94	7.77	5.60	7.78	7.83
15	C0011C-3H-7W, 82–84	19.108	19.127	9.78	7.55	5.54	7.62	7.33
16	C0011C-3H-9W, 65–67	20.287	20.306	9.72	7.49	5.42	7.55	7.37
17	C0011D-1H-1W, 65–67	21.611	21.630	9.74	7.13	3.91	7.02	7.76
18	C0011C-3H-10W, 81–83	21.762	21.781	9.90	7.32	4.13	7.19	7.69
19	C0011D-1H-2W, 57–59	22.862	22.881	9.63	6.99	3.89	6.89	6.85
20	C0011D-1H-3W, 57–59	24.189	24.207	9.94	7.73	5.54	7.75	7.94
20 rep.				9.94	7.76	5.56	7.77	7.94
20 rep.				9.73	7.37	5.22	7.44	7.04
20 average				9.87	7.62	5.44	7.65	7.64
20 S.D.				0.12	0.22	0.19	0.18	0.52
21	C0011D-1H-5W, 18–20	25.355	25.374	9.89	7.63	5.33	7.63	7.68
22	C0011D-1H-6W, 2–4	26.526	26.545	9.61	7.22	5.27	7.35	6.70
23	C0011D-1H-7W, 38–40	27.072	27.09	10.00	7.63	5.42	7.68	7.28
24	C0011D-1H-8W, 87–89	28.656	28.675	9.77	7.49	5.39	7.55	7.31
25	C0011D-1H-9W, 40–42	29.550	29.569	9.55	7.08	4.72	7.13	6.85
26	C0011D-2H-1W, 28–30	30.772	30.792	9.54	7.32	5.41	7.41	7.05
27	C0011D-2H-2W, 31–33	32.158	32.177	9.65	7.37	5.37	7.46	7.06
28	C0011D-2H-3W, 61–63	33.830	33.850	9.66	7.44	5.47	7.52	7.17
29	C0011D-2H-4W, 56–58	35.162	35.182	9.72	7.34	4.85	7.32	8.02
30	C0011D-2H-4W, 76–78	35.357	35.376	7.86	4.47	2.44	4.84	3.13
30 rep.				8.11	4.88	2.61	5.12	3.41
30 rep.				8.29	5.01	2.61	5.22	3.32
30 average				8.09	4.79	2.55	5.06	3.29
30 S.D.				0.22	0.28	0.10	0.20	0.14
31	C0011D-2H-4W, 98–100	35.571	35.590	7.80	4.88	3.16	5.19	4.16
32	C0011D-2H-7W, 59–61	36.806	36.825	9.53	7.38	5.36	7.43	7.28
33	C0011D-2H-9W, 39–41	39.052	39.071	9.80	7.61	5.29	7.59	7.78
34	C0011D-3H-1W, 74–76	40.702	40.722	9.38	7.05	4.90	7.12	6.80
35	C0011D-3H-2W, 70–72	42.008	42.027	9.74	7.51	5.34	7.54	7.47
36	C0011D-3H-3W, 10–12	42.777	42.796	9.55	7.18	4.98	7.24	7.00
37	C0011D-3H-4W, 41–43	44.419	44.438	9.80	7.41	4.71	7.35	7.82
38	C0011D-3H-6W, 33–35	45.340	45.359	9.81	7.35	4.65	7.32	7.58
39	C0011D-3H-6W, 36–38	45.369	45.388	9.80	7.39	4.85	7.38	7.41
40	C0011D-3H-7W, 55–57	46.897	46.916	9.67	7.43	4.95	7.39	7.88
40 rep.				9.48	7.07	4.45	7.05	7.10
40 rep.				9.52	7.17	4.67	7.16	7.23
40 average				9.56	7.23	4.69	7.20	7.40
40 S.D.				0.10	0.19	0.25	0.17	0.41
41	C0011D-3H-8W, 9–11	47.813	47.832	9.63	7.03	4.47	7.07	6.78
42	C0011D-4H-1W, 82–84	49.653	49.669	9.57	7.12	4.38	7.06	7.60
43	C0011D-4H-2W, 67–69	50.661	50.677	10.00	7.72	5.04	7.64	8.10
44	C0011D-4H-3W, 8–10	51.322	51.338	9.70	7.43	4.98	7.40	7.72
45	C0011D-4H-6W, 59.5–61.5	52.592	52.609	9.60	6.91	3.85	6.83	7.56
46	C0011D-4H-7W, 34.5–36.5	53.345	53.361	9.24	5.90	3.85	6.27	4.63
47	C0011D-4H-8W, 8–10	54.261	54.277	9.91	7.63	4.71	7.50	8.02
48	C0011D-5H-1W, 88–90	56.341	56.360	9.65	7.35	4.97	7.35	7.49
49	C0011D-5H-2W, 66–68	57.474	57.493	9.82	7.37	4.26	7.21	8.23
50	C0011D-5H-3W, 38–40	58.554	58.573	9.49	7.11	4.72	7.13	7.20
50 rep.				9.31	6.91	4.94	7.04	6.49



Table T1 (continued). (Continued on next page.)

Sample	Hole, core, section, interval (cm)	Core depth CSF-B (m)		10-percentile	50-percentile	90-percentile	Mean	Mode
		Top	Bottom					
50 rep.				9.82	7.42	4.75	7.37	8.04
50 average				9.54	7.15	4.80	7.18	7.24
50 S.D.				0.26	0.26	0.12	0.17	0.77
51	C0011D-5H-4W, 60–62	60.107	60.126	9.91	7.52	4.92	7.49	7.82
52	C0011D-5H-6W, 68–70	61.555	61.574	9.91	7.38	4.65	7.36	7.66
53	C0011D-5H-7W, 76–78	62.983	63.002	9.56	7.14	4.59	7.14	7.21
54	C0011D-5H-8W, 18–20	63.772	63.791	9.88	7.39	4.76	7.38	7.61
55	C0011D-6H-1W, 48–50	65.456	65.475	9.89	7.51	5.04	7.51	7.55
56	C0011D-6H-2W, 59–61	66.905	66.924	9.54	6.82	3.76	6.72	7.83
57	C0011D-6H-3W, 50–52	68.154	68.173	9.60	6.80	4.16	6.86	6.70
58	C0011D-6H-5W, 90–92	69.878	69.897	9.46	7.06	4.49	7.04	7.21
59	C0011D-6H-6W, 105–107	71.360	71.379	9.50	7.15	4.90	7.19	6.99
60	C0011D-6H-7W, 105–107	72.704	72.724	9.41	6.92	4.16	6.87	7.19
60 rep.				9.64	7.26	4.62	7.23	7.40
60 rep.				9.56	7.13	4.41	7.09	7.53
60 average				9.54	7.11	4.39	7.06	7.37
60 S.D.				0.11	0.18	0.23	0.18	0.17
61	C0011D-6H-8W, 62–63	73.645	73.655	9.57	7.21	4.80	7.22	7.18
62	C0011D-7H-1W, 108–110	75.005	75.015	9.64	6.93	3.94	6.86	7.97
63	C0011D-7H-2W, 100–102	75.620	75.630	9.28	6.88	4.84	6.99	6.48
64	C0011D-7H-3W, 108–110	76.317	76.327	9.52	7.21	4.74	7.19	7.31
65	C0011D-8H-1W, 46–48	79.134	79.140	9.95	7.64	5.02	7.58	7.89
66	C0011D-8H-2W, 12–14	79.446	79.452	9.23	6.80	4.26	6.80	7.02
67	C0011D-9H-1W, 73–75	82.213	82.232	9.56	7.27	5.02	7.30	7.33
68	C0011D-9H-2W, 77–79	83.618	83.638	9.80	7.65	5.30	7.62	7.73
69	C0011D-9H-4W, 65–67	85.136	85.156	9.57	7.10	4.74	7.15	7.10
70	C0011D-9H-5W, 75–77	86.127	86.146	9.64	7.32	5.03	7.35	7.22
70 rep.				9.80	7.47	5.05	7.47	7.80
70 rep.				9.54	7.26	5.02	7.29	7.20
70 average				9.66	7.35	5.03	7.37	7.40
70 S.D.				0.13	0.11	0.02	0.09	0.34
71	C0011D-9H-6W, 74–76	87.493	87.513	9.64	7.23	4.62	7.21	7.45
72	C0011D-9H-7W, 79–81	88.904	88.924	9.70	7.42	5.01	7.42	7.43
73	C0011D-9H-8W, 54–56	89.851	89.870	9.55	7.34	5.47	7.44	7.07
74	C0011D-10H-1W, 96–98	91.411	91.430	9.15	6.46	4.63	6.71	5.52
75	C0011D-10H-2W, 68–70	92.455	92.474	9.05	6.47	4.47	6.64	6.06
76	C0011D-10H-3W, 70–72	93.817	93.836	8.78	5.96	4.23	6.27	5.18
77	C0011D-10H-4W, 73–75	95.169	95.188	9.55	7.35	5.21	7.39	7.30
78	C0011D-10H-6W, 51–53	96.308	96.327	9.59	7.31	4.86	7.29	7.49
79	C0011D-10H-7W, 63–65	97.756	97.774	9.59	7.44	5.34	7.47	7.38
80	C0011D-10H-8W, 68–70	99.141	99.160	9.74	7.59	5.43	7.60	7.62
80 rep.				9.69	7.58	5.45	7.59	7.58
80 rep.				9.76	7.63	5.61	7.67	7.54
80 average				9.73	7.60	5.50	7.62	7.58
80 S.D.				0.04	0.03	0.10	0.05	0.04
81	C0011D-11H-1W, 58–60	100.564	100.583	9.64	7.52	5.38	7.53	7.43
82	C0011D-11H-2W, 68–70	102.042	102.061	9.60	7.52	5.63	7.58	7.39
83	C0011D-11H-3W, 9–11	102.849	102.868	9.76	7.68	5.71	7.72	7.60
84	C0011D-11H-4W, 19–21	104.118	104.137	9.43	7.09	5.03	7.18	6.82
85	C0011D-11H-6W, 42–44	104.794	104.813	9.86	7.68	5.28	7.64	8.00
86	C0011D-11H-7W, 59–61	106.340	106.359	9.79	7.67	5.48	7.66	7.69
87	C0011D-11H-8W, 39–41	107.531	107.550	9.93	7.80	5.62	7.79	7.89
88	C0011D-12H-1W, 115–117	110.596	110.615	9.82	7.63	5.53	7.67	7.56
89	C0011D-12H-2W, 107–109	111.820	111.839	9.56	7.31	5.22	7.37	7.13
90	C0011D-12H-3W, 93–95	113.030	113.049	9.42	7.15	5.29	7.27	6.80
90 rep.				9.73	7.45	5.09	7.45	7.56
90 rep.				9.62	7.50	5.42	7.53	7.52
90 average				9.59	7.37	5.27	7.42	7.29
90 S.D.				0.16	0.19	0.17	0.13	0.43
91	C0011D-12H-4W, 46–48	113.921	113.940	9.56	7.30	5.47	7.43	6.88
92	C0011D-12H-6W, 101–103	115.427	115.446	9.49	7.20	5.27	7.31	6.86
93	C0011D-12H-7W, 33–35	116.127	116.146	9.34	7.01	5.02	7.12	6.76
94	C0011D-12H-8W, 64–66	117.814	117.833	9.68	7.36	5.29	7.45	7.03
95	C0011D-13H-1W, 82–84	119.488	119.499	9.84	7.60	5.32	7.61	7.68
96	C0011D-13H-2W, 80–82	120.323	120.335	9.37	7.11	5.25	7.23	6.80
97	C0011D-13H-3W, 63–65	121.063	121.075	9.68	7.45	5.29	7.49	7.33
98	C0011D-13H-4W, 46–48	121.563	121.575	9.81	7.50	4.98	7.47	7.72
99	C0011D-13H-6W, 63–65	122.235	122.247	9.71	7.47	5.21	7.48	7.44
100	C0011D-14H-1W, 85–87	125.740	125.758	9.51	7.26	5.29	7.35	6.99

Table T1 (continued). (Continued on next page.)

Sample	Hole, core, section, interval (cm)	Core depth CSF-B (m)		10-percentile	50-percentile	90-percentile	Mean	Mode
		Top	Bottom					
100 rep.				9.90	7.86	5.56	7.82	8.01
100 rep.				9.63	7.38	5.45	7.48	7.03
100 average				9.68	7.50	5.43	7.55	7.34
100 S.D.				0.20	0.32	0.14	0.24	0.58
101	C0011D-13H-7W, 75-77	123.151	123.162	9.97	7.66	5.41	7.70	7.60
102	C0011D-14H-2W, 89-91	126.999	127.016	9.93	7.85	5.73	7.85	7.86
103	C0011D-14H-3W, 88-90	128.218	128.235	9.69	7.34	5.04	7.38	7.17
104	C0011D-14H-4W, 92-94	129.481	129.498	9.78	7.34	4.86	7.35	7.50
105	C0011D-14H-6W, 88-90	130.696	130.713	9.67	7.41	5.31	7.48	7.24
106	C0011D-14H-7W, 95-97	132.011	132.028	10.07	7.95	5.48	7.87	8.42
107	C0011D-14H-8W, 39-41	132.751	132.768	9.48	7.18	4.94	7.22	7.21
108	C0011D-14H-8W, 55-57	132.890	132.908	8.71	5.79	3.96	6.08	5.31
109	C0011D-15H-1W, 109-111	134.523	134.542	9.99	7.74	5.52	7.77	7.73
110	C0011D-15H-2W, 99-101	135.762	135.781	9.81	7.50	4.95	7.46	7.70
110 rep.				9.83	7.45	4.88	7.42	7.67
110 rep.				9.74	7.45	4.98	7.43	7.49
110 average				9.79	7.46	4.94	7.44	7.62
110 S.D.				0.05	0.03	0.05	0.02	0.11
111	C0011D-15H-3W, 86-88	136.983	137.001	9.86	7.78	5.61	7.77	7.87
112	C0011D-15H-5W, 85-87	138.536	138.555	9.91	7.73	5.65	7.77	7.65
113	C0011D-15H-6W, 103-105	140.043	140.062	9.97	7.78	5.42	7.76	8.15
114	C0011D-15H-6W, 110-112	140.109	140.128	9.96	7.71	5.61	7.77	7.58
115	C0011D-15H-7W, 100-102	141.352	141.371	9.46	7.15	5.11	7.24	7.09
116	C0011D-15H-8W, 85-87	142.540	142.559	9.39	7.03	5.13	7.17	6.51
117	C0011D-16H-1W, 109-111	144.040	144.059	9.45	7.14	5.18	7.25	6.81
118	C0011D-16H-3W, 79-81	145.255	145.275	9.99	7.72	5.35	7.72	7.88
119	C0011D-16H-4W, 43-45	145.871	145.890	9.91	7.63	5.23	7.61	7.93
120	C0011D-16H-5W, 104-106	147.230	147.249	9.43	7.21	5.35	7.32	6.96
120 rep.				9.65	7.48	5.50	7.55	7.31
120 rep.				9.44	7.10	5.22	7.24	6.70
120 average				9.51	7.26	5.36	7.37	6.99
120 S.D.				0.13	0.19	0.14	0.16	0.31
121	C0011D-16H-6W, 44-46	148.007	148.026	9.93	7.86	5.66	7.84	8.00
122	C0011D-17H-1W, 86-88	150.725	150.742	9.91	7.76	5.46	7.74	7.89
123	C0011D-17H-2W, 83.5-85.5	151.910	151.927	9.58	7.32	5.37	7.42	6.96
124	C0011D-17H-3W, 14-16	152.525	152.542	10.23	8.32	5.98	8.23	8.55
125	C0011D-17H-4W, 20-22	153.592	153.609	9.92	7.68	5.29	7.66	7.86
126	C0011D-17H-5W, 82.5-84.5	154.326	154.343	9.85	7.66	5.37	7.65	7.73
127	C0011D-17H-7W, 15-17	155.148	155.165	10.20	8.11	5.69	8.04	8.48
128	C0011D-17H-8W, 25-27	156.253	156.270	10.03	7.78	5.20	7.71	8.40
129	C0011D-17H-9W, 13-15	157.345	157.362	9.82	7.65	5.50	7.67	7.72
130	C0011D-18H-2W, 36-38	159.043	159.062	9.42	7.16	5.38	7.30	6.76
130 rep.				9.59	7.31	5.22	7.38	7.10
130 rep.				9.63	7.40	5.71	7.56	6.93
130 average				9.55	7.29	5.44	7.42	6.93
130 S.D.				0.11	0.12	0.25	0.13	0.17
131	C0011D-18H-3W, 36-38	160.380	160.399	9.39	7.11	5.19	7.22	6.71
132	C0011D-18H-5W, 40-42	161.984	162.003	9.72	7.44	5.23	7.48	7.45
133	C0011D-18H-6W, 32-34	163.255	163.274	9.98	7.83	5.46	7.79	8.14
134	C0011D-18H-7W, 32-34	164.607	164.626	9.60	7.26	5.00	7.30	7.37
135	C0011D-18H-8W, 32-34	165.953	165.972	9.96	8.04	5.95	8.01	8.10
136	C0011D-19H-1W, 113-115	168.892	168.908	9.92	8.02	5.87	7.98	8.12
137	C0011D-19H-2W, 100-102	169.898	169.914	9.67	7.57	5.55	7.61	7.53
138	C0011D-19H-4W, 108-110	171.263	171.279	9.79	7.80	5.47	7.74	7.90
139	C0011D-19H-5W, 74-76	172.123	172.139	9.94	8.04	5.92	8.00	8.11
140	C0011D-19H-6W, 80-82	173.280	173.295	9.54	7.32	5.37	7.41	7.15
140 rep.				9.52	7.32	5.24	7.37	7.30
140 rep.				9.50	7.31	5.34	7.39	7.18
140 average				9.52	7.31	5.32	7.39	7.21
140 S.D.				0.02	0.01	0.07	0.02	0.08
141	C0011D-20H-2W, 98-100	176.296	176.314	9.61	7.43	5.34	7.47	7.54
142	C0011D-20H-3W, 85-87	177.502	177.521	9.90	7.92	5.89	7.92	7.97
143	C0011D-20H-5W, 91-93	178.868	178.887	NA	NA	NA	NA	NA
144	C0011D-20H-6W, 66-68	179.971	179.990	9.77	7.63	5.48	7.64	7.57
145	C0011D-21H-1W, 109.5-111.5	181.289	181.304	9.89	7.85	5.96	7.90	7.75
146	C0011D-21H-2W, 66.5-68.5	181.988	182.003	9.72	7.74	6.00	7.81	7.59
147	C0011D-21H-5W, 32-34	183.080	183.095	9.92	7.78	5.70	7.81	7.72
148	C0011D-22H-1W, 65.5-67.5	184.663	184.668	9.59	7.49	5.63	7.56	7.33
149	C0011D-21H-6W, 33-35	183.952	183.967	9.56	6.68	4.16	6.79	4.93

Table T1 (continued). (Continued on next page.)

Sample	Hole, core, section, interval (cm)	Core depth CSF-B (m)		10-percentile	50-percentile	90-percentile	Mean	Mode
		Top	Bottom					
150	C0011D-22H-2W, 20–22	184.897	184.902	8.95	6.34	4.06	6.45	6.17
150 rep.				9.18	6.52	4.01	6.57	6.86
150 rep.				8.81	6.04	3.86	6.21	5.09
150 average				8.98	6.30	3.98	6.41	6.04
150 S.D.				0.19	0.24	0.10	0.18	0.89
151	C0011D-23T-1W, 125–127	187.250	187.270	10.07	8.08	6.01	8.07	8.17
152	C0011D-23T-2W, 99–101	188.395	188.415	9.84	7.74	5.89	7.82	7.51
153	C0011D-23T-3W, 109–111	189.905	189.925	9.90	7.90	5.96	7.93	7.88
154	C0011D-24T-1W, 50.5–52.5	196.005	196.025	9.88	7.78	5.77	7.82	7.71
155	C0011D-24T-2W, 35–37	196.765	196.785	9.84	7.71	5.64	7.74	7.63
156	C0011D-25T-1W, 69–71	200.69	200.710	9.87	7.87	6.05	7.93	7.73
157	C0011D-25T-3W, 114–116	202.305	202.325	9.89	8.09	6.31	8.11	8.07
158	C0011D-25T-4W, 97–99	203.540	203.560	9.94	7.84	5.70	7.85	7.87
159	C0011D-26X-1W, 109–111	205.656	205.668	10.08	8.00	5.92	8.02	8.03
160	C0011D-26X-2W, 127–129	206.613	206.624	9.88	7.75	5.70	7.78	7.67
160 rep.				9.95	7.89	5.84	7.90	7.90
160 rep.				9.97	7.87	5.77	7.88	7.86
160 average				9.93	7.84	5.77	7.85	7.81
160 S.D.				0.05	0.08	0.07	0.07	0.12
161	C0011D-26X-4W, 68–70	207.301	207.314	9.92	7.98	6.24	8.04	7.84
162	C0011D-26X-5W, 74–76	207.990	208.002	10.00	8.02	5.96	8.01	8.05
163	C0011D-27X-1W, 44–46	210.330	210.345	10.01	7.93	5.94	7.96	7.88
164	C0011D-26X-6W, 109–111	209.046	209.058	9.91	7.90	5.91	7.92	7.88
165	C0011D-27X-2W, 52–54	211.445	211.460	9.82	7.86	6.18	7.95	7.69
166	C0011D-26X-7W, 10–12	209.296	209.308	9.97	7.90	6.01	7.95	7.71
167	C0011D-27X-4W, 17–19	212.508	212.523	9.75	7.71	5.71	7.74	7.71
168	C0011D-27X-5W, 60–62	213.656	213.671	9.96	8.00	6.07	8.02	7.97
169	C0011D-28X-1W, 32–35	215.296	215.324	9.99	7.96	5.88	7.96	7.96
170	C0011D-27X-6W, 40–42	214.561	214.576	9.42	6.91	4.65	7.00	6.84
170 rep.				9.28	6.83	4.72	6.94	6.65
170 rep.				9.38	7.00	4.82	7.07	6.92
170 average				9.36	6.91	4.73	7.00	6.80
170 S.D.				0.07	0.08	0.09	0.07	0.14
171	C0011D-28X-2W, 50–52	216.773	216.792	9.38	6.87	4.94	7.04	6.02
172	C0011D-28X-3W, 67–69	218.232	218.250	9.57	7.34	5.35	7.42	7.09
173	C0011D-28X-4W, 73–75	219.593	219.611	9.38	6.81	4.57	6.92	6.40
174	C0011D-29X-1W, 81–83	220.690	220.707	9.48	7.17	5.19	7.28	6.84
175	C0011D-29X-2W, 82–84	221.895	221.912	9.52	7.35	5.36	7.42	7.36
176	C0011D-29X-3W, 40–42	222.738	222.756	9.51	7.39	5.57	7.49	7.18
177	C0011D-29X-5W, 37–39	223.923	223.939	9.49	7.18	4.88	7.20	7.42
178	C0011D-30X-1W, 48–50	225.480	225.500	9.71	7.55	5.27	7.54	7.70
179	C0011D-29X-CC, 12–13	224.732	224.740	9.92	7.86	5.79	7.87	7.86
180	C0011D-30X-2W, 65–67	227.050	227.070	9.90	7.73	5.71	7.78	7.60
180 rep.				9.84	7.70	5.83	7.79	7.42
180 rep.				9.97	7.79	5.78	7.85	7.67
180 average				9.90	7.74	5.77	7.81	7.56
180 S.D.				0.06	0.05	0.06	0.04	0.13
181	C0011D-30X-3W, 85–87	228.475	228.495	9.84	7.77	5.68	7.78	7.80
182	C0011D-31X-1W, 14–16	234.640	234.660	9.65	7.47	5.52	7.55	7.37
183	C0011D-31X-2W, 14–16	236.025	236.045	9.24	6.73	4.56	6.84	6.70
184	C0011D-31X-3W, 14–16	237.435	237.455	10.05	8.02	5.89	8.00	8.14
185	C0011D-31X-5W, 29–31	238.740	238.760	9.99	7.59	5.54	7.70	7.42
186	C0011D-31X-6W, 14–16	240.000	240.020	10.00	8.06	5.90	8.01	8.34
187	C0011D-32X-1W, 127–129	242.638	242.656	9.49	7.13	4.92	7.19	7.24
188	C0011D-32X-2W, 127–129	243.897	243.915	10.02	8.03	5.99	8.02	8.11
189	C0011D-32X-5W, 134–136	245.756	245.774	10.23	8.18	6.02	8.16	8.50
190	C0011D-33X-1W, 75–77	247.196	247.214	9.68	7.52	5.47	7.57	7.54
190 rep.				9.73	7.54	5.49	7.59	7.54
190 rep.				9.60	7.39	5.36	7.46	7.36
190 average				9.67	7.48	5.44	7.54	7.48
190 S.D.				0.06	0.08	0.07	0.07	0.10
191	C0011D-33X-2W, 50–52	248.249	248.267	10.07	8.15	6.13	8.13	8.27
192	C0011D-33X-4W, 34–36	249.487	249.506	9.68	7.50	5.60	7.60	7.22
193	C0011D-33X-5W, 32–34	250.767	250.786	10.16	8.15	6.08	8.14	8.29
194	C0011D-34X-1W, 72–74	251.997	252.010	9.82	7.90	6.09	7.94	7.82
195	C0011D-34X-2W, 98–100	253.145	253.159	9.67	7.48	5.48	7.55	7.53
196	C0011D-34X-3W, 81–83	254.000	254.014	10.28	8.25	6.09	8.22	8.51
197	C0011D-35X-1W, 42–44	256.920	256.940	10.28	8.18	5.99	8.17	8.37
198	C0011D-34X-5W, 87–89	255.290	255.303	10.21	8.15	6.00	8.13	8.20

Table T1 (continued). (Continued on next page.)

Sample	Hole, core, section, interval (cm)	Core depth CSF-B (m)		10-percentile	50-percentile	90-percentile	Mean	Mode
		Top	Bottom					
199	C0011D-34X-6W, 73–75	256.165	256.179	10.20	8.09	5.85	8.06	8.35
200	C0011D-36X-1W, 115.5–117.5	267.087	267.106	9.79	7.68	5.74	7.74	7.58
200 rep.				9.64	7.54	5.69	7.62	7.38
200 rep.				9.60	7.48	5.69	7.58	7.24
200 average				9.68	7.57	5.71	7.64	7.40
200 S.D.				0.10	0.10	0.03	0.08	0.17
201	C0011D-36X-2W, 133.5–135.5	268.580	268.599	10.01	8.04	6.04	8.05	8.05
202	C0011D-36X-3W, 60.5–62.5	269.229	269.248	10.02	7.96	5.93	7.98	7.94
203	C0011D-36X-4W, 59.5–61.5	270.543	270.562	10.05	8.17	6.27	8.17	8.19
204	C0011D-36X-6W, 78–80	272.045	272.063	9.77	7.77	5.74	7.78	7.79
205	C0011D-36X-6W, 90.5–92.5	272.162	272.181	9.94	7.91	5.83	7.91	7.98
206	C0011D-36X-7W, 103–105	273.608	273.626	10.09	8.10	6.09	8.11	8.15
207	C0011D-36X-8W, 83–85	274.747	274.766	10.00	8.01	5.99	8.02	8.07
208	C0011D-37X-1W, 86–88	276.288	276.306	10.01	8.04	6.05	8.05	8.09
209	C0011D-37X-2W, 85–87	277.543	277.561	10.07	8.05	6.03	8.06	8.07
210	C0011D-37X-3W, 130–132	279.247	279.266	10.00	8.01	5.94	8.00	8.21
210 rep.				10.04	8.01	6.00	8.03	8.05
210 rep.				9.94	7.90	5.82	7.90	8.00
210 average				9.99	7.97	5.92	7.98	8.09
210 S.D.				0.05	0.06	0.09	0.06	0.11
211	C0011D-37X-5W, 71–73	280.315	280.333	9.96	8.01	6.04	8.02	8.04
212	C0011D-37X-6W, 72–74	281.314	281.332	10.05	8.09	6.14	8.11	8.12
213	C0011D-37X-7W, 51–53	282.042	282.060	10.13	8.17	6.12	8.16	8.37
214	C0011D-38X-1W, 113–115	283.630	283.650	9.92	8.03	6.16	8.05	8.04
215	C0011D-38X-2W, 114–116	285.050	285.070	9.77	7.87	6.13	7.92	7.76
216	C0011D-38X-4W, 20–22	285.890	285.910	9.96	8.09	6.20	8.09	8.09
217	C0011D-38X-5W, 134–136	287.615	287.635	9.91	7.95	5.89	7.94	8.03
218	C0011D-38X-6W, 67–69	288.345	288.365	10.08	8.05	6.00	8.06	8.05
219	C0011D-38X-7W, 10–12	289.255	289.275	9.88	7.99	6.21	8.03	7.90
220	C0011D-38X-CC, 7–9	289.765	289.785	10.09	8.23	6.35	8.24	8.26
220 rep.				10.08	8.17	6.22	8.17	8.22
220 rep.				9.90	7.95	6.07	7.98	7.90
220 average				10.02	8.12	6.21	8.13	8.13
220 S.D.				0.10	0.15	0.14	0.13	0.20
221	C0011D-39X-1W, 76–78	292.729	292.748	9.91	7.99	6.17	8.03	7.90
222	C0011D-39X-2W, 86–88	294.167	294.186	10.07	8.18	6.20	8.17	8.28
223	C0011D-39X-3W, 104–105	295.691	295.700	10.10	8.10	6.08	8.10	8.15
224	C0011D-39X-4W, 94–96	296.937	296.956	10.04	8.20	6.30	8.20	8.24
225	C0011D-39X-6W, 77–79	298.135	298.154	9.93	8.04	6.13	8.05	8.05
226	C0011D-39X-7W, 96–98	299.679	299.698	9.98	8.05	6.12	8.06	8.02
227	C0011D-39X-8W, 45–47	300.546	300.565	10.01	8.05	5.96	8.03	8.18
228	C0011D-40X-1W, 111–113	302.549	302.568	9.95	8.10	6.15	8.08	8.17
229	C0011D-40X-2W, 95–97	303.726	303.745	10.04	8.15	6.02	8.10	8.36
230	C0011D-40X-3W, 67–69	304.799	304.818	10.06	8.08	5.81	8.02	8.36
230 rep.				10.02	8.05	5.86	8.00	8.23
230 rep.				9.95	7.98	5.87	7.96	8.08
230 average				10.01	8.04	5.85	7.99	8.22
230 S.D.				0.06	0.05	0.03	0.03	0.14
231	C0011D-40X-4W, 63–65	306.094	306.113	9.90	7.98	6.11	8.00	7.94
232	C0011D-40X-6W, 71–73	307.328	307.346	10.02	8.20	6.36	8.20	8.21
233	C0011D-40X-7W, 67–69	308.623	308.642	10.03	8.15	6.11	8.12	8.22
234	C0011D-40X-8W, 75–77	310.031	310.050	9.92	8.01	6.11	8.03	8.00
235	C0011D-41X-1W, 117–119	312.170	312.190	10.04	8.13	6.15	8.12	8.16
236	C0011D-41X-2W, 127–129	313.620	313.640	9.96	8.39	6.98	8.45	8.26
237	C0011D-41X-3W, 96–98	314.720	314.740	10.07	8.12	6.15	8.13	8.10
238	C0011D-41X-4W, 41–43	315.585	315.605	10.16	8.20	6.01	8.16	8.38
239	C0011D-41X-6W, 74–76	317.515	317.535	9.90	8.08	6.66	8.21	7.84
240	C0011D-41X-7W, 35–37	318.535	318.555	10.00	8.15	6.32	8.16	8.12
240 rep.				9.98	8.03	5.99	8.02	8.10
240 rep.				9.96	8.04	5.97	8.01	8.12
240 average				9.98	8.07	6.09	8.06	8.11
240 S.D.				0.02	0.07	0.19	0.09	0.01
241	C0011D-42X-1W, 46.5–48.5	320.443	320.462	10.02	8.05	6.03	8.06	8.08
242	C0011D-42X-2W, 53–55	321.844	321.863	10.08	8.13	5.94	8.08	8.26
243	C0011D-42X-3W, 55–57	323.197	323.216	10.08	8.11	5.94	8.07	8.32
244	C0011D-42X-5W, 117–119	325.517	325.536	9.98	7.91	5.86	7.93	7.88
245	C0011D-42X-6W, 12–14	325.860	325.879	10.06	8.13	6.11	8.12	8.20
246	C0011D-42X-7W, 13–15	327.208	327.227	10.12	8.26	6.33	8.25	8.27
247	C0011D-42X-8W, 21–23	328.623	328.642	9.96	8.06	6.17	8.08	8.03

Table T1 (continued).

Sample	Hole, core, section, interval (cm)	Core depth CSF-B (m)		10-percentile	50-percentile	90-percentile	Mean	Mode
		Top	Bottom					
248	C0011D-43X-1W, 14-16	329.615	329.631	9.92	8.21	6.38	8.18	8.22
249	C0011D-43X-2W, 12-14	330.732	330.748	10.03	7.94	5.83	7.95	7.97
250	C0011D-43X-4W, 58-60	332.579	332.595	9.71	7.78	6.13	7.86	7.57
250 rep.				9.79	7.81	5.94	7.85	7.71
250 rep.				9.78	7.81	6.02	7.87	7.66
250 average				9.76	7.80	6.03	7.86	7.65
250 S.D.				0.05	0.02	0.10	0.01	0.07
251	C0011D-43X-5W, 62-64	333.765	333.782	9.89	7.95	5.97	7.96	7.99
252	C0011D-44X-1W, 49-51	334.912	334.929	9.79	7.71	6.09	7.84	7.27
253	C0011D-44X-2W, 36-38	335.987	336.004	9.93	7.95	5.82	7.93	8.06
254	C0011D-44X-3W, 3-5	336.891	336.908	9.99	8.00	5.78	7.96	8.32
255	C0011D-44X-5W, 61-63	338.055	338.072	9.96	8.00	5.85	7.97	8.15
256	C0011D-44X-6W, 45-47	338.450	338.466	9.65	7.48	5.11	7.44	7.96
257	C0011D-45X-1W, 24-26	339.720	339.738	10.00	8.19	6.55	8.24	8.06
258	C0011D-44X-6W, 112-114	339.013	339.029	9.96	7.97	5.78	7.93	8.09
259	C0011D-44X-CC, 4-6	339.240	339.256	9.97	8.15	6.60	8.23	7.95
260	C0011D-45X-2W, 3-5	340.816	340.835	9.99	8.06	6.06	8.06	8.11
260 rep.				9.91	7.89	5.84	7.89	7.96
260 rep.				10.18	8.19	5.95	8.13	8.52
260 average				10.02	8.05	5.95	8.03	8.20
260 S.D.				0.14	0.15	0.11	0.12	0.29
261	C0011D-45X-4W, 5-7	342.500	342.518	10.05	8.18	6.52	8.25	8.03
262	C0011D-45X-5W, 55-57	343.890	343.908	9.95	8.08	6.49	8.16	7.88
263	C0011D-45X-CC, 5-7	344.147	344.165	10.05	8.00	5.76	7.96	8.25
264	C0011D-46X-1W, 33-35	344.804	344.823	9.98	8.04	5.94	8.02	8.18
265	C0011D-46X-2W, 25-27	346.022	346.041	9.93	7.99	5.91	7.97	8.08
266	C0011D-46X-4W, 19-21	347.277	347.295	9.92	7.99	5.90	7.96	8.11
267	C0011D-47X-3W, 18-20	351.447	351.462	8.55	5.25	3.57	5.67	4.41
268	C0011D-47X-4W, 27-29	351.818	351.833	10.00	8.07	6.31	8.13	7.96
269	C0011D-47X-6W, 19-21	352.489	352.504	9.95	7.04	4.87	7.24	5.46
270	C0011D-49X-1W, 56-58	359.954	359.970	10.10	8.01	5.67	7.96	8.37
270 rep.				10.04	8.00	5.77	7.97	8.29
270 rep.				9.89	7.84	5.67	7.83	7.97
270 average				10.01	7.95	5.70	7.92	8.21
270 S.D.				0.11	0.10	0.06	0.08	0.21
271	C0011D-49X-2W, 38-40	360.936	360.952	9.97	8.00	5.86	7.97	8.14
272	C0011D-49X-4W, 14-16	362.278	362.295	9.76	7.71	6.09	7.84	7.35
273	C0011D-49X-5W, 6-8	363.357	363.374	9.26	6.67	4.92	6.92	5.75
274	C0011D-52X-2W, 55-57	376.945	376.965	10.03	8.02	5.86	7.99	8.21
275	C0011D-52X-3W, 41-43	378.220	378.240	10.01	8.06	5.95	8.03	8.22
276	C0011D-52X-5W, 31-33	379.260	379.280	10.04	8.11	6.05	8.09	8.27
277	C0011D-52X-CC, 12-14	379.700	379.720	10.02	8.18	6.30	8.18	8.21

rep. = repeat measurement, S.D. = standard deviation. NA = not applicable.