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5. Data Report: Dissolved Manganese Concentrations in Deep Drill Holes off New Zealand (ODP Leg 181)[1]

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INTRODUCTION

During Leg 181, seven locations (Sites 1119–1125) were drilled off the eastern coast of New Zealand. Although the sites were primarily targeted to reconstruct the stratigraphy and paleoceanography of the region (Shipboard Scientific Party, 1999), they are particularly interesting from a geochemical perspective because, as clearly evidenced by shipboard pore water and gas analyses, recovered sediment cores span an exceptional range of chemical environments. Pore water alkalinity, NH_4^+, SO_4^{2-}, and PO_4^{3-} concentrations, as well as headspace CH_4 concentrations, indicate significant differences in sediment redox conditions across the region (Shipboard Scientific Party, 1999). The distribution of solid and dissolved manganese plays an important role in geochemical interpretations of such sedimentary environments (e.g., Froelich et al., 1979; Thamdrup and Dalsgaard, 2000). Dissolved Mn^{2+} concentrations of pore waters at four sites (1119, 1122, 1123, and 1125) drilled during Leg 181 are presented in this report.

METHODS

Pore waters were squeezed from whole-round sediment intervals, acidified with HNO_3, and sealed in plastic tubes according to standard procedures aboard the *JOIDES Resolution*. The samples were shipped to James Cook University (JCU). After cutting each tube, precisely 1.00 mL of solution was removed with a pipette, placed into a plastic vial, and mixed with 8.90 mL of deionized water and 0.10 mL of 1% HNO_3

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spiked with 10 ppm rhodium for use as an internal standard. All samples were then analyzed for Mn concentrations by inductively coupled plasma–mass spectrometry (ICP-MS) at the JCU Advanced Analytical Centre (AAC). Prepared solutions were injected into a Varian Ultramass ICP-MS with a quadrupole mass analyzer. Manganese concentrations in solution were obtained through standard comparisons to a concentration curve. The curve was constructed by spiking the certified CASS-2 seawater standard with known concentrations of Mn and Ba. Four pore water samples from Leg 181 were prepared and analyzed a second time to assess precision. Repeated analyses of these true replicates are within 6% (Table **T1**).

T1. Manganese concentrations in pore waters, p. 5.

RESULTS

Dissolved Mn^{2+} concentrations range between 0.1 and 26.5 µM (Table **T1**; Fig. **F1**) and average 1.8, 3.3, 3.8, and 1.0 µM at Sites 1119, 1122, 1123, and 1125, respectively. Thus, Mn^{2+} concentrations are relatively high at the deep sites (1122 and 1123) and relatively low at the shallow sites (1119 and 1125). This observation may reflect higher inputs of reducible solid Mn phases at the deeper locations. There is an overall positive correlation between dissolved Mn^{2+} and dissolved SO_4^{2-} concentrations (Fig. **F1**). Because SO_4^{2-} reduction increases alkalinity, it is probable that Mn^{2+} profiles are strongly influenced by authigenic carbonate precipitation and incorporation of Mn.

F1. Dissolved Mn^{2+} and SO_4^{2-} concentrations, p. 4.

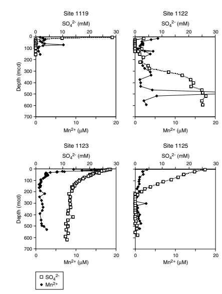

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Figure F1. Downcore profiles of dissolved Mn^{2+} and dissolved SO_4^{2-} concentrations at ODP Sites 1119, 1122, 1123, and 1125. Concentrations of dissolved SO_4^{2-} are reported in Leg 181 site chapters (Shipboard Scientific Party, 1999). mcd = meters composite depth.

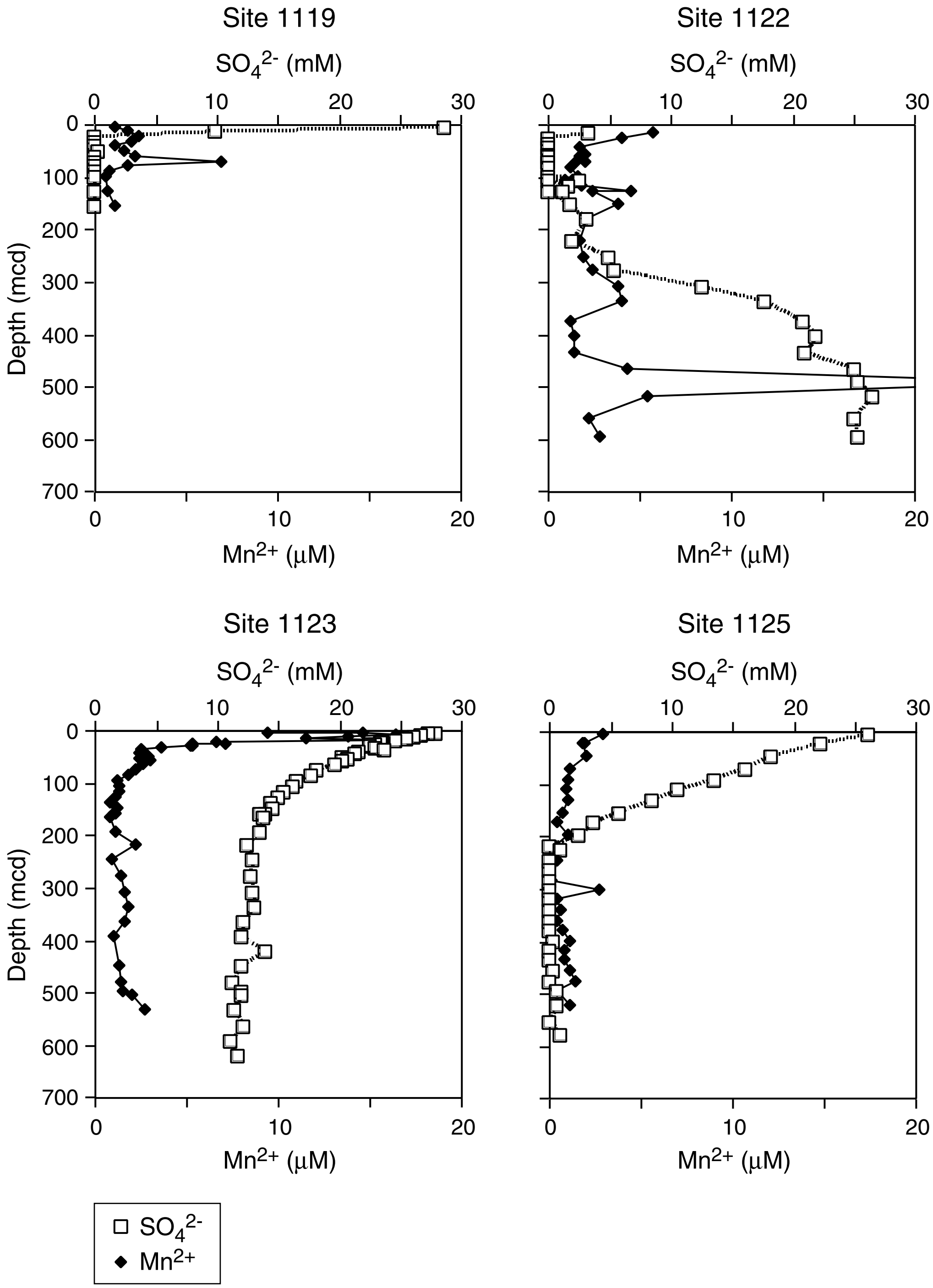

Table T1. Manganese concentrations in pore waters Sites 1119, 1122, 1123, and 1125.

Core, section, interval (cm)	Depth (mbsf)	Depth (mcd)	Mn (µM)
181-1119B-			
1H-2, 145–150	2.95	NA	1.0
2H-4, 145–150	10.65	NA	1.8
3H-4, 145–150	20.15	NA	2.4
4H-4, 145–150	29.65	NA	1.9
5H-4, 135–140	39.05	NA	1.0
6H-4, 145–150	48.65	NA	1.5
7H-4, 135–140	58.05	NA	2.2
8H-4, 140–155	67.60	NA	6.9
9H-4, 135–140	77.05	NA	1.7
10H-4, 140–150	86.60	NA	0.7
11H-4, 140–150	96.10	NA	0.5
14H-4, 150–155	124.70	NA	0.6
17H-4, 140–150	153.10	NA	1.1
181-1122A-			
1H-4, 140–150	5.90	13.78	5.6
2H-4, 140–150	15.20	22.65	3.9
4H-4, 140–150	34.20	42.10	1.7
5H-5, 130–140	45.10	53.44	2.0
6H-4, 140–150	53.20	59.66	1.6
7H-4, 140–150	62.70	68.86	1.9
11X-1, 140–150	96.40	102.98	1.3
12X-2, 140–150	107.60	114.18	1.8
13X-2, 140–150	117.20	123.78	4.5
181-1122C-			
9H-4, 140–150	67.40	70.44	1.5
10H-4, 140–150	76.90	79.54	1.1
12H-4, 140–150	92.80	95.44	1.5
13H-4, 140–150	100.80	103.44	0.9
16X-3, 140–150	122.00	124.64	2.3
19X-1, 140–150	147.90	150.54	3.8
22X-1, 130–140	176.60	179.24	2.0
26X-2, 90–100	216.40	219.04	1.6
29X-3, 140–150	247.30	249.94	1.8
32X-1, 140–150	272.70	275.34	2.4
35X-4, 140–150	305.90	308.54	3.7
38X-2, 140–150	331.80	334.44	4.0
42X-2, 140–150	370.40	373.04	1.2
45X-2, 140–150	399.50	402.14	1.3
48X-4, 140–150	431.40	434.04	1.3
51X-4, 140–150	460.30	462.94	4.2
54X-3, 140–150	487.40	490.04	26.5
57X-2, 140–150	514.80	517.44	5.4
61X-3, 140–150	554.80	557.44	2.1
65X-2, 140–150	591.80	594.44	2.8
181-1123A-			
1H-1, 140–150	1.40	1.40	9.4
1H-3, 135–145	4.35	4.35	14.6
2H-1, 140–150	7.50	5.70	16.3
2H-3, 140–150	10.50	8.70	13.8
2H-5, 140–150	13.50	11.70	11.5
3H-1, 140–150	17.00	16.76	15.8
3H-3, 140–150	20.00	19.76	6.5
3H-5, 120–130	22.80	22.56	7.1
4H-1, 140–150	26.50	24.06	5.2
4H-3, 140–150	29.50	27.06	5.2
4H-3, 140–150*			5.1
4H-5, 140–150	32.50	30.06	3.6
5H-1, 140–150	36.00	35.86	2.5
5H-3, 140–150	39.00	38.86	2.5
5H-5, 140–150	42.00	41.86	2.4
6H-1, 140–150	45.50	48.06	2.8
6H-3, 140–150	48.50	51.06	2.3
6H-5, 140–150	51.50	54.06	2.9
7H-4, 140–150	59.50	62.20	2.6
8H-4, 140–150	69.00	72.80	2.2
9H-4, 140–150	78.50	82.88	1.8
10H-4, 140–150	88.00	93.88	1.2
10H-4, 140–150*			1.1
11H-4, 140–150	97.50	103.58	1.2
12H-4, 140–150	107.00	113.66	1.3
13H-4, 140–150	116.50	124.26	1.1
14H-4, 140–150	126.00	134.70	0.8
15H-4, 140–150	135.50	145.66	1.1
16H-4, 140–150	145.00	156.64	0.9
17H-4, 140–150	154.50	158.14	1.1
181-1123B-			
17H-4, 140–150	151.80	163.74	0.8
20X-4, 140–150	178.20	190.20	1.1
23X-3, 140–150	205.60	217.54	2.2
26X-2, 140–150	232.90	244.84	0.9
29X-4, 140–150	264.70	276.64	1.3
32X-4, 140–150	293.60	305.54	1.5
35X-4, 140–150	322.40	334.34	1.8
38X-4, 140–150	351.00	362.94	1.5
41X-4, 140–150	380.00	391.94	0.9
47X-2, 135–150	434.65	446.59	1.2
50X-4, 135–150	466.25	478.19	1.4
52X-3, 135–150	483.65	495.59	1.5
181-1123C-			
19X-4, 135–150	494.35	503.67	2.0
22X-4, 135–150	532.85	532.57	2.7
181-1125A-			
1H-2, 145–150	2.95	2.95	2.9
3H-4, 145–150	19.75	19.64	1.9
3H-4, 145–150*	19.75	19.64	1.8
5H-4, 145–150	38.75	43.80	1.9
7H-4, 140–150	57.70	67.88	1.1
9H-4, 140–150	76.70	88.62	1.0
11H-4, 140–150	95.70	109.28	0.8
13H-2, 145–155	111.75	127.98	1.0
15H-4, 145–155	133.75	151.73	0.7
17H-4, 145–155	152.75	171.50	0.3
19H-4, 143–153	171.73	194.53	1.0
21H-4, 140–150	190.70	216.56	0.3
181-1125B-			
21X-4, 140–150	194.70	221.76	0.5
23X-4, 140–150	212.70	243.77	0.3
27X-4, 140–150	251.10	282.17	0.1
29X-4, 140–150	270.30	301.37	2.6
31X-2, 140–150	286.60	317.67	0.4
31X-2, 140–150*	286.60	317.67	0.4
33X-4, 140–150	308.90	339.97	0.5
35X-4, 140–150	327.80	358.87	0.4
37X-3, 140–150	345.50	376.57	0.7
39X-4, 140–150	366.30	397.37	1.1
41X-4, 140–150	385.60	416.67	0.7
43X-3, 140–150	403.40	434.47	0.7
45X-3, 135–150	422.65	453.72	1.0
47X-4, 135–150	443.35	474.42	1.3
49X-4, 135–150	462.25	493.32	0.4
52X-4, 135–150	490.75	521.82	1.0

Notes: mcd = meters composite depth (Shipboard Scientific Party, 1999). NA = not applicable. * = Core, section, interval (cm) value was duplicated.