Preliminary Report
of
The Hakuhō Maru Cruise KH-70-1

February 3 - March 5, 1970
Western North Pacific

Ocean Research Institute
University of Tokyo
1971

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By
The Scientific Members of the Expedition
Edited by
Yoshio Horibe

Contents

1. Scientists Aboard

HORIBE, Yoshio	Ocean Res. Inst.	Isotope oceanography
TERAMOTO, Toshihiko	Ocean Res. Inst.	Physical oceanography
AKIBA, Yoshio	Hokkaido Univ.	Physical oceanography
SUGIMURA, Yukio	Meteorol. Res. Inst.	Nuclear oceanography
NAKAI, Toshisuke	Ocean Res. Inst.	Physical oceanography
YAMAMOTO, Katsumi	Kobe Marine Observatory	Chemical oceanography
TSUNOGAI, Shizuo	Hokkaido Univ.	Analytical chemistry
SHIGEHARA, Koji	Ocean Res. Inst.	Isotope oceanography
MAEDA, Akio	Ocean Res. Inst.	Physical oceanography
SUGIMORI, Yasuhiro	Ocean Res. Inst.	Physical oceanography
MORITA, Yasuhiro	Res. Inst. Atmospherics	Physics
SAKURAI, Masahito	Ocean Res. Inst.	Physical oceanography
OTOBE, Hirotaka	Ocean Res. Inst.	Physical oceanography
TORIYAMA, Noriji	Res. Inst. Atmospherics	Physics
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MAYEDA, Masaru	Tokyo Kyoiku Univ.	Chemical oceanography
YASUJIMA, Tadahide	Tokyo Kyoiku Univ.	Chemical oceanography
SUGINOHARA, Nobuo	Univ. Tokyo	Physical oceanography
SHISHIDO, Masaaki	Univ. Tokyo	Physical oceanography
NAGASHIMA, Hideki	Univ. Tokyo	Physical oceanography
SATO, Hideo	Kyoto Univ.	Physical oceanography
YOSHIOKA, Hiroshi	Kyoto Univ.	Physical oceanography
WAKATUTI, Masaaki	Hokkaido Univ.	Physical oceanography
TAKASUGI, Yoshio	Tokyo Fisheries Univ.	Physical oceanography
NOZAKI, Yoshiyuki	Hokkaido Univ.	Chemical oceanography

2. Outline of the Expedition

The main purpose of the expedition was to take physical data and water samples for the physical and chemical studies of the intermediate and deep waters of the North Pacific in the region north of 30°N at winter time. Unfortunately the weather in February of 1970 was exceptionally too bad to go up to north, and we heard the tragedy of S.S."California" just after we left station H-2. We struggled with waves higher than the bridge of our R.V."Hakuhō Maru", and we were forced to abundon our plan to go up to north of 40°N.

The standard hydrocasts were done at eleven stations - every 180 miles - from 40°N to 9°N along 158°E longitude, and S.T.D. hydrocasts were done at 27 stations between 34°20'N and 10°30'N as were shown in Figure 1.

3. Hydrocasts

by

Chemistry Group

Details of hydrocast procedures, and analytical methods of salinity, dissolved oxygen, silicate, phosphate, nitrite and nitrate were the same as were described in "Preliminary Report of the "Hakuhō Maru" Cruise KH-68-4" (edited by Y. Horibe, Ocean Research Institute, University of Tokyo, 1970). pH and alkalinity were determined by the method of Strickland and Parsons (A Practical Handbook of Seawater Analysis, Fisheries Research Board of Canada, Ottawa, 1968). Stations of hydrocasts are tabulated in Table 1, and the cross sections of temperature, salinity, σ_t, dissolved oxygen, pH, total alkalinity, silicate-Si, phosphate-P, nitrite, and nitrate are shown in Figures 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11, respectively. Detail data are tabulated in Appendix I.

4. S.T.D. Observation

by

Physics Group

An *in situ* S.T.D System (Bissett-Berman Model 9006) was used for the preliminary examination of the subtropical Countercurrent. Observations were done at 27 stations along 158°E longitude, and the depth-temperature-salinity data at each station are tabulated in Appendix II.

Results: Temperature and salinity sections along 158°E are shown in Figures 12 and 13, respectively.

Temperature section. A thermocline undulates southward from about 25°N with a wave length of about 90 miles. This suggests the existence of a banded zonal system of easterly and westerly currents, 40 to 50 miles in breadth. The Subtropical Mode Water is developed in the region north of 28°N.

Salinity section. A main feature seems normal as that of meridional salinity sections in the region in question. A halocline undulates in a similar manner to the termocline. A salinity minimum lies on an isanosteric surface very close to 130 cl/t, although the surface of salinity minimum coincides with an isanosteric surface of slightly higher value in a region south of 25°N.

Table 1. Hydrocast stations

Station No.	Position		Depth (m)
	Longitude	Latitude	
H 1	157°56'E	30°11'N	5,600
H 2	158°05'E	33°06'N	3,300
H 3	158°05'E	35°59'N	3,400
H 4	157°58'E	40°00'N	5,350
H 5	158°00'E	26°59'N	5,865
H 6	158°02'E	24°02'N	5,410
H 7	157°54'E	20°52'N	5,500
H 8	158°00'E	18°01'N	5,700
H 9	157°59'E	15°04'N	5,830
H 10	158°02'E	12°01'N	5,855
H 11	157°57'E	09°05'N	4,900

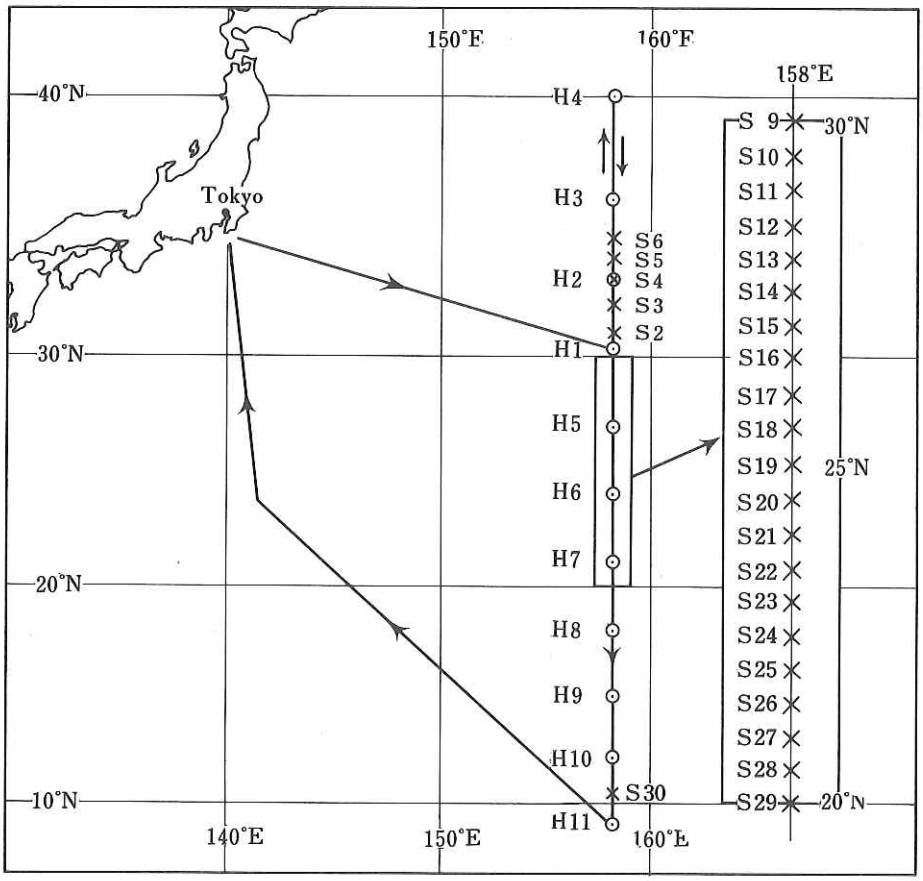

Fig. 1. Hydrographic and S.T.D. stations

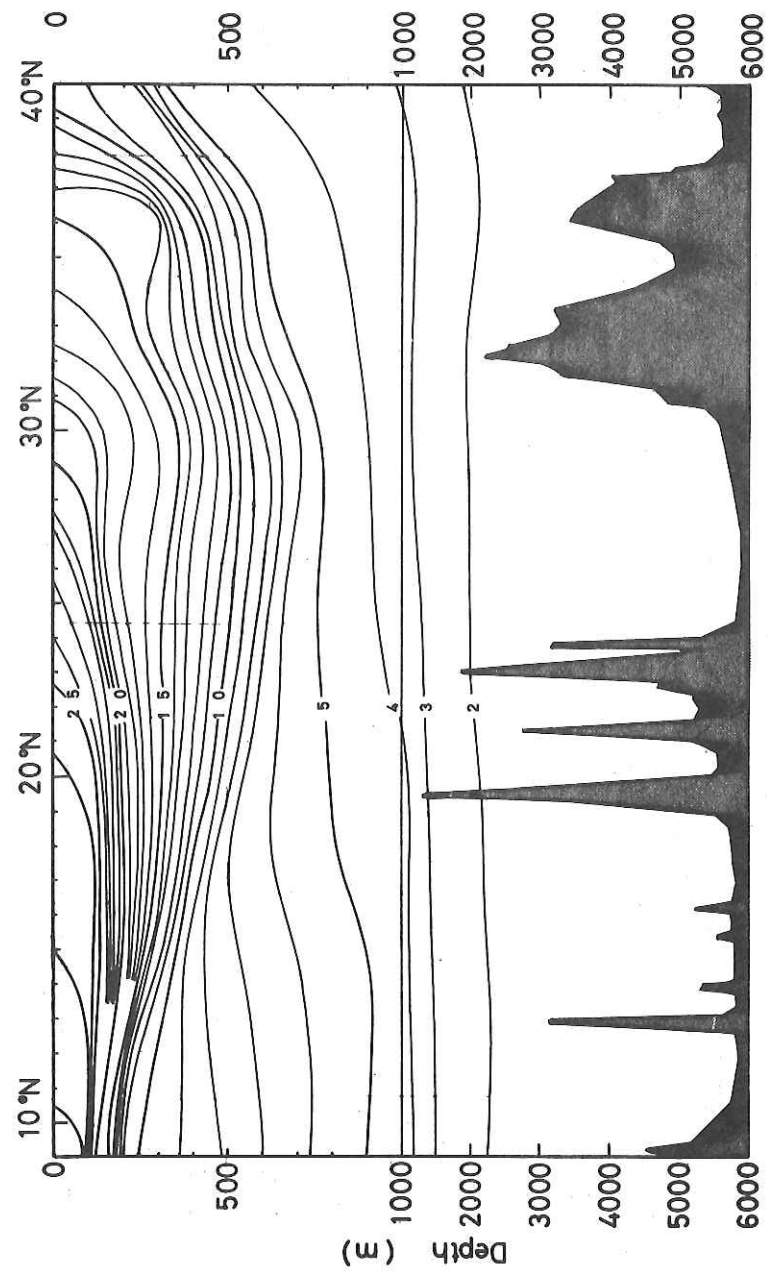

Fig. 2. Temperature profile, 158°E, 40°N-9°N.(Unit: °C)

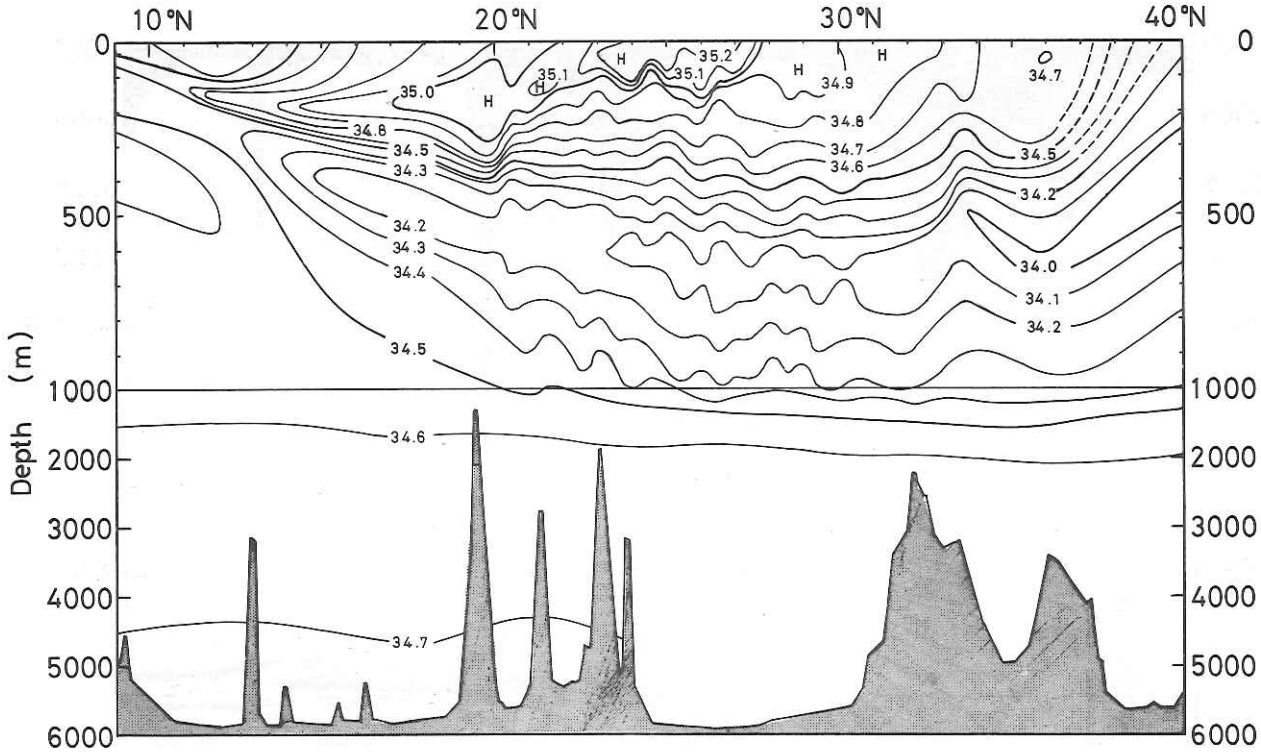

Fig. 3. Salinity profile, 158°E, 40°N-9°N. (Unit: ‰)

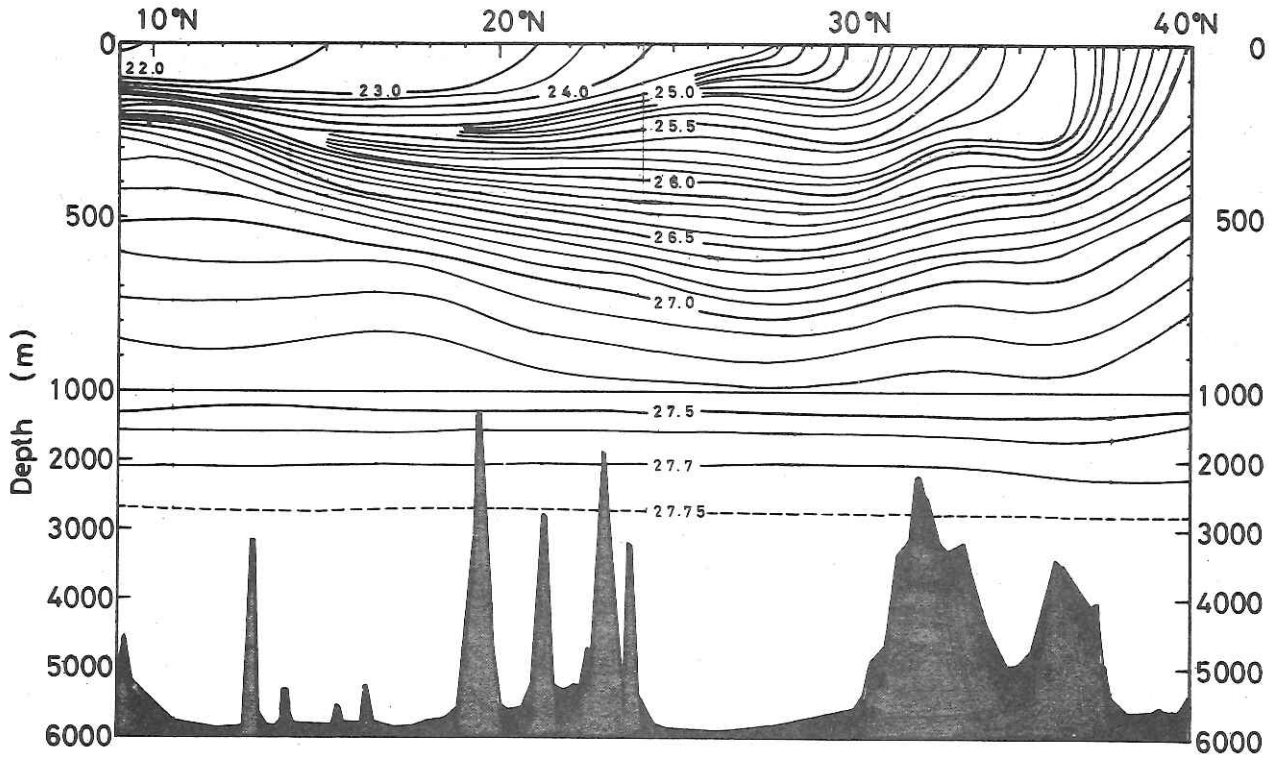

Fig. 4. σ_t profile, 158°E, 40°N-9°N.

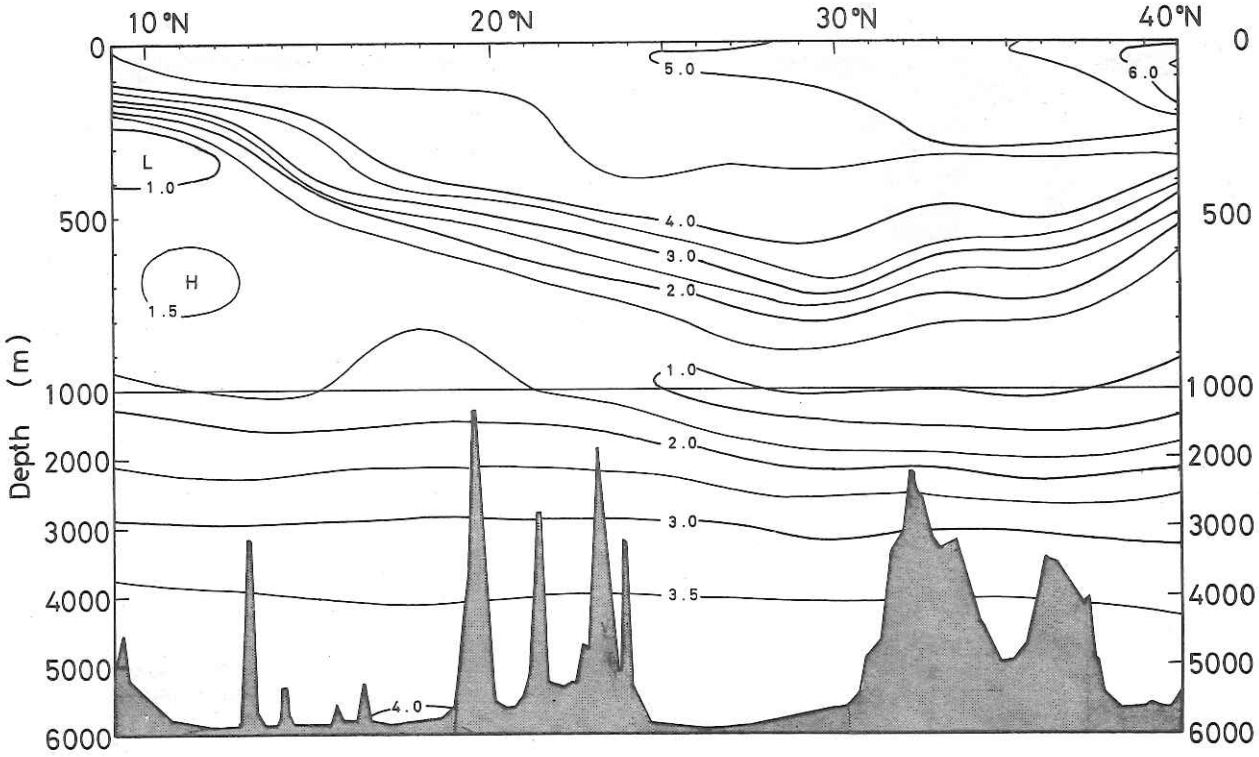

Fig. 5. Dissolved oxygen, 158°E, 40°N-9°N.(Unit: ml/l)

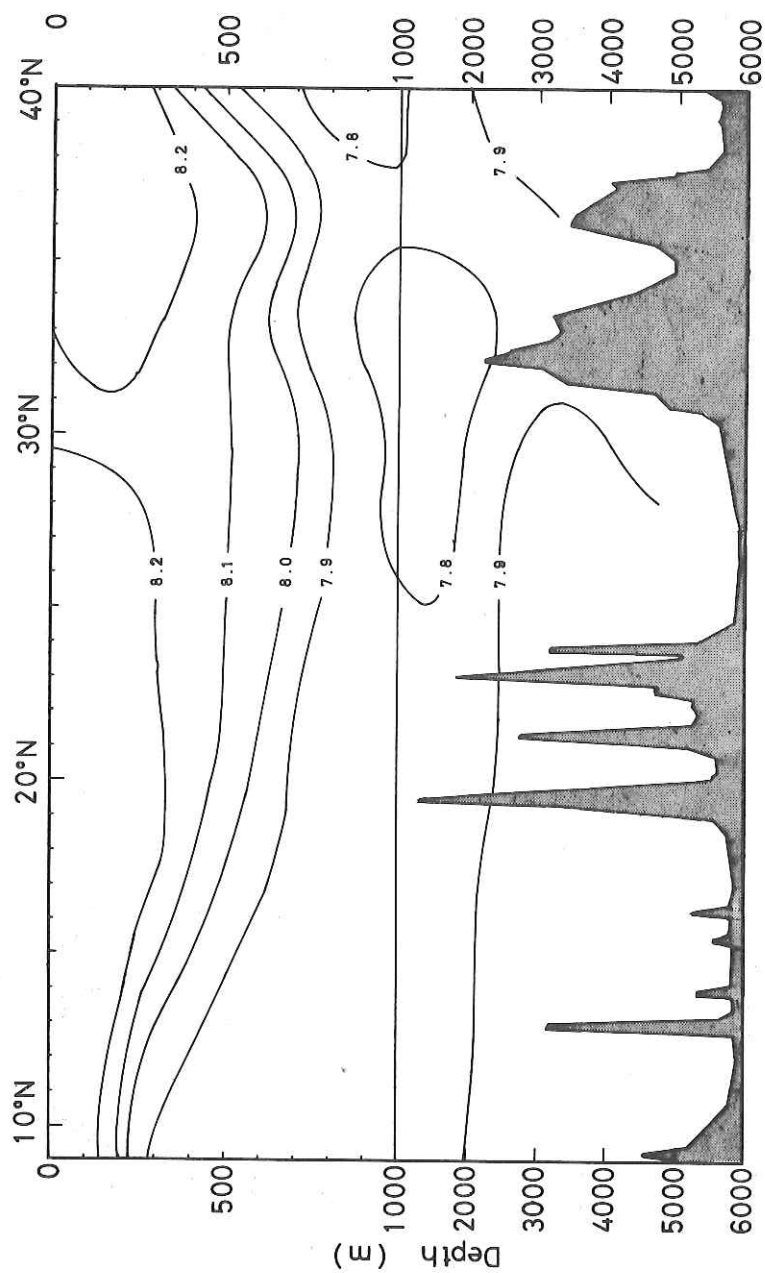

Fig. 6. pH profile, 158°E, 40°N-9°N.

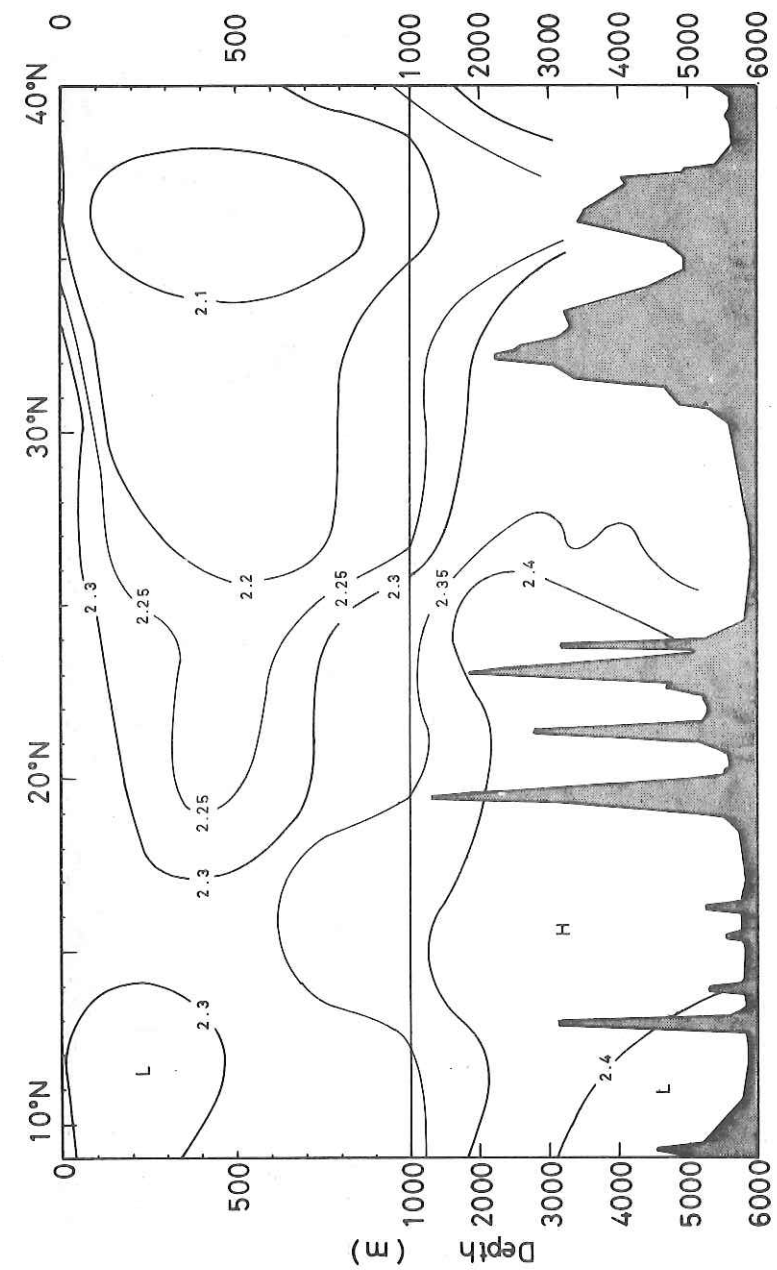

Fig. 7. Total alkalinity profile, 158°E, 40°N-9°N.

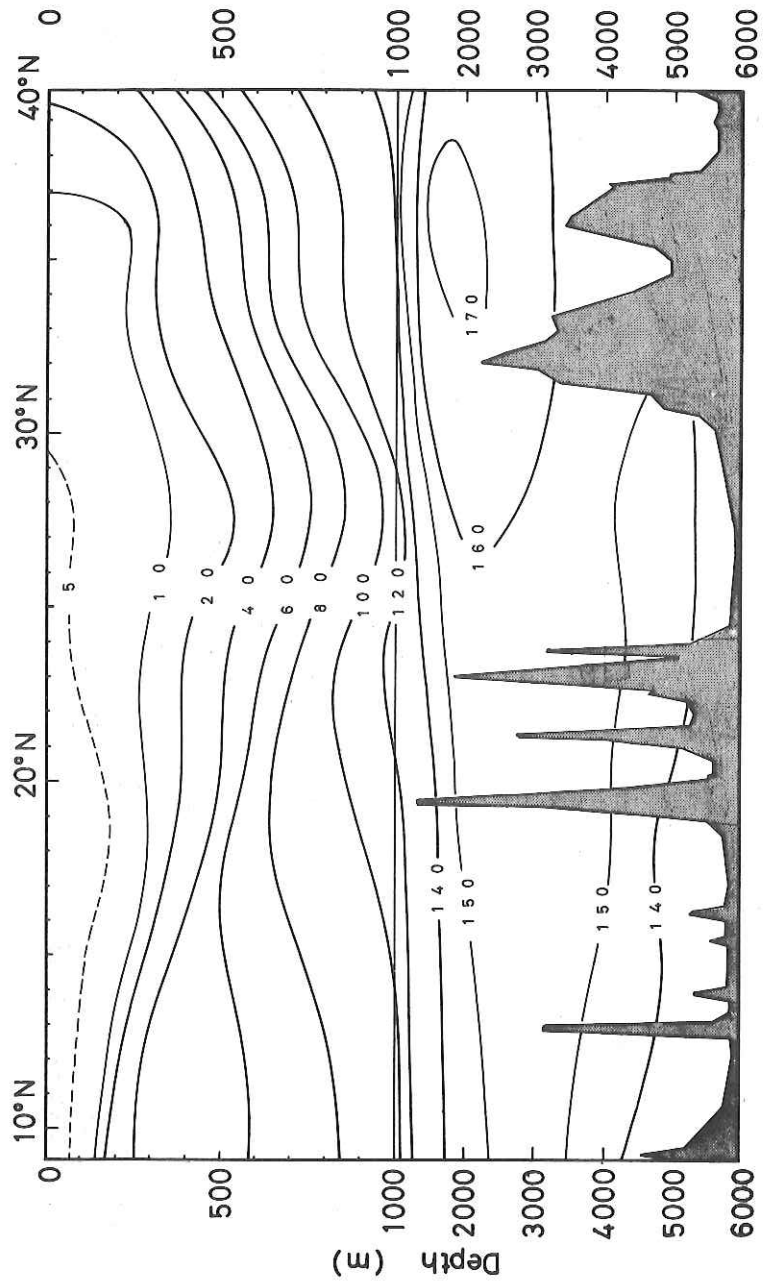

Fig. 8. Silicate-Si profile, 158°E, 40°N-9°N. (Unit: µg at/l)

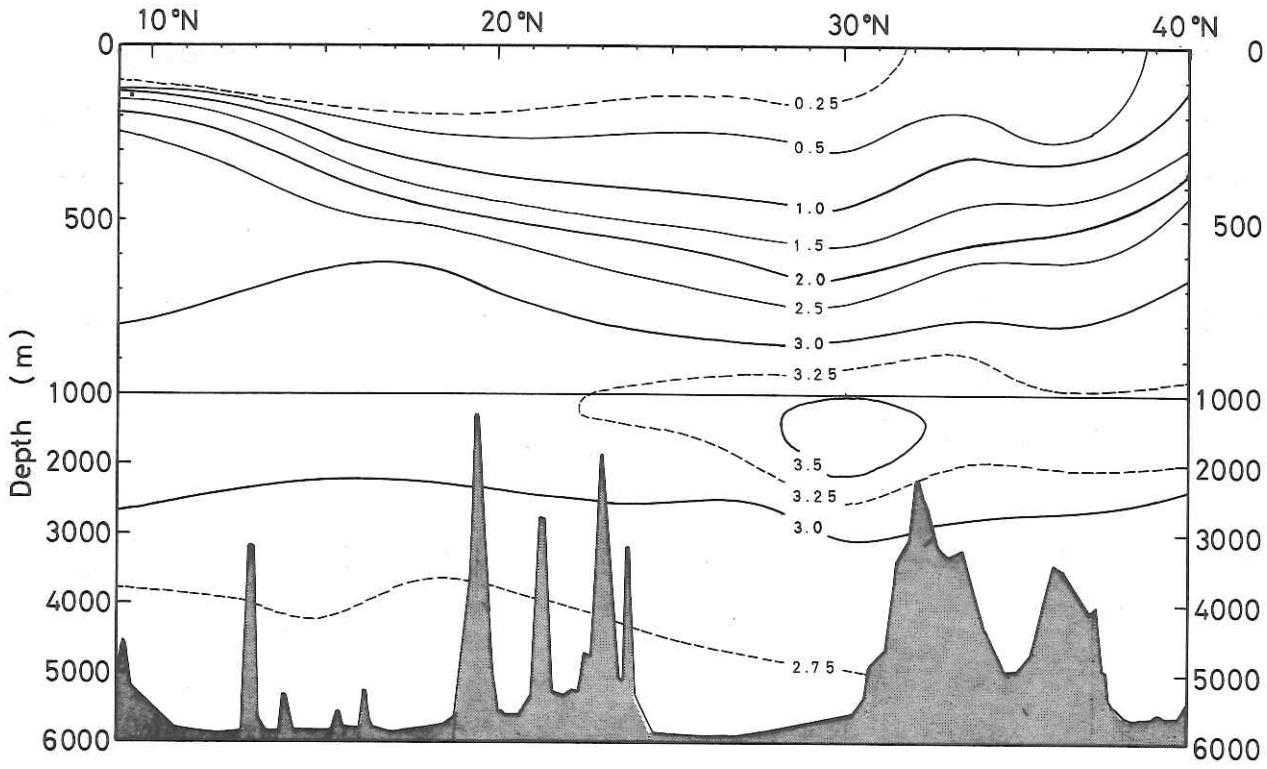

Fig. 9. Phosphate-P profile, 158°E, 40°N-9°N. (Unit: µg at/l)

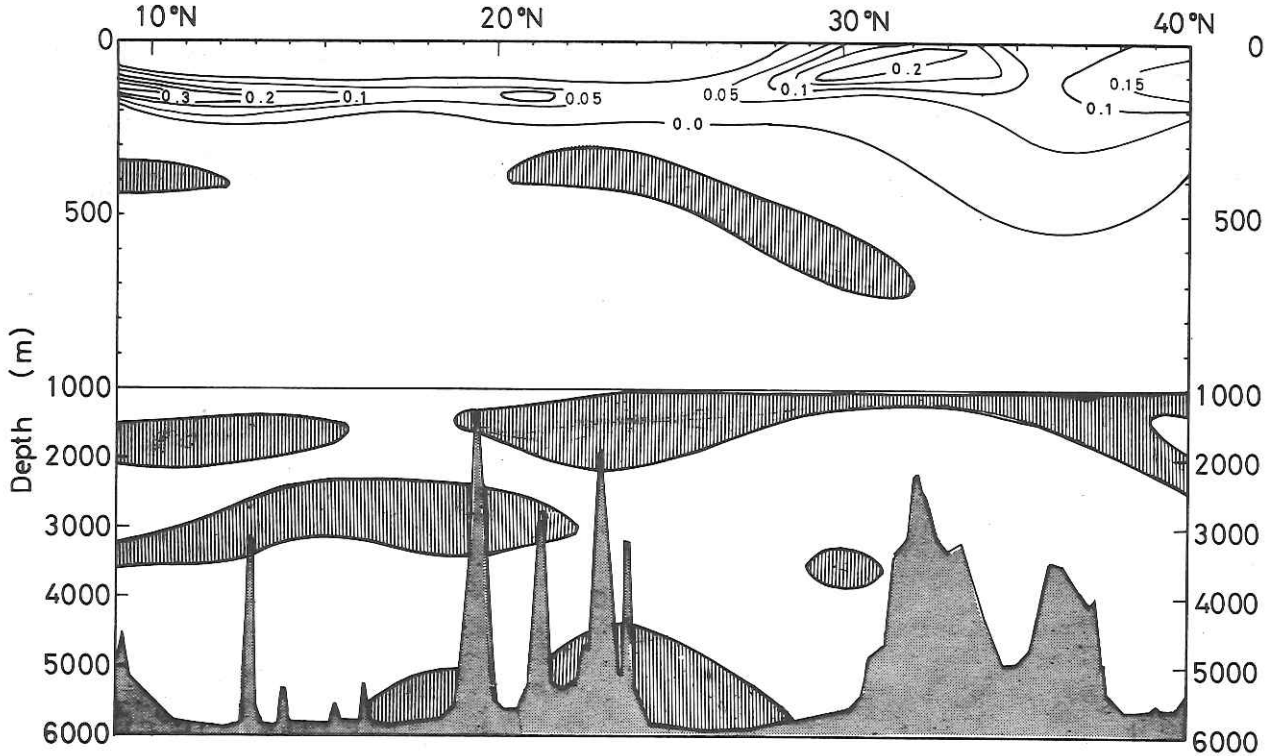

Fig.10. Nitrite-N profile, 158°E, 40°N-9°N.(Unit: µg at/l)

0-0.05 µg at/l

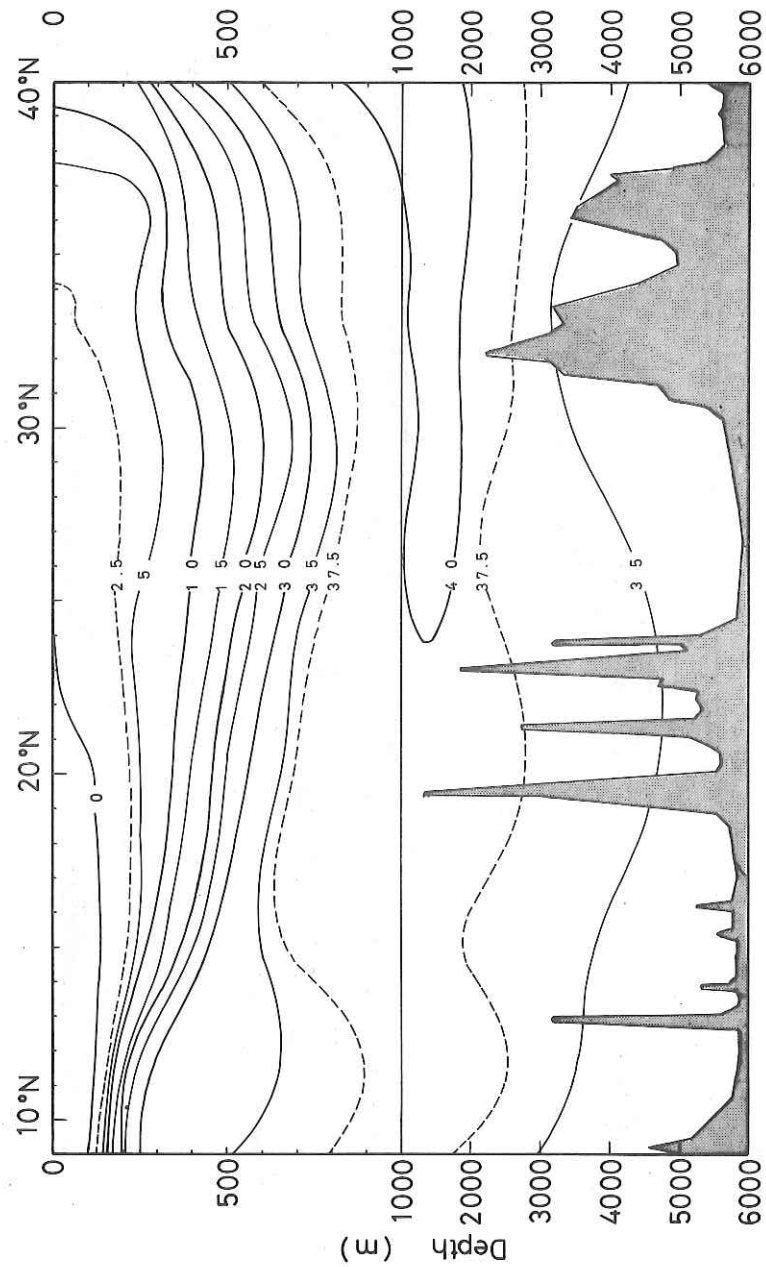

Fig.11. Nitrate-N profile, 158°E, 40°N-9°N. (Unit: µg at/l)

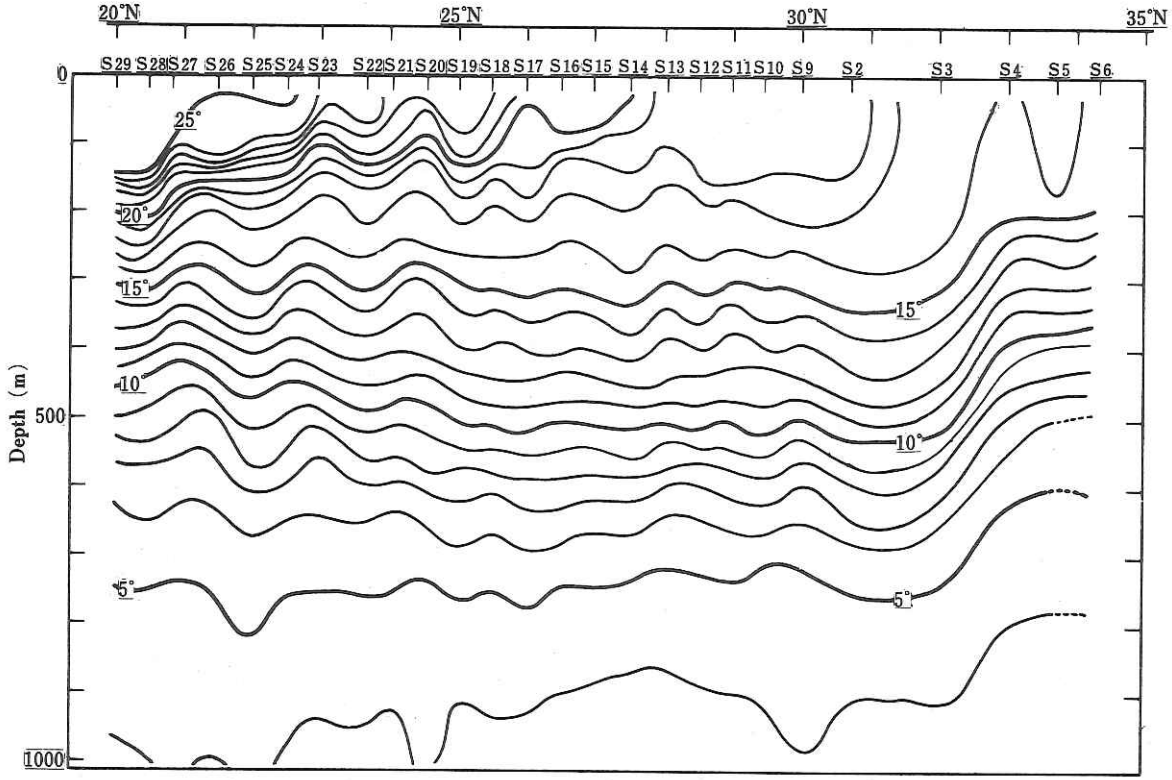

Fig.12. Temperature profile from S.T.D. data, 158°E, 34°20'N-20°N, February, 1970.

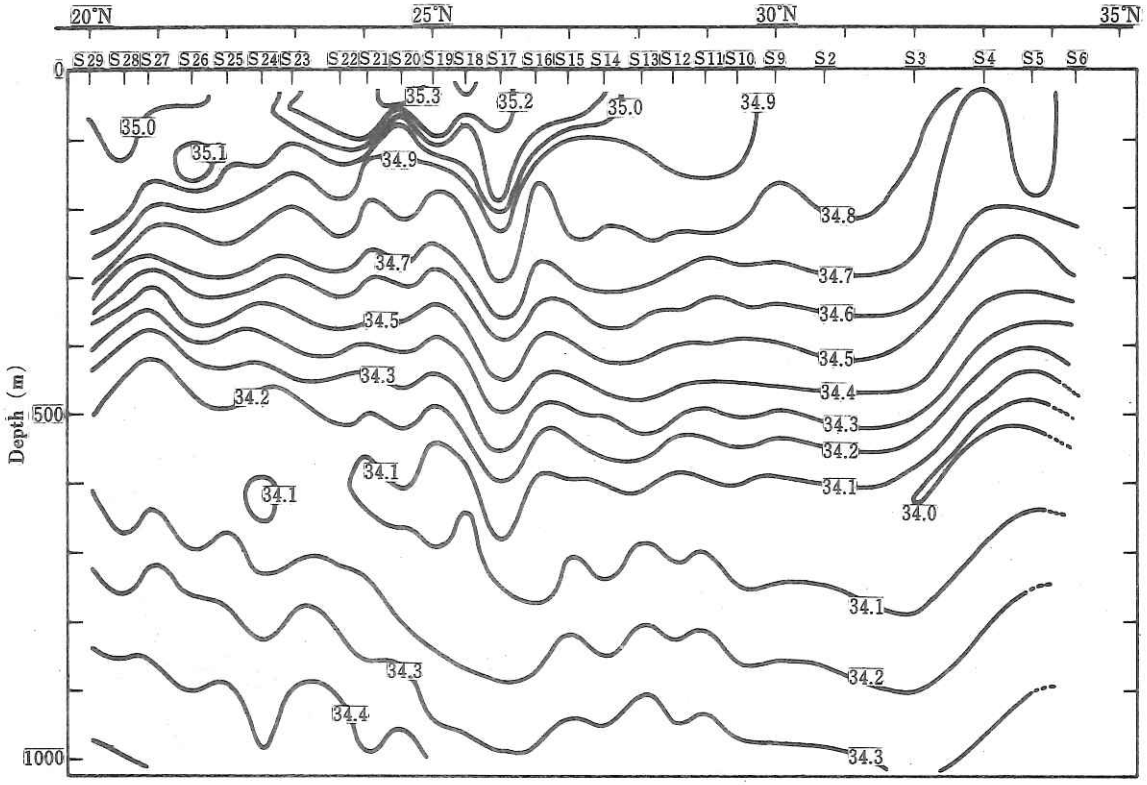

Fig.13. Salinity profile from S.T.D. data, 158°E, 34°20'N-20°N, February, 1970.

5. Individual Research Works

5.1. Oxygen isotopic contents in dissolved gas

by

Y.Horibe, and K.Shigehara

Dissolved oxygen gas was extracted from sea water aboard by the same method described in "Preliminary Report of the "Hakuhō Maru" Cruise KH-68-4". Oxygen gas is to be converted to carbon dioxide for the analysis of isotopic ratio of oxygen in the laboratory on land. Samples were taken at various depth at stations H-1, H-3, H-4, H-5, H-7, H-9, and H-11.

5.2. Carbon dioxide in the surface water and in the atmosphere

by

Y.Sugimura

A continuous determination of partial pressure of CO_2 in the air and in the surface sea water was carried out during this cruise by the infrared absorption method. By means of the system which consists of equilibration chamber and an infrared gas analyzer coupled with the solenoid valves and timer switches, the determination of the CO_2 partial pressure in sea water and in the air and the standardization of the analyzer were done automatically every one hour.

The result showed that the partial pressure in the air was fairly constant while that in the surface water changed widely. Although CO_2 partial pressure in the surface sea waters was nearly in equilibrium with that of atmospheric carbon dioxide in the area around 40°N and 10°N,

it is to be noticed that there is wide area of undersaturation in sea water between these two latitude.

5.3. Iodide and iodate in sea water

by
S.Tsunogai, and Y.Nozaki

A mechanism of iodide formation which was developed by Tsunogai and Sase (1969) predicts the transformation of iodate to iodide during the storage of the sea water samples after the collection. Iodide, therefore, was separated from iodate by adding silver nitrate solution to the samples on board. Colorimetric determinations of iodide and iodate are done at the laboratory of Hokkaido University for 106 samples collected at four hydrographic stations (H-2, H-6, H-8, and H-10).

5.4. Calcium in sea water

by
S.Tsunogai, and Y.Nozaki

To study the alteration of deep water and to relate it to the abyssal circulation, calcium in sea water was measured. The sea water samples for calcium determination were collected from the various depths at all the hydrographic stations through the cruise. Titrimetric determination of calcium is to be done at Hokkaido University by the method of Tsunogai et al.(1968).

5.5. The distribution of iron and aluminum

by
K.Yamamoto

To clarify the distribution of iron and aluminum in the western North Pacific waters, about 120 samples were collected from various depths at four stations.

As to the shipboard determination of iron and aluminum in sea water, a spectrophotometric method with oxine-metal complex was used (Hashitani and Yamamoto, 1959). After an acidified sample was stood for a few days, pH of the solution was adjusted to 5.5 and one per cent solution of oxine in acetic acid was added to the solution. The iron- and aluminum-oxinates formed in the solution were extracted into a portion of chloroform. To eliminate interfering ions in the spectrophotometry, the organic layer was washed with a small portion of potassium cyanide solution, and dried with anhydrous sodium sulfate.

The spectrophotometric determination of iron- and aluminum-oxinate in chloroform was carried out by measuring the absorbance at the wave length of 390 and 470 mμ in a 10 mm cell, respectively.

The results of determination will be described later in elsewhere with geochemical consideration.

5.6. Plutonium, strontium 90, and cesium 137

by
Y.Sugimura

Five samples of surface sea water were processed on board. Plutonium isotopes were coprecipitated from a large amount of sea water with ferric hydroxide and isolated by means of an anion exchange resin. An α-spectrometric determination will be done at the land laboratory.

Carbonate precipitate and ammonium molybdophosphate were used to concentrate artificial radioactive strontium and cesium from each 100 liter of sea water, respectively. γ-spectrometric determination of cesium 137 will be done at

the land laboratory. Further purification of strontium in the carbonate precipitate and measurement of γ-ray will be carried out at the laboratory on land.

5.7. Lead 210 and polonium 210 in sea water and in air

by

S.Tsunogai, and Y.Nozaki

It is examined that the possibility of the use of ^{210}Pb and ^{210}Po which are produced from radon in the atmosphere as tracers for mixing of sea water of upper 200 meters depth. 26 sea water samples for ^{210}Pb and ^{210}Po were collected at three hydrographic stations (H-2, H-6, and H-9), and treated by sodium carbonate to make calcium carbonate precipitate. 14 samples of ^{210}Pb and ^{210}Po in aerosols were collected on millipore filter (HA type) by the suction of air through filter paper. Radiochemical analysis is to be made at our laboratory on land as soon as the samples are brought back.

5.8. Uranium and thorium series disequilibrium

by

Y.Sugimura, M.Mayeda, and T.Yasujima

For the studies on uranium and thorium series radio-elements in marine hydrosphere, about 60 samples of sea water for uranium determination and five samples for thorium determination were processed on board. The determination of the content and the isotopic ratio will be done in the land laboratory by means of β-ray spectrometry.

5.9. Measurements of underwater spectra of light at 15°N, 158°E

by

Y.Sugimori, and H.Otobe

Purpose. A purpose of the present measurements was to examine the variation in spectral energy of underwater light with depth.

Instrument. Details of the system of spectroradiometer was described in "Preliminary Report of the "Hakuhō Maru" Cruise KH-69-3".

Specification of the system

Type of the spectroradiometer	single beam & double monochrometer, radiance measurement, slit fixed
Range of wavelength	330 - 800 mμ
Scanning speed	2 min./scanning
Analysis performance	0.5 mμ for blaze wavelength
Controlling and recording	on board

Measurements were made three times at 15°N, 158°E. Two measurements failed owing to malfunction of the automatic controlling- and recording-system, which was equipped in the underwater unit. In the third measurement, the automatic controlling- and recording-system was removed from the underwater unit, and the signals transmitted from underwater unit was operated manually, and this change gave us satisfactory results. We could get spectra of natural light at depth of 0, 5, 10, 20, 30, 50, and 70 meters.

The results show that

(a) Relative radiance at each depth was measurable as are shown in Figure 14.

(b) Underwater specta varied quickly with time as are shown in Figure 15.

(c) Measurements in a layer from surface to 10 m were difficult, because radiance fluctuations were masked with noise due to changes of water thickness associated with surface waves.

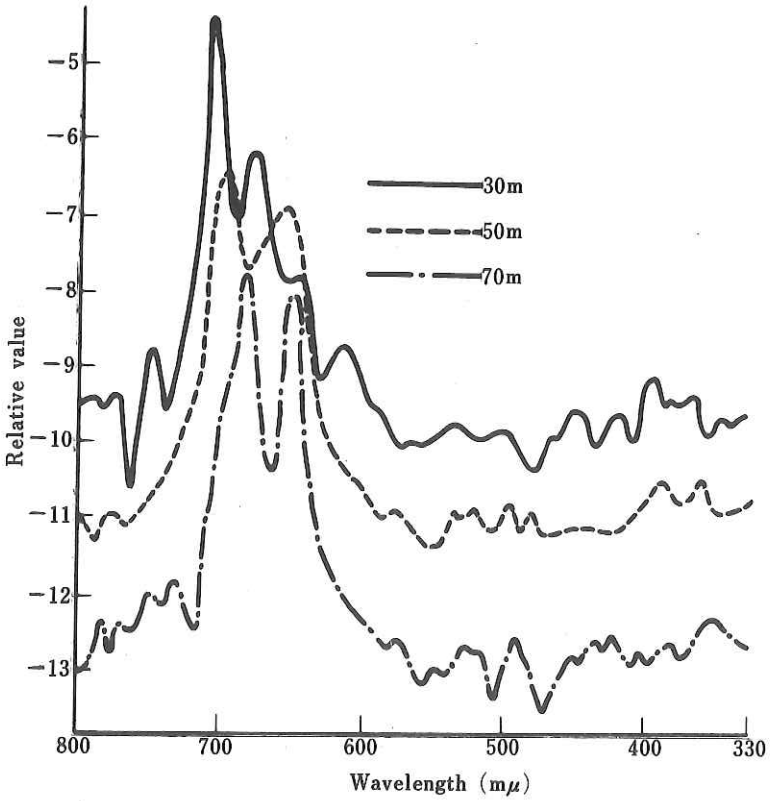

Fig.14. Change of relative radiance (V/V_o) with depth.
V_o : surface radiance
V : radiance at any depth

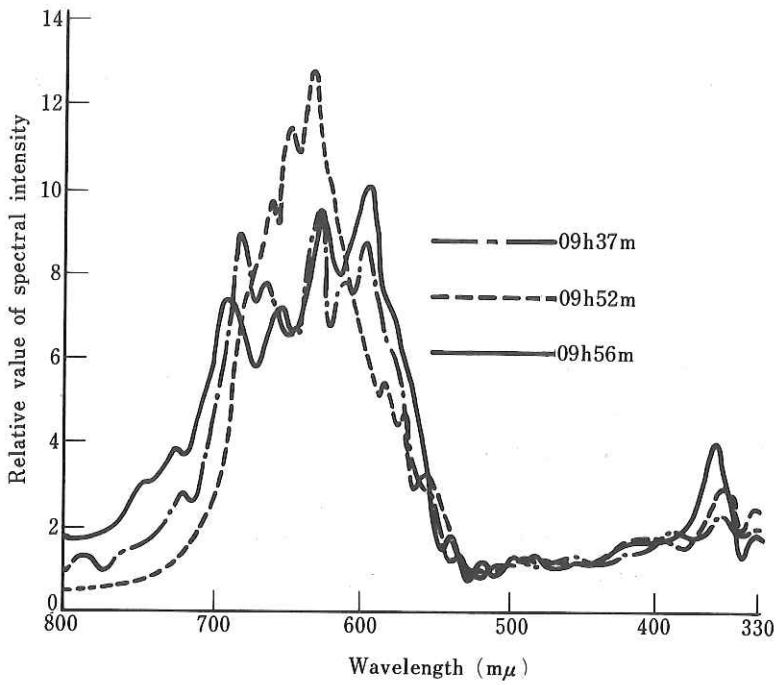

Fig.15. Change of relative radiance with time.

5.10. Measurements of atmospheric ion density, electric conductivity, electric field and aerosols over the sea surface

by

Y.Morita, N.Toriyama, M.Kanada, N.Takagi, and H.Ishikawa

(a) Objective

The main objective of the present ship-borne measurements is to collect data on the following atmospheric electric variables : (1) ion density, (2) electric conductivity, (3) potential gradient and (4) aerosols. It is expected that measurements of these parameters over the sea surface, will in principle lead to a better understanding of the various physical processes that influence them. For example, the potential gradient measured at the sea surface is more likely to yeild a better insight into the global atmospheric phenomenon than that measured over the land surface. Also, ship-borne measurements can be used to study the latitude effects. Similarly, the measurements of the ion density, conductivity and aerosols, can be expected to throw light on the maintenance of the ionization equilibrium in the air over the sea surface vis-a-vis that on the land surface. Thus the relative importance of the contribution of sea salt nuclei to the condensation nuclei, the vertical transport of small ions, and these transitional aspects with the distance from land to the sea, in maintaining the ionization equilibrium can be better understood.

(b) Measurements and results

Measurements of these various parameters over the sea surface have been made by installing suitable instruments aboard R.V."Hakuhō Maru" of the Ocean Research Institute, University of Tokyo. The potential gradient was measured by means of an induction type field meter. For the ion

density and conductivity, ordinary aspiration type Gerdien condensers were used, and for aerosols Pollak type condensation nuclei counters were used. The details of these apparatus were described in "Preliminary Report of the "Hakuhō Maru" Cruise KH-68-4". The measurements were carried out in the period between February 3 and March 4, 1970.

One of the results obtained is shown in Figure 16. It was shown that the ion density (black circles) and the electric conductivity (crosses) increase with the distance between about 30 km and 200 km from the land to the sea. It was also shown that the ion density and the electric conductivity are almost constant above 200 km distance and the values estimated are 400-500 ions per cc and 1.0-2.0 $\times 10^{-14}$ mho per meter, respectively. It is hoped that a systematic analysis of the data collected will soon be completed.

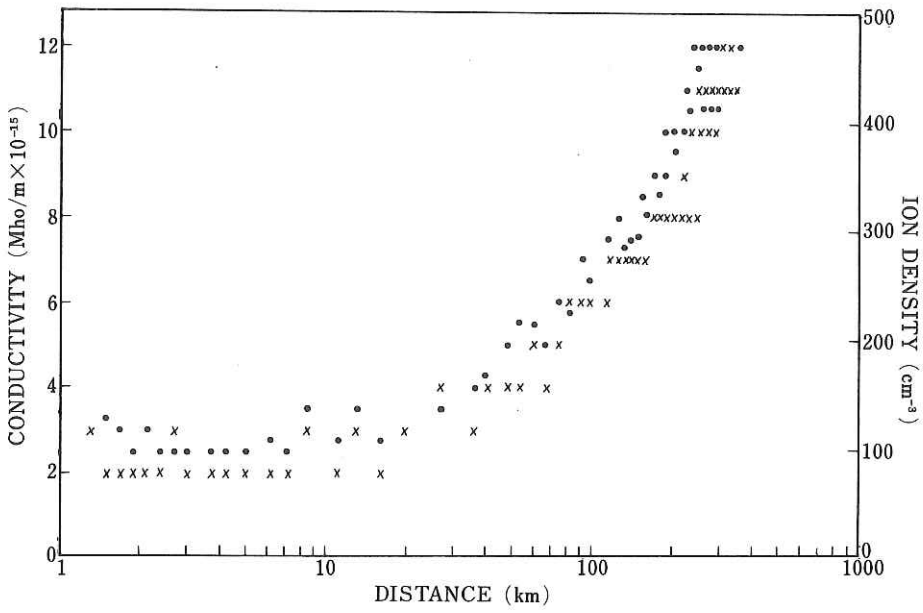

Fig.16. Transitional aspects of the small ion density (black circles) and the electric conductivity (crosses) with the distance from continent.

Appendix I

Oceanographic Data

KH-70-1 Latitude 30°11'N February 7, 1970 Depth 5,600 meters Air Temperature 13.0°C
Station H-1 Longitude 157°56'E 1330-2020

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Interpolated Water Temp.	Interpolated Salinity
0	19.2	34.928	5.16	8.17	2.36	0.15	7	0.07	0.3	0	19.2	34.928
15	19.19	34.917	5.12	8.19	2.31	0.20	6	0.16	0.1	25	19.18	34.917
30	19.18	34.917	5.13	8.14	2.37	0.15	6	0.16	0.1	50	19.15	34.917
45	19.16	34.918	5.16	8.15	2.34	0.13	6	0.12	0.2	75	19.12	34.908
60	19.13	34.913	5.13	8.10	2.31	0.09	5	0.12	0.2	100	19.05	34.900
89	19.10	34.901	5.05	8.11	2.26	0.13	7	0.25	0.1	150	18.23	34.810
116	18.88	34.893	5.15	8.17	2.24	0.09	6	0.20	0.2	200	17.50	34.785
-	-	-	-	-	-	-	-	-	-	250	16.75	34.781
168	17.92	34.789	4.78	8.18	2.17	0.26	7	0.00	2.2	300	16.16	34.743
194	17.62	34.784	4.68	8.18	2.17	0.30	9	0.04	2.6	350	15.22	34.660
222	17.14	34.787	4.67	8.17	2.19	0.36	9	0.01	2.6	400	14.00	34.563
279	16.44	34.763	4.68	8.17	2.17	0.45	9	0.00	3.9	500	11.10	34.322
335	15.59	34.691	4.59	8.17	2.15	0.58	13	0.00	5.4	600	8.05	34.155
386	14.30	34.586	4.43	8.13	2.15	0.80	17	0.01	8.6	700	6.00	34.095
437	13.00	34.498	4.41	8.13	2.13	0.90	20	0.00	10.3	800	4.88	34.155
540	9.81	34.241	4.28	8.09	2.09	1.46	34	0.01	17.4	1000	3.80	34.305
681	6.28	34.103	3.56	8.01	2.13	2.08	58	0.03	25.1	1200	3.02	34.410
1136	3.22	34.366	0.97	7.79	2.24	3.66	143	0.02	38.0	1500	2.40	34.520
1354	2.68	34.483	0.84	7.75	2.26	3.67	154	0.00	41.3	2000	1.92	34.601
1737	2.17	34.561	1.33	7.75	2.27	3.62	168	0.02	41.2	2500	1.69	34.643
2121	1.87	34.615	1.91	7.84	2.39	3.51	168	0.00	38.8	3000	1.54	34.668
2522	1.68	-	-	-	-	-	-	-	-	3500	1.48	34.679
2927	1.57	-	-	-	-	-	-	-	-	4000	1.46	34.687
3343	1.49	34.678	3.08	7.96	2.31	2.98	159	0.04	35.0	4500	1.46	34.689
3761	1.46	34.684	3.39	7.90	2.24	2.83	155	0.03	34.5			
4194	1.46	34.689	3.54	7.88	2.34	2.94	155	0.00	34.5			
4624	1.46	34.689	3.72	7.87	2.32	2.87	149	0.00	34.3			

KH-70-1 Latitude 33°06'N February 8-9, 1970 Depth 3,300 meters Air Temperature 11.8°C
Sation H-2 Longitude 158°05'E 2230-0345

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Water Temp.	Salinity
0	17.1	34.794	5.36	8.20	2.32	0.39	7	0.11	1.8	0	17.1	34.794
24	16.86	34.793	5.32	8.20	2.26	0.45	7	0.20	1.8	25	16.85	34.793
47	16.77	34.786	5.32	8.20	2.21	0.45	8	0.18	1.8	50	16.75	34.782
71	16.41	34.757	5.29	8.22	2.17	0.45	8	0.18	2.9	75	16.40	34.756
94	16.31	34.751	5.17	8.26	2.20	0.45	8	0.16	2.9	100	16.29	34.745
140	15.93	34.676	5.19	8.25	2.17	0.45	8	0.10	3.2	150	15.86	34.675
187	15.73	34.666	5.28	8.24	2.19	0.51	8	0.03	3.5	200	15.64	34.657
-	-	-	-	-	-	-	-	-	-	250	14.67	34.565
278	13.95	34.527	5.35	8.24	2.19	0.92	15	0.00	8.3	300	13.55	34.518
322	13.12	34.501	4.19	8.19	2.13	1.07	22	0.07	12.4	350	12.52	34.462
367	12.11	34.430	4.20	8.17	2.20	1.07	27	0.01	13.9	400	11.34	34.369
465	9.42	34.239	3.97	8.11	2.19	1.52	35	0.00	19.7	500	8.33	34.157
543	6.98	34.043	3.90	8.09	2.11	1.93	54	0.00	24.0	600	5.73	34.027
631	5.27	34.048	2.69	7.94	2.13	2.64	80	0.00	31.1	700	4.71	34.108
716	4.60	34.123	1.95	7.88	2.17	2.89	99	0.00	35.4	800	4.16	34.200
890	3.70	34.269	1.16	7.79	2.22	3.28	126	0.00	38.7	1000	3.38	34.331
1067	3.15	34.372	0.97	7.77	2.24	3.36	143	0.02	40.1	1200	2.92	34.415
1036	3.34	34.350	1.00	7.74	2.20	3.38	136	0.00	40.0	1500	2.40	34.516
1304	2.72	34.451	0.92	7.76	2.24	3.42	158	0.00	40.0	2000	1.92	34.616
1748	2.15	34.557	1.33	7.75	2.29	3.34	168	0.00	40.1	2500	1.69	34.644
2189	1.80	34.632	2.07	7.70	2.32	3.09	170	0.00	38.3	3000	1.49	34.665
2647	1.63	34.648	2.63	7.84	2.29	3.04	166	0.00	36.8			
3110	1.43	34.673	3.24	7.86	2.32	2.89	162	0.00	35.3			

KH-70-1 Latitude 35°59'N February 12, 1970 Depth 3,400 meters Air Temperature 7.4°C
Station H-3 Longitude 158°05'E 1149-1530

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Water Temp.	Salinity
0	15.1	34.642	5.51	8.28	2.22	0.39	9	0.08	4.0	0	15.1	34.642
27	14.86	34.677	5.57	8.32	2.11	0.39	9	0.09	4.5	25	14.87	34.675
53	14.84	34.713	5.48	8.32	2.13	0.39	10	0.09	3.9	50	14.84	34.708
79	14.82	34.660	5.49	8.29	2.11	0.39	10	0.07	4.4	75	14.82	34.665
104	14.82	34.658	5.47	8.28	2.09	0.39	9	0.09	3.9	100	14.82	34.658
155	14.81	34.661	5.46	8.30	2.06	0.43	9	0.09	4.5	150	14.81	34.661
207	14.76	34.656	5.49	8.30	2.04	0.45	9	0.08	3.0	200	14.77	34.658
254	14.72	34.654	5.47	8.29	2.06	0.47	10	0.09	4.4	250	14.72	34.655
299	14.26	34.600	4.95	8.27	2.04	0.62	14	0.06	7.5	300	14.26	34.600
350	11.90	34.414	4.28	8.24	2.02	1.12	25	0.02	14.4	350	11.90	34.415
395	10.45	34.310	4.40	8.21	2.00	1.28	30	0.01	16.7	400	10.28	34.303
489	7.99	34.143	4.13	8.12	2.02	1.72	44	0.03	21.9	500	7.70	34.129
584	5.74	34.019	3.19	8.13	1.97	2.31	70	0.00	29.0	600	5.42	34.002
679	4.25	33.992	2.43	8.02	2.02	2.78	91	0.00	33.9	700	4.25	34.036
775	4.26	34.138	1.74	7.89	2.06	2.94	105	0.00	36.3	800	4.20	34.165
967	3.56	34.292	1.16	7.87	2.11	3.17	130	0.00	39.0	1000	3.48	34.310
1160	3.04	34.388	0.89	7.84	2.17	3.32	157	0.00	40.5	1200	3.10	34.398
1140	3.11	34.376	1.06	7.83	2.09	3.32	157	0.02	40.1	1500	2.50	34.493
1404	2.64	34.464	0.87	7.87	2.17	3.38	171	0.01	41.0	2000	2.07	34.587
1847	2.10	34.560	1.39	7.85	2.24	3.30	170	0.00	40.3	2500	1.83	34.646
2298	1.98	34.634	1.98	7.86	2.22	3.08	169	0.01	38.6	3000	1.55	34.666
2743	1.64	34.652	2.62	7.88	2.20	2.98	165	0.00	37.5			
3194	1.49	34.684	3.19	7.89	2.20	2.85	160	0.01	35.1			

KH-70-1 Latitude 40°00'N February 13, 1970 Depth 5,350 meters Air Temperature 3.7°C
Station H-4 Longitude 157°58'E 1330-1930

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Water Temp.	Salinity
0	9.8	34.235	5.93	8.24	2.22	1.00	24	0.11	12.4	0	9.8	34.235
28	9.44	34.218	6.12	8.27	2.19	1.00	24	0.14	12.4	25	9.49	34.220
56	9.15	34.190	6.04	8.25	2.19	1.07	25	0.15	12.7	50	9.20	34.195
84	9.00	34.170	6.10	8.23	2.17	1.07	25	0.14	12.8	75	9.03	34.175
112	8.94	34.167	6.10	8.26	2.19	1.05	24	0.16	12.7	100	8.95	34.169
167	8.85	34.154	6.07	8.24	2.13	1.14	25	0.16	12.7	150	8.89	34.161
221	8.13	34.066	5.47	8.25	2.11	1.39	34	0.07	14.1	200	8.49	34.117
275	6.23	33.901	4.83	8.21	2.13	1.84	47	0.04	23.3	250	7.32	33.975
329	4.84	33.825	4.49	8.15	2.17	2.14	60	0.01	26.1	300	5.22	33.847
383	4.84	33.910	3.59	8.06	2.17	2.42	71	0.00	29.5	350	4.84	33.844
436	4.44	33.946	2.93	7.98	2.15	2.53	82	0.00	33.1	400	4.74	33.925
543	4.16	34.118	1.86	7.88	2.19	2.93	101	0.03	37.2	500	4.26	34.055
650	3.82	34.203	1.37	7.86	2.20	3.04	116	0.02	39.1	600	3.97	34.164
756	3.54	34.291	1.15	7.77	2.22	3.19	127	0.00	39.7	700	3.69	34.245
863	3.23	34.355	1.02	7.78	2.24	3.19	137	0.00	40.3	800	3.41	34.320
1080	2.86	34.426	0.99	7.78	2.26	3.30	147	0.02	41.0	1000	2.97	34.403
1307	2.52	-	-	-	-	-	-	-	-	1200	2.66	34.470
1088	2.87	34.426	0.97	7.84	2.29	3.32	147	0.01	40.6	1500	2.29	34.537
1358	2.44	34.514	1.01	7.83	2.29	3.32	161	0.05	40.9	2000	1.92	34.600
1813	2.04	34.579	1.50	7.88	2.31	3.28	168	0.06	40.0	2500	1.70	34.646
2268	1.80	34.627	2.10	7.95	2.32	3.00	165	0.01	38.5	3000	1.57	34.667
2728	1.63	34.659	2.74	7.95	2.29	2.94	163	0.00	37.5	3500	1.50	34.679
-	-	-	-	-	-	-	-	-	-	4000	1.48	34.687
3645	1.49	34.681	3.31	8.00	2.32	2.79	157	0.05	35.4	4500	1.50	34.691
4112	1.48	34.688	3.49	7.98	2.29	2.72	154	0.01	35.2	5000	1.53	34.694
4583	1.50	34.692	3.64	7.96	2.31	2.68	153	0.00	34.6			
5070	1.53	34.694	3.74	8.00	2.32	2.89	150	0.01	34.3			

KH-70-1 Latitude 26°59'N February 17-18, 1970 Depth 5860-5870 meters Air Temperature 20.2°C
Station H-5 Longitude 158°00'E 2130-0310

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Water Temp.	Salinity
0	22.7	35.288	4.89	8.24	2.37	0.11	5	0.00	0.0	0	22.7	35.287
26	21.86	35.232	4.99	8.25	2.36	0.11	4	0.01	0.1	25	21.88	35.232
51	20.84	35.133	5.56	8.25	2.29	0.11	4	0.00	0.0	50	20.85	35.132
77	20.66	35.120	5.04	8.26	2.27	0.11	5	0.00	0.0	75	20.68	35.120
103	20.45	35.107	5.00	8.26	2.26	0.11	5	0.03	0.1	100	20.50	35.110
155	17.76	34.838	4.64	8.25	2.22	0.32	6	0.07	1.6	150	17.90	34.842
207	16.92	34.801	4.74	8.23	2.22	0.43	6	0.01	4.6	200	17.00	34.800
259	16.14	34.742	4.68	8.24	2.22	0.53	7	0.00	3.5	250	16.30	34.750
311	15.34	34.668	4.70	8.18	2.20	0.56	9	0.00	5.6	300	15.60	34.691
363	13.93	34.543	4.48	8.17	2.15	0.81	10	0.00	8.4	350	14.30	34.575
414	12.56	34.435	4.44	8.14	2.17	0.96	15	0.00	10.7	400	12.94	34.459
518	10.13	34.261	4.28	8.09	2.15	1.41	19	0.01	16.4	500	10.59	34.294
622	7.40	34.090	3.46	8.04	2.15	2.01	30	0.00	25.1	600	7.97	34.113
725	5.43	34.078	2.29	7.93	2.17	2.70	52	0.00	33.8	700	5.80	34.068
829	4.53	34.164	1.52	7.84	2.22	2.96	79	0.00	37.9	800	4.75	34.134
1036	3.48	34.349	0.87	7.78	2.24	3.39	101	0.03	40.9	1000	3.59	34.320
1244	2.90	34.456	0.91	7.79	2.29	3.43	135	0.00	41.7	1200	3.03	34.440
1331	2.76	34.486	1.04	7.79	2.29	3.39	147	0.01	40.4	1500	2.44	34.535
1621	2.26	34.558	1.46	7.79	2.32	3.32	152	0.00	40.3	2000	1.94	34.618
2106	1.88	34.623	2.36	7.84	2.34	3.11	163	0.00	35.9	2500	1.70	34.649
2590	1.68	34.653	2.74	7.93	2.36	2.94	159	0.00	35.8	3000	1.58	34.669
3069	1.56	34.671	3.14	7.92	2.36	2.96	157	0.00	35.4	3500	1.50	34.680
3547	1.49	34.679	3.53	7.92	2.34	2.85	155	0.00	34.8	4000	1.47	34.687
4017	1.47	34.687	3.50	7.93	2.36	2.80	151	0.00	35.3	4500	1.48	34.688
4487	1.48	34.688	3.69	7.93	2.34	2.79	146	0.01	34.1	5000	1.50	34.692
4954	1.49	34.692	3.82	7.92	2.32	2.70	144	0.00	34.6	5500	1.55	34.692
5422	1.54	34.692	3.89	7.91	2.32	2.74	138	0.03	35.3			
5888	1.60	34.694	3.91	7.92	2.31	2.89	140	0.05	34.1			

KH-70-1 Latitude 24°02'N February 19,1970 Depth 5,410-5,335 meters Air Temperature 20.8°C
Station H-6 Longitude 158°02'E 0130-0625

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Interpolated Water Temp.	Interpolated Salinity
0	24.0	35.194	4.80	8.23	2.34	0.11	5	0.00	0.0	0	24.0	35.194
28	23.50	35.237	4.90	8.24	2.34	0.11	4	0.00	0.1	25	23.54	35.236
56	23.22	35.211	4.82	8.26	2.32	0.11	5	0.00	0.1	50	23.30	35.213
84	22.84	35.271	4.87	8.24	2.32	0.11	5	0.00	0.1	75	22.92	35.263
112	22.66	35.291	4.86	8.25	2.32	0.11	5	0.00	0.1	100	22.73	35.290
168	18.30	34.870	4.62	8.23	2.29	0.30	7	0.03	2.3	150	19.50	34.965
224	16.91	34.803	4.66	8.22	2.29	0.45	9	0.00	5.3	200	17.45	34.827
279	15.69	34.704	4.62	8.23	2.27	0.60	11	0.00	6.5	250	16.34	34.761
334	14.28	34.605	4.55	8.19	2.26	0.77	14	0.01	9.2	300	15.11	34.670
389	12.98	34.455	4.51	8.16	2.24	0.92	18	0.01	11.2	350	13.92	34.566
443	11.26	34.322	4.36	8.14	2.24	1.20	22	0.00	15.0	400	12.65	34.428
553	8.24	34.136	3.49	8.07	2.24	1.93	44	0.00	24.8	500	9.69	34.210
665	5.76	34.104	2.28	7.94	2.26	2.68	76	0.00	34.0	600	6.92	34.103
776	4.98	34.222	1.36	7.87	2.31	2.89	95	0.00	38.3	700	5.48	34.130
886	4.27	34.327	1.13	7.83	2.32	3.21	112	0.00	39.8	800	4.82	34.252
1109	3.56	34.455	1.31	7.82	2.34	3.30	130	0.01	39.8	1000	3.87	34.395
1337	2.95	34.521	1.59	7.84	2.36	3.24	141	0.00	40.4	1200	3.31	34.481
1372	2.96	34.529	1.61	7.84	2.37	3.26	141	0.01	39.1	1500	2.58	34.551
1656	2.36	34.578	1.96	7.86	2.40	3.19	151	0.02	38.9	2000	1.96	34.618
2129	1.88	34.628	2.45	7.87	2.41	3.08	156	0.02	38.3	2500	1.71	34.650
2602	1.69	34.653	2.78	7.91	2.44	3.00	155	0.00	37.2	3000	1.58	34.670
3070	1.57	34.671	3.13	7.91	2.41	2.98	155	0.00	36.7	3500	1.50	34.681
3539	1.49	34.682	3.36	7.92	2.40	2.89	152	0.00	36.3	4000	1.46	34.697
4004	1.46	34.697	3.51	7.92	2.40	2.83	152	0.00	35.5	4500	1.47	34.699
4465	1.47	34.692	3.71	7.93	2.40	2.74	149	0.01	35.4	5000	1.49	34.700
4930	1.48	34.700	3.85	7.92	2.40	2.72	143	0.02	34.8	(5500)	1.54	34.701
5395	1.53	34.694	3.91	7.93	2.39	2.70	140	0.01	34.5			

KH-70-1 Latitude 20°52'N February 20, 1970 Depth 5,500 meters Air Temperature 24.6°C
Station H-7 Longitude 157°54'E 0815-1355

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Water Temp.	Salinity
0	26.1	34.957	4.68	8.22	2.32	0.07	4	0.00	0.0	0	26.1	34.957
27	25.73	34.957	4.75	8.24	2.34	0.07	4	0.00	0.0	25	25.76	34.957
52	25.46	34.987	4.69	8.27	2.32	0.07	4	0.00	0.0	50	25.48	34.984
78	25.40	35.016	4.62	8.28	2.32	0.07	4	0.01	0.0	75	25.41	35.013
104	25.34	35.031	4.68	8.27	2.32	0.07	5	0.00	0.0	100	25.36	35.030
130	24.30	35.047	4.62	8.27	2.31	0.11	5	0.01	0.1	125	24.70	35.046
155	22.63	35.091	4.49	8.25	2.31	0.15	5	0.11	0.3	150	22.93	35.089
207	19.44	34.994	4.35	8.23	2.27	0.47	7	0.02	2.4	200	19.89	35.018
259	17.02	34.814	4.48	8.23	2.26	0.47	9	0.00	5.3	250	17.42	34.845
311	15.21	34.642	4.56	8.21	2.26	0.60	12	0.00	8.1	300	15.60	34.680
350	13.78	34.501	4.43	8.19	2.20	0.81	14	0.00	10.8	350	13.78	34.501
400	11.88	34.342	4.22	8.15	2.19	1.16	20	0.01	15.0	400	11.88	34.342
500	8.88	34.189	3.08	8.07	2.22	1.97	35	0.00	25.8	500	8.88	34.189
600	6.76	34.161	2.13	7.98	2.26	2.55	64	0.00	33.2	600	6.76	34.161
701	5.58	34.247	1.40	7.88	2.27	2.96	84	0.00	37.7	700	5.59	34.246
802	4.95	34.331	1.26	7.81	2.31	3.06	99	0.00	38.7	800	4.97	34.330
1005	4.19	34.466	1.52	7.81	2.31	3.15	113	0.00	39.2	1000	4.20	34.464
-	-	-	-	-	-	-	-	-	-	1200	3.50	34.518
1415	2.96	34.564	1.93	7.86	2.36	3.21	137	0.01	39.1	1500	2.80	34.578
1693	2.50	34.603	2.11	7.86	2.37	3.12	144	0.01	39.1	2000	2.12	34.633
2159	1.98	34.662	2.51	7.88	2.39	3.04	155	0.00	38.8	2500	1.80	34.660
2622	1.76	34.662	2.77	7.90	2.44	2.94	159	0.01	38.6	3000	1.63	34.672
3081	1.62	34.675	3.11	7.91	2.41	2.94	156	0.01	36.7	3500	1.54	34.685
3543	1.53	34.687	3.35	7.91	2.41	2.83	154	0.00	36.0	4000	1.49	34.693
4020	1.49	34.693	3.45	7.94	2.43	2.72	151	0.00	35.9	4500	1.46	34.696
4486	1.46	34.696	3.77	7.93	2.40	2.72	147	0.00	35.3	5000	1.48	34.701
4953	1.48	34.701	3.90	7.92	2.40	2.70	143	0.00	34.6			

KH-70-1 Latitude 18°01'N February 21, 1970 Depth 5,700 meters Air Temperature 26.0°C
Station H-8 Longitude 158°00'E 0845-1435

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Interpolated Water Temp.	Interpolated Salinity
0	26.8	34.798	4.62	8.26	2.34	0.07	5	0.00	0.0	0	26.8	34.798
27	26.54	34.796	4.69	8.26	2.34	0.11	4	0.00	0.0	25	26.57	34.796
53	26.50	34.833	4.60	8.27	2.34	0.07	4	0.00	0.0	50	26.50	34.830
80	26.50	34.846	4.60	8.27	2.34	0.07	4	0.00	0.0	75	26.50	34.845
106	26.50	34.862	4.59	8.26	2.32	0.07	4	0.00	0.0	100	26.50	34.858
159	23.65	35.040	4.49	8.25	2.32	0.15	4	0.05	0.1	150	24.45	35.030
210	19.74	34.994	4.15	8.25	2.31	0.36	6	0.00	2.0	200	20.57	35.015
265	16.25	34.733	4.44	8.24	2.29	0.56	9	0.00	5.3	250	16.92	34.805
317	14.28	34.543	4.35	8.20	2.29	0.86	14	0.00	8.9	300	14.98	34.602
370	11.53	34.318	4.17	8.15	2.27	1.24	22	0.00	15.4	350	12.50	34.400
423	9.82	34.209	3.83	8.10	2.27	1.61	31	0.00	19.7	400	10.60	34.245
528	6.63	34.168	2.00	7.97	2.26	2.70	67	0.00	34.0	500	7.20	34.160
635	5.83	34.362	1.34	7.92	2.31	3.00	82	0.00	37.6	600	6.00	34.300
740	5.32	34.443	1.43	7.87	2.36	3.06	91	0.00	38.3	700	5.50	34.420
846	4.88	34.487	1.53	7.88	2.36	3.08	98	0.00	39.0	800	5.07	34.468
1057	4.09	34.528	1.81	7.89	2.36	3.06	113	0.00	39.0	1000	4.29	34.520
1270	3.42	34.565	1.86	7.89	2.39	3.15	126	0.00	39.6	1200	3.60	34.553
1040	4.07	34.533	1.72	7.90	2.37	3.15	114	0.00	39.0	1500	2.85	34.584
1338	3.22	34.571	1.83	7.88	2.39	3.15	130	0.00	39.1	2000	2.14	34.625
1833	2.32	34.611	2.22	7.89	2.39	3.11	151	0.00	38.7	2500	1.82	34.655
2326	1.90	34.649	2.55	7.94	2.47	2.98	153	0.02	38.5	3000	1.65	34.670
2818	1.70	34.667	2.92	7.93	2.43	2.98	157	0.00	37.3	3500	1.53	34.680
3306	1.57	34.676	3.16	7.93	2.43	2.91	155	0.01	37.0	4000	1.48	34.690
3787	1.50	34.687	3.33	7.93	2.41	2.72	153	0.00	35.7	4500	1.45	34.696
4261	1.46	34.693	3.64	7.94	2.41	2.72	148	0.00	35.2	5000	1.46	34.700
4735	1.45	34.698	3.91	7.95	2.39	2.68	139	0.00	34.3	5500	1.48	34.701
5208	1.46	34.701	3.99	7.95	2.40	2.66	135	0.01	34.1	6000		
5692	1.49	34.701	4.04	7.95	2.41	2.57	135	0.02	33.7			

KH-70-1 Latitude 15°04'N February 22, 1970 Depth 5,830 meters Air Temperature 25.8°C
Station H-9 Longitude 157°59'E 0348-1030

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Interpolated Water Temp.	Interpolated Salinity
0	27.0	34.660	4.58	8.23	2.36	0.13	4	0.00	0.0	0	27.0	34.660
28	26.72	34.656	4.65	8.24	2.32	0.11	4	0.00	0.0	25	26.75	34.657
57	26.72	34.660	4.55	8.25	2.32	0.13	4	0.00	0.0	50	26.72	34.659
85	26.74	34.665	4.55	8.25	2.34	0.13	5	0.00	0.0	75	26.73	34.663
114	26.74	34.675	4.58	8.26	2.31	0.13	5	0.00	0.0	100	26.74	34.669
170	23.25	34.952	4.39	8.25	2.32	0.20	5	0.17	0.1	150	25.20	34.750
225	18.53	34.797	3.78	8.20	2.32	0.62	9	0.00	4.5	200	20.80	34.935
283	13.99	34.484	3.45	8.13	2.31	1.16	17	0.00	12.6	250	16.34	34.645
340	10.68	34.272	3.41	8.07	2.31	1.57	27	0.00	16.6	300	13.00	34.410
396	8.62	34.164	3.21	8.03	2.31	1.97	43	0.00	23.8	350	10.22	34.250
452	7.70	34.272	1.74	7.93	2.32	2.46	58	0.00	30.8	400	8.55	34.165
564	6.92	34.433	1.07	7.84	2.34	2.89	67	0.00	34.9	500	7.26	34.363
675	6.17	34.486	1.04	7.82	2.36	3.06	73	0.01	37.8	600	6.61	34.457
785	5.53	34.506	1.15	7.80	2.37	3.17	88	0.00	38.1	700	6.03	34.494
895	5.04	34.522	1.14	7.80	2.39	3.19	95	0.00	39.0	800	5.48	34.509
1109	4.15	34.550	1.46	7.81	2.39	3.21	111	0.00	38.8	1000	4.56	34.536
1311	3.30	34.578	1.84	7.85	2.41	3.11	128	0.00	38.2	1200	3.70	34.560
1295	3.49	34.569	1.73	7.85	2.40	3.15	127	0.00	38.2	1500	2.95	34.592
1553	2.86	34.597	1.97	7.86	2.40	3.15	139	0.01	37.6	2000	2.22	34.634
1982	2.25	34.632	2.32	7.89	2.43	3.08	147	0.00	37.0	2500	1.84	34.666
2408	1.90	34.665	2.58	7.93	2.48	2.89	154	0.01	37.1	3000	1.67	34.675
2837	1.71	34.671	2.93	7.92	2.44	2.89	157	0.01	36.5	3500	1.54	34.685
3270	1.60	34.681	3.16	7.90	2.44	2.85	154	0.00	36.1	4000	1.48	34.694
3709	1.50	34.688	3.32	7.92	2.47	2.76	154	0.00	34.5	4500	1.46	34.700
4154	1.47	34.696	3.67	7.94	2.47	2.76	147	0.00	33.6	5000	1.48	34.704
4606	1.46	34.703	3.86	7.94	2.43	2.70	142	0.00	33.2	5500	1.51	34.706
5068	1.48	34.702	3.93	7.93	2.43	2.70	139	0.00	33.0			
5542	1.51	34.706	3.93	7.93	2.41	2.57	136	0.00	33.2			

KH-70-1 Latitude 12°01'N February 23, 1970 Depth 5,855 meters Air Temperature 27.0°C
Station H-10 Longitude 158°02'E 0415-0900

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Interpolated Water Temp.	Interpolated Salinity
0	27.3	34.336	4.52	8.23	2.31	0.11	5	0.00	0.0	0	27.3	34.336
26	27.11	34.336	4.62	8.24	2.29	0.15	5	0.01	0.0	25	27.12	34.336
51	27.08	34.335	4.54	8.25	2.27	0.11	5	0.00	0.0	50	27.08	34.335
77	27.10	34.346	4.55	8.26	2.26	0.13	4	0.00	0.0	75	27.10	34.344
103	27.09	34.351	4.54	8.26	2.22	0.13	5	0.00	0.0	100	27.09	34.350
154	20.65	34.730	4.03	8.25	2.26	0.53	8	0.29	2.0	150	21.30	34.728
206	12.86	34.439	2.96	8.13	2.26	0.52	21	0.01	16.7	200	13.40	34.455
258	10.42	34.422	1.87	8.00	2.26	2.19	35	0.00	25.9	250	10.68	34.420
-	-	-	-	-	-	-	-	-	-	300	9.80	34.500
363	9.06	34.580	0.93	7.93	2.26	2.70	44	0.00	33.3	350	9.20	34.573
415	8.53	34.581	1.03	7.86	2.27	2.74	47	0.01	33.4	400	8.68	34.581
520	7.58	34.607	1.34	7.86	2.34	2.87	55	0.00	33.5	500	7.76	34.603
626	6.81	34.533	1.51	7.85	2.34	2.89	63	0.00	33.8	600	7.02	34.555
732	6.00	34.525	1.63	7.84	2.32	3.00	74	0.00	35.1	700	6.28	34.524
836	5.48	34.536	1.44	7.82	2.34	3.11	83	0.00	36.9	800	5.61	34.532
1044	4.54	34.553	1.50	7.83	2.34	3.19	102	0.00	38.2	1000	4.75	34.550
1254	3.62	34.593	1.74	7.84	2.36	3.19	120	0.00	38.4	1200	3.80	34.580
1274	3.57	34.580	1.75	7.85	2.37	3.21	121	0.00	38.2	1500	2.98	34.603
1565	2.84	34.608	2.06	7.84	2.39	3.17	135	0.01	37.9	2000	2.22	34.637
2050	2.18	34.640	2.42	7.89	2.37	3.08	147	0.02	36.7	2500	1.91	34.666
2531	1.90	34.667	2.64	7.94	2.43	2.98	153	0.00	36.7	3000	1.71	34.674
3015	1.71	34.674	3.00	7.93	2.41	2.98	154	0.01	35.4	3500	1.56	34.684
3491	1.56	34.684	3.30	7.93	2.40	2.89	151	0.01	35.3	4000	1.48	34.693
3963	1.48	34.692	3.54	7.95	2.40	2.74	146	0.00	34.1	4500	1.46	34.699
4431	1.46	34.699	3.81	7.95	2.39	2.74	142	0.00	33.3	5000	1.46	34.703
4908	1.46	34.694	3.96	7.94	2.39	2.70	138	0.00	33.2	5500	1.49	34.705
5390	1.48	34.708	3.98	7.95	2.37	2.70	138	0.00	33.0			
5876	1.56	34.706	3.93	7.94	2.40	2.50	135	0.00	32.9			

KH-70-1 Latitude 09°05'N February 24, 1970 Depth 4,900-5,000 meters Air Temperature 26.2°C
Station H-11 Longitude 157°57'E 0200-0907

Depth (m)	Water Temp. (°C)	Salinity (‰)	Dissolved O_2 (ml/l)	pH	Alkalinity (meq/l)	PO_4-P (µgat/l)	SiO_2-Si (µgat/l)	NO_2-N (µgat/l)	NO_3-N (µgat/l)	Interpolated Depth	Interpolated Water Temp.	Interpolated Salinity
0	28.3	34.489	4.45	8.23	2.32	0.13	5	0.00	0.0	0	28.3	34.489
22	28.10	34.498	4.54	8.25	2.31	0.15	5	0.00	0.0	25	28.10	34.499
44	28.09	34.500	4.44	8.26	2.31	0.15	5	0.00	0.0	50	28.10	34.499
66	28.10	34.497	4.46	8.26	2.29	0.15	5	0.00	0.0	75	28.10	34.487
87	28.03	34.476	4.47	8.27	2.26	0.15	6	0.01	0.0	100	27.80	34.495
130	19.92	34.678	3.96	8.20	2.27	0.64	9	0.37	3.2	150	16.75	34.620
175	13.06	34.464	2.75	8.13	2.29	1.57	21	0.00	17.7	200	11.33	34.480
218	10.64	34.505	1.46	8.01	2.31	2.27	35	0.00	27.6	250	10.00	34.578
262	9.85	34.600	0.91	7.91	2.29	2.57	41	0.00	32.2	300	9.62	34.626
306	9.56	34.627	0.83	7.86	2.27	2.66	43	0.00	33.0	350	9.13	34.624
350	9.13	34.624	0.87	7.85	2.31	2.66	43	0.03	33.0	400	8.82	34.618
437	8.52	34.607	1.03	7.85	2.31	2.72	46	0.03	33.7	500	7.92	34.582
525	7.62	34.568	1.24	7.83	2.31	2.79	55	0.00	35.1	600	6.87	34.542
611	6.72	34.539	1.42	7.86	2.32	2.83	67	0.00	35.6	700	6.10	34.534
697	6.13	34.534	1.43	7.84	2.31	2.83	73	0.00	36.7	800	5.58	34.539
874	5.24	34.544	1.34	7.84	2.32	3.08	81	0.01	37.9	1000	4.71	34.554
1062	4.42	34.558	1.81	7.85	2.32	3.11	102	0.01	36.8	1200	3.95	34.568
1087	4.58	34.554	1.75	7.84	2.32	3.08	100	0.00	36.8	1500	2.98	34.599
1348	3.41	34.585	2.05	7.86	2.36	3.11	123	0.00	37.5	2000	2.18	34.640
1780	2.45	34.624	2.29	7.89	2.39	3.11	142	0.04	37.0	2500	1.85	34.662
2204	2.01	34.651	2.54	7.93	2.43	2.91	148	0.00	36.3	3000	1.62	34.672
2637	1.79	34.665	2.88	7.93	2.40	2.91	156	0.01	35.1	3500	1.50	34.682
3069	1.58	34.674	3.18	7.93	2.40	2.87	152	0.00	34.0	4000	1.47	34.690
3513	1.50	34.682	3.35	7.96	2.39	2.79	150	0.01	33.9	4500	1.44	34.695
3970	1.47	34.690	3.67	7.96	2.39	2.72	144	0.00	33.2			
4444	1.44	34.694	3.84	7.95	2.39	2.70	139	0.02	32.9			

Appendix II

S. T. D. Data

Depth (m)	Station S-2 Lat. 30°42'N Long. 157°40'E Feb. 8, 1970 Temp. (°C)	Salinity (‰)	Station S-3 Lat. 32°00'N Long. 158°00'E Feb. 8, 1970 Temp. (°C)	Salinity (‰)	Station S-4 Lat. 33°01'N Long. 158°01'E Feb. 8, 1970 Temp. (°C)	Salinity (‰)	Station S-5 Lat. 33°41'N Long. 157°59'E Feb. 9, 1970 Temp. (°C)	Salinity (‰)	Station S-6 Lat. 34°20'N Long. 158°00'E Feb. 9, 1970 Temp. (°C)	Salinity (‰)
0	18.36	34.87	16.88	34.86	17.10	34.794	16.34	34.76	-	-
25	18.36	34.87	16.87	34.80	16.10	34.79	16.35	34.76	15.46	34.66
50	18.36	34.87	16.85	34.80	16.01	34.79	16.28	34.76	15.46	34.66
75	18.36	34.87	16.82	34.80	16.02	34.79	16.27	34.76	15.46	34.66
100	18.22	34.87	16.80	34.80	16.02	34.79	16.25	34.76	15.46	34.66
125	18.06	34.87	16.59	34.78	16.02	34.79	16.20	34.76	15.46	34.66
150	18.05	34.85	16.38	34.75	16.00	34.78	16.18	34.76	15.46	34.66
200	17.42	34.82	16.29	34.75	15.95	34.77	14.75	34.62	15.02	34.65
250	16.66	34.78	16.00	34.70	14.25	34.60	13.25	34.49	13.88	34.56
300	16.00	34.72	15.32	34.64	13.07	34.58	12.21	34.43	12.50	34.52
400	14.99	34.53	12.85	34.46	10.15	34.34	8.73	34.20	9.05	34.23
500	11.50	34.33	10.63	34.32	7.20	34.20	5.88	34.00		
600	8.76	34.13	7.50	34.06	5.62	34.20	5.00	34.08		
700	6.01	34.05	5.53	34.03	4.73	34.21	4.29	34.16		
800	4.76	34.15	4.67	34.11	4.22	34.29	3.92	34.24		
1000	3.62	34.31	3.65	34.28	3.57	34.36	3.22	34.36		
1200	2.97	34.37	3.02	34.39	3.04	34.37	2.74	34.40		

Depth (m)	Station S-9 Lat. 30°00'N Long. 158°02'E Feb. 16, 1970 Temp. (°C)	Salinity (‰)	Station S-10 Lat. 29°26'N Long. 158°01'E Feb. 17, 1970 Temp. (°C)	Salinity (‰)	Station S-11 Lat. 28°58'N Long. 158°00'E Feb. 17, 1970 Temp. (°C)	Salinity (‰)	Station S-12 Lat. 28°31'N Long. 158°03'E Feb. 17, 1970 Temp. (°C)	Salinity (‰)	Station S-13 Lat. 28°03'N Long. 158°06'E Feb. 17, 1970 Temp. (°C)	Salinity (‰)
0	19.20	34.928	-	-	18.18	34.90	18.47	34.91	-	-
25	18.32	34.87	17.38	34.92	18.18	34.90	18.47	34.91	18.53	34.91
50	18.32	34.87	17.38	34.92	18.10	34.90	18.41	34.91	18.42	34.92
75	18.31	34.87	17.35	34.92	18.06	34.90	18.32	34.91	18.34	34.92
100	18.30	34.87	17.33	34.92	18.05	34.90	18.28	34.91	18.28	34.92
125	18.28	34.87	17.30	34.92	18.05	34.90	18.21	34.91	17.65	34.88
150	18.26	34.87	17.17	34.92	17.41	34.90	18.20	34.91	17.08	34.88
200	16.90	34.80	17.07	34.82	16.62	34.83	16.98	34.81	16.72	34.84
250	16.19	34.76	16.46	34.79	15.75	34.80	16.49	34.80	16.11	34.79
300	15.42	34.66	15.42	34.69	14.55	34.69	15.70	34.70	15.25	34.71
400	13.15	34.49	13.22	34.52	12.18	34.50	13.38	34.54	12.97	34.52
500	10.50	34.31	10.91	34.34	9.60	34.30	10.97	34.37	10.76	34.38
600	7.35	34.08	8.10	34.13	6.95	34.12	7.48	34.09	7.15	34.10
700	5.25	34.05	5.73	34.08	5.08	34.09	5.42	34.08	5.27	34.10
800	4.48	34.15	4.72	34.12	4.15	34.17	4.55	34.16	4.38	34.19
1000	3.55	34.31	3.69	34.30	3.42	34.35	3.48	34.34	3.38	34.37
1200										

Depth (m)	Station S-14 Lat. 27°31'N Long. 158°04'E Feb. 17, 1970		Station S-15 Lat. 26°58'N Long. 158°00'E Feb. 18, 1970		Station S-16 Lat. 26°30'N Long. 158°01'E Feb. 18, 1970		Station S-17 Lat. 25°59'N Long. 158°02'E Feb. 18, 1970		Station S-18 Lat. 25°29'N Long. 157°59'E Feb. 18, 1970	
	Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)
0	20.60	35.081	22.70	35.288	21.00	35.177	22.10	35.273	22.13	35.292
25	20.26	35.11	21.70	35.21	20.83	35.17	22.00	35.29	22.15	35.30
50	19.81	35.02	20.75	35.14	20.47	35.11	21.05	35.18	21.87	35.28
75	19.55	34.98	20.56	35.13	20.41	35.10	20.74	35.14	20.75	35.09
100	18.94	34.87	19.45	34.97	20.29	35.08	20.67	35.15	20.50	35.04
125	18.58	34.87	18.05	34.84	18.96	34.90	20.62	35.15	19.92	35.04
150	18.52	34.89	17.70	34.83	17.66	34.81	20.68	35.07	19.00	34.94
200	17.07	34.82	16.93	34.81	16.73	34.79	17.85	34.88	16.96	34.81
250	16.63	34.78	16.30	34.77	16.07	34.74	16.62	34.80	16.35	34.77
300	16.11	34.76	15.51	34.70	15.25	34.66	15.59	34.72	15.35	34.67
400	13.84	34.56	13.18	34.49	13.23	34.49	13.38	34.50	13.02	34.45
500	10.95	34.30	10.55	34.26	10.45	34.25	10.80	34.30	10.80	34.28
600	8.16	34.15	7.70	34.09	7.86	34.08	8.00	34.12	7.59	34.07
700	5.79	34.07	5.75	34.07	6.00	34.05	6.07	34.10	5.62	34.06
800	4.46	34.15	4.69	34.15	4.65	34.12	4.84	34.16	4.63	34.14
1000	3.47	34.33	3.54	34.13	3.56	34.31	3.74	34.36	3.82	34.32
1200										

	Station S-19		Station S-20		Station S-21		Station S-22		Station S-23	
	Lat. 25°01'N Long. 158°01'E Feb. 18, 1970		Lat. 24°32'N Long. 158°02'E Feb. 18, 1970		Lat. 24°02'N Long. 158°02'E Feb. 19, 1970		Lat. 23°39'N Long. 158°05'E Feb. 19, 1970		Lat. 22°58'N Long. 158°05'E Feb. 19, 1970	
Depth (m)	Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)
0	22.60	35.270	22.80	35.251	24.00	35.194	23.85	35.186	24.25	35.108
25	22.54	35.27	22.74	35.30	23.67	35.20	23.57	35.22	24.18	35.12
50	22.45	35.27	22.52	35.29	23.28	35.24	23.42	35.24	23.60	35.20
75	22.13	35.27	20.38	35.00	22.80	35.28	23.04	35.23	22.52	35.14
100	21.75	35.22	19.48	34.96	22.57	35.30	21.87	35.15	20.68	35.01
125	20.86	34.98	18.52	34.90	21.43	34.98	20.50	35.06	19.72	34.96
150	19.35	34.84	17.65	34.86	18.88	34.89	18.77	34.96	18.25	34.88
200	17.25	34.81	16.70	34.83	17.07	34.81	17.39	34.87	16.74	34.80
250	16.16	34.71	15.93	34.77	16.20	34.77	16.24	34.76	16.06	34.74
300	15.02	34.58	14.99	34.63	14.95	34.64	15.21	34.64	14.65	34.56
400	12.76	34.40	12.40	34.43	12.57	34.45	12.41	34.42	12.24	34.40
500	10.07	34.19	9.93	34.24	9.88	34.22	9.63	34.21	8.80	34.14
600	7.29	34.08	7.28	34.10	7.10	34.10	6.75	34.09	6.66	34.12
700	5.85	34.11	5.45	34.12	5.58	34.17	5.36	34.16	5.48	34.18
800	4.66	34.17	4.59	34.21	4.78	34.25	4.65	34.25	4.68	34.32
1000	3.66	34.35	3.68	34.43	3.72	34.41	3.76	34.43	3.83	34.46
1200										

Depth (m)	Station S-24 Lat. 22°30'N Long. 158°00'E Feb. 19, 1970 Temp. (°C)	Salinity (‰)	Station S-25 Lat. 22°00'N Long. 158°01'E Feb. 19, 1970 Temp. (°C)	Salinity (‰)	Station S-26 Lat. 21°29'N Long. 157°59'E Feb. 20, 1970 Temp. (°C)	Salinity (‰)	Station S-27 Lat. 20°51'N Long. 157°51'E Feb. 20, 1970 Temp. (°C)	Salinity (‰)	Station S-28 Lat. 20°31'N Long. 157°59'E Feb. 20, 1970 Temp. (°C)	Salinity (‰)
0	25.30	35.009	25.40	35.001	25.30	34.998	26.10	34.957	25.56	34.97
25	25.05	35.01	25.20	35.01	25.11	35.00	25.68	34.96	25.56	34.97
50	25.05	35.01	25.20	35.01	24.88	35.03	25.65	34.98	25.45	34.98
75	24.85	35.02	25.14	35.03	24.73	35.05	25.40	35.02	25.43	34.98
100	24.40	35.09	23.56	35.07	24.24	35.11	25.30	35.04	25.42	34.98
125	22.30	35.04	21.65	35.02	24.04	35.18	23.95	35.06	25.33	34.99
150	20.51	34.97	19.76	34.96	22.80	35.19	21.98	35.05	24.42	35.01
200	17.85	34.87	17.65	34.85	17.37	34.89	-	34.93	20.25	35.00
250	16.48	34.78	16.53	34.78	16.20	34.79	16.68	34.75	17.75	34.87
300	15.25	34.65	15.62	34.68	14.87	34.64	15.10	34.58	15.44	34.66
400	12.05	34.37	12.17	34.36	11.80	34.38	11.36	34.25	11.47	34.30
500	9.31	34.18	9.35	34.17	8.25	34.15	8.55	34.15	8.61	34.17
600	7.32	34.11	7.04	34.15	6.39	34.17	6.66	34.17	6.57	34.15
700	5.59	34.17	5.66	34.23	5.42	34.23	5.28	34.29	5.46	34.23
800	4.75	34.28	5.11	34.34	4.74	34.36	4.76	34.37	4.68	34.34
1000	3.92	34.43	4.13	34.48	4.00	34.50	4.02	34.49	3.89	34.48
1200										

	Station S-29		Station S-30	
	Lat. 20°00'N Long. 158°00'E Feb. 20, 1970		Lat. 10°30'N Long. 158°00'E Feb. 23, 1970	
Depth (m)	Temp. (°C)	Salinity (‰)	Temp. (°C)	Salinity (‰)
0	25.94	34.89	27.62	34.875
25	25.42	34.98	27.59	34.45
50	25.35	35.00	27.55	34.45
75	25.33	35.00	27.54	34.45
100	25.22	35.05	27.54	34.47
125	25.16	35.06	24.40	34.75
150	25.02	35.06	17.50	34.72
200	21.75	35.09	12.25	34.55
250	19.32	34.98	10.11	34.61
300	16.83	34.82	9.58	34.64
400	12.88	34.40	8.84	34.62
500	9.75	34.21	7.90	34.59
600	6.73	34.19	7.07	34.56
700	5.45	34.29	6.12	34.55
800	4.83	34.38	5.65	34.54
1000	3.96	34.51	4.64	34.55
1200			3.80	34.56