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13. Data Report: Alkenone Compounds and Major Element Composition in Late Quaternary Hemipelagic Sediments from ODP Site 1151 off Sanriku, Northern Japan[1]

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INTRODUCTION

Ocean Drilling Program (ODP) Site 1151 (Sacks, Suyehiro, Acton, et al., 2000) is located in an area where the surface water mass is influenced by both the Kuroshio and Oyashio Currents. The site also receives a relatively high flux of detrital materials from riverine input from Honsyu Island and eolian input from Central and East Asia. We analyzed alkenones and alkenoates in the sediments to reconstruct alkenone unsaturation index (Uk'_{37})–based sea-surface temperature (SST), total organic carbon, and total nitrogen to estimate the terrigenous contribution by the C/N ratio during the last glacial–interglacial cycle. The major elements were also analyzed to examine the variation in terrigenous composition.

SAMPLES

A total of 75 samples were taken at 30-cm intervals from Cores 186-1151C-1H through 3H. The subbottom depth (in a modified meters below seafloor [mbsf*] depth scale; equation shown in Table T1) for each sample was corrected for the effect of core expansion when core recovery exceeds 100%.

T1. Sample depth correction, p. 7.

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Currently, only a crude age model is available, but comparison of the magnetic susceptibility profile of Leg 186 cores with that of nearby core LM 8 (Yamane and Oba, 1999) suggests that the studied interval (0 to ~21.0 mbsf*) covers the last 150 to 200 k.y. The uppermost datum level, which is based on occurrences of diatoms in the Hole 1151C core is at ~21.44 to ~26.43 mbsf, which corresponds to 0.3 Ma (Sacks, Suyehiro, Acton, et al., 2000). This is basically consistent with our age model, based on comparison of the magnetic susceptibility profile of Leg 186 cores with that of nearby core LM 8.

METHODS

Alkenones

Long-chain alkenones were analyzed to estimate paleo-SSTs. The analytical method is based on Yamamoto et al. (2000) with slight modifications. A 1-g sample of freeze-dried sediment was ultrasonic extracted with dichloromethane:methanol (6:4) for 6 min then concentrated and passed through a short bed of Na_2SO_4 to remove water, yielding a solvent extraction.

An aliquot of the lipid extract was separated into four fractions by column chromatography (eluants are as follows: F1 = 3 mL *n*-hexane, F2 = 3 mL *n*-hexane:toluene [3:1], F3 = 4 mL toluene, and F4 = 3 mL toluene:methanol [3:1]). The column was 5.5 mm in diameter × 45 mm long and was filled with 5% deactivated SiO_2. C_{36} *n*-alkane was added as an internal standard into fraction F3 (alkenone and alkenoates). Fraction F3 was dissolved in 100 µL of *n*-hexane, and a 1-µL aliquot was then analyzed by gas chromatography at Hokkaido University, on a Hewlett-Packard Model 6890 gas chromatograph equipped with a 6-m × 0.25-µm (0.25 µm film thickness) CP-Sil 5CB (Chrompack) capillary column. For the analysis of the F3 fraction, the oven temperature was programmed from 70° to 310°C at 20°C/min ramp rate and then held at 310° for 40 min. Identification of alkenone compounds was based on comparison of mass spectra and retention time with those in the literature (e.g., de Leeuw et al., 1980; Volkman et al., 1980). The unsaturation index of alkenone was calculated as

$$Uk'_{37} = (C37{:}2)/[(C37{:}2) + (C37{:}3)],$$

where [C37:2] and [C37:3] are the concentration of C_{37} in each compound (Prahl and Wakeham, 1987). The calculation of paleotemperature was conducted according to the equation

$$Uk'_{37} = 0.034\ SST + 0.039,$$

based on an experimental result for cultured *Emiliania huxleyi* (Prahl et al., 1988).

Organic Carbon, Nitrogen, and Sulfur in Acid-Treated Samples

Organic carbon (Org-C), nitrogen (N), and sulfur (S) contents in acid-treated samples were determined for all 75 samples. Approximately 0.2–0.3 g of powdered sample was treated with 1-M HCl for ~12 hr, then was washed two times with 50 mL deionized filtered water (DIFW) to remove HCl and sea salt. These samples were then dried at 70°C in a glass centrifuge tube for ~24 hr. The samples were analyzed using a LECO-CNS2000 elemental analyzer at the Department of Earth and Planetary Science, Tokyo University. Approximately 0.1 g of sample was weighed in a ceramic crucible and oxidized at 1350°C. The evolved C and S were measured in an infrared absorption analyzer, and N was measured in a thermal conductivity analyzer. The standard deviations for six duplicate analyses are C = 0.251, N = 0.064, and S = 0.081.

Major Element Oxides

The concentrations of 10 major element oxides (SiO_2, TiO_2, Al_2O_3, Fe_2O_3, MnO, CaO, Na_2O, K_2O, and P_2O_5) were determined for all 75 samples by X-ray fluorescence (XRF) analysis of fused glass beads using a Philips-PW1480 at the Department of Earth and Planetary Science, University of Tokyo. Powdered samples were dried at 110°C for >4 hr and were then ignited at 1000°C for 6 hr. Loss on ignition (LOI) was calculated from the weight loss. Approximately 0.4 g of ignited sample was mixed with ~4 g of $Li_2B_4O_7$ flux with an exact 1:10 mixing ratio and was fused in a platinum crucible to make a glass bead. The accuracy of these analyses are ±0.7% for SiO_2, ±1.2% for TiO_2, ±1.3% for Al_2O_3, ±2.0% for Fe_2O_3, ±3.8% for MnO, ±1.5% for MgO, ±2.9% for CaO, ±3.9% for Na_2O, ±3.9% for K_2O, and ±4.6% for P_2O_5 (Yoshida and Takahashi, 1997).

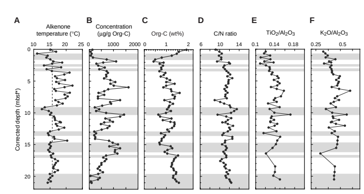
ANALYTICAL RESULTS

Uk'_{37}-SST

Uk'_{37}-derived paleotemperature (Uk'_{37}-SST) ranges between 11.1° and 21.9°C (Table T2; Fig. F1A). The temperature for the surface samples (between 0.06 and 0.37 mbsf*) were close to the annual mean SST at the site (~15.5°C) (Levitus and Boyer, 1994). Uk'_{37}-SST is relatively higher within the intervals 1.90–2.26, 2.83, 3.69–8.85, 10.57–12.63, 13.80–14.38, 16.41, and 17.29–19.56 mbsf*, whereas it is relatively low within intervals 0.68–1.60, 2.57, 3.13–3.40, 9.13–10.28, 12.92–13.50, 14.67–16.12, 16.71–17.00, and below 19.86 mbsf*. The Org-C–normalized alkenone concentrations range between 56.8 and 1608.3 µg/g Org-C, with an average of 617.9 µg/g Org-C (Fig. F1B). The concentration is higher than the average in the intervals 3.69, 4.84–6.56, 7.13, 7.99–8.56, 9.99–12.34, 14.96–18.16, 19.56, and 20.16 mbsf*, whereas it tends to be lower in intervals 0.06–3.40, 3.98–4.55, 6.85, 7.41–7.70, 8.85–9.71, 12.63–14.67, 18.45–9.26, 19.86, and below 20.46 mbsf*. Uk'_{37}-SST shows moderate positive correlation with alkenone concentration within the upper 14.0 mbsf*. Uk'_{37}-SSTs are relatively stable below 14.0 mbsf*, whereas alkenone concentrations fluctuate significantly within the interval.

T2. Alkenone and alkenoate concentrations, p. 8.

F1. Depth plots for Hole 1151C, p. 6.



Org-C and C/N Ratio in Acid-Treated Samples

Org-C, nitrogen, and sulfur contents in acid-treated samples vary between 0.42 and 1.91, 0.04 and 0.21, and 0.06 and 171 wt%, respectively (Table T3; Fig. F1C). Org-C is high in the intervals 0.06–0.98, 4.84, 5.38,

T3. Carbon, nitrogen, and sulfur, p. 10.

6.27–7.70, 8.27–9.71, 10.85, 11.42–12.34, 15.25–15.54, and the lower part of 16.71 mbsf*, whereas it is relatively low in intervals 1.29–4.55, 5.12, 5.70–5.98, 7.99, 9.99–10.57, 11.14, 12.63–14.96, and 15.83–16.41 mbsf*. Org-C shows moderate positive correlation with Uk'_{37}-SST within intervals 3.40–9.42 and 9.99–13.50 mbsf*. C/N ratio varies between 8.97 and 13.50 (Fig. **F1D**). C/N ratio for land-derived organic matter ranges from 20 to 80 or more (Meyers and Ishiwatari 1993), whereas marine-derived organic matter has lower C/N ratios between 6 and 9 (e.g., Müller, 1977). Thus, the C/N ratios of the analyzed samples suggest variable contributions of terrigenous organic matter.

MAJOR ELEMENT OXIDES

TiO_2/Al_2O_3 and K_2O/Al_2O_3 are occasionally used as indicators of provenance of detrital material. TiO_2/Al_2O_3 varies between 0.11 and 0.17, and K_2O/Al_2O_3 varies between 0.29 and 0.60 (Table **T4;** Fig. **F1E, F1F**). The two values show positive correlation, suggesting that compositional variation of detrital material can be explained by mixing of two components. High values at 6.56 and 10.38 mbsf* correspond to sand patches. There seems to be weak positive correlation between Ti/Al and C/N ratios.

T4. Major element oxides, p. 12.

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Figure F1. Depth plots for Hole 1151C. **A.** Alkenone temperature. **B.** Total alkenone concentration. **C.** Organic carbon content. **D.** C/N ratio. **E.** TiO_2/Al_2O_3 ratio. **F.** K_2O/Al_2O_3 ratio. Modern annual sea-surface temperature is marked as a dashed line in plot A. Relatively low temperature intervals are shown as shaded areas.

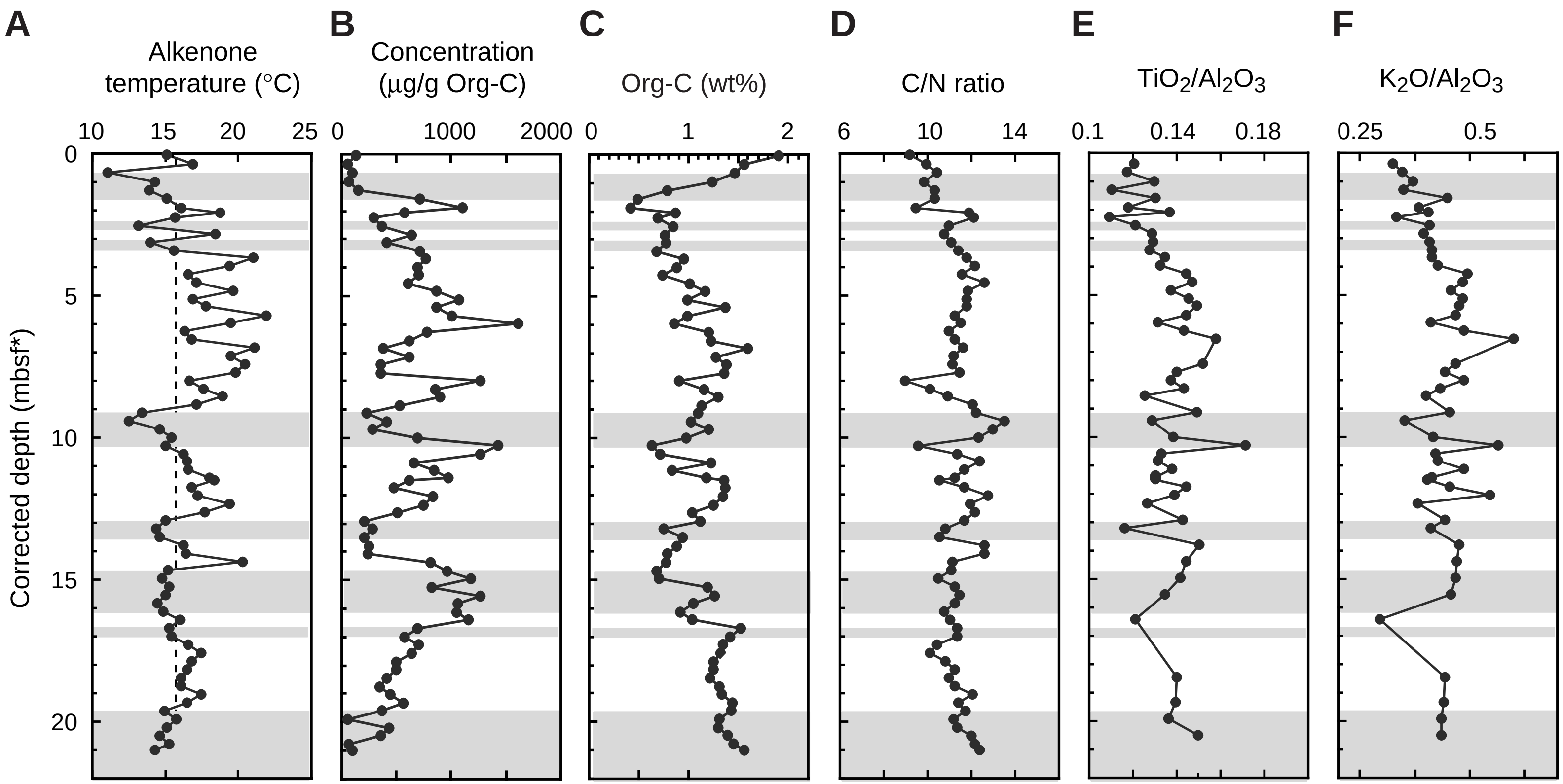

Table T1. Sample depth correction equations.

Core	Interval (mbsf)	Core recovery	Equation
186-1151C-			
1H	0.0–2.2	0.977	D = d
2H	2.2–11.7	1.047	D = 2.20 + d/1.047
3H	11.7–21.2	1.031	D = 11.7 + d/1.031

Note: D = corrected depth, d = uncorrected depth.

Table T2. Alkenone and alkenoate concentrations, Site 1151. (**See table notes.** Continued on next page.)

Core, section, interval (cm)	Depth (mbsf)	Corrected depth (mbsf*)	Concentration (µg/g TOC)													$U^{K'}_{37}$	$U^{K'}_{37}$ SST (°C)
			37:4MK	37:3MK	36:3ME	37:2MK	36:2ME	36:2EE	38:3EK	38:3MK	38:2EK	38:2MK	39:3EK	39:2EK	Total		
186-1151C-																	
1H-1, 5–7	0.06	0.06	ND	24.64	ND	30.39	ND	5.06	13.97	9.93	26.20	9.10	4.04	4.08	127.41	0.55	15.09
1H-1, 35–37	0.36	0.37	1.40	8.91	2.81	14.23	3.91	1.62	4.16	5.28	10.55	1.71	0.65	1.53	56.78	0.61	16.94
1H-1, 65–67	0.66	0.68	0.83	28.51	ND	20.26	ND	3.60	14.41	11.89	8.87	1.74	4.30	1.74	96.15	0.42	11.07
1H-1, 95–97	0.96	0.98	0.17	11.77	ND	12.97	ND	2.48	9.88	11.14	12.28	2.54	4.42	0.57	68.21	0.52	14.27
1H-1, 125–127	1.26	1.29	7.66	34.43	3.15	36.01	6.63	4.70	9.14	17.87	23.70	7.17	2.51	4.38	157.35	0.51	13.89
1H-2, 5–7	1.56	1.60	1.26	151.54	0.00	186.74	0.00	21.32	72.50	60.79	139.66	44.22	22.49	17.92	718.45	0.55	15.09
1H-2, 35–37	1.92	1.90	30.21	201.78	11.84	285.51	38.92	35.13	74.92	90.50	204.70	69.29	19.15	40.12	1102.07	0.59	16.09
1H-CC, 5–7	2.03	2.08	ND	98.83	ND	207.84	ND	14.39	19.17	87.36	74.02	45.57	7.60	13.84	568.63	0.68	18.79
2H-1, 5–7	2.26	2.26	ND	58.82	ND	78.84	ND	9.48	19.64	9.30	65.96	23.18	12.46	12.78	290.46	0.57	15.70
2H-1, 35–37	2.56	2.54	ND	76.52	ND	72.17	ND	10.46	36.84	23.61	82.55	23.98	22.59	15.35	364.08	0.49	13.13
2H-1, 65–67	2.86	2.83	4.48	98.54	ND	195.79	23.61	17.32	33.29	43.42	140.03	52.26	8.76	26.15	643.65	0.67	18.42
2H-1, 95–97	3.16	3.13	1.74	90.58	ND	95.69	ND	12.64	49.72	19.21	88.67	29.51	10.37	16.56	414.69	0.51	13.96
2H-1, 125–127	3.46	3.40	16.60	144.95	6.19	192.41	24.42	13.87	48.88	57.94	137.08	43.17	9.93	23.48	718.92	0.57	15.63
2H-2, 5–7	3.76	3.69	2.84	79.91	ND	244.31	ND	20.00	52.72	52.44	202.08	63.41	17.64	34.63	769.97	0.75	21.02
2H-2, 35–37	4.06	3.98	9.35	83.44	ND	194.59	ND	19.36	63.96	52.68	169.86	49.32	20.54	29.78	692.88	0.70	19.44
2H-2, 65–67	4.36	4.26	13.57	132.13	ND	199.16	18.42	13.06	42.27	52.54	147.58	49.58	9.40	24.65	702.36	0.60	16.53
2H-2, 95–97	4.66	4.55	9.04	117.71	ND	192.83	ND	13.57	27.76	42.61	148.35	26.99	11.95	13.03	603.84	0.62	17.12
2H-2, 125–127	4.96	4.84	10.13	124.87	ND	303.56	15.74	10.04	34.87	47.17	199.54	80.00	6.27	32.40	864.57	0.71	19.69
2H-3, 5–7	5.26	5.12	14.68	191.43	ND	303.64	ND	29.42	83.50	63.17	261.55	73.78	17.30	36.26	1074.73	0.61	16.89
2H-3, 35–37	5.53	5.38	15.02	151.66	ND	274.17	19.19	16.49	41.89	51.31	193.92	59.44	8.88	29.58	861.53	0.64	17.79
2H-3, 65–67	5.86	5.70	10.05	84.13	ND	305.35	ND	24.50	82.59	54.17	301.32	75.54	18.99	45.74	1002.36	0.78	21.91
2H-3, 95–97	6.16	5.98	6.51	242.03	ND	570.75	ND	24.98	82.47	84.48	383.41	154.86	20.05	38.73	1608.27	0.70	19.51
2H-3, 125–127	6.46	6.27	14.64	148.89	ND	216.93	21.55	18.21	46.44	56.53	163.10	54.55	10.36	26.31	777.53	0.59	16.29
2H-4, 5–7	6.76	6.56	1.92	107.13	ND	168.80	ND	14.13	54.64	38.34	145.62	46.87	13.76	25.33	616.53	0.61	16.85
2H-4, 35–37	7.07	6.85	ND	39.44	ND	122.44	ND	5.38	22.19	14.43	119.65	31.06	5.41	20.41	380.41	0.76	21.10
2H-4, 65–67	7.36	7.13	ND	83.27	ND	196.62	ND	7.25	33.63	27.88	173.05	50.49	13.24	31.15	616.58	0.70	19.50
2H-4, 95–97	7.66	7.41	ND	42.01	ND	116.91	ND	5.09	21.50	16.44	104.09	32.42	0.00	16.50	354.96	0.74	20.50
2H-4, 125–127	7.96	7.70	ND	43.29	ND	107.09	ND	6.23	24.70	16.37	106.95	29.72	6.44	19.89	360.68	0.71	19.80
2H-5, 5–7	8.26	7.99	10.57	238.18	ND	363.24	44.02	22.45	74.05	89.88	271.88	89.20	18.12	47.60	1269.18	0.60	16.60
2H-5, 35–37	8.56	8.27	ND	146.40	ND	257.98	ND	15.35	56.21	56.84	206.96	72.13	12.65	31.73	856.25	0.64	17.60
2H-5, 65–67	8.86	8.56	ND	135.04	ND	291.72	ND	16.73	57.54	48.37	225.79	74.82	11.79	32.53	894.32	0.68	19.00
2H-5, 95–97	9.16	8.85	1.00	82.56	ND	135.31	ND	14.63	52.18	30.99	150.89	38.13	3.42	24.94	534.05	0.62	17.10
2H-5, 125–127	9.46	9.13	1.71	46.18	ND	45.07	ND	8.45	32.90	19.32	41.61	13.92	8.55	7.58	225.30	0.49	13.40
2H-6, 5–7	9.76	9.42	3.08	98.47	ND	85.61	ND	10.90	40.78	41.44	81.86	26.51	7.18	14.65	410.48	0.47	12.50
2H-6, 35–37	10.06	9.71	3.44	57.52	ND	66.19	ND	8.16	31.34	22.07	64.45	8.27	7.19	11.64	280.28	0.54	14.60
2H-6, 65–67	10.36	9.99	8.17	139.89	ND	180.35	ND	18.70	70.69	48.82	159.37	21.69	15.04	26.55	689.27	0.56	15.40
2H-6, 95–97	10.66	10.28	26.38	277.26	ND	338.25	44.59	41.29	99.51	129.28	288.73	100.55	22.61	55.23	1423.68	0.55	15.00
2H-6, 125–127	10.96	10.57	ND	223.11	ND	323.96	ND	28.93	120.85	89.51	291.80	91.77	35.72	63.94	1269.59	0.59	16.30
2H-7, 5–7	11.26	10.85	7.29	121.07	ND	181.60	22.36	12.23	42.99	53.89	129.34	55.61	9.58	25.69	661.66	0.60	16.50
2H-7, 35–37	11.56	11.14	ND	147.44	ND	223.84	ND	19.26	81.49	55.23	197.68	63.07	19.82	38.05	845.87	0.60	16.60
2H-7, 65–67	11.85	11.42	ND	169.61	ND	316.30	ND	17.79	38.83	62.73	224.27	91.13	16.06	37.41	974.13	0.65	18.00
2H-CC, 5–7	12.03	11.49	3.63	96.35	ND	190.72	12.23	10.16	35.35	40.04	139.60	55.01	6.59	25.31	614.99	0.66	18.40
3H-1, 5–7	11.76	11.76	1.10	86.50	ND	135.57	ND	10.11	40.31	32.53	102.33	39.24	9.03	17.16	473.87	0.61	16.80
3H-1, 35–37	12.06	12.05	ND	143.91	ND	240.37	ND	14.25	75.00	55.75	186.61	68.06	14.29	31.20	829.44	0.63	17.30
3H-1, 65–67	12.36	12.34	ND	107.07	ND	250.26	ND	9.55	46.21	41.87	176.46	72.67	10.66	30.27	745.02	0.70	19.50
3H-1, 95–97	12.66	12.63	0.94	77.88	ND	138.50	ND	7.37	44.23	52.62	105.43	46.48	3.13	29.55	506.14	0.64	17.70
3H-1, 125–127	12.96	12.92	5.29	37.81	ND	46.21	6.52	6.08	14.20	21.32	38.35	14.50	2.11	8.76	201.15	0.55	15.00

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	Corrected depth (mbsf*)	Concentration (µg/g TOC)													UK′37	UK′37 SST (°C)
			37:4MK	37:3MK	36:3ME	37:2MK	36:2ME	36:2EE	38:3EK	38:3MK	38:2EK	38:2MK	39:3EK	39:2EK	Total		
3H-2, 5–7	13.26	13.21	3.25	62.02	ND	69.50	ND	9.61	19.09	25.48	50.83	19.24	9.13	10.65	278.78	0.53	14.40
3H-2, 35–37	13.56	13.50	8.57	38.31	ND	44.13	7.12	8.45	14.40	23.89	36.20	14.72	3.26	10.47	209.51	0.54	14.60
3H-2, 65–67	13.86	13.80	ND	41.19	ND	59.52	ND	2.84	30.75	29.58	51.59	16.65	3.38	14.77	250.28	0.59	16.20
3H-2, 95–97	14.16	14.09	ND	40.24	ND	59.85	ND	3.89	29.03	20.35	48.47	16.88	4.33	10.82	233.87	0.60	16.40
3H-2, 125–127	14.46	14.38	ND	70.90	ND	190.38	ND	19.58	97.14	55.62	238.33	66.96	22.19	46.29	807.40	0.73	20.30
3H-3, 5–7	14.76	14.67	ND	157.64	ND	197.64	ND	22.25	119.98	63.74	256.49	63.80	29.14	49.26	959.93	0.56	15.20
3H-3, 35–37	15.06	14.96	ND	218.71	ND	260.03	ND	24.91	111.50	91.66	293.72	89.21	32.97	52.60	1175.31	0.54	14.80
3H-3, 65–67	15.36	15.25	2.38	172.37	ND	218.28	ND	14.97	66.52	70.12	167.53	63.59	16.00	32.66	824.42	0.56	15.30
3H-3, 95–97	15.66	15.54	8.72	261.49	ND	319.32	33.28	20.03	88.85	106.54	259.74	97.50	19.36	50.06	1264.87	0.55	15.00
3H-3, 125–127	15.96	15.83	2.11	233.98	ND	264.92	ND	20.66	92.36	92.67	217.06	78.52	23.08	32.75	1058.10	0.53	14.50
3H-4, 5–7	16.36	16.12	3.06	220.44	ND	263.43	ND	33.25	81.13	89.78	223.85	79.33	19.89	37.41	1051.59	0.54	14.90
3H-4, 35–37	16.66	16.41	10.51	230.01	ND	321.46	34.42	29.28	61.94	91.04	243.88	85.22	12.45	41.45	1161.65	0.58	16.00
3H-4, 65–67	16.96	16.71	6.32	157.64	ND	199.04	ND	18.14	30.27	58.55	143.46	45.83	12.60	23.33	695.18	0.56	15.30
3H-4, 95–97	17.26	17.00	5.61	127.28	ND	165.41	ND	15.24	43.11	45.48	110.31	42.03	10.58	10.17	575.23	0.57	15.50
3H-4, 125–127	17.56	17.29	5.86	139.33	ND	210.26	ND	18.12	51.38	52.49	131.85	57.37	11.38	21.56	699.59	0.60	16.50
3H-5, 5–7	17.76	17.58	4.23	116.63	ND	201.62	ND	7.69	51.59	43.29	139.75	53.29	11.10	8.27	637.46	0.63	17.50
3H-5, 35–37	18.06	17.87	2.19	88.59	ND	139.05	ND	13.62	42.67	32.43	110.73	40.74	8.78	17.23	496.05	0.61	16.80
3H-5, 65–67	18.36	18.16	4.85	104.60	ND	156.92	ND	14.27	43.85	37.20	66.60	41.60	9.63	15.51	495.04	0.60	16.50
3H-5, 95–97	18.66	18.45	2.53	76.44	ND	108.56	ND	13.27	24.82	28.20	101.47	30.09	9.22	15.53	410.14	0.59	16.10
3H-5, 125–127	18.96	18.74	1.63	69.34	ND	97.90	ND	8.73	28.77	26.21	65.92	26.69	7.60	10.80	343.59	0.59	16.10
3H-6, 5–7	19.26	19.03	1.13	76.19	ND	131.31	ND	12.10	38.37	28.87	100.68	36.22	8.44	15.85	449.16	0.63	17.50
3H-6, 35–37	19.56	19.32	6.47	108.09	ND	162.51	13.90	11.78	36.47	40.68	110.43	41.45	7.06	18.85	557.70	0.60	16.50
3H-6, 65–67	19.86	19.61	4.37	84.23	ND	102.06	ND	9.79	35.12	28.51	68.15	24.64	4.20	9.39	370.47	0.55	15.00
3H-6, 95–97	20.16	19.91	0.67	11.57	0.49	15.56	1.85	1.61	4.28	5.01	11.20	4.33	0.97	2.06	59.60	0.57	15.70
3H-6, 125–127	20.46	20.20	ND	98.64	ND	121.79	ND	16.96	35.29	22.32	89.26	29.36	9.28	13.62	436.51	0.55	15.10
3H-7, 5–7	20.76	20.49	ND	80.21	ND	92.93	ND	12.76	37.07	36.94	66.46	22.10	4.77	9.62	362.87	0.54	14.60
3H-7, 35–37	21.06	20.78	ND	12.26	ND	15.55	ND	2.00	7.34	5.18	12.92	4.53	1.43	2.41	63.63	0.56	15.30
3H-CC, 5–7	121.24	21.01	0.80	19.68	ND	21.80	ND	2.98	11.61	10.98	19.46	7.42	1.52	2.73	98.98	0.53	14.30

Notes: TOC = total organic carbon. ND = not detected.

Table T3. Total organic carbon, total sulfur, and total nitrogen, Site 1151. (Continued on next page.)

Core, section, interval (cm)	Depth (mbsf)	Corrected depth (mbsf*)	Carbon (wt%)	Sulfur (wt%)	Nitrogen (wt%)	C/N ratio	S/C ratio
186-1151C-							
1H-1, 5–7	0.06	0.06	1.908	0.063	0.208	9.17	0.03
1H-1, 35–37	0.36	0.37	1.561	0.531	0.157	9.93	0.34
1H-1, 65–67	0.66	0.68	1.468	0.385	0.141	10.45	0.26
1H-1, 95–97	0.96	0.98	1.234	0.613	0.125	9.86	0.50
1H-1, 125–127	1.26	1.29	0.786	0.296	0.076	10.31	0.38
1H-2, 5–7	1.56	1.60	0.490	0.318	0.047	10.34	0.65
1H-2, 35–37	1.92	1.90	0.421	0.632	0.044	9.48	1.50
1H-CC, 5–7	2.03	2.08	0.868	0.817	0.073	11.90	0.94
2H-1, 5–7	2.26	2.26	0.692	0.661	0.057	12.13	0.95
2H-1, 35–37	2.56	2.54	0.844	0.589	0.077	10.97	0.70
2H-1, 65–67	2.86	2.83	0.757	0.425	0.070	10.78	0.56
2H-1, 95–97	3.16	3.13	0.779	0.520	0.070	11.06	0.67
2H-1, 125–127	3.46	3.40	0.675	0.750	0.059	11.42	1.11
2H-2, 5–7	3.76	3.69	0.955	0.488	0.081	11.77	0.51
2H-2, 35–37	4.06	3.98	0.878	0.645	0.072	12.19	0.74
2H-2, 65–67	4.36	4.26	0.733	0.826	0.063	11.56	1.13
2H-2, 95–97	4.66	4.55	1.006	0.427	0.080	12.59	0.42
2H-2, 125–127	4.96	4.84	1.169	0.996	0.099	11.82	0.85
2H-3, 5–7	5.26	5.12	0.991	0.602	0.084	11.80	0.61
2H-3, 35–37	5.53	5.38	1.363	0.535	0.116	11.78	0.39
2H-3, 65–67	5.86	5.70	0.994	0.624	0.088	11.24	0.63
2H-3, 95–97	6.16	5.98	0.853	0.472	0.074	11.54	0.55
2H-3, 125–127	6.46	6.27	1.208	0.809	0.110	10.98	0.67
2H-4, 5–7	6.76	6.56	1.224	0.820	0.109	11.27	0.67
2H-4, 35–37	7.07	6.85	1.599	0.573	0.138	11.62	0.36
2H-4, 65–67	7.36	7.13	1.273	0.499	0.114	11.19	0.39
2H-4, 95–97	7.66	7.41	1.383	0.599	0.124	11.13	0.43
2H-4, 125–127	7.96	7.70	1.361	0.545	0.119	11.46	0.40
2H-5, 5–7	8.26	7.99	0.906	0.610	0.101	8.97	0.67
2H-5, 35–37	8.56	8.27	1.156	0.538	0.115	10.09	0.47
2H-5, 65–67	8.86	8.56	1.291	0.782	0.118	10.91	0.61
2H-5, 95–97	9.16	8.85	1.130	0.901	0.094	12.06	0.80
2H-5, 125–127	9.46	9.13	1.096	0.787	0.090	12.23	0.72
2H-6, 5–7	9.76	9.42	1.018	0.589	0.075	13.50	0.58
2H-6, 35–37	10.06	9.71	1.204	0.597	0.093	13.00	0.50
2H-6, 65–67	10.36	9.99	0.972	0.512	0.079	12.31	0.53
2H-6, 95–97	10.66	10.28	0.633	0.510	0.066	9.55	0.81
2H-6, 125–127	10.96	10.57	0.714	0.604	0.063	11.35	0.85
2H-7, 5–7	11.26	10.85	1.225	0.501	0.099	12.38	0.41
2H-7, 35–37	11.56	11.14	0.834	0.345	0.071	11.66	0.41
2H-7, 65–67	11.85	11.42	1.180	0.621	0.105	11.23	0.53
2H-CC, 35921	12.03	11.49	1.357	0.666	0.129	10.52	0.49
3H-1, 5–7	11.76	11.76	1.363	1.575	0.117	11.66	1.15
3H-1, 35–37	12.06	12.05	1.348	0.624	0.105	12.78	0.46
3H-1, 65–67	12.36	12.34	1.253	0.912	0.105	11.95	0.73
3H-1, 95–97	12.66	12.63	1.030	0.704	0.085	12.18	0.68
3H-1, 125–127	12.96	12.92	1.122	0.553	0.096	11.70	0.49
3H-2, 5–7	13.26	13.21	0.752	1.710	0.069	10.83	2.27
3H-2, 35–37	13.56	13.50	0.941	0.552	0.089	10.56	0.59
3H-2, 65–67	13.86	13.80	0.879	0.575	0.070	12.59	0.65
3H-2, 95–97	14.16	14.09	0.781	0.533	0.062	12.61	0.68
3H-2, 125–127	14.46	14.38	0.779	0.322	0.070	11.15	0.41
3H-3, 5–7	14.76	14.67	0.675	0.385	0.061	11.10	0.57
3H-3, 35–37	15.06	14.96	0.707	0.983	0.067	10.50	1.39
3H-3, 65–67	15.36	15.25	1.190	0.475	0.106	11.23	0.40
3H-3, 95–97	15.66	15.54	1.261	0.370	0.110	11.49	0.29
3H-3, 125–127	15.96	15.83	1.043	0.365	0.093	11.24	0.35
3H-4, 5–7	16.36	16.12	0.922	0.351	0.086	10.74	0.38
3H-4, 35–37	16.66	16.41	1.034	0.639	0.094	11.05	0.62
3H-4, 65–67	16.96	16.71	1.527	0.775	0.134	11.36	0.51
3H-4, 95–97	17.26	17.00	1.413	0.698	0.124	11.35	0.49
3H-4, 125–127	17.56	17.29	1.339	0.507	0.128	10.44	0.38
3H-5, 5–7	17.76	17.58	1.326	0.457	0.131	10.12	0.34
3H-5, 35–37	18.06	17.87	1.246	0.408	0.115	10.79	0.33
3H-5, 65–67	18.36	18.16	1.255	0.657	0.111	11.26	0.52
3H-5, 95–97	18.66	18.45	1.214	0.502	0.110	10.99	0.41

Table T3 (continued).

Core, section, interval (cm)	Depth (mbsf)	Corrected depth (mbsf*)	Carbon (wt%)	Sulfur (wt%)	Nitrogen (wt%)	C/N ratio	S/C ratio
3H-5, 125–127	18.96	18.74	1.314	0.724	0.117	11.27	0.55
3H-6, 5–7	19.26	19.03	1.332	0.442	0.111	12.04	0.33
3H-6, 35–7	19.56	19.32	1.440	0.451	0.126	11.40	0.31
3H-6, 65–67	19.86	19.61	1.424	0.287	0.121	11.76	0.20
3H-6, 95–97	20.16	19.91	1.304	0.453	0.116	11.22	0.35
3H-6, 125–127	20.46	20.20	1.292	0.451	0.114	11.36	0.35
3H-7, 5–7	20.76	20.49	1.388	0.364	0.115	12.03	0.26
3H-7, 35–37	20.78	20.78	1.453	0.423	0.119	12.17	0.29
3H-CC, 5–7	21.01	21.01	1.554	0.399	0.126	12.37	0.26

Table T4. Major element oxide concentrations, Site 1151.

Core, section, interval (cm)	Depth (mbsf)	Corrected depth (mbsf*)	Major element oxide (wt%)										LOI (wt%)	Total (wt%)
			SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5		
186-1151C-														
1H-1, 35–37	0.36	0.37	58.00	0.67	5.58	5.75	0.09	2.13	6.15	2.33	1.81	0.14	8.06	90.71
1H-1, 65–67	0.66	0.68	61.15	0.59	5.06	4.84	0.06	1.90	7.13	2.30	1.75	0.12	9.32	94.22
1H-1, 95–97	0.96	0.98	65.97	0.60	4.65	4.94	0.06	1.81	6.48	2.19	1.72	0.12	7.78	96.32
1H-1, 125–127	1.26	1.29	58.35	0.58	5.22	5.39	0.07	1.95	9.62	2.28	1.82	0.11	8.69	94.07
1H-2, 5–7	1.56	1.60	65.64	0.62	4.78	8.28	0.08	2.19	3.77	2.50	2.15	0.10	4.02	94.13
1H-2, 35–37	1.92	1.90	63.63	0.61	5.18	6.65	0.08	1.93	4.05	2.63	1.98	0.11	4.13	90.99
1H-CC, 5–7	2.03	2.08	64.60	0.68	4.95	7.87	0.09	2.14	3.98	2.43	2.00	0.12	5.19	94.05
2H-1, 5–7	2.26	2.26	61.89	0.52	4.80	4.73	0.07	1.65	10.77	2.34	1.59	0.11	9.24	97.71
2H-1, 35–37	2.56	2.54	61.12	0.63	5.20	5.63	0.06	2.11	5.21	2.02	2.12	0.10	7.51	91.72
2H-1, 65–67	2.86	2.83	62.89	0.64	4.93	6.31	0.07	2.27	5.54	2.11	1.94	0.11	6.13	92.95
2H-1, 95–97	3.16	3.13	65.41	0.65	5.03	5.56	0.07	2.25	5.31	2.14	2.06	0.11	6.56	95.13
2H-1, 125–127	3.46	3.40	65.93	0.65	5.11	5.94	0.07	2.05	4.35	2.37	2.12	0.12	5.29	94.01
2H-2, 5–7	3.76	3.69	64.58	0.68	5.07	5.44	0.07	2.21	5.16	2.13	2.10	0.10	6.68	94.22
2H-2, 35–37	4.06	3.98	65.10	0.67	5.04	5.32	0.07	2.04	3.51	2.23	2.15	0.10	5.80	92.03
2H-2, 65–67	4.36	4.26	69.46	0.61	4.23	5.23	0.07	1.84	3.50	2.24	2.09	0.10	5.20	94.57
2H-2, 95–97	4.66	4.55	68.84	0.70	4.73	5.12	0.06	2.13	3.20	2.23	2.29	0.11	5.95	95.36
2H-2, 125–127	4.96	4.84	65.97	0.71	5.15	5.97	0.06	2.28	3.33	2.05	2.35	0.12	7.31	95.30
2H-3, 5–7	5.26	5.12	68.62	0.72	4.95	5.47	0.06	2.34	2.18	2.11	2.40	0.10	6.19	95.15
2H-3, 35–37	5.53	5.38	69.01	0.67	4.48	5.04	0.06	2.22	2.48	2.03	2.13	0.12	6.86	95.10
2H-3, 65–67	5.86	5.70	69.35	0.71	4.89	5.69	0.06	2.26	2.33	2.20	2.29	0.10	6.25	96.14
2H-3, 95–97	6.16	5.98	64.18	0.68	5.15	5.61	0.08	2.07	3.23	2.34	2.12	0.11	5.81	91.38
2H-3, 125–127	6.46	6.27	68.75	0.61	4.28	5.37	0.06	2.09	3.26	1.98	2.08	0.10	7.54	96.13
2H-4, 5–7	6.76	6.56	73.02	0.53	3.37	4.28	0.05	1.71	2.24	2.02	2.02	0.10	7.34	96.69
2H-4, 95–97	7.66	7.41	69.87	0.62	4.05	4.88	0.06	2.17	4.89	1.84	1.89	0.11	8.71	99.08
2H-4, 125–127	7.96	7.70	67.07	0.68	4.88	5.43	0.06	2.27	3.81	2.04	2.16	0.11	7.45	95.95
2H-5, 5–7	8.26	7.99	67.17	0.71	5.15	5.54	0.06	2.20	1.95	2.18	2.51	0.10	6.33	93.88
2H-5, 35–37	8.56	8.27	69.08	0.66	4.64	5.33	0.06	2.16	3.37	1.97	2.01	0.13	6.86	96.27
2H-5, 65–67	8.86	8.56	64.55	0.55	4.38	4.82	0.05	1.99	5.60	1.74	1.76	0.11	9.77	95.32
2H-5, 125–127	9.46	9.13	68.49	0.71	4.75	5.99	0.07	2.16	2.91	2.30	2.16	0.13	6.02	95.69
2H-6, 5–7	9.76	9.42	65.10	0.66	5.13	5.17	0.08	2.07	5.14	2.24	1.81	0.13	6.11	93.63
2H-6, 65–67	10.36	9.99	64.97	0.65	4.66	5.49	0.07	2.10	5.30	2.20	1.94	0.11	6.41	93.90
2H-6, 95–97	10.66	10.28	75.59	0.72	4.21	5.60	0.06	2.16	3.59	2.25	2.37	0.12	5.59	102.26
2H-6, 125–127	10.96	10.57	66.33	0.72	5.40	5.62	0.07	2.23	2.56	2.33	2.28	0.11	5.57	93.21
2H-7, 5–7	11.26	10.85	64.03	0.69	5.23	5.15	0.06	2.20	4.78	2.28	2.23	0.12	7.13	93.90
2H-7, 35–37	11.56	11.14	68.37	0.65	4.71	4.68	0.06	1.91	2.56	2.55	2.30	0.10	5.55	93.43
2H-7, 65–67	11.85	11.42	65.16	0.62	4.78	4.90	0.05	2.14	6.67	2.07	1.99	0.12	9.80	98.29
2H-CC, 5–7	12.03	11.49	64.17	0.65	4.99	5.23	0.06	2.23	6.56	1.96	2.02	0.11	9.24	97.21
3H-1, 5–7	11.76	11.76	67.46	0.64	4.42	6.97	0.05	2.06	4.13	1.88	2.01	0.11	8.72	98.45
3H-1, 35–37	12.06	12.05	70.34	0.53	3.80	4.37	0.05	1.59	3.58	2.21	2.07	0.10	7.93	96.58
3H-1, 65–67	12.36	12.34	63.56	0.54	4.30	5.05	0.05	2.25	9.55	1.68	1.64	0.14	11.75	100.50
3H-1, 125–127	12.96	12.92	67.17	0.70	4.91	5.58	0.06	2.12	2.84	2.31	2.18	0.12	6.19	94.18
3H-2, 5–7	13.26	13.21	65.31	0.57	4.88	6.49	0.06	1.73	4.92	2.37	2.01	0.11	6.49	94.93
3H-2, 65–67	13.86	13.80	68.91	0.70	4.64	5.40	0.07	2.05	2.82	2.48	2.21	0.13	5.19	94.59
3H-2, 125–127	14.46	14.38	65.94	0.70	4.83	4.98	0.06	2.09	4.61	2.16	2.28	0.11	6.77	94.54
3H-3, 35–37	15.06	14.96	67.56	0.68	4.83	6.12	0.06	2.10	3.84	2.17	2.26	0.11	6.08	95.82
3H-3, 95–97	15.66	15.54	66.59	0.66	4.91	4.89	0.06	2.07	4.78	2.15	2.24	0.11	7.74	96.20
3H-4, 35–37	16.66	16.41	64.08	0.69	5.67	5.47	0.07	1.92	5.25	2.15	1.67	0.12	6.49	93.59
3H-5, 95–97	18.66	18.45	67.49	0.59	4.19	4.75	0.05	2.06	6.67	1.68	1.86	0.11	9.74	99.18
3H-6, 35–37	19.56	19.32	67.96	0.58	4.18	4.55	0.05	2.02	6.64	1.79	1.83	0.11	10.07	99.78
3H-6, 95–97	20.16	19.91	68.39	0.60	4.37	4.72	0.05	1.96	4.90	2.07	1.90	0.11	8.57	97.64
3H-7, 5–7	20.76	20.49	66.42	0.63	4.23	4.37	0.05	2.00	6.58	1.74	1.84	0.10	9.93	97.91