

Oceanographic Data of the 11th Japanese Antarctic Research Expedition 1969–1970

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第11次南極地域観測隊海洋部門報告

脊戸義郎*・猿渡了己*

要旨：第11次南極地域観測において、定常観測（1969～1970）として行なった表面観測、STD 観測、BT 観測および鉛直（各層）観測の結果を報告する。

This report deals with the data of the oceanographic observations made on board the icebreaker FUJI during the summer mission of the 11th Japanese Antarctic Research Expedition in 1969–1970. The track chart of the cruise is shown in Fig. 1. The locations of the vertical(serial) observation station, bathythermograph (BT) observation stations, and Salinity-Temperature-Depth(STD) recorder observation stations in the Southern Ocean are given in Fig. 2.

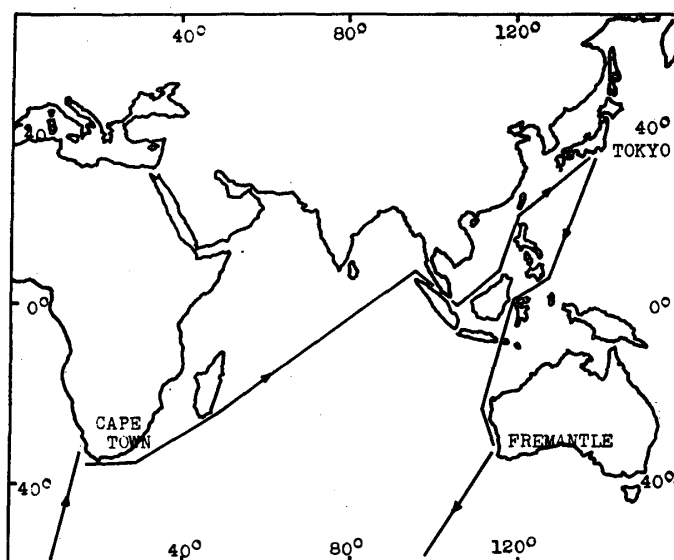


Fig. 1. Track of JARE-11 cruise 1969–1970.

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Surface observations: Surface temperature measurements and surface water samplings for chemical analyses were made three times a day during the cruise Fremantle to Syowa Station and twice a day from Tokyo to Fremantle. The results are given in Table. 1.

Current measurements: Measurements of surface currents were made by GEK from Tokyo to Syowa Station except the region near the magnetic equator and in the pack ice area. The results are also given in Table 1.

Bathythermograph observation: Water temperature in the upper layer (surface to about 250 meters depth) was measured with bathythermograph (BT) at almost the same frequency as the surface observations. The results are given in Table 2.

Vertical(serial) observation : The observation was made at $47^{\circ}44'S$, $110^{\circ}27'E$. The observed data are shown in Table 3 with relevant meteorological data.

The interpolated and computed values (temperature, salinity, $\sigma-t$ and dynamic depth anomalies) at standard depths are also included in Table 3. These values were calculated using electronic computer facilities available at the Japanese Oceanographic Data Center of the Hydrographic Division.

STD observation: The observations were made at 11 stations in the Southern Ocean along the track of the cruise from Fremantle to Syowa Station (Fig. 2). The results are given in Fig. 3.

Chemical analyses of sea water: The followings are the elements and the meth-

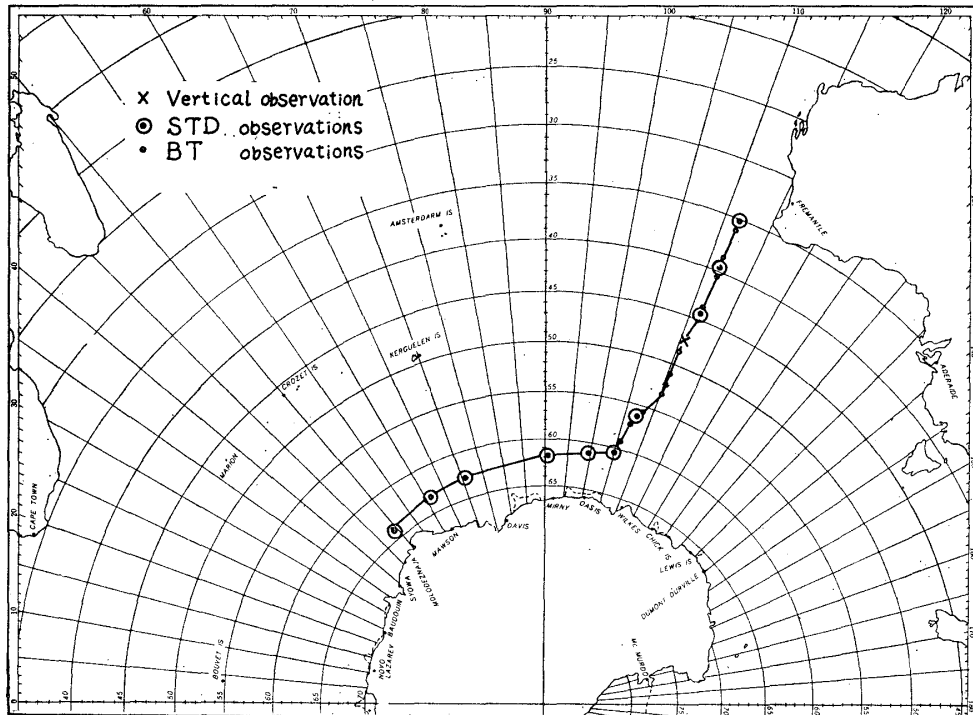


Fig. 2. Track of JARE-11 cruise and oceanographic station.

ods(or instrument) of analyses. The results are also presented in Table 3.

Salinity	Inductive salinometer (Auto-Lab-Model 401 MK III)
pH	pH meter (KPH-51 B Yokogawa Electric Works Inc.)
Dissolved oxygen	Winkler's method
Phosphate-P	Molybdenum blue method*
Reactive silicate-Si	Molybdenum yellow method and reduction method**
Nitrate-N	Modified Morris and Riley method*
Nitrite-N	Sulphanilamide and N-(1-naphtyl)-ethylene-diamine 2 HCl were used as reagent*.
Ammonium-N	Indophenol method
Alkalinity	After 15.00 ml of N/100 HCl was added to 50.0 ml sample, pH of the sample was measured and alkalinity was calcu- lated by Strickland's table*.

Acknowledgements

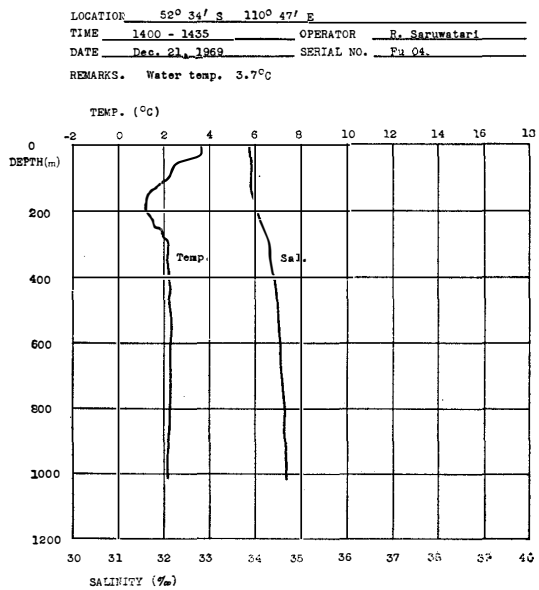
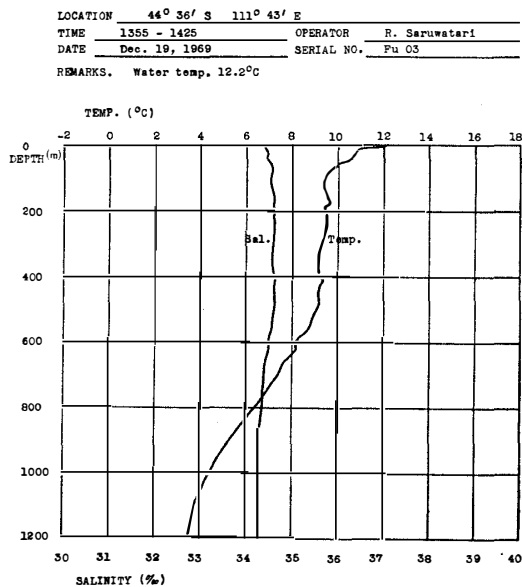
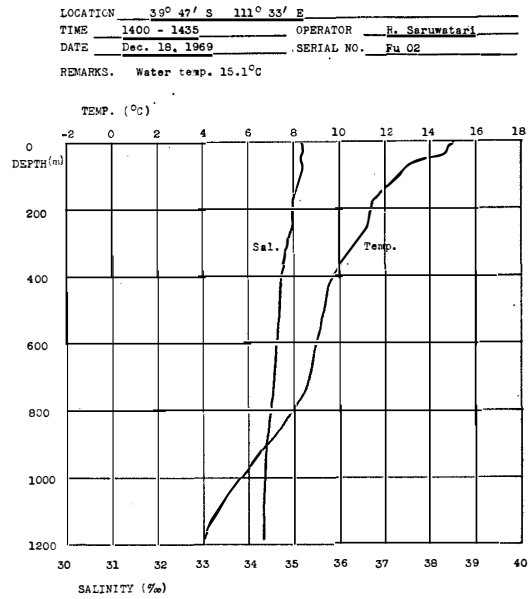
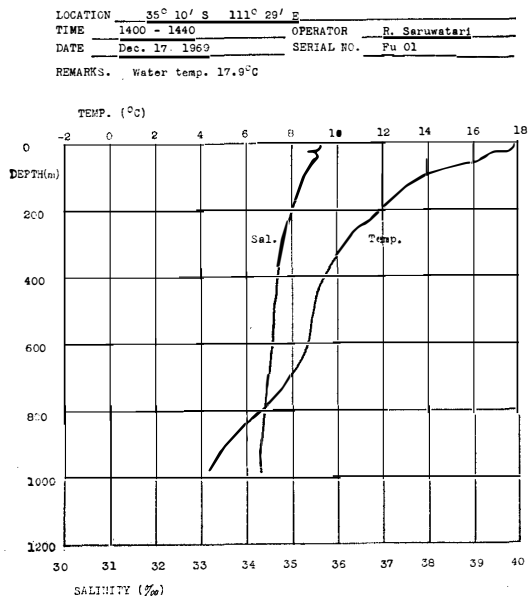
The authors are indebted to Captain H. ISOBE of the icebreaker FUJI and his officers and crew for their co-operation which made these observations possible.

(Received June 14, 1971)

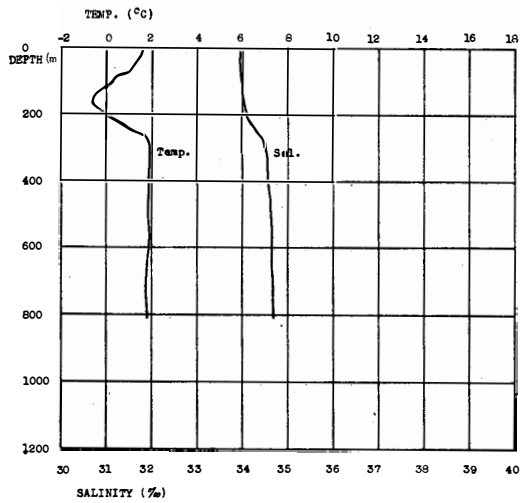
* J. D. H. Strickland and T. R. Parsons, Manual of Sea Water Analysis (Fisheries Research Board of Canada).

** Silicate determination was done by the molybdenum yellow method for higher silicate concentration samples, and the reduction method using methol-hyposulfite solution as a reductant was adopted for the majority of the samples of lower silicate concentration.

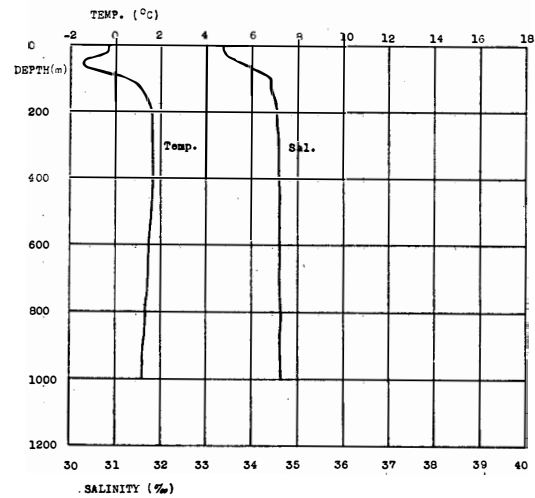
Fig. 3. The results of STD observation.



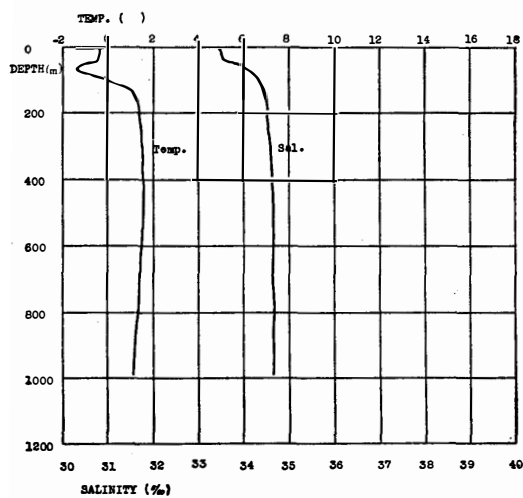
LOCATION 55° 36' S 106° 51' E
 TIME 1355 - 1430 OPERATOR R. Saruwatari
 DATE Dec. 22, 1969 SERIAL NO. Fu 05
 REMARKS. Water temp. 1.6°C



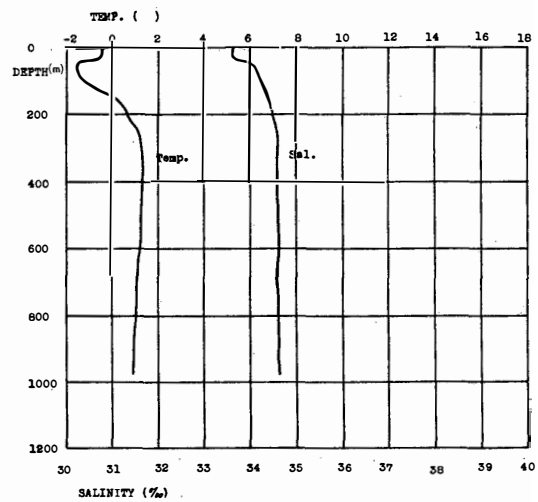
LOCATION 60° 44' S 106° 50' E
 TIME 1355 - 1430 OPERATOR R. Saruwatari
 DATE Dec. 23, 1969 SERIAL NO. Fu 06
 REMARKS. Water temp. -0.4°C



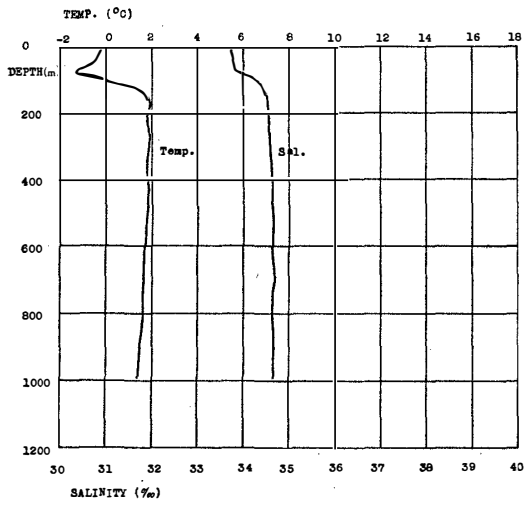
LOCATION 61° 25' S 100° 06' E
 TIME 1400 - 1440 OPERATOR R. Saruwatari
 DATE Dec. 24, 1969 SERIAL NO. Fu 07
 REMARKS. Water temp. -0.4°C



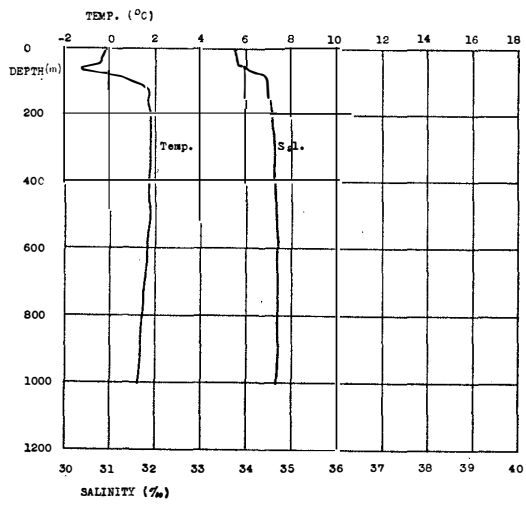
LOCATION 61° 57' S 90° 28' E
 TIME 1400 - 1430 OPERATOR R. Saruwatari
 DATE Dec. 25, 1969 SERIAL NO. Fu 08
 REMARKS. Water temp. -0.5°C



LOCATION 62° 35' S 71° 01' E
 TIME 1400 - 1435 OPERATOR R. Saruwatari
 DATE Dec. 27, 1969 SERIAL NO. Fu 09
 REMARKS. Water temp. -0.2°C



LOCATION 63° 35' S 61° 10' E
 TIME 1405 - 1440 OPERATOR R. Saruwatari
 DATE Dec. 28, 1969 SERIAL NO. Fu 10
 REMARKS. Water temp. -0.2°C



LOCATION 64° 06' S 49° 36' E
 TIME 1855 - 1925 OPERATOR R. Saruwatari
 DATE Dec. 29, 1969 SERIAL NO. Fu 11
 REMARKS. Water temp. -1.0°C

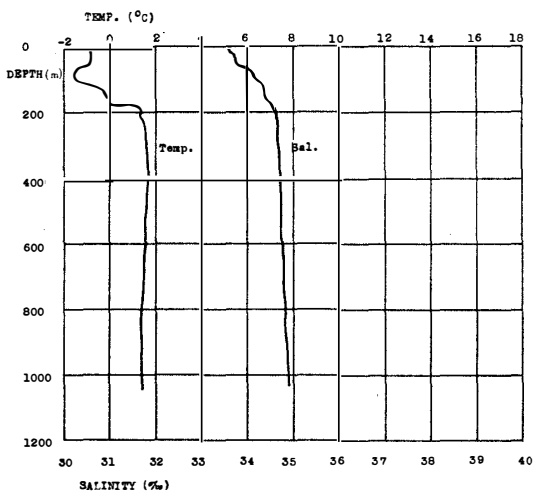


Table 1. Surface observation data.

Date	Time		Position		Air temp.	Water temp.	S	pH	O ₂	Phosphate-P	Sili-cate-Si	Ni-trite-N	Ni-trate-N	Ammo-nium-N	Alka-linity	Current			
	GMT	LMT	Lat.	Long.	°C	‰										cc/L	μg-atoms/L	Dir.	Speed (kt)
1969																			
Nov. 26	1000	1900	29-32N	136-41E	17.0	22.1	34.651	8.29	5.21	0.08	2								
30	1000	1900	12-04	126-42	27.1	26.3	34.523	8.32	5.58	0.10	2	0.08	0.0						
Dec. 1	2300*	0800	8-58	126-52	27.3	26.7	34.339	8.28	6.27	0.12	2	0.08	0.0						
	1000	1900	6-03	126-21	28.0	29.2	34.347	8.33	5.69	0.08	2	0.03	0.0						
2	2300*	0800	3-51	123-51	28.0	28.7	34.047	8.24	5.58	0.08	3	0.07	0.0		2.36				
	1000	1900	2-24	122-04	26.5	28.1	33.143	8.28	5.68	0.06	4	0.09	0.0		2.34				
3	0000	0800	0-53	119-45	27.3	28.4	33.525	8.27	5.41	0.04	5	0.05	0.0	0.4	2.22				
	1100	1900	1-26S	118-56	28.3	30.0	33.623		5.61										
4	0000	0800	4-13	118-35	28.8	29.8	33.955	8.28	6.24	0.04	5	0.03	0.0	0.4	2.31				
	1100	1900	6-23	117-24	29.9	30.3	34.212	8.29		0.10	1	0.03	0.0	0.2					
5	0000	0800	8-32	115-53	27.7	29.9	34.061	8.25	5.84	0.02	5	0.03	0.0	0.1	2.47				
	1100	1900	10-51	115-08	29.0	29.8	34.774	8.26	5.73	0.05	2	0.04	0.0	0.2	2.41	8	1.8		
6	0000	0800	13-44	114-30	27.6	28.7	34.768	8.27	5.36	0.21	1	0.02	0.0	0.1	2.44	340	0.9		
	1100	1900	16-11	114-27	27.6	28.6	34.912	8.27	5.42	0.04	2	0.04	0.0	0.4	2.53	325	0.9		
7	0000	0800	18-40	114-09	25.2	25.8	35.140	8.25	4.72	0.10	2	0.00	0.0	0.1	2.48	1	1.0		
	1100	1900	20-52	113-42	23.6	25.8	35.060	8.27	5.28	0.04	2	0.03	0.0	0.1	2.50	339	0.8		
8	0000	0800	23-39	112-57	22.1	24.0	35.220	8.31	4.98	0.02	3	0.06	0.0	0.1	2.34	26	0.5		
	1100	1900	25-45	112-41	21.7	22.4	35.408	8.26	5.31	0.06	1	0.02	0.0		2.57	23	1.0		
10					Arrive in Fremantle														
16					Leave Fremantle														
17	0000	0800	34-05	111-35	18.0	18.8	35.837	8.24	5.36	0.06	3	0.02	0.1	0.5	2.58	253	0.6		
	0600	1400	35-10	111-29	17.5	17.9	35.000	8.25	6.47	0.17	2	0.01	0.0	0.1					
	1100	1900	36-01	111-32	16.3	17.7	35.746	8.26	6.55	0.12	2	0.05	0.0	0.1	2.59	2	1.4		
18	0000	0800	38-36	111-33	14.5	16.1	35.572	8.24	6.43	0.17	3	0.03	0.0	0.1	2.60	225	0.2		
	0600	1400	39-47	111-33	14.1	15.2	35.294	8.24	6.42	0.43	3	0.07	0.3	0.5	2.59				

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Oceanographic Data of the 11th JARE

Date	Time		Position		Air temp.	Water temp.	S	pH	O ₂	Phosphate-P	Sili-cate-Si	Ni-trite-N	Ni-trate-N	Ammonium-N	Alkalinity	Current	
	GMT	LMT	Lat.	Long.	°C	‰										cc/L	μg-atoms/L
19	1100	1900	40-39S	111-43E	13.6	14.4	35.104	8.23	6.28	0.50	1	0.13	2.2	0.7	2.61	323	0.4
	0100	0800	43-25	111-43	11.1	11.8	34.689	8.16	6.58	0.77	3	0.26	7.9	0.9	2.61	351	0.3
	0700	1400	44-36	111-43	11.8	12.2	34.586	8.15	6.79	0.87	4	0.22					
20	1200	1900	45-27	111-30	11.1	11.3	34.655	8.06	6.77	0.85	3	0.28		0.4	2.60	83	0.5
	1200	1900	48-42	110-28	6.0	6.9	34.027		6.96							0	0.4
Dec. 21	0100	0800	51-22	110-42	4.9	4.8	33.956	8.14	8.04	1.47	4	0.35		1.6	2.55	35	0.6
	0700	1400	52-34	110-47	4.3	3.7	33.997		8.01								
	1200	1900	53-22	110-11	3.9	3.3	34.006	8.17	7.88	1.59	5	0.40	25	0.6	2.58	284	0.3
22	0100	0800	55-38	108-00	3.0	2.9	34.041	8.19	7.78	1.51	5	0.43		0.3	2.56	342	0.5
	0700	1400	56-38	106-51	3.8	1.6	34.053	8.18	7.87	1.86	34	0.45		0.3	2.61		
	1200	1900	57-10	106-25	3.1	1.4	34.058	8.18	8.68	1.88	42	0.44		0.3	2.57	336	0.1
23	0100	0800	59-32	105-51	1.7	0.4	33.958	8.11	7.92	2.09	47	0.40		0.3	2.61	2	0.5
	0700	1400	60-44	105-50	1.0	-0.4	33.587	8.00	7.95	1.99	49	0.31		0.7	2.62		
	1200	1900	61-30	105-44	0.5	-0.6	33.496	8.06	7.98	1.95	47	0.36		1.0	2.59	83	0.5
24	0100	0800	61-10	102-23	-0.2	-1.2	33.618	8.06	8.07	2.01	54	0.35		0.7	2.64	55	0.4
	0700	1400	61-23	100-06	0.3	-0.5	33.678	8.05	8.21	1.78	53	0.34		0.5	2.67		
	1200	1900	61-32	98-17	0.1	0.4	33.753	8.00	8.16	1.72	46	0.28		0.6	2.57	14	0.3
25	0200	0800	61-53	92-50	-0.4	0.2	33.763	8.08	7.98	1.68	41	0.36		0.5	2.57	72	0.2
	0800	1400	61-57	90-28	0.0	-0.6	33.817	8.16	7.97	1.68	56	0.26		0.5	2.55		
	1300	1900	61-36	88-36	-1.0	-1.2	33.540	8.10	8.08	2.01	54	0.30		0.6	2.60		
26	0200	0800	61-23	83-04	-0.1	0.2	33.888	8.05	7.93	1.97	55	0.31		0.6	2.58	6	0.5
	0800	1400	61-26	81-03	1.8	0.4	33.931	8.09	8.02	1.78	46	0.31		0.2	2.56		
	1300	1900	61-34	79-18	0.5	0.3	33.930	8.07	8.15	1.47	32	0.44		0.4	2.62	53	0.4
27	0300	0800	62-16	73-30	0.0	-0.2	33.922	8.06	7.89	1.93	48	0.35		1.2	2.57		
	0900	1400	62-35	71-01	0.0	-0.2	33.897	8.01	7.36	1.88	47	0.42		0.8	2.57		
	1400	1900	62-45	69-06	-0.1	-0.2	33.906	8.03	7.94	1.88	46	0.34		1.0	2.57		

Date	Time		Position		Air temp.	Water temp.	S	pH	O ₂	Phos-phate-P	Sili-cate-Si	Ni-trite-N	Ni-trate-N	Ammo-nium-N	Alka-linity	Current	
	CMT	LMT	Lat.	Long.	°C	‰	cc/L		µg-atoms/L						Dir.	Speed (kt)	
28	0400	0800	63-21S	63-09E	-0.1	-0.3	33.958	8.05	7.86	2.42	42	0.28		0.8	2.58	296	0.3
	1000	1400	63-35	61-10	0.5	-0.3	33.959	8.04	7.84	1.86	45	0.25		0.7	2.60		
	1500	1900	63-37	59-05	1.0	-0.4	33.966	8.03	7.67	2.05	51	0.13		1.5	2.64		
29	0400	0800	63-50	53-38	-0.6	-1.0	33.915	8.11	7.89	1.84	49	0.25		1.0	2.53	1	0.2
	1500	1900	64-06	49-36	0.0	-1.0	33.858	8.16	8.05	1.86	58	0.20		2.61			
30	0500	0800	64-36	44-20	-0.5	-0.8	33.710	8.02	7.96	1.84	62	0.25				327	0.4
31	0500	0800	67-36	42-25	-1.2	-1.4	33.948	8.06	7.88	2.07	69	0.17		2.64			
		1600	1900	68-26	34-41	-0.3	0.0	33.891	8.11	8.05	1.80	61	0.13		2.58		
1970																	
Jan. 4					Arrive at Ongul Island												
Feb. 20					Leave Ongul Island												
Mar. 20	0500	0800	65-18	36-33	0.1	1.0	34.043	8.15		1.95	54	0.52	25		2.45		
	1600	1900	63-59	35-21	1.1	1.6	33.927	8.16	8.34	1.76	44	0.44	28	1.4	2.53		
21	0500	0800	62-25	34-07	2.1	1.7	33.865	8.04	7.66	1.68	42	0.39	26	0.3	2.60		
	1600	1900	60-56	33-50	2.7	1.7	33.805	8.08	7.68	1.55	32	0.47	31	0.6	2.60		
22	0500	0800	58-45	31-43	2.0	1.7	33.792	8.06	7.58	1.41	34	0.28	25	0.2	2.64		
	1600	1900	57-51	30-52	1.9	2.4	33.939		8.02	1.64	18	0.30	31	0.9	2.54		
23	0500	0800	55-33	29-08	2.7	2.2	33.937	8.08	7.74	1.64	20	0.45	27	0.9	2.60		
	1600	1900	54-16	28-32	3.0	2.5	33.986	8.05	7.90	1.70	34	0.36	25	0.9	2.60		
24	0600	0800	52-24	26-51	2.0	2.1	34.069	8.05	7.75	2.40	40	0.33	26	0.7	2.51		
	1700	1900	50-38	25-45	5.9	4.2	33.849	8.10	7.73	1.64	15	0.31	22	0.2	2.53		
25	0600	0800	48-38	24-39	7.9	5.4	33.850	8.12	7.47	1.55	5	0.31	23	0.7	2.55		
	1700	1900			11.0	7.5	33.887	8.12	7.12	1.57	2	0.33	20	0.1	2.54		
26	0800	0800	44-38	22-49	10.1	9.0	33.963	8.09	6.61	1.18	5	0.23	16	0.5	2.49		
	1900	1900	42-23	21-34	12.1	20.9	35.458	8.23	5.41	0.14	2	0.00	0.4	0.0	2.55		
27	0800	0800	39-07	20-03	12.0	20.5	35.396	8.24	5.33	0.21	0	0.03	0.9	0.0	2.60		

Date	Time		Position		Air temp.	Water temp.	S	pH	O ₂	Phosphate-P	Silicate-Si	Nitrite-N	Nitrate-N	Ammonium-N	Alkalinity	Current	
	GMT	LMT	Lat.	Long.	°C											‰	cc/L
28	1900	1900	35-14S	18-44E	15.7	20.1	35.286	8.26	5.59	0.10	2	0.00	0.1	0.3	2.74		
	0800	0800			17.2	19.7	35.394	8.25	5.49	0.12	2	0.00	0.0	2.59			
29	Arrive in Cape Town																
Apr. 4	Leave Cape Town																
5	0600	0800	34-51	22-14	20.2	18.6	35.296	8.27	6.38	0.08	1	0.03	0.3	0.0	2.54		
	1700	1900			22.5	19.0	35.338	8.25	6.52	0.17	1	0.00	0.2	0.0	2.46		
6	0600	0800	33-37	27-40	22.5	25.1	35.376	8.23	5.49	0.06	3	0.00	0.0	0.0	2.56		
	1700	1900	32-49	29-35	24.3	24.0	35.537	8.25	5.86	0.04	3	0.00	0.1	0.1	2.57		
7	0600	0800	31-52	32-00	25.0	25.2	35.209	8.23	4.94	0.17	4	0.03	0.3	0.1	2.53		
	1700	1900	31-00	34-16	24.4	25.1	35.250	8.24	5.69	0.06	5	0.01	0.1	0.0	2.54		
8	0600	0800	29-39	36-50	24.4	24.8	35.471	8.25	4.91	0.12	2	0.04	0.1	0.3	2.56		
	1700	1900	28-35	39-11	24.0	24.2	35.069	8.24	5.33	0.06	1	0.05	0.0	0.1	2.54		
9	0500	0800	27-33	41-38	24.4	24.8	35.261	8.26	5.47	0.06	2	0.00	0.1	0.1	2.59		
	1600	1900	26-42	43-36	25.0	24.8	34.764	8.27	4.96	0.12	0	0.01	0.1	0.0	2.49		
10	0500	0800	24-43	45-54	24.0	22.5	35.120	8.24	5.66	0.17	2	0.14	0.5	0.5	2.56		
	1600	1900	24-50	47-55	25.1	25.6	35.042	8.29	5.25	0.31	0	0.04	0.1	0.7			
11	0400	0800	23-00	50-17	25.0	25.4	35.040	8.29	5.25	0.02	2	0.04	0.1	0.2	2.55		
	1500	1900	22-56	52-36	25.5	25.3	34.721	8.28	5.10	0.10	3	0.04	0.1	0.0	2.47		
12	0400	0800	21-55	54-51	25.9	26.5	34.999	8.26	5.10	0.04	0	0.04	0.1	0.4	2.47		
	1500	1900	20-56	56-52	25.5	26.8	35.002	8.26	5.19	0.14	1	0.06	0.0	0.4	2.50		
13	0400	0800	19-51	59-04	26.5	27.0	35.000	8.26	5.52	0.08	0	0.11	0.0	0.3	2.56		
	1500	1900	18-35	60-51	26.9	26.4	34.942	8.27	5.30	0.29	3	0.05	0.1	0.7	2.51		
14	0400	0800	17-01	63-04	27.2	27.1	34.964	8.25	5.04	0.19	3	0.07	0.0	2.50			
	1500	1900	15-47	64-52	27.9	28.2	34.637	8.26	5.16	0.12	2	0.03	0.2	2.52			
15	0400	0800	14-22	66-57	27.0	27.6	34.464	8.25	4.95	0.33	1	0.00	0.6	2.50			
	1500	1900	13-06	68-45	28.6	29.0	34.448	8.26	4.77	0.27	3	0.03	0.2	2.49			

Date	Time		Position		Air temp.	Water temp.	S	pH	O ₂	Phosphate-P	Silicate-Si	Nitrite-N	Nitrate-N	Ammonium-N	Alkalinity	Current	
	GMT	LMT	Lat.	Long.	°C		‰		cc/L	µg-atoms/L						Dir.	Speed (kt)
16	0300	0800	12-14S	70-05E	28.7	28.8	34.277	8.27	5.18	0.14	4	0.07	0.2	0.9	2.48		
	1400	1900	11-16	71-09	29.0	28.9	34.317	8.26	4.90	0.05	3	0.02	0.1	0.2	2.57		
17	0300	0800	10-18	72-06	28.6	28.9	34.227	8.27	4.82	0.05	2	0.01	0.1	0.7	2.49		
	1400	1900	9-20	73-41	28.3	29.4	34.139	8.26	4.70	0.20	2	0.03	0.1	0.7	2.47		
18	0300	0800	8-19	75-11	27.3	29.5	34.052	8.27	4.75	0.04	1	0.03	0.1	1.0	2.47		
	1400	1900	6-55	77-13	28.3	29.0	34.021	8.27	4.87	0.05	0	0.04	0.1	0.0	2.45		
19	0200	0800	5-00	79-22	29.0	29.0	34.078		4.48								
	1300	1900	3-54	81-33	28.3	29.2	34.050	8.27	4.59	0.29	2	0.00	0.1	0.7	2.50		
20	0200	0800	2-12	83-48	28.0	29.4	34.248	8.25	4.57	0.40	0	0.01	0.0	0.1	2.46		
	1300	1900	1-47	85-39	27.9	29.4	34.438	8.26	4.55	0.09	0	0.01	0.1	0.4	2.49		
21	0200	0800	0-38N	88-01	28.8	29.5	34.369	8.25	4.48	0.11	1	0.02	0.1	0.4	2.52		
	1300	1900	2-17	90-09	29.2	29.8	34.590	8.26	5.43								
22	0200	0800	4-10	92-42	29.0	29.4	33.866	8.25	5.84	0.00	2	0.01	0.1	0.0	2.52		
	1300	1900	5-29	94-18	29.1	29.8	33.622	8.26	5.40	0.16	2	0.00	0.1	0.1	2.43		
23	0200	0800	5-51	96-23	29.0	29.7	32.418	8.26	5.43	0.09	2	0.04	0.1		2.45		
26	0100	0800	4-01	106-05	28.9	29.0	33.826	8.26	4.99	0.04	2	0.05	0.1	0.3	2.54		
	1200	1900	5-22	107-13	29.0	29.1	33.875	8.27	5.45	0.05	2	0.05	0.0	0.2	2.49		
27	0100	0800	7-34	109-05	27.0	29.8	33.471	8.23	4.95	0.00	3	0.02	0.1	0.4	2.43		
	1200	1900	9-25	110-29	27.9	28.8	33.857	8.26	4.97	0.07	3	0.04	0.2	0.5	2.53		
28	0100	0800	11-28	112-28	29.0	28.8	33.914	8.25	5.06	0.09	1	0.01	0.1	0.4	2.48		
	1200	1900	13-14	114-11	28.9	29.1	33.756	8.24	4.62	0.50	4	0.04	0.0	0.5	2.46		
29	0000	0800	14-51	115-57	28.5	28.7	33.763	8.26	5.08	0.00	2	0.01	0.1	0.2	2.53		
	1100	1900	16-23	117-53	28.0	29.5	33.717	8.25	5.10	0.05	3	0.06	0.1	0.1	2.56		
30	0000	0800	18-11	119-55	28.0	27.4	34.100	8.26	4.89	0.05	2	0.00	0.1	0.5	2.54		
	1100	1900	19-33	121-19	27.3	26.4	34.346	8.28	4.88	0.04	3	0.03	0.0	0.2	2.54		
May. 1	0000	0800	20-26	122-17	26.9	27.0	34.576	8.30	4.72	0.04	0	0.02	0.1	0.4	2.55		

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Cate	Time		Position		Air temp.	Water temp.	S	pH	O ₂	Phos- phate-P	Sili- cate-Si	Ni- trite-N	Ni- trate-N	Ammo- nium-N	Alka- linity	Current	
	GMT	LMT	Lat.	Long.	°C	‰				cc/L	μg-atoms/L						Dir.
2	1100	1900	21-19N	123-09E	26.5	26.6	34.571	8.27	4.89	0.09	2	0.02	0.1	0.2	2.55		
	2300*	0800	22-06	124-07	26.0	26.3	34.721	8.30	4.81	0.00	2	0.04	0.1	0.5	2.55		
	1000	1900	23-12	125-12	25.9	26.1	34.601	8.28	4.79	0.02	2	0.04	0.1	0.8	2.54		
3	2300*	0800	24-26	126-28	25.1	25.4	34.601	8.29	4.74	0.63	2	0.06	0.2	0.8	2.55		
	1000	1900	25-38	127-57	23.3	22.8	34.847	8.32	5.19	0.11	1	0.03	0.1	0.7	2.56		

Table 2. Bathythermograph observation data.

St. No.	Date			Time		Position		Temperature (°C) at indicated depth (m)										
	Day	Month	Year	GMT	LMT	Lat.	Long.	0	10	20	30	50	75	100	125	150	200	250
1	25	Nov.	1969	2300*	0800	31-42N	137-45E	22.5	22.5	22.5	22.5	22.5	22.5	20.2	19.5	19.2	18.0	17.6
2	26			1000	1900	29-32	136-41	22.1	22.1	22.1	22.1	22.1	22.1	20.7	19.6	19.0	18.1	
3	30			1000	1900	12-04	126-42	26.3	26.4	26.5	26.3	26.3	26.3	23.8	20.7	16.9	13.7	
4	1	Dec.		2300*	0800	8-58	126-52	26.7	26.6	26.6	26.6	26.6	25.4	22.6	19.2	15.4		
5	2			2300*	0800	3-51	123-51	28.7	30.1	29.8	29.1	28.2	27.0	26.5	24.3	20.9		
6	2			1000	1900	2-24	122-04	28.1	28.1	28.2	28.1	27.6	26.1	23.7	23.4	22.3	16.2	
7	3			0000	0800	0-48	119-46	28.4	28.4	28.2	28.2	27.5	27.3	22.7	22.1	19.4	14.9	
8	3			1100	1900	1-22S	118-55	30.0	29.7	29.3	29.0	28.2	27.0	24.7	22.8	18.6		
9	4			0000	0800	4-13	118-35	29.8	29.2	29.0	28.4	28.1	27.0	24.5	19.6	15.9	13.7	
10	4			1100	1900	6-26	117-27	30.3	30.0	29.9	29.2	28.3	24.9	22.5	20.3	18.2	15.0	
11	5			0000	0800	8-32	115-49	29.9	29.9	29.1	27.7	26.1	22.8	19.3	15.5	14.4		
12	5			1100	1900	10-51	115-08	29.8	29.6	27.7	25.5	26.1	24.8	22.7	21.0	17.8		
13	6			0000	0800	13-44	114-30	28.7	28.6	28.6	28.2	26.4	24.2	22.2	21.5	19.3	16.8	
14	6			1100	1900	16-11	114-27	28.6	28.6	28.6	27.2	26.0	24.4	23.5	22.2	20.4	17.0	
15	7			0000	0800	18-40	114-09	25.8	25.8	25.6	23.9	24.1	23.3	22.4	21.6	20.9	17.9	
16	7			1100	1900	20-52	113-42	25.8	25.8	25.8	25.5	24.0	23.0	22.2	21.4	20.3		
17	8			0000	0800	23-29	112-57	24.0	24.0	24.0	24.0	22.2	21.3	20.4	19.7			
18																		
19	17			1100	1900	36-01	111-32	17.7	17.7	17.6	17.1	15.9	15.2	14.4	13.8	13.1	12.4	
20	18			0000	0800	38-36	111-33	16.1	16.1	16.1	16.1	14.2	13.1	12.6	12.2	11.9	11.3	
21	18			1100	1900	40-39	111-43	14.4	14.2	14.2	14.2	13.4	12.8	12.4	12.2	11.8		
22	19			0100	0800	43-14	111-43	11.8	11.8	11.8	11.6	11.3	10.3	10.0	10.0	9.9		
23																		
24	20			1200	1900	48-42	110-28	6.9	6.9	6.9	6.9	6.8	5.7	5.7	5.3	5.1		
25	21			0100	0800	51-22	110-42	4.8	4.8	4.8	4.8	4.0	2.9	2.8	2.6	2.8	2.9	
26	21			1200	1900	53-22	110-11	3.3	3.4	3.4	3.3	3.0	2.1	2.0	1.6	1.4	1.8	2.3
27	22			0100	0800	55-28	108-10	2.9	2.9	2.9	2.8	1.8	1.7	1.7				
28	22			1200	1900	57-10	106-25	1.4	1.4	1.3	1.3	1.2	0.3	0.0	-0.7			
29	23			0100	0800	59-32	105-51	0.4	0.4	0.4	0.4	0.1	-0.3	-1.1	-0.3	0.9	1.7	

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Table 3. Vertical observation data.

St. 1

		Meteorological observation			
Date	: Dec. 20, 1969	Time (GMT): 0100	Wind dir.: SW		
Time (GMT): 0125-0320		(LMT): 0800	vel.: 24 kt		
(LMT): 0825-1020		Weather : Cloudy	Humidity : 76%		
Lat. : 47-44 S		Air temp. : 7.1°C	Sea : 4		
Long. : 110-27 E		Atm. press : 994.1 mb	Swell : SW 3		

Observed								Interpolated				
Depth (m)	T(°C)	S (‰)	pH	O ₂ (cc/L)	PO ₄ -P	SiO ₃ -Si	NO ₂ -N	Depth (m)	T(°C)	S (‰)	σ _t	ΔD
					μg-atoms/L							
0	9.3	34.385	8.19	6.68	1.14	5	0.30	0	9.3	34.385	26.46	0.000
10	9.27	34.384	8.20	6.87	1.20	5	0.45	10	9.27	34.385	26.46	0.016
19	9.27	34.382	8.21	6.98	1.26	6	0.35	20	9.27	34.384	26.46	0.032
29	9.26	34.386	8.17	6.76	1.18	4	0.33	30	9.26	34.386	26.46	0.047
48	9.26	34.388	8.15	6.79	1.18	4	0.30	50	9.25	34.390	26.46	0.079
71	9.11	34.468	8.18	6.79	1.14	3	0.27	75	9.08	34.478	26.52	0.118
95	9.00	34.513	8.23	6.58	1.20	3	0.29	100	8.99	34.527	26.57	0.156
118	8.93	34.557	8.13	7.00	1.22	4	0.41	150	8.84	34.577	26.60	0.231
141	8.88	34.578	8.20	6.33	1.28	3	0.49	200	8.33	34.530	26.68	0.303
187	8.52	34.551	8.16	6.59	1.28	3		250	7.73	34.429	26.72	0.373
233	7.81	34.439	8.18	6.55	1.47	5	0.09	300	7.55	34.420	26.75	0.442
280	7.62	34.422	8.15	6.38	1.64	5	0.05	400	7.00	34.406	26.82	0.574
373	7.22	34.416	8.17	6.15	1.70	9	0.06	500	5.95	34.352	26.93	0.699
465	6.24	34.355	8.08	5.86	1.90	14	0.06	600	5.25	34.344	27.01	0.815
559	5.58	34.354	8.03	5.53	2.11	20	0.09	700	4.31	34.311	27.10	0.923
701	4.31	34.310	8.06	5.35	2.26	29	0.06	800	3.75	34.321	27.17	1.024
879	3.41	34.343	7.95	4.89	2.38	38	0.02	1000	3.06	34.394	27.26	1.210
1060	2.93	34.421	7.94	5.01	2.42	59	0.00	1200	2.76	34.484	27.32	1.383
1339	2.68	34.546	7.91	2.59	2.59	69	0.00	1500	2.58	34.610	27.39	1.627
1802	2.40	34.699	7.96	4.88	2.32	73	0.00	2000	2.27	34.723	27.47	2.002
2280	2.07	34.742	7.92	4.59	2.28	69	0.00					