

Organic Phosphorus and Total Iron in the Antarctic Ocean and Adjacent Seas

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南極海及びその関連海域における有機リン及び全鉄

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要 旨
第7次南極観測(1965-66)において海洋化学

的研究として有機リンおよび全鉄の定量を行な
った。その結果を報告する。

During the summer mission of the 7th Japanese Antarctic Research Expedition (1965-1966) the organic phosphorus and the total iron in sea water were determined as a part of geochemical research projects. This paper contains only the results of chemical analyses of the organic phosphorus and the total iron.

Organic substances in samples were decomposed and converted into inorganic form by a wet digestion method using a potassium persulfate medium. Following the digestion the total phosphorus and the total iron were determined, by colorimetric analysis of the phosphomolybdate and iron-dipyridyl complex after the method of LEWIS and GOLDBERG. Further discussion on the occurrences of these elements will be given in other reports.

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Table 1. Surface observations.

Date	Time		Location		Org.-P ($\mu\text{g-atoms/l}$)	Total iron ($\mu\text{g-atoms/l}$)
	LMT	GMT	Lat.	Long.		
1965 Nov. 21	0900	0000	32°-13.0'N	137°-54.0'E	0.12	0.50
22	0900	0000	27 - 13.0	135 - 40.0	0.32	0.27
23	0900	0000	22 - 17.0	133 - 42.0	0.28	0.31
24	0900	0000	18 - 36.0	134 - 32.5	0.17	0.39
25	0900	0000	14 - 30.0	131 - 35.0	0.35	0.35
26	0900	0000	10 - 08.5	128 - 22.0	0.56	0.31
27	0900	0100	4 - 51.5	125 - 14.0	0.57	0.70
28	0900	0100	1 - 26.8	120 - 17.0	0.32	0.42

* 気象庁海洋気象部. Marine Division, Japan Meteorological Agency.

Table 1. Surface observations.

Date	Time		Location		Org.-P ($\mu\text{g-atoms/l}$)	Total iron ($\mu\text{g-atoms/l}$)	
	LMT	GMT	Lat.	Long.			
1965 Nov. 29	0900	0100	3° - 42.9'S	118° - 40.5'E	0.60	0.39	
30	0900	0100	8 - 05.0	116 - 11.5	0.36	0.25	
Dec. 1	0900	0100	13 - 14.0	114 - 50.0	0.75	0.34	
2	0900	0100	18 - 42.0	113 - 42.0	0.39	0.58	
3	0900	0100	23 - 25.0	112 - 45.0	0.31	0.31	
4	0900	0100	28 - 30.2	112 - 52.0	0.51	0.56	
12	0900	0200	34 - 39.5	111 - 15.0	0.23	0.32	
13	0900	0200	37 - 55.1	106 - 33.4	0.43	0.32	
14	0900	0200	41 - 02.0	101 - 42.4	0.59	0.46	
15	0900	0300	44 - 04.4	97 - 09.1	0.38	0.65	
16	0900	0300	49 - 03.3	97 - 12.0	0.20	0.84	
17	0900	0300	54 - 08.0	97 - 20.8	0.63	0.33	
18	0900	0300	59 - 16.0	97 - 19.0	—	0.37*	
19	0900	0300	62 - 13.0	92 - 30.5	2.21	0.23	
20	1500	0900	64 - 01.5	81 - 25.0	0.89	0.27	
21	0900	0400	64 - 11.5	72 - 44.0	0.96	0.31	
22	0900	0400	62 - 25.6	70 - 24.5	1.51	0.41	
23	0900	0500	63 - 49.0	60 - 53.0	2.11	—	
24	0900	0500	64 - 39.7	53 - 20.0	0.82	0.30	
		1300	0900	64 - 36.0	53 - 14.5	0.53	0.34**
Dec. 24	2100	1700	64 - 27.2	51 - 58.0	1.35	0.34	
25	0900	0500	64 - 41.0	49 - 06.5	1.67	0.31	
26	0830	0530	64 - 39.8	46 - 45.8	1.97	0.25	
27	0900	0600	64 - 43.3	45 - 22.0	1.49	0.27	
28	0900	0600	65 - 58.6	45 - 42.5	1.36	0.20	
1966 Feb. 13	0900	0700	69 - 23.5	17 - 24.0	1.25	0.54	
14	0830	0630	66 - 41.8	13 - 42.1	0.89	0.13	
15	1500	1300	62 - 31.7	14 - 22.0	0.37	0.77	
17	0500	0300	57 - 26.3	9 - 01.0	0.73	—	
18	1000	0800	53 - 38.0	10 - 20.0	0.56	0.96	

* St. 1, ** St. 4

Table 1. Surface observations.

Date	Time		Location		Org.-P ($\mu\text{g-atoms/l}$)	Total iron ($\mu\text{g-atoms/l}$)
	LMT	GMT	Lat.	Long.		
1966 Feb. 19	1700	1500	47°-34.0'S	11°-34.0'E	0.46	1.24
20	2330	2130	42-41.0	13-26.3	1.19	0.91
22	1625	1425	37-24.5	16-03.0	0.54	0.63
Mar. 4	0900	0700	34-51.0	22-38.9	0.38	0.63
5	0900	0700	33-37.3	27-50.8	0.00	0.45
6	0900	0700	31-31.0	32-52.0	1.46	0.67
7	0900	0600	29-26.4	37-42.9	0.48	1.21
8	0900	0600	27-23.1	42-26.0	0.68	1.07
9	0900	0600	25-35.8	46-23.3	0.26	0.00
10	0900	0600	23-01.7	49-48.0	0.52	0.70
11	0900	0500	20-56.5	54-36.7	0.62	0.69
12	0900	0500	18-52.7	59-32.0	0.26	0.46
13	0900	0500	15-40.5	63-25.9	0.27	0.68
14	0900	0500	12-25.0	67-12.5	0.48	1.00
15	0900	0400	9-12.0	71-05.5	0.47	1.03
16	0900	0400	4-45.3	74-20.8	0.56	0.51
17	0900	0400	0°-06.2'N	76-42.3	0.20	0.40
18	0845	0315	4-12.7	78-45.6	0.33	0.85
24	0900	0300	5-48.9	83-44.8	0.25	0.58
25	0900	0300	5-53.9	88-49.5	0.21	0.73
26	0900	0300	6-13.0	93-57.2	0.73	1.51
27	0900	0200	4-27.0	98-50.2	0.77	0.89
28	0900	0200	1-22.2	103-13.0	1.04	1.03
29	0900	0200	4-37.0	106-35.0	0.61	0.80
30	0900	0200	8-34.9	110-02.4	0.71	1.06
31	0900	0200	12-36.5	113-23.9	0.51	0.58
Apr. 1	0900	0100	15-55.2	117-14.0	0.41	0.46
2	0900	0100	19-20.3	121-01.6	0.89	0.88
3	0900	0100	24-04.0	123-15.5	0.56	0.47
4	0900	0000	27-44.3	126-56.5	1.05	0.89
5	0900	0000	30-38.8	130-18.0	—	0.17

Table 2. Vertical observations.

Station 1

Date : 18 Dec., 1965 Lat. : 59°16.'0 S
 Time(GMT) : 0300-0730 Long. : 97°19.'0 E
 (LMT) : 0900-1330 Depth : 4450 m

Depth m	Total P.	Org.-P.	Total iron
	μg-atoms/l		
0	—	—	0.37
10	2.51	0.78	—
20	2.47	0.71	0.37
30	2.05	0.33	—
50	—	—	0.51
75	—	—	0.91
100	2.10	0.09	0.52
150	—	—	0.70
200	—	—	1.16
293	2.34	0.21	1.16
391	—	—	0.76
486	—	—	0.53
580	—	—	—
770	2.27	0.29	0.89
965	2.63	0.57	0.79
1165	2.86	0.92	0.00
1380	—	—	0.39
1880	—	—	0.75
2380	—	—	0.64
2880	2.14	0.24	0.42
3380	2.38	0.38	0.75
3880	2.73	0.62	0.54

Station 2

Date : 19 Dec., 1965 Lat. : 63°00.'4 S
 Time(GMT) : 1000-1330 Long. : 89°12.'0 E
 (LMT) : 1600-1930 Depth : 3820 m

Depth m	Total P.	Org.-P.	Total iron
	μg-atoms/l		
0	2.98	1.26	0.34
11	2.41	0.63	0.69
20	2.38	0.63	0.27
30	2.21	0.43	0.65
47	2.37	0.44	0.47
70	3.24*	1.18*	0.37
93	2.51	0.37	0.61
143	—	—	0.54
220	2.21	0.12	0.40
315	—	—	0.87
405	3.58	1.52	1.12
495	3.27	1.14	0.38
590	3.89	1.78	1.74
770	2.54	0.43	0.58
950	2.10	0	0.26
1150	—	—	0.68
1610	2.94	0.83	0.79
2070	—	—	0.69
2550	3.32	1.22	0.55
3035	—	—	0.69
3525	—	—	1.46

* value doubtful

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Station 3

Date : 21 Dec., 1965 Lat. : 64°17.5 S
 Time(GMT) : 0930-1210 Long. : 71°15.5 E
 (LMT) : 1430-1710 Depth : 3440 m

Depth m	Total P.	Org.-P.	Total iron
	$\mu\text{g-atoms/l}$		
0	—	—	0.22
10	2.17	0.30	0.82
20	1.98	0.06	0.42
30	2.94	1.04	0.49
50	2.21	0.21	1.08
75	2.67	0.61	0.75
100	2.23	0.16	0.65
149	2.78	0.73	0.65
199	—	—	0.31
296	2.58	0.38	—
394	3.31	1.20	0.41
491	—	—	0.72
605	2.87	0.76	0.43
800	—	—	0.91
990	2.31	0.19	0.12
1190	3.00	0.93	0.30
1480	3.20	1.09	0.40
1970	—	—	0.28
2460	3.14	1.00	0.53
2950	—	—	0.22

Station 4

Date : 24 Dec., 1965 Lat. : 64°36.0 S
 Time(GMT) : 0840-1100 Long. : 53°14.5 E
 (LMT) : 1240-1500 Depth : 3500 m

Depth m	Total P.	Org.-P.	Total iron
	$\mu\text{g-atoms/l}$		
0	2.34	0.53	0.34
9	3.83	2.07	0.22
18	3.40	1.63	0.30
27	2.14	0.24	0.58
46	—	—	0.36
69	—	—	0.10
92	2.71	0.62	0.10
135	2.87	0.73	0.34
185	2.67	0.52	0.08
285	2.54	0.29	—
380	3.00	0.89	0.30
477	2.64	0.53	0.43
574	—	—	0.38
764	2.74	0.63	0.68
953	3.10	0.91	1.44
1148	3.06	0.91	0.33
1430	3.38	1.13	0.32
1910	2.73	0.70	0.17
2400	2.50	0.30	1.36
2890	2.83	0.77	0.83
3380	2.81	0.64	0.31

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Station 6

Date : 1 Feb., 1966 Lat. : 69°11.'7 S
 Time(GMT) : 1330-1400 Long. : 39°32.'7 E
 (LMT) : 1630-1700 Depth : 272 m

Depth m	Total P.	Org.-P.	Total iron
	$\mu\text{g-atoms/l}$		
0	1.14	0.96	0.39
10	2.46	2.12	0.65
20	—	—	0.44
30	3.94	1.83	0.42
50	2.47	0.37	0.71
75	2.54	0.36	0.65
100	2.34	0.18	0.67
150	—	—	0.63
200	2.21	0.01	0.91
250	2.21	0.01	0.27

Station 7

Date : 2 Feb., 1966 Lat. : 68°07.'1 S
 Time(GMT) : 1130-1245 Long. : 38°50.'5 E
 (LMT) : 1430-1545 Depth : —

Depth m	Total P.	Org.-P.	Total iron
	$\mu\text{g-atoms/l}$		
0	2.90	0.85	0.47
10	2.61	0.65	0.45
20	2.31	0.37	0.49
30	2.51	0.49	0.65
50	—	—	0.66
75	4.05	1.90	0.42
100	3.11	0.86	0.53
149	3.43	1.22	0.77
198	2.37	0.17	0.66
297	—	—	0.68
395	3.60	1.37	0.36
495	3.35	1.14	0.74
594	3.20	0.89	0.92
794	3.21	0.89	0.92
994	3.00	0.63	0.66
1190	4.31	2.00	0.66
1480	3.51	1.17	1.06
1972	—	—	0.95

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Station 8

Date : 6 Feb., 1966 Lat. : 67°11.'3 S
 Time(GMT) : 1410-1540 Long. : 43°50.'0 E
 (LMT) : 1710-1840 Depth : —

Depth m	Total-P.	Org.-P.	Total iron
	μg-atoms/l		
0	3.00	1.09	0.44
10	—	—	—
17	2.27	0.30	0.16
26	2.67	0.30	0.86
42	2.63	0.67	0.36
62	2.23	0.05	1.44
84	2.63	0.45	0.13
130	2.63	0.45	0.68
174	3.00	0.82	0.58
272	2.94	0.73	0.85
362	2.47	0.18	0.86
451	2.79	0.53	0.65
545	3.20	0.91	0.65
720	2.54	0.30	0.00
909	2.41	0.11	0.83
1092	2.94	0.60	0.54
1346	2.67	0.32	0.65

Station 9

Date : 13 Feb., 1966 Lat. : 69°08.'6 S
 Time(GMT) : 0800-0920 Long. : 16°37.'0 E
 (LMT) : 1000-1120 Depth : —

Depth m	Total P.	Org.-P.	Total iron
	μg-atoms/l		
0	2.81	1.21	1.18
10	2.27	0.60	0.66
20	2.23	0.55	1.00
30	2.61	0.80	0.60
50	2.27	0.46	0.44
75	2.90	0.77	1.67
100	3.34	1.16	—
150	2.87	0.69	1.86
200	2.93	0.72	1.53
300	2.50	0.25	1.14
400	2.54	0.23	—
500	—	—	—
600	2.67	0.35	1.63
790	—	—	1.45
990	2.47	0.08	1.39
1190	—	—	1.18
1480	2.63	0.24	1.81
1980	2.58	0.26	1.62

Station 10

Date : 14 Feb., 1966 Lat. : 64°58.'3 S
 Time(GMT) : 1520-1800 Long. : 13°56.'7 E
 (LMT) : 1720-2000 Depth : —

Depth m	Total P.	Org.-P.	Total iron
	$\mu\text{g-atoms/l}$		
0	4.44	2.54	0.97
9	3.38	1.38	1.83
20	2.51	0.54	1.30
30	2.71	0.74	—
48	2.83	0.82	1.51
71	—	—	1.05
94	3.19	0.90	0.97
140	3.51	1.05	1.70
189	3.54	1.12	—
289	2.71	0.30	1.32
383	3.36	0.92	1.14
476	2.65	0.26	1.33
575	—	—	1.22
755	—	—	1.49
952	2.87	0.40	—
1152	2.67	0.26	1.56
1495	2.64	0.20	1.07
1980	2.54	0.15	1.28
2470	2.81	0.44	1.21
2960	2.90	0.49	—
3450	2.54	0.17	1.82

Station 11

Date : 16 Feb., 1966 Lat. : 59°56.'0 S
 Time(GMT) : 0550-0940 Long. : 12°15.'6 E
 (LMT) : 0750-1140 Depth : —

Depth m	Total P.	Org.-P.	Total iron
	$\mu\text{g-atoms/l}$		
0	—	—	0.40
7	2.61	0.86	—
15	2.79	0.96	1.07
22	—	—	1.04
40	2.43	0.68	1.90
50	1.88	0.04	0.94
67	—	—	0.94
100	2.81	0.55	0.91
133	2.81	0.39	1.49
198	2.81	0.26	1.40
259	3.54	0.89	1.33
320	4.47	1.88	1.61
388	4.31	1.67	1.26
515	3.85	1.25	1.70
646	—	—	0.42
815	3.34	0.82	—
1192	4.47	1.96	0.65
1645	3.23	0.82	1.04
2110	2.90	0.56	0.64
2590	—	—	1.32
3080	3.27	0.88	1.11
3560	2.87	0.45	0.49
4080	3.40	0.96	0.33

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Station 12

Date : 17 Feb., 1966 Lat. : 55°12.5 S
 Time(GMT) : 1800-2245 Long. : 9°32.5 E
 (LMT) : 2000-0045 Depth : —

Depth m	Total-P.	Org.-P.	Total iron
	$\mu\text{g-atoms/l}$		
0	3.74	2.04	1.30
10	2.92	1.16	1.15
20	—	—	—
30	2.30	0.51	0.90
50	2.21	0.43	0.90
75	3.24	1.24	1.14
105	3.34	1.14	0.90
151	3.00	0.68	—
207	3.53	1.14	1.18
302	3.21	0.79	0.84
405	—	—	—
510	3.07	0.60	0.86
603	3.03	0.51	0.54
823	3.14	0.65	—
1048	3.94	1.47	1.06
1262	3.64	1.23	1.13
1525	2.94	0.48	1.54
2075	—	—	1.35
2575	3.27	0.83	1.85
3090	—	—	—
3600	3.21	0.84	—
4130	2.58	0.17	1.72

Station 13

Date : 19 Feb., 1966 Lat. : 50°02.5 S
 Time(GMT) : 0050-0315 Long. : 10°29.4 E
 (LMT) : 0250-0515 Depth : —

Depth m	Total P.	Org.-P.	Total iron
	$\mu\text{g-atoms/l}$		
0	2.18	0.67	1.42
10	1.64	0.13	1.14
20	—	—	—
30	1.57	0.05	1.63
60	1.57	0.05	—
75	1.67	0.10	1.12
102	2.87	0.81	1.76
145	2.81	0.65	1.38
194	2.53	0.28	—
284	2.94	0.57	—
378	—	—	1.70
488	2.41	0.00	—
555	3.16	0.59	1.26
741	3.29	0.78	1.42
925	2.74	0.38	1.70
1123	3.35	1.09	1.47
1415	3.32	1.16	—
1905	3.23	1.08	1.09
2420	3.27	1.01	1.40
2940	3.27	0.98	—
3450	3.32	0.98	—

Station 14

Date : 20 Feb., 1966 Lat. : 45°12.'5 S
 Time(GMT) : 0250-0540 Long. : 11°44.'5 E
 (LMT) : 0450-0740 Depth : —

Depth m	Total P.	Org.-P.	Total iron
	$\mu\text{g-atoms/l}$		
0	2.11	0.58	—
10	2.05	0.66	—
18	—	—	—
28	1.60	0.26	—
42	1.88	0.52	—
64	1.73	0.33	0.80
86	2.30	0.94	1.85
134	2.15	0.55	—
183	2.27	0.60	—
263	2.67	0.86	1.63
360	—	—	—
463	2.98	0.87	1.78
606	3.78	1.53	0.90
814	3.78	1.44	1.35
974	3.67	1.18	1.61
1197	2.49	0.03	1.54
1453	3.13	0.78	0.92
1953	3.43	1.32	1.30
2455	2.45	0.39	1.30
2920	2.47	0.29	—
3390	2.58	0.30	0.61
3860	—	—	1.09

Station 15

Date : 21 Feb., 1966 Lat. : 39°57.'0 S
 Time(GMT) : 1710-1950 Long. : 14°54.'0 E
 (LMT) : 1910-2150 Depth : —

Depth m	Total P.	Org.-P.	Total iron
	$\mu\text{g-atms/l}$		
0	1.88	1.39	0.46
8	0.87	0.43	1.67
17	—	—	—
24	0.81	0.37	0.97
40	0.62	0.18	1.18
60	0.66	0.14	1.81
80	1.43	0.59	0.66
118	1.72	0.90	1.30
160	1.77	0.59	1.45
237	2.07	0.62	—
325	—	—	—
415	3.24	1.23	0.90
485	2.67	0.56	1.85
658	2.81	0.52	1.14
850	3.40	0.94	—
1040	3.19	0.70	—
1325	2.74	0.45	—
1840	2.63	0.71	0.91
2350	2.26	0.42	1.04
2885	2.18	0.34	1.63
3420	—	—	1.54