Data report: elemental and isotopic composition and Rock-Eval pyrolysis of bulk sediments, IODP Expedition 344[1]

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Chapter contents

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Abstract

Multiple geochemical analyses (total carbon [TC], total nitrogen [TN], total sulfur, isotopic compositions of $\delta^{13}C_{org}$ and $\delta^{15}N_{org}$, and Rock-Eval pyrolysis) were performed on bulk sediment samples from Integrated Ocean Drilling Program Expedition 344 to assess geochemical characteristics and variations with depth at each drilled site. Downcore profiles of geochemical analyses vary with site and composition and do not correlate with lithostratigraphic units. In addition, the downcore profiles of TC, total organic carbon (TOC), total inorganic carbon (TIC), and TN analyzed post-cruise displayed similar trends to those determined from onboard analyses at all sites.

Based on Rock-Eval pyrolysis, most of the organic matter is at an immature stage of Type III (vascular land plants) evolution, which is inconsistent with the results from TOC/TN, $\delta^{13}C_{org}$, and $\delta^{15}N_{org}$ that indicated that most of the organic matter originates from an admixture of marine and freshwater algae (Sites U1380 and U1413) or from marine algae (Site U1412).

Introduction

Integrated Ocean Drilling Program (IODP) Expedition 344 drilled five sites located offshore the Osa Peninsula, Costa Rica, where the incoming Cocos Ridge has lifted the seismogenic zone to within reach of scientific drilling (see the **"Expedition 344 summary"** chapter [Harris et al., 2013]). The location of Site U1381 is ~4.5 km seaward of the deformation front offshore Osa Peninsula and Caño Island; Sites U1413, U1380, and U1412 are in the upper, middle, and base slope of the Costa Rica margin, respectively; and Site U1414 is on the flank of the subducting aseismic Cocos Ridge (see the **"Expedition 344 summary"** chapter [Harris et al., 2013]). Among the five sites, we selected Sites U1380, U1412, U1413, and U1414 to investigate the elemental and isotopic composition (total carbon [TC], total nitrogen [TN], total sulfur [TS], $\delta^{13}C_{org}$, and $\delta^{15}N_{org}$) and Rock-Eval pyrolysis of sediment at erosional subduction zones. Based on lithostratigraphic units defined during the expedition, Site U1380 is divided into three units (Unit I and Subunits IIA and IIB), Sites U1412 and U1413 are divided into three units (Units I, II, and III), and Site U1414 is divided into five units (Subunits IA, IB, IIA, and IIB and Unit III) (see the **"Expedition 344 summary"** chapter [Harris et al., 2013]). Correlation of elements and organic matter in bulk sediment with lithostratigraphic units can be useful for documenting the depositional environment and origin of organic matter. Hence, this study reports several geochemical results on bulk sediment from offshore the Osa Peninsula.

Methods

Elemental analysis

A total of 214 squeeze cake samples from Sites U1380, U1412, U1413, and U1414 were used for geochemical analyses. A part of each squeeze cake was dried using a freeze dryer for 24 h at the Korea Institute of Geoscience and Mineral Resources (KIGAM). After the bulk sediment samples were dried, they were ground and homogenized in an agate mortar. TC and TN contents were measured by combustion method using a CHN-900 (LECO, USA) apparatus at KIGAM with detection limits of 0.001% for TC and 0.01% for TN. The reproducibility of TC and TN measurements, estimated from repeated analyses of the LECO soil standard (TC = 2.6 wt% and TN = 0.209 wt%) was <3% and <4%, respectively. TS contents were determined using an S-144DR (LECO, USA) at KIGAM with a detection limit of 0.001%. Four LECO standards (0.28, 0.95, 1.51, and 2.30 wt%) were used for the analysis of TS. The reproducibility of TS was monitored by repeated analysis of LECO standard (1.51 wt%) was <3%.

Rock-Eval pyrolysis

A Rock-Eval Turbo 6 (Vinci Technologies, France) instrument at KIGAM was utilized for the 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 (<300°C). The second peak (S_2) in the pyrogram represents hydrocarbons released by kerogen cracking when the sample is heated from 300°C to 650°C. The maximum S_2 temperature 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 total organic carbon (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). TOC was also measured by the Rock-Eval Turbo 6, summing up the pyrolyzed carbon (PC) and residual carbon (RC) (Arthur et al., 1998; Lafargue et al., 1998; Kim et al., 2007, 2014). IFP 160,000 (Vinci-Technologies, France) was used as standard for the Rock-Eval analysis. The reproductivity of TOC, S_2, S_3, and T_{max} is estimated from repeated analyses of the IFP 160,000 standard was better than 2%, 4%, 5%, and 1%, respectively.

Total inorganic carbon (TIC) was calculated as the difference between TC measured by the CHN-900 and TOC measured by the Rock-Eval Turbo 6:

$$\text{TIC (wt\%)} = \text{TC (wt\%)} - \text{TOC (wt\%)}.$$

Isotope analysis

The aliquots of powdered bulk samples from Sites U1380, U1412, and U1413 were pretreated with 3 M 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 (Kim et al., 2014). $\delta^{13}C_{org}$ and $\delta^{15}N_{org}$ were measured using a stable isotope ratio mass spectrometer system with elemental analyzer (Vision-EA, Isoprime, UK) at the National Instrumentation Center for Environmental Management (NICEM, Korea). 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:

$$\delta\ (‰) = [(R_{sample} - R_{standard})/R_{standard}] \times 1000,$$

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

The elemental composition of samples analyzed are listed in Table T1 and their downcore profiles are illustrated in Figures F1, F2, F3, and F4. Because not all samples from Sites U1380, U1412, and U1413 were analyzed for TC, TOC, and TN during the expedition, we completed the analyses of all samples from Expedition 344 postcruise. Most of the samples that were analyzed for TC, TOC, TIC, and TN content both during the expedition and postcruise display similar values at all sites. However, TOC content values obtained onboard from samples deeper than ~160 mbsf at Site U1414 are higher than those measured postcruise (Fig. F4).

Downcore profiles of TC, TOC, TIC, and TN vary with depth at Site U1414 (Fig. F4). TOC and TN gradually decrease from the seafloor to ~200 mbsf and then slightly increase deeper than 270 mbsf, whereas TC and TIC contents are relatively constant from the seafloor to ~120 mbsf and then gradually increase with depth with the exception of the interval from 215 to 230 mbsf. Deeper than 120 mbsf, the downcore profiles of TOC and TN are mirror images to those of TC and TIC (Fig. F4). TOC also decreases from seafloor to ~120 mbsf, with a minimum (<1.0 wt%) deeper than ~500 mbsf at Site U1413 (Fig. F3). In contrast, downcore profiles of TC, TOC, TIC, and TN from seafloor to 490 mbsf at Sites U1380 and U1412 and downcore profiles of TC, TIC, and TN at Site U1413 do not show variation with depth (Table T1; Figs. F1, F2, F3).

Organic matter derived from marine algae typically has an atomic TOC/TN ratio of 4–10; ratios derived from vascular land plants are 20 or higher (Emerson and Hedges, 1988; Meyers, 1994). Most atomic TOC/TN ratios at Sites U1380, U1412, and U1413 are 4–12 and are relatively constant with depth (Table T1; Figs. F1, F2, F3). On the other hand, TOC/TN ratios at Site U1414 are constant at 7–10 in the upper 200 mbsf and are mostly >10 deeper than 200 mbsf, varying from 9 to 38 (Table T1; Fig. F4). Deeper than 200 mbsf at Site U1414, TOC/TN ratios calculated using onboard and postcruise data show significant deviation because TOC contents are remarkably different between them (Fig. F4).

Most TS contents are <3 wt% and have a mid-maximum around 50 mbsf at Site U1414 (Table T1; Fig. F4). In addition, TS values decrease with depth at Site U1380 (Table T1; Fig. F1). TOC/TS ratios at Sites U1380 and U1412 have maximum values in the lower sections (~584 mbsf at Site U1380 and ~352 mbsf at U1412), where TS content is at minimum values at each site (Table T1; Figs. F1, F2).

Rock-Eval pyrolysis

Most S_2 and S_3 values are <2 mg HC/g Rock and <3 mg CO_2/g Rock, respectively, and show higher values at shallow depths at Sites U1412–U1414 (Table T1; Figs. F1, F2, F3, F4). In addition, S_2 and S_3 values display mirror images to each other at depths shallower than 100 mbsf at Site U1412, whereas these values tend to decrease with depth deeper than 200 mbsf at Site U1414 (Figs. F2, F4). S_3 values at Site U1413 also decrease with depth (Fig. F3).

Most HI and OI values range from 50 to 150 mg HC/g TOC and from 100 to 300 mg CO_2/g TOC, respectively (Table T1; Figs. F1, F2, F3, F4). OI maximum values are found at ~160 mbsf at Site U1412, ~110 mbsf at Site U1413, and ~200 mbsf at Site U1414. Maximum OI values are in lithostratigraphic unit Unit I at Site U1412, Unit II at Site U1413, and at the Subunit IIA/IIB boundary at Site U1414 (Figs. F2, F3, and F4).

Plots of modified van Krevelen–type and S_2 versus TOC diagrams using Rock-Eval data show that most data correspond to the Type III evolution field (Fig. F5). In addition, there is a strong positive correlation between S_2 and TOC at Sites U1380, U1413, and U1414 (R^2 > 0.80) and a moderate positive correlation at Site U1412 (R^2 = 0.68) (Fig. F5).

T_{max} values are mostly lower than 435°C, suggesting that organic matter is at a thermally immature stage (Nali et al., 2000). T_{max} generally does not show vertical variation with depth at Sites U1380, U1412, U1413, and U1414 (Table T1; Figs. F1, F2, F3, F4). However, T_{max} values rapidly decrease (<400°C) between 175 and 200 mbsf in Subunit IIA at Site U1414 (Fig. F4).

Isotopic composition

$\delta^{13}C_{org}$ and $\delta^{15}N_{org}$ values at Site U1380 display significant different trends at depths shallower than 500 mbsf (Table T1; Fig. F4). Their values at shallow depths are relatively constant ($\delta^{13}C_{org}$ = 27.01‰ ± 0.48‰ and $\delta^{15}N_{org}$ = 6.70‰ ± 0.21‰; N = 5), whereas $\delta^{13}C_{org}$ increases and $\delta^{15}N_{org}$ decreases with depth deeper than 500 mbsf. In addition, the downcore profile of $\delta^{13}C_{org}$ decreases in the intervals from seafloor to 75 mbsf and from 450 mbsf to the bottom of the hole and is relatively constant between 75 and 450 mbsf at Site U1413. $\delta^{15}N_{org}$ decreases from 150 to 225 mbsf and then gradually increases with depth at Site U1413 (Fig. F3). The variation of $\delta^{13}C_{org}$ and $\delta^{15}N_{org}$ at Sites U1380 and U1413 do not correlate with lithostratigraphic units (Figs. F1, F3).

Organic matter produced by land plants through the C_3 pathway has an average $\delta^{13}C_{org}$ of approximately –27‰ (range = –32‰ to –21‰ VPDB) (Deines, 1980); through the C_4 pathway, average $\delta^{13}C_{org}$ is approximately –14‰ (range = –17‰ to –9‰ VPDB) (Deines, 1980). 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 do not clearly identify the source of organic matter, rather they reveal that the organic matter in the sediment could be derived from an admixture of marine algae and C_3 land plants (Table T1; Figs. F1, F2, F3, and F4). However, the relationship between TOC/TN ratios and $\delta^{13}C_{org}$ values leads to a different interpretation. As shown in Figure F6, most organic matter at Sites U1380 and U1413 lies in the marine/fresh algal admixture origin, whereas organic matter at Site U1412 predominantly originated from marine algae. There is no correlation of organic matter source with lithostratigraphic units.

Acknowledgments

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Figure F1. Downcore profiles of element and isotopic composition and Rock-Eval pyrolysis, Site U1380. For onboard data, see the **Expedition 344 summary** chapter (Harris et al., 2013). TC = total carbon, TOC = total organic carbon, TIC = total inorganic carbon, TN = total nitrogen, TS = total sulfur, T_{max} = maximum S_2 temperature, S_2 = second pyrogram temperature peak, S_3 = third pyrogram temperature peak, HI = hydrogen index, OI = oxygen index.

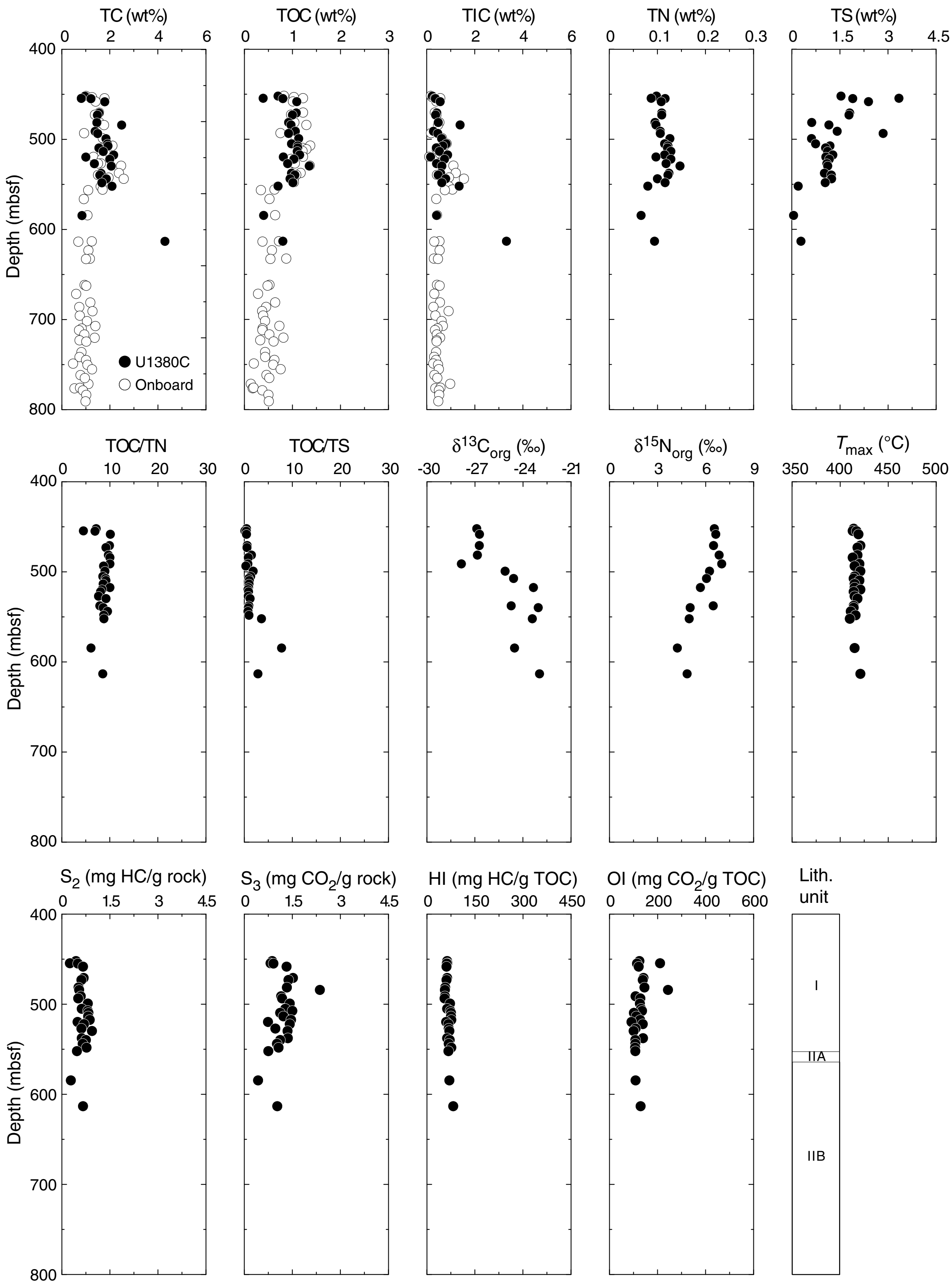

Figure F2. Downcore profiles of element and isotopic composition and Rock-Eval pyrolysis, Site U1412. For onboard data, see the **Expedition 344 summary** chapter (Harris et al., 2013). TC = total carbon, TOC = total organic carbon, TIC = total inorganic carbon, TN = total nitrogen, TS = total sulfur, T_{max} = maximum S_2 temperature, S_2 = second pyrogram temperature peak, S_3 = third pyrogram temperature peak, HI = hydrogen index, OI = oxygen index.

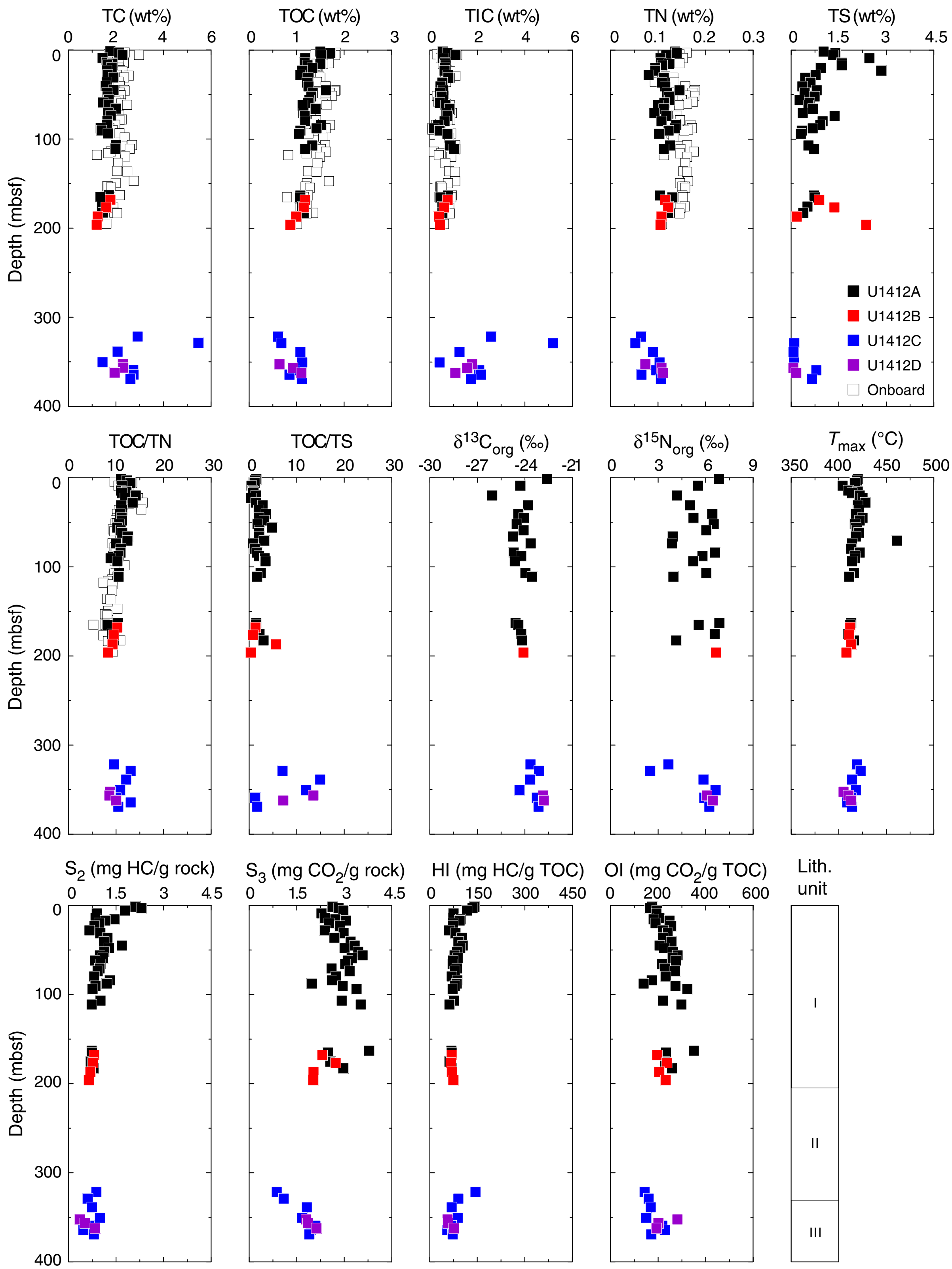

Figure F3. Downcore profiles of element and isotopic composition and Rock-Eval pyrolysis, Site U1413. For onboard data, see the **Expedition 344 summary** chapter (Harris et al., 2013). TC = total carbon, TOC = total organic carbon, TIC = total inorganic carbon, TN = total nitrogen, TS = total sulfur, T_{max} = maximum S_2 temperature, S_2 = second pyrogram temperature peak, S_3 = third pyrogram temperature peak, HI = hydrogen index, OI = oxygen index.

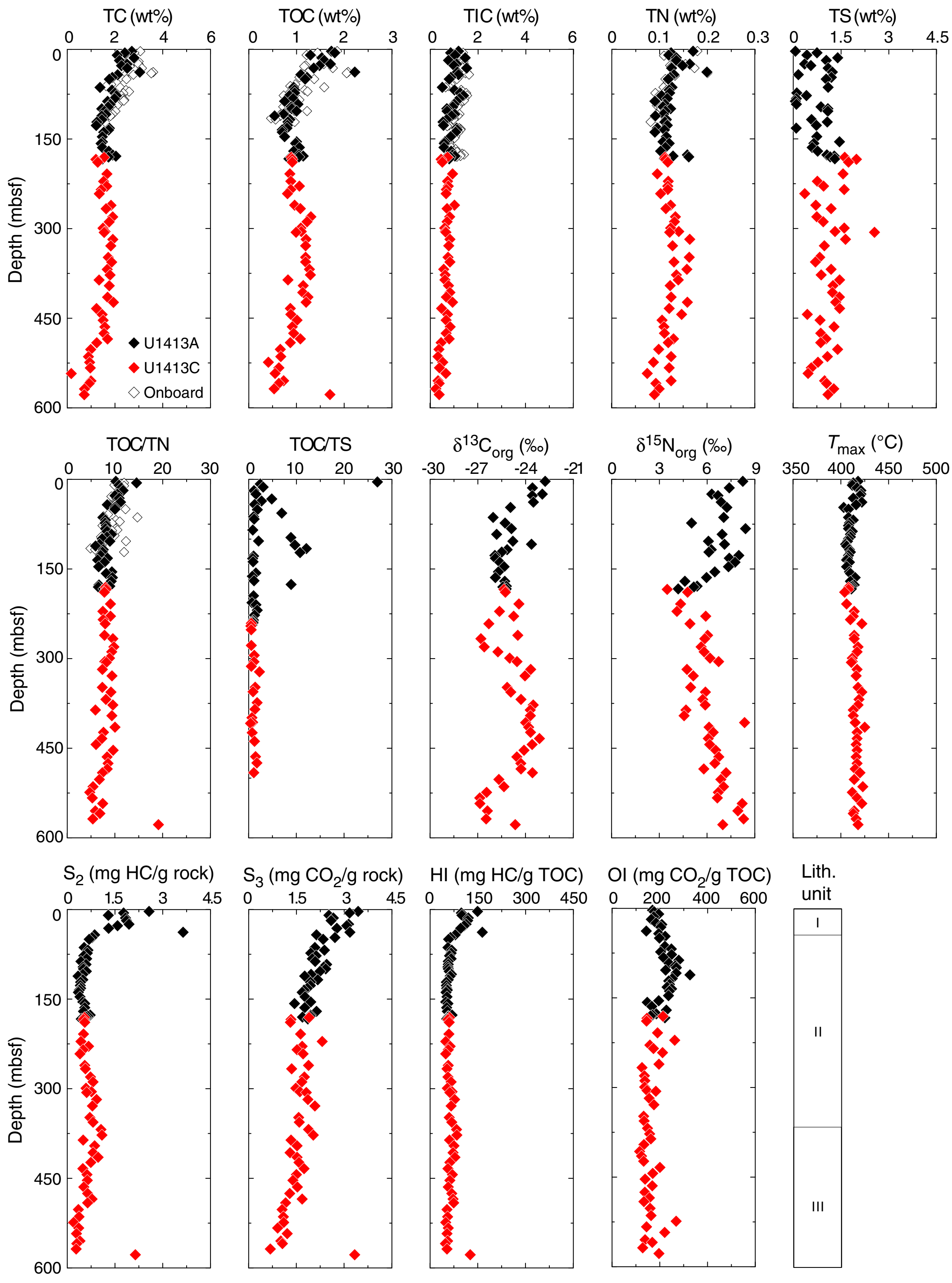

Figure F4. Downcore profiles of element and isotopic composition and Rock-Eval pyrolysis, Site U1414. For onboard data, see the **Expedition 344 summary** chapter (Harris et al., 2013). TC = total carbon, TOC = total organic carbon, TIC = total inorganic carbon, TN = total nitrogen, TS = total sulfur, T_{max} = maximum S_2 temperature, S_2 = second pyrogram temperature peak, S_3 = third pyrogram temperature peak, HI = hydrogen index, OI = oxygen index.

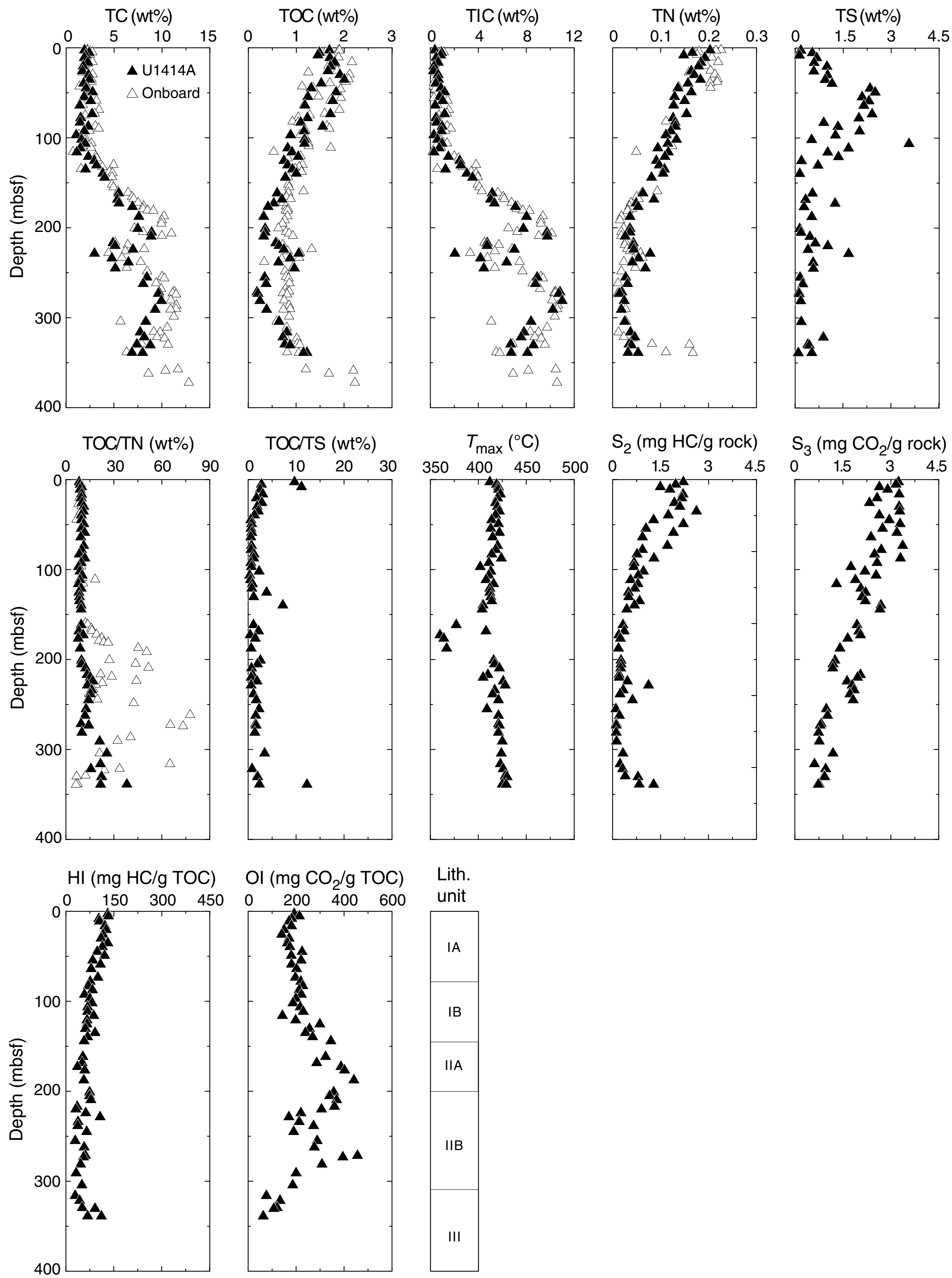

Figure F5. Modified van Krevelen–type diagrams of hydrogen index (HI) versus oxygen index (OI) and crossplots of second pyrogram temperature peak (S_2) and total organic carbon (TOC). Type I = lacustrine algae, Type II = marine algae, Type III = vascular plants. **A.** Site U1380. **B.** Site U1412. **C.** Site U1413. (Continued on next page.)

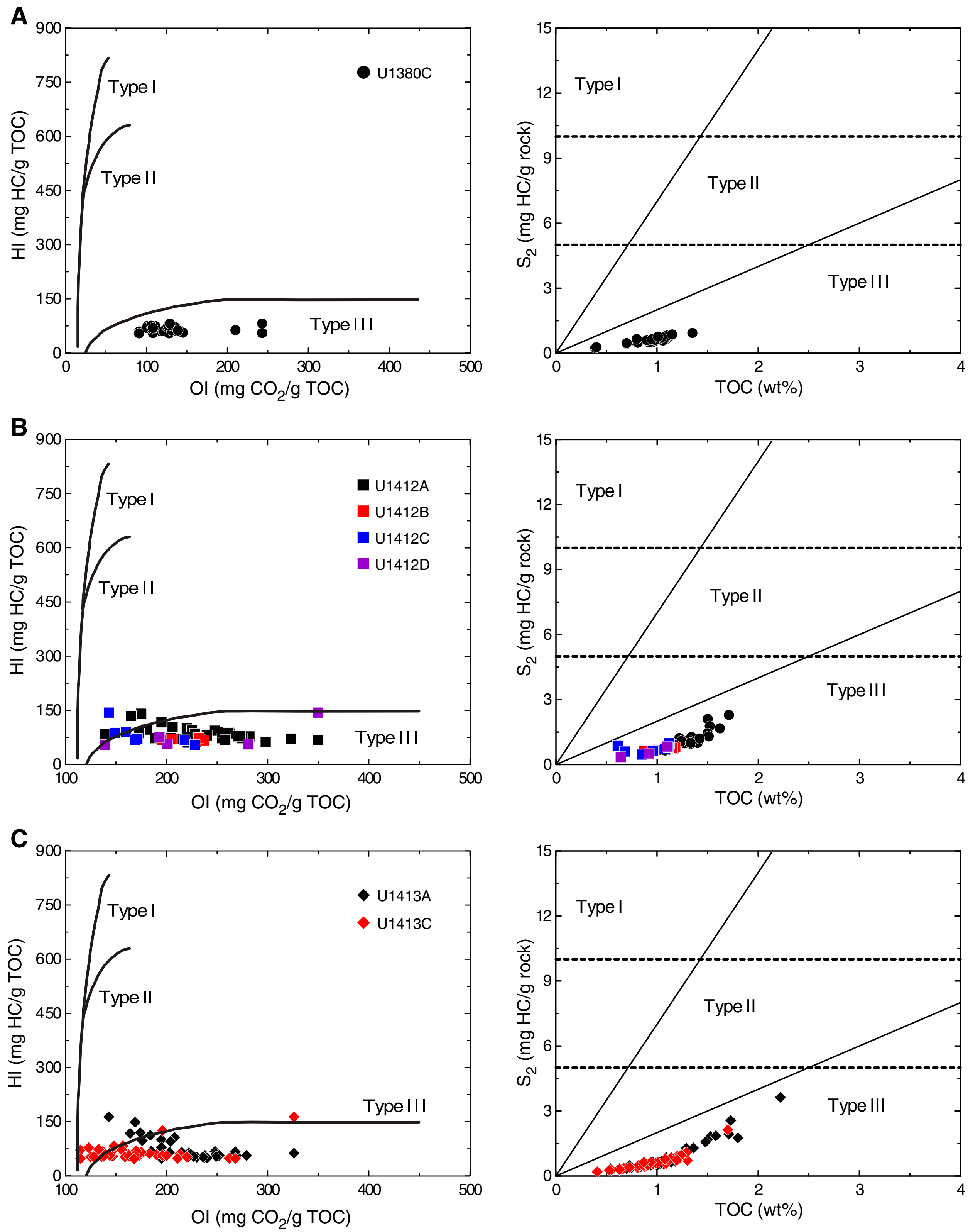

Figure F5 (continued). D. Site U1414.

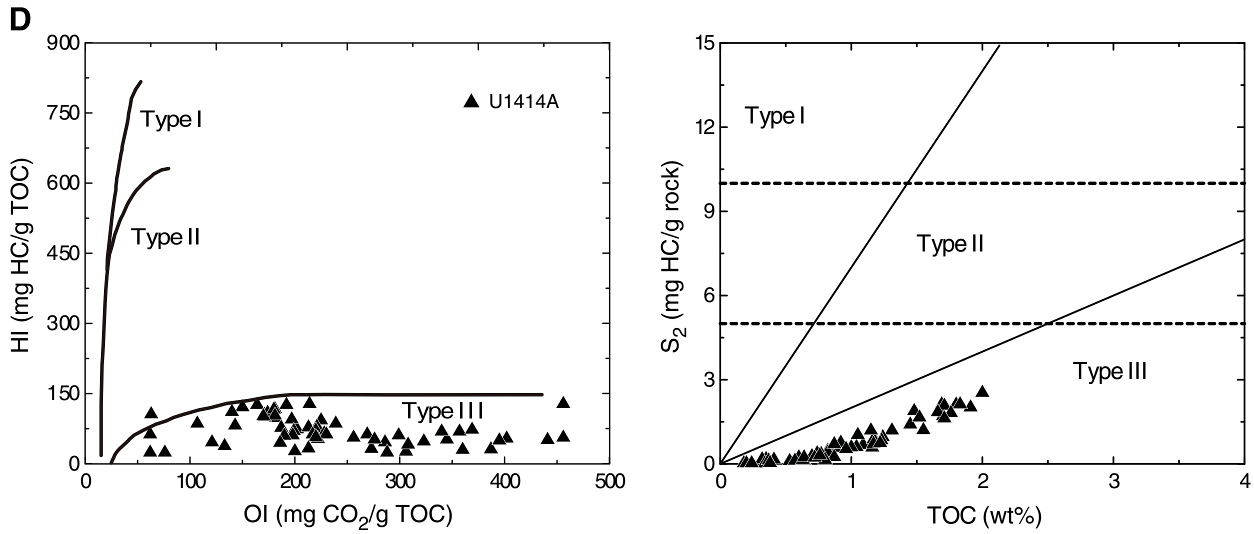

Figure F6. Crossplots of $\delta^{13}C_{org}$ and total organic carbon/total nitrogen (TOC/TN) ratios, Sites U1380, U1412, and U1413 (adapted after Lamb et al., 2006).

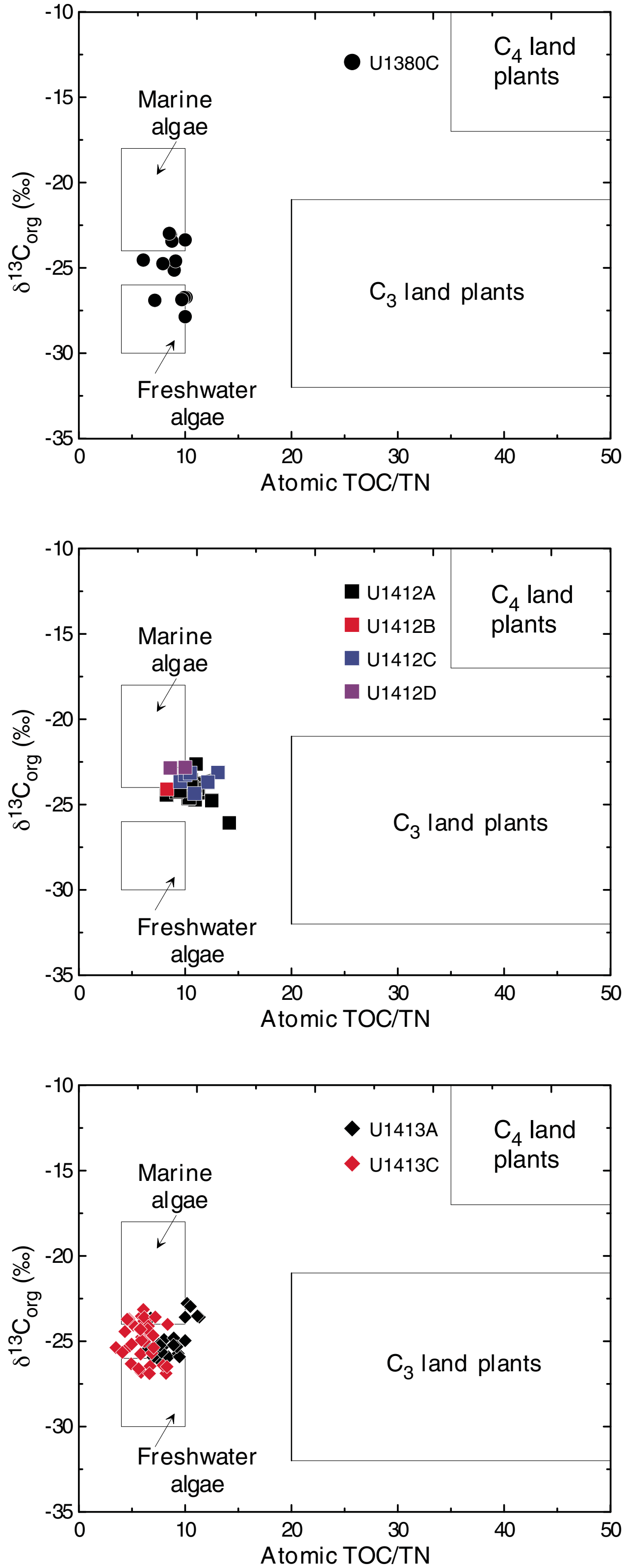

Table T1. Elemental and isotopic compositions and Rock-Eval pyrolysis of bulk sediment, Sites U1380, U1412, U1413, and U1414. (Continued on next four pages).

Core, section, interval (cm)	Depth (mbsf)	TC (wt%)	TOC (wt%)	TIC (wt%)	TN (wt%)	TS (wt%)	TOC/TN	TOC/TS	$\delta^{13}C_{org}$ (‰)	$\delta^{15}N_{org}$ (‰)	S_1 (mg HC/g rock)	S_2 (mg HC/g rock)	S_3 (mg CO_2/g rock)	T_{max} (°C)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)
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3R-3, 114–144	451.9	0.96	0.70	0.23	0.10	1.53	7.14	0.46	–26.89	6.54	0.04	0.44	0.87	414	63	124
3R-5, 112–142	454.7	0.81	0.39	0.33	0.09	3.34	4.48	0.12	—	—	0.03	0.25	0.82	413	64	210
3R-5, 112–150	454.7	1.22	0.80	0.36	0.12	1.90	6.90	0.42	—	—	0.05	0.50	0.91	417	62	114
4R-1, 51–73	458.1	1.79	1.09	0.56	0.11	2.39	10.09	0.46	–26.72	6.63	0.05	0.66	1.32	419	61	121
5R-3, 107–137	470.7	1.56	1.08	0.42	0.11	1.80	9.91	0.60	–26.73	6.49	0.06	0.68	1.52	421	63	141
5R-5, 86–116	472.9	1.49	1.00	0.37	0.11	1.78	9.17	0.56	—	—	0.05	0.61	1.38	418	61	138
6R-3, 122–152	481.3	1.46	0.92	0.48	0.10	0.62	9.68	1.49	–26.85	6.84	0.05	0.52	1.33	418	57	145
6R-5, 120–150	484.0	2.49	0.97	1.39	0.10	1.16	10.00	0.84	—	—	0.04	0.54	2.36	413	56	243
7R-3, 120–150	491.0	1.39	1.06	0.28	0.11	1.41	10.00	0.75	–27.85	7.00	0.05	0.59	1.15	420	56	108
7R-5, 87–107	493.4	1.50	0.92	0.46	0.11	2.85	8.68	0.32	—	—	0.05	0.51	1.18	415	55	128
8R-2, 116–146	499.1	1.84	1.13	0.62	0.13	0.61	8.97	1.85	–25.12	6.24	0.05	0.81	1.42	421	72	126
8R-6, 107–137	504.9	1.91	0.98	0.81	0.12	0.74	8.52	1.33	—	—	0.05	0.62	1.28	415	63	131
9R-1, 102–132	507.2	1.93	1.11	0.67	0.12	1.19	9.10	0.93	–24.59	6.05	0.06	0.81	1.50	414	73	135
9R-3, 71–96	509.7	1.55	1.11	0.40	0.12	1.05	9.17	1.06	—	—	0.06	0.83	1.12	420	75	101
9R-6, 79–109	513.3	1.73	1.10	0.53	0.13	1.11	8.59	0.99	—	—	0.06	0.82	1.22	415	75	111
10R-2, 35–65	517.3	2.16	1.15	0.87	0.12	1.28	10.00	0.90	–23.35	5.67	0.07	0.87	1.46	415	76	127
10R-4, 53–78	519.5	1.00	0.81	0.16	0.10	1.06	8.35	0.76	—	—	0.04	0.49	0.74	421	60	91
10R-6, 64–90	521.9	2.00	1.03	0.74	0.13	1.17	8.05	0.88	—	—	0.06	0.69	1.42	414	67	138
11R-2, 59–89	526.9	1.36	0.90	0.41	0.12	1.09	7.63	0.82	—	—	0.05	0.61	0.97	415	68	108
11R-4, 87–117	529.5	2.06	1.35	0.63	0.15	1.12	9.18	1.21	—	—	0.07	0.94	1.35	418	70	100
12R-2, 79–113	537.5	1.64	0.98	0.58	0.12	1.01	7.90	0.97	–24.74	6.47	0.06	0.62	1.36	414	63	139
12R-4, 78–108	539.6	1.59	1.05	0.48	0.12	1.23	8.61	0.85	–23.05	5.03	0.06	0.75	1.12	414	71	107
12R-8, 62–92	543.7	1.86	0.95	0.79	0.10	1.24	9.50	0.77	—	—	0.08	0.65	1.02	411	68	107
13R-3, 50–80	548.0	1.67	1.01	0.63	0.12	1.04	8.71	0.97	—	—	0.06	0.77	1.07	416	76	106
13R-6, 58–88	551.9	2.09	0.70	1.35	0.08	0.20	8.75	3.58	–23.42	4.97	0.04	0.47	0.75	410	67	107
17R-1, 63–90	584.4	0.84	0.40	0.41	0.07	0.05	6.06	7.76	–24.53	4.23	0.03	0.28	0.43	415	70	108
20R-1, 35–65	613.4	4.30	0.80	3.32	0.09	0.28	8.51	2.84	–22.97	4.84	0.04	0.66	1.03	421	82	129
344-U1412A-																
1H-1, 138–150	1.4	1.77	1.50	0.55	0.14	1.02	11.03	1.47	–22.61	6.84	0.24	2.11	2.63	420	141	175
1H-2, 138–150	2.9	2.13	1.71	0.74	0.14	1.39	12.30	1.23	—	—	0.23	2.30	2.82	419	135	165
1H-4, 98–110	5.5	2.27	1.52	1.08	0.12	1.32	12.99	1.15	—	—	0.19	1.78	2.97	417	117	195
2H-2, 138–150	8.8	1.44	1.18	0.55	0.11	2.47	11.24	0.48	–24.30	5.52	0.14	0.89	2.28	404	75	193
2H-6, 72–84	14.2	1.61	1.17	0.64	0.11	1.59	11.04	0.74	—	—	0.13	0.86	2.39	410	74	204
2H-7, 106–118	15.4	1.85	1.50	0.63	0.12	1.59	12.20	0.94	—	—	0.18	1.45	2.72	420	97	181
3H-1, 138–150	16.8	1.64	1.23	0.67	0.11	1.60	11.28	0.77	—	—	0.14	1.16	3.05	414	94	248
3H-3, 138–150	19.8	1.82	1.33	0.63	0.09	0.94	14.15	1.42	–26.06	4.19	0.12	0.97	2.52	422	73	189
3H-5, 138–150	22.8	1.61	1.12	0.62	0.09	2.84	11.91	0.39	—	—	0.10	0.82	2.86	425	73	255
4H-2, 138–150	27.8	1.65	1.08	0.76	0.08	0.77	13.50	1.40	—	—	0.09	0.66	2.39	428	61	221
4H-4, 138–150	30.9	1.90	1.24	0.78	0.11	0.44	11.07	2.82	–23.79	5.02	0.13	1.00	2.98	420	81	240
5H-3, 118–135	36.2	1.61	1.22	0.53	0.11	0.61	11.30	2.00	—	—	0.15	1.23	2.69	421	101	220
5H-7, 133–150	40.5	1.57	1.25	0.45	0.12	0.35	10.87	3.58	–24.42	6.41	0.14	1.12	3.20	418	90	256
6H-2, 132–149	44.9	1.90	1.62	0.55	0.15	0.80	11.17	2.02	–24.06	5.23	0.17	1.68	3.33	425	104	206
6H-4, 134–151	47.9	1.62	1.34	0.43	0.12	0.42	11.26	3.17	—	—	0.15	1.28	3.01	422	96	225
7H-2, 128–145	51.9	1.65	1.31	0.50	0.12	0.74	10.65	1.78	–24.52	6.51	0.15	1.13	3.44	417	86	263
7H-5, 103–120	55.9	1.70	1.27	0.56	0.12	0.26	10.24	4.82	—	—	0.14	0.99	3.58	418	78	282
8H-1, 129–151	58.9	1.45	1.24	0.42	0.11	0.58	10.97	2.15	–24.08	6.04	0.18	1.09	3.24	419	88	261
8H-3, 100–122	61.6	1.69	1.13	0.66	0.10	0.54	11.30	2.08	—	—	0.14	0.83	3.11	421	73	275
9H-2, 128–150	65.8	2.00	1.40	0.83	0.11	0.68	12.50	2.05	–24.76	3.93	0.19	1.01	3.03	418	72	216

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

Core, section, interval (cm)	Depth (mbsf)	TC (wt%)	TOC (wt%)	TIC (wt%)	TN (wt%)	TS (wt%)	TOC/TN	TOC/TS	$\delta^{13}C_{org}$ (‰)	$\delta^{15}N_{org}$ (‰)	S_1 (mg HC/g rock)	S_2 (mg HC/g rock)	S_3 (mg CO_2/g rock)	T_{max} (°C)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)
9H-6, 135–157	70.5	1.67	1.14	0.70	0.09	0.36	12.39	3.13	—	—	0.17	0.98	2.60	—	86	228
10H-1, 128–150	73.6	1.79	1.17	0.74	0.12	1.37	10.00	0.86	–23.63	3.87	0.17	0.92	3.17	414	79	271
10H-5, 134–156	79.6	1.64	1.18	0.62	0.11	0.99	11.03	1.19	—	—	0.16	0.81	2.74	413	69	232
11H-2, 130–152	83.9	1.63	1.51	0.35	0.14	0.92	10.94	1.65	–24.71	6.59	0.19	1.31	2.61	422	87	173
12H-1, 115–137	87.6	1.36	1.42	0.17	0.14	0.68	10.52	2.09	–24.23	5.80	0.20	1.21	1.98	417	85	139
12H-3, 94–116	90.1	1.40	1.08	0.41	0.12	0.33	8.85	3.26	—	—	0.14	0.85	2.95	417	79	273
13H-2,124–146	93.6	1.67	1.05	0.74	0.10	0.30	10.29	3.46	–24.64	5.22	0.13	0.76	3.39	414	72	323
15H-2, 93–115	106.8	2.01	1.33	0.84	0.13	0.54	10.64	2.46	–23.97	6.04	0.19	1.01	2.92	416	76	220
16X-2, 126–148	111.0	1.98	1.18	1.02	0.11	0.72	10.54	1.64	–23.54	3.96	0.16	0.73	3.52	411	62	298
22X-1, 131–151	162.9	1.70	1.08	0.76	0.10	0.72	10.38	1.50	–24.59	6.86	0.16	0.73	3.78	413	68	350
22X-3, 68–88	165.0	1.35	1.07	0.45	0.13	0.75	8.23	—	–24.42	5.56	0.10	0.74	2.49	412	69	233
23X-3, 100–120	175.3	1.42	1.12	0.53	0.12	0.51	9.18	2.19	–24.25	6.57	0.10	0.70	2.56	410	62	229
24X-2, 56–81	182.5	1.46	1.15	0.53	0.12	0.38	9.50	3.04	–24.19	4.14	0.14	0.79	2.97	416	69	258
344-U1412B-																
4X-2, 100–120	168.0	1.77	1.18	0.75	0.12	0.88	10.26	1.34	—	—	0.12	0.81	2.31	412	69	196
5X-1,120–140	176.4	1.59	1.15	0.60	0.12	1.36	9.50	0.84	—	—	0.10	0.77	2.73	411	67	237
6X-2, 99–125	186.7	1.23	0.99	0.38	0.11	0.17	9.25	5.67	—	—	0.10	0.69	2.03	413	70	205
7X-2, 51–73	196.0	1.19	0.87	0.43	0.11	2.37	8.29	0.37	–24.09	6.65	0.09	0.64	2.02	408	74	232
344-U1412C-																
4R-CC, 19–24	321.5	2.91	0.61	2.57	0.06	0.03	9.53	19.75	–23.65	3.65	0.07	0.88	0.87	419	144	143
5R-1,0–36	328.8	5.47	0.68	5.19	0.05	0.10	13.08	7.02	–23.11	2.50	0.03	0.61	1.09	423	90	160
6R-1, 9–20	338.6	2.07	1.08	1.25	0.09	0.07	12.13	14.94	–23.67	5.86	0.08	0.74	1.82	414	69	169
7R-2, 96–112	350.3	1.44	1.12	0.41	0.10	0.09	10.87	11.97	–24.34	6.63	0.10	0.99	1.67	418	88	149
8R-1, 121–148	359.1	2.72	0.96	2.08	0.10	0.79	10.00	—	–23.25	5.91	0.08	0.65	2.09	413	68	218
8R-5, 59–95	364.1	2.74	0.85	2.15	0.07	—	13.08	—	—	—	0.07	0.47	1.94	409	55	228
9R-2, 58–88	369.0	2.61	1.11	1.73	0.11	0.66	10.47	1.69	–23.14	6.23	0.07	0.80	1.90	414	72	171
344-U1412D-																
2R-2, 78–101	352.2	2.30	0.64	1.78	0.07	0.01	8.77	72.26	—	—	0.07	0.36	1.80	405	56	281
2R-5, 106–131	356.5	2.31	0.92	1.57	0.11	0.07	8.60	13.51	–22.84	6.07	0.07	0.52	1.85	410	57	201
3R-3, 61–86	362.0	1.95	1.10	1.07	0.11	0.15	10.00	7.18	–22.81	6.45	0.09	0.84	2.12	413	76	193
344-U1413A-																
1H-2, 138–150	3.0	2.71	1.73	1.18	0.17	0.06	10.18	26.96	–22.77	8.24	0.30	2.57	2.92	418	149	169
1H-4, 110–122	5.6	2.41	1.80	0.85	0.12	0.74	14.52	2.42	—	—	0.24	1.77	3.17	413	98	176
2H-2, 138–150	9.5	2.09	1.29	1.04	0.12	0.43	10.84	3.03	—	—	0.17	1.29	2.52	412	100	195
2H-5, 138–150	14.0	2.80	1.53	1.46	0.14	1.39	11.33	1.10	–23.57	7.39	0.20	1.83	2.66	417	120	174
3H-2, 100–112	18.3	2.19	1.58	0.76	0.14	1.04	11.70	1.53	—	—	0.22	1.86	2.59	421	118	164
3H-6, 140–152	24.4	2.50	1.71	1.10	0.16	0.35	10.49	4.83	–22.95	6.29	0.20	1.94	3.14	421	113	184
4H-1, 136–151	27.0	2.27	1.48	0.99	0.15	0.55	10.00	2.69	–23.58	6.68	0.20	1.58	3.08	420	107	208
4H-4, 137–152	31.3	2.51	1.36	1.52	0.13	1.09	10.88	1.24	—	—	0.18	1.30	2.77	413	96	204
5H-2, 135–150	37.9	3.04	2.22	1.13	0.20	1.23	11.16	1.81	–23.51	6.88	0.30	3.64	3.18	422	164	143
5H-5, 135–150	42.2	2.11	1.09	1.18	0.13	0.16	8.38	6.93	—	—	0.12	0.86	2.13	416	79	195
6H-2, 137–152	46.7	1.89	1.22	0.86	0.12	1.20	10.00	1.02	–24.95	7.24	0.15	0.78	2.71	403	64	222
6H-4, 135–150	49.7	1.76	1.18	0.79	0.12	1.03	10.00	1.14	—	—	0.11	0.69	2.34	408	58	198
8H-2, 131–151	63.4	1.37	0.94	0.50	0.13	1.09	7.46	0.86	–26.04	7.04	0.10	0.53	2.08	408	56	221
8H-5, 136–156	67.9	1.88	0.96	1.01	0.12	—	8.00	—	—	—	0.10	0.65	2.38	413	68	248
9H-2, 132–154	72.8	2.00	0.96	1.25	0.12	0.11	7.93	8.85	–25.29	5.02	0.10	0.63	1.95	409	66	203
9H-5, 133–155	77.2	2.06	0.85	1.39	0.10	0.41	8.17	2.07	—	—	0.09	0.52	2.12	408	61	249
10H-2, 130–152	82.2	1.98	0.93	1.22	0.12	0.10	8.02	9.69	–24.89	8.41	0.10	0.61	2.00	408	66	215
10H-5, 131–153	86.7	1.69	0.75	1.10	0.09	0.06	8.33	12.07	—	—	0.07	0.43	2.09	412	57	279

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

Core, section, interval (cm)	Depth (mbsf)	TC (wt%)	TOC (wt%)	TIC (wt%)	TN (wt%)	TS (wt%)	TOC/TN	TOC/TS	$\delta^{13}C_{org}$ (‰)	$\delta^{15}N_{org}$ (‰)	S_1 (mg HC/g rock)	S_2 (mg HC/g rock)	S_3 (mg CO_2/g rock)	T_{max} (°C)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)
11H-2, 129–151	91.7	1.80	1.03	1.00	0.11	0.10	9.28	10.76	–25.82	6.94	0.10	0.59	2.45	410	57	238
11H-5, 130–152	96.1	1.71	0.89	0.94	0.11	0.87	8.32	1.03	—	—	0.08	0.50	2.36	410	56	265
12H-1, 128–150	99.2	1.45	0.90	0.69	0.12	1.08	7.32	0.83	—	—	0.11	0.51	2.42	408	57	269
12H-4, 109–131	103.3	1.56	1.00	0.70	0.11	1.08	8.93	0.92	–24.80	6.08	0.10	0.60	2.24	407	60	224
13H-2, 130–152	108.3	1.62	0.73	1.02	0.11	—	6.76	—	–23.63	7.09	0.08	0.49	1.96	405	67	268
13H-4, 130–152	111.3	1.45	0.54	0.89	0.09	—	5.93	—	—	—	0.06	0.34	1.76	406	63	326
14H-3, 128–150	117.4	1.45	0.86	0.68	0.11	0.57	7.54	1.50	–25.16	6.26	0.09	0.49	2.17	409	57	252
15H-2, 130–152	121.4	1.24	0.82	0.53	0.11	1.07	7.39	0.77	–25.50	6.11	0.08	0.42	1.94	410	51	237
16H-2, 126–150	127.1	1.22	0.81	0.55	0.12	0.72	6.98	1.12	–25.93	7.99	0.07	0.41	1.94	408	51	240
17H-2, 80–102	131.7	1.77	0.80	1.10	0.10	0.09	8.42	8.89	–25.90	7.39	0.08	0.42	1.84	407	52	230
17H-4, 128–150	134.6	1.73	0.70	1.12	0.11	0.06	6.36	11.14	—	—	0.07	0.38	1.74	406	54	249
18H-2, 130–152	138.4	1.53	0.70	1.06	0.09	0.04	7.78	19.73	–25.62	7.75	0.06	0.35	1.68	409	50	240
19X-4, 97–122	145.9	1.47	0.75	0.85	0.11	0.74	6.58	—	–25.35	7.34	0.07	0.40	1.77	406	53	236
20X-4, 65–90	154.6	1.47	1.00	0.61	0.11	1.45	9.35	0.69	–25.71	6.48	0.10	0.49	1.95	409	49	195
20X-6, 109–134	157.2	1.42	0.98	0.58	0.12	0.64	8.17	1.52	—	—	0.07	0.55	1.44	410	56	147
21X-3, 125–150	164.1	1.47	1.06	0.57	0.11	0.59	9.46	1.79	–25.90	5.96	0.07	0.55	1.76	415	52	166
22X-1, 56–85	170.3	1.74	0.94	0.87	0.10	0.76	9.22	1.23	–25.31	4.60	0.06	0.51	2.13	410	54	227
24X-1, 117–147	176.5	1.91	1.05	0.93	0.16	1.05	6.65	1.00	—	—	0.07	0.72	1.94	414	69	185
24X-3, 63–93	178.5	2.04	1.14	1.03	0.13	1.29	8.91	0.89	–25.21	5.37	0.09	0.65	1.93	412	57	169
25X-1, 48–84	179.9	1.73	1.05	0.83	0.16	1.16	6.52	0.91	–25.43	5.16	0.08	0.59	1.69	411	56	161
26X-1, 105– 140	183.1	1.49	0.84	0.79	0.11	1.30	7.64	0.64	–25.22	4.18	0.05	0.44	1.86	411	52	221
344-U1413C-																
2R-2, 119–149	180.5	1.54	0.89	0.72	0.11	1.61	8.02	0.55	—	—	0.06	0.54	1.90	408	61	213
2R-5, 53–83	183.9	1.20	0.91	0.45	0.11	1.98	8.13	0.46	–25.36	3.49	0.09	0.51	1.33	408	56	146
3R-1, 90–122	188.6	1.28	0.91	0.50	0.12	1.73	7.78	0.53	–25.27	4.77	0.14	0.55	1.31	404	60	144
5R-1, 116–146	208.3	1.66	0.86	0.93	0.10	1.56	9.05	—	–24.42	4.33	0.06	0.51	1.63	406	59	190
6R-3, 99–129	220.7	1.52	0.88	0.72	0.12	0.75	7.46	1.17	–25.64	4.10	0.05	0.43	2.31	414	49	262
7R-2, 77–107	228.8	1.65	1.06	0.75	0.12	0.95	9.06	1.12	–24.75	5.91	0.08	0.67	1.68	413	63	158
7R-6, 101–131	234.5	1.42	0.88	0.67	0.12	1.60	7.52	0.55	—	—	0.08	0.50	1.52	410	57	173
8R-4, 87–117	241.4	1.34	0.81	0.66	0.10	0.36	7.94	2.26	–26.31	4.92	0.05	0.40	1.71	422	49	211
10R-4, 116–150	260.7	1.83	0.96	1.01	0.12	0.71	7.80	1.36	–24.49	6.03	0.10	0.55	1.88	414	57	196
11R-1, 114–151	266.4	1.63	1.08	0.70	0.11	1.19	9.56	0.91	–26.81	5.85	0.08	0.57	1.35	414	53	125
12R-5, 80–119	280.1	1.91	1.30	0.81	0.13	0.74	9.77	1.77	–26.60	5.62	0.08	0.73	1.75	418	56	135
13R-3, 93–128	288.4	1.76	1.22	0.70	0.13	0.94	9.31	—	–25.74	5.81	0.08	0.81	1.67	417	66	137
14R-4,16–61	299.0	1.50	1.09	0.60	0.12	1.60	8.86	0.68	–25.00	6.18	0.07	0.59	1.48	412	54	136
15R-1, 65–95	304.8	1.59	1.10	0.63	0.14	1.31	7.86	0.84	–24.54	6.72	0.10	0.76	1.61	412	69	146
15R-2, 103–135	306.1	1.55	0.99	0.65	0.12	2.55	8.18	0.39	—	—	0.07	0.61	1.81	411	62	183
16R-3,114–150	317.8	1.91	1.20	0.82	0.16	1.64	7.36	0.73	–23.68	4.73	0.09	0.92	1.86	417	77	155
17R-4, 92–122	328.6	1.82	1.19	0.77	0.13	0.97	9.37	1.22	–24.04	5.13	0.07	0.79	2.08	416	66	175
19R-5, 66–96	347.9	1.72	1.19	0.74	0.16	0.83	7.35	1.44	–25.16	4.96	0.10	0.71	1.57	418	60	132
20R-3, 80–110	355.8	1.86	1.19	0.82	0.13	0.69	9.15	1.72	–24.93	5.89	0.07	0.81	1.59	422	68	134
21R-4, 123–153	368.0	1.67	1.27	0.56	0.16	1.19	8.09	1.07	–24.29	5.72	0.09	1.06	1.88	419	83	148
22R-4, 89–119	377.4	1.79	1.29	0.62	0.14	0.87	9.56	1.48	–23.52	5.88	0.08	1.09	2.03	418	84	157
23R-3, 122–152	385.7	1.33	0.82	0.61	0.14	1.45	5.90	0.56	–23.71	4.67	0.05	0.50	1.33	413	61	162
24R-3, 112–142	395.3	1.76	1.14	0.76	0.12	1.25	9.34	0.92	–23.70	4.55	0.08	0.86	1.52	413	75	133
25R-4, 122–152	406.8	—	1.13	0.82	—	1.23	—	0.92	–24.00	8.35	0.08	0.81	1.30	415	72	115
26R-3, 118–148	414.5	1.69	1.24	0.67	0.12	1.45	10.00	0.86	–23.81	6.12	0.08	0.97	1.52	425	78	123
27R-2, 120–150	423.1	1.94	1.20	0.93	0.16	1.33	7.59	0.90	–23.69	6.38	0.07	0.74	1.58	417	62	132
28R-3, 88–123	433.5	1.23	0.87	0.47	0.12	1.45	7.25	0.60	–23.13	6.07	0.05	0.49	1.74	417	56	200
29R-3, 100–135	443.5	1.46	0.88	0.72	0.15	0.44	6.03	2.01	–23.59	6.16	0.07	0.62	1.50	416	70	170
30R-3, 96–131	453.1	1.50	1.01	0.66	0.11	0.84	9.62	1.20	–24.10	6.54	0.06	0.63	1.39	417	62	138

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

Core, section, interval (cm)	Depth (mbsf)	TC (wt%)	TOC (wt%)	TIC (wt%)	TN (wt%)	TS (wt%)	TOC/TN	TOC/TS	$\delta^{13}C_{org}$ (‰)	$\delta^{15}N_{org}$ (‰)	S_1 (mg HC/g rock)	S_2 (mg HC/g rock)	S_3 (mg CO_2/g rock)	T_{max} (°C)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)
31R-4, 83–118	464.3	1.58	0.91	0.83	0.11	1.28	8.35	0.71	–24.55	6.73	0.05	0.52	1.53	416	57	168
32R-5, 66–101	475.1	1.54	0.94	0.66	0.11	0.86	8.55	1.09	–24.30	6.48	0.07	0.64	1.29	417	68	137
33R-5, 0–30	484.4	1.69	1.08	0.79	0.13	1.03	8.37	1.05	–24.29	5.79	0.06	0.78	1.68	415	72	156
34R-2, 87–122	490.8	1.24	0.87	0.45	0.12	0.86	7.37	1.01	–23.57	7.19	0.06	0.64	1.16	420	74	133
35R-3, 94–129	502.0	0.98	0.66	0.36	0.10	1.39	6.73	0.47	–25.68	6.86	0.05	0.35	1.05	414	53	159
36R-5, 62–97	514.1	0.89	0.67	0.32	0.12	1.07	5.40	0.63	–25.36	7.03	0.04	0.37	1.09	423	55	163
37R-5, 61–96	523.6	0.94	0.41	0.52	0.09	0.77	4.71	0.53	–26.45	6.70	0.03	0.20	1.10	412	49	268
38R-4, 117–152	532.9	0.97	0.63	0.38	0.12	0.56	5.25	1.12	–26.88	6.64	0.04	0.36	0.91	417	57	144
39R-4, 116–151	542.3	0.17	0.55	0.65	0.07	0.46	7.43	1.19	–26.87	8.20	0.03	0.29	1.21	422	53	220
40R-6, 97–132	554.6	0.99	0.73	0.32	0.12	0.98	5.89	0.74	–26.40	7.93	0.04	0.40	1.01	414	55	138
41R-2, 116–151	559.0	0.92	0.63	0.37	0.09	1.04	6.85	0.60	—	—	0.04	0.30	1.06	413	48	168
42R-2, 56–91	568.1	0.72	0.53	0.23	0.10	1.27	5.35	0.42	–26.48	8.29	0.04	0.28	0.68	416	53	128
43R-2, 73–105	577.7	0.71	1.70	0.37	0.09	1.09	19.10	1.56	–24.65	6.98	0.30	2.14	3.33	418	126	196
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1H-1, 51–61	0.6	1.91	1.69	0.38	0.20	0.17	8.33	9.67	—	—	0.30	2.21	3.24	412	131	192
2H-1, 131–141	3.3	2.41	1.48	0.93	0.17	0.53	8.92	2.78	—	—	0.24	1.97	3.16	419	133	214
2H-3, 131–141	6.1	2.05	1.45	0.85	0.15	0.13	9.80	11.13	—	—	0.21	1.49	2.64	421	103	182
2H-5, 131–141	8.9	1.89	1.70	0.49	0.19	0.67	8.85	2.53	—	—	0.25	1.79	2.90	421	105	171
3H-2, 131–141	14.2	2.27	1.80	0.65	0.18	0.59	9.78	3.06	—	—	0.28	2.20	3.26	423	122	181
3H-5, 131–141	18.4	1.78	1.71	0.30	0.18	0.99	9.55	1.73	—	—	0.29	2.16	2.57	420	126	150
4H-2, 131–141	23.7	1.70	1.66	0.26	0.16	0.58	10.12	2.87	—	—	0.27	1.93	2.33	418	116	140
4H-5, 132–142	27.9	2.33	1.91	0.65	0.17	1.01	11.24	1.89	—	—	0.28	2.10	3.26	420	110	171
5H-2, 131–141	33.2	2.44	2.00	0.68	0.18	0.93	10.93	2.15	—	—	0.33	2.62	3.28	422	131	164
5H-5, 131–141	37.4	1.82	1.52	0.45	0.16	1.15	9.68	1.32	—	—	0.33	1.74	2.64	418	114	174
6H-2, 135–145	42.8	2.08	1.31	0.88	0.14	2.34	9.63	0.56	—	—	0.25	1.28	2.95	414	98	225
6H-5, 135–145	47.1	2.76	1.83	1.19	0.16	2.50	11.16	0.73	—	—	0.25	2.21	3.29	421	121	180
7H-2, 140–150	52.4	1.87	1.24	0.77	0.13	2.09	9.61	0.59	—	—	0.20	1.04	2.74	413	84	221
7H-5, 140–150	56.9	2.56	1.76	1.04	0.15	2.30	11.73	0.76	—	—	0.23	1.90	3.19	422	108	181
8H-2, 140–150	61.9	1.43	1.18	0.40	0.13	2.14	9.29	0.55	—	—	0.20	0.93	2.38	415	79	202
9H-2, 140–150	71.4	2.71	1.71	1.18	0.15	2.40	11.10	0.71	—	—	0.31	1.71	3.37	420	100	197
9H-5, 140–150	75.9	1.51	1.23	0.46	0.13	1.99	9.76	0.62	—	—	0.21	0.93	2.70	418	76	220
10H-2, 140–150	80.9	1.45	1.09	0.53	0.13	0.89	8.38	1.22	—	—	0.19	0.76	2.49	414	70	228
10H-5, 140–150	85.4	2.32	1.55	0.98	0.13	1.34	11.83	1.16	—	—	0.16	1.29	3.30	424	83	213
11H-2, 140–150	90.4	1.89	1.16	0.92	0.12	2.01	9.59	0.58	—	—	0.19	0.67	2.57	411	58	222
11H-5, 140–150	94.9	1.05	0.88	0.29	0.11	1.26	7.93	0.70	—	—	0.16	0.66	1.75	402	75	199
12H-2, 140–150	99.9	1.60	1.17	0.60	0.13	0.51	8.80	2.29	—	—	0.21	0.96	2.19	413	82	187
12H-5, 140–150	104.4	1.98	1.17	0.98	0.12	3.56	10.17	0.33	—	—	0.18	0.80	2.54	411	68	217
13H-2, 140–150	109.4	1.48	0.82	0.74	0.09	1.67	8.72	0.49	—	—	0.15	0.56	1.89	408	68	230
13H-5, 140–150	113.9	1.11	0.91	0.30	0.12	1.01	7.84	0.90	—	—	0.17	0.79	1.30	416	87	143
14H-2, 140–150	118.9	2.31	1.04	1.50	0.11	1.35	9.54	0.77	—	—	0.17	0.69	2.06	412	66	198
14H-5, 135–150	123.3	2.95	0.74	2.45	0.09	0.19	8.13	3.85	—	—	0.11	0.49	2.21	412	66	299
15H-2, 140–150	128.4	3.17	0.82	2.54	0.10	0.71	8.45	1.16	—	—	0.13	0.50	2.10	413	61	256
15H-5, 140–150	132.9	2.01	0.92	1.26	0.11	0.05	8.52	19.42	—	—	0.19	0.84	2.20	414	91	239
16H-2, 110–120	137.6	3.82	1.00	3.04	0.11	0.14	9.52	7.23	—	—	0.07	0.68	2.69	405	68	269
16H-5, 140–150	142.1	4.01	0.77	3.52	0.08	—	9.51	—	—	—	0.10	0.44	2.66	404	57	345
18H-5, 130–150	159.4	5.49	0.60	5.16	0.06	0.54	9.52	1.12	—	—	0.11	0.32	1.94	377	53	323
19H-3, 135–150	166.3	5.35	0.70	5.02	0.09	0.32	8.14	2.17	—	—	0.04	0.36	2.00	408	51	286
19H-6, 135–150	170.7	5.50	0.53	5.34	0.05	1.24	10.82	0.43	—	—	0.04	0.19	2.05	360	36	387
20H-2, 135–150	174.5	6.91	0.41	7.10	0.05	0.27	7.74	1.50	—	—	0.07	0.24	1.65	364	59	402
21H-3, 135–150	185.5	7.58	0.32	8.02	0.04	0.51	8.89	0.62	—	—	0.03	0.18	1.41	367	56	441
22H-6, 70–85	198.9	7.47	0.35	7.76	0.04	0.14	9.72	2.56	—	—	0.05	0.26	1.25	416	74	357

Table T1 (continued).

Core, section, interval (cm)	Depth (mbsf)	TC (wt%)	TOC (wt%)	TIC (wt%)	TN (wt%)	TS (wt%)	TOC/TN	TOC/TS	$\delta^{13}C_{org}$ (‰)	$\delta^{15}N_{org}$ (‰)	S_1 (mg HC/g rock)	S_2 (mg HC/g rock)	S_3 (mg CO_2/g rock)	T_{max} (°C)	HI (mg HC/g TOC)	OI (mg CO_2/g TOC)
23X-2, 130–150	203.0	8.92	0.35	9.72	0.04	0.18	9.72	1.95	—	—	0.03	0.26	1.19	417	74	340
23X-5, 130–150	207.5	8.86	0.32	9.75	0.03	0.46	12.31	0.70	—	—	0.03	0.25	1.18	422	78	369
24X-4, 94–114	214.9	4.87	0.57	4.74	0.04	0.62	13.26	0.91	—	—	0.04	0.20	2.05	410	35	360
24X-6, 130–150	217.9	5.10	0.64	4.73	0.04	1.02	15.24	0.63	—	—	0.04	0.20	1.96	405	31	306
25X-2, 112–132	222.0	6.97	0.74	7.01	0.04	0.40	16.82	1.86	—	—	0.04	0.46	1.63	426	62	220
25X-5, 130–150	226.5	2.95	1.05	2.04	0.08	1.67	13.46	0.63	—	—	0.06	1.12	1.79	428	107	170
26X-2, 130–150	231.8	4.77	0.87	4.19	0.05	—	16.11	—	—	—	0.05	0.33	1.85	417	38	213
26X-5, 130–150	236.3	6.49	0.63	6.36	0.04	0.56	15.37	1.13	—	—	0.04	0.23	1.72	415	37	273
27X-3, 120–150	242.9	5.12	0.96	4.46	0.07	0.57	14.12	1.69	—	—	0.07	0.62	1.82	421	65	190
28X-4, 67–97	252.9	8.42	0.34	8.91	0.03	0.15	12.59	2.29	—	—	0.02	0.10	0.98	409	29	288
29X-2, 72–102	260.2	8.03	0.37	8.77	0.03	0.23	11.94	1.58	—	—	0.03	0.21	1.02	421	57	276
30X-2, 79–109	269.4	9.66	0.18	10.81	0.02	0.11	9.47	1.59	—	—	0.02	0.11	0.82	421	61	456
30X-4, 65–95	271.1	9.61	0.20	10.70	0.01	0.12	14.29	1.66	—	—	0.02	0.11	0.79	422	55	395
31X-2, 65–100	279.0	9.93	0.24	10.99	0.02	0.17	10.00	1.40	—	—	0.01	0.11	0.74	421	46	308
32X-2, 91–121	288.8	9.28	0.38	10.22	0.02	—	21.11	—	—	—	0.02	0.12	0.76	425	32	200
34X-1, 0–14	302.2	8.30	0.64	8.40	0.03	0.19	25.60	3.44	—	—	0.03	0.32	1.19	424	50	186
36R-2, 67–92	314.0	7.72	0.80	7.81	0.04	0.04	21.62	18.03	—	—	0.02	0.23	0.61	423	29	76
37R-3, 74–103	319.5	8.14	0.72	7.57	0.05	0.88	15.65	0.82	—	—	0.04	0.31	0.96	426	43	133
38R-1, 123–145	327.4	7.38	0.76	6.70	0.03	0.39	22.35	1.94	—	—	0.04	0.39	0.92	428	51	121
38R-2, 66–102	328.4	8.77	0.87	8.60	0.04	0.44	22.31	1.98	—	—	0.02	0.79	0.93	430	91	107
39R-1, 80–94	336.7	6.86	1.22	6.75	0.03	0.52	38.13	2.36	—	—	0.03	0.83	0.76	425	68	62
39R-1, 94–111	336.8	7.97	1.15	8.10	0.05	0.09	21.70	12.27	—	—	0.26	1.28	0.73	429	111	63

TC = total carbon, TOC = total organic carbon, TIC = total inorganic carbon, TN = total nitrogen, TS = total sulfur, T_{max} = maximum S_2 temperature, S_1 = first pyrogram peak under low temperature (<300°C), S_2 = second pyrogram temperature peak, S_3 = third pyrogram temperature peak, HI = hydrogen index, OI = oxygen index.— = no measurement.