Preliminary Report
of
The Hakuho Maru Cruise
KH-96-4

17 October – 27 November 1996

Studies on the Kuroshio
from the East China Sea to the East of Japan
and Deep Currents in the Japan Trench

Ocean Research Institute
University of Tokyo
1998

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by

The Scientific Members of the Cruise

Edited by

Masaki KAWABE

CONTENTS

1. Cruise Narrative

The Cruise KH-96-4 of R.V. Hakuho Maru was carried out for 42 days from October 17 to November 27 in 1996 with a port call at Yokohama between November 10 and November 16, composed of leg 1 (Tokyo to Yokohama) and leg 2 (Yokohama to Tokyo). In leg 1, we stopped at Kagoshima urgently (October 26 16:00 ~ October 27 09:00) to exchange the CTD instrument (SBE Carousel water sampler) which broke down in an initial stage of the cruise. Thirty-six scientists from eight universities joined this cruise: 30 in leg 1 and 31 in leg 2.

Study subjects of the Cruise KH-96-4 are

(1) to study spatial characteristics of velocity and water mass of the Kuroshio,
(2) to study transport and conversion of water masses in the Kuroshio,
(3) to measure volume and heat transports of the Kuroshio over the Izu Ridge using multi-path inverted echo sounders,
(4) to study deep currents and water masses in the eastern region of Japan,
(5) to study a heat budget at the sea surface in the Kuroshio region,
(6) to study characteristics of marine microorganisms,
(7) to test a moored instrument for pop-up XBT (expendable bathythermograph),
(8) to measure a microstructure of current velocity using XCP (expendable current profiler).

1-1. Leg 1

The main subject of leg 1 is to estimate water properties such as water temperature, salinity, and dissolved oxygen as well as dynamical parameters such as velocity, transport, and vorticity of the Kuroshio and to clarify their spatial characteristics. For this purpose, we observed water properties and velocity of the Kuroshio from the East China Sea to the east region of Japan with $CTDO_2$ (conductivity-temperature-depth-oxygen profiler), XBT, and shipboard ADCP (acoustic Doppler current profiler) of the Furuno Electric Co., Ltd. and the RD Instruments. Full-depth $CTDO_2$ casts were done at 116 stations (Sta. C001~C116) in ten sections crossing the Kuroshio. At 51 stations out of 116, water was sampled with 12l Niskin bottles, and its salinity and dissolved oxygen were measured. The sample measurement was used to calibrate the sensors of conductivity and dissolved oxygen of $CTDO_2$. Casts of XBT were done at 71 stations for the complement of CTD observation. The XBT casts at the southeast line of Cape Ashizuri-misaki were done with an especially small interval of 5' latitude.

The SBE (Sea-Bird Electronics Inc.) Carousel water sampler broke down at Sta. C008 because of a water leakage. Then another sampler was carried from the Ocean Research Institute, and we picked it up at Kagoshima and used it at the CTD casts at Sta. C055~C100. The new sampler, however, broke at Sta. C101 due to a water leakage again. After all, water sampling could not be done at Sta.

C008~C054 and C101~C116. We faced another trouble of instrument that the automated oxygen titration instrument was unstable. It was alternated with the spare instrument at Sta. C067.

We received the AVHRR (Advanced Very High Resolution Radiometer) sea-surface-temperature data from the satellite NOAA to evaluate a path of the Kuroshio. They were useful to determine the location of CTD and XBT stations, although the data to the east of the Kii Peninsula were little available since it was quite cloudy.

During an almost entire period of leg 1, the vessel was shaken by large swells. We heaved to after the CTD cast at Sta. C035 northwest of Okinoerabu-jima, and changed the CTD line to the southeast of Amami-oshima decreasing a number of station. The urgent port call at Kagoshima also lost time, and the CTD stations east of the Kii Peninsula were much less than the original plan. In addition, a strange Kuroshio path east of the Izu Ridge confused us; it was located much farther south and offshore than the usual state in which the Kuroshio flows close to the Boso Peninsula. Due to this unusual situation of the Kuroshio, we could not fully cross the Kuroshio in the eastern region of Japan, in particular at the 145°E line.

Despite of interruption due to bad weather and instrument trouble, we could observe the Kuroshio and its offshore flow at many sections in the whole Kuroshio region within a short period of 21 days, and obtained a valuable dataset for studying the Kuroshio, in particular its spatial characteristics.

1-2. Leg 2

The main subject of leg 2 is to clarify deep currents in the Izu-Ogasawara and Japan Trenches and their eastern regions, in terms of distribution and characteristics of velocity and water masses. We recovered two moorings of current meter at 34°N in the Izu-Ogasawara Trench (TR1, TR3), deployed five moorings of current meters at 38°N in the Japan Trench and to the east (M1~M5), and made full-depth CTD casts at 23 stations on the lines of 38°N and 148°E (PC01~PC23). A deep-sea microbial in-situ incubator was attached to the mooring M4, and sterile water sampling was made with the Niskin Butterfly water samplers at eight CTD stations (PC06, PC10, PC11, PC15, PC17, PC19, PC22, PC23) for a study of marine microorganisms. Five casts of XCP were also made at CTD stations of PC01, PC13, PC14, PC18, and PC19 (XCP1~XCP5) to measure a microstructure of current velocity for a study of diapycnal diffusivity.

Moreover, we tried to recover seven moorings of multi-path inverted echo sounder (MIES) in the east region of Miyake-jima (MIES1~MIES7), but failed for two moorings. MIES1 did not respond to acoustic signals from the vessel, and MIES2 was released from the sea bottom but did not rise to the sea surface maybe due to a damage of a glass-sphere float. The MIES moorings are to measure

volume and heat transports of the Kuroshio. Seven casts of CTD were made at the mooring points (CMI1~CMI7). Water sampling with Niskin bottles was made at 23 CTD stations in leg 2 including three stations over the Izu Ridge.

The deep current at 34°N has been long measured since 1987 by the Division of Physical Oceanography of the Ocean Research Institute (ORI). The past results conclude that the deep current in the Izu-Ogasawara Trench is southward on the western slope and northward on the eastern slope. The mooring on the western slope at TR1 had been long continued, while that at TR3 was for the current in the upper part of the eastern slope which had little been observed. The moorings at 38°N were deployed in a blank region of current measurement, and are important for studying the local deep current in the Japan Trench and the global deep current coming from the South Pacific. All the moorings at 38°N were recovered in the cruise of R.V. Tansei Maru KT-97-14 in September 1997.

Like leg 1, strong wind was still blowing during leg 2. Therefore, the mooring work of M5 was postponed for two days, and we could not reach the south of 32°N for the CTD casts at 148°E which had been planned to finish at 30°N. We should say, however, that we were so fortunate that we finally did all mooring works, most of the CTD casts, and the other works we planned.

A moored instrument for pop-up XBT, which releases XBT probes upward and measures temperature structure with a constant time interval, was tested between leg 1 and leg 2, by deployed in leg 1 and recovered in leg 2. At almost all CTD stations, we sampled sea-surface water with a bucket to measure temperature, salinity, and dissolved oxygen at the sea surface, and sampled the intake water to correct the salinity data of the thermosalinograph. All temperature data of CTD and XBT were sent to the Japan Meteorological Agency just after the casts with the BATHY telegram. Throughout this cruise, radiation fluxes of heat were measured to study a budget of heat flux at the sea surface.

Acknowledgements

I really express my gratitude to the captain and crew of R.V. Hakuho Maru for their cooperation throughout the cruise, particularly works in bad weather and the urgent port call. Thanks are extended to the administration office and the technical support office of the ORI, in particular to Ms. E. Inukai and Mr. H. Hasumoto, for their help to the urgent port call and the transportation of the instrument. I also thank Dr. H. Ogawa for giving us instruction and advice for titration of dissolved oxygen before and during the cruise.

Chief Scientist of the Cruise KH-96-4
Masaki Kawabe

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 (SBE 32).

A2. Conductivity

Conductivity of water samples was measured with a salinometer Guildline Portasal Model 8410 which was standardized by IAPSO Standard Seawater (Ocean Scientific International Ltd.) of Batch P128 (K_{15}=0.99986). The measurement was done in a laboratory in which air temperature was controlled and was a little lower than water temperature in the salinometer water bath.

A3. Dissolved Oxygen

Dissolved oxygen of water samples was measured with an automatic recording titrator Hirama Laboratories ART-3. At the titration we used 0.05 mol l^{-1} Sodium Thiosulfate Solution (Wako Pure Chemical Industries Ltd.).

B. $CTDO_2$

B1. Instrument

The $CTDO_2$ was a Sea-Bird Electronics instrument equipped with a dissolved oxygen sensor. The sensor of conductivity was manufactured by the Sea-Bird Electronics, Inc. (SBE 4) who claimed a resolution of 0.0004 mmho cm^{-1} and an accuracy of ±0.003 mmho cm^{-1}. The sensor of water temperature was manufactured by the Sea-Bird Electronics, Inc. (SBE 3) who claimed a resolution of 0.0002°C and an initial accuracy of ±0.002°C. The sensor of pressure was manufactured by the 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 the Sea-Bird Electronics, Inc. (SBE 13).

B2. Data Collection

Full signals of frequency, digitized 24 times per second and sent from the underwater CTD unit SBE 9 plus (Sea-Bird Electronics, Inc.), were received with the onboard unit SBE 11 plus and converted to output sequences of IEEE-488 (GPIB). The data were collected with the Sea-Bird Electronics CTD operating software SEASOFT, using an IBM-compatible personal computer JD1994DX2-66 (PROSIDE Corp.) with a 215 MByte hard disc which was connected to the onboard unit by a GPIB cable. The full signals of frequency were put into the hard disc during the lowering stage of CTD cast and then were stored in magnetic optical discs at

the deepest point of the cast. The data during the whole CTD cast were backed up in digital audio tapes.

B3. Sensor Calibration

The sensors of conductivity and temperature were calibrated before the cruise by the Sea-Bird Electronics, Inc. The obtained calibration coefficients were used in the CTD operating software SEASOFT.

a. Pressure

The pressure data were corrected by subtracting the pressure-sensor value in the air of -1.0.

b. Conductivity

The conductivity data were moreover calibrated using the data from the analysis of water samples. The ratio of conductivity from water sample to that from CTD, called cell factor (CF), was calculated. The vertical change of the cell factor was expressed with the polynomials of pressure P (db) such as

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

The result of the coefficients a~f for a station or a station pair is as follows.

	a	b	c	d	e	f
C001-C006	1.000139	-0.101058E-6	-0.801766E-11	0.992529E-14	-0.104396E-17	0.0
C055-C059	1.000286	0.932803E-7	-0.643712E-9	0.6312330E-12	-0.244719E-15	0.329326E-19
C060-C062	1.000284	-0.156482E-6	0.639304E-10	-0.116647E-13	0.797677E-18	0.0
C063	1.000073	0.387523E-7	-0.155734E-9	0.106464E-12	-0.273249E-16	0.237956E-20
C064	1.000312	-0.925251E-7	-0.487941E-11	0.322798E-14	0.0	0.0
C065-C071	1.000282	-0.180360E-6	0.118573E-9	-0.356550E-13	0.376992E-17	0.0
C072	1.000063	-0.114586E-7	0.248132E-10	-0.179173E-13	0.279210E-17	0.0
C073-C084	1.000283	-0.277032E-6	0.133390E-9	-0.194706E-13	0.0	0.0
C085	1.000078	-0.846814E-7	0.149703E-10	0.0	0.0	0.0
C086-C087	1.000218	-0.638818E-7	-0.161768E-11	0.249495E-14	0.0	0.0
C088-C091	1.000294	-0.904471E-7	0.126275E-10	0.0	0.0	0.0
C092-C095	1.000344	-0.282007E-6	0.110379E-9	-0.132273E-13	0.0	0.0
C096	1.000112	-0.866311E-7	0.399255E-10	-0.646305E-14	0.259039E-18	0.0
C097	1.000096	-0.180628E-6	0.897729E-10	-0.137376E-13	0.0	0.0
C098-C100	1.000262	-0.395812E-6	0.644166E-9	-0.565114E-12	0.216184E-15	-0.288398E-19
CMI1-CMI5	1.000358	-0.363832E-6	0.294508E-9	0.0	0.0	0.0
PC04-PC07	1.000422	-0.374863E-6	0.311640E-9	-0.120205E-12	0.207345E-16	-0.129321E-20

PC08	1.000344	-0.441829E-6	0.362714E-9	-0.149900E-12	0.286692E-16	-0.199780E-20
PC09-PC10	1.000422	-0.201804E-6	0.844202E-10	-0.173217E-13	0.141493E-17	0.0
PC11	1.000210	-0.631742E-7	0.697544E-11	0.0	0.0	0.0
PC12	1.000323	-0.211436E-7	0.0	0.0	0.0	0.0
PC13-PC14	1.000213	0.957049E-7	-0.169886E-9	0.709818E-13	-0.122214E-16	0.769698E-21
PC15-PC21	1.000319	-0.555879E-7	-0.630242E-12	0.270626E-14	-0.444222E-18	0.349401E-22
PC22	1.000116	0.110247E-6	-0.955967E-10	0.229247E-13	-0.172104E-17	0.0
PC23	1.000383	-0.118925E-6	0.168819E-10	0.0	0.0	0.0

The calibration was made with the cell factors computed from the above equation and coefficients. The salinity from the corrected conductivity was compared with the water-sample salinity. Finally, the conductivity at 26 stations (C001~C006, C036~C040, C055, C060, C061, C063, C066, C072, C085, CMI3, CMI5, PC08, PC09, PC11, PC16, PC19, PC22) was corrected with the above equation but not for the other stations.

Salinity was calculated with the conductivity. The salinity and temperature at pressure more than 1500 db were smoothed by a 20-db running mean. Moreover, deep salinity values were shifted to the water-sample values at C002 (> 1400db), PC04·PC06·PC07·PC09·PC22 (> 1600db), C060·C061·C086·C096·C097 ·PC05·PC10·PC12·PC19~PC21 (> 1800db), C058·C064·C066·C088·C090·C100· PC13·PC14·PC16·PC18·PC23 (> 2000db), C084·PC15 (> 2500db), C069·C087· PC17 (> 3000db), C070 (> 3500db), C067·C068·C071·PC08 (> 4000db).

The deep salinity data at Sta. C101~C116, where we could not sample seawater due to the water sampler trouble, were corrected by adding the correction ΔS. It was evaluated by the differences between the water-sample salinity and the CTD salinity with the no-corrected conductivity at Sta. PC04~PC12;

$$\Delta S = \begin{cases} 0 & (P < 1500\text{db}), \\ [1-(P-3000\text{db})^2/(1500\text{db}-3000\text{db})^2] \times 0.0032 & (1500\text{db} < P < 3000\text{db}), \\ 0.0032 & (P > 3000\ \text{db}). \end{cases}$$

c. Dissolved Oxygen

The 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. Dissolved oxygen was calculated from the polarographic oxygen sensor electric current and probe temperature with the algorithm

$$O_x = \left[A(O_c + B\frac{dO_c}{dt}) + C \right] O_x^*(T,S) \exp\left[D\{T + E(T_o - T)\} + FP\right]$$

where O_x is the concentration of dissolved oxygen (ml l^{-1}), O_c the oxygen electric current (mA), T_o the oxygen sensor temperature (°C), T, S, and P are water temperature (°C), salinity (psu), and pressure (db) measured with CTD, $O_x^*(T,S)$ the saturated oxygen for T and S, and t is time (sec). Initially, the oxygen electric current Oc was smoothed by a running mean of 15 data (taking 24 data s^{-1}), and six parameters A-F were determined with a nonlinear least squares fitting to the oxygen of water samples.

The result of the coefficients is shown below (the numbers on the right side of the station name are the number of station, the number of water sample, the number of the sample used for the calculation, the average and standard deviation of the difference in oxygen between the water-sample value and the corrected sensor value).

C001-C006	5	135	111	-0.00415	0.06358	A-F= 2.292, 0.000, 0.0440, -0.0245, 1.495, 0.00013
C055-C078	22	895	739	0.00689	0.16300	A-F= 2.695, 0.000, 0.0037, -0.0303, 1.651, 0.00014
C079-C100	22	954	785	-0.00324	0.05825	A-F= 2.588, 0.000, -0.0006, -0.0292, 1.560, 0.00015
CMI1-PC23	23	996	737	-0.00476	0.04311	A-F= 2.632, 0.000, 0.0056, -0.0301, 1.740, 0.00014

for the sensor values at the time of water sampling,

C001-C078	27	1011	672	-0.00859	0.07157	A-F= 2.615, 13.675, 0.0056, -0.0296, 1.303, 0.00014
C079-C100	22	956	803	-0.00245	0.05507	A-F= 2.595, 7.312, -0.0018, -0.0293, 1.368, 0.00015
CMI1-PC23	23	996	799	-0.00404	0.04395	A-F= 2.632, 12.452, 0.0043, -0.0296, 1.406, 0.00014

for the sensor values with a 1-db interval taken during the lowering cast,

The noisy values at PC05 between 2744 db and 2784 db were removed by the linear interpolation. The oxygen values at pressure more than 1500 db were smoothed by a 20-db running mean. Moreover, deep oxygen values were shifted to the water-sample values at CMI1 (> 500db), C002 (> 1400db), PC09 (> 1600db), C088·PC15·PC17 (> 1800db), C001·C066·C086·PC18 (> 2000db), C083·PC04 (> 2500db), PC21 (> 3000db), C067·PC05 (> 3500db), PC12·PC16 (> 4000db), PC07·PC13·PC14 (> 4500db), PC06·PC08·PC19·PC20·PC22·PC23 (> 5000db).

C. XBT

The Sparton XBT-7 probes were used. The depth of a falling XBT probe, z (m), was computed with the equation of the elapse time, t (sec), after falling from the sea surface:

$$z = 6.472 \cdot t - 0.00216 \cdot t^2.$$

D. ADCP

D1. ADCP of the Furuno Electric Co., Ltd.

The raw data of current velocity are taken in an interval of 15 seconds. The data were averaged for every one minute.

D2. ADCP of the RD Instruments

Accuracy of the measured velocity components is decreased by uncertainty of the ship heading direction and the measured flow direction relative to the ship head. The ship heading direction data by the gyrocompass is input manually when the system is switched on. Error of this input value is a source of inaccuracy of the measurement. Another source is a deviation of the direction of the shipboard transducer from the original design.

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

$$u_w = u_s + (1+\beta)(u'_d \cos\alpha - v'_d \sin\alpha)$$

$$v_w = v_s + (1+\beta)(u'_d \cos\alpha + v'_d \sin\alpha),$$

where α is the orientation error, and $1+\beta$ is the scale factor.

The absolute (correct) current velocity was measured by the sea-bottom tracking in the East China Sea (leg 1) and over the Izu Ridge (leg 2). This data was used as (u_w, v_w). The simultaneous data of the ship speed computed from the ship position measured by the Global Positioning System and the current velocity relative to the ship movement measured by the ADCP were used as (u_s, v_s) and (u_d, v_d), respectively. The result of the fitting in the equations was

$$\alpha \text{ (deg)} = \text{-0.058 (leg 1), -0.524 (leg 2)}$$

$$1+\beta = \text{0.933 (leg 1), 0.904 (leg 2).}$$

The current velocity data from the ADCP were corrected with the above equations and coefficients.

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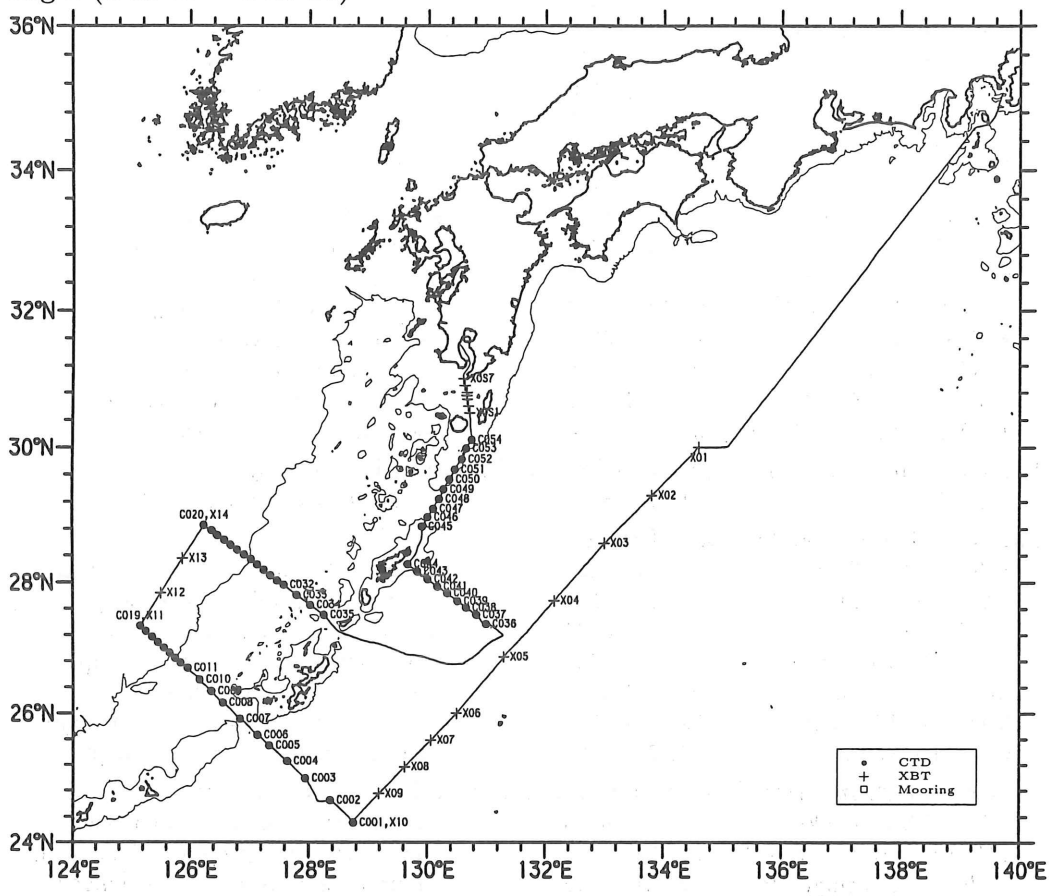
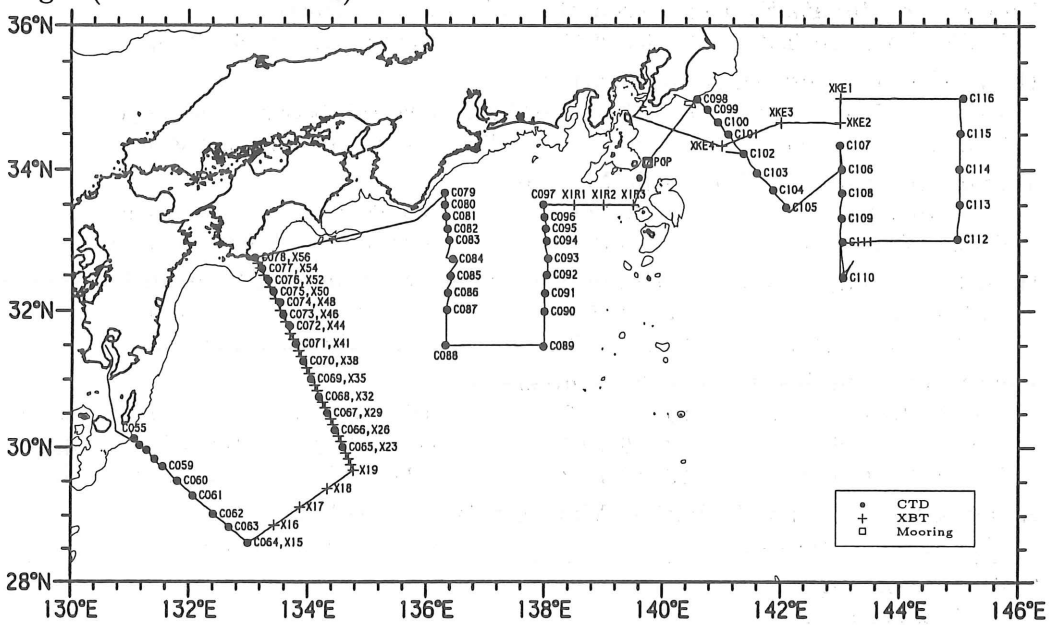
*1 Participating Leg-1
*2 Participating Leg-2

4. Track Charts

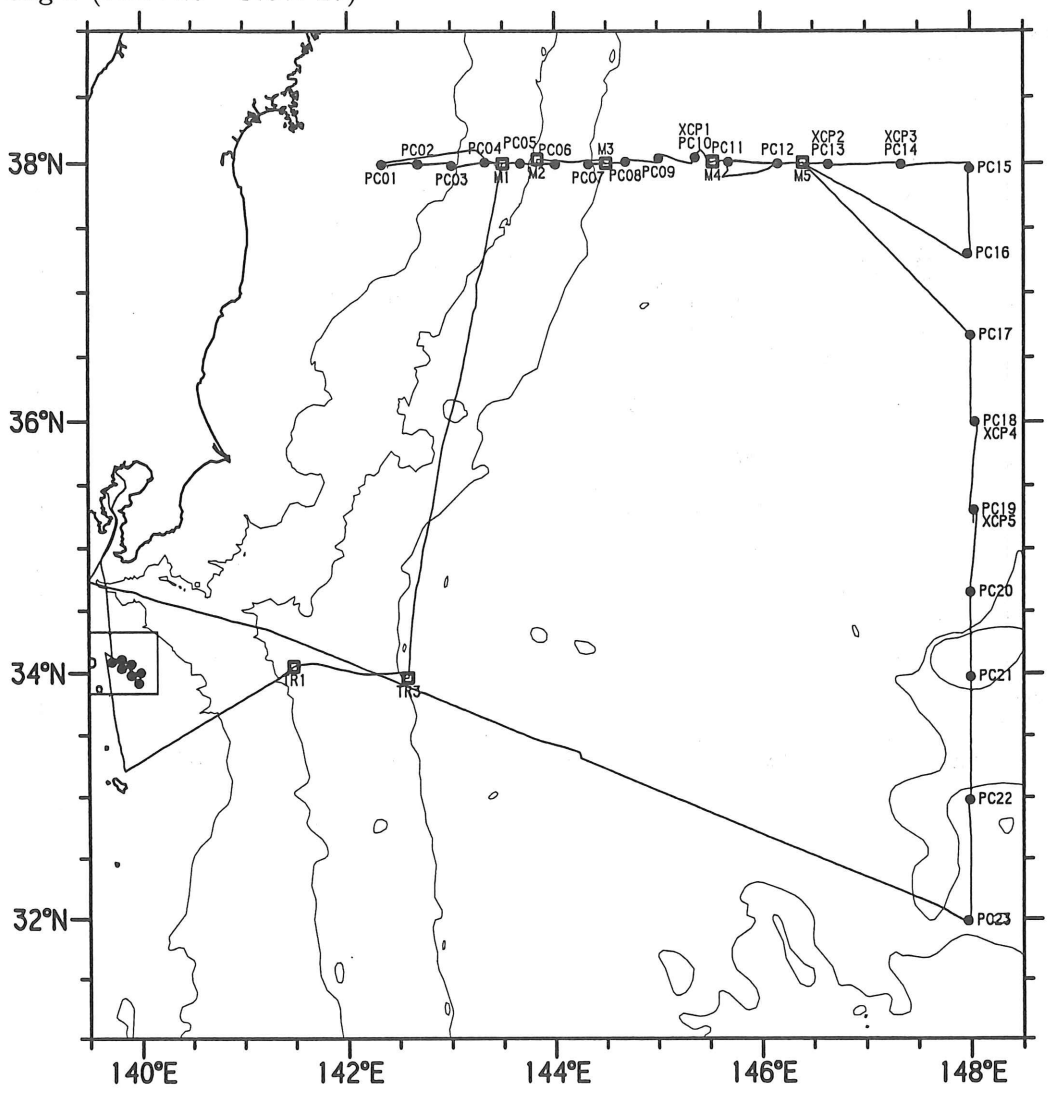
Leg-1 (Oct. 17 – Oct. 26)



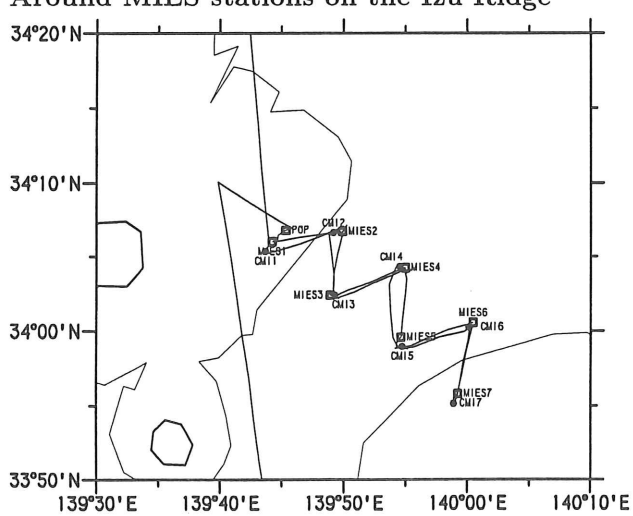
Leg-1 (Oct. 27 – Nov. 10)

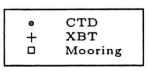


Leg-2 (Nov. 16 – Nov. 27)

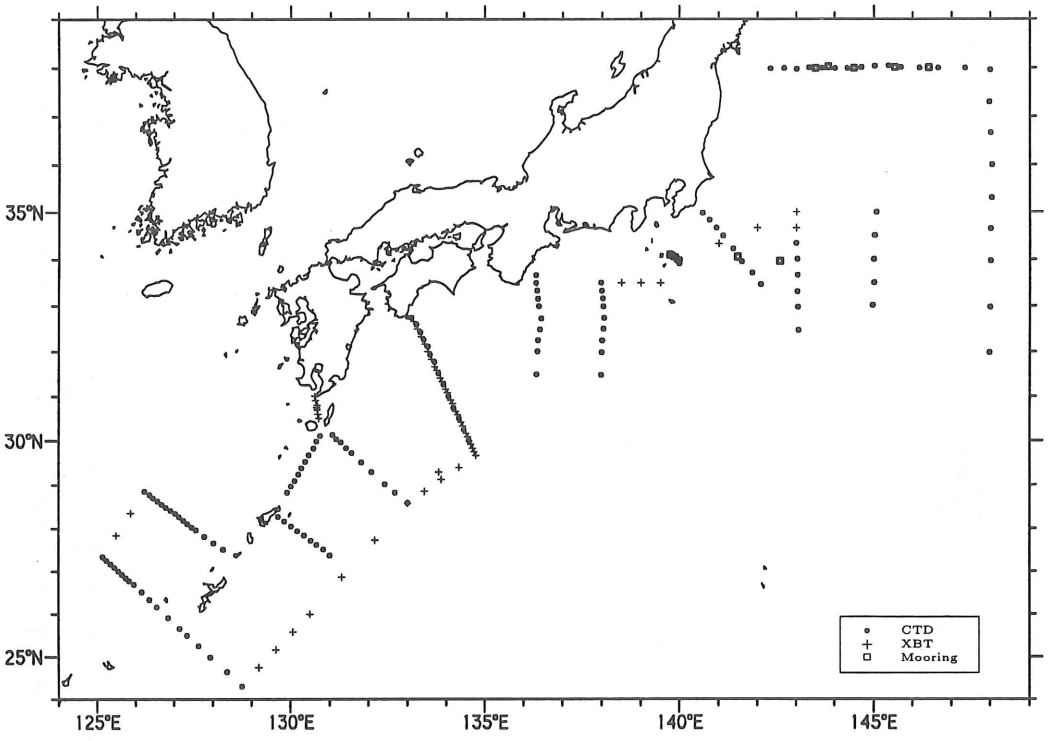


Around MIES stations on the Izu Ridge



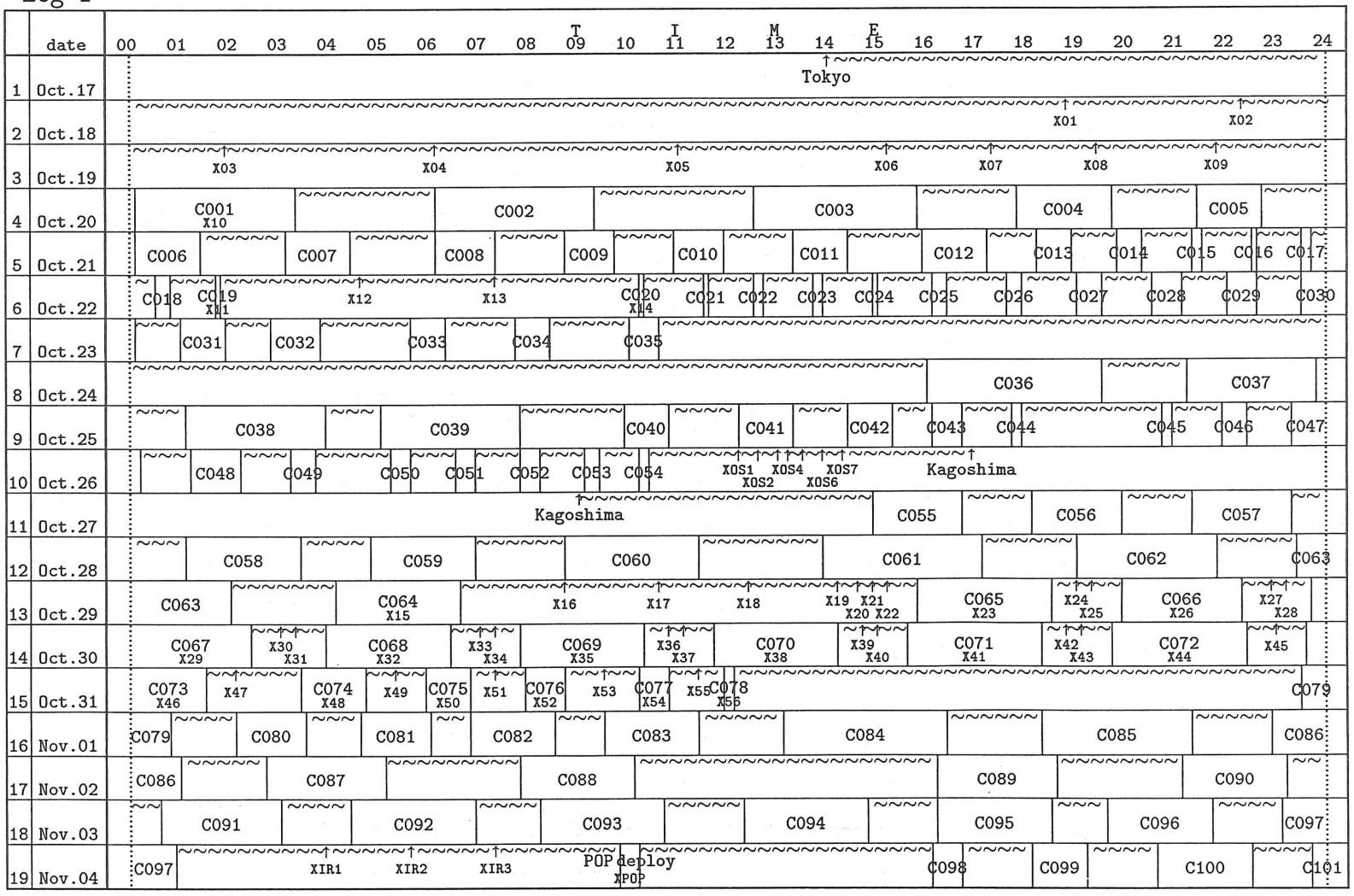


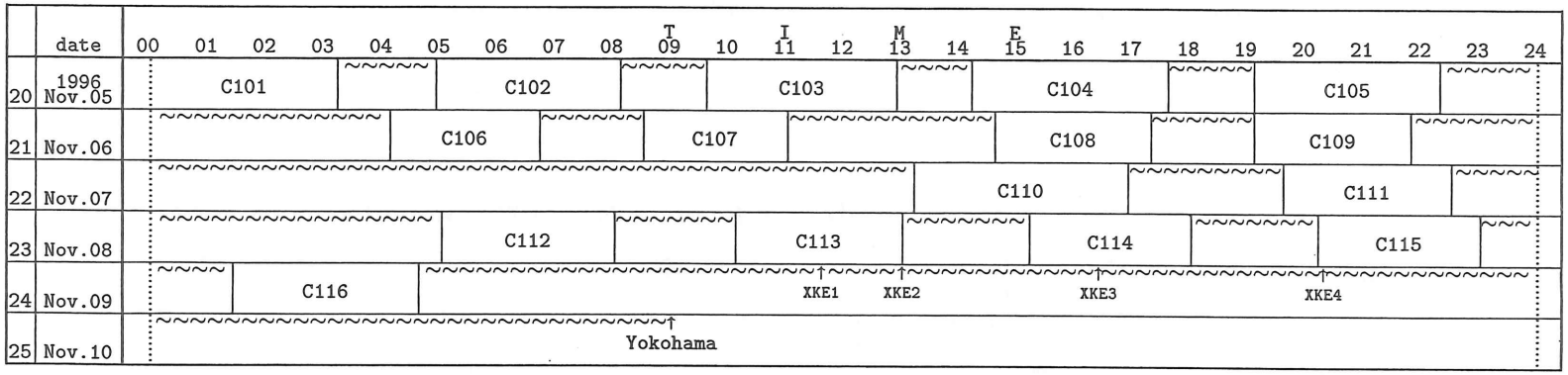
Distribution of all stations



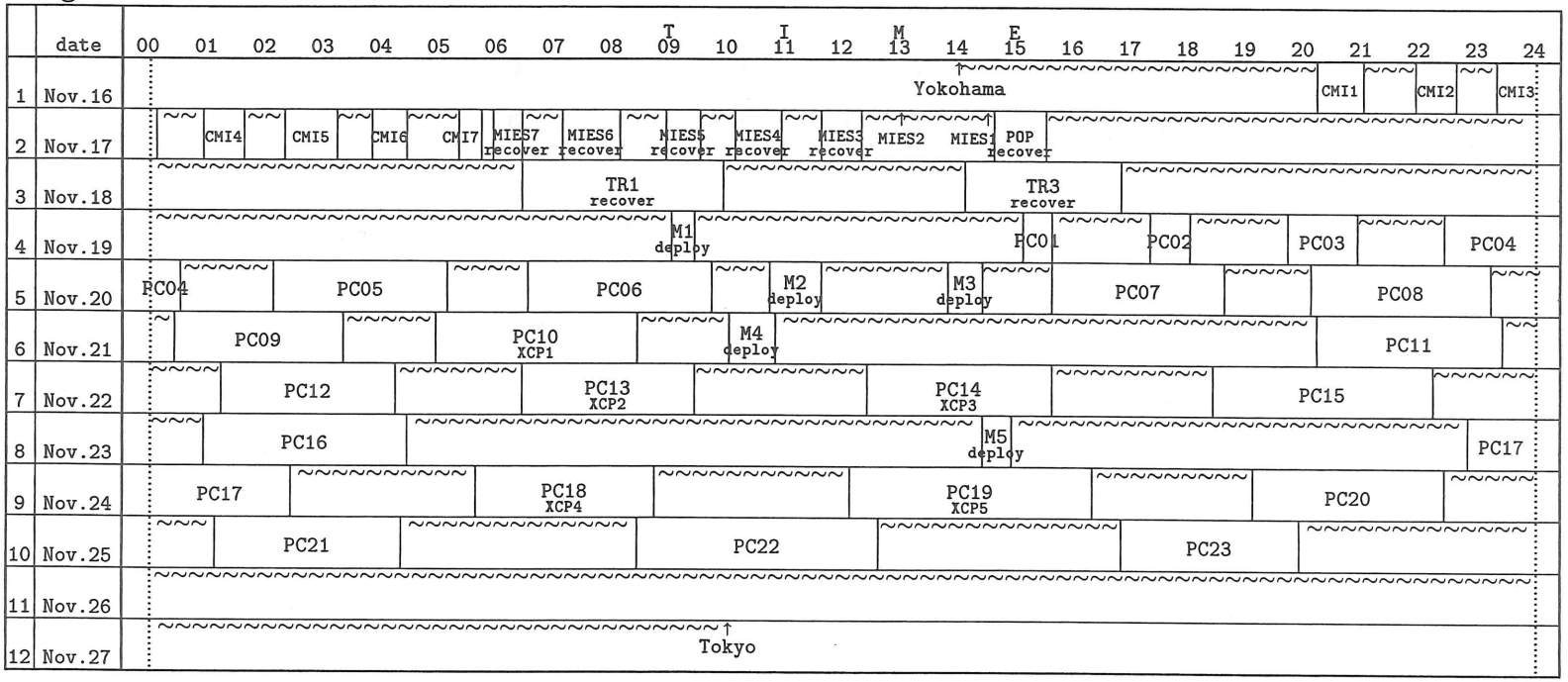
Time Table

Leg 1




date
00 01 02 03 04 05 06 07 08 T 09 10 I 11 12 M 13 14 E 15 16 17 18 19 20 21 22 23 24
20 1996 Nov.05
C101
C102
C103
C104
C105
21 Nov.06
C106
C107
C108
C109
22 Nov.07
C110
C111
23 Nov.08
C112
C113
C114
C115
24 Nov.09
C116
XKE1
XKE2
XKE3
XKE4
25 Nov.10
Yokohama

Leg 2


date
00 01 02 03 04 05 06 07 08 T 09 10 I 11 12 M 13 14 E 15 16 17 18 19 20 21 22 23 24
1 Nov.16
Yokohama
CMI1
CMI2
CMI3
2 Nov.17
CMI4
CMI5
CMI6
CMI7
MIES7 recover
MIES6 recover
MIES5 recover
MIES4 recover
MIES3 recover
MIES2
MIES1
POP recover
3 Nov.18
TR1 recover
TR3 recover
4 Nov.19
M1 deploy
PC01
PC02
PC03
PC04
5 Nov.20
PC04
PC05
PC06
M2 deploy
M3 deploy
PC07
PC08
6 Nov.21
PC09
PC10 XCP1
M4 deploy
PC11
7 Nov.22
PC12
PC13 XCP2
PC14 XCP3
PC15
8 Nov.23
PC16
M5 deploy
PC17
9 Nov.24
PC17
PC18 XCP4
PC19 XCP5
PC20
10 Nov.25
PC21
PC22
PC23
11 Nov.26
12 Nov.27
Tokyo

6. Summary of Observation Stations

STNNBR: Station number
TYPE: CTD=CTDO only, ROS=CTDO plus Rosette water sampler
MOR=Mooring, XBT=XBT, XCP=XCP
CODE: BE=Beginning of cast or mooring deployment,
BO=Bottom time for cast, EN=Time cast completed
DE=Time mooring, or XBT was deployed, RE=Time mooring was recovered
BOTDEP: Bottom depth in meters
MAXPRS: Maximum pressure in decibars
PARAM: Sampling Parameters: S=Salinity, O=Dissolved oxygen, Bio=Niskin Butterfly

Leg 1

X01	XBT	10/18/96	09:45	DE	29°59.95'N	134°35.91'E	4624	
X02	XBT	10/18/96	13:15	DE	29°17.49'N	133°48.17'E	2148	
X03	XBT	10/18/96	16:52	DE	28°34.91'N	132°59.91'E	4409	
X04	XBT	10/18/96	21:03	DE	27°43.33'N	132°09.46'E	6393	
X05	XBT	10/19/96	01:59	DE	26°51.69'N	131°18.41'E	5174	
X06	XBT	10/19/96	06:13	DE	25°59.95'N	130°29.91'E	4096	
X07	XBT	10/19/96	08:21	DE	25°35.00'N	130°03.61'E	5005	
X08	XBT	10/19/96	10:25	DE	25°10.00'N	129°37.32'E	4102	
X09	XBT	10/19/96	12:47	DE	24°44.99'N	129°11.10'E	6046	
C001	ROS	10/19/96	15:07	BE	24°19.71'N	128°45.10'E	5226	
X10	XBT	10/19/96	15:29	DE	24°18.90'N	128°45.24'E	5254	
C001	ROS	10/19/96	17:02	BO	24°18.26'N	128°45.19'E	5652	5349 S,O
C001	ROS	10/19/96	18:22	EN	24°17.88'N	128°44.94'E	7260	
C002	ROS	10/19/96	21:06	BE	24°39.74'N	128°21.12'E	5835	
C002	ROS	10/19/96	22:56	BO	24°38.78'N	128°21.65'E	5994	5944 S,O
C002	ROS	10/20/96	00:20	EN	24°38.64'N	128°21.00'E	5897	
C003	ROS	10/20/96	03:32	BE	24°59.86'N	127°57.14'E	5982	
C003	ROS	10/20/96	05:58	BO	24°59.26'N	127°56.53'E	6611	6003 S,O
C003	ROS	10/20/96	06:51	EN	24°59.37'N	127°56.35'E	9794	
C004	ROS	10/20/96	08:48	BE	25°15.08'N	127°38.73'E	3082	
C004	ROS	10/20/96	09:46	BO	25°15.39'N	127°38.46'E	2798	2788 S,O
C004	ROS	10/20/96	10:42	EN	25°15.55'N	127°38.13'E	2748	
C005	CTD	10/20/96	12:26	BE	25°29.86'N	127°20.67'E	2202	
C005	CTD	10/20/96	13:09	BO	25°30.09'N	127°20.24'E	2148	2158
C005	CTD	10/20/96	13:44	EN	25°30.32'N	127°20.17'E	2123	
C006	ROS	10/20/96	15:09	BE	25°39.91'N	127°08.90'E	1387	
C006	ROS	10/20/96	15:49	BO	25°39.78'N	127°08.45'E	1373	1359 S,O
C006	ROS	10/20/96	16:29	EN	25°39.58'N	127°08.00'E	1395	
C007	CTD	10/20/96	18:06	BE	25°54.87'N	126°50.97'E	1727	
C007	CTD	10/20/96	18:54	BO	25°54.88'N	126°50.44'E	1726	1653
C007	CTD	10/20/96	19:25	EN	25°55.07'N	126°50.21'E	1695	
C008	CTD	10/20/96	21:05	BE	26°09.97'N	126°32.91'E	1594	
C008	CTD	10/20/96	21:41	BO	26°09.84'N	126°32.58'E	1498	1463
C008	CTD	10/20/96	22:17	EN	26°09.68'N	126°32.32'E	1504	
C009	CTD	10/20/96	23:40	BE	26°20.25'N	126°21.03'E	1645	
C009	CTD	10/21/96	00:09	BO	26°20.35'N	126°21.08'E	1732	1584
C009	CTD	10/21/96	00:37	EN	26°20.58'N	126°21.19'E	1600	
C010	CTD	10/21/96	01:52	BE	26°30.13'N	126°09.12'E	2104	
C010	CTD	10/21/96	02:28	BO	26°30.90'N	126°09.32'E	1753	1753
C010	CTD	10/21/96	02:53	EN	26°31.23'N	126°09.60'E		
C011	CTD	10/21/96	04:15	BE	26°40.15'N	125°57.06'E	1640	
C011	CTD	10/21/96	04:57	BO	26°41.52'N	125°57.19'E	1620	1577
C011	CTD	10/21/96	05:20	EN	26°42.06'N	125°57.25'E	1625	

STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
C012	CTD	10/21/96	06:48	BE	26°45.25′N	125°50.83′E	1223		
C012	CTD	10/21/96	07:27	BO	26°46.29′N	125°50.01′E	1213	1148	
C012	CTD	10/21/96	08:09	EN	26°47.23′N	125°51.18′E	1199		
C013	CTD	10/21/96	09:05	BE	26°50.36′N	125°44.64′E	948		
C013	CTD	10/21/96	09:27	BO	26°50.57′N	125°44.61′E	924	894	
C013	CTD	10/21/96	09:48	EN	26°50.75′N	125°44.61′E	940		
C014	CTD	10/21/96	10:43	BE	26°55.08′N	125°39.02′E			
C014	CTD	10/21/96	11:10	BO	26°55.28′N	125°38.96′E	217	181	
C014	CTD	10/21/96	11:14	EN	26°55.29′N	125°38.89′E	214		
C015	CTD	10/21/96	12:11	BE	26°59.98′N	125°33.15′E	154		
C015	CTD	10/21/96	12:18	BO	27°00.04′N	125°33.20′E	152	128	
C015	CTD	10/21/96	12:22	EN	27°00.07′N	125°33.27′E	154		
C016	CTD	10/21/96	13:25	BE	27°05.07′N	125°27.09′E	142		
C016	CTD	10/21/96	13:30	BO	27°05.10′N	125°27.02′E	117	117	
C016	CTD	10/21/96	13:33	EN	27°05.13′N	125°27.02′E	139		
C017	CTD	10/21/96	14:28	BE	27°10.04′N	125°21.15′E	123		
C017	CTD	10/21/96	14:32	BO	27°10.04′N	125°21.13′E	122	98	
C017	CTD	10/21/96	14:37	EN	27°10.07′N	125°21.07′E	81		
C018	CTD	10/21/96	15:28	BE	27°15.09′N	125°14.91′E	231		
C018	CTD	10/21/96	15:43	BO	27°15.27′N	125°14.61′E	116	116	
C018	CTD	10/21/96	15:48	EN	27°15.32′N	125°14.53′E	116		
C019	CTD	10/21/96	16:40	BE	27°20.11′N	125°08.91′E	106		
C019	CTD	10/21/96	16:46	BO	27°20.19′N	125°08.87′E	110	97	
C019	CTD	10/21/96	16:49	EN	27°20.23′N	125°08.84′E	110		
X11	XBT	10/21/96	16:54	DE	27°20.33′N	125°08.79′E	215		
X12	XBT	10/21/96	19:32	DE	27°50.10′N	125°29.78′E	109		
X13	XBT	10/21/96	22:13	DE	28°21.12′N	125°51.92′E	116		
X14	XBT	10/22/96	00:56	DE	28°50.96′N	126°13.47′E	108		
C020	CTD	10/22/96	01:06	BE	28°50.78′N	126°13.46′E	108		
C020	CTD	10/22/96	01:11	BO	28°50.99′N	126°13.54′E	107	90	
C020	CTD	10/22/96	01:13	EN	28°51.00′N	126°13.54′E	104		
C021	CTD	10/22/96	02:25	BE	28°46.35′N	126°21.41′E	120		
C021	CTD	10/22/96	02:29	BO	28°46.33′N	126°21.42′E	118	102	
C021	CTD	10/22/96	02:32	EN	28°46.35′N	126°21.47′E	119		
C022	CTD	10/22/96	03:24	BE	28°42.01′N	126°26.89′E	144		
C022	CTD	10/22/96	03:29	BO	28°41.99′N	126°26.90′E	139	102	
C022	CTD	10/22/96	03:34	EN	28°41.96′N	126°26.86′E	129		
C023	CTD	10/22/96	04:34	BE	28°37.66′N	126°33.88′E	137		
C023	CTD	10/22/96	04:40	BO	28°37.74′N	126°33.90′E	141	116	
C023	CTD	10/22/96	04:43	EN	28°37.80′N	126°33.89′E	140		
C024	CTD	10/22/96	05:47	BE	28°33.14′N	126°40.37′E	152		
C024	CTD	10/22/96	05:52	BO	28°33.29′N	126°40.30′E	151	126	
C024	CTD	10/22/96	05:55	EN	28°33.35′N	126°40.25′E	151		
C025	CTD	10/22/96	06:59	BE	28°28.76′N	126°47.12′E	209		
C025	CTD	10/22/96	07:11	BO	28°29.02′N	126°47.08′E	210	183	
C025	CTD	10/22/96	07:17	EN	28°29.13′N	126°47.02′E			
C026	CTD	10/22/96	08:29	BE	28°24.32′N	126°54.15′E	281		
C026	CTD	10/22/96	08:38	BO	28°24.63′N	126°54.28′E	280	256	
C026	CTD	10/22/96	08:45	EN	28°24.88′N	126°54.30′E	278		
C027	CTD	10/22/96	09:54	BE	28°20.02′N	127°00.92′E	615		
C027	CTD	10/22/96	10:15	BO	28°20.71′N	127°01.15′E	622	583	
C027	CTD	10/22/96	10:26	EN	28°21.06′N	127°01.21′E	618		
C028	CTD	10/22/96	11:22	BE	28°15.13′N	127°07.29′E	966		
C028	CTD	10/22/96	11:48	BO	28°15.75′N	127°07.57′E	966	938	
C028	CTD	10/22/96	12:01	EN	28°15.99′N	127°07.69′E	967		

STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
C029	CTD	10/22/96	12:53	BE	28°10.54′N	127°14.08′E	1050		
C029	CTD	10/22/96	13:16	BO	28°10.97′N	127°14.11′E	1073	1040	
C029	CTD	10/22/96	13:30	EN	28°11.18′N	127°14.19′E	1065		
C030	CTD	10/22/96	14:24	BE	28°05.87′N	127°20.78′E	1050		
C030	CTD	10/22/96	14:47	BO	28°06.09′N	127°20.68′E	1050	1043	
C030	CTD	10/22/96	15:03	EN	28°06.29′N	127°20.59′E	986		
C031	CTD	10/22/96	15:58	BE	28°01.37′N	127°27.50′E	1175		
C031	CTD	10/22/96	16:30	BO	28°01.35′N	127°27.47′E	1152	1144	
C031	CTD	10/22/96	16:51	EN	28°01.58′N	127°27.32′E	1177		
C032	CTD	10/22/96	17:47	BE	27°57.04′N	127°34.34′E	1296		
C032	CTD	10/22/96	18:27	BO	27°57.60′N	127°34.12′E	1302	1305	
C032	CTD	10/22/96	18:48	EN	27°57.79′N	127°33.97′E	2443		
C033	CTD	10/22/96	20:34	BE	27°48.07′N	127°47.62′E	1051		
C033	CTD	10/22/96	20:59	BO	27°48.31′N	127°47.37′E	1051	954	
C033	CTD	10/22/96	21:15	EN	27°48.45′N	127°47.23′E	1430		
C034	CTD	10/22/96	22:43	BE	27°39.05′N	128°01.42′E	605		
C034	CTD	10/22/96	23:12	BO	27°39.37′N	128°01.09′E	800	785	
C034	CTD	10/22/96	23:25	EN	27°39.46′N	128°01.03′E	722		
C035	CTD	10/23/96	01:02	BE	27°30.27′N	128°15.04′E	1222		
C035	CTD	10/23/96	01:22	BO	27°30.39′N	128°15.00′E	1030	1015	
C035	CTD	10/23/96	01:35	EN	27°30.48′N	128°15.00′E	1035		
C036	CTD	10/24/96	07:02	BE	27°22.94′N	131°00.67′E	6119		
C036	CTD	10/24/96	09:21	BO	27°21.96′N	131°00.07′E	5600	5584	
C036	CTD	10/24/96	10:34	EN	27°21.23′N	131°00.25′E			
C037	CTD	10/24/96	12:14	BE	27°30.83′N	130°50.02′E	5031		
C037	CTD	10/24/96	13:48	BO	27°30.41′N	130°50.06′E	5074	5158	
C037	CTD	10/24/96	14:50	EN	27°30.24′N	130°50.31′E	5100		
C038	CTD	10/24/96	16:09	BE	27°37.08′N	130°39.51′E	5046		
C038	CTD	10/24/96	17:55	BO	27°36.94′N	130°39.56′E	5070	5140	
C038	CTD	10/24/96	18:57	EN	27°36.88′N	130°39.60′E	5070		
C039	CTD	10/24/96	20:00	BE	27°43.43′N	130°30.15′E	4962		
C039	CTD	10/24/96	21:45	BO	27°42.84′N	130°30.75′E	5163	5183	
C039	CTD	10/24/96	22:45	EN	27°42.58′N	130°31.05′E	5032		
C040	CTD	10/25/96	00:57	BE	27°49.93′N	130°20.07′E	3400		
C040	CTD	10/25/96	01:09	BO	27°50.12′N	130°20.40′E	3443	3450	
C040	CTD	10/25/96	01:49	EN	27°50.10′N	130°20.41′E	3445		
C041	CTD	10/25/96	03:13	BE	27°56.25′N	130°09.91′E			
C041	CTD	10/25/96	03:56	BO	27°55.99′N	130°10.17′E	1638	1635	
C041	CTD	10/25/96	04:16	EN	27°55.88′N	130°10.38′E	1647		
C042	CTD	10/25/96	05:26	BE	28°02.87′N	130°00.02′E	1076		
C042	CTD	10/25/96	06:07	BO	28°02.70′N	130°00.38′E	1151	1155	
C042	CTD	10/25/96	06:21	EN	28°02.54′N	130°00.48′E	1168		
C043	CTD	10/25/96	07:10	BE	28°09.52′N	129°50.07′E	534		
C043	CTD	10/25/96	07:38	BO	28°09.60′N	129°49.88′E	526	531	
C043	CTD	10/25/96	07:46	EN	28°09.66′N	129°49.80′E	519		
C044	CTD	10/25/96	08:48	BE	28°16.04′N	129°40.15′E	232		
C044	CTD	10/25/96	08:55	BO	28°16.09′N	129°40.04′E	231	223	
C044	CTD	10/25/96	09:00	EN	28°16.15′N	129°40.04′E	232		
C045	CTD	10/25/96	11:45	BE	28°49.79′N	129°54.55′E	265		
C045	CTD	10/25/96	11:53	BO	28°49.72′N	129°54.47′E	259	248	
C045	CTD	10/25/96	11:59	EN	28°49.68′N	129°54.38′E	257		
C046	CTD	10/25/96	12:56	BE	28°58.02′N	129°59.90′E	820		
C046	CTD	10/25/96	13:16	BO	28°58.01′N	130°00.06′E	836	818	
C046	CTD	10/25/96	13:27	EN	28°58.02′N	130°00.09′E	838		
C047	CTD	10/25/96	14:22	BE	29°05.80′N	130°05.34′E	1378		

STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
C047	CTD	10/25/96	14:53	BO	29°05.50′N	130°05.73′E	1386	1370	
C047	CTD	10/25/96	15:10	EN	29°05.20′N	130°05.85′E	1385		
C048	CTD	10/25/96	16:12	BE	29°14.91′N	130°10.96′E	1316		
C048	CTD	10/25/96	16:54	BO	29°14.21′N	130°11.64′E	1409	1358	
C048	CTD	10/25/96	17:12	EN	29°13.93′N	130°11.81′E	1450		
C049	CTD	10/25/96	18:10	BE	29°22.96′N	130°16.10′E	624		
C049	CTD	10/25/96	18:33	BO	29°22.80′N	130°16.21′E	637	613	
C049	CTD	10/25/96	18:41	EN	29°22.76′N	130°16.24′E	643		
C050	CTD	10/25/96	20:12	BE	29°31.75′N	130°21.85′E	325		
C050	CTD	10/25/96	20:26	BO	29°31.59′N	130°22.09′E	330	317	
C050	CTD	10/25/96	20:33	EN	29°31.52′N	130°22.22′E	330		
C051	CTD	10/25/96	21:30	BE	29°40.21′N	130°27.42′E	326		
C051	CTD	10/25/96	21:46	BO	29°40.30′N	130°27.50′E	317	317	
C051	CTD	10/25/96	21:52	EN	29°40.33′N	130°27.51′E	325		
C052	CTD	10/25/96	22:46	BE	29°49.17′N	130°33.94′E	358		
C052	CTD	10/25/96	23:03	BO	29°49.39′N	130°34.68′E	417	385	
C052	CTD	10/25/96	23:09	EN	29°49.46′N	130°34.84′E	429		
C053	CTD	10/26/96	00:06	BE	29°58.70′N	130°38.72′E	426		
C053	CTD	10/26/96	00:20	BO	29°58.95′N	130°39.14′E	441	434	
C053	CTD	10/26/96	00:26	EN	29°58.99′N	130°39.32′E	419		
C054	CTD	10/26/96	01:14	BE	30°06.19′N	130°44.23′E	270		
C054	CTD	10/26/96	01:23	BO	30°06.43′N	130°44.65′E	262	202	
C054	CTD	10/26/96	01:27	EN	30°06.50′N	130°44.84′E	260		
XOS1	XBT	10/26/96	03:13	DE	30°30.03′N	130°42.59′E	250		
XOS2	XBT	10/26/96	03:37	DE	30°36.00′N	130°41.39′E	169		
XOS3	XBT	10/26/96	04:02	DE	30°42.16′N	130°40.24′E	197		
XOS4	XBT	10/26/96	04:14	DE	30°45.13′N	130°39.68′E	208		
XOS5	XBT	10/26/96	04:33	DE	30°48.08′N	130°40.05′E			
XOS6	XBT	10/26/96	05:00	DE	30°54.28′N	130°37.88′E	146		
XOS7	XBT	10/26/96	05:26	DE	31°00.30′N	130°36.56′E			
C055	ROS	10/27/96	05:56	BE	30°06.22′N	131°01.95′E	697		
C055	ROS	10/27/96	07:12	BO	30°07.77′N	131°03.95′E	851	913	S,O
C055	ROS	10/27/96	07:46	EN	30°08.57′N	131°04.25′E	833		
C056	ROS	10/27/96	09:10	BE	30°00.63′N	131°09.12′E	1610		
C056	ROS	10/27/96	10:13	BO	30°02.05′N	131°09.57′E	1636	1629	S,O
C056	ROS	10/27/96	10:57	EN	30°03.19′N	131°09.58′E	1972		
C057	ROS	10/27/96	12:23	BE	29°54.86′N	131°16.53′E	2889		
C057	ROS	10/27/96	13:42	BO	29°57.68′N	131°16.77′E	2334	2222	S,O
C057	ROS	10/27/96	14:24	EN	29°58.77′N	131°17.17′E	2535		
C058	ROS	10/27/96	16:09	BE	29°48.25′N	131°24.69′E	3332		
C058	ROS	10/27/96	17:25	BO	29°49.90′N	131°25.00′E	3236	3256	S,O
C058	ROS	10/27/96	18:27	EN	29°50.77′N	131°25.32′E	3033		
C059	ROS	10/27/96	19:48	BE	29°42.32′N	131°32.91′E	3542		
C059	ROS	10/27/96	20:53	BO	29°43.38′N	131°33.26′E	3429	3486	S,O
C059	ROS	10/27/96	21:54	EN	29°44.21′N	131°33.75′E	3411		
C060	ROS	10/27/96	23:42	BE	29°29.87′N	131°48.47′E	4924		
C060	ROS	10/28/96	01:12	BO	29°30.55′N	131°48.26′E	4995	5033	S,O
C060	ROS	10/28/96	02:27	EN	29°31.22′N	131°48.24′E	5003		
C061	ROS	10/28/96	04:57	BE	29°17.71′N	132°03.87′E	5625		
C061	ROS	10/28/96	06:42	BO	29°17.46′N	132°03.83′E	5622	5753	S,O
C061	ROS	10/28/96	08:08	EN	29°17.11′N	132°04.15′E	5580		
C062	ROS	10/28/96	10:01	BE	29°01.83′N	132°24.72′E	4963		
C062	ROS	10/28/96	11:40	BO	29°01.19′N	132°24.48′E	4951	5038	S,O
C062	ROS	10/28/96	12:50	EN	29°01.02′N	132°24.58′E	4949		
C063	ROS	10/28/96	14:27	BE	28°49.91′N	132°40.40′E	4731		

STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
C063	ROS	10/28/96	15:50	BO	28°49.63'N	132°40.06'E	4723	4790	S,O
C063	ROS	10/28/96	16:59	EN	28°49.10'N	132°40.04'E	4717		
C064	ROS	10/28/96	19:03	BE	28°35.05'N	132°59.75'E	4419		
X15	XBT	10/28/96	19:10	DE	28°35.00'N	133°00.00'E			
C064	ROS	10/28/96	20:20	BO	28°35.19'N	132°59.64'E	4418	4475	S,O
C064	ROS	10/28/96	21:32	EN	28°35.27'N	132°59.21'E	4440		
X16	XBT	10/28/96	23:40	DE	28°51.29'N	133°26.25'E	3520		
X17	XBT	10/29/96	01:31	DE	29°07.51'N	133°52.07'E	2552		
X18	XBT	10/29/96	03:22	DE	29°23.83'N	134°19.76'E	4784		
X18A	XBT	10/29/96	03:25	DE	29°24.18'N	134°20.35'E	4765		
X19	XBT	10/29/96	05:11	DE	29°40.01'N	134°46.00'E	4789		
X20	XBT	10/29/96	05:35	DE	29°45.00'N	134°43.46'E	4551		
X21	XBT	10/29/96	05:55	DE	29°49.96'N	134°41.00'E	4556		
X22	XBT	10/29/96	06:15	DE	29°55.18'N	134°38.30'E	4644		
X23	XBT	10/29/96	06:50	DE	30°00.03'N	134°35.67'E	4619		
C065	ROS	10/29/96	06:52	BE	30°00.03'N	134°35.66'E	4623		
C065	ROS	10/29/96	08:16	BO	30°00.36'N	134°35.04'E	4399	4542	S,O
C065	ROS	10/29/96	09:35	EN	30°00.76'N	134°34.40'E	4577		
X24	XBT	10/29/96	10:05	DE	30°05.11'N	134°33.39'E	4641		
X25	XBT	10/29/96	10:25	DE	30°10.07'N	134°30.72'E	4598		
X26	XBT	10/29/96	10:56	DE	30°15.01'N	134°27.81'E	4530		
C066	ROS	10/29/96	10:59	BE	30°15.02'N	134°27.77'E	4537		
C066	ROS	10/29/96	12:18	BO	30°15.29'N	134°27.03'E	4571	4622	S,O
C066	ROS	10/29/96	13:25	EN	30°15.42'N	134°26.81'E	4582		
X27	XBT	10/29/96	13:57	DE	30°20.08'N	134°25.26'E	4552		
X28	XBT	10/29/96	14:17	DE	30°25.09'N	134°23.03'E	4569		
C067	ROS	10/29/96	14:48	BE	30°30.05'N	134°20.01'E	4536		
X29	XBT	10/29/96	14:54	DE	30°30.05'N	134°19.97'E	4525		
X29A	XBT	10/29/96	14:56	DE	30°30.12'N	134°19.89'E	4535		
C067	ROS	10/29/96	16:13	BO	30°30.44'N	134°19.48'E	4518	4571	S,O
C067	ROS	10/29/96	17:26	EN	30°30.66'N	134°19.10'E	4519		
X30	XBT	10/29/96	18:00	DE	30°35.10'N	134°17.38'E	4492		
X31	XBT	10/29/96	18:20	DE	30°40.03'N	134°14.82'E	4392		
C068	ROS	10/29/96	18:58	BE	30°44.98'N	134°11.70'E	4456		
X32	XBT	10/29/96	19:01	DE	30°44.94'N	134°11.64'E	4453		
C068	ROS	10/29/96	20:17	BO	30°44.71'N	134°10.95'E	4456	4513	S,O
C068	ROS	10/29/96	21:25	EN	30°44.19'N	134°10.44'E	4465		
X33	XBT	10/29/96	22:03	DE	30°50.09'N	134°09.46'E	4445		
X34	XBT	10/29/96	22:23	DE	30°55.00'N	134°06.80'E	4439		
C069	ROS	10/29/96	22:51	BE	30°59.98'N	134°03.93'E	4425		
X35	XBT	10/29/96	22:56	DE	30°59.99'N	134°03.82'E	4428		
C069	ROS	10/30/96	00:15	BO	31°00.37'N	134°03.02'E	4451	4504	S,O
C069	ROS	10/30/96	01:21	EN	31°00.89'N	134°02.81'E	4450		
X36	XBT	10/30/96	01:52	DE	31°05.03'N	134°01.44'E	4476		
X37	XBT	10/30/96	02:11	DE	31°10.04'N	133°58.66'E	4496		
X37A	XBT	10/30/96	02:17	DE	31°11.61'N	133°57.77'E	4519		
X38	XBT	10/30/96	02:44	DE	31°15.10'N	133°55.82'E	4533		
C070	ROS	10/30/96	02:45	BE	31°15.12'N	133°55.78'E	4534		
C070	ROS	10/30/96	04:06	BO	31°15.89'N	133°55.30'E	4549	4609	S,O
C070	ROS	10/30/96	05:15	EN	31°16.56'N	133°55.13'E	4564		
X39	XBT	10/30/96	05:46	DE	31°20.00'N	133°53.31'E	4617		
X40	XBT	10/30/96	06:05	DE	31°25.04'N	133°50.67'E	4690		
C071	ROS	10/30/96	06:42	BE	31°30.10'N	133°47.73'E	4855		
X41	XBT	10/30/96	06:44	DE	31°31.30'N	133°47.71'E	4849		
C071	ROS	10/30/96	08:14	BO	31°31.03'N	133°47.70'E	4850	4939	S,O

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C071	ROS	10/30/96	09:26	EN	31°31.81′N	133°47.97′E	4869		
X42	XBT	10/30/96	09:54	DE	31°35.05′N	133°45.16′E	4869		
X43	XBT	10/30/96	10:14	DE	31°40.04′N	133°41.85′E	4866		
C072	ROS	10/30/96	10:48	BE	31°45.20′N	133°40.29′E	4524		
X44	XBT	10/30/96	10:55	DE	31°45.32′N	133°40.35′E	4524		
C072	ROS	10/30/96	12:21	BO	31°46.31′N	133°41.54′E	4437	4535	S,O
C072	ROS	10/30/96	13:30	EN	31°46.95′N	133°42.62′E	4492		
X45	XBT	10/30/96	14:07	DE	31°50.07′N	133°37.12′E	3621		
C073	ROS	10/30/96	14:44	BE	31°55.39′N	133°34.00′E	2988		
X46	XBT	10/30/96	14:45	DE	31°55.41′N	133°34.02′E	2982		
C073	ROS	10/30/96	15:40	BO	31°56.21′N	133°34.62′E	2998	3002	S,O
C073	ROS	10/30/96	16:32	EN	31°56.65′N	133°35.18′E	2991		
X47	XBT	10/30/96	17:07	DE	32°00.00′N	133°31.62′E	2281		
C074	ROS	10/30/96	18:28	BE	32°06.04′N	133°30.34′E	1853		
X48	XBT	10/30/96	18:32	DE	32°06.11′N	133°30.44′E	1838		
C074	ROS	10/30/96	19:09	BO	32°06.78′N	133°31.53′E	1838	1812	S,O
C074	ROS	10/30/96	19:45	EN	32°07.00′N	133°32.57′E	1843		
X49	XBT	10/30/96	20:21	DE	32°10.10′N	133°26.50′E	1350		
C075	ROS	10/30/96	20:59	BE	32°15.41′N	133°23.51′E	1188		
X50	XBT	10/30/96	21:05	DE	32°15.45′N	133°23.58′E	1172		
C075	ROS	10/30/96	21:25	BO	32°15.86′N	133°24.77′E	1101	1084	S,O
C075	ROS	10/30/96	21:52	EN	32°16.23′N	133°25.84′E	1035		
X51	XBT	10/30/96	22:23	DE	32°20.11′N	133°20.79′E	1224		
C076	ROS	10/30/96	22:57	BE	32°25.09′N	133°18.46′E	947		
X52	XBT	10/30/96	23:01	DE	32°25.08′N	133°18.43′E	950		
C076	ROS	10/30/96	23:22	BO	32°25.62′N	133°19.62′E	922	910	S,O
C076	ROS	10/30/96	23:47	EN	32°26.23′N	133°20.53′E	753		
X53	XBT	10/31/96	00:30	DE	32°30.02′N	133°14.85′E	809		
C077	ROS	10/31/96	01:13	BE	32°35.31′N	133°12.80′E	825		
X54	XBT	10/31/96	01:14	DE	32°35.35′N	133°12.86′E	829		
C077	ROS	10/31/96	01:29	BO	32°35.64′N	133°13.34′E	635	581	S,O
C077	ROS	10/31/96	01:46	EN	32°35.85′N	133°13.88′E	689		
X55	XBT	10/31/96	02:26	DE	32°40.02′N	133°08.86′E	260		
C078	ROS	10/31/96	02:58	BE	32°44.91′N	133°05.90′E	157		
X56	XBT	10/31/96	02:59	DE	32°44.91′N	133°05.89′E	154		
C078	ROS	10/31/96	03:04	BO	32°44.94′N	133°05.84′E	154	138	S,O
C078	ROS	10/31/96	03:12	EN	32°44.95′N	133°05.77′E	146		
C079	ROS	10/31/96	14:33	BE	33°39.93′N	136°19.26′E	1968		
C079	ROS	10/31/96	15:10	BO	33°40.04′N	136°18.50′E	1966	1937	S,O
C079	ROS	10/31/96	15:50	EN	33°40.03′N	136°17.51′E	1951		
C080	ROS	10/31/96	17:04	BE	33°29.80′N	136°19.53′E	2014		
C080	ROS	10/31/96	17:46	BO	33°29.93′N	136°18.59′E	2001	1981	S,O
C080	ROS	10/31/96	18:26	EN	33°30.02′N	136°17.97′E			
C081	ROS	10/31/96	19:32	BE	33°19.94′N	136°20.11′E	2015		
C081	ROS	10/31/96	20:19	BO	33°19.96′N	136°20.06′E	2016	1994	S,O
C081	ROS	10/31/96	20:55	EN	33°19.84′N	136°19.86′E	2017		
C082	ROS	10/31/96	21:43	BE	33°09.97′N	136°20.29′E	2197		
C082	ROS	10/31/96	22:40	BO	33°09.38′N	136°21.36′E	2307	2262	S,O
C082	ROS	10/31/96	23:22	EN	33°09.14′N	136°21.89′E	3911		
C083	ROS	11/01/96	00:23	BE	33°00.17′N	136°20.85′E	3279		
C083	ROS	11/01/96	01:26	BO	32°59.92′N	136°23.01′E	3264	3232	S,O
C083	ROS	11/01/96	02:18	EN	32°59.63′N	136°24.41′E	3665		
C084	ROS	11/01/96	03:56	BE	32°44.84′N	136°21.12′E	4550		
C084	ROS	11/01/96	05:40	BO	32°43.92′N	136°26.67′E	4523	3690	S,O
C084	ROS	11/01/96	07:16	EN	32°43.16′N	136°30.49′E	4513		

STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
C085	ROS	11/01/96	09:07	BE	32°29.87′N	136°20.12′E	4466		
C085	ROS	11/01/96	10:44	BO	32°29.44′N	136°24.43′E	4437	4493	S,O
C085	ROS	11/01/96	12:06	EN	32°28.91′N	136°26.57′E	4379		
C086	ROS	11/01/96	13:42	BE	32°15.24′N	136°19.70′E	4060		
C086	ROS	11/01/96	14:55	BO	32°15.26′N	136°21.60′E	3964	3932	S,O
C086	ROS	11/01/96	16:00	EN	32°15.07′N	136°23.23′E	3961		
C087	ROS	11/01/96	17:42	BE	32°00.48′N	136°19.99′E	4294		
C087	ROS	11/01/96	19:04	BO	32°00.63′N	136°20.73′E	4252	4254	S,O
C087	ROS	11/01/96	20:06	EN	32°00.60′N	136°21.13′E	4250		
C088	ROS	11/01/96	22:45	BE	31°30.20′N	136°19.77′E	4075		
C088	ROS	11/01/96	23:59	BO	31°29.81′N	136°19.11′E	4055	4102	S,O
C088	ROS	11/02/96	01:02	EN	31°29.61′N	136°19.06′E	4057		
C089	ROS	11/02/96	07:08	BE	31°29.91′N	137°59.83′E	3952		
C089	ROS	11/02/96	08:26	BO	31°28.91′N	137°59.07′E	3963	3986	S,O
C089	ROS	11/02/96	09:30	EN	31°28.33′N	137°58.55′E	3969		
C090	ROS	11/02/96	12:04	BE	31°59.74′N	137°59.98′E	3824		
C090	ROS	11/02/96	13:10	BO	31°59.18′N	138°00.08′E	3838	3863	S,O
C090	ROS	11/02/96	14:07	EN	31°58.99′N	138°00.16′E	3855		
C091	ROS	11/02/96	15:34	BE	32°15.09′N	138°00.02′E	3910		
C091	ROS	11/02/96	16:53	BO	32°14.85′N	138°00.71′E	3888	3925	S,O
C091	ROS	11/02/96	17:56	EN	32°14.60′N	138°01.13′E	3877		
C092	ROS	11/02/96	19:21	BE	32°30.14′N	138°00.24′E	3985		
C092	ROS	11/02/96	20:42	BO	32°30.41′N	138°02.57′E	4442	4021	S,O
C092	ROS	11/02/96	21:52	EN	32°30.33′N	138°03.68′E	3991		
C093	ROS	11/02/96	23:08	BE	32°44.94′N	138°00.20′E	3751		
C093	ROS	11/03/96	00:34	BO	32°44.47′N	138°03.78′E	3723	3602	S,O
C093	ROS	11/03/96	01:39	EN	32°43.92′N	138°05.38′E	3677		
C094	ROS	11/03/96	03:16	BE	32°59.86′N	138°00.31′E	4035		
C094	ROS	11/03/96	04:40	BO	32°59.44′N	138°02.49′E	3986	4013	S,O
C094	ROS	11/03/96	05:45	EN	32°59.02′N	138°03.72′E	3985		
C095	ROS	11/03/96	07:08	BE	33°09.89′N	137°59.77′E	4016		
C095	ROS	11/03/96	08:21	BO	33°09.77′N	138°01.49′E	4028	3912	S,O
C095	ROS	11/03/96	09:25	EN	33°09.43′N	138°01.75′E	4085		
C096	ROS	11/03/96	10:30	BE	33°19.91′N	137°59.94′E	3544		
C096	ROS	11/03/96	11:39	BO	33°19.54′N	138°00.22′E	3588	3572	S,O
C096	ROS	11/03/96	12:36	EN	33°18.90′N	138°00.53′E	3529		
C097	ROS	11/03/96	14:03	BE	33°30.00′N	137°59.39′E	3067		
C097	ROS	11/03/96	15:02	BO	33°30.17′N	137°58.99′E	3208	3149	S,O
C097	ROS	11/03/96	15:53	EN	33°30.29′N	137°58.66′E	3297		
XIR1	XBT	11/03/96	18:52	DE	33°30.02′N	138°30.20′E	3496		
XIR2	XBT	11/03/96	20:32	DE	33°30.01′N	139°00.00′E	1706		
XIR3	XBT	11/03/96	22:12	DE	33°30.04′N	139°30.00′E	1490		
XPOP	XBT	11/04/96	00:44	DE	34°05.84′N	139°44.31′E	900		
POP	MOR	11/04/96	01:00	BE	34°06.06′N	139°44.57′E	908		
POP	MOR	11/04/96	01:02	DE	34°06.11′N	139°44.62′E	910		
C098	ROS	11/04/96	07:02	BE	34°59.12′N	140°35.09′E	820		
C098	ROS	11/04/96	07:22	BO	34°59.09′N	140°35.00′E	875	832	S,O
C098	ROS	11/04/96	07:40	EN	34°59.09′N	140°34.88′E	931		
C099	ROS	11/04/96	09:00	BE	34°50.14′N	140°45.36′E	1684		
C099	ROS	11/04/96	09:37	BO	34°50.50′N	140°45.53′E	1601	1626	S,O
C099	ROS	11/04/96	10:07	EN	34°50.71′N	140°45.37′E	1581		
C100	ROS	11/04/96	11:29	BE	34°39.80′N	140°55.28′E	3070		
C100	ROS	11/04/96	12:31	BO	34°40.06′N	140°56.18′E	3398	3188	S,O
C100	ROS	11/04/96	13:22	EN	34°40.15′N	140°56.63′E	3570		
C101	CTD	11/04/96	14:37	BE	34°29.95′N	141°04.84′E	6484		

STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
C101	CTD	11/04/96	16:23	BO	34°29.90′N	141°06.69′E	6570	6002	
C101	CTD	11/04/96	18:15	EN	34°30.04′N	141°07.46′E	6645		
C102	CTD	11/04/96	19:51	BE	34°14.84′N	141°20.15′E	6746		
C102	CTD	11/04/96	21:45	BO	34°13.64′N	141°22.37′E	6947	6002	
C102	CTD	11/04/96	23:01	EN	34°13.58′N	141°23.71′E	6781		
C103	CTD	11/05/96	00:33	BE	33°59.35′N	141°34.80′E	7277		
C103	CTD	11/05/96	02:26	BO	33°57.14′N	141°35.84′E	7148	6002	
C103	CTD	11/05/96	03:49	EN	33°55.97′N	141°36.05′E	7285		
C104	CTD	11/05/96	05:12	BE	33°44.92′N	141°50.01′E	8283		
C104	CTD	11/05/96	07:20	BO	33°42.71′N	141°52.02′E	8334	6008	
C104	CTD	11/05/96	08:37	EN	33°41.48′N	141°52.39′E	8170		
C105	CTD	11/05/96	10:05	BE	33°29.58′N	142°04.96′E	8695		
C105	CTD	11/05/96	11:59	BO	33°27.82′N	142°05.34′E	8653	6004	
C105	CTD	11/05/96	13:14	EN	33°26.67′N	142°06.12′E	8632		
C106	CTD	11/05/96	19:03	BE	34°00.17′N	143°00.23′E	5162		
C106	CTD	11/05/96	20:37	BO	34°00.34′N	143°01.70′E	5228	5289	
C106	CTD	11/05/96	21:40	EN	34°00.43′N	143°02.12′E	5239		
C107	CTD	11/05/96	23:28	BE	34°20.18′N	142°59.83′E	5323		
C107	CTD	11/06/96	01:02	BO	34°20.64′N	142°59.76′E	5312	5407	
C107	CTD	11/06/96	02:01	EN	34°20.73′N	142°59.90′E	5312		
C108	CTD	11/06/96	05:35	BE	33°40.36′N	143°00.73′E	5266		
C108	CTD	11/06/96	07:14	BO	33°40.06′N	143°02.02′E	5245	5361	
C108	CTD	11/06/96	08:15	EN	33°39.63′N	143°02.84′E	5239		
C109	CTD	11/06/96	10:05	BE	33°19.82′N	143°00.80′E	5416		
C109	CTD	11/06/96	11:44	BO	33°18.70′N	143°01.67′E	5524	5304	
C109	CTD	11/06/96	12:48	EN	33°17.40′N	143°01.07′E	5763		
C110	CTD	11/07/96	04:10	BE	32°29.62′N	143°00.68′E	5599		
C110	CTD	11/07/96	06:31	BO	32°28.38′N	143°03.16′E	5598	5708	
C110	CTD	11/07/96	07:50	EN	32°27.91′N	143°04.09′E	5610		
C111	CTD	11/07/96	10:32	BE	32°59.67′N	143°00.43′E	5577		
C111	CTD	11/07/96	12:18	BO	32°58.66′N	143°02.40′E	5576	5687	
C111	CTD	11/07/96	13:28	EN	32°58.11′N	143°02.96′E	5584		
C112	CTD	11/07/96	20:00	BE	33°00.15′N	144°58.85′E	5685		
C112	CTD	11/07/96	21:49	BO	33°01.10′N	144°57.78′E	5625	5775	
C112	CTD	11/07/96	23:02	EN	33°01.76′N	144°57.64′E	5637		
C113	CTD	11/08/96	01:08	BE	33°29.81′N	145°00.32′E	5698		
C113	CTD	11/08/96	02:50	BO	33°30.41′N	145°00.08′E	5727	5839	
C113	CTD	11/08/96	04:00	EN	33°30.71′N	144°59.96′E	5732		
C114	CTD	11/08/96	06:16	BE	34°00.00′N	144°59.73′E	5731		
C114	CTD	11/08/96	07:57	BO	34°00.53′N	144°59.64′E	5722	5866	
C114	CTD	11/08/96	09:06	EN	34°01.01′N	144°59.69′E	5711		
C115	CTD	11/08/96	11:15	BE	34°30.01′N	145°00.00′E	5762		
C115	CTD	11/08/96	12:56	BO	34°30.76′N	145°00.77′E	5762	5907	
C115	CTD	11/08/96	14:03	EN	34°31.01′N	145°01.36′E	5766		
C116	CTD	11/08/96	16:23	BE	35°00.20′N	145°00.57′E	5763		
C116	CTD	11/08/96	18:16	BO	35°00.17′N	145°03.58′E	5798	5921	
C116	CTD	11/08/96	19:33	EN	35°00.48′N	145°05.20′E	5781		
XKE1	XBT	11/09/96	02:38	DE	34°59.96′N	143°00.53′E	5902		
XKE2	XBT	11/09/96	04:04	DE	34°39.87′N	143°00.01′E	5377		
XKE3	XBT	11/09/96	07:30	DE	34°39.85′N	142°00.00′E	8488		
XKE4	XBT	11/09/96	11:22	DE	34°20.09′N	141°00.13′E	5578		

Leg 2

STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
CMI1	ROS	11/16/96	11:10	BE	34°05.64′N	139°43.91′E	893		

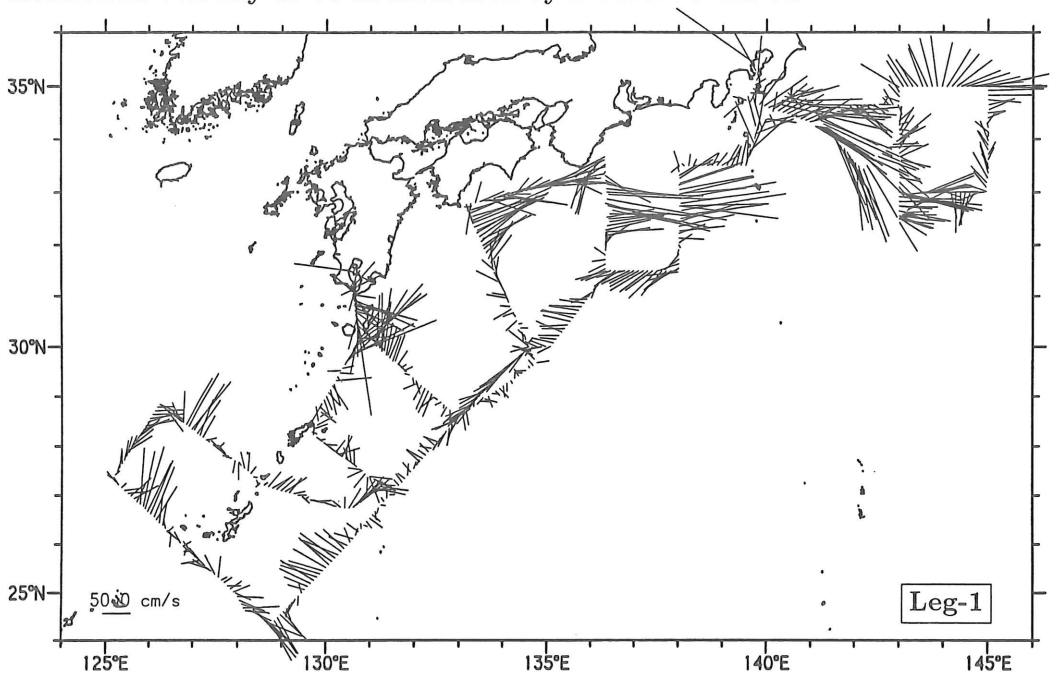
STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
CMI1	ROS	11/16/96	11:34	BO	34°05.36′N	139°43.72′E	894	867	S,O
CMI1	ROS	11/16/96	11:58	EN	34°05.16′N	139°43.62′E	894		
CMI2	CTD	11/16/96	12:54	BE	34°06.87′N	139°49.58′E	1023		
CMI2	CTD	11/16/96	13:19	BO	34°06.62′N	139°49.16′E	1014		
CMI2	CTD	11/16/96	13:34	EN	34°06.58′N	139°48.92′E	1015		
CMI3	ROS	11/16/96	14:16	BE	34°02.82′N	139°49.18′E	1103		
CMI3	ROS	11/16/96	14:42	BO	34°02.42′N	139°49.24′E	1114	1097	S,O
CMI3	ROS	11/16/96	15:07	EN	34°02.24′N	139°49.31′E	1116		
CMI4	CTD	11/16/96	15:56	BE	34°04.15′N	139°54.85′E	1177		
CMI4	CTD	11/16/96	16:20	BO	34°04.33′N	139°54.49′E	1174		
CMI4	CTD	11/16/96	16:36	EN	34°04.27′N	139°54.34′E	1172		
CMI5	ROS	11/16/96	17:19	BE	33°59.06′N	139°54.19′E	1157		
CMI5	ROS	11/16/96	17:46	BO	33°58.95′N	139°54.68′E	1145	1109	S,O
CMI5	ROS	11/16/96	18:15	EN	33°59.17′N	139°56.27′E	1107		
CMI6	CTD	11/16/96	18:51	BE	34°00.11′N	139°59.95′E	1078		
CMI6	CTD	11/16/96	19:12	BO	34°00.25′N	140°00.11′E	1081		
CMI6	CTD	11/16/96	19:28	EN	34°00.26′N	140°00.33′E	1132		
CMI7	CTD	11/16/96	20:23	BE	33°55.09′N	139°58.85′E	692		
CMI7	CTD	11/16/96	20:39	BO	33°55.15′N	139°58.89′E	698		
CMI7	CTD	11/16/96	20:50	EN	33°55.15′N	139°58.98′E	698		
MIES7	MOR	11/16/96	21:01	BE	33°55.36′N	139°58.92′E	736		
MIES7	MOR	11/16/96	21:32	RE	33°55.80′N	139°59.24′E	1370		
MIES6	MOR	11/16/96	22:12	BE	34°00.06′N	140°00.13′E	1080		
MIES6	MOR	11/16/96	23:12	RE	34°00.57′N	140°00.45′E	1189		
MIES5	MOR	11/17/96	00:02	BE	33°58.84′N	139°54.13′E	1158		
MIES5	MOR	11/17/96	00:40	RE	33°59.56′N	139°54.59′E	1157		
MIES4	MOR	11/17/96	01:11	BE	34°03.54′N	139°55.05′E	1182		
MIES4	MOR	11/17/96	02:00	RE	34°04.25′N	139°54.95′E	1179		
MIES3	MOR	11/17/96	02:42	BE	34°02.38′N	139°49.30′E	1117		
MIES3	MOR	11/17/96	03:23	RE	34°02.41′N	139°48.90′E	1107		
MIES2	MOR	11/17/96	04:07	RE	34°06.70′N	139°49.89′E	1034		
MIES1	MOR	11/17/96	05:40	RE	34°06.64′N	139°49.80′E	1038		
POP	MOR	11/17/96	05:46	BE	34°06.04′N	139°44.38′E	910		
POP	MOR	11/17/96	06:41	RE	34°06.77′N	139°45.35′E	923		
TR1	MOR	11/17/96	21:26	BE	33°57.87′N	141°21.06′E	6162		
TR1	MOR	11/18/96	00:58	DE	34°03.28′N	141°29.20′E	7122		
TR3	MOR	11/18/96	05:08	BE	33°56.91′N	142°31.83′E	6053		
TR3	MOR	11/18/96	07:50	DE	33°57.78′N	142°34.83′E	5854		
M1	MOR	11/18/96	23:58	BE	37°59.83′N	143°30.34′E	4418		
M1	MOR	11/19/96	00:21	DE	37°59.81′N	143°30.27′E	4439		
PC01	CTD	11/19/96	06:03	BE	37°59.70′N	142°20.10′E	963		
PC01	CTD	11/19/96	06:23	BO	37°59.30′N	142°20.21′E	959		
PC01	CTD	11/19/96	06:36	EN	37°59.16′N	142°20.20′E	957		
PC02	CTD	11/19/96	08:16	BE	37°59.76′N	142°40.90′E	1372		
PC02	CTD	11/19/96	08:45	BO	37°59.60′N	142°41.21′E	1383		
PC02	CTD	11/19/96	09:00	EN	37°59.54′N	142°41.29′E	1382		
PC03	CTD	11/19/96	10:39	BE	37°59.59′N	143°00.41′E	1869		
PC03	CTD	11/19/96	11:22	BO	37°58.77′N	143°00.79′E	1889		
PC03	CTD	11/19/96	11:51	EN	37°58.37′N	143°00.86′E	1894		
PC04	ROS	11/19/96	13:20	BE	38°00.39′N	143°19.89′E	3828		
PC04	ROS	11/19/96	14:32	BO	38°00.36′N	143°20.10′E	3411	3417	S,O
PC04	ROS	11/19/96	15:30	EN	38°00.17′N	143°20.25′E	3418		
PC05	ROS	11/19/96	17:03	BE	37°59.88′N	143°40.35′E	5455		
PC05	ROS	11/19/96	18:44	BO	37°59.90′N	143°40.36′E	5456	5531	S,O
PC05	ROS	11/19/96	20:04	EN	37°59.71′N	143°40.63′E	5472		

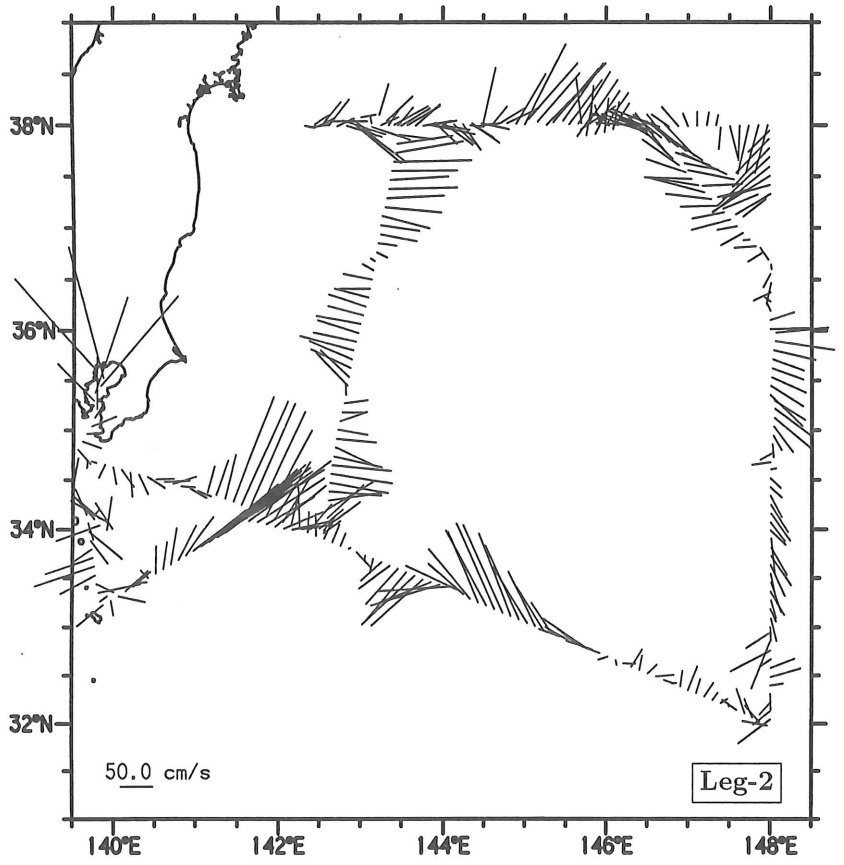
STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
PC06	ROS	11/19/96	21:30	BE	38°00.00′N	144°00.01′E	7424		
PC06	ROS	11/19/96	23:11	BO	37°59.52′N	144°00.63′E	7393	6003	S,O,Bio
PC06	ROS	11/20/96	00:42	EN	37°59.19′N	144°00.56′E	7375		
M2	MOR	11/20/96	01:43	BE	38°00.12′N	143°50.15′E	6252		
M2	MOR	11/20/96	02:35	DE	38°01.72′N	143°50.30′E	6300		
M3	MOR	11/20/96	04:46	BE	38°01.35′N	144°27.92′E	5821		
M3	MOR	11/20/96	05:25	DE	37°59.96′N	144°30.15′E	5940		
PC07	ROS	11/20/96	06:31	BE	37°59.83′N	144°20.02′E	6057		
PC07	ROS	11/20/96	08:13	BO	37°59.52′N	144°19.85′E	6058	6002	S,O
PC07	ROS	11/20/96	09:32	EN	37°59.26′N	144°19.59′E	6061		
PC08	ROS	11/20/96	11:00	BE	38°00.14′N	144°40.38′E	5607		
PC08	ROS	11/20/96	12:41	BO	38°00.60′N	144°41.55′E	5563	5665	S,O
PC08	ROS	11/20/96	14:03	EN	38°01.58′N	144°42.05′E	5542		
PC09	ROS	11/20/96	15:22	BE	38°00.63′N	145°00.14′E	5419		
PC09	ROS	11/20/96	16:59	BO	38°02.26′N	145°00.98′E	5335	5401	S,O
PC09	ROS	11/20/96	18:16	EN	38°03.12′N	145°00.98′E	5340		
PC10	ROS	11/20/96	19:52	BE	38°00.33′N	145°20.30′E	5312		
PC10	ROS	11/20/96	21:41	BO	38°02.74′N	145°22.05′E	5281	5359	S,O,Bio
PC10	ROS	11/20/96	23:21	EN	38°05.22′N	145°23.75′E	5277		
XCP1	XCP	11/20/96	23:53	DE	38°06.18′N	145°24.86′E	5298		
M4	MOR	11/21/96	00:56	BE	38°00.61′N	145°30.13′E	5446		
M4	MOR	11/21/96	01:46	DE	38°00.72′N	145°32.22′E	5315		
PC11	ROS	11/21/96	11:07	BE	37°59.91′N	145°40.47′E	5306		
PC11	ROS	11/21/96	12:53	BO	38°00.60′N	145°41.29′E	5303	5411	S,O,Bio
PC11	ROS	11/21/96	14:21	EN	38°01.06′N	145°41.53′E	5337		
PC12	ROS	11/21/96	16:15	BE	37°59.93′N	146°09.93′E	5262		
PC12	ROS	11/21/96	17:56	BO	37°59.88′N	146°09.98′E	5274	5349	S,O
PC12	ROS	11/21/96	19:13	EN	37°59.70′N	146°10.20′E	5264		
PC13	ROS	11/21/96	21:25	BE	38°00.21′N	146°39.65′E	5382		
PC13	ROS	11/21/96	23:03	BO	37°59.61′N	146°39.08′E	5399	5486	S,O
PC13	ROS	11/22/96	00:24	EN	37°59.33′N	146°38.90′E	5403		
XCP2	XCP	11/22/96	00:40	DE	37°59.27′N	146°39.16′E	5400		
PC14	ROS	11/22/96	03:28	BE	38°00.10′N	147°20.20′E	5547		
PC14	ROS	11/22/96	05:21	BO	37°59.55′N	147°20.41′E	5532	5647	S,O
PC14	ROS	11/22/96	06:39	EN	37°58.94′N	147°20.40′E	5571		
XCP3	XCP	11/22/96	06:58	DE	37°58.52′N	147°21.05′E	5582		
PC15	ROS	11/22/96	09:25	BE	37°59.78′N	148°00.15′E	5671		
PC15	ROS	11/22/96	11:25	BO	37°57.56′N	147°59.60′E	5671	5703	S,O,Bio
PC15	ROS	11/22/96	13:15	EN	37°56.13′N	147°58.92′E	5682		
PC16	ROS	11/22/96	15:56	BE	37°19.76′N	147°59.88′E	5648		
PC16	ROS	11/22/96	18:04	BO	37°18.10′N	147°58.24′E	5648	5715	S,O
PC16	ROS	11/22/96	19:25	EN	37°16.82′N	147°57.63′E	5640		
M5	MOR	11/23/96	05:25	BE	37°59.21′N	146°25.61′E	5365		
M5	MOR	11/23/96	05:55	DE	38°00.38′N	146°24.51′E	5396		
PC17	ROS	11/23/96	13:48	BE	36°40.12′N	148°00.00′E	5714		
PC17	ROS	11/23/96	15:52	BO	36°40.19′N	147°59.88′E	5711	5805	S,O,Bio
PC17	ROS	11/23/96	17:24	EN	36°40.02′N	147°59.79′E	5712		
PC18	ROS	11/23/96	20:33	BE	36°00.12′N	148°00.47′E	5803		
PC18	ROS	11/23/96	22:17	BO	35°59.92′N	148°02.36′E	5775	5881	S,O
PC18	ROS	11/23/96	23:39	EN	35°59.88′N	148°03.37′E	5772		
XCP4	XCP	11/23/96	23:51	DE	35°59.74′N	148°03.57′E	5776		
XCP5	XCP	11/24/96	02:42	DE	35°20.11′N	147°59.67′E	5793		
PC19	ROS	11/24/96	03:03	BE	35°19.50′N	147°59.79′E	5770		
PC19	ROS	11/24/96	04:56	BO	35°18.46′N	148°01.78′E	5785	5808	S,O,Bio*5
PC19	ROS	11/24/96	07:16	EN	35°17.50′N	148°03.58′E	5826		

STNNBR	TYPE	DATE	GMT	CODE	LATITUDE	LONGITUDE	BOTDEP	MAXPRS	PARAM
PC20	ROS	11/24/96	10:02	BE	34°40.05′N	147°59.66′E	5946		
PC20	ROS	11/24/96	11:50	BO	34°39.17′N	147°59.99′E	5952	6016	S,O,Bio
PC20	ROS	11/24/96	13:20	EN	34°38.35′N	148°00.40′E	5965		
PC21	ROS	11/24/96	16:06	BE	33°59.90′N	147°59.93′E	5870		
PC21	ROS	11/24/96	17:53	BO	33°58.47′N	147°59.95′E	5929	5952	S,O
PC21	ROS	11/24/96	19:19	EN	33°57.82′N	148°00.23′E	5958		
PC22	ROS	11/24/96	23:24	BE	32°59.93′N	147°59.79′E	5865		
PC22	ROS	11/25/96	01:15	BO	32°58.79′N	147°59.57′E	5830	5959	S,O,Bio*6
PC22	ROS	11/25/96	03:38	EN	32°57.92′N	147°58.83′E	5742		
PC23	ROS	11/25/96	07:46	BE	31°59.65′N	147°59.64′E	5514		
PC23	ROS	11/25/96	09:25	BO	31°59.09′N	147°58.51′E	5514	5640	S,O,Bio
PC23	ROS	11/25/96	10:52	EN	31°58.65′N	147°57.82′E	5578		

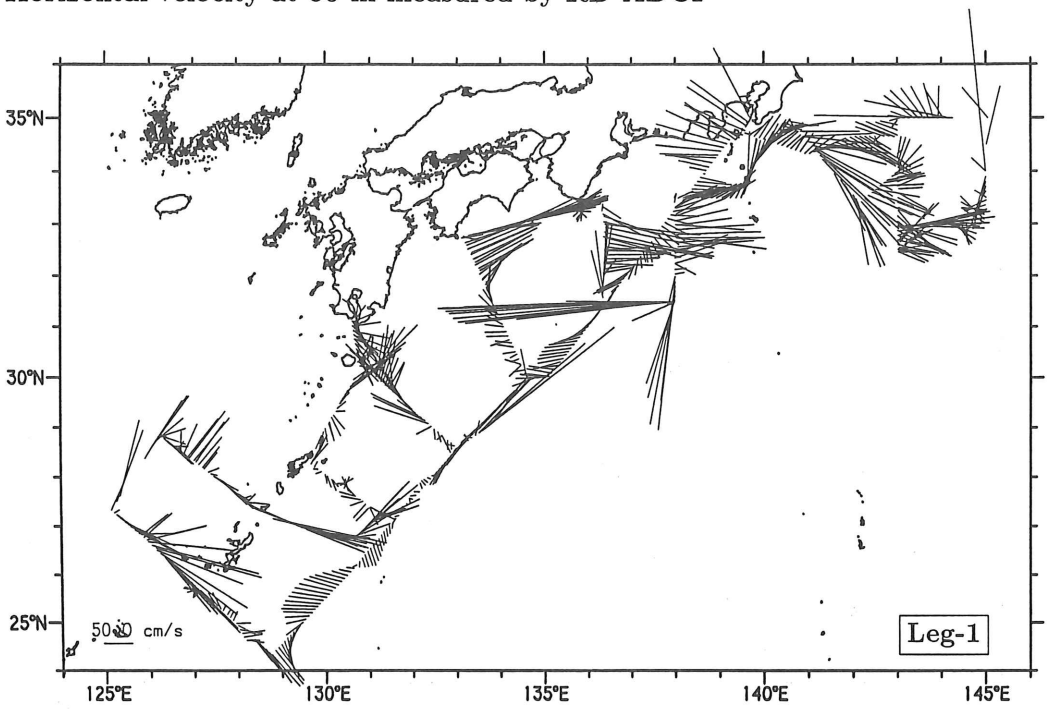
7. Charts of Surface Currents

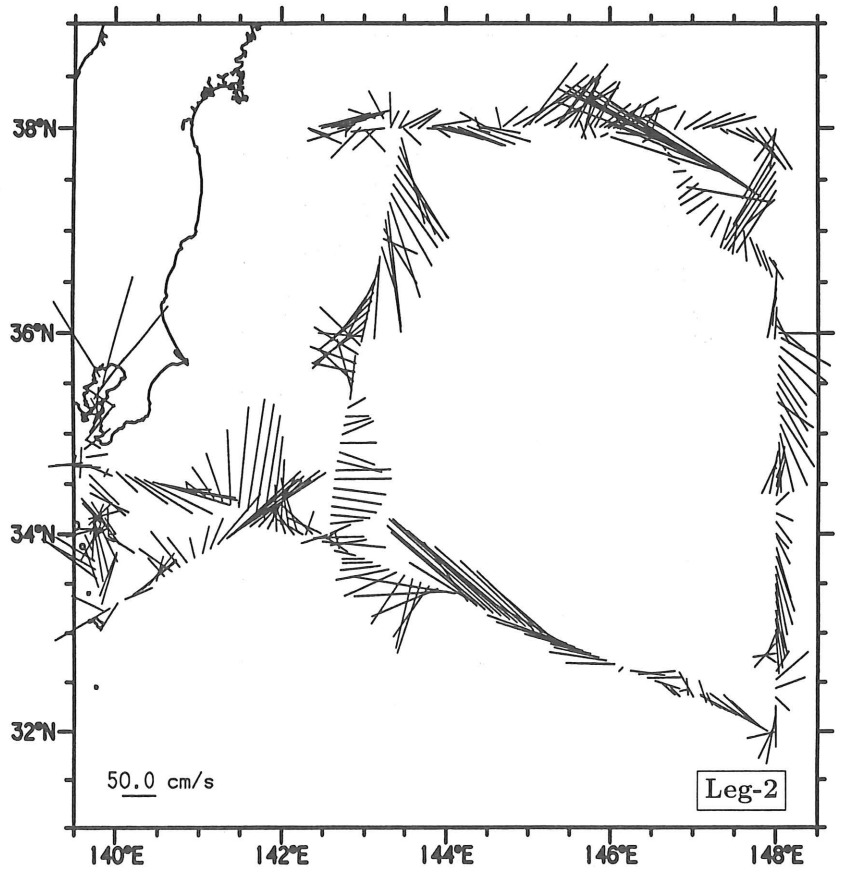
Horizontal velocity at 50 m measured by FURUNO ADCP



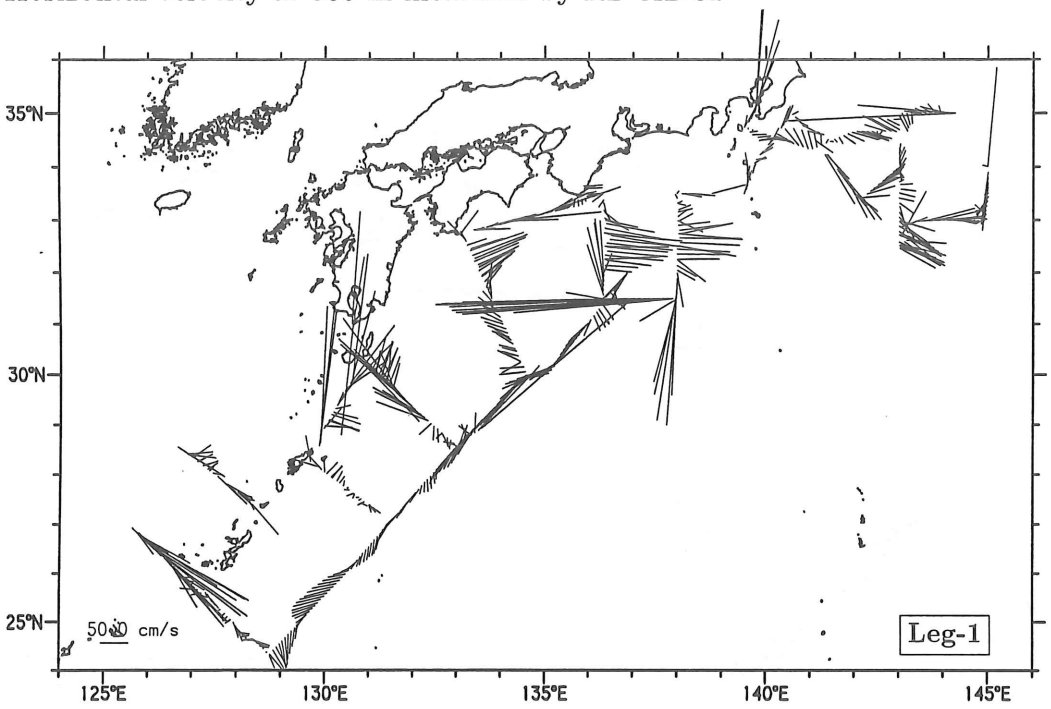


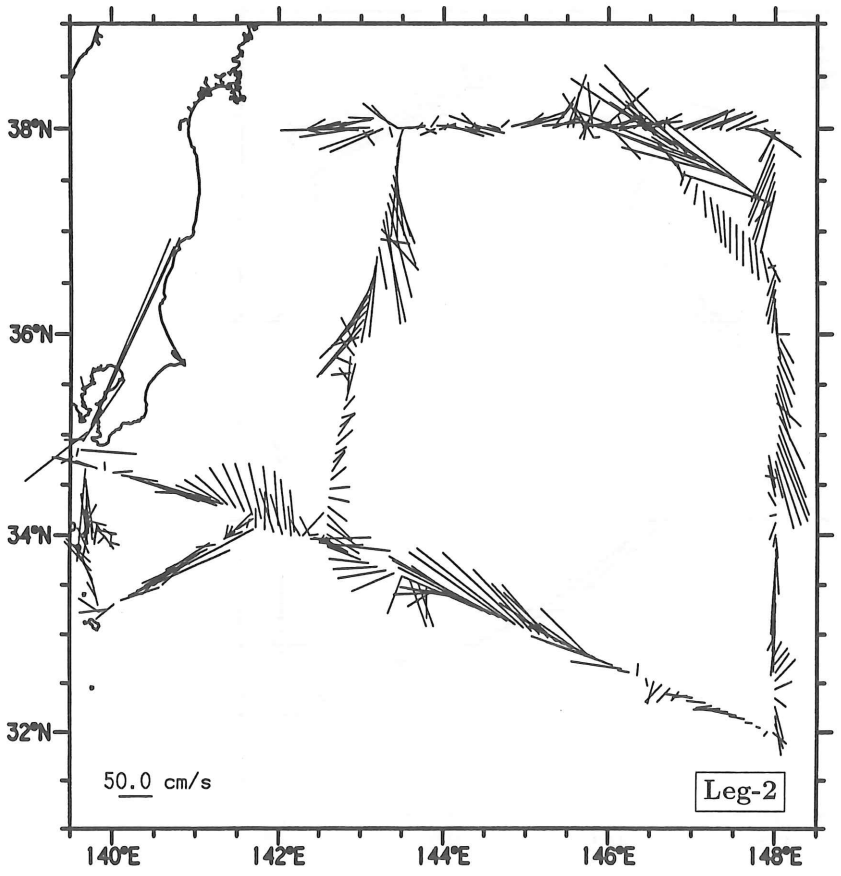
Horizontal velocity at 50 m measured by RD ADCP



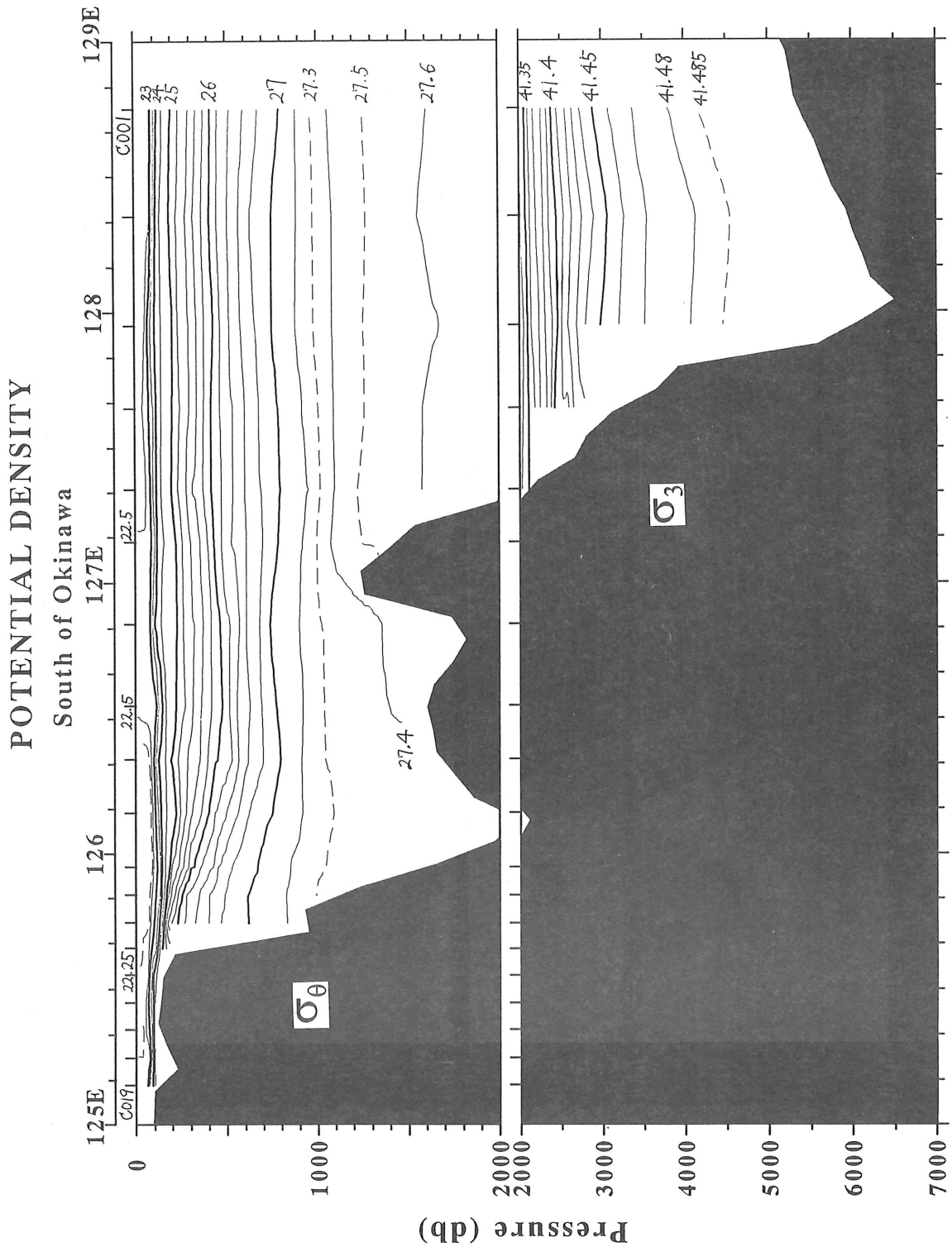


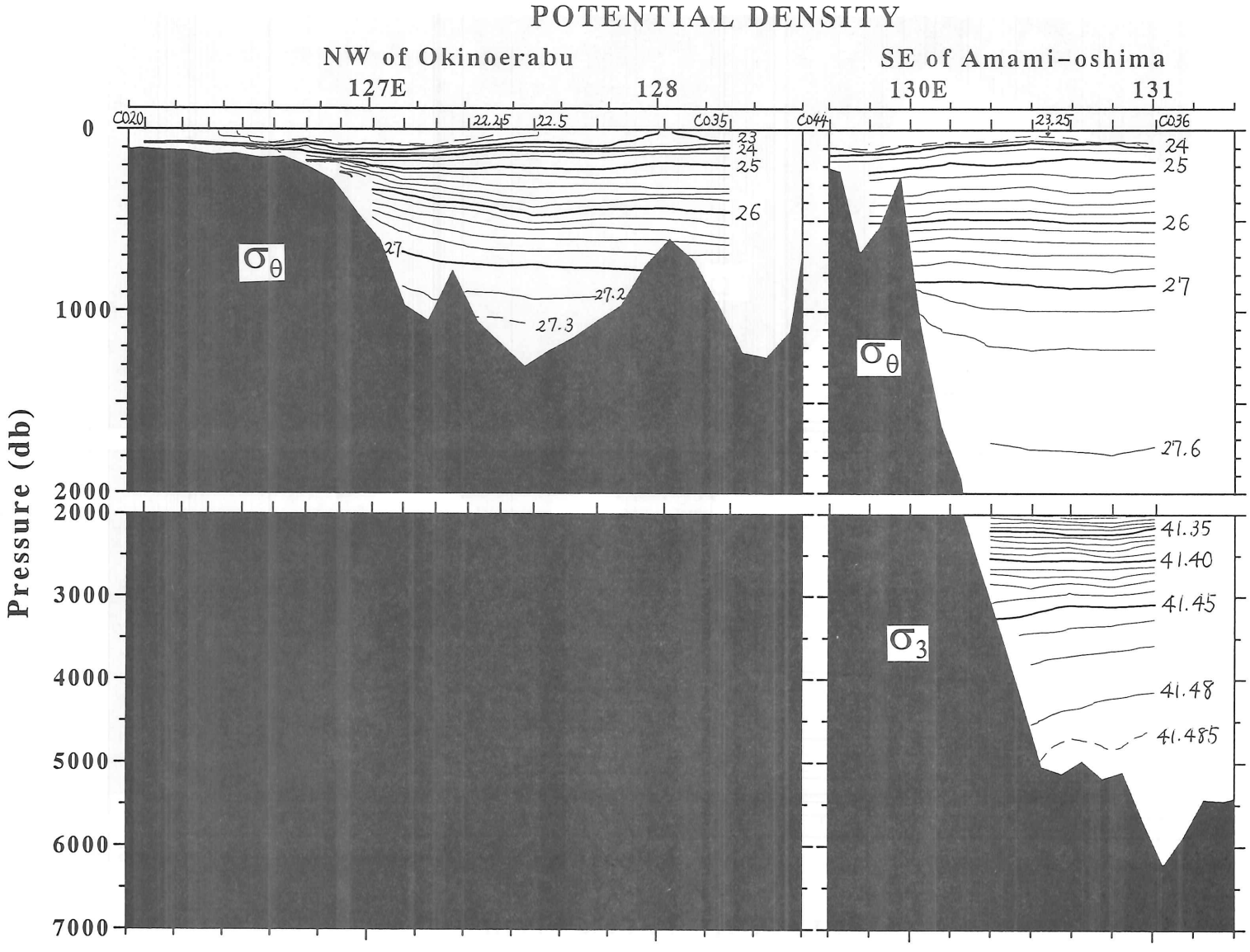
Horizontal velocity at 500 m measured by RD ADCP

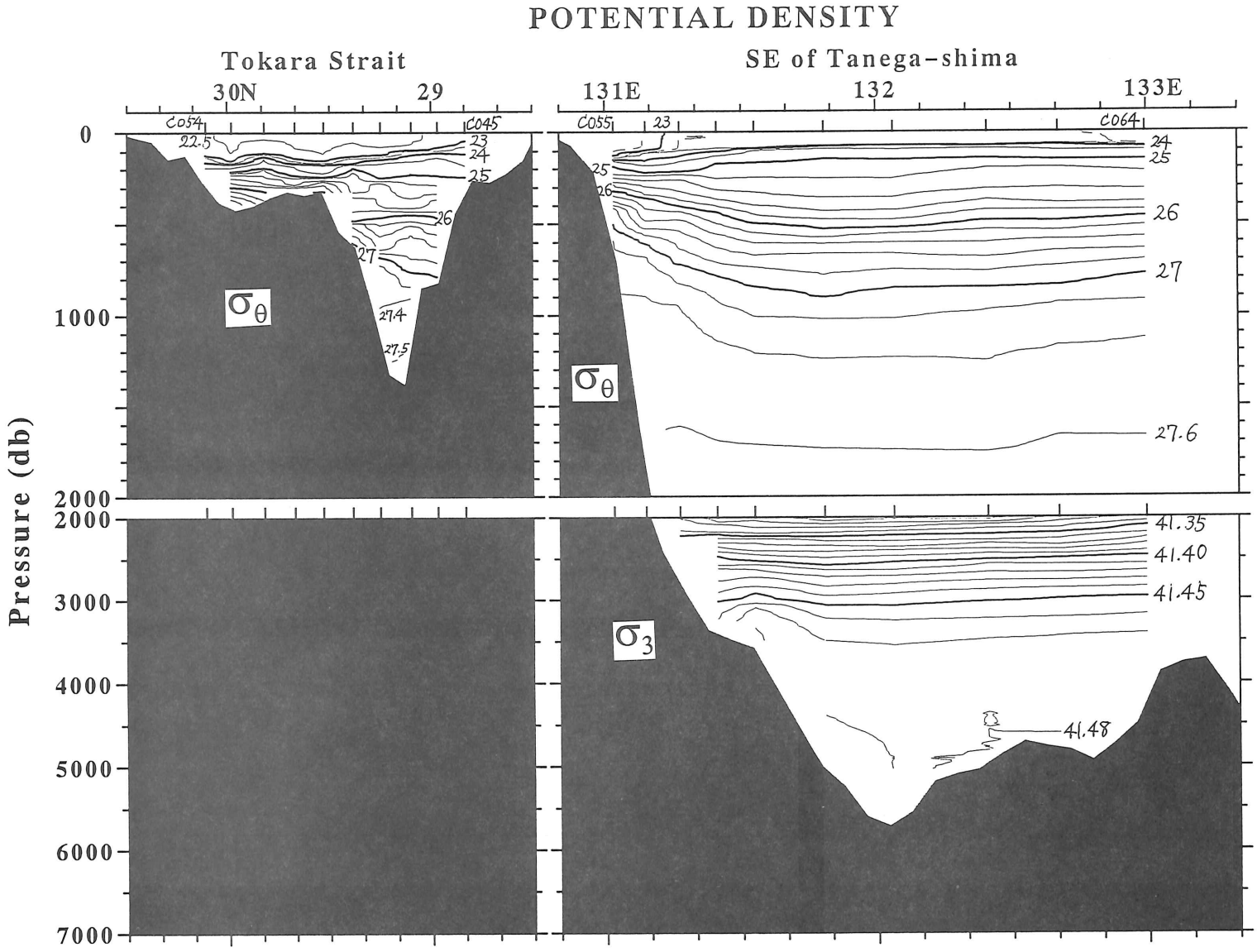


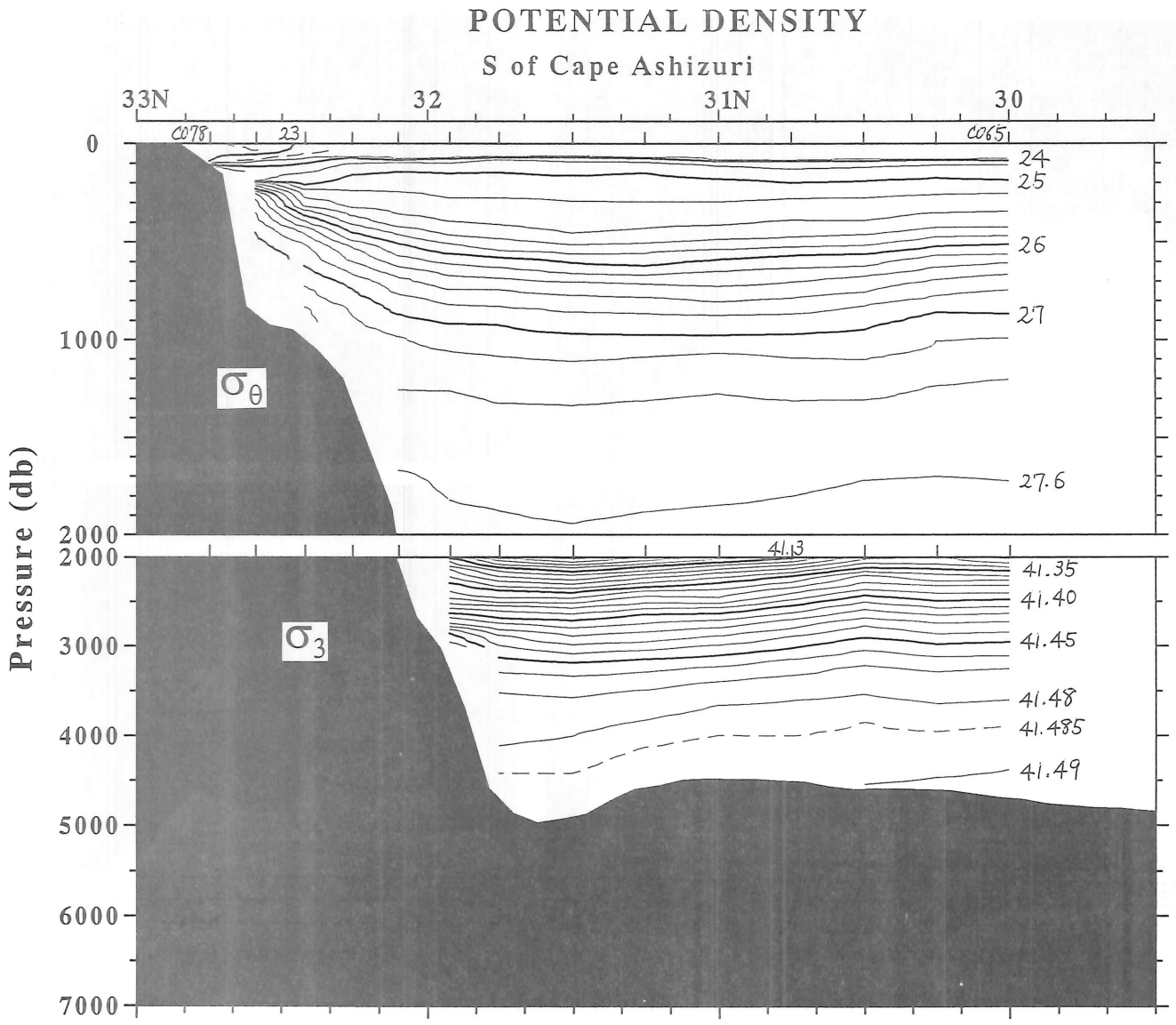


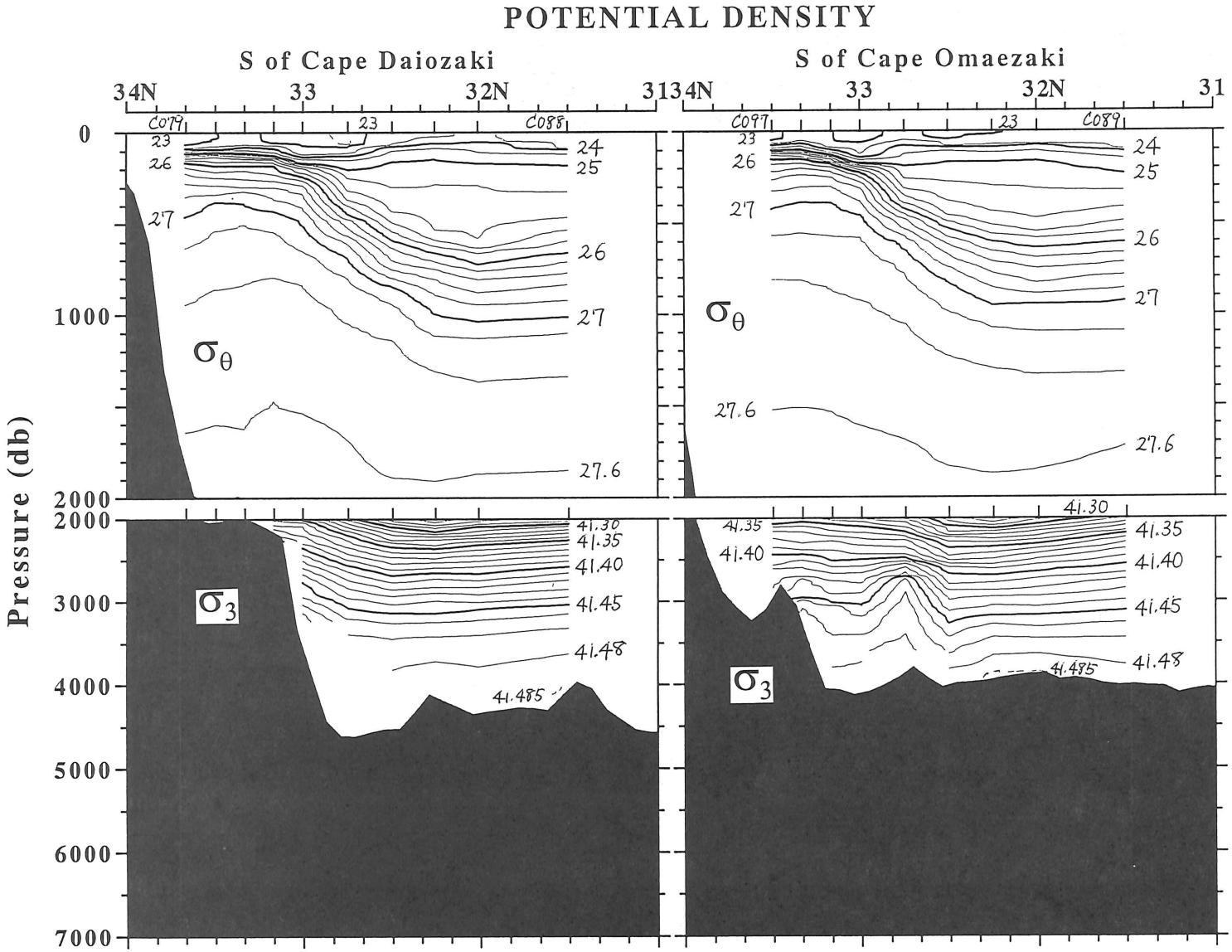
8. Vertical Sections of $CTDO_2$ Data

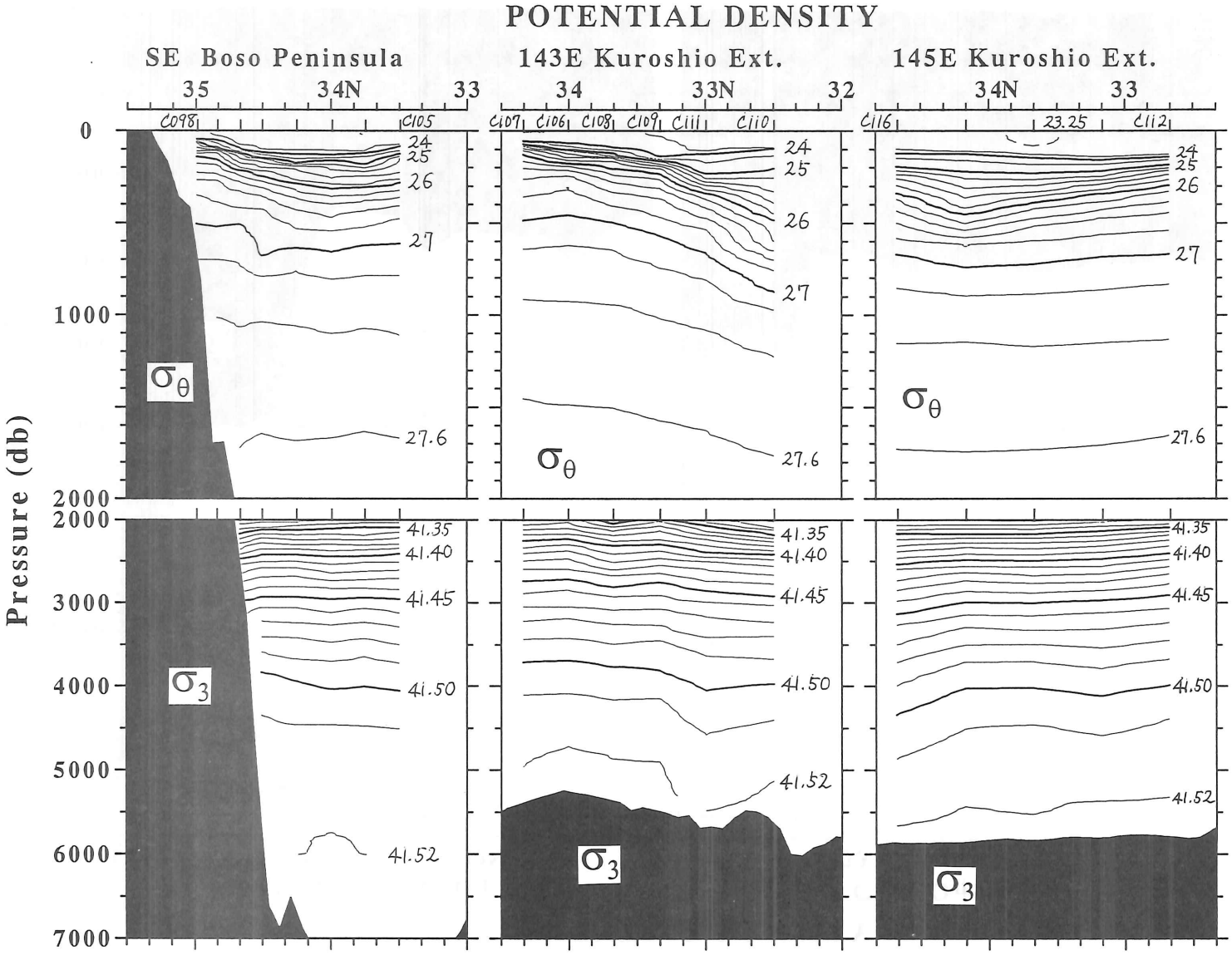


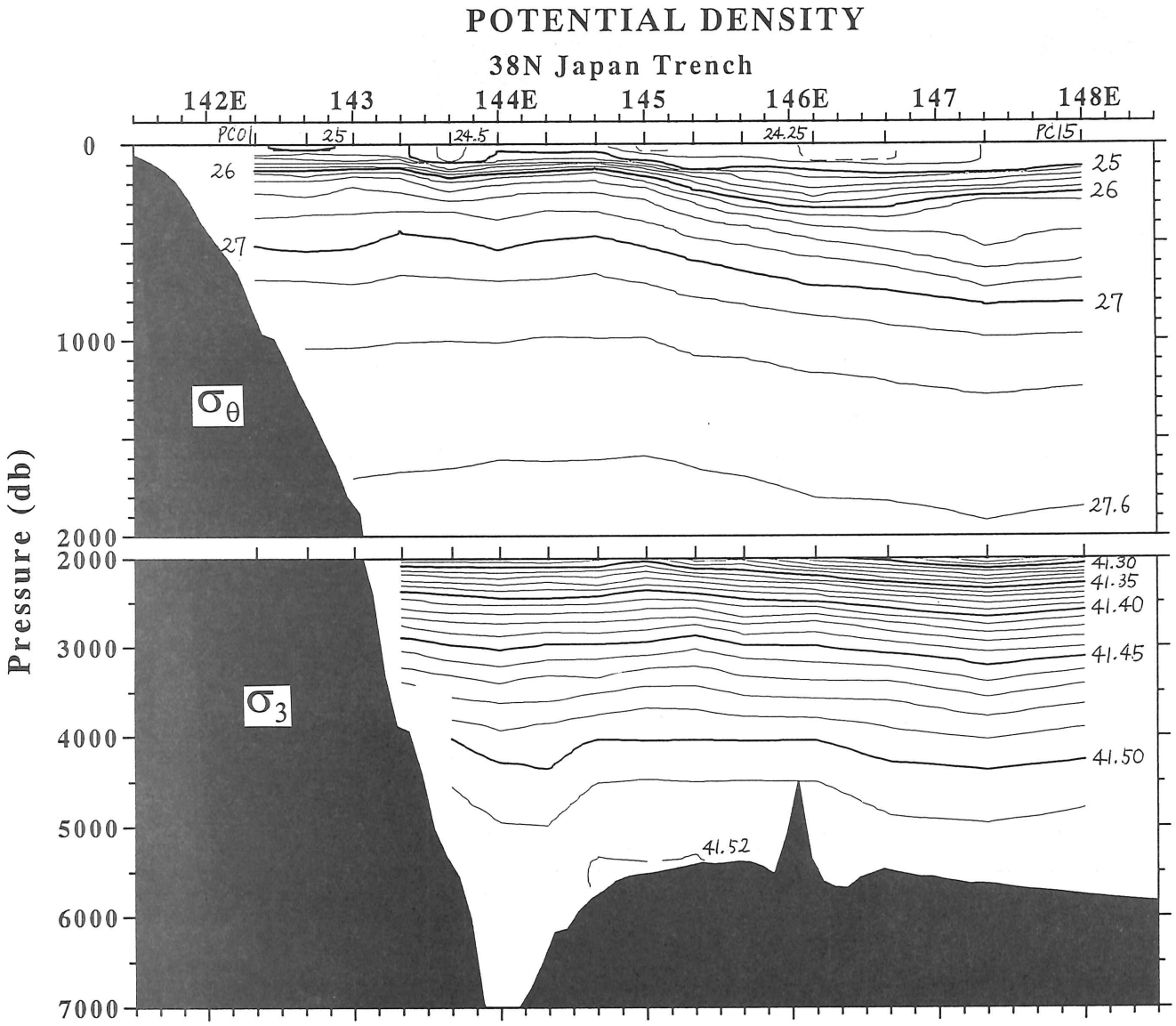

POTENTIAL DENSITY
NW of Okinoerabu
SE of Amami-oshima
127E
128
130E
131
C020
22.25
22.5
C035
C044
23.25
C036
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
σθ
σ3
23
24
25
26
27
27.2
27.3
27.6
41.35
41.40
41.45
41.48
41.485

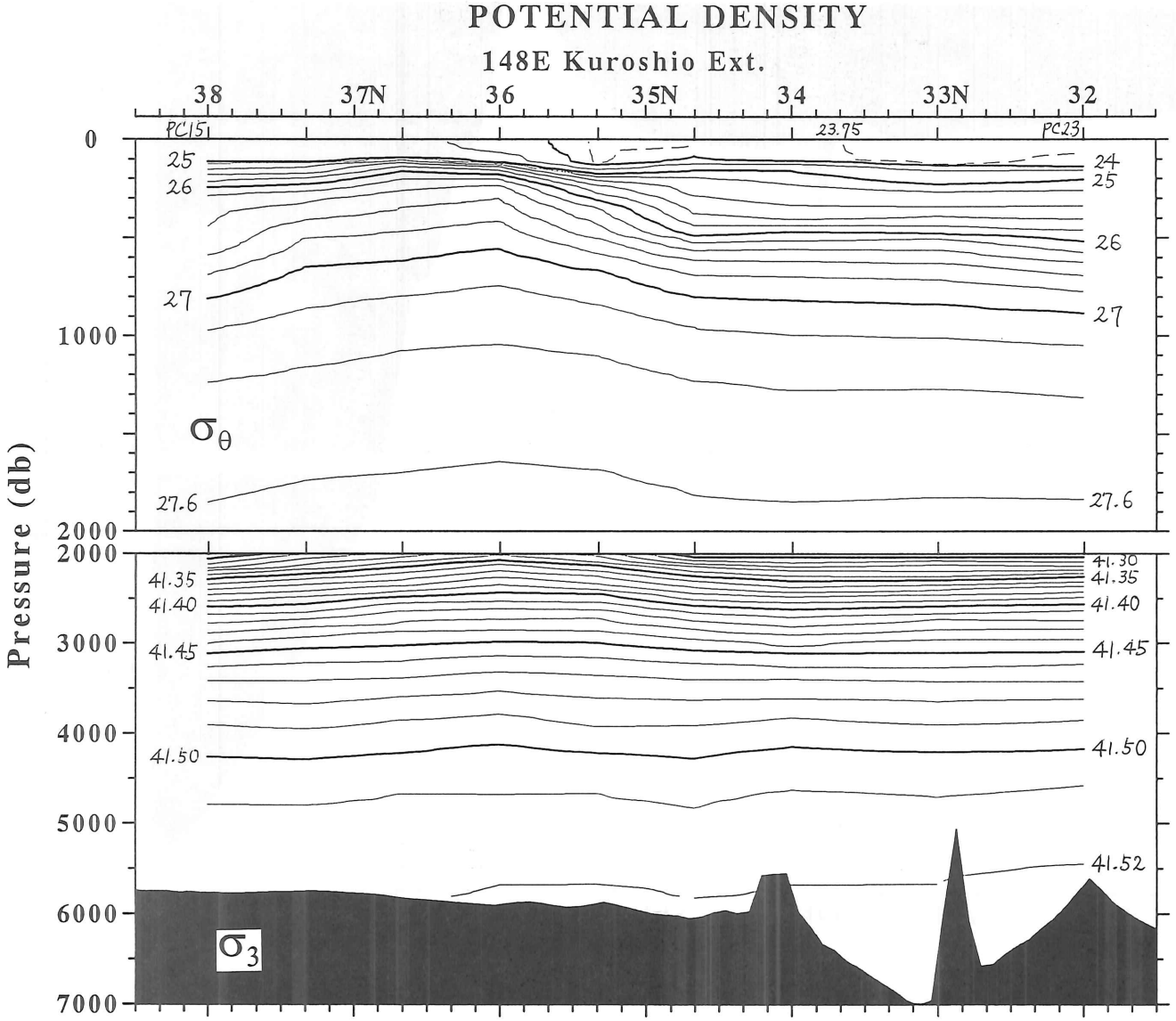

POTENTIAL DENSITY
Tokara Strait
SE of Tanega-shima
30N
29
131E
132
133E
C054
C045
C055
C064
22.5
23
24
25
26
27
27.4
27.5
σ_θ
σ_θ
27.6
σ_3
41.35
41.40
41.45
41.48
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000

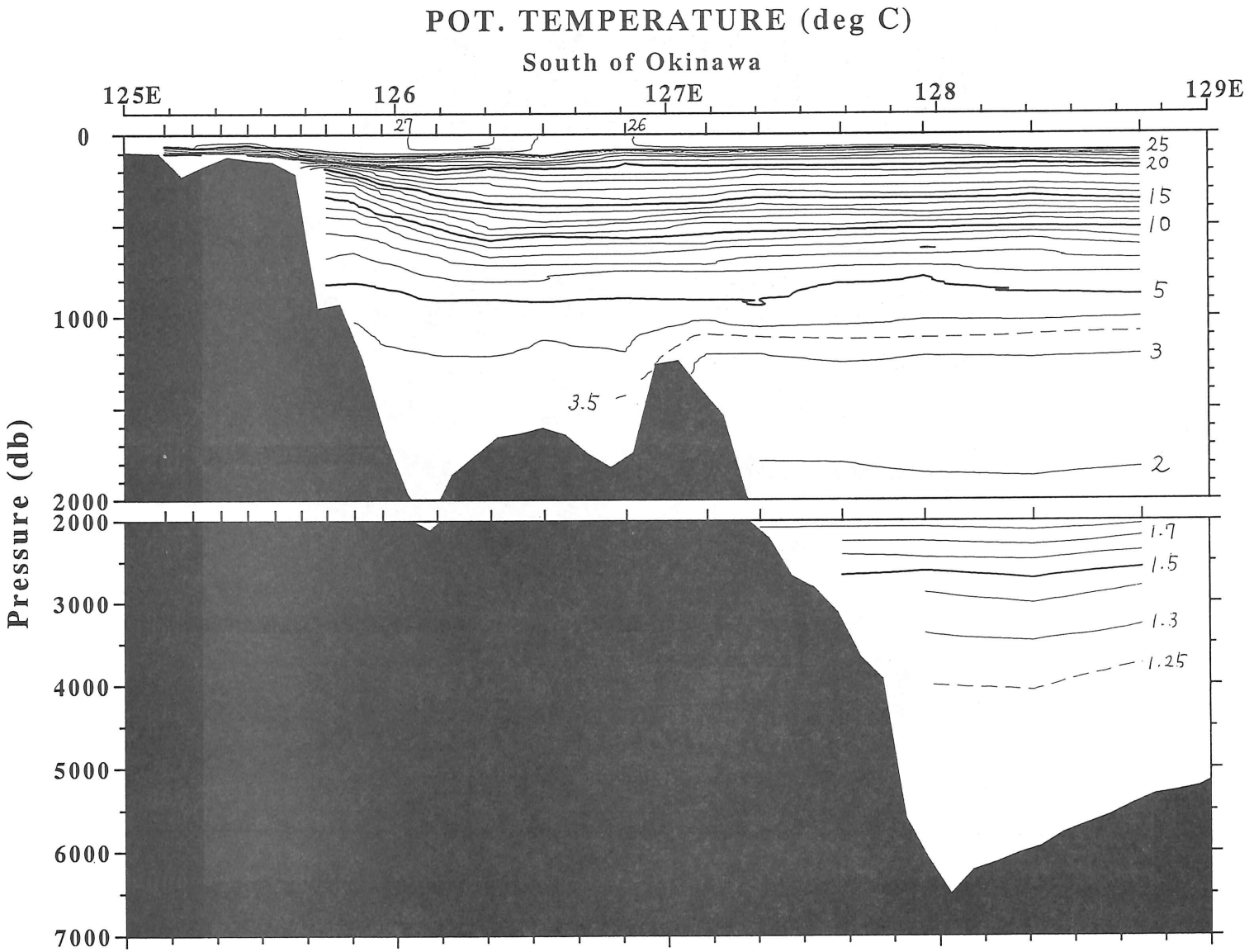

POTENTIAL DENSITY
S of Cape Ashizuri
33N
32
31N
30
C078
23
C065
0
1000
2000
3000
4000
5000
6000
7000
Pressure (db)
σθ
σ3
24
25
26
27
27.6
41.13
41.35
41.40
41.45
41.48
41.485
41.49

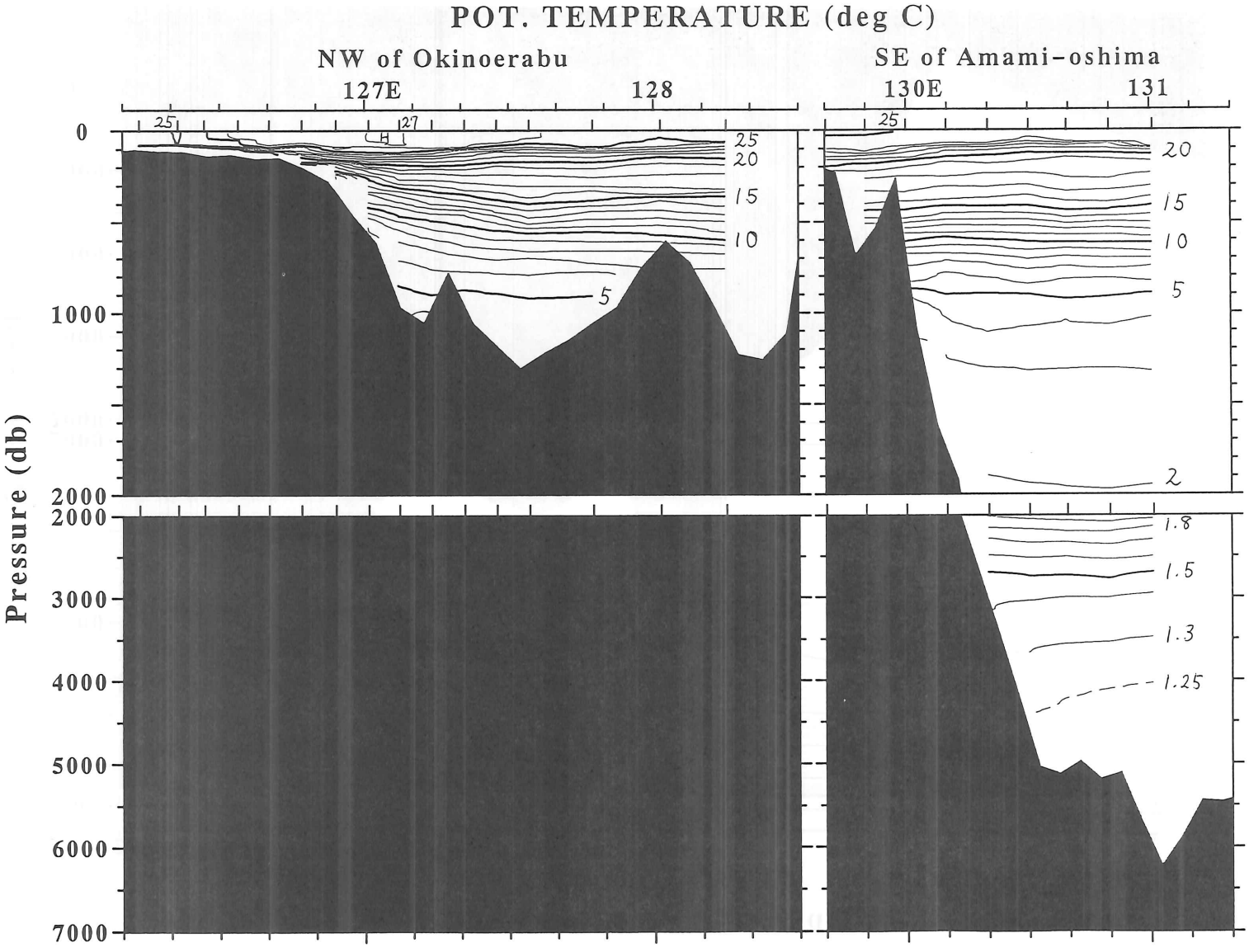

POTENTIAL DENSITY
S of Cape Daiozaki
S of Cape Omaezaki
34N
33
32N
31
C079
C088
C097
C089
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
σθ
σ3
23
24
25
26
27
27.6
41.30
41.35
41.40
41.45
41.48
41.485

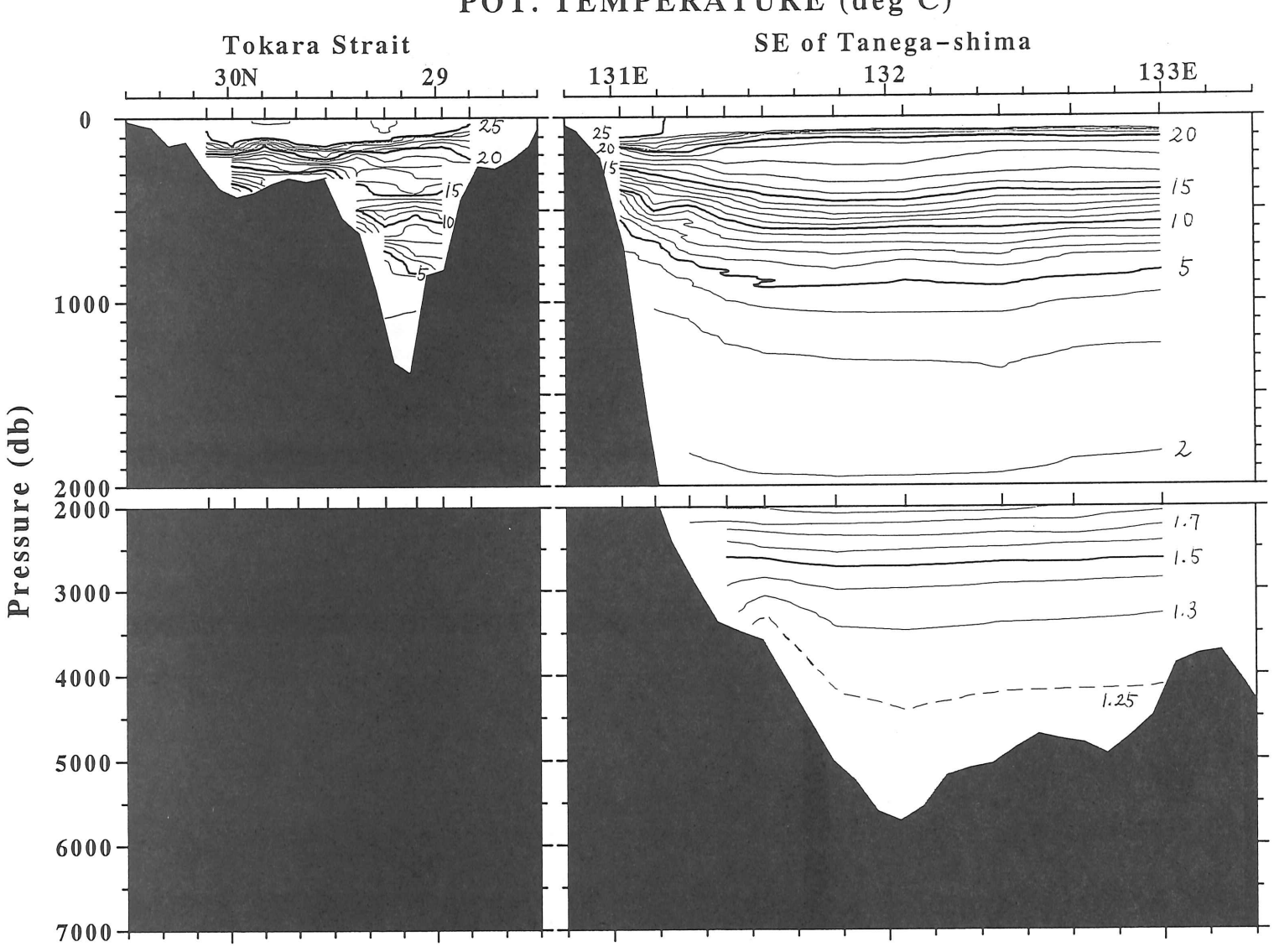

POTENTIAL DENSITY
SE Boso Peninsula
143E Kuroshio Ext.
145E Kuroshio Ext.
35
34N
33
34
33N
32
34N
33
23.25
C098
C105
C107
C106
C108
C109
C111
C110
C116
C112
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
24
25
26
27
27.6
σθ
41.35
41.40
41.45
41.50
41.52
σ3

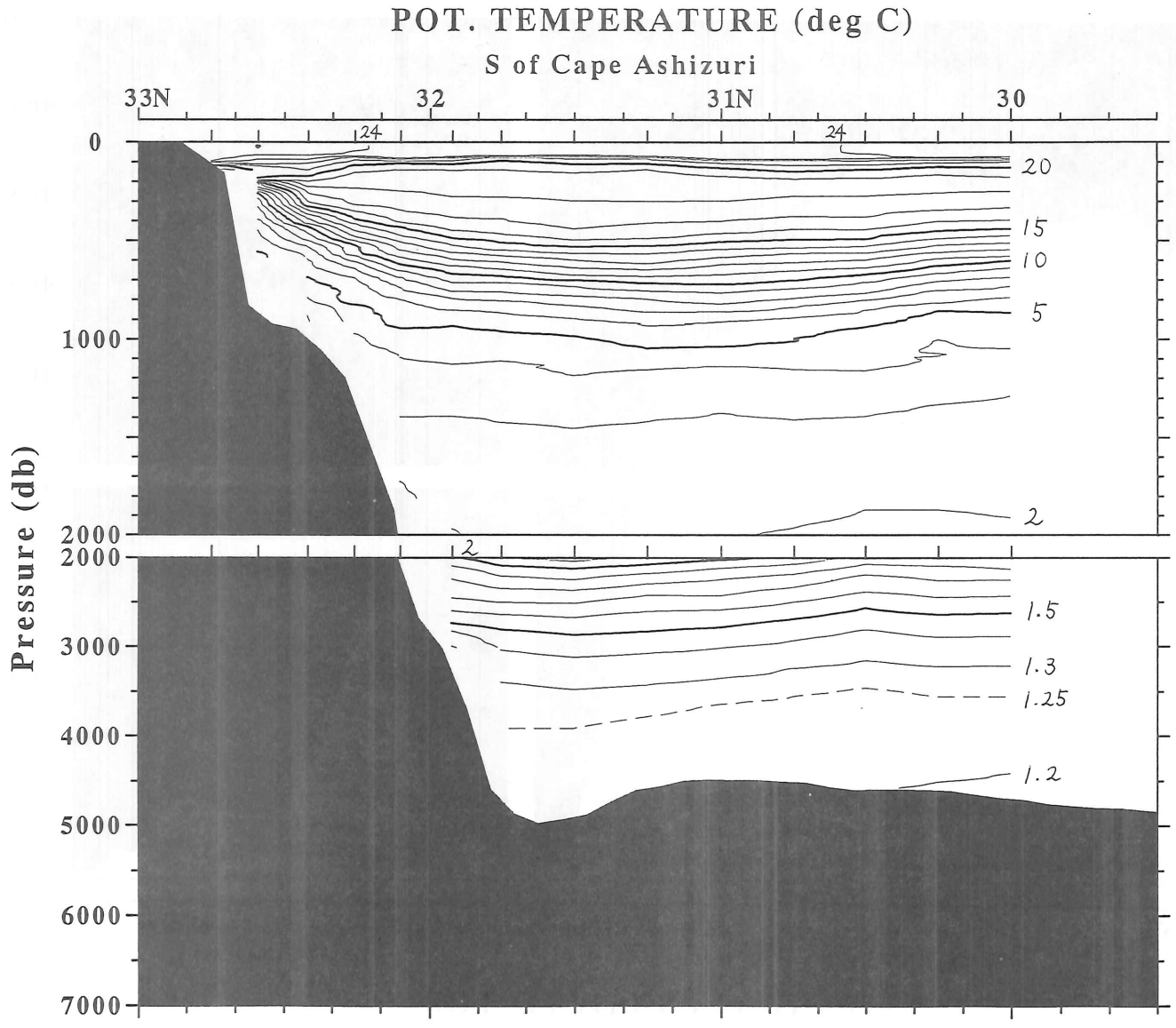

POTENTIAL DENSITY
38N Japan Trench
142E
143
144E
145
146E
147
148E
PC01
25
24.5
24.25
PC15
0
1000
2000
3000
4000
5000
6000
7000
Pressure (db)
26
27
25
26
27
27.6
σ_θ
σ_3
41.30
41.35
41.40
41.45
41.50
41.52

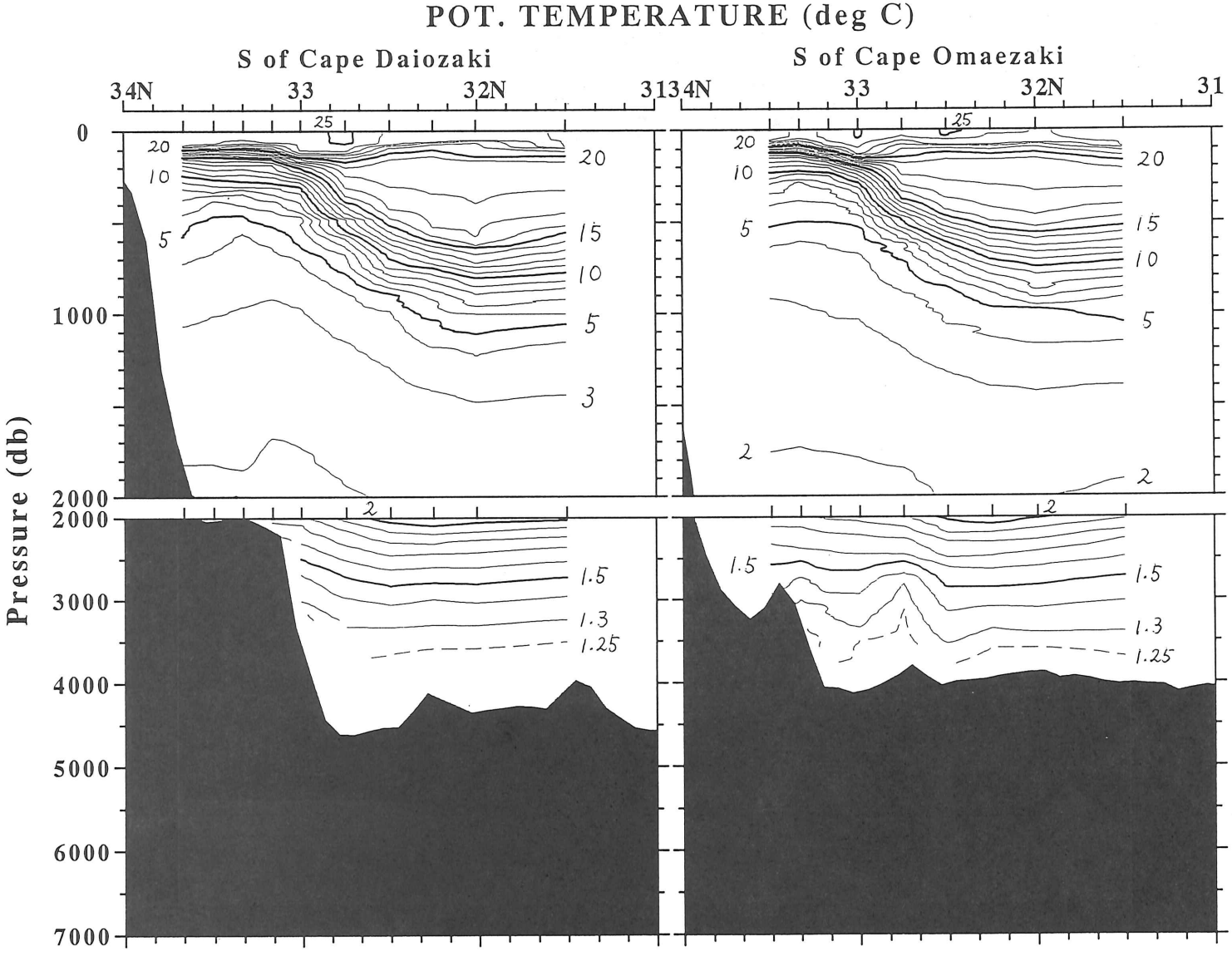

POTENTIAL DENSITY
148E Kuroshio Ext.
38
37N
36
35N
34
33N
32
PC15
23.75
PC23
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
25
26
27
24
25
26
27
27.6
σ_θ
41.35
41.40
41.45
41.50
41.30
41.35
41.40
41.45
41.50
41.52
σ_3

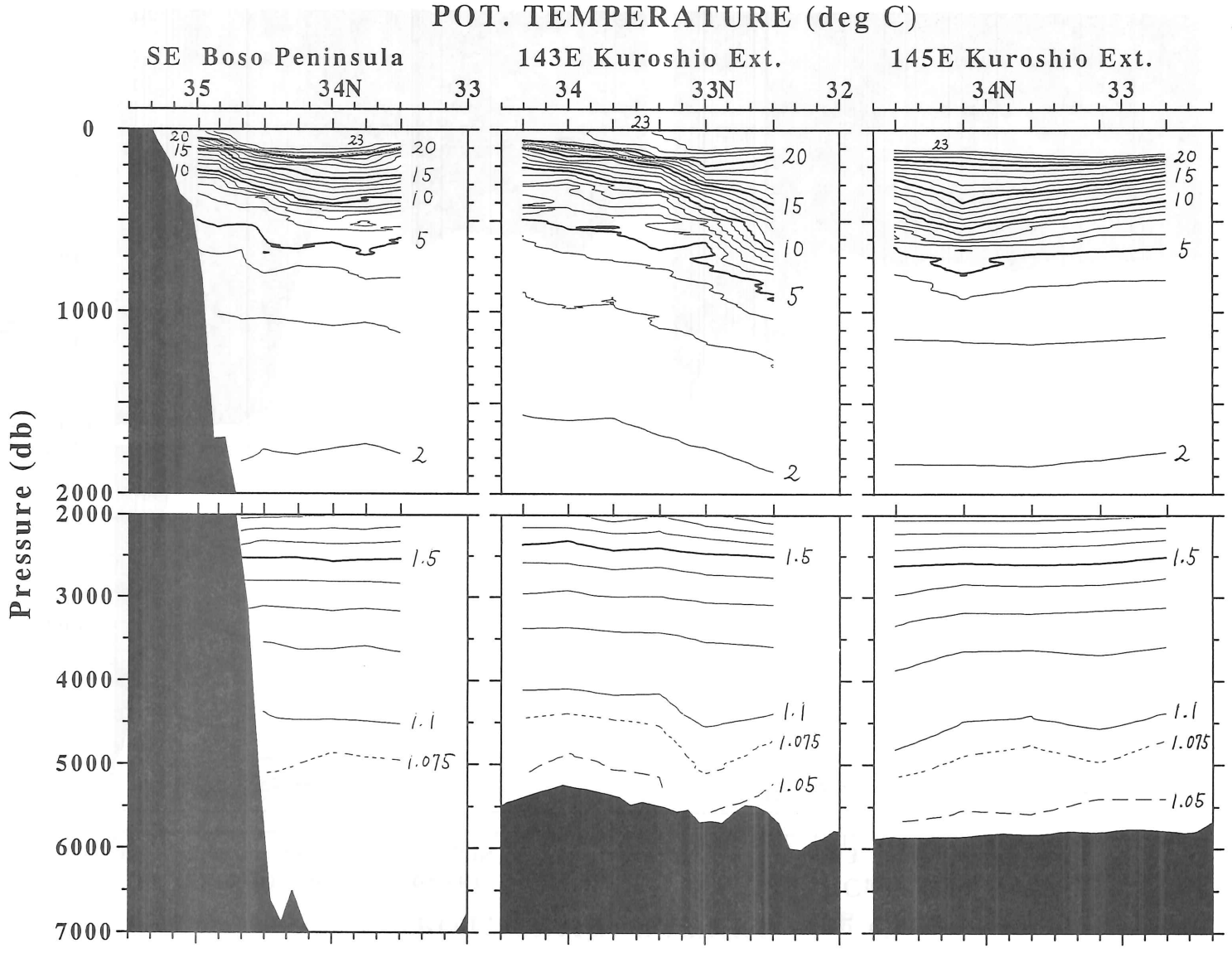

POT. TEMPERATURE (deg C)
South of Okinawa
125E
126
127E
128
129E
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
27
26
25
20
15
10
5
3
3.5
2
1.7
1.5
1.3
1.25

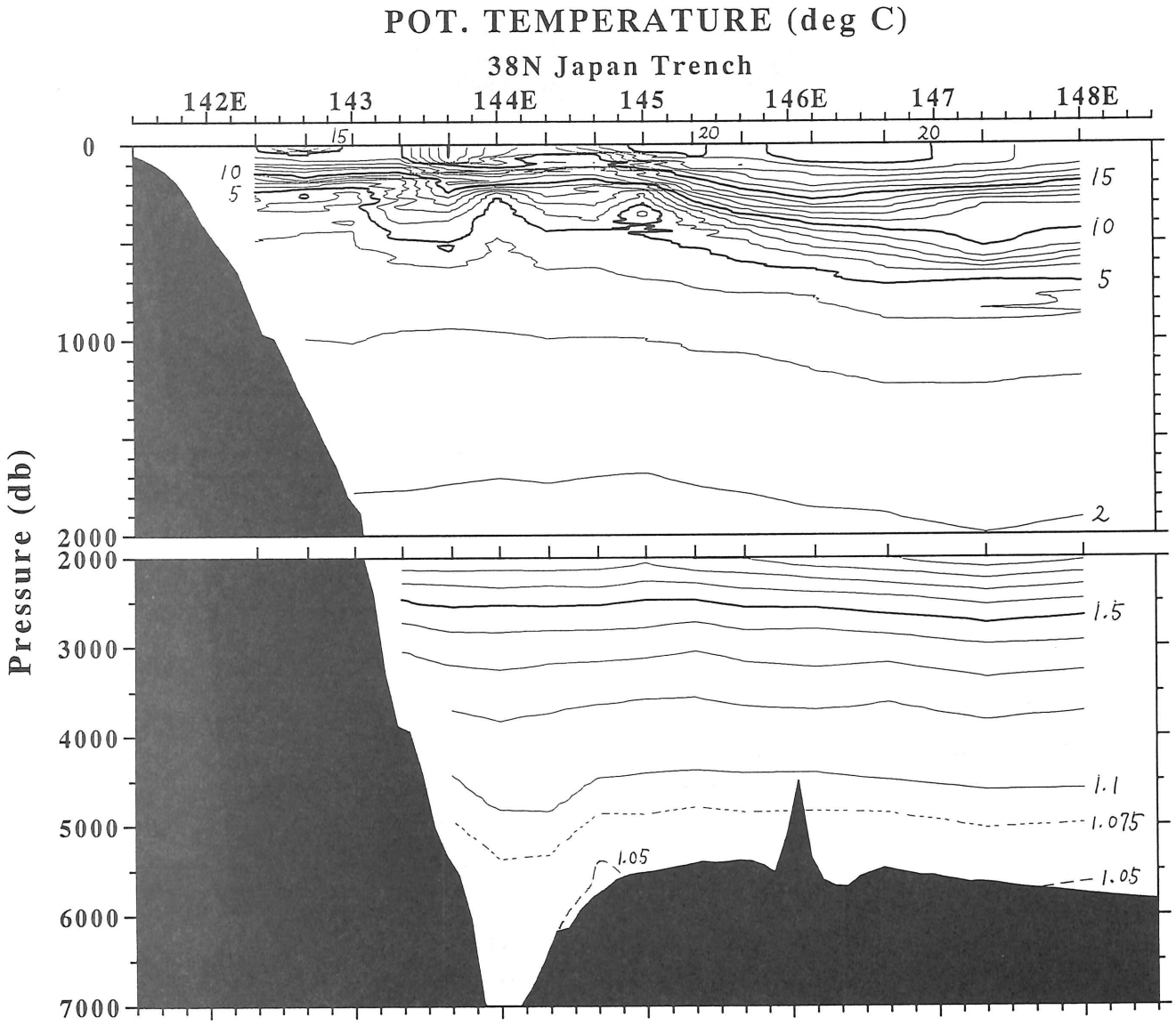

POT. TEMPERATURE (deg C)
NW of Okinoerabu
127E
128
SE of Amami-oshima
130E
131
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
25
20
15
10
5
2
1.8
1.5
1.3
1.25

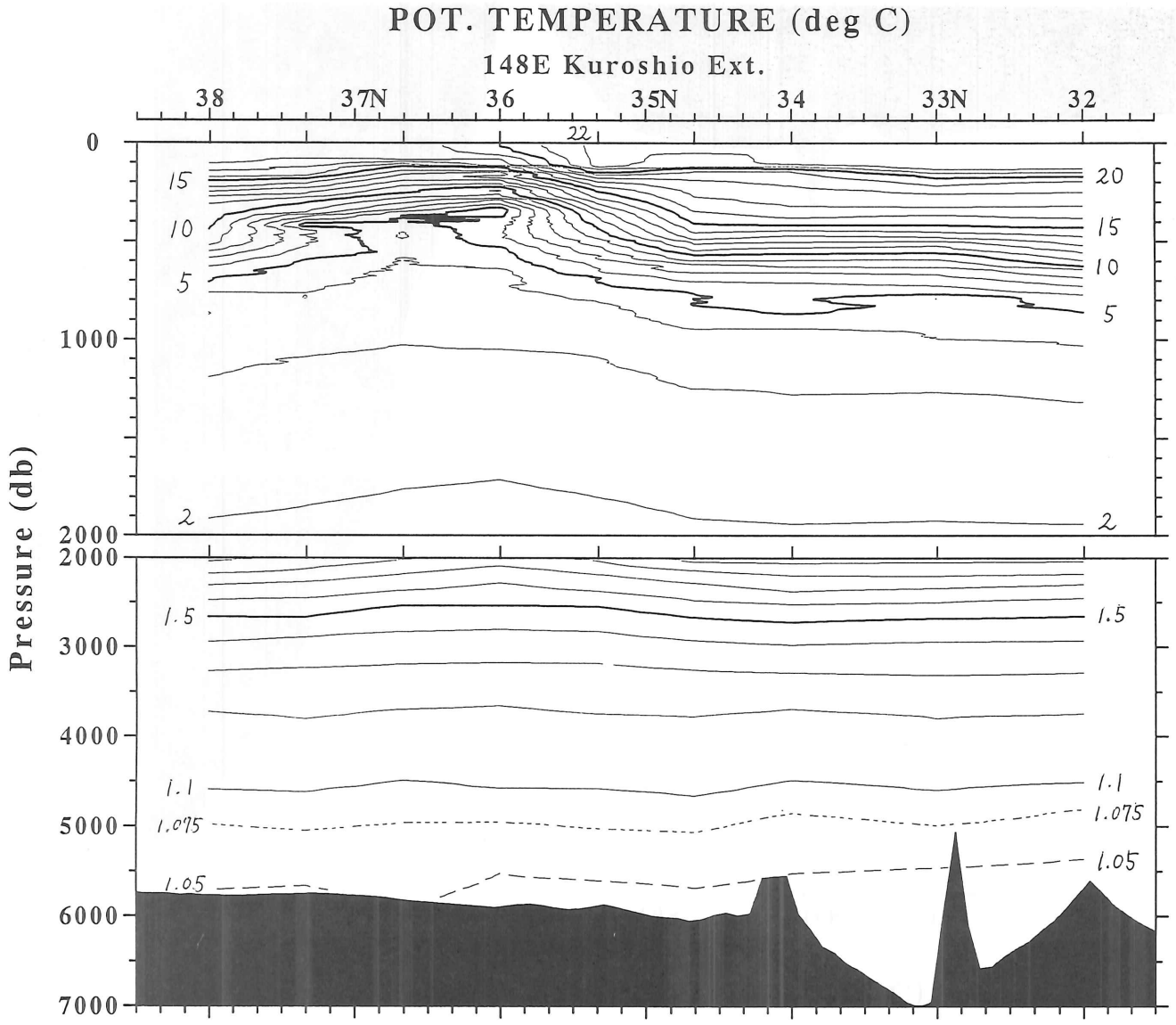

POT. TEMPERATURE (deg C)
Tokara Strait
SE of Tanega-shima
30N
29
131E
132
133E
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
25
20
15
10
5
2
1.7
1.5
1.3
1.25

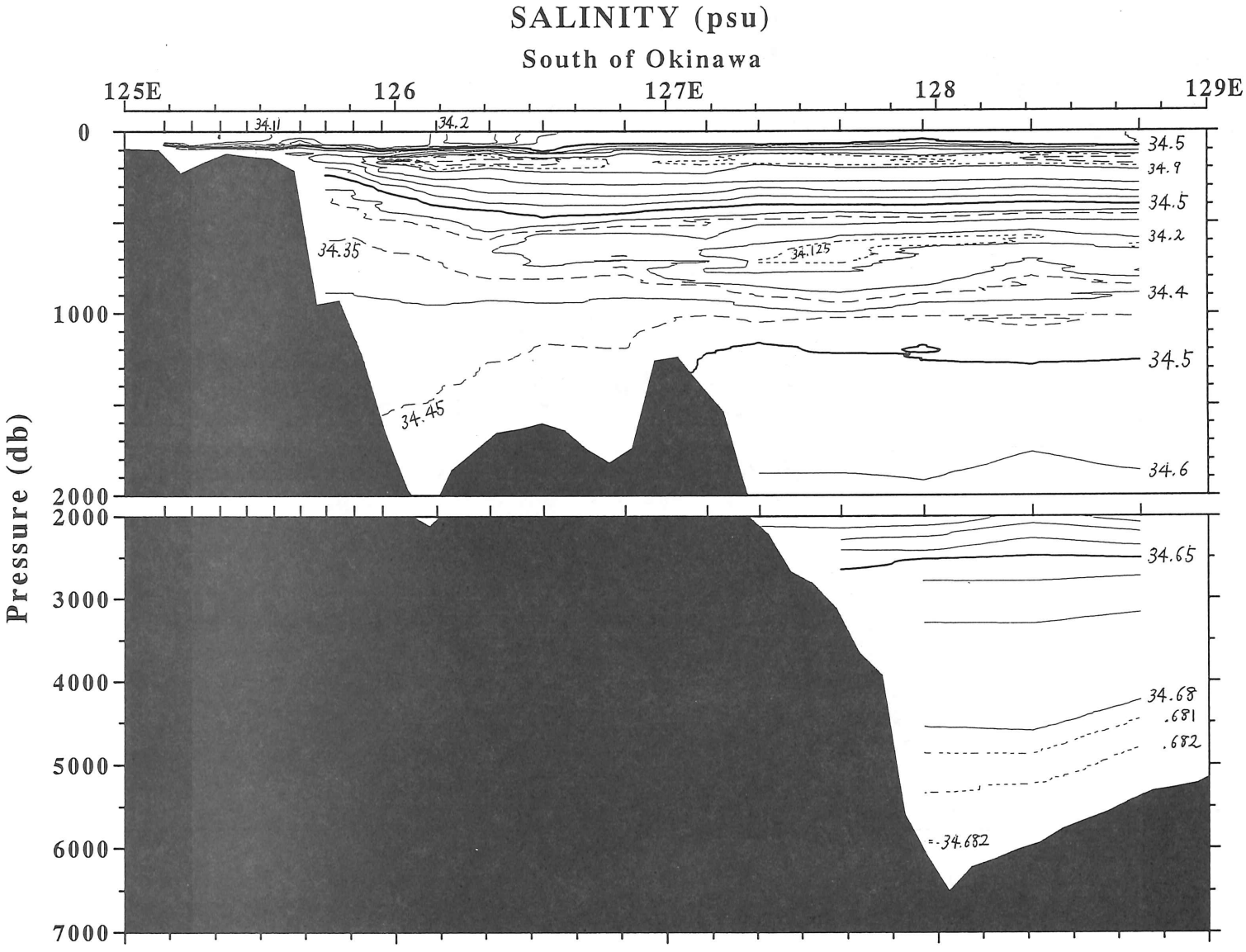

POT. TEMPERATURE (deg C)
S of Cape Ashizuri
33N
32
31N
30
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
24
24
20
15
10
5
2
2
1.5
1.3
1.25
1.2

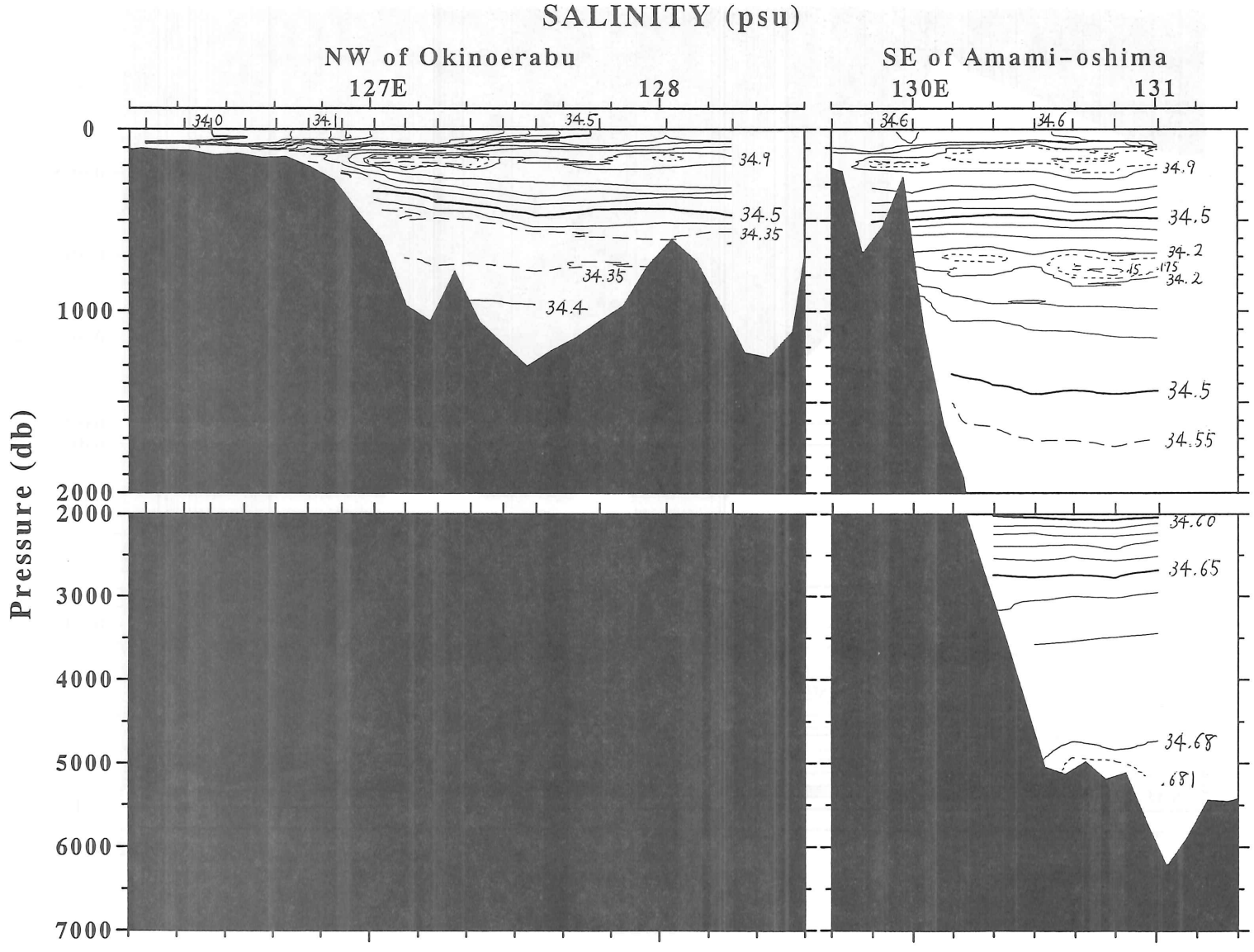

POT. TEMPERATURE (deg C)
S of Cape Daiozaki
S of Cape Omaezaki
34N
33
32N
31
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
25
20
10
5
15
3
2
1.5
1.3
1.25

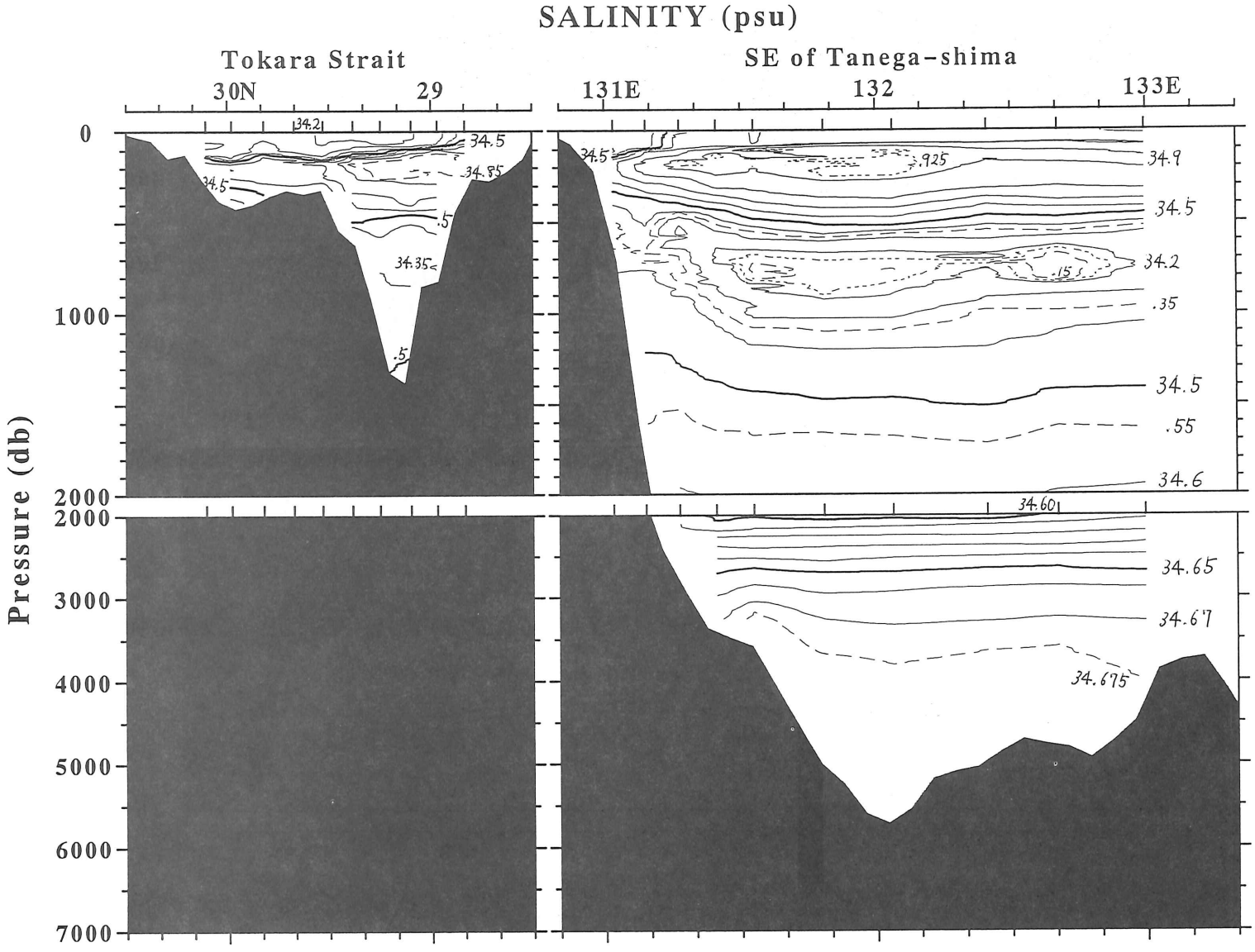

POT. TEMPERATURE (deg C)
SE Boso Peninsula
143E Kuroshio Ext.
145E Kuroshio Ext.
35
34N
33
34
33N
32
34N
33
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
20
15
10
5
2
1.5
1.1
1.075
1.05
23

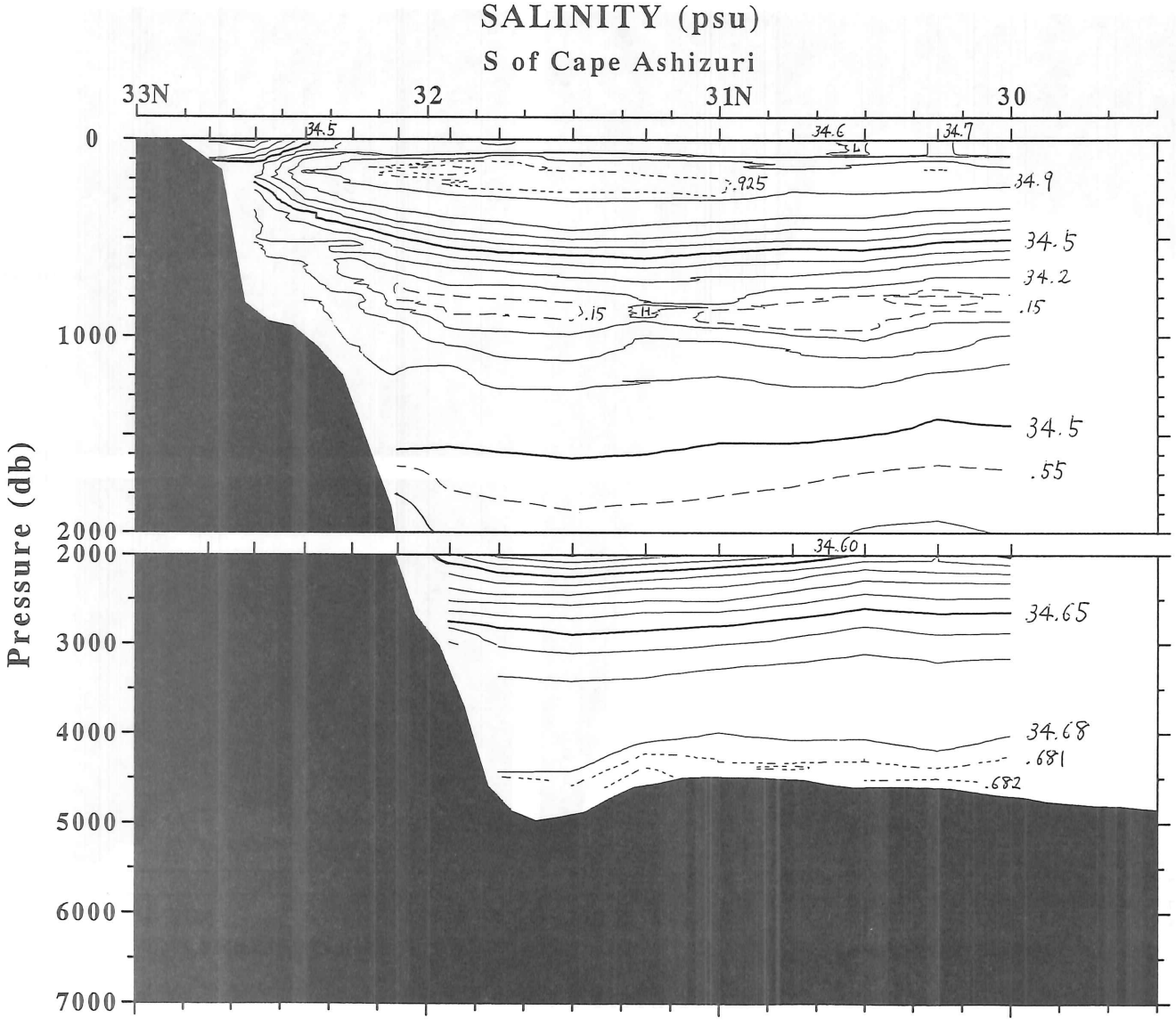

POT. TEMPERATURE (deg C)
38N Japan Trench
142E
143
144E
145
146E
147
148E
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
15
20
20
10
5
15
10
5
2
1.5
1.1
1.075
1.05
1.05

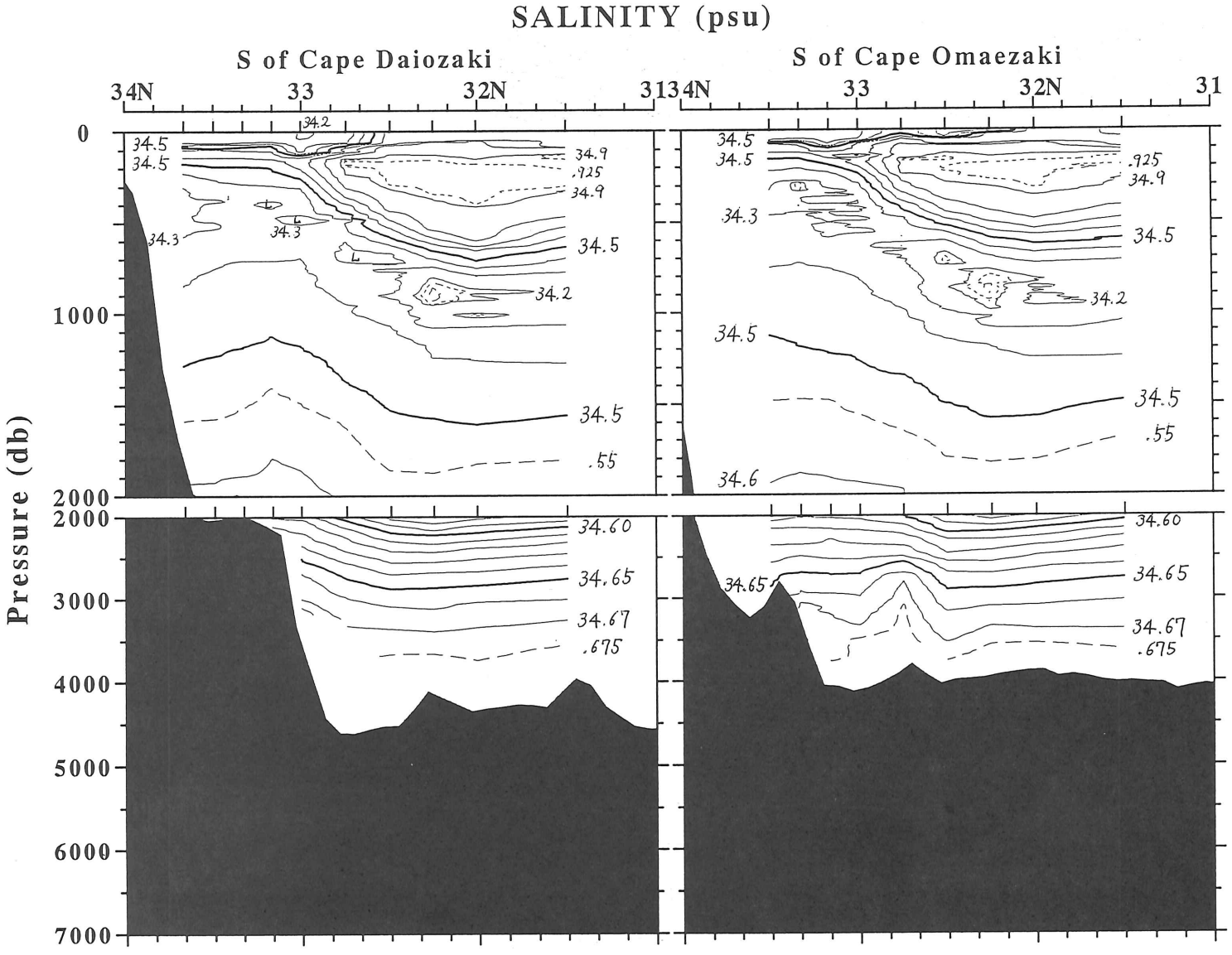

POT. TEMPERATURE (deg C)
148E Kuroshio Ext.
38
37N
36
35N
34
33N
32
22
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
15
10
5
2
20
15
10
5
2
1.5
1.5
1.1
1.075
1.05
1.1
1.075
1.05

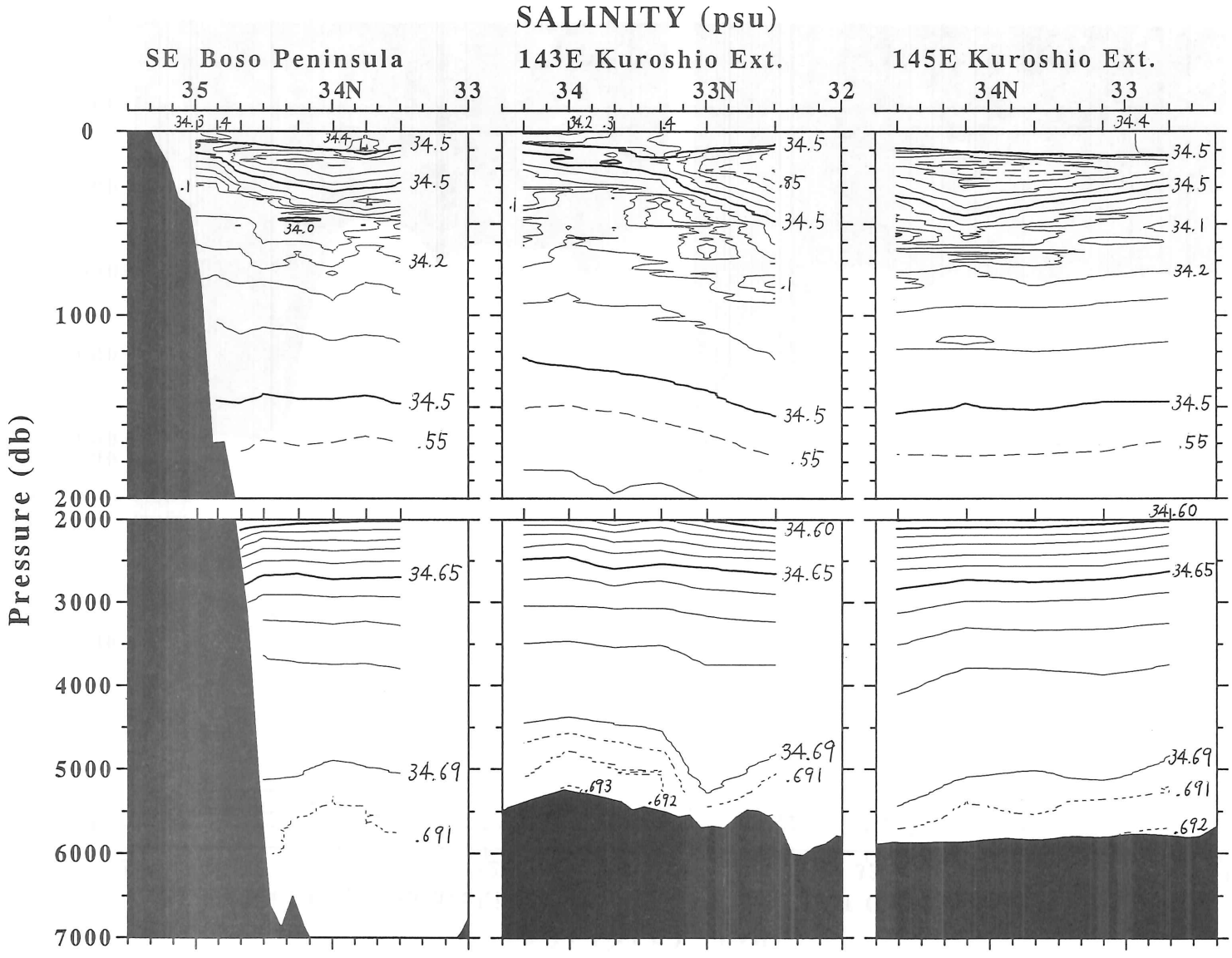

SALINITY (psu)
South of Okinawa
125E
126
127E
128
129E
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
34.11
34.2
34.5
34.9
34.5
34.2
34.4
34.5
34.6
34.35
34.125
34.45
34.65
34.68
.681
.682
=.34.682

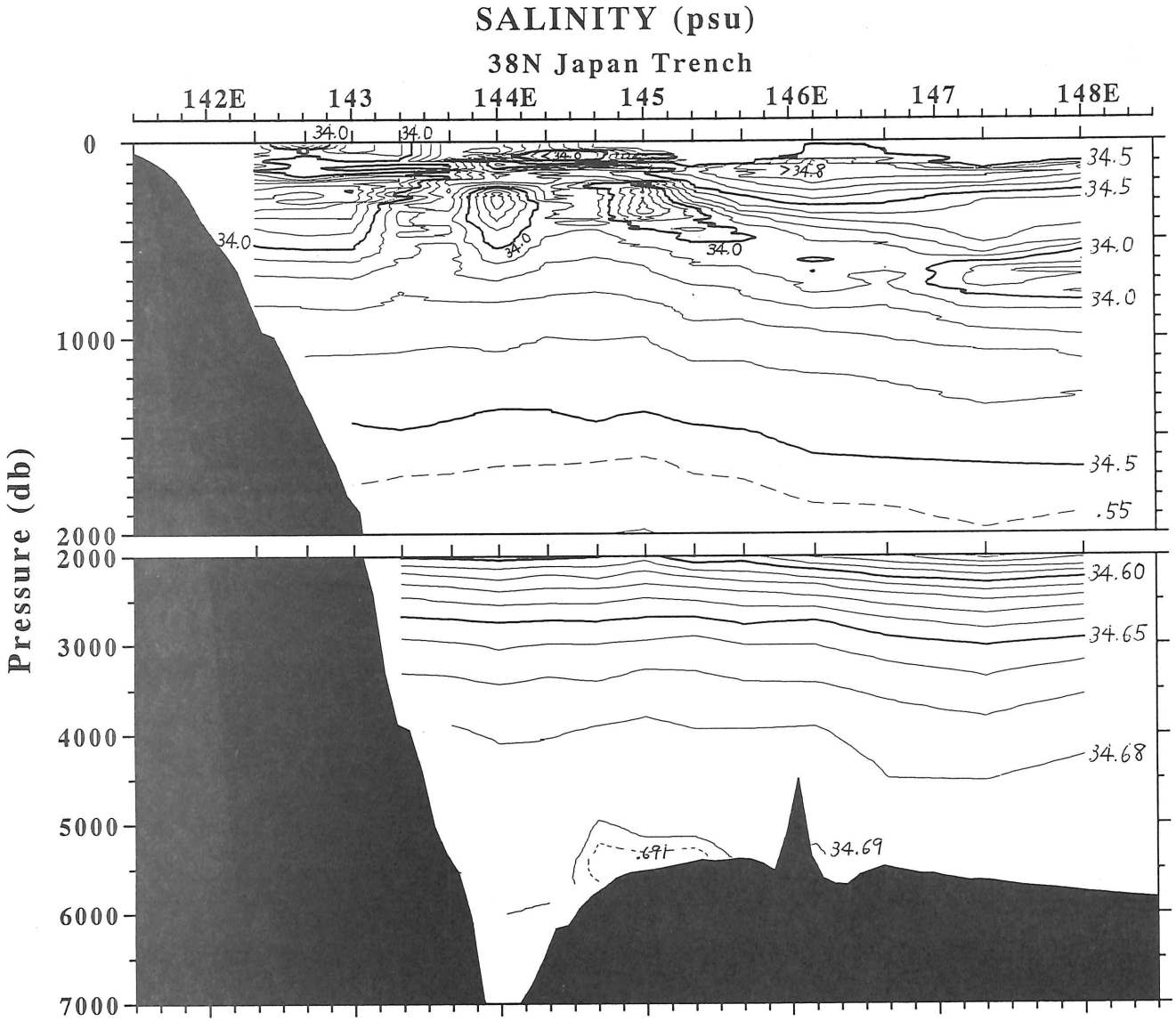

SALINITY (psu)
NW of Okinoerabu
127E
128
SE of Amami-oshima
130E
131
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
34.0
34.1
34.5
34.6
34.6
34.9
34.5
34.35
34.35
34.4
34.9
34.5
34.2
34.2
34.5
34.55
34.60
34.65
34.68
.681

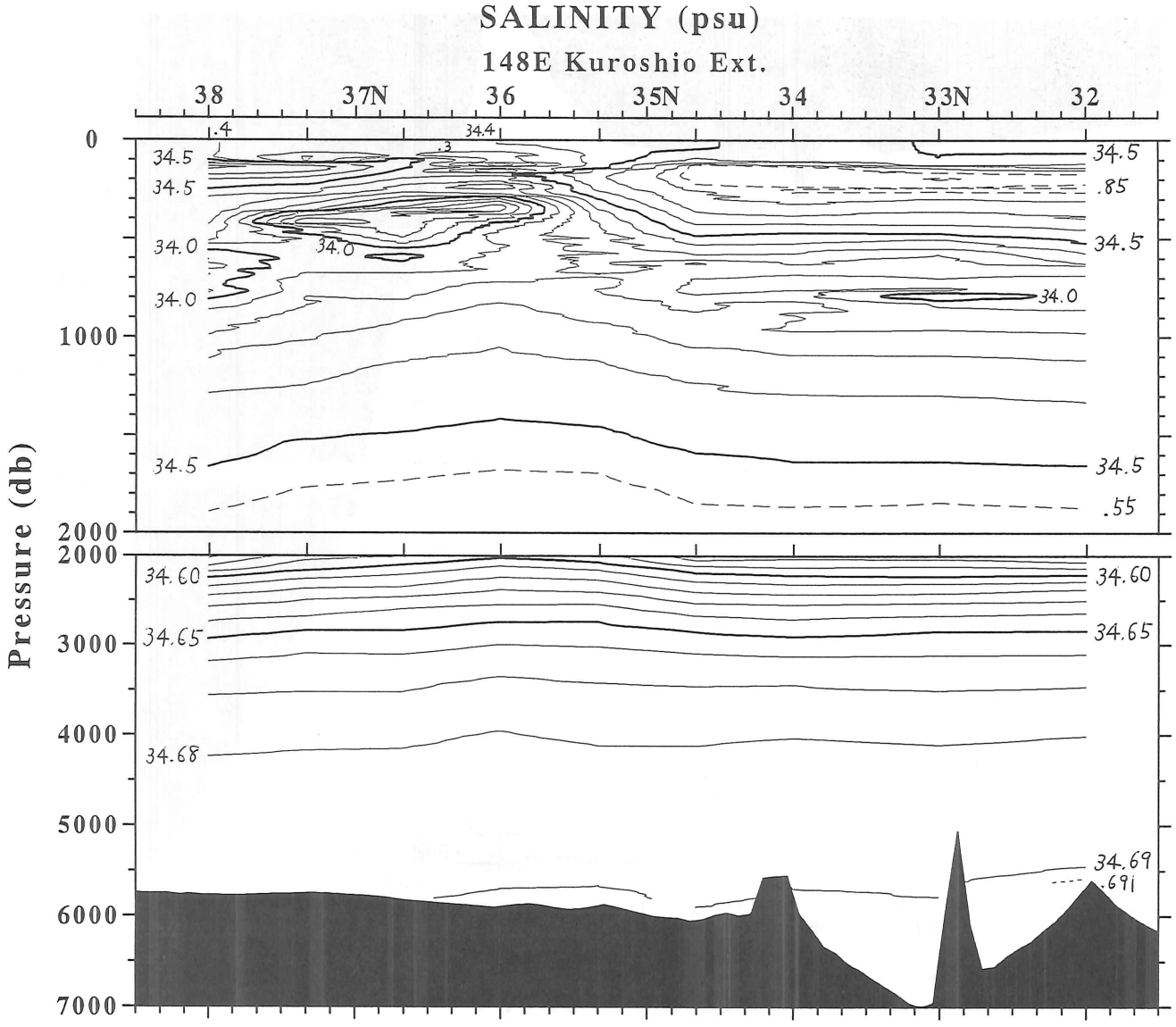

SALINITY (psu)
Tokara Strait
SE of Tanega-shima
30N
29
131E
132
133E
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
34.2
34.5
34.85
34.35
.5
.925
34.9
34.5
.15
.35
34.2
34.5
.55
34.6
34.60
34.65
34.67
34.675

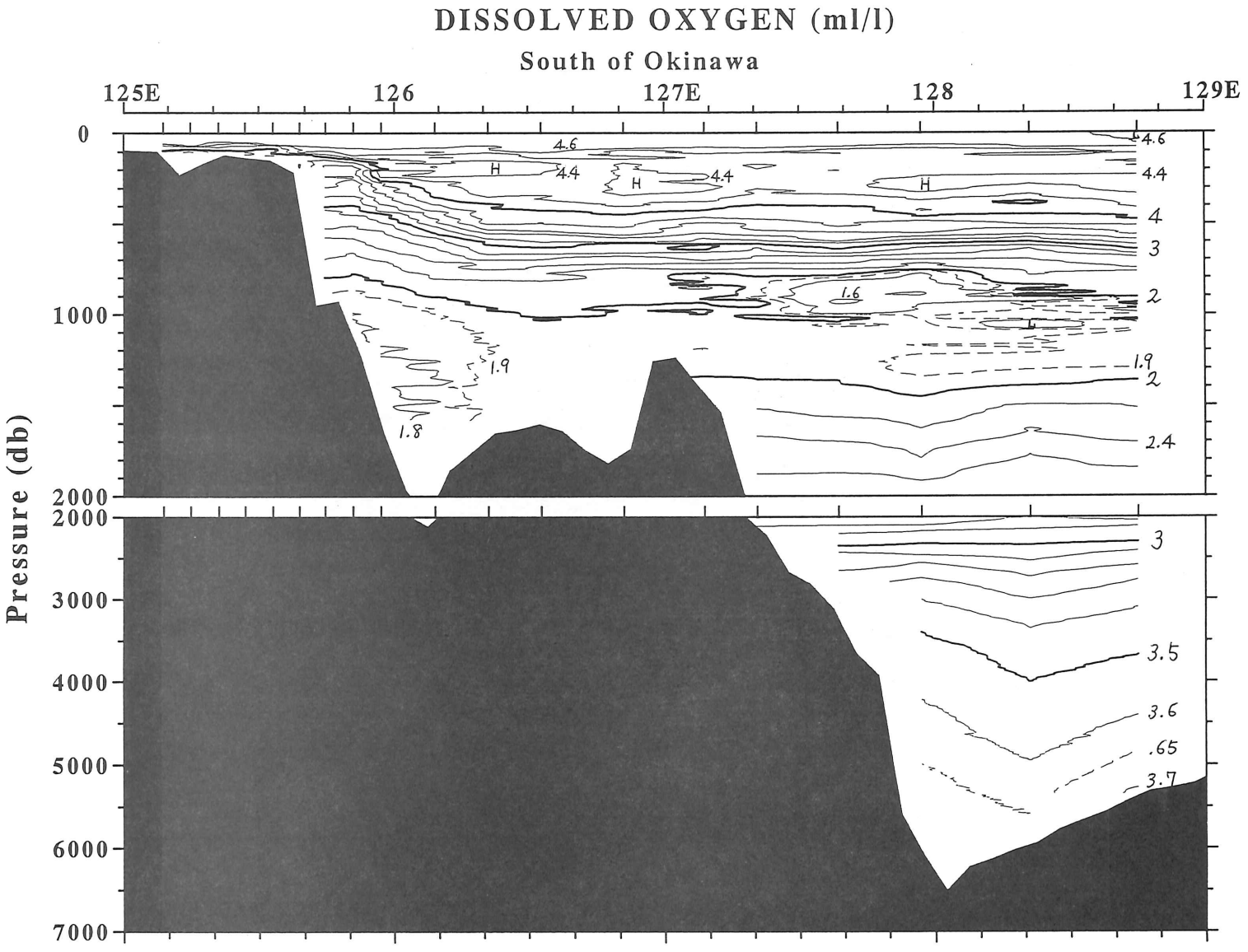

SALINITY (psu)
S of Cape Ashizuri
33N
32
31N
30
0
1000
2000
3000
4000
5000
6000
7000
Pressure (db)
34.5
34.6
34.7
34.9
34.5
34.2
.15
34.5
.55
34.60
34.65
34.68
.681
.682

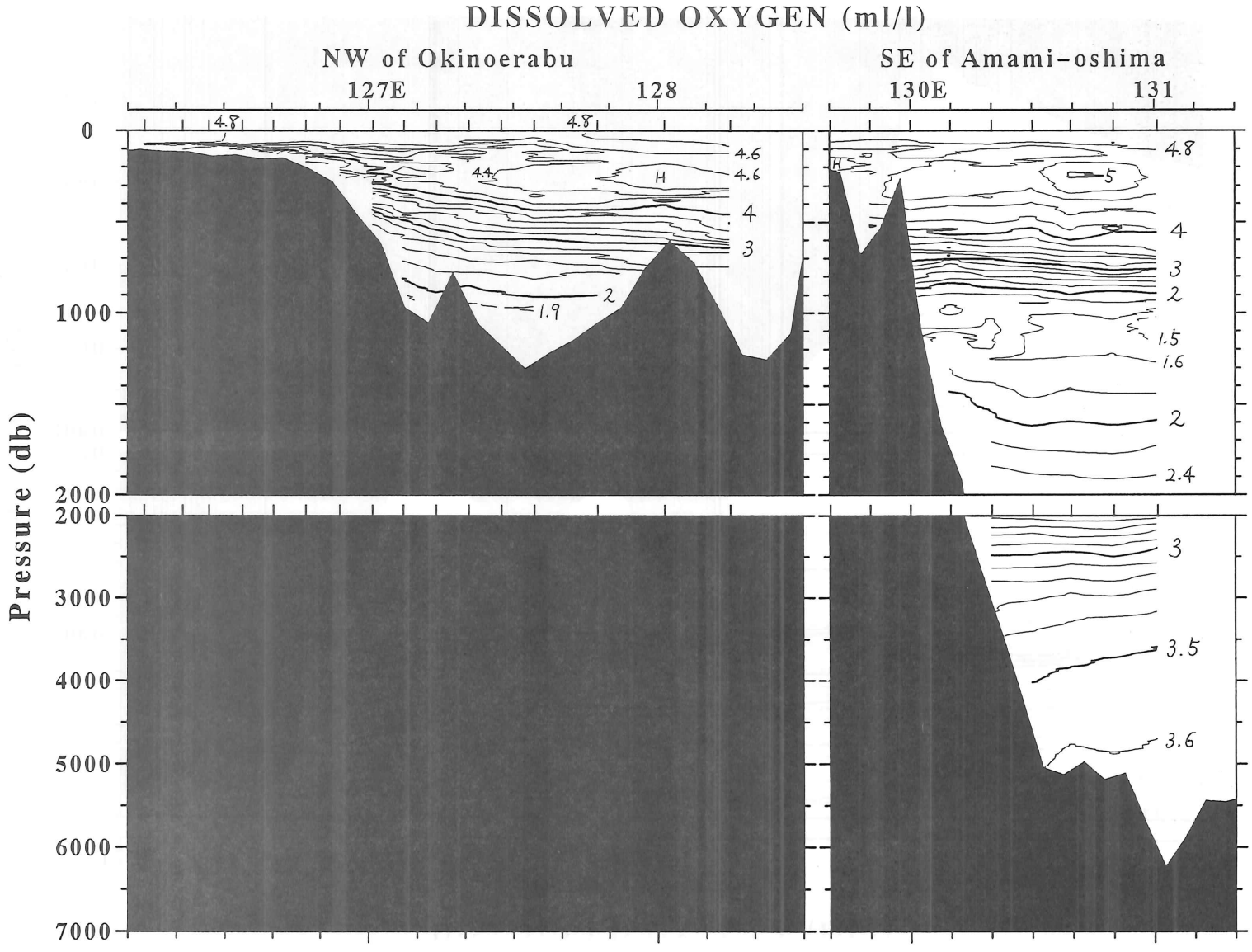

SALINITY (psu)
S of Cape Daiozaki
S of Cape Omaezaki
34N
33
32N
31
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
34.2
34.5
34.9
.925
34.3
34.6
.55
34.60
34.65
34.67
.675

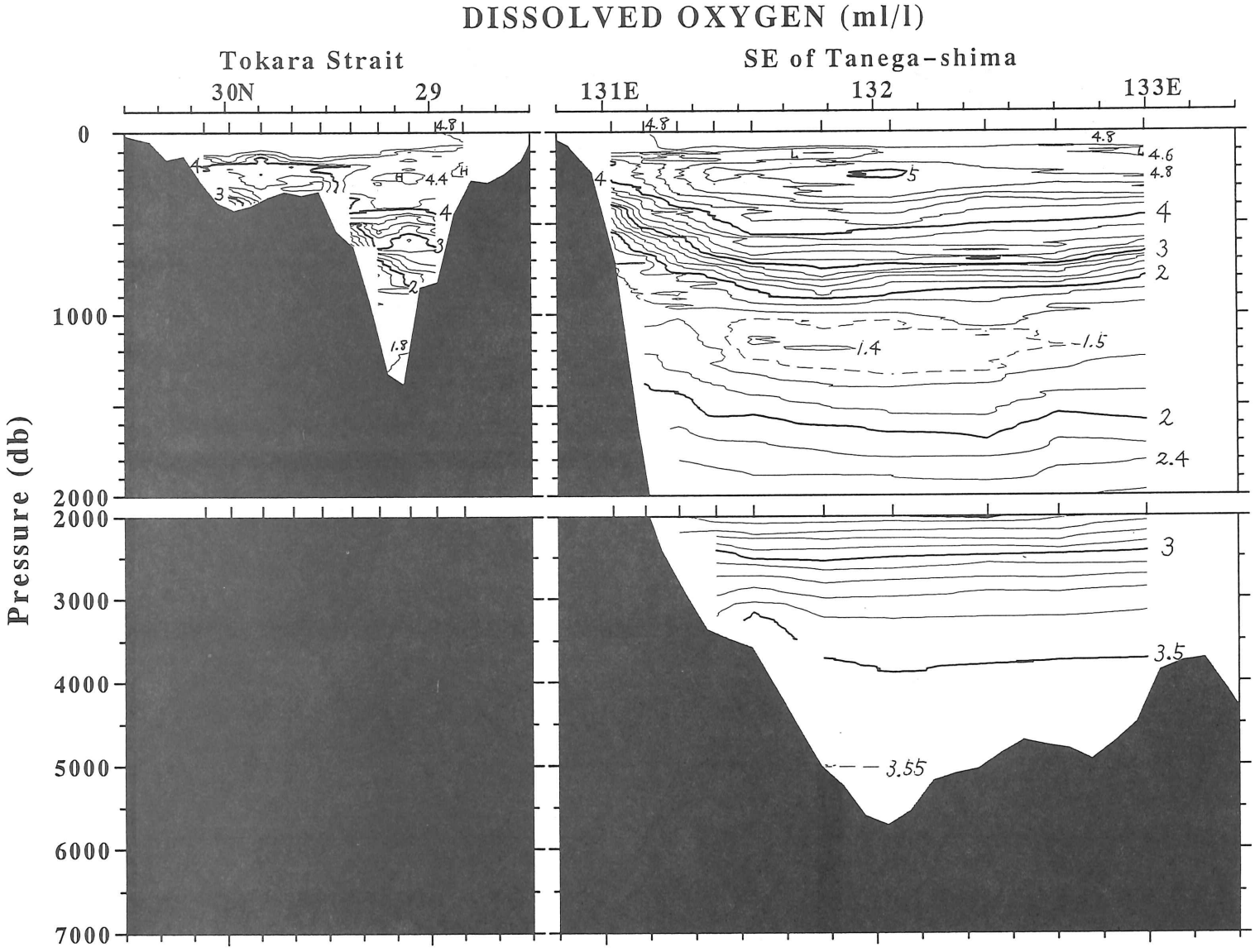

SALINITY (psu)
SE Boso Peninsula
143E Kuroshio Ext.
145E Kuroshio Ext.
35
34N
33
34
33N
32
34N
33
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
34.5
34.5
34.2
34.5
.55
34.5
.85
34.5
.1
34.5
.55
34.5
34.5
34.1
34.2
34.5
.55
34.65
34.69
.691
34.60
34.65
34.69
.691
.693
.692
34.60
34.65
34.69
.691
.692

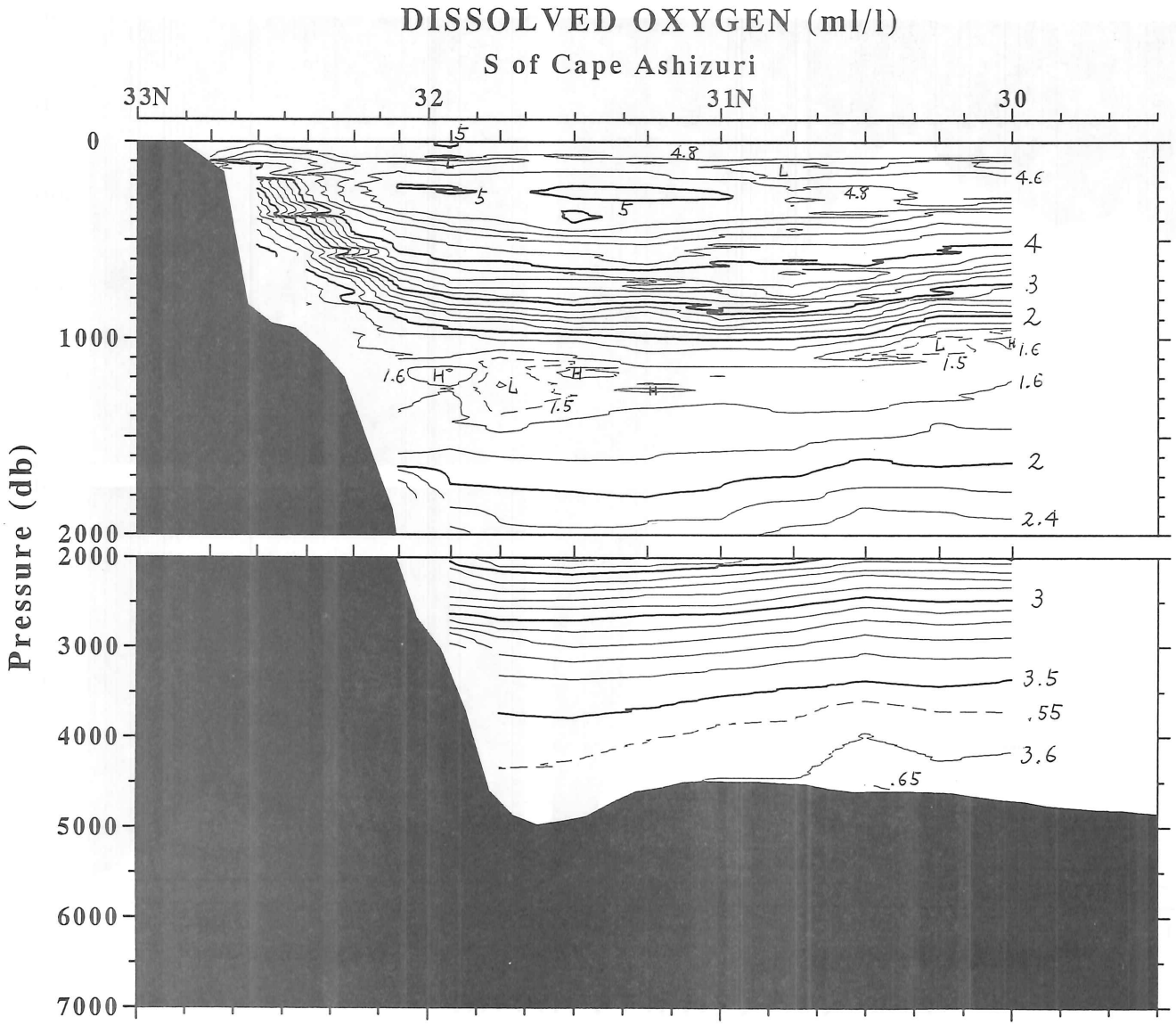

SALINITY (psu)
38N Japan Trench
142E
143
144E
145
146E
147
148E
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
34.0
34.0
34.0
34.0
34.0
34.0
34.5
34.5
34.0
34.0
34.5
.55
34.60
34.65
34.68
34.69
.691

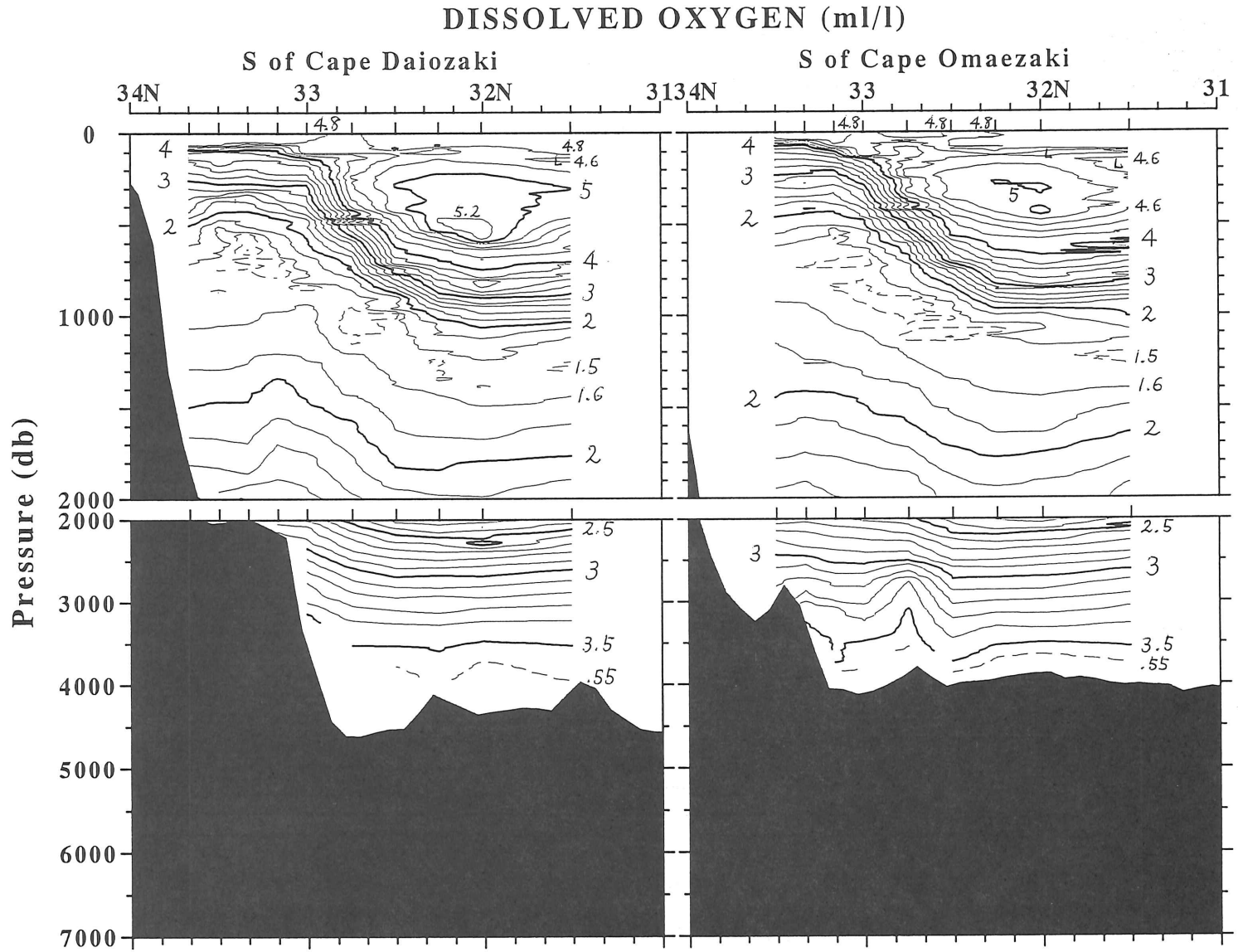

SALINITY (psu)
148E Kuroshio Ext.
38
37N
36
35N
34
33N
32
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
34.5
34.0
34.60
34.65
34.68
34.69
.691
.85
.55

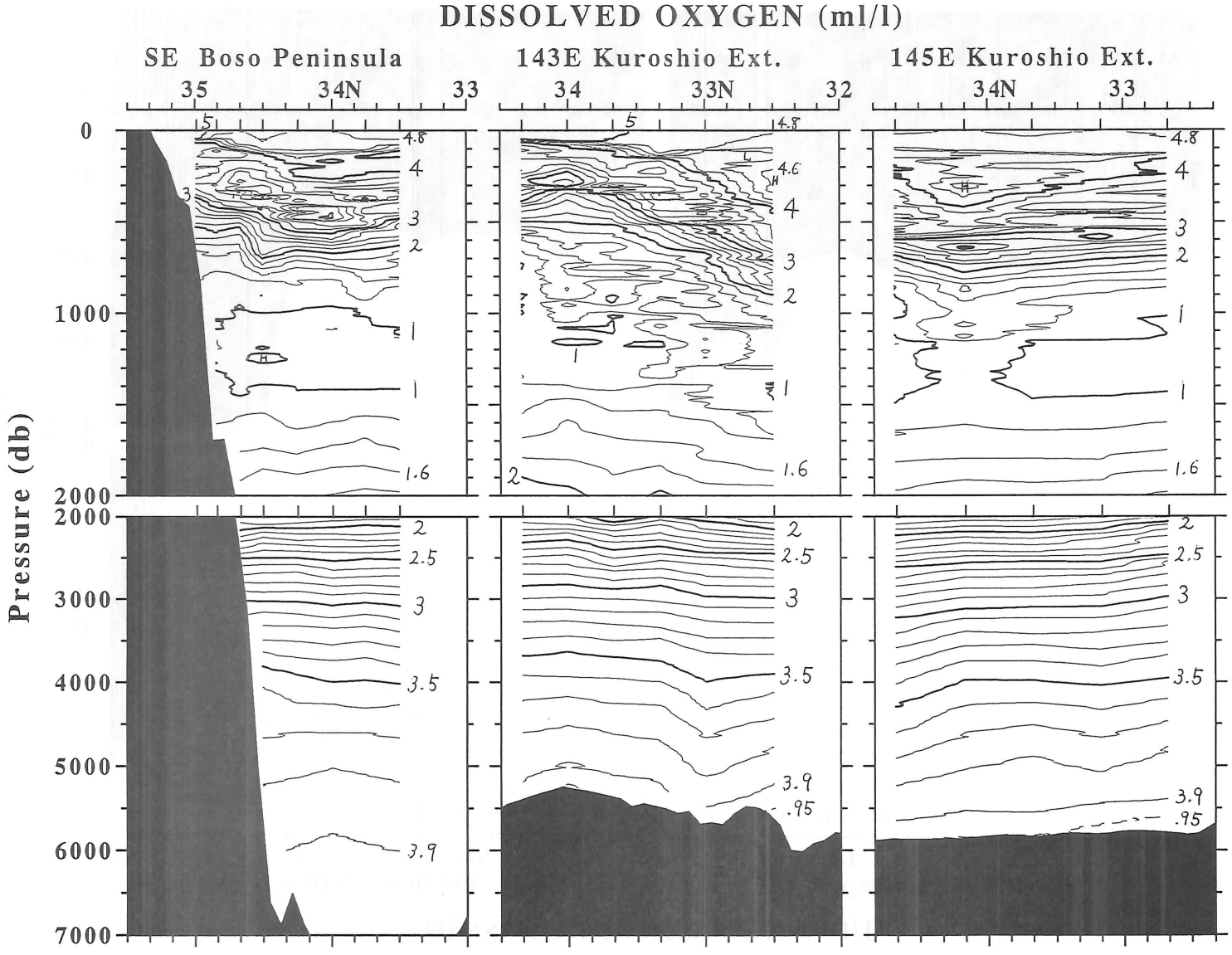

DISSOLVED OXYGEN (ml/l)
South of Okinawa
125E
126
127E
128
129E
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
4.6
4.4
4
3
2
1.9
2.4
1.6
1.8
H
3.5
3.6
.65
3.7

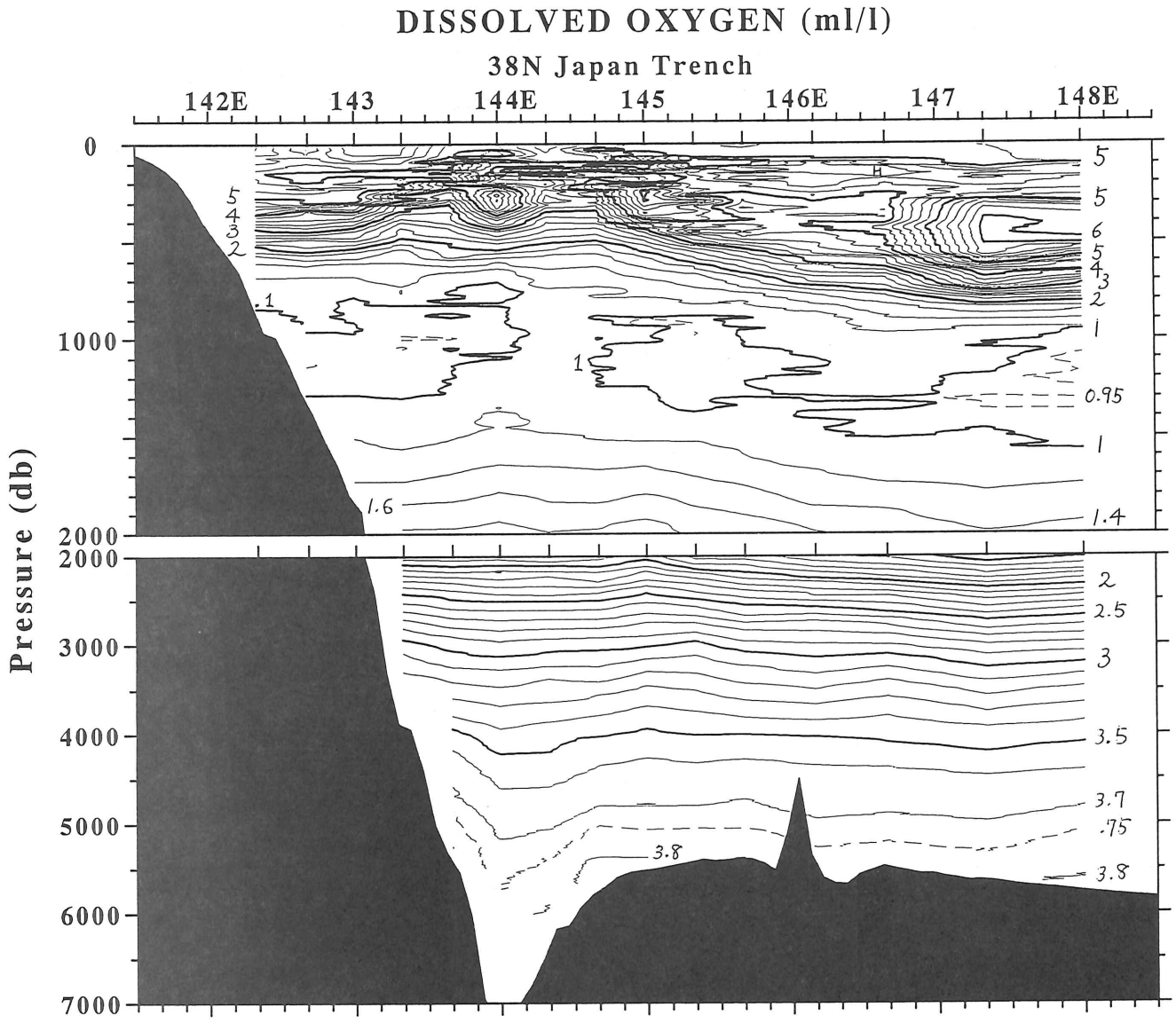

DISSOLVED OXYGEN (ml/l)
NW of Okinoerabu
127E
128
SE of Amami-oshima
130E
131
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
4.8
4.8
4.6
4.6
4.4
H
4
3
2
1.9
4.8
H
5
4
3
2
1.5
1.6
2
2.4
3
3.5
3.6

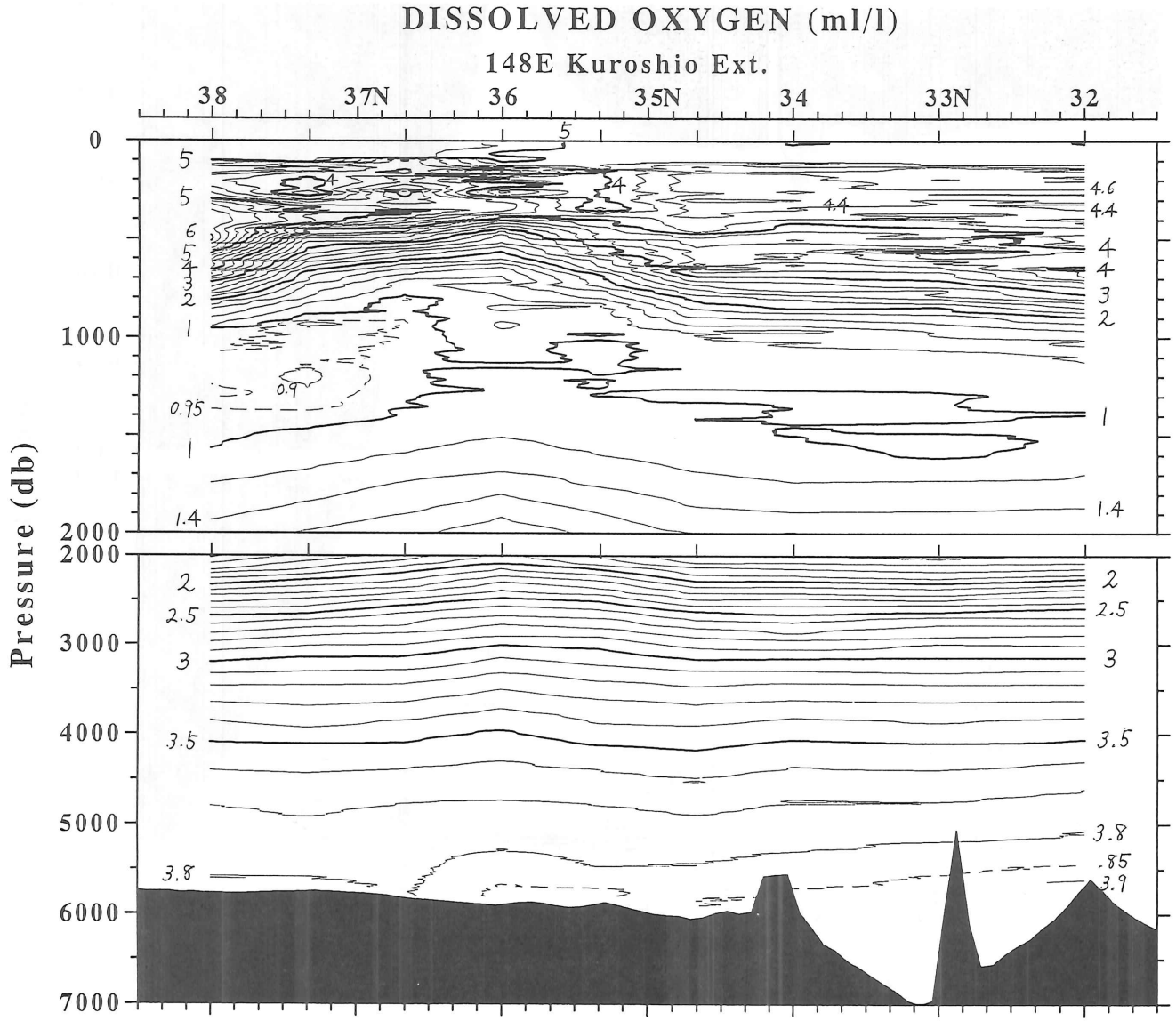

DISSOLVED OXYGEN (ml/l)
Tokara Strait
SE of Tanega-shima
30N
29
131E
132
133E
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
4.8
4.6
4.4
4
3
2
1.8
1.4
1.5
2.4
3.5
3.55


DISSOLVED OXYGEN (ml/l)
S of Cape Ashizuri
33N
32
31N
30
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
4.8
4.6
4
3
2
1.6
1.5
2.4
3.5
.55
3.6
.65
H
L


DISSOLVED OXYGEN (ml/l)
S of Cape Daiozaki
S of Cape Omaezaki
34N
33
32N
31
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
4.8
4.6
5
5.2
4
3
2
1.5
1.6
2.5
3.5
.55

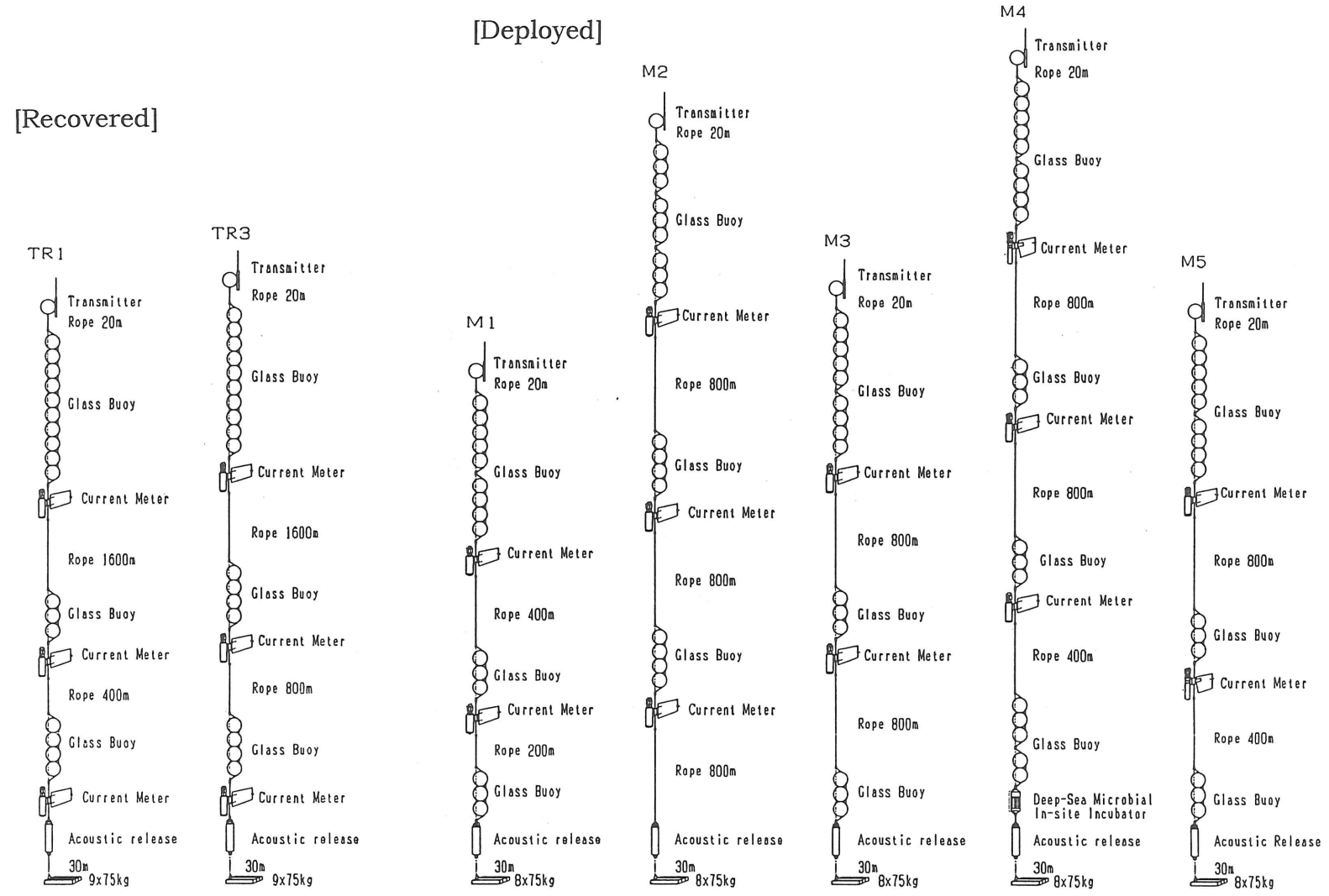

DISSOLVED OXYGEN (ml/l)
SE Boso Peninsula
143E Kuroshio Ext.
145E Kuroshio Ext.
35
34N
33
34
33N
32
34N
33
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
4.8
4
3
2
1
1.6
4.6
2.5
3.5
3.9
.95


DISSOLVED OXYGEN (ml/l)
38N Japan Trench
142E
143
144E
145
146E
147
148E
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
5
4
3
2
1
1.6
1
0.95
1.4
2.5
3.8
.75


DISSOLVED OXYGEN (ml/l)
148E Kuroshio Ext.
38
37N
36
35N
34
33N
32
Pressure (db)
0
1000
2000
3000
4000
5000
6000
7000
5
4
6
3
2
1
0.9
0.95
1.4
4.6
4.4
2.5
3.5
3.8
.85
3.9

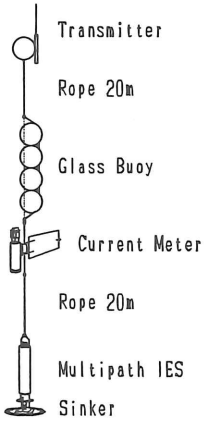
[Recovered]

[Deployed]



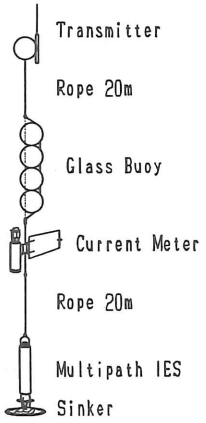
[Recovered]

MIES-1



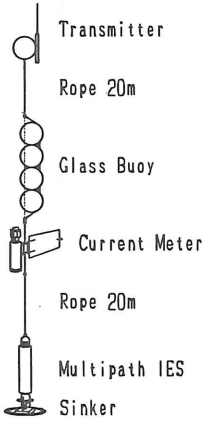
1996 4/23 -
34° 05. 9' N, 130° 44. 1' E
897m

MIES-2



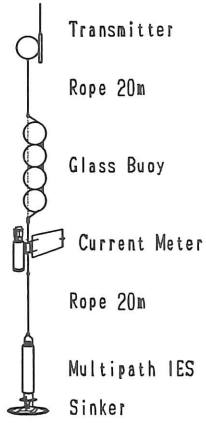
1996 4/23 -
34° 06. 8' N, 139° 50. 0' E
1036m

MIES-3



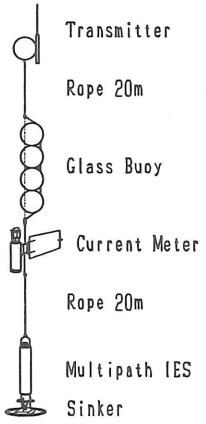
1996 4/23 - 1996 11/17
34° 02. 5' N, 139° 49. 2' E
1108m

MIES-4



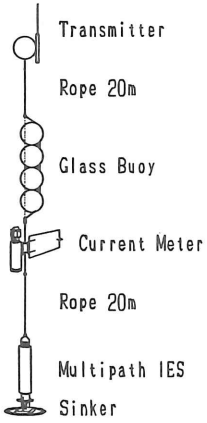
1996 4/23 - 1996 11/17
34° 03. 5' N, 139° 55. 3' E
1184m

MIES-5



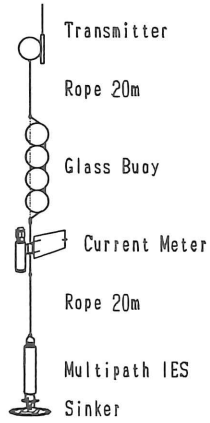
1996 4/23 - 1996 11/17
33° 58. 8' N, 139° 54. 0' E
1167m

MIES-6



1996 4/23 - 1996 11/17
34° 00. 1' N, 140° 00. 2' E
1082m

MIES-7



1996 4/23 - 1996 11/17
33° 55. 3' N, 139° 59. 0' E
756m

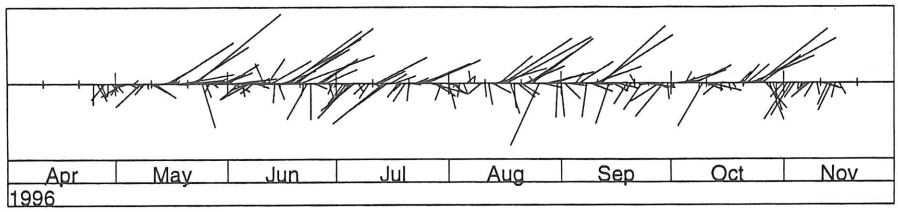
10. Results of Moored Current Meters

MIES Mooring sites east of Miyake Island

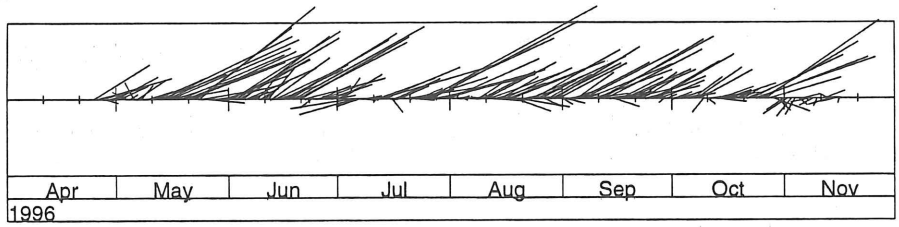
Deploy : 23 April 1996
Recover : 17 November 1996

N
E
10 cm/s

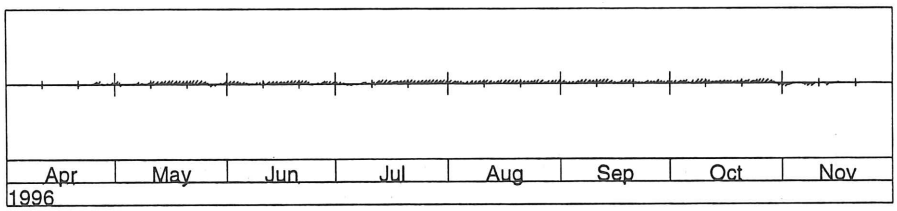
MIES-3 34-02.5°N, 139-49.2°E, 1086m/1108m



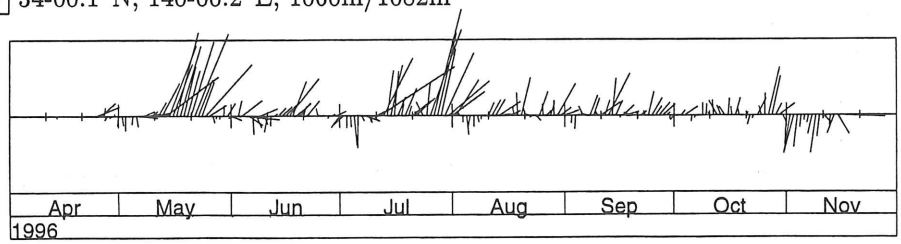
MIES-4 34-03.5°N, 139-55.3°E, 1162m/1184m



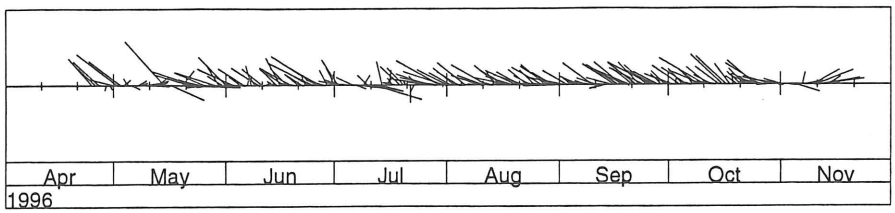
MIES-5 33-58.8°N, 139-54.0°E, 1145m/1167m [no speed]



MIES-6 34-00.1°N, 140-00.2°E, 1060m/1082m



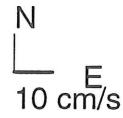
MIES-7 33-55.3°N, 139-59.0°E, 735m/756m



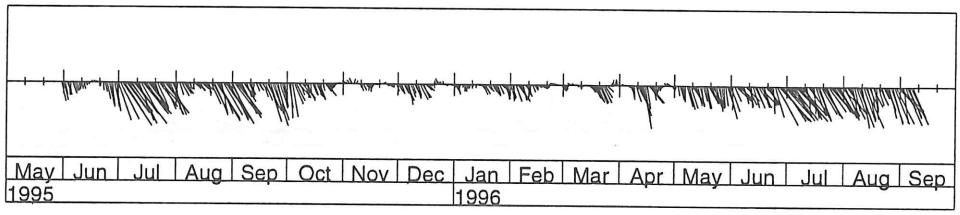
Izu-Ogasawara Trench

Station TR1

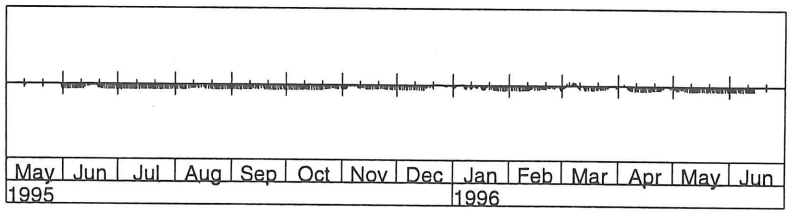
Location : 33-57.8°N, 141-21.1°E
Water depth : 5934m
Deploy : 29 May 1995
Recover : 18 November 1996



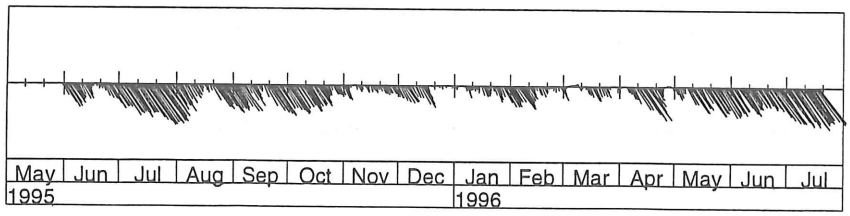
TR1-1 (3900m)



TR1-2 (5500m) [roter lost]

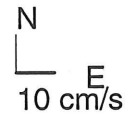


TR1-3 (5900m)

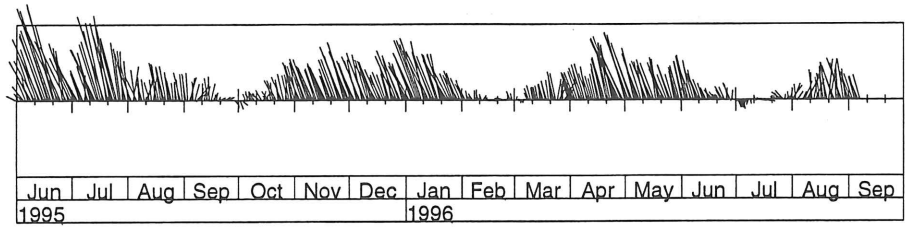


Station TR3

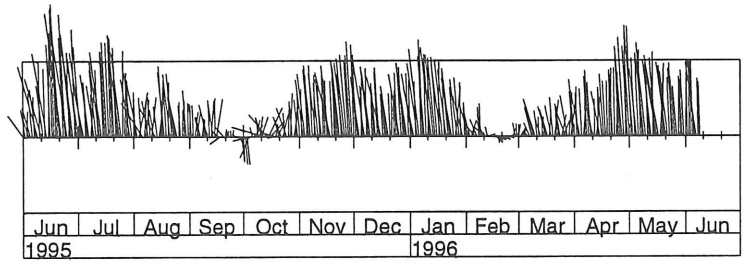
Location : 33-56.9°N, 142-31.5°E
Water depth : 6076m
Deploy : 30 May 1995
Recover : 18 November 1996



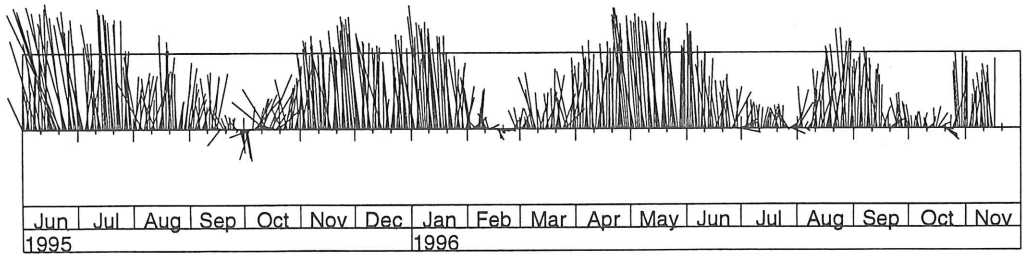
TR3-1 (3830m)



TR3-2 (4835m)



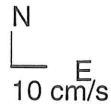
TR3-3 (6040m)



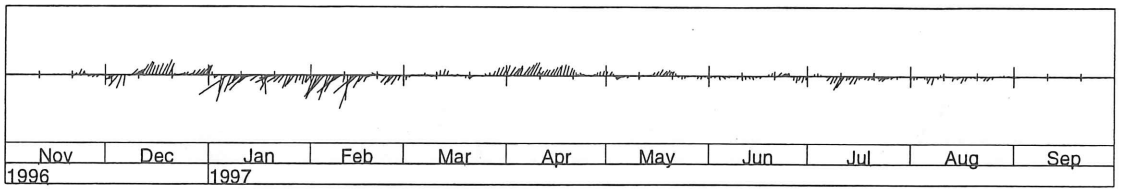
38°N - Line

Station M1

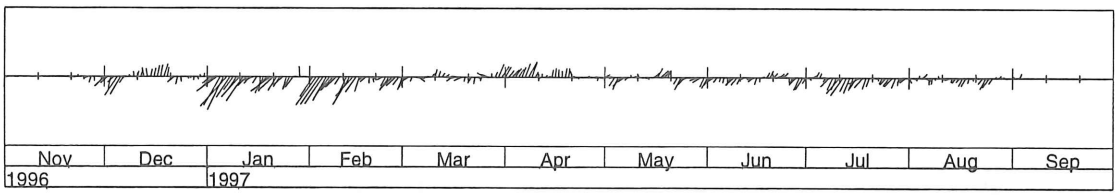
Location : 37-59.81°N, 143-30.27°E
Water depth : 4439m
Deploy : 19 November 1996
Recover : 4 September 1997 (in KT97-18, R/V Tansei-maru)



M1-1 (3800m)

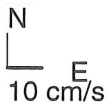


M1-2 (4205m)

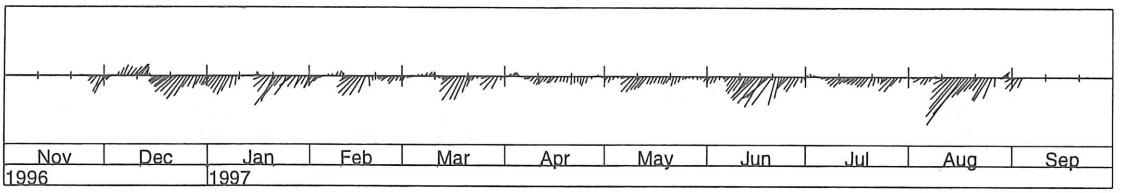


Station M2

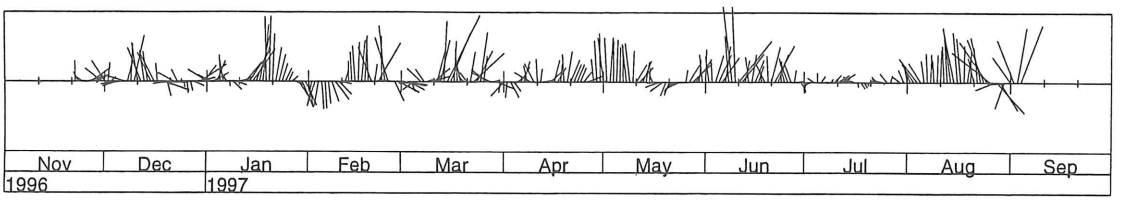
Location : 38-01.72°N, 143-50.30°E
Water depth : 6300m
Deploy : 20 November 1996
Recover : 5 September 1997 (in KT97-18, R/V Tansei-maru)



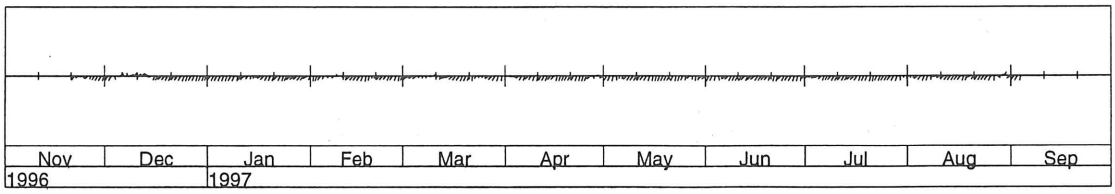
M2-1 (3860m)



M2-2 (5105m)

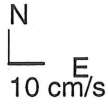


M2-3 (5465m) [no speed]

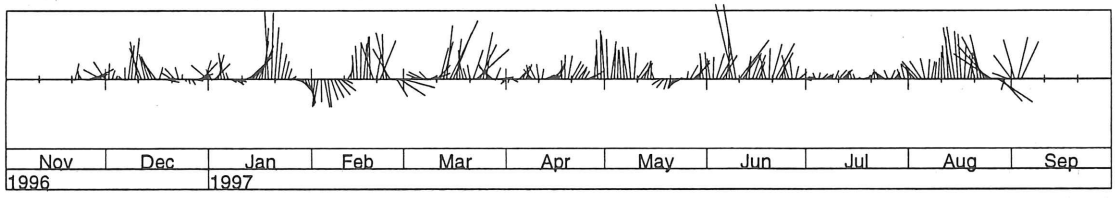


Station M3

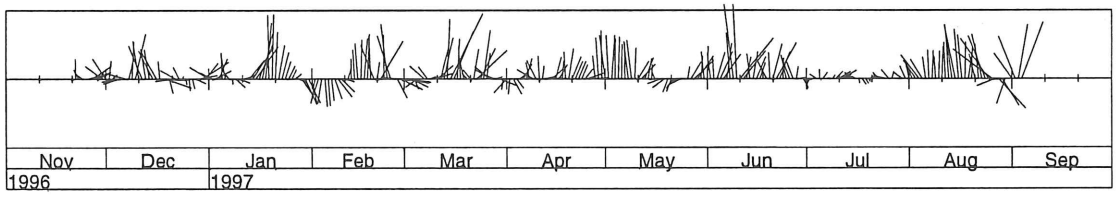
Location : 37-59.96°N, 144-30.15°E
Water depth : 5940m
Deploy : 20 November 1996
Recover : 5 September 1997 (in KT97-18, R/V Tansei-maru)



M3-1 (4300m)

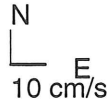


M3-2 (5105m)

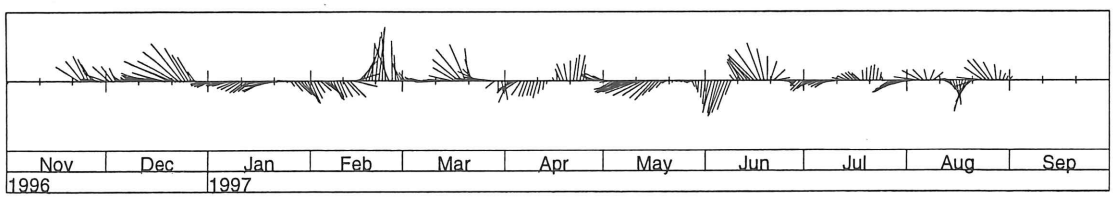


Station M4

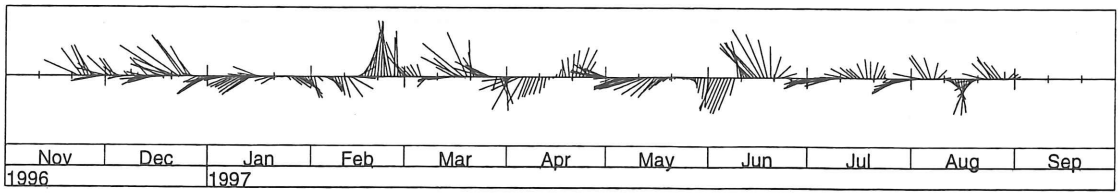
Location : 38-00.72°N, 145-32.22°E
Water depth : 5315m
Deploy : 21 November 1996
Recover : 2 September 1997 (in KT97-18, R/V Tansei-maru)



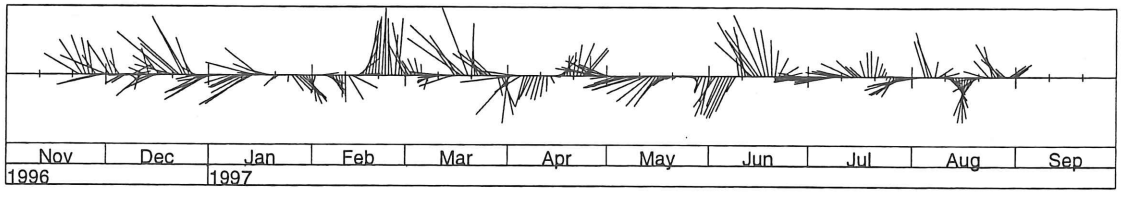
M4-1 (3260m)



M4-2 (4060m)

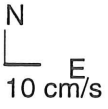


M4-3 (4860m)

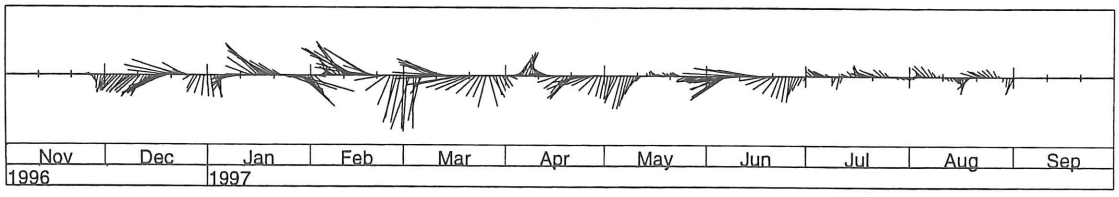


Station M5

Location : 38-00.38°N, 146-24.51°E
Water depth : 5396m
Deploy : 23 November 1996
Recover : 2 September 1997 (in KT97-18, R/V Tansei-maru)



M5-1 (4166m)



M5-2 (4966m)