

Oceanographic Data of the 19th Japanese Antarctic Research Expedition 1977–1978

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第19次南極地域観測隊海洋部門報告

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要旨：第19次南極地域観測において、定常観測（1977–1978）として海上保安庁水路部の担当した海洋観測の結果を報告する。

Abstract: This report presents the results of oceanographic observations, which were carried out by the 19th Japanese Antarctic Research Expedition in 1977–1978.

This report presents the data of the oceanographic observations obtained on board the icebreaker FUJI during the summer mission of the 19th Japanese Antarctic Research Expedition in 1977–1978. The track chart of the cruise is shown in Fig. 1. The locations of serial (vertical) observation stations, the Salinity-Temperature-Depth (STD) recorder observation stations, the bathythermograph (BT) observation stations and the expendable bathythermograph (XBT) observation stations in the Southern Ocean are given in Fig. 2.

Surface observation: Surface temperature measurements and surface water samplings for chemical analysis were made three times a day during the cruise. The results are given in Table 1.

Current measurement: Measurements of surface current were made by Geomagnetic Electrokinetograph (GEK) through the cruise except in the magnetic equator region and in the pack ice area. The results are also shown in Table 1.

BT observation: Water temperature distributions in the upper layer (down to a depth about 250 m) were surveyed with bathythermograph (BT) at almost the same frequency as the surface observations. The results are given in Table 2.

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XBT observation: The vertical distributions of temperature in the upper layer (down to depths about 500 m and 2000 m) were investigated at 34 stations in the Southern Ocean along the track from Fremantle to Mauritius through Syowa Station. The results are shown in Table 4.

Serial observation: The serial observations were made at 5 stations in the Southern Ocean along the track from Fremantle to Mauritius (Fig. 2). The 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.

Chemical analysis of sea water: The following are the elements and the methods (or instruments) of analysis. The results are also presented in Table 3.

Salinity	Inductive salinometer (Auto-Lab Model 601 MK III)
pH	pH meter (Denki-Kagaku Keiki Co. HG-3)
Dissolved oxygen	Winkler's method
Phosphate-P	Molybdenum blue method*
Reactive silicate-Si	Molybdenum yellow 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 25 ml of 1/100 N HCl was added to 100 ml sample, pH of the sample was measured and alkalinity was calculated by STRICKLAND's table*.

Acknowledgments

The authors are indebted to Captain G. TANABE of the icebreaker FUJI and his officers and crew, and also to the members of the 19th Japanese Antarctic Research Expedition for their co-operation during the cruise.

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* STRICKLAND, J. D. H. and PARSONS, T. R. (1960): A manual of sea water analysis. Bull. Fish. Res. Bd. Canada, **125**, 185p.

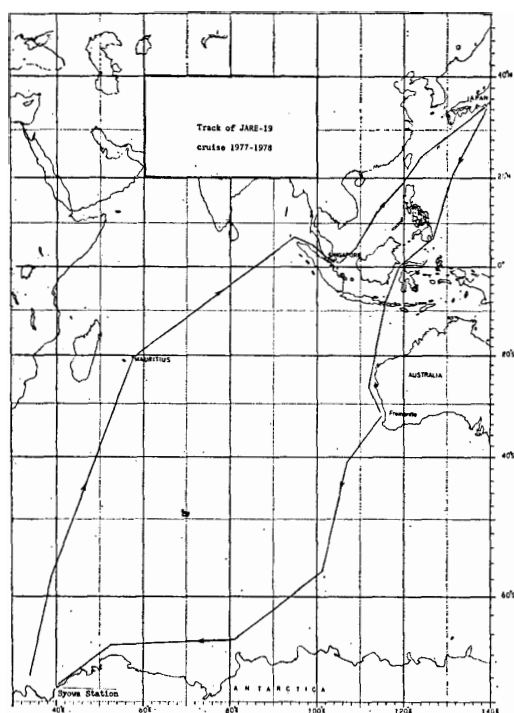


Fig. 1. Track of JARE-19 cruise 1977-1978.

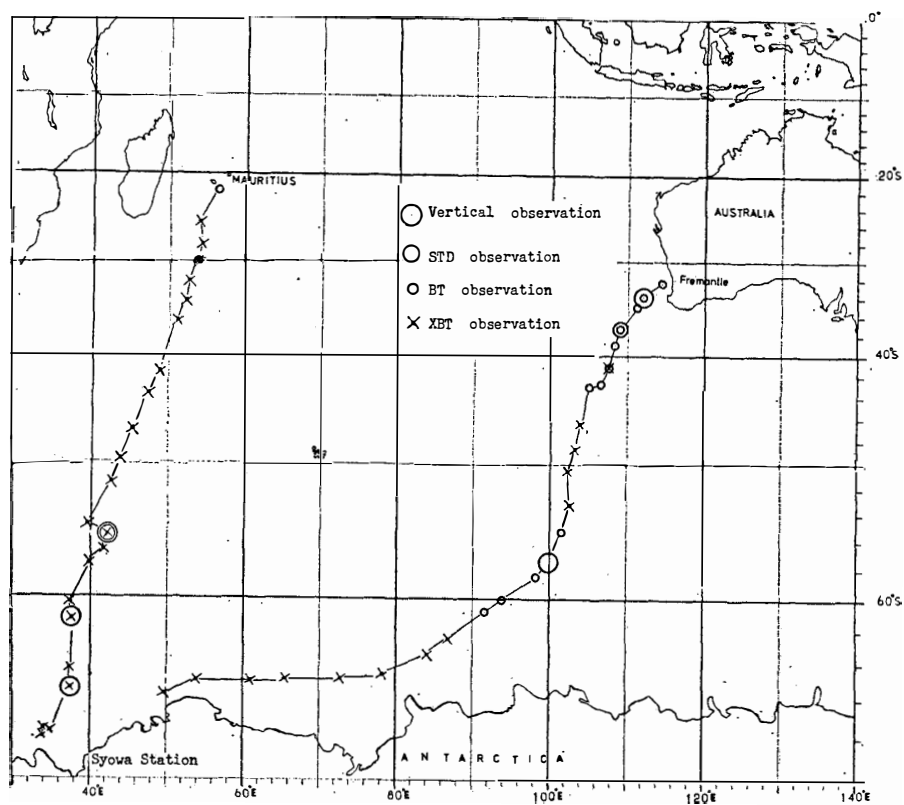


Fig. 2. Track of JARE-19 cruise and oceanographic station.

Table 1. Surface observation data.

Date	Time		Position		Air temp.	Water temp.	S ‰	pH	O ₂ cc/L	Phos- phate- P	Sili- cate- Si	Ni- trite- N	Ni- trate- N	Ammo- nia-N	Alkalini- ty meq/L	Current	
	GMT	LMT	Lat.	Long.	°C					μg-atoms/L						Dir.	Speed (Kn)
1977																	
Nov. 25			Leave Tokyo														
26	2300*	0800	31-34N	137-48E	19.0	22.3	34.456	8.30	5.46	0.29	6	0.06	0.00		2.36	115	0.1
	0300	1200	31-09	137-05	20.0	22.2	34.487	8.30	5.05	0.12	21	0.06	0.00		2.37		
	0900	1800	30-30	135-48	20.4	23.3	34.588	8.30	4.88	0.08	7	0.06	0.00		2.38		
27	2300*	0800	27-58	134-19	21.7	23.3	34.488	8.33	4.76	0.04	3	0.06	0.00		2.36	007	0.5
	0300	1200	27-08	134-00	24.6	24.7	34.432	8.34	4.83	0.04	21	0.01	0.06	2.6	2.36		
	0900	1800	25-52	133-35	22.1	24.8	34.597	8.34	4.74	0.02	2	0.04	0.00	3.1	2.36	240	0.2
28	2300*	0800	22-52	132-36	23.1	27.2	34.694	8.29	4.59	0.00	3	0.04	0.00	1.3	2.39	229	1.0
	0300	1200	22-03	132-20	24.9	27.2	34.656	8.29	4.64	0.00	37	0.03	0.00	0.0	2.39		
	0900	1800	20-44	131-55	25.2	27.2	34.751	8.30	4.59	0.02	1	0.02	0.00	0.0	2.40	318	0.7
29	2300*	0800	17-46	130-47	24.5	27.6	34.055	8.31	4.57	0.00	3	0.04	0.00	0.0	2.37		
	0300	1200	17-02	130-32	24.4	27.6	34.329	8.32	4.59	0.00	18	0.02	0.00	0.0	2.38		
	0900	1800	15-54	130-07	27.4	27.6	34.476	8.29	4.57	0.00	2	0.01	0.00	0.0	2.39		
30	2300*	0800	13-16	129-16	28.0	28.0	34.453	8.32	4.55	0.00	2	0.04	0.06	0.0	2.38		
	0300	1200	12-31	129-05	28.1	28.6	34.383	8.32	4.55	0.00	4	0.01	0.08	0.0	2.39		
	0900	1800	11-28	128-34	28.6	28.9	34.408	8.32	4.47	0.04	5	0.01	0.00	0.0	2.38		
Dec. 1	2300*	0800	08-39	127-15	29.2	28.9	34.155	8.29	4.57	0.02	3	0.01	0.00	0.0	2.36		
	0300	1200	07-51	126-55	27.5	29.3	34.405	8.28	4.52	0.04	3	0.01	0.00	0.2	2.38		
	0900	1800	06-23	126-27	28.0	28.8	34.173	8.30	4.49	0.08	3	0.02	0.00	0.2	2.36		
2	0000	0800	04-09	124-04	27.5	28.7	34.190	8.28	4.76	0.00	3	0.01	0.00	0.3	2.39		
	0400	1200	03-34	123-23	28.4	28.9	34.332	8.29	4.68	0.00	3	0.01	0.00	0.5	2.40		

* The time of the data of the preceding day.

Table 1 (continued).

Date		Time		Position		Air temp.	Water temp.	S ‰	pH	O ₂ cc/L	Phos- phate- P	Sili- cate- Si	Ni- trite- N	Ni- trate- N	Ammo- nia-N	Alkalin- ity meq/L	Current	
		GMT	LMT	Lat.	Long.	°C					µg-atoms/L						Dir.	Speed (Kn)
Dec.	2	1000	1800	02-48N	122-27E	27.1	29.1	34.327	8.31	4.49	0.00	2	0.02	0.00	0.3	2.40		
	3	0000	0800	01-24	120-35	27.9	28.6	33.519	8.30	4.79	0.00	4	0.03	0.00	0.3	2.33		
		0400	1200	01-04	120-01	27.7	29.3	33.437	8.28	4.63	0.00	5	0.03	0.00	0.1	2.32		
		1000	1800	00-02	119-26	27.2	29.0	33.600	8.28	4.61	0.00	6	0.01	0.00	0.2	2.33		
	4	0000	0800	02-36S	118-37	25.5	28.9	33.917	8.28	4.71	0.00	2	0.03	0.00	0.3	2.36		
		0400	1200	03-20	118-20	25.5	28.9	32.941	8.28	4.65	0.00	5	0.03	0.00	0.4	2.28		
		1000	1800	04-23	117-44	28.1	29.9	34.182	8.29	4.51	0.00	4	0.03	0.00	0.3	2.37		
	5	0000	0800	06-56	116-29	28.5	29.4	34.211	8.39	4.65	0.00	4	0.02	0.00	0.3	2.37		
		0400	1200	07-39	116-10	29.8	29.0	34.359	8.28	4.51	0.00	4	0.01	0.00	0.2	2.37		
		1000	1800	08-39	115-44	28.0	29.4	34.410	8.27	4.48	0.00	6	0.02	0.00	0.5	2.37		
	6	0000	0800	11-05	115-01	28.1	28.9	34.312	8.26	4.64	0.00	4	0.03	0.00	0.3	2.37	286	0.9
		0400	1200	11-50	114-50	28.9	29.3	34.255	8.26	4.53	0.00	3	0.04	0.00	0.3	2.38		
		1000	1800	12-56	114-37	28.1	29.7	34.432	8.27	4.48	0.04	2	0.01	0.00	0.8	2.40	240	0.7
	7	0000	0800	15-34	114-13	27.2	28.1	34.523	8.27	4.67	0.00	9	0.01	0.11	0.6	2.40	095	0.1
		0400	1200	16-21	114-10	27.9	28.5	34.533	8.27	4.55	0.00	6	0.01	0.00	0.4	2.40		
		1000	1800	17-33	114-00	27.2	28.8	34.898	8.25	4.61	0.00	5	0.01	0.03	0.5	2.41	004	0.7
	8	0000	0800	20-31	113-19	25.0	25.5	35.165	8.26	4.73	0.00	5	0.01	0.03	0.6	2.42	259	0.2
		0400	1200	21-24	113-09	25.1	25.1	35.147	8.28	4.84	0.00	5	0.02	0.00	0.5	2.42		
		1000	1800	22-42	112-57	24.6	24.4	35.191	8.28	4.76	0.06	5	0.04	0.00	0.5	2.43	100	0.1
	9	0000	0800	25-40	112-22	21.5	22.7	35.354	8.29	4.96	0.00	15	0.06	0.04	2.0	2.44		
0400		1200	26-31	112-35	21.8	22.1	35.434	8.29	5.02	0.04	9	0.04	0.00	1.1	2.45			
1000		1800	27-56	112-56	21.1	21.9	35.530	8.28	5.03	0.08	3	0.04	0.00	0.7	2.45			
10	0000	0800	30-36	114-26	20.3	21.1	35.625	8.31	5.12	0.00	7	0.04	0.19	1.5	2.46			

Table 1 (continued).

Date	Time		Position		Air temp.	Water temp.	S ‰	pH	O ₂ cc/L	Phos- phate- P	Sili- cate- Si	Ni- trite- N	Ni- trate- N	Ammo- nia-N	Alkalin- ity meq/L	Current	
	GMT	LMT	Lat.	Long.	°C					μg-atoms/L						Dir.	Speed (Kn)
Dec. 10	0400	1200	31-18S	114-56E	22.0	21.1	35.662	8.31	5.07	0.00	4	0.04	0.00	0.3	2.46		
			Arrive in Fremantle														
16			Leave Fremantle														
	1000	1800	32-28	114-24	22.0	21.0	35.747	8.34	5.14	0.08	2	0.01	0.46	0.9	2.46	257	0.8
17	0100	0800	34-06	111-41	19.0	19.4	35.685	8.29	5.20	0.46	1	0.04	0.08	0.5	2.46	173	0.1
	1100	1800	35-02	111-26	18.0	19.0	35.807	8.32	5.70	0.04	6	0.04	0.25	0.8	2.47	143	0.5
18	0100	0800	37-17	108-58	16.6	16.9	35.270	8.31	5.71	0.10	4	0.04	0.56	1.0	2.45	330	0.5
	1100	1800	38-43	108-13	15.2	15.7	34.177	8.30	5.80	0.25	4	0.05	0.74	0.7	2.45	020	0.3
19	0100	0800	41-10	107-01	12.5	13.1	34.729	8.28	6.19	0.47	3	0.13	5.08	0.7	2.42	155	0.1
	0500	1200	41-50	106-39	13.0	12.3	34.684	8.28	6.12	0.37	3	0.16	4.96	3.5	2.42		
	1100	1800	42-54	106-05	13.1	12.6	34.678	8.28	6.21	0.60	4	0.19	5.56	1.2	2.44		
20	0100	0800	45-06	104-51	10.8	10.3	34.760	8.30	6.41	0.54	5	0.19	5.13	0.4	2.41		
	0500	1200	45-46	104-30	10.3	10.7	34.507	8.27	6.23	0.74	5	0.19	6.94	0.7	2.41		
	1100	1800	46-37	103-54	7.1	9.5	34.345	8.26	6.58	0.83	3	0.16	7.33	0.5	2.39		
21	0100	0800	48-55	102-54	7.2	6.1	33.978	8.27	7.03	0.97	5	0.09	14.08	0.7	2.40		
	0500	1200	49-33	102-32	6.8	6.1	33.930	8.25	7.09	1.20	4	0.15	14.65	0.7	2.39		
	1100	1800	50-40	102-14	6.0	4.6	33.888	8.28	7.45	1.30	3	0.12	14.05	1.0	2.41		
22	0100	0800	53-26	102-13	3.8	3.1	33.914	8.22	7.81	1.20	7	0.13	15.97	1.1	2.43		
	0500	1200	54-14	102-13	3.6	2.9	33.937	8.21	7.69	1.57	12	0.12	18.23	0.5	2.42		
	1100	1800	55-19	101-30	1.7	1.5	33.938	8.17	7.70	1.80	32	0.13	19.39	0.7	2.43	075	0.1
23	0100	0800	57-40	99-49	1.1	0.9	33.862	8.30	7.73	1.82	37	0.29	27.13	0.3	2.43	075	0.3
	1100	1800	58-25	98-02	0.0	0.8	33.698	8.19	7.88	1.78	45	0.04	—	0.4	2.42	209	0.3
24	0200	0800	60-01	93-41	0.9	0.0	33.230	8.19	7.50	1.59	40	0.06	25.20	0.7	2.42	142	0.2

Table 1 (continued).

Date	Time		Position		Air temp.	Water temp.	S ‰	pH	O ₂ cc/L	Phosphate-P	Silicate-Si	Nitrite-N	Nitrate-N	Ammonia-N	Alkalinity meq/L	Current			
	GMT	LMT	Lat.	Long.	°C					µg-atoms/L						Dir.	Speed (Kn)		
1978	Dec. 24	0500	1200	60-24S	92-42E	1.0	0.3	33.771	8.20	8.02	1.55	46	0.19	21.75	1.0	2.42	000	0.0	
		1100	1700	60-53	91-05	1.5	0.3	33.964	8.19	8.05	1.61	55	0.19	16.13	0.8	2.43			
	25	0200	0800	62-26	86-20	1.1	0.8	33.697	8.27	8.27	1.46	59	0.06	18.04	1.3	2.42			
		0500	1200	63-00	85-14	1.1	0.3	33.283	8.21	8.13	1.57	51	0.23	19.11	1.4	2.40			
	26	0200	1800	63-54	83-30	0.7	0.3	33.413	8.16	8.44	1.28	55	0.20	22.22	—	2.41			
		0300	0800	64-32	76-49	1.1	1.0	33.471	8.17	8.01	1.28	66	0.23	26.93	—	2.41			
		0700	1200	64-39	74-57	2.0	0.8	33.563	8.17	7.81	1.63	56	0.28	22.65	—	2.40			
		1300	1800	64-50	72-06	1.0	1.6	33.544	8.18	7.80	1.71	57	0.30	18.77	—	2.41			
	27	0400	0800	64-57	65-05	0.0	0.5	34.014	8.22	—	1.01	57	0.12	17.87	0.2	2.44			
		0800	1200	64-55	63-13	-0.4	0.9	34.006	8.21	8.05	1.46	60	0.19	22.29	0.3	2.44			
		1400	1800	64-53	60-30	0.0	0.7	33.629	8.18	8.14	1.55	51	0.36	21.92	0.3	2.42			
	28	0400	0800	65-11	53-46	-1.2	-0.1	33.664	8.18	7.98	1.69	61	0.22	20.47	0.2	2.43			
	29	0400	0800	65-39	48-53	-1.5	-1.6	33.571	8.26	8.57	1.42	61	0.65	19.48	0.8	2.42			
		0800	1200	66-12	47-23	-0.5	-1.0	33.651	8.20	7.93	1.73	65	0.79	19.33	0.7	2.44			
	Arrive in Ongul Islands																		
	Leave Ongul Islands																		
	Feb. 23	1600	1800	67-45	34-01	-0.8	-1.2	33.618	8.10	8.05	1.88	71	0.26	20.76	0.8	2.40	290	0.3	
		24	0300	0500	67-52	33-44	-3.5	-1.3	33.695	8.13	7.91	1.75	74	0.28	22.60	1.2	2.39	185	0.3
	1600		1800	67-46	33-54	-2.6	-1.5	33.695	8.12	8.41	1.73	71	0.23	22.43	1.2	2.39	216	0.6	
	25	0300	0500	67-50	36-17	-1.3	-1.3	33.682	8.10	6.82	2.04	67	0.28	21.13	3.4	2.39			
	26	0500	0800	65-28	36-41	1.5	1.8	34.038	8.12	7.41	1.77	58	0.35	17.35	0.0	2.42	161	0.2	
		1600	1800	64-13	36-59	0.9	1.7	33.906	8.12	7.40	1.65	54	0.47	23.42	0.0	2.41	180	0.2	

Table 1 (continued).

Date	Time		Position		Air temp.	Water temp.	S ‰	pH	O ₂ cc/L	Phos- phate- P	Sili- cate- Si	Ni- trite- N	Ni- trate- N	Ammo- nia-N	Alkalini- ty meq/L	Current	
	GMT	LMT	Lat.	Long.	°C					μg-atoms/L						Dir.	Speed (Kn)
Feb. 27	0500	0800	61-31S	34-04E	1.6	2.0	34.085	8.12	7.19	1.78	48	0.41	19.23	1.2	2.42	123	0.3
	1600	1800	60-12	37-05	3.2	2.2	33.941	8.12	7.30	1.90	46	0.40	24.28	0.7	2.42	180	0.2
28	0900	1200	57-33	39-42	3.9	2.3	34.028	8.11	8.14	1.67	28	0.44	10.99	0.0	2.43		
	1500	1800	56-45	41-14	3.8	2.5	34.026	8.15	7.57	1.65	6	0.12	12.96	0.4	2.44		
Mar. 1	0500	0800	55-24	41-34	3.5	2.8	34.079	8.17	7.98	1.20	40	0.13	10.24	0.0	2.43	029	0.6
	1500	1800	55-14	41-01	5.8	3.6	33.955	8.17	7.30	0.83	37	0.36	7.44	1.1	2.42	050	0.6
2	0900	1200	52-46	41-19	5.0	3.7	33.974	8.18	7.35	1.44	28	0.09	12.01	0.4	2.42		
	1500	1800	51-49	42-06	4.8	3.7	33.978	8.17	7.24	1.47	26	0.27	14.55	0.2	2.42		
3	0500	0800	49-16	43-49	5.5	5.5	33.849	8.19	7.07	1.44	16	0.28	16.70	0.6	2.40		
	0900	1200	48-22	44-23	6.8	6.2	33.825	8.17	6.92	1.24	11	0.23	19.22	0.1	2.40		
4	1500	1800	46-57	45-12	7.7	7.1	33.840	8.15	6.90	1.32	5	0.28	17.42	0.8	2.41		
	0500	0800	43-45	47-00	12.2	7.8	33.683	8.18	7.19	1.26	8	0.15	12.65	0.4	2.39		
5	0900	1200	42-49	47-36	13.9	10.4	33.695	8.17	6.39	0.78	4	0.10	12.67	0.1	2.39		
	1500	1800	41-23	48-24	17.5	15.3	34.580	8.26	5.80	0.10	2	0.06	0.29	0.2	2.42		
6	0500	0800	38-47	49-53	20.7	19.2	35.276	8.28	5.24	0.06	1	0.01	0.34	0.0	2.44		
	0900	1200	38-04	50-23	21.4	19.4	35.520	8.29	5.12	0.08	2	0.03	0.23	0.1	2.45		
7	1500	1800	36-56	50-56	20.9	19.6	35.511	8.27	5.27	0.00	3	0.02	0.19	0.2	2.45		
	0500	0800	34-29	52-12	21.8	22.1	35.591	8.25	5.17	0.02	4	0.04	0.85	0.4	2.45		
8	0900	1200	33-43	52-29	23.3	21.8	35.615	8.23	5.26	0.00	5	0.04	0.00	0.3	2.45		
	1500	1800	32-33	52-53	22.7	22.5	35.591	8.25	5.08	0.00	3	0.03	0.00	0.0	2.45		
9	0400	0800	29-54	53-42	23.1	23.6	35.615	8.27	4.89	0.00	4	0.03	0.00	0.4	2.45	060	0.3
	0400	1200	29-11	53-55	24.3	23.8	35.597	8.27	4.86	0.02	3	0.04	0.11	0.4	2.45		
10	1400	1800	28-04	54-14	25.4	24.4	35.635	8.20	4.78	0.06	2	0.03	0.85	0.5	2.45	015	0.2

Table 1 (continued).

Date	Time		Position		Air temp.	Water temp.	S ‰	pH	O ₂ cc/L	Phos- phate- P	Sili- cate- Si	Ni- trite- N	Ni- trate- N	Ammo- nia-N	Alkalin- ity meq/L	Current			
	GMT	LMT	Lat.	Long.	°C	µg-atoms/L						Dir.	Speed (Kn)						
Mar. 8	0400	0800	25-49S	54-28E	26.1	26.1	35.375	8.30	4.62	0.04	3	0.03	0.03	0.1	2.44	110	1.2		
	0800	1200	25-14	54-47	27.9	26.1	35.202	8.29	4.58	0.04	4	0.04	0.00	0.4	2.42				
	1400	1800	24-27	55-26	27.7	26.1	35.297	8.35	4.58	0.06	3	0.04	0.00	0.5	2.44				
9	0400	0800	21-56	56-36	27.8	26.9	35.367	8.34	5.60	0.04	4	0.04	0.12	0.0	2.42			305	0.2
	0800	1200	21-05	57-03	27.8	26.6	35.197	8.35	5.54	0.06	4	0.04	0.00	0.5	2.43				
16	Arrive in Mauritius																	189	0.7
	Leave Mauritius																		
	0800	1200	19-46	57-37	27.9	27.3	35.212	8.35	4.74	0.04	3	0.05	0.17	0.0	2.43				
17	1400	1800	19-19	58-28	27.5	27.5	35.211	8.34	4.77	0.06	3	0.05	0.00	0.0	2.43	009	0.3		
	0400	0800	17-59	60-44	27.1	27.4	34.946	8.34	4.57	0.04	4	0.06	0.01	0.0	2.41	298	0.8		
	0800	1200	17-37	61-19	27.9	27.7	34.959	8.35	4.50	0.06	3	0.08	0.00	0.0	2.41				
18	1400	1800	17-00	62-11	27.7	27.9	34.749	8.28	5.13	0.06	3	0.08	0.00	0.2	2.41			250	1.4
	0400	0800	15-33	64-12	28.3	27.6	34.682	8.28	4.73	0.08	3	0.08	0.00	0.3	2.41				
	0800	1200	15-06	64-41	29.5	27.9	34.801	8.28	4.71	0.04	3	0.08	0.00	0.2	2.41				
19	1400	1800	14-17	65-20	28.4	27.8	34.631	8.28	4.58	0.08	4	0.08	0.02	0.7	2.40	355	0.5		
	0300	0800	12-49	67-01	27.3	27.8	34.440	8.33	4.51	0.04	4	0.04	0.00	0.4	2.40				
	0700	1200	12-18	67-28	26.7	27.9	33.286	8.33	4.61	0.06	5	0.05	0.00	0.5	2.33				
20	1300	1800	11-39	68-26	26.2	26.7	34.380	8.31	4.43	0.21	6	0.06	0.00	0.2	2.40				
	0300	0800	11-03	71-04	28.2	27.9	34.448	8.35	4.54	0.06	3	0.01	0.00	0.1	2.41				
	0700	1200	10-52	71-49	29.0	28.3	34.595	8.34	4.56	0.04	4	0.03	0.00	0.3	2.42				
21	1300	1800	10-33	72-59	29.0	28.6	34.519	8.35	4.55	0.12	3	0.01	0.00	0.3	2.41				
	0300	0800	9-05	75-12	29.1	28.6	34.407	8.33	4.62	0.04	3	0.00	0.10	0.4	2.41				
	0700	1200	8-35	75-47	29.8	28.6	34.423	8.33	4.60	0.04	3	0.01	0.03	0.3	2.40				

Table 1 (continued).

Date	Time		Position		Air temp.	Water temp.	S ‰	pH	O ₂ cc/L	Phos- phate- P	Sili- cate- Si	Ni- trite- N	Ni- trate- N	Ammo- nia-N	Alkalin- ity meq/L	Current	
	GMT	LMT	Lat.	Long.	°C					μg-atoms/L						Dir.	Speed (Kn)
Mar. 21	1300	1800	7-56S	76-44E	29.4	28.6	34.367	8.34	4.51	0.04	3	0.01	0.05	0.5	2.39	320	0.1
22	0300	0800	6-18	78-52	28.7	28.7	34.355	8.31	4.62	0.04	3	0.04	0.00	0.4	2.40		
	0700	1200	5-49	79-31	30.0	28.8	34.294	8.31	4.61	0.04	4	0.04	0.00	0.4	2.39		
	1300	1800	5-08	80-30	29.7	28.8	34.169	8.32	4.54	0.04	3	0.04	0.00	0.3	2.38		
23	0200	0800	3-26	82-36	29.3	29.0	34.153	8.32	4.70	0.08	3	0.04	0.00	0.1	2.38		
	0600	1200	2-56	83-14	30.3	29.6	34.116	8.32	4.73	0.08	3	0.06	0.00	0.0	2.37		
	1200	1800	2-10	84-06	30.1	29.7	34.245	8.32	4.65	0.08	3	0.05	0.00	0.1	2.37		
24	0200	0800	0-22	86-08	29.6	30.1	34.544	8.31	4.60	0.08	2	0.06	0.00	0.3	2.40		
	0600	1200	0-07N	86-45	30.8	30.6	33.927	8.33	4.56	0.08	2	0.07	0.00	0.2	2.41		
	1200	1800	0-51	87-35	29.8	30.2	33.369	8.33	4.48	0.08	3	0.06	0.00	0.3	2.34		
25	0200	0800	2-14	89-17	27.0	29.7	33.588	8.34	4.59	0.00	2	0.10	0.00	0.0	2.36		
	0600	1200	2-35	89-48	30.1	30.3	33.543	8.33	4.47	0.00	3	0.04	0.00	0.0	2.35		
	1200	1800	3-03	90-33	30.0	30.1	33.510	8.34	4.42	0.00	3	0.01	0.00	0.3	2.35		
26	0200	0800	4-08	92-18	29.7	29.7	34.238	8.32	4.55	0.00	3	0.02	0.03	0.8	2.40		
	0600	1200	4-27	92-48	30.4	29.3	33.241	8.31	4.57	0.00	4	0.01	0.00	0.9	2.34		
	1200	1800	4-56	93-26	29.9	29.1	32.921	8.30	4.48	0.06	3	0.02	0.07	0.6	2.32		
27	0200	0800	6-07	94-54	29.4	29.5	33.347	8.33	4.76	0.04	3	0.03	0.02	0.9	2.35		
	0600	1200	6-11	95-23	30.1	29.8	32.844	8.31	4.74	0.06	3	0.05	0.00	0.8	2.33		
	1200	1800	6-09	96-17	29.2	29.8	32.806	8.31	4.66	0.06	3	0.05	0.00	0.9	2.33		
28	0100	0800	5-32	97-54	28.3	29.7	32.523	8.31	4.65	0.04	4	0.07	0.00	0.9	2.31		
	0500	1200	5-14	98-36	27.1	29.4	32.088	8.30	4.58	0.04	4	0.07	0.00	0.9	2.28		
	1100	1800	4-36	99-45	28.0	29.7	32.235	8.31	4.49	0.04	3	0.05	0.00	0.8	2.28		
30	0500	1200	3-10	100-38	29.1	30.1	31.833	8.21	4.67	0.08	14	0.13	0.00	0.2	2.28		

Table 1 (continued).

Date	Time		Position		Air temp.	Water temp.	S ‰	pH	O ₂ cc/L	Phos- phate- P	Sili- cate- Si	Ni- trite- N	Ni- trate- N	Ammo- nia-N	Alkalin- ity meq/L	Current	
	GMT	LMT	Lat.	Long.	°C	μg-atoms/L						Dir.	Speed (Kn)				
Mar. 30	1100	1800	2-33N	101-28E	29.2	29.7	31.941	8.21	4.62	0.08	9	0.07	0.00	0.3	2.28		
31	0100	0800	1-10	103-47	28.5	29.6	32.505	8.26	4.42	0.06	6	0.14	3.17	0.4	2.31		
			Arrive in Singapore														
Apr. 8			Leave Singapore														
	1100	1800	1-46	105-21	28.9	29.1	33.534	8.33	4.81	0.04	4	0.04	0.00	0.3	2.35		
9	0100	0800	2-45	107-53	28.8	28.6	33.429	8.34	4.83	0.08	4	0.04	0.00	0.2	2.35		
	0500	1200	3-22	108-24	29.8	28.9	33.307	8.34	4.72	0.08	5	0.04	0.00	0.4	2.34		
	1100	1800	4-24	108-58	29.1	29.3	33.496	8.36	4.63	0.06	5	0.04	0.00	0.2	2.35		
10	0100	0800	6-50	110-17	28.7	28.5	33.991	8.30	4.72	0.00	2	0.04	0.00	0.9	2.38		
	0500	1200	7-29	110-44	29.3	28.7	34.043	8.30	4.78	0.00	2	0.04	0.00	1.3	2.38		
	1100	1800	8-30	111-18	29.1	28.7	33.882	8.31	4.46	0.00	2	0.04	0.00	0.8	2.36		
11	0000	0800	10-50	112-48	29.0	28.8	33.803	8.27	4.59	0.00	3	0.04	0.00	0.4	2.37		
	0400	1200	11-35	113-16	29.7	28.4	33.776	8.26	4.52	0.00	2	0.05	0.00	0.1	2.36		
	1000	1800	12-27	113-58	29.3	28.9	33.862	8.31	4.43	0.00	3	0.05	0.00	0.4	2.36		
12	0000	0800	14-34	115-52	28.7	28.7	33.943	8.31	4.53	0.08	2	0.04	0.00	0.1	2.37		
	0400	1200	15-05	116-26	29.0	28.7	33.014	8.32	4.46	0.19	1	0.04	0.00	0.0	2.37		
	1000	1800	15-59	117-20	27.6	28.8	33.930	8.32	4.39	0.19	2	0.04	0.00	0.0	2.36		
13	0000	0800	17-55	119-34	28.1	28.4	34.042	8.30	4.53	0.19	2	0.04	0.00	0.0	2.38		
	0400	1200	18-34	120-16	30.0	28.2	34.076	8.30	4.49	0.08	4	0.05	0.00	0.0	2.38		
	1000	1800	19-24	120-16	27.3	25.8	34.560	8.32	4.56	0.19	3	0.08	0.00	0.0	2.41		
14	0000	0800	21-15	123-13	24.7	25.6	34.714	8.33	4.63	0.06	1	0.02	0.00	0.2	2.43		
	0400	1200	21-46	123-51	25.5	25.4	34.776	8.33	4.66	0.06	2	0.04	0.00	0.3	2.43		
	1000	1800	22-34	124-39	25.1	24.8	34.951	8.34	4.69	0.08	1	0.03	0.00	0.4	2.43		

Table 1 (continued).

Date	Time		Position		Air temp.	Water temp.	S ‰	pH	O ₂ cc/L	Phos- phate- P	Sili- cate- Si	Ni- trite- N	Ni- trate- N	Ammo- nia-N	Alkalin- ity meq/L	Current	
	GMT	LMT	Lat.	Long.	°C					μg-atoms/L						Dir.	Speed (Kn)
Apr. 15	2300*	0800	24-39N	126-45E	24.0	23.0	34.962	8.37	4.83	0.08	1	0.02	0.00	0.3	2.43		
	0300	1200	25-15	127-23	24.1	23.4	34.929	8.37	4.82	0.08	1	0.00	0.02	0.8	2.43		
	0900	1800	26-07	128-27	23.1	22.6	34.897	8.36	4.89	0.08	2	0.02	0.00	0.5	2.43		
16	2300*	0800	28-13	130-44	21.5	20.2	34.856	8.37	5.08	0.08	2	0.02	0.00	0.4	2.43		
	0300	1200	28-48	131-10	22.4	22.6	34.866	8.39	4.87	0.06	2	0.04	0.00	0.4	2.43		
	0900	1800	29-45	132-04	21.6	20.4	34.873	8.37	5.09	0.08	3	0.04	0.00	0.5	2.42		
			Arrive in Tokyo														

* The time of the data of the preceding day.

Table 2. *Bathythermograph data.*

Station 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	26	Nov.	1977	0800	0800	31-34N	137-48E	22.3	22.3	22.3	22.3	22.3	22.3	22.2	21.3	19.2	16.5	14.1
2	27			0800	0800	27-58	134-19	23.3	23.3	23.3	23.3	23.3	23.3	23.3	22.6	21.1	19.3	18.3
3	27			1800	1800	25-52	133-35	24.8	24.8	24.8	24.8	24.8	24.8	23.5	22.5	21.4	19.5	18.2
4	28			0800	0800	22-52	132-36	27.2	27.2	27.2	27.2	27.4	27.5	25.3	23.7	23.0	20.4	19.2
5	28			1800	1800	20-44	131-55	27.2	27.2	27.2	27.2	27.2	27.2	27.2	25.3	24.3	24.3	19.9
6	29			0800	0800	17-46	130-47	27.6	27.6	27.6	27.6	27.6	27.6	26.3	24.7	23.7	20.5	18.1
7	29			1800	1800	15-54	130-07	27.6	27.5	27.1	26.8	25.9	25.1	24.4	23.7	22.0	18.1	16.3
8	30			0800	0800	13-16	129-16	28.0	27.9	27.9	27.9	27.7	27.8	27.6	25.8	24.1	20.3	16.0
9	30			1800	1800	11-28	128-34	28.9	28.9	28.9	28.9	28.7	27.9	26.8	25.4	24.2	18.5	14.4
10	1	Dec.		0900	0800	08-39	127-15	28.9	28.9	28.9	28.8	28.5	27.0	25.7	24.5	21.5	16.0	12.4
11	1			1900	1800	06-23	126-27	28.8	28.8	28.5	28.3	28.2	26.5	25.2	22.4	19.7	16.3	11.8
12	6			0900	0800	11-05S	115-01	28.9	28.9	27.6	26.9	26.1	22.9	22.1	20.3	18.0	13.4	11.9
13	6			1900	1800	12-56	114-37	29.7	29.2	28.7	27.9	25.9	24.8	23.3	20.6	20.0	16.5	13.9
14	7			0900	0800	15-34	114-13	28.1	28.1	27.7	27.7	27.7	25.8	23.7	22.5	20.6	18.5	15.6
15	7			1900	1800	17-33	114-00	28.8	28.1	27.7	27.5	26.4	25.1	24.4	23.6	22.0	19.3	17.6
16	8			0900	0800	20-31	113-19	25.5	25.2	25.0	24.5	24.3	23.9	23.5	23.0	22.1	20.5	17.8
17	8			1900	1800	22-42	112-57	24.4	24.4	23.8	23.4	22.7	22.2	21.6	21.4	20.8	19.4	19.6
	10			Arrive in Fremantle														
	16			Leave Fremantle														
18	16			1900	1800	32-28	114-24	21.0	20.8	20.4	20.2	19.2	17.8	17.0	16.3	15.9	14.8	14.1
19	17			1000	0800	34-06	114-41	19.4	19.4	19.4	19.4	16.8	15.8	15.5	14.8	14.1	12.9	12.7
20	17			2000	1800	35-02	111-26	19.0	19.0	19.0	18.8	17.5	16.8	15.7	15.2	14.9	12.7	9.8
21	18			1000	0800	37-17	108-58	16.9	16.9	16.9	16.4	14.8	13.5	13.1	12.8	12.4	11.8	11.4
22	18			2000	1800	38-43	108-13	15.7	15.4	15.3	15.3	14.5	13.1	13.0	12.9	12.7	12.0	12.9
23	19			1000	0800	41-10	107-01	13.1	13.1	13.0	12.8	12.4	12.0	10.5	10.1	9.8	10.5	10.5

Table 2 (continued).

Station 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
24	19	Dec.	1977	2000	1800	42-54S	106-05E	12.6	12.6	12.6	12.5	12.0	11.1	10.3	10.2	10.2	10.3	10.4
25	20			1000	0800	45-06	104-51	10.3	10.3	10.3	10.3	10.3	9.9	9.8	9.3	9.2	9.1	9.1
26	22			2000	1800	55-19	101-30	1.5	1.5	1.5	1.6	1.6	-0.2	-0.2	-0.3	0.0	1.3	1.9
27	23			2000	1800	58-25	98-02	0.8	0.8	0.8	0.8	-0.6	-0.6	-0.6	-0.6	-0.4	1.1	1.6
28	24			1100	0800	60-01	93-41	0.0	0.0	0.0	0.0	-0.4	-0.6	-0.6	-0.2	0.4	1.6	2.1
29	24			2000	1700	60-53	91-05	0.3	0.3	0.1	0.0	-0.7	-1.2	-1.2	-1.0	-0.9	0.6	1.7
	17	Jan.	1978	Arrive in Syowa Station														
	3	Feb.		Leave Syowa Station														
30	7	Mar.		1300	0800	29-54	53-42	23.6	23.6	23.6	23.4	23.2	20.7	18.5	17.7	16.4	15.5	15.2
31	9			1300	0800	21-56	56-36	26.9	26.9	26.9	26.9	25.6	23.9	22.2	20.9	20.0	17.9	16.3
	9			Arrive in Mauritius														
	16			Leave Mauritius														
32	16			2300	1800	19-19	58-28	27.5	27.5	27.5	27.5	26.6	24.4	23.0	21.9	21.0	19.4	17.6
33	17			1300	1800	17-59	60-44	27.4	27.4	27.2	27.3	27.3	26.1	24.2	22.8	22.0	20.0	19.1
34	17			2300	1800	17-00	12-11	27.9	27.9	27.9	27.9	27.8	26.1	23.7	22.3	21.6	19.2	18.1
35	18			1300	0800	15-33	64-12	27.6	27.6	27.5	27.5	25.9	24.9	23.1	22.8	21.9	19.2	16.8
36	18			2300	1800	14-17	65-20	27.8	27.8	27.8	27.8	27.4	23.9	23.0	21.5	20.3	18.3	16.6
37	19			1200	0800	12-49	67-01	27.8	27.8	26.7	24.3	22.8	22.1	20.6	17.9	16.5	14.4	13.3
38	21			1200	0800	09-05	75-12	28.6	28.6	28.6	28.6	28.6	24.2	20.6	19.1	17.6	14.8	13.4
39	21			2200	1800	07-56	76-44	28.6	28.6	28.6	28.6	25.0	20.9	18.4	16.8	15.8	12.9	11.9
40	22			1200	0800	06-18	89-52	28.7	28.7	28.7	28.6	23.9	20.5	17.4	15.0	13.6	11.4	
41	22			2200	1800	05-08	80-30	28.8	28.8	28.7	28.7	28.6	26.1	20.0	17.3	15.2	12.7	11.6
42	23			1100	0800	03-26	82-36	29.0	29.0	28.9	28.9	28.6	25.1	22.3	20.1	18.1	13.7	12.0
43	23			2100	1800	02-10	84-06	29.7	29.6	29.5	29.4	27.6	26.4	22.1	19.7	18.1	13.8	12.6
44	24			1100	0800	00-22	86-08	30.1	30.1	30.1	30.1	29.8	24.9	22.5	21.2	19.5	16.0	13.9

Table 2 (continued).

Station 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
45	24	Mar.	1978	2100	1800	00-51N	87-35E	30.2	30.2	30.3	30.0	29.5	27.2	24.4	20.5	17.2	14.4	12.7
46	25			1100	0800	02-14	89-17	29.7	29.7	29.6	29.2	29.0	27.8	21.3	18.8	16.2	13.9	12.4
47	25			2100	1800	03-03	90-33	30.1	30.1	30.1	30.0	29.3	27.8	21.4	15.8	14.6	13.6	12.6
48	26			1100	0800	04-08	92-18	29.7	29.7	29.7	29.5	27.4	25.7	17.7	16.1	14.6	12.7	11.9
49	26			2100	1800	04-56	93-26	29.1	27.0	24.5	23.6	22.2	19.5	16.7	15.9	14.1	12.6	11.5
50	27			1100	0800	06-07	94-54	29.5	29.5	29.3	28.9	27.0	24.1	23.2	22.2	16.9	14.4	12.8
51	27			2100	1800	06-09	96-17	29.8	29.8	28.5	26.6	24.3	22.7	18.1	15.3	14.3	12.9	12.5

Table 3. Vertical observation data.

Station 1

Date : December 17, 1977
 Time (GMT): 0130-0330
 (LMT): 0830-1030
 Latitude : 34-06S
 Longitude : 111-41E

Meteorological observation

Time (GMT) : 0100
 (LMT) : 0800
 Weather : Clear
 Air temperature : 19.0°C
 Atmospheric pressure: 1015.5 mb
 Wind direction: E
 velocity : 22 Kn
 Humidity : 79%
 Sea : 3
 Swell : ESE/4

Observed											Interpolated				
Depth (m)	T(°C)	S(‰)	pH	O ₂ (cc/L)	PO ₄ -P	SiO ₃ -Si	NO ₂ -N	NO ₃ -N	NH ₄ -N	Alkalinity	Depth (m)	T(°C)	S(‰)	σ_t	ΔD
					(μg-atoms/L)					(meq/L)					
0	19.40	35.685	8.29	5.20	0.08	1	0.04	0.08	0.49	2.46	0	19.40	35.685	25.46	0.000
10	19.44	35.784	8.27	5.29	0.06	3	0.08	0.24	0.81	2.46	10	19.44	35.784	25.52	0.025
15	19.39	35.792	8.30	5.27	0.06	13	0.09	0.11	0.60	2.48	20	19.40	35.793	25.54	0.050
23	19.41	35.792	8.28	5.30	0.10	5	0.08	0.17	0.43	2.47	30	19.37	35.794	25.55	0.074
35	19.22	35.792	8.30	5.28	0.12	4	0.20	0.17	0.21	2.48	50	17.64	35.736	25.94	0.120
55	17.05	35.713	8.30	5.42	0.10	3	0.17	0.17	1.06	2.48	75	16.10	35.645	26.24	0.168
70	16.32	35.667	8.30	5.36	0.19	3	0.23	0.18	0.26	2.48	100	15.42	35.570	26.34	0.213
85	15.71	35.603	8.29	5.32	0.27	2	0.20	1.40	0.32	2.47	125	14.95	35.516	26.40	0.255
107	15.32	35.559	8.30	5.38	0.27	1	0.08	1.66	0.57	2.46	150	14.32	35.433	26.47	0.296
143	14.52	35.462	8.27	5.38	0.27	3	0.07	2.70	0.30	2.47	200	14.13	35.251	26.58	0.375
178	13.54	35.317	8.26	5.45	0.40	2	0.07	3.60	0.38	2.48	250	12.11	35.089	26.66	0.449
215	12.88	35.209	8.27	5.55	0.38	1	0.05	3.92	0.32	2.45	300	11.03	34.930	26.74	0.520
285	11.33	34.972	8.22	5.48	0.69	10	0.09	7.12	0.26	2.44	400	9.72	34.750	26.83	0.656
358	10.07	34.802	8.17	5.56	0.92	7	0.04	8.50	0.74	2.44	500	9.10	34.662	26.86	0.786
430	9.54	34.724	8.14	5.50	0.98	48	0.07	9.18	0.68	2.44	600	8.31	34.577	26.92	0.914
575	8.55	34.600	8.15	5.21	1.17	11	0.13	16.20	0.77	2.45	700	7.17	34.488	27.01	1.035
720	6.91	34.471	8.19	4.66	1.65	18	0.04	20.94	0.21	2.45	800	5.73	34.409	27.14	1.145
864	4.86	34.376	8.03	4.47	1.83	37	0.08	27.57	0.19	2.45	900	4.59	34.380	27.25	1.243
1084	3.83	34.453	7.98	3.62	2.17	74	0.04	30.68	0.26	2.48	1000	4.05	34.408	27.33	1.331
1467	2.98	34.578	7.96	3.42	2.40	84	0.08	32.28	0.26	2.48	1250	3.37	34.510	27.48	1.524
1926	2.36	34.676	7.98	3.80	2.23	101	0.22	24.92	0.21	2.49	1500	2.92	34.587	27.59	1.689
											1750	2.55	34.645	27.66	1.833

Table 3 (continued).

Station 2

Date : December 23, 1977
 Time (GMT): 0130-0430
 (LMT): 0830-1130
 Latitude : 57-40S
 Longitude : 99-49E

Meteorological observation

Time (GMT) : 0100
 (LMT) : 0800
 Weather : Clear
 Air temperature : 1.1°C
 Atmospheric pressure: 963.7 mb
 Wind direction: NNW
 velocity : 10 Kn
 Humidity : 90%
 Sea : 3
 Swell : W/4

Observed											Interpolated				
Depth (m)	T(°C)	S(‰)	pH	O ₂ (cc/L)	PO ₄ -P	SiO ₃ -Si	NO ₂ -N	NO ₃ -N	NH ₄ -N	Alkalinity	Depth (m)	T(°C)	S(‰)	σ_t	ΔD
					(μg-atoms/L)					(meq/L)					
0	0.90	33.862	8.30	7.73	1.81	37	0.29	27.13	0.25	2.43	0	0.90	33.862	27.16	0.000
10	0.90	33.889	8.29	7.90	1.79	37	0.28	28.15	0.13	2.42	10	0.90	33.889	27.18	0.009
19	0.79	33.894	8.31	7.86	1.82	37	0.38	23.28	0.09	2.42	20	0.79	33.893	27.19	0.018
29	0.79	33.883	8.30	7.86	1.77	35	0.37	18.73	0.09	2.42	30	0.80	33.883	27.18	0.027
49	0.77	33.897	8.31	7.85	1.77	35	0.43	20.97	0.16	2.42	50	0.74	33.899	27.20	0.045
74	-0.13	33.934	8.31	8.09	1.77	35	0.28	20.08	0.13	2.42	75	-0.15	33.934	27.28	0.066
98	-0.37	33.942	8.31	8.09	1.81	35	0.29	20.91	0.32	2.43	100	-0.41	33.942	27.29	0.085
121	-0.64	33.960	8.30	7.90	1.87	39	0.28	27.59	0.44	2.44	125	-0.61	33.973	27.33	0.105
144	-0.31	34.061	8.25	7.19	1.98	48	0.25	33.81	0.25	2.43	150	-0.15	34.114	27.42	0.122
192	1.04	34.425	8.16	5.34	2.25	64	0.04	29.45	0.25	2.44	200	1.18	34.414	27.59	0.152
238	1.63	34.331	8.11	4.57	2.31	77	0.04	25.48	0.06	2.45	250	1.70	34.370	27.51	0.180
285	1.81	34.518	8.11	4.28	2.25	81	0.03	24.70	0.31	2.46	300	1.85	34.545	27.64	0.206
379	1.93	34.601	8.12	4.25	2.25	87	0.05	24.26	0.25	2.47	400	1.93	34.616	27.69	0.251
473	1.91	34.658	8.11	4.24	2.21	98	0.03	23.38	0.19	2.46	500	1.91	34.670	27.74	0.292
567	1.90	34.693	8.12	4.34	2.17	81	0.01	30.10	0.38	2.46	600	1.89	34.700	27.76	0.331
754	1.83	34.720	8.14	4.40	2.06	95	0.04	31.44	0.16	2.47	700	1.86	34.716	27.78	0.367
942	1.68	34.736	8.15	4.50	2.02	96	0.01	25.92	0.25	2.48	800	1.80	34.725	27.79	0.403
1129	1.52	34.741	8.17	4.55	1.96	103	0.01	22.02	0.28	2.48	900	1.72	34.733	27.80	0.438
1414	1.29	34.734	8.16	4.63	2.08	69	0.01	22.25	0.06	2.48	1000	1.63	34.739	27.81	0.472
1902	0.88	34.712	8.16	4.76	2.08	121	0.02	21.92	0.03	2.48	1250	1.42	34.739	27.83	0.554
2399	0.52	34.694	8.14	4.91	2.21	132	0.07	21.94	0.22	2.49	1500	1.22	34.730	27.84	0.634
2882	0.22	34.685	8.14	5.12	2.17	139	0.03	30.64	0.50	2.48	1750	1.01	34.719	27.84	0.712
3365	0.03	34.677	8.13	5.24	2.06	140	0.04	32.62	0.28	2.48	2000	0.81	34.708	27.85	0.788
3847	-0.05	34.677	8.13	5.39	2.08	137	0.21	27.45	0.97	2.49	2500	0.45	34.692	27.85	0.932
											3000	0.16	34.683	27.86	1.062
											3500	-0.00	34.676	27.87	1.182

Table 3 (continued).

Station 3

Date : February 26, 1978
 Time (GMT): 0610-0810
 (LMT): 0810-1010
 Latitude : 65-28S
 Longitude : 36-41E

Meteorological observation

Time (GMT) : 0600
 (LMT) : 0800
 Weather : Cloudy
 Air temperature : 1.5°C
 Atmospheric pressure: 973.5 mb
 Wind direction: SSW
 velocity : 10 Kn
 Humidity : 84%
 Sea : 2
 Swell : ENE/4

Observed											Interpolated				
Depth (m)	T(°C)	S(‰)	pH	O ₂ (cc/L)	PO ₄ -P	SiO ₃ -Si	NO ₂ -N	NO ₃ -N	NH ₄ -N	Alkalinity	Depth (m)	T(°C)	S(‰)	σ_t	ΔD
					(μ g-atoms/L)					(meq/L)					
0	1.80	34.038	8.11	7.41	1.75	58	0.35	17.35	0.00	2.42	0	1.80	34.038	27.24	0.000
10	1.71	33.979	8.10	7.44	1.85	55	0.37	20.73	0.25	2.42	10	1.71	33.979	27.20	0.009
20	1.69	33.972	8.11	7.39	1.81	52	0.41	22.00	0.06	2.42	20	1.69	33.972	27.20	0.017
30	1.68	33.981	8.11	7.41	1.81	53	0.41	22.22	0.03	2.42	30	1.68	33.981	27.20	0.026
49	1.59	34.034	8.11	7.45	1.75	57	0.44	17.44	0.75	2.43	50	1.47	34.038	27.26	0.043
74	-1.51	34.205	8.11	7.28	1.90	57	0.28	21.49	1.17	2.45	75	-1.55	34.222	27.56	0.060
98	-1.28	34.559	8.01	4.83	2.17	90	0.14	24.22	0.94	2.45	100	-1.09	34.563	27.82	0.070
122	1.05	34.546	7.94	4.34	2.21	98	0.22	20.39	1.25	2.47	125	1.14	34.554	27.70	0.079
145	1.27	34.615	7.91	4.24	2.15	100	0.06	25.43	0.47	2.46	150	1.29	34.622	27.74	0.089
198	1.36	34.651	7.91	4.27	2.17	103	0.03	21.80	—	2.46	200	1.36	34.652	27.76	0.106
239	1.37	34.673	7.89	4.25	2.21	104	0.03	23.09	0.25	2.46	250	1.37	34.677	27.78	0.124
286	1.37	34.688	7.91	4.29	2.06	103	0.02	22.81	0.28	2.47	300	1.36	34.691	27.79	0.140
381	1.31	34.706	7.93	4.37	2.17	107	0.06	26.29	0.31	2.46	400	1.30	34.708	27.81	0.172
475	1.27	34.714	7.93	4.40	2.21	110	0.03	27.63	0.69	2.46	500	1.24	34.716	27.82	0.202
571	1.16	34.721	7.93	4.45	2.06	114	0.10	28.57	0.44	2.48	600	1.13	34.721	27.83	0.232
763	0.99	34.714	7.97	4.51	2.06	120	0.04	20.48	0.81	2.48	700	1.04	34.718	27.84	0.261
956	0.82	34.709	7.98	4.56	2.15	123	0.10	24.02	0.53	2.47	800	0.96	34.713	27.84	0.290
1151	0.64	34.703	7.99	4.58	2.16	129	0.10	28.88	0.25	2.48	900	0.87	34.710	27.84	0.319
1444	0.50	34.698	7.98	4.61	2.00	132	0.06	20.74	0.00	2.48	1000	0.78	34.708	27.85	0.347
1923	0.31	34.685	7.97	4.78	2.21	135	0.05	27.70	0.00	2.47	1250	0.58	34.701	27.85	0.416
2390	0.09	34.682	7.97	4.96	2.21	137	0.04	23.99	0.00	2.47	1500	0.47	34.696	27.86	0.484
2873	-0.07	34.673	7.95	5.20	2.13	138	0.08	21.74	0.11	2.47	1750	0.38	34.689	27.86	0.551
											2000	0.27	34.684	27.86	0.616
											2500	0.05	34.686	27.87	0.740

Katsuyuki Oda and Masakatsu Nobukuni

[南極資料]

Table 3 (continued).

Station 4

Date : February 27, 1978
 Time (GMT): 0620-0815
 (LMT): 0820-1015
 Latitude : 61-31S
 Longitude : 37-04E

Meteorological observation

Time (GMT) : 0600
 (LMT) : 0800
 Weather : Snow
 Air temperature : 1.6°C
 Atmospheric pressure: 972.9 mb
 Wind direction: ENE
 velocity : 25 Kn
 Humidity : 86%
 Sea : 4
 Swell : ENE/4

Observed											Interpolated				
Depth (m)	T (°C)	S (‰)	pH	O ₂ (cc/L)	PO ₄ -P	SiO ₃ -Si	NO ₂ -N	NO ₃ -N	NH ₄ -N	Alkalinity	Depth (m)	T (°C)	S (‰)	σ_t	ΔD
					(μ g-atoms/L)					(meq/L)					
0	2.20	34.085	8.12	7.19	1.77	48	0.41	19.23	1.17	2.42	0	2.20	34.085	27.25	0.000
8	2.21	33.963	8.09	7.38	1.62	39	0.44	18.58	0.00	2.42	10	2.22	33.954	27.14	0.009
17	2.23	33.949	8.16	7.39	1.67	45	0.44	23.40	0.00	2.42	20	2.22	33.945	27.13	0.018
26	2.20	33.940	8.12	7.30	1.63	44	0.41	19.90	0.03	2.42	30	2.28	33.936	27.12	0.028
43	2.22	33.943	8.14	7.30	1.60	44	0.50	17.52	0.00	2.42	50	1.46	33.980	27.22	0.046
65	-0.26	34.065	8.12	7.91	1.73	50	0.23	22.34	0.00	2.42	75	-0.54	34.084	27.41	0.065
87	-0.51	34.095	8.11	7.71	1.85	54	0.29	23.93	0.00	2.43	100	-0.44	34.117	27.44	0.082
106	-0.39	34.129	8.09	7.44	1.85	58	0.41	19.59	0.00	2.43	125	-0.42	34.178	27.48	0.097
127	-0.41	34.184	8.06	6.96	1.98	64	0.26	25.51	0.00	2.43	150	0.40	34.300	27.54	0.112
170	1.21	34.406	7.95	4.89	2.31	84	0.04	26.26	0.00	2.44	200	1.51	34.503	27.63	0.138
210	1.53	34.525	7.91	4.33	2.35	90	0.04	25.82	0.00	2.45	250	1.70	34.569	27.67	0.160
252	1.70	34.570	7.91	4.06	2.25	82	0.04	24.10	0.00	2.45	300	1.76	34.607	27.70	0.182
330	1.75	34.624	7.91	4.03	2.17	97	0.04	28.26	0.00	2.45	400	1.75	34.650	27.73	0.222
413	1.74	34.654	7.92	4.10	2.21	99	0.04	27.82	0.00	2.46	500	1.67	34.685	27.77	0.259
490	1.67	34.681	7.95	4.12	2.08	101	0.04	21.85	0.00	2.46	600	1.64	34.722	27.80	0.294
653	1.62	34.736	7.97	4.34	2.10	101	0.06	20.75	0.00	2.47	700	1.58	34.737	27.82	0.327
820	1.45	34.725	7.98	4.44	2.16	104	0.06	26.04	0.00	2.47	800	1.48	34.728	27.82	0.359
983	1.22	34.710	7.97	4.51	2.06	110	0.05	27.26	0.00	2.47	900	1.34	34.717	27.82	0.391
1230	1.01	34.720	7.97	4.60	2.02	115	0.04	20.24	0.00	2.47	1000	1.20	34.710	27.82	0.423
1655	0.66	34.696	7.95	4.64	2.25	129	0.08	29.87	0.00	2.47	1250	0.99	34.720	27.84	0.500
2085	0.43	34.700	7.96	4.70	2.21	135	0.04	28.12	0.00	2.47	1500	0.78	34.706	27.85	0.573
2566	0.23	34.688	7.93	4.86	2.19	137	0.06	22.21	0.00	2.47	1750	0.60	34.696	27.85	0.645
											2000	0.47	34.699	27.86	0.714
											2500	0.25	34.691	27.86	0.844

Table 3 (continued).

Station 5

Date : March 1, 1978
 Time (GMT): 0520-0715
 (LMT): 0820-1015
 Latitude : 55-24S
 Longitude : 41-34E

Meteorological observation

Time (GMT) : 0500
 (LMT) : 0800
 Weather : Cloudy
 Air temperature : 3.5°C
 Atmospheric pressure: 1010.4 mb
 Wind direction: N
 velocity : 23 Kn
 Humidity : 85%
 Sea : 4
 Swell : W/4

Observed											Interpolated				
Depth (m)	T(°C)	S(‰)	pH	O ₂ (cc/L)	PO ₄ -P	SiO ₃ -Si	NO ₂ -N	NO ₃ -N	NH ₄ -N	Alkalinity	Depth (m)	T(°C)	S(‰)	σ_t	ΔD
					(μg-atoms/L)					(meq/L)					
0	2.80	34.077	8.17	7.98	1.19	40	0.13	10.24	0.00	2.43	0	2.80	34.077	27.19	0.000
5	2.88	34.105	8.17	7.11	1.50	29	0.44	6.05	0.00	2.44	10	2.88	34.049	27.16	0.009
11	2.87	34.036	8.17	7.20	1.58	28	0.42	9.81	0.00	2.44	20	2.83	34.037	27.16	0.018
19	2.83	34.037	8.18	7.25	1.54	28	0.39	5.57	0.00	2.44	30	2.85	34.040	27.16	0.027
32	2.86	34.040	8.19	7.14	1.63	29	0.39	16.10	0.00	2.43	50	2.83	34.036	27.15	0.046
50	2.83	34.036	8.18	7.15	1.62	29	0.36	17.83	0.00	2.44	75	2.86	34.036	27.15	0.009
66	2.85	34.030	8.18	7.18	1.58	31	0.42	16.02	0.00	2.42	100	2.42	34.049	27.20	0.092
79	2.85	34.039	8.18	7.25	1.73	28	0.36	12.66	0.00	2.44	125	1.01	34.120	27.36	0.112
96	2.64	34.039	8.19	7.19	1.63	29	0.37	20.20	0.24	2.44	150	0.59	34.158	27.42	0.129
128	0.80	34.130	8.11	6.81	1.98	56	0.31	17.50	0.00	2.43	200	1.12	34.262	27.47	0.162
160	0.65	34.169	8.09	6.60	1.98	61	0.24	20.43	0.00	2.43	250	1.43	34.364	27.53	0.192
190	1.04	34.240	8.06	5.86	2.15	66	0.15	22.01	0.00	2.45	300	1.78	34.454	27.57	0.220
241	1.36	34.345	7.99	5.04	2.37	75	0.07	27.18	0.00	2.45	400	1.98	34.514	27.61	0.272
298	1.77	34.452	7.97	4.19	2.35	83	0.10	24.96	0.00	2.46	500	1.86	34.545	27.64	0.321
360	1.99	34.500	7.94	3.97	2.40	86	0.11	24.85	0.00	2.45	600	1.85	34.601	27.69	0.368
469	1.87	34.532	7.96	4.00	2.31	92	0.11	25.24	0.00	2.46	700	1.79	34.657	27.74	0.410
574	1.86	34.583	7.96	4.01	2.19	86	0.08	28.17	0.00	2.47	800	1.73	34.678	27.76	0.449
663	1.81	34.643	8.00	4.02	2.13	98	0.10	19.33	0.00	2.47	900	1.68	34.689	27.77	0.486
780	1.73	34.675	7.99	4.19	2.15	96	0.08	17.45	0.00	2.47	1000	1.54	34.697	27.79	0.553
966	1.63	34.693	7.99	4.34	2.06	98	0.12	22.58	0.00	2.47	1250	1.15	34.725	27.84	0.606
1160	1.55	34.716	7.97	4.46	1.98	101	0.18	18.30	0.00	2.47					
1350	1.32	34.734	7.99	4.51	2.02	110	0.08	19.15	0.00	2.47					

Table 4. Expendable bathythermograph data.

Station No.	1*	2	3	4	5	6	7	8	9	10	11	12
Date	1977											
Time (GMT)	Dec. 2	Dec. 19	Dec. 20	Dec. 21	Dec. 21	Dec. 22	Dec. 25	Dec. 25	Dec. 26	Dec. 26	Dec. 27	Dec. 27
(LMT)	10-00	00-00	11-00	01-00	11-00	01-00	02-00	12-00	03-00	13-00	04-00	14-00
Latitude	18-00	08-00	18-00	08-00	18-00	08-00	08-00	18-00	08-00	18-00	08-00	18-00
Longitude	02-48N	41-10 S	46-37 S	48-55 S	50-40 S	53-26 S	62-26 S	63-54 S	64-32 S	64-50 S	64-57 S	64-53 S
	122-27 E	107-01 E	103-54 E	102-54 E	102-14 E	102-13 E	86-20 E	83-30 E	76-49 E	72-06 E	65-05 E	60-30 E
0 m	29.1	13.1	9.5	6.1	4.6	3.1	0.8	0.3	1.0	1.6	0.5	0.7
10	29.1	13.1	9.5	6.0	4.6	3.1	0.0	-0.7	0.5	0.6	-0.5	-0.1
20	29.1	13.0	9.5	6.0	4.6	3.1	-0.6	-0.9	-0.1	-0.4	-1.0	-0.6
30	29.0	12.6	9.5	6.0	4.6	3.1	-1.2	-1.4	-0.8	-1.5	-1.3	-0.8
50	27.7	12.4	9.5	6.0	4.0	2.7	-1.4	-1.7	-1.2	-1.7	-1.5	-1.6
75	26.4	11.0	9.3	5.6	3.5	2.3	-1.4	-0.7	-1.3	-1.8	-1.5	-1.0
100	22.8	10.1	8.8	5.2	2.7	1.8	-1.4	0.4	-1.2	-1.8	-1.5	0.5
125	22.8	10.1	8.4	4.5	2.3	1.4	-1.0	-0.3	-0.8	-1.3	-1.5	1.4
150	19.1	10.2	8.1	4.0	2.0	1.0	0.0	-0.8	-0.1	-0.1	-1.5	1.5
200	15.5	10.3	7.4	4.2	2.0	1.9	0.9	-0.2	0.9	-0.2	-1.2	1.7
250	13.1	10.3	7.2	3.9	2.4	2.0	1.3	1.1	1.3	0.9	-0.2	1.7
300	10.7	10.3	6.6	3.9	2.5	2.0	0.9	0.9	1.5	0.7	0.2	1.7
350	9.5	9.9	6.8	3.9	2.4	2.0	1.3	0.9	1.6	0.9	0.3	1.7
400	8.9	9.6	6.6	3.6	2.4	2.0	1.4	0.6	1.6	0.9	0.8	1.7
450	7.6	9.3	6.1	3.2	2.4	2.0	1.4	0.7	1.7	1.1	0.9	1.7
500	7.3	8.9	5.1	2.9	2.4	1.9	1.3	1.2	1.6	1.1	0.9	1.7
600												
700												
800												
900												
1000												
1100												
1200												
1300												
1400												
1500												
1600												
1700												
1800												
1900												
2000												

* In the Celebes Sea.

Table 4 (continued).

Station No.	13	14	15	16	17	18	19	20	21	22	23	24
Date	1977		1978									
Time (GMT)	Dec. 28	Dec. 29	Feb. 23	Feb. 24	Feb. 24	Feb. 26	Feb. 26	Feb. 27	Feb. 27	Feb. 28	Feb. 28	Mar. 1
Time (LMT)	05-00	05-00	15-00	02-00	15-00	05-00	15-00	05-00	15-00	09-00	15-00	05-00
Latitude	08-00	08-00	18-00	05-00	18-00	08-00	18-00	08-00	18-00	12-00	18-00	08-00
Longitude	65-11 S	65-39 S	67-45 S	67-52 S	67-46 S	65-28 S	64-13 S	61-31 S	60-12 S	57-33 S	56-45 S	55-24 S
	53-23 E	48-53 E	34-01 E	33-44 E	33-54 E	36-41 E	36-59 E	37-04 E	37-06 E	39-42 E	41-14 E	41-34 E
0 m	-0.1	-1.1	-1.2	-1.2	-1.2	1.8	1.7	2.0	2.2	2.3	2.5	2.6
10	-0.1	-1.1	-1.3	-1.1	-1.3	1.7	1.6	2.0	2.1	2.3	2.4	2.5
20	-0.2	-1.1	-1.5	-1.1	-1.4	1.6	1.6	1.9	2.0	2.2	2.3	2.5
30	-0.6	-1.5	-1.7	-1.3	-1.7	1.6	1.6	1.9	2.0	2.2	2.2	2.4
50	-1.0	-1.6	-1.8	-1.6	-1.7	1.6	0.9	1.9	1.9	2.1	2.2	2.4
75	-1.0	-1.7	-1.8	-1.6	-1.7	-1.5	-1.8	-1.4	-1.1	2.1	2.2	2.4
100	-1.0	-1.7	-1.8	-1.6	-1.7	-0.2	-1.4	-1.2	-1.3	-0.9	-0.5	1.7
125	-1.0	-1.7	-1.7	-1.6	-1.7	0.9	0.2	-1.4	-1.4	-1.0	-0.6	0.6
150	-1.0	-1.7	-1.6	-1.6	-1.7	1.2	0.8	-0.6	0.2	-0.9	-0.6	0.7
200	-0.2	-1.7	-1.4	-1.6	-1.1	1.4	1.0	1.0	1.3	0.3	0.7	1.3
250	-0.2	-0.4	-0.8	-1.5	-0.6	1.4	1.1	1.4	1.6	1.5	1.4	1.7
300	1.0	0.9	-0.1	-0.8	0.1	1.4	1.1	1.4	1.7	1.6	1.6	1.6
350	1.5	1.2	0.2	-0.2	0.2	1.3	1.1	1.5	1.7	1.7	1.6	1.7
400	1.4	1.3	0.4	0.1	0.3	1.3	1.1	1.5	1.7	1.7	1.6	1.7
450	1.3	1.3	0.5	0.4	0.3	1.3	1.1	1.5	1.8	1.7	1.6	1.8
500	1.3	1.3	0.5	0.5	0.4	1.2	1.0	1.5	1.9	1.7	1.6	1.9
600			0.5	0.5	0.5	1.1	0.9	1.5	1.8	1.7	1.6	1.8
700			0.5	0.3	0.4	1.0	0.8	1.3	1.8	1.7	1.6	1.7
800			0.4	0.3	0.3	0.9	0.7	1.3	1.7	1.6	1.6	1.7
900			0.3	0.4	0.2	0.8	0.6	1.1	1.5	1.4	1.5	1.6
1000			0.2	0.4	0.2	0.7	0.6	1.0	1.4	1.3	1.5	1.5
1100			0.1	0.4	0.1	0.7	0.5	0.9	1.4	1.3	1.4	1.4
1200			0.0	0.4	0.0	0.6	0.4	0.8	1.2	1.1	1.3	1.4
1300				0.4	0.0	0.5	0.4	0.7	1.2	1.0	1.2	1.3
1400				0.4	0.0	0.5	0.4	0.6	1.1	0.9	1.1	1.2
1500				0.4	0.0	0.5	0.3	0.5	1.0	0.8	1.0	1.1
1600				0.4	0.1	0.4	0.3	0.5	1.0	0.8	1.0	1.0
1700				0.4	0.1	0.4	0.2	0.5	1.0	0.7	0.9	0.9
1800				0.4		0.3	0.1	0.4	1.0	0.7	0.8	0.9
1900				0.3		0.2	0.1	0.3	0.9		0.7	0.8
2000				0.3		0.2	0.1	0.3	0.9		0.6	0.7

Table 4 (continued).

Station No.	25	26	27	28	29	30	31	32	33	34	35
Date	1978										
Time (GMT)	Mar. 1	Mar. 2	Mar. 3	Mar. 3	Mar. 4	Mar. 4	Mar. 5	Mar. 6	Mar. 6	Mar. 7	Mar. 8
(LMT)	15-00	15-00	05-00	15-00	05-00	15-00	15-00	04-00	14-00	14-00	04-00
Latitude	18-00	18-00	08-00	18-00	08-00	18-00	18-00	08-00	18-00	18-00	08-00
Longitude	55-14 S	51-49 S	49-16 S	46-57 S	43-45 S	41-23 S	36-56 S	34-29 S	32-33 S	28-04 S	25-49 S
	41-01 E	42-05 E	43-49 E	45-12 E	47-00 E	48-24 E	50-56 E	52-12 E	52-53 E	54-14 E	54-28 E
0 m	3.6	3.7	5.5	7.1	7.8	15.3	19.6	22.1	22.5	24.4	26.1
10	4.2	3.7	5.5	7.1	7.9	15.3	19.6	22.3	22.3	24.9	26.6
20	4.1	3.6	5.5	7.0	7.8	15.1	19.6	22.4	22.3	25.0	26.6
30	3.9	3.6	5.5	6.9	7.2	14.6	19.1	22.5	22.2	24.8	26.7
50	3.9	3.5	5.4	6.4	7.1	14.6	18.7	19.6	20.2	24.2	26.9
75	3.3	3.5	4.3	6.0	6.6	14.6	17.3	17.3	16.7	18.9	22.6
100	2.0	3.5	3.8	5.6	4.9	13.9	16.8	16.3	15.7	17.0	20.6
125	1.9	2.9	3.8	5.0	4.0	13.1	16.4	16.0	15.2	16.3	19.2
150	2.3	1.0	3.6	4.6	3.6	12.8	16.2	16.0	14.8	15.7	18.2
200	2.5	0.9	3.5	4.3	3.4	11.6	15.9	15.6	14.3	14.8	16.7
250	2.6	1.4	3.4	4.3	3.5	11.0	15.7	15.3	13.7	14.1	15.6
300	2.3	1.6	3.2	4.1	3.3	10.5	15.3	14.8	13.3	13.6	14.6
350	2.7	1.8	2.8	3.8	3.1	9.6	15.0	14.4	12.8	13.1	13.7
400	2.7	1.9	2.7	3.6	3.0	8.8	14.6	14.0	12.5	12.8	12.9
450	2.7	1.9	2.6	3.4	3.2	8.4	14.0	13.4	12.2	12.3	12.4
500	2.7	2.0	2.6	3.1			13.6	12.8	11.7	11.9	11.8
600	2.7	2.0	2.6	2.9							
700	2.7	2.0	2.7	2.8							
800	2.6	2.0	2.7	2.7							
900	2.6	1.9	2.7	2.7							
1000	2.6	1.9	2.6	2.6							
1100	2.5	1.8	2.6	2.5							
1200	2.4	1.7	2.6	2.5							
1300	2.3	1.7	2.6	2.5							
1400	2.3	1.6	2.6	2.4							
1500	2.2	1.4	2.5	2.4							
1600	2.1	1.4	2.4	2.4							
1700	2.0	1.2	2.4	2.4							
1800	1.9	1.2	2.4	2.4							
1900	1.9	1.1	2.3	2.4							
2000	1.7	1.0	2.2	2.3							