Preliminary Report
of
The Hakuho Maru Cruise
KH-11-8

12 August ~ 4 October 2011

Tokyo – San Francisco – Tokyo

Atmosphere and Ocean Research Institute
The University of Tokyo
2011

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Cruise for overturning circulation, turbulence, and subduction in the northeastern North Pacific

by

The Scientific Members of the Cruise

Edited by

Masaki KAWABE


KH-11-8
Leg1


KH-11-8
Leg2

CONTENTS

1. Cruise Narrative

The research cruise KH–11–8 of R.V. *Hakuho Maru* was conducted for 54 days between 12 August and 4 October 2011 for study of physical oceanography entitled "Study of overturning circulation of deep water and subduction of surface water in the northeastern region of the North Pacific".

We departed from the Harumi Pier of Tokyo Port at 14:00 on 12 August 2011 and returned there at 10:00 on 4 October. We called at Pier 30-32 of the Port of San Francisco in USA between 10:00 on 5 September and 14:00 on 8 September. During the port call, we were supplied with water, food, and fuel, and received batteries of lowered acoustic Doppler current profiler (LADCP) sent from the Atmosphere and Ocean Research Institute (AORI), The University of Tokyo.

Study subjects of the cruise KH–11–8 were
(1) to study the deep circulation and upwelling of deep water (AORI),
(2) to study variations of deep circulation current (AORI),
(3) to study vertical eddy diffusivity using a deep-water vertical microstructure profiler (AORI; Graduate School of Science, The University of Tokyo),
(4) to study the surface-water subduction in northeastern North Pacific (AORI; Tohoku University),
(5) to study the coefficient of diffusivity in surface layer by measuring density ratios and turbulence (Tokyo University of Marine Science and Technology),
(6) to study living planktic foraminifera and diatom for reconstruction of paleoclimate (Akita University),
(7) to study oceanographic variations in northern North Pacific using Argo profiling floats (Japan Agency for Marine-Earth Science and Technology, JAMSTEC),
(8) to study radioactivity in seawater and aerosol — Observations related to the Great East-Japan Earthquake (AORI; Meteorological Research Institute, the Japan Meteorological Agency).

The primary works in this cruise were recovery of 3 moorings of current meters, which were deployed on the R.V. *Tansei Maru* cruise in 2010 (KT-10-9), and deployment of 7 moorings to obtain time series of current velocity, as well as casts of $CTDO_2$ (conductivity, temperature, depth, oxygen profiler) to measure water temperature, salinity, dissolved oxygen, and chlorophyl, LADCP (lowered acoustic Doppler current profiler) to measure current velocity and echo intensity of sound pulse, and water sampler with Niskin bottles to measure salinity, dissolved oxygen, and nutrients. We performed $CTDO_2$ casts to near the sea bottom, obtaining continuous data from the $CTDO_2$ sensors during downcast and seawater samples at 24 positions during upcast.

The water sampler frame was equipped with $CTDO_2$ sensors, 24 Niskin bottles, and one LADCP (leg 1) and two LADCPs (leg 2) with batteries. In order to avoid a touch and collision to sea bottom of the underwater instruments, we equipped the water sampler frame with an altimeter and a bottom-touch-switch. The altimeter monitored the distance of 40-70 m (80 m at several stations) from sea bottom. The bottom-touch-switch hanging a 10–m string and a weight informed us that the instruments reached less than 10 m above sea bottom, by ringing buzzer in laboratory of the vessel.

Salinity, dissolved oxygen, and nutrients of water samples were measured on board, and the sample values of salinity and dissolved oxygen were used for the calibration of sensor values of $CTDO_2$. At all CTD stations, water temperature, salinity, and dissolved oxygen at sea surface were measured with seawater sampled by a bucket, and salinity of the intake water was measured to correct the data of salinograph.

Temperature and salinity data by CTD and XCTD (expendable CTD) were transferred to the Japan Meteorological Agency in quasi–real time using E-mail on the TESAC format. Throughout the cruise, we measured current velocity in a surface layer with shipboard ADCP of Furuno Electric Co., Ltd. and RD Instruments, and measured downward solar (short-wave) and downward long-wave radiations with pyranometer and pyrgeometer of Prede Cp., Kipp and Zonen which were set on the compass deck.

In addition, for measurements of radioactivity discharged from the Fukushima atomic power plant damaged by tsunami due to the Great East-Japan Earthquake on 11 March 2011, we sampled the intake water and the involved materials once a day and water at depths less than 400 m at five points west of 175°W using CTD, and sampled aerosol throughout the cruise with the sampler set on the compass deck by exchanging the filter every four days.

Leg 1 (Tokyo → San Francisco)

We loaded the instruments and materials for the observation into the vessel at the Harumi Pier of Tokyo Port on 9 August 2011. We left Tokyo Port at 14:00 on 12 August, after finishing the exit procedure to leave Japan by 09:00 and the training for urgent escape from the vessel at 13:00.

On 13 August, we deployed two Argo profiling floats in the morning and recovered the mooring N1 at 38°N, 144°30′E in the afternoon. At the point of N1, we performed $CTDO_2$/LADCP cast (called CTD cast hereafter) and tested the function of the weight releaser of VMP5500 and 8 acoustic releasers of moorings at night. On 14 August, we recovered the moorings N3 and N2. Thus, we successfully performed the works in the adjacent area to Japan under good weather conditions. Then we started to sail toward northeastern North Pacific.

During the cruise to the northeastern North Pacific, we performed the disaster-related observations and prepared for the mooring observation by constructing floats composed of glass spheres chained to next and reeling ropes on the drum of winch. We sailed on small waves in a dense fog along the economical lane for cruise. We shifted to north later to avoid swells from the south and sailed in the Bering Sea along the Aleutian Islands in the air colder than ~11°C.

In the evening of 21 August, we arrived at the first observation point (50°06′ N, 145°W) in the northeastern North Pacific and performed casts of CTD and TurboMap. We moved to south on 145°W repeating casts of CTD and TurboMap, and reached 47°N in early morning of 23 August. At 47°N, 145°W, we first casted CTD, released a free-falling turbulence profiler VMP5500 at 06:30, and then deployed the mooring M1. We estimated that VMP5500 would return to the sea surface around 10:10. However, it did not return at the time. We searched VMP5500 all day, looking for it during the day and the light emitted by the flasher on VMP5500 at night and observing the onboard directional finder which shows the direction of surfaced VMP5500 by catching radio waves from the transmitter on it. While we could not find it, a developing atmospheric low was coming. We had to stop the search of VMP5500 at 06:30 on 24 August. One day had passed since it was released. We moved to east and then south performing CTD casts at some stations, and deployed the mooring M2 at 45°N, 145°W.

If we went south from the point of M2, we could not recover VMP5500 in this cruise at all. If we went north to search VMP5500 again, we would have weak (probably extremely weak) possibility of success in recovery but would lose one day of our observation time. We were faced with difficult decision. We carefully considered the prospect of our observation plan and the merit and demerit of the second trial to pick up VMP5500, and decided to try again to find VMP5500. We turned north at 11:00 on 25 August. In fact, VMP5500 was waiting for us at the sea surface, although we had no way to know that. Around 18:15, I found a faint signal on the directional finder at a little more than 5 miles to the south of the release point of VMP5500. We moved toward this weak signal, and the signal strengthened gradually. One hour later, VMP5500 had been laid on its carrier rack on deck of R.V. *Hakuho Maru*. It was in the same shape as that released to the sea, except plenty mud of sediment filling between the sensors. The mud shows that VMP5500 reached the sea bottom due to malfunction of the weight releaser, and was caught by sticky sediment, probably for more than two days. Fortunately, we picked up VMP5500 without any damage and obtained valuable turbulence data reaching the exact sea bottom.

Afterward, we continued the observations at 145°W. We performed casts of CTD, XCTD, and TurboMap as well as casts of VMPS and water sampling to have planktons. Moreover, we deployed the moorings M3 (43°N) on 26 August, M4 (41°N) on 27 August, M5 (39°50′N) and M6 (38°30′N) on 28 August, and M7 (36°30′N) on 30 August. In the mooring works, great record was achieved by Mr. Shoji Kitagawa (the Senior Technical Specialist of AORI). The number of current meter set by him exceeded 1000 in his career total and reached up to 1004. This record shows that he did excellent jobs over 35 years and greatly contributed to current measurements for technical development and data acquisition.

At 30°50′N, 145°W, we performed a CTD cast and sampled water at a depth of approximately 10 m for future measurements of nutrients. Thus, we finished the deck works for observation in leg 1 at 18:40 on 1 September. We sailed for San Francisco, performing the laboratory works such as measurements of salinity, dissolved oxygen, and nutrients of water samples. We arrived at the Port of San Francisco at 9:00 on 5 September.

Summarizing the recovered mooring instruments, 16 current meters were recovered in total, out of which 14 current meters functioned well throughout the mooring period for one year and two months (9 Aanderaa RCM11, 3 Union Engineering SDCM, 2 Union Engineering URCM), 1 URCM functioned for 280 days, and one SDCM malfunctioned because the rotor was lost. Moreover, 3 moored CTDs (Sea–Bird Electronics Micro CAT) were recovered; 2 CTDs functioned throughout the mooring period, but the conductivity sensor of the remaining CTD had broken in March 2011.

Leg 2 (San Francisco → Tokyo)

We left the Port of San Francisco at 14:00 on 8 September. Wind blowed strongly and waves were high in the bay and ocean, since strong atmospheric high stayed near the coast. Wind speed around the rim of the high was always more than 20 m s^{-1}. Due to that, the vessel could not run fast, and we took a few days to get out of the rugged weather area. On 11 September, weather became calm, and we went to the third station (43°N, 131°40′W) of the original plan and performed “free fall” of the CTD cable to remove twists of the cable and then a CTD cast. After that, we moved to west along 43°N by 15 September, performing casts of CTD, VMPS, TurboMap, and water sampling for helium measurements successfully.

In the morning of 16 September, weather became bad after we finished the CTD cast at 43°N, 151°40′W. We waited a passage of an atmospheric low. Although wind weakened at night, swells were still high, and strong atmospheric lows were coming. Then we gave up to continue the observation along 43°N and turned south at 19:30. On 17 September, we performed casts of CTD, VMPS, and TurboMap at 40°05′N, 155°W in the morning and then CTD casts at 38°N and 36°N, 155°W. On 18 September, we turned west at 36°N, 155°W to observe along 36°N, but the atmospheric low located north affected us much harder than expected, and we reluctantly moved to further south. We could not perform the observation along 36°N before we barely started a CTD cast at 36°N, 158°45′W at 10:00 on 19 September. After this cast, big swells disabled us from observing, and we skipped two CTD casts and a TurboMap cast. Thereafter, we tried CTD casts at 160°W and 165°W but shortly stopped them at a wire length of 500 and 3000 m, respectively. Under bad weather conditions, we performed a CTD cast at 166°15′W, but, during this cast, an LADCP got water leak and was not usable later.

On 22 September, sea condition and weather were becoming calm with small wind speed less than 10 m s^{-1}. We successfully performed CTD and TurboMap casts toward west from 36°N, 167°30′W. Ship speed, which had been 13 knot at most due to big swells, was regained to 15 knot in the evening of 22 September, 15.5 knot on 23 September, and more than 16 knot on 24 September in a completely calm condition. We released two Argo profiling floats on 28 September. The observations were successful until the last CTD cast which finished just after the midnight from 28 to 29 September. Then we finished the deck work for observation in this cruise by water sampling in the 400-m surface layer for radioactivity measurements at 16:00 on 29 September.

Lastly, we should note the concern about the CTD armored cable. Quality of the CTD cable lowered obviously due to the long-time usage. Therefore, we cut the cable of 10 m in leg 1 and 345 m (140, 95, 10, 100 m) in leg 2 of this cruise. As a result, the length of the CTD cable decreased to less than 10,000 m. A new roll of enoughly long CTD titanium armored cable should be prepared early.

Acknowledgements

The cruise KH-11-8 was carried out during a long period of 54 days. I am grateful to Captain Shoichi Suzuki, the crew of R.V. *Hakuho Maru*, and the scientists and technical staff for their cooperation in the work throughout this cruise.

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2. Summary of the measurement and correction

A. Water Sample

A1. Instrument

Seawater was sampled from 12-liter Niskin bottles mounted at 24 places on a Sea-Bird Electronics Carousel water sampler SBE32 for 24 bottles (Serial Number 3253585-0704).

A2. Conductivity

Conductivity of water samples was measured with a salinometer Guildline Portasal Model 8410A, S/N 66402 for C000~C036 and S/N 63893 for C037 and later, which was standardized by IAPSO Standard Seawater (Ocean Scientific International Ltd.) of Batch P153 (K_{15} = 0.99979). The measurement was done in Laboratory 5 in which air temperature was controlled to be a little lower (≈ 4°C) than water temperature in the salinometer water bath being 24°C.

A3. Dissolved Oxygen

Dissolved oxygen of water samples was measured with an automatic recording titrator Metrohm Shibata 798 MPT Titrion (S/N 03105). We used 0.02 mol l^{-1} Sodium Thiosulfate Solution (Wako Pure Chemical Industries Ltd.) (factor = 0.99) for titration.

A4. Nutrients

We analyzed nitrate, nitrite, silicate, and phosphate using an auto analyzer BLTEC SWAAT. Nitrate, nitrite, and phosphate standard solutions were prepared in laboratory before the cruise. Silicate standard solution was 1,000-ppm Silicon Standard Solution for atomic absorption spectrometry (Wako Pure Chemical Industries, Ltd.). For working standards and baseline solution, we used natural seawater of low nutrients which was filtered and analyzed in laboratory before the cruise.

B. $CTDO_2$

B1. Instrument

The $CTDO_2$ was a Sea-Bird Electronics instrument for 6800 db (SBE9plus). The sensor of conductivity was manufactured by Sea-Bird Electronics, Inc. (SBE4) who claimed a resolution of 0.00004 S m^{-1} (0.0004 mmho cm^{-1}) and an accuracy of ±0.0003 S m^{-1} (±0.003 mmho cm^{-1}). The sensor of water temperature was manufactured by Sea-Bird Electronics, Inc. (SBE3plus) who claimed a resolution of 0.0002°C and an initial accuracy of ±0.001°C. The sensor of pressure was manufactured by Paroscientific Digiquartz (Model 4xK) with a resolution of 0.001 % of full scale and an accuracy of ±0.015 % of full scale (6000 db range).

The sensor of dissolved oxygen was manufactured by Sea-Bird Electronics, Inc. (SBE43) who claimed an accuracy of 2 % of saturation.

We used a set of the $CTDO_2$ underwater instrument. Instrument No. 1 was CTD SBE9plus (S/N 55807-0951) equipped with conductivity sensor SBE4 (S/N 2496), temperature sensor SBE3plus (S/N 4749), pressure sensor (S/N 114746), oxygen sensor SBE43 (S/N 0628), pump SBE5T (S/N 5124), and a fluorometer Aquatracka III manufactured by Chelsea Instruments Ltd. (S/N 08-6984-001).

B2. Data Collection

Full signals of frequency digitized 24 times per second and sent from the underwater CTD unit SBE9plus were received with the onboard unit SBE11plus and converted to output sequences of RS232C. The data were collected with the Sea-Bird Electronics CTD operating software SEASOFT, using a personal computer EPSON Endeavor MR6700, whose operating system is Windows. Then, the Windows version of software was used. The full signals of frequency were stored in the hard disc during the downcast and upcast of CTD and then were copied in DVD-RAM discs after the recovery of the CTD unit.

B3. Calibration

The sensors of conductivity, temperature, and dissolved oxygen were calibrated by Sea-Bird Electronics, Inc. in June 2011. The pressure sensor was calibrated by Sea-Bird Electronics, Inc. in June 2009. The obtained coefficients were used in the CTD operating software SEASOFT.

a. Pressure

Pressure data were corrected by subtracting 0.376 dbar for C000 and 0.384 dbar for the other CTD casts, which are the pressure sensor values under the standard air pressure P_0 (= 10.1325 dbar). We observed the atmospheric pressure P and the CTD pressure sensor values p on deck simultaneously for 1 hour, and calculated the correction value of pressure by $P_0 - P + p$.

b. Conductivity

Conductivity data were calibrated using water-sample data. The ratio of conductivity from water sample to that from CTD (CF) was calculated. Vertical change of CF was expressed with polynomials of pressure P (dbar) such as

$$CF = a + bP + cP^2 + dP^3 + eP^4 + fP^5.$$

The sensor value of conductivity was multiplied by CF computed from the above equation and the following coefficients a~f for each of the station groups.

1) C000

a~f = 1.000237, -.1502111E-6, .3182867E-10, -.2078693E-14, 0.0, 0.0

2) C001~C007

$a \sim f$ = 1.000175, -.2927476E-6, .1598156E-9, -.3863532E-13, .3360168E-17, 0.0

3) C008~C013

$a \sim f$ = 1.000227, -.4516321E-6, .2723233E-9, -.6883589E-13, .6094097E-17, 0.0

4) C014~C026

$a \sim f$ = 1.000067, -.5040508E-7, .5773871E-11, 0.0, 0.0, 0.0

5) C027~C047

$a \sim f$ = 1.000258, -.4143162E-6, .2196544E-9, -.4789605E-13, .3621248E-17, 0.0

6) C048~C057

$a \sim f$ = 1.000081, -.4850129E-7, .5424102E-11, 0.0, 0.0, 0.0

7) C058~C070

$a \sim f$ = 1.000043, .1157940E-7, -.1936315E-10, .3034657E-14, 0.0, 0.0

c. Dissolved Oxygen

Oxygen data were obtained with the method in the World Ocean Circulation Experiment (WOCE) Operations Manual, WOCE Hydrographic Programme Office Report WHPO 91-1, WOCE Report No. 68/91.

For SBE43, dissolved oxygen was calculated from the polarographic oxygen sensor electric voltage with the algorithm

$$O_x = \left[A(O_V + B\frac{dO_V}{dt} + F) + C\exp(-0.03T) \right] O_x^*(T,S) \exp\left[DT + EP\right]$$

where O_x is the concentration of dissolved oxygen (ml l^{-1}), O_V the oxygen electric voltage, T, S, and P are water temperature (°C), salinity (pss78), and pressure (dbar) measured with CTD, and $O_x^*(T,S)$ the saturated oxygen for T and S.

The six coefficients $A \sim F$ were determined with a nonlinear least squares fitting to the oxygen of water samples, assuming that the coefficient B was fixed to zero. The result of the coefficients is as follows.

1) C000

$A \sim F$ = 0.414, 0.0, 0.21, 6.51E-3, 1.37E-4, -0.965

2) C001~C012

$A \sim F$ = 0.406, 0.0, 0.29, 1.45E-2, 1.38E-4, -1.168

3) C013~C014

$A \sim E$ = 0.417, 0.0, 0.24, 1.05E-2, 1.36E-4; F = -1.030 (C013), -1.036 (C014)

4) C015~C026

$A \sim F$ = 0.423, 0.0, 0.20, 7.75E-3, 1.37E-4, -0.944

5) C027~C047

$A \sim F$ = 0.410, 0.0, 0.25, 1.29E-2, 1.39E-4, -1.062

6) C048~C057

$A \sim F$ = 0.435, 0.0, 0.33, 9.72E-3, 1.30E-4, -1.211

7) C058~C069

$A \sim F$ = 0.439, 0.0, 0.23, 7.11E-3, 1.34E-4, -1.007

C. XCTD

We used probes of TSK XCTD-1. The depth of a falling probe was computed with the equation that

$$z = 3.4254320 \cdot t - 0.0004702604 \cdot t^2.$$

The data were recorded with TSK MK-130 (Tsurumi Seiki Co., Ltd).

D. Shipboard ADCP

D1. ADCP (Furuno Electric Co., Ltd.)

Current velocities at three depths of 20 m, 50 m, and 100 m were measured at an interval of 15 seconds. The data were averaged for every minute and recorded with Doppler Sonar Current Profiler System CI-20H.

D2. ADCP (RD Instruments)

Current velocities at 80 levels at an interval of 16 m from 32-m depth down to about 1300 m were measured with Broadband 38 kHz ADCP and recorded every minute.

Misalignment of shipboard transducer decreases accuracies of the measured flow direction relative to the ship head and the measured velocity components.

According to Joyce (1989; *Journal of Atmospheric and Oceanic Technology*, **6**, 169-172), the correct velocity (u_w, v_w) is given from a ship speed (u_s, v_s) and a measured ADCP velocity (u_d, v_d) as

$$u_w = u_s + \beta (u'_d \cos \alpha - v'_d \sin \alpha)$$

$$v_w = v_s + \beta (u'_d \sin \alpha + v'_d \cos \alpha),$$

where α is the error in orientation of transducer, and β is the scale factor.

The values of α and β were estimated by comparing the ship speed obtained from bottom tracking with that from the Global Positioning System. For the comparison, 1905 ensemble data were used. The result is

$$\alpha \text{ (rad)} = 0.0010, \quad \beta = 0.9974.$$

The current velocity data from the RDI ADCP should be corrected with the above equations and coefficients.

E. Lowered ADCP

An ADCP instrument of 300 kHz Workhorse manufactured by RD Instruments was attached to the frame of the SBE Carousel water sampler and used as a lowered ADCP in order to obtain vertical profiles of horizontal velocity. Two transducers were set downward at the bottom and upward at the top of the water sampler frame, and a battery package was mounted on the frame. 4-meter bins and 1 ping per a second were selected. Transducers used at every station are as follows:

C000-C026: only a downward unit (S/N 14797)
C027-C051: a downward unit (master, S/N 14797) and an upward unit (slave, S/N 14626)
C052-C055: only an upward unit (S/N 14626) because of a downward unit at fault
C056-C069: only a downward unit (S/N 14626)

Data were stored in the underwater ADCP unit and recovered on the deck after the cast. Noises and an influence of vertical move and rotation of the ADCP unit must be removed from the original data. Further processes of data should be made after the cruise to obtain correct data of current velocity.

F. Altimeter

An altimeter PSA-916T (S/N 1000) manufactured by BENTHOS Inc. was attached to the water sampler frame. It indicated the distance from the sea bottom being 40~70 m. Owing to the use of the altimeter, we could observe safely to just above the sea bottom.

G. TurboMap

TurboMap (Turbulence Ocean Microstructure Acquisition Profiler), manufactured by JFE Alec Electronics(Now JFE Advantec), Kobe, Japan, is 2.426 m in length, 0.405 m in diameter, 43 kg on deck, and 0.6~0.9 kg in water. This instrument is equipped with two shear probes and fast response temperature (FPO7), slow response temperature (platinum wire), conductivity, chlorophyll, turbidity, acceleration and pressure sensors. See the KH-04-4 Preliminary Report for the details.

TurboMap is lowered freely with adjusted ballasts at 0.6~0.7 m s^{-1}. Sea cable is attached at an opposite side of sensors, and is connected to a personal computer through the portable winch system. Data is transferred through output sequence of USB. The sampling rate is 512 Hz, and transferring rate is 115.2 kbps. TurboMap must be operated freely without tension to measure velocity shear correctly. When the observation is finished, TurboMap is recovered by the portable winch.

The velocity shear data are analyzed by using FFT and are fitted on to the Nasymth universal spectral form to obtain energy dissipation rate. TurboMap CTD data are used to calculate buoyancy frequency, and eddy diffusivity of momentum is calculated by the dissipation rate and the buoyancy frequency.

H. VMP5500

VMP5500 (Vertical Microstructure Profiler) manufactured by Rockland Scientific International, Inc. is 3.8 m in length, 0.64 m in diameter, 160 kg on deck, and 5.2 kg in water. This instrument is the un-tethered free-fall microstructure profiler which is equipped with microstructure sensors, such as the shear probe and FP07 thermistor, as well as a pressure sensor, a 3-axis accelerometer. The sampling rates of these sensors are 512 Hz. VMP5500 also supports acquisition from Sea-Bird temperature and conductivity sensors. The sampling rates of the Sea-Bird sensors are 64 Hz.

The data acquisition starts automatically upon VMP5500's power up and is stopped by removing the power from the instrument after its recovery. VMP5500 descends freely at a speed of ~0.65 m s^{-1}. Energy dissipation and scaled dissipation rate are calculated using the shear data sampled while descending. When VMP5500 reaches a pre-selected depth, ballast weights are released then VMP5500 starts floating back to the sea surface.

I. VMPS

Planktic foraminifera were collected using the VMPS (Vertical Multi-layer Plankton Sampler), manufactured by Tsurumi Seiki Co., Ltd (Model: VMPS3000 D2). This instrument was equipped with four 100-μm nylon nets having an opening of 0.25 m^2, and with a sensor of water temperature. Vertical sampling intervals ranged from the sea surface down to 100 m depth at 20 m, and down to 500 m at 100 m to 200 m in interval. A flow meter was used to assess the sampled water volumes. Samples were preserved on board in 95 % ethanol, and kept in cold storage until we returned to the laboratory. In the laboratory, the samples are sieved through a 125-μm stainless steel screen and then all planktic foraminifera in each sample will be picked up and counted under a dissecting microscope.

Diatom samples were collected using six Niskin bottles, from the waters ranged from the surface to 200 m and/or 250 m in depth. Three liters of water samples were collected in each depth and then condensed into one liter through a membrane filter (pore size: 2 μm). All water samples were fixed on board with Lugol's solution. In the laboratory, diatom assemblage will be analyzed.

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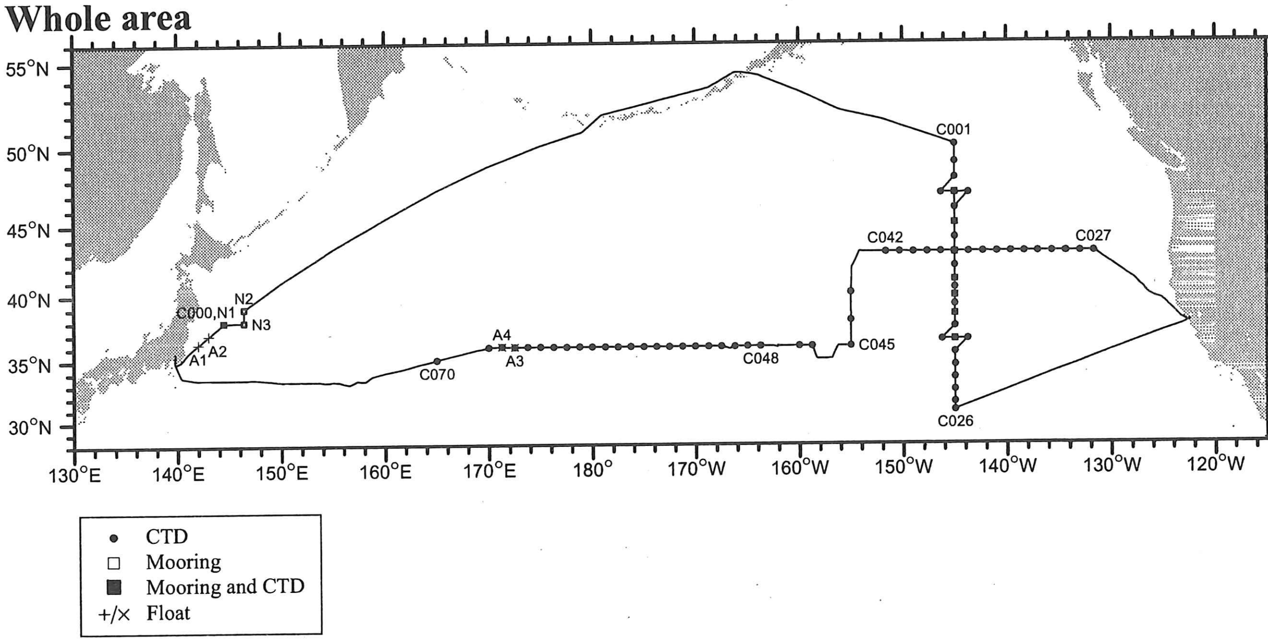
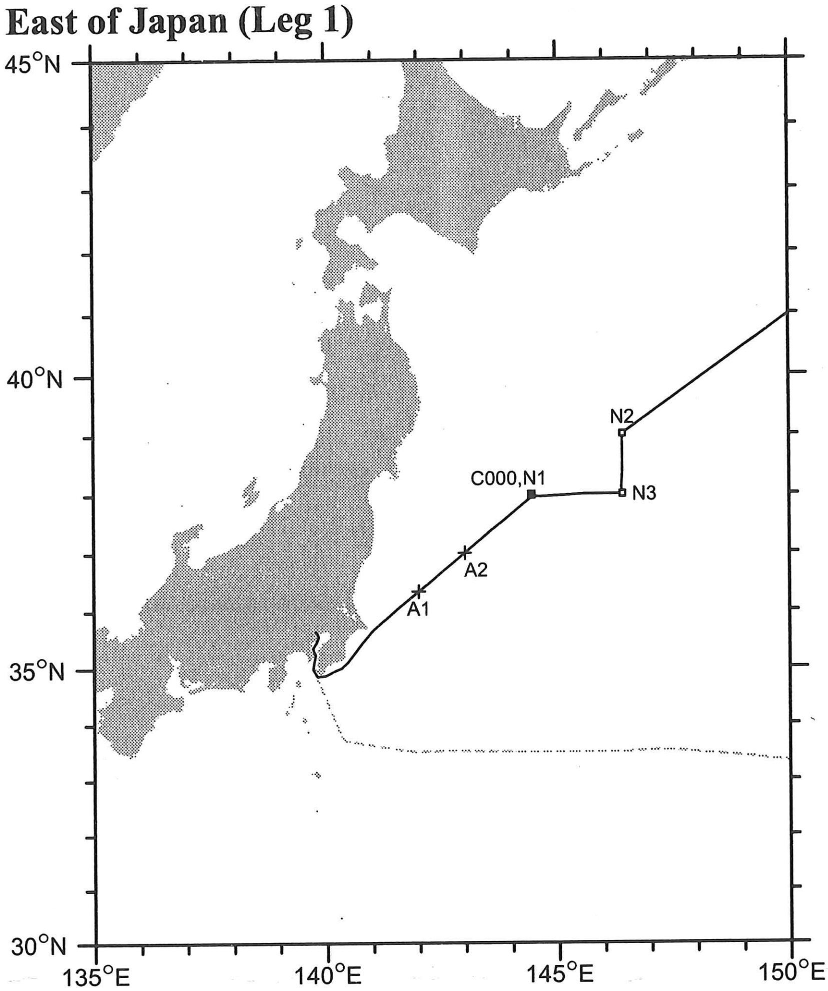
[1] only Leg-1, [2] only Leg-2

4. Track Chart

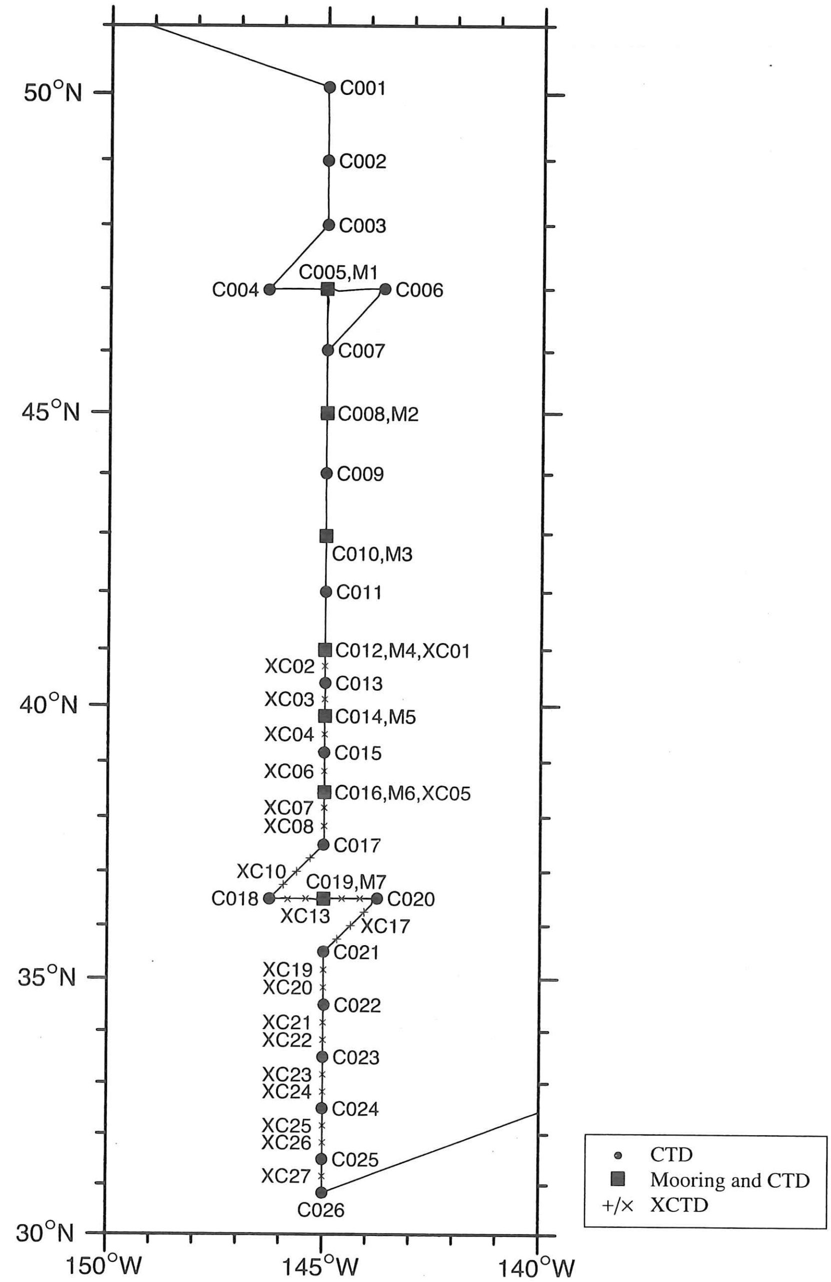
Whole area



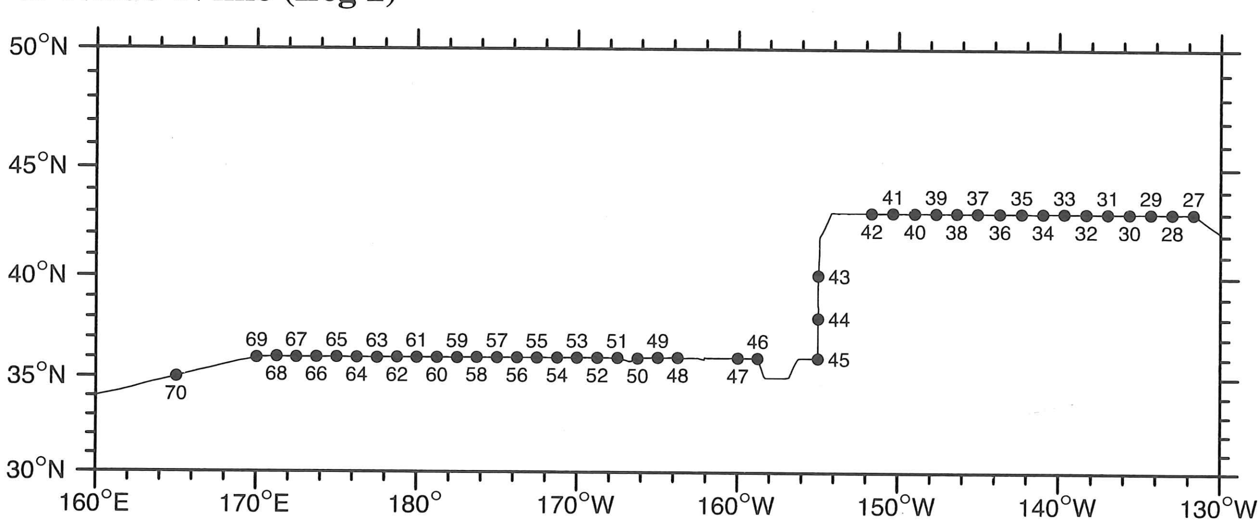
East of Japan (Leg 1)



145°W line (Leg 1)



43°N&36°N line (Leg 2)



5. Time Table

Leg 1

TIME (UTC): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

	Date	TIME (UTC)
1	08/12	Tokyo, A1, A2
2	08/13	N1 Recover, C000, N3 Recover
3	08/14	N2 Recover
4	08/15	
5	08/16	
6	08/17	
7	08/18	
8	08/19	
9	08/20	
10	08/21	
11	08/22	C001 TM01, C002, TM02 C003
12	08/23	C004, C005 VMP Cast TM03, M1Deploy VMPS1
13	08/24	C006
14	08/25	C007, C008, M2 Deploy
15	08/26	VMP Recover, C009
16	08/27	VMPS2 M3Deploy, C010, C011, C012, M4Deploy TM04 XC01
17	08/28	XC02, C013, XC03, C014, TM05, VMPS3, M5 Deploy, XC04
18	08/29	M6Deploy TM06 XC05, C015, XC06, C016, XC07 XC08, C017, XC09
19	08/30	XC10 XC11, C018, XC12 XC13, TM07 C019, M7Deploy VMPS4, XC14 XC15
20	08/31	C020, XC16 XC17 XC18, C021, XC19 XC20, C022, XC21
21	09/01	XC22, C023, XC23 XC24, C024, XC25 XC26, C025, XC27
22	09/02	C26C, C026
23	09/03	
24	09/04	
25	09/05	San Francisco

Leg 2

	Date	TIME (UTC) 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
1	09/08	↑ San Francisco ~~~
2	09/09	~~~
3	09/10	~~~
4	09/11	~~~ C027 ~~~ TM08 C028
5	09/12	TM08 C028 ~~~ C029 ~~~ C030 VMPS5 ~~~ C031 ~~
6	09/13	~~~ C32S ~~~ C032 ~~~ C033 ~~~
7	09/14	TM09 C034 ~~~ C035 ~~~ C036 ~~~
8	09/15	C037 ~~~ C038 ~~~ C039 ~~~ C040 VMPS6 TM10
9	09/16	C040 VMPS6 TM10 ~~~ C041 ~~~ C042 ~~~
10	09/17	~~~ C043 VMPS7 TM11
11	09/18	C043 VMPS7 TM11 ~~~ C044 ~~~ C045
12	09/19	~~~ C046
13	09/20	C046 ~~~ C047 ~~~
14	09/21	~~~ C048 ~~~ C049 ~~~
15	09/22	~~~ TM12 C050 ~~~ C051 ~~~
16	09/23	~ C052 ~~~ C053 ~~~ C054 ~~~
17	09/24	~~~ TM13 C055 ~~~ C056 ~~~ C057 ~~~
18	09/25	~ C058 ~~~ C059 ~~~ C060 ~~~ C061
19	09/26	C061 ~~~ TM14 C062 ~~~ C063 ~~~ C064 ~~~
20	09/27	~~~ C065 ~~~ C066 ~~~ C067 ↑ A3 ~~~
21	09/28	~ TM15 C068 ↑ A4 ~~~ C069 ~~~
22	09/29	~~~ C070 ~~~
23	09/30	~~~
24	10/01	~~~
25	10/02	~~~
26	10/03	~~~
27	10/04	~~↑ Tokyo

6. Summary of Observation Stations

STN: Station number
TYPE: CTD=CTDO only, ROS=CTDO plus water sampler, MOR=Mooring, XCTD=XCTD,
TMAP=TurboMAP, VMP=Vertical Microstructure Profiler,
NET=Plankton net, FLT=Float
CODE: BE=Beginning of cast or work, EN=End of work, BO=Bottom
DE=Deployment of instruments, RE=Recovery of instruments
DEPTH: Uncorrected water depth in meters
MAXP: Maximum pressure in decibars
PARAM: Sampling parameters
1=Salinity, 2=Dissolved oxygen, 3-6=Nutrients (NO_3,NO_2,SiO_2,PO_4),
7=Helium, 8=Tritium, 9=Plankton, 10=FLC, 11=radioactivity
LADCP=Lowered ADCP
COMMENTS are included in the columns of MAXP/PARAM

Leg 1

STN	TYPE	DATE	GMT	CODE	LATITUTE	LONGITUDE	DEPTH	MAXP	PARAM	COMMENTS
A1	FLT	081211	1725	DE	36°20.23′N	142°00.02′E	3016			*PROVOR, S/N 09026*
A2	FLT	081211	2125	DE	36°59.97′N	142°59.93′E	5139			*PROVOR, S/N 10004*
N1	MOR	081311	0506	BE	37°59.76′N	144°31.71′E	5924			*6 CM, 1 MicroCAT*
N1	MOR	081311	0602	RE	37°59.24′N	144°30.29′E	5944			*Transmitter 43.528MHz, A/R 3F*
C000	ROS	081311	0742	BE	37°59.92′N	144°26.01′E	5895		LADCP	
C000	ROS	081311	0923	BO	37°59.31′N	144°26.30′E	5896	5725	1-7	*SBE9p951 CTDO*
C000	ROS	081311	1110	EN	37°59.03′N	144°26.76′E	5890			
N3	MOR	081311	2247	BE	38°00.06′N	146°24.29′E	5390			*5 CM, 1 MicroCAT*
N3	MOR	081311	2338	RE	38°00.54′N	146°22.81′E	5384			*Transmitter 43.528MHz, A/R 3D*
N2	MOR	081411	0426	BE	39°00.84′N	146°24.33′E	5286			*5 CM, 1 MicroCAT*
N2	MOR	081411	0512	RE	39°01.70′N	146°25.44′E	5280			*Transmitter 43.528MHz, A/R 3E*
C001	ROS	082211	0013	BE	50°06.04′N	144°59.61′W	4258		LADCP	
C001	ROS	082211	0141	BO	50°05.75′N	144°59.41′W	4257	4305	1-6,9	*SBE9p951 CTDO*
C001	ROS	082211	0302	EN	50°05.42′N	144°59.53′W	4255			
TM01	TMAP	082211	0350	BE	50°05.23′N	144°59.54′W	4253			*-9 TurboMAP*
TM01	TMAP	082211	0402	BO	50°05.16′N	144°59.22′W	4256			
TM01	TMAP	082211	0408	EN	50°05.12′N	144°59.11′W	4256			
C002	ROS	082211	0956	BE	48°59.57′N	145°00.05′W	4381		LADCP	
C002	ROS	082211	1120	BO	48°59.47′N	145°00.02′W	4382	4435	1-6	*SBE9p951 CTDO*
C002	ROS	082211	1239	EN	48°59.58′N	145°00.03′W	4382			
TM02	TMAP	082211	1712	BE	48°00.81′N	145°00.40′W	4468			*TurboMAP*
TM02	TMAP	082211	1733	BO	48°00.88′N	145°00.24′W	4480	527		
TM02	TMAP	082211	1740	EN	48°00.92′N	145°00.19′W	4494			
C003	ROS	082211	1830	BE	48°00.06′N	145°00.08′W	4516		LADCP	
C003	ROS	082211	2010	BO	48°00.12′N	144°59.55′W	4516	4571	1-6	*SBE9p951 CTDO*
C003	ROS	082211	2133	EN	48°00.22′N	144°59.01′W	4513			
C004	ROS	082311	0404	BE	46°59.37′N	146°19.98′W	4865		LADCP	
C004	ROS	082311	0542	BO	46°58.96′N	146°20.51′W	4862	4939	1-6	*SBE9p951 CTDO*
C004	ROS	082311	0708	EN	46°58.65′N	146°21.13′W	4778			
C005	ROS	082311	1212	BE	47°00.02′N	145°00.12′W	4719		LADCP	
C005	ROS	082311	1342	BO	46°59.86′N	145°00.39′W	4718	4790	1-6,9	*SBE9p951 CTDO*
C005	ROS	082311	1508	EN	46°59.85′N	145°00.32′W	4719			
VMP1	VMP	082311	1531	DE	47°00.02′N	145°00.22′W	4627			*VMP5500*
TM03	TMAP	082311	1626	BE	47°00.76′N	145°00.33′W	4721			*TurboMAP*
TM03	TMAP	082311	1641	BO	47°00.72′N	145°00.14′W	4721	550		
TM03	TMAP	082311	1650	EN	47°00.73′N	145°00.10′W	4721			
M1	MOR	082311	2118	BE	46°58.74′N	144°57.55′W	4716			*5 CM, 2 MicroCAT*
M1	MOR	082311	2224	DE	46°59.45′N	144°59.35′W	4718			*Transmitter 43.528MHz, A/R 3G*

STN	TYPE	DATE	GMT	CODE	LATITUTE	LONGITUDE	DEPTH	MAXP	PARAM	COMMENTS
VMPS1	NET	082311	2258	BE	46°59.68′N	144°59.97′W	4719			*VMPS*
VMPS1	NET	082311	2316	BO	46°59.41′N	144°59.95′W	4718			*500-300-200-100-80m*
VMPS1	NET	082311	2337	EN	46°59.11′N	145°00.07′W	4718			
VMPS1	NET	082311	2353	BE	46°59.71′N	145°00.27′W	4719			*VMPS*
VMPS1	NET	082311	2359	BO	46°59.61′N	145°00.29′W	4720			*80-60-40-20-0m*
VMPS1	NET	082411	0006	EN	46°59.49′N	145°00.33′W	4719			
C006	ROS	082411	1917	BE	46°59.94′N	143°40.06′W	4622		LADCP	
C006	ROS	082411	2046	BO	46°59.96′N	143°40.03′W	4622	4687	1-6	*SBE9p951 CTDO*
C006	ROS	082411	2207	EN	46°59.99′N	143°40.13′W	4622			
C007	ROS	082511	0542	BE	46°01.06′N	145°00.06′W	4734		LADCP	
C007	ROS	082511	0716	BO	46°01.08′N	144°59.49′W	4733	4806	1-6	*SBE9p951 CTDO*
C007	ROS	082511	0838	EN	46°01.09′N	144°59.34′W	4732			
C008	ROS	082511	1333	BE	45°01.00′N	144°59.92′W	4732		LADCP	
C008	ROS	082511	1505	BO	44°59.96′N	144°59.23′W	4743	4816	1-6	*SBE9p951 CTDO*
C008	ROS	082511	1631	EN	44°59.69′N	144°59.09′W	4703			
M2	MOR	082511	1824	BE	44°58.42′N	144°58.10′W	4663			*5 CM, 2 MicroCAT*
M2	MOR	082511	1931	DE	45°00.03′N	145°00.04′W	4737			*Transmitter 43.528MHz, A/R 3H*
VMP1	VMP	082611	0351	RE	46°58.19′N	144°56.28′W	4716			*VMP5500*
C009	ROS	082611	1541	BE	44°00.00′N	144°59.98′W	4800		LADCP	
C009	ROS	082611	1711	BO	44°00.50′N	144°59.90′W	4787	4870	1-6	*SBE9p951 CTDO*
C009	ROS	082611	1838	EN	44°00.99′N	145°00.07′W	4801			
VMPS2	NET	082611	2307	BE	42°57.01′N	144°59.90′W	4526			*VMPS*
VMPS2	NET	082611	2324	BO	42°57.00′N	144°59.80′W	4538			*500-300-200-100-80m*
VMPS2	NET	082611	2346	EN	42°57.03′N	144°59.74′W	4542			
VMPS2	NET	082611	2357	BE	42°57.10′N	145°00.04′W	4520			*VMPS*
VMPS2	NET	082711	0003	BO	42°57.13′N	144°59.99′W	4524			*80-20-0m*
VMPS2	NET	082711	0010	EN	42°57.14′N	144°59.97′W	4554			
M3	MOR	082711	0053	BE	42°59.31′N	144°58.08′W	4500			*1 FLC, 4 CM, 2 MicroCAT*
M3	MOR	082711	0150	DE	43°00.12′N	145°00.40′W	4532			*Transmitter 43.528MHz, A/R 3B*
C010	ROS	082711	0227	BE	42°56.99′N	144°59.85′W	4531		LADCP	
C010	ROS	082711	0355	BO	42°57.34′N	144°59.52′W	4522	4670	1-6,9	*SBE9p951 CTDO*
C010	ROS	082711	0519	EN	42°57.50′N	144°59.63′W	4528			
C011	ROS	082711	0929	BE	41°59.98′N	144°59.88′W	4682		LADCP	
C011	ROS	082711	1057	BO	42°00.03′N	144°59.45′W	4698	4760	1-6	*SBE9p951 CTDO*
C011	ROS	082711	1221	EN	42°00.01′N	144°59.29′W	4699			
C012	ROS	082711	1633	BE	40°59.81′N	144°59.81′W	4730		LADCP	
C012	ROS	082711	1800	BO	40°59.51′N	145°00.12′W	4722	4804	1-6	*SBE9p951 CTDO*
C012	ROS	082711	1928	EN	40°59.59′N	145°00.07′W	4723			
M4	MOR	082711	2108	BE	41°00.90′N	144°56.97′W	4740			*5 CM, 2 MicroCAT*
M4	MOR	082711	2213	DE	40°59.90′N	145°00.35′W	4720			*Transmitter 43.528MHz, A/R 3A*
TM04	TMAP	082711	2239	BE	41°00.01′N	145°01.43′W	4702			*TurboMAP*
TM04	TMAP	082711	2253	BO	41°00.10′N	145°01.33′W	4711	596		
TM04	TMAP	082711	2301	EN	41°00.18′N	145°01.27′W	4711			
XC01	XCTD	082711	2317	DE	40°59.88′N	145°01.17′W	4676			*TSK XCTD-1*
XC02	XCTD	082811	0032	DE	40°42.45′N	145°00.00′W	4769			*TSK XCTD-1*
C013	ROS	082811	0242	BE	40°24.81′N	144°59.86′W	4714		LADCP	
C013	ROS	082811	0411	BO	40°24.62′N	144°59.54′W	4730	4802	1-6	*SBE9p951 CTDO*
C013	ROS	082811	0537	EN	40°24.34′N	144°59.06′W	4727			
XC03	XCTD	082811	0658	DE	40°07.25′N	144°59.99′W	3790			*TSK XCTD-1*
C014	ROS	082811	0822	BE	39°49.73′N	144°59.67′W	5667		LADCP	
C014	ROS	082811	1004	BO	39°49.36′N	144°59.67′W	5674	5808	1-6,9	*SBE9p951 CTDO*
C014	ROS	082811	1145	EN	39°48.66′N	145°00.30′W	5585			
TM05	TMAP	082811	1332	BE	39°49.62′N	145°00.34′W	5605			*TurboMAP*
TM05	TMAP	082811	1346	BO	39°49.48′N	145°00.38′W	5607	610		

STN	TYPE	DATE	GMT	CODE	LATITUTE	LONGITUDE	DEPTH	MAXP	PARAM	COMMENTS
TM05	TMAP	082811	1355	EN	39°49.40'N	145°00.39'W	5610			
VMPS3	NET	082811	1506	BE	39°49.99'N	145°00.02'W	5638			*VMPS*
VMPS3	NET	082811	1523	BO	39°49.99'N	145°00.11'W	5628			*500-300-200-100-80m*
VMPS3	NET	082811	1544	EN	39°49.98'N	145°00.09'W	5629			
VMPS3	NET	082811	1557	BE	39°49.96'N	145°00.11'W	5625			*VMPS*
VMPS3	NET	082811	1604	BO	39°49.97'N	145°00.17'W	5620			*80-60-40-20-0m*
VMPS3	NET	082811	1612	EN	39°49.98'N	145°00.22'W	5616			
M5	MOR	082811	1724	BE	39°46.67'N	145°00.19'W	5409			*7 CM, 2 MicroCAT*
M5	MOR	082811	1844	DE	39°50.21'N	145°00.01'W	5643			*Transmitter 43.528MHz, A/R 3D*
XC04	XCTD	082811	2014	DE	39°29.59'N	145°00.03'W	4767			*TSK XCTD-1*
M6	MOR	082911	0027	BE	38°27.75'N	145°02.36'W	5113			*6 CM, 2 MicroCAT*
M6	MOR	082911	0113	DE	38°30.01'N	144°59.94'W	5085			*Transmitter 43.528MHz, A/R 3C*
TM06	TMAP	082911	0154	BE	38°29.29'N	144°59.42'W	5016			*TurboMAP*
TM06	TMAP	082911	0207	BO	38°29.17'N	144°59.39'W	5008	600		
TM06	TMAP	082911	0215	EN	38°29.07'N	144°59.37'W	5007			
XC05	XCTD	082911	0228	DE	38°29.09'N	144°59.39'W	5007			*TSK XCTD-1*
C015	ROS	082911	0525	BE	39°10.05'N	145°00.04'W	5147		LADCP	
C015	ROS	082911	0705	BO	39°10.20'N	145°00.28'W	5113	5226	1-6	*SBE9p951 CTDO*
C015	ROS	082911	0837	EN	39°10.35'N	145°01.00'W	5133			
XC06	XCTD	082911	1013	DE	38°49.82'N	145°00.00'W	5306			*TSK XCTD-1*
C016	ROS	082911	1202	BE	38°26.99'N	144°59.78'W	4685		LADCP	
C016	ROS	082911	1334	BO	38°26.88'N	144°59.74'W	4683	4958	1-6	*SBE9p951 CTDO*
C016	ROS	082911	1506	EN	38°26.68'N	145°00.07'W	5019			
XC07	XCTD	082911	1624	DE	38°09.94'N	144°59.99'W	4998			*TSK XCTD-1*
XC08	XCTD	082911	1743	DE	37°49.87'N	144°59.97'W	4949			*TSK XCTD-1*
C017	ROS	082911	1916	BE	37°29.90'N	145°00.17'W	5245		LADCP	
C017	ROS	082911	2055	BO	37°29.49'N	145°00.52'W	5231	5362	1-6	*SBE9p951 CTDO*
C017	ROS	082911	2228	EN	37°28.68'N	145°01.44'W	5191			
XC09	XCTD	082911	2358	DE	37°14.83'N	145°18.94'W	5162			*TSK XCTD-1*
XC10	XCTD	083011	0118	DE	36°59.87'N	145°37.56'W	5246			*TSK XCTD-1*
XC11	XCTD	083011	0236	DE	36°45.38'N	145°55.91'W	5345			*TSK XCTD-1*
C018	ROS	083011	0420	BE	36°30.01'N	146°15.15'W	5263		LADCP	
C018	ROS	083011	0559	BO	36°29.65'N	146°15.11'W	5265	5372	1-6	*SBE9p951 CTDO*
C018	ROS	083011	0733	EN	36°29.07'N	146°15.18'W	5265			
XC12	XCTD	083011	0910	DE	36°29.18'N	145°49.86'W	5264			*TSK XCTD-1*
XC13	XCTD	083011	1034	DE	36°29.99'N	145°24.90'W	5312			*TSK XCTD-1*
TM07	TMAP	083011	1300	BE	36°29.92'N	145°00.03'W	5297			*TurboMAP*
TM07	TMAP	083011	1317	BO	36°29.70'N	145°00.23'W	5294	600		
TM07	TMAP	083011	1320	EN	36°29.56'N	145°00.38'W	5299			
C019	ROS	083011	1401	BE	36°29.99'N	144°59.99'W	5298		LADCP	
C019	ROS	083011	1539	BO	36°29.81'N	145°00.24'W	5295	5400	1-6,9	*SBE9p951 CTDO*
C019	ROS	083011	1715	EN	36°30.08'N	145°00.59'W	5329			
M7	MOR	083011	1751	BE	36°28.41'N	145°03.23'W	5174			*6 CM, 2 MicroCAT*
M7	MOR	083011	1902	DE	36°29.60'N	145°00.82'W	5313			*Transmitter 43.528MHz, A/R 3E*
VMPS4	NET	083011	1922	BE	36°30.06'N	145°00.20'W	5303			*VMPS*
VMPS4	NET	083011	1943	BO	36°30.15'N	145°00.43'W	5324			*500-300-200-100-80m*
VMPS4	NET	083011	2004	EN	36°30.19'N	145°00.42'W	5326			
VMPS4	NET	083011	2016	BE	36°30.21'N	145°00.41'W	5328			*VMPS*
VMPS4	NET	083011	2023	BO	36°30.23'N	145°00.41'W	5330			*80-60-40-20-0m*
VMPS4	NET	083011	2030	EN	36°30.24'N	145°00.41'W	5330			
XC14	XCTD	083011	2200	DE	36°29.96'N	144°34.89'W	5334			*TSK XCTD-1*
XC15	XCTD	083011	2320	DE	36°30.04'N	144°09.85'W	5361			*TSK XCTD-1*
C020	ROS	083111	0057	BE	36°29.98'N	143°45.09'W	5246		LADCP	
C020	ROS	083111	0238	BO	36°30.25'N	143°45.56'W	5400	5542	1-6	*SBE9p951 CTDO*

STN	TYPE	DATE	GMT	CODE	LATITUTE	LONGITUDE	DEPTH	MAXP	PARAM	COMMENTS
C020	ROS	083111	0416	EN	36°30.69′N	143°45.96′W	5334			
XC16	XCTD	083111	0554	DE	36°14.86′N	144°03.85′W	5528			*TSK XCTD-1*
XC17	XCTD	083111	0716	DE	35°59.93′N	144°22.57′W	5454			*TSK XCTD-1*
XC18	XCTD	083111	0840	DE	35°44.80′N	144°41.37′W	5403			*TSK XCTD-1*
C021	ROS	083111	1021	BE	35°30.05′N	144°59.95′W	5046		LADCP	
C021	ROS	083111	1209	BO	35°30.30′N	144°59.85′W	5100	5383	1-6	*SBE9p951 CTDO*
C021	ROS	083111	1346	EN	35°30.33′N	144°59.81′W	5128			
XC19	XCTD	083111	1518	DE	35°09.94′N	144°59.97′W	5299			*TSK XCTD-1*
XC20	XCTD	083111	1634	DE	34°49.96′N	144°59.99′W	5268			*TSK XCTD-1*
C022	ROS	083111	1809	BE	34°29.96′N	144°59.94′W	5340		LADCP	
C022	ROS	083111	1948	BO	34°30.23′N	144°59.00′W	5332	5462	1-6	*SBE9p951 CTDO*
C022	ROS	083111	2126	EN	34°30.33′N	144°59.76′W	5323			
XC21	XCTD	083111	2317	DE	34°09.95′N	145°00.09′W	5320			*TSK XCTD-1*
XC22	XCTD	090111	0036	DE	33°49.93′N	145°00.13′W	5489			*TSK XCTD-1*
C023	ROS	090111	0208	BE	33°30.05′N	145°00.11′W	4257		LADCP	
C023	ROS	090111	0330	BO	33°30.13′N	145°00.13′W	4258	4396	1-6	*SBE9p951 CTDO*
C023	ROS	090111	0446	EN	33°30.30′N	144°59.99′W	4232			
XC23	XCTD	090111	0618	DE	33°09.86′N	145°00.03′W	5590			*TSK XCTD-1*
XC24	XCTD	090111	0739	DE	32°49.88′N	145°00.01′W	5485			*TSK XCTD-1*
C024	ROS	090111	0908	BE	32°29.98′N	145°00.08′W	5507		LADCP	
C024	ROS	090111	1052	BO	32°30.30′N	145°00.58′W	5428	5712	1-6	*SBE9p951 CTDO*
C024	ROS	090111	1230	EN	32°30.48′N	145°00.64′W	5412			
XC25	XCTD	090111	1405	DE	32°10.00′N	144°59.96′W	5590			*TSK XCTD-1*
XC26	XCTD	090111	1523	DE	31°49.91′N	144°59.97′W	5472			*TSK XCTD-1*
C025	ROS	090111	1656	BE	31°30.04′N	145°00.94′W	5335		LADCP	
C025	ROS	090111	1833	BO	31°30.19′N	145°00.28′W	5325	5444	1-6	*SBE9p951 CTDO*
C025	ROS	090111	2008	EN	31°30.22′N	145°00.39′W	5326			
XC27	XCTD	090111	2140	DE	31°09.90′N	144°59.98′W	5640			*TSK XCTD-1*
C26C	ROS	090111	2314	BE	30°49.83′N	145°00.01′W	5463			
C26C	ROS	090111	2320	BO	30°49.81′N	145°00.13′W	5459	51	3-6	*SBE9p951 CTDO*
C26C	ROS	090111	2327	EN	30°49.79′N	145°00.15′W	5458			
C026	ROS	090211	0021	BE	30°49.95′N	145°00.02′W	5463		LADCP	
C026	ROS	090211	0201	BO	30°50.06′N	145°00.04′W	5459	5583	1-6	*SBE9p951 CTDO*
C026	ROS	090211	0339	EN	30°50.33′N	145°00.29′W	5458			

Leg 2

STN	TYPE	DATE	GMT	CODE	LATITUTE	LONGITUDE	DEPTH	MAXP	PARAM	COMMENTS
C027	ROS	091111	1450	BE	42°59.81′N	131°41.31′W	3641		LADCP	
C027	ROS	091111	1600	BO	42°59.88′N	131°41.48′W	3642	3665	1-7	*SBE9p951 CTDO*
C027	ROS	091111	1706	EN	42°59.99′N	131°41.72′W	3642			
TM08	TMAP	091111	2125	BE	42°59.98′N	133°00.10′W	3746			*TurboMAP*
TM08	TMAP	091111	2140	BO	42°59.80′N	133°00.20′W	3747	600		
TM08	TMAP	091111	2148	EN	42°59.73′N	133°00.26′W	3748			
C028	ROS	091111	2219	BE	43°00.04′N	133°00.10′W	3745		LADCP	
C028	ROS	091111	2330	BO	42°59.90′N	133°00.49′W	3746	3778	1-6	*SBE9p951 CTDO*
C028	ROS	091211	0037	EN	42°59.70′N	133°00.79′W	3751			
C029	ROS	091211	0444	BE	42°59.93′N	134°20.04′W	3966		LADCP	
C029	ROS	091211	0600	BO	42°59.91′N	134°19.83′W	3968	4002	1-6	*SBE9p951 CTDO*
C029	ROS	091211	0718	EN	42°59.80′N	134°19.54′W	3969			
C030	ROS	091211	1138	BE	42°59.96′N	135°39.72′W	4058		LADCP	
C030	ROS	091211	1259	BO	42°59.70′N	135°38.98′W	4058	4096	1-6,9	*SBE9p951 CTDO*
C030	ROS	091211	1414	EN	42°59.79′N	135°39.20′W	4057			
VMPS5	NET	091211	1440	BE	42°59.77′N	135°39.45′W	4058			*VMPS*
VMPS5	NET	091211	1458	BO	42°59.80′N	135°39.41′W	4058			*500-300-200-100-80m*

STN	TYPE	DATE	GMT	CODE	LATITUTE	LONGITUDE	DEPTH	MAXP	PARAM	COMMENTS
VMPS5	NET	091211	1519	EN	42°59.81′N	135°39.25′W	4058			
VMPS5	NET	091211	1533	BE	42°59.88′N	135°39.20′W	4057			*VMPS*
VMPS5	NET	091211	1540	BO	42°59.90′N	135°39.17′W	4055			*80-60-40-20-0m*
VMPS5	NET	091211	1547	EN	42°59.90′N	135°39.12′W	4058			
C031	ROS	091211	2024	BE	42°59.85′N	137°00.08′W	4138		LADCP	
C031	ROS	091211	2142	BO	42°59.76′N	137°00.23′W	4137	4179	1-7	*SBE9p951 CTDO*
C031	ROS	091211	2257	EN	42°59.80′N	136°59.97′W	4186			
C32S	CTD	091311	0336	BE	42°59.93′N	138°20.01′W	3906		LADCP	
C32S	CTD	091311	0344	BO	42°59.91′N	138°20.03′W	3908	105		*SBE9p951 CTDO*
C32S	CTD	091311	0349	EN	42°59.90′N	138°20.00′W	3870			
C032	ROS	091311	0844	BE	43°00.14′N	138°21.92′W	4203		LADCP	
C032	ROS	091311	1020	BO	43°00.13′N	138°21.79′W	4198	4244	1-6	*SBE9p951 CTDO*
C032	ROS	091311	1134	EN	42°59.86′N	138°21.80′W	4198			
C033	ROS	091311	1629	BE	42°59.95′N	139°40.11′W	4272		LADCP	
C033	ROS	091311	1755	BO	43°00.09′N	139°40.05′W	4276	4360	1-7	*SBE9p951 CTDO*
C033	ROS	091311	1916	EN	42°59.90′N	139°40.09′W	4280			
TM09	TMAP	091311	2347	BE	43°00.18′N	140°59.67′W	4424			*TurboMAP*
TM09	TMAP	091411	0000	BO	43°00.28′N	140°59.23′W	4437	485		
TM09	TMAP	091411	0010	EN	43°00.34′N	140°58.94′W	4439			
C034	ROS	091411	0050	BE	43°00.02′N	140°59.88′W	4406		LADCP	
C034	ROS	091411	0216	BO	42°59.56′N	140°59.20′W	4436	4484	1-6	*SBE9p951 CTDO*
C034	ROS	091411	0337	EN	42°59.07′N	140°59.00′W	4440			
C035	ROS	091411	0825	BE	42°59.92′N	142°19.48′W	4298		LADCP	
C035	ROS	091411	0949	BO	42°59.70′N	142°19.26′W	4308	4357	1-6	*SBE9p951 CTDO*
C035	ROS	091411	1106	EN	42°59.47′N	142°19.17′W	4307			
C036	ROS	091411	1552	BE	42°59.78′N	143°40.24′W	4396		LADCP	
C036	ROS	091411	1717	BO	42°59.51′N	143°40.65′W	4410	4452	1-7	*SBE9p951 CTDO*
C036	ROS	091411	1835	EN	42°59.29′N	143°40.99′W	4422			
C037	ROS	091411	2315	BE	43°00.03′N	145°04.00′W	4389		LADCP	
C037	ROS	091511	0037	BO	42°59.73′N	145°03.97′W	4364	4460	1-6,10	*SBE9p951 CTDO*
C037	ROS	091511	0155	EN	42°59.31′N	145°04.15′W	4438			
C038	ROS	091511	0603	BE	43°00.02′N	146°22.17′W	4937		LADCP	
C038	ROS	091511	0736	BO	43°00.14′N	146°22.10′W	4941	5023	1-6	*SBE9p951 CTDO*
C038	ROS	091511	0903	EN	43°00.22′N	146°22.03′W	4946			
C039	ROS	091511	1331	BE	43°00.04′N	147°39.85′W	4646		LADCP	
C039	ROS	091511	1500	BO	42°59.89′N	147°39.44′W	4507	4723	1-6	*SBE9p951 CTDO*
C039	ROS	091511	1623	EN	42°59.61′N	147°39.29′W	4491			
C040	ROS	091511	2055	BE	43°00.22′N	148°59.66′W	4949		LADCP	
C040	ROS	091511	2230	BO	42°59.88′N	148°59.03′W	4986	5072	1-9	*SBE9p951 CTDO*
C040	ROS	091611	0000	EN	42°59.17′N	148°59.49′W	4972			
VMPS6	NET	091611	0015	BE	42°59.22′N	148°59.56′W	4982			*VMPS*
VMPS6	NET	091611	0035	BO	42°59.14′N	148°59.49′W	4986			*500-300-200-100-80m*
VMPS6	NET	091611	0055	EN	42°59.08′N	148°59.52′W	4982			
VMPS6	NET	091611	0108	BE	42°59.12′N	148°59.62′W	4991			*VMPS*
VMPS6	NET	091611	0114	BO	42°59.07′N	148°59.61′W	4994			*80-60-40-20-0m*
VMPS6	NET	091611	0121	EN	42°59.02′N	148°59.60′W	4984			
TM10	TMAP	091611	0234	BE	42°58.58′N	149°00.09′W	4967			*TurboMAP*
TM10	TMAP	091611	0250	BO	42°58.40′N	149°00.16′W	4936	600		
TM10	TMAP	091611	0258	EN	42°58.29′N	149°00.22′W	4958			
C041	ROS	091611	0719	BE	43°00.15′N	150°20.07′W	5112		LADCP	
C041	ROS	091611	0857	BO	43°00.00′N	150°19.64′W	5087	5202	1-6	*SBE9p951 CTDO*
C041	ROS	091611	1029	EN	42°59.82′N	150°19.17′W	5086			
C042	ROS	091611	1505	BE	42°59.90′N	151°39.79′W	5078		LADCP	
C042	ROS	091611	1644	BO	42°59.75′N	151°39.54′W	5105	5204	1-6	*SBE9p951 CTDO*

STN	TYPE	DATE	GMT	CODE	LATITUTE	LONGITUDE	DEPTH	MAXP	PARAM	*COMMENTS*
C042	ROS	091611	1814	EN	42°59.73′N	151°39.12′W	5137			
C043	ROS	091711	1944	BE	40°05.05′N	154°59.86′W	5140		LADCP	
C043	ROS	091711	2125	BO	40°04.74′N	154°59.66′W	5160	5249	1-7,9	*SBE9p951 CTDO*
C043	ROS	091711	2259	EN	40°04.58′N	154°59.61′W	5181			
VMPS7	NET	091711	2315	BE	40°04.58′N	154°59.62′W	5182			*VMPS*
VMPS7	NET	091711	2333	BO	40°04.56′N	154°59.56′W	5176			*500-300-200-100-80m*
VMPS7	NET	091711	2354	EN	40°04.52′N	154°59.47′W	5170			
VMPS7	NET	091811	0009	BE	40°04.50′N	154°59.46′W	5170			*VMPS*
VMPS7	NET	091811	0015	BO	40°04.47′N	154°59.40′W	5169			*80-10-0m*
VMPS7	NET	091811	0021	EN	40°04.43′N	154°59.35′W	5169			
TM11	TMAP	091811	0042	BE	40°04.36′N	154°59.28′W	5155			*TurboMAP*
TM11	TMAP	091811	0056	BO	40°04.29′N	154°58.93′W	5116	625		
TM11	TMAP	091811	0107	EN	40°04.22′N	154°58.91′W	5116			
C044	ROS	091811	0929	BE	38°00.00′N	154°59.83′W	5498		LADCP	
C044	ROS	091811	1109	BO	37°59.71′N	154°59.59′W	5444	5619	1-6	*SBE9p951 CTDO*
C044	ROS	091811	1249	EN	37°59.73′N	154°59.23′W	5404			
C045	ROS	091811	2052	BE	35°59.84′N	154°59.93′W	5609		LADCP	
C045	ROS	091811	2237	BO	35°59.72′N	154°59.85′W	5605	5739	1-6	*SBE9p951 CTDO*
C045	ROS	091911	0017	EN	35°59.23′N	154°59.72′W	5597			
C046	ROS	091911	2103	BE	35°59.97′N	158°44.87′W	5937		LADCP	
C046	ROS	091911	2257	BO	35°59.62′N	158°44.95′W	5975	6137	1-7	*SBE9p951 CTDO*
C046	ROS	092011	0043	EN	35°59.60′N	158°44.92′W	5975			
C047	CTD	092011	0646	BE	36°00.26′N	159°59.62′W	5802		LADCP	
C047	CTD	092011	0727	BO	36°00.27′N	159°59.42′W	5815	596		*SBE9p951 CTDO*
C047	CTD	092011	0740	EN	36°00.32′N	159°59.35′W	5821			
C048	ROS	092111	0821	BE	36°00.12′N	163°44.95′W	5826		LADCP	
C048	ROS	092111	1105	BO	36°00.85′N	163°44.46′W	5832	5981	1-6	*SBE9p951 CTDO*
C048	ROS	092111	1250	EN	36°01.42′N	163°44.38′W	5838			
C049	ROS	092111	1821	BE	36°00.52′N	164°59.44′W	5683		LADCP	
C049	ROS	092111	1932	BO	36°01.06′N	164°59.13′W	5689	3005	1-8	*SBE9p951 CTDO*
C049	ROS	092111	2027	EN	36°01.34′N	164°58.99′W	5696			
TM12	TMAP	092211	0348	BE	35°59.80′N	166°14.08′W	6206			*TurboMAP*
TM12	TMAP	092211	0401	BO	35°59.53′N	166°13.84′W	6200	550		
TM12	TMAP	092211	0414	EN	35°59.34′N	166°13.71′W	6183			
C050	ROS	092211	0438	BE	35°59.34′N	166°13.67′W	6212		LADCP	
C050	ROS	092211	0637	BO	35°58.61′N	166°13.80′W	6407	6407	1-6	*SBE9p951 CTDO*
C050	ROS	092211	0829	EN	35°58.14′N	166°14.55′W	6056			
C051	ROS	092211	1521	BE	35°59.99′N	167°30.21′W	6473		LADCP	
C051	ROS	092211	1727	BO	35°59.83′N	167°30.44′W	6504	6743	1-6	*SBE9p951 CTDO*
C051	ROS	092211	1924	EN	35°59.52′N	167°31.03′W	6454			
C052	ROS	092311	0042	BE	35°59.76′N	168°45.08′W	6100		LADCP	
C052	ROS	092311	0238	BO	35°59.66′N	168°45.85′W	6084	6265	1-6	*SBE9p951 CTDO*
C052	ROS	092311	0427	EN	35°59.68′N	168°46.58′W	5999			
C053	ROS	092311	0901	BE	35°59.99′N	170°00.55′W	5696		LADCP	
C053	ROS	092311	1104	BO	35°59.81′N	170°01.22′W	5959	6120	1-6	*SBE9p951 CTDO*
C053	ROS	092311	1251	EN	35°59.82′N	170°01.41′W	5912			
C054	ROS	092311	1729	BE	35°59.98′N	171°14.91′W	6026		LADCP	
C054	ROS	092311	1923	BO	35°59.64′N	171°15.35′W	5990	6231	1-8	*SBE9p951 CTDO*
C054	ROS	092311	2112	EN	35°59.13′N	171°16.06′W	5792			
TM13	TMAP	092411	0139	BE	35°59.73′N	172°30.30′W	5445			*TurboMAP*
TM13	TMAP	092411	0152	BO	35°59.44′N	172°30.43′W	5535	522		
TM13	TMAP	092411	0203	EN	35°59.26′N	172°30.55′W	5518			
C055	ROS	092411	0229	BE	35°59.27′N	172°30.97′W	5482		LADCP	
C055	ROS	092411	0408	BO	35°59.38′N	172°31.47′W	5505	5611	1-6	*SBE9p951 CTDO*

STN	TYPE	DATE	GMT	CODE	LATITUTE	LONGITUDE	DEPTH	MAXP	PARAM	COMMENTS
C055	ROS	092411	0547	EN	35°59.24′N	172°32.01′W	5502			
C056	ROS	092411	1005	BE	35°59.96′N	173°44.97′W	5428		LADCP	
C056	ROS	092411	1145	BO	35°59.67′N	173°45.53′W	5429	5547	1-6	*SBE9p951 CTDO*
C056	ROS	092411	1322	EN	35°59.63′N	173°46.01′W	5442			
C057	ROS	092411	1741	BE	35°59.87′N	175°00.30′W	4917		LADCP	
C057	ROS	092411	1912	BO	35°59.75′N	175°00.89′W	4908	5011	1-7,11	*SBE9p951 CTDO*
C057	ROS	092411	2042	EN	35°59.77′N	175°01.14′W	4907			
C058	ROS	092511	0046	BE	36°00.37′N	176°16.11′W	4906		LADCP	
C058	ROS	092511	0215	BO	36°00.45′N	176°16.64′W	4928	5009	1-6	*SBE9p951 CTDO*
C058	ROS	092511	0351	EN	36°00.50′N	176°16.90′W	4938			
C059	ROS	092511	0749	BE	35°59.87′N	177°30.13′W	4854		LADCP	
C059	ROS	092511	0920	BO	35°59.44′N	177°30.24′W	4848	4936	1-6	*SBE9p951 CTDO*
C059	ROS	092511	1046	EN	35°58.87′N	177°30.38′W	4838			
C060	ROS	092511	1447	BE	35°59.87′N	178°45.15′W	4765		LADCP	
C060	ROS	092511	1614	BO	35°59.98′N	178°45.51′W	4770	4860	1-6	*SBE9p951 CTDO*
C060	ROS	092511	1740	EN	36°00.41′N	178°45.80′W	4716			
C061	ROS	092511	2147	BE	36°00.00′N	179°59.80′E	4781		LADCP	
C061	ROS	092511	2317	BO	35°59.78′N	179°59.73′E	4777	4861	1-7,11	*SBE9p951 CTDO*
C061	ROS	092611	0043	EN	35°59.63′N	179°59.62′E	4775			
TM14	TMAP	092611	0457	BE	35°59.99′N	178°45.05′E	4356			*TurboMAP*
TM14	TMAP	092611	0511	BO	36°00.07′N	178°45.34′E	4362	580		
TM14	TMAP	092611	0519	EN	36°00.12′N	178°45.48′E	4367			
C062	ROS	092611	0536	BE	36°00.17′N	178°45.59′E	4370		LADCP	
C062	ROS	092611	0657	BO	36°00.13′N	178°46.01′E	4370	4430	1-6	*SBE9p951 CTDO*
C062	ROS	092611	0815	EN	36°00.00′N	178°46.47′E	4378			
C063	ROS	092611	1245	BE	35°59.88′N	177°30.17′E	3732		LADCP	
C063	ROS	092611	1400	BO	35°59.22′N	177°30.87′E	3735	3770	1-6	*SBE9p951 CTDO*
C063	ROS	092611	1509	EN	35°58.80′N	177°31.33′E	3736			
C064	ROS	092611	1938	BE	35°59.97′N	176°15.03′E	4796		LADCP	
C064	ROS	092611	2109	BO	35°59.66′N	176°15.50′E	4795	4881	1-8	*SBE9p951 CTDO*
C064	ROS	092611	2233	EN	35°59.47′N	176°15.40′E	4796			
C065	ROS	092711	0250	BE	36°00.10′N	175°00.06′E	5044		LADCP	
C065	ROS	092711	0422	BO	36°00.41′N	175°00.02′E	5068	5172	1-6,11	*SBE9p951 CTDO*
C065	ROS	092711	0551	EN	36°00.87′N	175°00.01′E	5056			
C066	ROS	092711	1003	BE	36°00.11′N	173°44.83′E	5104		LADCP	
C066	ROS	092711	1138	BO	36°00.62′N	173°45.16′E	5109	5210	1-6	*SBE9p951 CTDO*
C066	ROS	092711	1310	EN	36°00.82′N	173°45.14′E	5114			
C067	ROS	092711	1732	BE	35°59.84′N	172°29.89′E	4566		LADCP	
C067	ROS	092711	1900	BO	35°59.91′N	172°29.76′E	4562	4634	1-6,8	*SBE9p951 CTDO*
C067	ROS	092711	2021	EN	36°00.00′N	172°29.92′E	4559			
A3	FLT	092711	2036	DE	35°59.85′N	172°29.57′E	4564			*PROVOR, S/N 10011*
TM15	TMAP	092811	0042	BE	36°00.17′N	171°15.08′E	4457			*TurboMAP*
TM15	TMAP	092811	0059	BO	36°00.61′N	171°15.18′E	4476	700		
TM15	TMAP	092811	0111	EN	36°00.80′N	171°15.38′E	4492			
C068	ROS	092811	0135	BE	36°01.20′N	171°15.72′E	4509		LADCP	
C068	ROS	092811	0300	BO	36°01.71′N	171°16.26′E	4532	4588	1-6	*SBE9p951 CTDO*
C068	ROS	092811	0421	EN	36°02.16′N	171°16.67′E	4560			
A4	FLT	092811	0429	DE	36°02.14′N	171°16.78′E	3968			*PROVOR, S/N 10013*
C069	ROS	092811	0900	BE	36°00.01′N	170°00.17′E	5221		LADCP	
C069	ROS	092811	1041	BO	35°59.16′N	170°01.57′E	5225	5346	1-6,11	*SBE9p951 CTDO*
C069	ROS	092811	1219	EN	35°58.54′N	170°02.46′E	5226			
C070	ROS	092911	0416	BE	35°00.62′N	165°00.16′E	5894			
C070	ROS	092911	0434	BO	35°00.47′N	165°00.55′E	5880	400	1-6,11	*SBE9p951 CTDO*
C070	ROS	092911	0452	EN	35°00.40′N	165°00.98′E	5878			

Sampling of radioactive materials

Suspended matter in sea surface water

SMP	DATE	GMT	LATITUDE	LONGITUDE
1	0812	0908	34°50.7′N	139°54.9′E
2	0813	0855	37°59.4′N	144°26.2′E
3	0814	0854	39°36.7′N	147°29.6′E
4	0815	0941	43°22.9′N	155°01.6′E
5	0816	0703	46°12.9′N	162°08.5′E
6	0817	0544	48°50.2′N	169°59.7′E
7	0818	0516	50°55.5′N	179°05.5′E
8	0819	0549	53°04.8′N	171°37.3′W
9	0924	0338	35°59.3′N	172°31.3′W
10	0925	0154	36°00.4′N	176°16.6′W
11	0926	0328	35°59.9′N	179°09.0′E
12	0927	0312	36°00.2′N	175°00.1′E
13	0928	0138	36°01.3′N	171°15.8′E
14	0929	0311	35°04.0′N	165°16.9′E
15	0930	0412	33°32.5′N	158°24.4′E
16	1001	0515	33°20.0′N	152°25.6′E
17	1002	0008	33°30.8′N	146°43.5′E
18	1003	0222	33°48.5′N	140°19.0′E

Aerosol (replacement of filter)

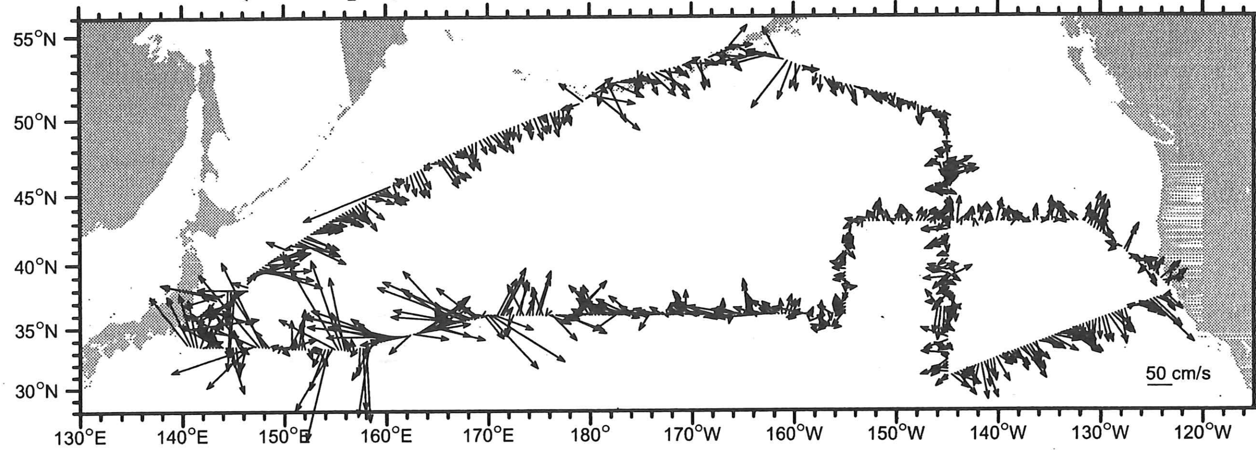
SMP	DATE	GMT	LATITUDE	LONGITUDE
1	0812	0539	35°33.34′N	139°50.17′E
2	0816	0007	45°19.81′N	159°47.25′E
3	0819	2059	54°21.45′N	165°16.68′W
4	0823	1837	46°59.91′N	144°59.97′W
5	0827	1857	40°59.57′N	145°00.08′W
6	0831	1856	34°30.10′N	144°59.93′W
7	0904	1703	36°01.45′N	128°30.61′W
8	0908	1957	37°47.19′N	122°23.06′W
10	0916	1955	43°00.27′N	152°07.38′W
11	0920	1956	35°55.02′N	162°07.28′W
12	0924	2103	35°59.78′N	175°03.47′W
13	0928	2156	35°23.95′N	166°58.40′E
	1003	0453	35°23.95′N	166°58.40′E

Sea surface water

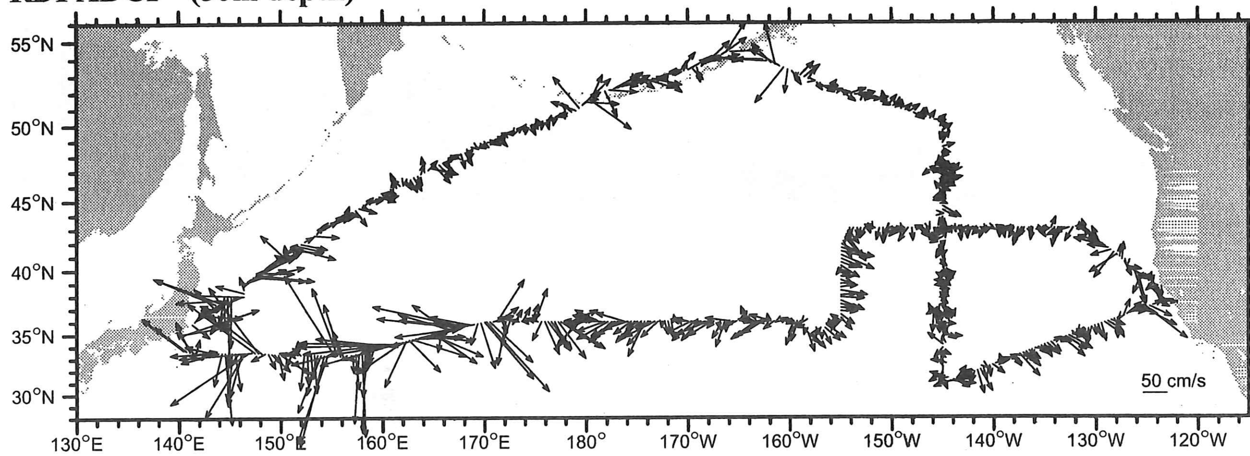
SMP	DATE	GMT	LATITUDE	LONGITUDE
1	0812	0900	34°50.6′N	139°52.0′E
2	0813	0851	37°59.4′N	144°26.2′E
3	0814	0848	39°35.8′N	147°28.0′E
4	0815	0936	43°22.2′N	154°59.8′E
5	0816	0700	46°12.4′N	162°07.4′E
6	0817	0540	48°49.8′N	169°58.2′E
7	0818	0512	50°54.9′N	179°04.2′E
8	0819	0546	53°04.5′N	171°38.7′W
9	0820	0446	53°47.1′N	162°04.0′W
10	0821	0344	51°43.9′N	152°55.6′W
11	0822	0346	50°05.2′N	144°59.5′W
12	0823	0141	47°20.1′N	145°52.8′W
13	0824	0506	47°00.0′N	145°00.1′W
14	0825	0157	46°19.5′N	144°33.9′W
15	0826	0259	46°54.3′N	145°00.2′W
16	0828	0137	40°26.3′N	144°59.9′W
17	0829	0307	38°37.2′N	144°59.4′W
18	0830	0223	36°47.9′N	145°52.6′W
19	0831	0108	36°30.0′N	143°45.1′W
20	0901	0107	33°42.1′N	145°00.1′W
21	0902	0107	30°50.0′N	145°00.1′W
22	0903	0054	32°45.6′N	139°00.7′W
23	0903	2348	34°32.5′N	133°20.3′W
24	0910	0244	39°56.0′N	126°28.7′W
25	0911	0106	41°41.7′N	129°09.1′W
26	0912	0124	42°59.9′N	133°12.9′W
27	0913	0504	42°59.4′N	138°23.8′W
28	0914	0132	42°59.8′N	140°59.4′W
29	0915	0351	42°59.9′N	145°39.8′W
30	0916	0350	42°58.6′N	149°12.0′W
31	0917	0456	43°01.7′N	154°05.4′W
32	0918	0427	39°16.3′N	155°00.0′W
33	0919	0351	36°00.0′N	156°00.9′W
34	0920	0305	35°59.9′N	159°13.9′W
35	0921	0534	36°02.4′N	163°46.0′W
36	0922	0518	35°59.1′N	166°13.6′W
37	0923	0335	35°59.6′N	168°46.2′W
38	0924	0332	35°59.3′N	172°31.2′W
39	0925	0150	36°00.4′N	176°16.5′W
40	0926	0324	35°59.9′N	179°10.4′E
41	0927	0310	36°00.2′N	175°00.1′E
42	0928	0133	36°01.2′N	171°15.7′E
43	0929	0309	35°04.1′N	165°17.3′E
44	0930	0408	33°32.9′N	158°25.1′E
45	1001	0512	33°20.0′N	152°26.7′E
46	1002	0005	33°30.8′N	146°44.4′E
47	1003	0219	33°47.9′N	140°19.4′E

7. Chart of Surface Current

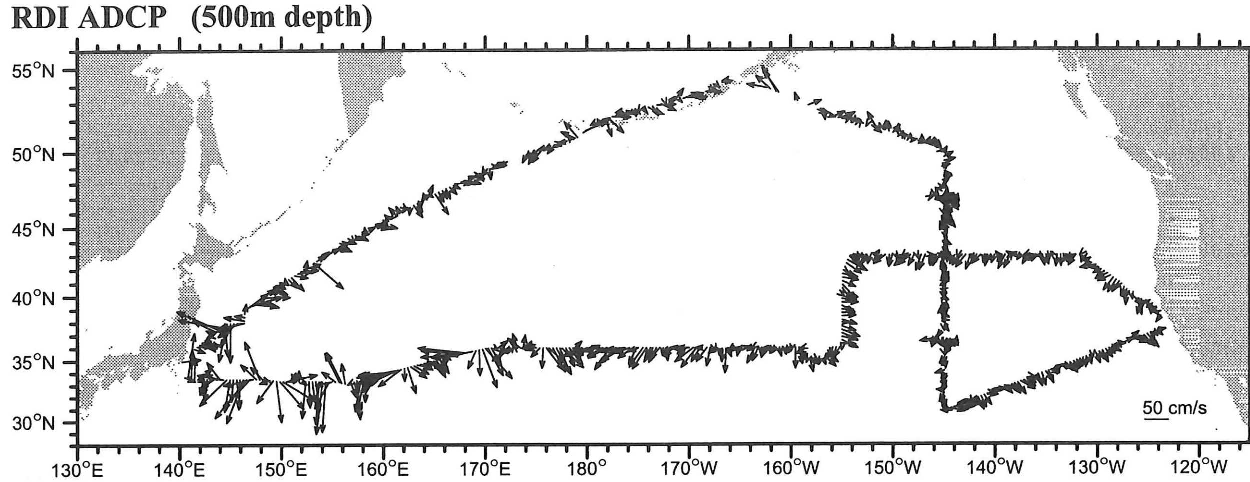
Furuno ADCP (50m depth)



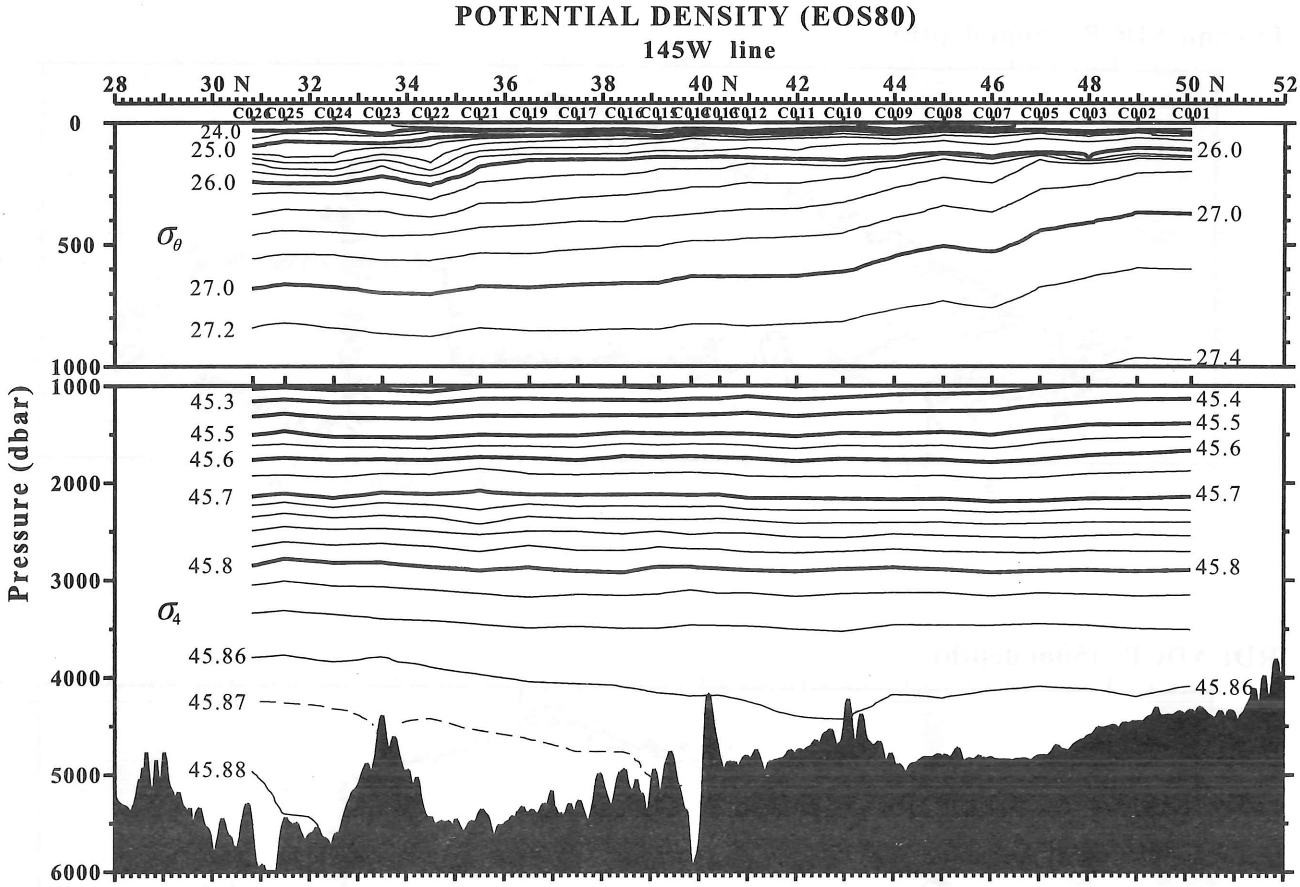
RDI ADCP (50m depth)

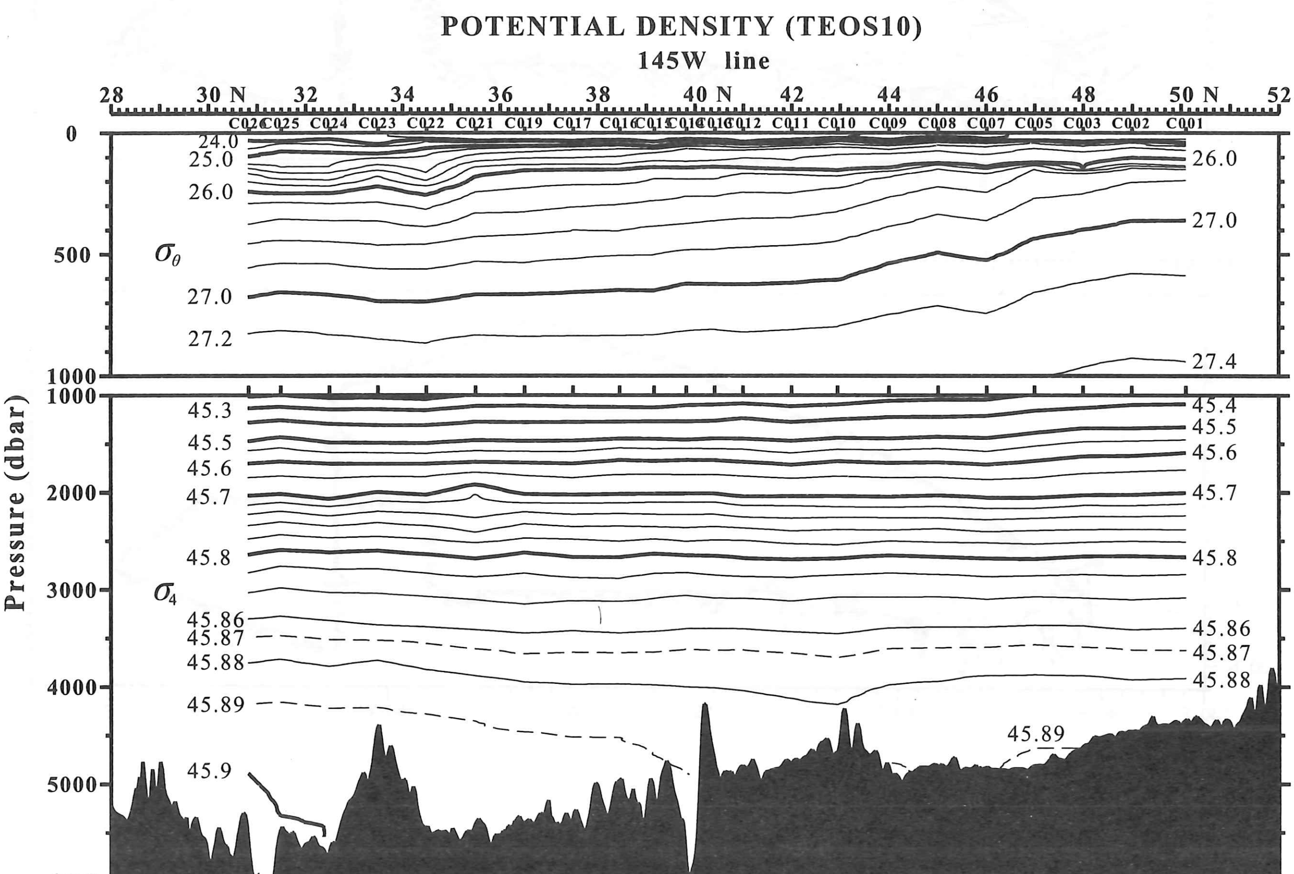


RDI ADCP (500m depth)

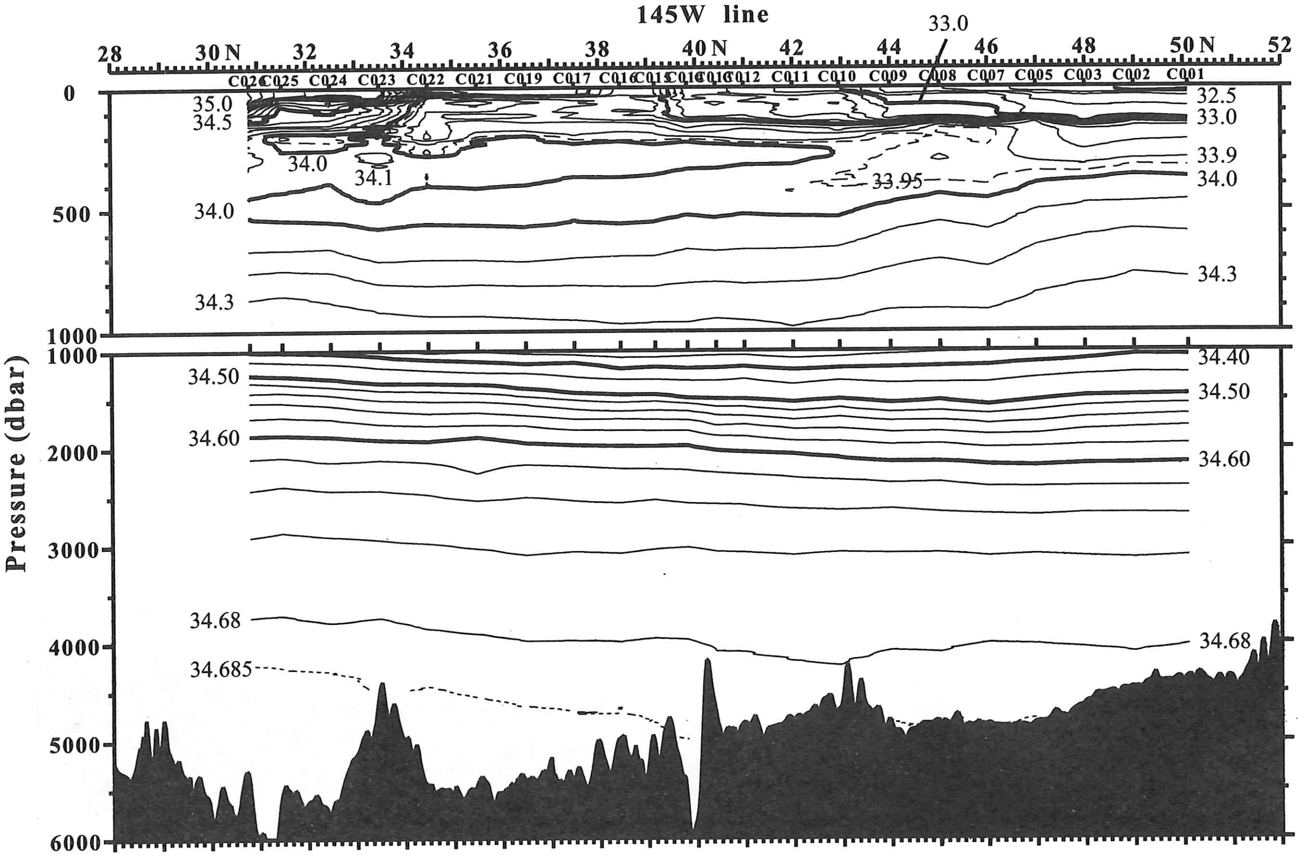


8. Vertical Sections of $CTDO_2$ Data

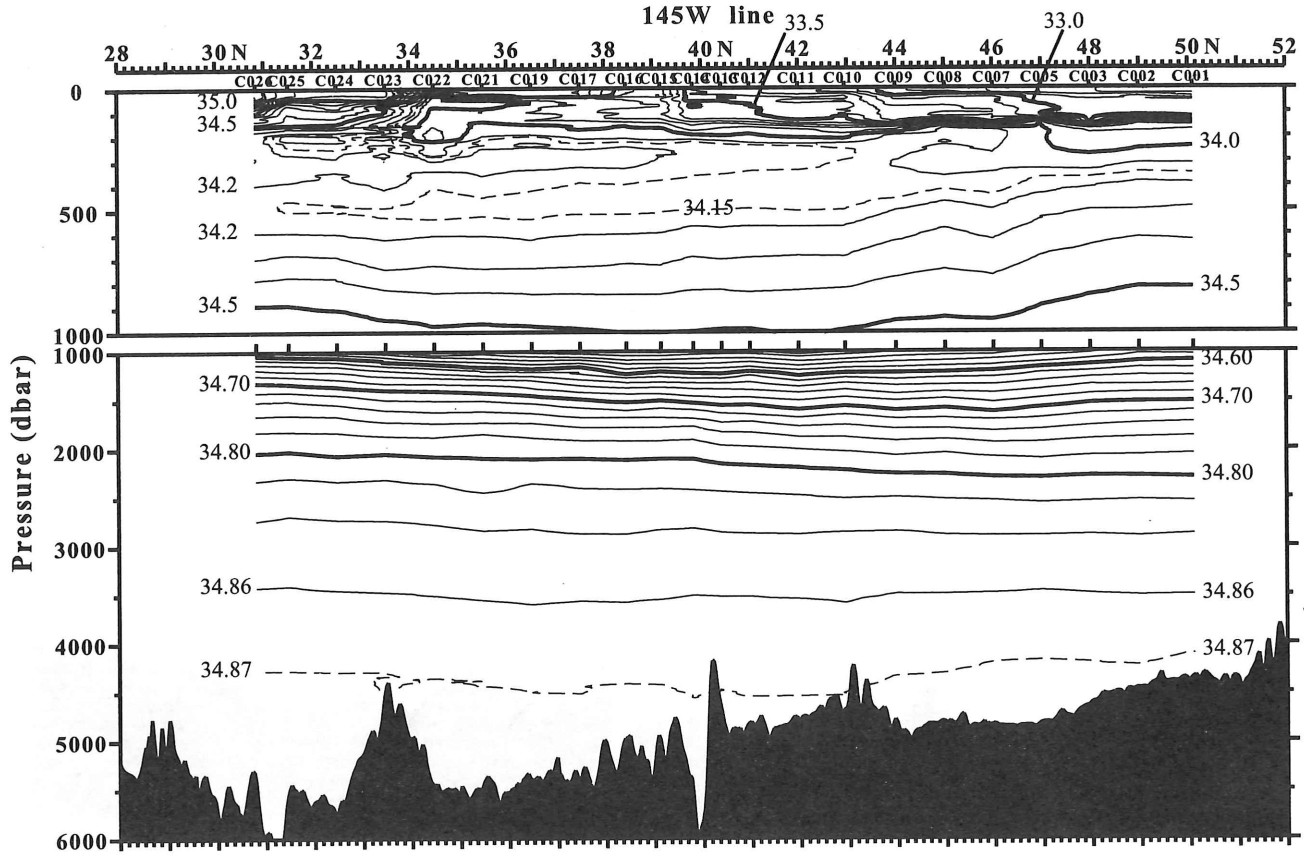




SALINITY (pss78)
145W line

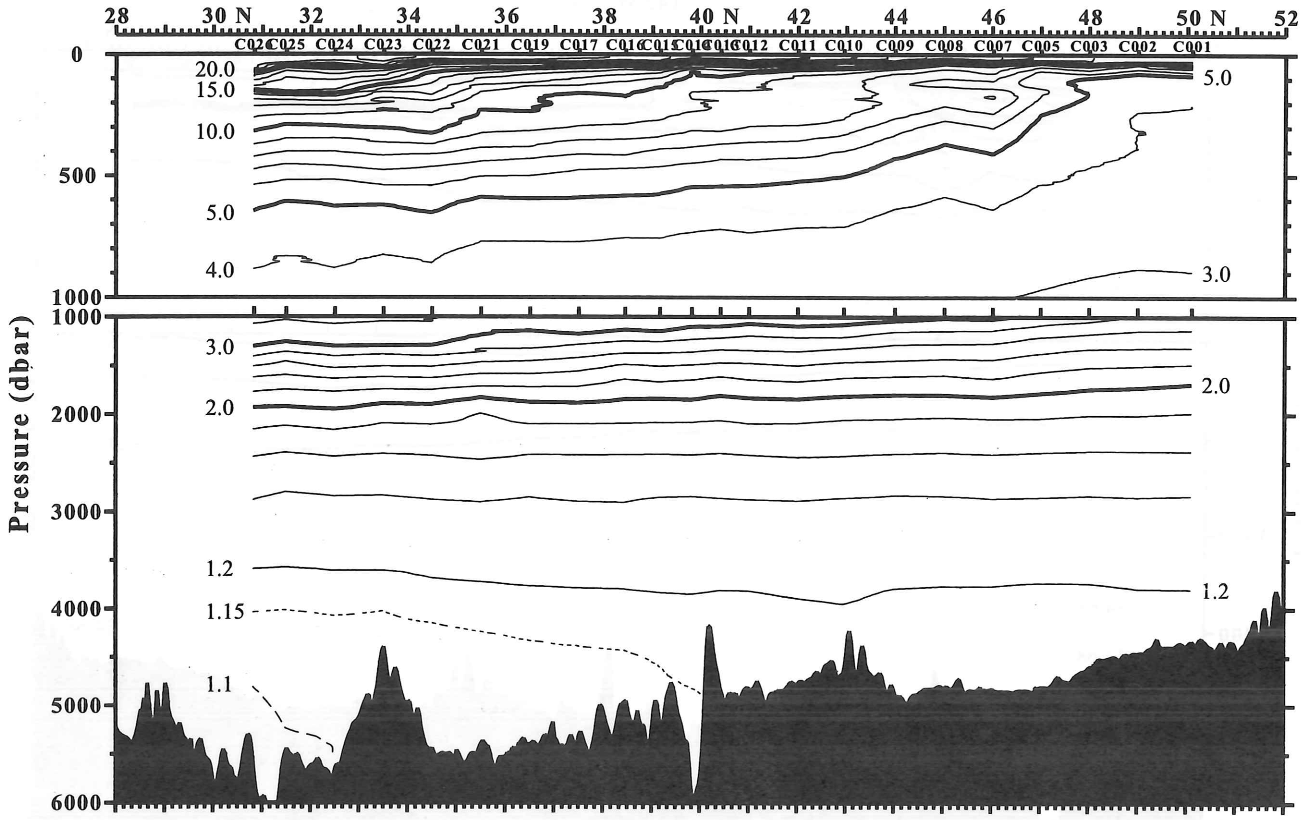


Absolute Salinity (g/kg)
145W line



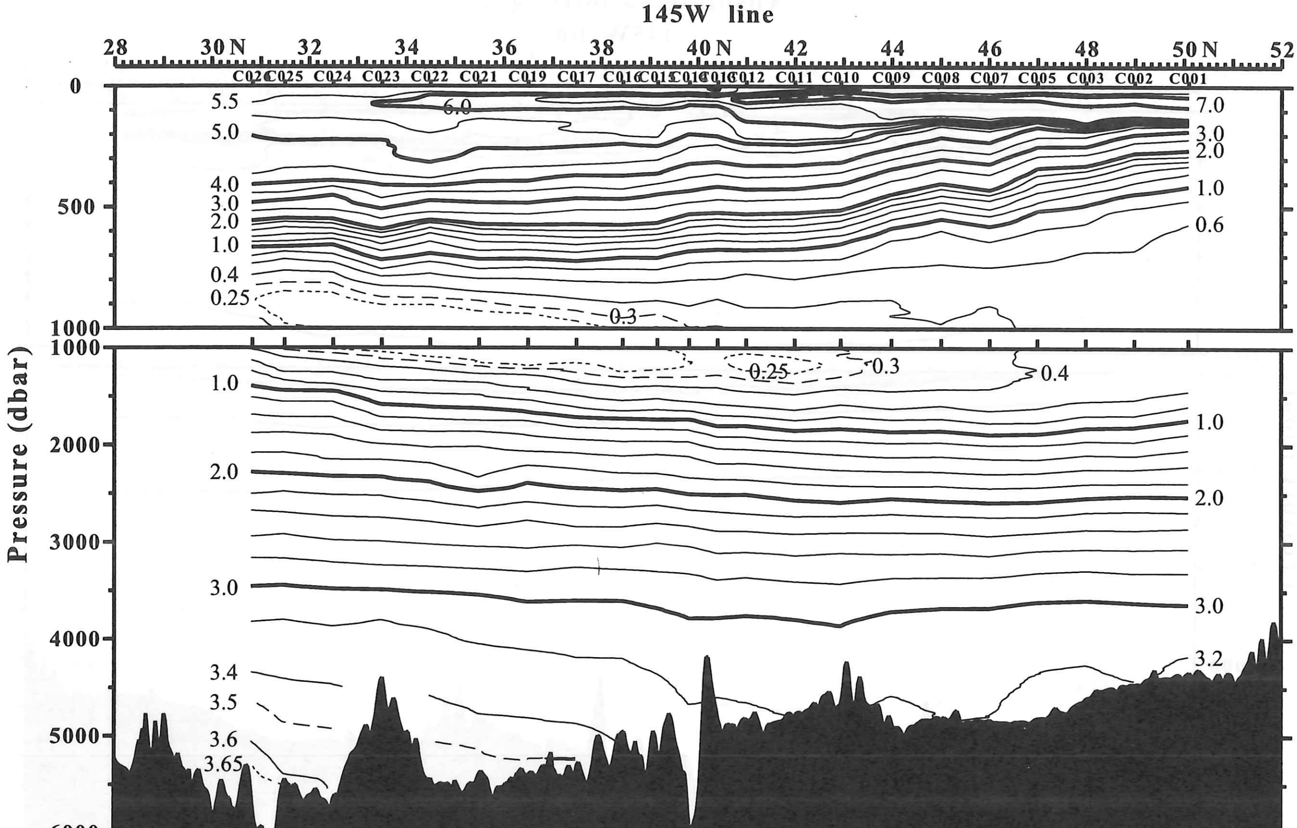
POT. TEMPERATURE (deg C) (TEOS10)

145W line

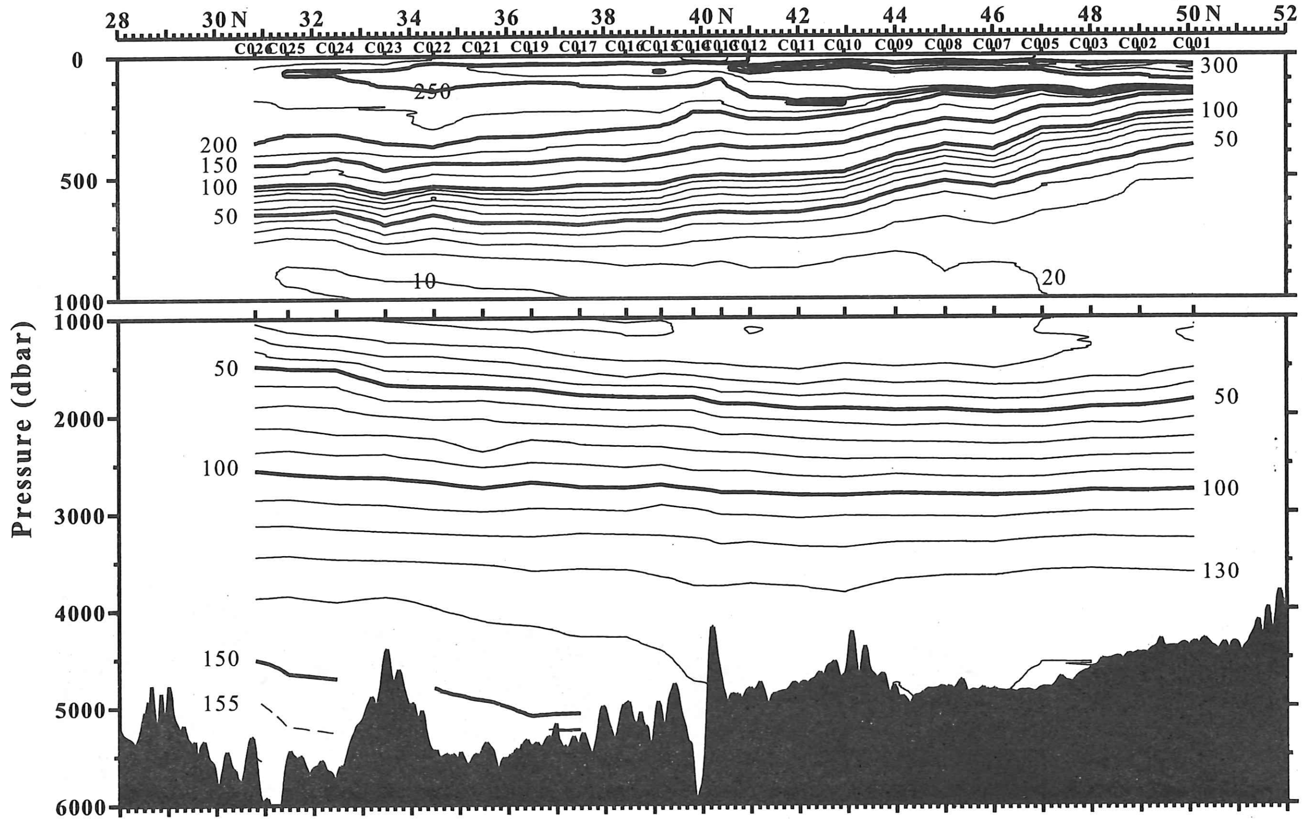


DISSOLVED OXYGEN (ml/l)

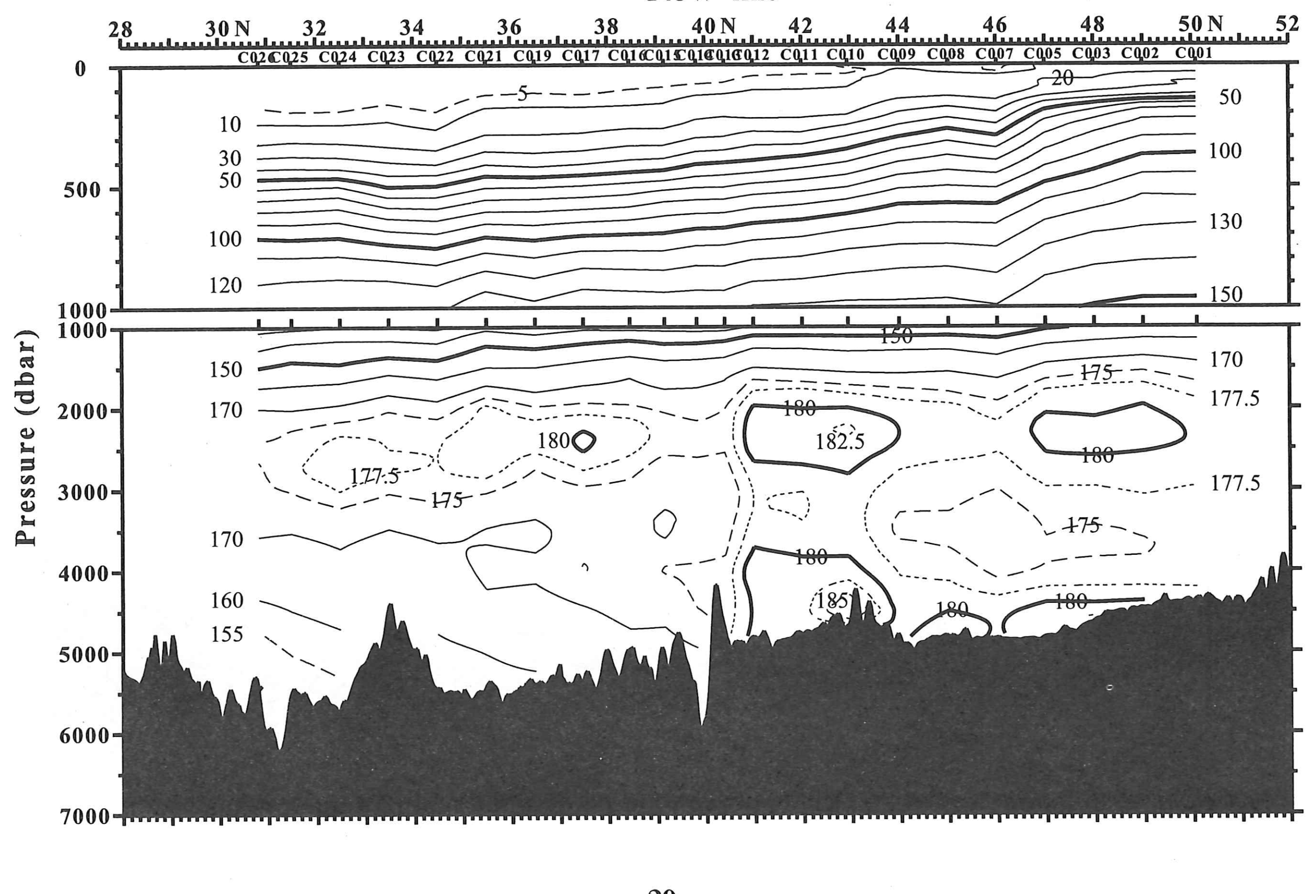
145W line

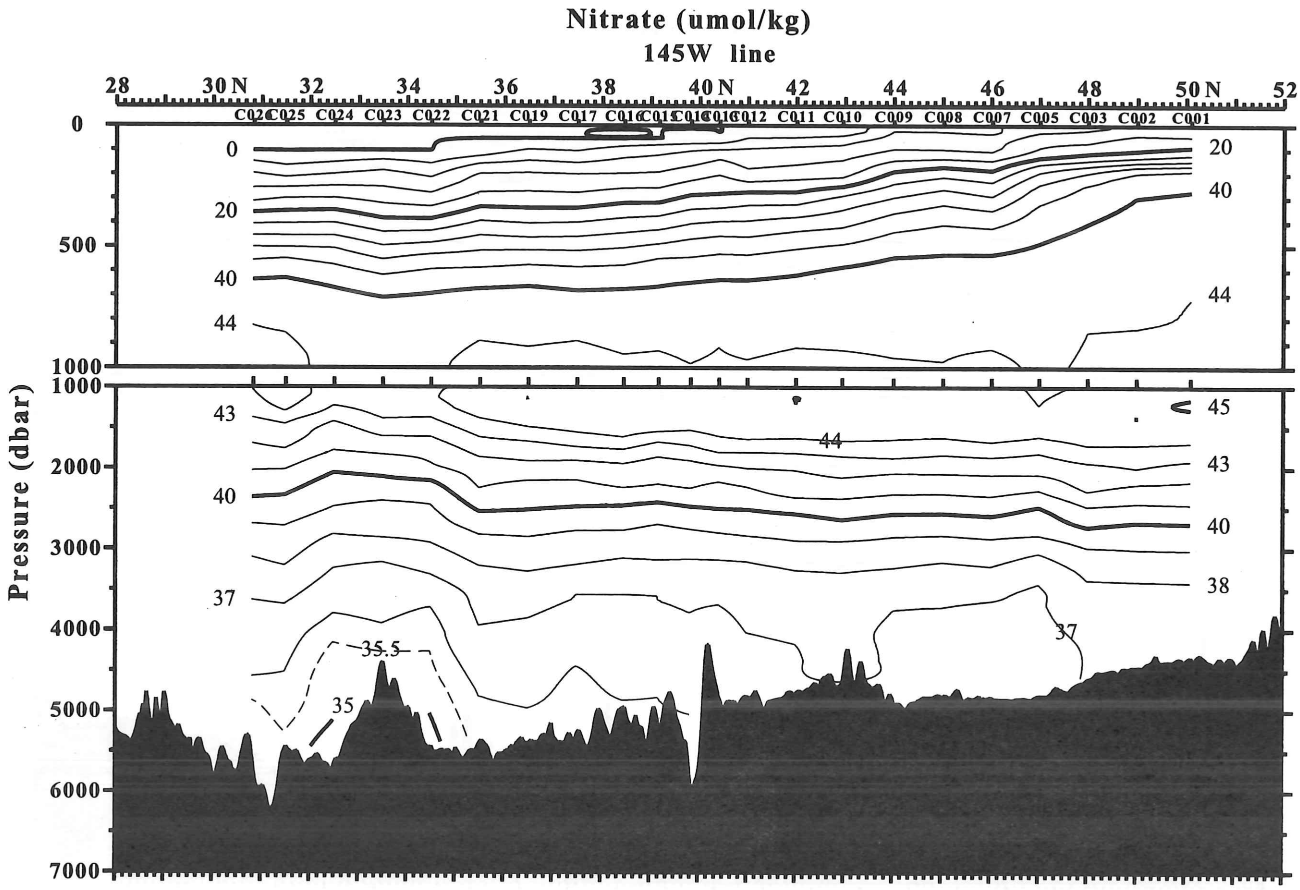


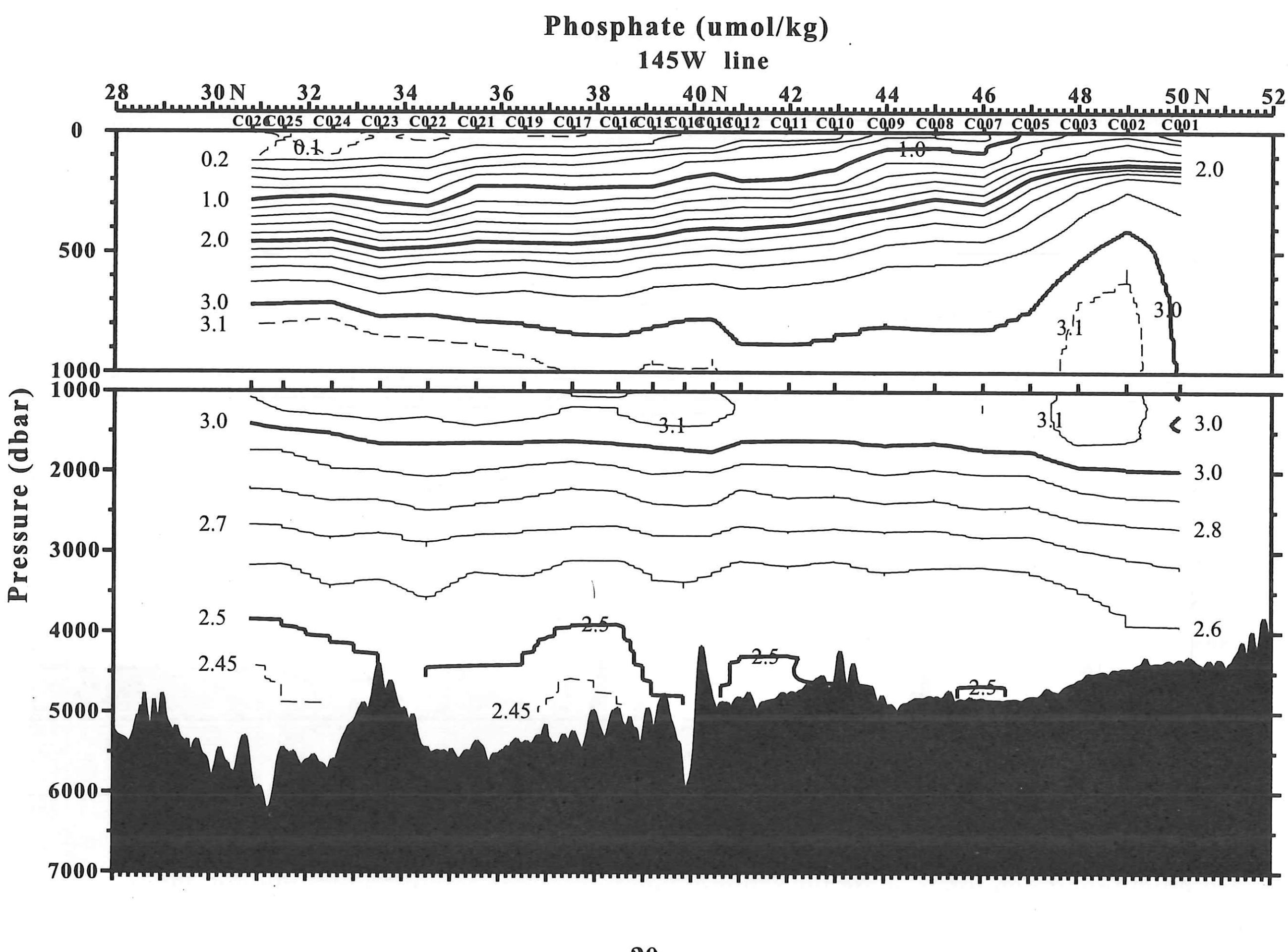
Dissolved oxygen (umol/kg)
145W line



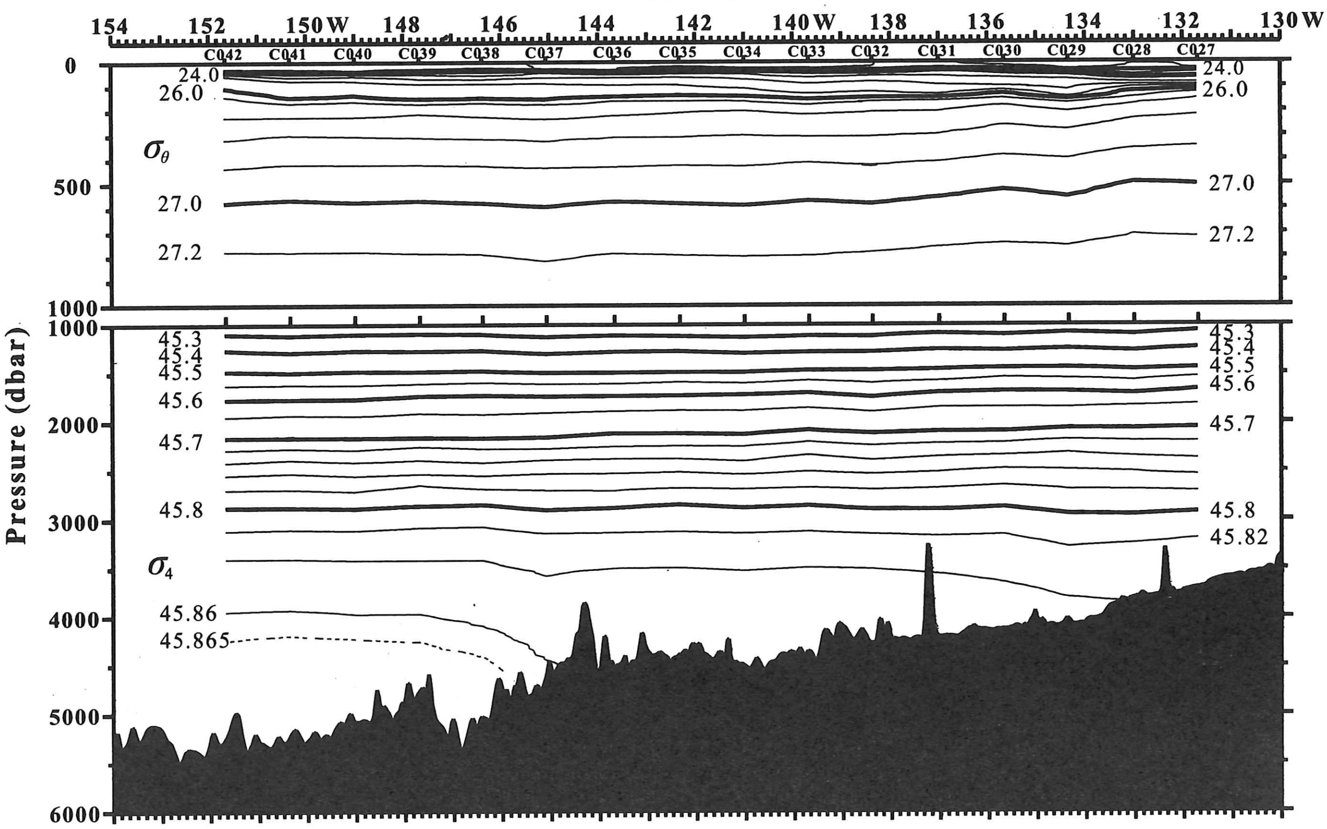
Silica (umol/kg)
145W line



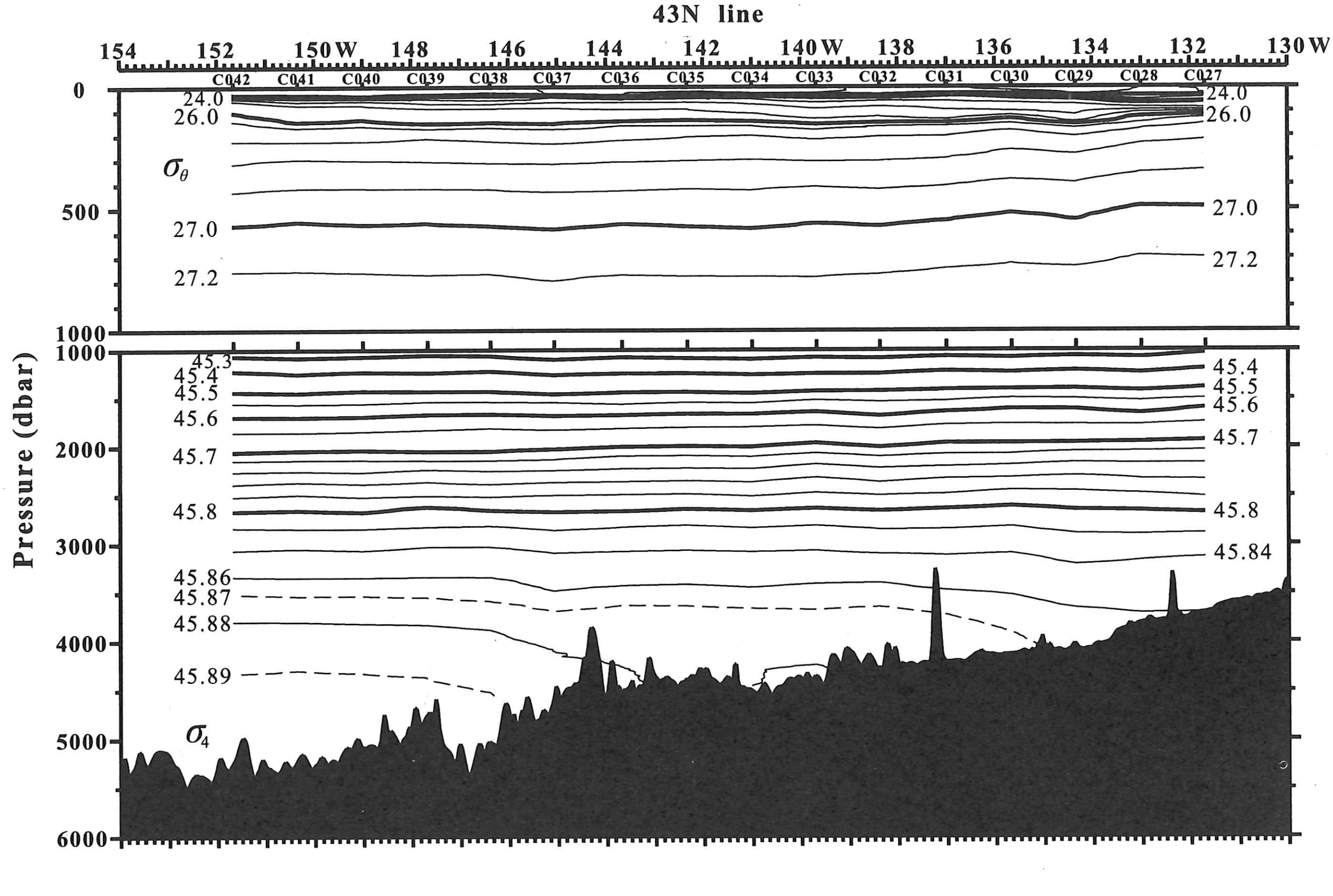

Nitrate (umol/kg)
145W line
Pressure (dbar)
C026 C025 C024 C023 C022 C021 C019 C017 C016 C015 C014 C013 C012 C011 C010 C009 C008 C007 C005 C003 C002 C001


Phosphate (umol/kg)
145W line
Pressure (dbar)

POTENTIAL DENSITY (EOS80)
43N line

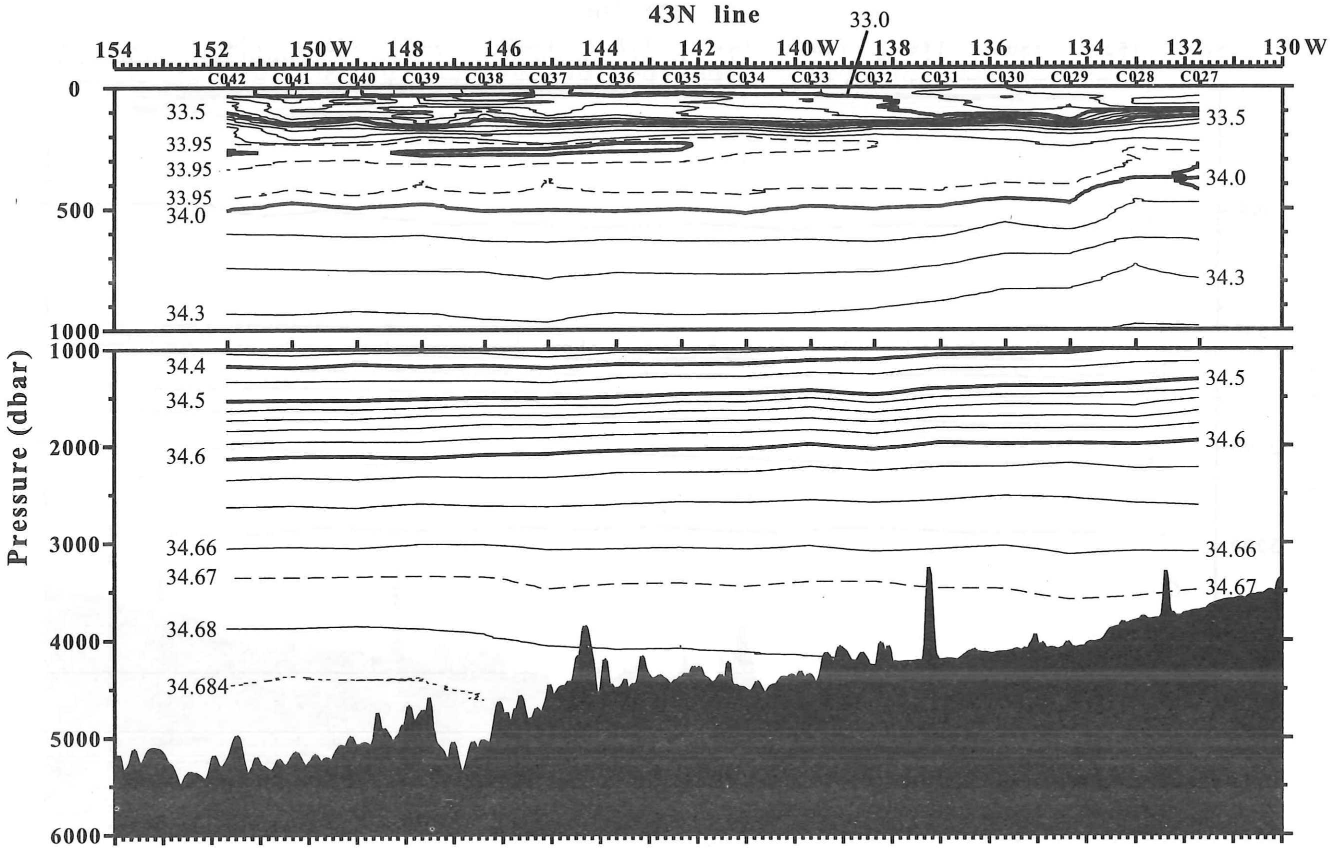


POTENTIAL DENSITY (TEOS10)
43N line



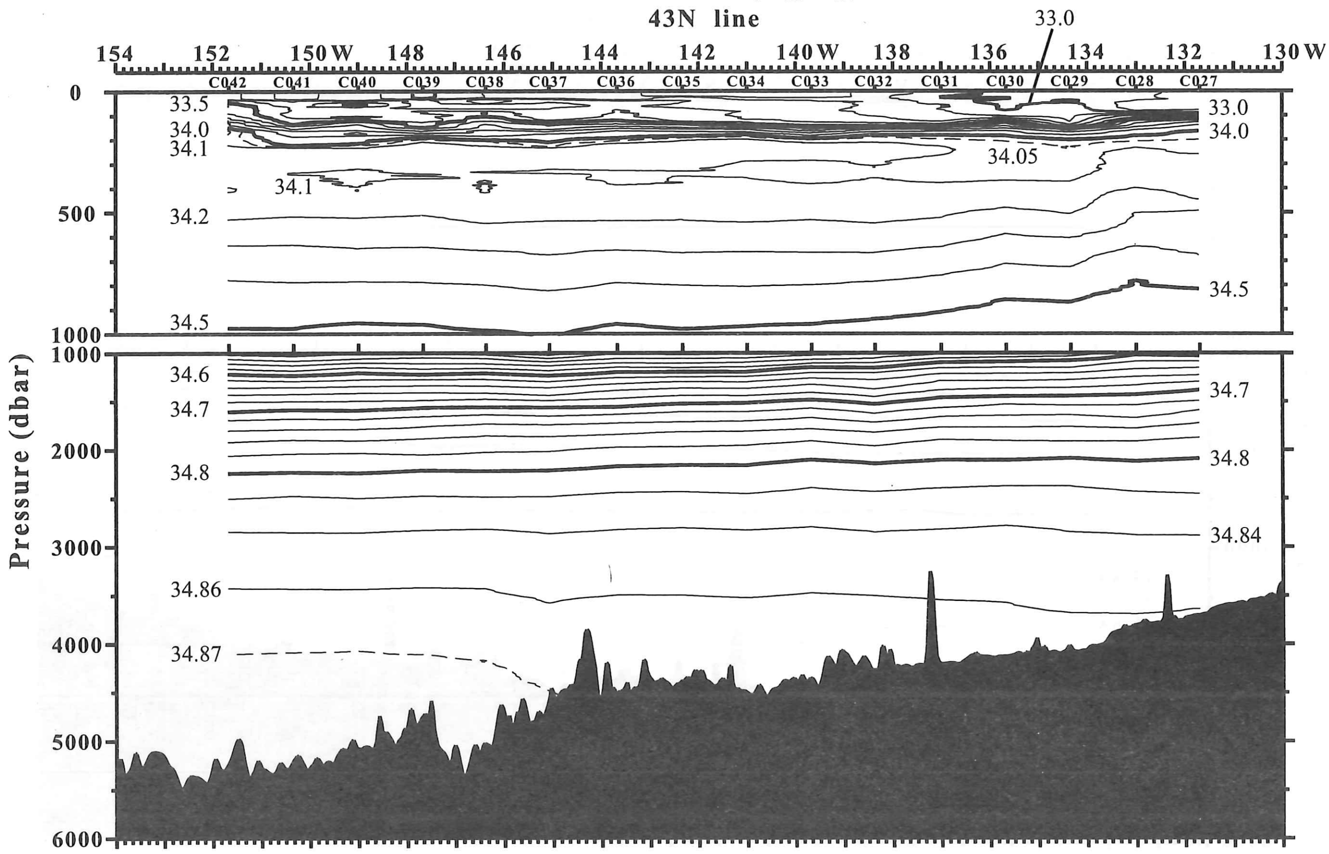
Practical Salinity (pss78)

43N line



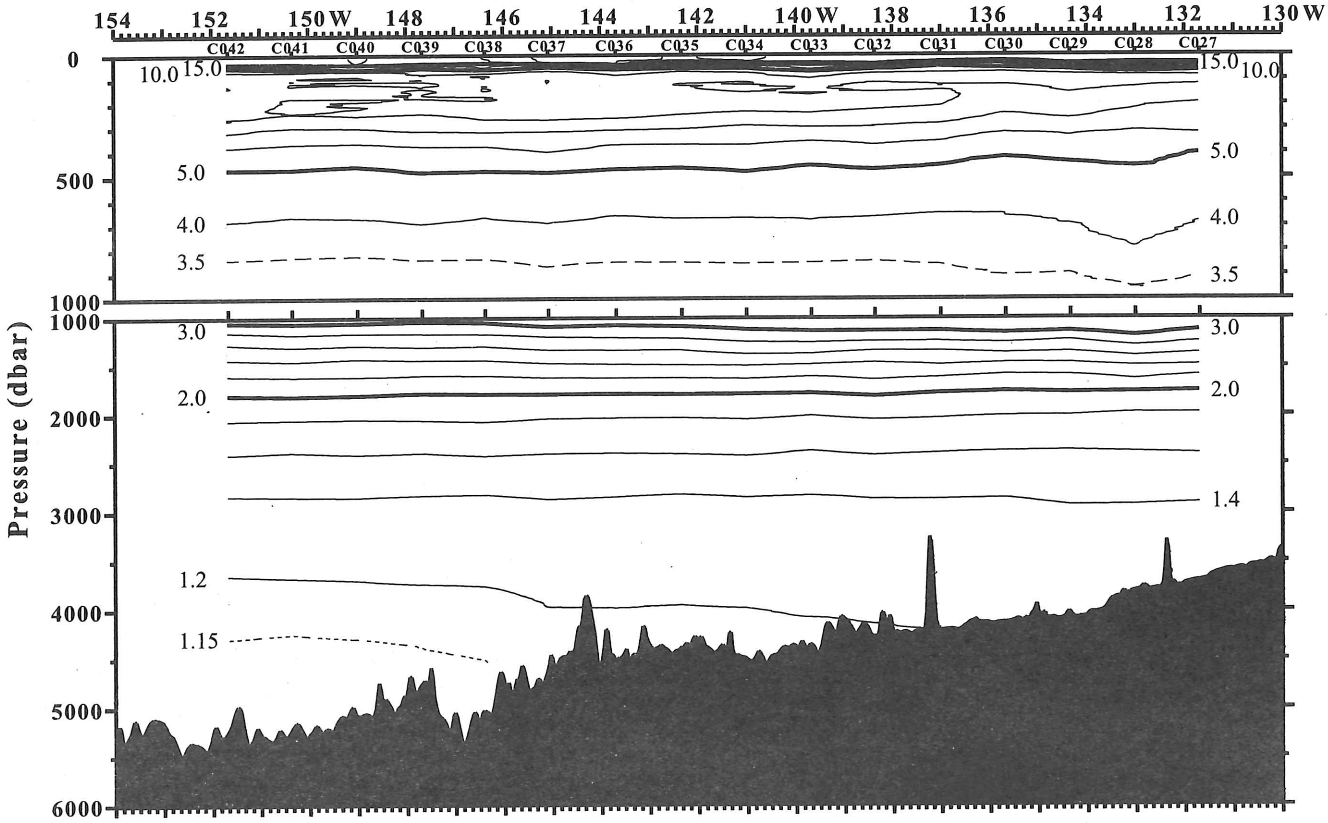
Absolute Salinity (g/kg)

43N line



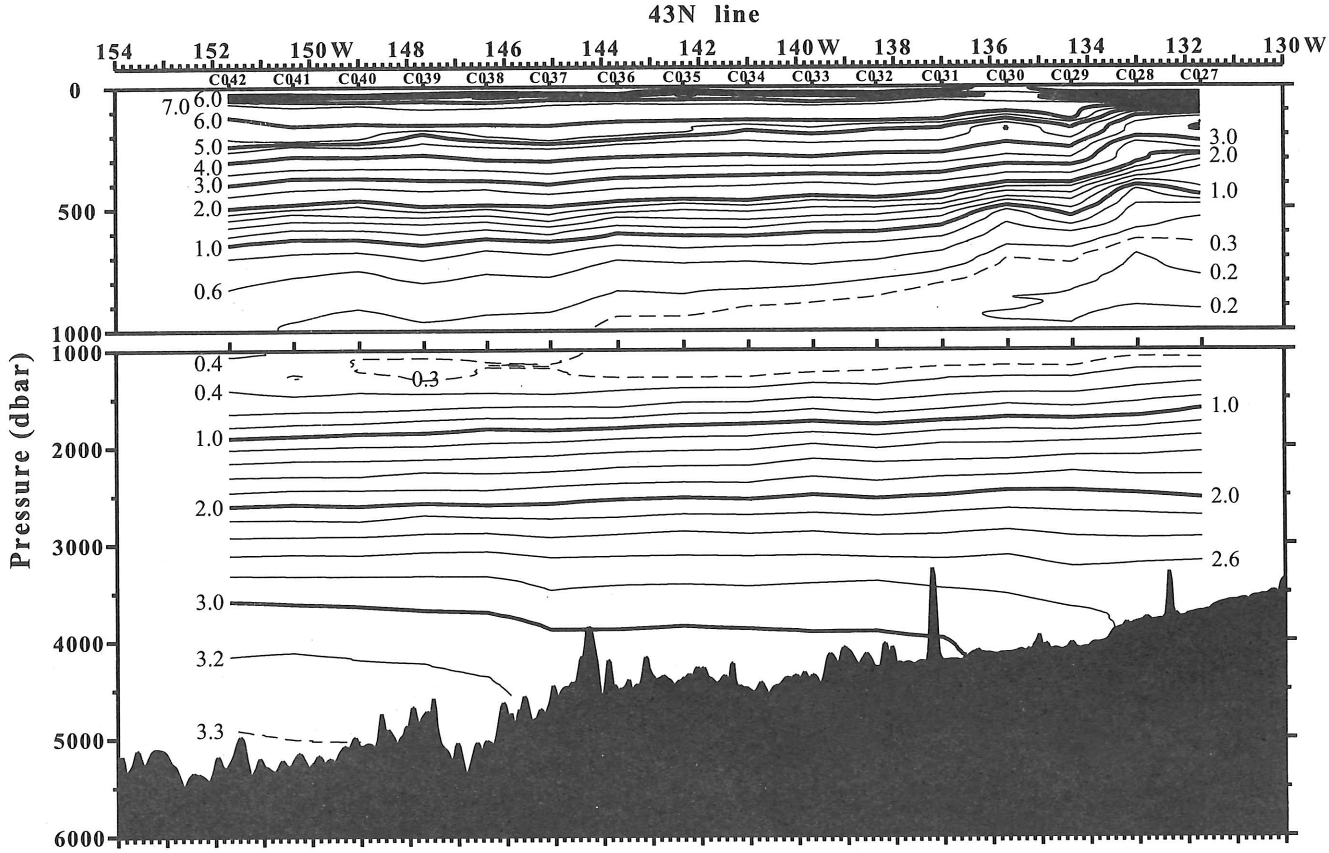
POT. TEMPERATURE (deg C) (TEOS10)

43N line

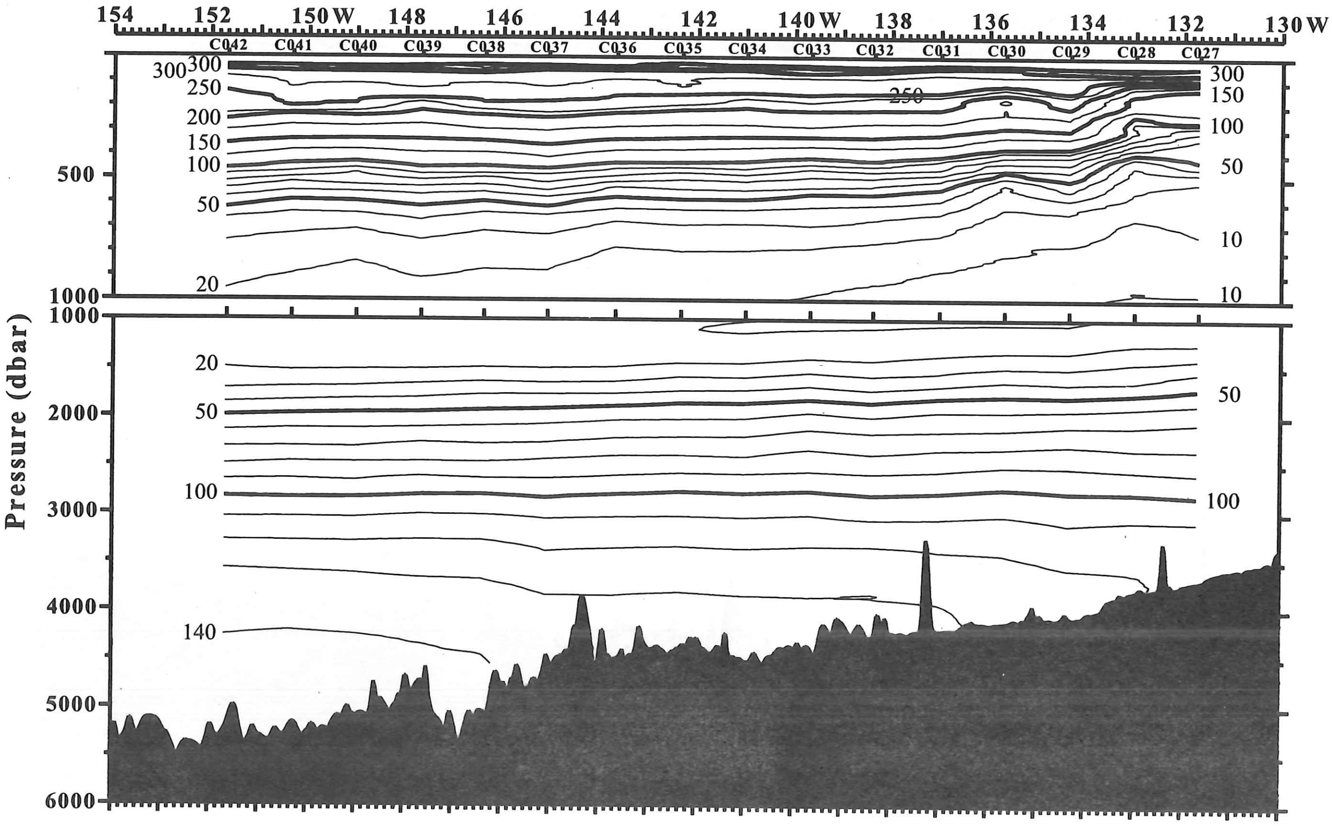


DISSOLVED OXYGEN (ml/l)

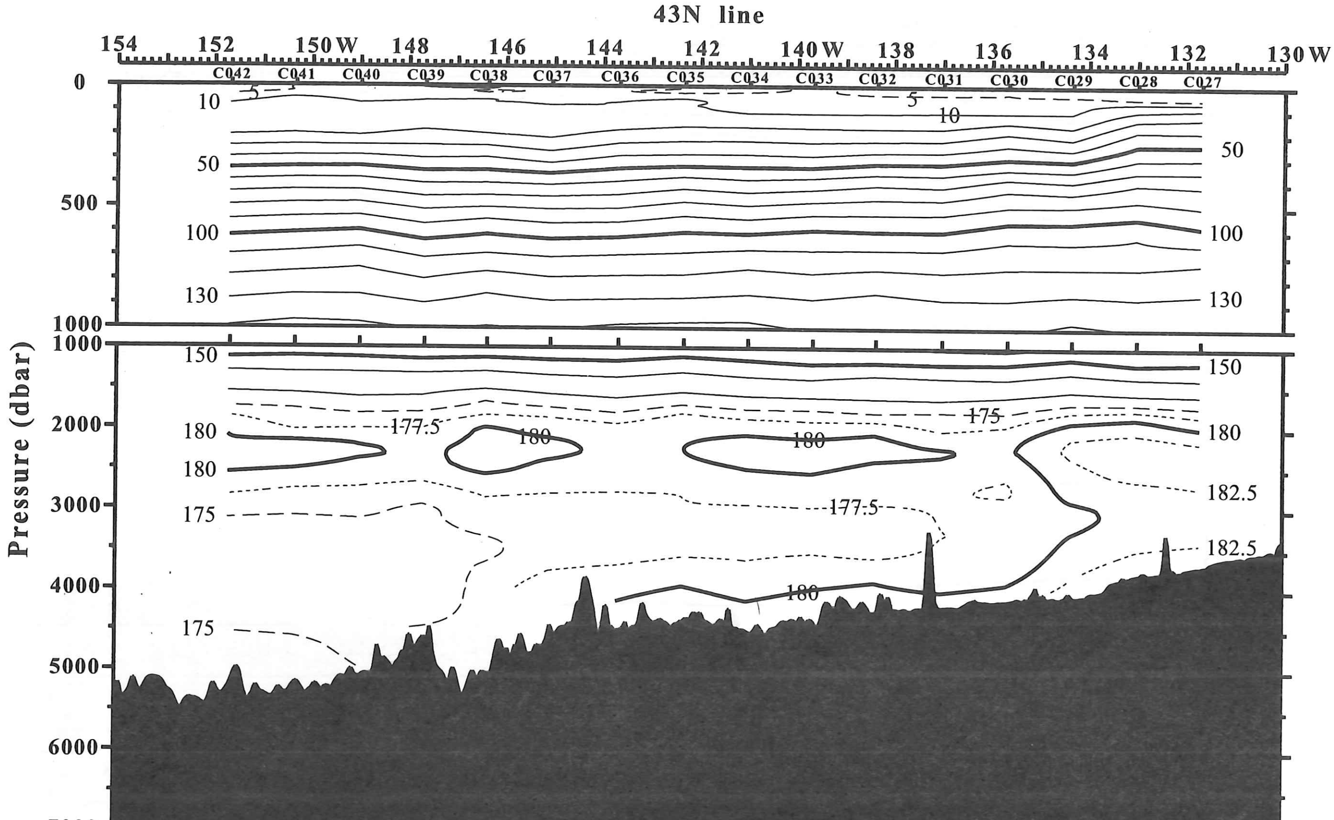
43N line



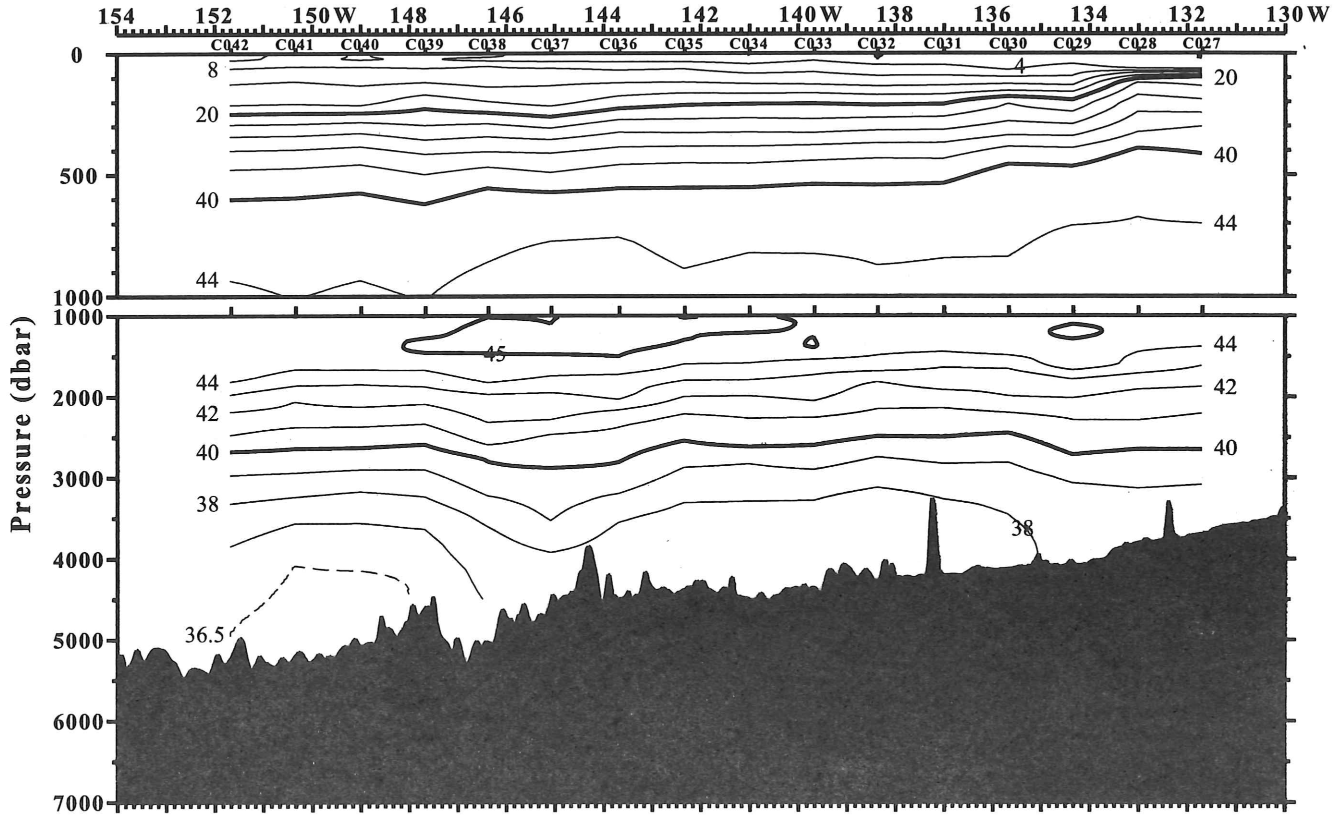
Dissolved Oxygen (umol/kg)
43N line



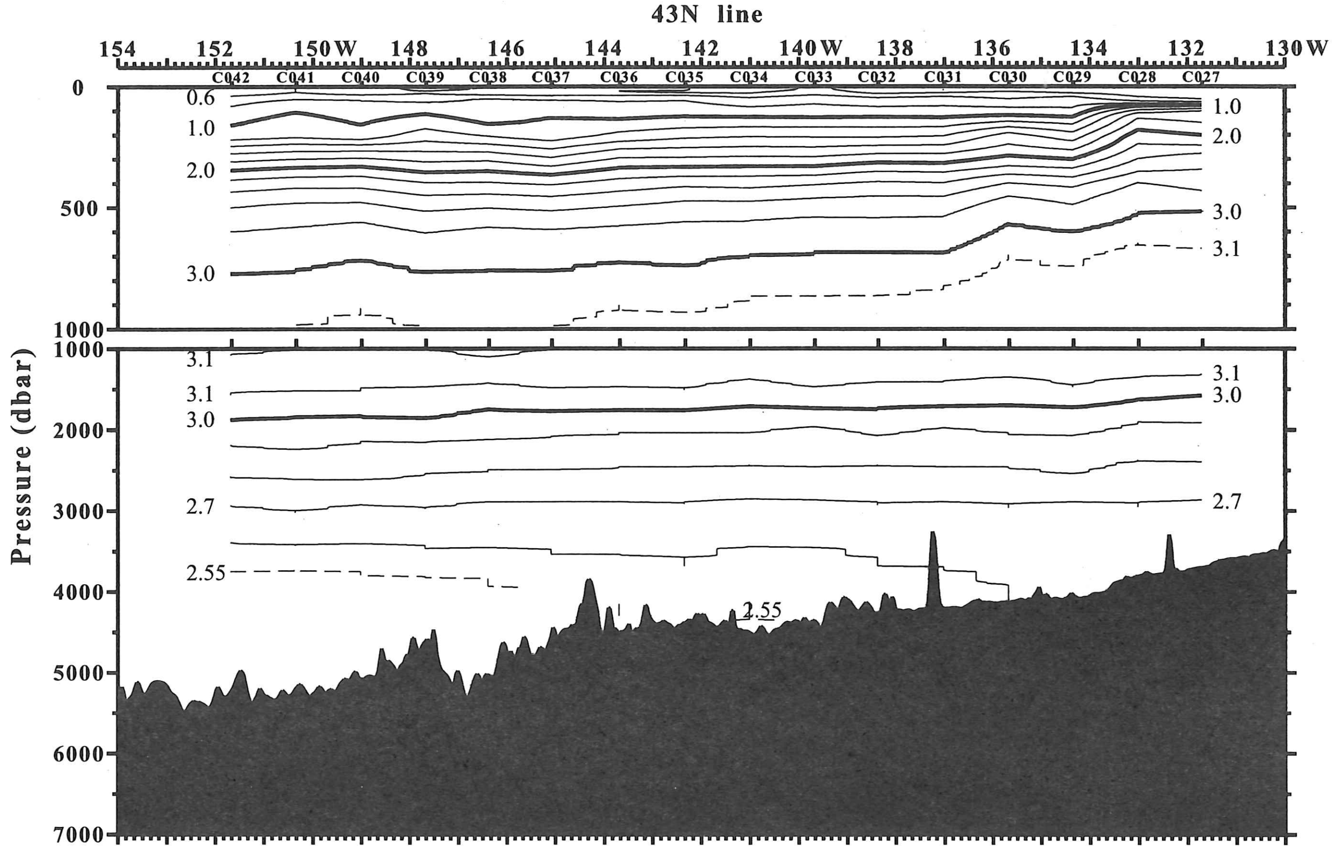
Silica (umol/kg)
43N line



Nitrate (umol/kg)
43N line

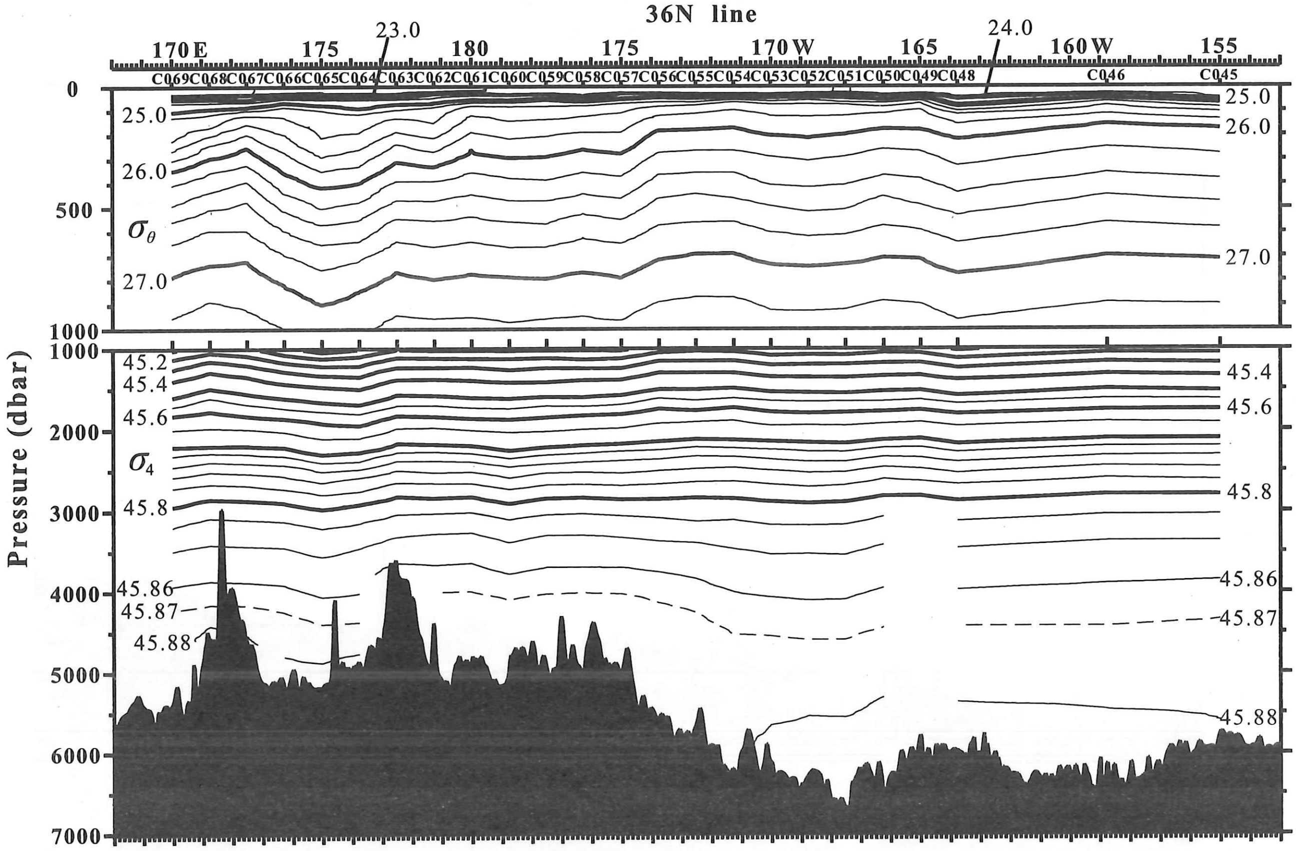


Phosphate (umol/kg)
43N line



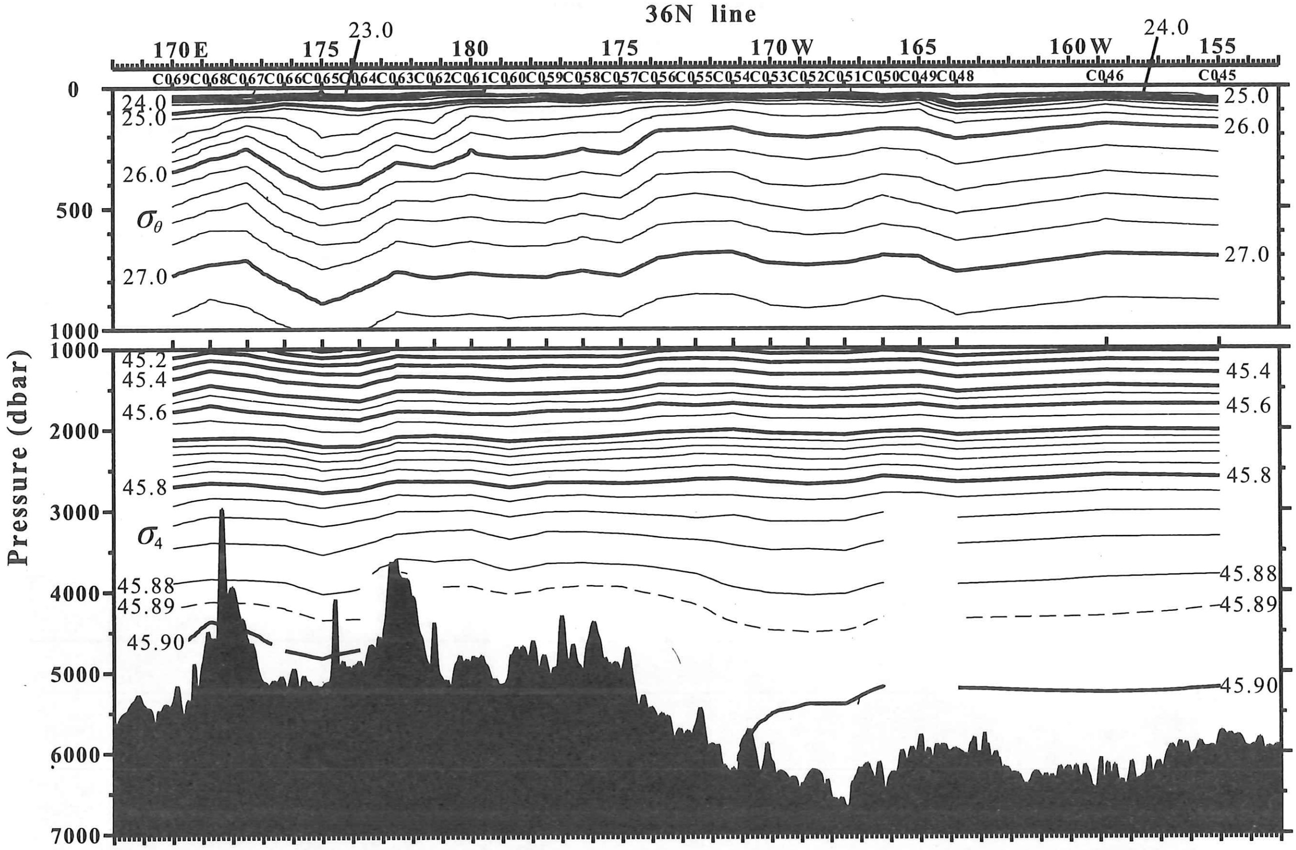
POTENTIAL DENSITY (EOS80)

36N line

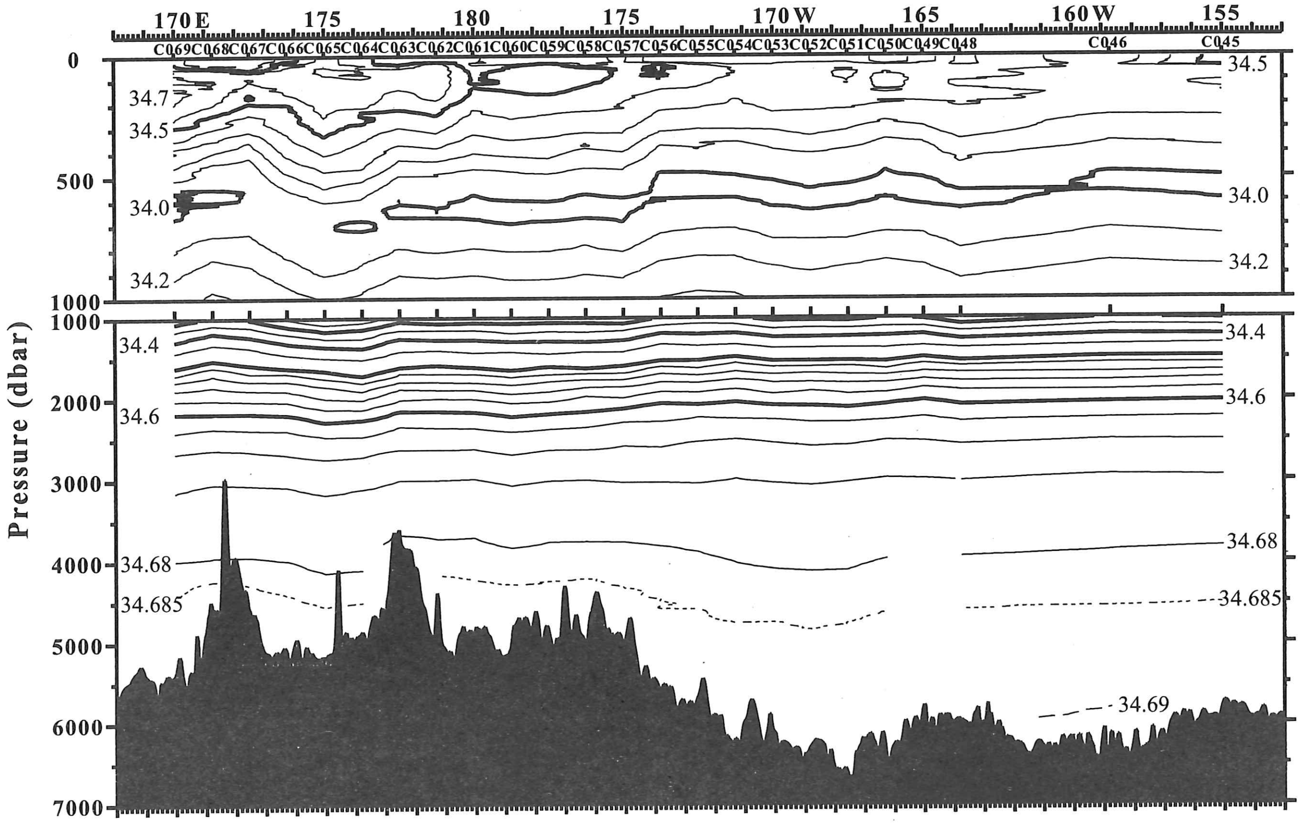


POTENTIAL DENSITY (TEOS10)

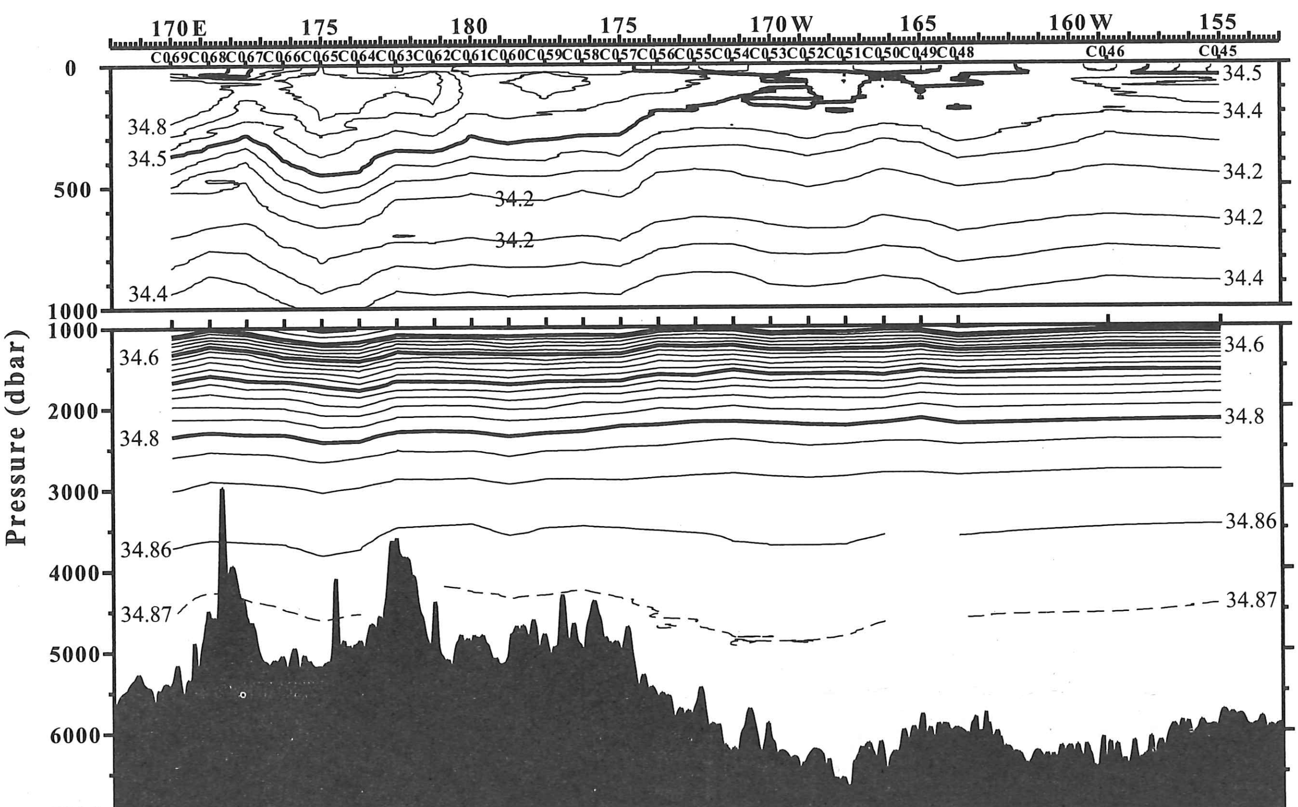
36N line



Practical Salinity (pss78)
36N line

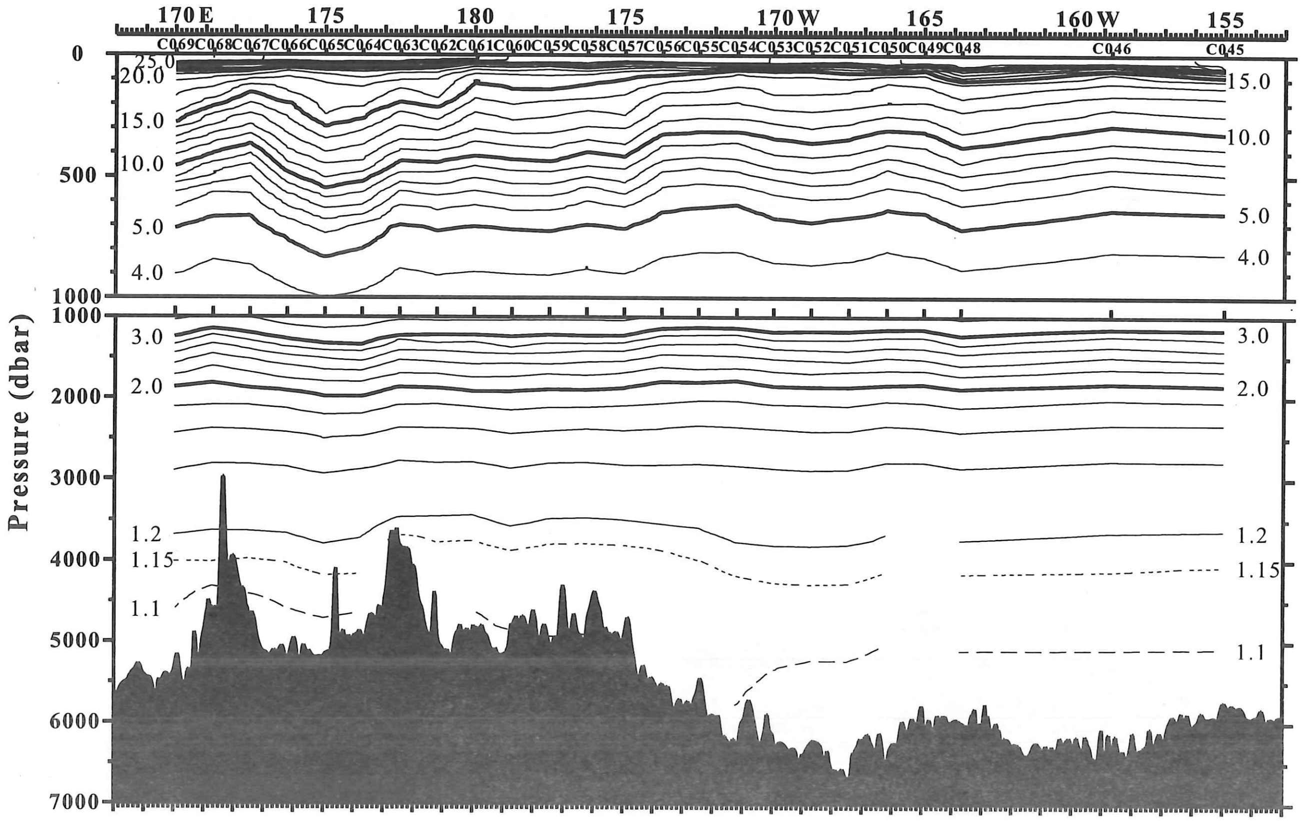


Absolute Salinity (g/kg)
36N line



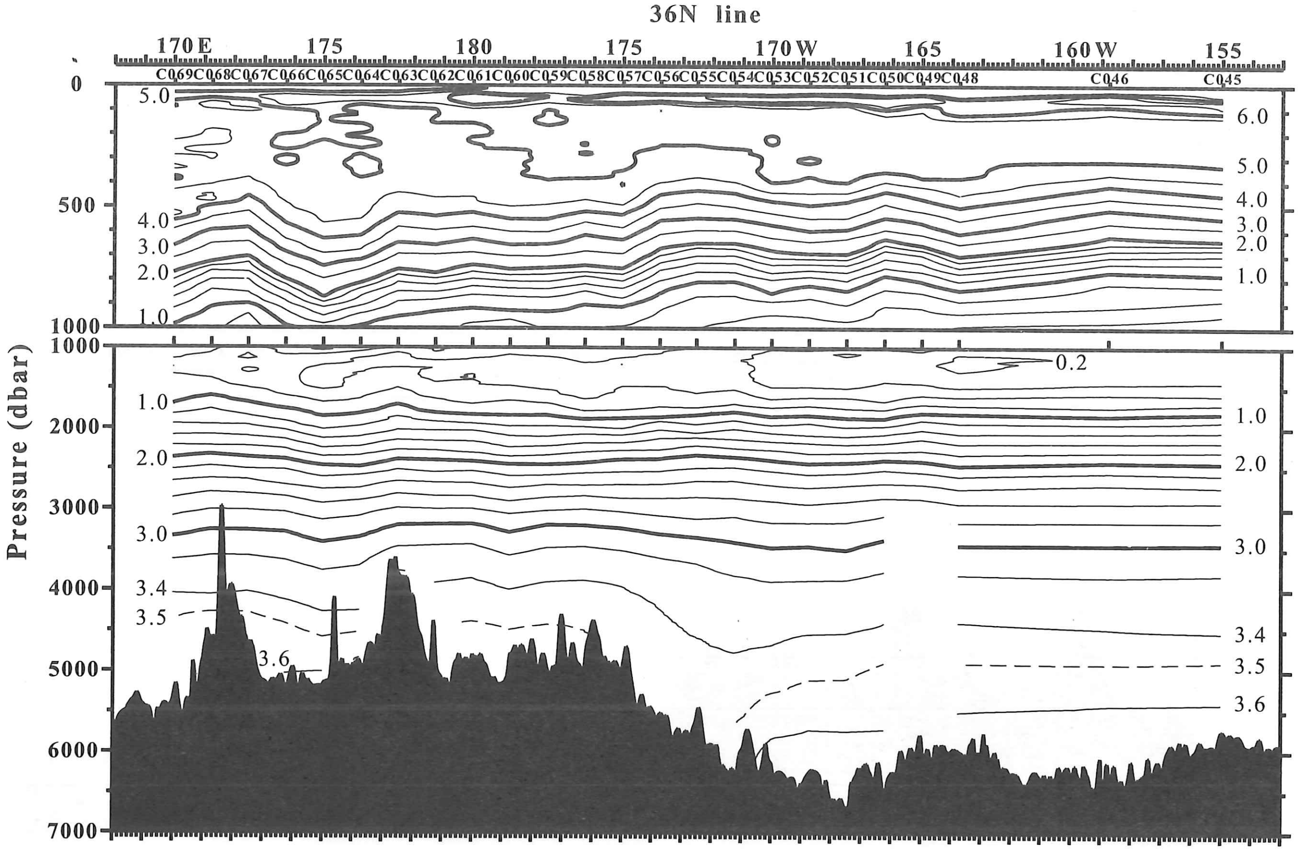
POT. TEMPERATURE (deg C) (TEOS10)

36N line

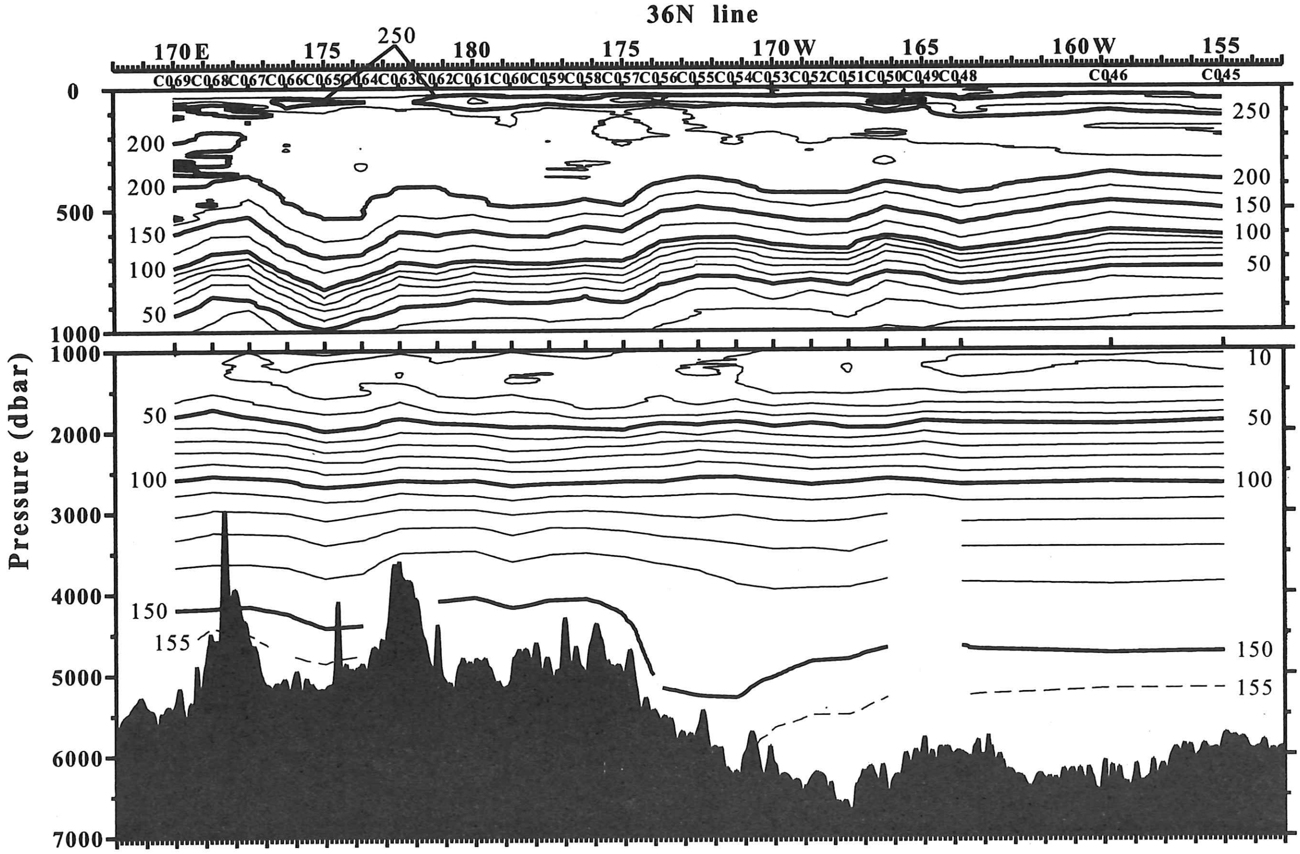


DISSOLVED OXYGEN (ml/l)

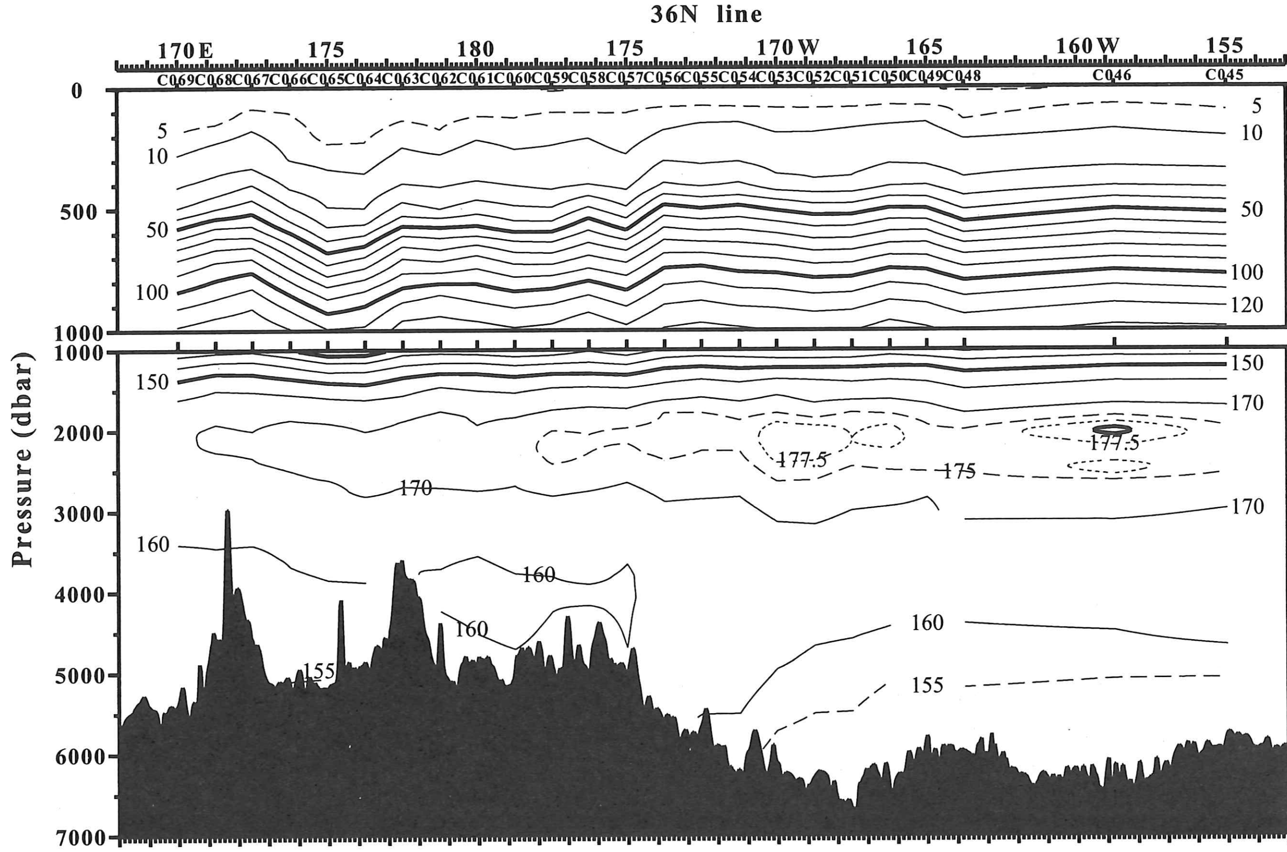
36N line



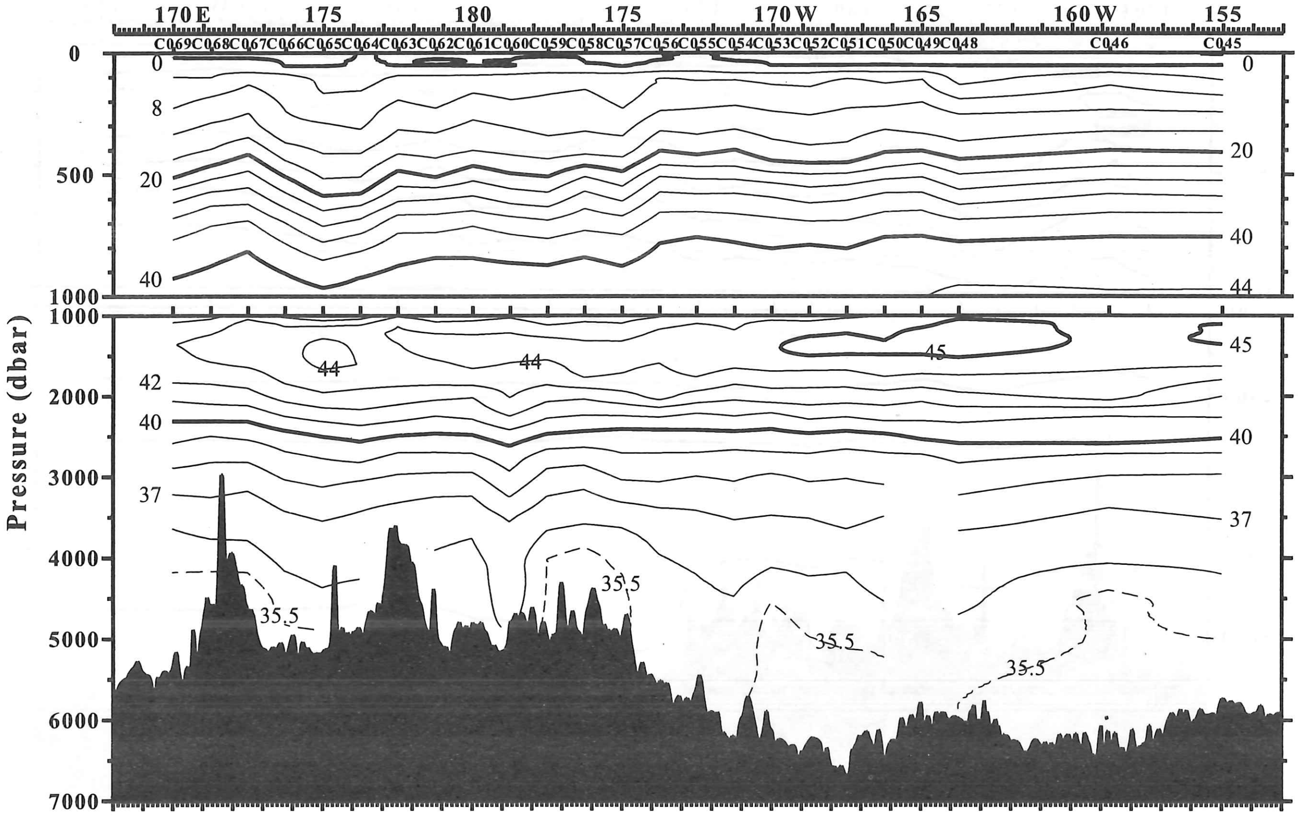
Dissolved Oxygen (umol/kg)
36N line



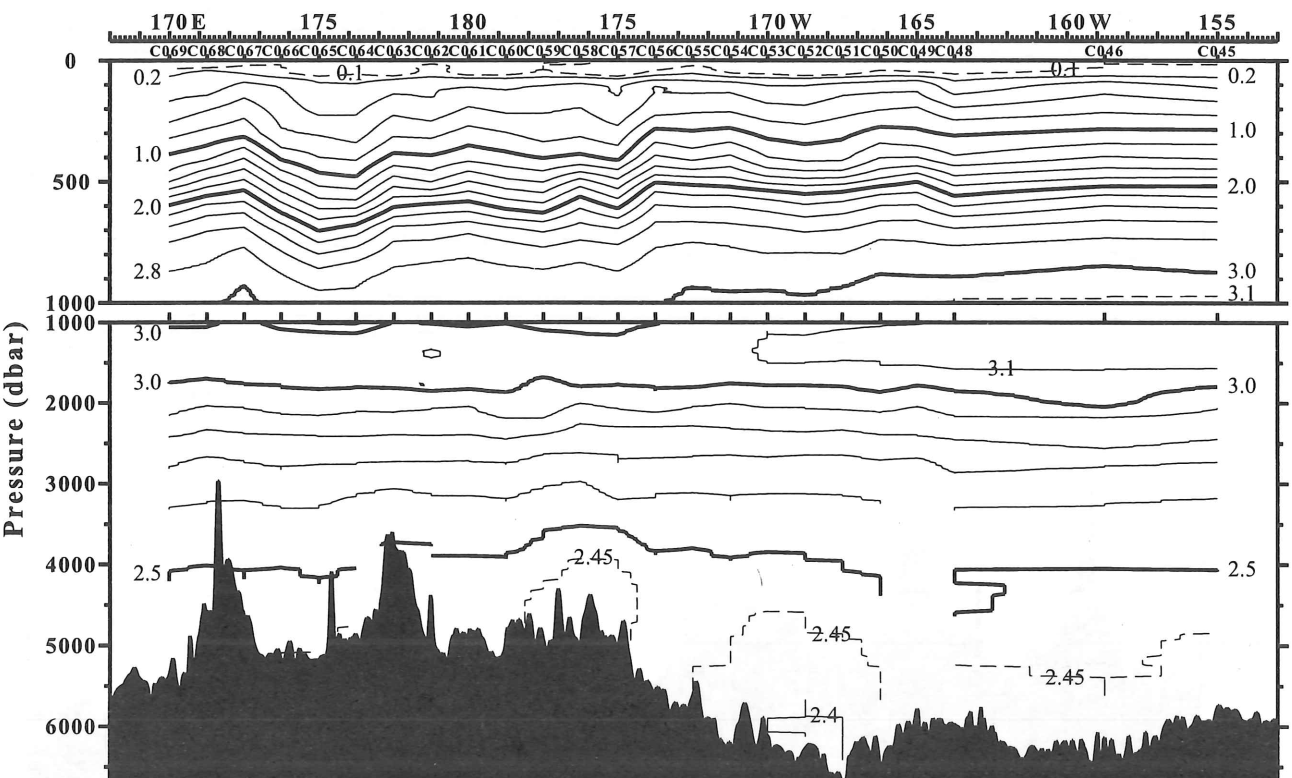
Silica (umol/kg)
36N line



Nitrate (umol/kg)
36N line

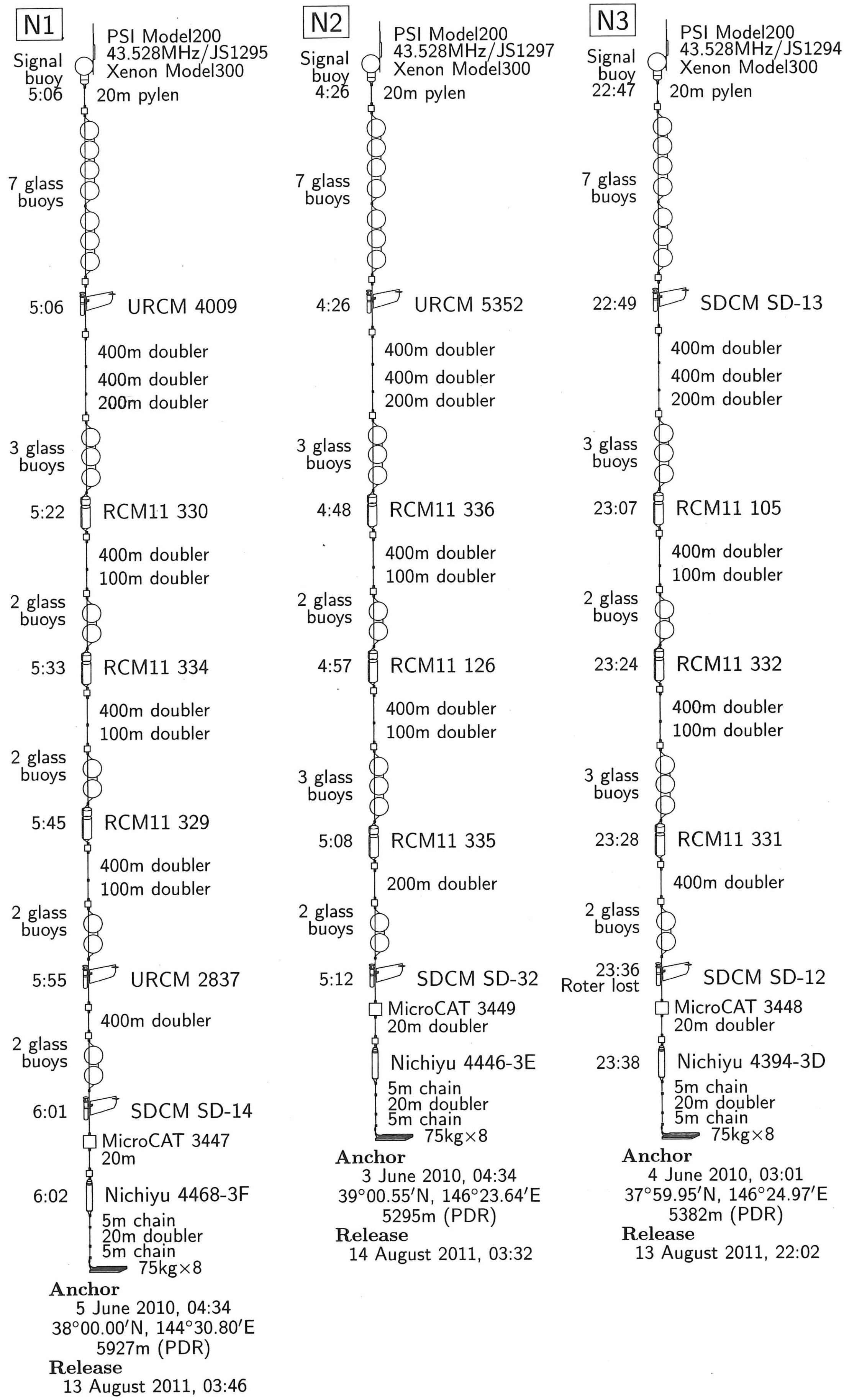


Phosphate (umol/kg)
36N line

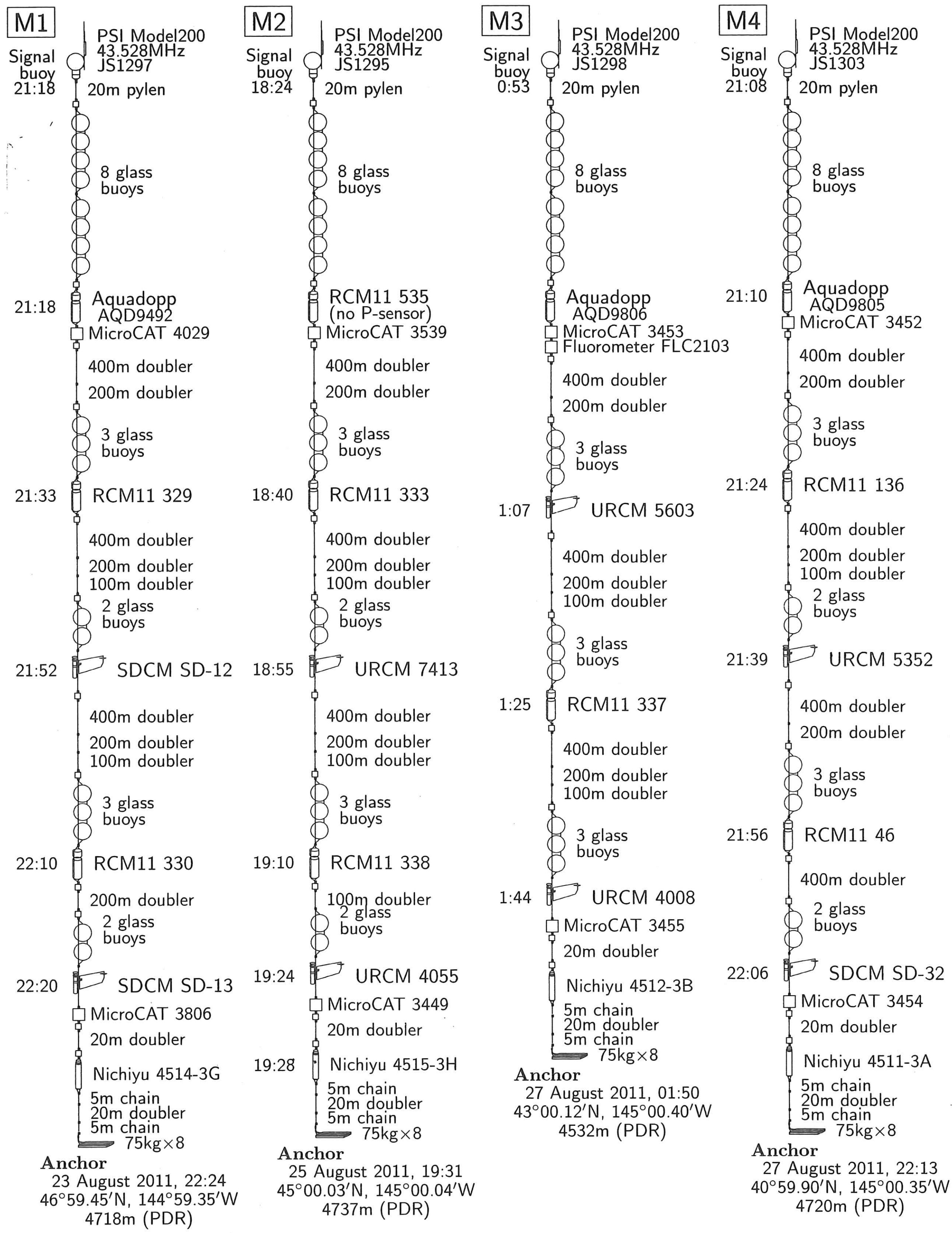


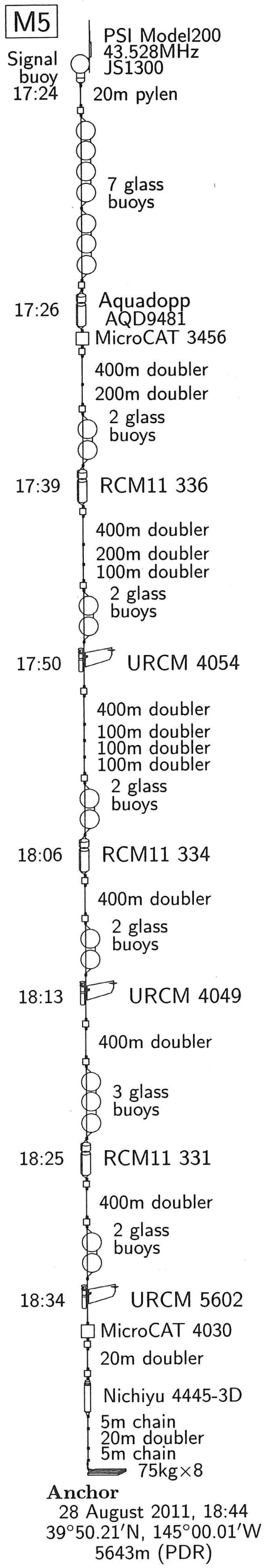
9. Mooring Systems

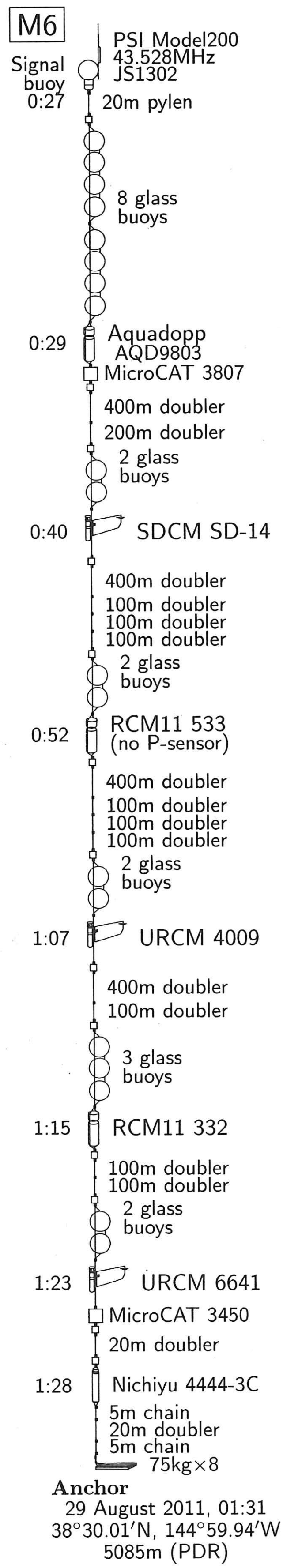
Recovered Systems in 38°N Area

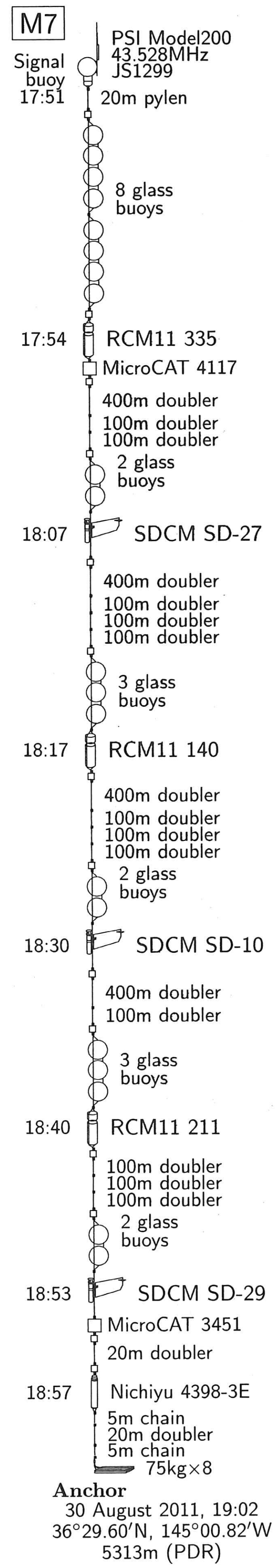


Deployed Systems at 145°W




M5
Signal buoy
17:24
PSI Model200
43.528MHz
JS1300
20m pylen
7 glass buoys
17:26
Aquadopp
AQD9481
MicroCAT 3456
400m doubler
200m doubler
2 glass buoys
17:39
RCM11 336
400m doubler
200m doubler
100m doubler
2 glass buoys
17:50
URCM 4054
400m doubler
100m doubler
100m doubler
100m doubler
2 glass buoys
18:06
RCM11 334
400m doubler
2 glass buoys
18:13
URCM 4049
400m doubler
3 glass buoys
18:25
RCM11 331
400m doubler
2 glass buoys
18:34
URCM 5602
MicroCAT 4030
20m doubler
Nichiyu 4445-3D
5m chain
20m doubler
5m chain
75kg×8
Anchor
28 August 2011, 18:44
39°50.21′N, 145°00.01′W
5643m (PDR)


M6
Signal buoy
0:27
PSI Model200
43.528MHz
JS1302
20m pylen
8 glass buoys
0:29
Aquadopp
AQD9803
MicroCAT 3807
400m doubler
200m doubler
2 glass buoys
0:40
SDCM SD-14
400m doubler
100m doubler
100m doubler
100m doubler
2 glass buoys
0:52
RCM11 533
(no P-sensor)
400m doubler
100m doubler
100m doubler
100m doubler
2 glass buoys
1:07
URCM 4009
400m doubler
100m doubler
3 glass buoys
1:15
RCM11 332
100m doubler
100m doubler
2 glass buoys
1:23
URCM 6641
MicroCAT 3450
20m doubler
1:28
Nichiyu 4444-3C
5m chain
20m doubler
5m chain
75kg×8
Anchor
29 August 2011, 01:31
38°30.01′N, 144°59.94′W
5085m (PDR)


M7
Signal buoy
17:51
PSI Model200
43.528MHz
JS1299
20m pylen
8 glass buoys
17:54
RCM11 335
MicroCAT 4117
400m doubler
100m doubler
100m doubler
2 glass buoys
18:07
SDCM SD-27
400m doubler
100m doubler
100m doubler
100m doubler
3 glass buoys
18:17
RCM11 140
400m doubler
100m doubler
100m doubler
100m doubler
2 glass buoys
18:30
SDCM SD-10
400m doubler
100m doubler
3 glass buoys
18:40
RCM11 211
100m doubler
100m doubler
100m doubler
2 glass buoys
18:53
SDCM SD-29
MicroCAT 3451
20m doubler
18:57
Nichiyu 4398-3E
5m chain
20m doubler
5m chain
75kg×8
Anchor
30 August 2011, 19:02
36°29.60′N, 145°00.82′W
5313m (PDR)

10. Results of Moored Current Meters