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49. *DATA REPORT:* TRACE METAL COMPOSITION OF PORE WATER FROM SITES 855 THROUGH 858, MIDDLE VALLEY, JUAN DE FUCA RIDGE[1]

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INTRODUCTION

Pore waters were collected from each of the four sites drilled during Ocean Drilling Program Leg 139 in Middle Valley, Juan de Fuca Ridge. Each site was drilled in a distinct physical and geological setting. Site 855 is located at the eastern boundary fault of the Middle Valley rift, where seawater enters basement either along the normal fault or through an outcrop. Site 856 is located on a massive sulfide deposit and a nearby uplifted sediment hill. Site 857 was positioned to drill into the hydrothermal fluid reservoir that feeds active hydrothermal vents 1.5 km to the north. Site 858 is located in an area of active hydrothermal venting where effluent temperatures reach 275°C. Pore waters were obtained by squeezing whole-round and quarter-round sections of sediment core using a titanium squeezer designed by Manheim and Sayles (1974) and by in-situ extraction using the water sampler temperature probe (WSTP) (Barnes, 1988). Samples also were obtained using a pressure core sampler and the Los Alamos titanium sampler. Detailed descriptions of sampling methods are given by the Shipboard Scientific Party (Davis, Mottl, Fisher, et al., 1992).

In this data report, we present analyses of pore waters from Leg 139 for Li, Rb, B, Sr, Ba, Mn, Fe, Ni, and Zn (Tables 1–4 and Figures 1–5). Only pore waters from whole-round sections are shown in Figures 4 and 5 because evaporation and water-rock reactions may have altered the pore-water chemistry of the quarter-round sections (Davis, Mottl, Fisher, et al., 1992). The chlorinity of each sample is also listed in the tables as it provides a measure of pore-water dilution with surface seawater/drilling fluid and, in the WSTP samples, distilled water. Some samples have higher chlorinity than expected. These high chlorinities probably resulted from evaporation.

ANALYTICAL METHODS AND ARTIFACTS

Li and Rb were determined by flame emission spectrometry using a standard addition method similar to that of Stoffyn-Egli (1982) on a five-fold dilution of the unacidified sample used for shipboard analyses. We measured Li at 671.0 nm and Rb at 779.4 nm, using a 0.2-nm slit. To account for spectral interferences we measured the background intensity 0.4 nm above and below the peak intensity. The average background intensity was then subtracted from the peak intensity.

Squeezing pore water from sediment can artificially increase the concentrations of K, Li, and Rb in pore water. Early diagenesis typically results in a decrease in the pore-water concentration of Li with depth, as is observed in the upper few meters of the sediment column at Site 855; however, pore waters from the uppermost meter of the sediment column from Site 855 have Li concentrations greater than that measured in bottom seawater. This elevated Li concentration cannot be supported by diagenesis in the upper meter of the sediment column based on flux calculations; it must result from ion-exchange reactions during sample handling. Similarly, Rb artifacts are evident in pore waters from the upper 10 m of the sediment column from Sites 855, 856, and 857. Diffusive and advective processes mask any squeezing artifacts that may be evident from Site 858. Some of the observed scatter in the Li and Rb data is caused by the pattern of pore fluid circulation (Site 858) and by processing lithified sediments that yielded only several ml of pore water upon squeezing at the maximum allowable pressure for periods of up to 12 hours (Sites 857 and 858) (Davis, Mottl, Fisher, et al., 1992).

Some of the in-situ samples were contaminated with Li and Rb. Concentrations of Li in samples from the WSTP 10-mL titanium sample coil agree with concentrations from squeezed samples. The only in-situ samples that are contaminated with Li are the overflow samples from the WSTP (designated BO in the tables). These samples have concentrations of Li up to 10 times greater than expected. Lubri-

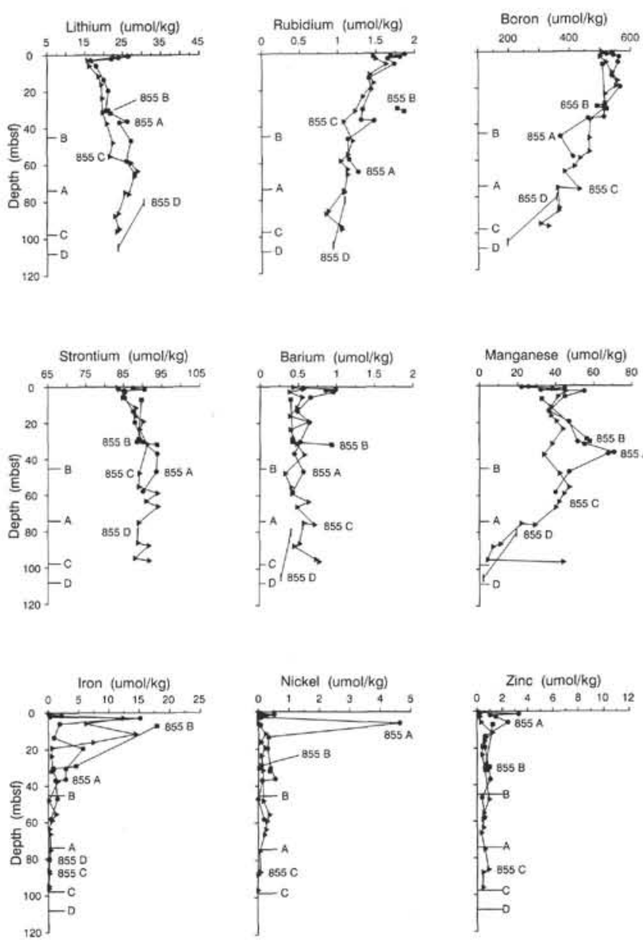

Figure 1. Trace metal composition of pore water in sediment from Site 855. Hole 855A = circles; Hole 855B = squares; Hole 855C = triangles; and Hole 855D = bars. The depth at which basalt was encountered is labeled along the depth axis.

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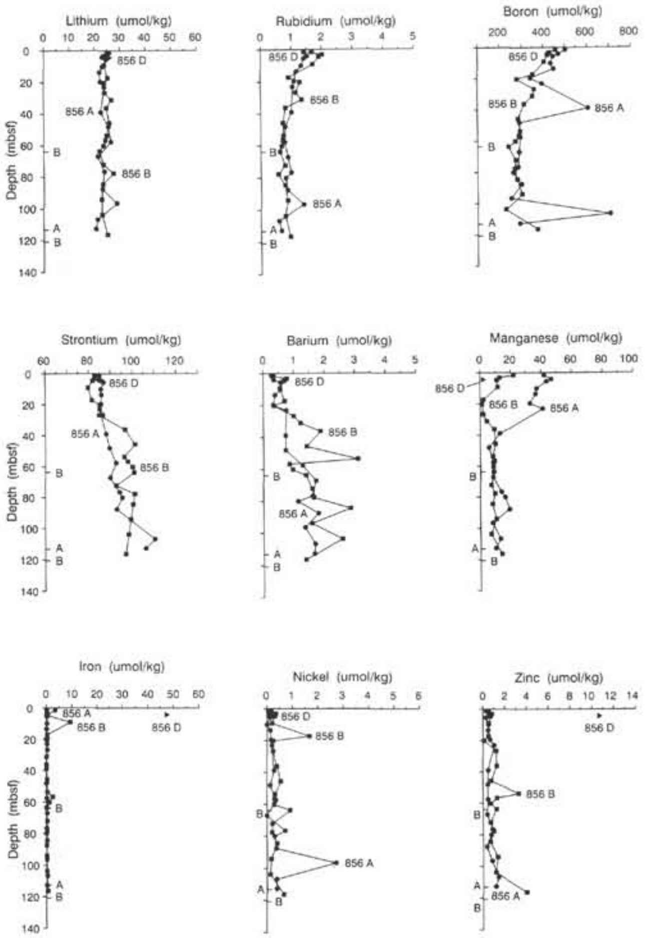

Figure 2. Trace metal composition of pore water in sediment from Site 856. Hole 856A = circles; Hole 856B = squares; and Hole 856D = triangles. The depth at which the tops of basaltic sills were encountered is labeled along the depth axis.

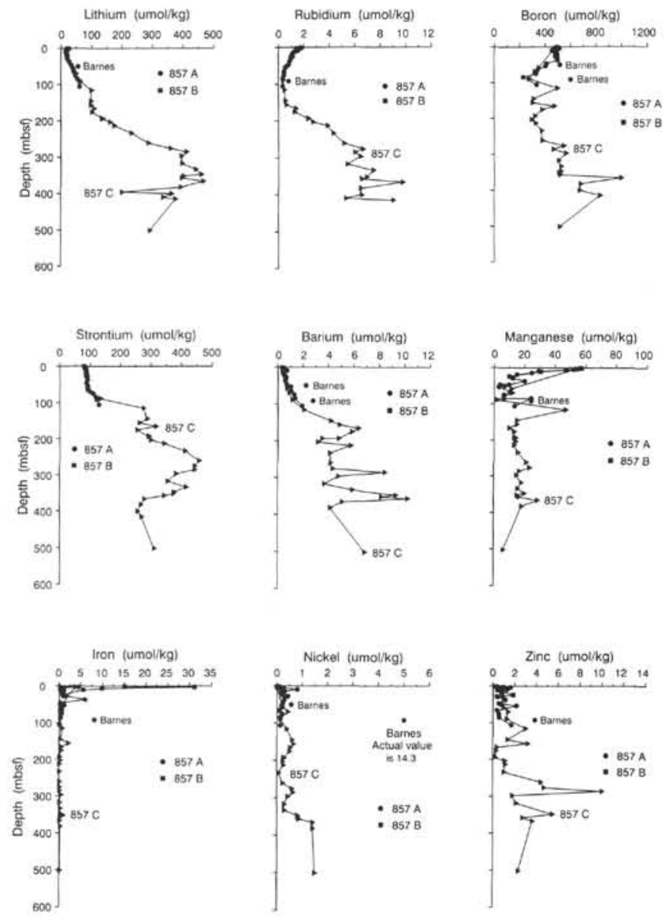

Figure 3. Trace metal composition of pore water in sediment and one sample of diabase (139-857C-62R-1, 142–150) from Site 857. Hole 857A = circles; Hole 857B = squares; and Hole 857C = triangles. The Barnes label on the plots indicates analyses of the aliquot from the WSTP titanium sample coil.

cating grease is the most likely source for this excess Li. Concentrations of Rb in samples from the WSTP 10-mL titanium sample coil agree with concentrations from squeezed samples from Site 855, but are generally at least 50% greater than squeezed samples from the other three sites. A possible explanation is that during retrieval of sediment from Sites 856, 857, and 858, all of which have temperature gradients greater than that at Site 855, the concentration of dissolved Rb decreased by ion exchange caused by the change in temperature from in-situ values to room temperature. WSTP overflow samples (BO) generally have higher concentrations of Rb than samples from the 10-mL titanium sample coil.

B, Sr, Ba, Mn, Fe, Ni, and Zn were determined by inductively coupled plasma atomic emission spectrometry (ICPAES) on acidified samples. These samples were acidified with 0.015 mL of sub-boiled hydrochloric acid (6N) per 10 mL of sample, and they were diluted fivefold before analysis. Cu also was determined but concentrations are not reported because samples were contaminated. Each site has concentrations of Cu that range from 0 to 13 µmol/kg with the exception of three samples with higher concentrations. Concentrations of Cu are highly scattered with depth, making trends difficult to visualize and impossible to interpret.

Concentrations of B are listed in Tables 1 to 4. The value for surface seawater is 17% greater than it should be based on Millero's (1974) ratio of boron to chlorinity and the chlorinity of the surface seawater sample. For example, the surface seawater has a chlorinity of 497.6 mmol/kg; the concentration of B should therefore be about 377 µmol/kg, but the measured concentration is 440 µmol/kg. Concentrations of B from Leg 139 pore waters also may be too high, but results obtained by analyzing samples with a range of B concentrations using the method of Grinstead and Snider (1967) agree with our results (Gieskes, pers. comm., 1993).

Differences in B concentration between in-situ samples and neighboring squeezed samples are insignificant for 11 of 15 samples. Two of the in-situ samples are about 20% lower than expected because of inclusion of bottom seawater in the sample coil; the remaining two samples are about 15% and 300% greater than expected. The sample with the greatest difference is 857A-12I-1, 74–97 cm, which has an anomalously high chlorinity, possibly because the small (5-mL) sample partially evaporated before analysis. This sample is also greatly contaminated with transition metals.

Concentrations of Sr and chlorinity in the surface seawater samples agree with Sr/chlorinity ratios presented by Millero (1974). In general, in-situ samples agree well with neighboring squeezed samples except for the cases where bottom seawater is entrained in the sample coil.

Concentrations of Ba, Mn, Fe, Ni, and Zn in pore waters from Leg 139 generally are greater than concentrations in the overlying bottom seawater. Concentrations of Ba and Mn are easily determined by ICPAES, in contrast to concentrations of Fe and Ni that are often at the limit of detection by ICPAES. Concentrations of Zn are low but detectable. The observed scatter in the data probably results from biological processes (e.g., Fe at Site 855), contamination (e.g., Ni at Site

Table 1. Trace metal composition of pore water in sediment from Site 855.

Sample type[a]/number	Hole, core, section, interval (cm)	Depth (mbsf)	Chlorinity (mmol/kg)	Fe (µmol/kg)	Mn (µmol/kg)	Ni (µmol/kg)	Zn (µmol/kg)	Sr (µmol/kg)	Ba (µmol/kg)	B (µmol/kg)	Li (µmol/kg)	Rb (µmol/kg)
Surface seawater, 9 August 1991			497.6	0.05	0.00	0.02	0.01	83.1	0.02	440	23.3	1.28
IW-1	855A-1R-1, 55–70	0.63	543.6	0.12	22.0	0.07	0.15	87.5	0.56	539	26.5	1.87
IW-2	855A-1R-1, 144–150	1.47	539.1	2.17	44.8	0.52	3.30	90.5	0.99	521	23.9	1.69
IW-3	855A-1R-2, 53–67	2.10	541.6	0.31	32.1	0.35	1.04	85.2	0.86	544	21.9	1.81
IW-4	855A-1R-2, 144–150	2.97	537.7	15.2	55.1	0.43	1.49	85.4	0.96	562	16.5	1.65
IW-5	855A-1R-4, 144–150	5.97	542.6	1.90	44.9	0.42	2.45	85.3	0.66	557	17.9	1.73
IW-6	855A-2R-4, 140–150	13.55	543.6	0.89	36.4	0.33	0.63	87.6	0.49	538	19.9	1.40
IW-7	855A-3R-2, 140–150	19.55	548.4	5.68	47.2	0.30	0.61	88.0	0.65	564	21.1	1.43
IW-8	855A-4R-3, 140–150	30.45	551.4	2.86	51.7	0.40	0.91	90.1	0.53	513	20.5	1.32
BC-9	855A-5I-1, 74–97	36.35	548.4	77.0	70.5	0.56	42.8	99.7	1.90	512	26.2	1.30
BO-9[b]	855A-5I-1, 74–97	36.35	382.4	1.25	66.2	73.6	24.4	95.6	1.34	456	47.8	1.28
IW-10	855A-5R-1, 140–150	36.95	548.4	1.15	67.5	0.13	1.04	93.8	0.45	460	24.1	1.47
IW-11	855A-6R-1, 140–150	46.95	544.5	1.48	47.2	0.00	0.40	93.6	0.57	369	27.2	1.13
IW-12	855A-7R-2, 140–150	58.05	540.7	0.47	40.0	0.20	0.61	90.1	0.43	411	25.9	1.14
IW-13	855A-8R-1, 10–12	64.91	537.7								28.1	1.26
Depth to basalt:		74										
IW-1	855B-2R-1, 140–150	7.15	547.5	17.9	32.7	0.07	1.25	89.7	0.40	507		
IW-2	855B-4R-3, 140–150	28.95	546.5	4.52	56.5	0.10	0.67	89.0	0.43	515		
IW-3	855B-4R-4, 130–144	30.37	547.9	0.79	58.2	0.03	0.97	88.6	0.43	489	21.1	1.77
IW-4	855B-4R-5, 132–147	31.90	559.1	0.52	55.2	0.38	0.82	93.8	0.94	521	21.6	1.86
Depth to basalt:		45										
IW-1	855C-1R-1, 40–52	0.46	537.8	0.12	25.9	0.00	0.10	83.4	0.43	507	26.4	
IW-2	855C-1R-1, 144–150	1.47	538.7	0.23	38.4	0.10	0.19	83.7	0.56	504	22.5	1.46
IW-3	855C-1R-2, 144–150	2.97	542.6	12.4	45.1	0.00	0.22	85.1	0.38	500	15.6	1.49
IW-4	855C-1R-4, 144–150	5.97	541.6	6.20	41.2	0.00	0.33	84.7	0.55	518	16.0	1.62
IW-5	855C-2R-2, 140–150	11.65	541.6	14.3	37.5	0.23	1.19	88.2	0.48	537	18.5	1.41
IW-6	855C-2R-5, 140–150	16.15	547.5	7.34	37.5	0.08	0.57	88.2	0.39	555	19.2	1.46
IW-7	855C-3R-1, 140–150	19.15	550.4	0.60	40.5	0.22	0.40	90.2	0.64	550		
IW-8	855C-3R-4, 140–150	23.65	551.3	0.52	44.0	0.10	0.39	89.3	0.40	515	19.5	1.32
IW-9	855C-4R-3, 140–150	31.55	554.2	0.75	38.2	0.15	0.60	91.2	0.48	513	19.6	1.22
BC-10	855C-5I-1, 74–97	37.45	544.5	1.52	33.7			80.3	0.58	468	20.7	1.07
BO-10[b]	855C-5I-1, 74–97	37.45	185.7	0.00	21.9	8.82	9.28	91.1	1.21	402	177	1.38
IW-11	855C-6R-1, 140–150	47.95	535.8	0.10	42.1	0.17	0.96	89.1	0.33	464	22.3	1.19
IW-12	855C-6R-6, 140–150	55.45	537.8	1.29	47.2	0.38	0.55	89.0	0.41	465	21.4	1.13
IW-13	855C-7R-2, 140–150	59.05	547.5	0.61	44.4	0.30	0.48	93.9	0.42	433	27.0	1.03
IW-14	855C-7R-5, 140–150	63.55	544.5	0.12	41.9	0.25	0.51	90.9	0.64	415	28.8	1.12
IW-15	855C-8R-1, 70–75	66.43	544.5	0.26	40.1	0.20	0.31	94.0	0.49	382	27.9	1.12
BC-16	855C-9I-1, 74–97	76.05	542.6	10.6	29.1			84.0	0.72	431	26.5	1.08
BO-16[b]	855C-9I-1, 74–97	76.05	477.8	0.14	32.9	2.55	10.51	88.4	0.64	482	42.0	1.37
IW-17	855C-9R-1, 0–5	75.23	532.9	0.35	22.0	0.05	0.60	89.0	0.58	360	25.6	1.07
IW-18	855C-10R-2, 0–10	86.35	537.2	0.05	10.7	0.08	0.90	88.6	0.52	365	23.8	0.87
IW-19	855C-10R-3, 140–150	87.85	537.7	0.16	6.8	0.00	0.45	91.5	0.45	363	22.9	0.84
IW-20	855C-11R-1, 20–33	94.87	541.0	0.05	4.1			87.9	0.74	304	24.0	1.04
IW-21	855C-11R-2, 0–10	96.15	538.0	0.07	43.9	0.00	0.45	91.6	0.78	330	23.4	1.05
Depth to basalt:		97.5										
BC-1	855D-1I-1, 74–97	80.35	513.4	0.10	18.3			83.9	0.38	336	30.5	1.03
BO-1[b]	855D-1I-1, 74–97	80.35	355.9	0.13	17.7	2.66	2.52	85.0	0.35	354	53.5	1.02
IW-2	855D-4R-1, 45–50	104.78	535.8		1.9			60.0	0.28	195	23.8	0.94
Depth to basalt:		108										

[a] IW = squeezed interstitial water sample; BC = sample from the titanium coil of the WSTP; BO = overflow aliquot from the WSTP (diluted with distilled water).
[b] Concentrations measured in overflow aliquots have been adjusted to the chlorinity of the prime aliquot.

856), squeezing highly lithified sediments (e.g., Ba and Zn at Site 857), or the circulation of pore waters (e.g., Ba, Mn, Fe, Ni, and Zn concentrations in Holes 858B and 858D are greatest in the depth intervals where lateral fluid flow occurs).

In-situ samples from Site 855 are contaminated with Ba, Fe, Ni, and Zn. Both the overflow aliquot and aliquot from the titanium sample coil are affected. These artifacts are probably caused by oxidation during production and storage of the tool, as these were the first samples taken with the WSTP during Leg 139, and none of the other WSTP samples from the titanium sample coil are contaminated with Fe. The grease that is used to seal the pressure case is another possible source of contamination. WSTP samples from Site 856 do not appear to be contaminated with Ba, Fe, Mn, Ni, and Zn. Both of the overflow samples from Site 857 are contaminated with Ni and Zn, and one of the two samples taken from the titanium sample coil is contaminated with all five metals (Ba, Mn, Fe, Ni, and Zn). Ni and Zn contamination is evident in each of the overflow samples from Site 858. Fe contamination is evident in each of the sediment samples from the pressure core sampler at Site 858, and Zn contamination is often evident in aliquots of the overlying water from the pressure core sampler. The Mn data provide no evidence of a squeezing artifact or contamination in the in-situ samples, with the exception of one sample.

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* Abbreviations for names of organizations and publications in ODP reference lists follow the style given in *Chemical Abstracts Service Source Index* (published by American Chemical Society).

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Table 2. Trace metal composition of pore water in sediment from Site 856.

Sample type[a]/number	Hole, core, section, interval (cm)	Depth (mbsf)	Chlorinity (mmol/kg)	Fe (µmol/kg)	Mn (µmol/kg)	Ni (µmol/kg)	Zn (µmol/kg)	Sr (µmol/kg)	Ba (µmol/kg)	B (µmol/kg)	Li (µmol/kg)	Rb (µmol/kg)
Surface seawater 9 August 1991			497.6	0.05	0.00	0.02	0.01	83.1	0.02	440	23.3	1.28
IW-1	856A-1H-2, 0–6	1.53	540.6	3.48	42.1	0.05	0.31	85.1	0.28	503	25.9	1.68
IW-2	856A-2H-1, 140–150	4.15	540.6	0.52	46.9	0.07	0.58	85.0	0.35	471	23.1	1.50
IW-3	856A-2H-2, 140–150	5.65	542.6	0.24	43.7	0.13	0.27	87.0	0.57	446	24.7	1.41
IW-4	856A-2H-5, 140–150	10.15	539.7	0.19	37.1	0.00	0.52	85.7	0.56	435	23.1	1.32
IW-5	856A-3H-1, 143–150	13.67	538.7	0.00	36.4	0.13	0.48	86.0	0.38	449	22.2	1.17
IW-6	856A-3H-5, 143–150	19.67	540.6	0.35	32.7	0.15	0.66	85.8	0.33	343	22.5	1.10
IW-7	856A-4H-1, 140–150	23.15	541.6	0.17	41.2	0.18	1.03	85.2	0.75	397	24.0	1.05
IW-8	856A-5H-6, 140–150	39.03	538.7	0.05	12.9	0.28	0.49	88.1	0.72	607	22.6	1.01
IW-9	856A-6H-5, 140–150	48.15	538.7	0.00	5.6	0.13	0.45	89.7	0.72	292	25.6	0.80
IW-10	856A-7H-5, 140–150	57.65	541.6	0.10	8.4	0.35	0.46	92.6	1.28	296	26.6	0.78
IW-11	856A-8H-5, 140–150	67.15	540.6	0.28	8.2	0.00	0.39	89.9	1.71	290	21.4	0.89
IW-12	856A-9H-5, 140–150	76.65	543.6	0.05	13.9	0.71	0.87	94.3	1.62	285	24.0	0.99
IW-13	856A-10X-1, 140–150	80.15	540.6	0.02	16.4	0.30	0.75	95.6	1.14	262		0.81
IW-14	856A-11X-1, 140–150	87.65	538.7	0.00	19.2	0.37	0.34	93.0	1.80	300	23.1	0.87
BC-15	856A-12I-1, 74–97	96.55	539.7	0.09	8.0	2.73	0.82	55.7	1.36	252	28.8	1.39
BO-15[b]	856A-12I-1, 74–97	96.55	331.6								71.5	1.58
IW-16	856A-13X-1, 140–150	106.75	538.7	0.31	13.1	0.38	1.40	110	1.69	707	21.3	0.59
IW-17	856A-13X-5, 140–150	112.75	534.8	0.05	10.0	0.38	1.15	106	1.67	293	20.7	0.67
Depth to basalt:		113.2										
IW-1	856B-1H-1, 144–150	1.47	538.7	0.12	22.0	0.17	0.54	83.0	0.33	458	25.1	1.42
IW-2	856B-2H-1, 140–150	3.25	542.6	0.14	12.9	0.35	0.84	82.8	0.77	430	23.8	2.01
IW-3	856B-2H-2, 140–150	4.75	538.7	0.07	10.9	0.32	0.70	82.0	0.69	420	24.9	1.90
IW-4	856B-2H-5, 140–150	9.25	541.6	9.40	11.6	0.20	0.52	79.8	0.55	405	23.8	1.70
IW-5	856B-3H-4, 140–150	17.25	538.7	0.24	2.2	1.68	0.51	81.6	0.70	355	25.4	0.92
IW-6	856B-3H-6, 140–150	20.25	540.6	0.00	1.3	0.23	0.12	85.3	0.35	280	24.0	1.29
IW-7	856B-4H-4, 140–150	26.75	541.6	0.26	2.0	0.23	1.19	86.6	0.99	360	24.1	1.15
BC-8	856B-5I-1, 74–97	31.15	516.3	0.07	4.3			84.9	1.21	352	26.8	1.35
IW-9	856B-5H-4, 140–150	36.25	537.7	0.09	9.2	0.40	1.28	96.8	1.88	314	24.8	0.81
IW-10	856B-6H-4, 140–150	45.75	540.6	0.28	10.0	0.55	0.76	101	1.41	285	26.0	0.73
IW-11	856B-7H-3, 140–150	53.75	539.7	0.42	8.1	0.32	1.82	96.4	3.10	295	24.9	0.74
IW-12	856B-7H-5, 140–150	56.75	540.6	2.45	9.2	0.30	1.28	98.0	0.85	290	24.4	0.72
IW-13	856B-8H-1, 140–150	60.25	536.8	1.19	8.5	0.28	0.72	100	0.95	273	23.6	0.68
IW-14	856B-9X-1, 140–150	63.75	537.7	0.02	8.7	0.91	1.24	101	1.39	241	22.1	0.63
IW-15	856B-10H-1, 140–150	72.25	517.3	0.33	7.3	0.22	0.69	92.8	1.61	274	23.6	0.79
IW-16	856B-11X-3, 140–150	77.75	535.8	0.17	9.7	0.20	0.99	101	1.66	270	27.5	0.57
IW-17	856B-12X-2, 140–150	84.55	534.8	0.23	7.9	0.40	0.66	101	2.86	280	23.3	0.78
IW-18	856B-13X-2, 140–150	94.05	536.8	0.00	10.4	0.17	1.34	99.5	1.59	302	22.8	0.87
IW-19	856B-14X-2, 140–150	103.75	534.8	0.10	7.0	0.13	1.16	98.5	2.59	229	23.1	0.80
IW-20	856B-15X-4, 140–150	116.35	536.8	0.42	13.9	0.66	3.98	97.1	1.38	375	25.2	0.96
Thin sill at:		63.8										
Depth to basalt:		120.7										
IW-1	856D-1H-3, 140–150	4.45	536.8	47.3	2.0	0.20	10.7	86.2	0.72	423	25.9	1.52

[a] IW = squeezed interstitial water sample; BC = sample from the titanium coil of the WSTP; BO = overflow aliquot from the WSTP tool (diluted with distilled water).
[b] Concentrations measured in overflow aliquots have been adjusted to the chlorinity of the prime aliquot.

Table 3. Trace metal composition of pore water in sediment and one sample of metadiabase (139-857C-62R-1, 142–150 cm) from Site 857.

Sample type[a]/number	Hole, core, section, interval (cm)	Depth (mbsf)	Chlorinity (mmol/kg)	Fe (µmol/kg)	Mn (µmol/kg)	Ni (µmol/kg)	Zn (µmol/kg)	Sr (µmol/kg)	Ba (µmol/kg)	B (µmol/kg)	Li (µmol/kg)	Rb (µmol/kg)
Surface seawater 9 August 1991			497.6	0.05	0.00	0.02	0.01	83.1	0.02	440	23.3	1.28
IW-1	857A-1H-1, 144–150	3.37	539.4	4.44	54.3	0.12	1.60	81.8	0.40	504	20.3	1.56
IW-2	857A-1H-2, 144–150	4.87	537.8	1.10	51.9	0.25	0.72	81.7	0.36	511	17.3	1.46
IW-3	857A-1H-5, 144–150	9.37	543.2	0.21	29.1	0.80	1.28	83.4	0.72	452	16.8	1.54
IW-4	857A-2H-2, 140–150	14.35	539.7	1.07	24.5	0.30	0.79	86.3	0.40	482	18.8	1.17
IW-5	857A-2H-5, 140–150	18.85	540.6	0.58	14.8	0.18	0.81	88.7	0.43	495	20.4	1.09
PO-6	857A-3P-1, 0–100	21.40	504.6	0.00	3.3	1.35	8.54	81.5	0.06	409	62.7	1.24
IW-7	857A-4H-4, 140–150	27.85	548.4	1.55	11.9	0.43	0.87	90.6	0.62	482	21.2	1.04
IW-8	857A-5H-4, 140–150	37.35	550.3	5.92	19.8	0.28	1.13	91.1	0.58	500	27.3	0.91
IW-9	857A-6H-4, 140–150	46.85	552.3	0.31	9.6	0.23	0.55	87.5	0.68	412	34.2	0.83
BC-10	857A-7I-1, 74–97	50.40	612.1	0.19	6.7	0.56	0.79	89.7	2.22	518		0.94
BO-10[b]	857A-7I-1, 74–97		285.7	0.04	8.4	13.6	2.97	96.6	2.25	508	122	1.43
IW-11	857A-7H-2, 140–150	53.35	557.1	1.14	3.0	0.18	2.15	91.2	1.02	404	38.3	0.60
IW-12	857A-8H-4, 140–150	65.85	560.0	0.59	10.4	0.08	0.37	92.5	1.05	339	43.7	0.45
IW-13	857A-9H-4, 140–150		562.9	0.52	6.2	0.20	0.54	109	1.29	328	47.7	0.44
IW-14	857A-10H-4, 140–150	84.85	564.5	0.26	6.3	0.12	0.55	118	1.35	228	54.5	0.34
BC-15	857A-12I-1, 74–97	91.90	587.9	8.04	24.2	14.3	3.84	121	2.77	601	63.1	0.82
BO-15[b]	857A-12I-1, 74–97	453.2	0.32	19.3	2.07	11.2	122	3.32	596	100	1.07	
IW-16	857A-13R-3, 140–150	105.95	558.0	0.00	13.3	0.13	1.67	128	1.92	335	61.8	0.33
IW-1	857B-1H-1, 144–150	1.47	536.9	15.0	57.0	0.05	0.27	79.7	0.33	497	24.2	1.76
IW-2	857B-1H-2, 144–150	2.97	539.7	31.1	53.8	0.00	0.90	84.2	0.47	486	20.0	1.59
IW-3	857B-2H-2, 140–150	6.35	535.9	9.84	46.9	0.25	1.31	84.5	0.40	471	14.9	1.43
IW-4	857B-2H-5, 140–150	10.85	539.7	5.54	30.4	0.18	0.40	86.6	0.38	471	16.6	1.30
IW-5	857B-3H-2, 140–150	23.95	537.8	0.80	9.7	0.23	1.85	85.7	0.53	481	20.7	1.14
IW-6	857B-3H-5, 140–150	28.45	540.7	1.05	12.2	0.32	0.39	87.3	0.63	498	21.7	0.99
IW-1	857C-1R-1, 144–150	1.47	540.7	0.17	56.3	0.08	0.54	80.6	0.38	496	24.7	1.82
IW-2	857C-1R-2, 144–150	2.97	542.6	3.67	53.3	0.00	0.55	81.5	0.39	478	18.1	1.45
IW-3	857C-2R-1, 140–150	57.95	547.4	0.19	11.2	0.22	0.96	89.6	0.71	350	39.8	0.50
IW-4	857C-3R-2, 140–150	69.45	548.4	0.10	11.7	0.42	1.37	101	0.88	318	49.7	0.41
IW-5	857C-6R-2, 140–150	89.15	557.1	0.16	18.1	0.12	1.24	134	1.12	273	59.8	0.36
IW-6	857C-9R-1, 109–114	115.62	571.5	0.65	46.7	0.37	2.98	275	2.05	496	100	0.47
IW-7	857C-12R-2, 0–10	145.05	574.4	0.26	14.9	0.60	1.36	287	4.18	310	98.8	0.54
IW-8	857C-13R-2, 140–150	156.05	568.7	2.11	14.7	0.65	3.21	262	4.87	301	97.6	0.62
IW-9	857C-14R-3, 0–10	165.85	562.9	0.49	9.7	0.52	0.37	316	6.37	473	108	1.38
IW-10	857C-15R-3, 0–10	175.55	565.8	0.42	12.9	0.50	0.28	254	5.85	377	102	1.29
IW-11[a]	857C-17R-1, 135–150	193.33	561.9	0.14	14.1	0.28	0.24	291	4.80	321	137	2.34
IW-11[b]	857C-17R-1, 135–150	193.33	561.9	0.02	13.0	0.25	0.13	294	3.49	321	134	2.38
IW-12	857C-18R-2, 0–15	203.18	560.0	0.24	13.9	0.22	1.10	299	3.16	293	161	2.73
IW-13	857C-19R-2, 0–15	212.88	555.2	0.00	13.0	0.25	1.13	343	5.75	325	176	3.88
IW-14	857C-21R-2, 135–150	233.53	563.8	0.00	15.5	0.07	0.99	411	4.11	372	232	4.34
IW-15	857C-24R-2, 0–10	260.75	565.8	0.00	21.0	0.22	4.40	457	4.16	378	288	5.18
IW-16	857C-26R-1, 135–150	275.93	566.7	0.00	23.4	0.58	4.67	443	4.35	547	360	6.66
IW-17	857C-27R-1, 135–150	285.53	574.9	0.00	16.5	0.63	10.0	443	8.45	465	413	6.03
IW-18	857C-28R-3, 0–15	296.88	574.4	0.35	14.8	0.42	1.79	383	4.79	563	396	6.47
IW-19	857C-30R-3, 134–150	317.52	576.4	0.03	17.9	0.28	2.12	355	3.69	504	398	5.42
IW-20	857C-33R-1, 135–150	333.83	582.1	0.19	15.5			415	5.91	525	443	7.48
IW-21	857C-36R-2, 3–18	347.71	594.7	0.17	19.9	0.80	5.46	376	9.31	523	461	
IW-22	857C-37R-1, 140–150	352.25	589.9	0.84	15.0			374	8.17	507	403	6.95
IW-23	857C-38R-2, 0–15	357.38	590.8	0.12	16.2	0.85	2.72	344	10.2	517	397	6.56
IW-24	857C-40R-1, 121–136	366.69	585.0	0.00	28.6	1.41	3.61	278	5.09	996	467	9.76
IW-25	857C-42R-3, 0–15	382.78	591.8	0.17	18.1			266	4.16	677	394	6.49
IW-26	857C-45R-2, 0–15	395.88	593.7								202	
IW-27	857C-46R-2, 0–15	400.58	587.0					256		672	365	6.58
IW-28	857C-48R-1, 132–147	410.10	579.3								338	5.34
IW-29	857C-49R-1, 135–150	415.13	589.9					269		834	377	9.05
IW-30	857C-62R-1, 142–150	501.46	604.3	0.00	6.1	1.48	2.31	311	6.87	515	293	
IW-1	857D-12R-1, 16–20	686.08	589.5									

[a] IW = squeezed interstitial water sample; BC = sample from the titanium coil of the WSTP; BO = overflow aliquot from the WSTP (diluted with distilled water); PO = overflow aliquot from the pressure core sampler.

[b] Concentrations measured in overflow aliquots have been adjusted to the chlorinity of the prime aliquot.

Table 4. Trace metal composition of pore water in sediment from Site 858.

Sample type[a]/number	Hole, core, section, interval (cm)	Depth (mbsf)	Chlorinity (mmol/kg)	Fe (µmol/kg)	Mn (µmol/kg)	Ni (µmol/kg)	Zn (µmol/kg)	Sr (µmol/kg)	Ba (µmol/kg)	B (µmol/kg)	Li (µmol/kg)	Rb (µmol/kg)
Surface seawater 9 August 1991			497.6	0.05	0.00	0.02	0.01	83.1	0.02	440	23.3	1.28
IW-1	858A-1H-1, 144–150	1.47	541.6	1.54	47.6	0.00	0.69	85.4	0.50	425	25.4	1.69
IW-2	858A-2H-2, 144–150	5.37	542.6	0.49	53.8	0.00	3.30	87.3	0.67	361	19.3	1.46
IW-3	858A-2H-3, 144–150	6.87	544.5	0.28	57.4	0.00	1.03	85.7	0.43	351	19.6	1.33
IW-4	858A-2H-5, 144–150	9.87	541.0	0.02	46.5	0.00	0.52	87.7	0.72	360	22.4	1.46
IW-5	858A-3H-4, 140–150	17.62	543.6	0.28	20.8	0.00	1.28	92.2	0.76	340	39.4	1.98
IW-6	858A-4H-4, 140–150	27.35	545.5	0.09	21.3	0.00	1.01	96.4	1.06	373	62.2	2.97
IW-7	858A-5H-4, 140–150	36.85	549.4	1.00	17.8	0.30	0.69	105	1.55	361	120	2.92
IW-8	858A-6H-2, 140–150	43.35	552.3	0.16	21.5	0.28	1.12	115	1.77	404	142	2.73
IW-9	858A-7H-2, 140–150	52.85	554.2	1.01	22.7	0.28	0.66	140	2.42	410	165	2.11
IW-10	858A-9X-2, 0–10	64.05	556.2	0.16	24.7	0.45	0.84	154	1.95	385	166	2.20
IW-11	858A-9X-5, 140–150	69.95	558.1	8.07	38.4	0.22	2.33	156	3.54	462	210	2.45
IW-12	858A-10P-1, 0–8	71.94	560.0	38.3	46.7	1.23	4.85	170	3.28	451	231	2.52
PO-12	858A-10P-1, 0–8	71.94	498.1	0.00	5.3	0.43	9.94	78.8	0.15	348	39.7	1.41
BC-13	858A-11I-1, 74–97	73.76	499.0	0.00	7.1	0.15	9.61	82.6	0.62	272	32.2	1.45
BO-13[b]	858A-11I-1, 74–97	73.76	461.9	0.00	29.0	11.8	17.7	107	1.87	387	96.9	3.25
IW-14	858A-11X-1, 43–53	73.38	555.2	0.00	36.4	0.27	7.46	171	2.90	440	213	2.51
IW-15	858A-15X-1, 84–98	111.51	566.9	0.42	35.7	0.28	3.79	216	3.14	525	275	3.82
IW-16	858A-16X-1, 52–62	120.87	562.0	0.23	4.1	0.12	3.07	225	2.22	525	268	4.38
IW-17	858A-18X-1, 137–147	141.02	544.0	0.35	42.3	0.18	1.43	146	2.15	356	182	3.92
IW-18	858A-20X-1, 138–150	160.37	549.4	0.37	32.7	0.12	1.96	171	1.93	297	188	2.08
IW-19	858A-21X-2, 90–100	171.05	546.5	0.26	46.5	0.50	2.82	200	3.55	338	194	2.76
IW-20	858A-23X-1, 22–31	188.17	546.5	0.21	46.3	1.66	2.85	151	2.64	364	242	4.10
IW-21	858A-25X-1, 0–10	207.35	538.7	0.07	92.5	0.23	2.36	136	2.43	379	251	5.61
IW-22	858A-27X-1, 3–13	226.68	544.5	0.28	49.7	0.91	4.15	156	4.62	452	270	6.08
IW-23	858A-29X-1, 39–46	246.33	575.5	0.56	20.1			227	2.37	1000	408	10.2
IW-24	858A-30X-1, 90–102	256.56	578.4	0.00	25.0	1.36	11.01	224	8.81	830	412	8.75
IW-25	858A-31X-1, 69–84	266.07	581.3		6.3			251		830	427	6.30
IW-26	858A-32X-1, 15–22	274.69	578.4	0.16	10.8			234	2.93	901	443	8.41
IW-27	858A-34X-1, 8–15	291.62	556.5	0.09	20.1	0.85	9.27	230	2.47	617	325	7.11
IW-1	858B-1H-1, 140–150	1.45	542.6	3.20	27.2	0.20	0.46	91.6	0.90	408	27.0	1.58
IW-2	858B-1H-2, 73–79	2.26	563.5	0.00	25.2	0.38	1.70	95.0	1.14	299	31.6	1.62
IW-3	858B-1H-2, 140–150	2.95	548.4	0.00	36.8	0.23	0.46	101	0.80	414	38.8	1.65
IW-4	858B-1H-3, 118–129	4.24	573.2	0.00	11.7	0.28	0.25	115	0.79	183	51.2	2.39
IW-5	858B-1H-4, 38–44	4.91	576.2	0.14	5.0	0.48	0.60	121	1.07	178	65.0	2.80
IW-6	858B-1H-4, 140–150	5.95	552.1	1.08	3.8	0.55	0.61	125	1.12	421	86.7	2.49
IW-7	858B-2H-1, 41–73	7.77	576.2	0.33	12.2	8.28	1.45	145	2.55	472	96.1	3.26
IW-8	858B-2H-2, 7–21	8.84	569.4	0.12	6.4	2.23	20.3	112	2.46	351	64.6	2.55
IW-9	858B-2H-2, 129–141	10.05	572.3	0.05	6.5	1.01	4.94	137	3.71	515	140	4.45
IW-10	858B-2H-4, 140–150	13.15	589.4	26.2	21.3	1.16	0.07	252	11.0	1410	441	10.1
IW-11	858B-2H-5, 75–87	14.01	606.3	0.05	45.1	4.65	6.22	288	7.53	1170	413	10.1
IW-12	858B-2H-6, 17–32	14.95	579.1	0.00	21.3	1.56	1.10	262	12.9	1070	309	11.5
IW-13	858B-2H-6, 110–124	15.87	578.1	0.07	10.9	0.71	0.40	256	19.2	966	314	10.5
IW-14	858B-3H-1, 3–13	16.78	557.4	10.6	74.4	0.15	0.15	234	4.90	1260	420	15.6
BC-15	858B-4I-1, 74–97	19.26	603.5								521	25.8
BO-15[b]	858B-4I-1, 74–97	19.26	517.5	0.14	17.3	28.9	11.1	103	3.44	759	264	7.28
IW-16	858B-5H-1, 125–138	25.22	622.9	0.09	12.8	0.66	9.55	326	7.09	911	489	14.4
IW-17	858B-5H-2, 143–150	26.87	631.1								589	14.0
IW-18	858B-5H-3, 140–150	28.35	616.6	14.6	11.0	0.88	0.10	353	95.2	1100	543	13.8
IW-1	858C-1H-1, 144–150	1.47	543.6	8.00	35.2	0.05	2.25	82.2	1.09	488	29.5	1.87
IW-2	858C-1H-2, 144–150	2.97	545.5	7.28	33.6	0.17	1.43	85.1	1.16	459	34.5	2.23
IW-3	858C-2H-2, 144–150	6.47	546.5	0.00	45.3	0.12	0.58	85.4	1.59	379	42.5	2.55
IW-4	858C-2H-3, 140–150	7.95	546.5	0.00	37.8	0.00	0.43	87.3	0.66	350	46.4	2.70
IW-5	858C-2H-5, 144–150	10.97	549.4	7.84	33.4	0.18	3.21	93.5	0.96	305	53.2	2.39
IW-6	858C-3H-3, 144–150	17.47	556.2	0.12	24.3	2.44	1.03	112	1.32	359	54.9	1.72
IW-7	858C-3H-5, 144–150	20.47	556.2	0.10	27.0	7.78	0.81	117	1.44	318	53.8	
BC-8	858C-5I-1, 74–97	24.36	533.8	0.65	20.2	4.80	7.36	96.0	1.64	417	44.6	2.70
BO-8[b]	858C-5I-1, 74–97	24.36	502.6	0.13	20.7	10.1	14.4	99.8	2.14	409	50.9	2.60
IW-9	858C-5H-4, 140–150	29.45	547.0	0.35	9.1	0.66	1.39	97.8	1.72	356	38.0	1.16
IW-10	858C-6H-3, 140–150	37.45	547.5	0.19	9.1	0.18	0.73	105	1.17	324	37.1	1.21
IW-11	858C-7H-1, 140–150	42.95	550.6	0.19	9.4	0.95	1.46	103	1.17	304	44.2	1.44
IW-12	858C-10aX-CC, 20–25	48.03	546.5								64.1	2.34
IW-12	858C-10bX-CC, 20–25	48.03	549.4	1.68	9.5	1.10	1.87	102	1.92	326	64.0	2.03
IW-12	858C-10X-CC, 30–35	48.13	546.5								97.9	2.64
IW-13	858C-11X-1, 5–15	54.60	546.5	0.21	11.2	0.90	3.00	99.8	2.32	317	66.8	1.46
IW-14	858C-12X-1, 131–145	65.38	547.5	0.12	17.7	0.47	1.91	117	2.27	293	81.0	0.99
IW-15	858C-13X-1, 41–46	74.14	545.5	0.30	43.0	0.48	5.31	155	4.20	412	103	3.08
IW-16	858C-14X-1, 68–78	84.13	556.2	15.4	28.9	0.00	0.19	145	12.4	529	103	3.11
IW-1	858D-1H-1, 144–150	1.47	596.1	0.16	5.1	0.05	0.03	183	2.95	886	150	7.19
IW-2	858D-1H-3, 3–12	3.08	666.7	0.03	17.6	0.43	2.22	257	49.8	758	281	11.4
IW-3	858D-1H-3, 144–150	4.47	655.7	143	55.1	0.33	1.64	278	12.0	1220	336	10.1
IW-4	858D-1H-4, 103–117	5.60	675.4	0.00	15.2	0.63	1.69	310	116	614	352	11.9
IW-5	858D-1H-5, 144–150	7.47	660.3	106	32.5	0.38	4.95	321	255	1340	422	9.30
IW-6	858D-1H-6, 128–142	8.85	656.0	0.00	6.7	0.27	1.15	316	222	742	409	11.1
IW-7	858D-2H-2, 2–16	10.89	638.5	0.00	8.5	0.22	2.79	287	21.0	662	425	7.29
IW-8	858D-2H-2, 120–133	12.07	638.3	0.00	10.6	2.08	6.85	281	17.6	657	445	6.54
IW-9	858D-2H-3, 144–150	13.77	596.3	5.90	15.0	0.70	0.19	271	16.0	1350	525	6.86
IW-10	858D-2H-4, 133–147	15.20	629.7	0.00	12.4	1.30	4.31	293	42.1	859	491	7.36
IW-11	858D-2H-5, 144–150	16.77	621.1	0.52	17.7	0.40	1.72	304	19.4	1060	474	4.46
IW-12	858D-2H-6, 133–147	18.20	596.6	0.00	16.9	0.65	5.46	278	6.34	1160	473	8.20
IW-13	858D-3P-1, 0–13	18.87	580.0	118	38.9	0.53	1.27	251	5.91	1310	468	7.23
PO-13	858D-3P-1, 0–13	18.87	512.5	0.17	17.9	0.86	93.1	79.5	0.37	418	183	1.37
BC-14	858D-4I-1, 74–97	20.66	569.8	34.4	31.8			240	36.9	1580	471	18.9

Table 4 (continued).

Sample type[a]/number	Hole, core, section, interval (cm)	Depth (mbsf)	Chlorinity (mmol/kg)	Fe (µmol/kg)	Mn (µmol/kg)	Ni (µmol/kg)	Zn (µmol/kg)	Sr (µmol/kg)	Ba (µmol/kg)	B (µmol/kg)	Li (µmol/kg)	Rb (µmol/kg)
BO-14[b]	858D-4I-1, 74–97	20.66	532.9	63.5	36.3	15.3	4.28	250	11.2	1690	482	22.0
IW-15	858D-4H-2, 56–80	20.72	579.1	0.00	32.5	1.60	6.15	144	1.90	585	146	5.08
IW-16	858D-4H-2, 144–150	21.51	562.3	15.7	40.8	0.33	1.04	218	6.87	1270	368	5.89
IW-17	858D-4H-3, 100–107	22.58	600.5	0.00	9.8	2.73	2.91	253	12.7	1060	426	7.97
IW-18	858D-4H-4, 104–118	24.15	598.6	0.00	25.6	10.3	17.5	264	11.0	1070	455	6.15
IW-19	858D-4H-5, 144–150	26.01	585.4	0.24	20.8	2.06	0.46	275	42.6	1330	496	5.03
IW-20	858D-4H-6, 134–149	27.46	566.4	0.00	28.2	5.35	5.51	243	10.3	1090	410	7.38
IW-21	858D-6X-1, 96–105	38.21	569.1	3.23	29.3	0.60	0.19	225	3.62	1030	390	12.0
IW-1	858F-9R-CC, 0–1	94.21	570.7								422	17.5
IW-2	858F-11R-1, 0–3	113.62	530.0	2.97	38.7			156	4.19	594	180	7.72
IW-3	858F-14R-1, 0–3	142.62	570.7	13.3	27.5			246	3.91	1270	461	9.72
IW-4	858F-17R-1, 0–3	171.62	561.5	33.4	11.7			224	14.4	1200	393	18.1
IW-5	858F-18R-1, 67–72	182.00	567.8					221		1070	389	16.5
IW-6	858F-19R-1, 9–12	191.01	565.8					212		1070	333	15.1
IW-7	858F-21R-1, 9–13	210.41	565.8	11.2	24.0			215	5.82	918	359	9.29
IW-8	858F-24R-CC, 0–4	239.32	567.8	1.19	33.0			228	9.73	1240	448	20.4
IW-9	858F-25R-1, 2–8	248.95	566.8	0.70	22.0	0.96	4.16	218	5.33	893	403	11.7
LA-1	858F			101.80	502.6	0.09	3.9	8.08	10.4	80.6	0.50	414

[a] IW = squeezed interstitial water sample; BC = sample from the titanium coil of the WSTP; BO = overflow aliquot from the WSTP (diluted with distilled water); PO = overflow aliquot from the pressure core sampler; LA = sample from the Los Alamos National Laboratory borehole water sampler.
[b] Concentrations measured in overflow aliquots have been adjusted to the chlorinity of the prime aliquot.

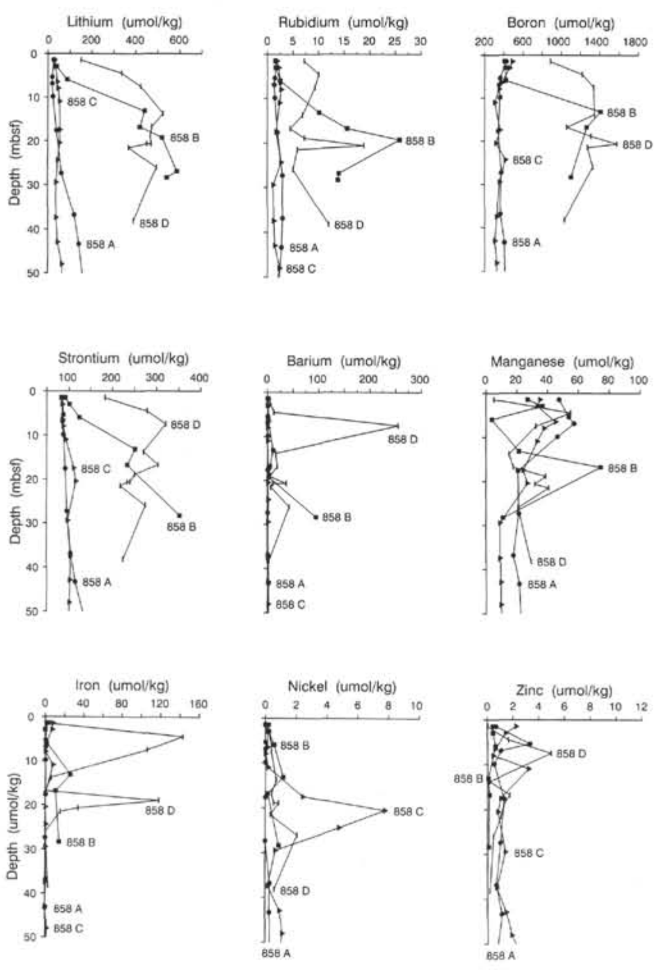

Figure 4. Trace metal composition of pore water in sediment from Site 858. Hole 858A = circles; Hole 858B = squares; Hole 858C = triangles; and Hole 858D = bars. Only the upper 50 mbsf are shown and none of the quarter-round samples are plotted.

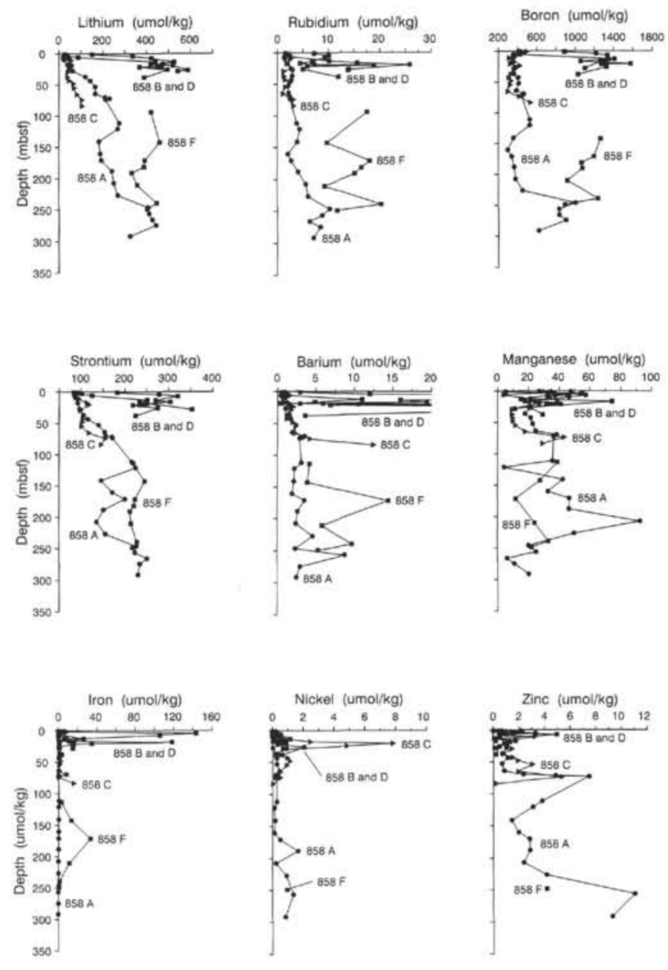

Figure 5. Trace metal composition of pore water in sediment from Site 858. Hole 858A = circles; Hole 858B = squares; Hole 858C = triangles; Hole 858D = squares; and Hole 858F = squares. None of the quarter-round samples are plotted.