Preliminary Report

of

The Hakuhō Maru Cruise KH-70-2

(Great Bear Expedition)

April 14—June 18, 1970

North Pacific

Ocean Research Institute

University of Tokyo

1971

Captain Tsuyoshi Yano

1920 - 1971

We wish to express our appreciation to the deep understanding on the research of oceanography of Late Captain Yano.

He was always the best friend to all of the Scientific members of the Expedition.

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Dedicated to

Late Captain Tsuyoshi Yano

by

The Scientific Members of the Expedition

Edited by

Yoshio Horibe

Contents

1. Objects

KH-70-2 Cruise (Great Bear Expedition) is a part of the Pan Pacific Program by chemistry group of the Japanese oceanographers. The program aims at the establishment of the chemical and isotopic data of the ocean for the better understanding of the large scale circulation and mixing processes and chemical processes occurring in the Pacific.

The Great Bear Expedition was preceeded by the Southern Cross Cruise (KH-68-4) which was done in the Central Pacific from 30°N down to 70°S, and the expedition was expected to supplement the Southern Cross Cruise by adding the data north of 30°N along 170°W.

The expedition will be followed by the KH-71-5 Cruise (Phoenix Expedition) which will be carried out in 1971-1972 in the eastern Central and South Pacific.

2. Scientists Aboard

HORIBE, Yoshio	Ocean Res. Inst., Univ. of Tokyo	Isotope oceanography
TOMODA, Yoshibumi	Ocean Res. Inst., Univ. of Tokyo	Submarine geophysics
SUGIMURA, Yukio	Meteor. Res. Inst.	Nuclear oceanography
WATANUKI, Kunihiko	Dept. of Chem., Univ. of Tokyo	Geochemistry
NAKAI, Toshisuke	Ocean Res. Inst., Univ. of Tokyo	Physical oceanography
YAMAMOTO, Katsumi	Kobe Marine Observatory	Chemical oceanography
NAGAYA, Hiroshi	Natl. Inst. Radiological Sciences	Radio-ecology
HANDA, Nobuhiko	Water Res. Lab., Nagoya Univ.	Geochemistry
OKAZAKI, Moriyoshi	Inst. Phys. Chem. Res.	Physical oceanography
SHIGEHARA, Koji	Ocean Res. Inst., Univ. of Tokyo	Isotope oceanography
KAMATANI, Akiyoshi	Tokyo Univ. of Fisheries	Marine biology
TSUNOGAI, Shizuo	Dept. of Chem., Hokkaido Univ.	Geochemistry
KITAZAWA, Kazuhiro	Ocean Res. Inst., Univ. of Tokyo	Submarine geophysics
NAKAMURA, Kiyoshi	Natl. Inst. Radiological Sciences	Radio-ecology
KISHINO, Motoaki	Inst. Phys. Chem. Res.	Physical oceanography
OTOBE, Hirotaka	Ocean Res. Inst., Univ. of Tokyo	Oceanography
KOIZUMI, Kinichiro	Ocean Res. Inst., Univ. of Tokyo	Submarine geophysics
IGARASHI, Takao	Ocean Res. Inst., Univ. of Tokyo	Submarine geophysics
YANAGI, Katsumi	Water Res. Lab., Nagoya Univ.	Chemistry
YASUJIMA, Tadahide	Tokyo Kyoiku Univ.	Chemistry
MATUMOTO, Eiji	Tokyo Kyoiku Univ.	Chemistry
KIDO, Katsutoshi	Dept. of Chem., Hokkaido Univ.	Chemistry
SAITO, Osamu	Dept. of Chem., Hokkaido Univ.	Chemistry
ISHIHARA, Shoji	Tokyo Univ. of Fisheries	Chemistry
NOMURA, Tamotsu	Dept. of Chem., Kanazawa Univ.	Chemistry
MOTOMURA, Hirotoshi	Ocean Res. Inst., Univ. of Tokyo	Chemistry
KERREST, Yann M.	Ocean Res. Inst., Univ. of Tokyo	Chemistry

3. Outline of the Expedition

The expedition was devided into three legs, as is shown in Figure 1. Leg I was from Tokyo to Honolulu, Hawaii, in which oceanographic works were done along 170°W longitude between 51°N and 30°N. Leg II was from Honolulu to Seattle, where oceanographic works were done along 146°W between 17°N and 50°N, and along 50°N latitude. Leg III was from Seattle to Tokyo, where only chemical works on surface sea water and geophysical works were done.

Table I shows the items of sampling, measurements done in each leg, and all the stations for hydrocast, large volume water sampling, piston coring are shown in Table 2, 3, and 4, respectively.

Table 1. Observation Items

	Leg		
	I	II	III
1. Hydrocast	x	x	
2. Large volume water sampling	x	x	
3. Core sampling	x	x	x
4. Air sampling	x	x	x
5. Surface CO_2 measurement	x	x	x
6. Magnetic intensity measurement	x	x	x
7.Gravity measurement	x	x	x

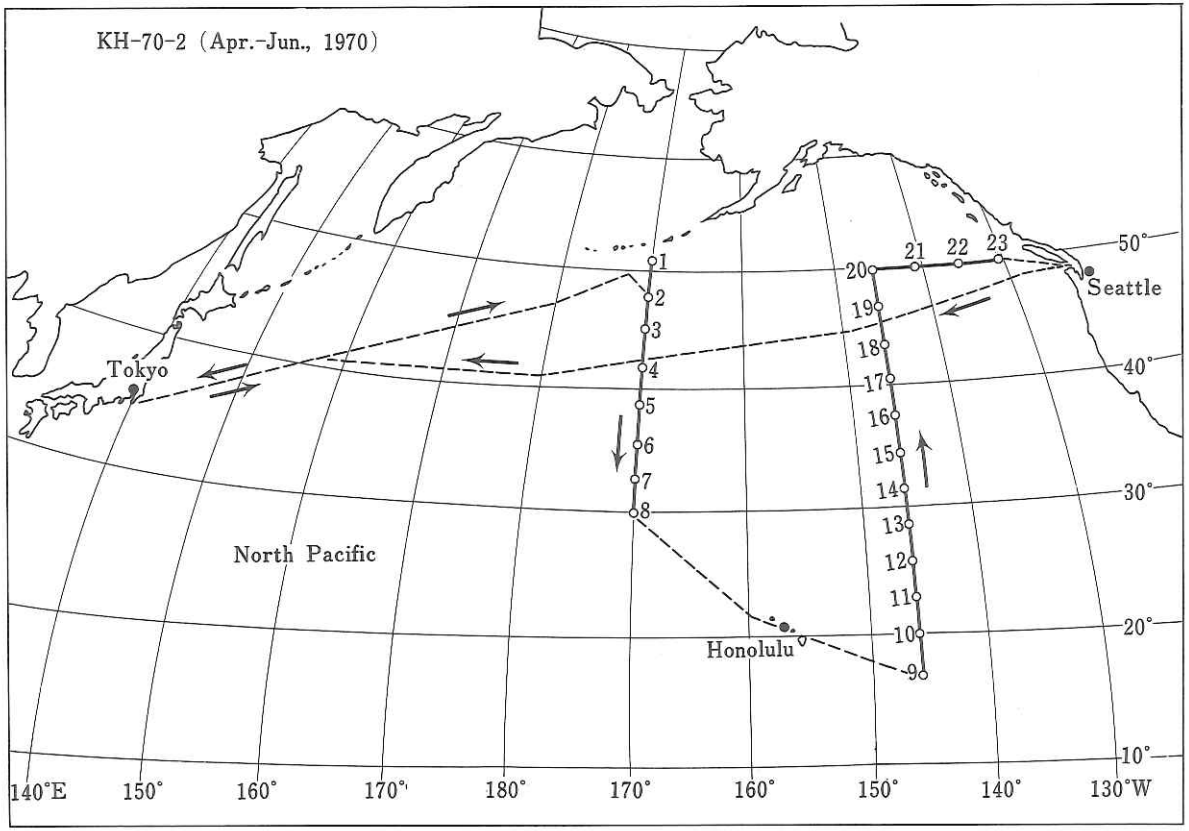

Fig. 1. Hydrographic station

4. Hydrocast

by

Y.Horibe, Y.Sugimura, K.Watanuki, T.Nakai
S.Tsunogai, K.Yamamoto, and N.Handa

The standard hydrocasts were done at 23 stations along 170°W longitude, 146°W longitude, and 50°N latitude, which were shown in Table 2.

The hydrocast was carried out by the same way as was described in detail in the Preliminary Report of the "Hakuhō Maru" Cruise KH-68-4.[1] In some cases when the circumstances permitted, the S.T.D. system (Hyteck Model 9006) with eleven Rosette samplers (2.4 liter capacity) was used for the upper 1200 meters cast, and the procedure was found to be very satisfactory for the effective sampling of sea water.

4.1. Salinity

Details of the salinity measurement were the same as was described earlier[1], except that the temperature of the sample sea water was equilibrated with room temperature by electric fan. The sea water sample in the cell of the salinometer was transferred and sealed into an ampoule which was brought back to the laboratory for oxygen and hydrogen isotopic analyses.

4.2. Dissolved oxygen

Dissolved oxygen was measured by the same method as was described earlier in detail[1].

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1) Preliminary Report of the "Hakuhō Maru" Cruise KH-68-4 (Southern Cross Cruise), Nov.14,1968 - March 3,1969, Ocean Research Institute, University of Tokyo, 1970, Edited by Y.Horibe. Available on request.

Table 2. Stations of Standard Hydrocast

Station Number	Position		Time			Depth* (m)
	Latitude	Longitude	Date		Hour	
1	51°00'N	169°59'W	Apr.22	1970	1218-1840	5,890
2	48°00'N	169°59'W	Apr.21	1970	1533-2100	5,460
3	45°00'N	169°51'W	Apr.24	1970	0415-0910	5,600
4	42°03'N	169°57'W	Apr.24-25	1970	2235-0445	5,935
5	39°01'N	169°59'W	Apr.25-26	1970	2157-0212	5,245
6	35°56'N	169°53'W	Apr.27	1970	0300-0910	5,915-5,500
7	33°03'N	169°59'W	Apr.27-28	1970	2205-0445	5,835
8	30°03'N	170°03'W	May 1	1970	0022-0514	5,420
9	17°06'N	146°14'W	May 11	1970	1615-2135	4,950
10	20°02'N	145°59'W	May 13	1970	0130-0700	5,270
11	23°01'N	146°02'W	May 13-14	1970	2100-0250	5,650
12	26°01'N	146°02'W	May 14	1970	1650-2306	5,040
13	29°00'N	146°01'W	May 15	1970	1230-1746	4,950
14	31°57'N	146°07'W	May 16	1970	1110-1600	5,585
15	34°58'N	146°01'W	May 17	1970	1037-1612	5,405
16	37°43'N	145°49'W	May 18	1970	1400-2046	5,400
17	41°00'N	145°58'W	May 19	1970	1240-1545	4,795-4,765
18	44°00'N	146°01'W	May 20	1970	0755-1250	4,906
19	46°58'N	146°04'W	May 21	1970	0700-1505	4,850
20	49°57'N	146°00'W	May 22	1970	0515-1308	4,340
21	50°01'N	140°58'W	May 23	1970	1840-2212	4,000
22	50°00'N	135°59'W	May 24	1970	1223-1615	3,630
23	50°01'N	131°09'W	May 25	1970	0750-1215	3,000

* Time: Ship time

Depth is corrected for the velocity of sound.

4.3. Reactive Phosphate

Reactive phosphate in sea water was analysed according to the method of Murphy and Riley[Anal.Chim.Acta, 27, 31(1962)]. A composite reagent of molybdic acid, ascrobic acid and trivalent antimony was added to the sea water sample, and the absorbancy was measured at the wave length of 700 mμ in a 40 mm cell of the photoelectric colorimenter with a strip chart recorder. The CSK standard solution was used for the calibration in every series of analysis. The experimental error did not exceed more than 3% of the reported value.

4.4. Reactive Silicate

The analysis of reactive silicate was done by the same method as that reported in the Preliminary Report of the "Hakuhō Maru" Cruise KH-68-4.

4.5. Nitrite and nitrate

The analyses of nitrite and nitrate were done by the same method as those reported in the Preliminary Report of the "Hakuhō Maru" Cruise KH-68-4, except in some points described below.

(1) To a 40 ml portion of a sample in a 50 ml graduated cylinder was added 1.6 ml of 0.1 M EDTA solution. The solution was mixed and passed through a copperized cadmium column. Successively another 40 ml portion of the sample was treated in the same way.

(2) The column and beaker were washed with the first 50 ml portion of the solution and the next 25 ml portion of the elute was used for colorimetric determination by the method of Bendschneider and Robinson (1952).

(3) The calibration was done at the same time as the samples analysed, using an acutual or artificial seawater solution containing 40 μM nitrate.

(4) The standard deviation was 1-2% at the level of 40 μM. The accuracy seemed to be more than 95%.

4.6. pH and total alkalinity

pH and total alkalinity measurements were carried out by the method described in A Manual of Seawater Analysis by Strickland and Parsons (1968).

pH meter and reagents: Hitachi Model F-5 pH meter of precision (expandmatic) type was used throughout the cruise. The instrument was guaranteed to have precision of ±0.01 pH unit. Hitachi glass electrode (#1026-05 T 0-80°C) and Hitachi reference electrode (#2080-05 T 0-80°C) were used.

Tow buffer solutions were used to standardize the pH meter.

Phosphate buffer: 6.86 buffer solution standard (Wako Chem.Co.)
Phthalate buffer: 4.01 buffer solution standard (Wako Chem.Co.)

Procedure: The sample was taken into wide-mouth screw capped 100 ml polyethylene bottle directly from Nansen bottle. The bottle was warmed to the room temperature before measurement. A portion of the sample was transfered to another polyethylene bottle with a 50 ml pipette for the total alkalinity determination. The electrodes were immersed directly into the remaining sample water to measure pH. pH_s and pH_d were calculated by the following equation

$$pH_s = pH_m - \alpha (t - t_m)$$

$$pH_d = pH_s - \beta d$$

α and β were found in the tables of Strickland's manual. pH_d was shown in the table.

For the total alkalinity determination, 15.0 ml of 0.0100 N HCl solution was added to 50 ml of sea water, and resulting pH was measured by pH meter.

Total alkalinity was calculated by the following equation:

$$\text{Total alkalinity} = 3.00 - (1300\ a_H / f)$$

a_H and f were found in the tables of Strickland's manual.

4.7. Results

Cross section of temperature, salinity, σ_t, dissolved oxygen, pH, reactive phosphate, reactive silicate, nitrate along 170°W and 146°W longitude are shown in Figures 2-17. Cross sections along 170°W were drawn using the data of the present expedition together with those of the Southern Cross Cruise (KH-68-4).

All the data obtained and interpholated temperature and salinity data are tabulated in a separate tables (Oceanographic Data of KH-70-2 (Ursa Major-70 Expedition) of the Hakuhō Maru, Ocean Research Institute, University of Tokyo, 1971), and can be obtained on request.

5. Large Volume Water Sampling

by
Y.Sugimura

For the studies of distribution of radionuclides (thorium isotopes, plutonium, cesium-137, strontium-90, polonium-210, lead-210, uranium isotopes, and radium etc.), suspended matters and organic matters, large amount of water samples were collected at several stations along the meridional sections of 170°W and 146°W in the eastern North Pacific. As to the samplers which were used in this expedition, one is a plastic barrel water sampler of 200 liter and the other is the Niskin type water sampler of 400 liter (MRI Model).

Location and depth of water sampling are shown in Table 3.

Table 3. Stations for large volume water sampling

Station No.	Date & Hour	Location	Depth (m)
2-2	Apr. 23 0938-1300	48°01'N 169°58'W	0,25,50,75,100,125, 150,200
5-2	Apr. 26 0230-0500	39°02'N 169°58'W	0,25,50,75,100,125, 150,175,200,300
7-4	Apr. 28-29 1825-0049	33°07'N 169°54'W	0,25,50,75,100,125, 150,175,200,300,500, 700,1000,1500
9-4	May 11-12 2130-0732	17°07'N 146°16'W	0,25,50,75,100,125, 150,175,200,300,500, 1000,1500,2000
14-3	May 16 1555-1972	31°54'N 146°07'W	0,25,50,75,100,125, 150,175,200,300,500,
16-2	May 18 0630-1027	37°59'N 146°00'W	0,200,500,1000,2000
17-2	May 19 1543-1821	41°00'N 145°56'W	0,50,100,150,200,300, 500
20-2	May 22-23 1307-0254	49°58'N 146°01'W	0,25,50,75,100,125, 150,175,200,300,500, 700,1000,1500,2000, 3500

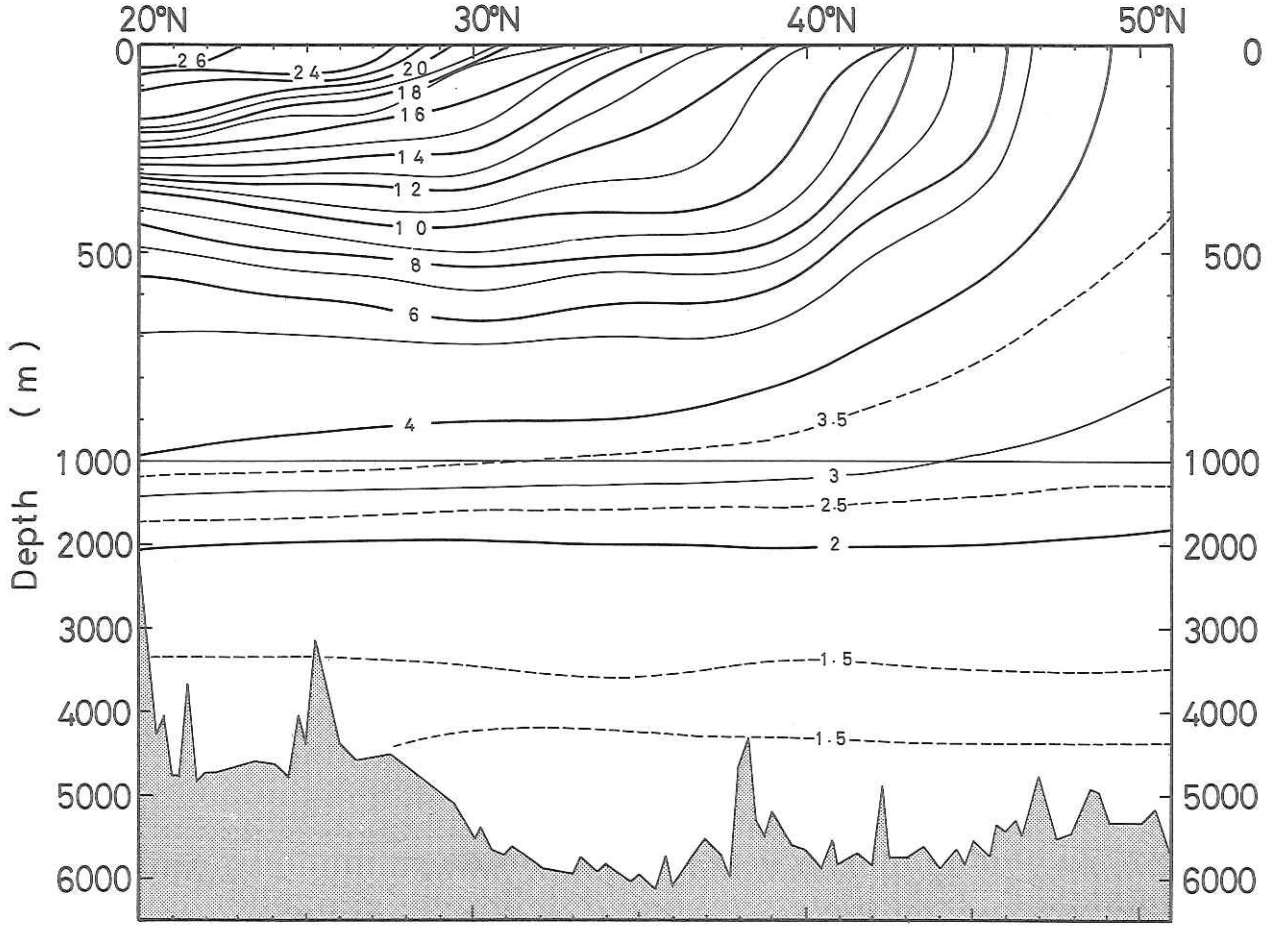

Fig. 2. Temperature profile, 170°W, 20°N-51°N.(Unit: °C)

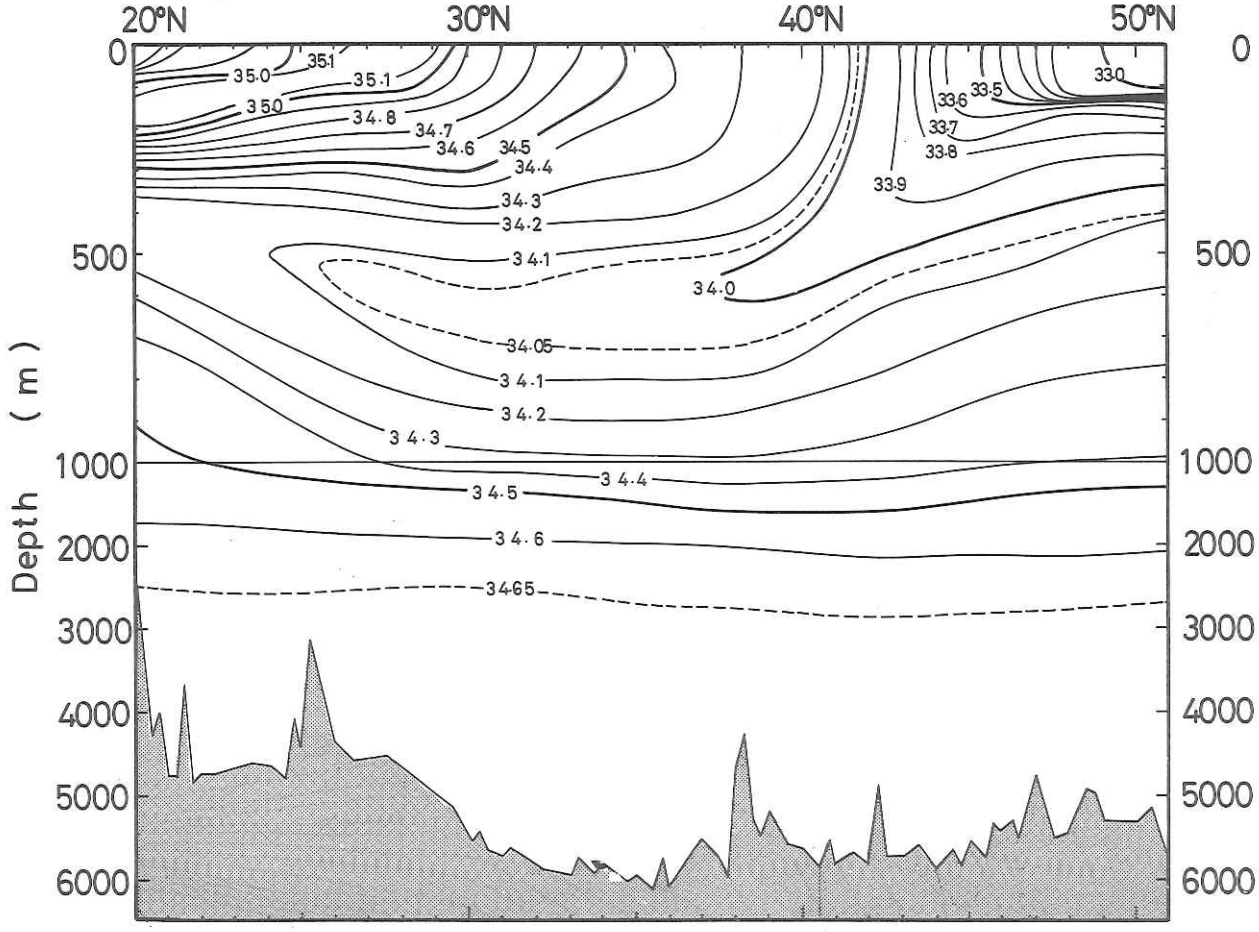

Fig. 3. Salinity profile, 170°W, 20°N-51°N.(Unit: ‰)

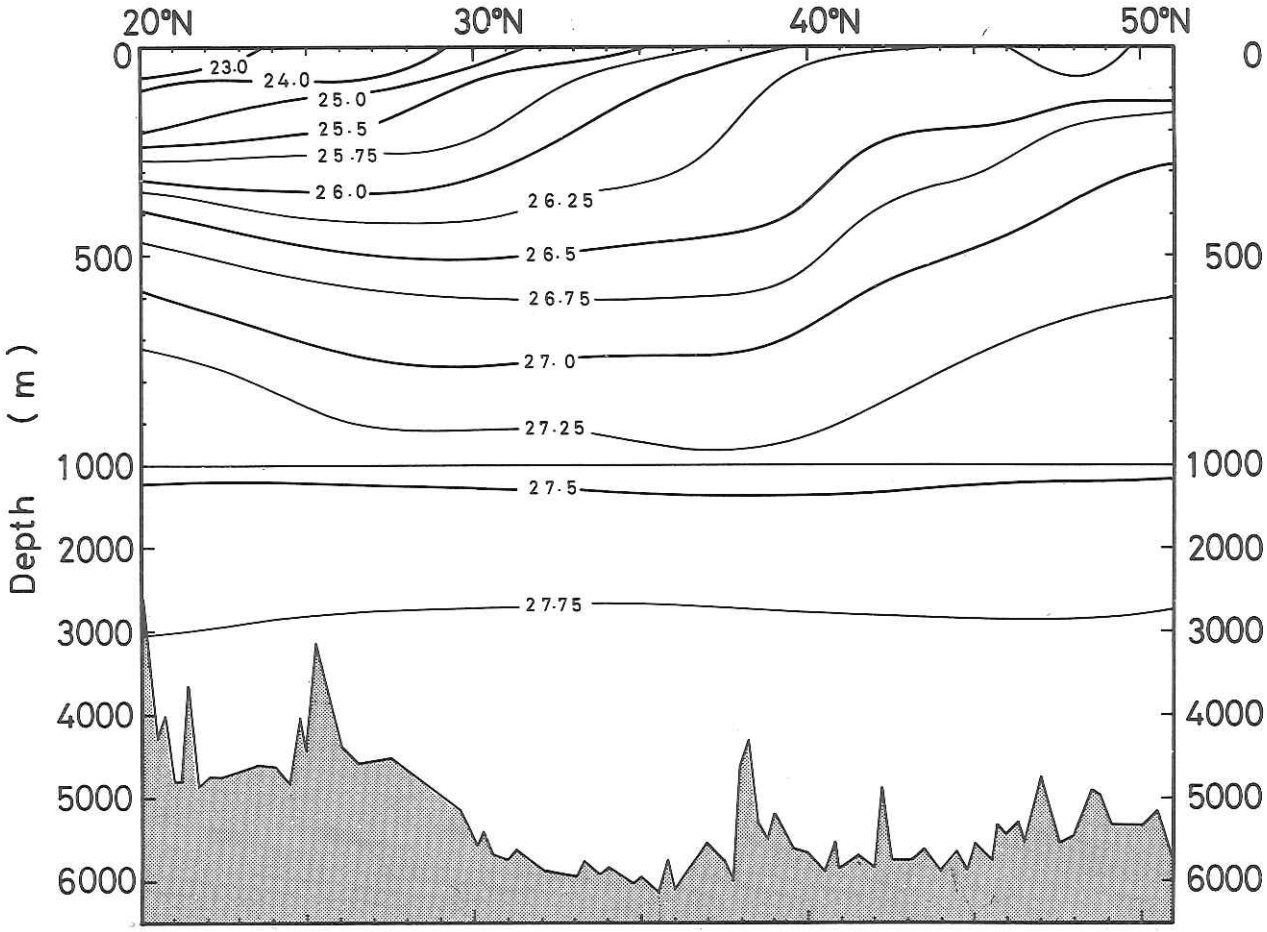

Fig. 4. σ_t profile, 170°W, 20°N-51°N.

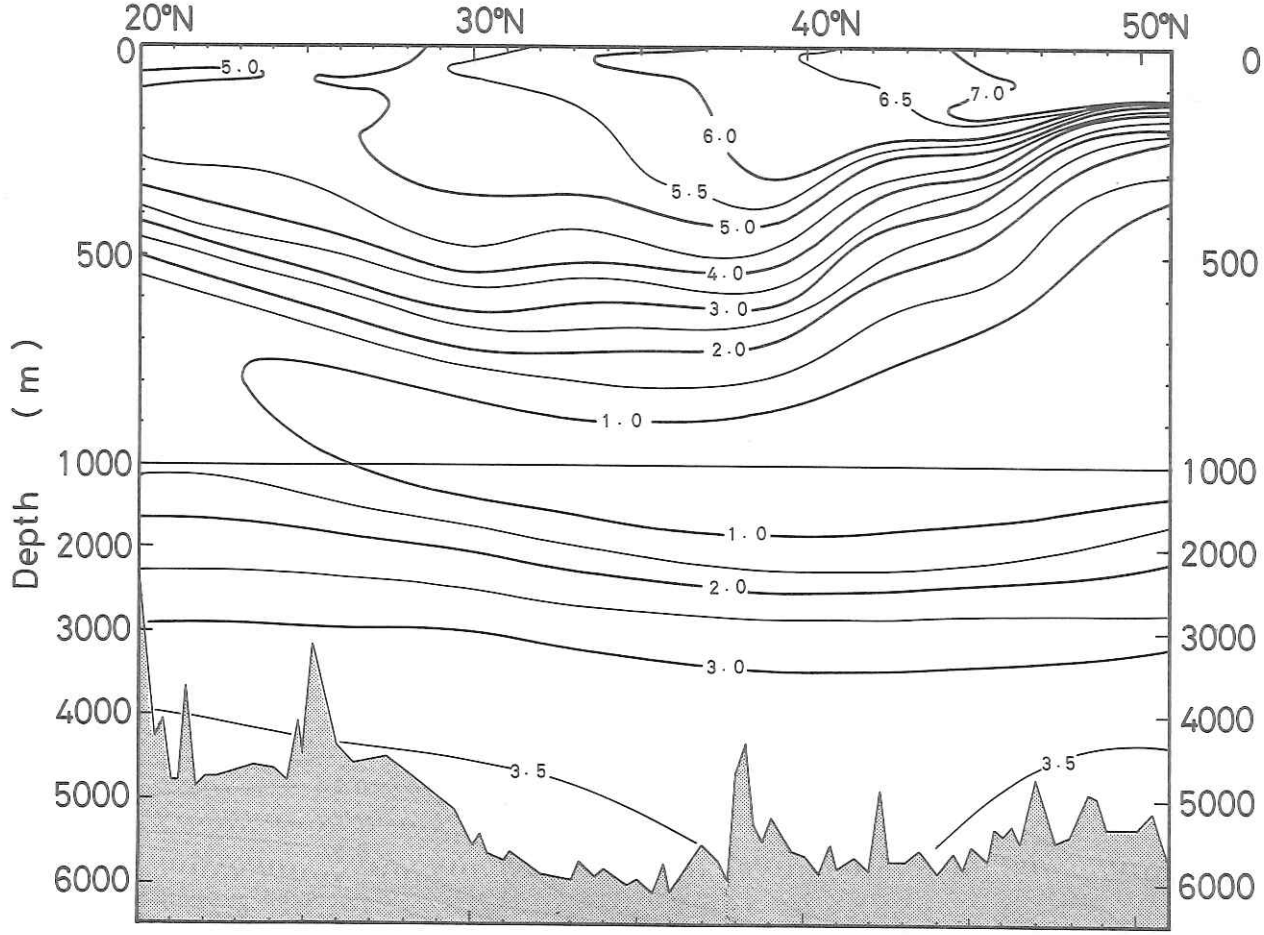

Fig. 5. Dissolved oxygen profile, 170°W, 20°N-51°N.(Unit: ml/l)

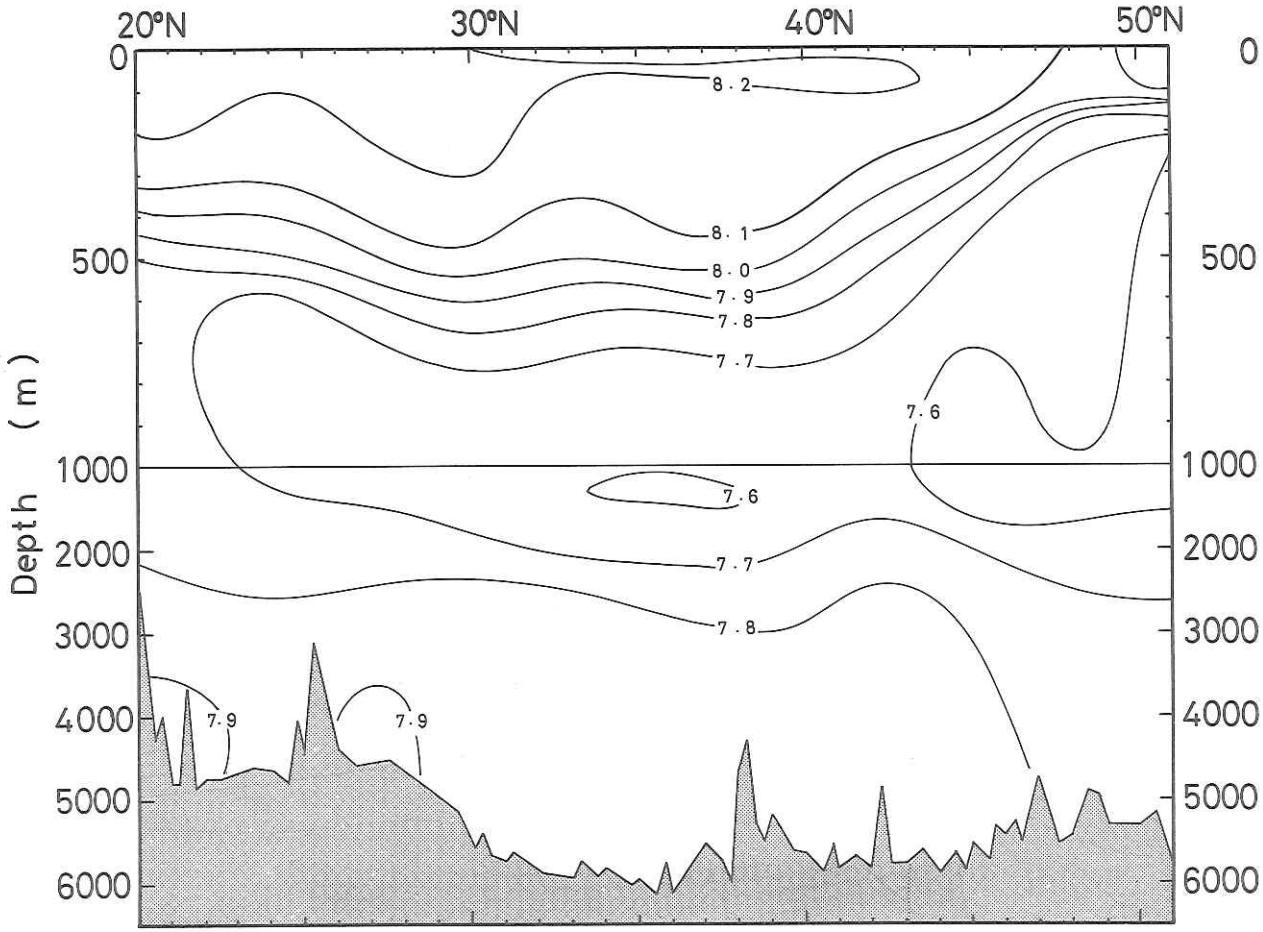

Fig. 6. pH profile, 170°W, 20°N-51°N.

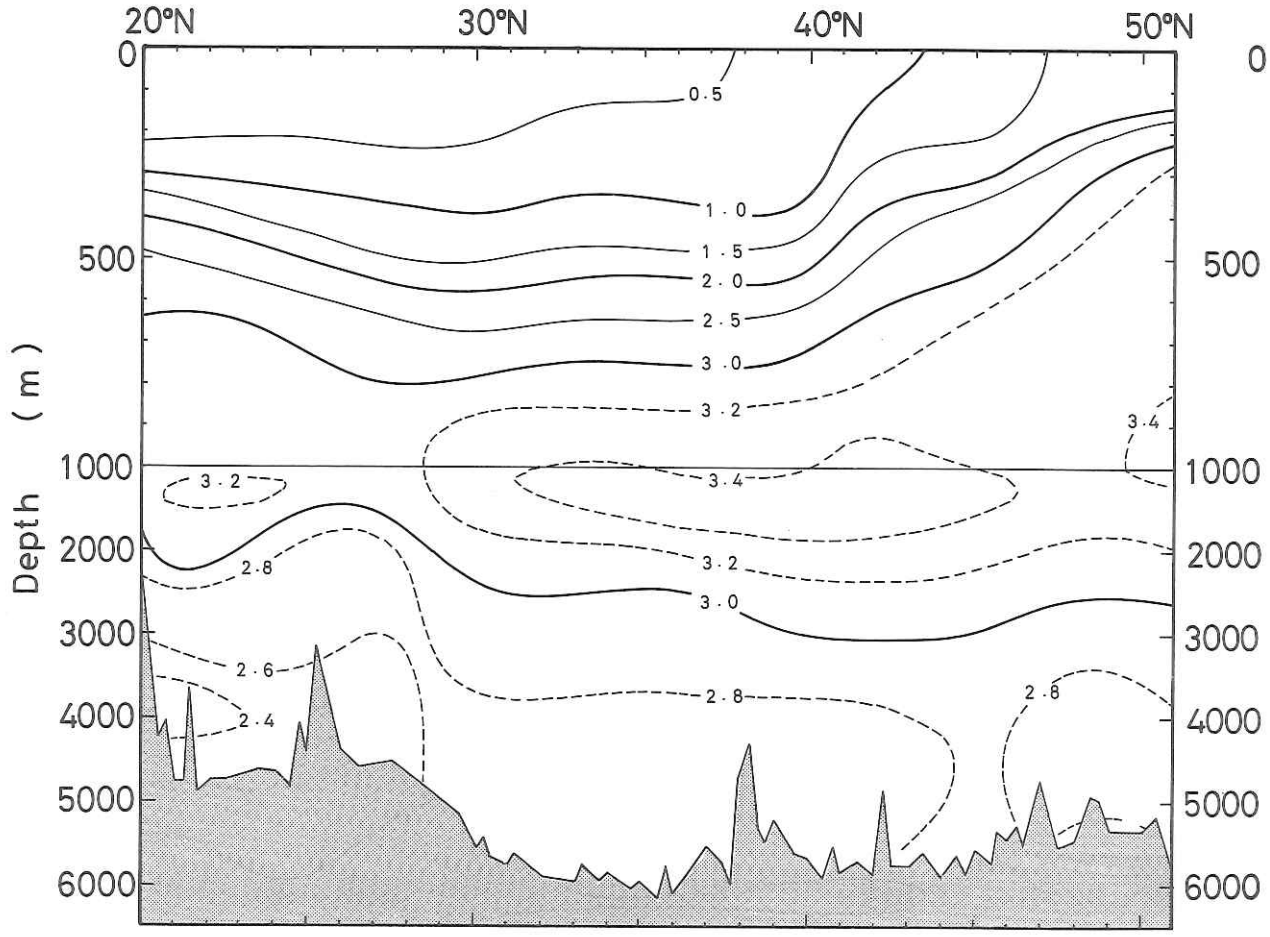

Fig. 7. Reactive phosphate profile, 170°W, 20°N-51°N.(Unit: µg at/l)

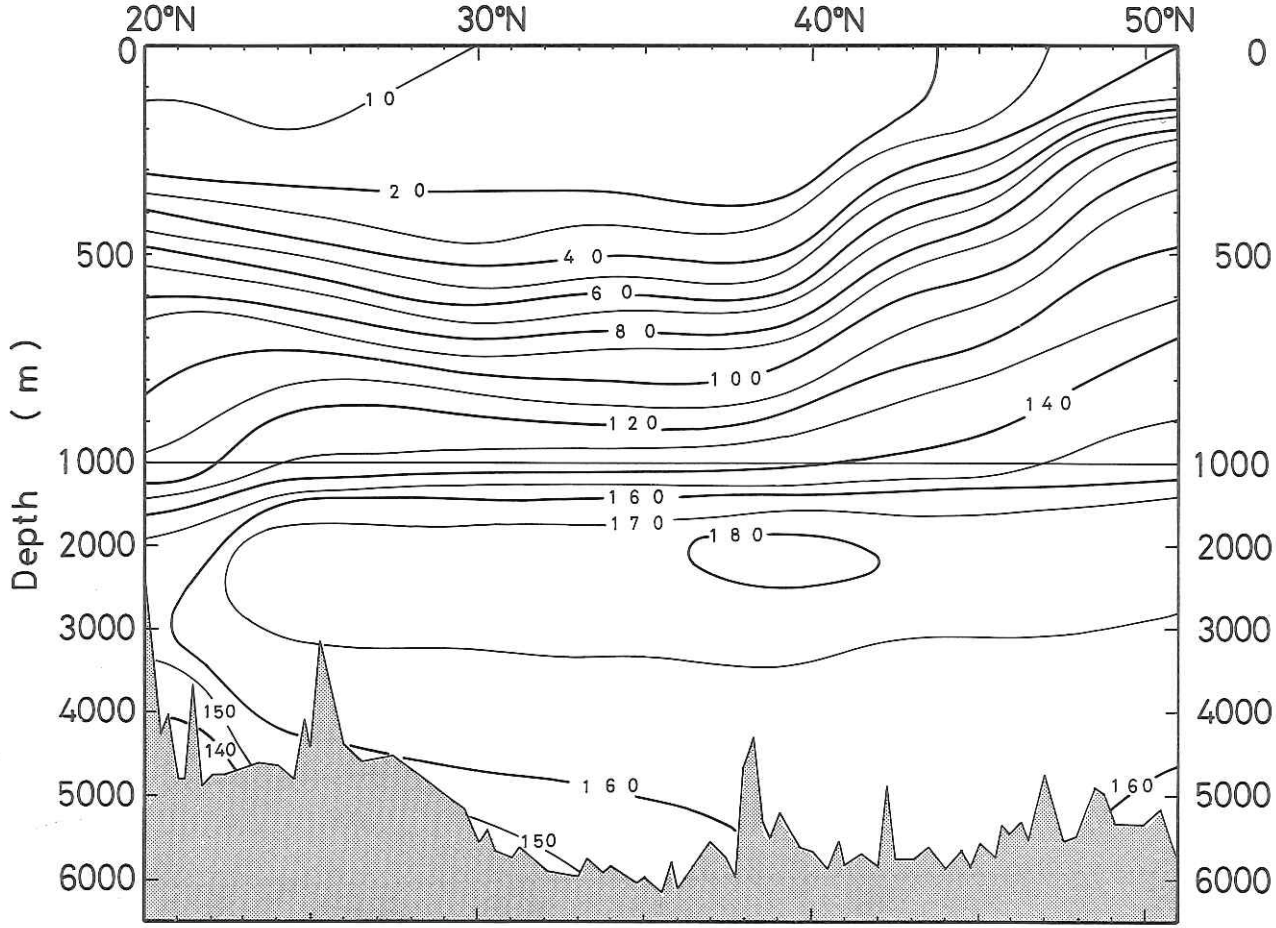

Fig. 8. Reactive silicate profile, 170°W, 20°N-51°N.(Unit: µg at/l)

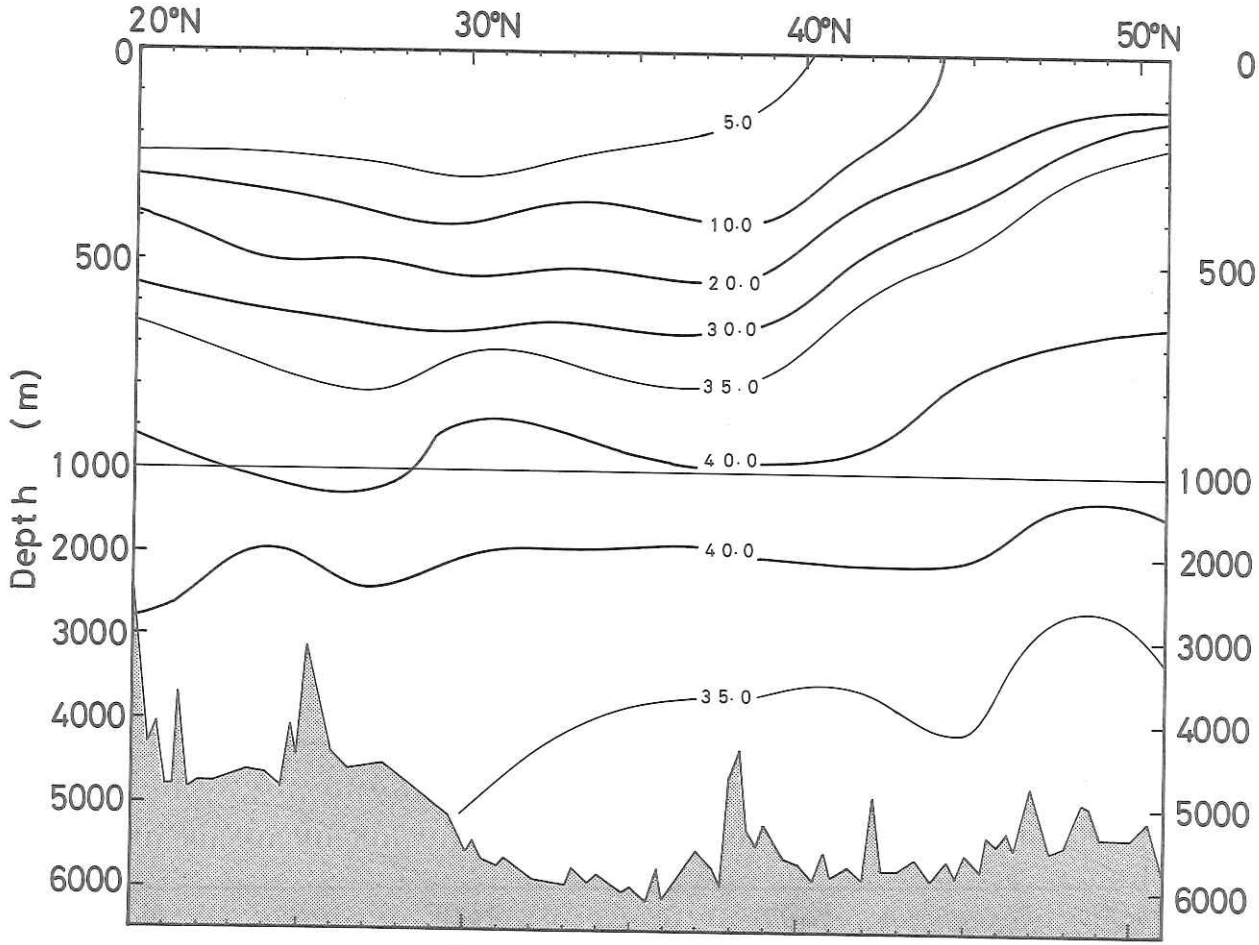

Fig. 9. Nitrate-nitrogen profile, 170°W, 20°N-51°N.(Unit: μg at/l)

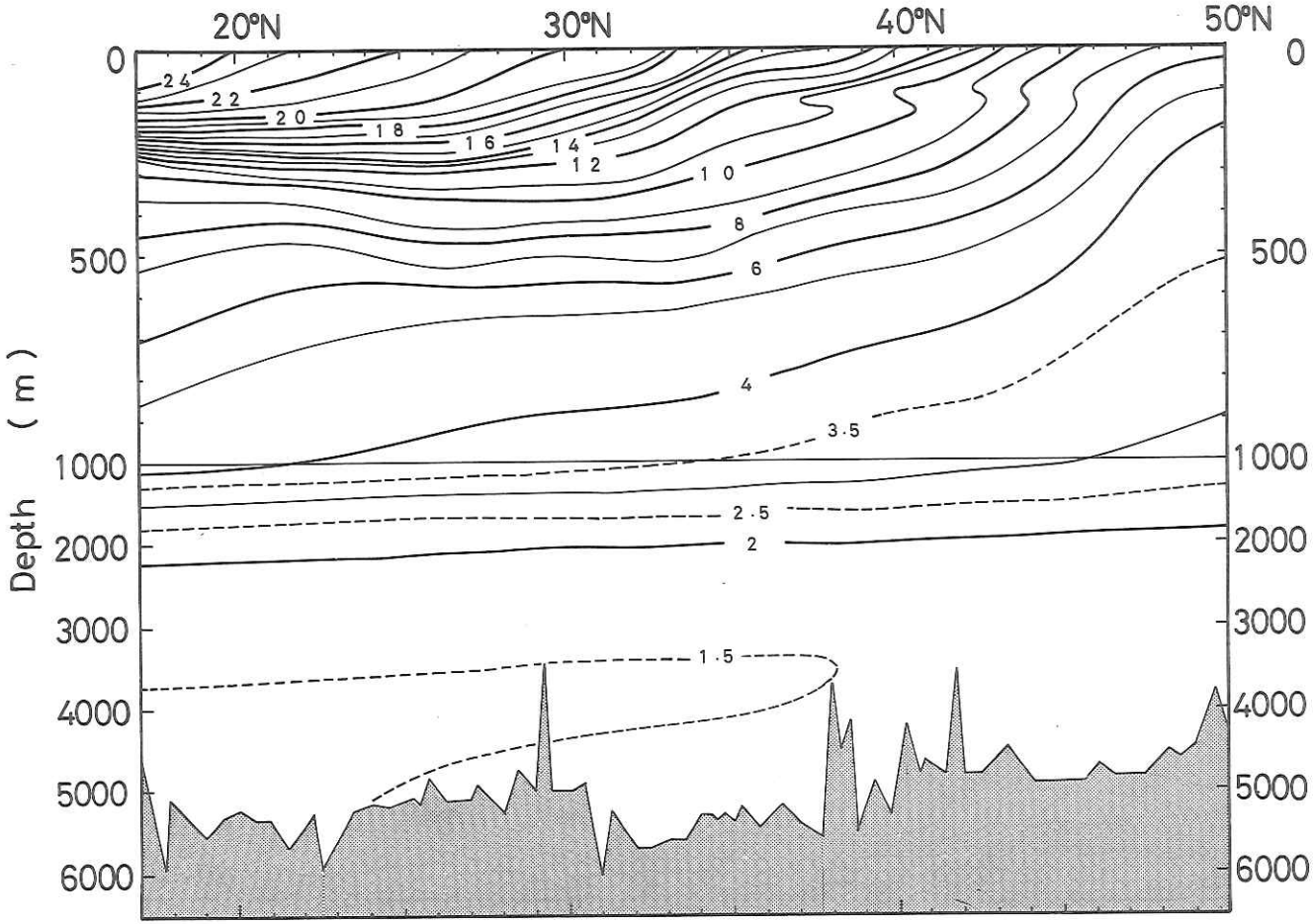

Fig.10. Temperature profile, 146°W, 17°N-50°N.(Unit: °C)

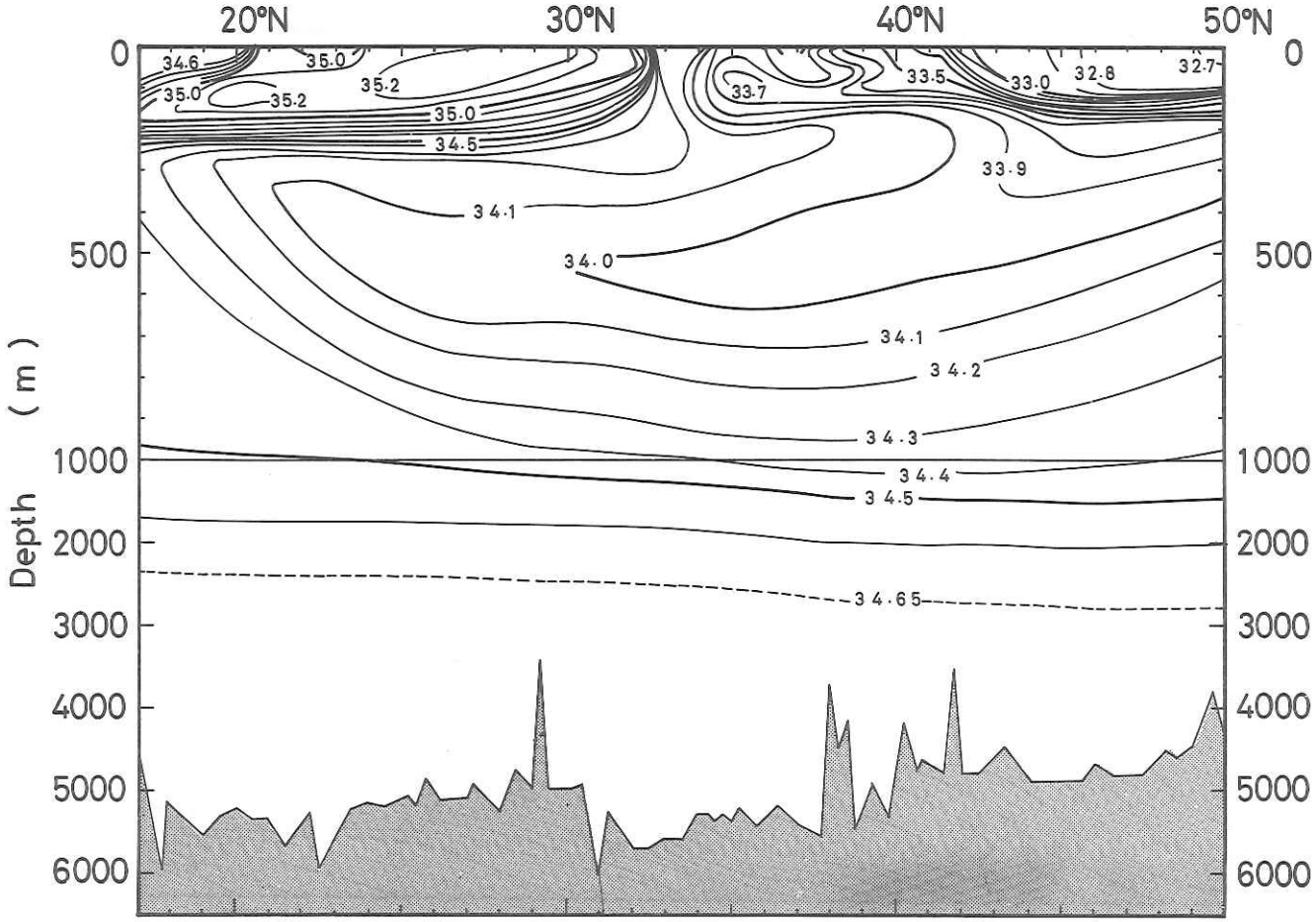

Fig.11. Salinity profile, 146°W, 17°N-50°N.(Unit: ‰)

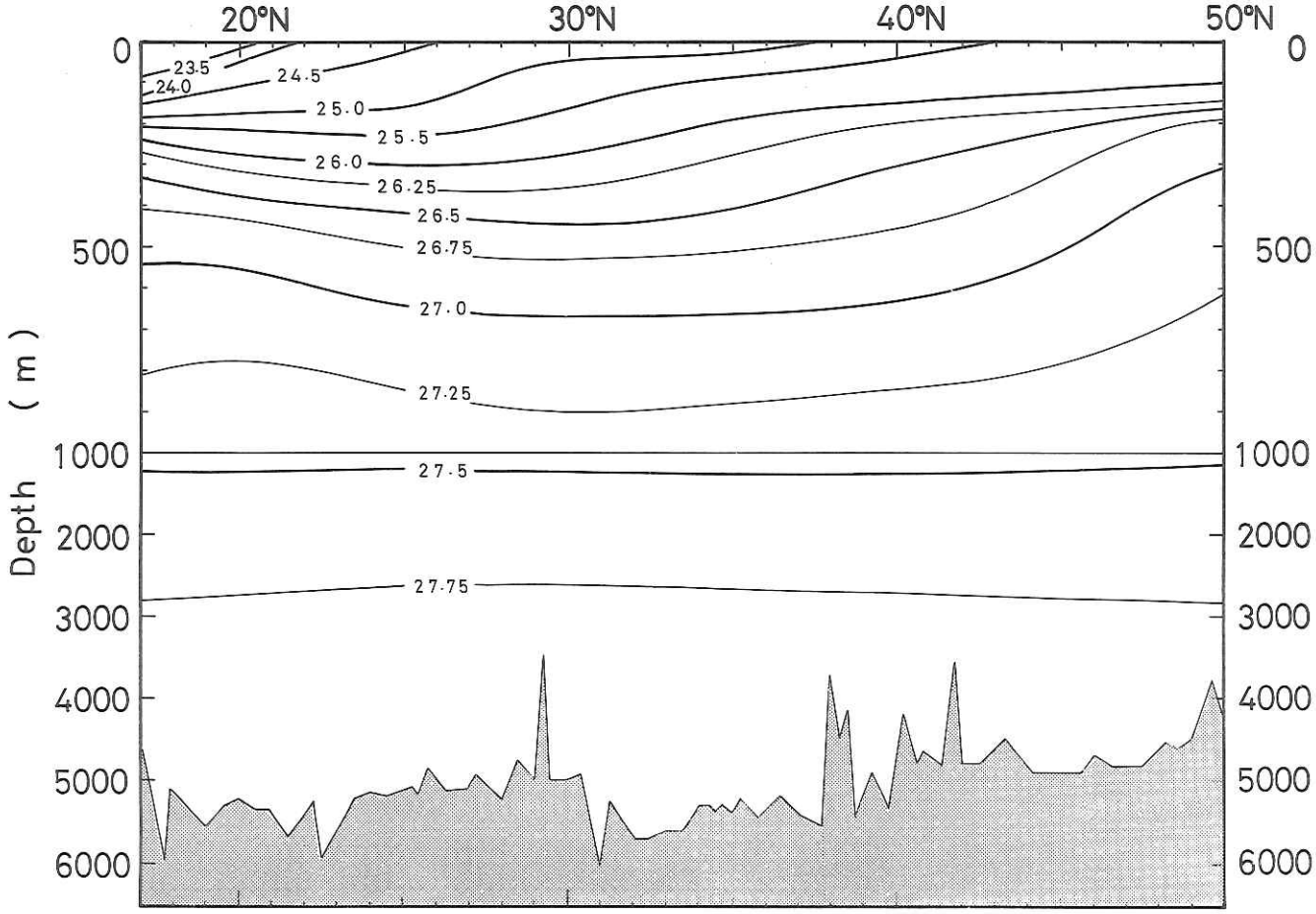

Fig.12. σ_t profile, 146°W, 17°N-50°N.

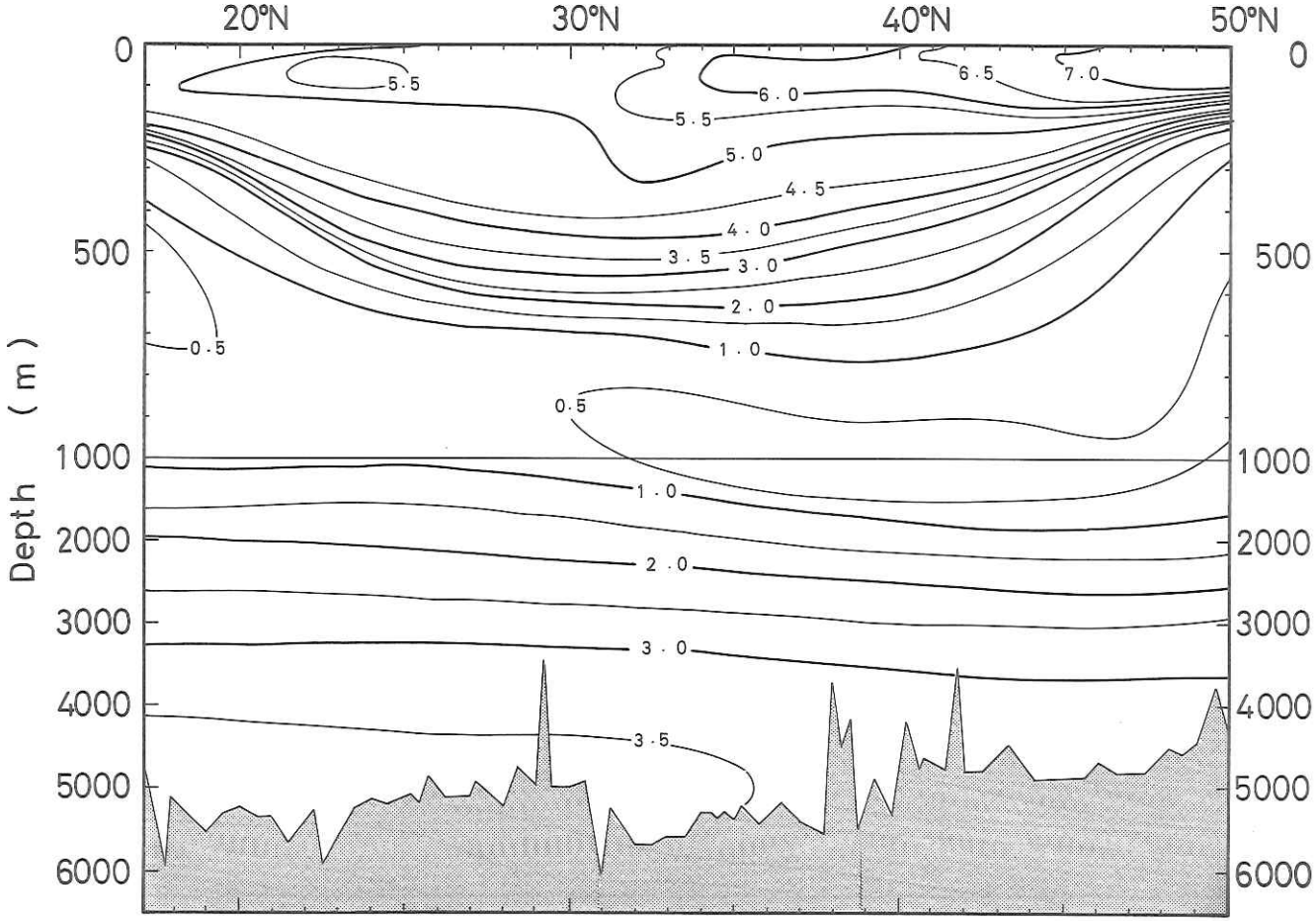

Fig.13. Dissolved oxygen profile, 146°W, 17°N-50°N.(Unit: ml/l)

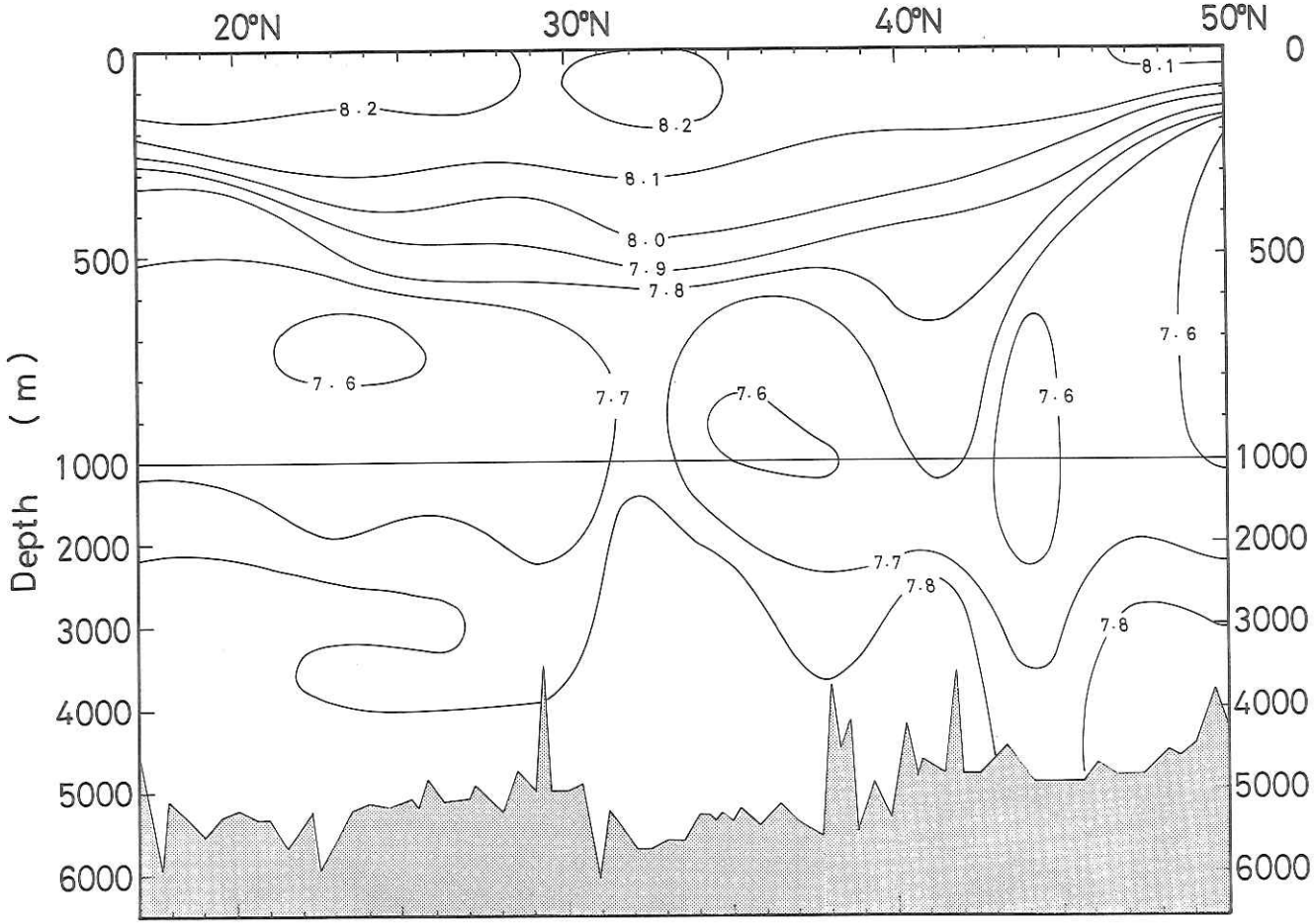

Fig.14. pH profile, 146°W, 17°N-50°N.

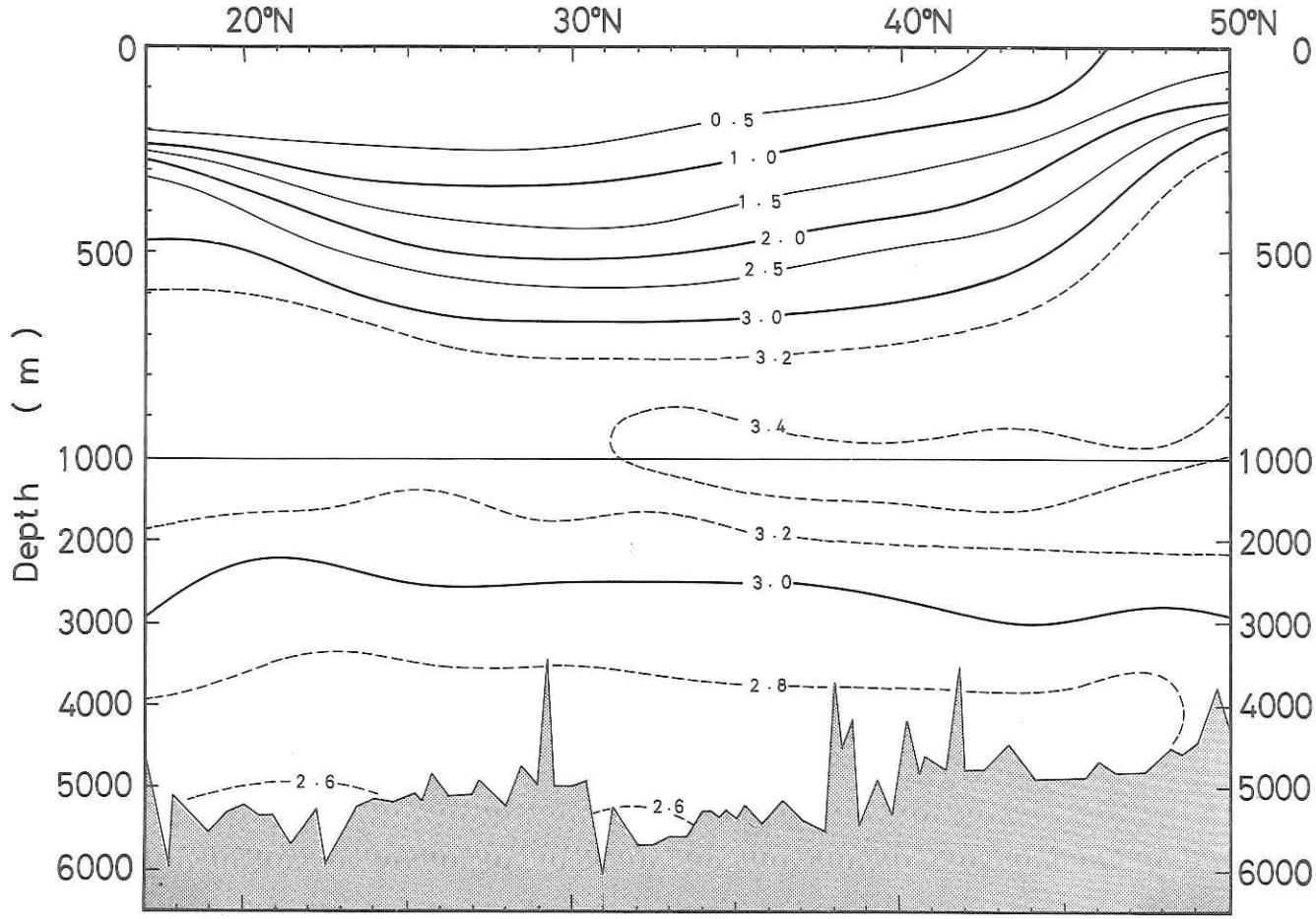

Fig.15. Reactive phosphate profile, 146°W, 17°N-50°N.(Unit: μg at/l)

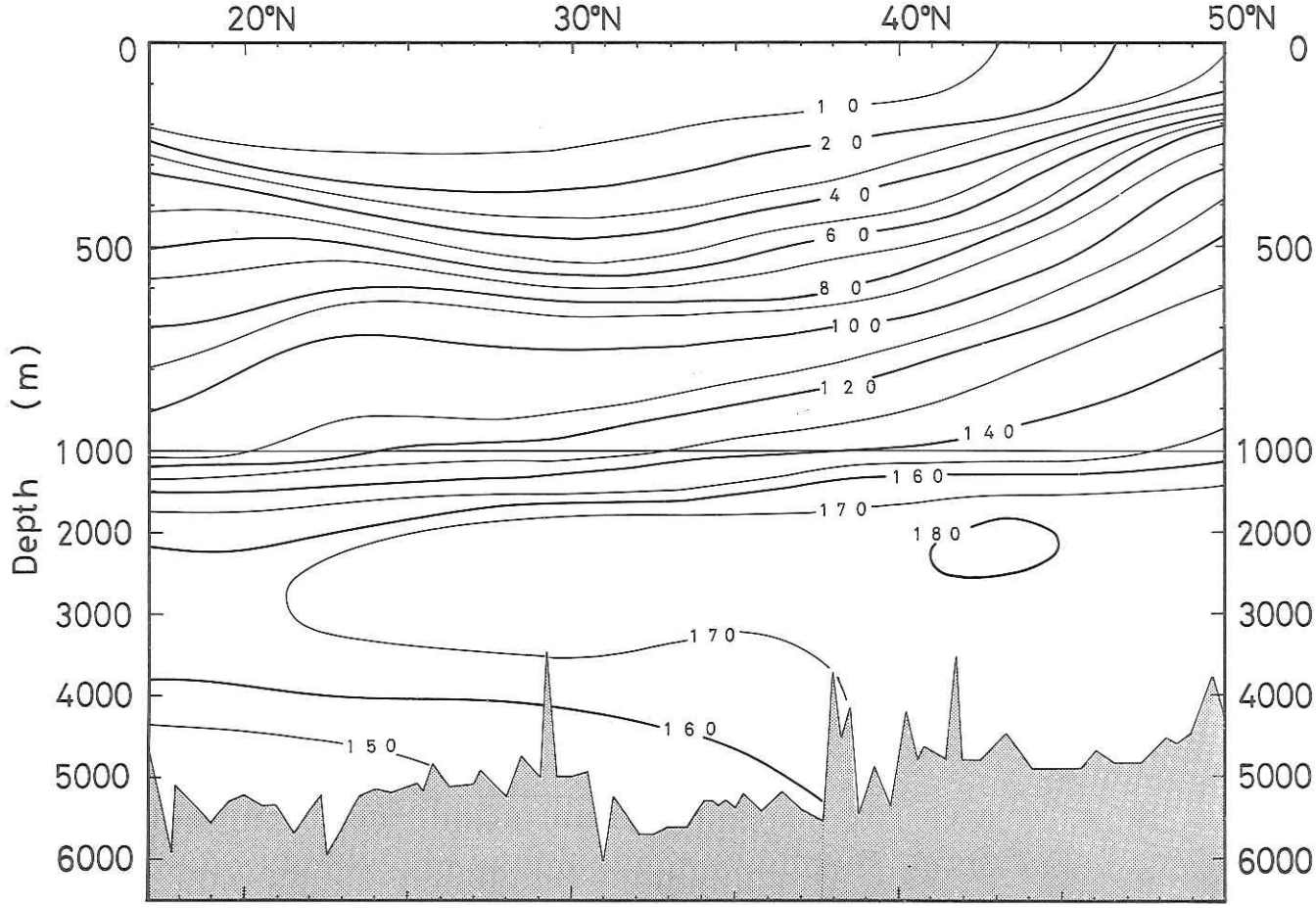

Fig.16. Reactive silicate profile, 146°W, 17°N-50°N.(Unit: µg at/l)

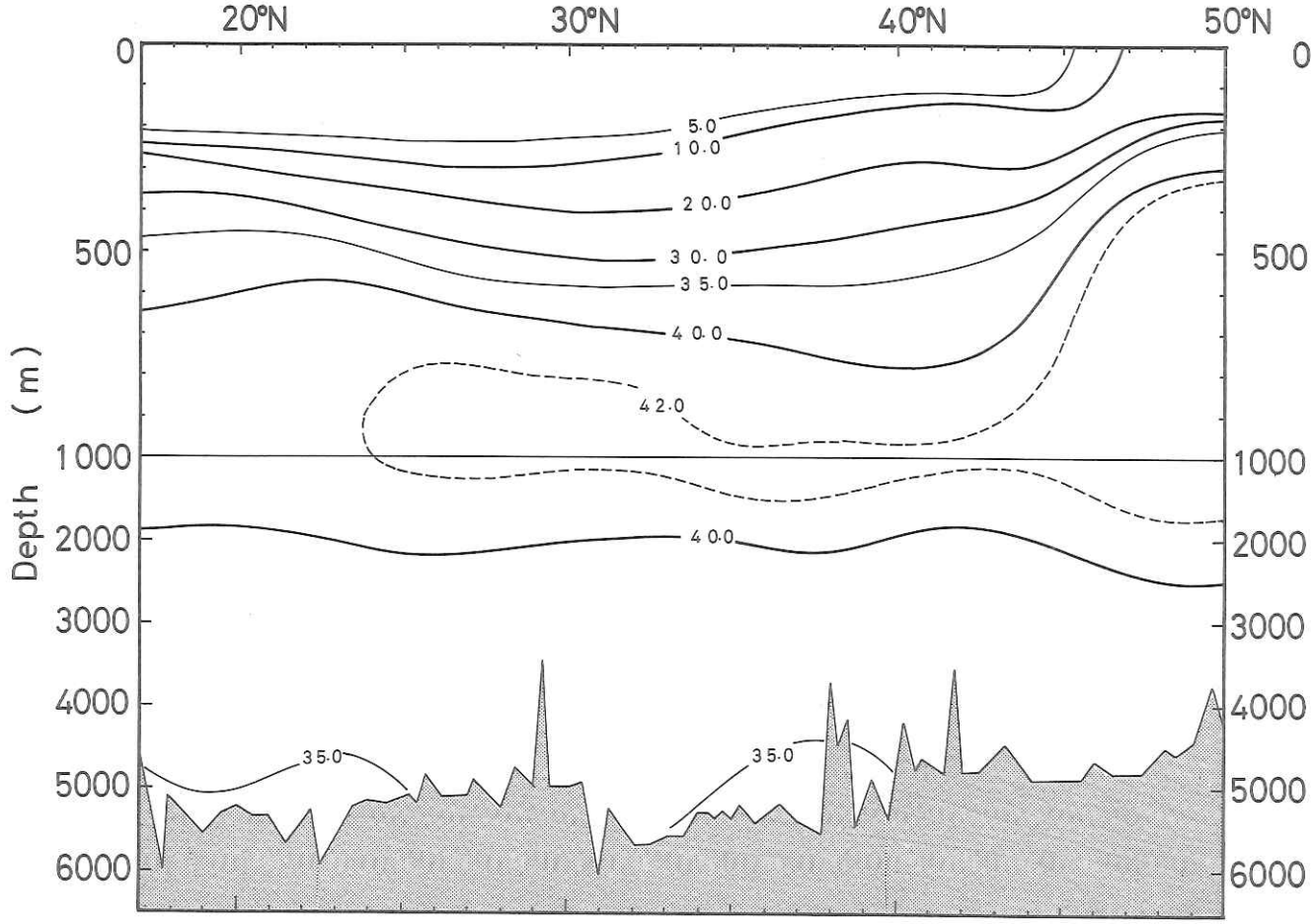

Fig.17. Nitrate-nitrogen profile, 146°W, 17°N-50°N.(Unit: µg at/l)

6. Chemical Works

6.1. Chemical constituents of air-borne dust in the atmosphere

by

O.Saito, and S.Tsunogai

Main purpose of this study is to estimate the falling rate of air-borne sudt of continental origin. 25 dry samples were collected on Millipore filter of 0.45 μ of pore size from 10-20 m^3 of the air, 25 dry samples on Millipore filter of 0.1 μ of pore size and 19 wet samples of air-borne dust by bubbling 5-10 m^3 of air into water. Also, 13 rain water samples were collected.

The samples will be analyzed at the laboratory for sodium, magnesium, potassium and calcium by the atomic absorption methods, for chloride, sulfate, silica and borate by the colorimetric methods, for Pb-210 and Po-210 by the radio-chemical methods.

6.2. Carbon dioxide in the surface sea water and in the atmosphere

by

Y.Sugimura

Determination of the partial pressure of CO_2 in the surface sea water and in the atmosphere was carried out continuously during the expedition. The method employed was in general the same as that previous used in the Ursa Minor-70 Expedition (KH-70-1) in the western North Pacific by using a nondispersive infra-red gas analyzer coupled with a stripping chart recorder and an equilibrator.

Rough description of the results: During the cruise, the

concentration of the atmospheric CO_2 was almost constant, however, it is to be noticed that the partial pressure of CO_2 in the surface water was generally undersaturated relative to the air. Only in the areas of the subtropical and subarctic convergences, the CO_2 concentration in sea water was shown nearly in equilibrium.

6.3. ^{18}O content of dissolved oxygen in sea water

by

Y.Horibe, and K.Shigehara

Dole and Rakestraw found that the oxygen-18 of dissolved gas in sea water of the Northeast Pacific is enriched as the oxygen content decrease. The same tendency was found in sea water of the Northwest, Central and Southern Pacific by the authors. This phenomenon is explained to be due to the preferential consumption of light isotope of dissolved oxygen in sea water. We have further found that the degree of osygen-18 enrichment with oxygen content decrease in dissolved gas is not always same but is able to classify some types by means of each water masses. For example, in the Northwest Pacific near Kuril Islands, we found that oxygen-18 content of the dissolved oxygen abov the oxygen minimum layer is lower than those of the deeper water, when they are compared at the same oxygen content. Further, in the Central and Southern Pacific where the oxygen minimum appears two times, we found that oxygen-18 content of the dissolved oxygen above the upper oxygen minimum layer is higher than those of the dissolved oxygen below the oxygen maximum layer which appears between the two minimum layers, when they are compared at the same oxygen content. These phenomena suggest that there might be various processes which change the oxygen-18 content above the ocygen minimum layer, and the process might be closely related to the movement of water masses above the

oxygen minimum layer.

It may be interesting to fined some other place in the North Pacific where same phenomena as above occur.

Water samples were taken from various depth at 9 stations (Station 1, 2, 3, 6, 9, 11, 14, 18, and 20).

The extraction of dissolved oxygen in sea water was done aboad as soon as the sea water samples were brought up on deck. The detail explanation of oxygen-extraction flasks have been given in the former report by the authors [The Preliminary Report of The Hakuhō Maru Curise KH-68-4 (Southern Cross Cruise) pp. 66-67 (1970)]. 500 ml sea water in Nansen sampler or 1000 ml sea water in plastic sampler of Rosette type was introduced into evacuated glass flask which was flushed with helium gas before pumping. More than 95 % of volume of dissolved gases was extracted to the attached storage flask which was sealed off and brought back to the laboratory for isotope analysis.

6.4. Total phosphorous

by
K.Yamamoto

The determination of total phosphorous in sea water obtained from phdrographic stations along the meridional section of 170°W and 146°W was carried out on board. To decompose the organic phosphorous compound, wet oxidation method by potassium persulfate solution(Menzel, Limnol, Oceanog., 10, 280-282 (1965) was used. The concentration of the total phosphorous was determined by the method as described in reactive phosphate. The vertical distribution of total phosphorous along the meridional section of 170°W in Figure18.

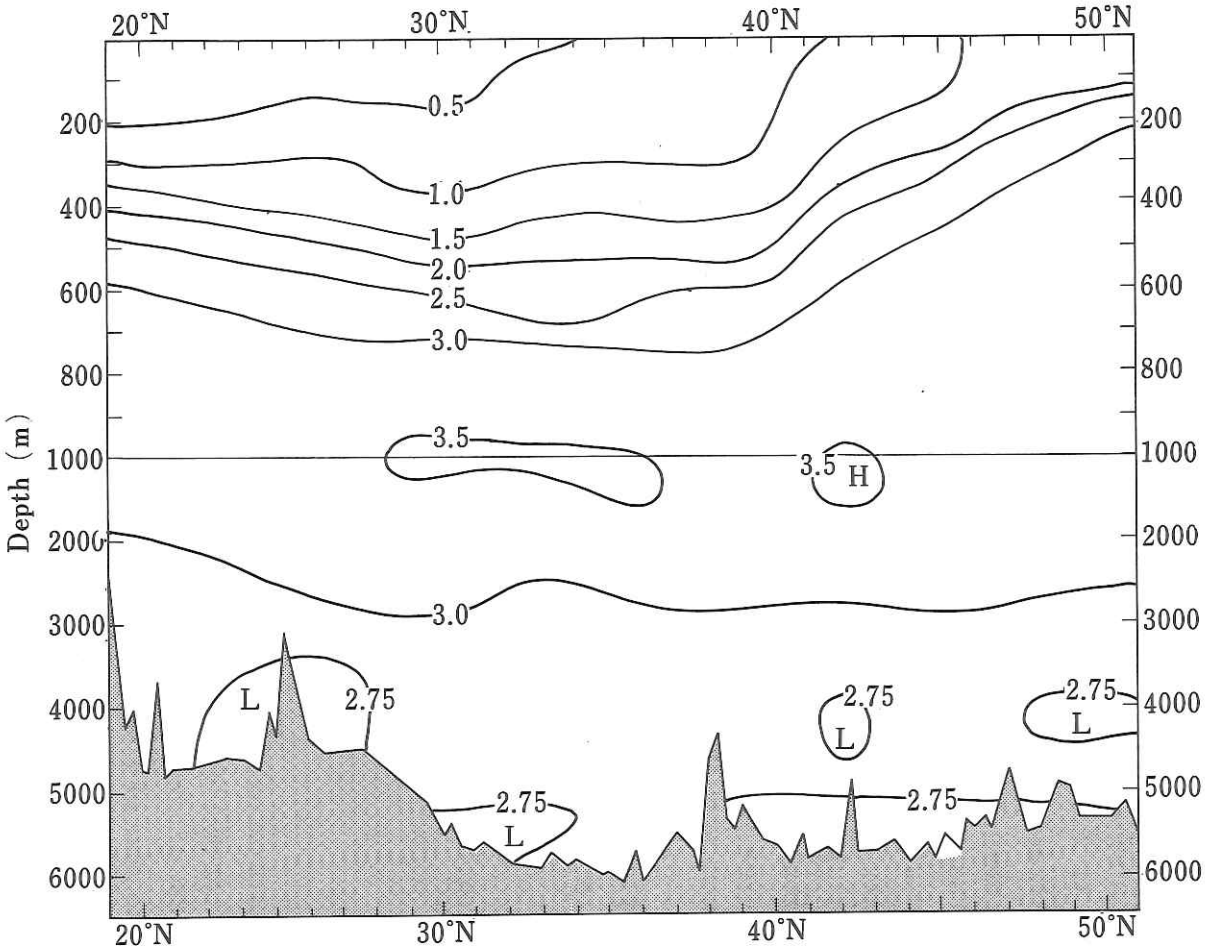

Fig.18. Total phosphorus profile along 170°W.(Unit: μg at/l)

6.5. Iodide-iodine in deep water

by
S.Tsunogai

Iodide in sea water is thermodynamically unstable as compared with iodate and is considered to be formed only in surface water by the biological activity. Iodide, however, is found sometimes in deep water, though its distribution has not shown any regularities.

According to the early studies on the determination of iodide in sea water, the samples were stored for few months before the chemical analysis. During the storage, some iodate is possible to be reduced to iodide by the biological activity. Therefore, 20 ml of 0.1 N silver nitrate solution was added to 300-500 ml of a sea water sample, as soon as the sample was collected, and the solution was stirred by a magnetic stirrer. After standing for one or more days, the precipitate of silver chloride containing iodide was filtered.

The number of the precipitated samples amounted to 214 (52 from surface water and 162 from various depths of 7 hydrographic stations). The filtrate fo sea water was stored for the analysis of iodate. The colorimetric determination of iodine will be done at the laboratory on land by the modified method of Sugawara et al. (1955).

6.6. Non ionic silica in sea water

by
K.Kido

Silica is one of main inorganic constituents in marine plankton and in seston. To study the behavior of silica at the degradation of organic matters in the ocean, non ionic

silica in sea water was determined.

352 sea water samples for total silica were obtained from 22 hydrographic stations. 305 particulate samples were obtained by the filtration of 5-10 l of sea water. The determination of silica content is to be made at the laboratory on land. The total silica content is determined photometrically after the fusion of the dried sample.

6.7. Silica in particulate matter and in marine sediment

by

A.Kamatani, and S.Ishihara

The concentration of silica in sea water, both dissolved and particulate, is affected by geochemical and biochemical processes. In the open sea, most of the particulate silica is remnants of organisms and the particulate silica is restored to the sea water by processes of redissolution. In the estimation of silica balance in the ocean, it is important to clarify the trend of dissolution of the particulate silica.

The main purposes of our works in this cruise were to clarify the vertical and horizontal profile of biogenous silica and to fractionate the silica into the readily soluble parts and the remainder. Sea water samples of large amount were collected with a large volume sampler at various depths, and particulate matter was separated from the sea water by the filteration with Millipore filter immediately after sampling on board. The collected samples were brought back to the laboratory on land and will be used for the following experiments.

The readily soluble parts of the silica in the particulate matter will be determined by a convenient method, which was developed one of the authors (A.Kamatani, in preparation).

The principle of the method is to heat sea water samples

on a water bath at 100°C for 60 minutes. The method was useful to estimate the amount of readily soluble silica in the particulate matter. For the determination of the total content of silica, the particulate matter was fused with anhydrous sodium carbonate in platinum crucible so as to convert the silica into a soluble form. The soluble silica will be determined by the colorimetric method (C.S.K. standard method, 1969). Meanwhile, the crystallegraphical form of silica in particulate matter collected from surface sea water is to be determined by X-ray diffraction and infrared spectrophotometry.

The dissolution rate of diatomaceous silica into sea water seems to vary considerably between diatom species. Under the marine environments, how long the diatoms keep alive during their sinking from the photic zone to the sea floor may regulate the dissolution rate of the silica frustules, in turn, influence the diatom assemblage at depths. Then, the counting and identification of diatom species in the particulate matter will be carried out under the microscopical observation.

The diatom assamblage in the bottom sediment is consequently quite different from those in the overling waters. Diatom frustules remained in bottom sediment offer us a good chance to find out an evidence of diagenetical transformation of the crystallographical form of silica. A mineralogical study and chemical analysis of the diatom silica in core samples give valuable informations concerning to how much physicochemical effects the silica has received during the diagenetical processes after deposition.

6.8. Calcium carbonate and silica in particulate matters

by

S.Tsunogai, K.Kido, and O.Saito

Tsunogai and Yamamoto (1969) reported that calcium content in the particulate matters (seston) in near surface water may be able to be use as a scale of the decomposition amount of seston. In deep water the increasing rates of silica and calcium content are large than the expected rate from AOU and the composition of plankton matters. Therefore, to study the decomposition process of seston in near surface water and in deep water, amount of seston in sea water, and amount and composition of inorganic matters in seston and in mineral particles were determined. Sea water of 5-10 l was filtered by using the Millopore filter HA type (0.45 μ of pore size).

3.5 particulate samples were obtained from surface water (176 samples) and subsurface water (129 samples from 13 stations). Chemical analyses are to be made at our laboratory for alkali and alkali earth metals by the atomic absorption methods, for chloride and silica by the colorimetric methods and for Pb-210 by the radiochemical method.

6.9. Calcium in sea water

by

S.Tsunogai, and O.Saito

Concentration of calcium in deep water increases gradually by the dissocution of calcium carbonate in particulate matters. Tsunogai estimated the increasing rate of calcium of 7×10^{-5} mM/yr. The purpose of this study is to verify the dissolution rate in the actual ocean and relate it to the abyssal circulation.

563 sea water samples for calcium determination (each 100 ml) were collected at 21 hydrographic stations and 53 samples from surface stations. The calcium content is to be determined at our laboratory by the method of Tsunogai et al. (1968).

6.10. Neutron activation analysis of manganess in suspended particulate matter in sea water

by
T.Nomura

To determine the content of manganese in suspended particulate matter by neutron activation, particulate matter was collected from 5 10 litter of surface water samples by filtering with Millipore Filters. Neutron activation analyses will be carried out at our laboratory on land.

6.11. Iron and aluminum

by
K.Yamamoto

Samples for the studies on iron and aluminum in sea water were collected at eight stations (Stn. 1, 4, 7, 9, 12, 15, 18, and 20) during this cruise. After the sea water was filtered with No. 5A filter paper, 1 ml of concentrated hydrochloric acid was added to the solution. The acidified sample was stored in glass bottle for analysis. The spectrophotometric determination of iron and aluminum by means of 8-hydroxyquinoline-complex (Hashitani and Yamamoto, J. Chem. Soc. Japan, 80, 727-731 (1971) will be done at the laboratory of Kobe Marine Observatory.

6.12. Determination of strontium and barium in sea water and deep sea sediment

by
K.Watanuki

To know the behavior of alkaline earth elements, author tried to determine the content of Sr and Ba in sea water and deep sea sediment. On board the content of Sr in sea water was determined by the atomic absorption technique. The content of Sr was found to be between 6.0 ppm and 8.5 ppm for the surface water. The content of Ba in the sea water and deep sea sediment will be determined in the laboratory.

Method of analysis: Determination of Sr was carried out using Hitachi 139 atomic absorption spectrophotometer. The spectral line employed was Sr 4607 A and the optimum condition for hollow cathode lamp was 15 mA, 200 V. The gas presure of acetylene was 0.4 kg/cm^2 and that of air was 1.4 kg/cm^2. The flow rate of acetylene was 1.5 l/min. and that of air was 7 l/min.

When sea water is diluted with distilled water to five times, the analytical curve for Sr shows good linearity. And the sample was prepared as follows. Take 5 ml of sea water in the measuring flask, then dilute to 25 ml. The other samples were prepared by adding 1 ppm or 5 ppm of Sr to the water sample. The absorption of the Sr 4607 A was measured by atomic absorption of 10 cm width flame.

6.13. ^{90}Sr and ^{137}Cs in sea water

by

Y.Nagaya, and K.Nakamura

To determine the distribution and transport of the artificial radionuclides, ^{90}Sr and ^{137}Cs, in the North Pacific Ocean, 68 sea water samples (35 of surface and 33 of various depth) were collected on 35 stations during the cruise. The stations were 20 hydrographic stations, 7 large volume sampling stations and 15 trans-Pacific stations with 5° to 10° longitudinal intervals from 135°W to 145°E.

56 of 68 samples were treated on board as descibed below:

After 50 mg of Cs^+ was added to a 100 liter of sea water sample, 1 kg of sodium carbonate was added and the water was agitated for 30 minutes. The carbonate precipitate was collected for analysis of ^{90}Sr, then cesium was scavenged from the supernatant with nickel ferrocyanide precipitate. Both precipitates were brought back to National Institute of Radiological Sciences (NIRS) for further analysis. 12 samples were not treated on board and brought back to NIRS laboratory.

On the other hand, 142 sea water samples (300 ml each) were collected from various depth on 29 stations (10 hydrographic stations, 4 large volume sampling stations and 15 trans-Pacific stations) and 150 ml of each sample was filtered with GS-type (0.22 μ) milipore filter. Both of the filtered and un-filtered sea waters were brought back to NIRS laboratory for analysis of particulate strontium and other elements.

6.14. Artificial radionuclide in the eastern North Pacific waters

by

Y.Sugimura

^{239}Pu and ^{238}Pu: Plutonium isotopes which were produced by the nuclear tests or escaped from fissile materials are distributed widely in the earth's surface. The distribution both in horizontal and vertical in sea water has been studied for several years in our laboratory in the areas of the western North Pacific and also in the South Pacific. During this expedition, each 500 liter of sea water sample, 20 in surface and 8 in deep, was collected. The plutonium isotopes were isolated by means of anion exchange resin and followed the electrodeposition on silver disk on board. The content and the isotopic ratio of plutonium isotopes

will be determined by the α-ray spectrometric method at the laboratory on land.

^{137}Cs and ^{90}Sr : To examine the surface distribution of the artificial radioactivity in the eastern North Pacific, about 20 samples of the surface water were subjected to the analysis. The method employed in this study is the same as described in the previous report (Preliminary Report of the Hakuhō Maru Cruise KH-68-4).

6.15. ^{210}Pb and ^{210}Po in sea water

by
S.Tsunogai

Radon daughter nuclides of ^{210}Pb and ^{210}Po are seemed to be a useful means for the problems in chemical oceanography such as the chemical form of lead in sea water, the settling velocity of particulate matters, the size distribution of particulate matters in sea water, the mixing rate of surface water and the geographical variation of the falling rate of air-borne dust over the ocean. To study these problems, 130 samples of surface water and 64 samples of subsurface water from seven stations were collected.

To a sea water sample of 30-50 l, the carriers of lead and bismuth, each 25 mg, were added. Lead and polonium in sea water were coprecipitated with calcium carbonate by the addition of ammonium carbonate (50 g) and sodium carbonate (130 g). The precipitate of carbonates was gathered and has been stored till ^{210}Pb and ^{210}Po are radiochemically analyzed by the method of Tsunogai and Nozaki (1969).

6.16. Radiochemical determination of Ra and Th in sea water

by

T.Nomura

For the determination of Ra and Th in sea water, the elements were collected by coprecipitation on board.

The procedure was as follows: After adding hydrochloric acid to 800 litter of sea water, ferric chloride and barium chloride solutions were added as carrier to collect the elements. The pH of the solution was adjusted to 10 with aqueous ammonia. After one or two days standing, the supernate was discarded and the ferric hydroxide and barium sulfate precipitate were gathered. The precipitate containing Ra and Th will be treated on land, then their activities will be measured by α and β spectroscopy.

Sampling: 400～800 liter of surface sea water samples were collected at the station No.1, 5, 8, 14, 17, 20. Subsurface water (100 m) and deep sea water (500 m) were collected at the station No.9 and 20 respectively.

6.17. Thorium and uranium series disequilibrium in the Pacific waters

by

Y.Sugimura, T.Yasujima, and E.Matsumoto

The presence of the remarkable disequilibrium in the radioactivity has been found among the nuclides which belong to the same family of radioactive disintegration due in our laboratory. This disequilibrium might be caused by the differences of the chemical behaviors among the nuclides and also caused by the hydrodynamic condition of the marine environment. The following works have been carried out during this expedition.

Thorium isotopes (^{232}Th, ^{230}Th and ^{228}Th): For the stidoes on thorium isotopes in sea water, each 500 liter of sea water,

20 in surface and 8 in deep, was subjected to the analysis. Thorium isotopes were isolated by means of anion exchange resin following by the electrodeposition on silver disk on board. The determination of the isotopic ratio and content will be done by the α-ray spectrometry at laboratory on land.

U - ^{234}Th relationship : From 50 liter of sea water, ^{234}Th was isolated by using coprecipitation of ferric hydroxide and an anion exchange resin successively. It was electroplated on silver disk and the β-activity was determined by the windwless type gas flow conter on board.

Uranium content and $^{234}U/^{238}U$ ratio : The method employed for the uranium study is essentially the same as described in our previous manuscript (Miyake, Sugimura and Uchida, 1966). As to the effective adsorption of uranium from the large amount of sea water, a batch method was used by means of submergeble pump and the chelating resin at the pH 3 of the solution.

Radium isotopes (^{226}Ra and ^{228}Ra) : Radium isotopes were coprecipitated with barium sulfate and ferric hydroxide on board. Further purification and determination of ^{226}Ra and ^{228}Ra will be carried out at the laboratory on land.

6.18. Samples for the studies on distribution of natural radionuclides in deep-sea sediment

by

Y.Sugimura

Among the core samples obtaining the eastern North Pacific, one is charaterized as reductive clayey ooze and others are oxidative ooze of red clay type. The geochronological study and the studies on distribution of the natural radionuclides on the sediment will be carried out at laboratory on land. The method of storage of the sediment is the same as employed during the last expedition of KH-68-4 (ref., P. 78).

6.19. Organic matter

by

N.Handa, and K.Yanagi

Chemical studies on organic matter give us an important clue to understand organic fertility of oceanic water. The organic matter in sea water is arbitrarily divided into particulate and dissolved organic materials. Much information on the chemical nature is available for the particulate organic matter at present, while quite few for the dissolved oarganic matter. Microbial utilizability of this matter is still left to disclose even though the bulk of researches has been made by many workers.

Main aim of our works in this cruise was to clarify chemical nature of organic matter dissolved in sea water of various depth and to discuss a role of secretion and decomposition of phytoplankton which represents the bulk of life in the ocean, for the production of dissolved organic matter.

In addition, our work was designed to draw vertical profile of chlorophyll a in subarctic through subtropical oceanic areas for better understanding of the formation of chlorophyll a maximum layer which appeared in subsurface water.

Collection of sea water samples. For the determination of dissolved organic carbon and carbohydrate, 100 ml of sea water samples were collected from all depths of the water layers at stations where the hydrocast was conducted. The samples were filtered through Millipore filter HA(pore size, 0.45 μ) and kept freezed. Analyses of the element and the compound were conducted on land.

100 liter of sea water samples were collected from the depths of 0, 50, 100, 200, 500, 1000, 1500, 2000 and 3000 m at stations 7, 14, and 20. After filtration of the sea water samples through ultra glass fiber filter (H.A.Reeve Angel Co., pore size, 1 μ), the samples were kept freezed. The isolation and the determination of dissolved organic

matter will be carried out on land.

Sea water samples of 50 liter were collected from the depths of 0, 25, 50, 75, 100, 125, 150, 175, 200, 300, and 500 m at stations 2, 5, 7, 9, 14, 17 and 20. The sea water was filtered through ultra glass fiber filter to collect the particulate matter, which was subjected to determine chlorophyll pigments and other biochemical organic constituents such as carbohydrate, protein and fatty acid.

On the way back from Seattle to Tokyo, 40 liter of the surface water were collected every twelve hours. The water was filtered through ultra glass fiber filter to obtain the particulate matter, which was analyzed phytoplankton species and the biochemical organic compounds as mentioned above.

Preliminary results. Chlorophyll a was analyzed fluorometrically after separation of the pigments by thin layer chromatographic technique on board. The concentration of chlorophyll a was found to be in a range from 0.2 to 0.8 μg/liter. It was found that the maximum layer tended to sink from the surface to 100 m as proceeding southward in the areas of Lat. 51°N to 30°N and Lat. 50°N to 17°N on Long. 170°W and 146°W respectively. Total particulate carbohydrate and water extractable carbohydrate of the particulate were found to be in a range from 6.5 to 35.9 μg/liter and from 0.5 to 13.4 μg/liter respectively. More detailed discussion on the formation of chlorophyll a maximum layer in these areas will be made with the results of vertical profile of σ_t, subsurface light intensity estimated by Secchi disk reading and organic composition of the particulate matter.

7. Biological Works

7.1. Plankton sampling

by

T.Nakai, and H.Otobe

Object: The object of plankton sampling is to know the biomass distributions above 150 m and to use taxonomic and biogeographic study in the North Pacific Ocean.

Net and sampling method: A Norpac net (double type) having inner net made of 0.33 mm and outer net of 0.09 mm mesh openings was towed verticaly from the depth of 150 m to the surface at a speed of 1 m/sec. A flow-meter was attached to the mouth ring of the net. Samples collected by the inner net represented macroplankton, while those obtained by the outer one was mainly consisted of microplankton. All samples was preserved in 10 % formalin sea water solution.

The sampling data are shown in Table 6.

Table 6. Plankton sampling with Norpac net

Station	Latitude	Longitude	Date	Time	Wire length (m)	Wire angle (°)	Caluculated depth of tow (m)
1	51-00.0N	169-57.5W	Apr. 22	16:58	150	65	64.8
2	48-00.0	169-58.0	21	21:18	150	64	65.7
3	44-59.0	169-50.4	24	09:06	150	40	116.4
4	42-05.8	169-55.0	25	04:31	175	38	137.9
5	39-00.7	169-59.8	25	21:36	150	53	90.3
6	36-00.0	169-56.2	27	08:29	150	40	116.4
7	33-08.0	169-54.1	28	18:51	150	7	148.9
8	30-02.2	170-00.2	May 1	05:10	150	-	-
9	17-05.5	146-10.5	11	11:09	150	0	150.0
10	20-01.0	146-00.5	13	04:00	150	40	116.4
11	23-01.2	146-03.5	14	02:00	150	30	132.9
12	26-00.0	146-00.0	14	19:08	150	41	113.2
13	29-00.5	146-00.8	15	16:00	150	27	133.6
14	31-54.7	146-06.8	16	15:15	150	-	-
15	34-55.5	146-02.2	17	14:40	150	0	150.0
16	37-44.7	145-58.7	18	13:50	150	0	150.0
17	41-00.0	145-59.2	19	13:45	150	30	129.9
18	44-00.3	146-01.6	20	14:40	150	10	147.7
19	46-56.3	146-07.7	21	14:00	150	16	144.1
20	49-57.0	146-00.0	22	17:20	150	23	138.1
22	50-00.0	136-00.0	24	13:50	150	0	150.0
23	50-01.4	131-09.0	25	09:00	150	15	144.9

8. Physical Works

8.1. Measurement of optical properties of sea water

by
M.Kishino

Underwater radiant energy is one of the most important factors of primary production, and is controlled by the optical properties of sea water which are influenced by suspended matter. Optical properties (attenuation coefficient and scattering function) and vertical distribution of suspended matter were studies with an underwater turbidity meter and a light scattering photometer.

The underwater turbidity meter has 1 m optical path, and the intersity of light received by the photocell of turbidity meter is recorded on board, and its sensitivity is maximum at 550 mμ. Attenuation coefficient α was calculated by the equation

$$\alpha = \ln (I_O/I) + C$$

where I_O is light intensity passed through 1 m length in air, I is light intensity passed through 1 m length in sea water and C is a correction term of reflection loss at the interfaces of glass and water. The underwater turbidity meter was lowered to about 400 m depth at every station except Station 1 and 21.

The light scattering phtometer is able to measure scattering function in the range of scattering angles of 25° and 145°. Wave length of 436 mμ and 546 mμ were used. 150 ml of sea water sample from hydrographic cast was used in every measurement.

Distribution and particle size of the suspended matter in sea water estimated theoretically from the values of scattering function and discussion will be reported elsewhere.

8.2. Measurements of deep ocean floor current

by
M.Okazaki

Since H.Stommel discussed the abyssal circulation theoretically, several investigations were carried out in different ways to verify the path of deep water circulation. In the Pacific Ocean, the movement of deep water has been estimated on basis of the distributions of water temperature, dissolved oxygen and other tracers. The deep water in the Northeast Pacific basin is considered to flow in through three entrances, the first is through basin in southeast far from Hawaiian ridge, the second through the trough of Emperor ridges near Midway Island, the third through southern area of Aleutian Islands (zone of about 45°N) from northwest Pacific basin. The cruise covered two of the entrances mentioned above, that is, the stations near Hawaii and Midway except near Aleutian, and the direct continuous measurements of deep ocean floor current were carried out.

Current meter. The current meter was a pendulum current meter which was developed in our laboratory. The pendulum current meter consists of a timer, a strobo flash, a camera as recorder, and a pendulum ball which serves as a velocity sensor, as shown in Figure 19. To obtain an average velocity of current by means of the photograph, strobo makes one flash in a second, therefore, photograph has superposed images of pendulum ball. The average velocity of current in a minute was calculated by deflection of the center of superposed ball images from the vertical point of pendulum ball. This instrument was programed to work continually for one minute in every five minutes. As the deep ocean floor current might be weak, the light pendulum was selected to measure velocity up to 12 cm/sec. The pendulum was set 60 cm above ocean floor.

Mooring system. It is very difficult to settle current

meter safely on the deep ocean floor of 6000 meters depth. The mooring system was shown in Figure 20. The benefit of the system is to free current meter from all disturbance of shallow water by chain and anchor, and to be able to keep current meter in steady condition.

Results. Current measurements were done at two stations: 1. Station 7 (33°09.9'N, 169°53.8'W, 5830 meters depth), 2. Station 9 (17°05.5'N, 146°10.5'W, 5100 meters depth). The observations were carried on for 48 hours at Station 7, and for 24 hours at Station 9, respectively. The observation at Station 7 was unfortunately failed due to the accident, and a photograph of ocean floor at Station 7 is shown in Figure 21. At Station 9, current meter was settled on ocean floor slope inclined 7°57' in direction of 74° (magnetic North) and material of the floor seemed to be muddy. The results of the observation are shown in Figure 22. The average velocity of the floor current was found to be 1.69 cm/sec in direction of 25.5° (magnetic North). The data indicates that the fluctuation of current was small in deep ocean floor, and that the direction of current rotated in clockwise in a period of about 12 hours and the north component of current was prominent on the whole. This tendency was found clearly in N-S and E-W components of current velocity as shown in Figure 22. The deep water movement from direct measurement of deep ocean floor current is considered to consist with that from indirect studies on tracer in deep sea water.

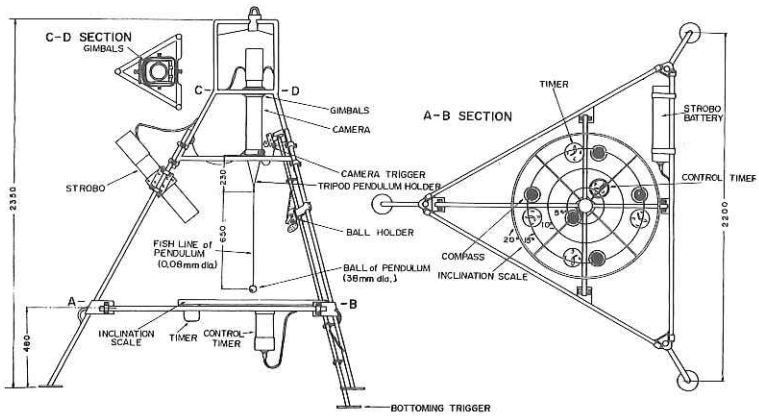

Fig.19. Diagram of pendulum current meter system.

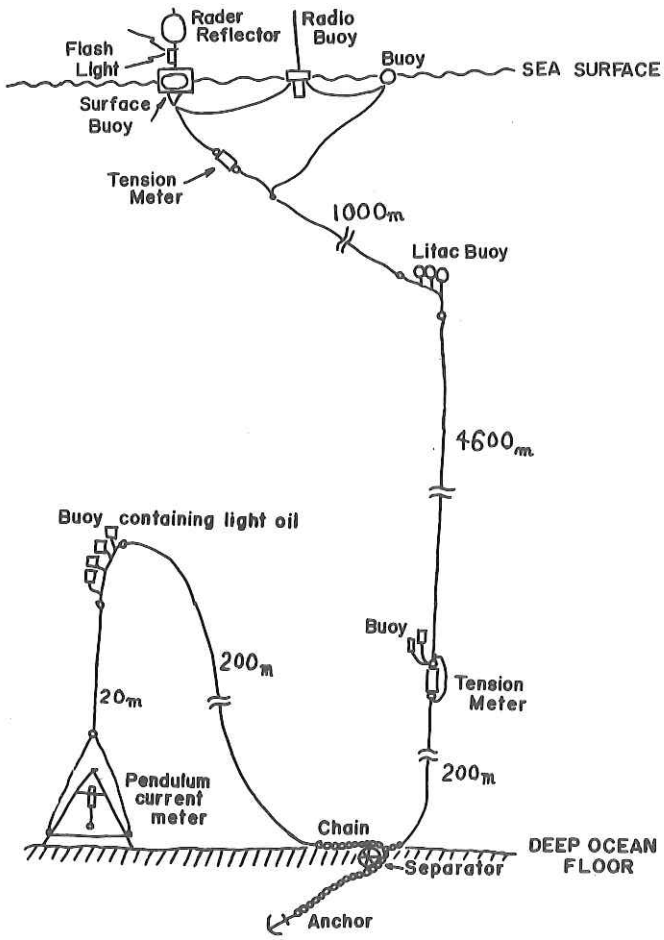

Fig.20. Mooring line system of the deep ocean floor current meter. Depth: 5100 m, Rope: Cross ropes of Nylon and Polypropylene.

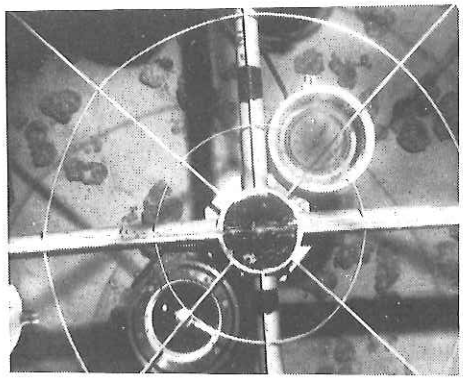

Fig.21. A photograph of ocean floor at Station 7 (33°09.9'N, 169°53.8'W, 5830 m depth). Ocean floor was red clay (brown color) and slope inclined 3°24' in direction of 221°. Many manganese nodules were found on the floor. (scale: diameter of timer is 7.5 cm)

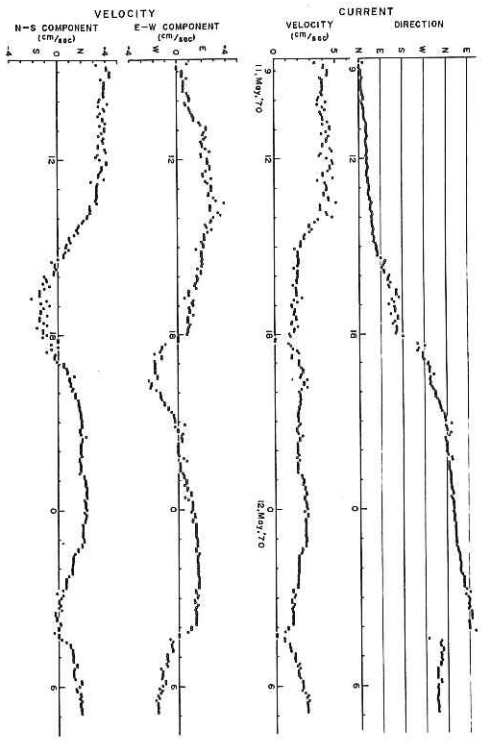

Fig.22. The record of the deep floor current.
Right: current velocity and direction.
Left: velocity components of N-S and E-W.

9. Measurement of Gravity, Magnetic Force and Bottom Topography in KH-70-2 Cruise

by

Y.Tomoda, K.Kitazawa, K.Koizumi, and T.Igarashi

During KH-70-2 Cruise of the Hakuhō Maru, gravity at sea and Earth's magnetic field were measured by use of surface ship gravity meters and a towed proton magnetometer.

9.1. Gravity measurement

In order to improve reliability of results, two sets of T.S.S.G.-type gravity meters were used. Signals from the two gravity meters were directly fed to the electronic computer FACOM 270-20 on board the ship and were processed by use of "on line real time processing program" made during KH-69-2 cruise" (Preliminary Report of the Hakuhō Maru Cruise KH-69-2).

In the first leg of the cruise - Tokyo to Honolulu - satisfactory gravimetric results were not obtained chiefly during first half of the leg. Reason of this can be interpreted to be caused by frequent course variations of the ship due to undesirable sea condition. That is, when large swells come from the stern of the ship and when the ship sails under the condition of auto-pilot switch held at "rough weather state", it was found that gravimetric results show variations as large as 20 mgals. During the next cruise it was found that variation in the gravity results is reduced to smaller than 5 mgals, if the auto-pilot switch is held at "normal state"' in spite of rough sea condition.

The two sets of gravity meter - T.S.S.G.-A and T.S.S.G.-B - used in this cruise had the following characteristics.

A : Draft rate of the meter was negligibly small (smaller than 1 mgal/month), but there was often some trouble about the vertical gyroscope in relation to its erection device.

B : Though drift rate of the meter B was large (1 - 2 mgal/day), the vertical gyroscope was quite stable.

On account of these characteristics, continuous observation was carried out by the gravity meter B, although continuous reliable data was not obtained by the meter A. Gravity profiles shown in Figs. 26-35 are those obtained by the meter B. The most reliable value based on both A and B will be given elsewhere.

In order to calibrate the surface ship gravity meter, gravity measurement was carried out at Honolulu Pier 8 and Seatle Pier 39, by use of the LaCoste Romberg land gravity meter G-124. Results are shown in Fig.23-24. Comparing the gravity values measured by the LaCoste Romberg and T.S.S.G.-A, differences of gravity difference between Honolulu and Seatle from that between Seatle and Tokyo are both smaller than 1 mgal.

9.2. Measurement of the Earth's magnetic field

Towed proton magnetometer used in this cruise was the same type as used in the former cruises such as KH-68-3, 68-4, 69-1,etc. Total magnetic field was measured every 1 min. Magnetic profiles were compiled based on these values and reliable values at every 5 min were punched on paper tapes together with ship position. Local magnetic anomalies were calculated by use of the batch processing program made during KH-68-4 cruise.

9.3. Several remarkable results

Results obtained by the T.S.S.G.-B, total magnetic force and the bottom topography are shown in Figs. 5-13. position index maps are shown in Figs. 25-26.

Hawaiian Ridge : (Fig. 29)

Free air gravity anomaly from the "moat" north of the Hawaiian Ridge to the crest of the Ridge exactly corresponds to arched topography (position index from May 0106 - May 0200). On the other hand, islands belonging to the Hawaiian Ridge such as represented by Nihoa (position index May 0306) also have gravimetric moat on both side showing that they have roats of the islands. The root of Hawaiian Ridge will be composed by accumulation of small horizontal scale but regionally positive free air gravity anomaly in the Ridge seems to suggest that mass compensation is achieved when large extent of area containing both the Ridge and the Moat are taken into account.

From the magnetic point of view, the moat north of Hawaiian Ridge (position index April 2712 - May 0100) corresponds to so called magnetically smooth zone. That is to say, as seen in the profile along 170°W longitude (position index from ST-1 - May 0100), local magnetic anomaly of "ocean floor spreading type" disappears at the moat. Such kind of magnetically smooth zone can also be recognized east of the Hawaiian Ridge (Fig. 30) - smooth zone starts from the Hawaiian trench and it continues to the Mendocino fault (position index may 1906). Isolated local magnetic anomalie in the profile mentioned above correspond to the Molokai and Murray fracture zones, and their origin should be considered as quite different from the anomalies observed in the Pacific coast of the North America.

Gravimetric fault at the Mendocino fracture zone :

As shown in Fig. 31, difference in the free air gravity

anomaly between north and south of the Mendocino fracture zone is about 20 mgals, and the southern region is regionaly negative and the northern region is regionaly positive. Results of gravity survey across the Mendocino fault at the region east of 132°W (Dehlinger etc. 1967) show the same characteristics, and the present results show that this characteristic feature continues far to 147°W.

Regional characteristics of the North Pacific :

Remarkable results in the profile of the North Pacific from Seatle to Tokyo is that free air gravity anomaly varies from negative to positive towards the west. Results based on gravity meter A and B suggest that there are two gravimetric boundaries in regional anomaly in the North Pacific. The one is the Emperor Ridge and the other is the Japanese island arc.

Free air gravity anomaly between Vanquver Is. to the Emperor Ridge is generally negative - -20∼-30 mgals -, while the anomaly between the Emperor Ridge to the Japanese island arc is nearly zero. It seems that about 20 - 30 mgals hiatus is observed in free air gravity anomaly between the west and east of the Emperor Ridge. (Fig. 34).

As already described elsewhere (Tomoda et. 1970), about 10 - 20 mgals anomaly difference between the Sea of Japan and the Pacific basin. (The characteristics mentioned in this section do not correspond to the Profile of this report, because of uncorrected drift of the gravity meter B).

Though its seems necessary to varify the data to discuss such a long profile, this kind of regionality seems to suggest on east-to-west mass transportation in the North Pacific.

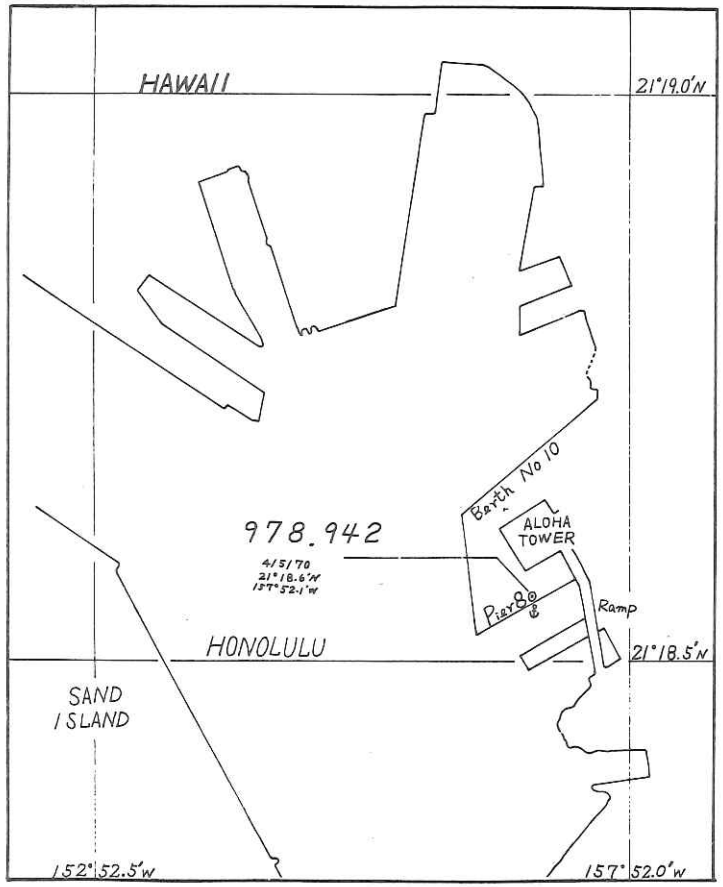

Fig.23. Gravity base station at Honolulu.

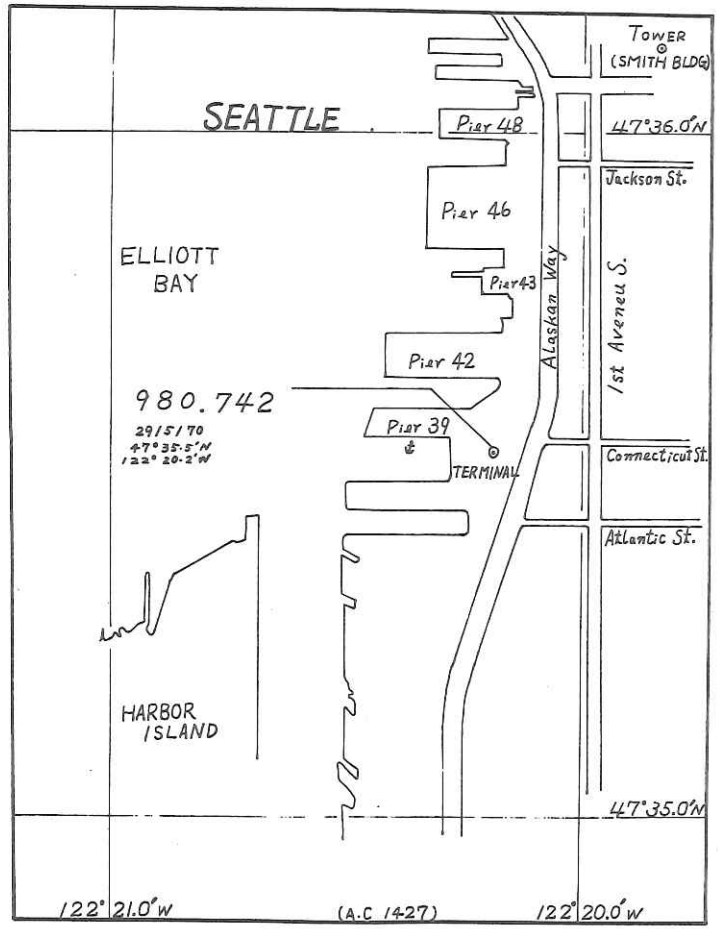

Fig.24. Gravity base station at Seattle.

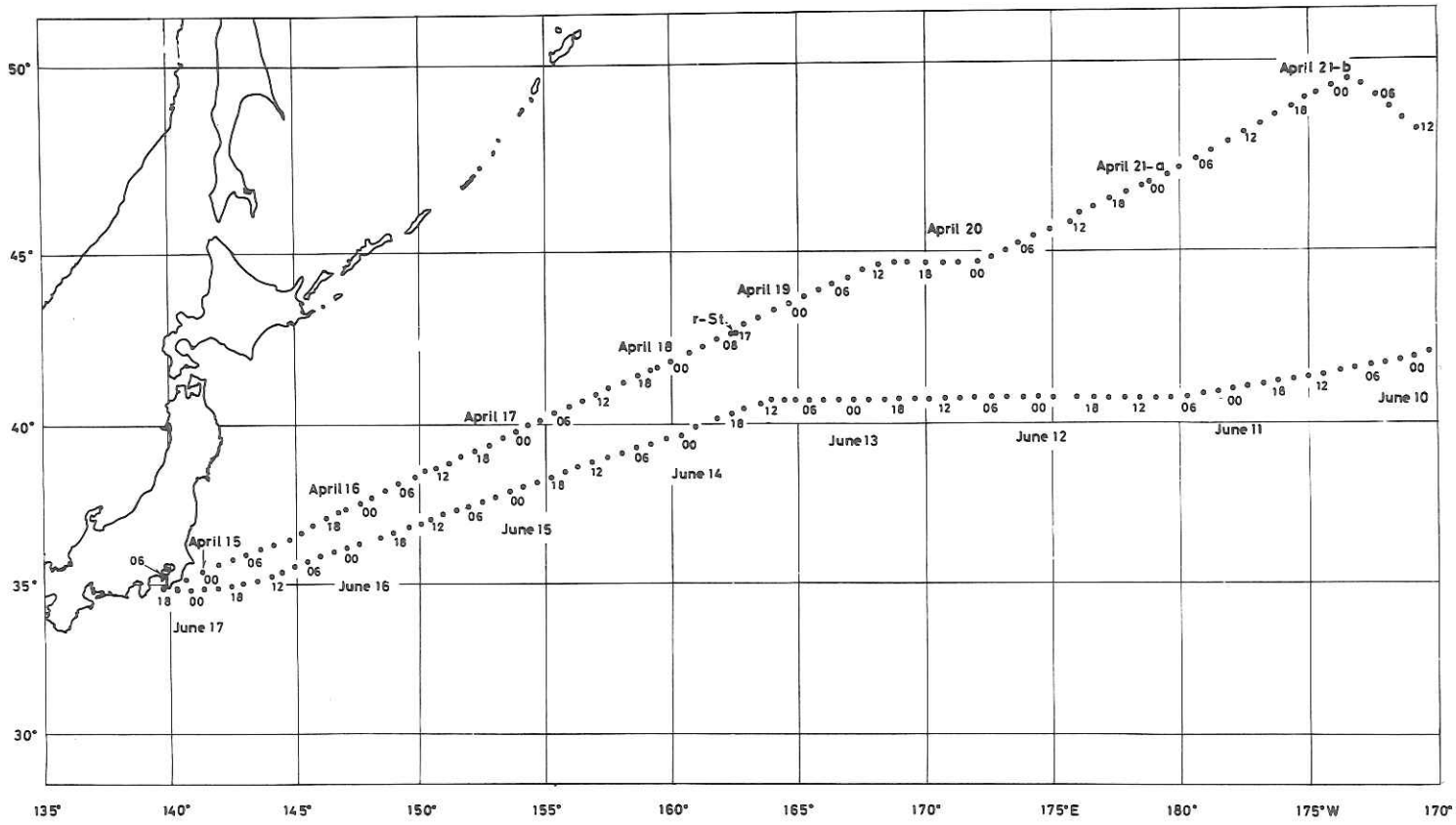

Fig.25. Position index map of Figs.27-35.

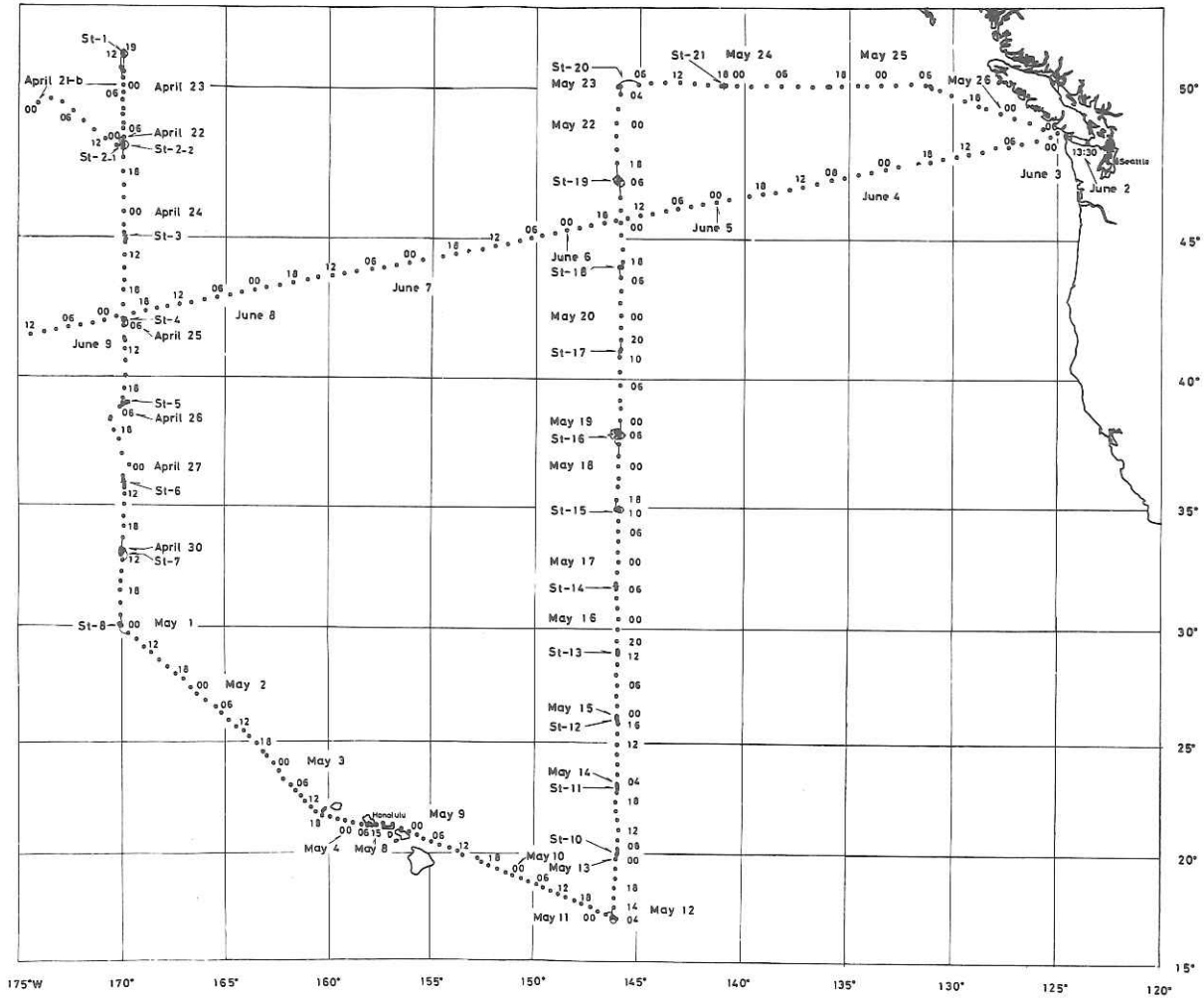

Fig.26. Position index map of Figs.27-35.

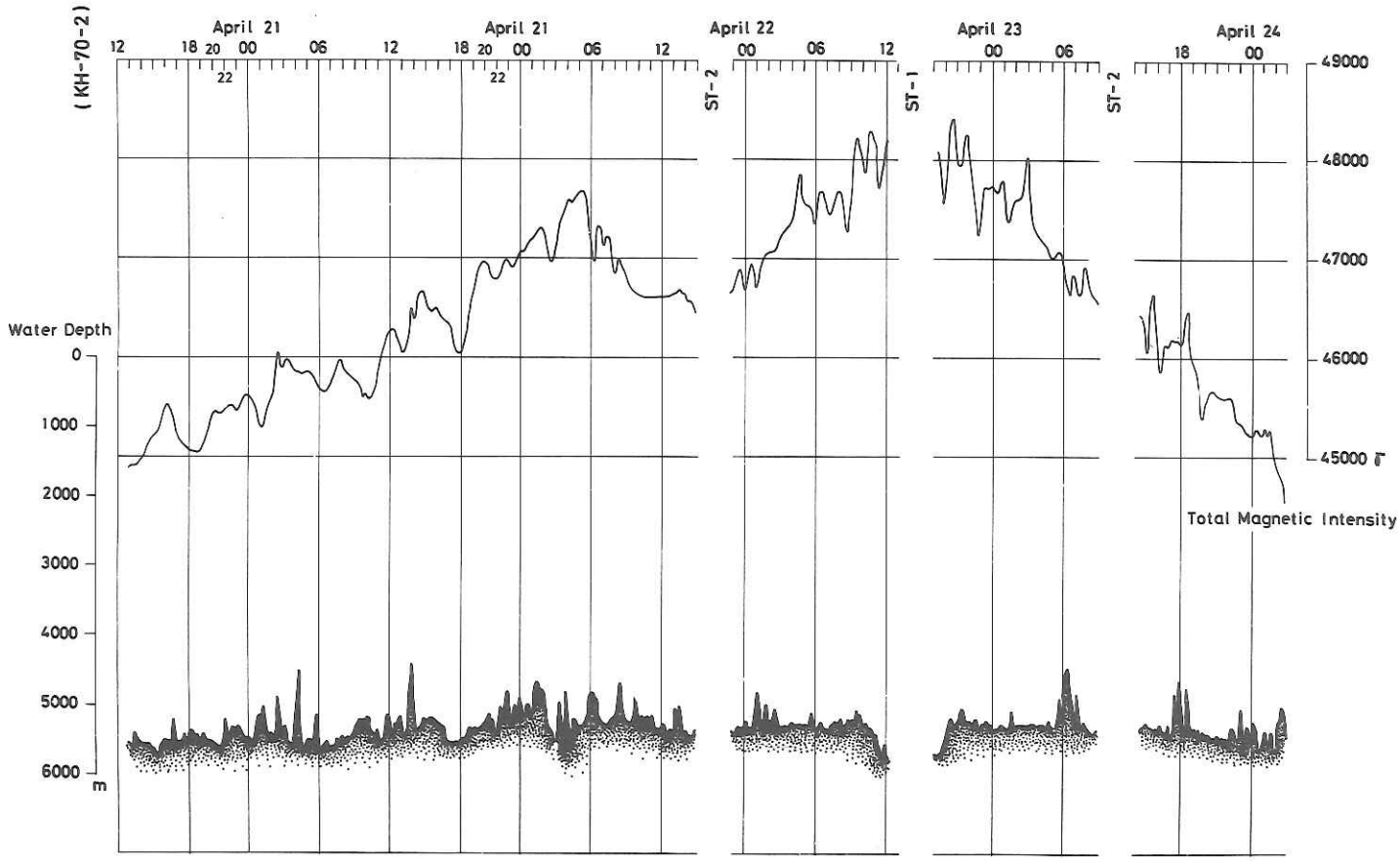

Fig.27. Profiles of magnetic total force and bottom topography.

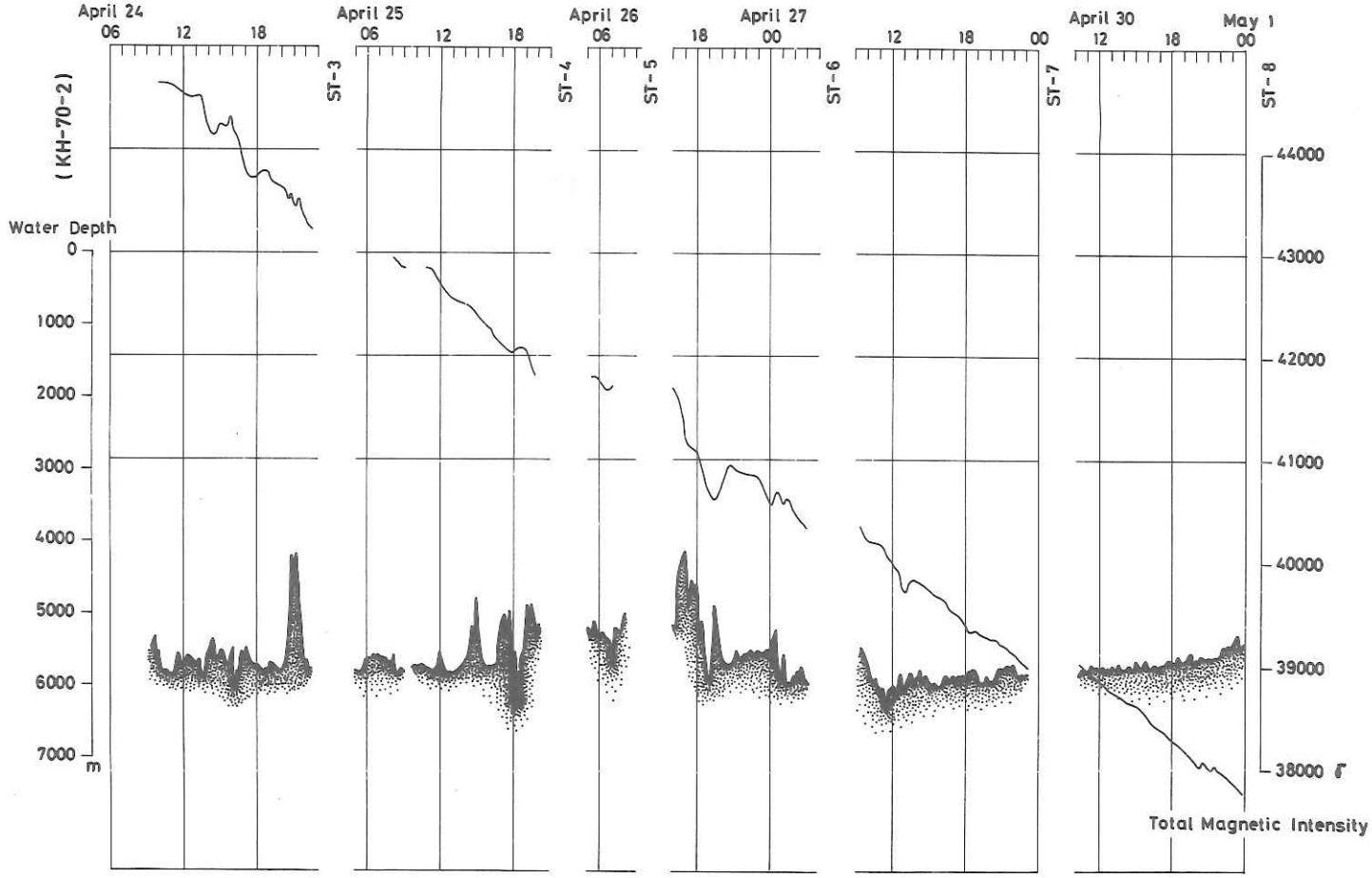

Fig.28. Profiles of magnetic total force and bottom topography.

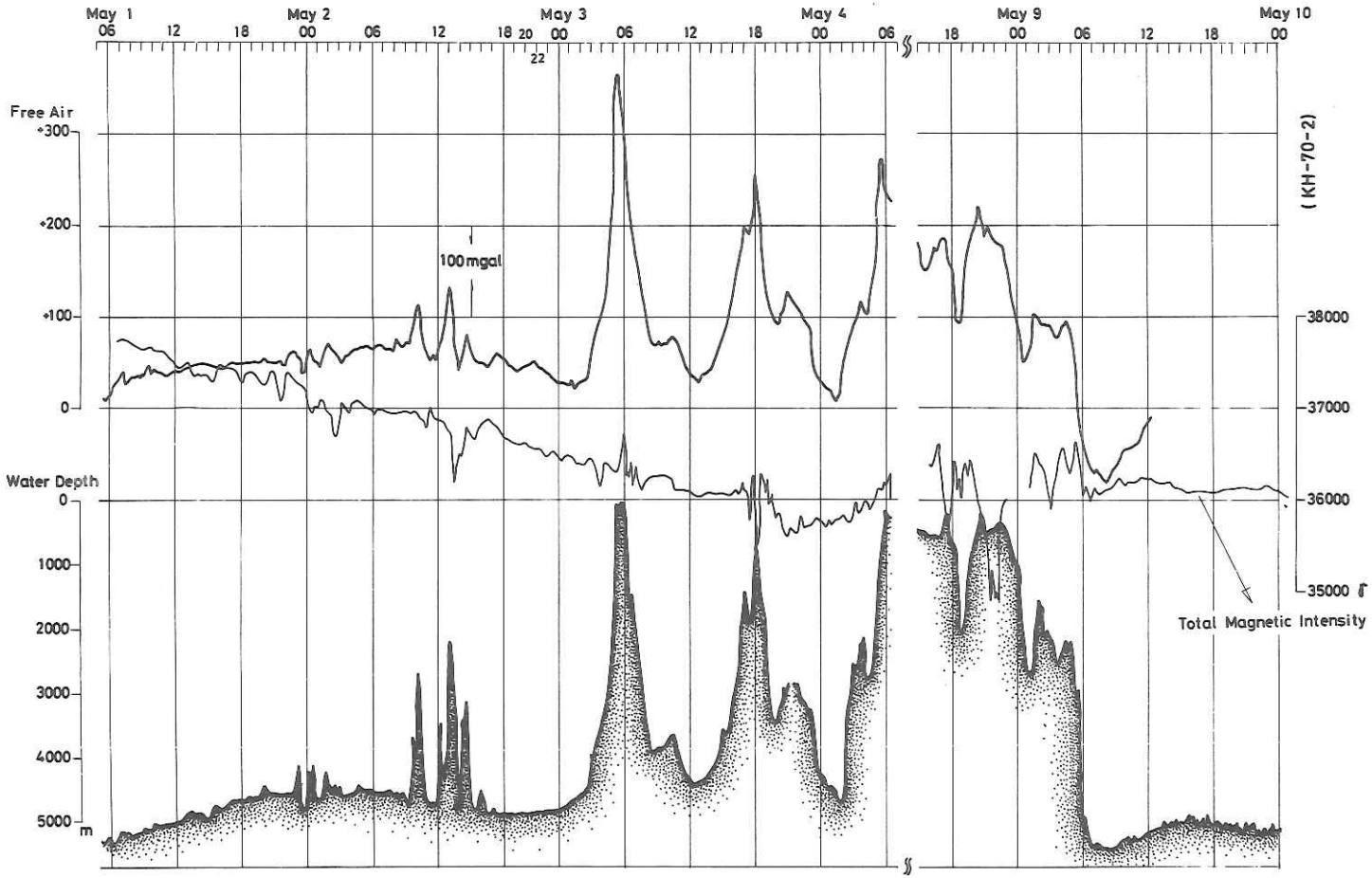

Fig.29. Profiles of free air gravity anomaly, magnetic total force and bottom topography.

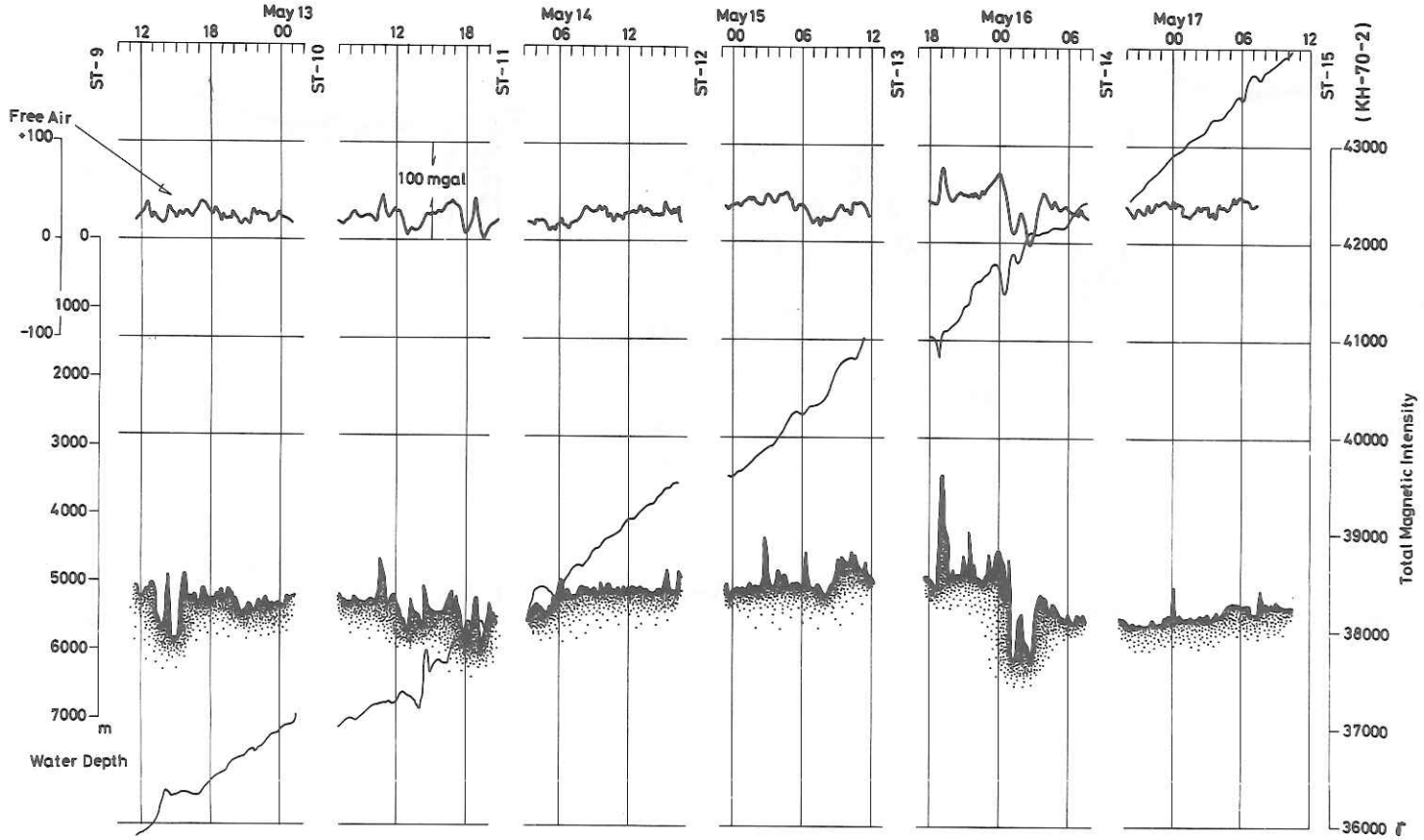

Fig.30. Profiles of free air gravity anomaly, magnetic total force and bottom topography.

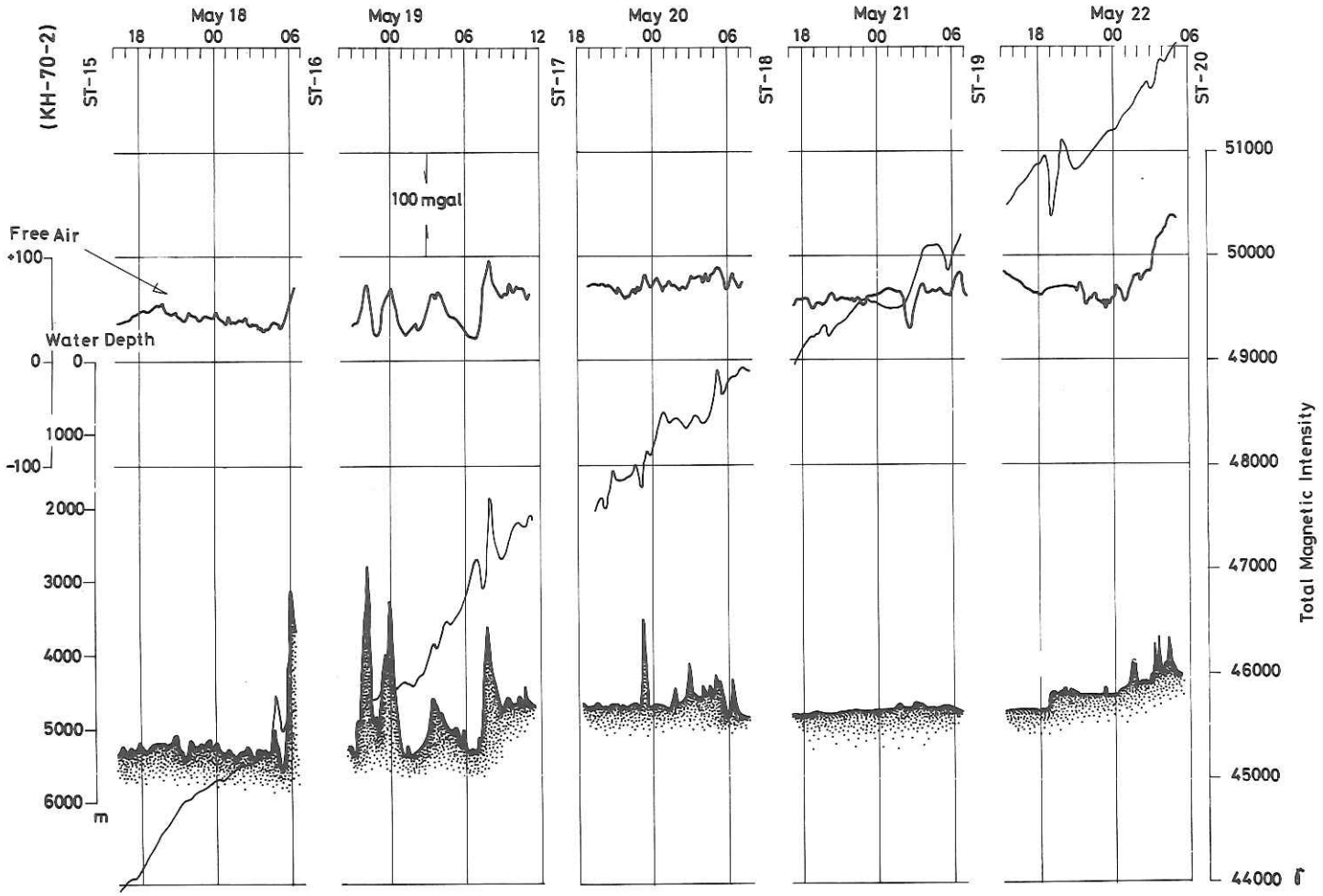

Fig.31. Profiles of free air gravity anomaly, magnetic total force and bottom topography.

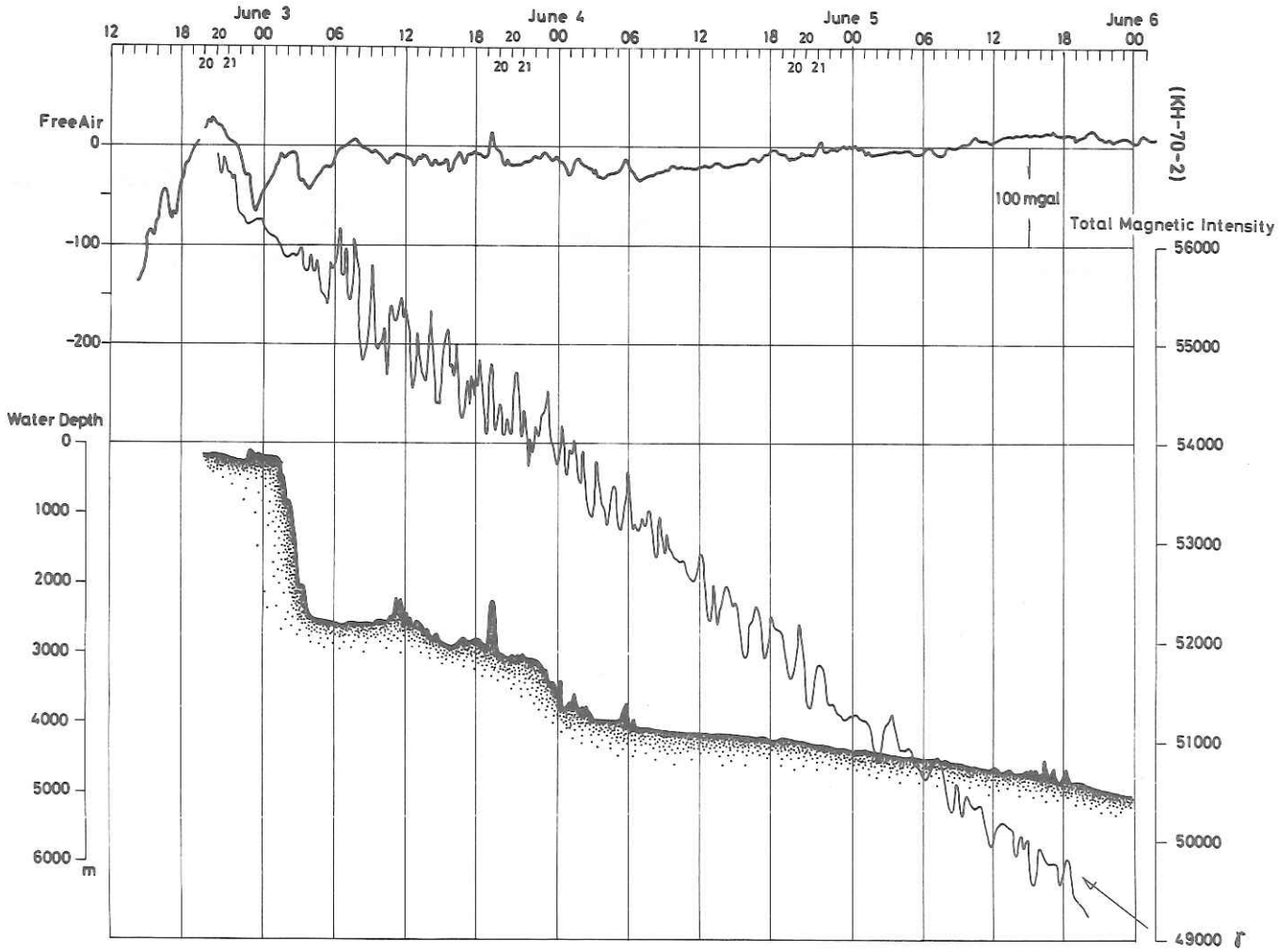

Fig.32. Profiles of free air gravity anomaly, magnetic total force and bottom topography.

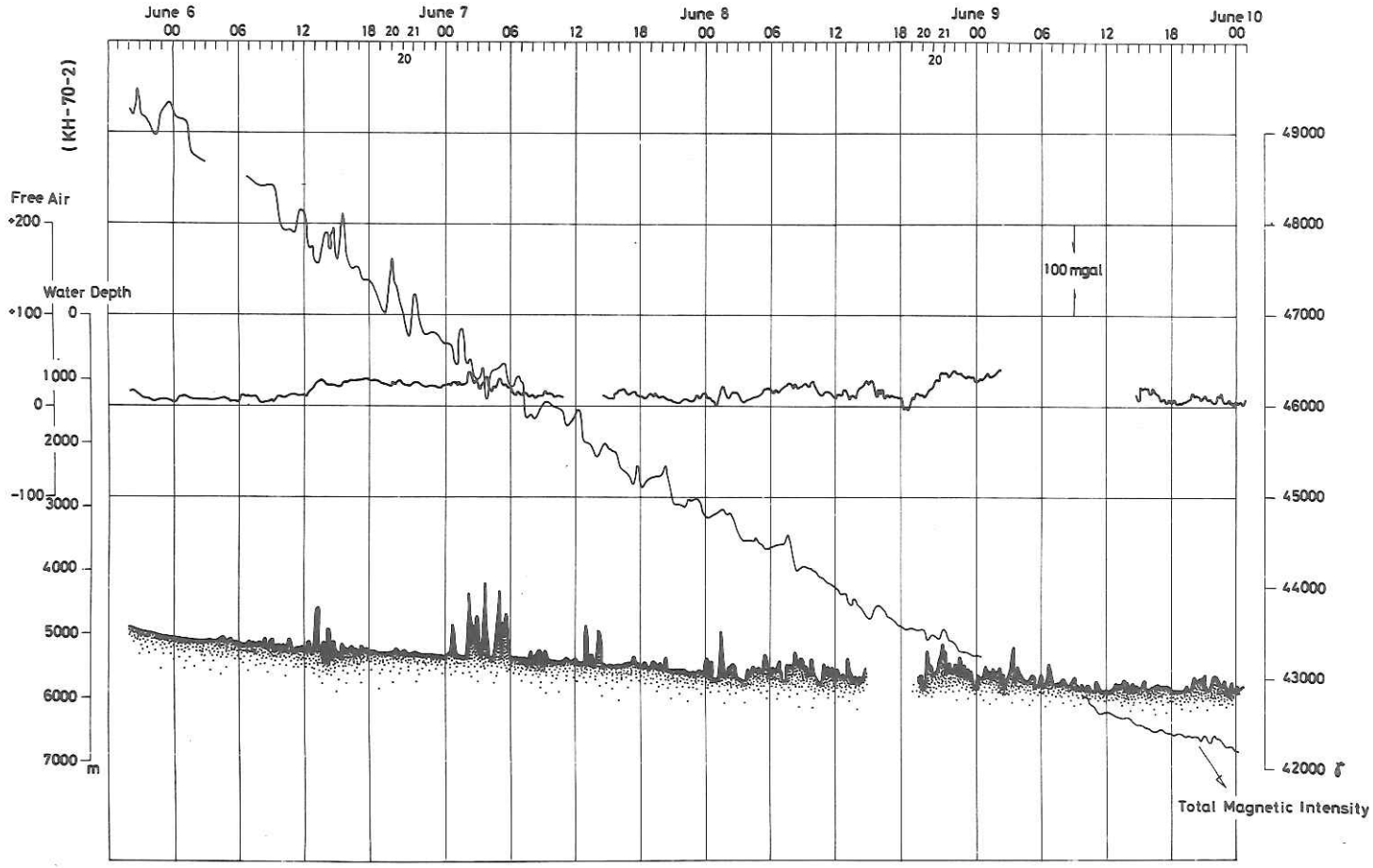

Fig.33. Profiles of free air gravity anomaly, magnetic total force and bottom topography.

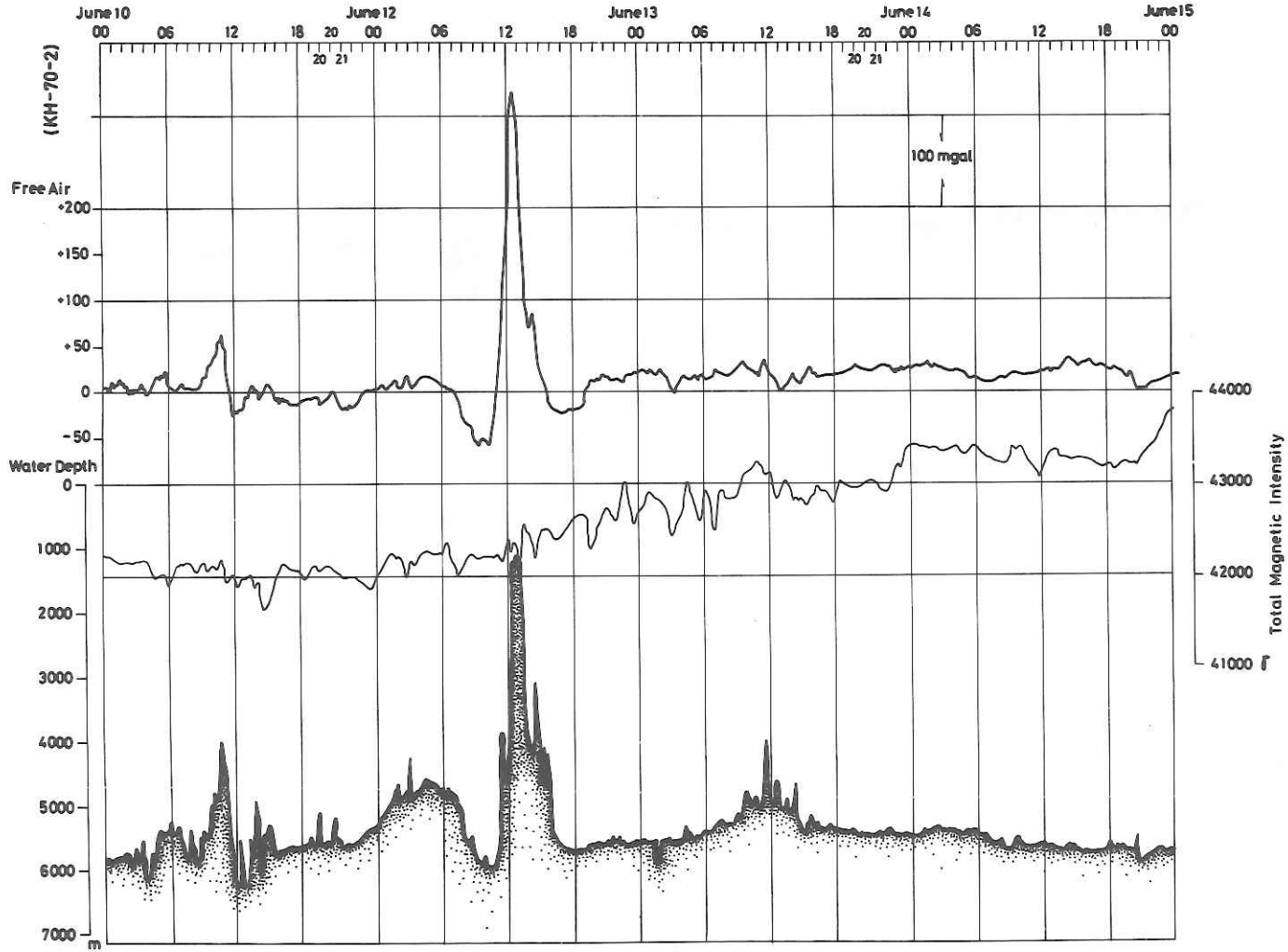

Fig.34. Profiles of free air gravity anomaly, magnetic total force and bottom topography.

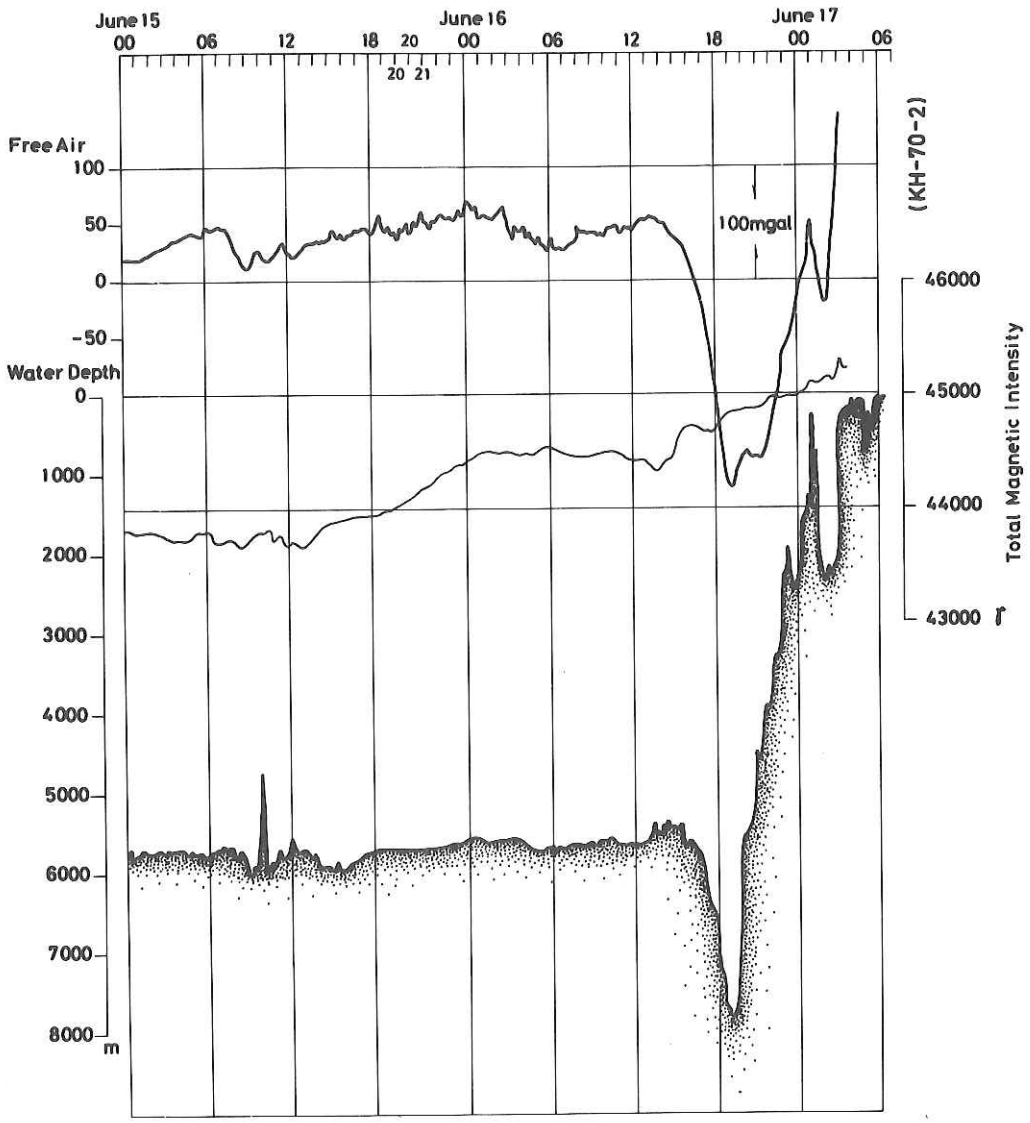

Fig.35. Profiles of free air gravity anomaly, magnetic total force and bottom topography.

Appendix

Oceanographic Data

KH-70-2 Latitude 51°00'N Apr. 22, 1970 Depth 5,890 meters Air Temperature 4.8°C
Station 1 Longitude 169°59'W 1218-1840

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	3.2	32.981	7.50	8.12	2.25	1.75	37	0.17	18.2	0	3.2	32.981
23	3.15	32.971	7.67	8.12	2.22	1.80	42	0.27	18.2	25	3.15	32.971
47	3.12	32.980	7.48	8.11	2.22	1.80	42	0.24	18.4	50	3.11	32.980
70	3.07	32.978	7.49	8.13	2.22	1.80	40	0.22	18.3	75	3.07	32.978
94	3.08	32.980	7.44	8.12	2.20	1.80	40	0.21	18.3	100	3.08	32.985
116	3.10	33.006	7.56	8.06	2.25	1.86	40	0.17	19.1	125	3.14	33.200
140	3.24	33.515	4.95	7.88	2.27	2.42	63	0.04	28.3	150	3.29	33.560
163	3.33	33.617	4.00	7.81	2.20	2.66	71	0.06	34.3	175	3.37	33.662
187	3.40	33.705	3.15	7.73	2.23	2.83	78	0.04	32.3	200	3.43	33.775
234	3.52	33.839	1.95	7.64	2.30	3.11	92	0.05	37.8	250	3.50	33.868
281	3.47	33.917	1.81	7.55	2.32	3.26	100	0.05	37.6	300	3.48	33.950
376	3.51	34.050	0.97	7.55	2.32	3.37	115	0.04	39.4	400	3.50	34.077
470	3.46	34.131	0.73	7.54	2.32	3.37	120	0.00	40.8	500	3.43	34.150
564	3.34	34.191	0.73	7.56	2.33	3.37	122	0.00	39.7	600	3.27	34.216
658	3.19	34.257	0.68	7.56	2.33	3.39	138	0.00	40.1	700	3.15	34.274
751	3.10	34.298	0.69	7.52	2.35	3.39	144	0.00	40.8	800	3.03	34.316
938	2.82	34.374	0.66	7.54	2.38	3.45	151	0.00	40.7	1000	2.72	34.398
1124	2.59	34.436	0.72	7.46	2.39	3.41	160	0.02	40.8	1200	2.50	34.459
1478	2.22	34.527	1.03	7.60	2.38	3.37	171	0.03	40.2	1500	2.21	34.530
1771	2.02	34.566	1.58	7.62	2.40	3.26	176	0.03	39.6	2000	1.87	34.594
2264	1.75	34.616	2.07	7.65	2.44	3.15	173	0.00	37.5	2500	1.67	34.639
2752	1.62	34.651	2.47	7.72	2.46	2.94	171	0.13	36.9	3000	1.57	34.662
3240	1.53	34.671	3.06	7.75	2.43	2.85	166	0.00	35.0	3500	1.50	34.676
3720	1.47	34.680	3.35	7.77	2.43	2.83	164	0.02	34.5	4000	1.47	34.682
4195	1.48	34.687	3.43	7.77	2.43	2.63	162	0.00	34.1	4500	1.51	34.689
4658	1.52	34.690	3.62	7.76	2.46	2.72	160	0.00	32.4	5000	1.55	34.690
5132	1.56	34.690	3.73	7.75	2.43	2.68	153	0.00	32.2	5500	1.60	34.692
5609	1.61	34.693	3.66	7.76	2.44	2.55	152	0.00	31.9	6000	1.67	34.700
6093	1.68	34.732	3.57	7.79	2.48	2.53	–	0.08	33.1			

KH-70-2 Latitude 48°00'N Apr. 21, 1970 Depth 5,460 meters Air Temperature 5.4°C
Station 2 Longitude 169°59'W 1533-2100

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	4.4	33.037	7.92	8.08	2.25	1.59	34	0.14	14.8	0	4.4	33.037
23	4.21	33.040	7.53	8.00	2.29	1.60	33	0.75	14.3	25	4.21	33.041
47	4.20	33.068	7.35	8.09	2.25	1.59	33	0.37	14.7	50	4.19	33.067
71	4.16	33.051	7.87	8.07	2.25	1.60	33	0.21	15.4	75	4.15	33.053
94	4.12	33.069	7.32	8.06	2.25	1.59	32	0.39	14.5	100	4.12	33.070
117	4.13	33.080	7.61	8.03	2.29	1.62	32	0.25	15.1	125	4.25	33.110
141	4.48	33.534	5.46	7.91	2.22	1.97	46	0.25	21.9	150	4.49	33.650
164	4.47	33.700	4.45	7.79	2.30	2.16	56	0.03	26.4	175	4.40	33.730
188	4.32	33.751	3.78	7.77	2.29	2.36	64	0.05	28.9	200	4.26	33.779
235	4.11	33.834	2.72	7.72	2.32	2.72	76	0.19	33.1	250	4.07	33.860
283	4.00	33.915	2.01	7.67	2.33	2.94	86	0.00	34.9	300	3.97	33.934
378	3.86	34.011	1.40	7.69	2.35	3.11	100	0.13	37.6	400	3.83	34.035
474	3.68	34.098	1.09	7.66	2.36	3.21	112	0.00	39.7	500	3.65	34.122
570	3.54	34.173	0.86	7.68	2.38	3.24	121	0.05	40.2	600	3.50	34.194
666	3.38	34.235	0.77	7.67	2.39	3.26	128	0.03	39.7	700	3.34	34.256
761	3.24	34.293	0.75	7.66	2.39	3.32	137	0.00	41.2	800	3.18	34.315
951	2.89	34.375	0.66	7.62	2.35	3.32	150	0.00	40.4	1000	2.82	34.390
1139	2.65	34.437	0.71	7.55	2.36	3.32	159	0.00	41.3	1200	2.50	34.475
1404	2.34	34.504	0.92	7.56	2.39	3.32	168	0.04	39.4	1500	2.18	34.535
1693	2.10	34.554	1.23	7.60	2.41	3.21	173	0.00	38.2	2000	1.92	34.592
2180	1.82	34.610	1.77	7.66	2.42	3.11	176	0.00	39.1	2500	1.72	34.634
2660	1.68	34.645	2.31	7.72	2.46	2.90	174	0.50	34.6	3000	1.60	34.659
3140	1.57	34.662	2.84	7.73	2.46	2.90	169	0.02	34.0	3500	1.51	34.679
3610	1.50	34.680	3.18	7.71	2.43	2.72	166	0.11	34.5	4000	1.50	34.690
4080	1.50	34.692	3.33	7.74	2.47	2.68	164	0.00	32.2	4500	1.52	34.690
4540	1.52	34.688	3.51	7.72	2.44	2.68	165	0.04	34.6	5000	1.57	34.691
5009	1.57	34.691	3.55	7.72	2.47	2.68	164	0.00	33.8	5500	1.62	34.687
5489	1.62	34.687	3.61	7.76	2.48	2.57	160	0.01	33.7			

KH-70-2 Latitude 45°00'N Apr. 24, 1970 Depth 5,600 meters Air Temperature 8.7°C
Station 3 Longitude 169°51'W 0415-0910

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	6.86	33.547	7.03	8.08	2.27	1.35	28	0.19	13.4	0	6.86	33.547
24	6.54	33.559	7.14	8.09	2.25	1.30	27	0.22	12.5	25	6.53	33.559
47	6.44	33.561	7.00	8.09	2.25	1.33	28	0.21	12.4	50	6.41	33.561
71	6.31	33.561	6.93	8.09	2.25	1.37	27	0.21	12.7	75	6.29	33.562
94	6.25	33.574	6.86	8.10	2.25	1.35	27	0.23	12.8	100	6.23	33.576
141	6.14	33.579	6.47	8.10	2.27	1.35	28	0.27	12.0	150	6.14	33.583
187	6.16	33.653	6.41	8.10	2.28	1.41	27	0.04	14.9	200	6.15	33.722
277	5.90	33.880	4.59	7.94	2.25	1.92	48	0.00	23.3	300	5.65	33.887
367	4.93	33.916	3.16	7.80	2.32	2.53	68	0.01	30.7	400	4.71	33.942
457	4.39	34.002	2.15	7.76	2.33	2.89	90	0.00	35.1	500	4.23	34.041
546	4.07	34.088	1.56	7.66	2.35	3.08	103	0.00	37.0	600	3.91	34.138
635	3.80	34.166	1.20	7.62	2.33	3.23	115	0.00	39.9	700	3.65	34.210
724	3.60	34.225	0.95	7.58	2.36	3.28	125	0.00	39.4	800	3.41	34.281
764	3.48	34.256	0.69	7.58	2.39	3.36	131	0.00	41.3	1500	2.34	34.509
907	3.16	34.333	0.68	7.57	2.39	3.34	143	0.01	40.2	1000	3.00	34.367
1054	2.94	34.385	0.64	7.58	2.36	3.40	151	0.00	40.2	2000	1.97	34.585
1094	2.83	34.404	0.64	7.58	2.40	3.40	154	0.00	40.7	1200	2.68	34.434
1543	2.30	34.516	0.74	7.58	2.43	3.40	171	0.00	40.2	2500	1.75	34.630
2022	1.96	34.589	1.31	7.71	2.47	3.23	178	0.04	41.1	3000	1.58	34.656
2503	1.75	34.630	2.04	7.73	2.44	3.12	178	0.00	37.9	3500	1.51	34.676
2980	1.58	34.655	2.63	7.79	2.48	3.00	176	0.00	35.8	4000	1.48	34.681
3458	1.51	34.675	3.03	7.86	2.51	2.81	167	0.00	36.4	4500	1.52	34.685
3931	1.48	34.680	3.34	7.85	2.48	2.81	164	0.00	36.6	5000	1.59	(34.682)
4400	1.50	34.685	3.44	7.87	2.46	2.81	166	0.00	34.4	5500	(1.64)	
4871	1.57	34.682	3.46	7.83	2.47	2.94	167	0.00	32.7	6000		
5354	1.62	-	3.54	7.92	-	2.18	168	0.00	37.7			

KH-70-2 Latitude 42°03'N Apr. 24-25, 1970 Depth 5,935 meters Air Temperature 10.7°C
Station 4 Longitude 169°57'W 2235-0445

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	10.1	34.034	6.66	8.19	2.33	0.86	16	0.20	6.3	0	10.1	34.034
23	9.72	34.033	6.83	8.21	2.32	0.86	16	0.20	6.3	25	9.67	34.033
47	9.21	34.021	6.65	8.20	2.30	0.86	16	0.21	6.2	50	9.05	34.020
70	8.52	33.938	6.55	8.20	2.28	0.86	17	0.29	7.7	75	8.50	33.940
93	8.49	33.960	6.46	8.20	2.28	1.00	17	0.34	7.3	100	8.47	33.973
140	8.30	33.972	6.36	8.17	2.32	1.05	20	0.15	8.8	150	8.26	33.971
187	8.16	33.970	6.35	8.18	-	1.05	19	0.03	9.0	200	8.12	33.999
280	7.42	33.987	4.95	8.07	-	1.60	36	0.00	16.8	300	7.08	33.979
372	6.14	33.960	3.67	7.96	2.32	2.14	54	0.00	24.2	400	5.87	33.965
464	5.26	33.993	2.65	7.88	2.33	2.57	70	0.00	30.6	500	4.94	34.015
557	4.52	34.054	1.92	7.75	2.35	2.92	90	0.00	35.1	600	4.29	34.084
648	4.08	34.115	1.42	7.71	2.35	3.11	104	0.00	36.4	700	4.00	34.149
740	3.93	34.174	1.11	7.67	2.38	3.17	114	0.00	38.3	800	3.77	34.214
926	3.39	34.293	0.58	7.65	2.40	3.40	133	0.00	39.4	1000	3.22	34.335
1113	2.98	34.392	0.47	7.63	2.42	3.45	148	0.00	41.4	1200	2.83	34.417
1386	2.55	34.468	0.41	7.65	2.40	-	164	0.00	42.6	1500	2.41	34.497
1675	2.23	34.533	0.71	7.71	2.43	3.43	173	0.00	41.1	2000	1.98	34.587
2158	1.88	34.604	1.38	7.71	2.44	3.30	180	0.00	39.8	2500	1.74	34.630
2637	1.70	34.638	2.06	7.89	2.49	3.04	175	0.00	38.4	3000	1.60	34.660
3120	1.56	34.666	2.75	7.85	2.46	2.94	170	0.00	36.8	3500	1.49	34.677
3596	1.48	34.678	3.15	7.86	2.47	2.87	164	0.00	34.6	4000	1.49	34.684
4065	1.49	34.685	3.27	7.90	2.48	2.70	160	0.00	33.7	4500	1.52	34.687
4528	1.52	34.687	3.40	7.87	2.47	2.79	165	0.00	33.9	5000	1.58	34.688
5001	1.58	34.688	3.41	7.86	2.47	2.79	165	0.00	34.7	5500	1.66	34.690
5471	1.65	34.690	3.36	7.89	2.49	2.68	166	0.00	34.2	6000	(1.72)	(34.686)
5945	1.72	34.686	3.44	7.83	2.47	2.87	166	0.00	34.6			

KH-70-2 Latitude 39°01'N Apr. 25-26, 1970 Depth 5,245 meters Air Temperature 13.7°C
Station 5 Longitude 169°59'W 2157-0212

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	12.1	34.246	6.30	8.19	2.36	0.64	17	0.14	4.2	0	12.1	34.246
23	11.60	34.231	6.46	8.20	2.33	0.66	12	0.15	4.2	25	11.47	34.230
45	10.92	34.218	6.30	8.20	2.33	0.69	15	0.16	4.2	50	10.83	34.216
68	10.66	34.213	6.34	8.20	2.32	0.71	16	0.22	4.2	75	10.62	34.220
90	10.58	34.240	6.14	8.20	2.32	0.75	15	0.49	4.9	100	10.53	34.239
136	10.30	34.227	6.08	8.15	2.30	0.79	22	0.04	6.1	150	10.29	34.228
181	10.28	34.230	6.08	8.16	2.32	0.79	16	0.02	5.9	200	10.25	34.228
273	10.06	34.210	6.24	8.17	2.32	0.85	17	0.00	6.4	300	9.97	34.199
364	9.55	34.161	5.83	8.15	2.28	0.96	20	0.02	8.5	400	9.03	34.127
456	8.18	34.063	4.86	8.08	2.30	1.50	33	0.00	15.9	500	7.50	34.024
547	6.72	33.994	3.92	7.93	2.32	1.99	49	0.00	23.3	600	5.84	33.996
639	5.36	34.004	2.70	7.80	2.32	2.63	73	0.00	30.3	700	4.80	34.048
730	4.57	34.073	1.85	7.72	2.35	2.98	95	0.00	34.3	800	4.10	34.150
914	3.64	34.250	0.80	7.63	2.39	3.30	128	0.00	39.0	1000	3.44	34.300
1099	3.25	34.340	0.53	7.63	2.40	3.40	142	0.00	40.4	1200	3.06	34.377
1177	3.10	(34.367)	0.46	7.63	2.40	3.43	–	0.00	43.8	1500	2.57	34.479
1466	2.61	34.468	0.46	7.61	2.38	3.45	165	0.00	42.3	2000	2.07	34.585
1949	2.10	34.578	1.07	7.66	2.44	3.38	185	0.00	40.5	2500	1.74	34.631
2433	1.77	34.627	1.80	7.77	2.48	3.11	183	0.00	39.1	3000	1.57	34.656
2913	1.58	34.671	2.66	7.79	2.45	3.00	177	0.00	35.0	3500	1.48	34.673
3389	1.49	34.670	2.91	7.80	2.45	2.92	172	0.00	35.6	4000	1.48	34.683
3863	1.48	34.683	3.32	7.86	2.44	2.79	167	0.00	34.2	4500	1.53	34.685
4331	1.50	34.685	3.41	7.83	2.44	2.83	170	0.01	34.8	5000	1.59	34.688
4795	1.56	34.692	3.43	7.83	2.44	2.79	169	0.00	33.9			
5278	1.63	34.688	3.40	7.84	2.48	2.74	168	0.00	35.0			

KH-70-2 Latitude 35°56'N Apr. 27, 1970 Depth 5,915-5,500 meters Air Temperature 15.9°C
Station 6 Longitude 169°53'W 0300-0910

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	14.42	34.381	5.98	8.19	2.31	0.44	12	0.13	1.6	0	14.42	34.381
24	13.49	34.395	6.19	8.19	2.31	0.47	10	0.14	1.8	25	13.44	34.395
48	12.83	34.385	6.10	8.21	2.31	0.50	11	0.22	2.5	50	12.77	34.386
72	12.55	34.403	5.90	8.19	2.33	0.47	11	0.61	3.0	75	12.51	34.402
96	12.43	34.402	5.84	8.18	2.31	0.47	12	0.09	3.5	100	12.41	34.400
144	12.08	34.371	5.81	8.19	2.37	0.66	16	0.01	4.7	150	12.03	34.371
191	11.73	34.367	5.79	8.19	2.36	0.66	14	0.09	4.7	200	11.68	34.348
285	11.10	34.304	5.76	8.18	2.34	0.81	15	0.01	6.9	300	10.97	34.292
379	10.06	34.216	5.22	8.14	2.36	1.07	22	0.01	10.0	400	9.78	34.188
473	8.46	34.090	4.67	8.09	2.37	1.49	32	0.00	15.7	500	7.83	34.061
567	6.57	34.006	3.52	7.91	2.36	2.13	53	0.00	23.5	600	6.10	34.006
661	5.39	34.018	2.63	7.78	2.37	2.66	74	0.00	29.3	700	5.02	34.037
754	4.60	34.072	1.88	7.68	2.40	3.00	93	0.00	33.6	800	4.33	34.115
940	3.74	34.248	0.76	7.68	2.41	3.32	123	0.00	37.5	1000	3.55	34.292
1129	3.20	34.366	0.47	7.55	2.44	3.44	143	0.00	41.8	1200	3.08	34.389
1280	2.92	34.423	0.45	7.54	2.49	3.49	154	0.00	42.3	1500	2.56	34.491
1560	2.47	34.508	0.61	7.62	2.50	3.43	167	0.00	41.4	2000	2.01	34.604
2015	2.00	34.605	1.39	7.64	2.49	3.26	179	0.01	39.9	2500	1.74	34.646
2483	1.75	34.645	2.12	7.80	2.55	2.98	176	0.00	37.3	3000	1.58	34.668
2960	1.59	34.667	2.75	7.81	2.50	2.94	172	0.00	35.5	3500	1.50	34.677
3438	1.51	34.676	3.07	7.86	2.50	2.89	169	0.00	35.6	4000	1.50	34.685
3901	1.50	34.683	3.20	7.86	2.51	2.72	163	0.00	34.3	4500	1.53	34.689
4380	1.52	34.688	3.42	7.83	2.50	2.79	165	0.01	34.8	5000	1.58	34.694
4844	1.56	34.693	3.47	7.83	2.50	2.79	163	0.00	34.2	5500	1.64	34.694
5311	1.61	34.697	3.48	7.85	2.51	2.66	158	0.00	33.3			
5793	1.67	34.690	3.62	7.84	2.50	2.72	154	0.00	33.1			

KH-70-2 Latitude 33°03'N Apr. 27-28, 1970 Depth 5,835 meters Air Temperature 19.2°C
Station 7 Longitude 169°59'W 2205-0445

Depth (m)	Water Termp. (°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	17.6	34.629	5.71	8.17	2.48	0.18	10	0.02	0.2	0	17.6	34.629
24	16.30	34.640	6.00	8.21	2.28	0.18	9	0.06	0.4	25	16.15	34.640
48	14.99	34.611	5.78	8.21	2.26	0.33	11	0.13	1.5	50	14.95	34.600
72	14.52	34.574	5.70	8.20	2.26	0.37	10	0.18	1.8	75	14.48	34.572
96	14.18	34.555	5.62	8.19	2.26	0.43	12	0.39	2.1	100	14.14	34.552
144	13.56	34.514	5.29	8.10	2.26	0.60	17	0.01	4.3	150	13.50	34.504
192	12.90	34.431	5.70	8.16	2.25	0.54	13	0.05	3.2	200	12.82	34.424
286	11.88	34.368	5.54	8.12	2.25	0.81	16	0.01	6.4	300	11.70	34.354
370	10.38	34.249	4.83	8.07	2.25	1.14	23	0.01	11.4	400	9.87	34.212
473	8.72	34.120	4.29	8.01	2.26	1.52	35	0.00	17.4	500	8.23	34.082
566	6.86	34.032	3.42	7.85	2.30	2.05	52	0.01	26.1	600	6.24	34.020
659	5.43	34.020	2.53	7.76	2.30	2.61	75	0.00	32.1	700	5.02	34.036
753	4.60	34.081	1.74	7.68	2.31	3.00	96	0.00	37.3	800	4.32	34.131
938	3.74	34.270	0.58	7.63	2.36	3.38	125	0.00	42.0	1000	3.55	34.319
1125	3.23	34.390	0.40	7.61	2.39	3.49	145	0.00	43.2	1200	3.09	34.423
1355	2.83	34.486	0.64	7.60	2.43	3.49	158	0.00	42.5	1500	2.59	34.532
1645	2.38	34.565	1.18	7.65	2.43	3.34	166	0.00	41.2	2000	2.02	34.611
2127	1.92	34.622	1.89	7.70	2.41	3.19	177	0.00	39.7	2500	1.71	34.643
2605	1.69	34.649	2.33	7.82	2.47	3.00	175	0.00	38.1	3000	1.58	34.663
3083	1.57	34.666	2.82	7.80	2.43	2.96	172	0.00	37.1	3500	1.52	34.675
3552	1.52	34.676	3.16	7.81	2.49	2.89	169	0.00	36.9	4000	1.50	34.682
4022	1.50	34.682	3.23	7.86	2.48	2.77	164	0.00	35.2	4500	1.52	34.690
4474	1.52	34.690	3.44	7.86	2.48	2.79	164	0.03	34.0	5000	1.56	34.694
4939	1.55	34.694	3.53	7.86	2.47	2.72	160	0.00	34.0	5500	1.61	34.690
5398	1.60	34.689	3.54	7.88	2.48	2.66	154	0.00	34.0			
5874	1.64	34.690	3.71	7.85	2.43	2.74	150	0.01	33.9			

KH-70-2 Latitude 30°03'N May 1, 1970 Depth 5,420 meters Air Temperature 17.6°C
Station 8 Longitude 170°03'W 0022-0514

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	19.4	34.894	5.35	8.21	2.34	0.11	10	0.01	0.3	0	19.4	34.894
24	19.48	34.887	5.45	8.24	2.31	0.11	11	0.01	0.1	25	19.47	34.886
48	16.98	34.829	5.65	8.26	2.31	0.13	11	0.00	0.1	50	16.92	34.828
71	16.53	34.825	5.39	8.26	2.28	0.21	11	0.56	0.0	75	16.50	34.825
94	16.37	34.828	5.30	8.26	2.28	0.25	13	0.03	0.4	100	16.37	34.827
141	15.83	34.745	5.29	8.24	2.31	0.27	15	0.04	0.5	150	15.70	34.725
188	15.13	34.653	5.30	8.24	2.30	0.37	14	0.06	1.2	200	15.00	34.638
281	13.78	34.530	5.25	8.21	2.28	0.59	15	0.05	3.3	300	13.45	34.500
374	11.86	34.353	4.98	8.18	2.30	0.86	22	0.02	7.6	400	11.28	34.294
467	9.71	34.172	4.57	8.10	2.30	1.30	29	0.01	14.2	500	8.96	34.140
560	7.62	34.086	3.74	7.97	2.38	1.84	45	0.01	22.1	600	6.91	34.051
652	6.01	34.019	2.93	7.85	2.31	2.39	68	0.01	29.4	700	5.35	34.030
744	4.87	34.071	1.70	7.75	2.33	2.91	92	0.01	37.3	800	4.47	34.134
929	3.86	34.269	0.55	7.64	2.37	3.29	125	0.00	42.6	1000	3.63	34.326
1115	3.37	34.402	0.57	7.63	2.35	3.37	140	0.01	43.5	1200	3.17	34.444
1357	2.83	34.504	0.91	7.64	2.46	3.35	157	0.02	43.0	1500	2.54	34.546
1642	2.30	34.575	1.39	7.66	2.46	3.25	167	0.03	40.6	2000	1.93	34.613
2119	1.87	34.622	2.05	7.76	2.48	3.13	174	0.03	39.7	2500	1.70	34.645
2589	1.67	34.652	2.58	7.96	2.50	2.95	168	0.06	38.4	3000	1.58	34.667
3057	1.56	34.669	3.01	7.82	2.48	2.95	170	0.01	37.1	3500	1.48	34.678
3519	1.48	34.678	3.22	7.84	2.50	2.89	168	0.03	37.0	4000	1.49	34.684
3981	1.49	34.684	3.33	7.89	2.50	2.77	162	0.00	36.1	4500	1.52	34.688
4446	1.52	34.688	3.48	7.88	2.48	2.81	166	0.01	35.5	5000	1.54	34.691
4914	1.54	34.690	3.60	7.87	2.48	2.79	158	0.00	35.3			
5383	1.56	34.696	3.71	7.89	2.50	2.69	149	0.01	34.2			

KH-70-2 Latitude 17°06'N May 11, 1970 Depth 4,950 meters Air Temperature 23.7°C
Station 9 Longitude 146°14'W 1615-2135

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	24.50	34.561	4.77	8.23	2.37	0.22	5	0.00	0.0	0	24.5	34.561
23	24.46	34.559	4.89	8.24	2.25	0.22	5	0.08	0.0	25	24.46	34.559
47	24.44	34.562	4.79	8.27	2.28	0.22	5	0.07	0.1	50	24.43	34.562
71	24.36	34.559	4.78	8.22	2.28	0.22	5	0.00	0.1	75	24.34	34.563
95	23.51	34.725	4.89	8.23	2.31	0.22	5	0.04	0.1	100	23.39	34.730
119	22.77	34.756	4.85	-	-	-	-	-	-	125	22.20	34.770
143	20.90	34.838	4.67	8.21	2.39	0.33	6	0.23	0.2	150	20.55	34.925
167	19.63	35.005	4.37	-	-	-	-	-	-	175	19.00	35.002
191	17.88	34.797	4.20	8.13	2.40	0.48	8	0.08	4.2	200	16.93	34.635
238	12.54	34.341	2.09	-	-	-	-	-	-	250	11.90	34.324
286	10.46	34.308	2.06	7.87	2.36	2.25	33	0.02	26.6	300	10.12	34.315
382	8.69	34.385	0.87	7.72	2.40	2.74	48	0.05	31.2	400	8.51	34.396
478	7.80	34.431	0.46	7.72	2.40	3.04	57	0.01	36.1	500	7.52	34.433
573	6.77	34.434	0.41	7.68	2.44	3.19	70	0.03	38.9	600	6.60	34.441
669	6.18	34.467	0.43	7.65	2.43	3.43	78	0.04	40.8	700	6.00	34.472
763	5.56	34.478	0.58	7.67	2.43	3.36	87	0.00	41.6	800	5.36	34.475
954	4.61	34.494	0.89	7.68	2.41	3.38	103	0.07	41.8	1000	4.44	34.502
1147	3.97	34.534	1.11	7.69	2.45	3.38	117	0.01	41.9	1200	3.77	34.542
1254	3.58	34.552	1.19	7.71	2.47	3.38	126	0.02	41.9	1500	2.98	34.583
1550	2.87	34.588	1.49	7.72	2.49	3.38	142	0.07	40.7	2000	2.15	34.627
2044	2.10	34.631	2.12	7.76	2.50	3.15	159	0.10	39.9	2500	1.82	34.655
2532	1.81	34.656	2.54	7.83	2.53	3.04	163	0.01	38.1	3000	1.64	34.671
3021	1.63	34.672	2.85	7.86	2.50	3.00	166	0.02	36.6	3500	1.52	34.679
3506	1.52	34.679	3.12	7.84	2.50	2.96	166	0.01	36.2	4000	1.46	34.689
3988	1.46	34.689	3.40	7.86	2.50	2.79	157	0.00	36.8	4500	1.42	34.695
4469	1.42	34.695	3.77	7.84	2.33	2.74	148	0.01	35.2	5000	1.44	34.695
4952	1.43	34.695	3.93	7.83	2.40	2.72	143	0.01	34.8			

KH-70-2 Latitude 20°02'N May 13, 1970 Depth 5,270 meters Air Temperature 22.1°C
Station 10 Longitude 145°59'W 0130-0700

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	23.9	34.550	4.85	-	2.23	0.15	2	0.00	0.0	0	23.9	34.550
18	23.66	34.537	4.82	8.22	2.31	0.15	3	0.00	0.0	25	23.66	34.56
63	22.41	34.969	5.07	8.23	2.33	0.11	3	0.00	0.2	50	22.42	34.995
132	20.74	35.171	4.82	8.27	2.36	0.11	3	0.01	0.1	75	22.20	35.16
272	11.60	34.130	-	8.09	2.28	1.20	13	0.00	15.8	100	21.74	35.22
345	9.75	34.219	1.48	7.71	2.33	2.31	38	0.00	28.9	150	20.32	35.16
436	7.63	34.251	0.92	7.72	2.36	2.77	52	0.00	34.1	200	17.38	34.82
649	5.74	34.404	0.59	7.65	2.37	3.28	79	0.00	40.7	300	10.34	34.13
998	4.23	(34.625)	0.90	7.67	2.40	3.38	107	0.00	42.7	400	8.36	34.22
1112	3.86	34.534	0.97	7.69	2.41	3.38	119	0.00	41.8	500	6.74	34.28
1408	3.13	34.570	1.31	7.76	2.47	3.32	134	0.00	41.5	600	6.01	34.37
1900	2.27	34.620	1.96	7.76	2.47	3.15	153	0.00	40.0	700	5.42	34.42
2389	1.86	34.656	2.39	7.86	2.50	2.96	160	0.00	39.0	800	4.95	34.45
2878	1.66	34.668	2.73	7.82	2.49	2.94	164	0.00	38.0	1000	4.23	34.50
3364	1.54	34.680	3.03	7.84	2.48	2.89	159	0.00	36.9	1200	3.64	34.545
3845	1.49	34.688	3.26	7.90	2.51	2.77	160	0.00	36.4	1500	2.93	34.580
4323	1.46	34.694	3.61	7.86	2.48	2.75	153	0.00	35.5	2000	2.18	34.630
4800	1.44	34.699	3.86	7.85	2.51	2.64	144	0.01	35.1	2500	1.80	34.660
5282	1.48	34.696	3.88	7.90	2.49	2.57	141	0.00	35.0	3000	1.62	34.672
										3500	1.52	34.682
										4000	1.48	34.691
										4500	1.45	34.696
										5000	1.46	34.698

KH-70-2 Latitude 23°01'N May 13-14, 1970 Depth 5,650 meters Air Temperature 21.4°C
Station 11 Longitude 146°02'W 2100-0250

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	22.2	34.920	4.96	8.24	2.28	0.09	4	0.00	0.3	0	22.2	34.920
24	22.26	34.921	5.66	8.28	2.28	0.09	4	0.00	0.3	25	22.25	34.922
48	21.79	35.069	5.60	8.28	2.30	0.07	3	0.00	0.3	50	21.70	35.075
72	21.14	35.132	5.69	8.29	2.31	0.09	4	0.00	0.3	75	21.13	35.137
96	21.01	35.159	5.63	8.28	2.34	0.09	5	0.00	0.2	100	20.98	34.159
144	19.85	35.112	4.88	8.17	2.28	0.13	2	0.12	0.0	150	19.63	35.085
192	17.50	34.794	4.62	8.17	2.23	0.24	4	0.02	2.7	200	17.10	34.735
288	11.77	34.128	4.72	8.11	2.19	0.88	13	0.00	12.4	300	10.78	34.113
384	8.63	34.066	3.57	7.97	2.17	1.80	33	0.00	25.6	400	8.28	34.053
431	7.54	34.034	3.09	-	-	-	-	-	-	450	6.90	34.030
479	6.32	34.034	2.35	7.81	2.24	2.46	60	0.00	35.1	500	6.08	34.044
574	5.50	34.113	1.19	7.66	2.34	3.00	79	0.00	40.1	600	5.36	34.145
670	5.05	34.249	0.55	7.55	2.30	3.28	96	0.00	41.1	700	4.93	34.299
765	4.70	34.377	0.58	7.59	2.33	3.32	105	0.00	41.7	800	4.60	34.405
955	4.16	34.489	0.89	7.63	2.34	3.32	116	0.00	41.5	1000	4.04	34.504
1144	3.66	34.534	1.12	7.67	2.34	3.26	126	0.00	41.5	1200	3.51	34.540
1514	2.80	34.579	1.50	7.61	2.41	3.21	147	0.00	41.9	1500	2.83	34.577
1809	2.35	34.607	1.81	7.68	2.37	3.11	157	0.00	40.9	2000	2.11	34.623
2304	1.84	34.644	2.30	7.74	2.40	3.00	170	0.00	39.3	2500	1.73	34.655
2800	1.63	34.669	2.68	7.83	2.41	2.83	170	0.00	38.8	3000	1.58	34.674
3293	1.54	34.679	3.05	7.79	2.40	2.79	170	0.00	37.6	3500	1.51	34.681
3777	1.48	34.684	3.27	7.78	2.43	2.74	167	0.00	36.1	4000	1.48	34.687
4254	1.47	34.692	3.46	7.83	2.45	2.64	157	0.00	35.4	4500	1.46	34.695
4727	1.46	34.697	3.76	7.82	2.39	2.64	148	0.00	34.9	5000	1.47	34.699
5205	1.48	34.701	3.85	7.82	2.39	2.55	146	0.00	34.7	5500	1.52	34.699
5686	1.56	34.698	3.78	7.84	2.43	2.46	146	0.00	34.6			

KH-70-2 Latitude 26°01'N May 14, 1970 Depth 5,040 meters Air Temperature 21.2°C
Station 12 Longitude 146°02'W 1650-23-6

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	21.6	35.178	5.07	8.25	2.43	0.05	4	0.00	0.1	0	21.6	35.178
28	21.25	35.205	5.09	8.25	2.41	0.05	6	0.00	0.3	25	21.35	35.22
70	20.49	35.276	5.33	8.24	2.39	0.05	5	0.00	0.3	50	20.67	35.275
128	19.58	35.167	5.02	8.23	2.39	0.07	6	0.01	0.4	75	20.48	35.275
196	17.25	34.792	4.71	8.15	2.37	0.26	8	0.04	3.0	100	20.44	35.27
263	13.70	34.343	4.72	8.11	2.09	0.60	9	0.02	7.9	150	19.00	35.07
273	13.27	34.299	4.66	8.10	2.14	0.67	11	0.01	8.7	200	17.05	34.765
318	11.32	34.166	4.61	8.08	2.26	0.99	17	0.00	13.9	300	11.97	34.195
329	11.04	34.171	4.61	8.08	2.23	1.00	16	0.00	14.5	400	9.65	34.11
512	6.85	34.010	3.16	7.87	2.30	2.16	52	0.00	31.0	500	7.18	34.015
649	4.87	34.113	1.10	7.60	2.40	3.13	93	0.00	41.8	600	5.32	34.055
782	4.26	(34.188)	0.85	7.60	2.39	3.21	102	0.00	42.7	700	4.53	34.165
1185	3.28	34.518	1.40	7.66	2.45	3.21	134	0.00	42.9	800	4.22	34.28
1404	2.90	34.555	1.45	7.67	2.47	3.19	143	0.00	41.1	1000	3.69	34.42
1698	2.42	34.595	1.68	7.73	2.47	3.17	157	0.00	40.9	1200	3.26	34.522
2186	1.89	34.633	2.03	7.56	2.47	3.09	172	0.00	40.1	1500	2.73	34.579
2670	1.64	34.660	2.50	7.80	2.50	2.89	174	0.00	38.7	2000	2.06	34.620
3156	1.53	34.673	2.96	7.83	2.49	2.83	170	0.00	37.4	2500	1.71	34.651
3633	1.46	34.682	3.23	7.79	2.49	2.79	165	0.00	36.1	3000	1.55	34.670
4106	1.48	34.687	3.36	7.84	2.49	2.68	159	0.00	35.7	3500	1.48	34.680
4579	1.50	34.693	3.60	7.82	2.47	2.68	152	0.00	35.4	4000	1.48	34.686
5056	1.53	34.694	3.69	7.81	2.47	2.66	149	0.00	35.1	4500	1.50	34.692
										5000	1.53	34.694

KH-70-2 Latitude 29°00'N May 15, 1970 Depth 4,950 meters Air Temperature 21.4°C
Station 13 Longitude 146°01'W 1230-1746

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	20.1	35.268	5.23	8.18	2.37	0.02	3	0.00	0.1	0	20.1	35.268
34	19.85	35.249	5.26	8.19	2.37	0.02	4	0.00	0.1	25	19.91	35.24
76	19.30	35.165	5.44	8.18	2.35	0.02	4	0.00	0.4	50	19.66	35.20
98	18.42	35.031	5.21	8.17	2.34	0.04	6	0.00	0.3	75	19.31	35.18
128	17.65	34.899	5.10	8.15	2.33	0.11	6	0.12	1.5	100	18.40	35.03
158	16.73	34.747	4.91	8.13	2.17	0.31	5	0.03	3.1	150	16.85	34.82
188	15.63	34.640	4.91	8.10	2.17	0.33	5	0.02	3.4	200	15.10	34.57
348	10.20	34.149	4.61	7.98	2.14	1.18	19	0.00	17.5	300	11.16	34.165
494	6.66	34.025	2.08	7.68	2.19	2.68	67	0.00	36.8	400	9.12	34.075
598	5.23	34.047	1.69	7.71	2.19	2.92	77	0.00	39.8	500	6.57	34.005
696	4.61	34.111	1.20	7.61	2.21	3.11	88	0.00	41.6	600	5.21	34.045
798	4.20	(34.100)	(1.36)	(7.62)	(2.21)	(3.11)	(88)	(0.00)	(41.2)	700	4.61	34.16
1095	3.46	34.459	0.80	7.58	2.31	3.24	122	0.00	42.7	800	4.20	34.265
1360	2.96	34.538	1.13	7.60	2.33	3.30	146	0.01	41.4	1000	3.65	34.41
1654	2.48	34.582	1.51	7.65	2.33	3.24	168	0.00	41.8	1200		
2093	1.97	34.625	1.93	7.64	2.41	3.13	173	0.01	39.9	1500	2.72	34.560
2579	1.69	34.653	2.39	7.73	2.39	2.94	174	0.00	39.5	2000	2.05	34.617
3067	1.54	34.671	2.92	7.72	2.37	2.89	173	0.00	40.2	2500	1.71	34.650
3545	1.48	34.680	3.21	7.74	2.39	2.79	170	0.00	36.5	3000	1.55	34.668
4023	1.48	34.685	3.31	7.81	2.39	2.66	161	0.00	38.5	3500	1.48	34.679
4468	1.50	34.689	3.57	7.76	2.33	2.70	155	0.01	35.9	4000	1.48	34.685
4972	1.54	34.692	3.59	7.79	2.34	2.66	153	0.01	34.7	4500	1.50	34.689
										5000	1.54	34.692

KH-70-2 Latitude 31°57'N May 16, 1970 Depth 5,585 meters Air Temperature 17.6°C
Station 14 Longitude 146°07'W 1110-1600

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	34.971	5.39	8.20	2.39	0.05	6	0.00	0.2	0	19.17	34.971
24	19.28	34.995	5.48	8.22	2.36	0.03	7	0.00	0.2	25	19.28	34.999
48	18.95	35.092	5.43	8.24	2.36	0.03	8	0.00	0.2	50	18.90	35.092
71	17.55	34.849	5.50	8.23	2.34	0.05	7	0.00	0.2	75	17.50	34.843
95	16.80	34.796	5.47	8.23	2.33	0.07	9	0.01	0.1	100	16.50	34.770
143	14.66	34.406	5.64	8.22	2.31	0.18	5	0.13	0.5	150	14.50	34.385
191	13.56	34.304	5.25	8.19	2.31	0.46	8	0.03	4.7	200	13.34	34.296
286	11.20	34.226	5.12	8.12	2.30	0.90	17	0.01	13.2	300	10.95	34.214
381	9.46	34.118	4.61	8.07	2.31	1.28	24	0.01	19.4	400	9.10	34.097
476	7.55	34.020	3.92	7.98	2.33	1.76	41	0.00	27.0	500	7.00	34.000
572	5.68	33.988	2.58	7.80	2.37	2.55	67	0.00	35.9	600	5.35	33.990
667	4.83	34.095	1.17	7.73	2.37	3.11	91	0.00	39.4	700	4.65	34.134
762	4.42	34.197	0.59	7.72	2.34	3.32	105	0.00	42.0	800	4.29	34.235
954	3.84	34.361	0.41	7.76	2.43	3.43	125	0.00	42.9	1000	3.70	34.390
1146	3.40	34.463	0.64	7.78	2.43	3.38	137	0.00	41.9	1200	3.29	34.483
1429	2.82	34.545	1.21	7.81	2.51	3.26	149	0.01	41.4	1500	2.69	34.556
1723	2.34	34.589	1.45	7.81	2.50	3.17	164	0.00	40.6	2000	2.05	34.615
2216	1.88	34.631	1.99	7.85	2.50	3.04	175	0.00	39.4	2500	1.74	34.647
2706	1.66	34.658	2.37	7.88	2.54	2.85	177	0.00	38.8	3000	1.57	34.669
3196	1.54	34.676	2.88	7.87	2.50	2.85	173	0.00	39.7	3500	1.50	34.680
3677	1.47	34.683	3.22	7.88	2.50	2.79	169	0.00	37.6	4000	1.49	34.689
4159	1.50	34.690	3.30	7.92	2.53	2.66	162	0.00	35.3	4500	1.51	34.687
4635	1.52	34.686		7.88	2.50	2.64	157	0.00	35.4	5000	1.55	34.690
5107	1.57	34.691	3.57	7.88	2.50	2.61	154	0.00	35.5	5500	1.64	34.692
5581	1.65	34.692	3.53	7.88	2.51	2.57	153	0.00	36.2			

KH-70-2 Latitude 34°58'N May 17, 1970 Depth 5,405 meters Air Temperature 21.6°C
Station 15 Longitude 146°01'W 1037-1612

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	16.5	33.798	5.70	8.15	2.26	0.18	5	0.00	0.3	0	16.5	33.798
24	15.02	33.806	6.10	8.16	2.28	0.16	7	0.00	0.1	25	14.90	33.806
48	13.43	33.711	6.15	8.18	2.26	0.22	7	0.00	0.1	50	13.35	33.709
72	12.73	33.693	6.20	8.19	2.28	0.22	7	0.00	0.1	75	12.70	33.695
96	12.55	33.766	6.06	8.20	2.28	0.24	7	0.00	0.2	100	12.50	33.770
144	11.44	33.817	5.68	8.19	2.21	0.44	7	0.02	3.4	150	11.40	33.832
193	11.14	34.077	5.16	8.16	2.25	0.69	12	0.02	9.0	200	11.04	34.090
289	9.79	34.110	4.96	8.09	2.28	1.18	22	0.00	14.4	300	9.64	34.105
384	8.36	34.053	4.23	8.02	2.28	1.54	32	0.01	21.3	400	8.02	34.039
480	6.50	33.972	3.36	7.96	2.26	2.12	53	0.01	29.0	500	6.16	33.965
576	5.12	33.974	2.44	7.73	2.34	2.66	72	0.00	35.1	600	4.93	33.995
672	4.52	34.068	1.31	7.66	2.34	3.07	93	0.00	38.3	700	4.40	34.097
767	4.18	34.157	0.77	7.62	2.37	3.24	108	0.00	40.7	800	4.07	34.185
958	3.56	34.305	0.30	7.59	2.40	3.45	130	0.00	41.8	1000	3.46	34.334
1148	3.12	34.425	0.31	7.61	2.40	3.45	146	0.00	42.1	1200	3.07	34.463
1264	3.01	34.491	0.57	7.63	2.45	3.43	149	0.00	42.6	1500	2.62	34.548
1557	2.53	34.559	1.03	7.65	2.45	3.32	161	0.00	40.9	2000	2.00	34.618
2045	1.95	34.623	1.69	7.72	2.48	3.15	175	0.00	39.1	2500	1.71	34.652
2531	1.70	34.654	2.14	7.84	2.49	2.94	177	0.00	37.9	3000	1.57	34.672
3020	1.56	34.672	2.77	7.80	2.43	2.89	170	0.00	37.1	3500	1.48	34.682
3499	1.48	34.682	3.10	7.82	2.49	2.85	167	0.00	36.2	4000	1.49	34.690
3976	1.49	34.692	3.22	7.83	2.49	2.77	164	0.00	35.1	4500	1.52	34.692
4448	1.52	34.692	3.41	7.82	2.48	2.68	161	0.00	35.9	5000	1.58	34.693
4926	1.56	34.694	3.51	7.83	2.48	2.68	156	0.00	35.0	5500	(1.64)	(34.694)
5407	1.63	34.694	3.49	7.94	2.49	2.66	154	0.01	34.8			

KH-70-2 Latitude 37°43'N May 18, 1970 Depth 5,400 meters Air Temperature 15.6°C
Station 16 Longitude 145°49'W 1400-2046

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	15.0	33.855	5.88	8.13	2.28	0.22	4	0.00	0.1	0	15.0	33.855
16	14.91	33.791	5.87	8.18	2.25	0.22	5	0.00	0.1	25	14.80	33.78
54	13.37	33.960	6.34	8.20	2.26	0.22	6	0.00	0.2	50	13.20	33.865
117	11.35	33.782	5.92	8.15	2.28	0.37	6	0.34	2.1	75	12.68	33.965
158	11.06	33.957	5.41	8.15	2.26	0.65	11	0.02	7.9	100	11.48	33.765
197	10.52	34.064	5.11	8.10	2.26	0.86	13	0.00	11.8	150	11.07	33.90
225	10.19	34.114	4.94	8.04	2.28	1.05	18	0.00	14.8	200	10.52	34.11
305	8.97	34.079	4.60	8.05	2.26	1.43	28	0.00	19.6	300	9.10	34.075
478	5.77	33.960	3.04	7.84	2.28	2.40	62	0.00	32.9	400	6.95	33.965
596	4.58	33.985	2.44	7.72	2.33	2.68	76	0.00	36.2	500	5.45	33.96
752	3.90	33.106	1.28	7.64	2.34	3.11	101	0.00	41.0	600	4.54	33.99
900	3.45	(33.147)	(1.10)	(7.64)	(2.36)	(3.17)	(110)	(0.00)	(41.8)	700	4.11	34.09
1098	3.01	33.390	0.36	7.59	2.41	3.45	148	0.00	43.6	800	3.72	34.19
1345	2.75	33.485	0.47	7.62	2.40	3.45	161	0.01	43.7	1000	3.22	34.325
1640	2.36	33.555	1.00	7.63	2.48	3.32	168	0.00	41.4	1200	2.87	34.42
2125	1.93	33.617	1.67	7.61	2.48	3.17	177	0.00	41.3	1500	2.50	34.525
2608	1.70	33.646	(2.78)	7.72	2.48	2.99	177	0.00	37.8	2000	2.01	34.605
3093	1.95	33.662	2.72	7.71	2.44	2.89	172	0.01	37.1	2500	1.74	34.641
3570	1.50	33.676	3.04	7.78	2.47	2.83	170	0.05	35.9	3000	1.60	34.660
4046	1.51	(33.696)	3.17	7.83	2.47	2.72	169	0.01	35.2	3500	1.50	34.674
4517	1.54	33.684	3.33	7.78	2.47	2.74	167	0.00	34.9	4000	1.51	34.681
4992	1.58	33.686	3.41	7.81	2.47	2.72	162	0.01	35.0	4500	1.54	34.684
5465	1.64	33.689	3.43	7.80	2.66	2.64	158	0.00	34.5	5000	1.58	34.686
										5500	(1.64)	(34.689)

KH-70-2 Latitude 41°00'N May 19, 1970 Depth 4,795-4,765 meters Air Temperature 13.1°C
Station 17 Longitude 145°58'W 1240-1545

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	12.0	33.338	6.39	8.17	2.25	0.28	4	0.00	0.2	0	12.0	33.338
24	11.38	33.493	6.75	8.19	2.23	0.30	4	0.00	0.2	25	11.30	33.493
47	10.12	33.481	6.44	8.18	2.25	0.46	5	0.11	2.4	50	10.12	33.482
71	10.14	33.534	6.29	8.17	2.23	0.48	5	0.20	2.9	75	10.13	33.536
95	9.64	33.544	6.13	8.17	2.23	0.54	7	0.72	4.6	100	9.66	33.547
142	9.90	33.928	5.47	8.12	2.25	0.84	12	0.01	10.7	150	9.86	33.965
189	9.33	34.015	5.29	8.10	2.25	1.00	18	0.02	14.5	200	9.22	34.029
284	8.21	34.029	4.67	8.02	2.26	1.50	34	0.00	21.8	300	7.97	34.015
379	6.68	33.956	3.73	7.92	2.28	1.97	48	0.00	28.3	400	6.33	33.951
474	5.31	33.961	2.64	7.81	2.31	2.57	70	0.00	33.9	500	5.07	33.971
569	4.53	34.013	2.01	7.86	2.37	2.85	88	0.00	36.0	600	4.32	34.034
664	4.04	34.089	1.34	7.80	2.37	3.13	103	0.00	38.5	700	3.94	34.125
758	3.84	34.181	0.91	7.74	2.37	3.28	118	0.00	39.4	800	3.74	34.215
949	3.32	34.313	0.42	7.74	2.40	3.40	138	0.00	41.3	1000	3.20	34.340
1140	2.94	34.398	0.35	7.73	2.40	3.47	151	0.01	43.0	1200	2.85	34.415
1128	2.97	34.392	0.31	7.67	2.41	3.43	151	0.00	40.7	1500	2.45	34.503
1424	2.54	34.483	0.43	7.63	2.43	3.43	166	0.00	40.5	2000	1.97	34.598
1915	2.02	34.586	1.16	7.69	2.44	3.28	178	0.00	39.8	2500	1.73	34.643
2400	1.78	34.636	1.84	7.80	2.48	3.07	180	0.00	39.1	3000	1.55	34.666
2888	1.60	34.663	2.50	7.80	2.45	2.96	178	0.00	38.3	3500	1.50	34.680
3370	1.50	34.677	2.88	7.80	2.49	2.89	178	0.00	38.0	4000	1.52	34.687
3842	1.51	34.686	3.02	7.83	2.49	2.79	176	0.00	37.4	4500	1.56	34.688
4310	1.54	34.688	3.18	7.81	2.47	2.79	178	0.00	36.8	5000		
4780	1.59	34.689	3.21	7.92	2.48	2.77	178	0.00	36.8			

KH-70-2 Latitude 44°00'N May 20, 1970 Depth 4906 meters Air Temperature 10.2°C
Station 18 Longitude 146°01'W 0755-1250

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	9.07	32.946	6.77	8.16	2.15	0.75	12	0.07	3.0	0	9.07	32.946
24	8.97	32.948	6.92	8.18	2.14	0.73	13	0.09	3.2	25	8.97	32.948
48	8.92	32.978	6.72	8.19	2.14	0.69	12	0.09	3.0	50	8.90	32.978
72	8.08	32.976	6.73	8.19	2.14	0.84	13	0.10	4.3	75	8.05	32.976
96	7.92	32.983	6.68	8.17	2.14	0.86	14	0.20	3.7	100	7.92	32.983
144	8.03	33.464	6.00	8.14	2.17	1.11	15	0.03	9.1	150	8.02	33.565
192	7.67	33.876	5.12	8.09	2.17	1.43	32	0.01	16.8	200	7.60	33.879
287	6.30	33.894	4.06	7.98	2.21	2.00	51	0.03	20.0	300	6.15	33.895
383	5.31	33.918	2.72	7.86	2.25	2.44	68	0.03	31.8	400	5.11	33.926
477	4.43	33.969	1.90	7.79	2.26	2.92	88	0.00	36.2	500	4.32	33.980
571	4.06	34.034	1.39	7.66	2.33	3.11	100	0.00	39.0	600	3.97	34.063
663	3.77	34.130	1.01	7.59	2.31	3.28	115	0.00	40.1	700	3.72	34.162
757	3.62	34.207	0.66	7.59	2.33	3.32	127	0.00	40.7	800	3.54	34.240
947	3.21	34.329	0.43	7.58	2.36	3.43	141	0.00	43.0	1000	3.13	34.357
1134	2.92	34.406	0.32	7.58	2.37	3.45	152	0.00	41.7	1200	2.81	34.427
1274	2.70	34.449	0.35	7.49	2.30	3.45	160	0.00	41.5	1500	2.40	34.505
1567	2.34	34.520	0.59	7.49	2.31	3.40	172	0.00	41.6	2000	1.97	34.594
2059	1.93	34.601	1.32	7.53	2.34	3.21	181	0.00	39.5	2500	1.72	34.639
2539	1.72	34.642	1.96	7.63	2.37	3.07	179	0.00	38.2	3000	1.57	34.665
3025	1.57	34.666	2.60	7.66	2.36	2.99	177	0.00	35.7	3500	1.50	34.680
3496	1.50	34.680	2.96	7.69	2.37	2.89	176	0.00	34.9	4000	1.52	34.687
3970	1.52	34.687	3.03	7.77	2.40	2.79	176	0.00	35.0	4500	1.57	34.688
4440	1.56	34.688	3.18	7.73	2.37	2.83	178	0.00	34.6	5000	(1.61)	(34.690)
4912	1.60	34.690	3.25	7.74	2.34	2.81	180	0.01	35.4			

KH-70-2 Latitude 46°58'N May 21, 1970 Depth 4,850 meters Air Temperature 8.1°C
Station 19 Longitude 146°04'W 0700-1505

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	7.1	32.745	7.08	8.07	2.17	1.18	21	0.11	10.5	0	7.1	32.745
24	7.04	32.746	7.25	8.11	2.17	1.18	21	0.13	10.1	25	7.03	32.746
48	6.86	32.745	7.09	8.12	2.15	1.22	23	0.15	10.5	50	6.50	32.745
72	6.10	32.742	7.02	8.10	2.15	1.33	25	0.17	10.7	75	6.10	32.745
40	6.94	32.741	7.08	8.13	2.15	1.20	23	0.13	10.3	100	5.88	32.750
51	6.48	32.743	7.08	8.14	2.15	1.24	21	0.12	10.8	150	5.53	33.480
108	5.82	32.752	6.99	8.11	2.17	1.35	24	0.22	12.6	200	5.04	33.771
184	5.26	33.748	4.34	7.91	2.23	2.05	49	0.02	27.0	300	4.21	33.866
261	4.42	33.816	2.39	7.74	2.23	2.72	72	0.01	36.1	400	3.87	33.962
352	4.00	33.930	1.59	7.68	2.26	3.06	89	0.00	40.5	500	3.69	34.070
439	3.78	33.998	1.14	7.65	2.37	3.21	100	0.00	42.9	600	3.58	34.165
521	3.67	34.093	0.97	7.64	2.37	3.21	110	0.00	42.5	700	3.40	34.231
588	3.60	34.158	0.71	7.66	2.37	3.28	119	0.02	42.0	800	3.21	34.282
764	3.27	34.265	0.54	7.64	2.37	3.32	134	0.00	42.2	1000	2.92	34.372
940	3.00	34.347	0.51	7.67	2.40	3.32	144	0.00	42.5	1200	2.67	34.440
1162	2.71	34.433	0.45	7.65	2.41	3.40	158	0.00	42.8	1500	2.34	34.510
1438	2.40	34.495	0.55	7.66	2.43	3.34	167	0.01	43.1	2000	1.95	34.585
1904	2.00	34.576	1.14	7.70	2.44	3.26	176	0.00	41.5	2500	1.72	34.631
2377	1.78	34.622	1.78	7.78	2.47	3.04	177	0.00	40.2	3000	1.56	34.661
2846	1.61	34.653	2.45	7.81	2.45	2.96	175	0.00	38.6	3500	1.50	34.678
3304	1.50	34.673	2.87	7.80	2.44	2.85	173	0.00	37.3	4000	1.51	34.683
3753	1.50	34.680	3.04	7.95	2.47	2.74	171	0.00	36.7	4500	1.56	34.685
4208	1.52	34.685	3.18	7.86	2.44	2.79	176	0.00	36.5			
4675	1.58	34.685	3.24	7.87	2.45	2.79	181	0.00	36.4			

KH-70-2 Latitude 49°57'N May 22, 1970 Depth 4,340 meters Air Temperature 7.04°C
Station 20 Longitude 146°00'W 0515-1308

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)	NO3-N (µgat/l)	Interpolated Depth	Water Temp.	Salinity
0	6.5	32.661	7.16	8.09	2.23	1.39	30	0.17	13.4	0	6.5	32.661
24	6.28	32.666	7.29	8.09	2.23	1.43	31	0.18	13.0	25	6.25	32.666
48	5.81	32.703	7.18	8.10	2.21	1.45	32	0.17	14.0	50	5.76	32.708
72	5.50	32.730	7.18	8.09	2.23	1.54	32	0.18	15.1	75	5.47	32.740
96	5.34	32.769	7.13	8.10	2.23	1.56	34	0.18	15.5	100	5.30	32.769
144	4.40	33.238	4.95	7.91	2.23	2.18	50	0.04	17.6	150	4.27	33.415
192	3.86	33.757	2.11	7.65	2.25	3.00	79	0.02	33.6	200	3.84	33.775
288	3.73	33.929	0.87	7.55	2.30	3.34	98	0.00	39.8	300	3.69	33.948
384	3.65	34.058	0.63	7.55	2.30	3.43	111	0.01	43.8	400	3.63	34.073
480	3.53	34.140	0.55	7.57	2.25	3.38	121	0.01	43.3	500	3.50	34.156
575	3.39	34.206	0.51	7.51	2.28	3.38	128	0.00	43.8	600	3.34	34.223
669	3.22	34.264	0.49	7.55	2.31	3.38	136	0.00	43.5	700	3.20	34.279
763	3.17	34.306	0.48	7.54	2.34	3.38	141	0.01	43.5	800	3.13	34.325
955	2.90	34.383	0.51	7.54	2.36	3.43	153	0.00	42.4	1000	2.83	34.400
1150	2.62	34.449	0.51	7.61	2.37	3.38	161	0.00	42.4	1200	2.56	34.461
1174	2.60	34.450	0.58	7.58	2.37	3.38	161	0.00	43.0	1500	2.25	34.526
1466	2.28	34.520	0.80	7.61	2.39	3.36	172	0.00	43.1	2000	1.90	34.598
1955	1.92	34.593	1.36	7.66	2.46	3.26	178	0.00	41.2	2500	1.73	34.640
2435	1.75	34.635	1.87	7.73	2.46	3.11	177	0.00	40.5	3000	1.58	34.664
2913	1.60	34.662	2.53	7.79	2.37	3.00	176	0.00	38.3	3500	1.51	34.675
3385	1.52	34.673	2.85	7.82	2.41	2.96	176	0.00	37.2	4000	1.52	34.684
3865	1.52	34.682	3.04	7.88	2.39	2.83	173	0.00	36.0	4500		
4327	1.54	34.689	3.24	7.83	2.37	2.85	175	0.04	34.7			

KH-70-2 Latitude 50°01'N May 23, 1970 Depth 4,000 meters Air Temperature 8.80°C
Station 21 Longitude 140°58'W 1840-2212

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	7.4	32.584	6.93	8.05	2.17	1.20	24	0.12	9.8	0	7.4	32.584
24	7.36	32.594	7.09	8.04	2.15	1.20	25	0.10	9.4	25	7.35	32.595
47	6.99	32.607	7.00	8.05	2.15	1.26	26	0.10	10.7	50	6.90	32.610
71	6.26	32.649	7.03	8.05	2.14	1.35	28	0.17	11.9	75	6.15	32.654
96	5.68	32.736	6.77	8.02	2.15	1.48	32	0.22	14.7	100	5.57	32.775
142	5.00	33.581	4.50	7.84	2.25	2.12	49	0.00	26.6	150	4.94	33.630
189	4.74	33.757	3.25	7.76	2.28	2.53	64	0.03	32.3	200	4.64	33.773
283	4.04	33.860	1.80	7.59	2.26	3.06	87	0.01	39.3	300	4.00	33.883
377	3.86	33.989	1.18	7.60	2.29	3.21	101	0.00	41.4	400	3.80	34.010
471	3.62	34.076	0.71	7.56	2.31	3.43	116	0.00	42.7	500	3.59	34.103
566	3.51	34.161	0.57	7.55	2.34	3.36	124	0.00	43.1	600	3.47	34.184
660	3.38	34.226	0.52	7.57	2.34	3.34	132	0.00	42.8	700	3.33	34.248
785	3.22	34.294	0.50	7.54	2.36	3.40	139	0.01	42.3	800	3.20	34.302
877	3.08	34.351	0.46	7.55	2.36	3.43	148	0.00	42.4	1000	2.90	34.391
1062	2.80	34.406	0.45	7.57	2.39	3.30	157	0.00	43.1	1200	2.66	34.444
1248	2.68	34.455	0.51	7.49	2.40	3.45	164	0.00	42.4	1500	2.32	34.512
1530	2.28	34.518	0.70	7.56	2.43	3.40	174	0.00	42.8	2000	1.94	34.580
2003	1.94	34.587	1.28	7.63	2.43	3.24	179	0.01	41.7	2500	1.75	34.630
2471	1.76	34.626	1.83	7.69	2.45	3.09	179	0.00	39.1	3000	1.59	34.656
2942	1.60	34.654	2.44	7.72	2.43	2.99	180	0.00	37.8	3500	1.53	34.671
3410	1.54	34.670	2.81	7.73	2.43	2.83	181	0.00	37.4	4000	1.56	34.676
3888	1.55	34.674	2.94	7.76	2.44	2.77	177	0.00	36.6			

KH-70-2 Latitude 50°00'N May 24, 1970 Depth 3,630 meters Air Temperature 8.6°C
Station 22 Longitude 135°59'W 1223-1615

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	8.4	32.432	6.91	8.17	2.26	1.02	18	0.09	5.7	0	8.4	32.432
24	8.27	32.426	7.03	8.16	2.25	1.00	19	0.10	6.2	25	8.25	32.427
48	7.89	32.436	6.93	8.17	2.25	1.00	19	0.10	6.5	50	7.77	32.435
73	6.92	32.286	6.90	8.16	2.23	1.16	21	0.15	7.4	75	6.91	32.287
97	6.81	32.486	6.83	8.16	2.23	1.18	21	0.17	8.0	100	6.77	32.525
145	5.36	33.226	5.25	8.03	2.28	2.00	38	0.01	22.5	150	5.28	33.350
193	4.84	33.756	3.30	7.84	2.31	2.38	62	0.00	31.5	200	4.78	33.766
289	4.31	33.857	2.01	7.71	2.33	2.94	82	0.02	38.3	300	4.22	33.867
384	3.98	33.963	1.25	7.66	2.34	3.13	97	0.00	40.8	400	3.96	33.983
479	3.84	34.053	0.91	7.64	2.36	3.32	108	0.01	42.0	500	3.80	34.080
574	3.70	34.154	0.58	7.59	2.37	3.36	119	0.00	42.3	600	3.67	34.170
670	3.60	34.211	0.55	7.55	-	3.32	127	0.02	42.4	700	3.55	34.238
766	3.44	34.271	0.42	7.51	-	3.38	134	0.01	43.1	800	3.37	34.295
433	3.90	34.018	1.08	7.55	-	3.21	103	0.01	41.1	1000	3.02	34.380
528	3.75	34.118	0.70	7.55	-	3.40	117	0.03	41.7	1200	2.72	34.438
721	3.48	34.259	0.44	7.57	-	3.32	132	0.00	42.4	1500	2.35	34.507
915	3.16	34.350	0.39	7.56	-	3.43	145	0.00	42.5	2000	1.93	34.590
1205	2.70	34.440	0.45	7.52	-	3.49	160	0.00	42.7	2500	1.71	34.633
1693	2.15	34.544	0.89	7.57	-	3.40	175	0.00	41.8	3000	1.58	34.655
2172	1.83	34.610	1.56	7.71	-	3.11	178	0.01	40.1	3500	1.56	34.669
2654	1.67	34.640	2.19	7.70	-	2.98	181	0.00	38.2			
3133	1.56	34.661	2.61	7.72	-	2.89	183	0.00	37.9			
3620	1.57	34.671	2.77	7.74	-	2.79	183	0.00	37.1			

KH-70-2 Latitude 50°01'N May 25, 1970 Depth 3,000 meters Air Temperature 9.1°C
Station 23 Longitude 131°09'W 0750-1215

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	9.5	32.395	6.75	8.12	2.21	0.90	24	0.13	4.6	0	9.52	32.395
25	9.23	32.397	6.76	8.14	2.19	0.90	27	0.08	4.8	25	9.23	32.397
48	8.42	32.533	6.91	8.15	2.21	0.84	26	0.07	5.8	50	8.38	32.53
97	7.35	32.633	6.47	8.12	2.19	1.05	29	0.16	10.4	75	7.54	32.50
124	6.40	33.224	5.23	8.01	2.23	1.67	45	0.02	20.9	100	7.33	32.64
147	6.30	33.443	4.78	7.96	2.25	1.82	45	0.01	23.5	125	6.34	33.22
173	6.28	33.655	4.34	7.91	2.28	1.97	57	0.00	26.4	150	6.30	33.46
196	6.10	33.756	3.96	7.90	2.26	2.12	54	0.00	28.7	175	6.27	33.66
299	4.86	33.871	2.33	7.74	2.28	2.81	81	0.00	37.1	200	6.06	33.76
398	4.21	33.951	1.63	7.66	2.33	3.13	103	0.00	41.0	300	4.86	33.87
497	3.90	34.054	1.07	7.63	2.36	3.30	114	0.00	42.1	400	4.20	33.95
581	3.78	34.122	0.82	7.61	2.34	3.32	132	0.00	42.6	500	3.90	34.055
610	3.83	34.125	0.75	7.63	2.34	3.34	124	0.00	40.9	600	3.80	34.120
705	3.72	34.220	0.48	7.62	2.37	3.43	133	0.00	41.8	700	3.73	34.215
799	3.60	34.281	0.35	7.66	2.40	3.36	141	0.00	42.5	800	3.60	34.281
894	3.36	34.322	0.36	7.61	2.40	3.49	150	0.00	42.7	1000	3.17	34.369
1085	3.03	34.402	0.36	7.67	2.44	3.40	160	0.00	42.2	1200	2.82	34.441
1276	2.70	34.465	0.49	7.64	2.43	3.47	173	0.00	41.4	1500	2.39	34.514
1567	2.30	34.523	0.82	7.66	2.44	3.36	186	0.00	39.8	2000	1.92	34.594
2058	1.89	34.602	1.49	7.72	2.45	3.15	194	0.00	39.0	2500	1.75	34.632
2533	1.74	34.633	1.90	7.82	2.49	3.07	190	0.00	38.0	3000	1.68	34.646
3012	1.68	34.647	2.27	7.77	2.43	3.07	199	0.00	37.3			