Data report: elemental, Rock-Eval, and isotopic compositions of bulk sediments, IODP Expedition 311[1]

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Chapter contents

[1] Kim, J.-H., and Lee, Y.-J., 2009. Data report: elemental, Rock-Eval, and isotopic compositions of bulk sediments, IODP Expedition 311. *In* Riedel, M., Collett, T.S., Malone, M.J., and the Expedition 311 Scientists, *Proc. IODP,* 311: Washington, DC (Integrated Ocean Drilling Program Management International, Inc.). doi:10.2204/iodp.proc.311.207.2009
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Abstract

Several geochemical analyses were performed on samples to assess their geochemical characteristics and variations according to vertical depth and site location. Total carbon, total organic carbon (TOC), and total nitrogen (TN) content decreased from northeast to southwest along the transect of Integrated Ocean Drilling Program Expedition 311 Sites U1329, U1327, U1325, and U1326. Variations with depth showed differing trends with sites and compositions. Most organic matter was at an immature stage and Type III evolution based on Rock-Eval pyrolysis. However, results from TOC/TN, $\delta^{13}C_{org}$, and $\delta^{15}N_{org}$ analyses showed that organic matter has an admixture of origin.

Introduction

Operations during Integrated Ocean Drilling Program (IODP) Expedition 311 drilled five sites across the northern Cascadia margin (see the **"Expedition 311 summary"** chapter). Among the five sites, the northeast–southwest transect of Sites U1329, U1327, U1325, and U1326 was cored to investigate gas hydrate occurrence and formation. Cold vent Site U1328 was also drilled. Based on recovered core sections, Sites U1329, U1327, U1326, and U1328 are divided into three lithostratigraphic units (I, II, and III) and Site U1325 is divided into five lithostratigraphic subunits (IA, IB, II, III, and IV) (see the **"Expedition 311 summary"** chapter). Characterization of elements (total carbon [TC], total nitrogen [TN], and total sulfur [TS]) and organic matter in bulk sediments according to transect and lithostratigraphic units could be helpful in understanding the depositional environment, diagenesis, and origin of organic matter and give additional information about gas hydrate occurrence. Hence, this study reports several geochemical results on bulk sediments from the northern Cascadia margin.

Methods

Elemental analysis

A total of 311 squeeze cake samples from Sites U1325–U1329 were used for geochemical analyses. A part of each squeeze cake was dried for 24 h using a freeze dryer at the Korea Institute of Geoscience and Mineral Resources. After drying the bulk sediment sam-

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ples were ground and homogenized in an agate mortar. TC and TN contents were measured by combustion method using a LECO CHN-900 apparatus with detection limits of 0.001% for TC and 0.01% for TN. TS contents were determined using a LECO SC-132 apparatus with a detection limit of 0.001%.

Rock-Eval pyrolysis

Using Rock-Eval pyrolysis, free and adsorbed hydrocarbons released during programmed heating of a sample are recorded as the first peak in a pyrogram (S_1) under low temperature. The second peak (S_2) in the pyrogram represents hydrocarbons released by kerogen cracking when the sample is heated to 550°C. The temperature at the maximum of the S_2 peak is defined as T_{max}. CO_2, shown as the third peak (S_3) in the program, is also generated by kerogen degradation. When these components are normalized to the TOC content, the S_2 peak becomes the hydrogen index (HI = $S_2 \times 100$/TOC) and S_3 becomes the oxygen index (OI = $S_3 \times 100$/TOC) (Tissot and Welte, 1984; Peters, 1986). Rock-Eval pyrolysis and TOC were determined by Rock-Eval 6.

Isotope analysis

Powdered bulk samples were pretreated with 3N HCl to remove carbonate ($CaCO_3$) and inorganic nitrogen for the analysis of organic carbon ($\delta^{13}C_{org}$) and nitrogen ($\delta^{15}N_{org}$) isotope ratios. $\delta^{13}C_{org}$ and $\delta^{15}N_{org}$ were measured by a VG Optima stable isotope ratio mass spectrometer at the National Instrumentation Center for Environmental Management. The analytical reproducibility was ±0.1‰ for $\delta^{13}C_{org}$ and ±0.2‰ for $\delta^{15}N_{org}$. All carbon and nitrogen isotopes are reported in the usual δ notation relative to Vienna Peedee belemnite (VPDB) for carbon and atmospheric N_2 for nitrogen:

$$\delta\,(‰) = \left(\frac{R_{Sample} - R_{Standard}}{R_{Standard}}\right) \times 1000\,,$$

where R represents the $^{13}C/^{12}C$ ratio and $^{15}N/^{14}N$ ratio of the sample and standard for each isotope.

Results

Elemental composition

TC, TOC, and TN contents show spatial variation across the transect of four sites (Table **T1;** Figs. **F1, F2**). Their values gradually decrease from land toward open sea. That is, the highest values are at Site U1329 and the lowest values are at Site U1326. Variation with depth show a similar trend among these elements. TC, TOC, and TN values slightly increase with depth at Sites U1329 and U1327, whereas they decrease with depth at Sites U1325 and U1326 (Fig. **F1**). In particular, TC values reach 7.34 wt% in the upper part of Site U1328 (Fig. **F1**), where many massive gas hydrates and authigenic carbonates were found on board (see the **"Site U1328"** chapter).

TOC and TN show a strong positive correlation ($R^2 > 0.80$) (Table **T1**). Also, moderate or strong positive correlations were observed between TC and TOC and between TC and TN, except for an abnormal value.

Organic matter from marine algae typically has an atomic TOC/TN ratio of 4–10; ratios from vascular land plants are ≥20 (Emerson and Hedges, 1988; Meyers, 1994). Most atomic TOC/TN ratios in tested Expedition 311 samples have a range of 4–10 (Table **T1;** Figs. **F1, F2**) and are relatively constant with depth.

TS content at Site U1328 is higher at the surface and shows a slightly increasing trend with depth. At Site U1326, TS content slightly decreases with depth (Fig. **F1**). TOC/TS ratios at Sites U1326 and U1328 have a slightly decreasing trend with depth, whereas they are slightly increasing at Sites U1325 and U1329 (Fig. **F1**).

Rock-Eval pyrolysis

Most analyzed S_2 and S_3 values from Expedition 311 samples are <3 mg hydrocarbon [HC]/g rock and 3 mg CO_2/g rock (Table **T1;** Fig. **F3**). S_2 values show vertical and spatial variations through the transect, whereas S_3 values do not show any trend (Fig. **F3**). S_2 values are higher at Sites U1329 and U1327, located nearer to land, than at other sites. Additionally, S_2 values at Sites U1329 and U1327 slightly increase with depth, whereas S_2 values at the other sites are relatively constant irrespective of depth (Fig. **F3**).

Most analyzed HI and OI values are 50–150 mg HC/g TOC and 100–300 mg CO_2/g TOC (Table **T1;** Figs. **F3, F4**). Plotting modified van Krevelen-type and S_2 versus TOC diagrams using analyzed values from Expedition 311, most samples are at Type III evolution. There is a strong positive correlation ($R^2 > 0.80$) between S_2 and TOC (Fig. **F4**).

Most analyzed T_{max} values were <435°C, which shows that organic matter in the samples is at a thermally immature stage. T_{max} did not show vertical variation with depth (Table **T1;** Fig. **F3**). However, T_{max} has the lowest values (<350°C) in the upper part of lithostratigraphic Unit I (<50 meters below seafloor) at Site U1328 (Fig. **F3**). This interval contains massive in situ gas hydrates (see the **"Site U1328"** chapter). Additionally, the T_{max} of Unit III at

Site U1326 has a lower value and shows variation (Fig. F3).

Isotopic composition

Marine organic matter typically has $\delta^{13}C$ values from –22‰ to –20 ‰ (Jasper and Gagosian, 1990; Meyers, 1994). Measured $\delta^{13}C_{org}$ values of Expedition 311 samples generally are from –27.5‰ to –22.5‰. $\delta^{13}C_{org}$ values are higher at Sites U1329 and U1327 compared to the other sites (Table T1; Figs. F1, F2). $\delta^{13}C_{org}$ values slightly increase with depth at Sites U1329, U1327, and U1328, whereas they show a slightly decreasing tend at Site U1325 (Figs. F1, F2).

Analyzed $\delta^{15}N_{org}$ values are from –3‰ to 6‰. $\delta^{15}N_{org}$ values are higher at Sites U1329, U1327, and U1328 than at Sites U1325 and U1326. $\delta^{15}N_{org}$ values slightly decrease with depth at Sites U1329, U1327, and U1325, whereas they show a slightly increasing tend at Site U1328 (Table T1; Figs. F1, F2).

Acknowledgments

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Figure F1. Element concentrations, ratios, and isotope profiles. TC = total carbon, TOC = total organic carbon, TN = total nitrogen, TS = total sulfur. **A.** Site U1325. **B.** Site U1326. **C.** Site U1327. (**Continued on next page.**)

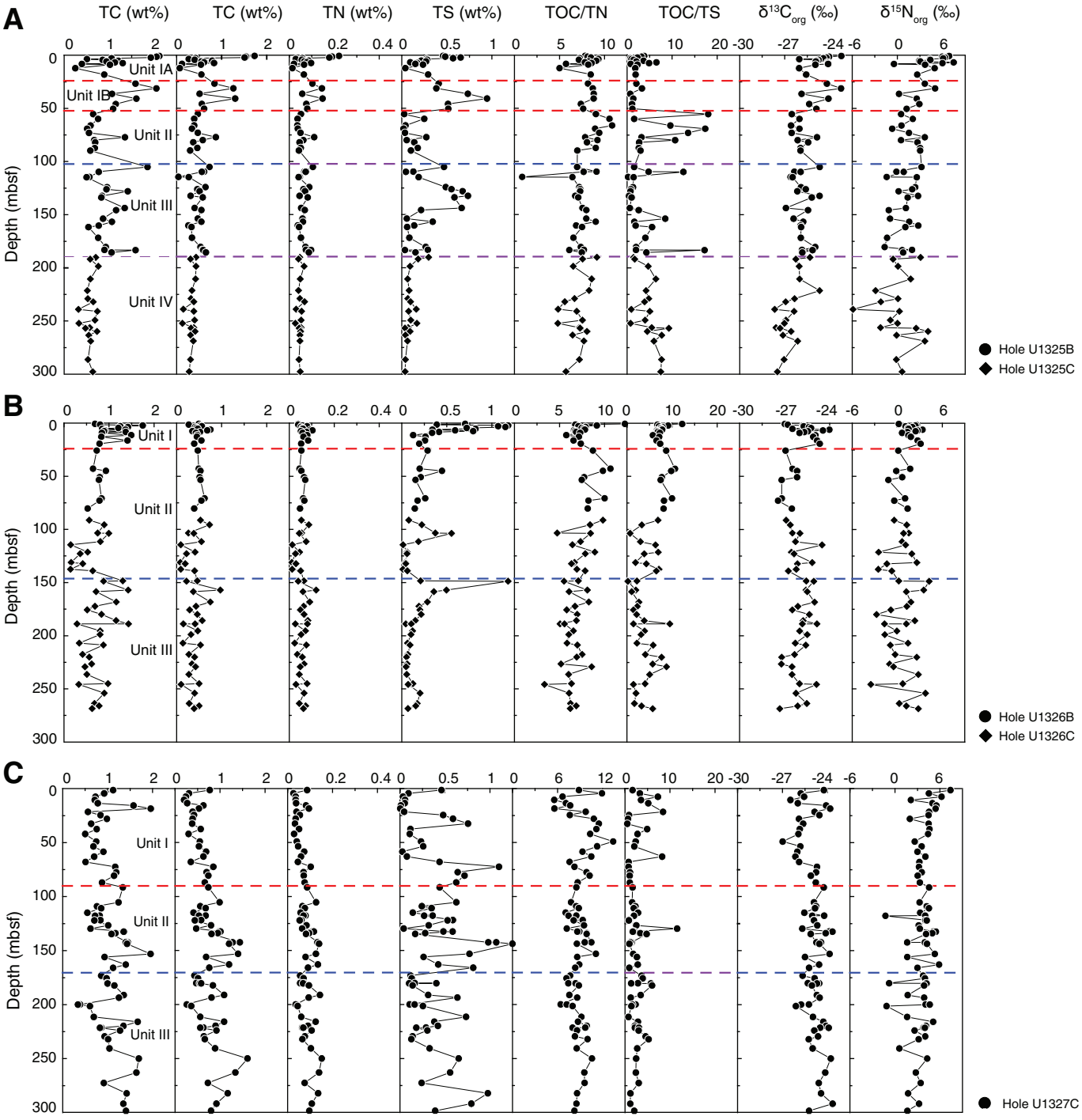

Figure F1 (continued). D. Site U1328. **E.** Site U1329.

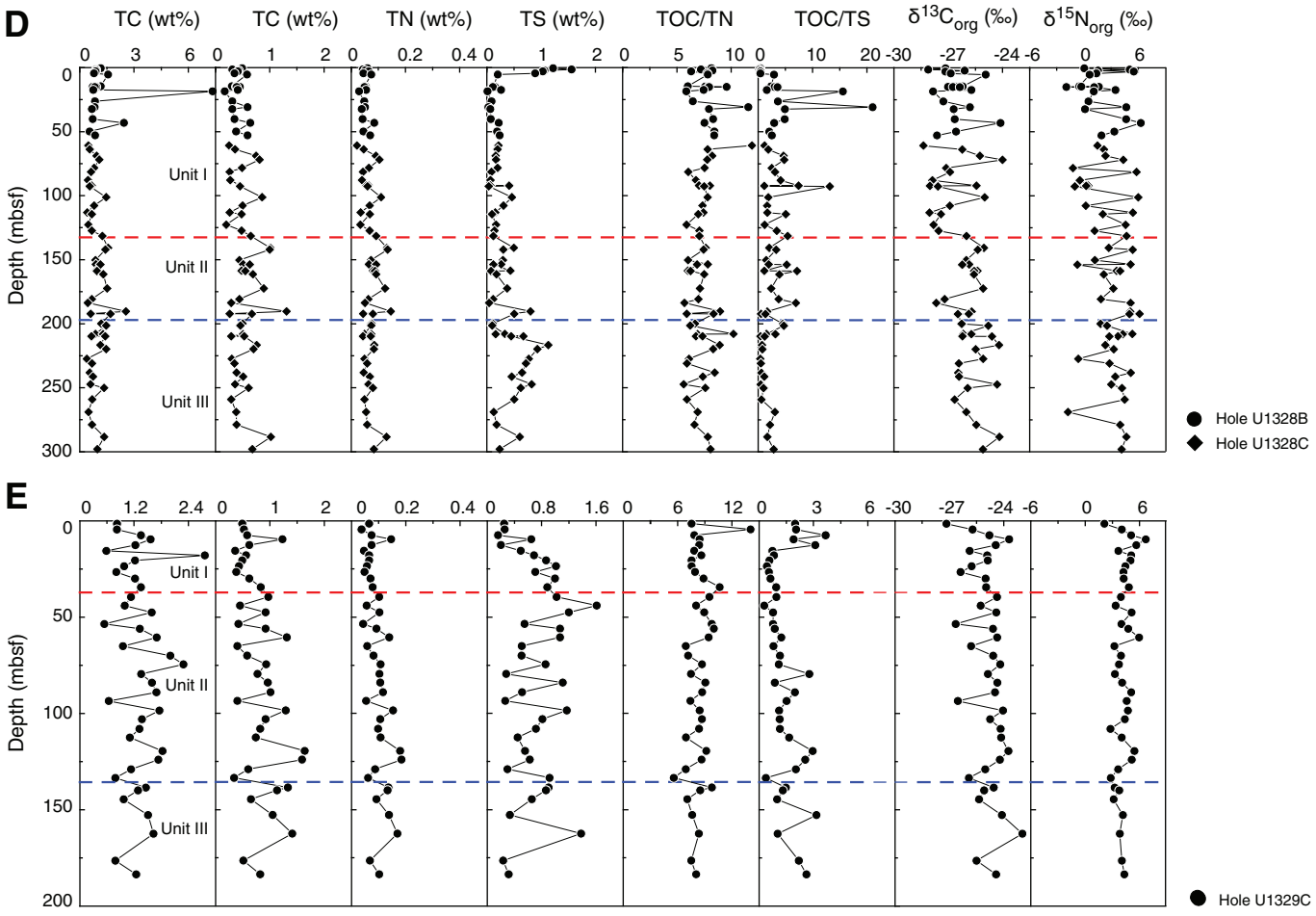

Figure F2. Element concentration, ratio, and isotope values by lithostratigraphic unit. Horizontal line = median, bottom box = first quartile (Q_1), top box = third quartile (Q_3), whiskers = lowest and highest observations inside the regions $Q_1 - 1.5(Q_3 - Q_1)$ and $Q_3 - 1.5(Q_3 - Q_1)$, respectively. * = outliers. **A.** Total carbon (TC). **B.** Total organic carbon (TOC). **C.** Total nitrogen (TN). **D.** Total sulfur (TS). **E.** TOC/TN. **F.** TOC/TS. **G.** Carbon isotope. **H.** Nitrogen isotope.

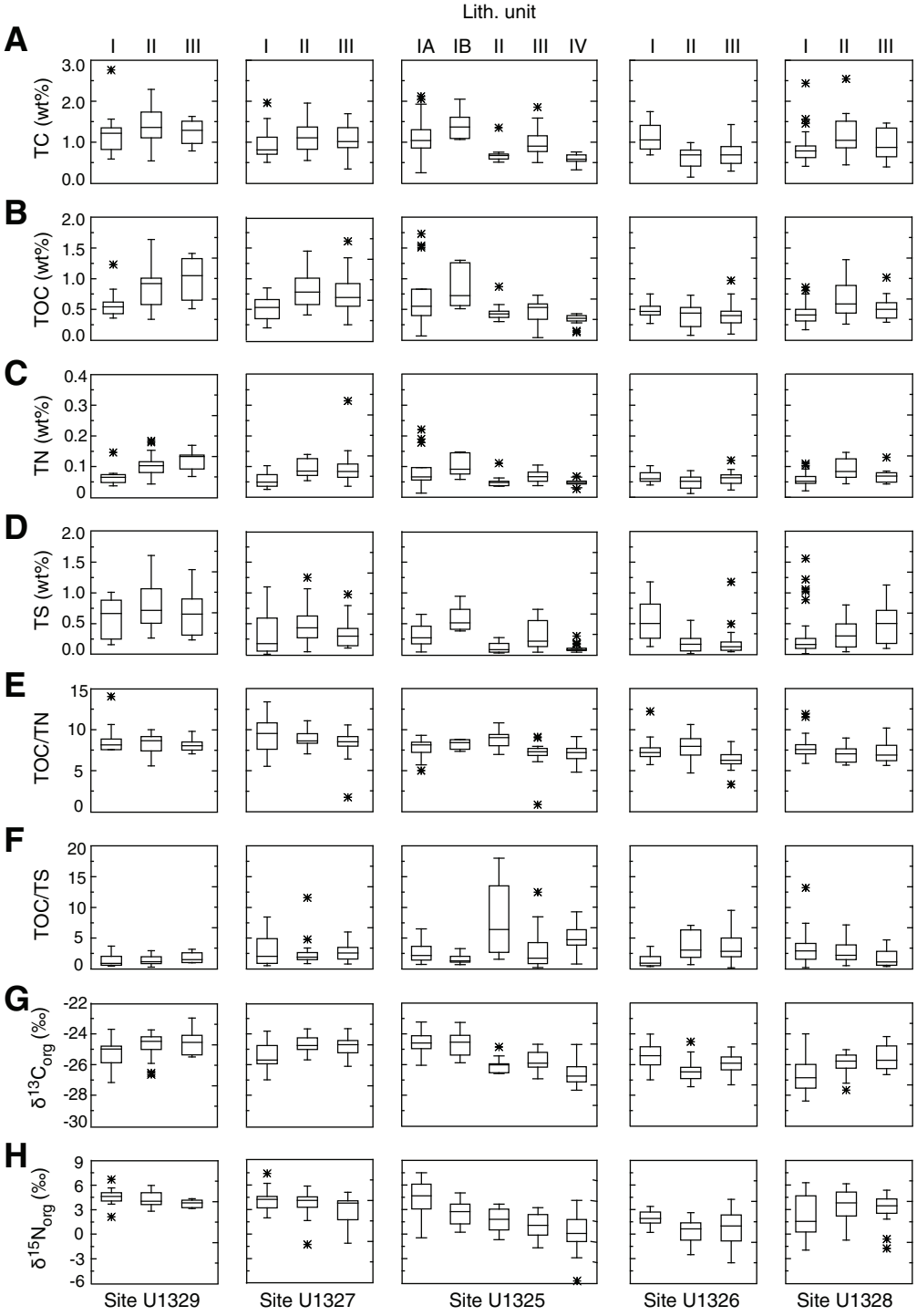

Figure F3. Rock-Eval pyrolysis profiles. S_2 = second peak, S_3 = third peak, T_{max} = temperature at S_2, HI = hydrogen index, HC = hydrocarbon, TOC = total organic carbon, OI = oxygen index. **A.** Site U1325. **B.** Site U1326. **C.** Site U1327. (**Continued on next page.**)

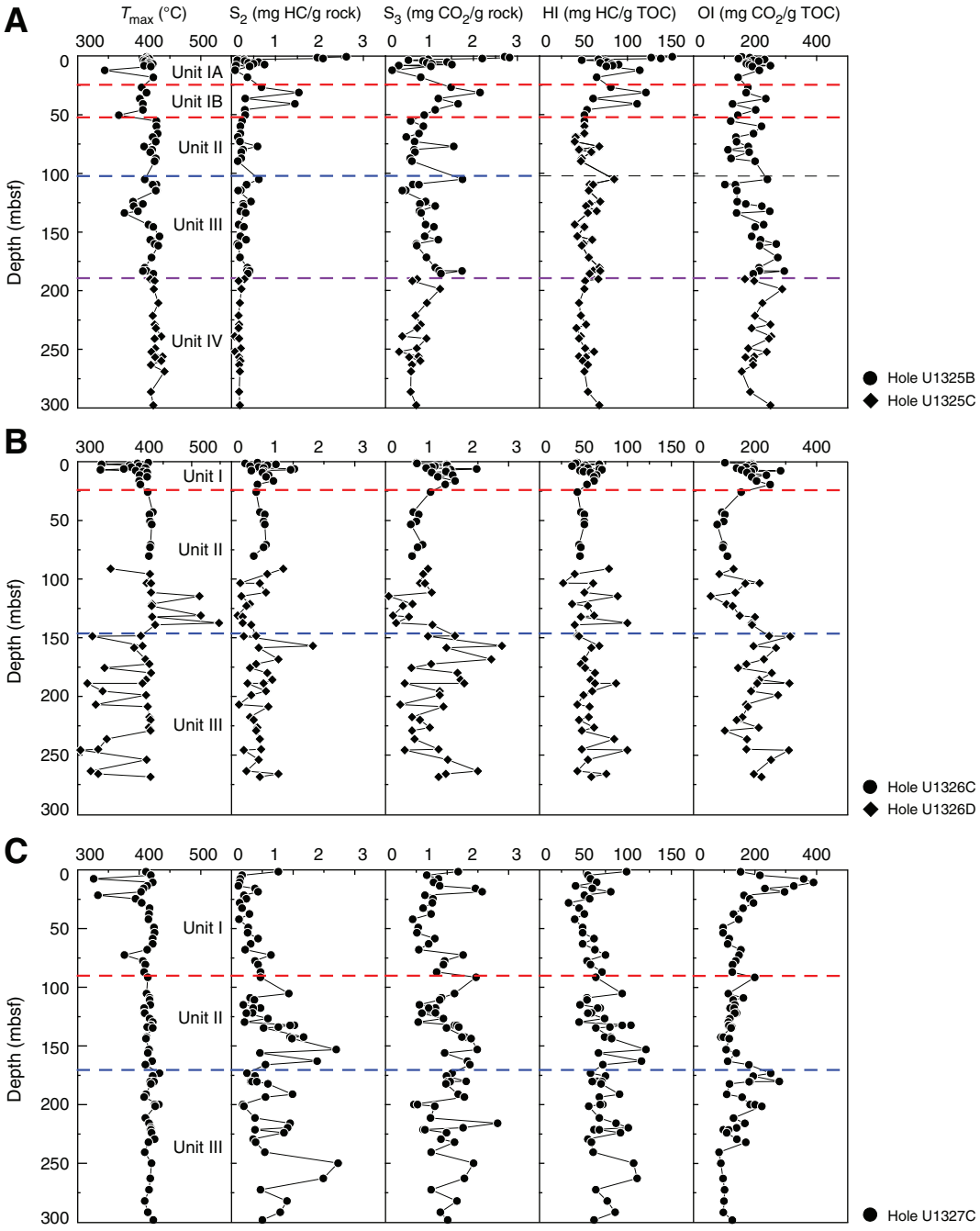

Figure F3 (continued). D. Site U1328. **E.** Site U1329.

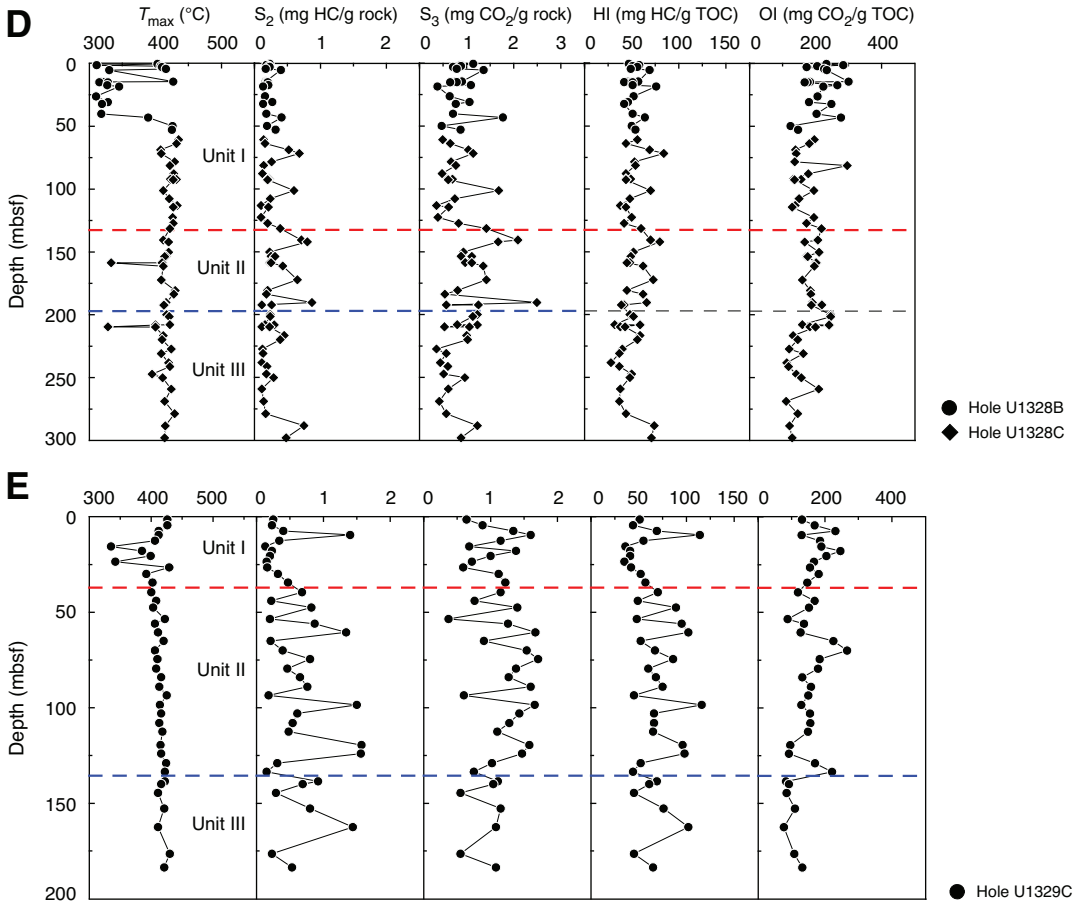

Figure F4. Modified van Krevelen-type diagrams and cross-plots. HI = hydrogen index, HC = hydrocarbon, OI = oxygen index, TOC = total organic carbon. **A.** Site U1325. **B.** Site U1326. **C.** Site U1327. (**Continued on next page.**)

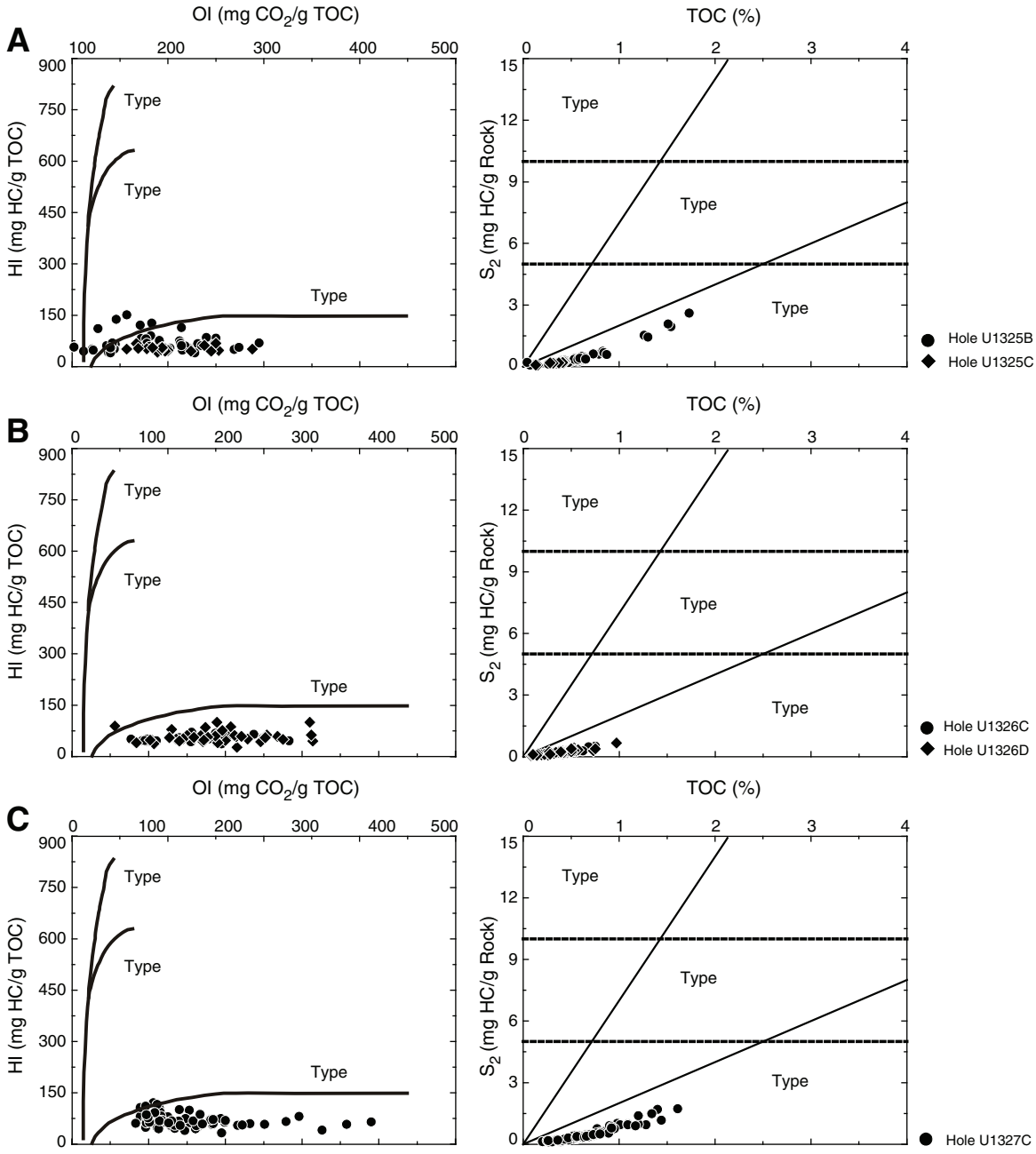

Figure F4 (continued). D. Site U1328. **E.** Site U1329.

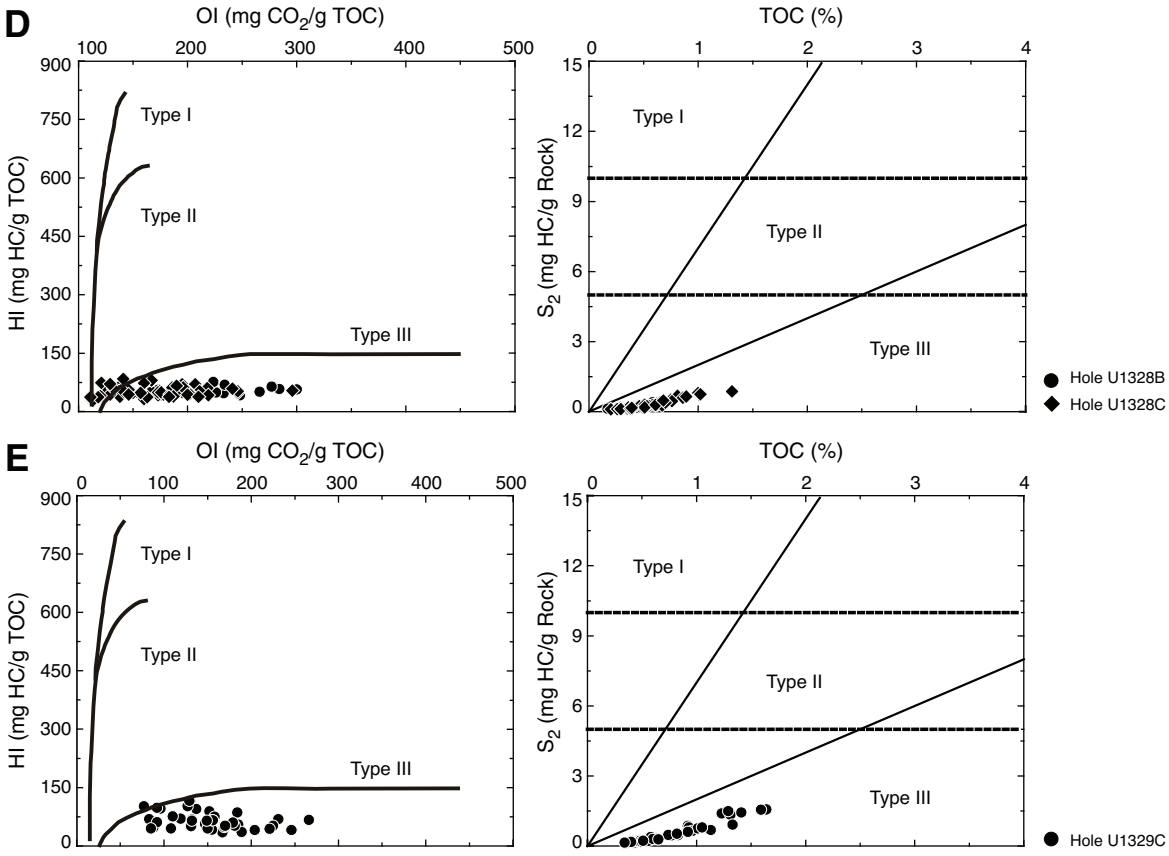

Table T1. Compositions of bulk sediments. (See table note.) (Continued on next four pages.)

Core, section, interval (cm)	Depth (mbsf)	Major elements (wt%)			Rock-Eval pyrolysis								Isotopes (‰)	
		TC	TN	TS	S_2 (mg HC/g rock)	S_3 (mg CO_2/g rock)	T_{max} (°C)	TOC (wt%)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)	TOC/TN	TOC/TS	$\delta^{13}C$	$\delta^{15}N$
311-U1325B-														
1H-1, 65–80	0.7	2.12	0.22	0.46	2.61	2.71	412	1.73	151	157	7.8	3.8	–23.2	6.9
1H-1, 135–150	1.4	2.05	0.19	0.48	1.95	2.82	415	1.54	127	183	8.1	3.2	–24.1	6.0
1H-2, 65–80	2.2	1.93	0.18	0.65	2.08	2.20	416	1.51	138	146	8.5	2.3	–24.2	6.4
1H-2, 135–150	2.9	1.06	0.06	0.57	0.28	0.97	411	0.42	67	231	7.2	0.7	–24.4	6.1
1H-3, 60–75	3.7	0.51	0.03	0.27	0.13	0.52	407	0.27	48	193	9.3	1.0	–26.0	4.3
1H-3, 135–150	4.4	0.86	0.06	0.28	0.30	0.85	410	0.40	75	212	7.1	1.4	–24.8	4.4
1H-4, 65–80	5.2	1.20	0.09	0.22	0.61	1.40	416	0.79	77	177	9.1	3.7	–24.9	2.9
1H-4, 135–150	5.9	0.94	0.07	0.27	0.38	0.94	417	0.55	69	171	8.2	2.0	–24.9	3.1
1H-5, 65–80	6.7	1.13	0.08	0.09	0.50	1.05	422	0.61	82	172	7.8	6.5	–24.2	7.5
1H-5, 135–150	7.4	1.30	0.10	0.17	0.75	1.51	417	0.83	90	182	8.6	4.9	–24.1	6.0
1H-6, 65–80	8.2	0.40	0.02	0.15	0.10	0.30	408	0.12	83	250	5.7	0.8	–24.1	–0.5
1H-6, 135–150	8.9	1.02	0.07	0.24	0.41	1.03	419	0.54	76	191	8.2	2.3	–25.0	3.7
2H-2, 135–150	12.2	0.25	0.01	0.04	0.08	0.15	344	0.07	114	214	5.0	1.8	–26.0	5.0
2H-6, 135–150	18.2	0.89	0.07	0.29	0.36	0.80	423	0.55	65	145	8.5	1.9	–25.6	2.7
4H-2,135–150	26.7	1.59	0.10	0.41	0.68	1.49	404	0.84	81	177	8.2	2.1	–24.2	3.7
4H-5, 135–150	31.2	2.05	0.15	0.38	1.53	2.15	412	1.26	121	171	8.7	3.3	–23.3	5.0
5H-2, 127–142	36.3	1.07	0.06	0.73	0.31	1.20	401	0.51	61	235	8.8	0.7	–25.9	0.2
5H-5, 135–150	40.8	1.61	0.15	0.95	1.44	1.65	406	1.30	111	127	8.8	1.4	–24.1	2.6
6H-2, 135–150	45.9	1.15	0.08	0.51	0.30	1.13	406	0.56	54	202	7.4	1.1	–25.4	2.9
6H-5, 135–150	50.4	1.09	0.08	0.52	0.31	0.88	367	0.61	51	144	7.6	1.2	–24.9	1.2
7H-2, 135–150	55.4	0.65	0.05	0.03	0.24	0.57	428	0.47	51	121	9.0	18.0	–26.5	0.5
7H-5, 135–150	59.9	0.76	0.04	0.25	0.20	0.86	428	0.39	51	221	10.5	1.6	–26.0	2.1
8H-3, 125–150	66.1	0.59	0.04	0.04	0.20	0.76	430	0.39	51	195	10.8	9.6	–26.6	0.6
8H-5, 123–150	69.1	0.51	0.04	0.02	0.14	0.47	422	0.34	41	138	8.9	17.3	–26.0	–0.7
9X-2, 0–25	73.0	0.55	0.05	0.03	0.19	0.66	427	0.47	40	140	9.4	13.5	–26.5	1.6
10X-3, 125–150	77.2	1.35	0.11	0.27	0.59	1.55	408	0.87	68	178	7.8	3.2	–24.9	3.7
10X-5, 107–117	79.9	0.67	0.06	0.05	0.26	0.65	421	0.58	45	112	9.2	10.7	–26.1	0.5
10X-7, 31–41	82.0	0.69	0.05	0.14	0.22	0.67	418	0.37	59	181	8.0	2.7	–25.4	2.7
12X-2, 125–150	87.3	0.68	0.05	0.18	0.22	0.56	427	0.46	48	122	9.0	2.6	–26.0	3.0
12X-4, 68–93	89.7	0.58	0.04	0.10	0.14	0.60	425	0.30	47	200	7.0	3.0	–26.0	3.0
14X-2, 125–150	105.2	1.85	0.11	0.47	0.62	1.75	409	0.73	85	240	7.0	1.6	–24.7	3.2
14X-5, 125–131	109.6	0.76	0.07	0.13	0.35	0.62	428	0.61	57	102	9.1	4.8	–26.4	–0.1
14X-6, 0–25	109.8	0.77	0.07	0.04	0.34	0.76	422	0.56	61	136	7.7	12.5	–25.9	0.9
15X-2, 120–150	114.6	0.57	0.05	0.18	0.21	0.46	428	0.04	525	1150	0.9	0.2	–26.6	–1.4
15X-3, 0–14	114.8	0.50	0.04	0.19	0.15	0.38	427	0.27	56	141	6.4	1.4	–26.5	2.6
16X-2, 120–150	124.2	0.96	0.09	0.49	0.44	0.91	390	0.64	69	142	7.2	1.3	–25.9	2.4
16X-4, 25–35	126.1	0.94	0.06	0.55	0.26	0.78	406	0.46	57	170	7.3	0.8	–25.6	2.0
16X-6, 120–150	128.0	1.42	0.07	0.68	0.27	1.13	391	0.51	53	222	7.3	0.8	–26.2	0.2
18X-1, 140–150	132.4	0.85	0.05	0.73	0.20	0.77	398	0.31	65	248	6.7	0.4	–24.7	2.8
18X-2, 126–156	133.8	0.83	0.08	0.58	0.32	0.81	376	0.58	55	140	7.1	1.0	–25.2	1.4
19X-3, 21–30	143.8	1.35	0.05	0.66	0.16	0.91	415	0.40	40	228	7.5	0.6	–26.9	1.1
19X-5, 31–53	145.7	1.16	0.07	0.21	0.28	1.10	423	0.55	51	200	8.0	2.6	–25.5	–1.1
20X-3, 45–64	153.7	0.87	0.06	0.06	0.20	0.89	433	0.47	43	189	8.0	8.5	–26.4	–1.0
20X-5, 120–150	156.7	1.06	0.06	0.34	0.33	1.20	418	0.55	60	218	9.0	1.6	–25.8	1.6
21X-1, 37–51	160.2	0.77	0.04	0.14	0.13	0.70	425	0.26	50	269	6.8	1.9	–26.0	2.8
21X-2, 120–150	161.7	0.54	0.04	0.06	0.16	0.71	431	0.33	48	215	7.5	5.5	–25.9	1.1
23X-1, 120–150	171.8	0.76	0.05	0.08	0.19	0.93	420	0.34	56	274	6.5	4.1	–25.9	–1.4
24X-2, 0–11	180.4	0.93	0.07	0.27	0.36	1.13	409	0.53	68	213	7.4	2.0	–25.0	–1.7
24X-3, 120–150	183.1	0.90	0.07	0.29	0.35	1.22	412	0.57	61	214	7.7	2.0	–25.9	2.0
24X-4, 0–14	183.3	1.59	0.10	0.03	0.41	1.74	406	0.59	69	295	6.1	17.2	–25.2	0.6
24X-5, 112–145	185.6	1.06	0.09	0.15	0.37	1.26	423	0.65	57	194	7.5	4.3	–25.8	0.8
311-U1325C-														
1X-1, 125–150	190.2	0.70	0.05	0.30	0.29	0.72	418	0.43	67	167	9.1	1.4	–25.3	3.1
1X-2, 141–150B	191.8	0.58	0.04	0.18	0.16	0.61	425	0.31	52	197	7.6	1.7	–26.3	–0.6
2X-1, 0–43	198.6	0.76	0.07	0.09	0.22	1.24	424	0.43	51	288	6.5	4.7	–26.0	0.1
4X-3, 0–79	210.5	0.58	0.05	0.07	0.19	0.94	431	0.42	45	224	8.6	6.4	–26.0	1.8
6X-3, 88–112	221.4	0.52	0.04	0.08	0.16	0.68	422	0.34	47	200	8.3	4.2	–24.7	–2.9
7X-2, 0–50	229.0	0.53	0.05	0.07	0.17	0.80	425	0.32	53	250	6.7	4.8	–26.4	0.1
7X-4, 69–79	231.9	0.65	0.07	0.10	0.16	0.72	427	0.38	42	189	5.6	3.9	–26.9	–2.2
8X-2, 62–85	239.0	0.32	0.03	0.16	0.07	0.38	436	0.15	47	253	4.8	0.9	–27.7	–5.9
8X-4, 0–50	240.9	0.74	0.06	0.08	0.17	0.93	425	0.38	45	245	6.9	5.1	–26.4	0.3
9X-2, 100–150	249.3	0.69	0.05	0.10	0.21	0.71	426	0.40	52	178	7.5	4.0	–26.9	–0.9
9X-4, 111–128	252.2	0.33	0.03	0.17	0.08	0.31	420	0.13	62	238	4.8	0.8	–27.0	0.0
10P-1, 6–16	256.2	0.57	0.05	0.07	0.17	0.75	438	0.38	45	197	7.2	5.5	–27.6	–2.2
10P-1, 60–70	256.8	0.48	0.04	0.03	0.17	0.54	426	0.32	53	169	7.3	9.3	–27.3	2.5

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

Core, section, interval (cm)	Depth (mbsf)	Major elements (wt%)			Rock-Eval pyrolysis								Isotopes (‰)	
		TC	TN	TS	S_2 (mg HC/g rock)	S_3 (mg CO_2/g rock)	T_{max} (°C)	TOC (wt%)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)	TOC/TN	TOC/TS	$\delta^{13}C$	$\delta^{15}N$
11X-2, 105–150	259.9	0.73	0.05	0.09	0.20	0.79	436	0.41	49	193	8.0	4.5	–26.6	4.1
11X-5, 0–45	263.3	0.55	0.05	0.04	0.17	0.60	419	0.31	55	194	6.5	7.7	–27.1	–0.1
12X-3, 0–45	268.9	0.59	0.05	0.06	0.19	0.58	441	0.37	51	157	7.7	5.9	–26.1	3.7
14X-2, 0–80	286.3	0.53	0.04	0.04	0.17	0.57	419	0.31	55	184	7.2	7.7	–27.0	–0.1
15X-3, 0–134	297.8	0.64	0.05	0.04	0.19	0.70	423	0.28	68	250	5.7	7.5	–27.5	0.6
311-U1326C-														
1H-1, 65–80	0.7	0.69	0.04	0.70	0.21	0.50	424	0.49	43	102	12.3	0.7	–27.0	0.2
1H-1, 135–150	1.4	0.80	0.04	0.39	0.11	0.51	405	0.27	41	189	6.8	0.7	–26.8	2.5
1H-2, 65–80	2.2	1.75	0.06	1.18	0.36	0.99	342	0.53	68	187	9.1	0.4	–25.8	2.4
1H-2, 135–150	2.9	1.25	0.08	1.07	0.29	1.00	391	0.56	52	179	7.1	0.5	–25.7	1.1
1H-3, 60–72	3.7	1.42	0.05	1.15	0.15	0.80	408	0.41	37	195	7.9	0.4	–25.4	2.0
2H-1, 60–75	4.6	1.21	0.06	0.72	0.22	0.75	394	0.44	50	170	7.5	0.6	–25.2	1.4
2H-1, 135–150	5.3	0.85	0.06	0.82	0.26	0.66	419	0.47	55	140	7.7	0.6	–26.5	1.5
2H-2, 65–80	6.1	1.36	0.10	0.34	0.51	1.48	381	0.75	68	197	7.8	2.2	–24.0	3.4
2H-2, 135–150	6.8	0.90	0.10	0.59	0.48	1.06	340	0.68	71	156	6.6	1.1	–24.5	2.7
2H-3, 60–75	7.6	0.89	0.05	0.79	0.16	0.99	402	0.35	46	283	6.7	0.4	–25.5	2.5
2H-3,135–150	8.3	1.37	0.08	0.41	0.26	0.98	415	0.52	50	188	6.8	1.3	–25.7	1.4
2H-4, 65–80	9.1	0.84	0.06	0.34	0.25	0.75	422	0.43	58	174	7.3	1.3	–26.0	0.6
2H-5, 135–150	11.3	1.49	0.08	0.13	0.30	1.09	409	0.46	65	237	5.8	3.7	–25.0	1.5
2H-6, 135–150	12.8	0.83	0.06	0.26	0.28	0.85	422	0.45	62	189	7.1	1.7	–25.1	1.8
3H-2, 135–150	16.3	1.41	0.08	0.26	0.34	1.13	408	0.55	62	205	6.5	2.1	–24.8	2.7
3H-4, 135–150	19.3	0.79	0.05	0.19	0.21	0.97	410	0.39	54	249	7.4	2.0	–24.7	3.1
4H-2, 135–150	25.8	0.73	0.05	0.29	0.20	0.73	423	0.47	43	155	8.7	1.6	–26.9	0.1
6X-2, 125–150	42.9	0.64	0.05	0.20	0.23	0.45	432	0.49	47	92	10.7	2.5	–26.5	1.7
6X-4, 83–96	44.9	0.93	0.05	0.45	0.27	0.54	426	0.53	51	102	9.8	1.2	–26.2	–0.1
7X-1, 93–133	50.8	0.79	0.07	0.21	0.26	0.50	427	0.51	51	98	7.7	2.4	–26.2	0.7
7X-3, 74–101	53.4	0.78	0.07	0.15	0.27	0.41	430	0.53	51	77	7.5	3.5	–27.2	–1.2
9X-2, 0–25	70.7	0.83	0.06	0.26	0.28	0.60	428	0.62	45	97	10.0	2.4	–27.2	1.0
9X-3, 66–91	72.9	0.79	0.07	0.18	0.26	0.52	427	0.55	47	95	8.2	3.1	–27.4	–0.4
10H-2, 0–30	80.4	0.52	0.05	0.14	0.18	0.43	425	0.39	46	110	8.1	2.7	–26.5	1.4
311-U1326D-														
2X-2, 125–150	91.3	0.56	0.05	0.08	0.42	0.69	358	0.53	79	130	9.8	6.9	–26.9	–0.4
2X-5, 104–144	95.6	0.89	0.09	0.22	0.29	0.61	427	0.73	40	84	8.4	3.3	–26.6	1.3
3X-4, 61–90	103.4	0.75	0.06	0.37	0.07	0.56	421	0.26	27	215	4.7	0.7	–26.5	1.6
3X-4, 90–119	103.6	0.99	0.05	0.55	0.23	0.64	429	0.38	61	168	8.4	0.7	–26.0	0.8
4X-3, 40–106	111.4	0.81	0.08	0.18	0.28	0.75	429	0.55	51	136	7.3	3.0	–26.3	0.6
4X-5, 126–146	114.5	0.15	0.01	0.01	0.08	0.05	514	0.09	89	56	6.4	6.3	–24.5	1.1
5X-3, 102–150	121.3	0.52	0.05	0.06	0.15	0.44	431	0.41	37	107	8.9	6.9	–26.6	–2.5
5X-4, 115–150	122.9	0.36	0.03	0.06	0.12	0.28	430	0.22	55	127	7.9	3.8	–26.4	1.9
6X-3, 100–113	131.1	0.16	0.01	0.04	0.05	0.12	516	0.08	62	150	6.7	1.9	–25.2	2.6
6X-4, 90–132	132.2	0.42	0.03	0.04	0.09	0.38	431	0.19	47	200	6.3	4.3	–26.2	–1.4
7X-1, 73–96	137.4	0.14	0.01	0.01	0.09	0.17	548	0.09	100	189	6.9	7.1	–26.2	–2.5
7X-3, 0–50	139.0	0.64	0.05	0.06	0.16	0.76	436	0.40	40	190	7.8	6.5	–26.8	–0.7
8X-2, 36–86	148.4	1.31	0.07	0.21	0.20	1.13	411	0.46	43	246	7.1	2.2	–25.6	0.2
8X-2, 86–96	148.7	0.88	0.04	1.18	0.10	0.69	326	0.22	45	314	5.5	0.2	–25.1	4.3
9X-1, 84–134	157.0	1.43	0.12	0.50	0.66	1.89	414	0.97	68	195	8.1	2.0	–25.6	3.5
9X-4, 35–48	158.5	0.71	0.06	0.36	0.22	0.99	399	0.37	59	268	6.1	1.0	–25.5	1.2
10X-2, 97–142	168.3	1.16	0.09	0.28	0.38	1.72	419	0.75	51	229	8.2	2.6	–25.0	1.8
10X-6, 0–66	172.4	0.69	0.06	0.19	0.20	0.74	426	0.43	47	172	6.7	2.3	–26.1	1.3
11X-1, 38–49	175.6	0.51	0.05	0.20	0.15	0.42	347	0.29	52	145	5.8	1.5	–26.5	–0.9
11X-4, 110–150	179.9	0.83	0.07	0.22	0.29	1.17	429	0.46	63	254	7.0	2.1	–25.4	–2.8
12X-1, 75–125	185.8	1.16	0.08	0.15	0.33	1.22	420	0.57	58	214	6.9	3.8	–25.8	2.3
12X-3, 100–150*	188.8	1.43	0.08	0.04	0.26	1.28	414	0.41	63	312	5.1	9.5	–24.9	1.2
12X-3, 100–150	188.8	0.29	0.03	0.11	0.13	0.31	317	0.15	87	207	5.6	1.4	–25.8	–1.7
13X-1, 100–110	195.5	0.80	0.07	0.12	0.28	0.88	344	0.47	60	187	6.5	3.9	–26.0	–0.1
13X-4, 60–112	198.9	0.80	0.05	0.10	0.16	0.88	420	0.32	50	275	6.0	3.1	–25.5	–1.7
14X-3, 58–73	206.9	0.34	0.02	0.06	0.06	0.24	332	0.14	43	171	5.8	2.2	–26.3	1.4
14X-5, 0–50	208.8	0.88	0.08	0.09	0.30	0.94	423	0.53	57	177	7.0	5.8	–25.6	–0.9
15X-3, 100–150	217.6	0.41	0.04	0.07	0.15	0.43	426	0.27	56	159	7.5	4.1	–26.3	–0.3
15X-5, 50–100	220.1	0.56	0.06	0.05	0.18	0.56	428	0.40	45	140	6.9	7.7	–27.2	2.6
16X-3, 0–50	226.6	0.61	0.07	0.06	0.21	0.72	425	0.34	62	212	5.2	5.7	–27.2	–1.0
16X-5, 0–52	229.2	0.47	0.05	0.05	0.20	0.43	428	0.42	48	102	8.6	8.8	–26.5	–0.5
17X-3, 0–100	236.4	0.51	0.05	0.05	0.23	0.47	351	0.27	85	174	6.0	5.0	–26.5	2.8
18X-3, 0–90	245.1	0.98	0.08	0.12	0.24	0.86	336	0.50	48	172	6.3	4.0	–26.0	0.7
18X-3, 90–120	245.8	0.33	0.03	0.07	0.10	0.31	305	0.10	100	310	3.3	1.4	–24.9	–3.5

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

Core, section, interval (cm)	Depth (mbsf)	Major elements (wt%)			Rock-Eval pyrolysis								Isotopes (‰)	
		TC	TN	TS	S_2 (mg HC/g rock)	S_3 (mg CO_2/g rock)	T_{max} (°C)	TOC (wt%)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)	TOC/TN	TOC/TS	$\delta^{13}C$	$\delta^{15}N$
19X-2, 0–83	254.0	0.89	0.07	0.20	0.22	1.01	421	0.40	55	252	6.1	2.0	–26.3	3.8
20X-2, 33–45	263.7	0.68	0.05	0.17	0.12	1.50	323	0.28	43	536	6.2	1.6	–25.5	0.3
20X-4, 50–150	266.0	0.78	0.07	0.16	0.38	0.98	336	0.50	76	196	6.8	3.2	–26.1	1.2
20X-6, 0–100	268.5	0.63	0.06	0.07	0.23	0.86	428	0.39	59	221	6.2	5.7	–27.3	2.8
311-U1327C-														
1H-1, 140–150	1.5	1.12	0.09	0.46	0.76	1.18	411	0.77	99	153	8.9	1.7	–24.2	7.4
1H-3, 140–150	4.5	0.92	0.03	0.09	0.17	0.67	419	0.31	55	216	11.9	3.3	–25.8	4.5
2H-1, 140–150	7.6	0.73	0.04	0.03	0.14	0.86	326	0.24	58	358	6.7	7.3	–25.6	6.2
2H-3, 140–150	10.6	0.71	0.04	0.06	0.13	0.78	422	0.20	65	390	5.6	3.6	–26.5	2.1
2H-5, 140–150	13.6	0.78	0.04	0.05	0.11	0.88	413	0.27	41	326	7.1	5.2	–26.0	5.0
2H-7, 54–64	15.7	1.58	0.08	0.01	0.38	1.46	407	0.63	60	232	7.7	66.9	–24.1	5.5
3H-2, 140–150	18.6	1.96	0.10	0.00	0.43	1.57	403	0.53	81	296	5.6	219.0	–23.8	5.4
3H-4, 140–150	21.6	0.56	0.04	0.05	0.20	0.64	333	0.39	51	164	9.8	8.4	–24.9	4.5
3H-6, 140–150	24.6	0.84	0.06	0.48	0.24	0.77	394	0.42	57	183	7.6	0.9	–24.5	4.5
4H-2, 135–150	28.0	0.99	0.04	0.59	0.13	0.76	404	0.39	33	195	10.8	0.7	–25.9	2.0
4H-5, 135–150	32.5	0.64	0.03	0.76	0.17	0.61	417	0.38	45	161	11.5	0.5	–25.6	4.5
5H-2, 135–150	37.5	0.76	0.05	0.12	0.29	0.74	416	0.57	51	130	11.2	4.9	–25.9	4.6
5H-5, 135–150	42.0	0.50	0.03	0.11	0.12	0.44	415	0.30	40	147	10.3	2.8	–25.9	4.4
7H-2, 135–150	49.0	0.75	0.04	0.23	0.27	0.53	424	0.55	49	96	13.4	2.4	–27.0	2.6
7H-5, 135–150	53.5	0.69	0.05	0.26	0.26	0.51	425	0.53	49	96	11.3	2.1	–25.8	3.6
8H-2, 120–150	58.5	0.91	0.07	0.03	0.43	0.80	422	0.69	62	116	9.3	26.5	–26.0	3.0
8H-5, 125–150	63.0	0.70	0.06	0.08	0.31	0.70	422	0.63	49	111	10.5	8.2	–26.1	4.1
9H-2, 120–150	68.0	0.51	0.05	0.44	0.22	0.54	413	0.35	63	154	7.6	0.8	–25.9	3.3
9H-5, 125–150	72.5	1.17	0.10	1.10	0.64	1.26	376	0.85	75	148	8.3	0.8	–24.7	3.2
10H-2, 125–150	77.5	1.19	0.07	0.64	0.38	0.96	406	0.70	54	137	9.9	1.1	–24.8	3.6
10H-5, 125–150	80.6	1.14	0.07	0.72	0.43	0.94	410	0.74	58	127	10.3	1.0	–25.1	3.0
11H-2, 125–150	87.0	0.88	0.08	0.63	0.47	0.83	408	0.66	71	126	8.7	1.1	–24.8	3.3
11H-5, 125–150	91.5	1.34	0.09	0.44	0.47	1.47	414	0.74	64	199	8.5	1.7	–24.3	4.6
13X-2, 115–150	105.3	1.24	0.13	0.63	0.93	1.12	412	0.99	94	113	7.8	1.6	–24.9	3.3
13X-5, 71–101	109.0	0.76	0.07	0.24	0.30	0.91	417	0.56	54	162	8.5	2.3	–24.8	4.2
13X-6, 110–150	110.8	0.86	0.08	0.35	0.37	0.88	417	0.68	54	129	8.8	1.9	–24.8	4.5
14X-2, 115–150	114.9	0.55	0.06	0.14	0.19	0.55	418	0.41	46	134	7.1	2.9	–25.5	3.4
14X-4, 102–112	117.7	0.82	0.08	0.36	0.47	0.81	408	0.68	69	119	8.5	1.9	–24.2	4.0
14X-4, 112–122	117.8	0.72	0.07	0.27	0.35	0.70	408	0.53	66	132	7.5	2.0	–25.0	–1.3
15P-1, 0–25	121.8	0.84	0.06	0.59	0.34	0.81	408	0.58	59	140	9.4	1.0	–24.9	4.1
15P-1, 25–50	122.1	0.71	0.05	0.53	0.24	0.59	409	0.44	55	134	8.1	0.8	–24.9	4.2
16X-2, 120–150	126.7	1.01	0.08	0.32	0.59	0.94	417	0.80	74	118	9.5	2.5	–24.7	3.2
16X-4, 120–150	129.7	0.62	0.07	0.04	0.21	0.53	422	0.47	45	113	7.2	11.6	–25.7	3.3
17X-2, 0–10	132.4	1.37	0.11	0.48	1.02	1.12	419	0.98	104	114	8.9	2.0	–23.9	5.1
17X-2, 10–20	132.5	1.36	0.12	0.59	0.95	1.16	419	1.01	94	115	8.6	1.7	–23.7	5.5
17X-3, 64–70	133.9	1.17	0.10	0.28	0.76	1.19	413	0.95	80	125	9.9	3.4	–24.1	5.0
17X-4, 65–74	134.6	1.09	0.08	0.17	0.52	0.99	422	0.81	64	122	9.9	4.8	–25.1	4.2
18X-2, 0–10	142.4	1.45	0.14	0.98	1.17	1.29	411	1.44	81	89	10.5	1.5	–24.7	1.6
18X-2, 0–10	142.4	1.40	0.13	1.07	0.95	1.24	412	1.28	74	97	9.6	1.2	–24.4	4.0
18X-2, 120–150	143.7	1.43	0.14	1.25	0.98	1.39	411	1.20	82	116	8.6	1.0	–24.5	4.3
19X-2, 69–79	153.1	1.96	0.13	0.77	1.70	1.49	416	1.40	121	106	11.1	1.8	–23.9	5.3
19X-4, 120–150	156.0	0.93	0.08	0.26	0.46	0.96	414	0.69	67	139	8.6	2.6	–25.5	1.6
20X-2, 48–76	162.9	1.40	0.14	0.43	1.39	1.33	421	1.20	116	111	8.9	2.8	–24.6	5.9
20X-4, 120–150	165.9	1.12	0.09	0.81	0.55	1.37	410	0.76	72	180	8.4	0.9	–25.2	3.0
21X-2, 113–143	173.2	0.86	0.06	0.12	0.25	1.08	433	0.43	58	251	7.7	3.7	–25.7	3.8
21X-4, 81–150	175.7	0.98	0.07	0.13	0.38	0.99	422	0.51	75	194	7.2	3.9	–24.9	4.0
22X-1, 0–17	180.2	0.99	0.06	0.16	0.31	1.31	421	0.47	66	279	8.4	2.9	–25.3	–0.8
22X-1, 17–26	180.3	1.02	0.07	0.40	0.33	1.01	418	0.55	60	184	7.4	1.4	–24.6	4.1
22X-1, 26–37	180.4	1.00	0.07	0.10	0.41	1.05	424	0.58	71	181	8.4	5.7	–24.7	4.2
22X-2, 86–118	182.3	1.15	0.10	0.14	0.59	0.98	419	0.84	70	117	8.8	6.0	–25.0	3.9
23X-1, 131–161	191.2	1.36	0.14	0.31	0.99	1.18	411	1.09	91	108	7.6	3.5	–24.7	1.7
23X-3, 62–89	193.6	1.25	0.09	0.64	0.55	1.28	408	0.81	68	158	8.6	1.3	–24.5	3.9
25X-1, 51–61	199.9	0.39	0.04	0.11	0.18	0.46	432	0.25	72	184	6.4	2.3	–25.2	4.1
25X-1, 61–71	200.0	0.34	0.04	0.16	0.18	0.52	425	0.26	69	200	7.2	1.6	–25.8	4.6
25X-3, 0–25	201.4	0.61	0.05	0.26	0.20	0.80	426	0.36	56	222	8.0	1.4	–26.1	–1.1
26X-2, 84–114	211.4	0.69	0.06	0.73	0.38	0.73	410	0.56	68	130	9.2	0.8	–25.0	1.6
26X-5, 120–150	215.9	1.67	0.13	0.38	0.95	1.82	416	1.09	87	167	8.7	2.9	–24.3	5.1
27X-1, 108–138	219.7	1.35	0.09	0.42	0.91	1.26	419	0.90	101	140	9.9	2.1	–24.1	4.1
27X-3, 0–10	221.3	0.87	0.07	0.29	0.39	0.61	418	0.63	62	97	9.7	2.2	–24.5	3.8
27X-3, 10–20	221.4	0.83	0.07	0.18	0.38	0.64	419	0.56	68	114	8.0	3.1	–23.9	4.0
27X-4, 114–144	224.0	1.28	0.11	0.30	0.85	0.99	420	0.92	92	108	8.6	3.0	–24.9	2.6

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

Core, section, interval (cm)	Depth (mbsf)	Major elements (wt%)			Rock-Eval pyrolysis								Isotopes (‰)	
		TC	TN	TS	S_2 (mg HC/g rock)	S_3 (mg CO_2/g rock)	T_{max} (°C)	TOC (wt%)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)	TOC/TN	TOC/TS	$\delta^{13}C$	$\delta^{15}N$
28X-1, 120–150	229.5	0.93	0.08	0.14	0.35	0.90	425	0.64	55	141	8.3	4.6	–24.6	4.0
28X-3, 96–125	232.1	1.01	0.07	0.13	0.39	1.12	415	0.66	59	170	10.0	5.2	–25.3	3.2
29X-2, 120–150	240.6	1.04	0.10	0.33	0.54	0.74	409	0.89	61	83	8.6	2.7	–25.0	0.6
30X-2, 88–118	249.9	1.69	0.15	0.65	1.73	1.43	420	1.61	107	89	10.6	2.5	–23.8	4.3
31X-4, 120–150	262.9	1.64	0.14	0.56	1.49	1.28	418	1.34	111	96	9.6	2.4	–24.2	2.8
32X-4, 120–150	272.6	0.92	0.08	0.24	0.47	0.74	416	0.73	64	101	9.6	3.0	–24.6	3.4
33X-4, 120–150	282.2	1.42	0.14	0.98	0.90	1.16	409	1.17	77	99	8.6	1.2	–24.4	1.8
34X-4, 120–150	291.8	1.35	0.11	0.79	0.79	0.89	414	0.92	86	97	8.5	1.2	–23.7	3.2
35X-2, 120–150	298.4	1.41	0.10	0.39	0.50	1.01	423	0.80	62	126	8.2	2.0	–25.2	1.7
311-U1328B-														
1H-1, 40–50	0.5	1.16	0.06	1.22	0.23	1.14	403	0.49	47	233	8.2	0.4	–27.2	0.0
1H-1, 140–150	1.5	0.90	0.04	1.56	0.18	0.88	311	0.31	58	284	7.2	0.2	–28.1	5.1
1H-2, 70–80	2.3	0.90	0.05	1.06	0.22	0.88	408	0.43	51	205	8.3	0.4	–26.1	1.6
1H-2, 140–150	3.0	0.88	0.07	1.03	0.23	0.71	410	0.41	56	173	6.3	0.4	–27.2	5.5
1H-3, 140–150	4.5	0.78	0.05	0.89	0.17	0.79	416	0.35	49	226	7.8	0.4	–26.9	1.4
2H-1, 80–100	5.4	1.56	0.07	0.20	0.40	1.36	330	0.58	69	234	7.8	2.9	–24.9	0.6
4P-1, 0–11	14.6	1.16	0.05	0.13	0.17	0.90	427	0.30	57	300	6.0	2.4	–26.2	–0.5
4P-1, 23–31	14.8	0.76	0.05	0.11	0.19	0.75	318	0.41	46	183	7.6	3.6	–26.6	–0.3
4P-1, 36–46	14.9	0.72	0.05	0.11	0.19	0.66	322	0.38	50	174	7.9	3.5	–27.0	1.7
4P-1, 50–57	15.0	0.91	0.05	0.15	0.19	0.79	315	0.45	42	176	9.6	3.0	–26.7	–1.9
4P-1, 61–67	15.1	0.83	0.05	0.11	0.20	0.65	328	0.39	51	167	8.0	3.5	–26.4	1.1
5H-1, 85–100	17.4	0.74	0.06	0.26	0.21	1.09	327	0.41	51	266	7.5	1.6	–25.7	3.5
6X-1, 0–20	18.5	7.34	0.03	0.01	0.13	0.38	345	0.17	76	224	5.9	15.6	–27.8	1.1
7P-1, 20–30	26.3	0.84	0.05	0.09	0.16	0.64	310	0.31	52	206	6.5	3.6	–27.3	0.5
8H-2, 120–150	30.9	0.82	0.05	0.03	0.27	1.06	328	0.59	46	180	11.6	21.1	–25.8	4.7
8H-3, 120–150	32.4	0.67	0.04	0.06	0.13	0.77	319	0.31	42	248	7.9	4.9	–26.7	0.1
9H-2, 109–134	40.2	0.71	0.04	0.07	0.18	0.71	318	0.35	51	203	8.3	4.9	–26.6	4.7
9H-4, 115–150	43.1	2.44	0.09	0.22	0.41	1.77	389	0.64	64	277	7.5	2.9	–24.1	6.3
10H-2, 125–150	49.9	0.55	0.05	0.19	0.19	0.47	426	0.38	50	124	8.4	2.0	–26.6	3.4
10H-4, 125–150	52.9	0.85	0.07	0.24	0.32	0.87	425	0.59	54	147	8.4	2.5	–27.6	1.9
311-U1328C-														
1H-3, 125–150	60.8	0.47	0.02	0.22	0.14	0.49	435	0.25	56	196	11.9	1.2	–28.4	1.5
1H-5, 125–150	63.8	0.55	0.05	0.20	0.16	0.65	432	0.36	44	181	7.8	1.8	–26.2	2.2
2H-2, 125–150	68.9	0.93	0.09	0.16	0.52	1.04	408	0.75	69	139	8.2	4.7	–25.3	2.4
2H-4, 125–150	71.9	1.08	0.10	0.17	0.68	1.14	409	0.81	84	141	7.8	4.8	–24.0	4.4
3H-2, 125–150	78.4	0.79	0.07	0.20	0.26	0.67	429	0.49	53	137	7.5	2.5	–27.1	–1.2
3H-4, 125–150	81.4	0.62	0.04	0.08	0.14	0.77	422	0.26	54	296	6.0	3.1	–26.9	5.8
4X-2, 125–150	87.9	0.45	0.04	0.07	0.12	0.48	428	0.27	44	178	6.8	4.1	–27.9	–0.5
5P-1, 5–15	92.1	0.60	0.06	0.06	0.22	0.60	423	0.45	49	133	7.0	7.4	–25.4	0.5
5P-1, 23–43	92.3	0.66	0.06	0.41	0.20	0.70	432	0.45	44	156	8.0	1.1	–28.0	0.3
5P-1, 60–70	92.7	0.55	0.06	0.03	0.20	0.61	427	0.45	44	136	7.5	13.2	–27.6	–1.0
6H-7, 125–150	101.3	1.45	0.11	0.46	0.60	1.68	412	0.86	70	195	7.8	1.9	–25.0	6.0
7X-3, 115–140	107.8	0.79	0.07	0.31	0.24	0.75	421	0.50	48	150	7.4	1.6	–26.9	0.2
8X-2, 120–150	113.2	0.41	0.04	0.15	0.10	0.36	433	0.26	38	138	7.4	1.7	–28.0	5.4
8X-3, 97–113	114.4	0.66	0.07	0.09	0.21	0.62	427	0.48	44	129	7.0	5.1	–27.4	2.1
9X-2, 110–140	122.7	0.47	0.03	0.17	0.10	0.39	426	0.20	50	195	5.9	1.2	–27.8	4.6
9X-6, 40–71	127.3	0.66	0.07	0.14	0.20	0.83	427	0.48	42	173	7.1	3.4	–27.5	1.2
10X-2, 22–52	131.5	1.25	0.09	0.12	0.39	1.42	422	0.65	60	218	7.1	5.4	–26.0	4.7
11X-1, 120–150	140.7	1.56	0.13	0.50	0.71	2.09	412	1.01	70	207	7.7	2.0	–25.0	2.8
11X-2, 120–150	142.2	1.41	0.13	0.30	0.80	1.67	420	1.00	80	167	7.5	3.3	–25.4	5.4
12X-1, 120–150	150.3	0.86	0.07	0.30	0.23	0.93	420	0.44	52	211	6.0	1.5	–26.0	1.2
12X-4, 11–28	153.6	0.89	0.07	0.26	0.25	0.88	416	0.51	49	173	7.8	1.9	–25.8	5.2
12X-4, 28–38	153.7	1.14	0.09	0.12	0.31	1.11	414	0.63	49	176	6.8	5.3	–26.2	–0.7
13X-1, 0–10	158.7	0.90	0.08	0.43	0.23	0.97	410	0.48	48	202	6.0	1.1	–25.4	3.6
13X-1, 10–20	158.8	0.95	0.09	0.08	0.25	1.11	333	0.55	45	202	6.3	7.2	–25.6	4.0
13X-2, 120–150	161.4	1.30	0.09	0.18	0.43	1.35	412	0.69	62	196	7.5	3.9	–25.6	2.2
14X-3, 120–150	172.4	1.51	0.13	0.37	0.65	1.42	409	0.89	73	160	7.1	2.4	–25.1	3.3
15X-2, 117–147	180.7	0.66	0.06	0.12	0.20	0.81	430	0.44	45	184	7.0	3.8	–27.2	1.9
15X-4, 115–150	183.7	0.45	0.05	0.04	0.18	0.54	428	0.29	62	186	5.7	6.9	–27.7	5.2
16X-2, 120–150	190.4	2.54	0.15	0.80	0.87	2.49	416	1.31	66	190	9.0	1.6	–25.7	5.1
16X-4, 21–28	192.2	0.60	0.04	0.50	0.11	0.57	414	0.26	42	219	5.9	0.5	–25.9	6.2
16X-4, 28–39	192.3	1.70	0.08	0.50	0.26	1.25	413	0.67	39	187	8.4	1.3	–26.5	5.0
17X-2, 120–150	200.0	1.18	0.08	0.11	0.24	1.23	417	0.50	48	246	6.7	4.5	–26.3	1.8
17X-3, 120–150	201.5	1.46	0.07	0.10	0.24	1.13	421	0.46	52	246	6.2	4.7	–24.8	2.6
18X-1, 120–130	208.0	0.87	0.05	0.33	0.16	0.80	422	0.50	32	160	10.2	1.5	–26.2	5.4

Table T1 (continued).

Core, section, interval (cm)	Depth (mbsf)	Major elements (wt%)			Rock-Eval pyrolysis								Isotopes (‰)	
		TC	TN	TS	S_2 (mg HC/ g rock)	S_3 (mg CO_2/ g rock)	T_{max} (°C)	TOC (wt%)	HI (mg HC/ g TOC)	OI (mg CO_2/ g TOC)	TOC/ TN	TOC/ TS	$\delta^{13}C$	$\delta^{15}N$
18X-2, 0–25	208.1	1.29	0.07	0.16	0.30	1.23	400	0.51	59	241	6.9	3.1	–25.7	4.3
18X-3, 67–72	209.7	0.64	0.04	0.67	0.11	0.53	328	0.29	38	183	6.7	0.4	–26.2	3.8
18X-3, 72–82	209.8	1.41	0.07	0.45	0.23	1.06	400	0.53	43	200	7.4	1.2	–24.6	2.8
19X-1, 20–40	216.6	1.14	0.09	1.13	0.45	1.00	412	0.76	59	132	8.9	0.7	–24.2	2.4
19X-3, 120–150	219.9	1.46	0.08	0.93	0.39	1.02	410	0.70	56	146	8.3	0.8	–25.5	3.3
20X-1, 120–150	227.4	0.39	0.05	0.77	0.12	0.36	424	0.30	40	120	6.1	0.4	–25.1	–0.6
20X-4, 120–150	230.9	0.67	0.06	0.72	0.13	0.57	409	0.35	37	163	5.9	0.5	–26.4	2.8
21X-2, 122–150	238.2	0.55	0.05	0.65	0.11	0.44	420	0.39	28	113	8.5	0.6	–26.5	5.2
21X-4, 120–150	241.2	0.72	0.07	0.46	0.19	0.60	422	0.51	37	118	7.4	1.1	–26.4	3.5
22X-2, 51–61	247.3	0.59	0.06	0.82	0.18	0.51	395	0.36	50	142	5.6	0.4	–24.3	3.0
22X-4, 120–150	250.2	1.34	0.08	0.63	0.29	0.96	411	0.61	48	157	7.6	1.0	–25.9	4.2
23X-3, 120–150	259.2	0.68	0.05	0.50	0.11	0.61	424	0.29	38	210	5.9	0.6	–26.7	4.5
24X-4, 0–40	268.9	0.48	0.06	0.12	0.14	0.42	414	0.38	37	111	6.9	3.1	–26.0	–1.8
25X-4, 0–40	278.8	0.67	0.06	0.18	0.17	0.57	429	0.39	44	146	6.6	2.2	–25.5	4.0
26X-4, 0–30	288.4	1.35	0.13	0.61	0.75	1.23	415	1.02	74	121	7.8	1.7	–24.2	4.7
27X-4, 0–50	298.0	0.97	0.08	0.24	0.48	0.88	414	0.68	71	129	8.1	2.9	–25.1	4.2
311-U1329C-														
1H-1, 140–150	1.5	0.82	0.07	0.25	0.25	0.64	426	0.49	51	131	7.5	2.0	–27.2	2.1
1H-3, 140–150	4.5	0.82	0.04	0.26	0.23	0.88	426	0.52	44	169	14.1	2.0	–25.7	4.0
1H-5, 140–150	7.5	1.35	0.07	0.16	0.40	1.34	412	0.58	69	231	7.8	3.7	–24.8	5.1
2H-1, 140–150	9.6	1.56	0.15	0.65	1.40	1.60	412	1.23	114	130	8.4	1.9	–23.7	6.7
2H-3,140–150	12.6	1.23	0.07	0.20	0.34	1.15	406	0.62	55	185	8.4	3.1	–24.4	5.6
2H-5, 140–150	15.6	0.59	0.05	0.49	0.13	0.68	335	0.36	36	189	7.8	0.7	–25.9	3.7
2H-7, 74–84	17.9	2.76	0.07	0.69	0.23	1.38	385	0.56	41	246	8.6	0.8	–24.9	5.1
3H-2, 135–150	20.5	1.22	0.07	0.87	0.20	1.00	399	0.49	41	204	7.5	0.6	–24.9	5.0
3H-4, 135–150	23.5	0.98	0.06	1.01	0.15	0.72	342	0.43	35	167	7.5	0.4	–25.8	4.4
3H-6, 135–150	26.5	0.81	0.05	0.71	0.16	0.59	429	0.38	42	155	7.9	0.5	–26.4	4.2
4H-2, 120–150	30.0	1.22	0.07	1.00	0.32	1.12	392	0.62	52	181	8.9	0.6	–25.0	4.3
4H-5, 120–150	34.5	1.35	0.08	0.88	0.47	1.22	402	0.83	57	147	10.6	0.9	–25.0	4.8
5H-2, 130–150	39.5	1.13	0.10	1.02	0.68	1.15	400	0.97	70	119	9.5	1.0	–24.4	3.9
5H-5, 130–150	44.0	0.99	0.06	1.61	0.22	0.76	408	0.45	49	169	8.0	0.3	–25.3	3.4
6H-1, 135–150	47.5	1.59	0.10	1.20	0.82	1.40	403	0.92	89	152	8.9	0.8	–24.4	5.1
6H-5, 135–150	53.5	0.54	0.04	0.55	0.20	0.37	422	0.42	48	88	9.8	0.8	–26.7	4.0
7P-1, 25–50	56.0	1.33	0.09	1.07	0.87	1.26	406	0.92	95	137	10.0	0.9	–24.6	4.8
8H-2, 135–150	60.5	1.70	0.14	1.07	1.34	1.67	411	1.31	102	127	9.4	1.2	–24.4	6.0
8H-5, 135–150	65.0	0.95	0.06	0.51	0.21	0.90	420	0.40	52	225	6.9	0.8	–25.8	3.2
9H-2, 135–150	70.0	2.00	0.08	0.50	0.39	1.54	406	0.58	67	266	7.2	1.2	–24.6	4.0
9H-5, 130–150	74.5	2.29	0.11	0.86	0.80	1.71	410	0.93	86	184	8.7	1.1	–24.2	3.7
10H-2, 130–150	79.5	1.36	0.10	0.28	0.46	1.38	408	0.77	60	179	7.5	2.8	–24.9	3.3
10H-5, 130–150	84.0	1.59	0.11	1.11	0.65	1.27	416	0.96	68	132	9.1	0.9	–24.4	4.1
11H-2, 130–150	89.0	1.69	0.12	0.51	0.76	1.60	413	1.01	75	158	8.7	2.0	–24.5	5.1
11H-5, 130–150	93.5	0.64	0.05	0.26	0.18	0.60	425	0.40	45	150	7.4	1.5	–26.5	4.6
12H-2, 120–150	98.5	1.76	0.15	1.17	1.50	1.66	414	1.29	116	129	8.4	1.1	–24.0	4.7
12H-5, 130–150	103.0	1.37	0.11	0.81	0.61	1.43	416	0.92	66	155	8.7	1.1	–24.8	4.4
13H-2, 130–150	108.0	1.32	0.10	0.72	0.54	1.28	413	0.82	66	156	8.4	1.1	–24.2	2.8
13H-5, 130–150	112.5	1.11	0.11	0.45	0.48	1.10	418	0.74	65	149	6.9	1.7	–24.1	4.0
15H-2, 130–150	119.5	1.83	0.18	0.56	1.57	1.58	415	1.64	96	96	9.2	3.0	–23.7	5.4
15H-5, 130–150	124.0	1.74	0.18	0.63	1.56	1.47	416	1.59	98	92	8.6	2.5	–24.2	5.1
16H-2, 130–150	129.0	1.13	0.09	0.30	0.31	1.02	424	0.60	52	170	6.9	2.0	–25.0	3.6
16H-5, 130–150	133.5	0.79	0.06	0.92	0.15	0.75	422	0.34	44	221	5.6	0.4	–25.9	2.8
17H-2, 125–145	138.5	1.46	0.14	0.90	0.92	1.11	422	1.33	69	83	9.8	1.5	–24.6	3.3
17H-3, 130–150	140.0	1.29	0.13	0.86	0.69	1.04	416	1.13	61	92	8.5	1.3	–25.1	3.8
18X-3, 125–150	144.6	0.97	0.09	0.66	0.29	0.55	411	0.65	45	85	7.1	1.0	–25.4	3.1
19X-2, 120–150	152.8	1.51	0.14	0.33	0.80	1.15	421	1.05	76	110	7.6	3.2	–24.1	4.2
20X-2, 120–150	162.5	1.63	0.17	1.38	1.44	1.08	411	1.41	102	77	8.3	1.0	–23.0	3.8
21X-6, 0–30	176.5	0.79	0.07	0.23	0.23	0.55	430	0.51	45	108	7.5	2.2	–25.5	4.1
22X-4, 0–35	183.6	1.25	0.10	0.31	0.53	1.08	421	0.82	65	132	8.0	2.6	–24.4	4.3

Note: * = clay.