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Biogeochemical processes accounting for the natural mercury variations in the Southern Ocean diatom ooze sediments

Sara Zaferani and Harald Biester

Correspondence to: Sara Zaferani (s.zaferani@tu-braunschweig.de)

Table S1. Total concentrations of major elements in the Adélie Basin sediments.

Depth (m)	Al (%)	Si (%)	S (%)	K (%)	Ca (%)	Ti (mg/kg)	Cl (%)
3.20	4.54	36.5	0.70	0.82	1.09	1168	10.6
4.00	3.52	34.6	0.80	0.85	1.00	1265	9.20
4.20	2.32	26.6	0.41	0.56	0.98	852	7.36
4.39	3.33	33.9	0.42	0.80	1.17	1165	9.58
4.80	7.33	47.5	0.81	0.96	1.16	1112	19.0
5.19	2.79	30.4	0.60	0.72	1.23	1125	7.14
5.99	3.12	32.8	0.50	0.73	0.89	1139	7.28
6.42	5.70	44.6	0.80	1.03	1.23	1352	14.1
6.80	2.01	25.8	0.34	0.56	0.85	948	5.11
7.20	2.79	30.4	0.50	0.70	0.95	1123	6.57
7.60	3.40	36.5	0.41	0.85	1.00	1384	5.91
8.20	2.79	28.4	0.43	0.77	1.27	1235	5.95
8.40	1.77	22.1	0.34	0.42	0.89	757	4.99
8.80	3.93	35.5	0.45	0.97	1.04	1471	7.44
9.99	4.18	38.9	0.53	1.07	1.00	1739	6.14
10.39	3.25	37.9	0.40	1.05	1.11	1648	6.12
10.79	4.33	41.7	0.87	0.99	1.12	1431	10.2
11.20	2.65	31.9	0.45	0.87	1.04	1406	5.43
11.59	2.18	26.2	0.48	0.61	0.90	1083	4.14
11.97	2.99	30.2	0.50	0.66	1.05	979	7.93
12.38	3.28	28.4	0.39	0.61	0.80	956	7.39
13.18	2.87	32.9	0.36	0.69	0.83	1091	6.18
13.58	2.77	31.3	0.34	0.96	0.90	1621	4.47
13.98	4.11	40.9	0.58	0.97	1.35	1472	7.94
14.38	3.55	32.2	0.38	0.87	1.11	1391	6.12
14.78	1.96	25.4	0.36	0.54	0.85	942	5.03
15.58	2.30	27.6	0.34	0.69	0.82	1182	4.42
15.98	3.94	35.6	0.54	0.79	1.03	1168	8.82
16.39	4.33	44.3	0.62	1.11	1.14	1778	6.63
16.50	2.49	28.8	0.39	0.70	0.87	1114	4.83
16.79	4.16	39.6	0.54	1.05	1.19	1576	7.46
17.20	2.60	30.1	0.51	0.68	0.93	1082	7.24
17.59	2.24	28.8	0.35	0.78	0.87	1297	4.19

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Table S1. (Cont.)

Depth (m)	Al (%)	Si (%)	S (%)	K (%)	Ca (%)	Ti (mg/kg)	Cl (%)
17.99	3.50	34.2	0.44	0.94	0.99	1561	4.29
18.41	2.80	29.9	0.55	0.58	0.87	951	6.49
18.80	3.34	37.4	0.54	0.90	1.04	1389	6.67
19.59	2.51	30.6	0.30	0.96	0.99	1617	3.19
19.75	2.12	27.8	0.32	0.75	0.88	1299	3.73
20.14	2.40	29.3	0.38	0.62	0.85	1097	4.46
20.47	1.59	21.1	0.38	0.39	0.78	716	4.40
20.64	3.57	39.5	0.52	0.74	1.04	1114	7.96
20.94	3.03	34.1	0.36	1.07	1.02	1748	3.43
21.34	3.34	34.7	0.49	0.84	0.92	1338	6.70
22.51	3.02	37.0	0.44	0.79	0.93	1262	5.59
25.05	1.64	25.2	0.25	0.55	0.81	984	3.40
29.05	3.33	38.4	0.56	0.65	0.81	886	7.86
33.35	4.00	40.1	0.52	0.87	1.08	1268	6.94
37.35	2.63	32.9	0.34	0.80	0.82	1357	3.82
45.85	2.90	36.0	0.41	0.87	0.86	1426	3.63
49.53	3.43	41.2	0.61	0.80	1.15	1161	6.23
54.21	2.46	31.2	0.32	0.70	0.85	1161	3.49
58.21	2.19	29.0	0.34	0.71	0.81	1296	2.63
62.45	2.72	33.3	0.39	0.84	0.86	1444	2.62
66.45	3.50	44.4	0.43	0.74	0.91	1124	4.94
71.32	2.24	32.4	0.31	0.54	0.73	942	2.90
75.22	2.19	35.8	0.37	0.64	0.83	1051	3.11
79.53	3.20	43.3	0.43	0.65	0.89	1066	4.31
83.38	1.86	29.7	0.27	0.50	0.81	928	2.30
91.68	1.59	31.0	0.28	0.43	0.72	787	2.80
95.86	1.67	27.9	0.20	0.37	0.81	757	2.82
100.01	2.55	43.3	0.37	0.68	0.86	1067	3.36
104.14	2.15	37.3	0.30	0.56	0.87	967	3.94
108.47	3.22	50.5	0.53	0.87	0.90	1424	4.19
112.42	2.27	35.7	0.33	0.48	0.83	892	3.77
116.77	2.75	40.3	0.27	0.66	0.95	1110	2.89
120.79	1.76	27.0	0.13	0.37	0.92	781	1.78

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Table S1. (Cont.)

Depth (m)	Al (%)	Si (%)	S (%)	K (%)	Ca (%)	Ti (mg/kg)	Cl (%)
124.77	1.92	32.3	0.22	0.54	0.72	1022	2.18
129.08	3.22	43.8	0.43	0.66	0.85	1108	3.58
133.08	2.43	38.2	0.39	0.63	0.88	1095	2.75
137.37	2.48	38.7	0.23	0.44	0.95	789	3.74
141.49	1.87	31.1	0.26	0.51	0.80	906	2.43
145.71	1.95	25.4	0.26	0.53	0.79	992	1.53
149.81	2.03	34.5	0.43	0.49	0.81	901	3.14
153.81	2.11	29.7	0.25	0.58	0.82	1026	1.78
157.98	3.10	39.7	0.44	0.70	1.00	1264	3.18
161.98	2.52	31.1	0.38	0.89	0.86	1457	1.28
166.35	2.57	40.0	0.49	0.70	1.18	1340	2.98
170.35	2.06	32.8	0.31	0.53	1.49	957	1.79

Table S2. Total concentrations of trace elements in the Adélie Basin sediments.

Depth (m)	Mn (mg/kg)	Fe (%)	Cu (mg/kg)	Zn (mg/kg)	As (mg/kg)	Br (mg/kg)	Hg (µg/kg)	Rb (mg/kg)	Sr (mg/kg)	Y (mg/kg)	Zr (mg/kg)	Ni (mg/kg)
3.20	173	2.24	73.3	194	15.9	1086	44.6	61.2	150	9.67	38.4	37.2
4.00	198	2.35	83.2	216	11.8	892	37.2	65.6	146	10.2	49.0	28.3
4.20	126	1.05	50.5	126	9.12	820	43.9	45.5	131	9.13	44.7	19.9
4.39	169	2.33	52.4	184	9.72	958	35.5	56.6	159	9.15	51.4	21.6
4.80	170	1.80	67.4	149	12.1	1129	28.4	46.3	133	6.51	22.0	18.6
5.19	168	2.64	116	188	15.3	995	41.8	62.9	190	10.8	91.0	51.4
5.99	169	2.67	92.2	154	18.1	902	38.6	62.3	138	10.4	44.5	36.7
6.42	219	1.91	68.9	143	9.71	1069	33.2	59.8	150	9.36	38.3	15.6
6.80	135	2.76	80.3	174	13.5	905	30.0	63.2	143	9.38	48.0	32.3
7.20	169	2.17	68.2	148	11.1	848	35.5	64.3	140	11.7	48.3	24.3
7.60	206	2.53	83.5	165	15.3	726	34.5	62.3	139	11.3	58.1	26.0
8.20	182	2.30	79.4	135	11.2	865	48.9	60.3	191	11.6	68.0	24.5
8.40	97.8	2.20	66.3	160	14.8	1014	31.7	58.0	165	9.74	46.5	20.3
8.80	220	3.03	83.9	151	13.2	826	30.2	75.3	138	9.91	97.5	30.8
9.99	256	3.03	83.5	178	14.4	699	50.4	77.0	124	11.5	63.0	22.4
10.39	249	3.46	93.3	153	13.4	773	36.1	78.5	143	12.6	71.6	32.1
10.79	201	2.20	76.5	135	13.0	873	29.6	60.6	133	9.14	49.3	20.9
11.20	206	2.96	79.7	173	13.8	741	34.6	72.5	150	12.4	65.3	32.7
11.59	154	2.51	87.4	149	15.0	781	28.5	67.0	133	11.4	50.2	20.2
11.97	134	1.81	46.6	172	17.8	963	21.7	55.6	136	9.25	42.7	28.0
12.38	134	2.09	77.0	145	9.84	999	24.5	53.7	127	15.2	29.4	32.9
13.18	163	2.30	69.7	151	10.5	754	29.9	58.5	101	8.84	48.7	12.8
13.58	245	3.38	88.1	200	12.8	652	30.3	88.4	138	11.8	90.6	34.3
13.98	204	2.35	74.3	162	14.0	739	30.3	63.0	145	11.0	53.4	19.8
14.38	209	3.33	91.0	192	11.6	786	31.7	79.8	162	10.8	72.8	26.7
14.78	131	2.46	76.2	154	21.6	909	29.3	58.0	125	10.8	49.1	13.1
15.58	172	2.93	97.1	178	16.7	734	30.3	72.9	138	10.9	54.2	37.4
15.98	163	2.96	102	169	15.0	990	33.2	64.4	144	9.45	43.6	33.1
16.39	257	2.34	72.9	173	15.9	670	34.0	74.7	137	11.8	70.3	25.4
16.50	168	1.81	61.0	116	9.29	675	34.6	61.3	120	11.0	58.7	26.8
16.79	235	2.54	80.5	166	11.6	742	33.6	71.6	151	11.8	89.8	36.7
17.20	155	2.81	80.2	165	19.2	960	29.4	61.9	136	10.1	37.0	25.9
17.59	190	3.08	92.6	161	15.1	671	34.5	74.6	128	12.6	65.8	28.7

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Table S2. (Cont.)

Depth (m)	Mn (mg/kg)	Fe (%)	Cu (mg/kg)	Zn (mg/kg)	As (mg/kg)	Br (mg/kg)	Hg (µg/kg)	Rb (mg/kg)	Sr (mg/kg)	Y (mg/kg)	Zr (mg/kg)	Ni (mg/kg)
17.99	244	2.60	64.6	149	12.6	561	32.9	73.9	133	12.1	93.3	21.5
18.41	136	2.57	72.7	185	15.4	942	31.7	52.2	119	8.39	49.6	32.6
18.80	208	2.74	79.0	198	15.2	789	33.5	70.4	128	11.3	61.5	27.2
19.59	236	3.11	86.8	127	13.3	545	26.2	86.9	127	12.8	101	24.9
19.75	216	2.69	81.9	142	13.3	642	34.2	73.8	133	14.2	58.6	27.9
20.14	166	2.46	77.1	172	18.3	710	34.4	69.3	133	10.7	61.9	34.2
20.47	108	1.69	65.3	149	14.7	968	31.4	41.8	129	9.71	41.2	23.6
20.64	158	1.72	65.0	141	12.6	838	25.0	54.8	117	9.33	42.8	36.2
20.94	285	2.01	57.7	108	11.8	445	39.7	79.5	126	12.4	81.3	26.6
21.34	197	2.23	80.3	146	12.3	816	36.9	64.8	125	10.1	61.2	22.0
22.51	190	2.16	77.2	159	14.0	775	28.3	62.5	138	10.7	54.9	34.9
25.05	139	2.26	75.9	139	13.1	695	33.7	59.3	127	11.6	68.3	34.6
29.05	122	1.46	60.7	139	8.44	861	30.5	39.0	90.4	8.90	37.2	28.4
33.35	203	2.04	59.0	146	8.03	730	33.6	55.0	118	10.1	46.6	25.6
37.35	198	2.77	86.5	170	15.0	696	36.0	74.2	114	11.4	54.0	38.6
45.85	209	2.06	63.9	124	15.3	511	36.2	64.4	105	10.8	67.3	25.2
49.53	186	1.84	60.9	127	17.3	759	31.1	47.6	143	10.5	50.6	29.5
54.21	174	1.94	56.5	121	16.8	590	39.6	62.0	106	10.4	60.4	28.0
58.21	182	2.20	60.8	141	12.3	491	32.2	66.2	103	11.6	71.2	25.1
62.45	204	2.58	57.2	137	15.7	461	30.2	60.4	105	12.0	77.8	12.4
66.45	157	1.51	41.1	127	15.0	592	29.1	42.6	100	8.47	30.8	20.2
71.32	135	1.67	62.3	160	16.1	551	33.7	47.5	80.6	8.86	42.2	30.9
75.22	159	1.62	56.6	132	19.9	528	33.6	46.3	90.7	9.61	73.3	23.9
79.53	158	1.09	53.5	126	17.7	583	39.3	38.5	84.1	9.03	32.2	20.0
83.38	144	1.70	54.8	150	16.5	531	33.9	43.4	86.5	9.68	49.4	23.6
91.68	109	1.41	61.9	145	14.3	576	32.8	35.4	87.3	10.3	35.5	16.9
95.86	94.6	1.41	49.9	154	14.2	592	42.5	36.1	140	7.46	38.0	31.7
100.01	149	1.35	49.4	128	10.6	499	37.6	41.6	91.1	9.18	41.9	13.1
104.14	137	1.55	45.9	152	13.9	595	36.4	35.6	96.4	11.3	56.7	21.5
108.47	214	1.69	51.9	148	13.1	489	40.3	45.4	87.6	9.13	36.1	19.8
112.42	117	1.38	53.6	156	14.5	552	28.9	31.0	74.4	9.00	23.7	27.1
116.77	170	1.27	52.5	132	10.8	425	33.7	45.1	93.3	9.82	38.7	24.8
120.79	123	1.36	65.4	140	13.3	472	31.6	41.7	118	10.1	53.9	18.6

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Table S2. (Cont.)

Depth (m)	Mn (mg/kg)	Fe (%)	Cu (mg/kg)	Zn (mg/kg)	As (mg/kg)	Br (mg/kg)	Hg (µg/kg)	Rb (mg/kg)	Sr (mg/kg)	Y (mg/kg)	Zr (mg/kg)	Ni (mg/kg)
124.77	144	1.42	58.0	142	13.4	470	36.2	49.2	81.7	10.2	54.2	17.1
129.08	162	1.41	57.1	139	10.3	461	30.4	43.1	88.2	10.3	51.2	27.4
133.08	166	1.36	47.8	132	8.60	395	22.2	46.4	101	10.1	69.6	18.3
137.37	110	1.17	60.2	155	12.7	525	12.6	31.1	96.6	10.2	27.9	23.1
141.49	133	1.80	63.6	153	9.05	429	15.1	45.8	89.3	9.71	56.4	32.8
145.71	155	2.28	67.9	156	14.2	382	20.2	64.3	109	12.1	66.1	33.2
149.81	128	1.77	62.1	144	6.77	481	13.6	38.6	81.7	8.79	41.5	29.8
153.81	167	1.50	57.1	132	6.60	321	14.8	56.4	95.5	11.7	66.0	24.0
157.98	196	1.97	54.0	150	6.52	390	14.5	51.2	98.7	10.6	47.7	26.2
161.98	259	1.89	36.0	95.6	6.50	217	17.2	74.5	107	13.5	115	27.0
166.35	235	1.62	30.5	108	8.94	319	14.7	52.9	112	11.0	54.8	16.0
170.35	153	1.71	52.9	160	5.80	289	21.1	47.4	173	9.40	50.1	24.4

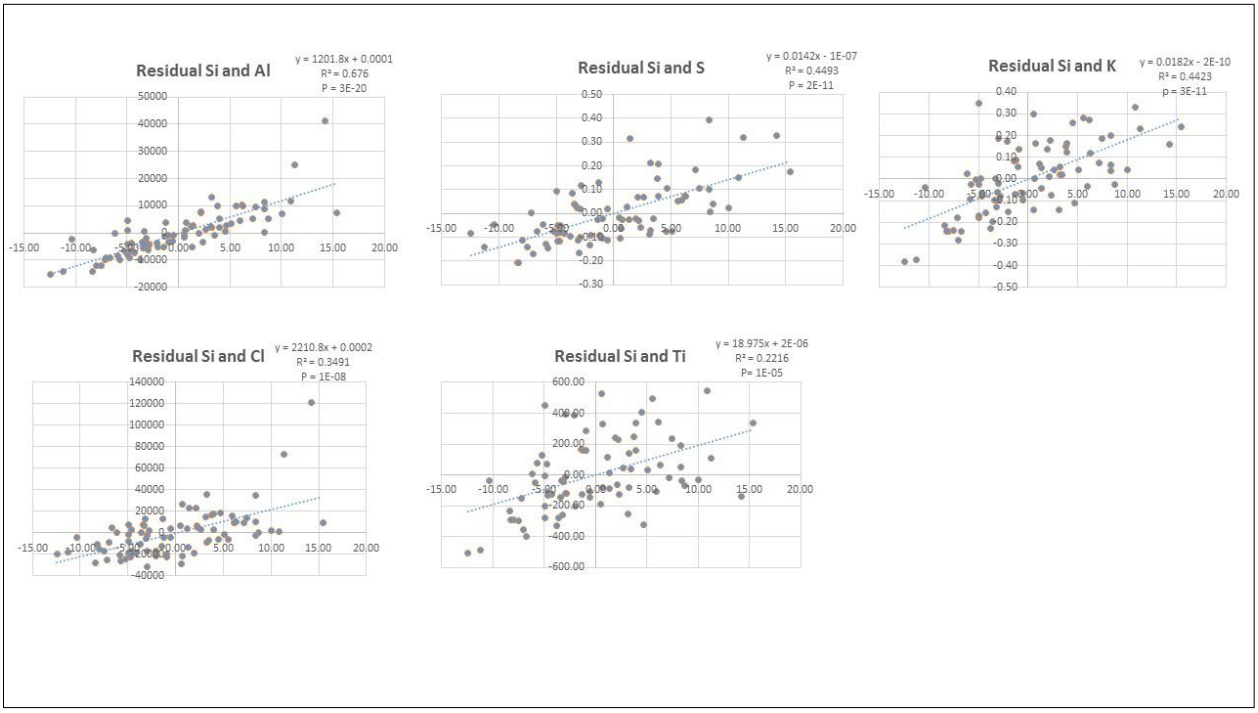

Figure. S1: A regression analysis on the elements concentrations residuals.

To go further and identify the important elemental relationships, a regression analysis was performed on the elements concentrations as well as their corresponding residuals. The regression results indicated that Si, as a proxy for diatom abundance, correlates with Al, S, K, Cl, and Ti (Fig. S1). After Si, which has the highest concentration of all elements in the sediments, these elements have relatively higher concentrations than other elements, but still very low. This can explain the found statistical correlation between Si and some elements, owing to the reason that for elements with lower concentrations there has always been excess algal material within or passing through the water column to scavenge/uptake all water column elements. These correlations along with high elements accumulation rates further emphasize that biological productivity and related scavenging/up taking of water phase elements by diatom particles controlled elements accumulation in the Adélie Basin sediments.