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CRUISE REPORT

TOCS K9505

July 1995

TOCS CRUISE REPORT NO.45

JAMSTEC

CONTENTS

1. Cruise Summary

Ship: R/V KAIYO
Institute: Japan Marine Scienceand Technology Center
Chief scientist: Yoshifumi Kuroda, JAMSTEC (Palau-Kavieng)
Chief scientist: Kentaro Ando, JAMSTEC (Kavieng-Guam)
Co-Chief scientist: Djoko Hartoyo, BPPT
Cruise code: K9505
Project title: Tropical Ocean Climate Study (TOCS)
Period: 30June1995 - 26 July 1995
Port of call: Palau, Republic of Palau (27-30 June1995)
Kavieng, Papua New Guinea (14 -16July 1995)
Guam, United States of America (26-27 July 1995)

Purpose:

The purpose of this cruise was to observe physical oceanographic conditions in the western tropical Pacific for better understanding of ocean-atmosphere interaction and its affects on the ENSO phenomena (El Nino/Southern Oscillation) and climate change. The cruise was carried out under the research program of Tropical Ocean Climate Study (TOCS) at the Japan Marine Science and Technology Center. The program is supported by the Science and Technology Agency of Japan. The cruise was conducted as a joint cruise between BPP Teknologi, Indonesia and JAMSTEC. Mr.Djoko Hartoyo, Ali Alkatiri (BPPT) and Lt. Ibrahim Lakoni (Security Officer) participated in the cruise.

During this cruise recoveries and deployments of meteorological and oceanographic buoys as part of the TAO array were conducted by Pacific Marine Environmental Laboratory (PMEL) of National Oceanic and Atmospheric Administration (NOAA), USA. Mr. David Zimmerman and Ms.Anne Nimershiem of PMEL participated in the cruise for the moorings during Kavien-Guam leg.

Observation summary:

The following measurements were completed: 50 CTD (Conductivity-Temperature-Depth profiler) casts, 58 upper air soundings (Omega sonde), continuous ADCP (Acoustic Doppler Current Profiler) measurements, two recoveries and four deployments of subsurface current meter buoys. Two recoveries, four deployments and one repair of TAO surface buoys were also carried out.

Observation results

The western Pacific area is a "crossroad" of many current systems such as the Mindanao Current, North Equatorial Countercurrent, South Equatorial Current, Equatorial Undercurrent, and New Guinea Undercurrent, and exhibits very complicated sea conditions. In TOCS K9505 cruise we intended to observe these boundary currents and equatorial currents in a total way as much as possible. During the period of observation, easterly winds was dominant in equatorial Pacific, and the sea-surface-temperature (SST) anomaly was +0.5C from TAO. Further, there was anomalous rain in the western Indonesia even though the Indonesia was usualy in the dry season. Hence, the equatorial area was in a La Nina-like condition.

On the equator the homogeneous temperature layer existed up to 70m to 80m between 138E-148E, which is deeper than usual detpth there. Further, salinity stratification developed in the homogeneous temperature layer so that the distinct barrier layer was formed. A thin salinity minimum layer was found from 142E to146E between the homogeneous temperature layer and thermocline. The shipboard ADCP showed that the South equatorial current flowed in the surface layer at about 0.5m/s.

In this cruise we have found the origin of the Equatorial Undercurrent (EUC) near 139E, which was shown by the shipboard ADCP. Further, EUC is also seen around equator (st. 35) in the meridional temperture and density sections along 142E (0.0 - 2.5S) because there was thermostad (or pycnostad) at about 220m deep. There was a salinity maximun (more than 35.5psu) at about 180m deep in the thermocline layer. Desolved oxygen (DO) also showed almost homogeneous value in this layer (about 3.4ml/l). Below this, however, there was a DO minimum layer at about 400m, which is probably advected from further east (we have observed low-oxygen layer in our past TOCS cruises).

The New Guinea Undercurrent is seen around sts. 29 & 30 along 142E. It has been found that the current has a deep structure extending more than 500m deep. The core of the current (at 200m deep) has a salinity maximun of 35.5 psu, which is similar value to that of EUC; DO at this depth was about 3.5ml/l, which is slightly larger. Further, there was a DO maximum at 500m deep, indicating the Antarctic Intermediate Water advected by the deep New Guinea Undercurrent.

In the Indonesian EEZ, observation has rarely been made and the data have not been accumulated. This cruise may be characterized as the one being made during a dry season of the Indonesian monsoon, while other cruises (e.g. JAMSTEC WOCE) in this region were made during the wet season. Relatively fresh water (less than 34.8psu) was observed at the stations near Mindanao; the water is originated in the mid-latitude of the North Pacific, and is advected by the Mindanao Current. At the other stations in the Indonesia EEZ, however, salinity maximum has the value of about 35.2psu; a lot of interleaving structures were observed, which implies that water mass formation due to mixing is active in this area. The density section along 2N shows that the current close to Halmahera Is. flowed northward in the upper 250m, while southward below 250m. The latter is one of descoveries of this cruise. This undercurrent could occur due to a baroclinic response to the anomalous easterly winds in the western equatorial Pacific. Further, this undercurrent may prevent the Antarctic Intermediate water (AIW) from being advected further north toward Mindanao, where AIW has been often observed previously.

From the TS analysis it has been found that the thermocline water near Indonesia (from st. 6 to 16) is contained within an envelope between the water mass from the North Pacific and a relatively saline water mass with the maximum salinity of 35.2psu. There are a lot of interleaving structures within the envelope, implying that the mixing occurs between the two water masses. Further, the saline water was advected up at least to 6N, which can be seen from the TS property at st.1.

From the time series of temperature and salinity obtained from moored CTD between Morotai and Talaudo have shown that relatively low-temperature and low-salinity water existed during the wet season of the Indonesian Monsoon. We have found that the water has the similar properties to those near Mindanao. This fresh water property was also found in the previous (WOCE) cruises along the sections between st. 4 and st.12. This implies that the water outflowed from the Indonesian seas. On the other hand, relatively high-temperature and high-salinity water existed during the dry season. Therefore, there are distinct seasonal variabilities of water properties in the western Pacific.

We maintain six ADCP moorings in the western equatoirial area at present (in which four moorings are deployed during this cruise), so as to study variabilities of EUC in the western end of the Pacific where EUC originates, and to study effects of these variabilities on the generation and dissipation of the warm pool . Further, relationship betwen variabilities of EUC and the New Guinea Undercurrent will be explored using these ADCP moorings.

Finally, we would like to thank Captain Tanaka and crew members of "KAIYO" for an exellent support during TOCS K9505. It is their support that made this research successful.

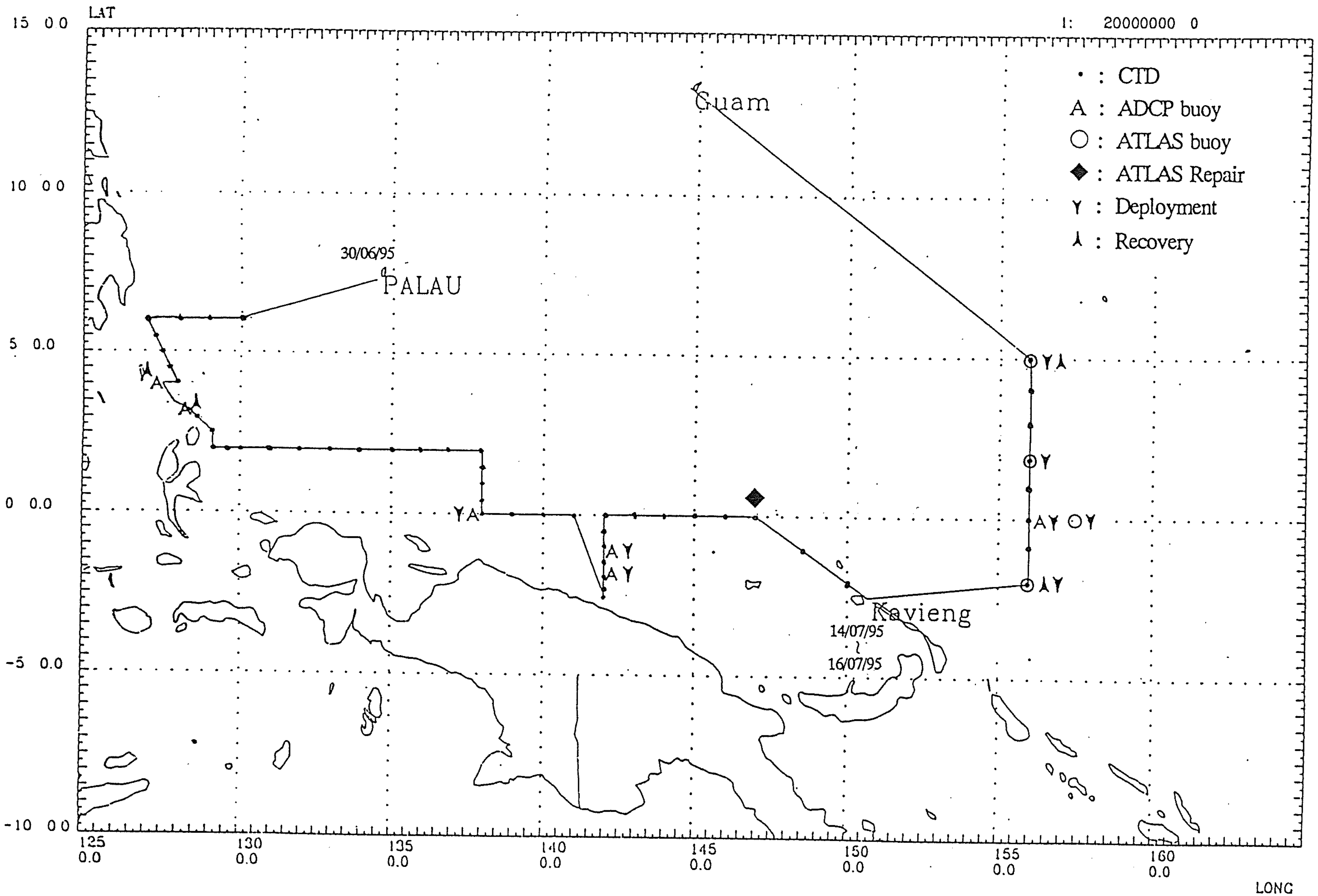
2. List of Shipboard Instruments

(1) CTD (Conductivity-Temperature-Depth profiler)
SBE 9-11plus system, Sea Bird Electronics, Inc, USA
for 6800m depth

(2) Shipboard ADCP (Acoustic Doppler Current Profiler)
a. JLN 610, Japan Radio Co. Ltd
(125kHz, 6 m bin width, 3 depth layers of 20m, 50m and 80m)
b. VM-ADCP, RD Instruments, USA
(75kHz, 16m bin length, Nominal range 560m starting 30m depth)

(3) Upper air soundings (Omega sonde)
Digi CORA MW11 Vaisala, Finland
Omega Sonde Rs-80N

Observation Sites K9505 TOCS Cruise



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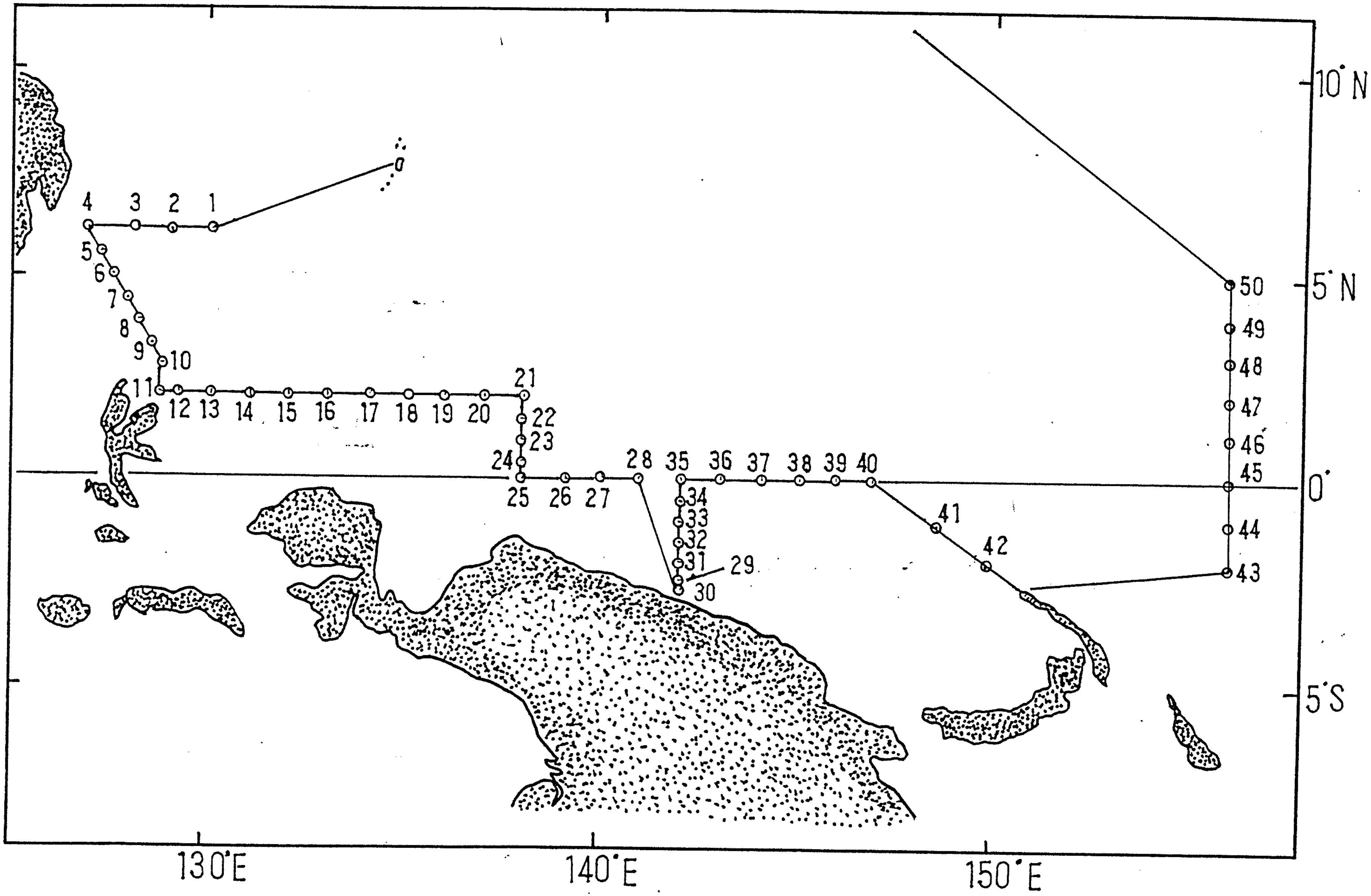

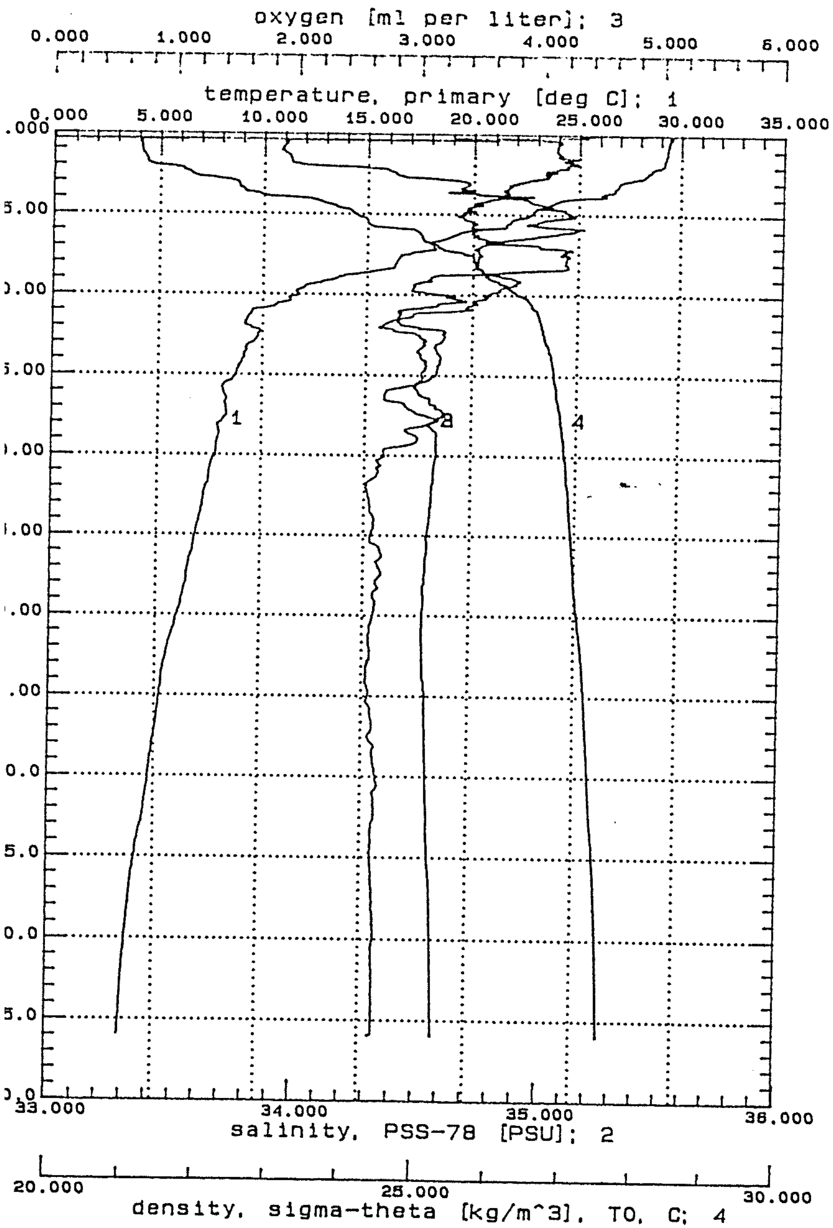

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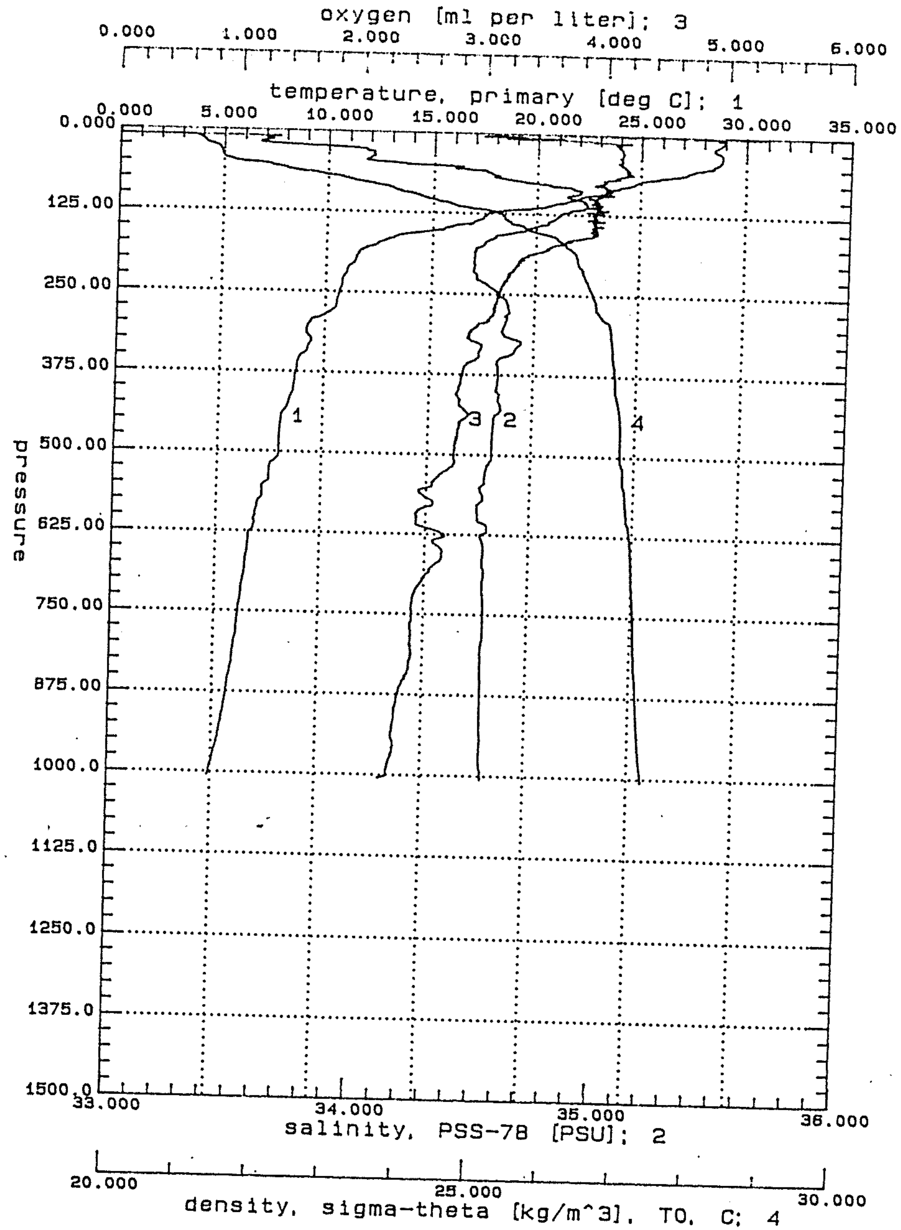

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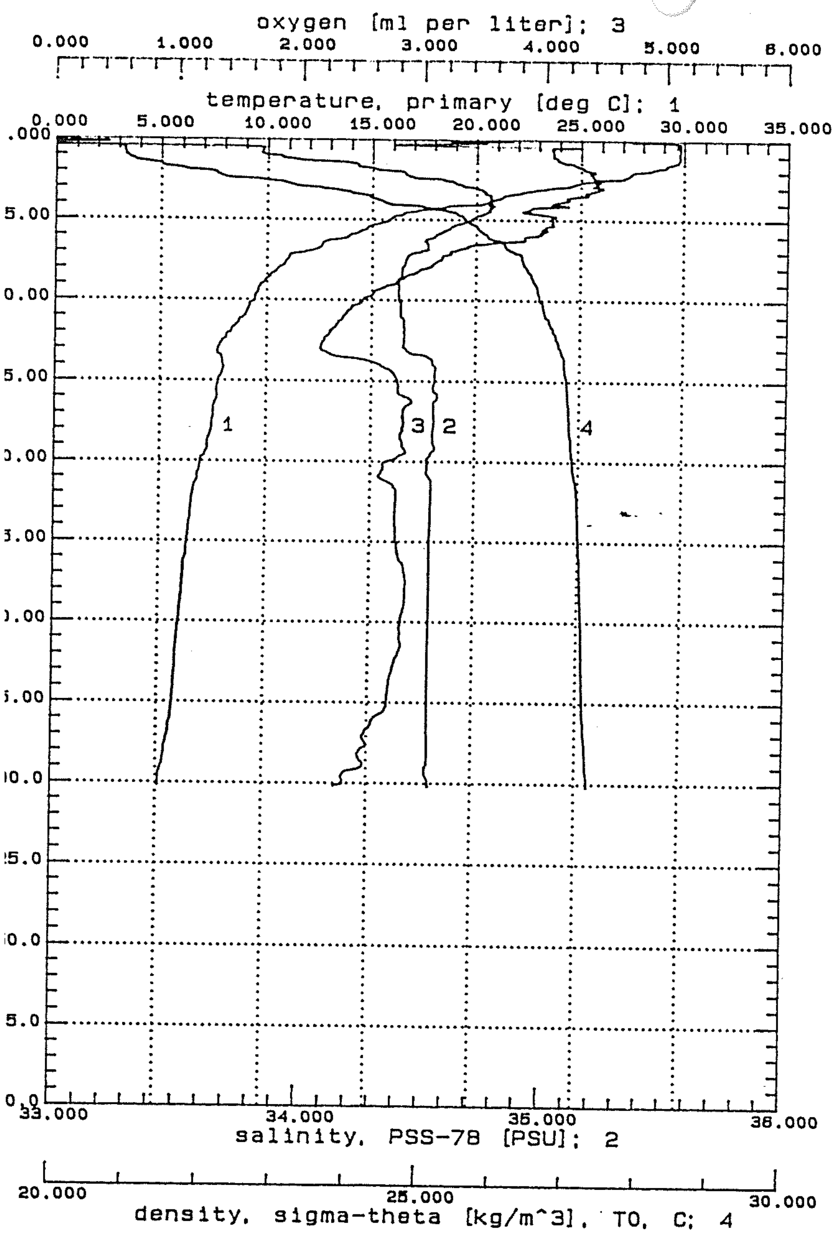

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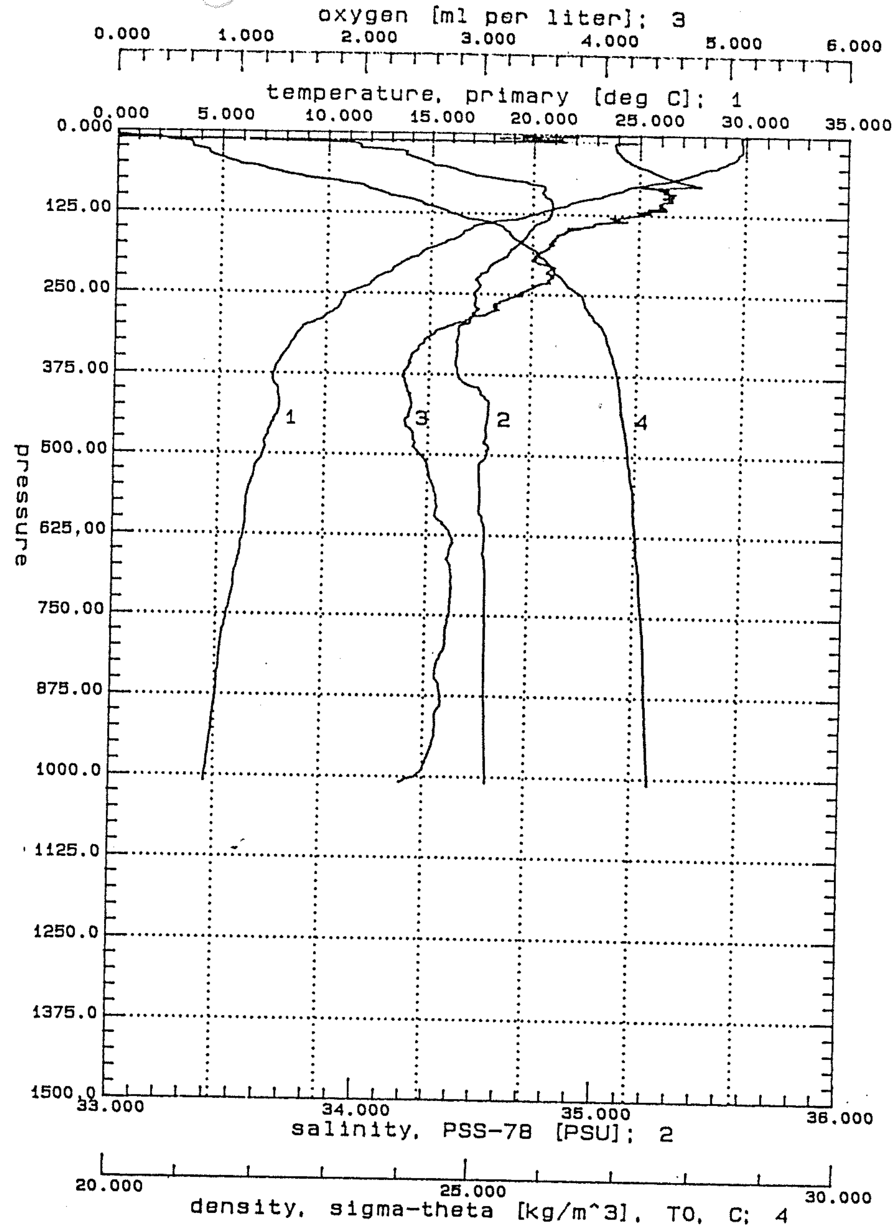

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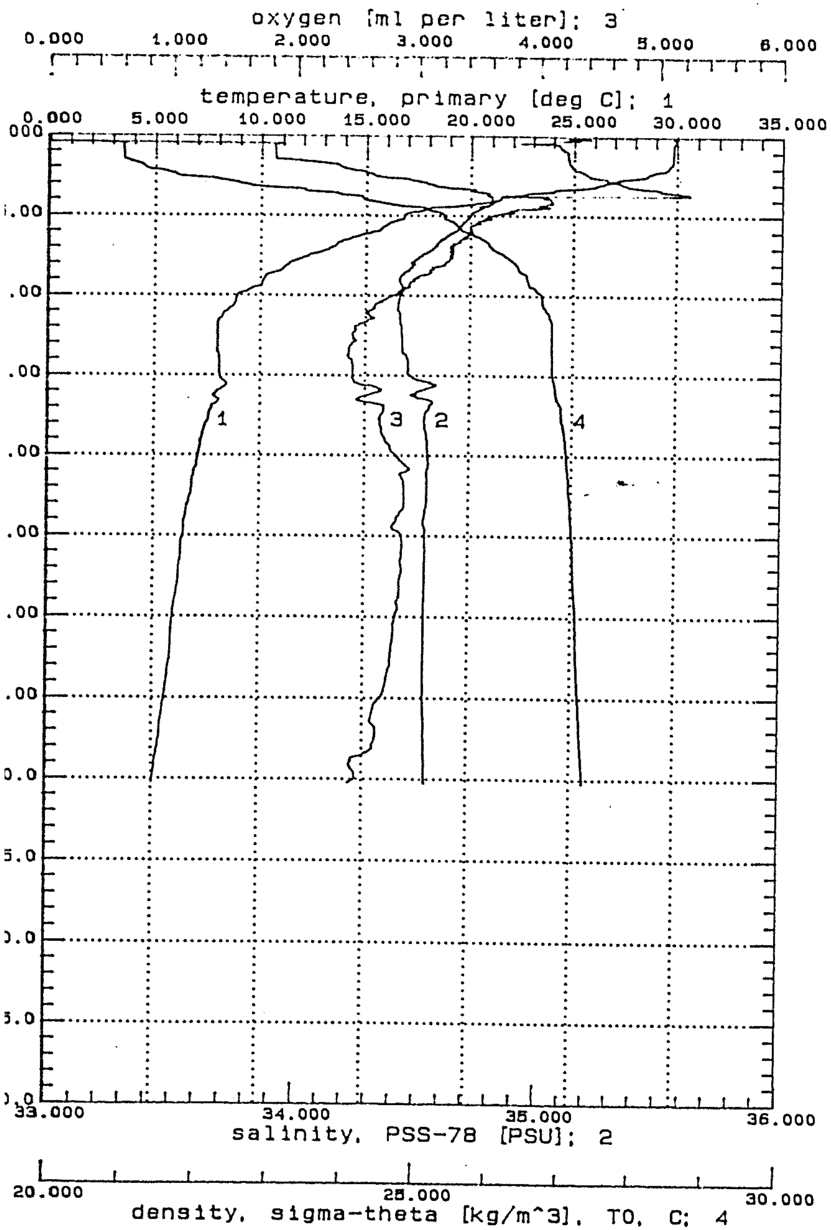

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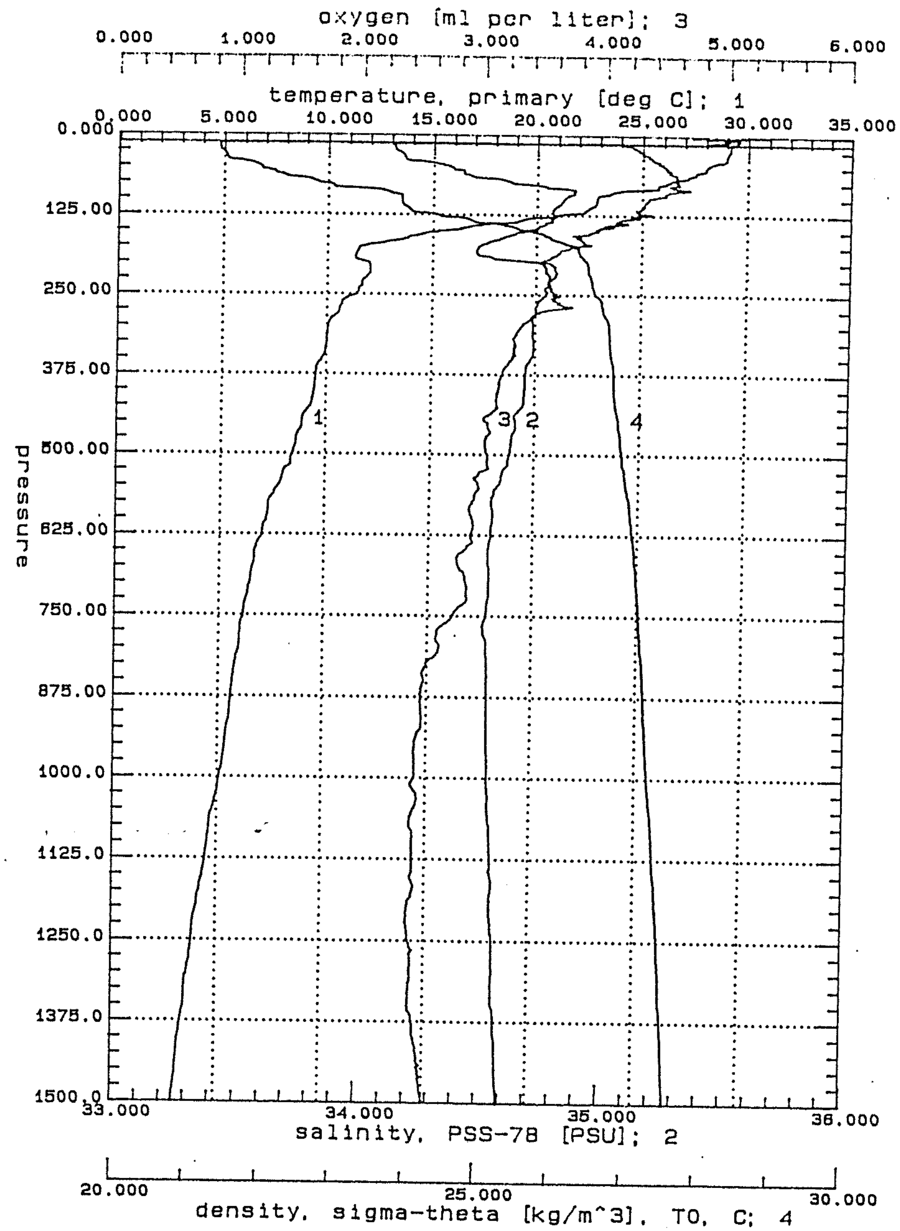

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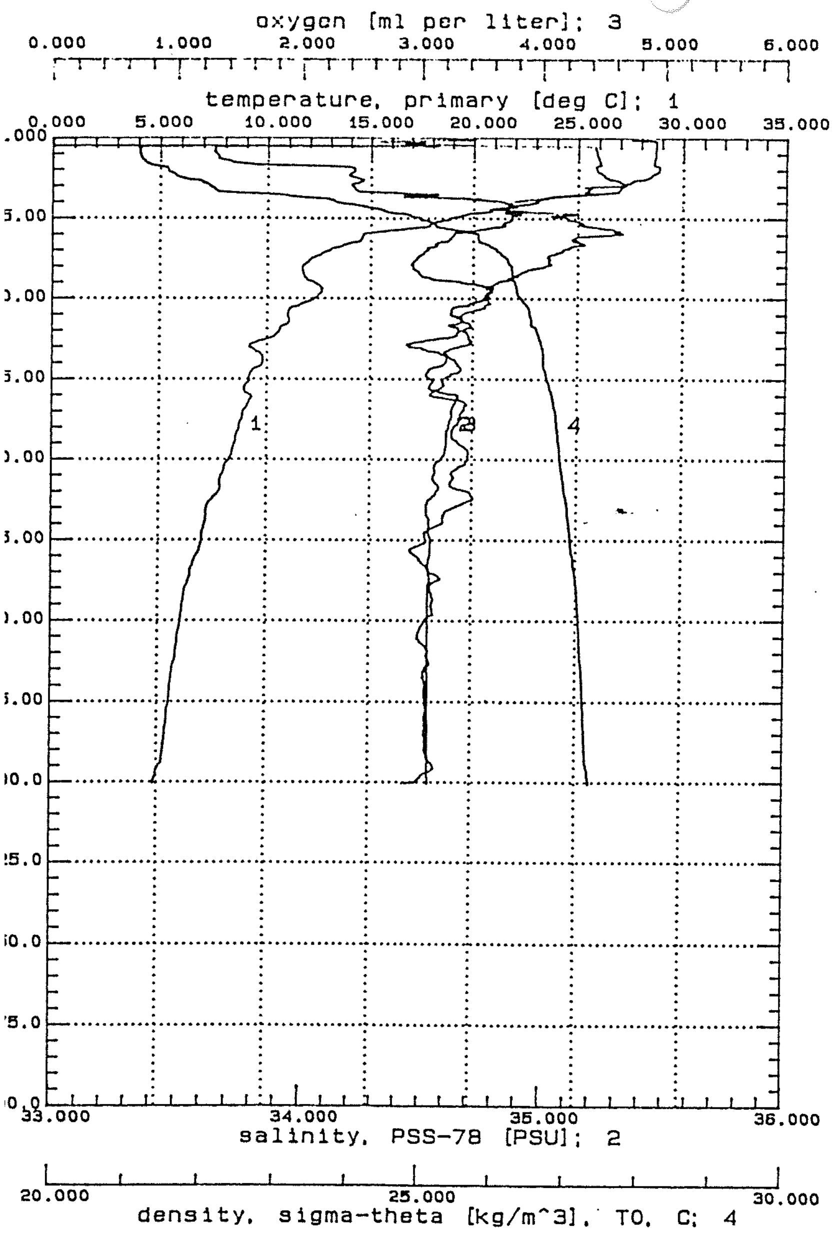

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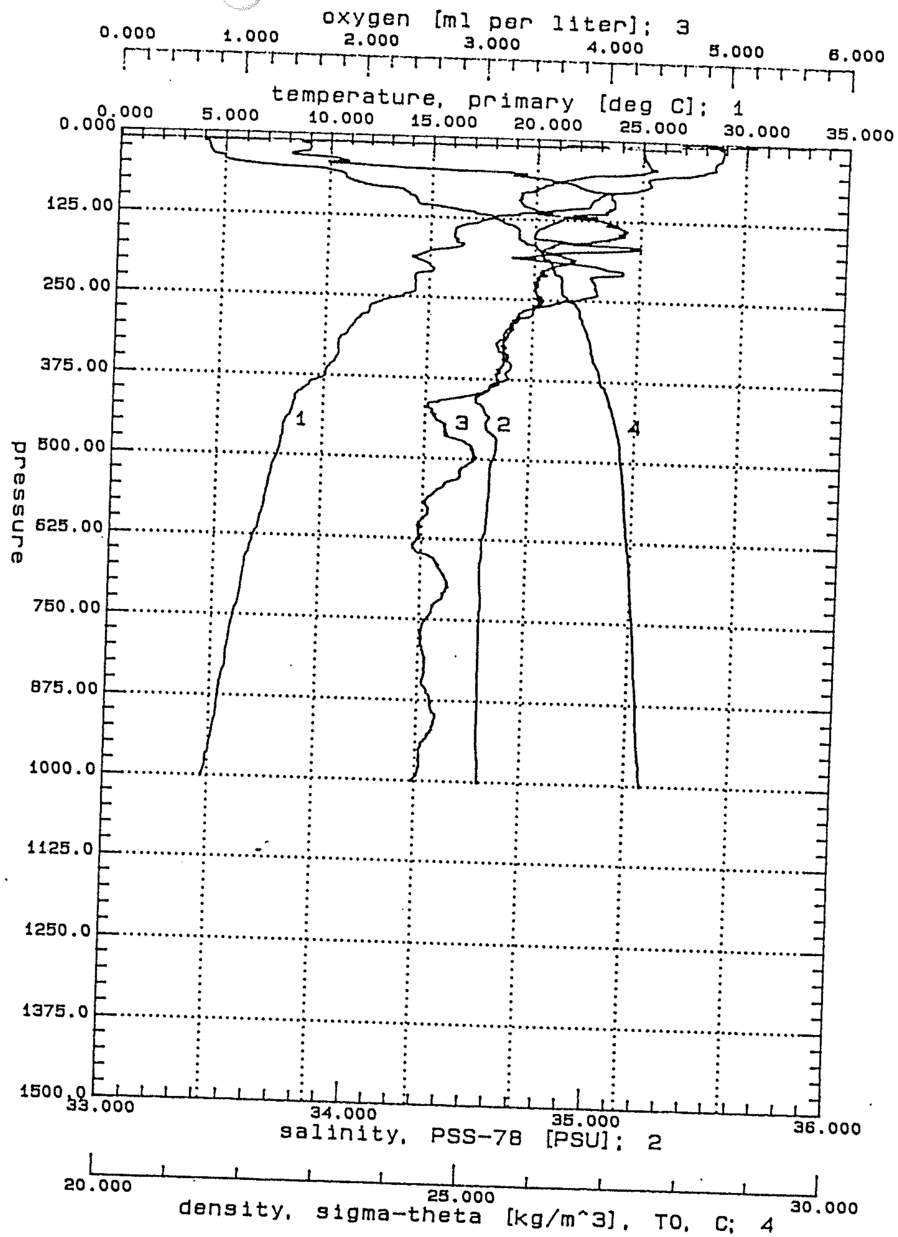

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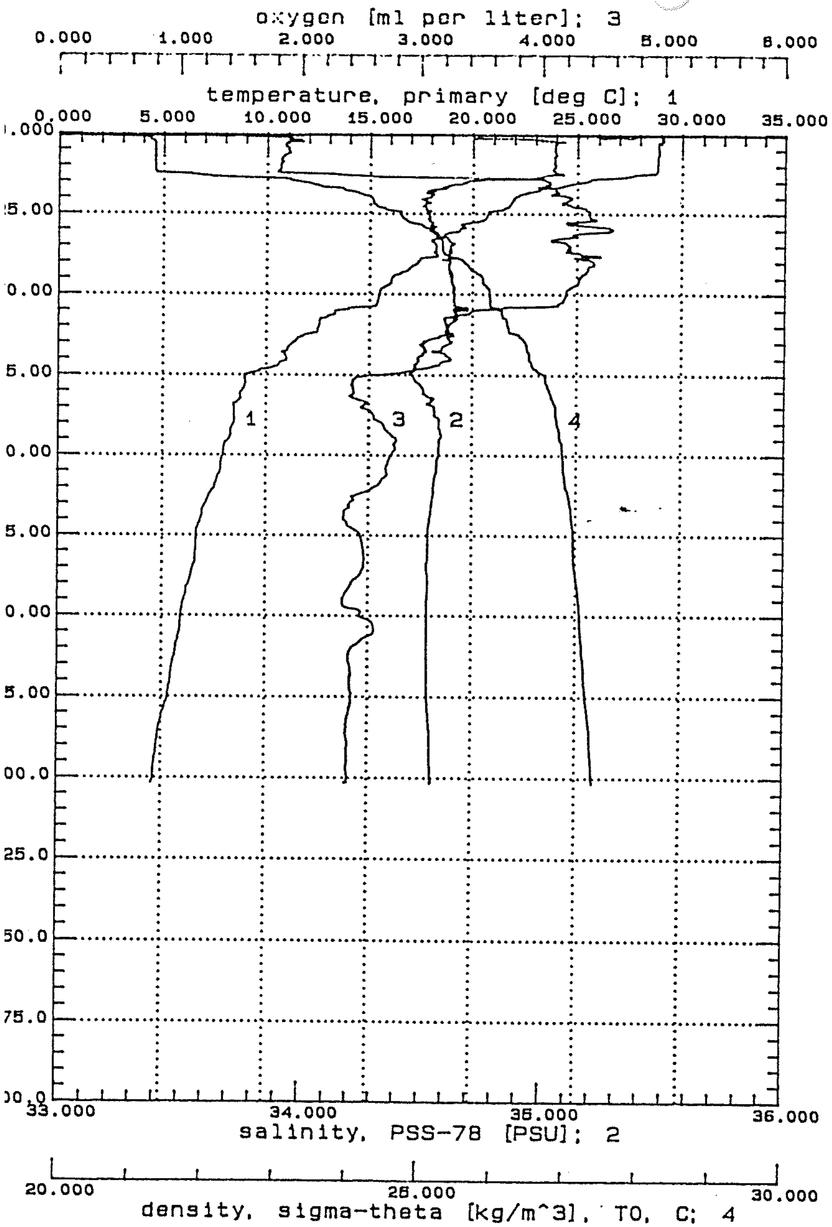

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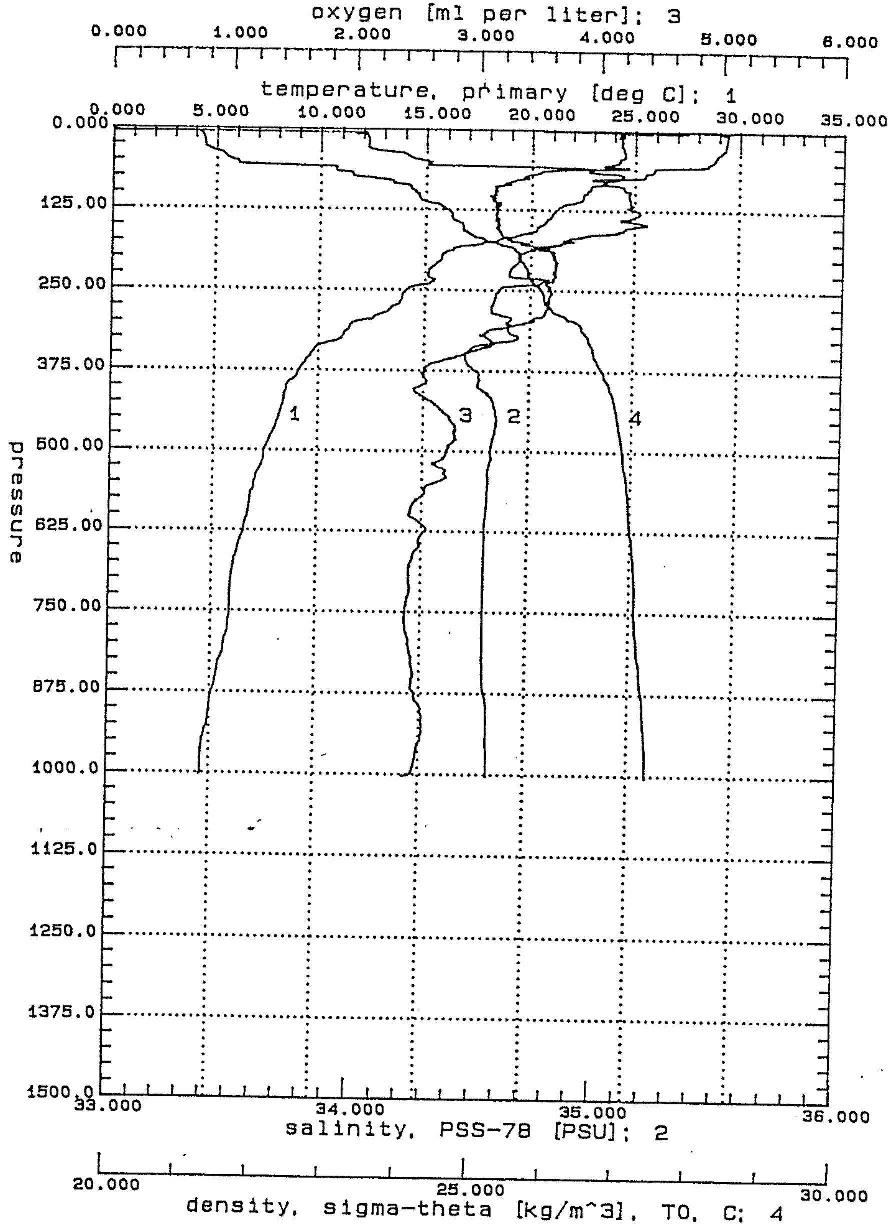

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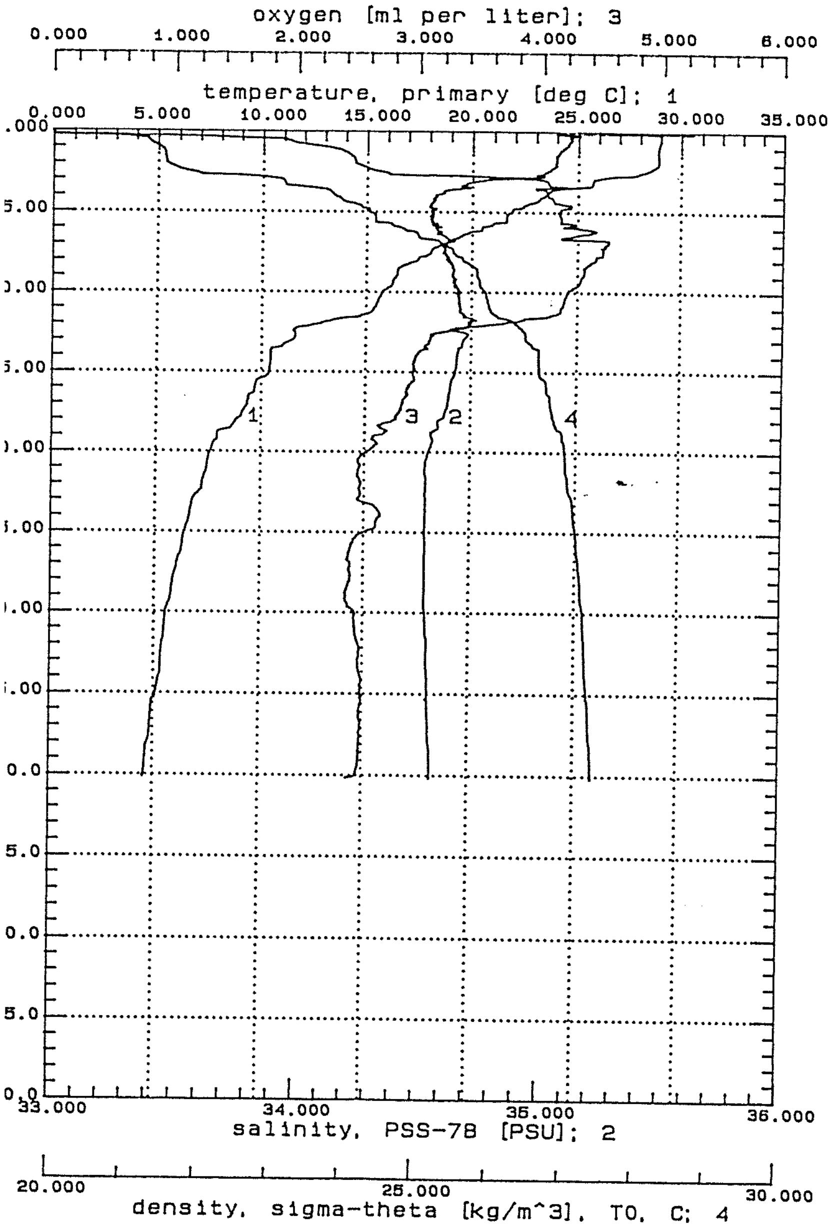

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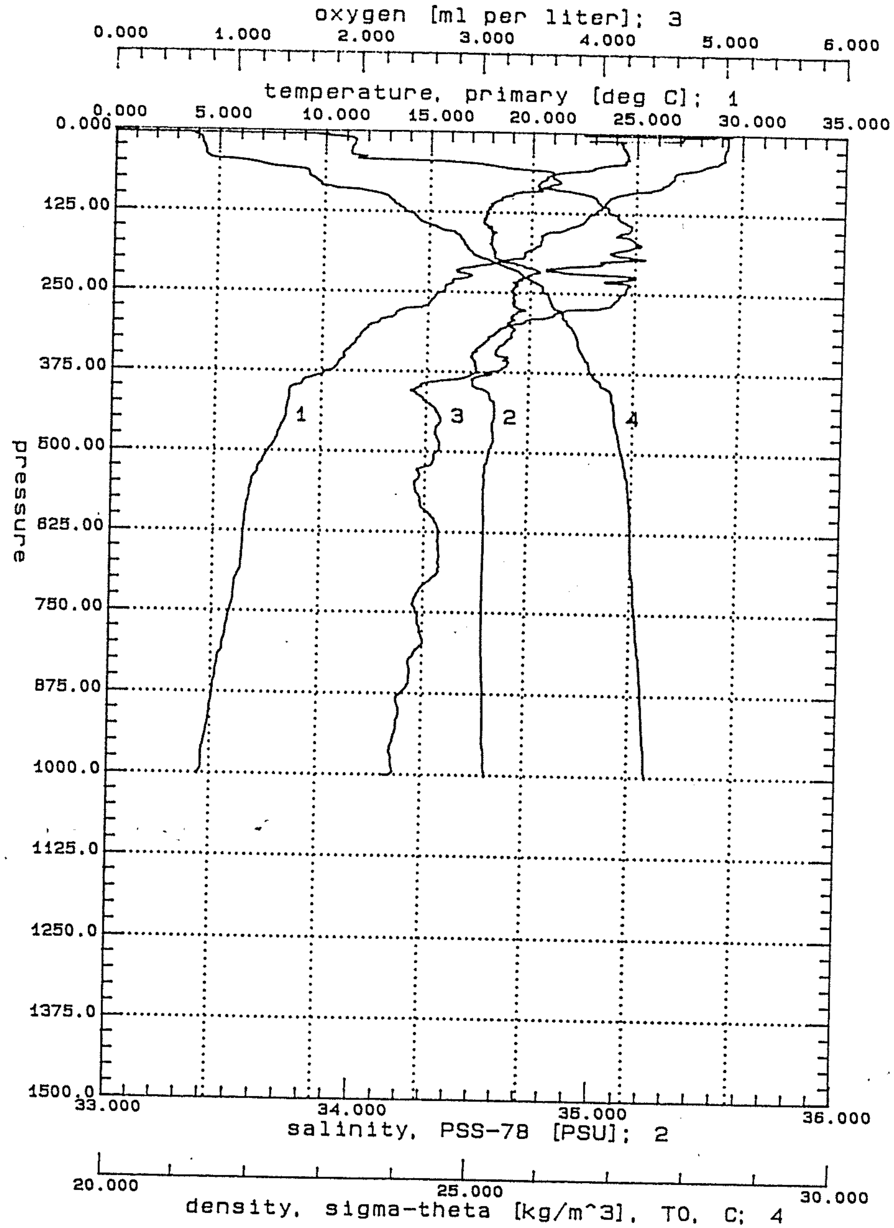

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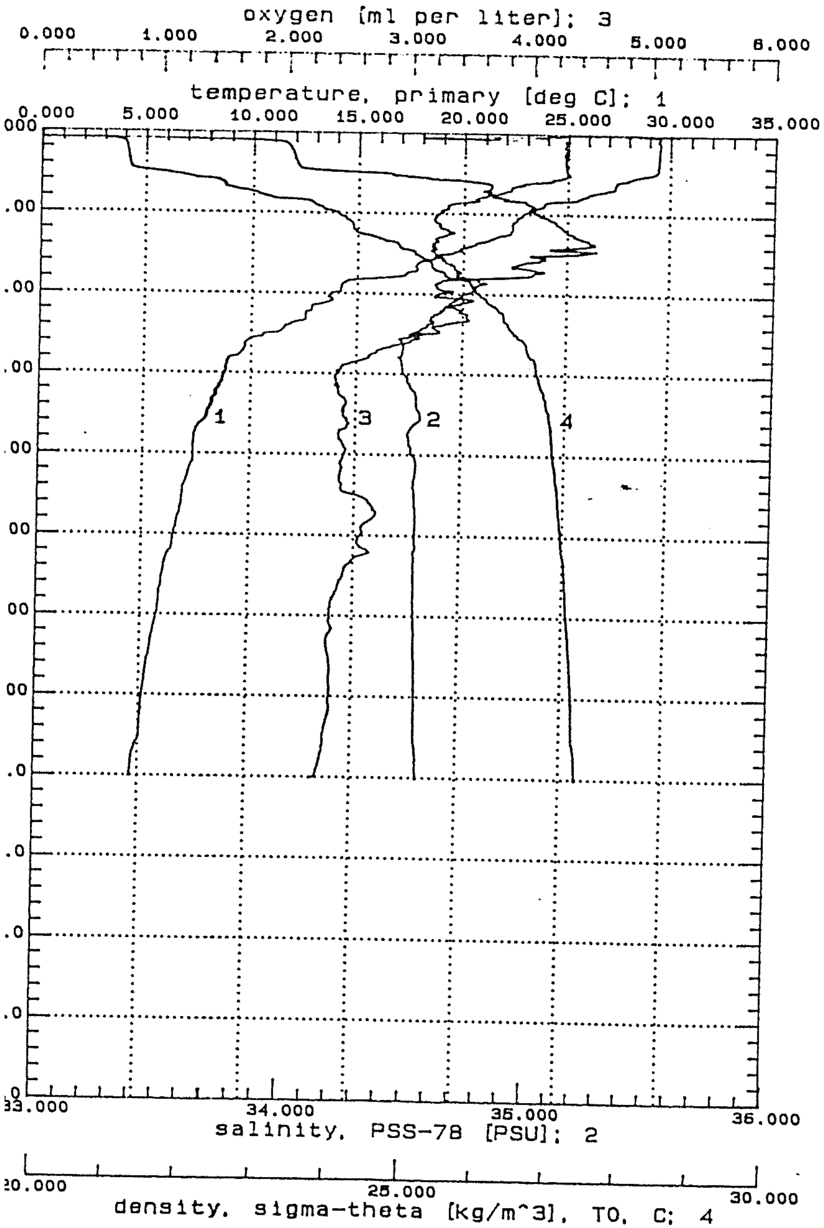

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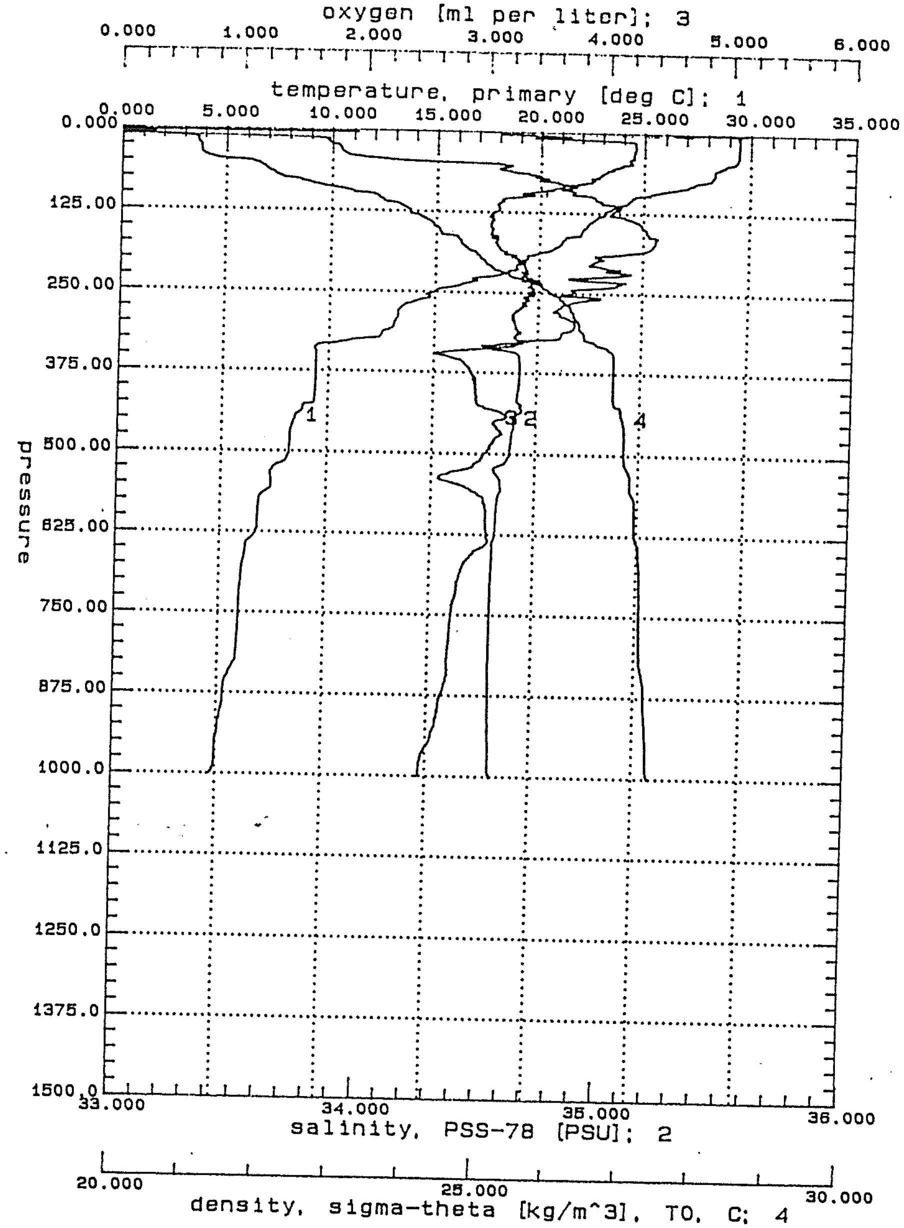

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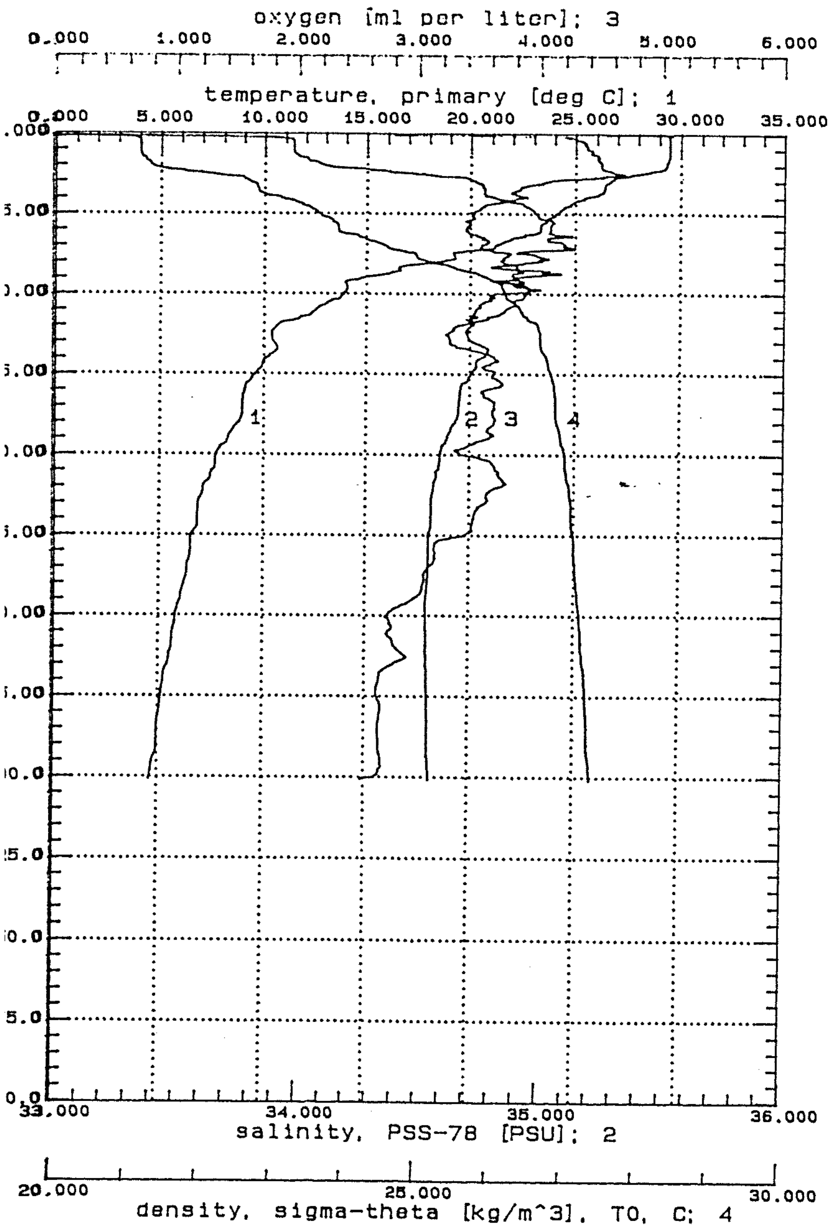

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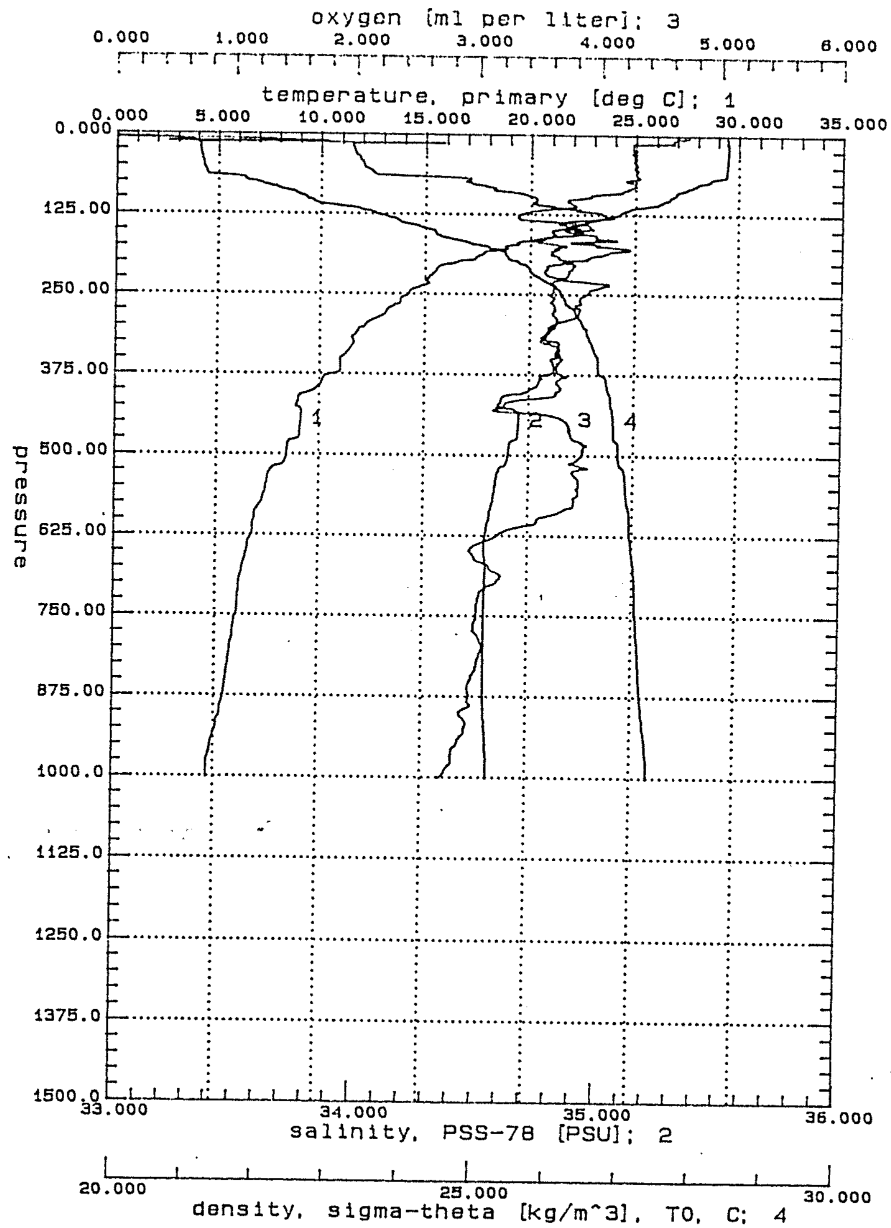

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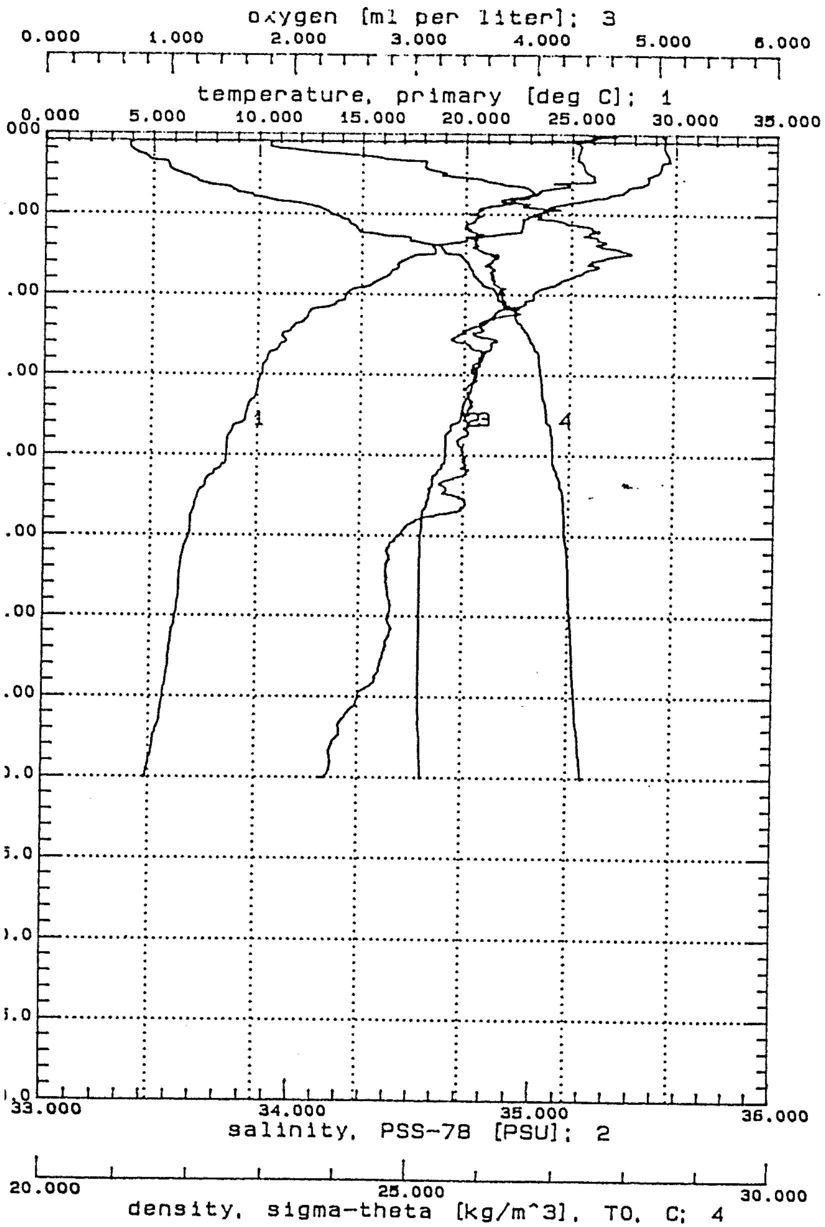

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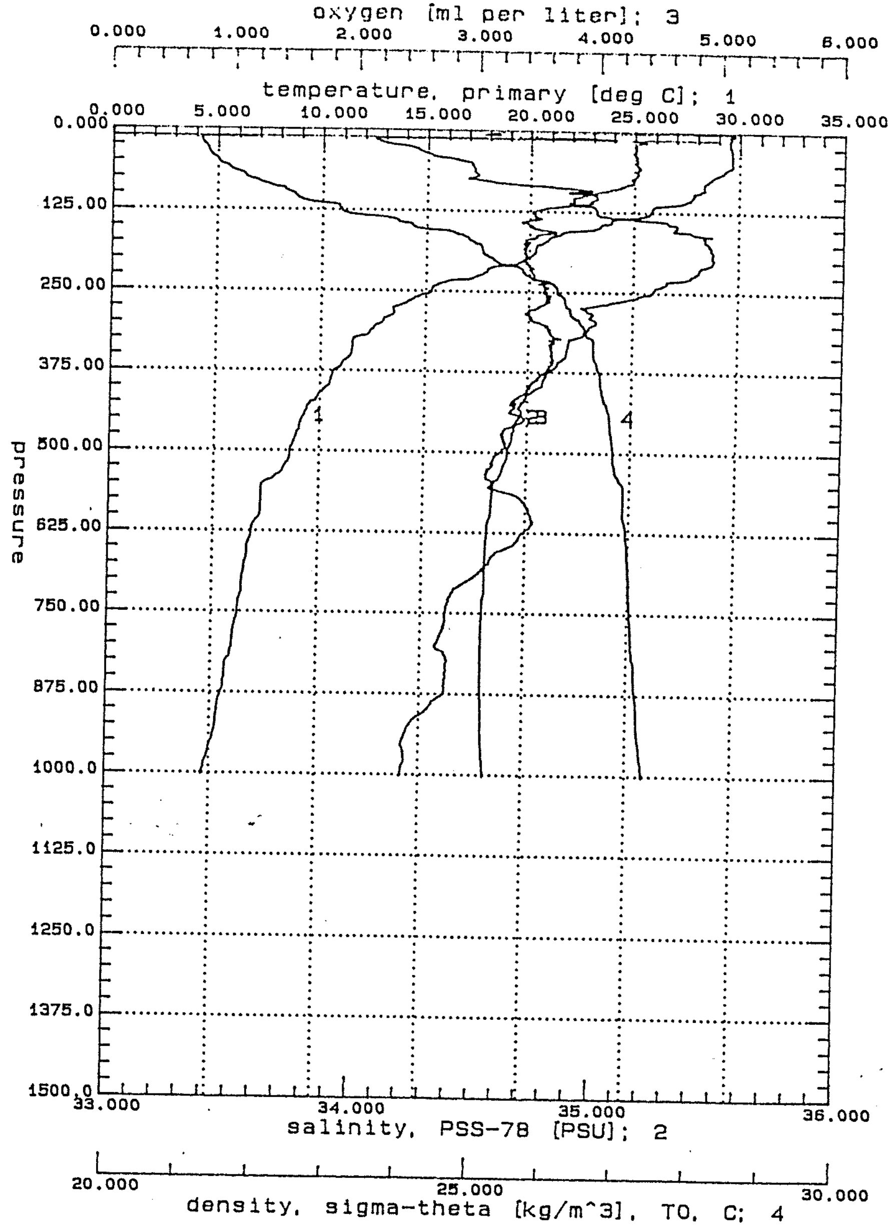

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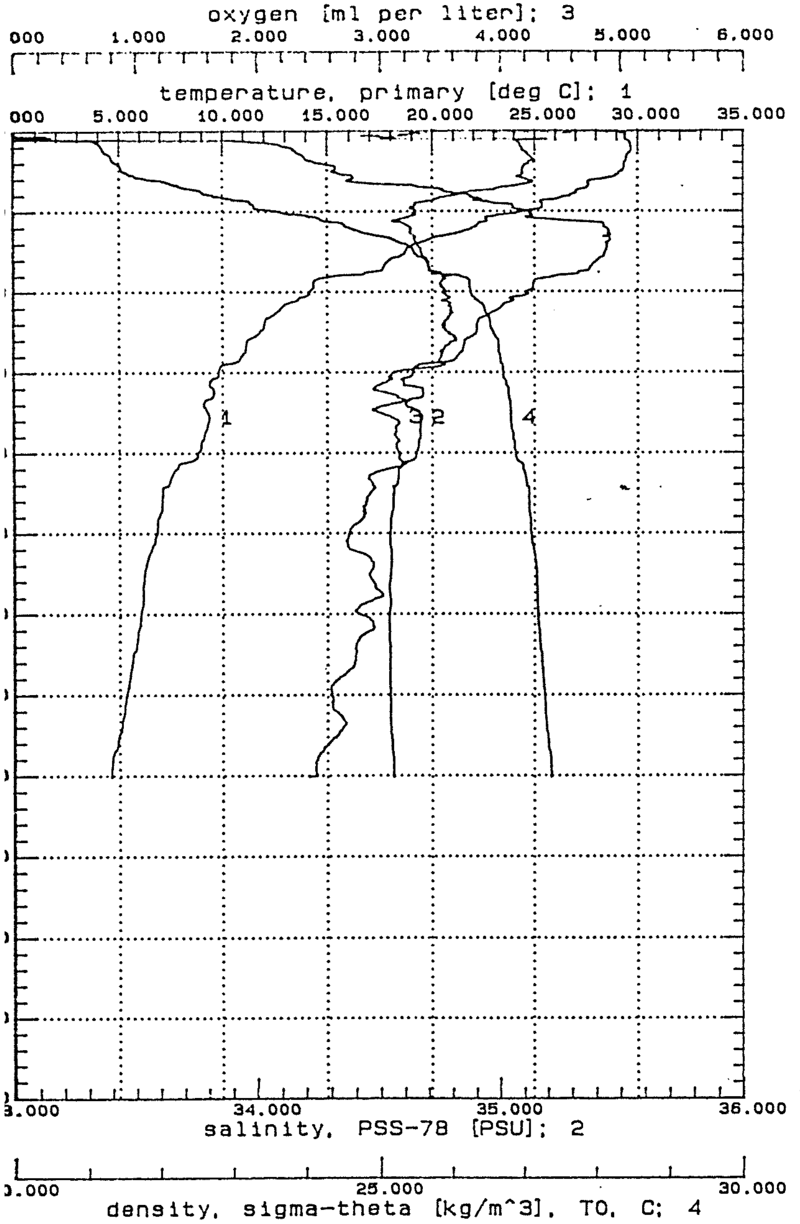

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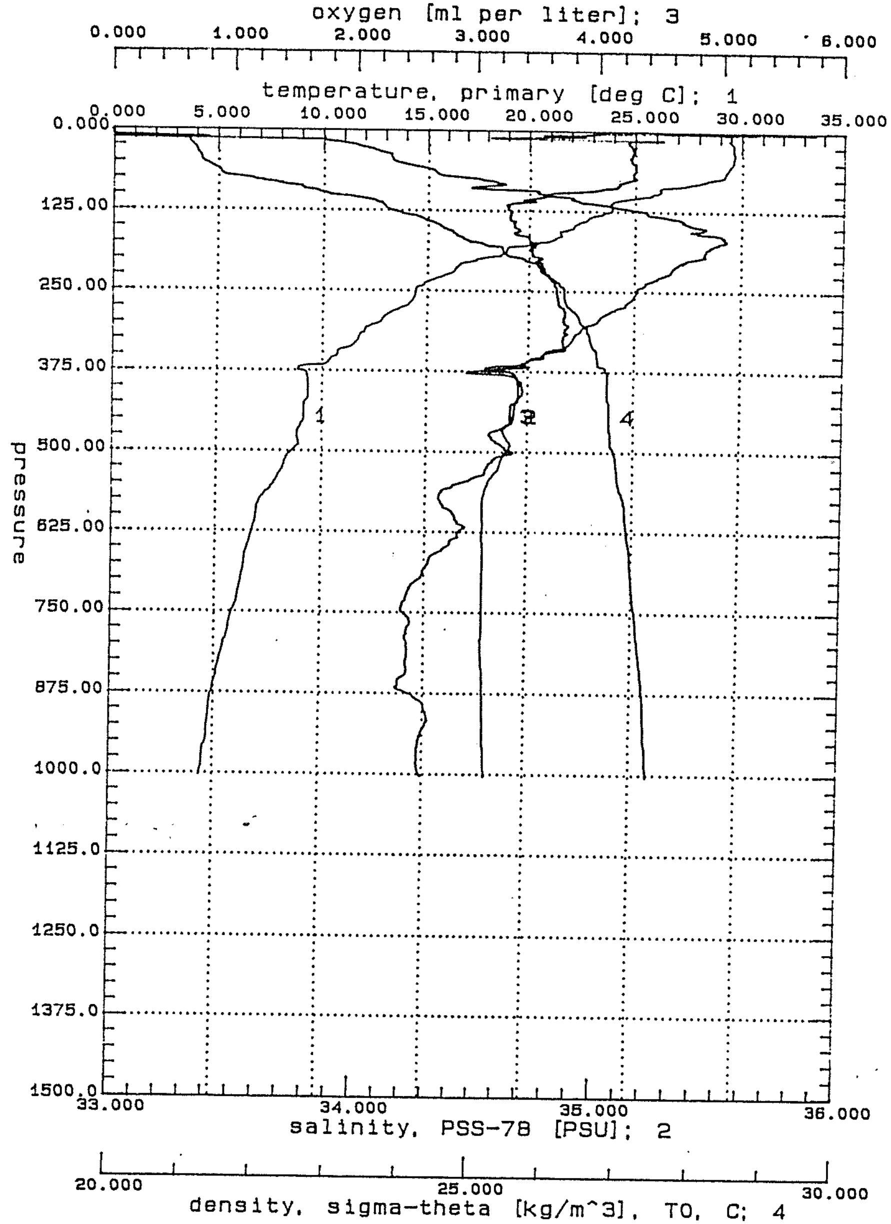

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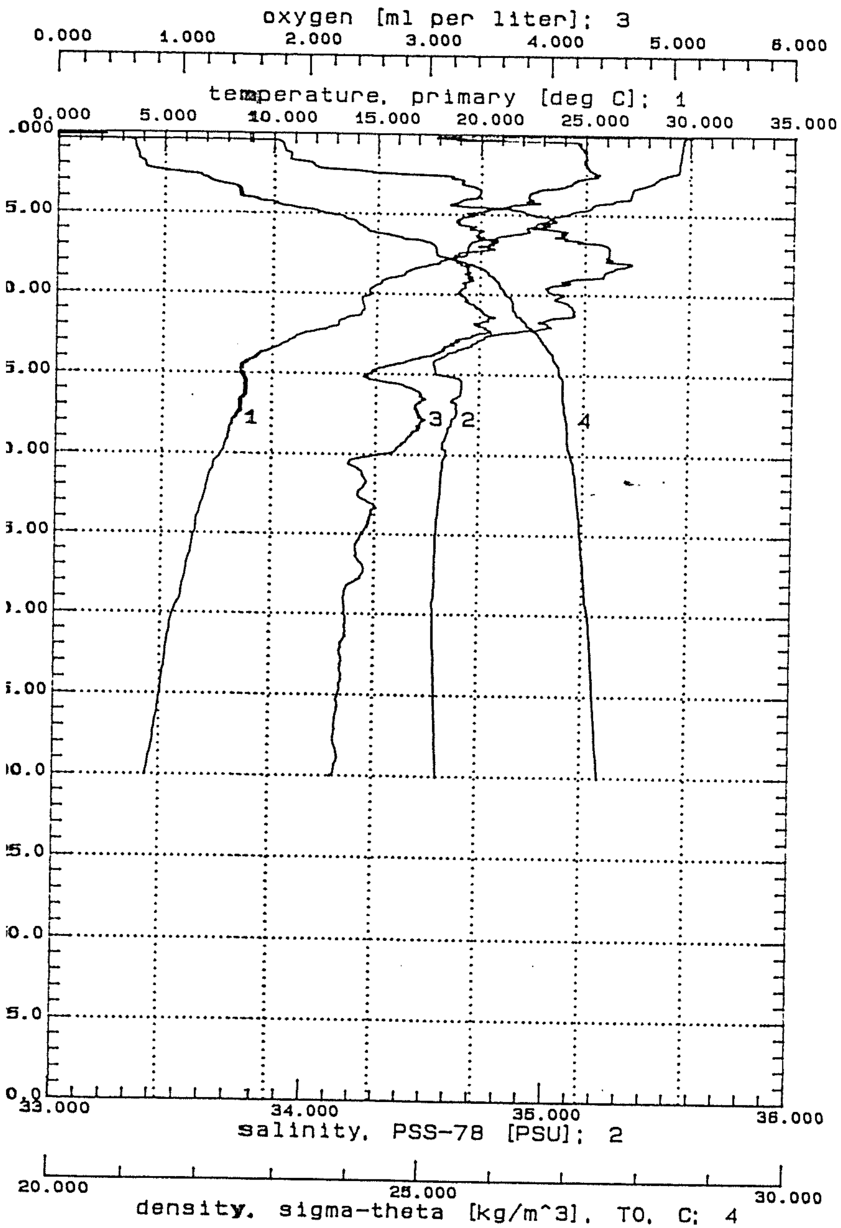

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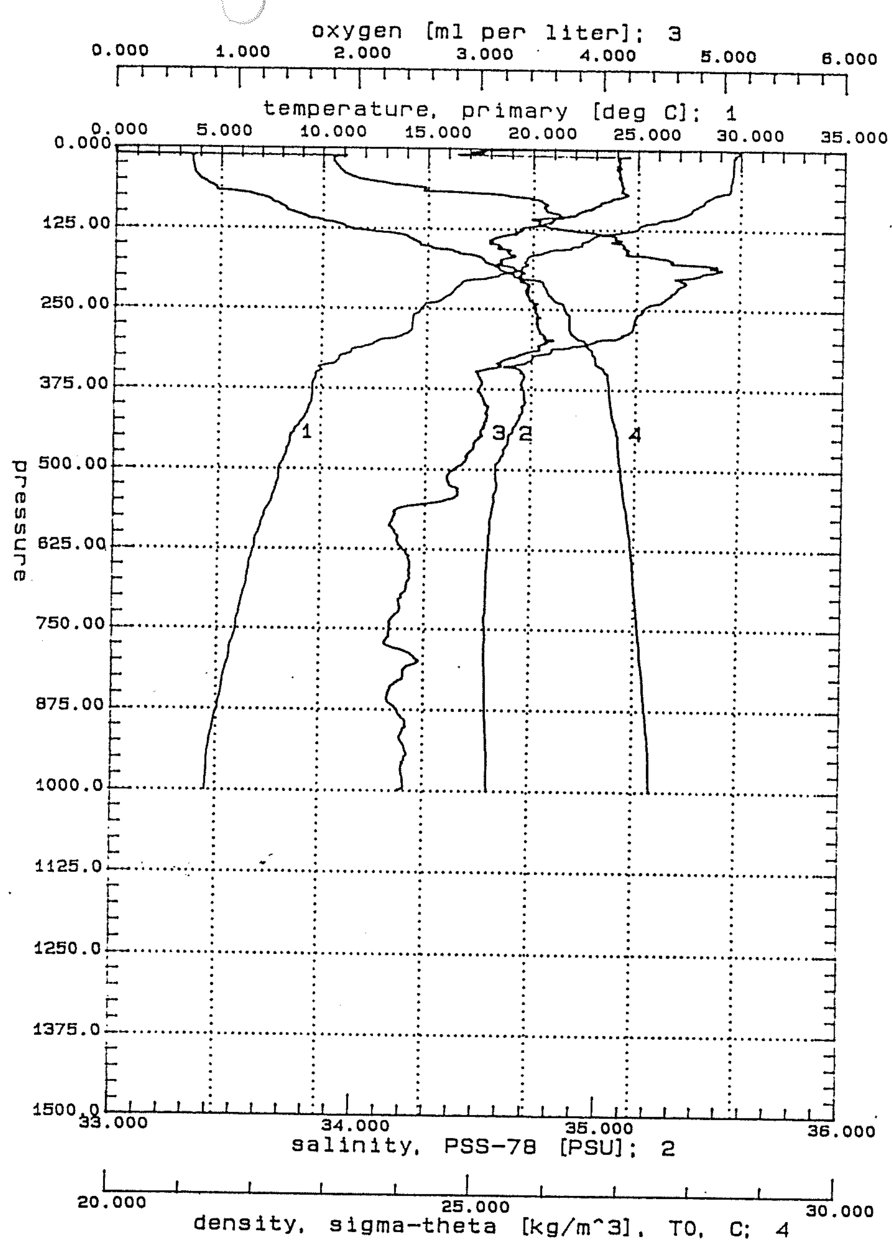

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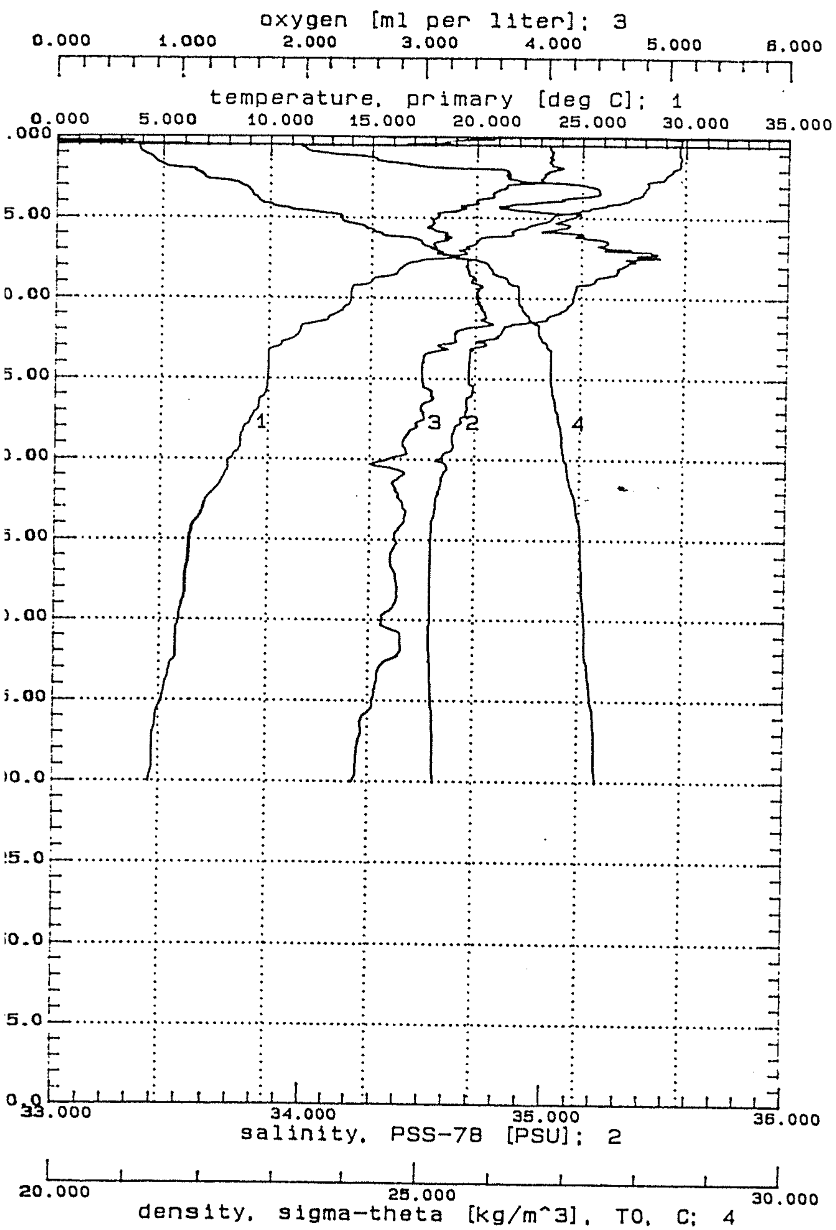

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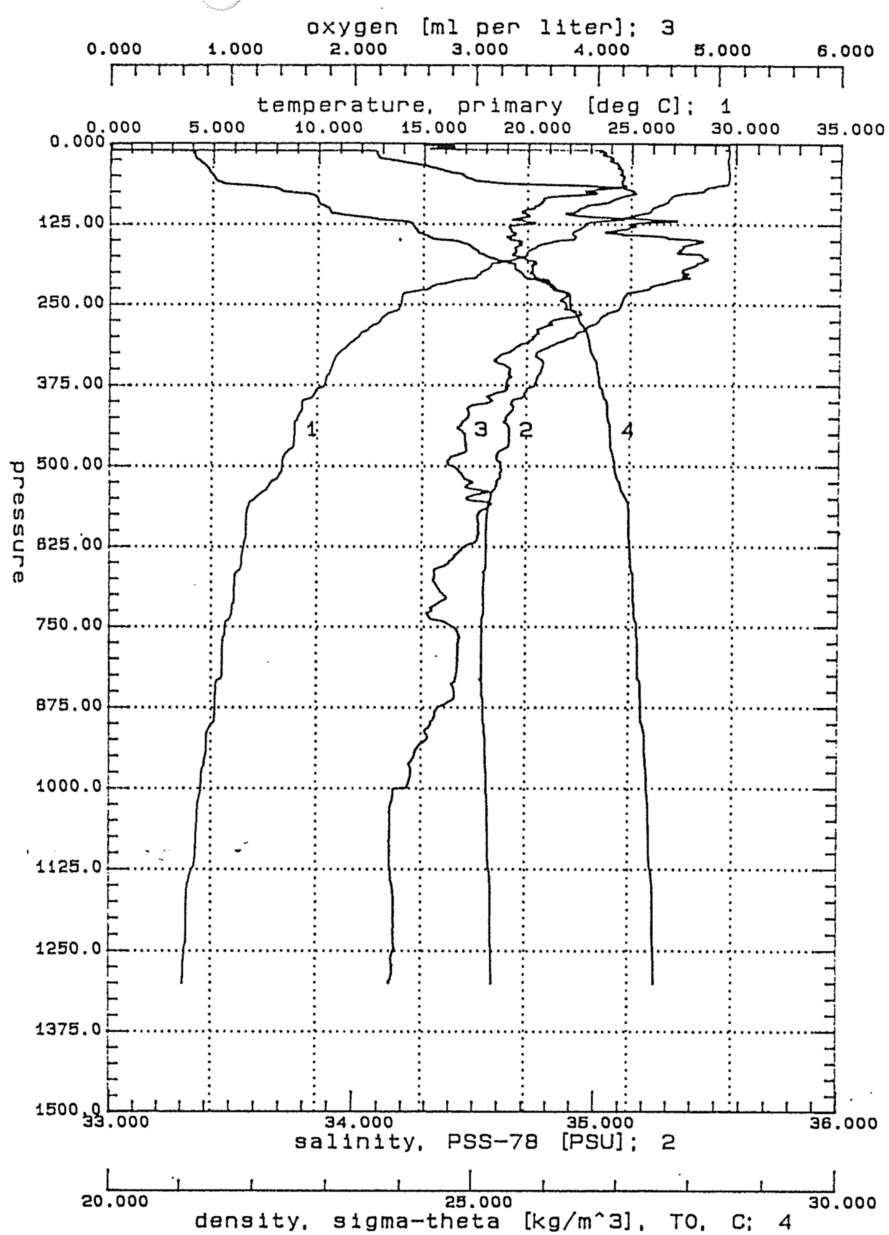

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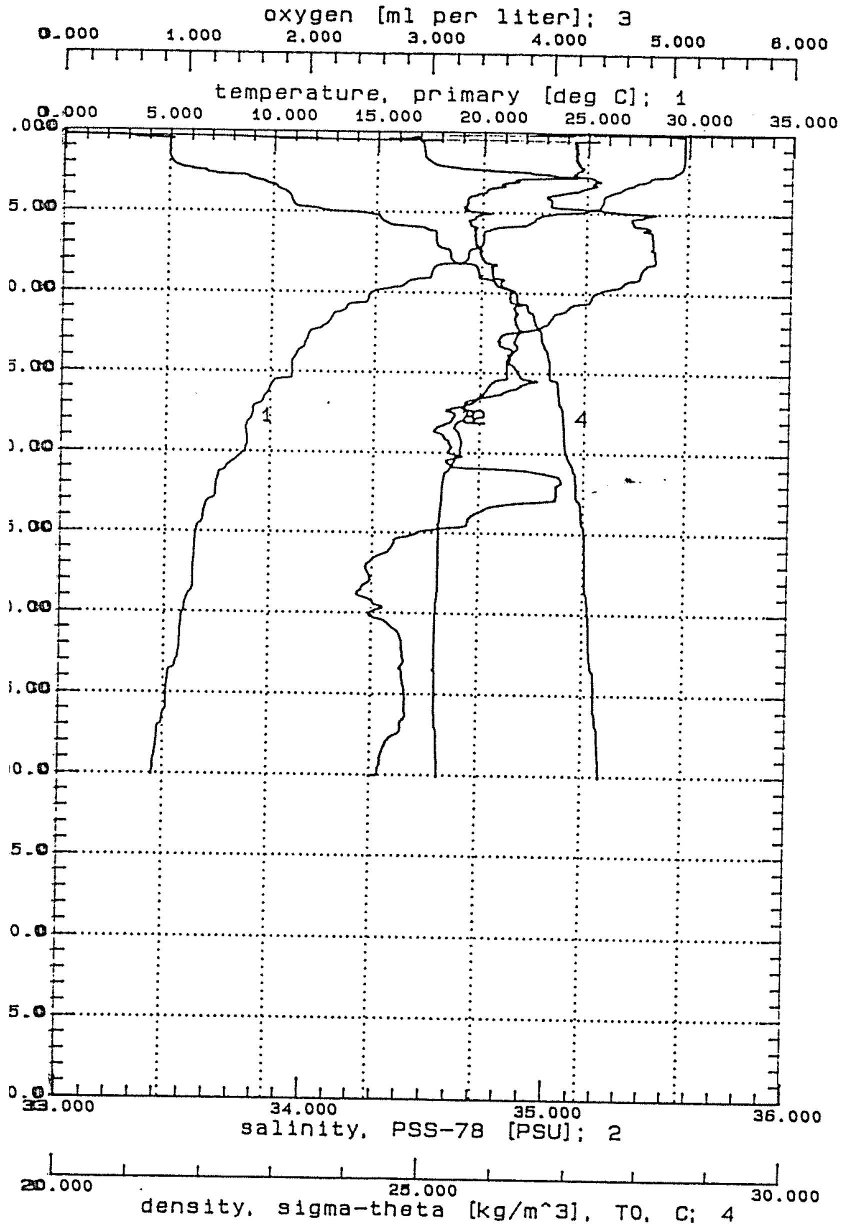

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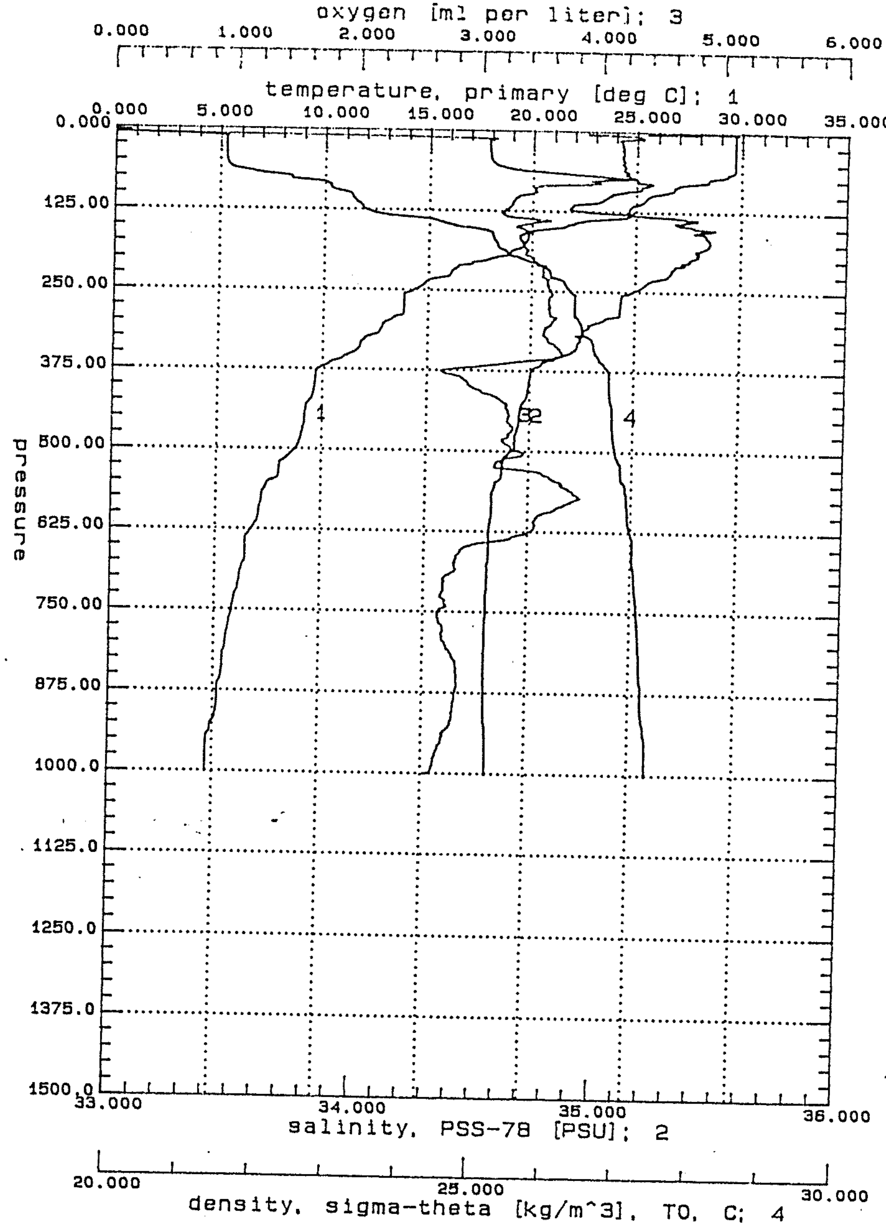

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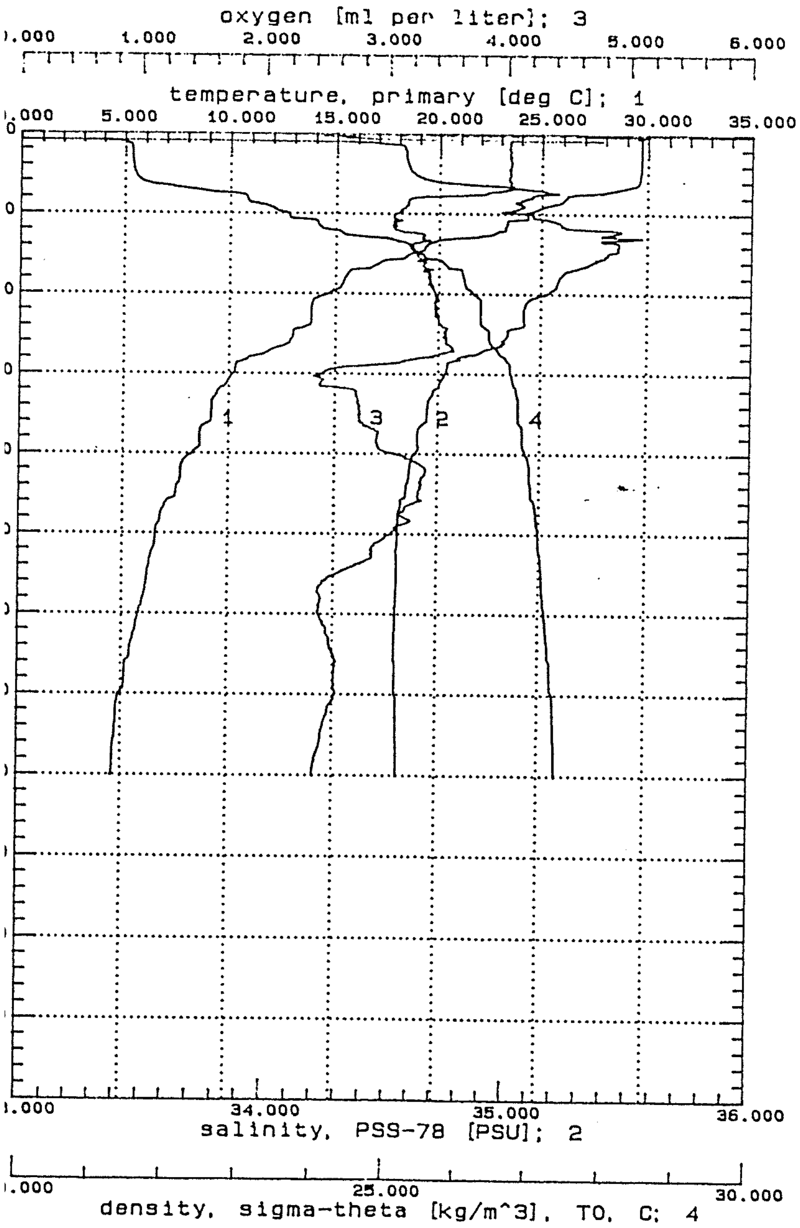

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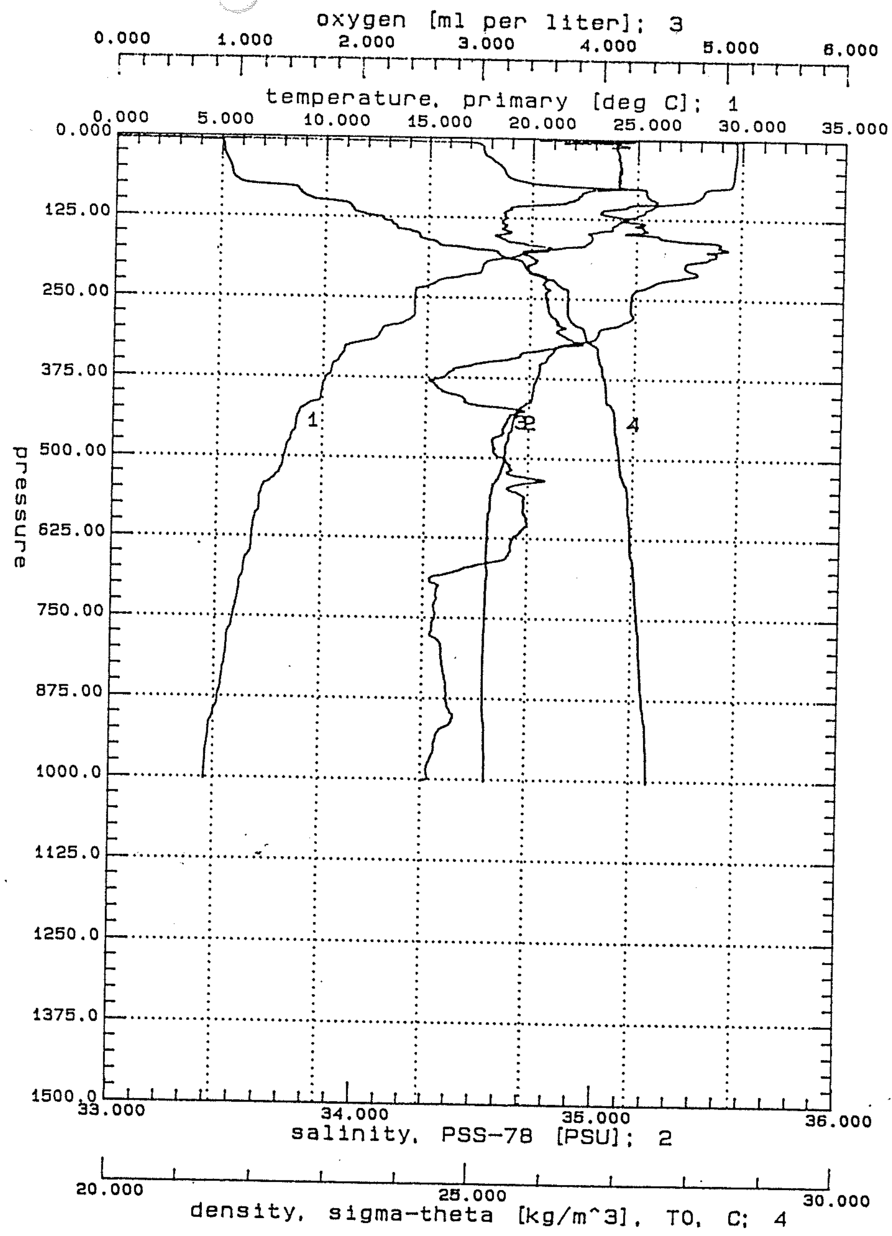

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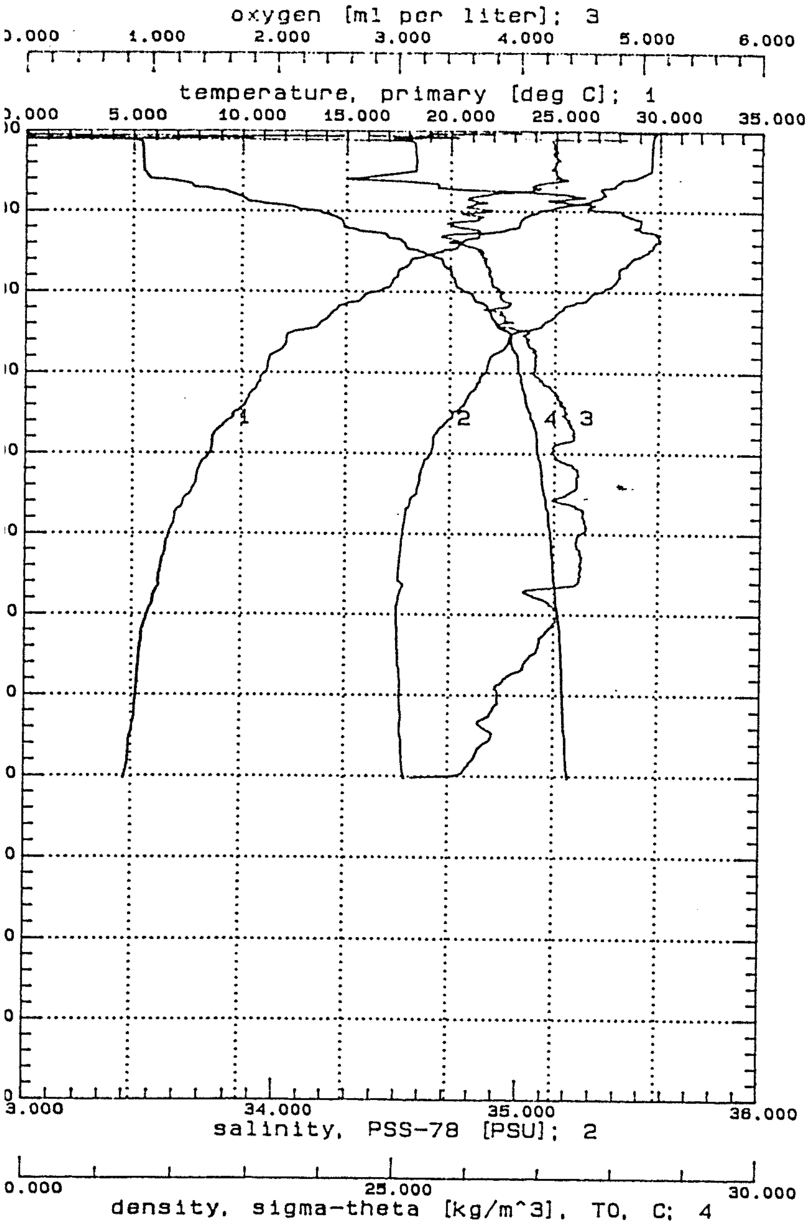

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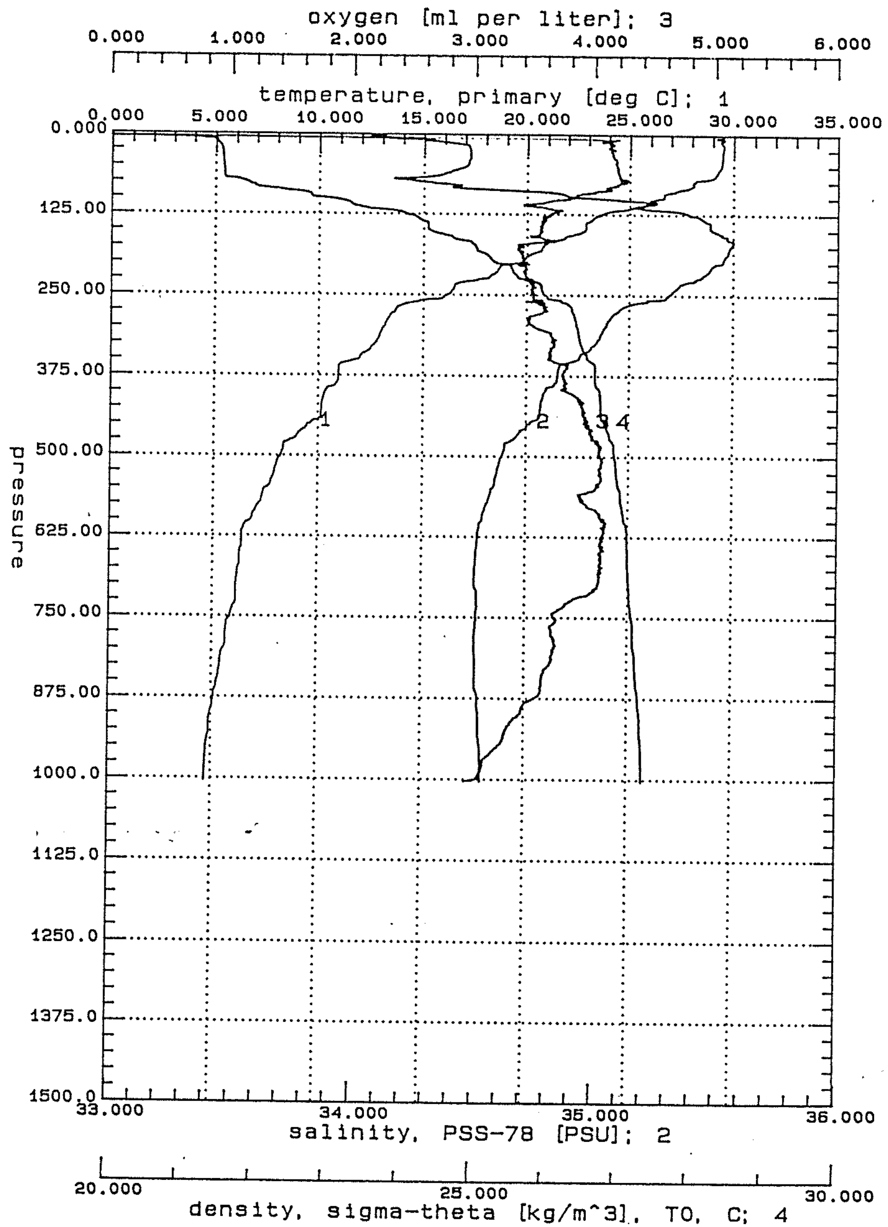

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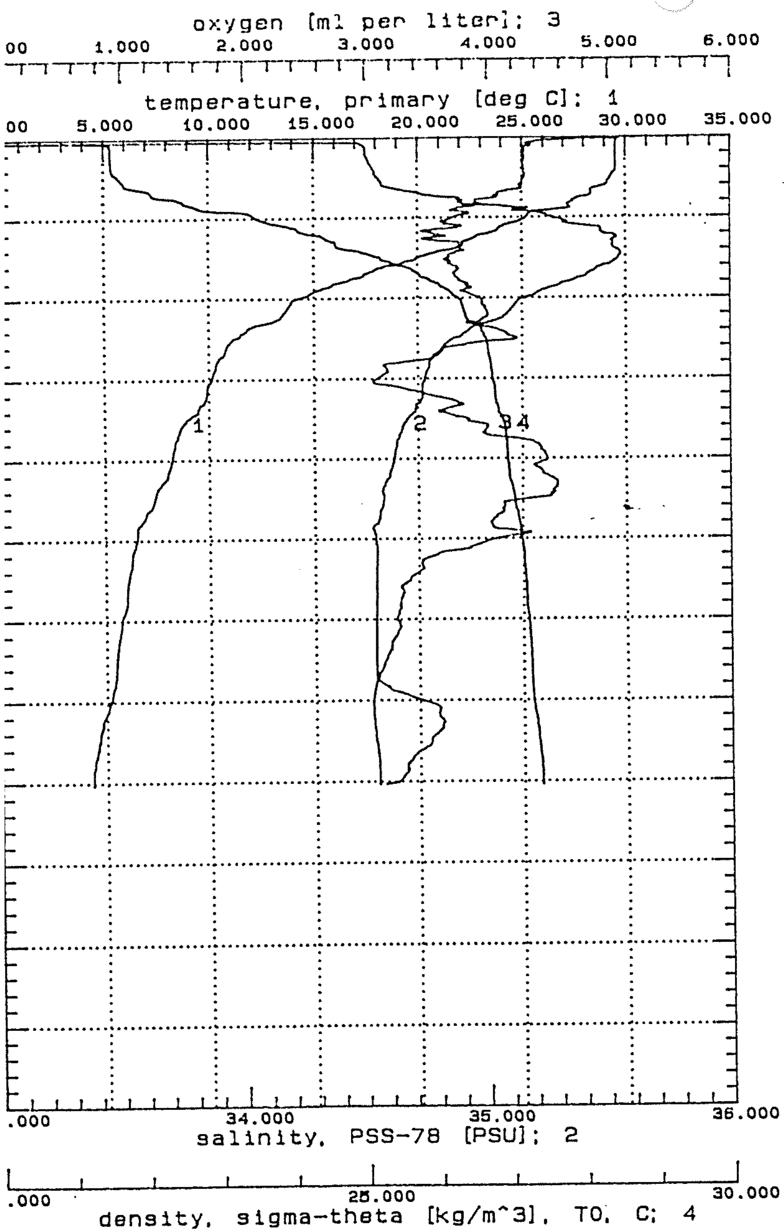

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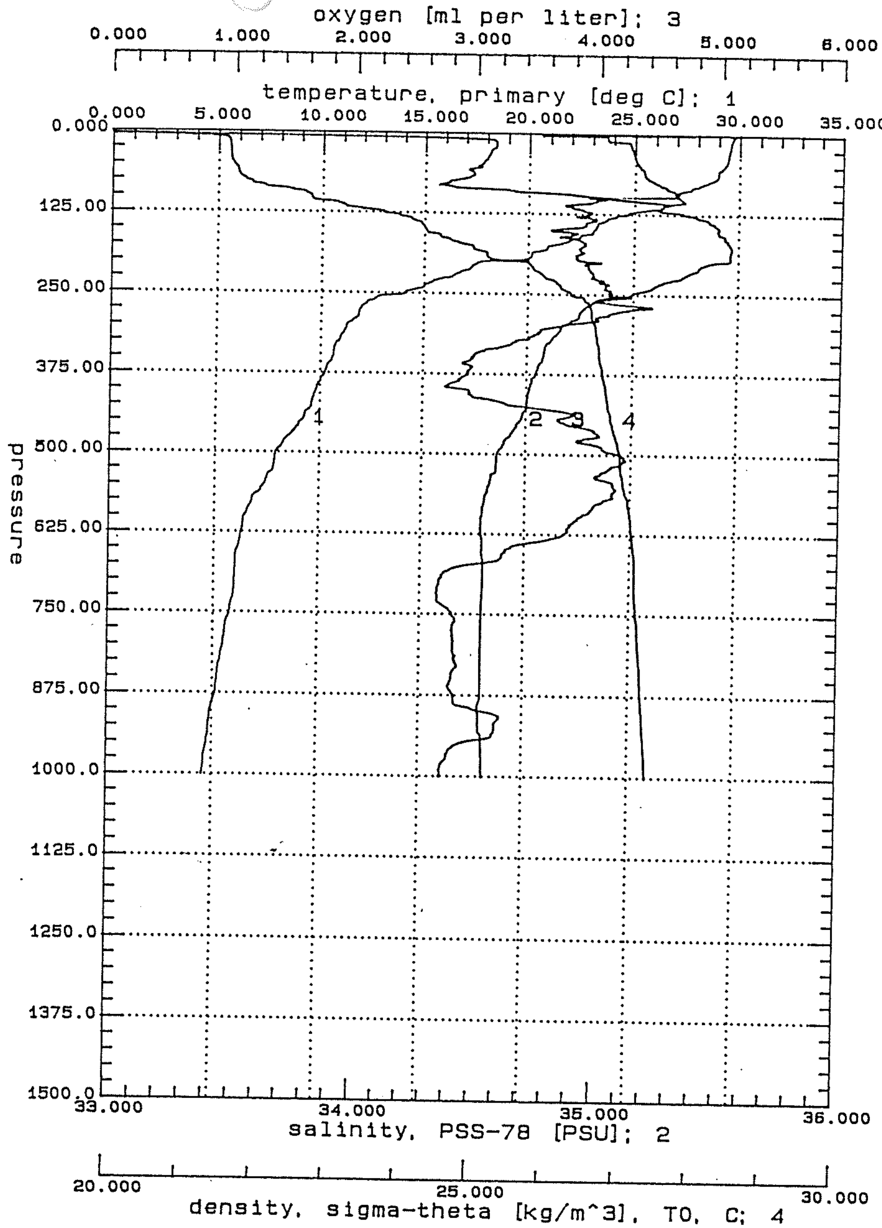

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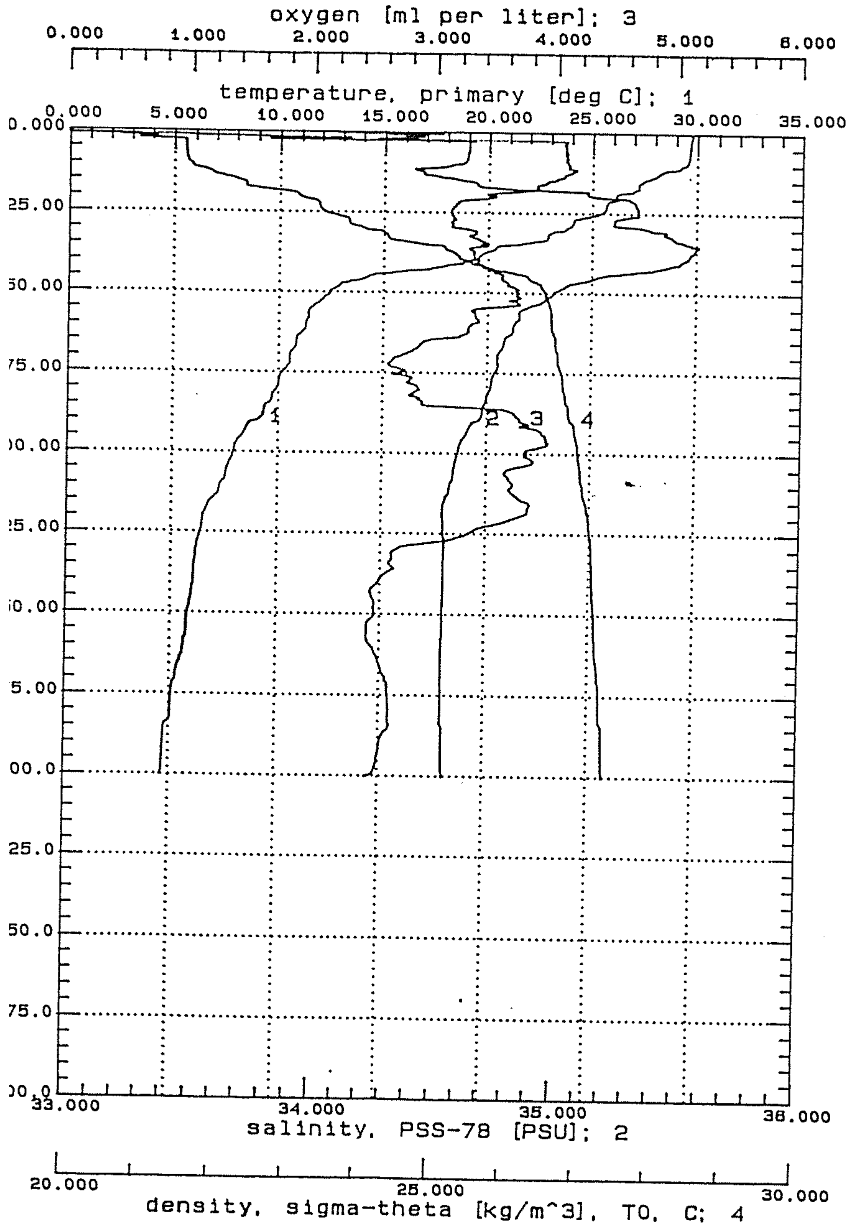

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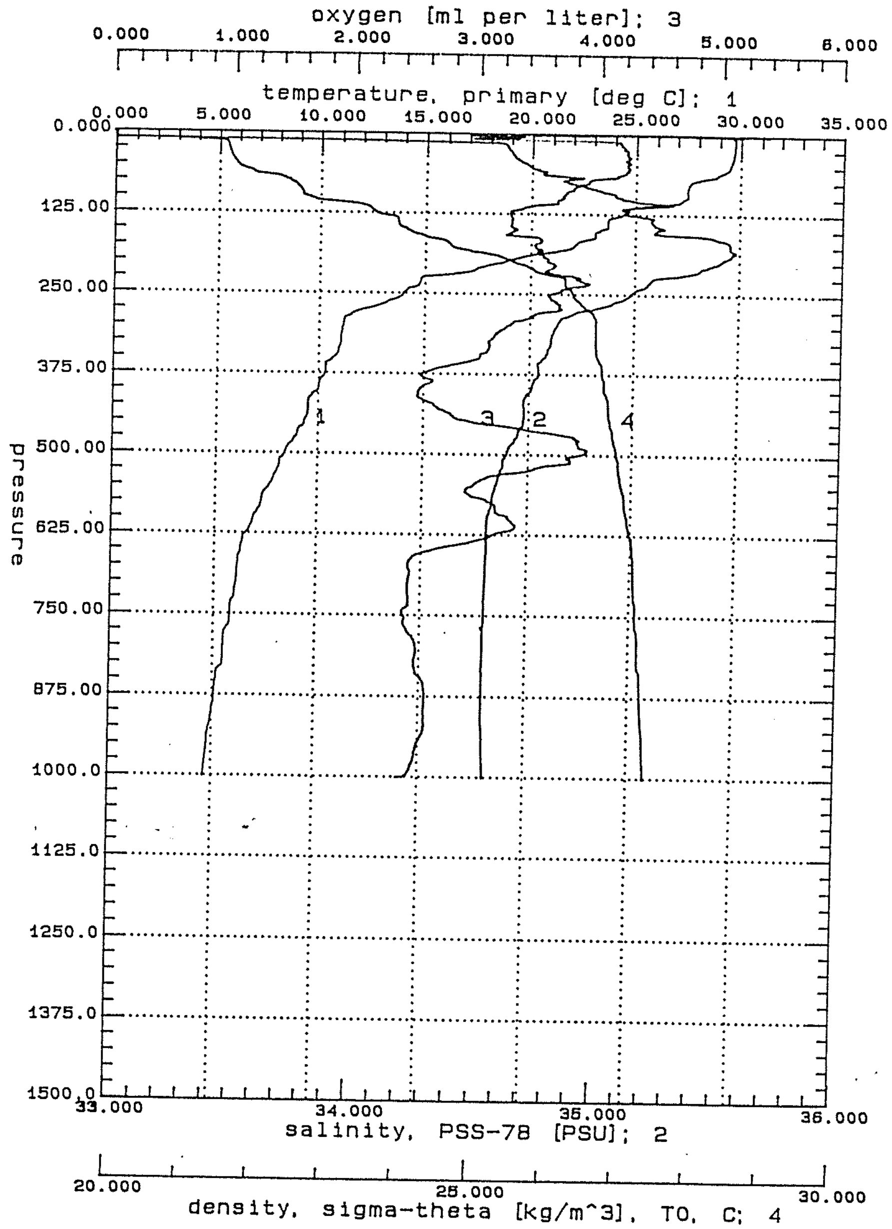

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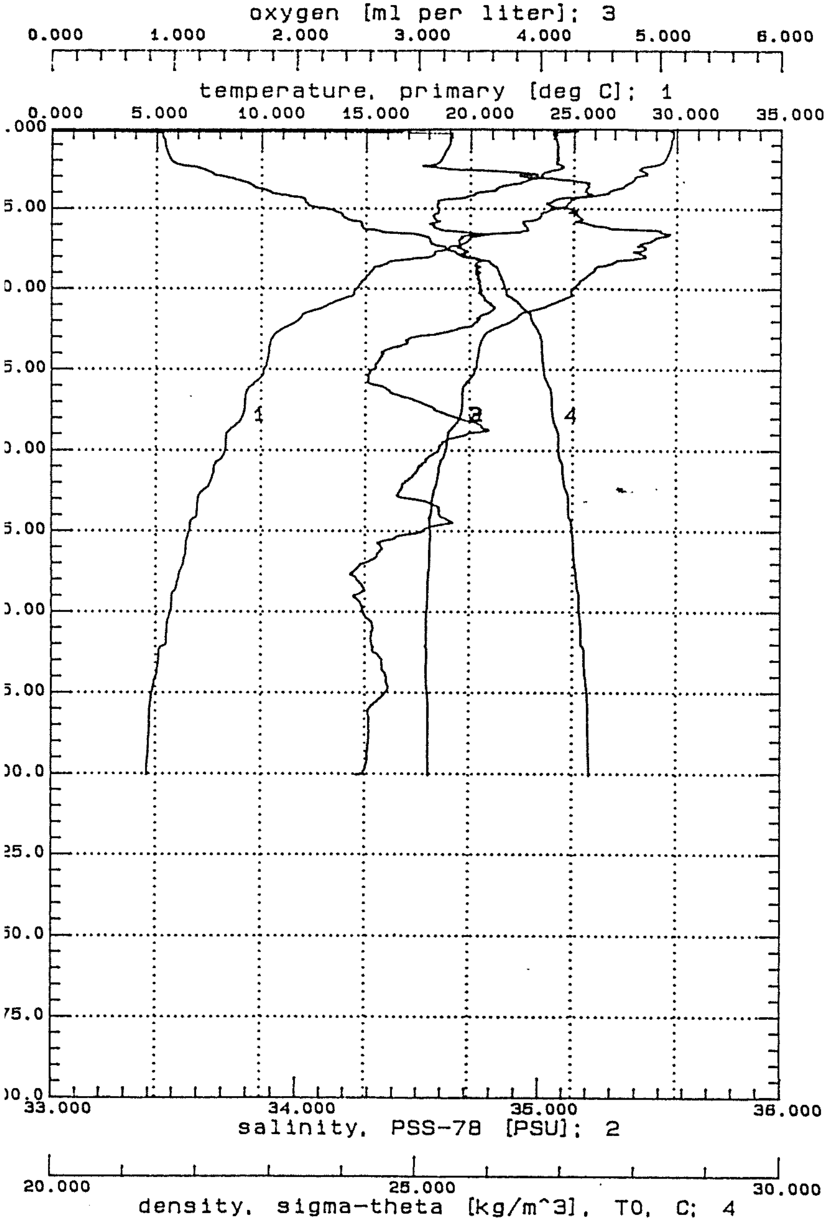

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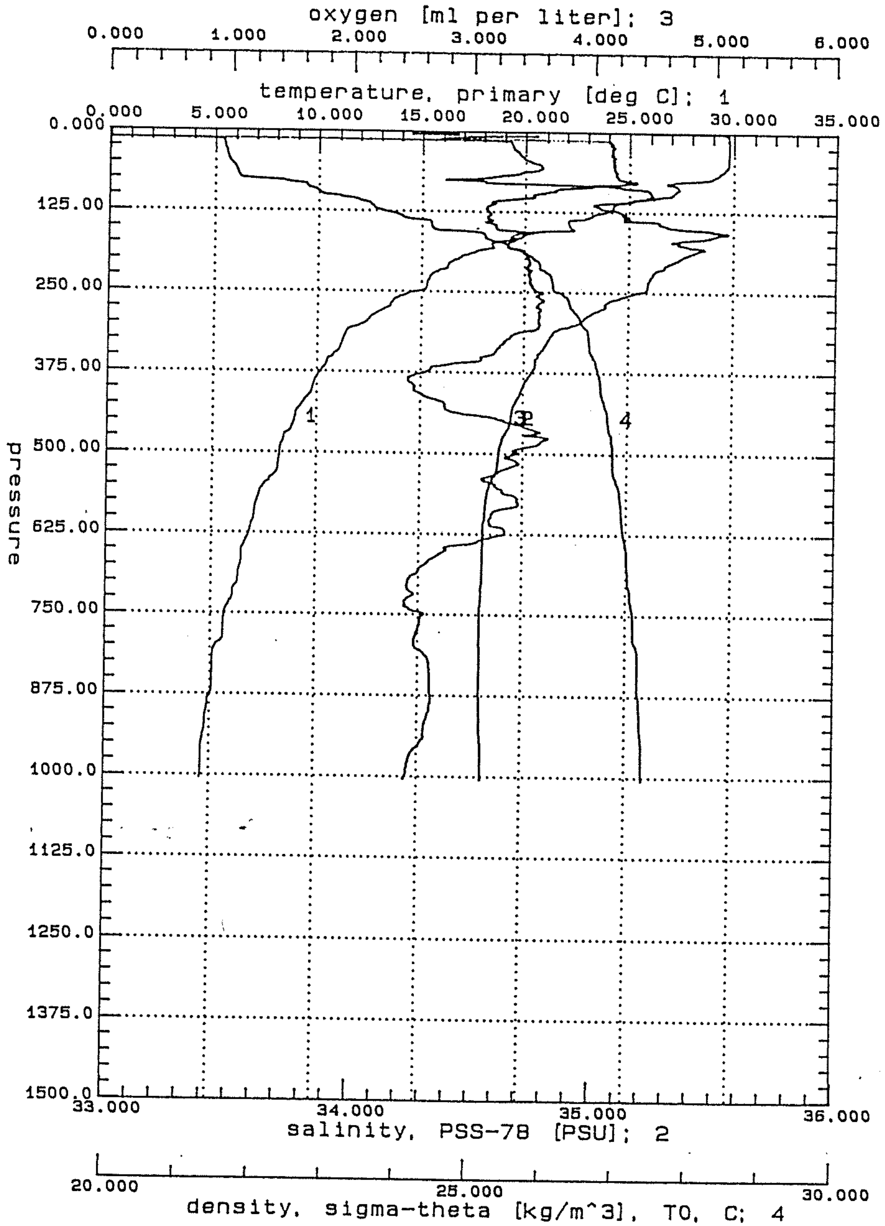

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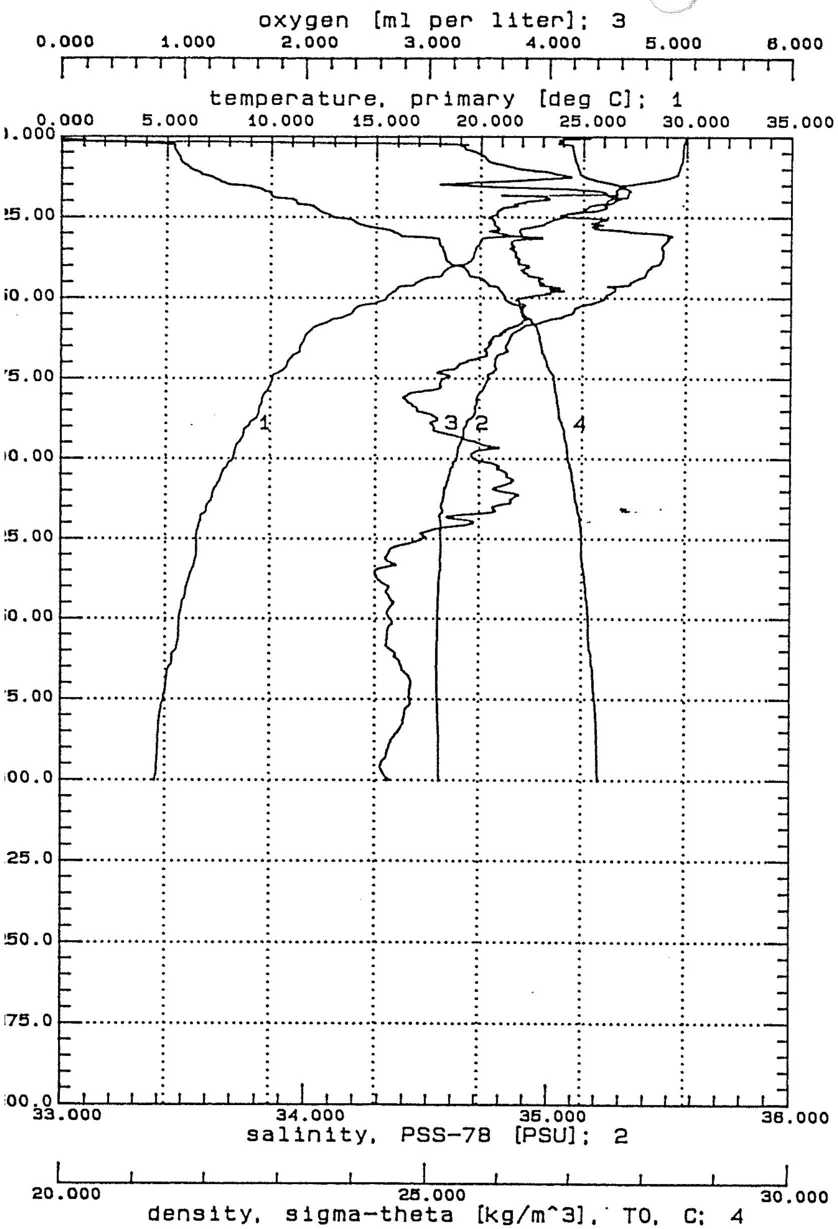

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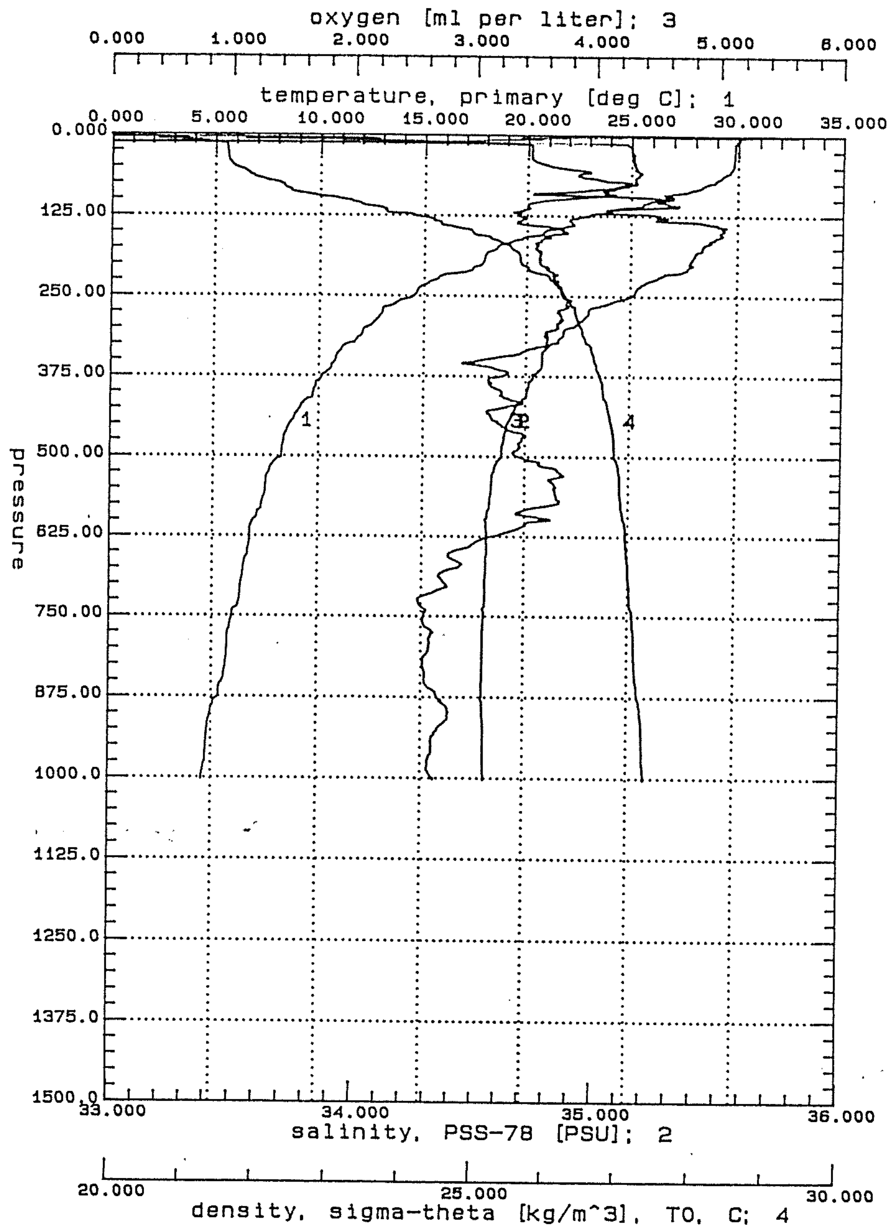

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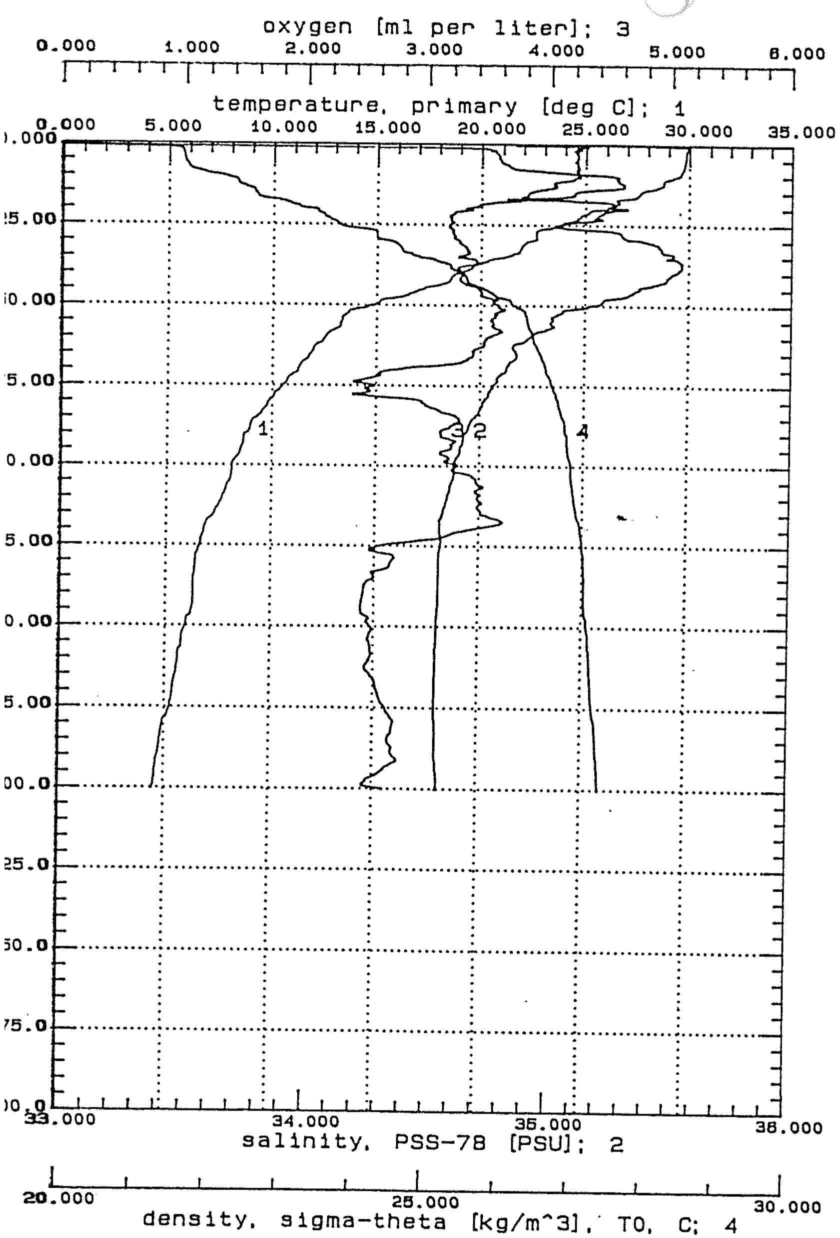

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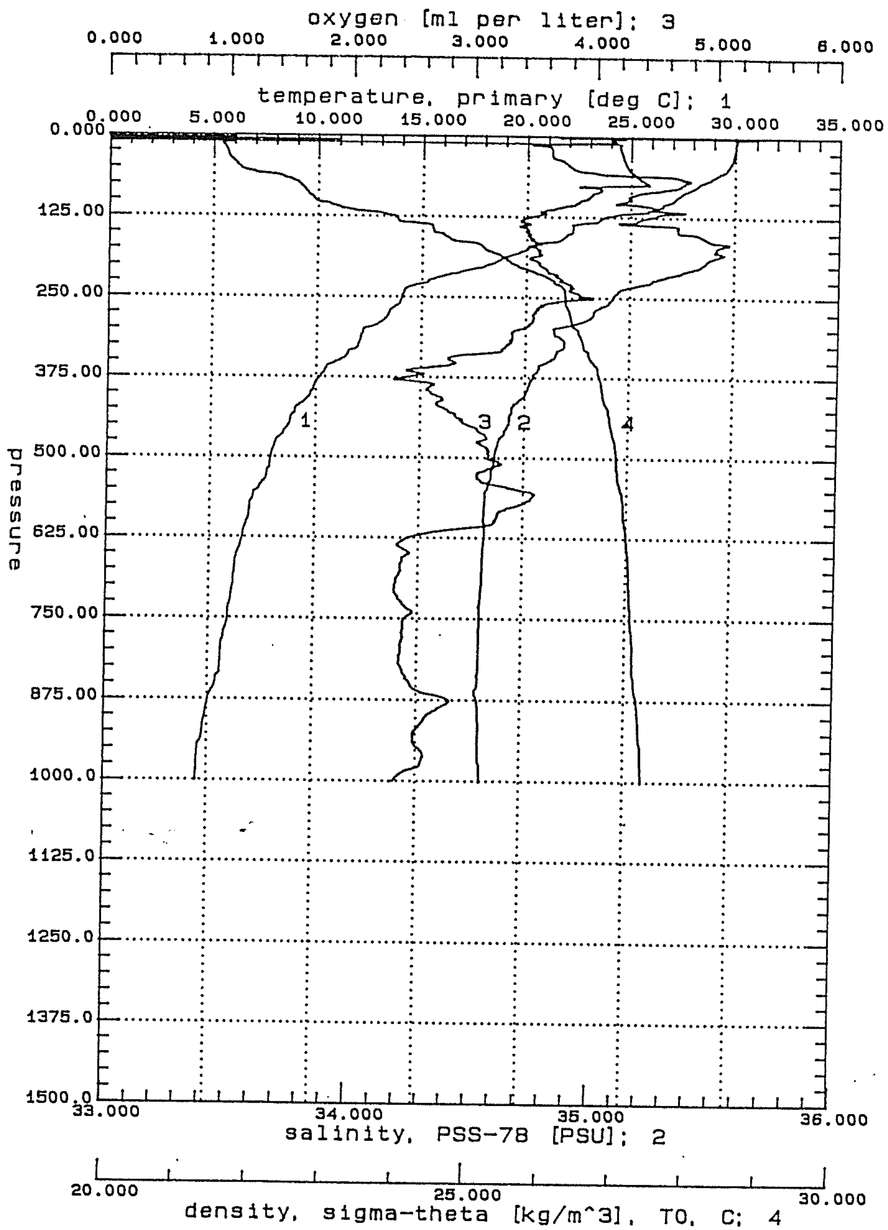

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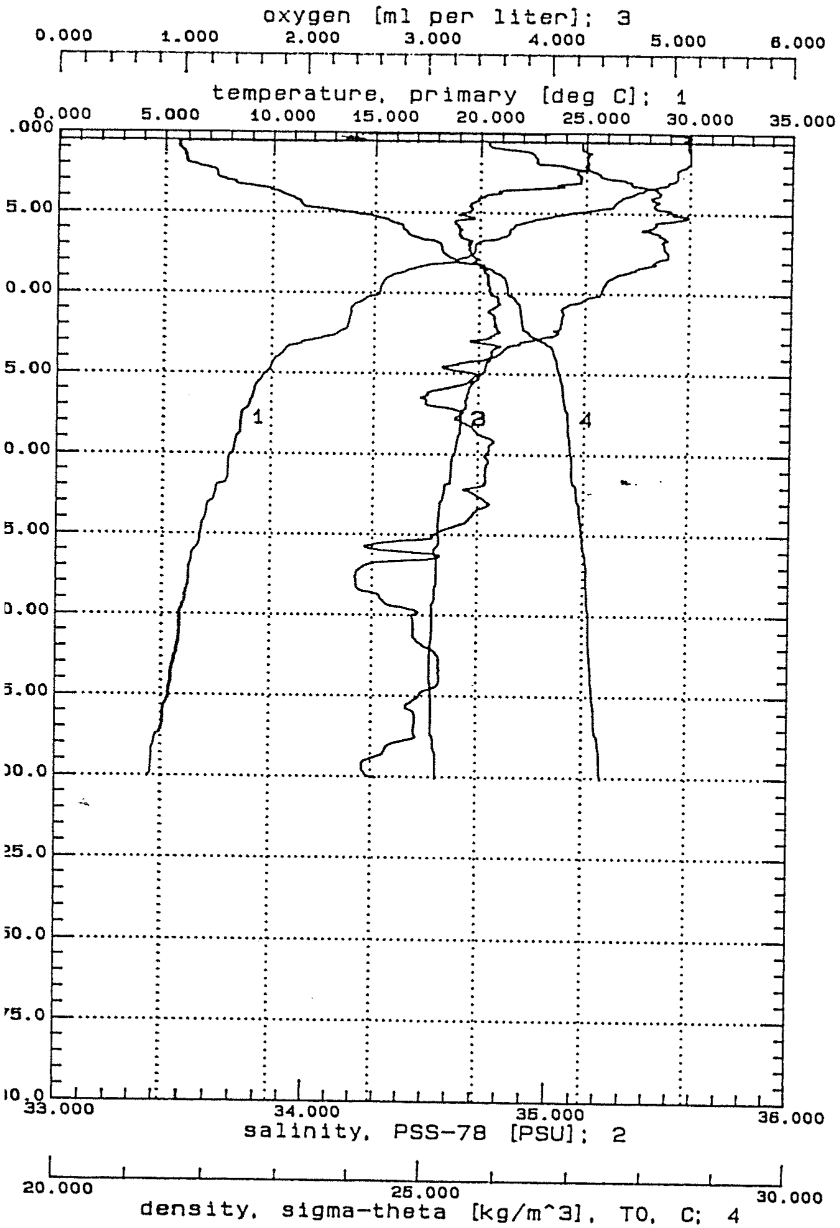

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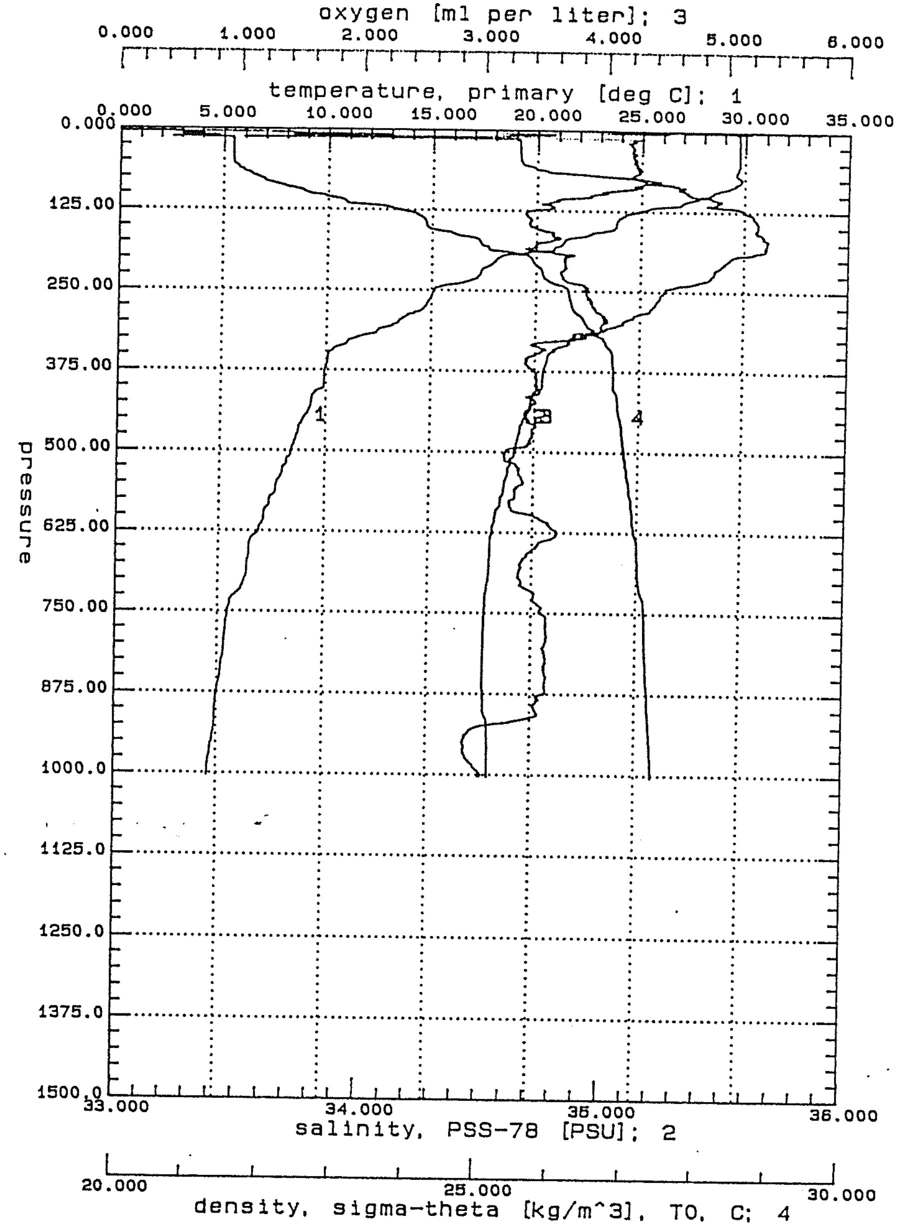

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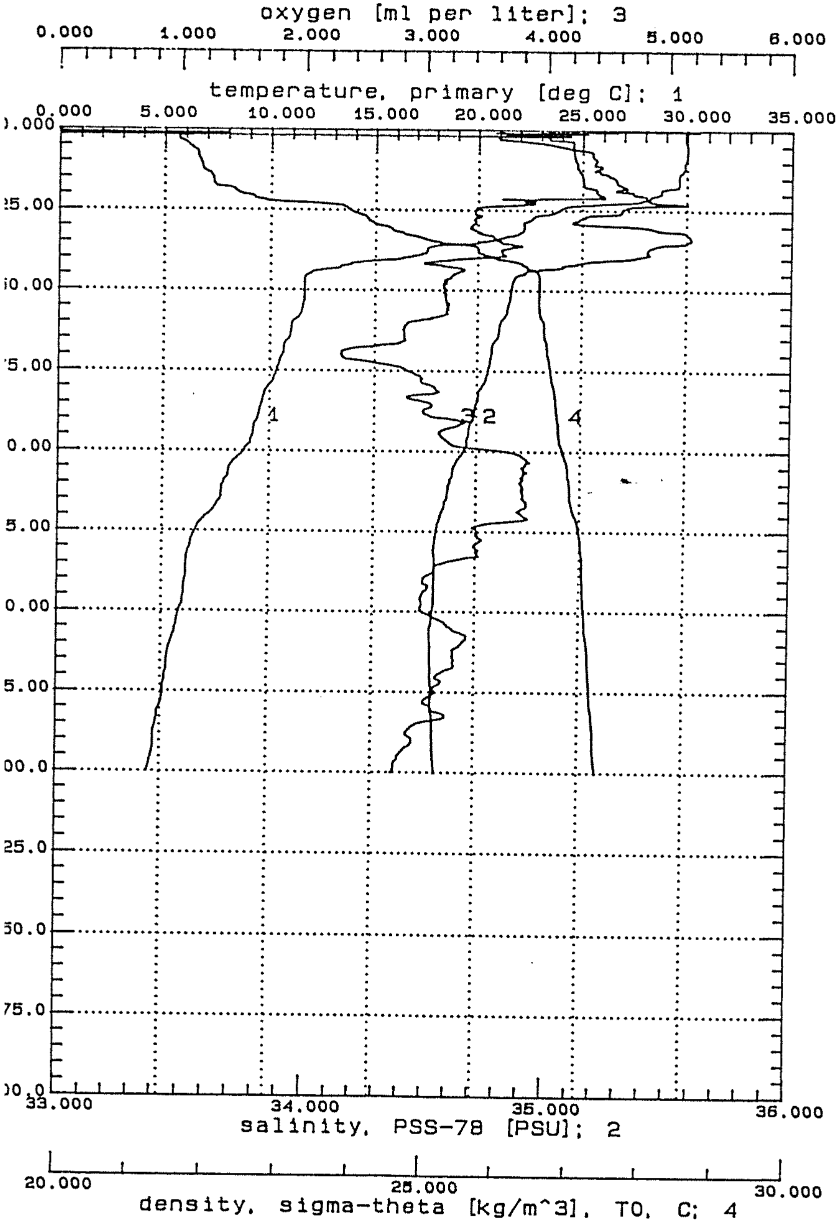

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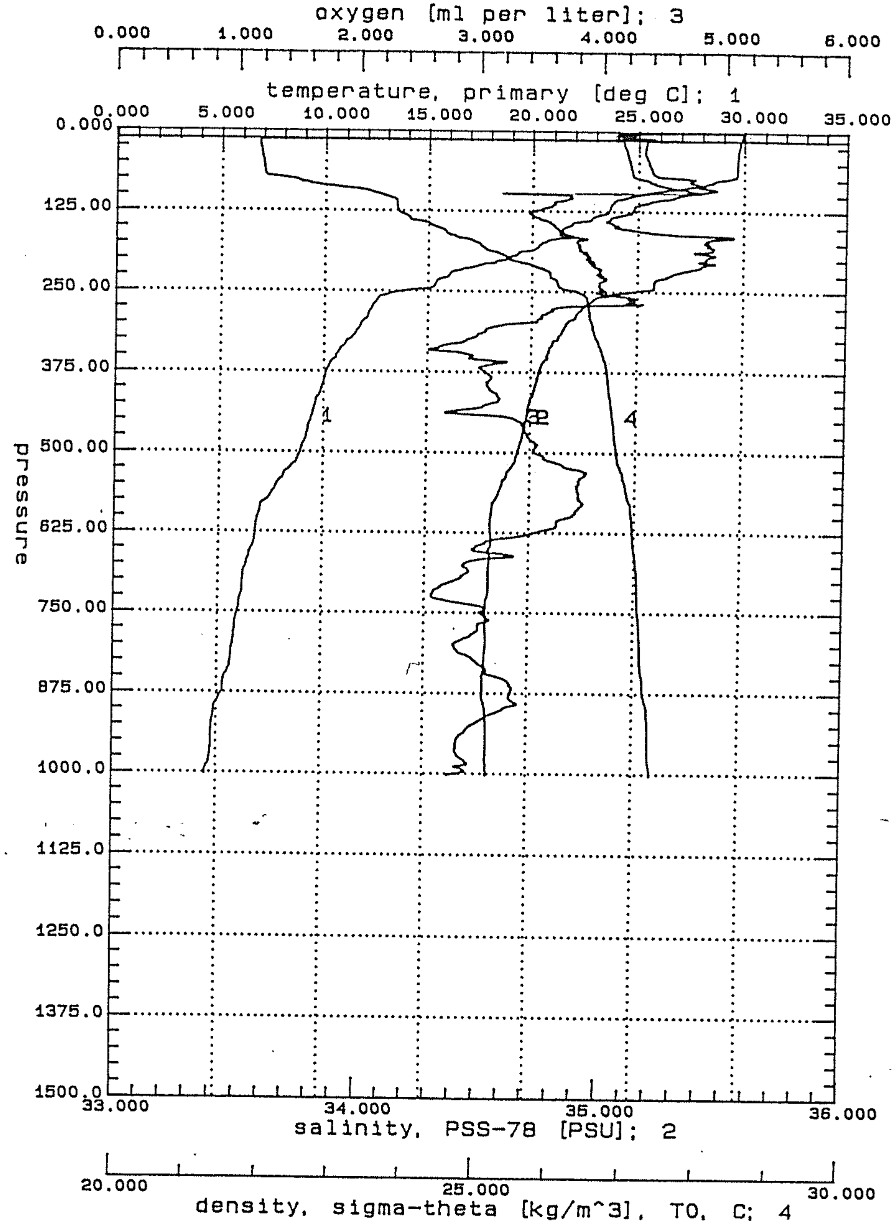
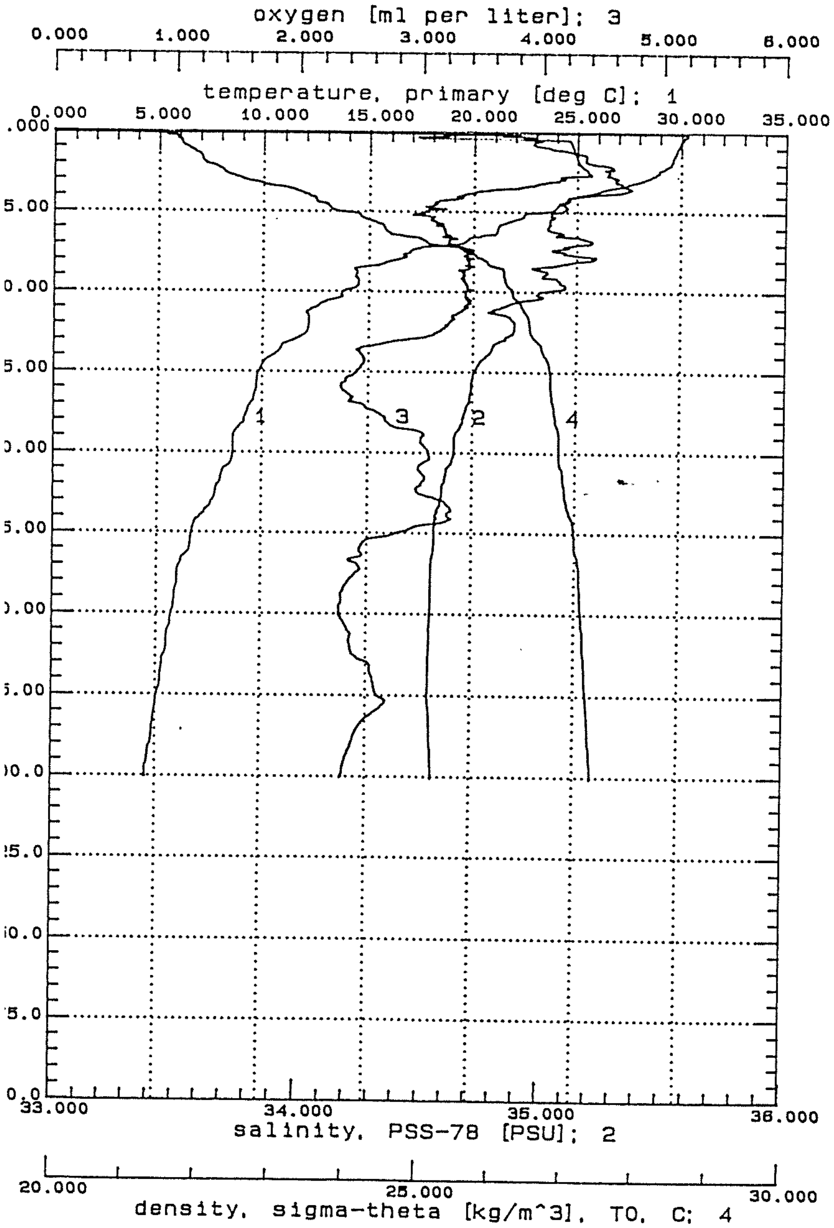
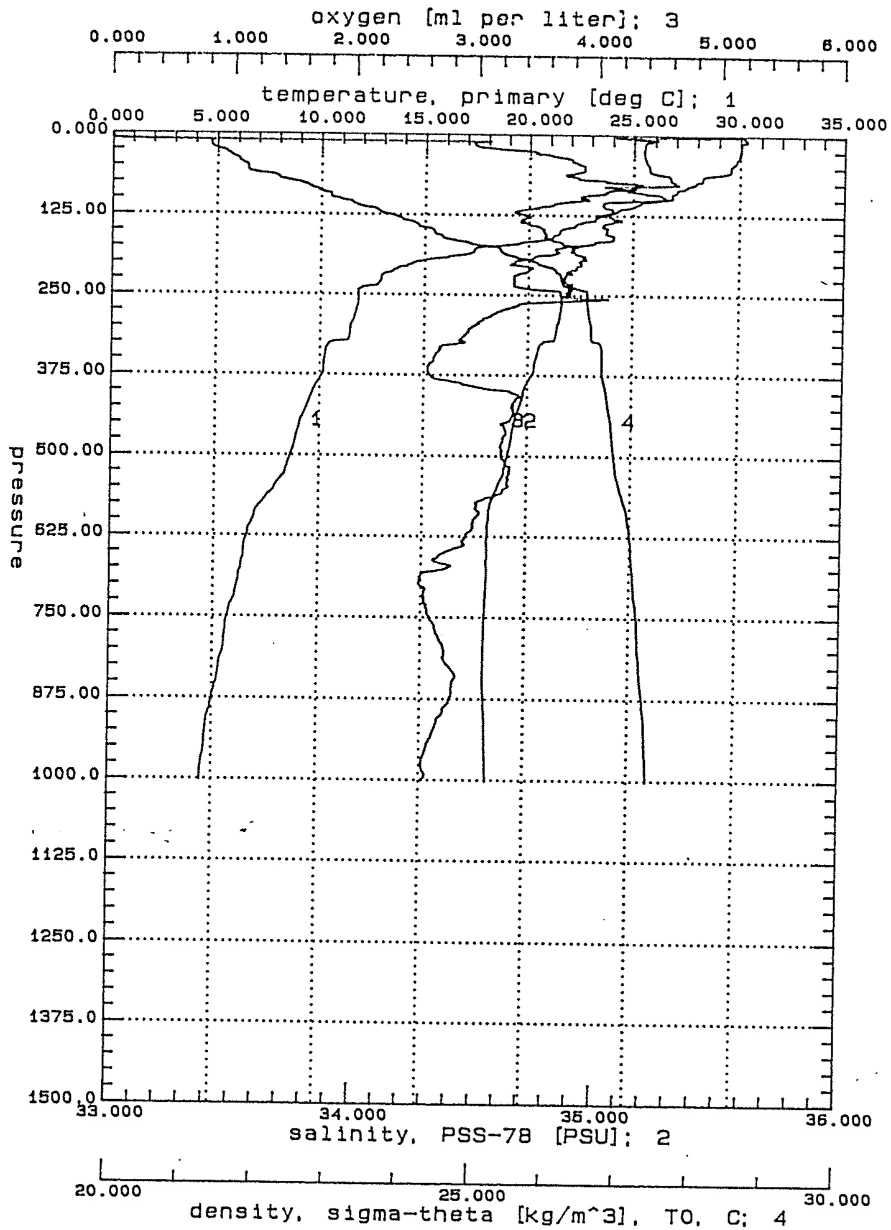


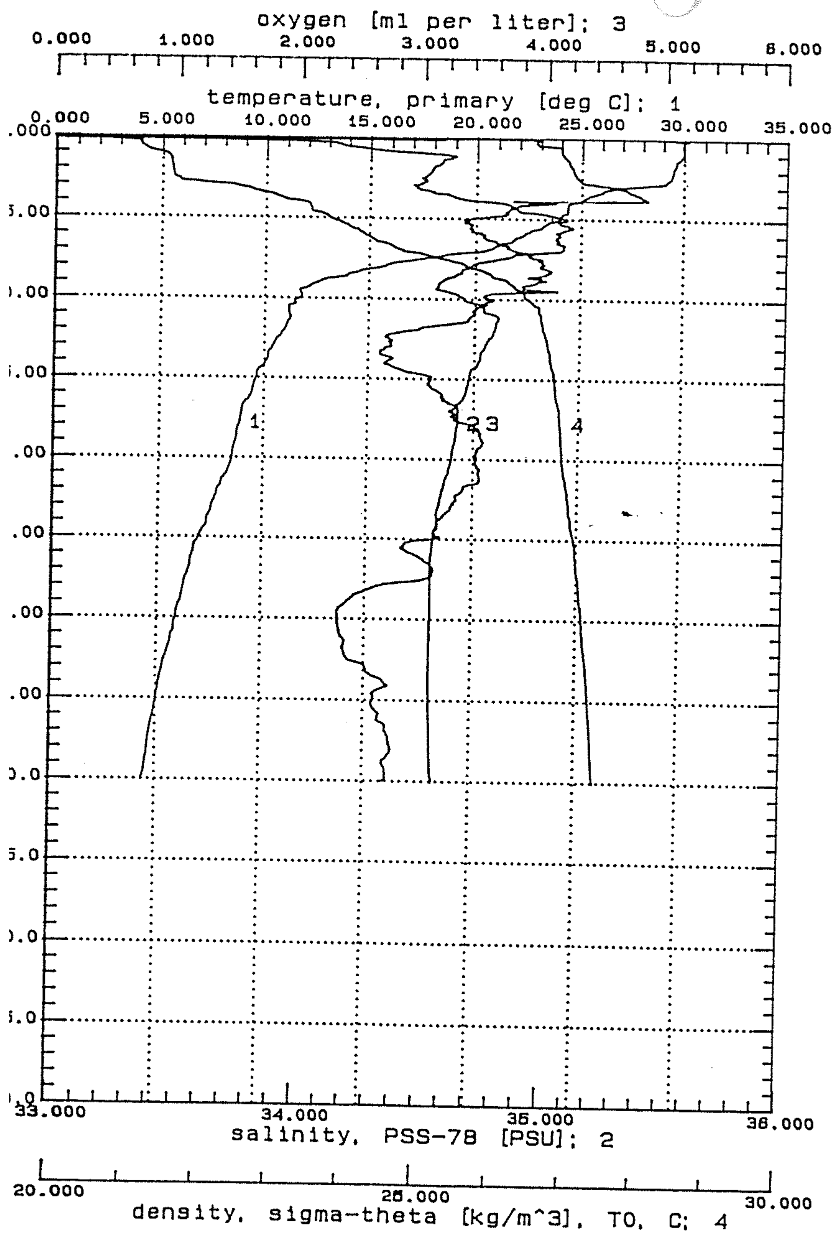
DTOCSC44.CNV: TOCS K9505 CTD-44 (1-00S, 156-00E) 95071804



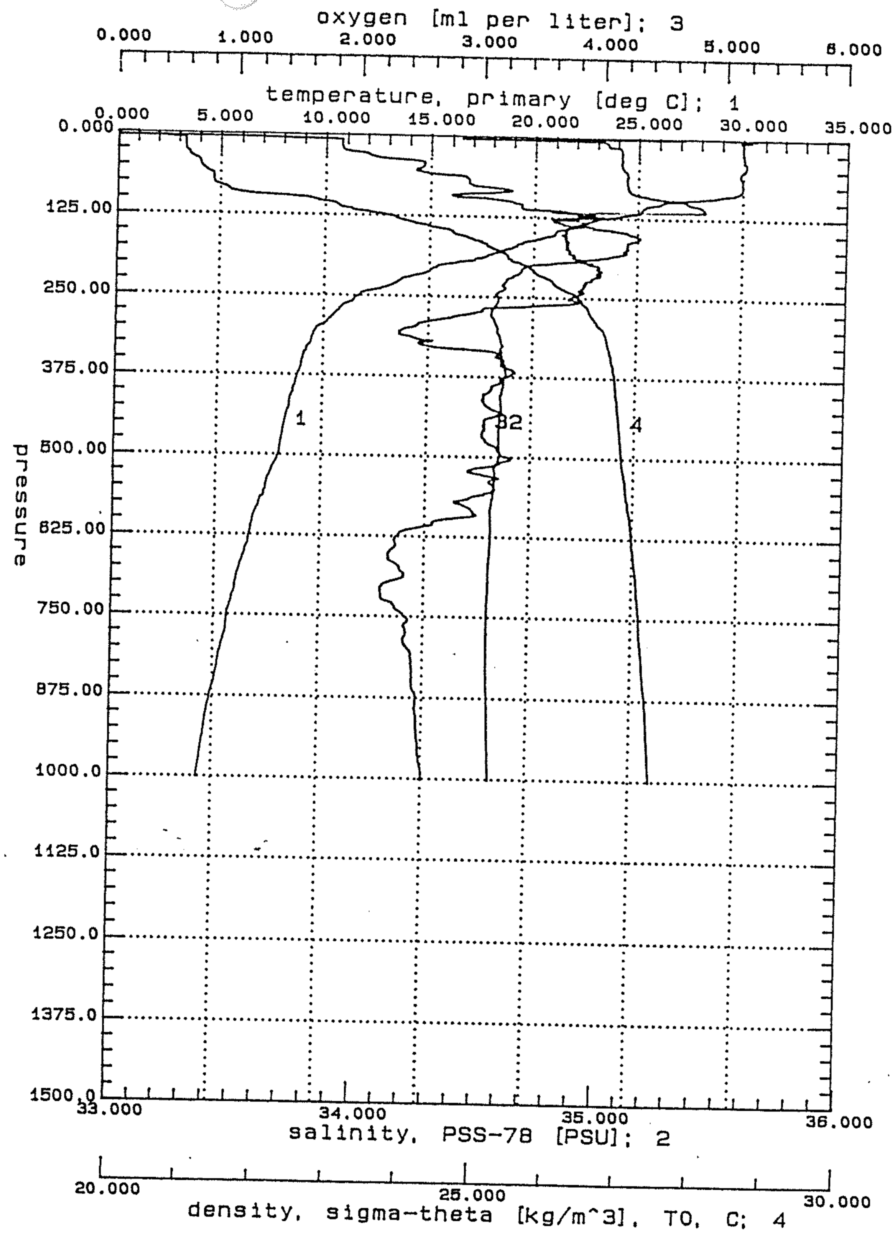
OCSC45.CNV: TOCS K9505 CTD-45 (0-00, 156-00E) 95071905



DTOCSC46.CNV: TOCS K9505 CTD-46 (1-00N, 156-00E) 95071911

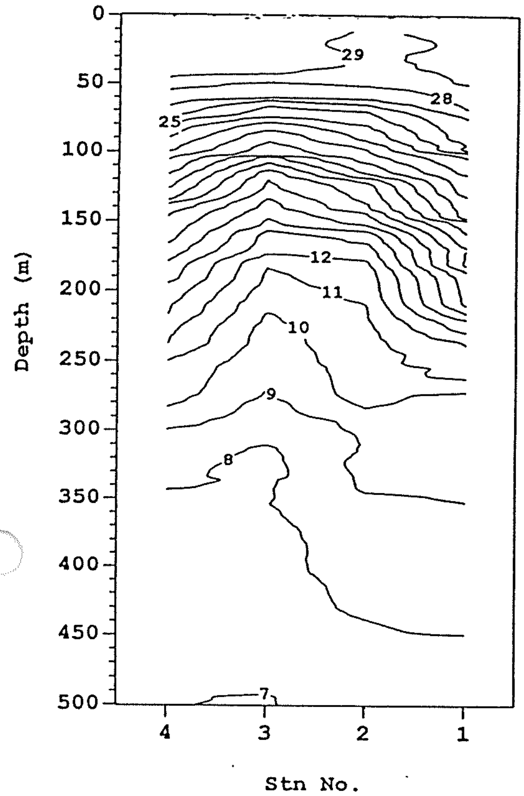


CSC47.CNV: TOCS K9505 CTD-47 (2-00N, 156-00E) 95072000

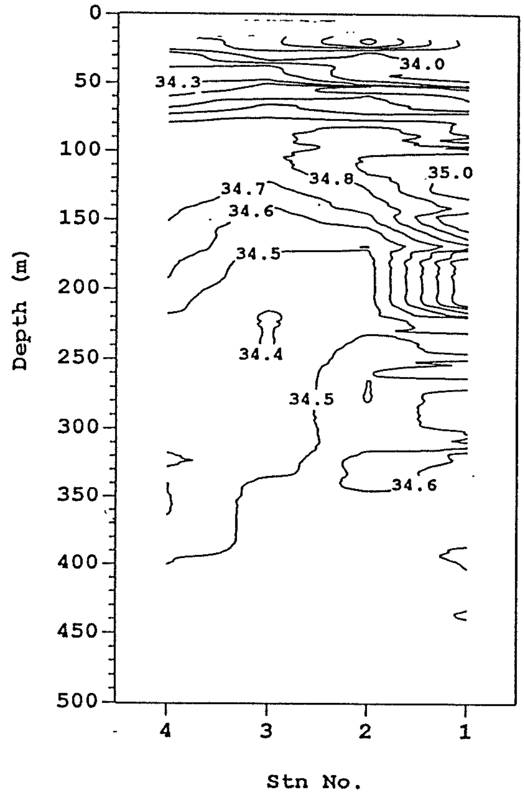


DTOCSC48.CNV: TOCS K9505 CTD-48 (3-00N, 156-00E) 95072023

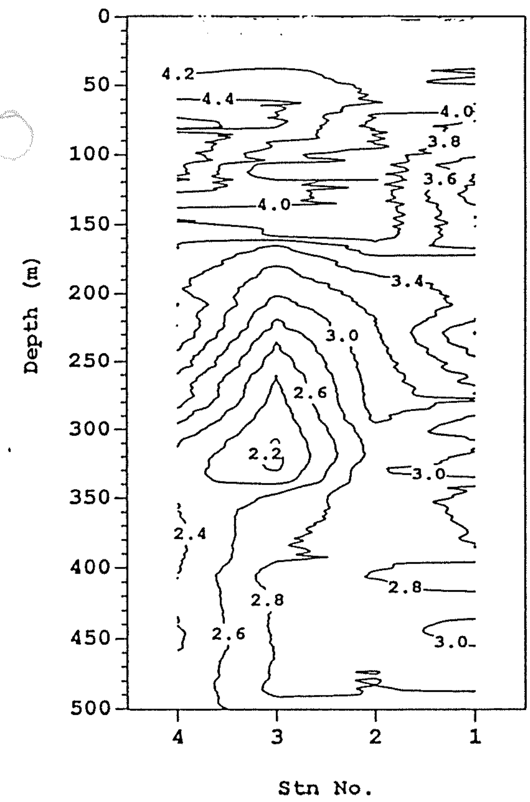
Zonal temperature section along 6N (127E-130E)



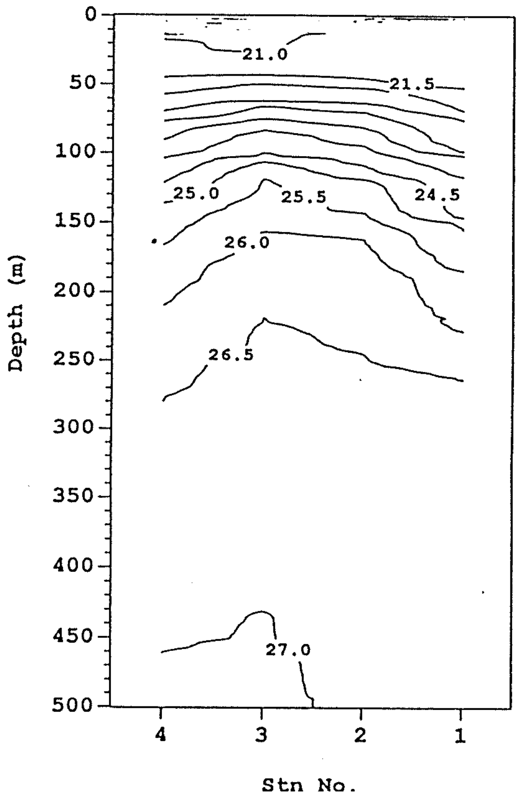
Zonal salinity section along 6N (127E-130E)



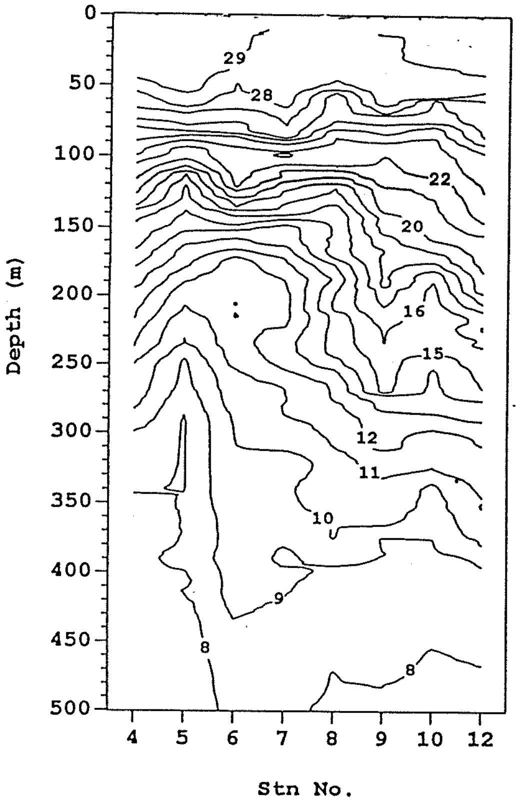
Zonal D.O. section along 6N (127E-130E)



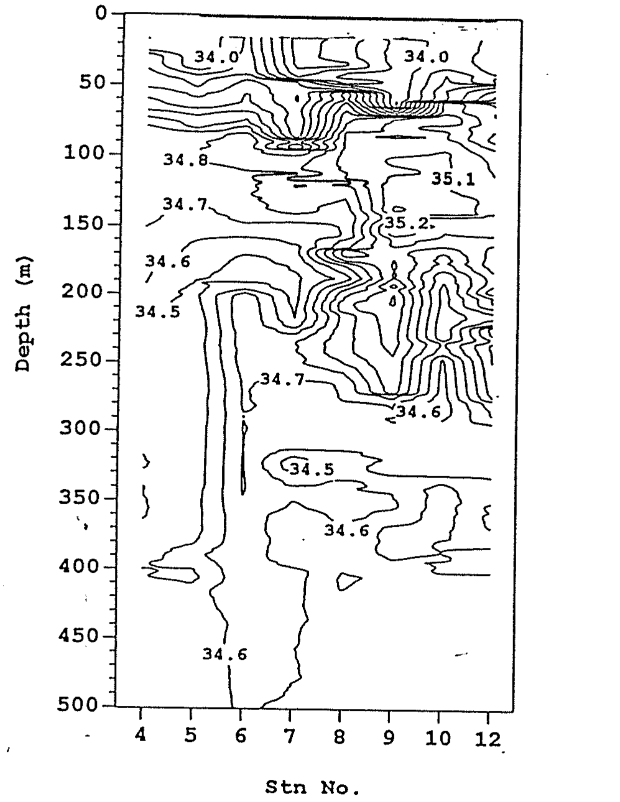
Zonal density section along 6N (127E-130E)



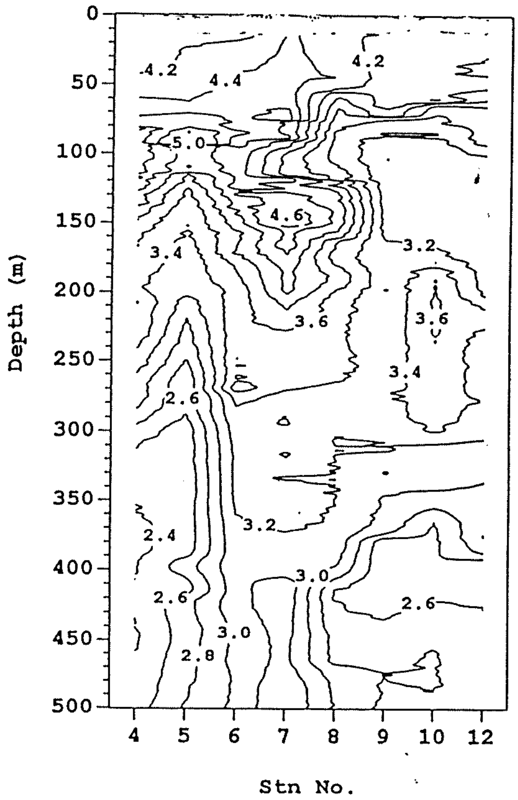
NNW-SSE temperature section (6N,127E-2S,129E)



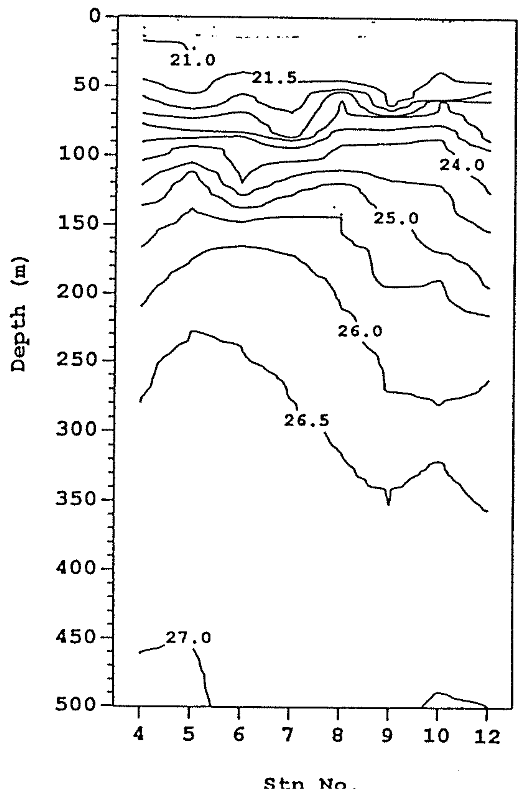
NNW-SSE salinity section (6N,127E-2S,129E)



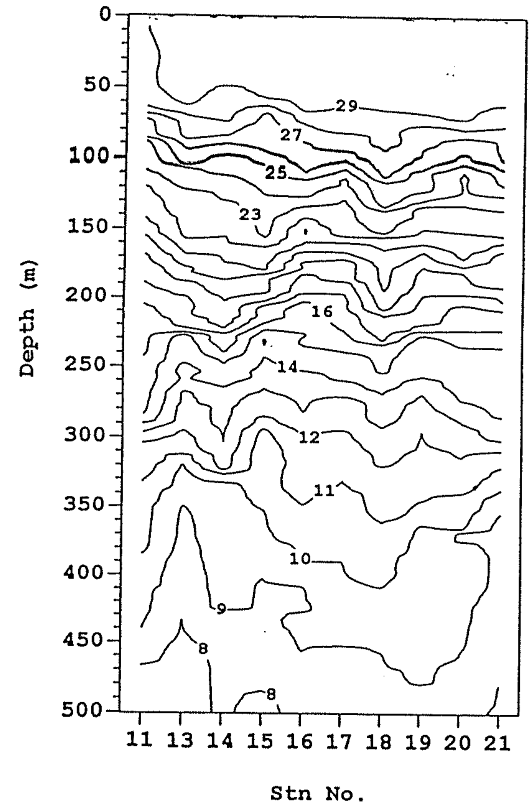
NNW-SSE D.O. section (6N,127E-2S,129E)



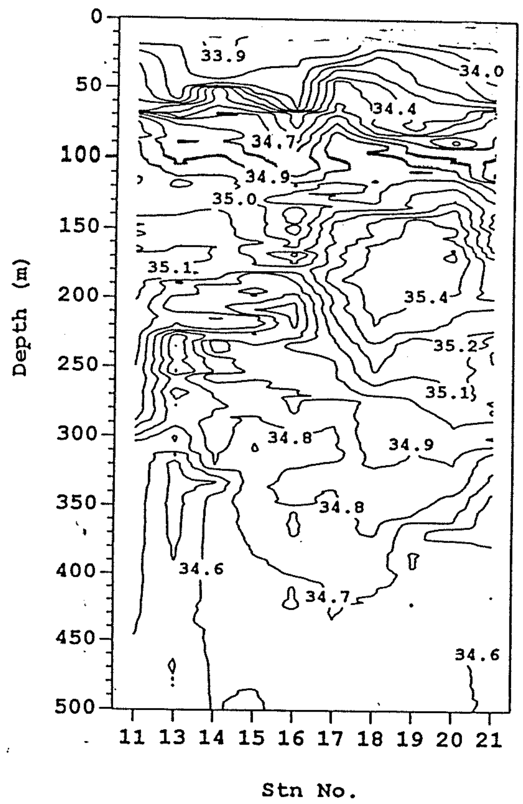
NNW-SSE density section (6N,127E-2S,129E)



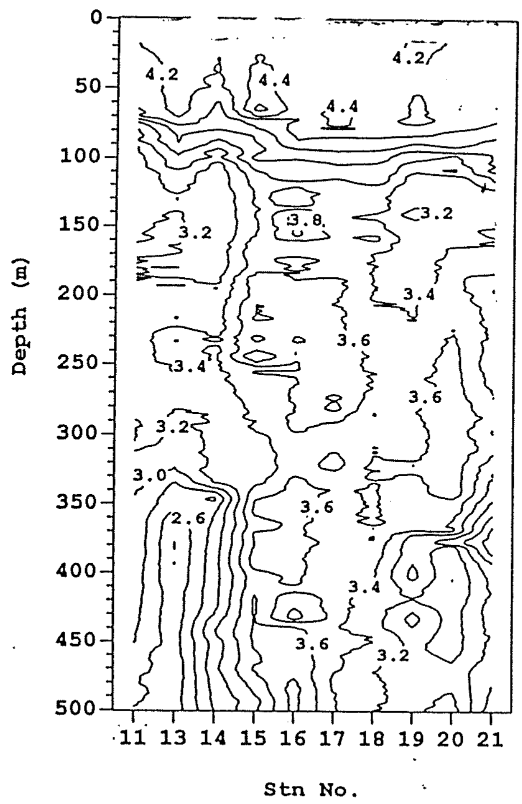
Zonal temperature section along 2N (129E-138E)



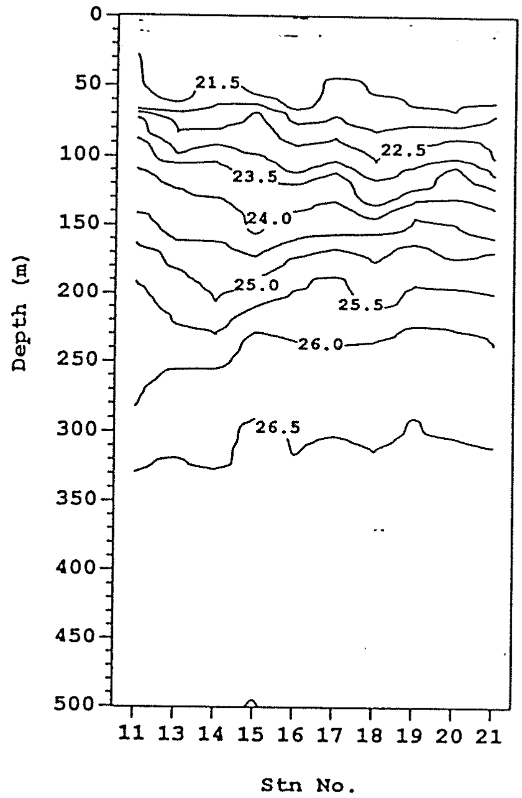
Zonal salinity section along 2N (129E-138E)



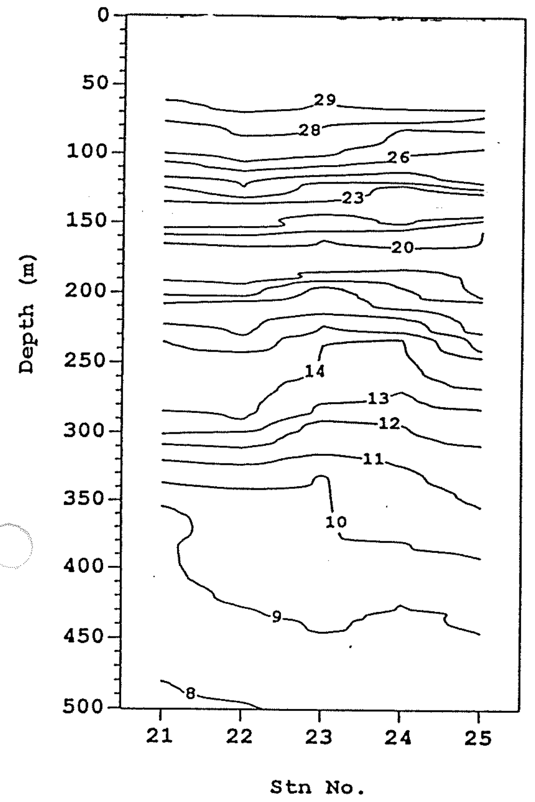
Zonal D.O. section along 2N (129E-138E)



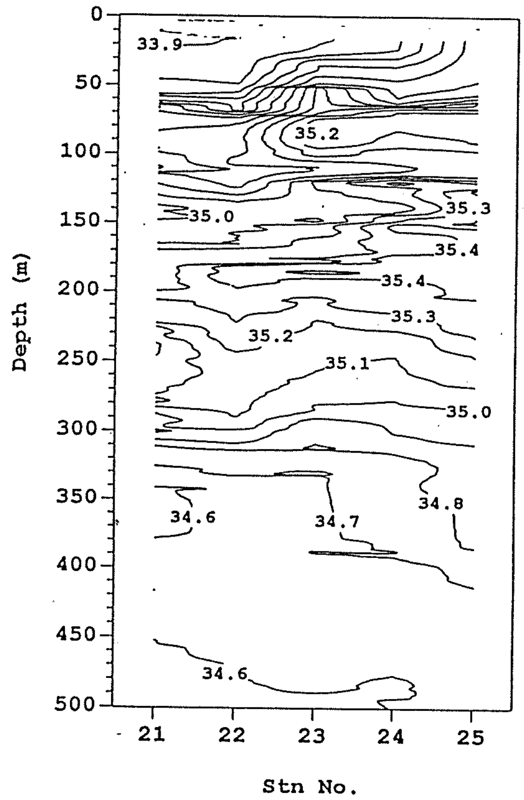
Zonal density section along 2N (129E-138E)



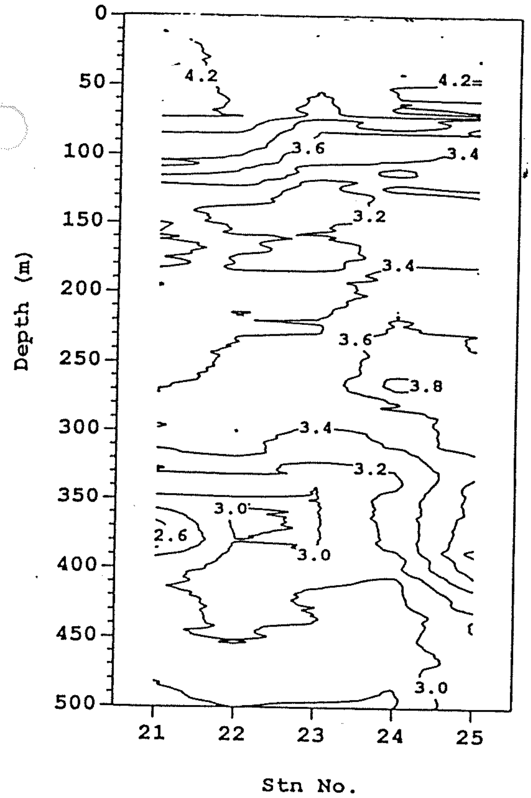
Meridional temperature section along 138E (2N-EQ)



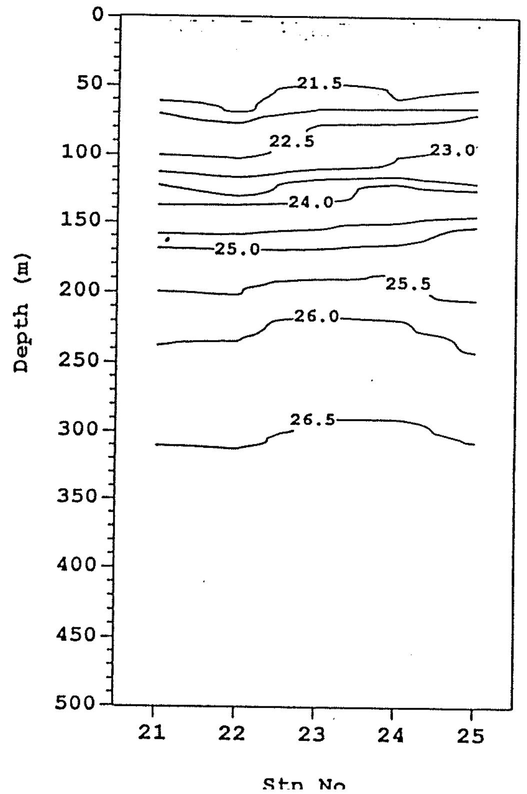
Meridional salinity section along 138E (2N-EQ)



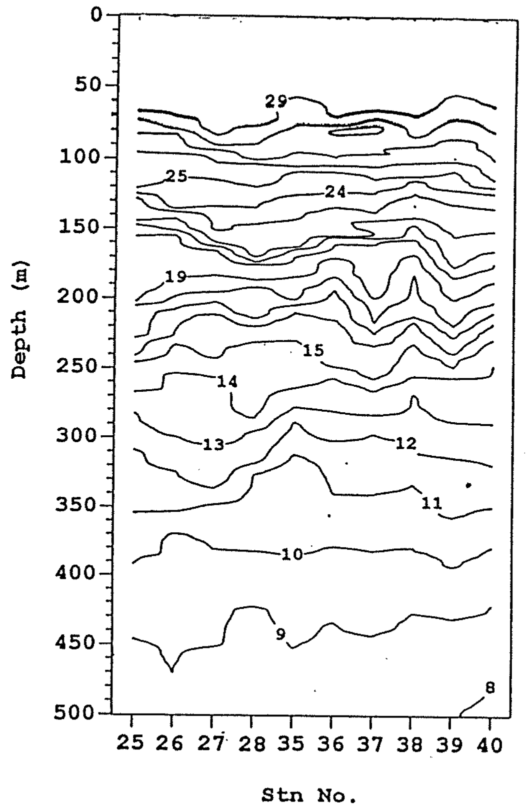
Meridional D.O. section along 138E (2N-EQ)



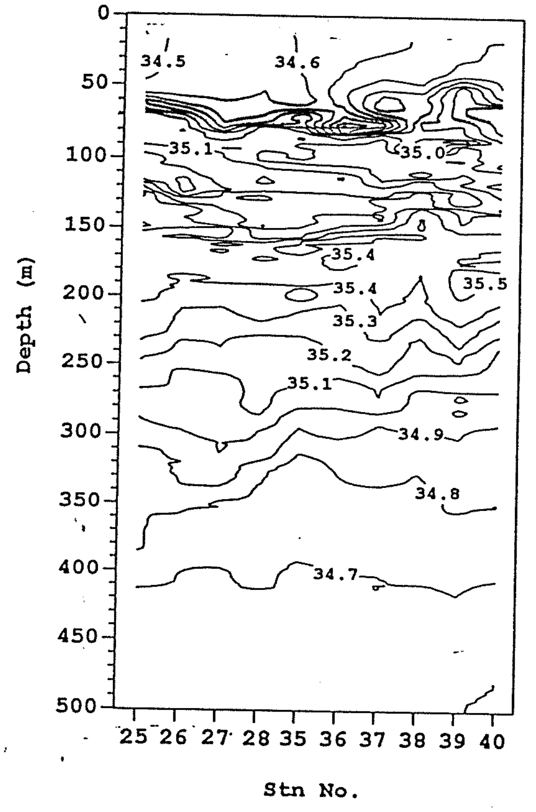
Meridional density section along 138E (2N-EQ)



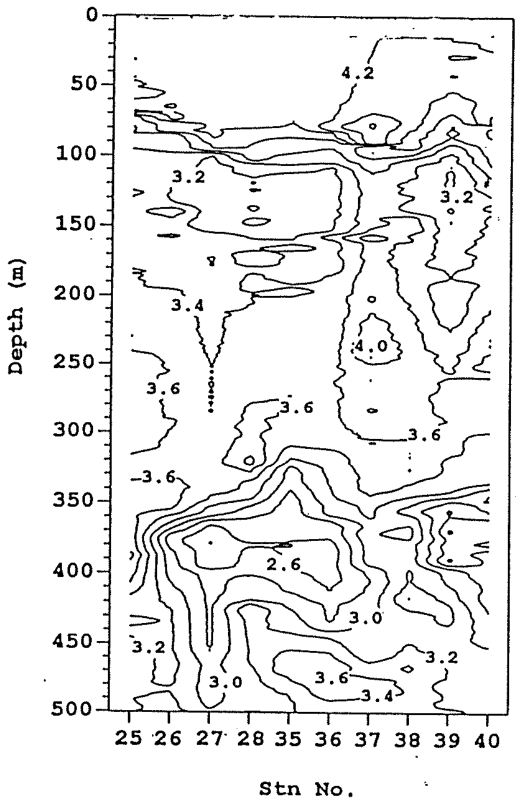
Zonal temperature section along EQ (138E-149E)



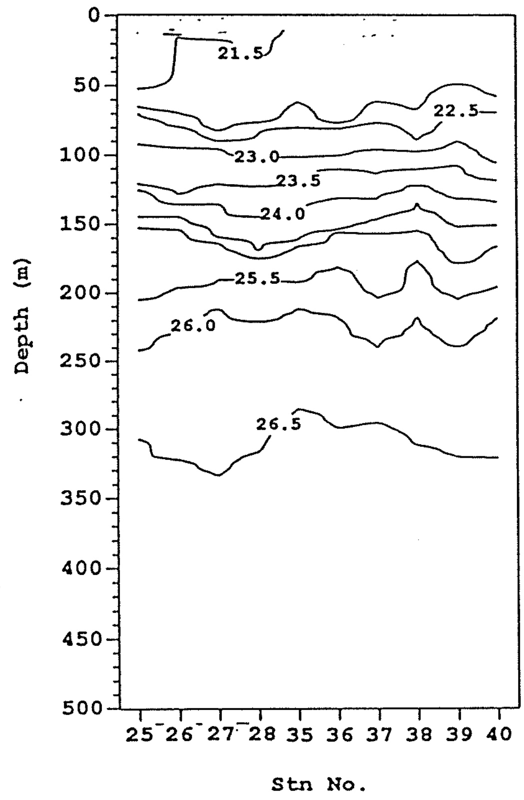
Zonal salinity section along EQ (138E-149E)



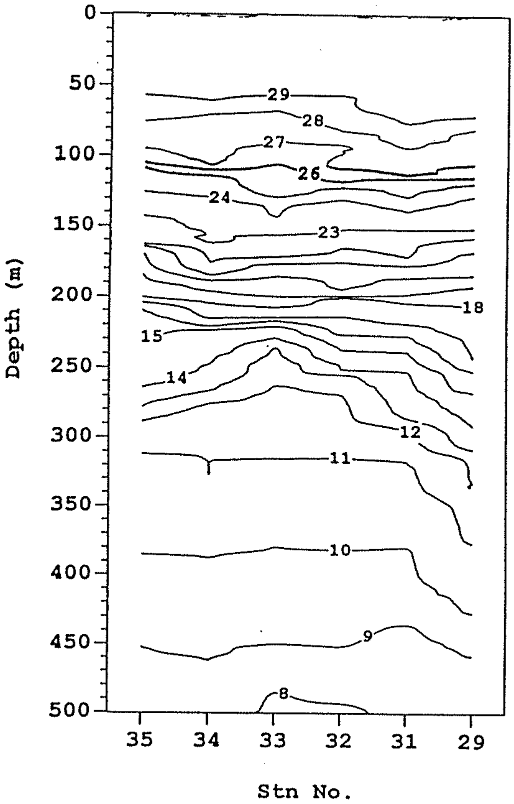
Zonal D.O. section along EQ (138E-149E)



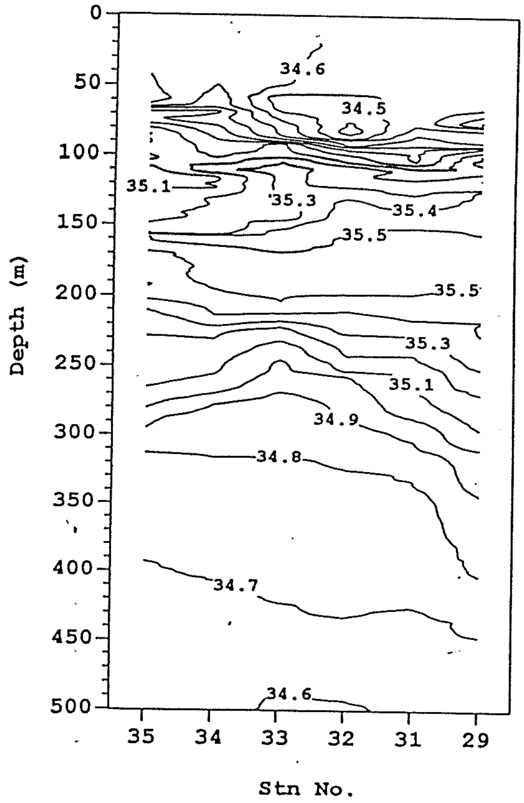
zonal density section along EQ (138E-149E)



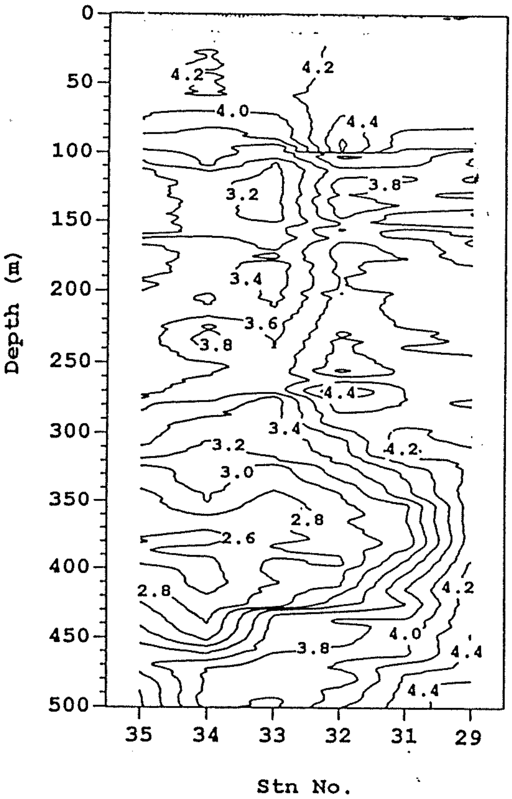
Meridional temperature section along 142E (EQ-2.5S)



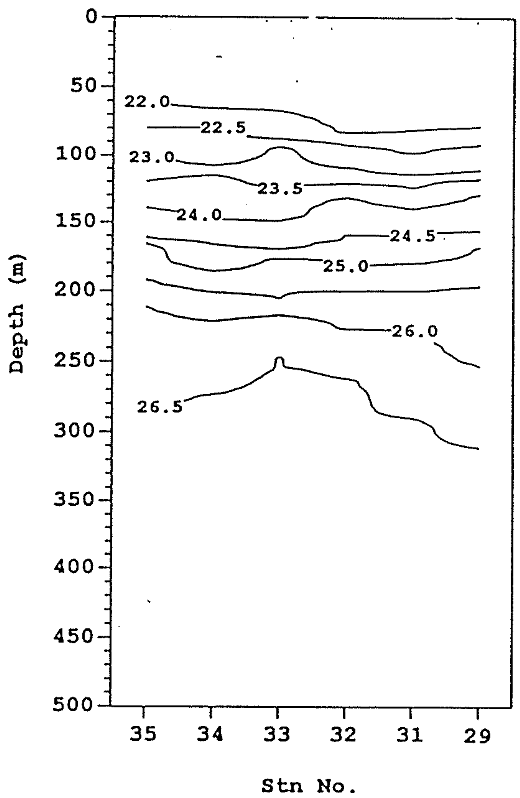
Meridional salinity section along 142E (EQ-2.5)



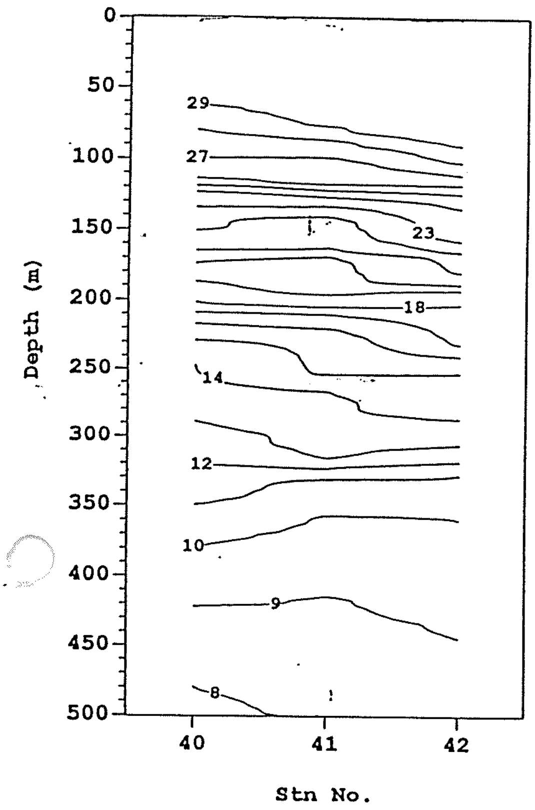
Meridional D.O. section along 142E (EQ-2.5S)



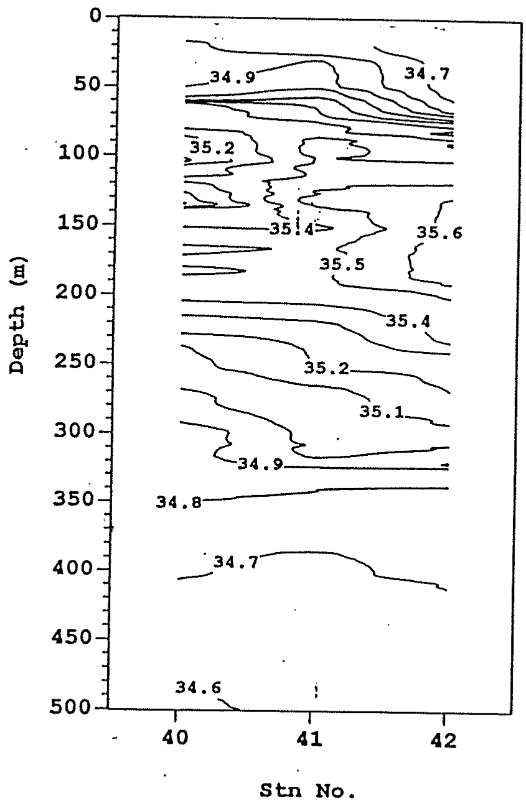
Meridional density section along 142E (EQ-2.5S)



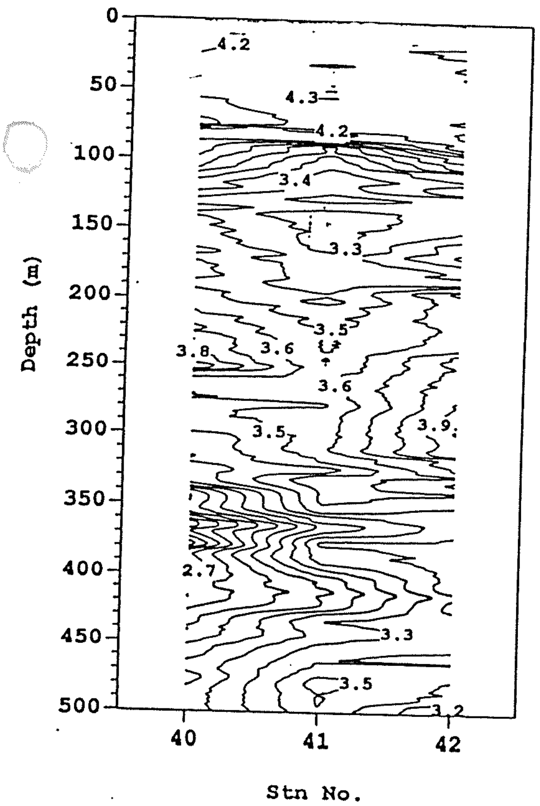
NW-SE temperature section (EQ,147E - 2S,150E)



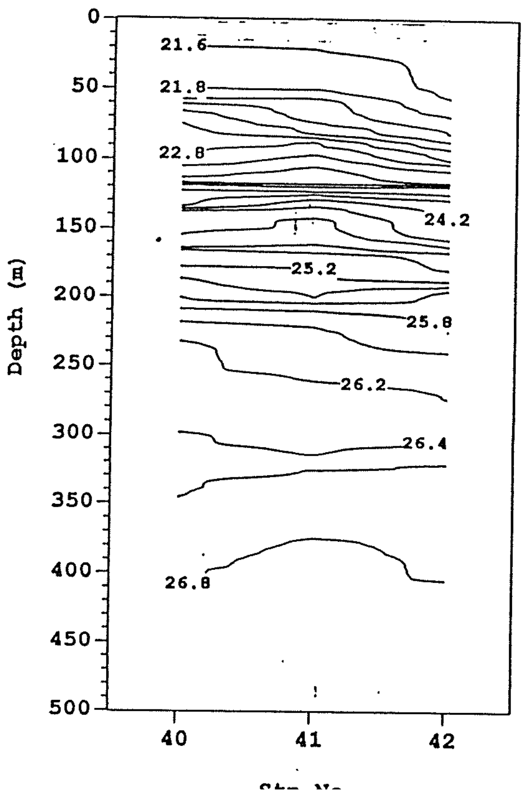
NW-SE salinity section (EQ,147E - 2S,150E)



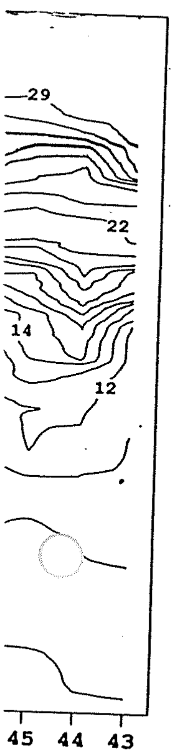
NW-SE D.O. section (EQ,147E - 2S, 150E)



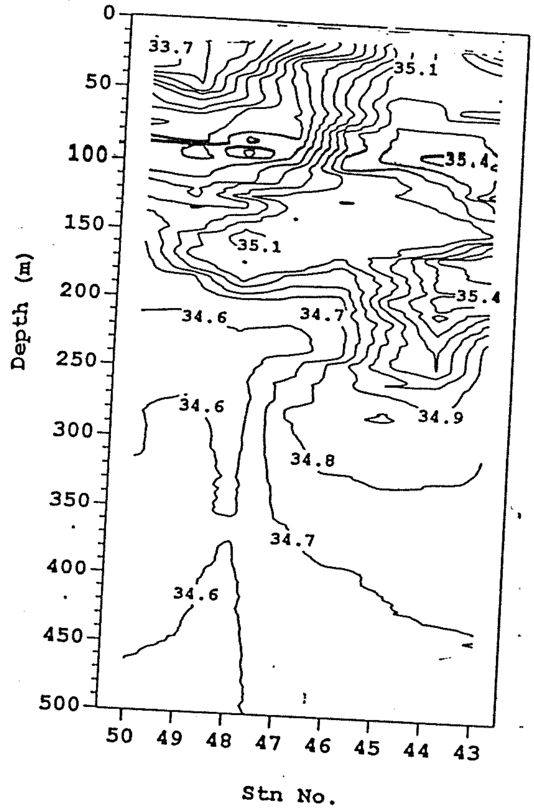
NW-SE density section (EQ,147E - 2S,150E)



ion along 156E (2N-2S)



Meridional salinity section along 156E (2N-2S)



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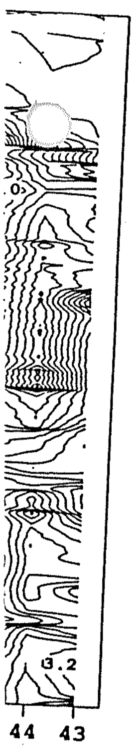
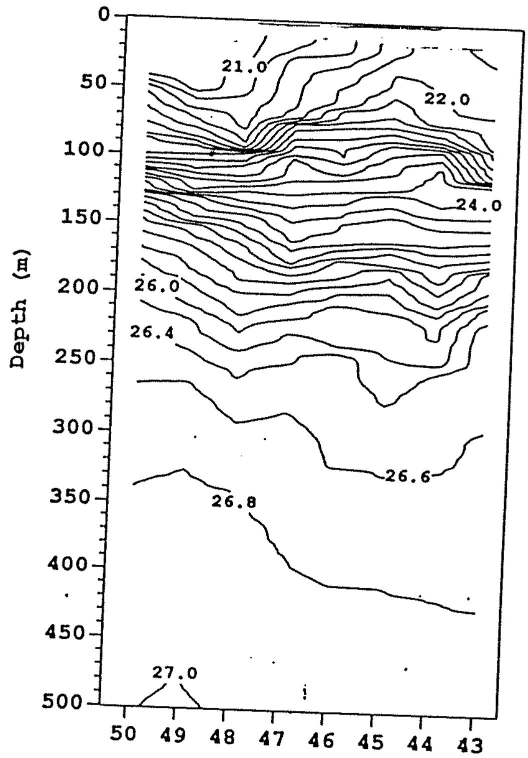
ong 156E (2N-2S)

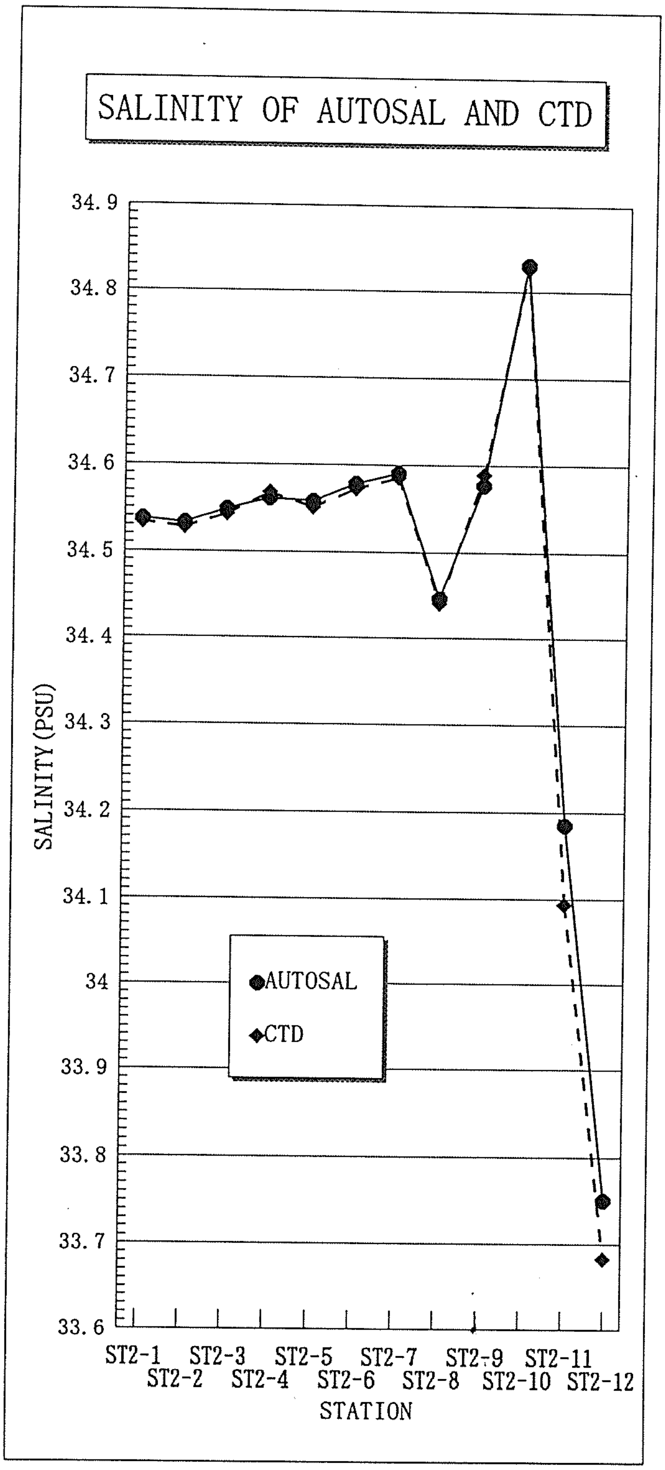


Meridional density section along 156E (2N-2S)

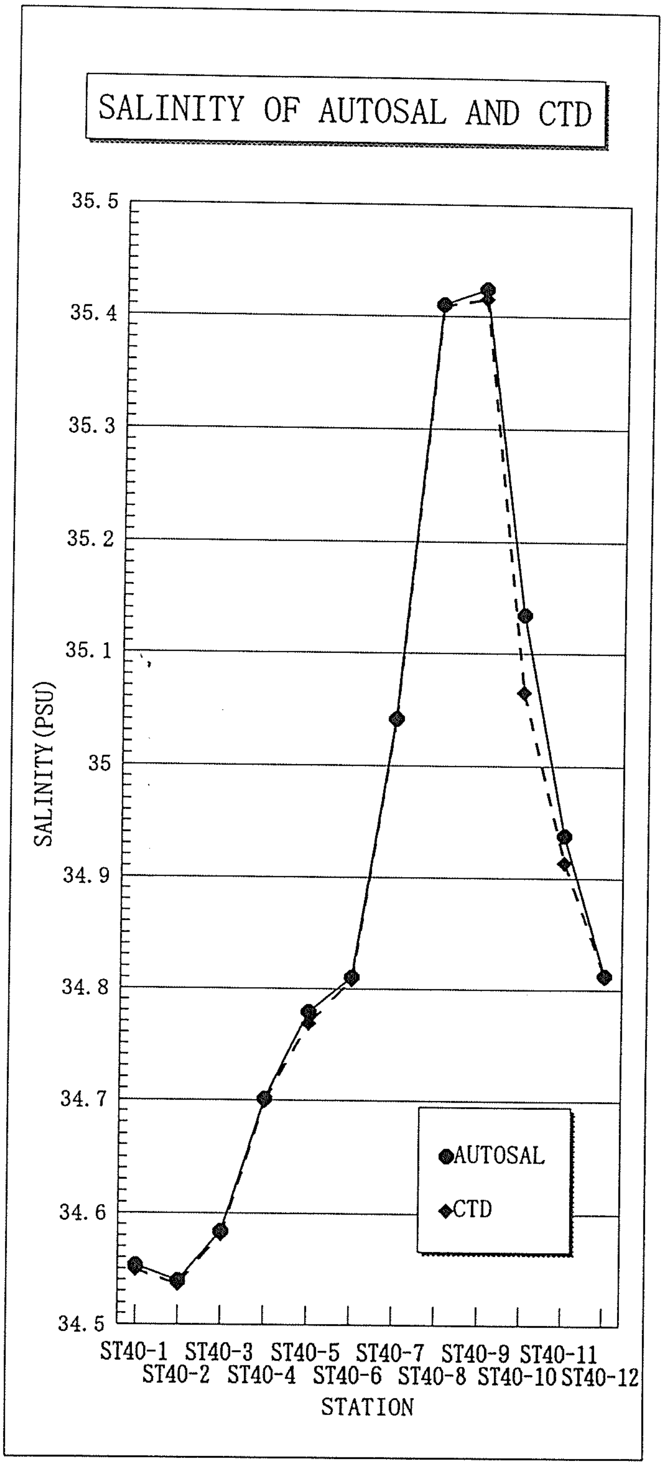


STATION	BOTTLE NO.	SALINITY-1	SALINITY-2	SALINITY-AVG.	CTD
1	1	34.5519	34.5517	34.5518	34.5453
2-1	2	34.5372	34.5375	34.5374	34.5333
3	14	34.5307	34.5311	34.5309	34.5378
4	15	34.5554	34.5556	34.5555	34.5505
5	16	34.5454	34.5450	34.5452	34.5392
6	17	34.5413	34.5417	34.5415	34.5370
7	18	34.5395	34.5391	34.5393	34.5356
8	19	34.5466	34.5466	34.5466	34.5423
9	20	34.5566	34.5568	34.5567	34.5514
10	21	34.5625	34.5625	34.5625	34.5593
11	22	34.5645	34.5645	34.5645	34.5614
12	23				34.5538
13	24	34.5576	34.5578	34.5577	34.5500
14	25	34.5503	34.5507	34.5505	34.5508
15	26	34.5521	34.5517	34.5519	34.5500
16	27	34.5529	34.5531	34.5530	34.5494
17	28	34.5486	34.5488	34.5487	34.5467
18	29	34.5519	34.5523	34.5521	34.5490
19	30	34.5523	34.5521	34.5522	34.5494
20	31	34.5574	34.5574	34.5574	34.5541
21	32	34.5586	34.5584	34.5585	34.5555
22	33	34.5562	34.5558	34.5560	34.5527
23	34	34.5531	34.5533	34.5532	34.5497
24	35	34.5539	34.5537	34.5538	34.5511
25	36	34.5547	34.5541	34.5544	34.5525
26	37	34.5511	34.5511	34.5511	34.5489
27	38	34.5503	34.5501	34.5502	34.5479
28	39	34.5486	34.5486	34.5486	34.5479
29	40	34.5354	34.5350	34.5352	34.5339
30	41	34.5328	34.5330	34.5329	34.5297
31	42	34.5470	34.5474	34.5472	34.5446
32	43	34.5484	34.5484	34.5484	34.5456
33	44	34.5472	34.5476	34.5474	34.5448
34	45	34.5470	34.5470	34.5470	34.5449
35	46	34.5474	34.5478	34.5476	34.5455
36	47	34.5494	34.5497	34.5496	34.5467
37	48	34.5492	34.5488	34.5490	34.5462
38-1	49	34.5499	34.5499	34.5499	34.5445
39	51	34.5497	34.5494	34.5496	34.5442
40-1	52	34.5533	34.5535	34.5534	34.5499
41	64	34.5519	34.5519	34.5519	34.5473
42	65	34.5383	34.5387	34.5385	34.5350
43	66	34.5499	34.5497	34.5498	34.5473
44	67	34.5472	34.5472	34.5472	34.5466

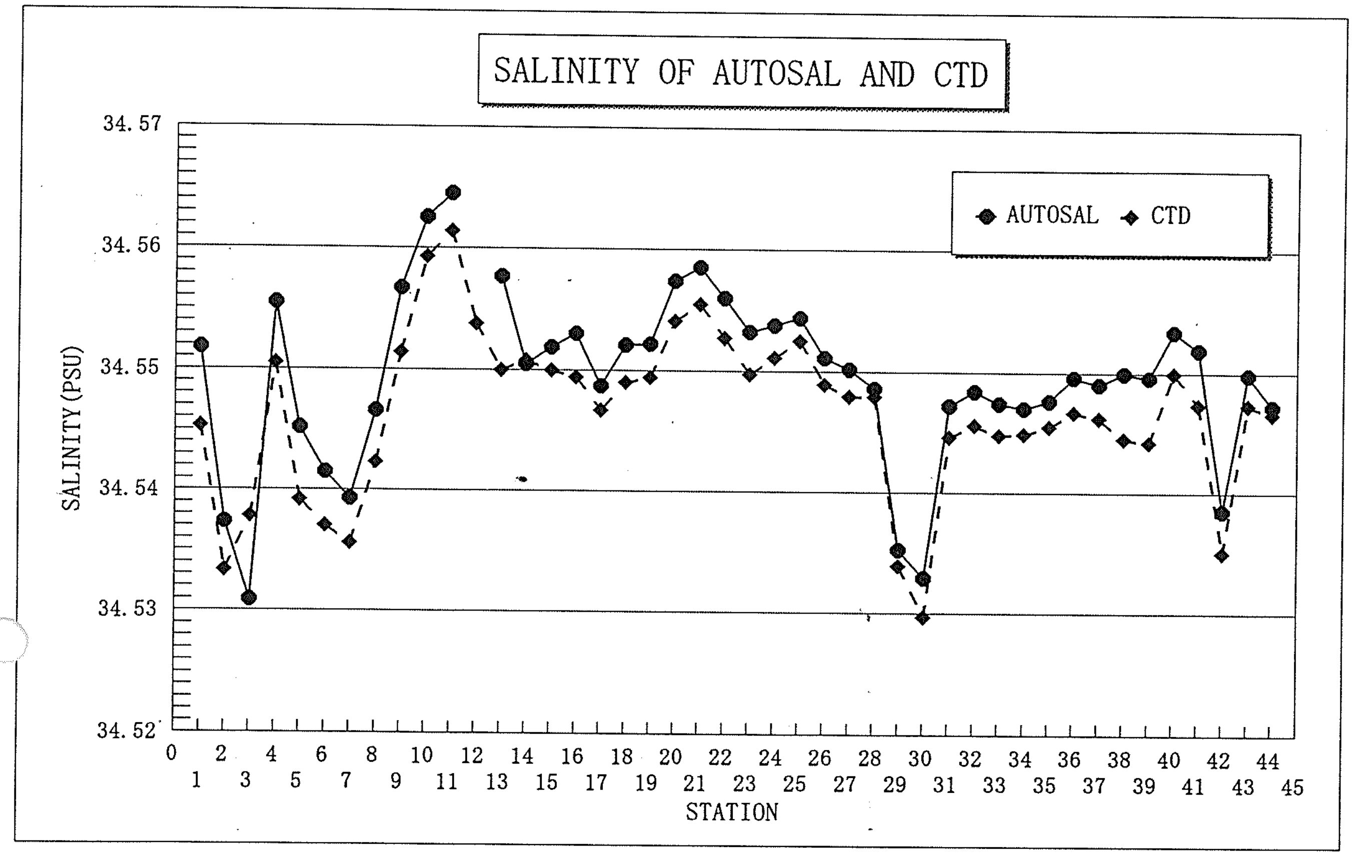
ST2-1	2	34.5372	34.5375	34.5374	34.5333
ST2-2	3	34.5330	34.5332	34.5331	34.5275
ST2-3	4	34.5490	34.5490	34.5490	34.5430
ST2-4	5	34.5612	34.5610	34.5611	34.5677
ST2-5	6	34.5586	34.5584	34.5585	34.5506
ST2-6	7	34.5783	34.5783	34.5783	34.5722
ST2-7	8	34.5903	34.5905	34.5904	34.5853
ST2-8	9	34.4465	34.4467	34.4466	34.4407
ST2-9	10	34.5769	34.5769	34.5769	34.5887
ST2-10	11	34.8312	34.8312	34.8312	34.8266
ST2-11	12	34.1844	34.1844	34.1844	34.0928
ST2-12	13	33.7504	33.7504	33.7504	33.6829
ST40-1	52	34.5533	34.5535	34.5534	34.5499
ST40-2	53	34.5397	34.5399	34.5398	34.5366
ST40-3	54	34.5838	34.5842	34.5840	34.5815
ST40-4	55	34.7006	34.7002	34.7004	34.6988
ST40-5	56	34.7790	34.7790	34.7790	34.7682
ST40-6	57	34.8105	34.8107	34.8106	34.8080
ST40-7	58	35.0410	35.0410	35.0410	35.0420
ST40-8	59	35.4103	35.4103	35.4103	35.4090
ST40-9	60	35.4243	35.4245	35.4244	35.4157
ST40-10	61	35.1348	35.1350	35.1349	35.0651
ST40-11	62	34.9379	34.9381	34.9380	34.9137
ST40-12	63	34.8123	34.8125	34.8124	34.8113
ST38-10	50	34.8824	34.8826	34.8825	34.9028



SALINITY OF AUTOSAL AND CTD
SALINITY (PSU)
34.9
34.8
34.7
34.6
34.5
34.4
34.3
34.2
34.1
34
33.9
33.8
33.7
33.6
AUTOSAL
CTD
ST2-1 ST2-2 ST2-3 ST2-4 ST2-5 ST2-6 ST2-7 ST2-8 ST2-9 ST2-10 ST2-11 ST2-12
STATION



SALINITY OF AUTOSAL AND CTD
SALINITY (PSU)
35.5
35.4
35.3
35.2
35.1
35
34.9
34.8
34.7
34.6
34.5
AUTOSAL
CTD
ST40-1 ST40-2 ST40-3 ST40-4 ST40-5 ST40-6 ST40-7 ST40-8 ST40-9 ST40-10 ST40-11 ST40-12
STATION


SALINITY OF AUTOSAL AND CTD
AUTOSAL
CTD
SALINITY (PSU)
34.57
34.56
34.55
34.54
34.53
34.52
STATION
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45

Dissolved Oxygen Measurement

T.Shiribiki and K.Komine
Sanyo Techno Marine,Inc.,Japan

Objective :

Measurement of dissolved oxygen using DO meter with correction of the Winkler titration.
Comparison of DO meter data corrected by the Winkler titration with CTD-DO data .

Instruments:

DO Meter ; TOA Portable Dissolved Oxygen Meter Model DO-25A
Titrator ; Metrohm Model 716 DMS Titrino / 10ml of titration vessel
Detector ; Pt Electrode / 6.0401.100
Software ; Data acquisition / Metrohm , METRODATA / 6.6013.000
Endpoint calculation / it was written in N88BASIC / MS-DOS(NEC)

Methods :

The samples for DO Meter were collected from 5-liter Niskin water samplers into 100ml D.O.glass bottles. In each cast, several samples for the Winkler titration were collected into calibrated BOD flasks (ca,180ml)(see Green and Carritt 1966). During sampling, 3-bottle-volume of sample water was overflowed and sampling water temperature was measured during sampling.

After the sampling, the samples were immediately measured by D.O.Meter with salinity correction. Before the measurement, the DO Meter was adjusted to 0-100%(see TOA DO Meter operation manual).

The samples for the titration method were analyzed within 2 hours. The D.O. values were obtained by Metrohm piston buret of 10ml with Pt Electrode using whole bottle titration in the laboratory controlled temperature (ca,22℃).

We corrected the values of the DO Meter with calibration factors. The factors were a linear regression line based on the Winkler titration Value vs DO Meter Value.

The standardizations have been done everyday before the sample titration. An analytical method was done according to the WHP Operations and Methods(Culberson,1991).

Reproducibility:

(1) DO Meter Value

142 pairs of samples were analyzed as replicates taken same Niskin bottle.
Difference of replicates samples was an average of 0.008 ml/l, and standard deviation (2 sigma) of 0.016 ml/l (0.35% of D.O. maximum in this cruise)

(2) Winkler Titration Value

In the same way, 71 pairs of samples were analyzed. Difference was an average of 0.011 ml/l, and standard deviation (2 sigma) of 0.022 ml/l (0.46% of D.O. maximum in this cruise).

Results :

(1) DO Meter Value Correction

Linear regression line was obtained by 237 pairs of DO Meter - Winkler data. (Fig. 1)

Formula : $Y = 0.111 + 0.988 \times X$ (n = 237)

$R = 0.997$

Y : Winkler value (ml/l) X : DO Meter value (ml/l)

All data in table 1 were corrected by this formula.

(2) CTD-DO Sensor Value correction

In the same way, linear regression line was obtained by 516 pairs of CTD-DO Sensor - Meter data. (Fig. 2)

Formula : $Y = -0.734 + 1.297 \times X$ (n = 516)

$R = 0.971$

Y : DO Meter value (ml/l) X : CDT-DO value (ml/l)

(3) Contour

Contours in Fig.3 were made from corrected dissolved oxygen data in Table 1.

Line 1 : Stn 1, 2, 3, 4
Line 2 : Stn 4, 5, 6, 7, 8, 9, 10, 11
Line 3 : Stn 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21
Line 4 : Stn 21, 22, 23, 24, 25
Line 5 : Stn 30, 29, 31, 32, 33, 34, 35
Line 6 : Stn 25, 26, 27, 28, 35, 36, 37, 38, 39, 40
Line 7 : Stn 40, 41, 42

Reference :

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Horibe,Y., Y. Kodama and K.Shigehara(1972) Errors in sampling procedure for the determimation of dissolved oxygen by Winkler method, J. Oceanogr. Soc. Jpn., 28, 203-206.

Murray,N., J.P.Riley and T.R.S.Wilson(1968) The solubility of oxygen in Winkler reagents used used for the determimation of dissolved oxygen, Deep-Sea Res., 15, 237-238.

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Fig. 1

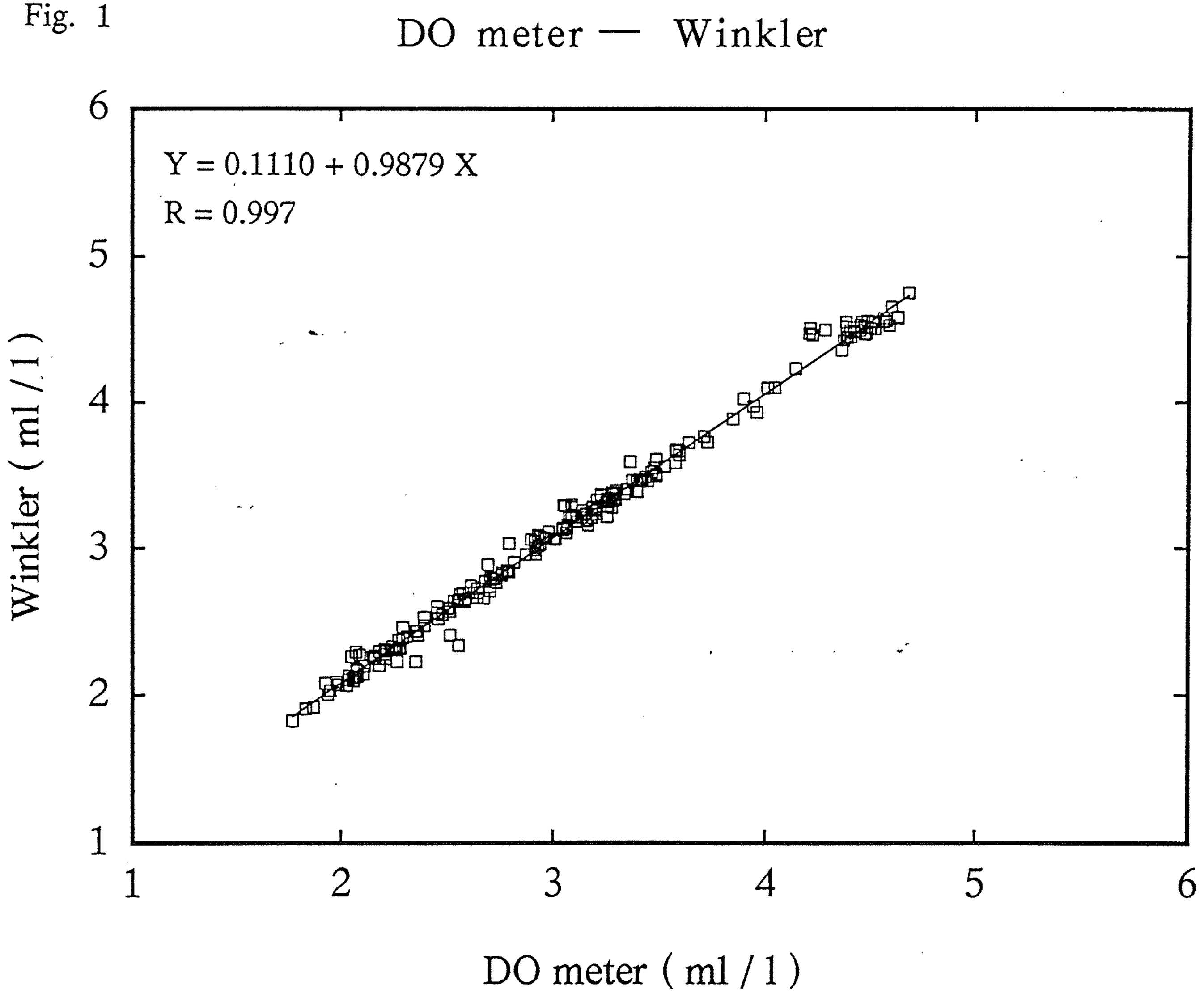

DO meter — Winkler
Y = 0.1110 + 0.9879 X
R = 0.997
Winkler (ml / 1)
DO meter (ml / 1)
1
2
3
4
5
6

Fig. 2

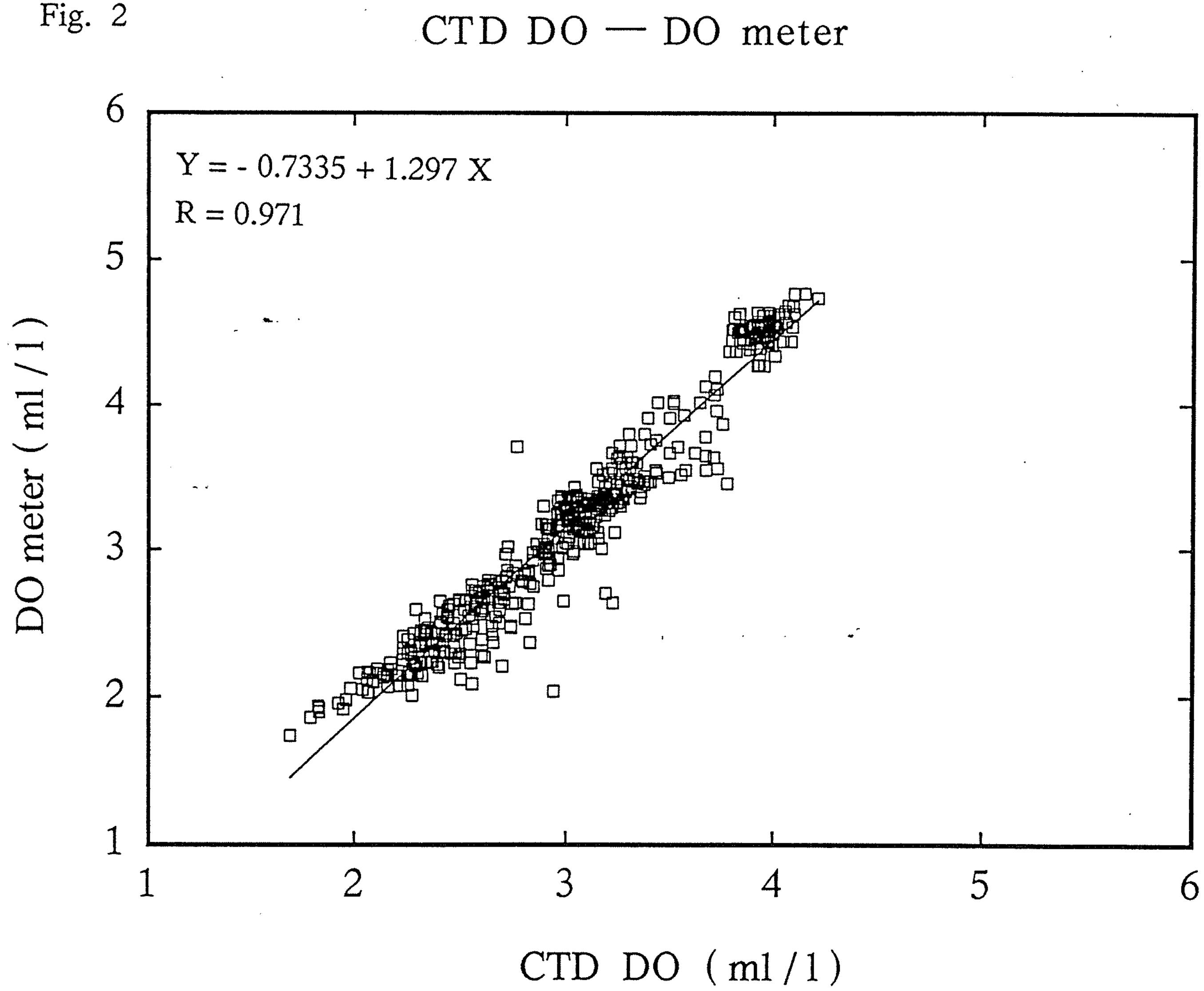
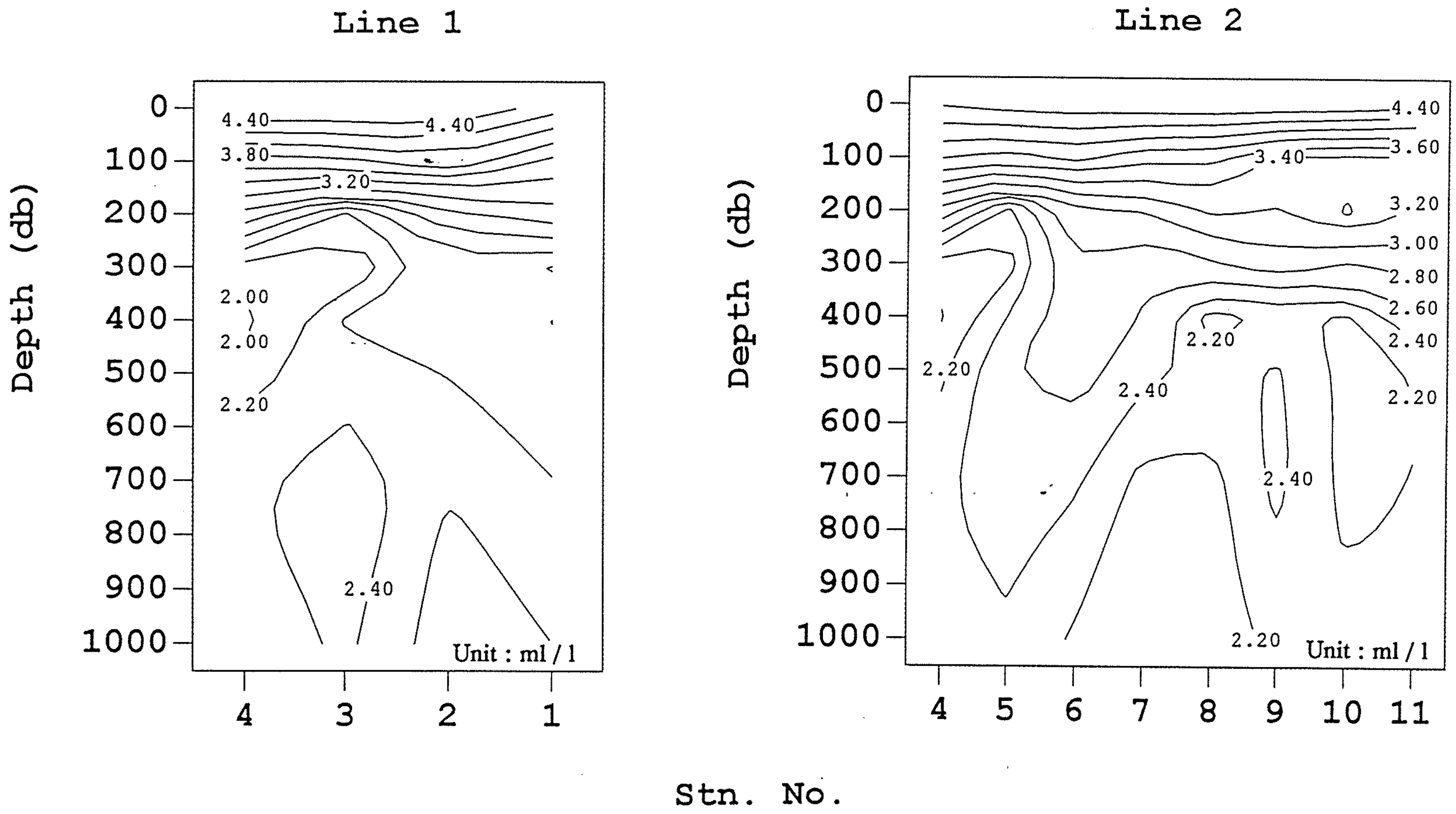
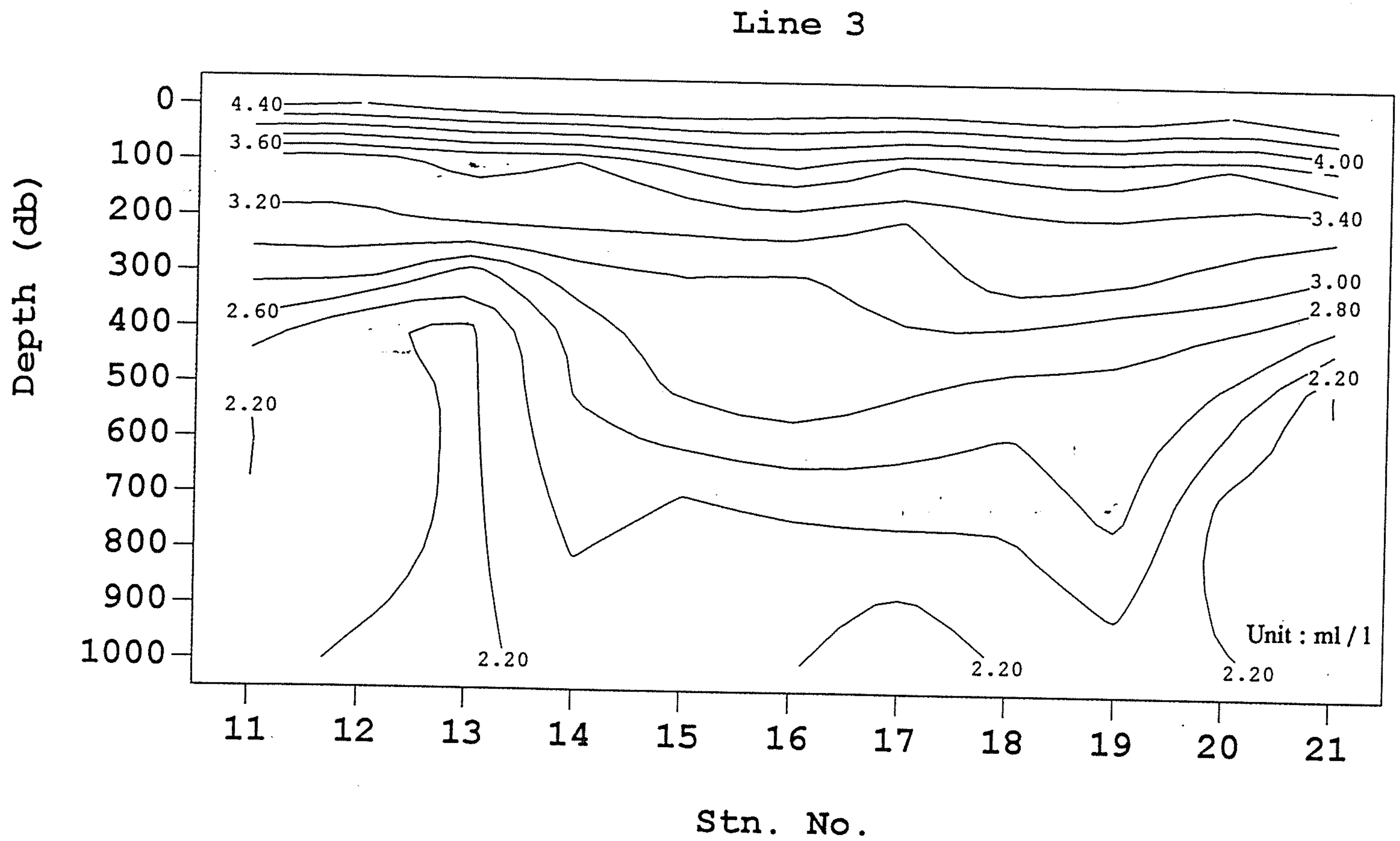

CTD DO — DO meter
Y = - 0.7335 + 1.297 X
R = 0.971
6
5
4
3
2
1
1
2
3
4
5
6
DO meter (ml / 1)
CTD DO (ml / 1)

Fig. 3 - 1



Line 1
Line 2
Depth (db)
0
100
200
300
400
500
600
700
800
900
1000
4.40
3.80
3.20
2.00
2.20
2.40
3.60
3.40
3.00
2.80
2.60
Unit : ml / l
4
3
2
1
5
6
7
8
9
10
11
Stn. No.

Fig. 3 - 2



Line 3
0
100
200
300
400
500
600
700
800
900
1000
Depth (db)
4.40
3.60
3.20
2.60
2.20
4.00
3.40
3.00
2.80
2.20
2.20
2.20
2.20
Unit : ml / l
11
12
13
14
15
16
17
18
19
20
21
Stn. No.

Fig. 3 - 3

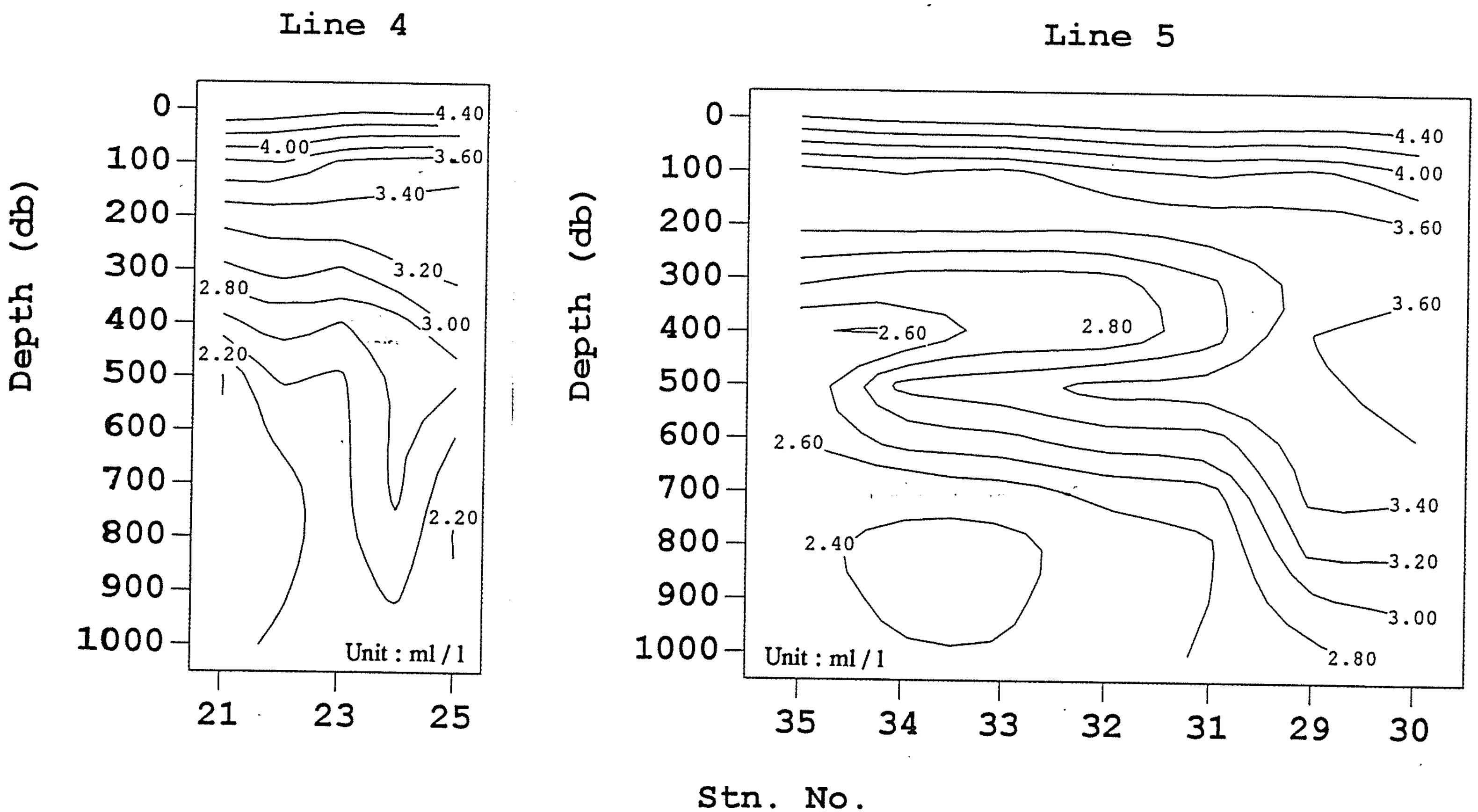
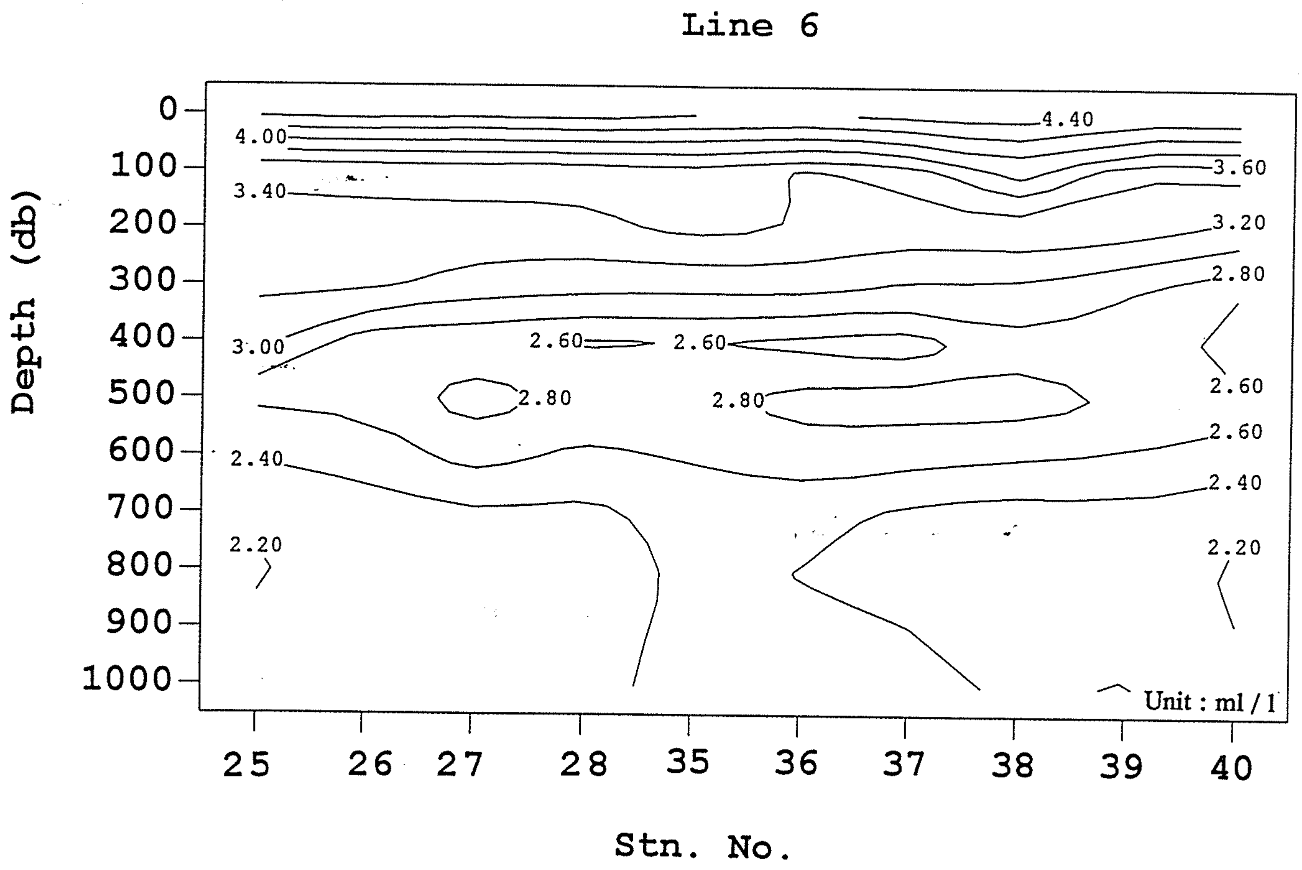
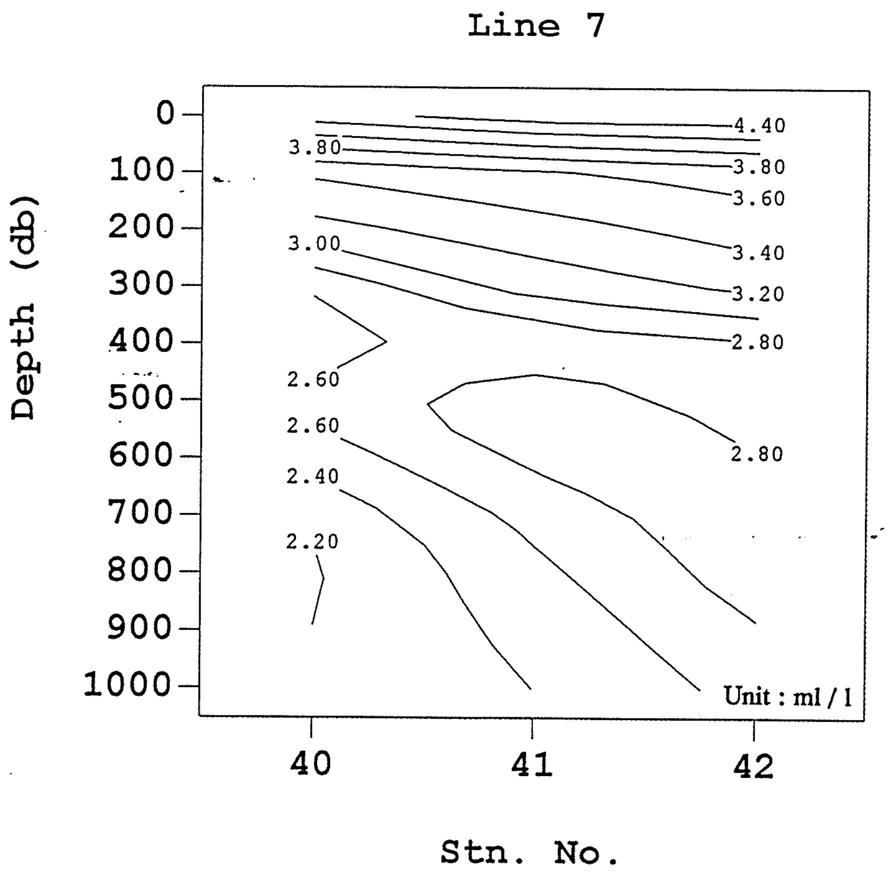

Line 4
Line 5
Depth (db)
0
100
200
300
400
500
600
700
800
900
1000
4.40
4.00
3.60
3.40
3.20
3.00
2.80
2.60
2.40
2.20
Unit : ml / l
21
23
25
35
34
33
32
31
29
30
Stn. No.

Fig. 3 - 4



Line 6
Depth (db)
0
100
200
300
400
500
600
700
800
900
1000
4.40
4.00
3.60
3.40
3.20
2.80
3.00
2.60
2.60
2.80
2.80
2.60
2.60
2.40
2.40
2.20
2.20
Unit : ml / l
25
26
27
28
35
36
37
38
39
40
Stn. No.

Fig. 3 - 5


Line 7
Depth (db)
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100
200
300
400
500
600
700
800
900
1000
4.40
3.80
3.80
3.60
3.40
3.00
3.20
2.80
2.60
2.80
2.60
2.40
2.20
Unit : ml / l
40
41
42
Stn. No.

Table 1-1 Dissolved Oxygen

K9505	STN. 1	K9505	STN. 2	K9505	STN. 3	K9505	STN. 4	K9505	STN. 5
6° N	130° E	6° N	129° E	6° N	128° E	6° N	127° E	5° 26.7N	127° 20E
Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)
0	4.49	0	4.56	0	4.48	0	4.43	0	4.48
25	n.d.	25	4.64	25	4.52	24	4.65	25	4.54
50	n.d.	50	4.63	50	4.77	49	4.74	49	4.77
100	n.d.	101	4.02	99	3.76	100	4.11	100	4.01
150	3.21	150	3.60	149	3.36	150	3.13	150	2.97
199	3.15	200	2.89	200	2.45	200	3.08	199	2.53
249	3.02	251	2.79	251	1.94	250	2.66	251	1.90
300	2.03	300	2.50	300	1.74	300	2.16	301	1.98
349	2.65	349	2.45	249	2.37	348	1.86	351	2.35
399	n.d.	399	2.51	399	2.54	399	1.96	400	2.36
500	n.d.	501	2.44	499	2.25	502	2.16	500	2.61
751	n.d.	752	2.19	750	2.59	750	2.37	749	2.55
1001	2.19	1004	2.08	1002	2.43	1002	2.23	1003	2.34

K9505	STN. 6	K9505	STN. 7	K9505	STN. 8	K9505	STN. 9	K9505	STN. 10
4° 53.0N	127° 40E	4° 20.0N	128° E	3° 46.6N	128° 20E	3° 13.3N	128° 40E	2° 40.0N	129° E
Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)
0	4.51	0	4.53	0	n.d.	0	4.57	0	4.50
24	4.61	24	4.63	24	4.54	25	4.52	25	4.58
50	4.65	50	4.63	50	4.54	52	4.48	50	4.45
99	4.13	100	3.38	98	3.26	100	3.15	100	3.17
150	3.24	151	3.67	149	3.87	149	3.26	149	3.17
196	2.98	200	3.04	199	3.19	201	3.17	200	3.51
250	2.82	250	2.75	249	3.05	249	3.17	250	3.39
301	2.79	300	2.64	300	2.75	299	2.99	300	2.86
351	2.77	348	2.54	350	2.68	349	2.70	349	2.44
400	2.71	401	2.63	399	1.92	400	2.13	399	2.11
501	2.72	499	2.48	499	2.39	499	2.43	500	2.14
750	2.39	749	2.09	749	2.08	750	2.46	750	2.14
1001	2.16	1001	2.04	1000	2.12	1007	2.22	1001	2.29

K9505	STN. 11	K9505	STN. 12	K9505	STN. 13	K9505	STN. 14	K9505	STN. 15
2° N	129° E	2° N	129° 20E	2° N	130° E	2° N	131° E	2° N	132° E
Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)
0	4.54	0	4.48	0	4.54	0	4.61	0	4.53
25	4.47	24	4.51	25	4.56	25	4.62	25	4.59
50	4.38	50	4.20	50	4.53	50	4.37	50	4.57
99	3.17	100	3.18	100	3.47	100	3.34	100	3.72
149	3.16	150	3.14	150	3.14	149	3.15	150	3.24
199	3.17	200	3.20	200	3.35	199	3.35	200	3.35
250	3.18	250	3.15	250	3.23	250	3.18	250	3.15
300	2.93	299	3.01	300	n.d.	300	3.08	300	2.86
350	2.67	349	2.68	350	2.06	350	2.65	350	3.14
400	2.59	400	2.10	400	2.19	400	2.67	399	2.95
500	2.18	500	2.32	500	2.16	500	2.64	500	2.89
749	2.21	749	2.34	750	2.15	749	2.45	749	2.31
1003	2.27	1000	2.16	1001	2.14	1001	2.29	1001	2.27

n.d. = No Data

Table 1-2 Dissolved Oxygen

K9505	STN. 16	K9505	STN. 17	K9505	STN. 18	K9505	STN. 19	K9505	STN. 20
2° N	133° E	2° N	134° E	2° N	135° E	2° N	136° E	2° N	137° E
Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)
0	4.43	0	4.43	0	4.50	0	4.49	0	n.d.
25	4.49	25	4.47	25	4.56	25	4.64	25	4.39
50	4.51	50	4.43	50	4.53	50	4.62	50	4.41
100	3.73	100	3.64	100	3.72	100	3.80	100	3.60
150	3.71	150	3.22	150	3.33	150	3.35	150	3.26
200	3.40	200	3.22	200	3.35	200	3.37	199	3.28
249	3.13	250	3.14	249	3.35	250	3.41	250	3.32
300	2.94	300	2.95	300	3.33	300	3.29	300	3.27
350	3.01	350	3.12	350	3.28	350	3.09	348	2.84
400	2.70	400	3.02	400	2.98	400	2.81	400	2.83
500	3.05	500	n.d.	499	2.72	500	2.78	501	2.60
750	2.36	750	2.43	749	2.41	750	2.66	750	2.07
1001	2.21	1000	2.01	1002	2.20	1001	2.29	1002	2.23

K9505	STN. 21	K9505	STN. 22	K9505	STN. 23	K9505	STN. 24	K9505	STN. 25
2° N	138° E	1° 30 N	138° E	1° N	138° E	0° 30 N	138° E	0° N	138° E
Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)
0	4.53	0	4.50	0	4.45	0	4.45	0	n.d.
24	4.61	25	4.55	25	4.51	25	4.50	25	4.45
50	4.63	50	4.58	49	4.37	50	4.46	50	4.45
100	3.91	100	4.03	99	3.56	100	3.43	100	3.37
149	3.30	149	3.24	150	3.25	150	3.28	149	3.25
200	3.30	200	3.31	200	3.33	200	3.30	199	3.30
250	3.24	250	3.36	250	3.36	250	3.37	249	3.35
300	3.29	300	3.25	300	3.04	300	3.23	300	3.29
350	2.43	349	2.76	350	2.76	350	3.04	350	3.15
400	2.72	400	2.79	400	n.d.	400	2.65	400	3.17
500	1.93	500	2.45	499	2.35	501	2.63	500	2.64
750	2.12	750	2.05	749	n.d.	751	2.66	750	2.15
1000	2.14	1001	2.24	1002	2.30	1001	2.31	1001	2.27

K9505	STN. 26	K9505	STN. 27	K9505	STN. 28	K9505	STN. 29	K9505	STN. 30
0° N	139° E	0° N	140° E	0° N	141° E	2° 30 N	142° E	2° 40 N	142° E
Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)
0	n.d.	0	4.41	0	4.45	0	4.46	0	4.52
25	4.50	25	4.45	25	4.52	25	4.47	25	4.52
50	4.48	50	4.43	50	4.52	50	4.47	50	4.53
100	3.37	100	3.36	100	3.37	99	3.63	100	4.02
150	3.28	151	3.36	151	3.25	150	3.57	150	3.67
200	3.32	200	3.32	200	3.35	201	3.47	200	3.56
249	3.35	250	3.31	250	3.37	250	3.47	250	3.56
299	3.27	300	3.34	300	3.39	300	3.40	299	3.52
349	3.18	350	2.76	350	2.53	350	3.52	350	3.60
400	2.61	400	2.55	400	2.53	400	3.64	400	3.67
500	2.69	500	2.99	500	2.79	500	3.55	500	3.78
750	2.23	750	2.29	750	2.26	750	3.46	749	3.36
1000	2.28	1001	2.30	1001	2.35	1002	2.70	1002	2.86

n.d. = No Data

Table 1-3 Dissolved Oxygen

K9505	STN. 31	K9505	STN. 32	K9505	STN. 33	K9505	STN. 34	K9505	STN. 35
2° N	142° E	1° 30 N	142° E	1° N	142° E	0° 30 N	142° E	0°	142° E
Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)
0	n. d.	0	4.47	0	4.50	0	4.50	0	4.52
25	4.56	25	4.55	25	4.48	25	4.55	25	4.39
50	4.54	76	4.54	51	4.44	50	4.42	50	4.28
100	3.93	101	3.80	100	3.34	100	3.65	100	3.52
150	3.43	150	3.38	150	3.47	150	3.29	150	3.33
200	3.48	200	3.47	200	3.38	200	3.48	200	3.47
250	3.50	250	3.35	250	3.55	250	3.49	250	3.47
300	3.55	300	3.04	300	3.08	300	3.02	300	3.31
350	2.56	350	2.59	350	2.47	350	2.59	351	2.59
399	3.08	400	2.58	400	2.75	399	2.33	401	2.56
499	3.56	500	3.65	500	3.45	500	3.42	499	2.77
750	2.53	750	2.48	750	2.30	750	2.29	750	2.42
1001	2.64	1001	2.47	1001	2.41	1001	2.41	1001	2.46

K9505	STN. 36	K9505	STN. 37	K9505	STN. 38	K9505	STN. 39	K9505	STN. 40
0°	143° E	0°	144° E	0°	145° E	0°	146° E	0°	147° E
Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)
0	4.45	0	4.36	0	4.48	0	4.43	0	4.36
25	4.35	25	4.43	25	4.51	25	4.46	25	4.27
50	4.34	49	4.44	49	4.49	85	3.91	50	4.27
100	3.17	100	3.30	90	4.07	100	3.37	100	3.44
150	3.31	150	3.39	150	3.34	150	3.27	150	3.16
198	3.38	200	3.23	200	3.33	200	3.20	200	3.13
250	3.45	249	3.30	250	3.35	250	3.33	250	3.12
299	3.23	300	3.05	300	3.13	300	3.14	300	2.87
350	2.72	350	2.74	350	2.62	350	2.23	351	2.17
400	2.41	400	2.29	400	2.71	400	2.74	400	2.37
500	2.97	501	2.99	500	2.97	500	2.84	499	2.77
749	2.39	750	2.23	750	2.16	751	2.25	750	2.14
1003	2.43	1000	2.50	1001	2.37	1000	2.42	1001	2.24

K9505	STN. 41	K9505	STN. 42	K9505	STN. 43	K9505	STN. 44
1° S	148° 50E	2° S	150° E	2° S	156° E	1° S	156° E
Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)	Dep. (db)	O_2(ml/l)
0	4.45	0	4.46	0	4.39	0	n. d.
25	4.54	25	4.54	49	4.44	25	4.69
50	4.57	49	4.51	99	3.96	50	4.68
99	3.53	99	3.61	149	3.18	100	3.35
150	3.27	149	3.49	176	n. d.	151	3.24
200	3.30	199	3.46	200	2.63	200	3.35
250	3.33	249	3.53	250	2.64	250	3.13
299	3.24	299	3.47	299	2.22	300	2.50
350	2.79	350	2.84	349	2.03	350	2.36
400	2.58	400	2.78	399	2.24	401	n. d.
500	3.04	500	2.66	500	3.12	500	2.90
750	2.59	750	3.01	750	3.71	750	2.48
1002	2.39	1002	2.65	1000	3.02	1000	2.37

n. d. = No Data

SBE

SEA-BIRD ELECTRONICS, INC.
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DISSOLVED OXYGEN SENSOR CALIBRATION: S/N 130311 10 March 1995

Sensor type:

Beckman, Module S/N 3-07-19

Sensor Current

m = 2.4477 E-7
b = -5.3850 E-10

The use of these constants in a linear equation of the form

$$I = mV + b$$

will yield DO sensor membrane current as a function of sensor output voltage.

Sensor Compensation Temperature

k = 8.9224
c = -7.0145

The use of these constants in a linear equation of the form

$$T = kV + c$$

will yield membrane temperature as a function of temperature channel voltage with a maximum error of about 0.5 deg C. The correction to dissolved oxygen resulting from the use of this calibration should be sufficient to achieve the precision of which the sensor is capable.

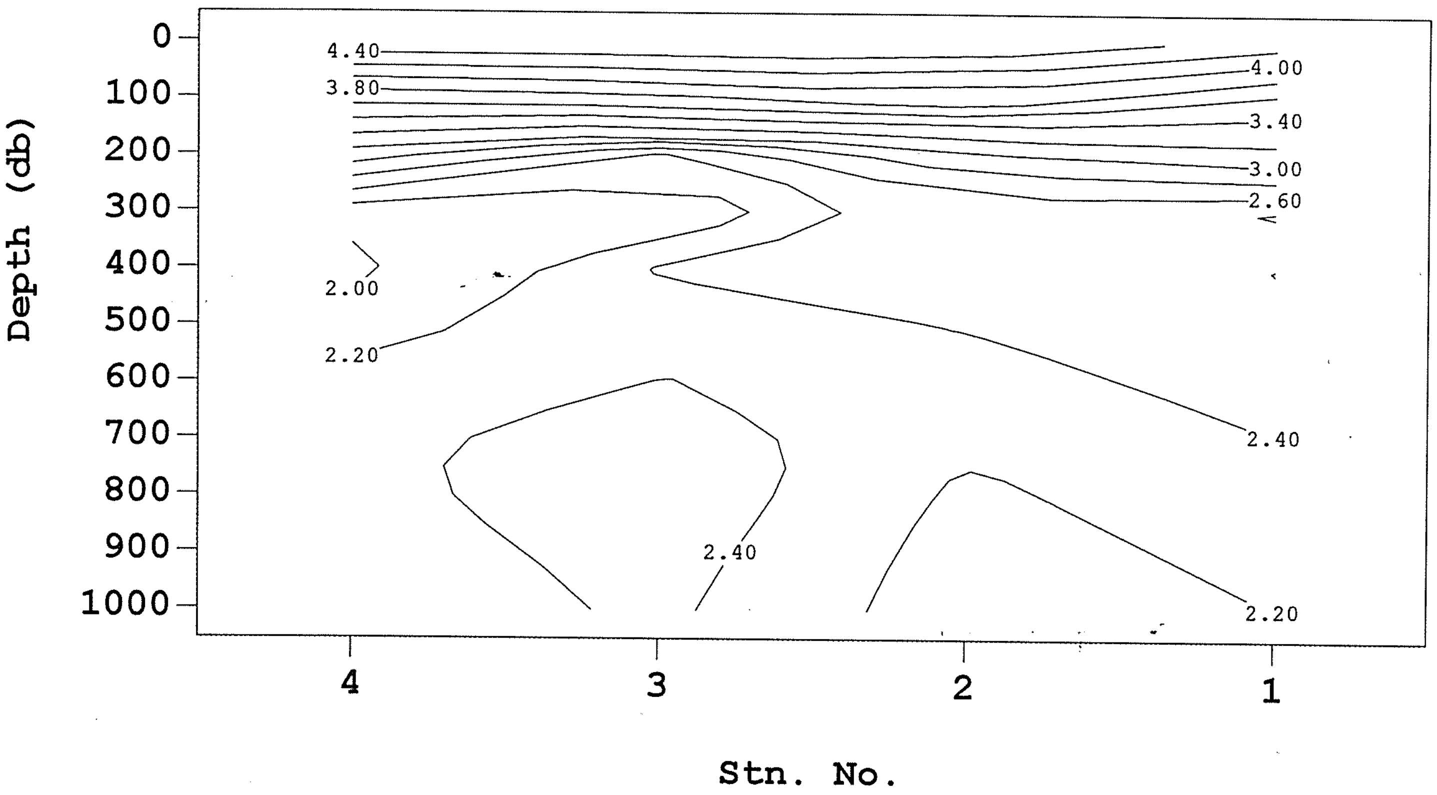
SEASOFT Coefficients based on Oxfit Calibration Results

Soc	2.2105	
Boc	-0.0399	
tcor	-0.033	(nominal)
pcor	1.50e-4	(nominal)
tau	2.0	(nominal)
wt	0.67	(nominal)

9.99046.e-1

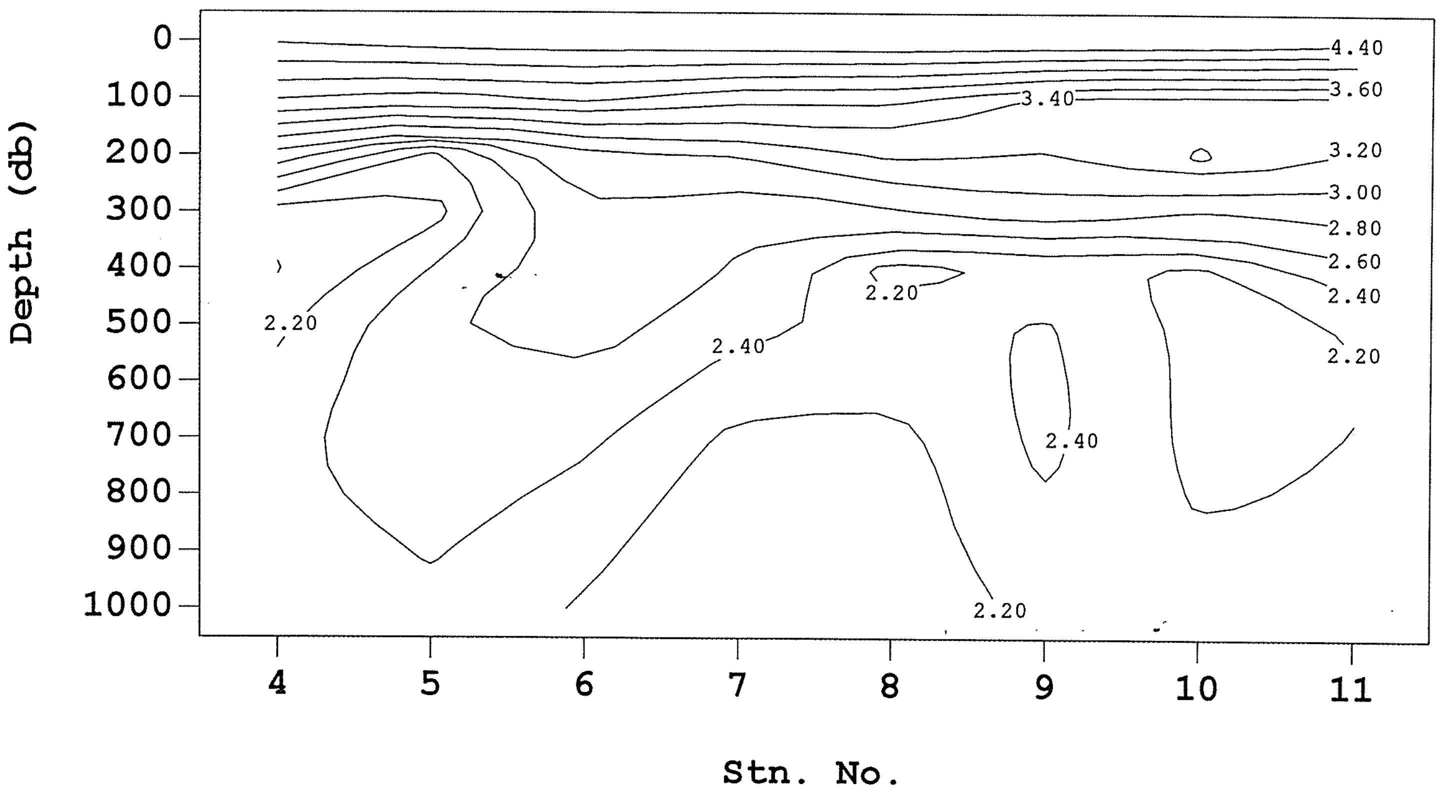
barometer	=	976.167	mB
Twater	=	7.545	deg C
Tcomp	=	7.368	deg C
Isat	=	0.560	uA
Iair	=	0.715	uA
Izero	=	0.018	uA

Line 1

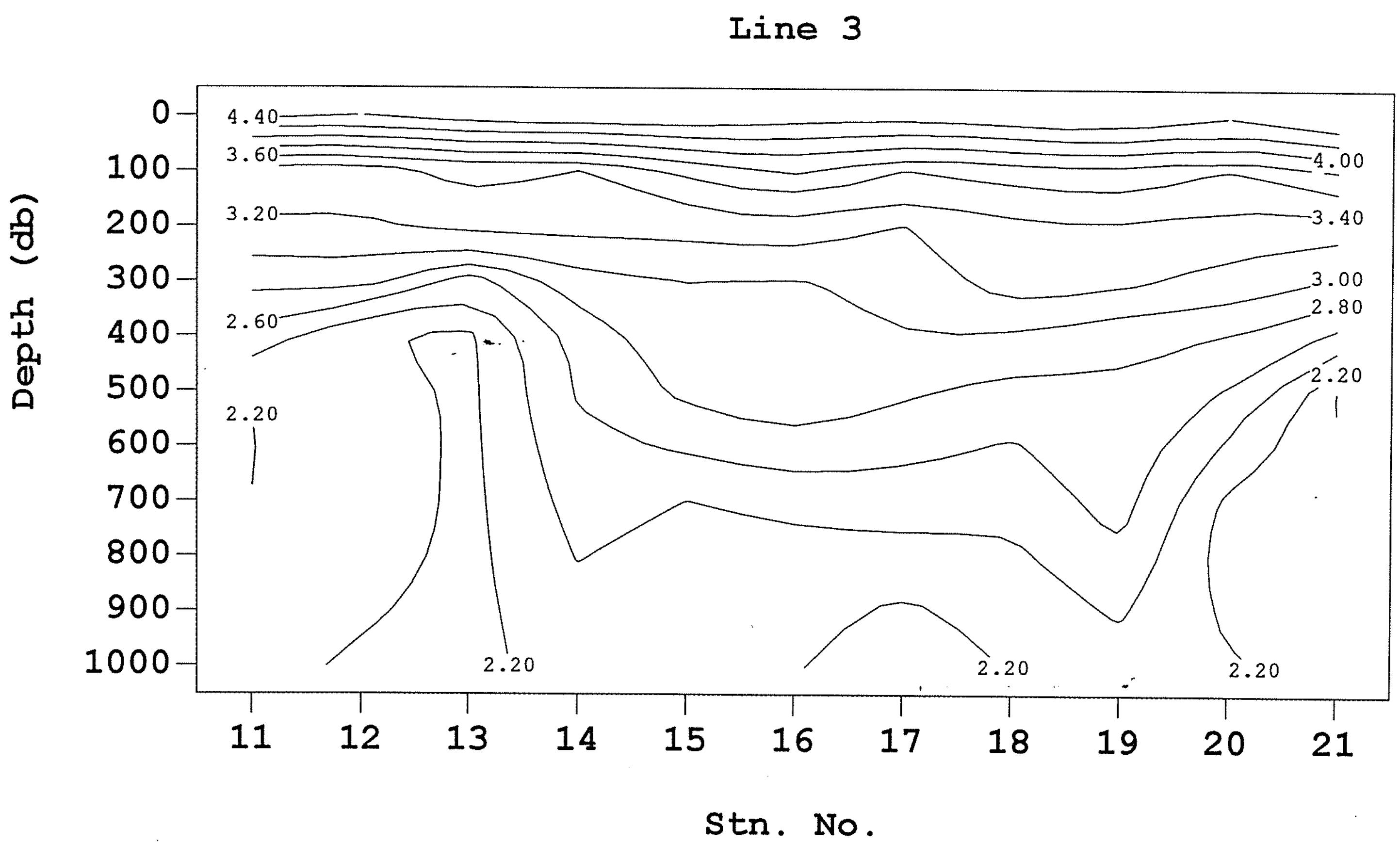


Jul 17 1995

Line 2



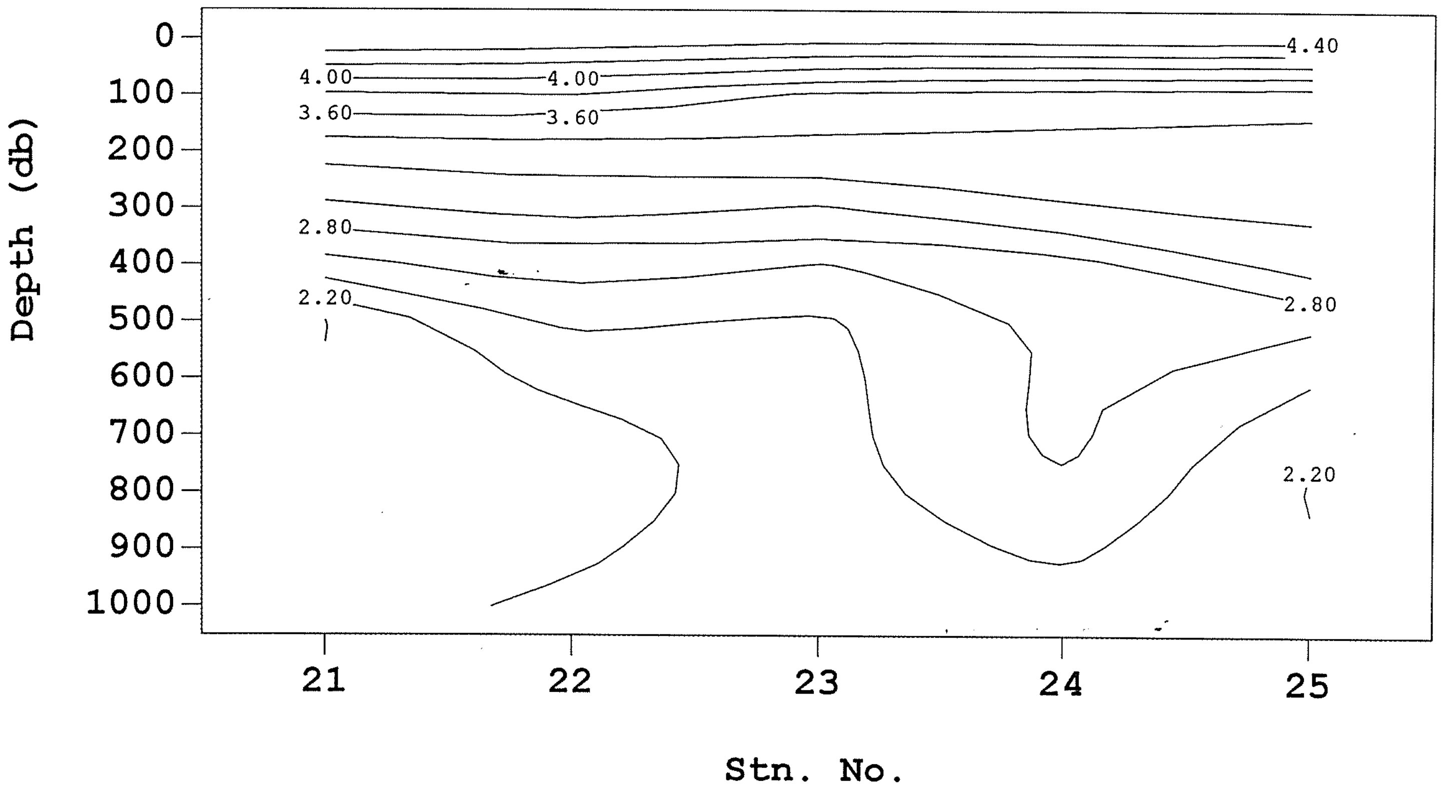
Jul 17 1995



Line 3
Depth (db)
0
100
200
300
400
500
600
700
800
900
1000
4.40
3.60
3.20
2.60
2.20
2.20
2.20
2.20
4.00
3.40
3.00
2.80
2.20
11
12
13
14
15
16
17
18
19
20
21
Stn. No.

Jul 17 1995

Line 4



Jul 17 1995

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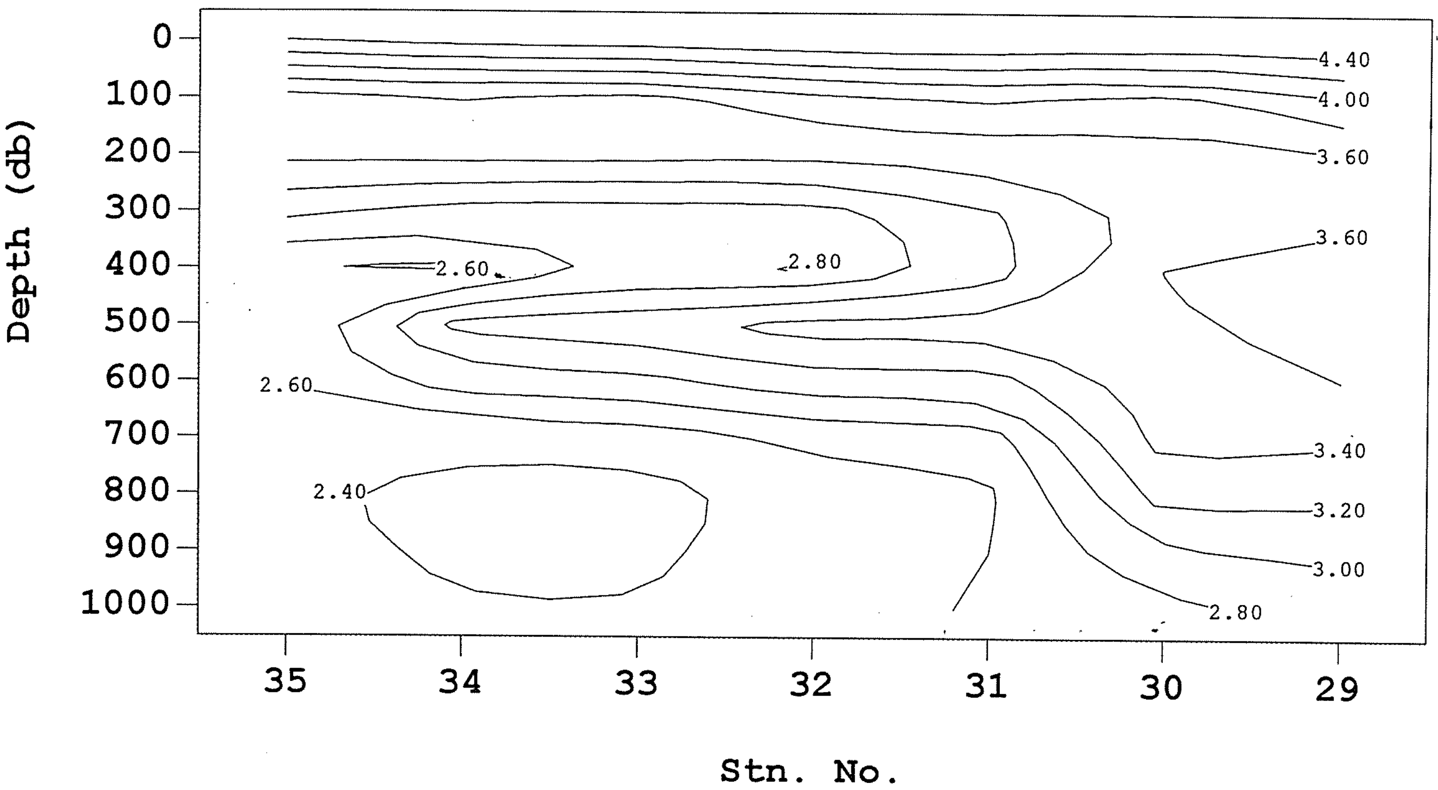

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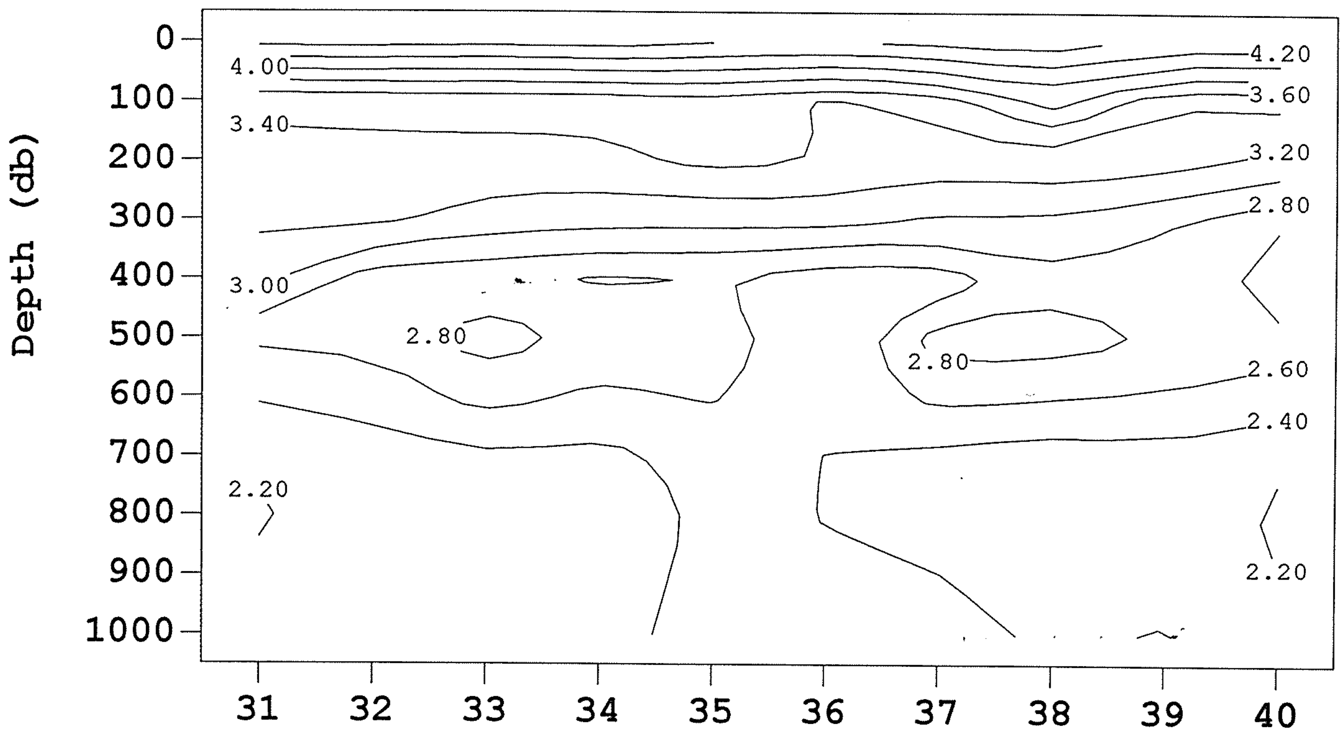

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5. Meteorological Measurements

5.1 Atmospheric Sounding

Objectives

To promote our understanding about the air-sea interaction over the "warm water pool"area.

Method

We observed vertical profiles of pressure, temperature, relative humidity, and wind speed/direction by VAISALA DigiCORA MW 11 Automatic Radiosonde Set.
The system consists of Main processor(MW11), Local VLF Antenna(CAS11B/CAA21), UHF Telemetry Antenna(RB21), Microdisk Recorder(MF12), Ground Check Set(GC22), printer(EPSON LX-1050), Balloon Launcher (ASAP JAMSTEC), and Radiosonde(RS80).
The range of measured parameter by RS80 and these accuracy is the follows ;

Parameter	Range	Accuracy
Pressure	1060 - 3 hPa	0.5 hPa
Temperature	-90 - +60 deg-C	0.2 deg-C
Relative humidity	0 - 100 %	3 %
Wind speed	0 - 180 m/s	0.5 m/s

We launched the balloon every 6 hours at 00Z, 06Z, 12Z, and 18Z during two weeks from 6 JUL '95 to 12 JUL '95 and from 17 JUL '95 to 23 JUL '95, and obtained 58 sounding data. Table 5-1 shows Radiosonde Launch Log.

Preliminary Result

Fig.5-1 shows the EMAGRAM and Wind profile with sounding time (YYMMDDTT UTC) and position.

The southeast trade wind dominated on the western side area of 147E at the first half period form 6 to 12 JUL. Near the sea surface, wind speed was around 5 m/s. And they have two type vertical profiles. One is the parabolic shear type of its center located at about 600 hPa level on the west side aria of 142E longitude line, and other is the liner shear one on the eastern area. Above 600 hPa, there is some dry air. From 1800 8 JUL to 0600 9 JUL and form 1200 to 1800 10 JUL, as we were covered with the advanced cumulonimbus, atmospher of lower layer was very wet.

On the equator, the inversion layer exists near the 550 hPa level (i.e. 0 deg-C or melting layer). It was already reported by TOGA-COREA, therefore the existence of this 0 deg-C layer inversion may be common occurrence feature over the equatorial Pacific ocean in all the year.

At latter half period from 17 to 23 JUL, the vertical profiles of the atmospheric was similar the first period one on the southern side area of 5N.

On the equator, 156E, we observed very weak westerly wind at the surface layer.

Northeast trade wind was very weak on the nothern side area of 5N. So it was not found the typical inversion layer at this aria.

Table 5-1

Radio Sonde Launch Log Sites

No.	Time (UTC) YYMMDDTT	Position lat.	Long.	Surface Press. (hP)	Temp. (DEG-C)	RH (%)	W.D. (deg)	W.S. (m/s)	Max Aititude (hPa)	(m)	Cloud Amount	Type
01	94070600	02 00 N	129 25 E	1008.0	30.9	70	232	3.8	41.1	21,888	9	Cu
02	94070606	02 00 N	130 24 E	1006.3	26.3	77	104	6.5	26.7	24,607	6	Cu, Ac
03	94070612	02 00 N	131 21 E	1007.2	27.7	80	110	7.0	35.6	22,806	10	Cu, Sc
04	94070618	02 00 N	132 18 E	1006.8	27.9	79	091	8.5	37.9	22,383	9	Cu, Sc
05	94070700	02 00 N	133 19 E	1008.2	30.0	74	068	6.5	31.4	23,579	4	Cu
06	94070706	02 00 N	134 14 E	1006.8	29.4	70	090	4.5	28.7	24,146	3	Cu
70	94070712	02 00 N	135 16 E	1009.1	28.4	77	072	5.0	32.1	23,450	1	Cu
08	94070718	01 59 N	136 15 E	1008.1	27.8	78	078	3.5	45.3	21,329	F	
09	94070800	02 00 N	137 20 E	1010.1	30.4	70	099	6.3	32.4	23,392	3	Ci, Cu
10	94070806	01 38 N	138 00 E	1007.9	29.6	73	090	3.0	37.7	22,402	2	Cu, Cb
11	94070812	00 44 N	138 00 E	1009.4	27.5	90	139	7.1	35.8	22,761	2	Cu, Ac
12	94070818	00 01 S	137 59 E	1008.0	27.8	78	100	4.3	43.3	21,569	4	Cb
13	94070900	00 02 S	138 02 E	1010.6	26.5	83	164	2.4	31.5	23,590	10	Cu, Ns
14	94070906	00 01 S	138 51 E	1008.2	26.5	80	075	6.5	34.7	22,915	9	Sc, Cu, Cb
15	94070912	00 00 S	139 50 E	1009.8	26.6	89	090	4.6	32.8	23,316	2	Cu, Cb
16	94070918	00 01 N	140 51 E	1008.7	26.3	91	329	3.0	30.7	23,711	4	Cb
17	94071000	00 56 S	141 23 E	1010.4	30.1	66	136	3.0	30.9	23,711	3	Cu, Ci
18	94071006	0 55 S	141 47 E	1006.8	28.9	79	292	1.4	39.2	22,169	3	Cu, Cb
19	94071012	02 38 S	142 00 E	1009.5	26.4	82	000	6.5	39.5	22,181	7	Cb
20	94071018	02 29 S	141 59 E	1008.8	25.8	84	174	12.1	50.9	19,692	10	Cb, Cu, Sc
21	94071100	02 24 S	141 59 E	1011.0	27.0	80	287	2.3	37.5	22,459	9	Cb, Cu, Sc, Ci
22	94071106	01 41 S	142 00 E	1007.3	28.1	69	233	2.3	32.2	23,399	2	Cu, Ac
23	94071112	00 47 S	142 00 E	1009.9	27.4	82	000	1.5	59.5	19,665	9	Cu, Ac
24	94071118	00 00 S	142 09 E	1008.3	26.5	83	009	4.9	58.7	19,761	4	Cu, Ci
25	94071200	00 01 S	143 04 E	1010.2	29.1	66	064	3.6	45.5	21,246	4	Ci, Cu
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27	94071212	00 00 S	145 01 E	1010.1	28.4	78	036	3.0	45.1	21,313	7	Cu, Cb, Ci
28	94071218	00 01 S	146 01 E	1008.4	27.7	78	calm	0.0	34.9	22,900	8	Cu, Ac
29	94071300	00 00	147 02 E	1010.3	34.0	47	165	4.0	33.0	23,261	4	Cu
30	94071700	02 05 S	155 07 E	1011.6	30.1	63	149	4.0	42.9	21,632	8	Cu, Ci
31	94071706	02 00 S	156 00 E	1008.5	34.2	50	150	4.0	39.4	22,148	9	Cu, Ci, Ac
32	94071712	01 55 S	155 53 E	1011.0	28.4	78	153	5.0	39.0	22,217	3	Cu, Ci
33	94071718	01 58 S	155 57 E	1009.3	27.4	76	127	5.0	46.9	21,061	2	Cu, Ci
34	94071800	02 01 S	156 01 E	1011.6	27.9	70	051	1.5	39.2	22,197	8	Cu
35	94071806	00 57 S	156 00 E	1009.2	34.2	51	124	1.2	34.9	22,883	3	Cu, Ci
36	94071812	00 00 S	156 03 E	1011.6	27.5	80	160	4.0	43.3	21,581	1	Cu
37	94071818	00 00 N	156 00 E	1010.2	26.6	82	148	1.8	46.3	21,158	2	Cu, Ci
38	94071900	00 00 S	156 03 E	1011.9	33.3	43	101	2.0	36.4	22,635	4	Cu, Ci
39	94071906	00 00 S	156 01 E	1009.5	30.0	63	080	1.0	37.2	22,518	5	Cu, Ci
40	94071912	00 00 N	156 00 E	1011.5	27.9	75	267	0.3	45.7	21,252	1	Ci
41	94071918	01 40 N	156 00 E	1009.5	26.9	82	139	2.0	47.4	20,999	4	Cu
42	94072000	01 59 N	156 05 E	1011.6	35.9	41	068	2.5	38.7	22,248	3	Cu
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44	94072012	02 28 N	156 00 E	1010.2	27.5	75	110	5.0	46.1	21,160	2	Cu
45	94072018	02 30 N	155 58 E	1008.7	26.9	78	095	5.0	46.8	21,063	2	Cu, Ac
46	94072100	03 00 N	156 00 E	1010.3	30.6	60	125	6.0	38.7	22,247	1	Cu
47	94072106	04 00 N	156 00 E	1007.8	29.4	65	125	4.2	37.5	22,438	2	Cu, Cb
48	94072112	04 24 N	156 01 E	1011.1	28.1	76	124	6.7	37.9	22,408	1	Ci
49	94072118	04 50 N	156 00 E	1009.4	27.1	79	091	3.8	39.1	22,168	0	
50	94072200	05 00 N	156 05 E	1011.4	30.6	65	065	3.0	41.5	21,829	3	Cu, Ci
51	94072206	05 03 N	155 58 E	1008.4	30.8	60	037	4.7	41.9	21,768	8	Ac, Cu, Ci
52	94072212	05 45 N	154 57 E	1012.3	24.7	92	069	4.8	48.6	20,865	10	Cu
53	94072218	06 29 N	153 56 E	1010.2	27.4	78	338	1.2	50.9	20,557	9	Cb, CU
54	94072300	07 11 N	152 57 E	1011.2	28.4	77	320	2.9	33.2	23,217	8	Cu, Cb, Ci
55	94072306	07 59 N	151 51 E	1008.3	29.5	74	346	4.5	44.2	21,434	7	Cb, Cu, Ac
56	94072312	08 54 N	150 34 E	1010.4	27.6	81	335	6.6	49.5	20,787	8	Cu
57	94072318	09 30 N	149 44 E	1008.7	27.8	80	342	4.5	45.3	21,295	10	Cu
58	94072400	10 16 N	148 40 E	1010.1	26.6	86	004	5.0	68.1	18,814	10	Cu, Cb

Fig. 5-1 EMAGRAM and Wind Profiles

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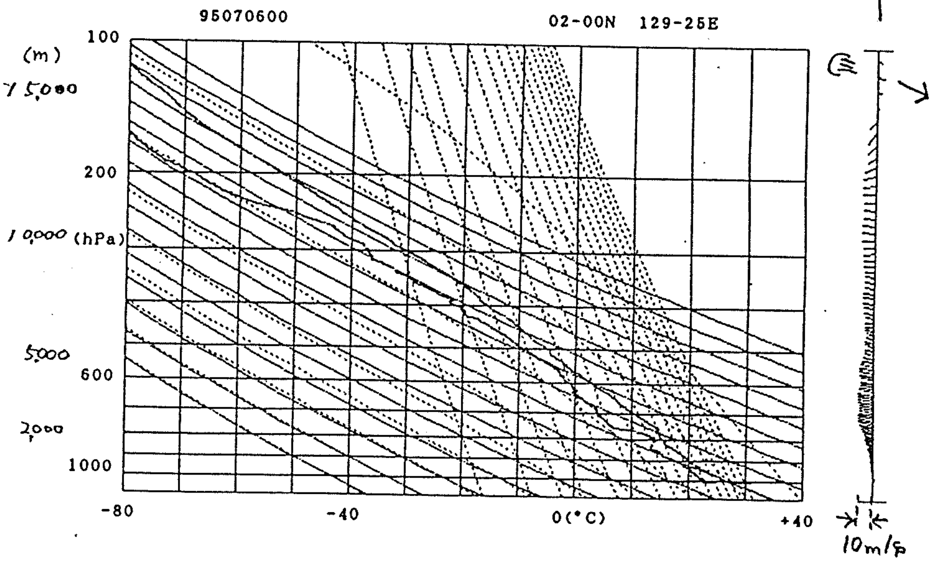

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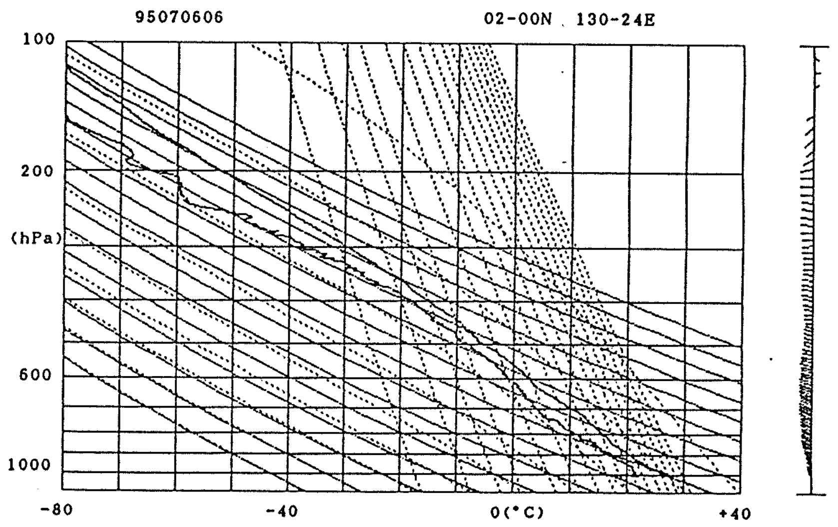

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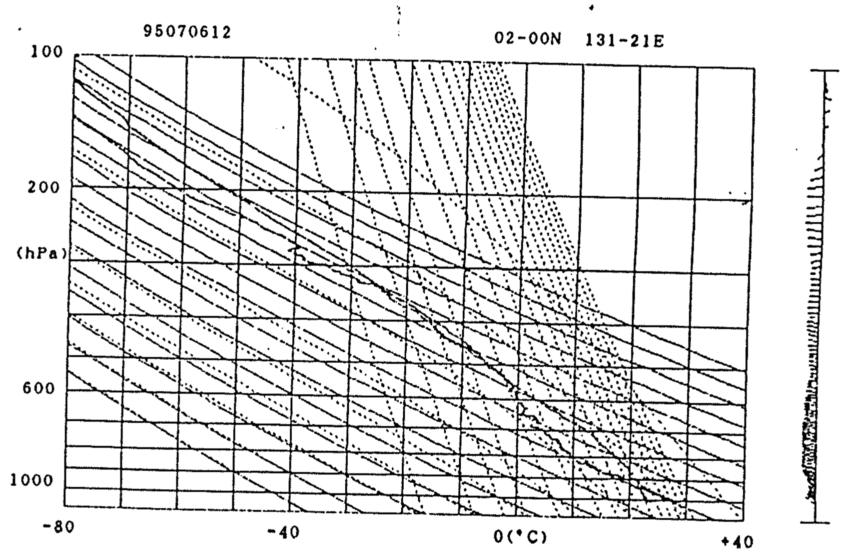

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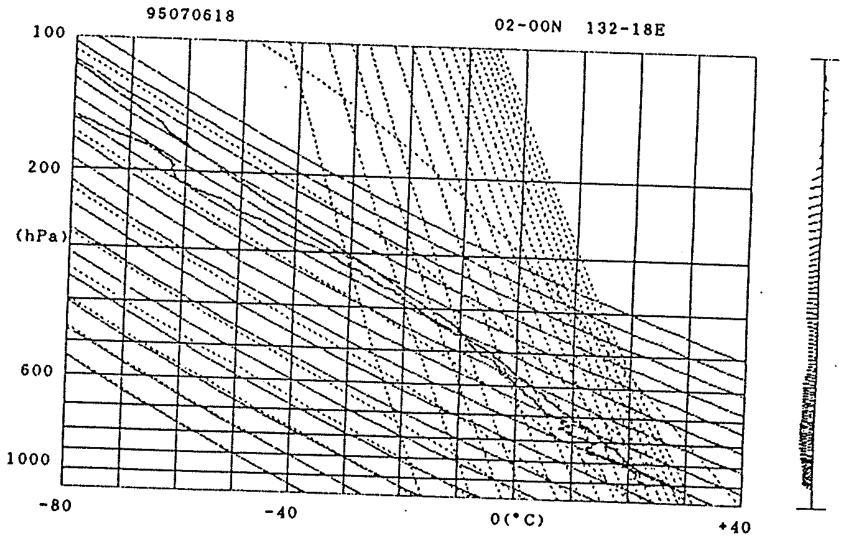
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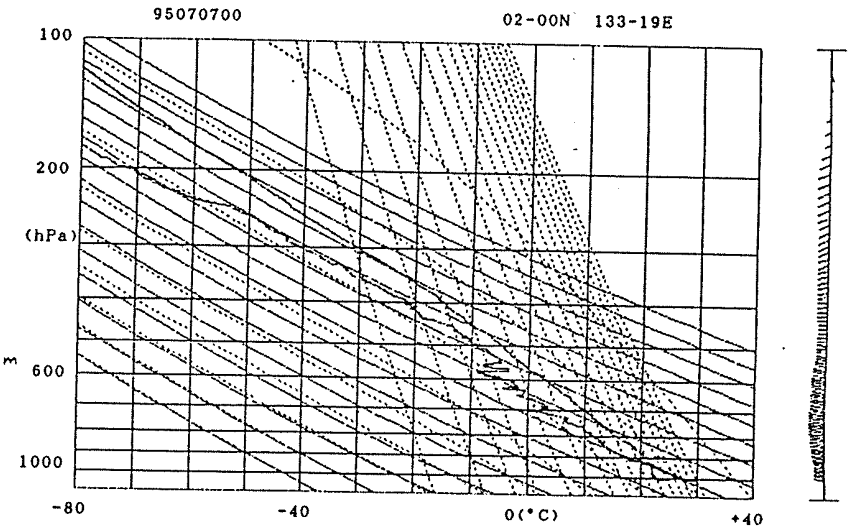
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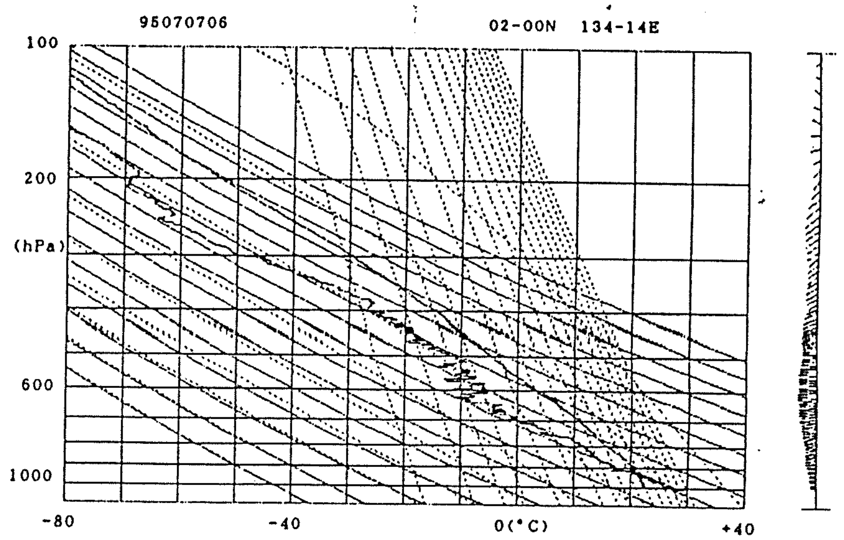
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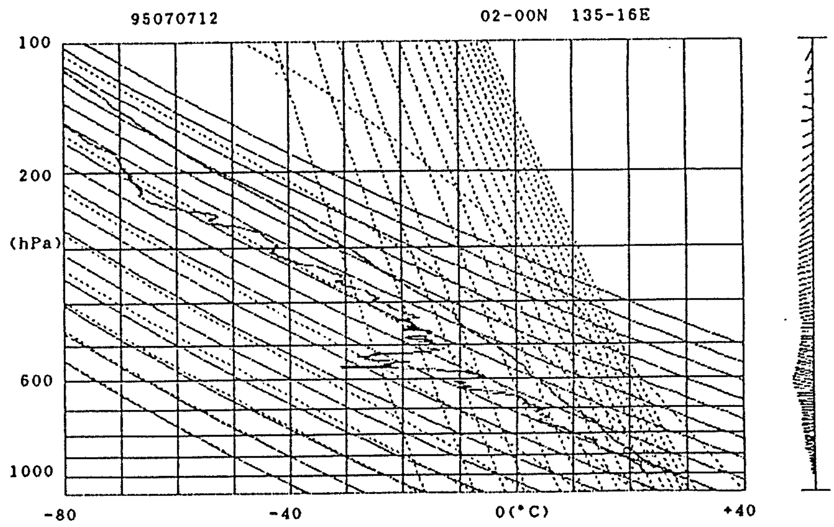
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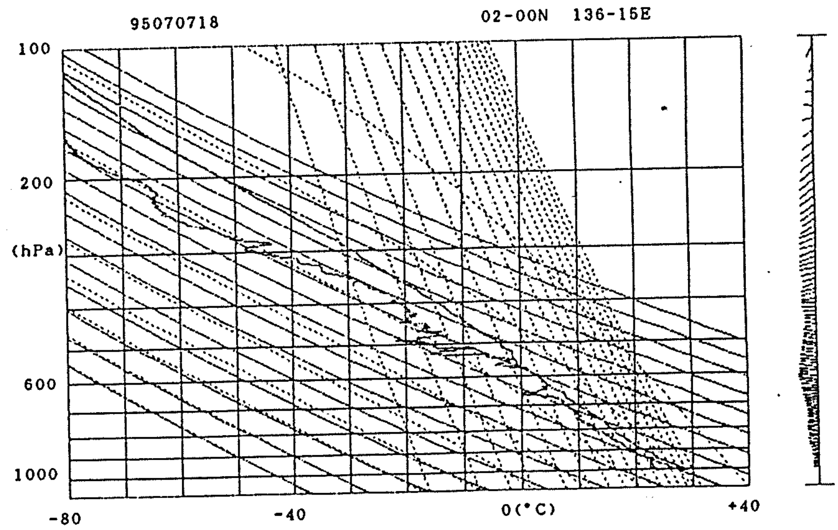
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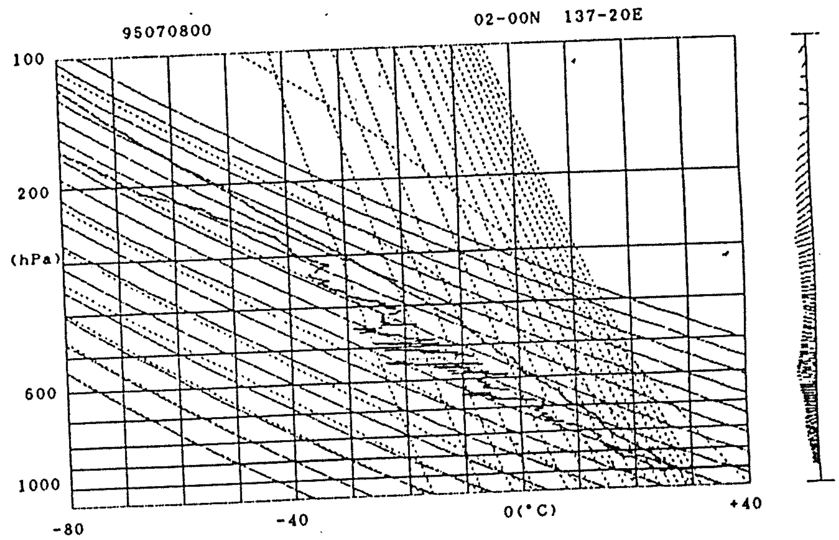
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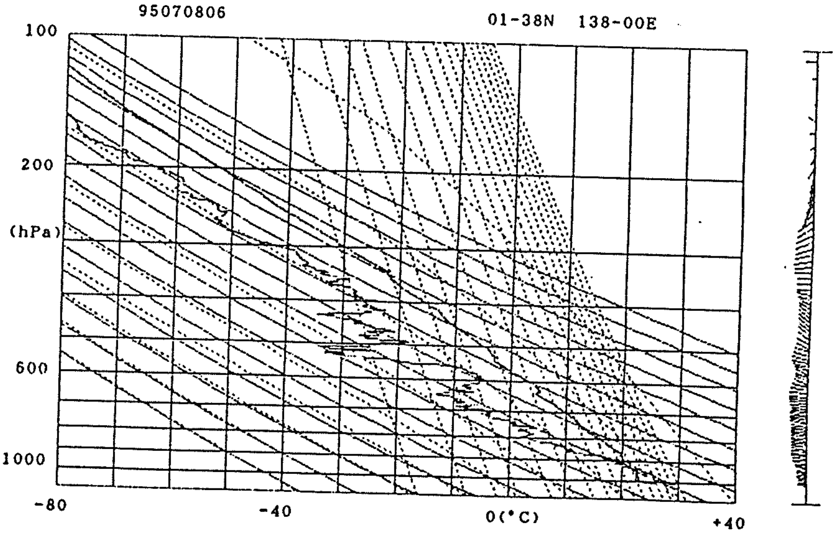

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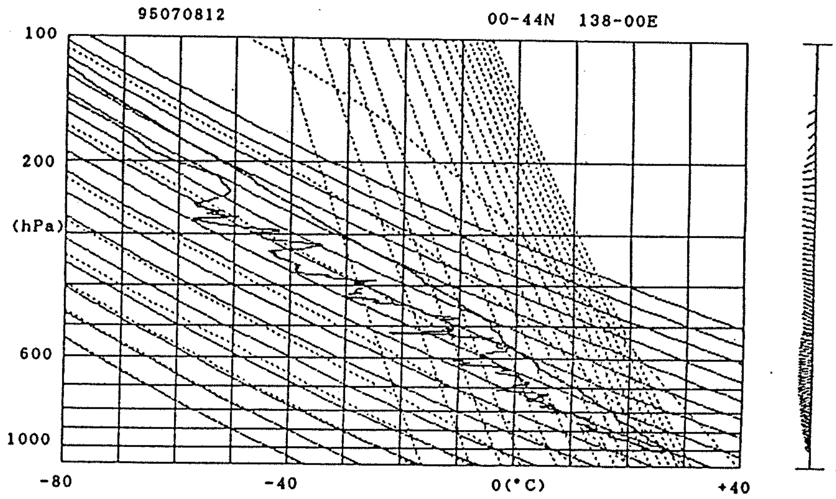

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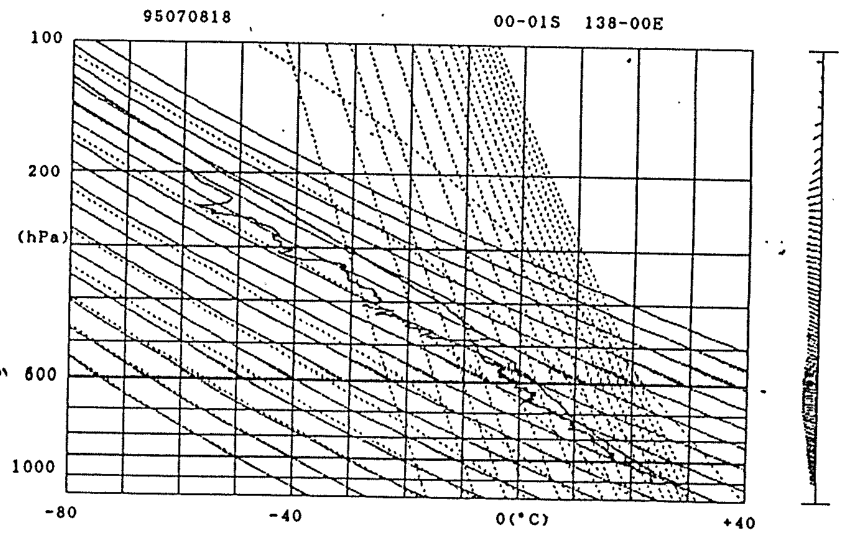

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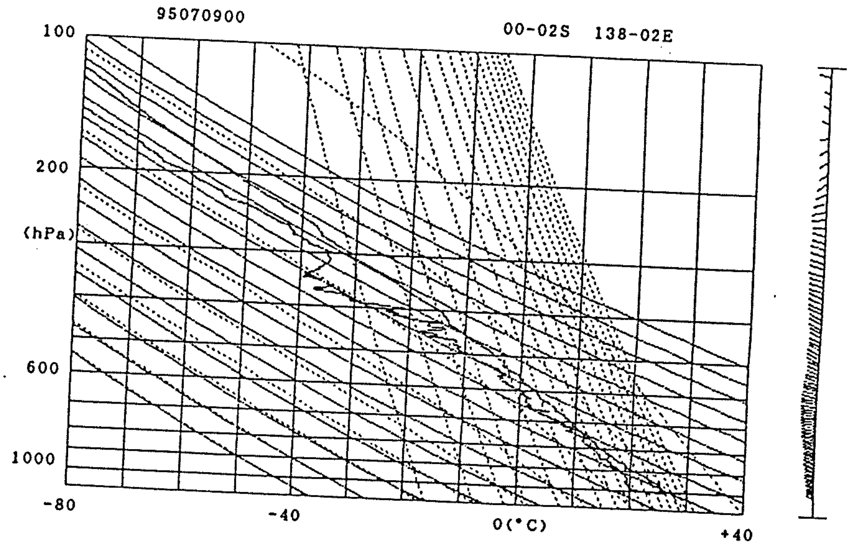
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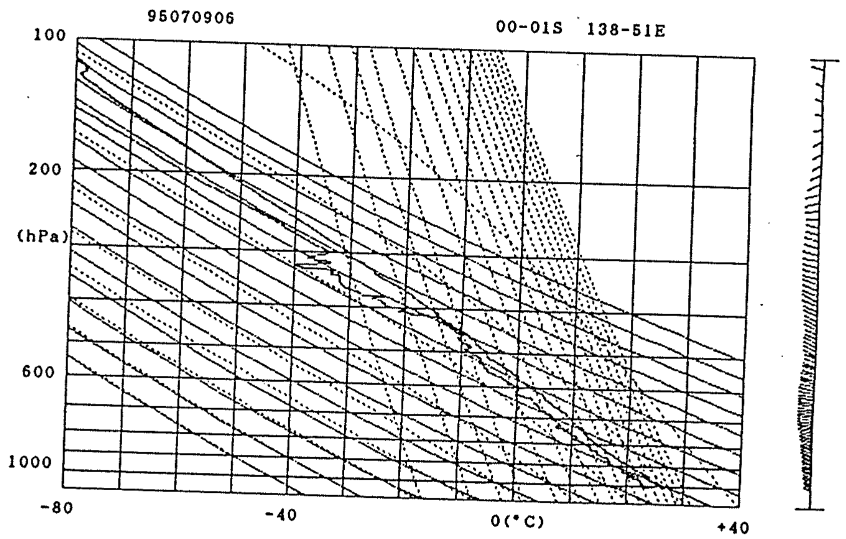
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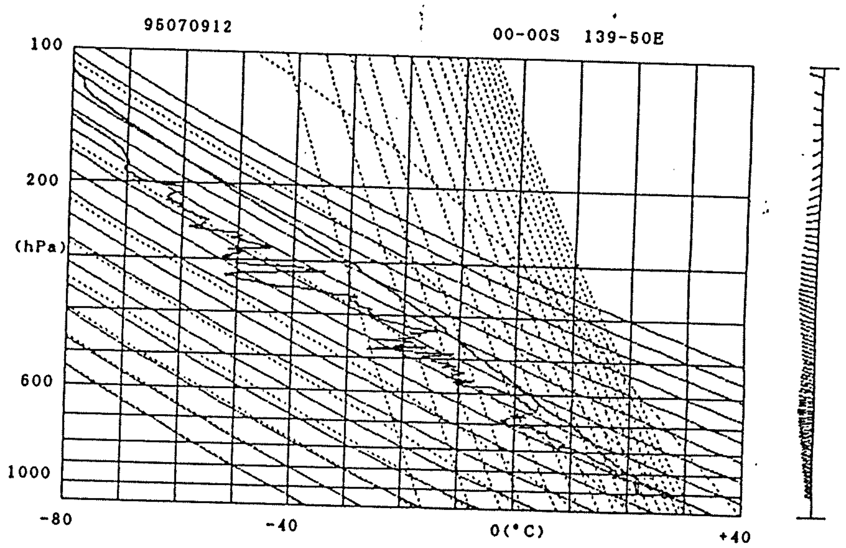
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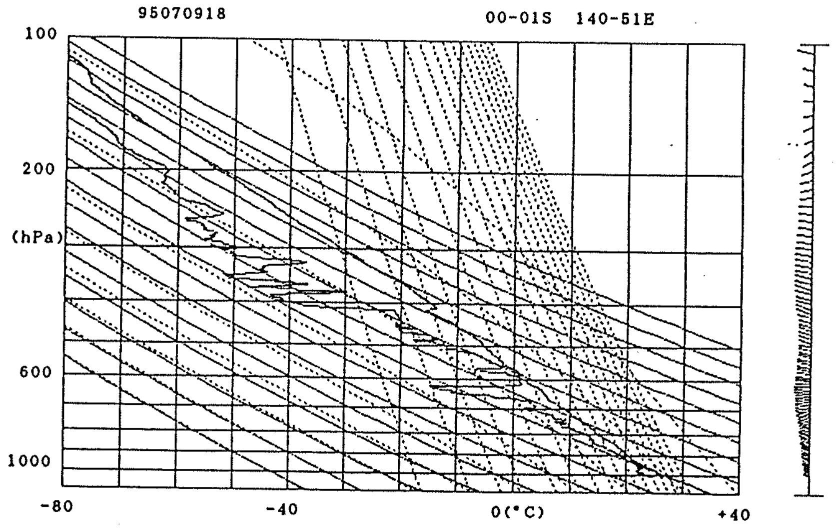
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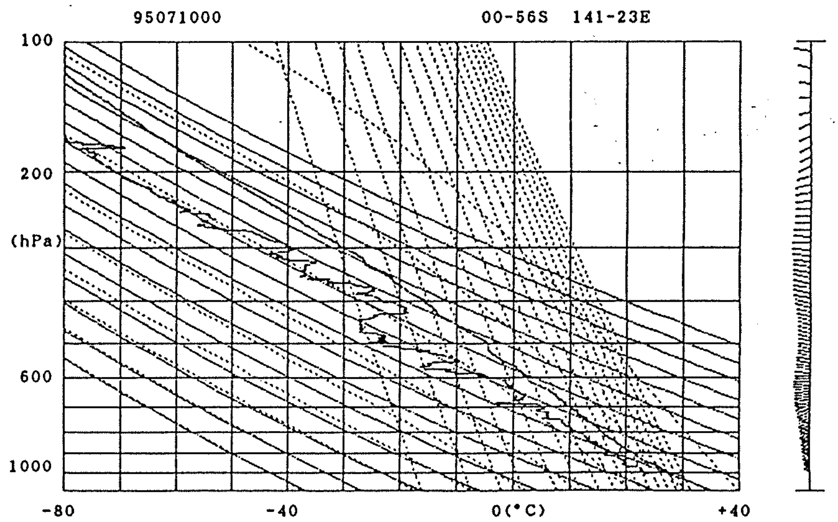
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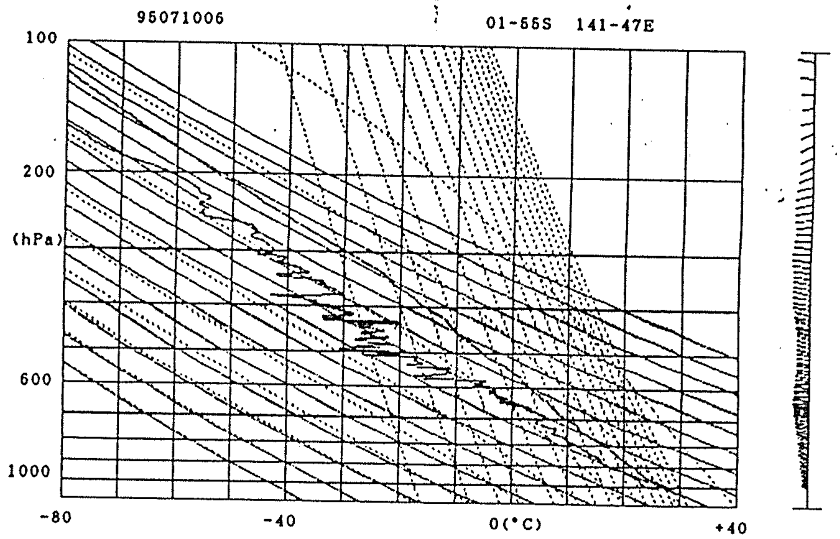
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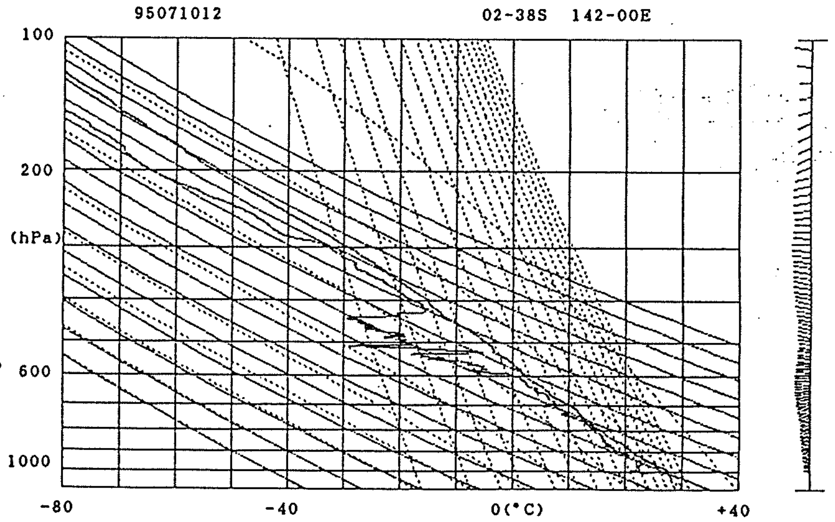

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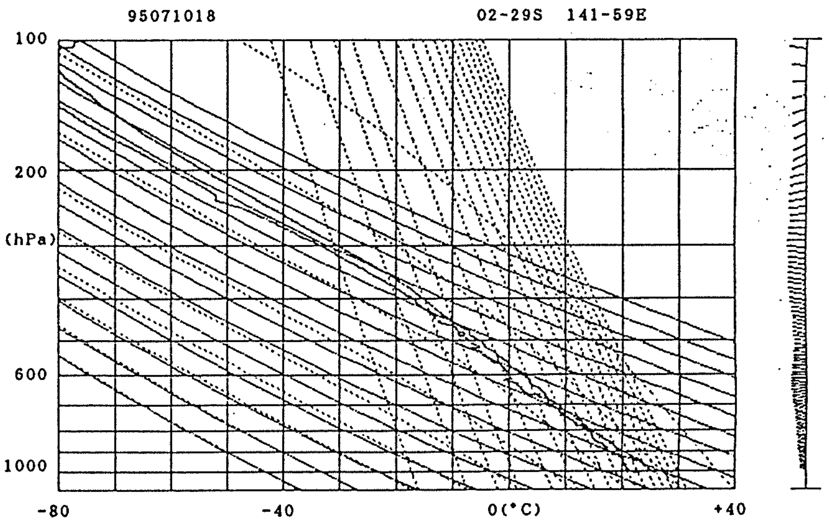

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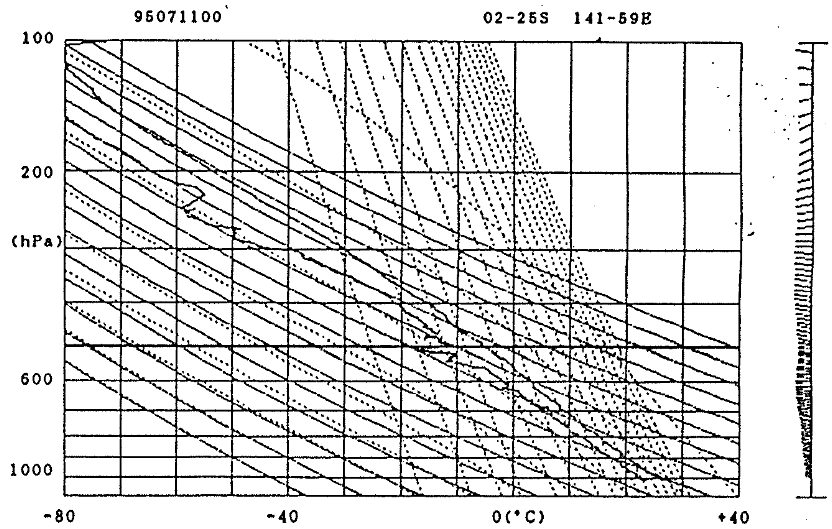

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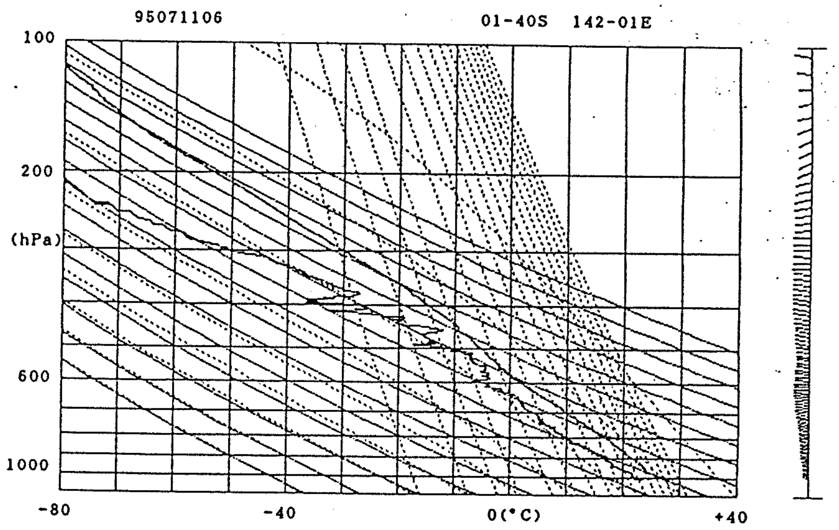
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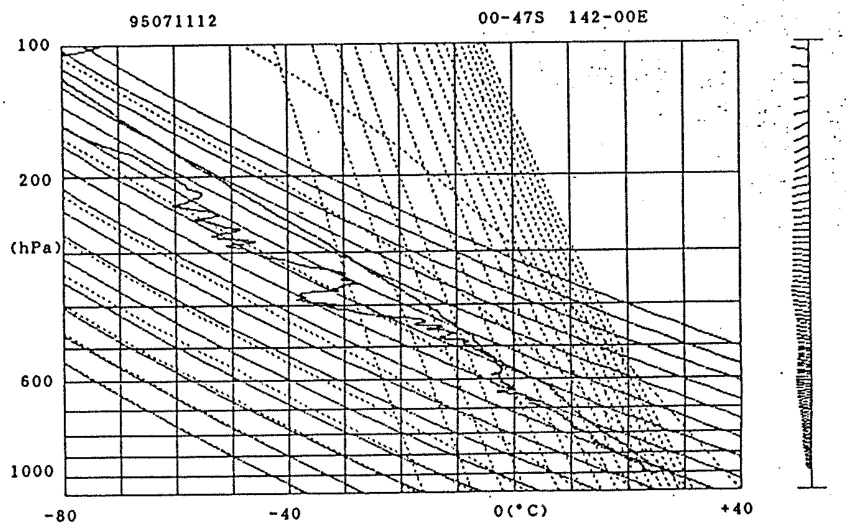
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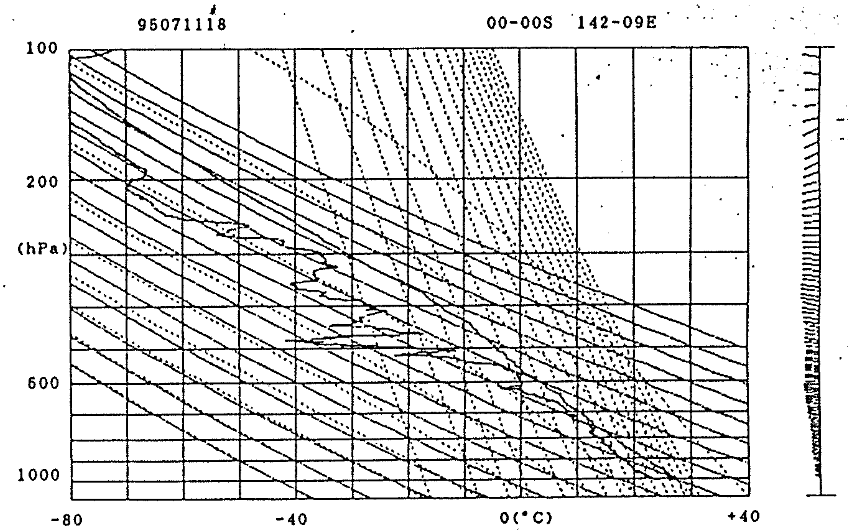
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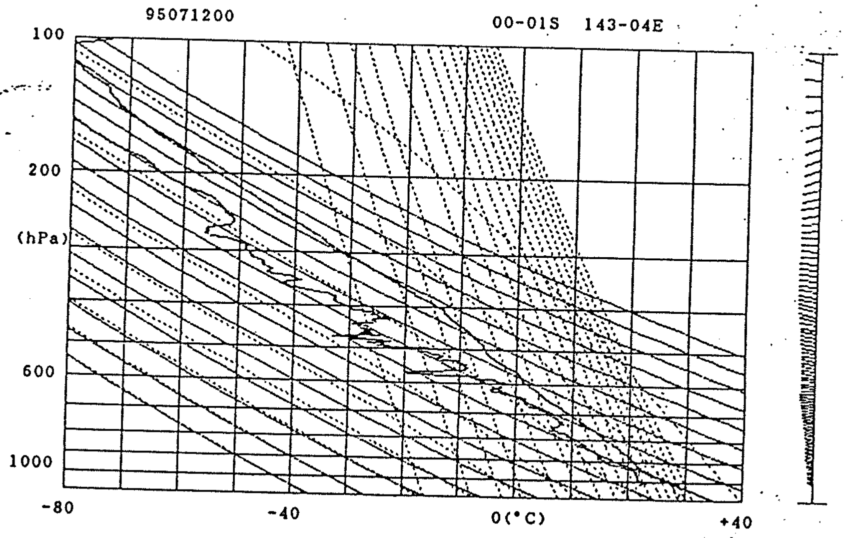
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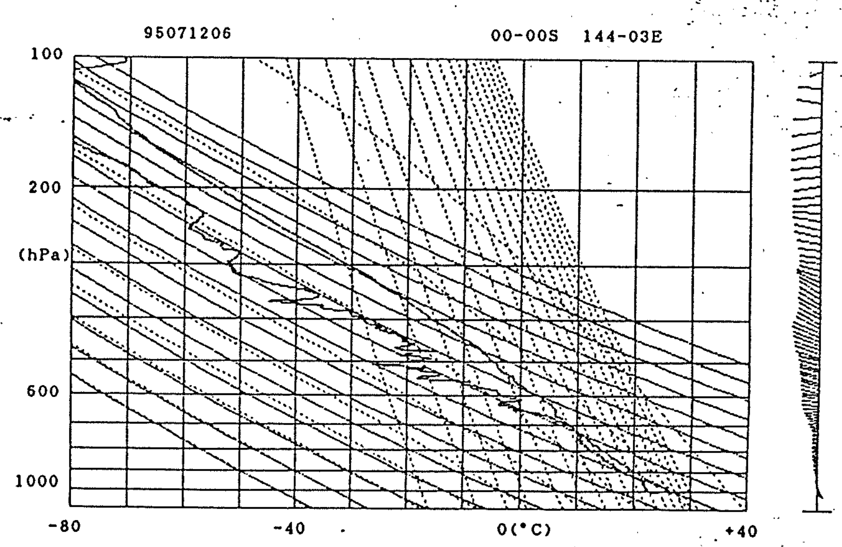
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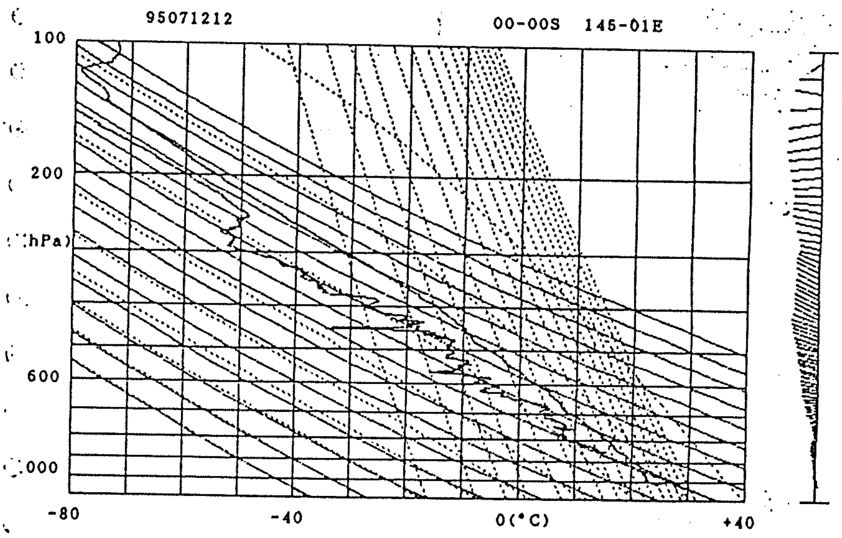
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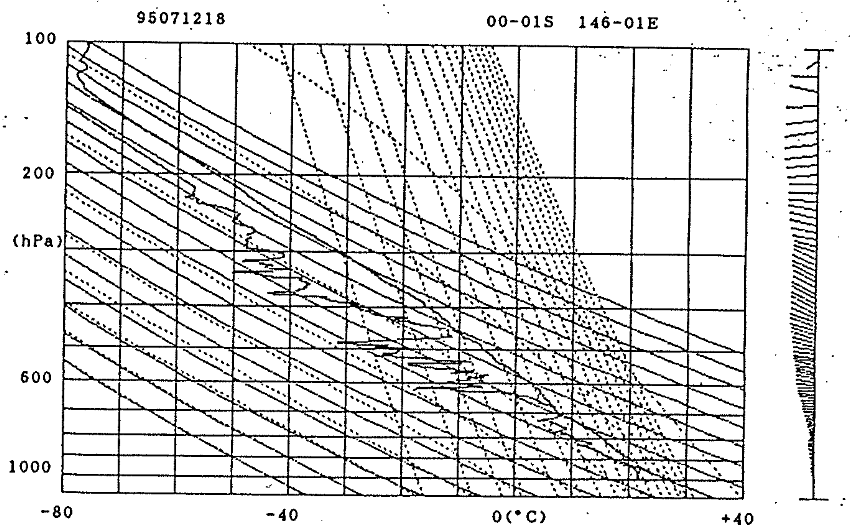
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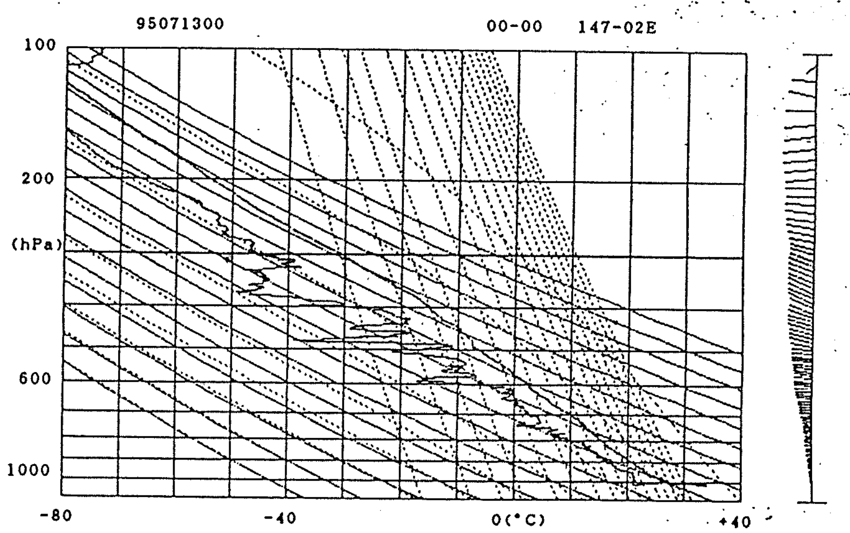
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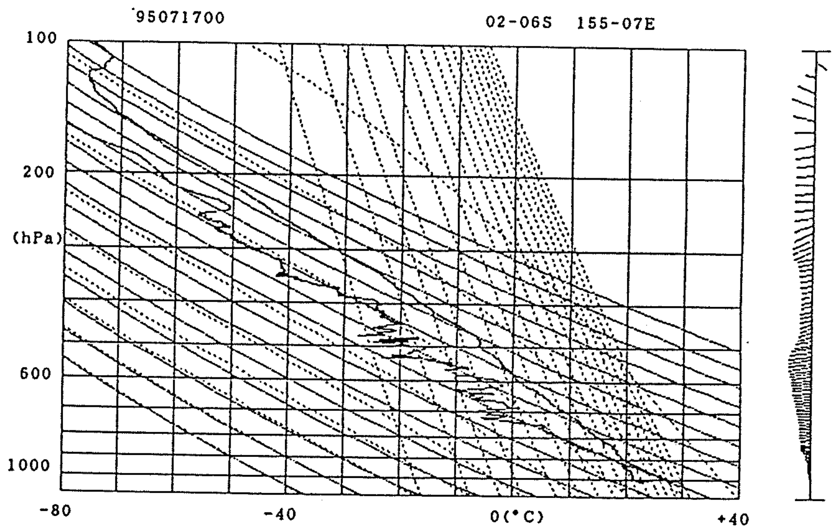
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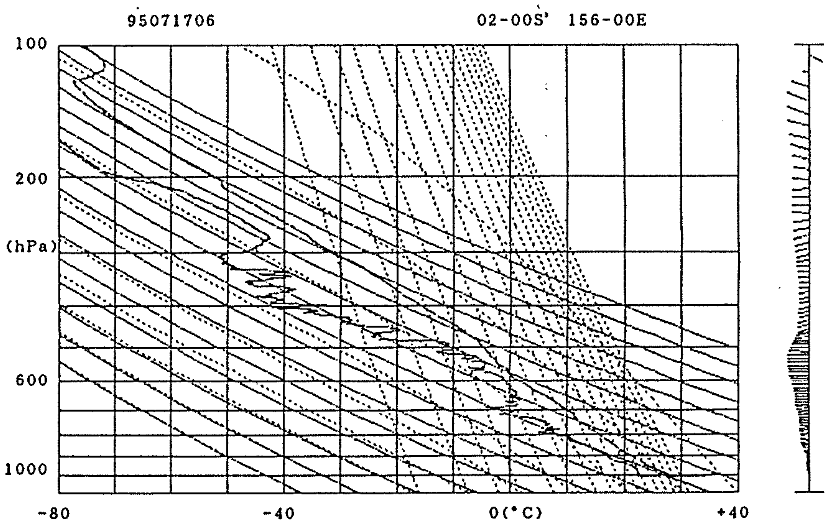
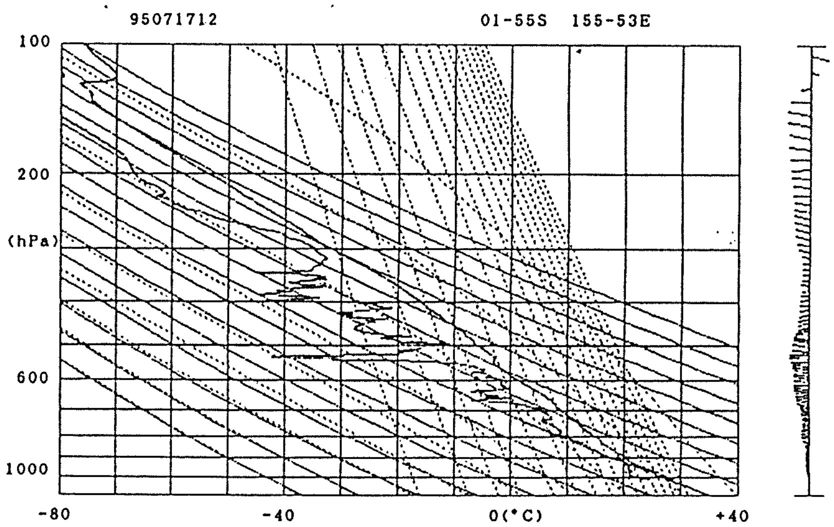
(31)

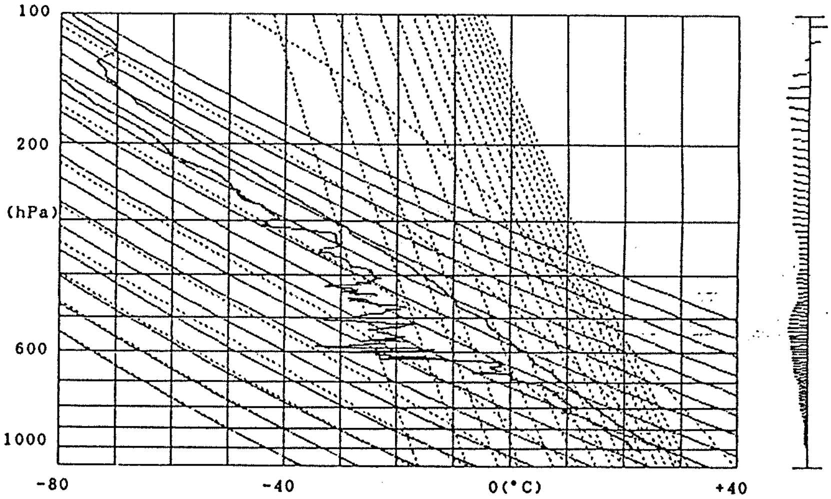

95071706
02-00S 156-00E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

(32)


95071712
01-55S 155-53E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

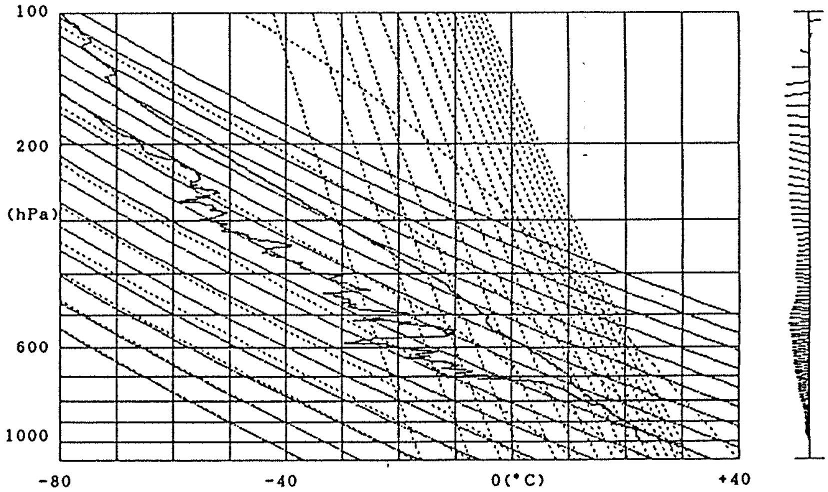
(33)

95071718 01-58S 155-57E



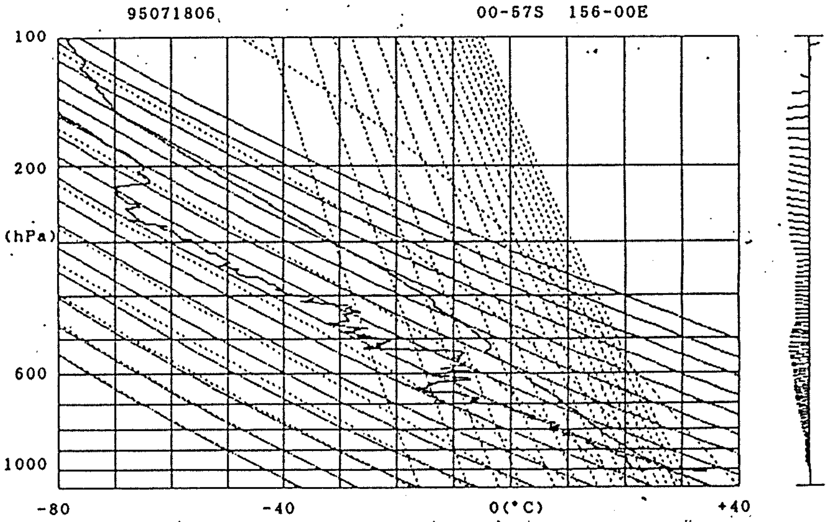
(34)

95071800 02-01S 156-01E



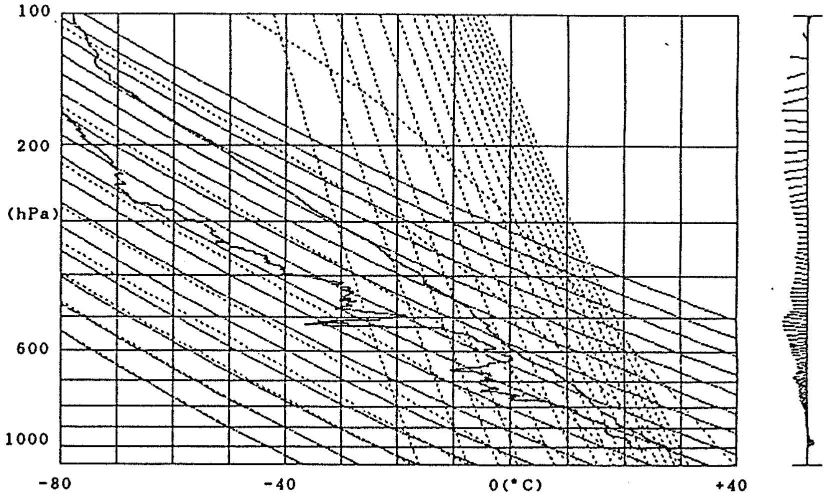
(35)

95071806 00-57S 156-00E



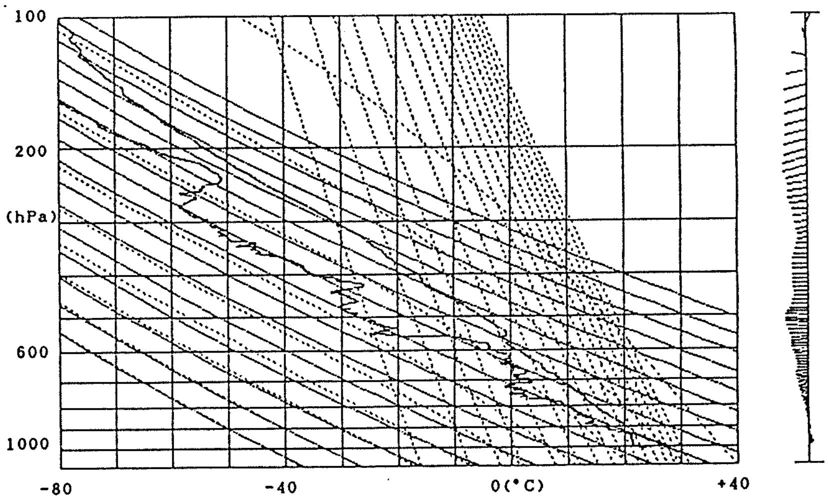
(36)

95071812 00-00S 156-03E



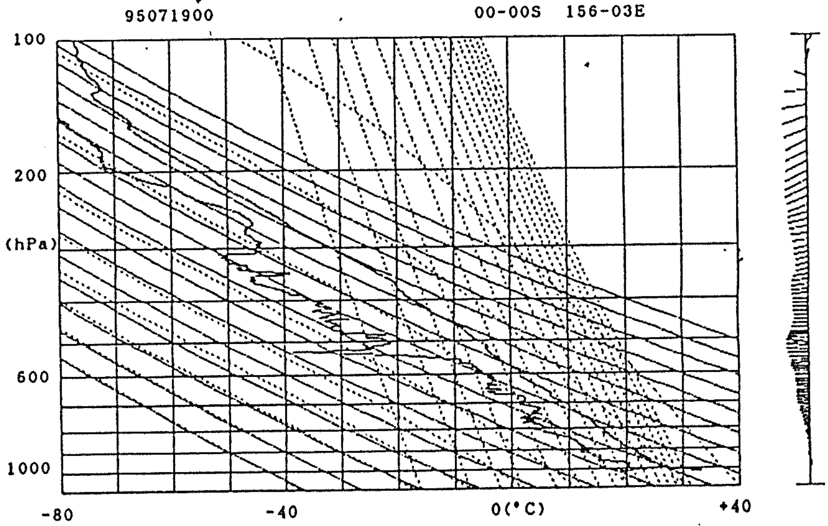
(37)

95071818 00-00N 156-00E

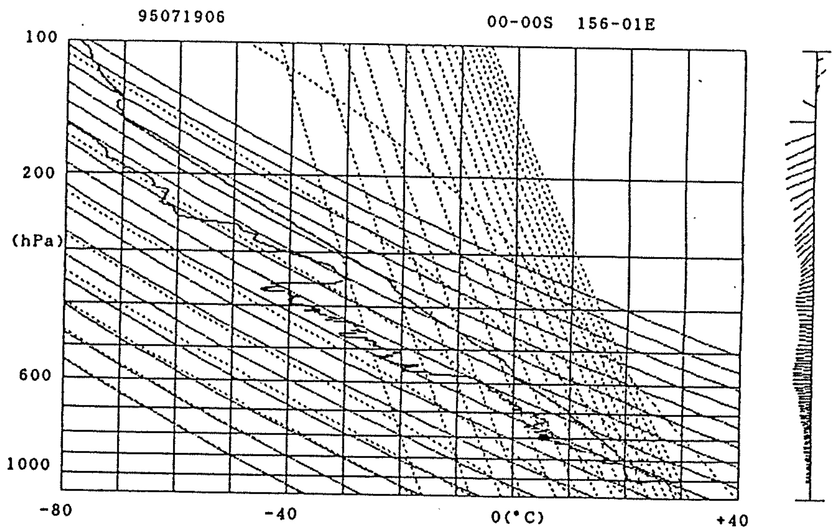


(38)

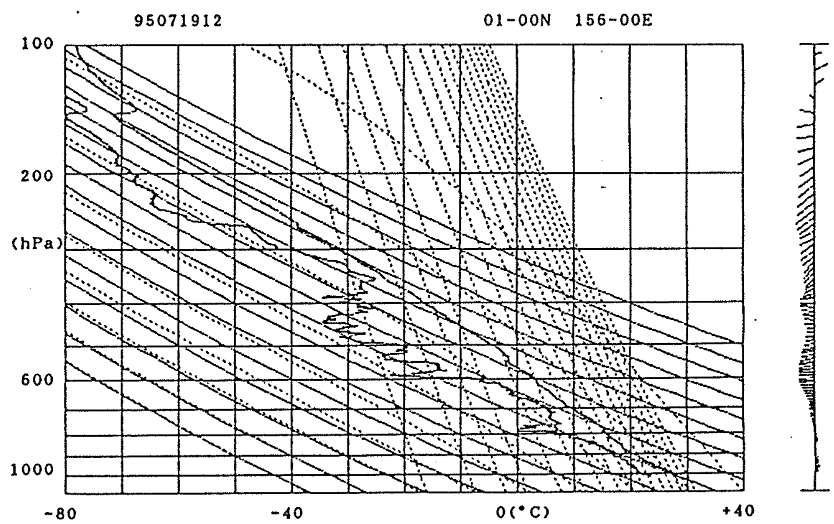
95071900 00-00S 156-03E



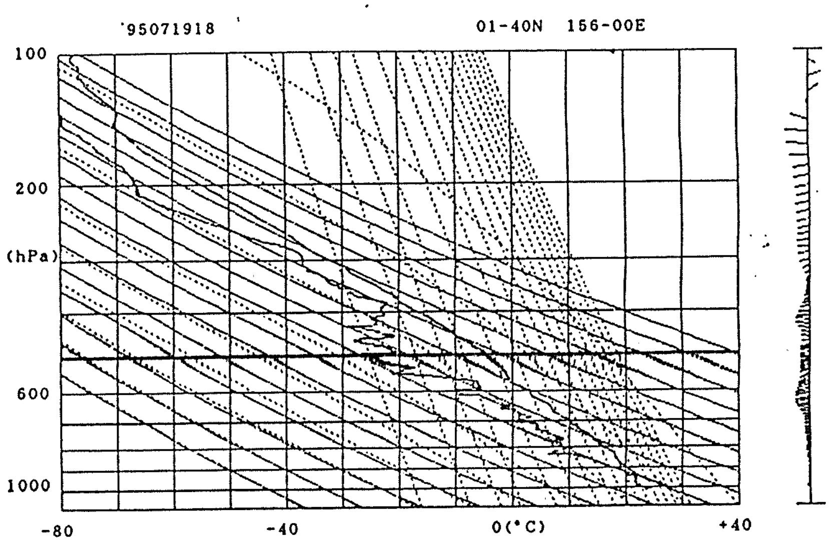
(39)

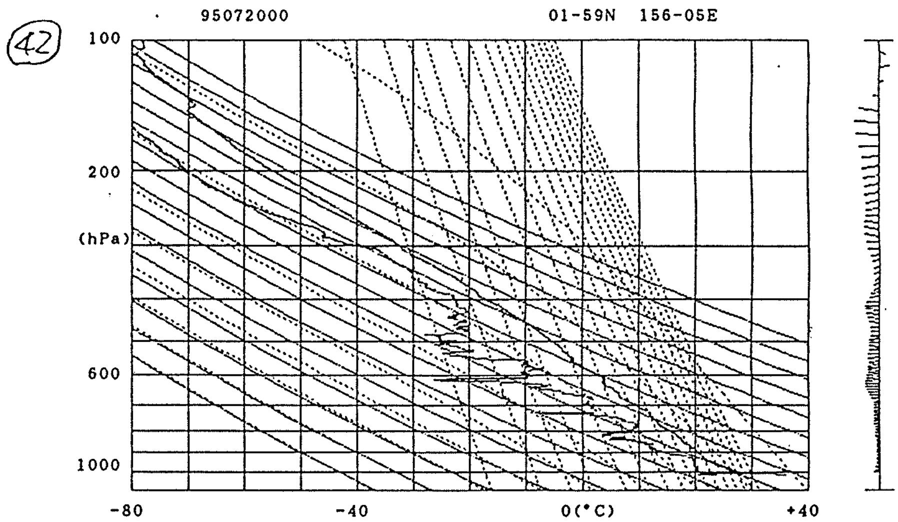

95071906
00-00S 156-01E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

(40)

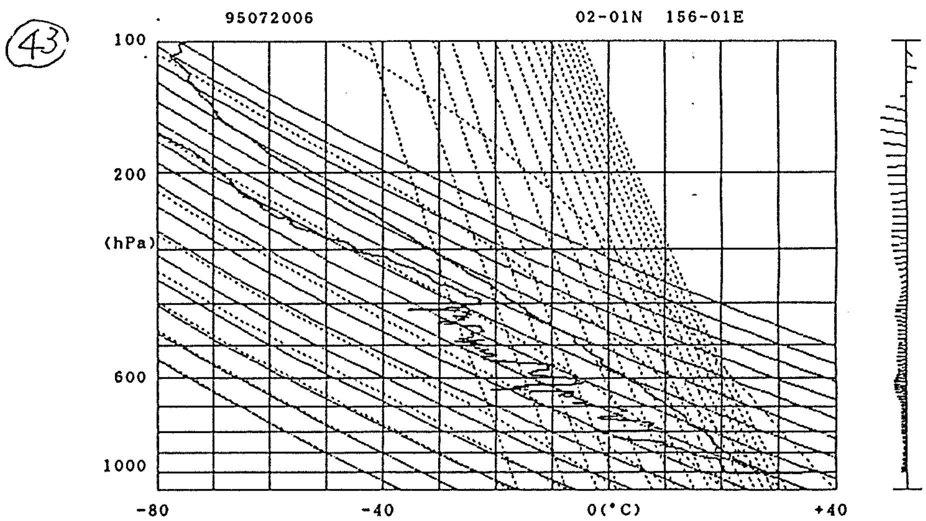

95071912
01-00N 156-00E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

(41)

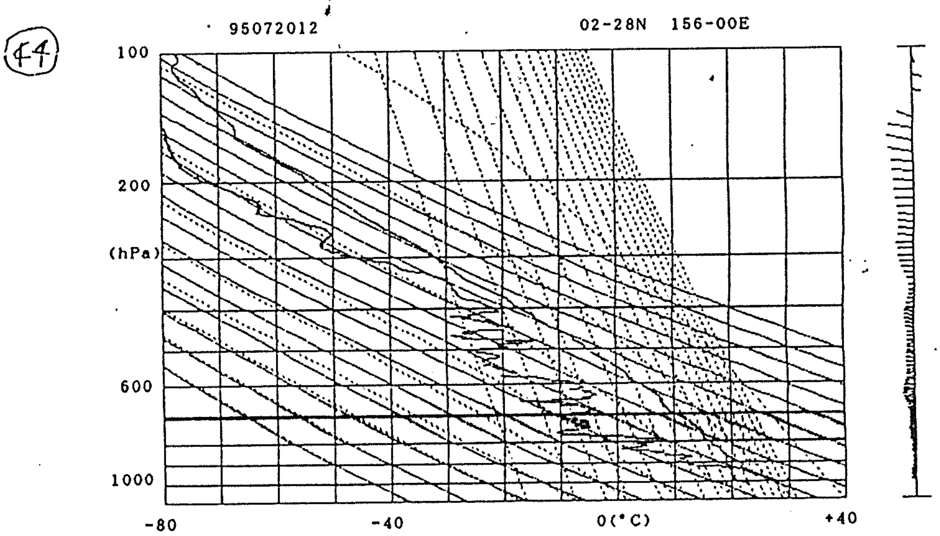

95071918
01-40N 156-00E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40



95072000
01-59N 156-05E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40



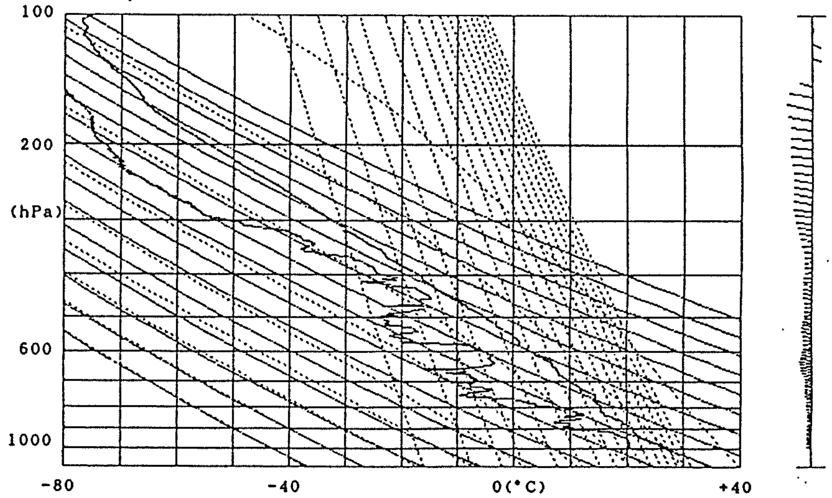
95072006
02-01N 156-01E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40



95072012
02-28N 156-00E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

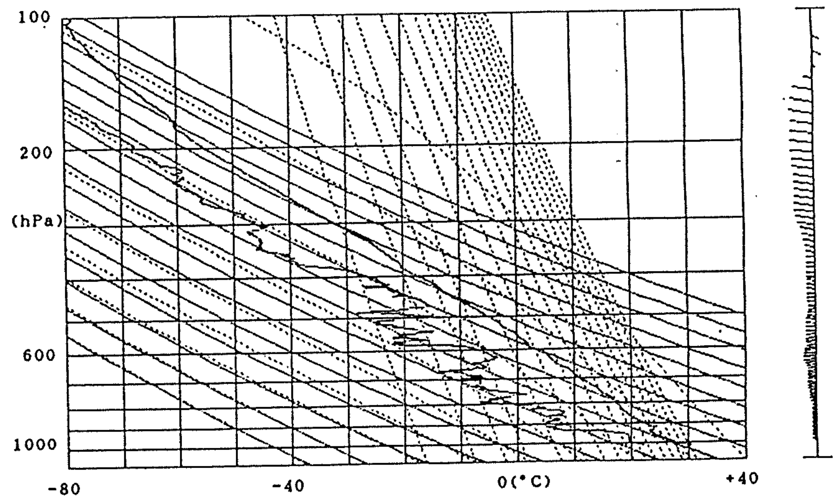
(45)

95072018 02-30N 155-58E



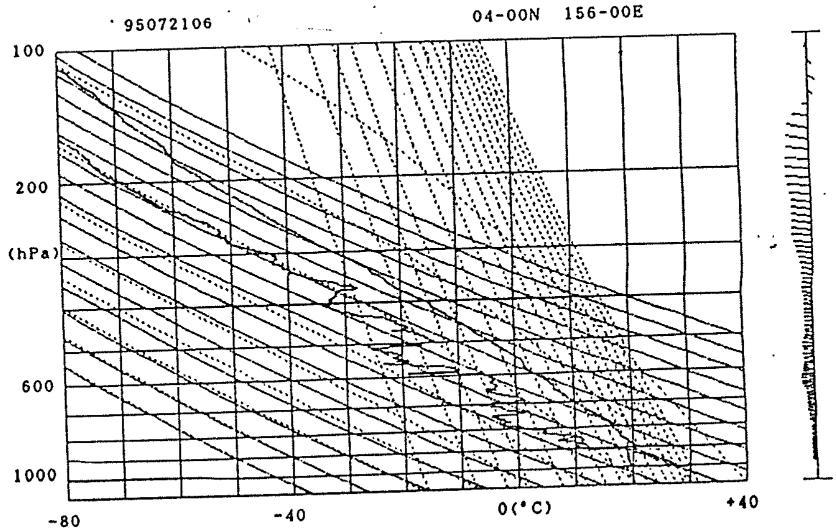
(46)

95072100 03-00N 156-00E

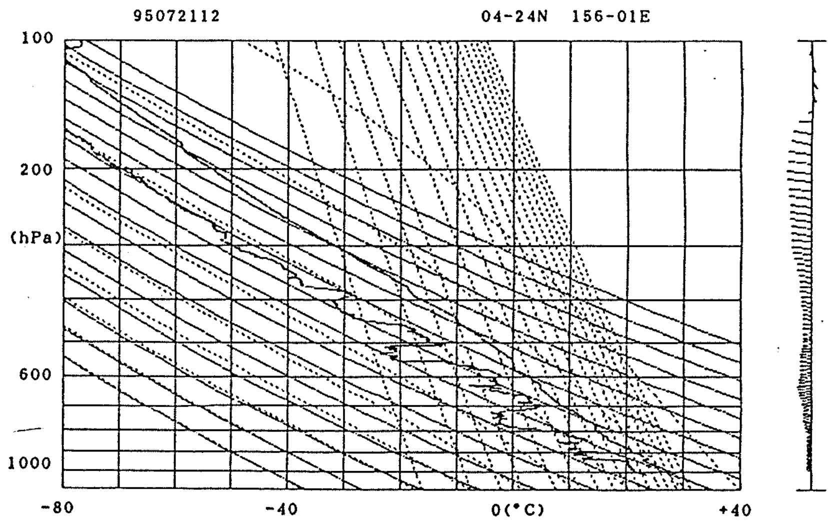


(47)

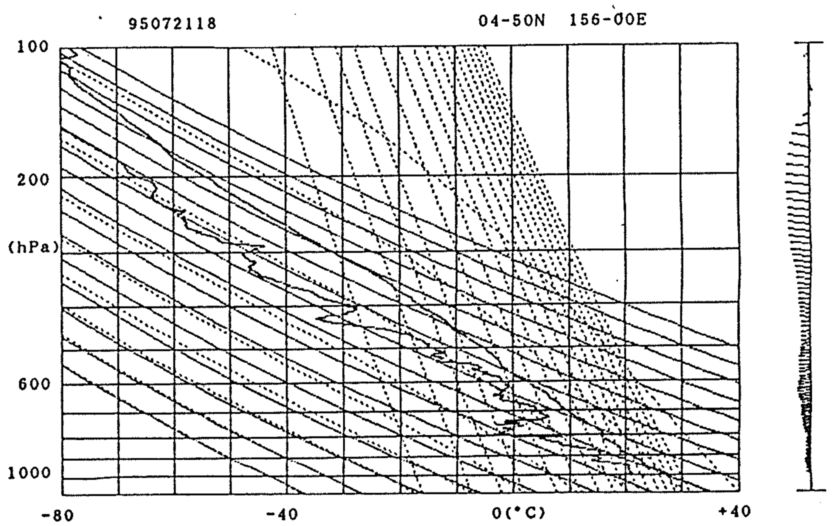
95072106 04-00N 156-00E



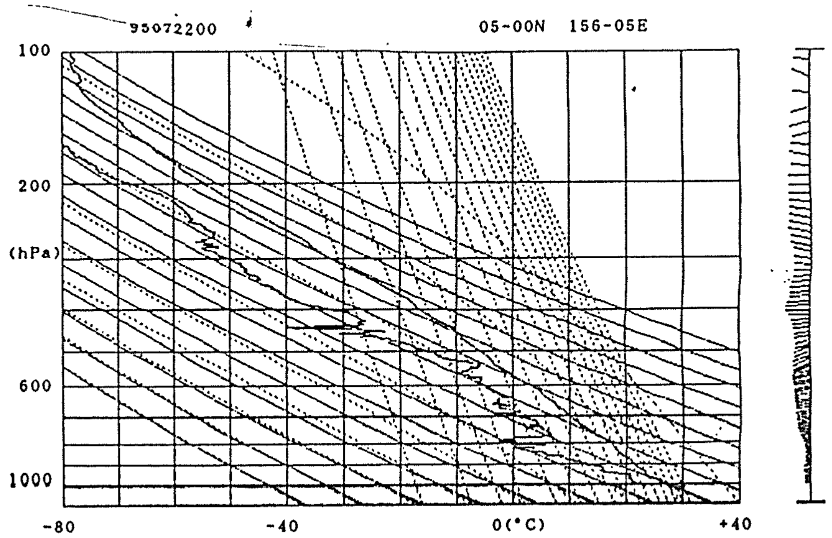
(48)


95072112
04-24N 156-01E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

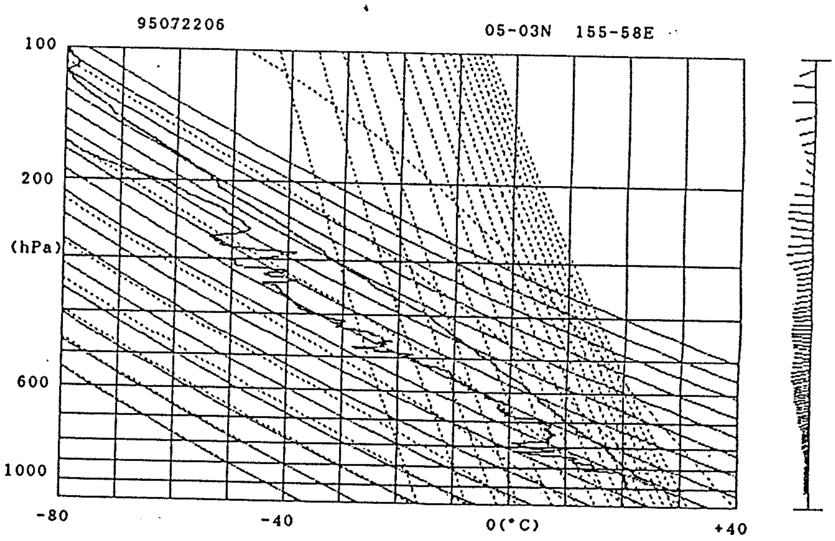
(49)


95072118
04-50N 156-00E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

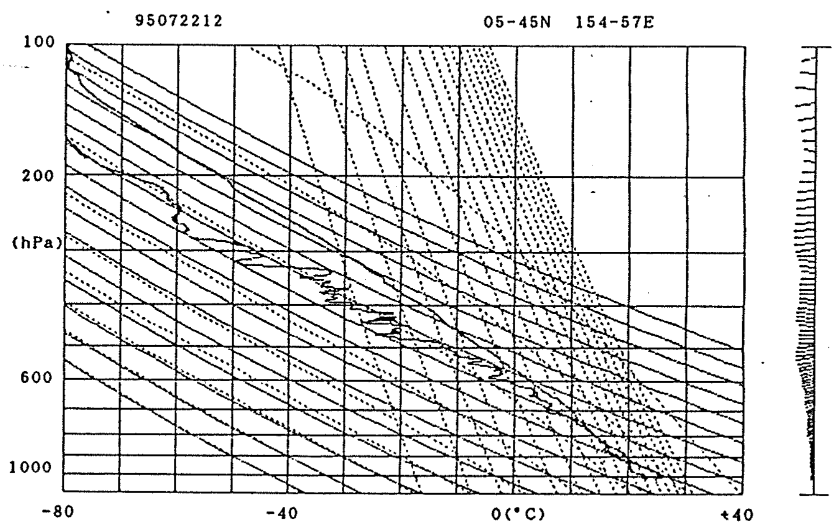
(50)


95072200
05-00N 156-05E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

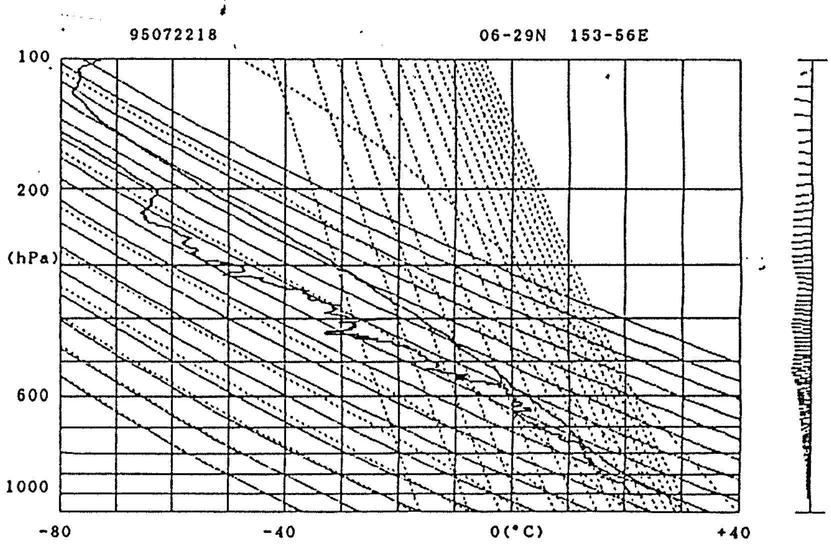
(51)


95072206
05-03N 155-58E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

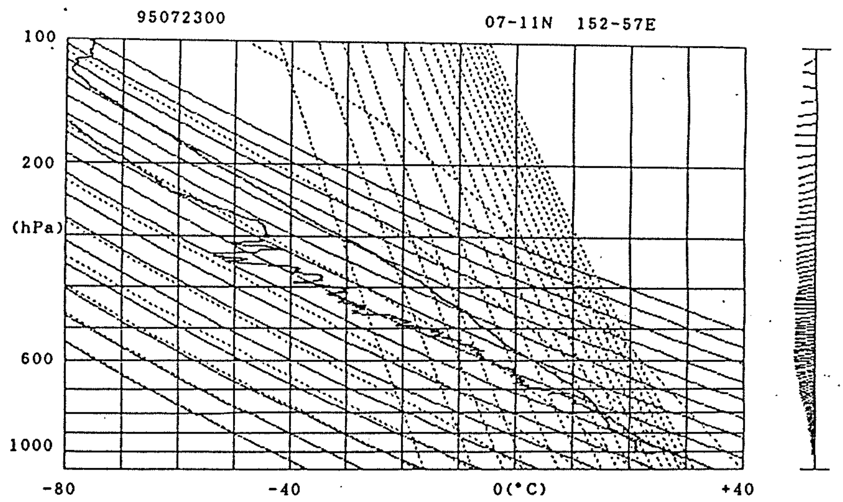
(52)


95072212
05-45N 154-57E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

(53)

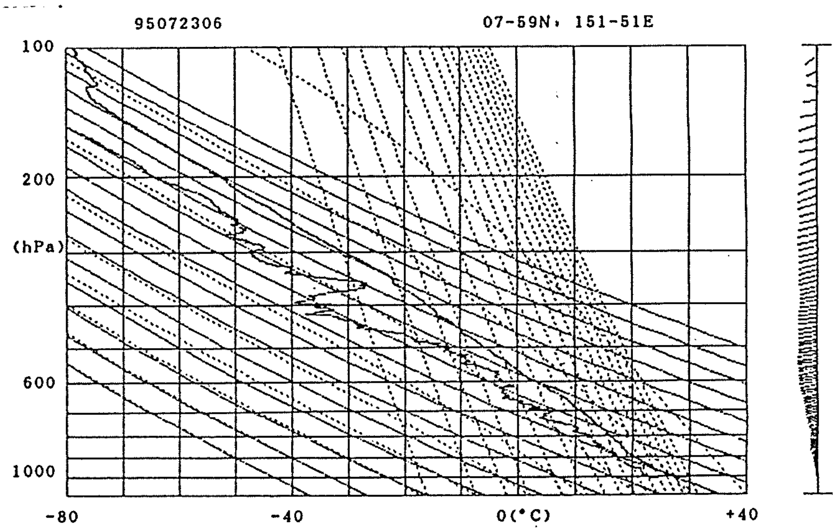

95072218
06-29N 153-56E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

(54)



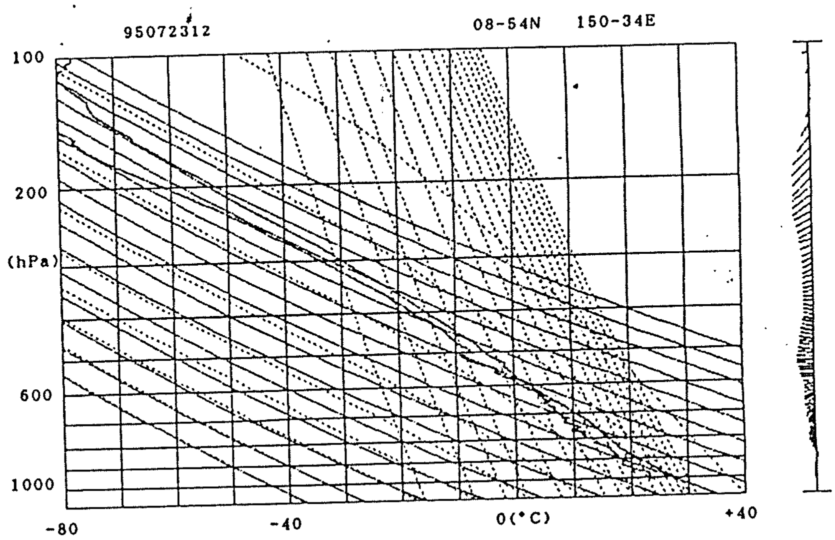
95072300
07-11N 152-57E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

(55)



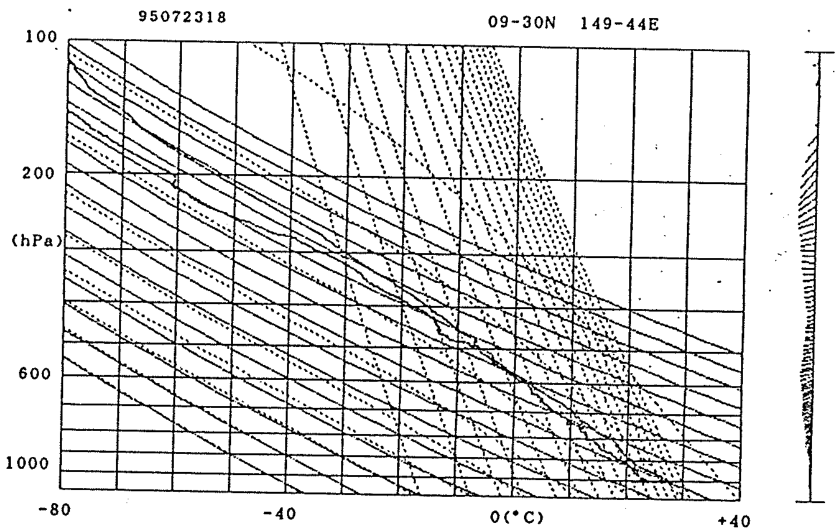
95072306
07-59N, 151-51E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

(56)

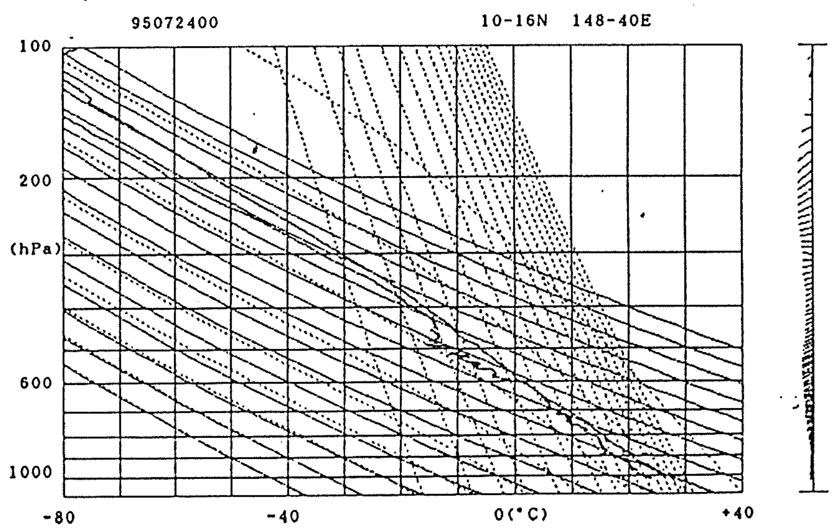


95072312
08-54N 150-34E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

(57)

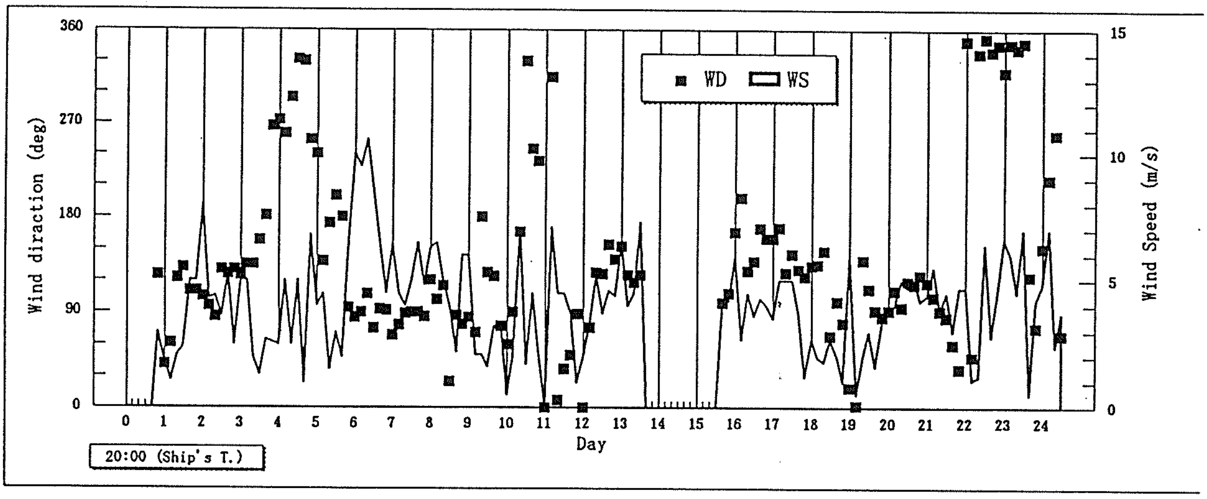

95072318
09-30N 149-44E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

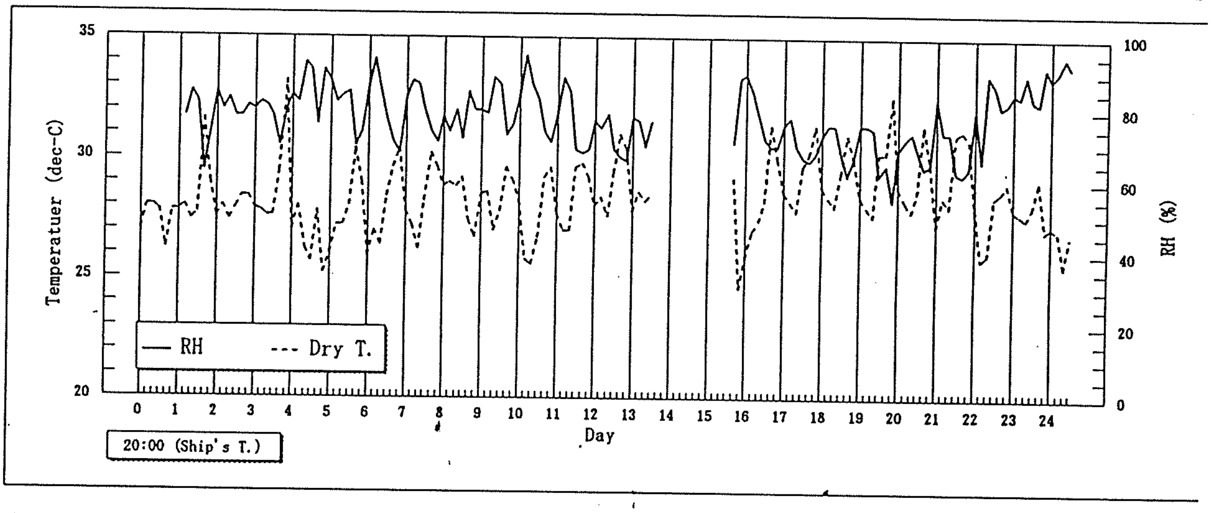
(58)


95072400
10-16N 148-40E
100
200
(hPa)
600
1000
-80
-40
0(°C)
+40

5.2 Surface Meteorological Measurments

We observated several parameter of surface meteorological every 4 hours from Palau to Kavieng and form Kavieng to Guam (Fig. 5-2 and Table5-2).





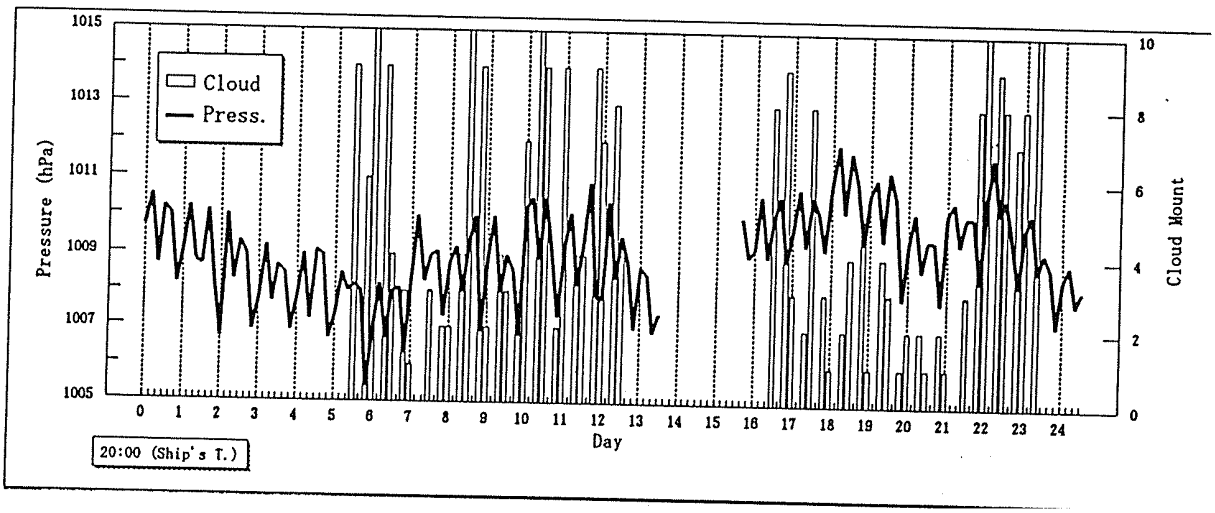


Table 5-2 Surface Meteorological Mesurements

Time UTC	Ship's T.	Position lat.	Long.	W.D. (deg)	W.S. (m/s)	Weather	Press. (hP)	Dry Temp. (DEG-C)	Wet Temp. (DEG-C)	Sea W.T. (DEG-C)	RH (%)
95 JUN 30 3	JUN 30 12	PALAU				bc	1010.2	31.5			
7	16	N	E			c	1008.9	27.5		29	
11	20	N	E			bc	1009.7	27.0		27	
15	24	N	E			bc	1010.5	28.0		29	
19	JUL 1 4	N	E			bc	1008.7	28.0		29	
23	8	N	E			c	1010.2	27.8		28	
JUL 1 3	12	N	E			c	1010.0	26.2		28	
7	16	6 0 N	130 0 E	125	3.0	c	1008.2	27.8		29	
11	20	6 0 N	129 34 E	41	1.8	bc	1009.1	27.8		28	
15	24	6 1 N	129 7 E	61	1.1	bc	1010.2	28.0	25.0	29	78
19	2 4	5 49 N	128 19 E	122	2.1	bc	1008.8	27.4	25.2	29	85
23	8	6 0 N	127 46 E	132	2.4	bc	1008.7	27.7	25.1	29	82
2 3	12	5 55 N	126 60 E	110	5.0	bc	1010.1	31.6	25.8	29	63
7	16	5 26 N	127 21 E	110	5.0	bc	1008.2	29.0	25.4	30	74
11	20	4 53 N	127 41 E	105	8.0	c	1006.7	27.5	25.5	29	85
15	24	4 33 N	127 36 E	96	4.3	bc	1010.0	28.0	25.2	29	80
19	3 4	4 5 N	127 33 E	86	4.4	bc	1008.3	27.4	25.2	29	83
23	8	4 4 N	127 30 E	130	3.6	bc	1009.3	27.9	24.9	29	78
3 3	12	3 39 N	127 55 E	126	5.3	bc	1009.0	28.4	25.4	28	78
7	16	3 11 N	128 26 E	130	2.5	bc	1006.9	28.4	25.8	28	81
11	20	3 12 N	128 22 E	125	5.0	bc	1007.7	27.9	25.2	29	80
15	24	3 14 N	128 20 E	135	5.0	bc	1009.2	27.8	25.4	28	82
19	4 4	3 12 N	128 27 E	135	2.0	bc	1007.7	27.6	25.0	29	81
23	8	3 14 N	128 29 E	158	1.3	bc	1008.7	27.6	24.6	28	78
4 3	12	3 14 N	128 29 E	181	2.7	bc	1008.5	29.4	25.0	28	70
7	16	3 13 N	128 27 E	267	2.6	bc	1006.9	33.2	30.0	29	80
11	20	3 23 N	128 3 E	273	2.5	bc	1007.8	27.0	24.9	29	84
15	24	3 30 N	127 53 E	260	5.0	c	1009.0	28.0	25.6	28	82
19	5 4	3 27 N	127 53 E	295	2.5	c	1007.2	26.2	25.3	28	93
23	8	3 40 N	127 55 E	332	5.0	c	1009.1	25.7	24.6	28	91
5 3	12	4 18 N	128 2 E	330	1.0	c	1009.0	27.8	24.4	28	76
7	16	3 44 N	128 22 E	254	6.8	c	1006.7	25.2	24.1	28	91
11	20	3 14 N	128 40 E	240	4.0	c	1007.3	26.0	24.5	29	88
15	24	2 43 N	128 58 E	138	4.5	c	1008.5	27.2	24.8	29	82
19	6 4	3 11 N	129 0 E	174	1.5	bc	1008.0	27.2	25.0	29	84
23	8	2 0 N	129 20 E	200	3.0	c	1008.2	28.0	26.0	29	85
6 3	12	2 0 N	130 0 E	180	2.0	bc	1008.0	30.4	25.8	29	70
7	16	2 0 N	130 36 E	94	6.5	bc	1005.4	29.0	25.4	29	74
11	20	2 0 N	131 12 E	85	10.0	c	1006.9	25.9	25.0	29	86
15	24	2 0 N	131 56 E	90	9.5	c	1008.2	27.0	26.2	29	94
19	7 4	3 0 N	132 33 E	107	10.6	c	1006.7	26.4	24.5	29	85
23	8	3 0 N	133 10 E	75	8.5	bc	1008.0	28.4	25.1	29	77
7 3	12	2 0 N	133 53 E	93	6.5	bc	1008.1	29.6	25.4	29	71
7	16	2 0 N	134 30 E	92	4.5	bc	1006.3	30.4	25.6	29	68
11	20	2 0 N	135 8 E	69	6.4	bc	1008.3	27.8	25.4	29	83
15	24	2 0 N	135 52 E	78	4.5	bc	1010.0	27.2	25.6	29	88
19	8 4	2 0 N	136 32 E	89	4.0	bc	1008.3	26.2	24.5	29	87
23	8	2 0 N	137 10 E	90	5.0	bc	1009.0	28.2	25.4	29	80
8 3	12	2 0 N	137 57 E	90	6.5	bc	1009.1	30.2	26.4	29	74
7	16	1 28 N	138 0 E	86	4.8	bc	1007.3	29.6	25.4	29	71
11	20	0 50 N	138 0 E	120	6.3	bc	1008.8	28.8	25.6	29	78
15	24	0 14 N	138 3 E	102	6.5	bc	1009.2	29.0	25.4	29	74
19	9 4	0 1 S	138 6 E	115	5.0	bc	1008.0	28.8	26.0	29	80
23	8	0 1 S	138 2 E	25	4.0	bc	1009.3	29.2	25.2	29	72
9 3	12	0 0 S	138 22 E	87	2.2	c	1010.0	27.4	25.4	29	85
7	16	0 0 N	139 2 E	79	6.0	o	1006.9	26.7	24.0	29	80
11	20	0 0 S	139 44 E	85	6.0	bc	1008.9	28.5	25.6	29	80
15	24	0 0 N	140 19 E	71	2.1	bc	1010.0	28.6	25.6	29	79
19	10 4	0 0 S	141 0 E	180	2.1	bc	1008.0	27.0	25.6	29	89
23	8	0 40 S	141 16 E	127	1.6	bc	1009.0	27.8	26.1	29	87
10 3	12	1 23 S	141 35 E	124	3.2	bc	1008.6	29.6	25.6	29	73
7	16	2 9 S	141 52 E	77	3.2	bc	1006.8	29.1	25.6	29	76
11	20	2 40 S	142 0 E	60	0.5	bc	1010.2	28.2	26.0	29	84
15	24	2 28 S	142 0 E	90	2.0	bc	1010.5	25.8	25.2	29	95
19	11 4	2 33 S	142 0 E	166	7.1	r	1008.9	25.6	24.0	29	87
23	8	2 26 S	142 58 E	330	1.7	c	1010.5	26.7	24.5	29	83
11 3	12	2 0 S	142 1 E	245	4.5	bc	1009.2	29.2	25.4	29	74
7	16	1 28 S	142 0 E	233	2.3	bc	1007.3	29.6	25.4	29	71
11	20	0 55 S	142 0 E	calm	0.0	bc	1009.2	27.7	24.8	29	79
15	24	0 16 S	142 1 E	315	7.1	c	1010.1	27.0	25.6	29	89
19	12 4	0 1 S	142 28 E	7	4.5	bc	1008.2	27.0	25.0	29	85
23	8	0 0 S	143 2 E	37	4.5	bc	1009.3	29.6	25.1	29	69

6. Shipboard ADCP Velocity Map

係留記録

係留系 No.940222-MARK I

プロジェクト	WOCE	メモ	
海域	TALAUD-MOROTAI Is.		
位置	03°12.6N 128°26.7E		
水深	2330m	基準時	UTC
期日	(自)940222 (至)	記録者 設置	
係留日数	予定 実績	回収	

全長 68 m 先端ブイ高度 m 正味浮力 kg シンカー水中重量 kg

トランスポンダ

型名	BENTHOS	型名	
S/N	630	S/N	
Receive F.	13.0	Receive F.	
Transmit F	13.5	Transmit F	
Enable C.	B	Enable C.	
Release C.	A	Release C.	
電池電圧		電池電圧	
船上テスト	応答 切離 セット	船上テスト	応答 切離 セット

設置

日時 94年 2月22日 05:50 ~ 05:57 船名 かいよう 航海番号 K93-07
天候 bc 海況 3 風向 NNW 風力 4
先端ブイ投入 シンカー投入 5:58 先端ブイ水没
着底時刻 6:17 測深値 2330m キャリブレーション深度 2220
船位 03°13.611N 128°26.670E 水平距離 1827m 方位 181.5°
投入地点 03°12.582N 128°26.696E 航法装置
設置地点(SSBL推定値) 03°12.660N 128°26.680E 降下速度 2.0 m/s

設置作業

メモ

SSBL 記録

時刻	S/R	水深
6:01	351.9	318.8
6:04	729.4	684.8
6:07	1080.4	1029.9
6:10	1453.6	1405.4

メモ

SSBL 記録

時刻	S/R	水深
6:13	1806.2	1753.6
6:16	2179.2	2117.2
6:17		2256

回収

日時 年 7月 3日 ~ 21:37 船名 航海番号
天候 海況 風向 風力
切離開始時刻 20:57 切離完了時刻 21:02
発見位置 航法装置
発見方位 距離 浮上速度 m/s

回収作業

メモ

SSBL 記録

時刻	S/R	水深

メモ

SSBL 記録

時刻	S/R	水深

浮上 21:25

係留記録

係留系 No.940222-MARK Ⅱ

プロジェクト	WOCE	メモ	
海域	TALAUD-MOROTAI Is.		
位置	03°27.8N 127°52.9E		
水深	2190m (計算値)	基準時	UTC
期日	(自)940223 (至)	記録者 設置	伊藤
係留日数	予定 実績	回収	

全長 m 先端ブイ高度 m 正味浮力 kg シンカー水中重量 kg

トランスポンダ

型名	BENTHOS.	型名	
S/N	632	S/N	
Receive F.	13.0	Receive F.	
Transmit F	14.0	Transmit F	
Enable C.	D	Enable C.	
Release C.	C	Release C.	
電池電圧		電池電圧	
船上テスト	応答 切離 セット	船上テスト	応答 切離 セット

設置

日時 94 年 2 月 22 日 23:50 ～ 24:00 船名 かいよう 航海番号 K93-07
天候 bc 海況 3 風向 N 風力 4
先端ブイ投入 シンカー投入 24:00 先端ブイ水没
着底時刻 24:14 測深値 2190m キャリブレーション深度 2140
船位 03°26.956N 127°54.078 水平距離 2729 方位 303.3
投入地点 03°27.778N 127°52.884E 航法装置 GPS
設置地点(SSBL推定値) 03°27.780N 127°52.87E 降下速度 2.3 m/s

設置作業

メモ

SSBL 記録

時刻	S/R	水深
24:03	556.2	468.2
24:06	1158.1	811.6
24:09	1622.4	1236.6
24:12	2193.7	1611.9

メモ

SSBL 記録

時刻	S/R	水深
24:14	2746.7	2037.1

回収

日時 年 7 月 4 日 ～ 船名 かいよう 航海番号 K94-05
天候 海況 風向 風力
切離開始時刻 20:52 切離完了時刻 20:55
発見位置 航法装置
発見方位 距離 浮上速度 m/s

回収作業

メモ

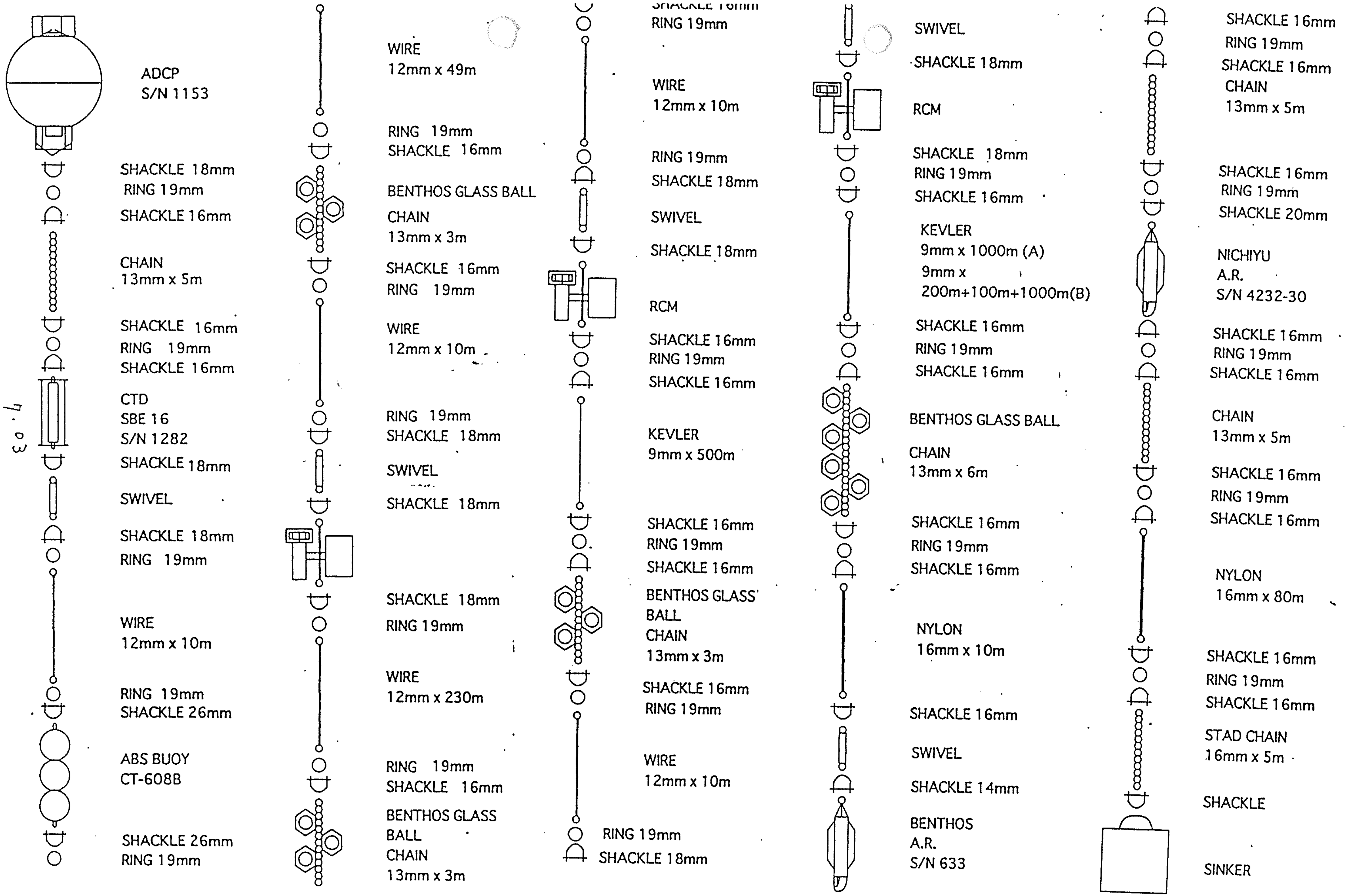
SSBL 記録

時刻	S/R	水深

メモ

SSBL 記録

時刻	S/R	水深


ADCP
S/N 1153
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
CHAIN
13mm x 5m
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
CTD
SBE 16
S/N 1282
SHACKLE 18mm
SWIVEL
SHACKLE 18mm
RING 19mm
WIRE
12mm x 10m
RING 19mm
SHACKLE 26mm
ABS BUOY
CT-608B
SHACKLE 26mm
RING 19mm
WIRE
12mm x 49m
RING 19mm
SHACKLE 16mm
BENTHOS GLASS BALL
CHAIN
13mm x 3m
SHACKLE 16mm
RING 19mm
WIRE
12mm x 10m
RING 19mm
SHACKLE 18mm
SWIVEL
SHACKLE 18mm
SHACKLE 18mm
RING 19mm
WIRE
12mm x 230m
RING 19mm
SHACKLE 16mm
BENTHOS GLASS
BALL
CHAIN
13mm x 3m
SHACKLE 16mm
RING 19mm
WIRE
12mm x 10m
RING 19mm
SHACKLE 18mm
SWIVEL
SHACKLE 18mm
RCM
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
KEVLER
9mm x 500m
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
BENTHOS GLASS
BALL
CHAIN
13mm x 3m
SHACKLE 16mm
RING 19mm
WIRE
12mm x 10m
RING 19mm
SHACKLE 18mm
SWIVEL
SHACKLE 18mm
RCM
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
KEVLER
9mm x 1000m (A)
9mm x
200m+100m+1000m(B)
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
BENTHOS GLASS BALL
CHAIN
13mm x 6m
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
NYLON
16mm x 10m
SHACKLE 16mm
SWIVEL
SHACKLE 14mm
BENTHOS
A.R.
S/N 633
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
CHAIN
13mm x 5m
SHACKLE 16mm
RING 19mm
SHACKLE 20mm
NICHIYU
A.R.
S/N 4232-30
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
CHAIN
13mm x 5m
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
NYLON
16mm x 80m
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
STAD CHAIN
16mm x 5m
SHACKLE
SINKER

係留記録

係留系 No.940221-

プロジェクト	WOCE	メモ	
海域	TALAUD - MOLOTAI Is.		
位置	04° 01.239 N ; 127° 30.634 E		
水深	2580 m (Seabeam)	基準時	UTC
期日	(自) 940221 (至)	記録者 設置	伊藤
係留日数	予定 330日 実績	回収	

全長 m　先端ブイ高度 2 m　正味浮力 650 kg　シンカー水中重量 1500 kg

トランスポンダ

型名	ベントス	型名	日油
S/N	633	S/N	4232-3D
Receive F.	13.0	Receive F.	
Transmit F	14.0	Transmit F	
Enable C.	E	Enable C.	なし
Release C.	D	Release C.	D
電池電圧		電池電圧	
船上テスト	応答 切離 セット	船上テスト	応答 切離 セット

設置

日時 '94年 2月 21日 09:03 ～ 1:55 船名 かいよう 航海番号 K93-07
天候 bc 海況 2 風向 NNE 風力 4
先端ブイ投入 00:07 シンカー投入 01:55 先端ブイ水没 02:06
着底時刻 02:10 測深値 2580 m キャリブレーション深度 2523 m
船位 04° 00.538 N 127° 30.611 E 水平距離 1292 m 方位 001.9°
投入地点 04° 01.324 N 127° 30.554 E 航法装置 GPS
設置地点(SSBL推定値) 04° 01.239 N 127° 30.634 E 降下速度 2.8 m/s

設置作業

メモ

SSBL 記録

時刻	S/R	水深
01:58		582.7
02:01		1132.2
02:04		1652.8
02:07		2115.2

メモ

SSBL 記録

時刻	S/R	水深
02:10		2440.5
02:		

回収

日時 年 7月 2日 21:22 ～ 23:12 船名 かいよう 航海番号 K95-05
天候 海況 風向 風力
切離開始時刻 20:55 切離完了時刻 21:05
発見位置 航法装置
発見方位 距離 浮上速度 m/s

回収作業

メモ

SSBL 記録

時刻	S/R	水深

メモ

SSBL 記録

時刻	S/R	水深

21:01 – 16回 – 2710
21:04 日油切離送信
21:11 浮上確認
7.04

0:03 開始 9:03 (LT)

係留記録

係留系 No.940221-

LT∞

名称	S/N, 種類, 型	個数等	設置時間	備考	回収時間	備考
ADCP	11.53	1	0:07		21:50	21:22 作業艇降下
CTD	SBE16 1282	1	0:08	生物付着防止付	21:52	21:36 ブイにロープ取付
ABSブイ	CT-608B	3	0:14		21:56	
ベントスブイ	2040-17V	3	0:24		22:01	
RCM	①	1	0:25		22:05	
ベントスブイ	2040-17V	3	0:36		22:13	
RCM	②	1	0:37		22:17	
ベントスブイ	2040-17V	3	0:51		22:32	
RCM	③	1	0:52		22:35	100m
ベントスブイ	2040-17V	6	1:23		23:08	ケブラーとナイロンとがよりがはいってからむ。
A.R.	BENTHOS 633	1	1:24		23:09	
A.R.	日油 4232-3D	1	1:24		23:11	
シンカー	コンクリート	1	1:55	1:53まで航走		
WIRE	12 mm	10 m	✓		✓	
〃	〃	49 m	~~0:14~~ ~~~0:~~ ✓		21:59 ~22:01	
〃	〃	10 m	✓		✓	
〃	〃	230 m	0:25 ~0:31		22:08 ~22:13	
〃	〃	10 m				
KEVLER	9 mm	500 m	0:37 ~0:50		22:20 ~22:31	
WIRE	12 mm	10 m				
KEVLER	9 mm	1300 m	0:53~1:13 ~1:17~1:20	1000+200 +100	22:~~37~~41~22:59 ~23:08~	
NYLON	16 mm	10 m				
〃	16 mm	60 m	1:26~ 1:28			

7.05

係留記録

係留系 No. 940222

プロジェクト	WOCE	メモ	
海域	TALAUD-MOLOTAI Is.		
位置	03°10.8N 128°27.4E		
水深	2277 m (Seabeam)	基準時	UTC
期日	(自)940222 (至)	記録者 設置	伊藤
係留日数	予定 330日 実績	回収	

全長 m 先端ブイ高度 m 正味浮力 kg シンカー水中重量 kg

トランスポンダ

型名	ベントス	型名	日油
S/N	666	S/N	4237-3C
Receive F.	13.0	Receive F.	
Transmit F	14.5	Transmit F	
Enable C.	F	Enable C.	なし
Release C.	E	Release C.	C
電池電圧		電池電圧	
船上テスト	応答 切離 セット	船上テスト	応答 切離 セット

設置

日時 '94年 2月 22日 00:33 ~ 02:05 船名 かいよう 航海番号 K93-07
天候 bc 海況 3 風向 NNE 風力 4
先端ブイ投入 0:36 シンカー投入 2:05 先端ブイ水没 2:14
着底時刻 2:22 測深値 2277 キャリブレーション深度 2116
船位 水平距離 方位
投入地点 03°10.649N 128°27.273E 航法装置 GPS
設置地点(SSBL推定値) 03°10.793N 128°27.367E 降下速度 2.0 m/s

設置作業

メモ

SSBL 記録

時刻	S/R	水深
2:07	368.1	263.9
2:10	1002.9	765.3
2:13	1416.0	1260.0
2:16	1824.6	1667.7

メモ

15m オーバーシュート

SSBL 記録

時刻	S/R	水深
2:19	2252.1	2059.9
~~2:22~~		
2:20	2349.5	2130.8
2:		

回収

日時 年 7月 3日 06:34 ~ 07:46 船名 かいよう 航海番号 K95-05
天候 海況 風向 風力
切離開始時刻 ~~04~~ 06:01 切離完了時刻 ~~04~~ 06:05
発見位置 航法装置 WGS 84
発見方位 距離 浮上速度 m/s

回収作業

メモ

SSBL 記録

時刻	S/R	水深

メモ

SSBL 記録

時刻	S/R	水深

15:00 → 06:00

00:33 開始

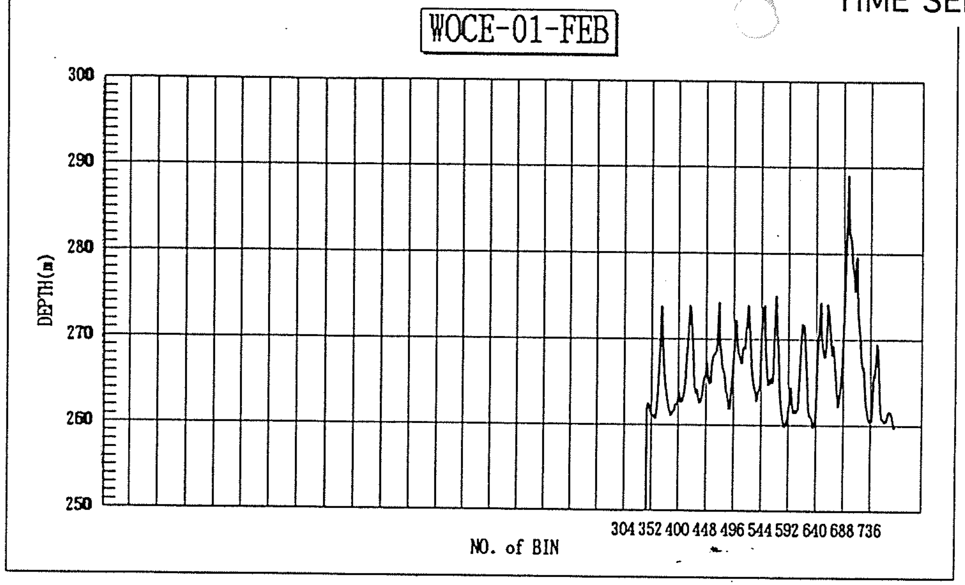
係留記録

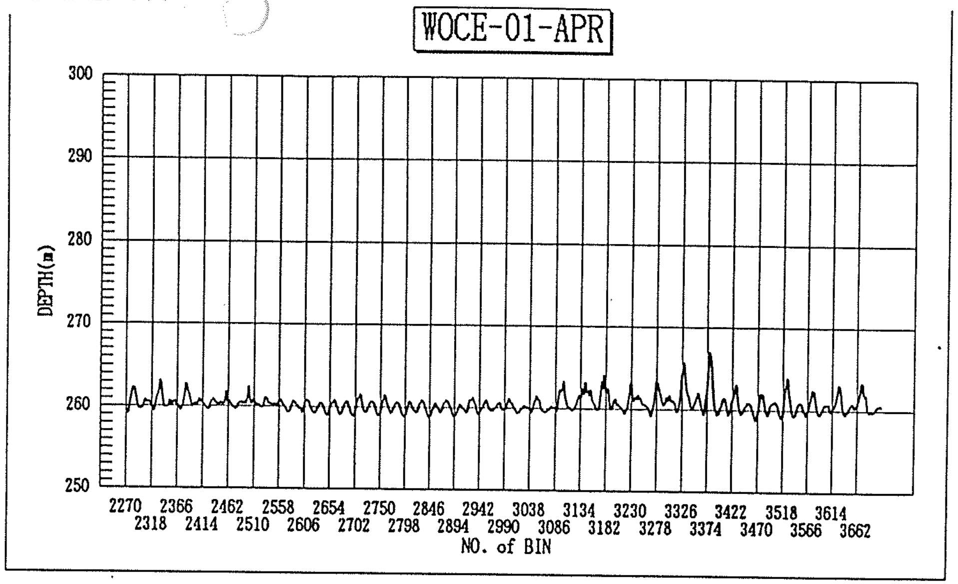
係留系 No. 940222-

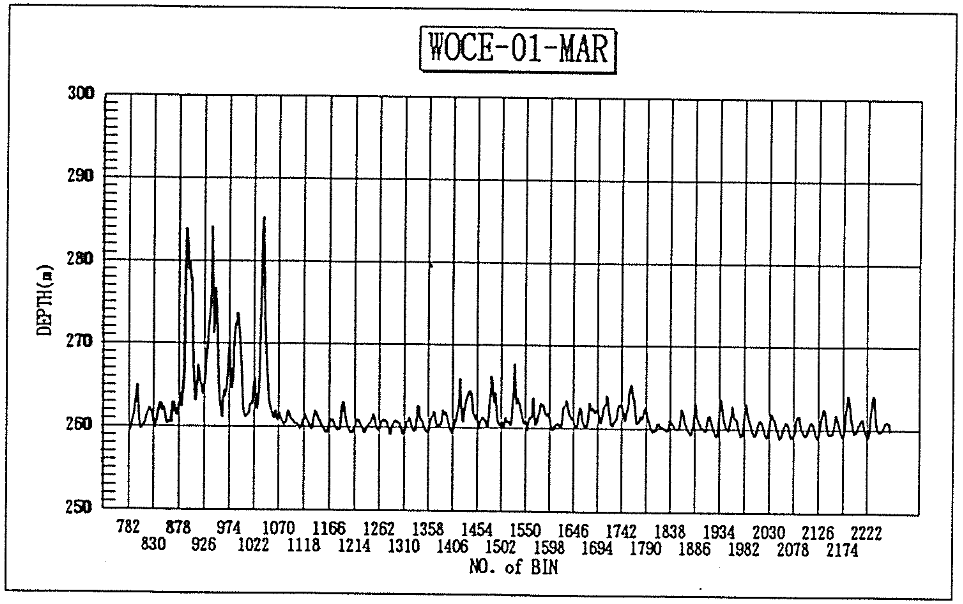
名称	S/N, 種類, 型	個数等	設置時間	備考	回収時間	備考
ADCP	1152	1	0:36		6:34	作業艇降下 6:18
CTD	SBE-16 1283	1	0:39		6:34	
ABSブイ	CT608B	3	0:42	*	6:42	
ベントスブイ		3	0:53	約7分トラブル	6:47	
RCM		1	0:54		6:51	
ベントスブイ		3	1:04		7:01	
RCM		1	1:05		7:04	
ベントスブイ		3	1:13		7:17	
RCM		1	1:14		7:20	
ベントスブイ		8	1:28		7:46	
A.R.	BENTHOS 666	1	1:29		7:52	
A.R.	日油 4237-3C	1	1:29		7:52	
シンカー		1	2:05	1:33 航走 ~2:00		
WIRE	12 mm	10 m	✓		✓	
〃	〃	49 m	✓		✓	
〃	〃	10 m			✓	
〃	〃	230 m	0:54 ~ 0:59		6:54 ~ 7:00	
〃	〃	10 m	✓			
KEVLER	9 mm	500 m	1:05 ~ 1:10		7:07 ~ 7:17	
WIRE	12 mm	10 m	✓			
KEVLER	9 mm	1000 m	1:14 ~ 1:25		7:23 ~ 7:46	
NYLON	16 mm	10 m	✓			
〃	16 mm	83 m	~~1:30~~ 1:31 ~ 1:32			

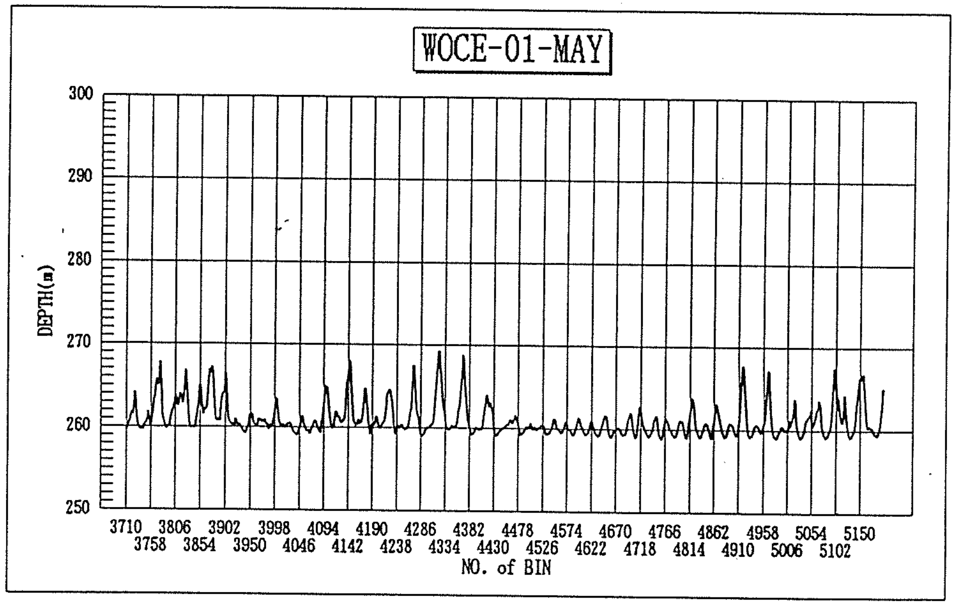
7.07

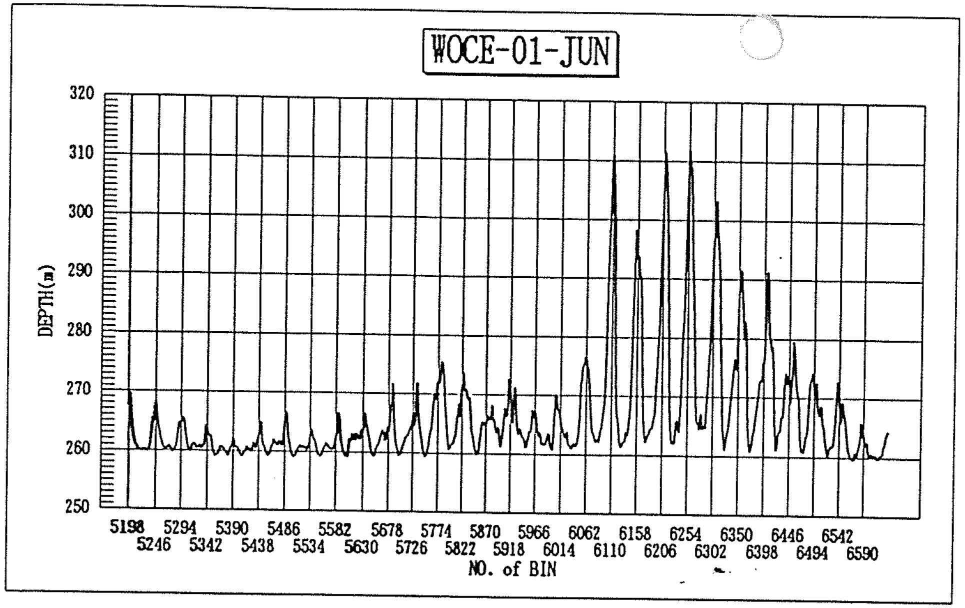
TIME SERIES OF CTD DEPTH

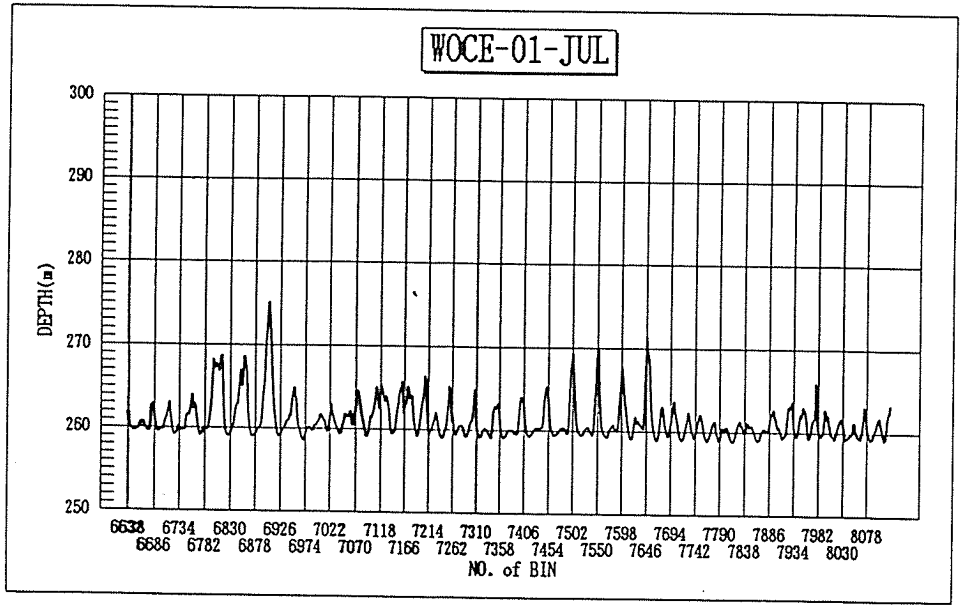


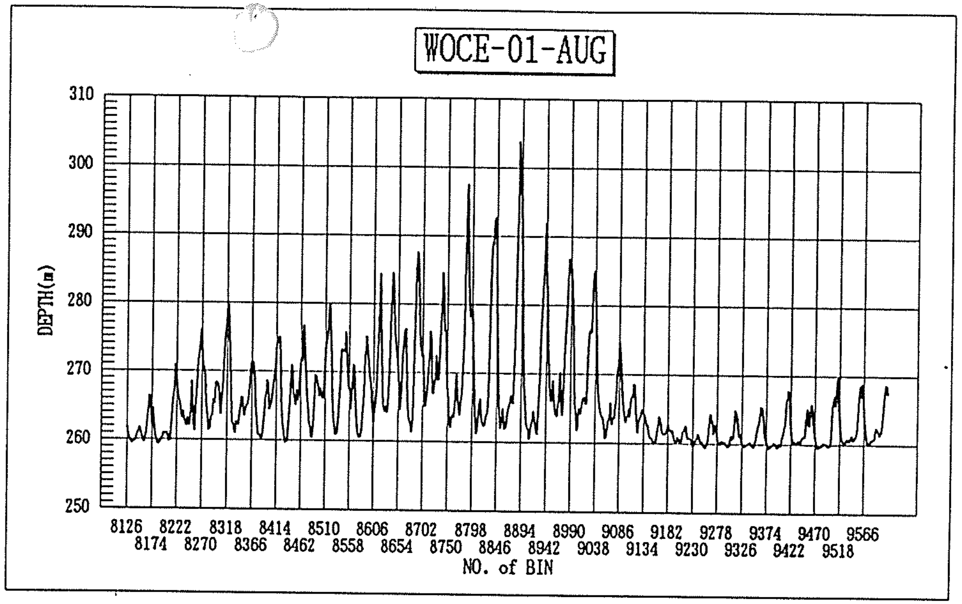


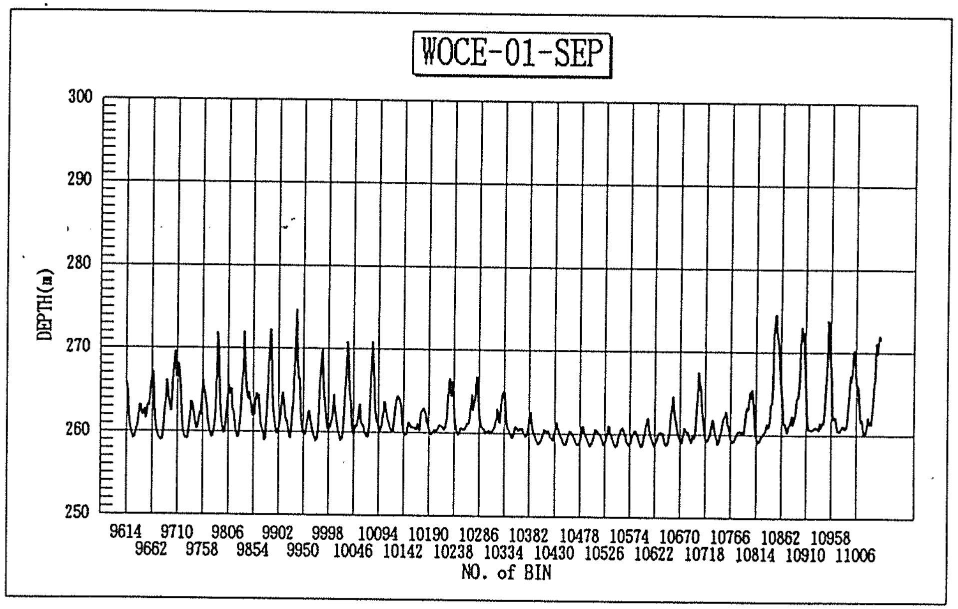


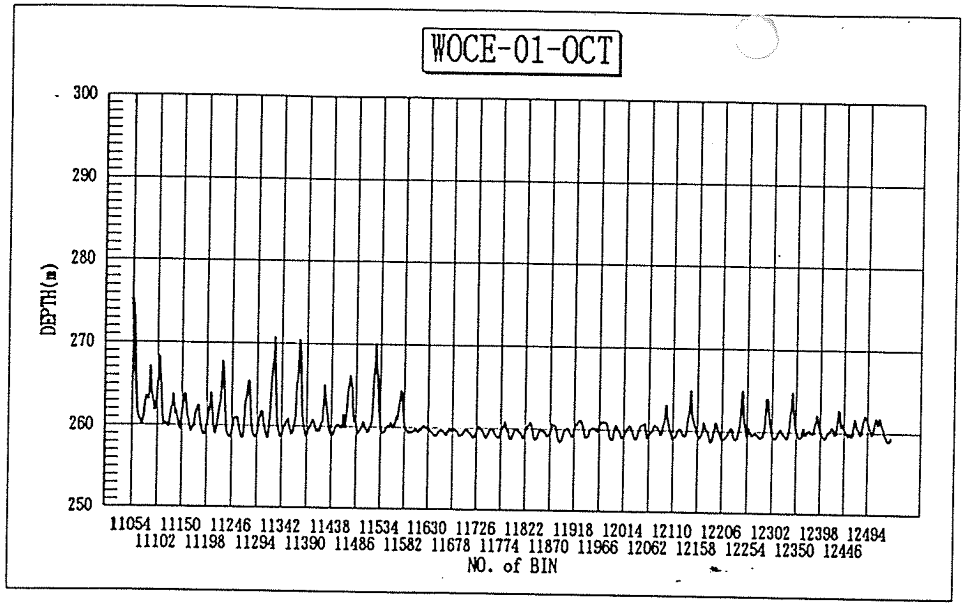


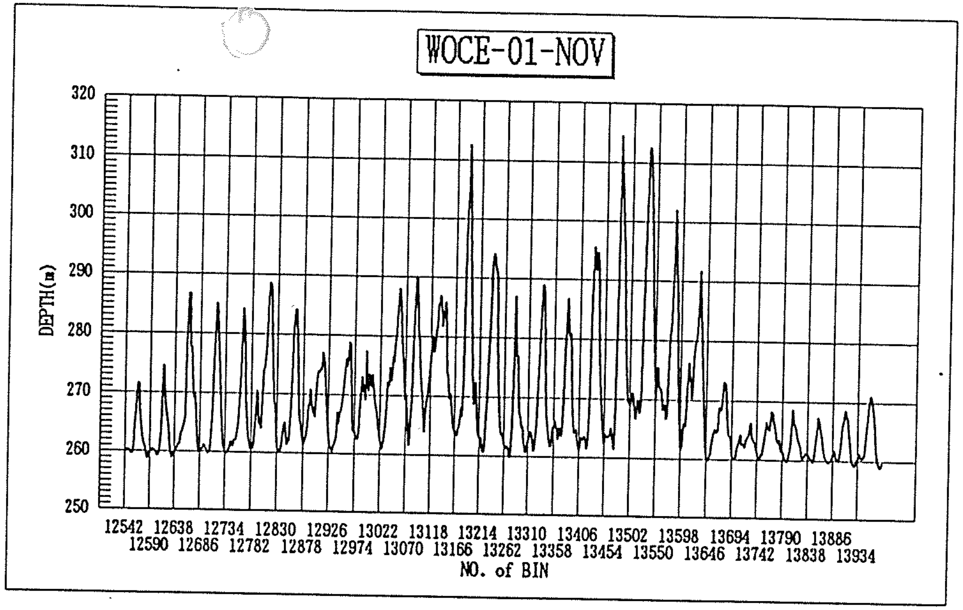

WOCE-01-JUN
DEPTH(m)
320 310 300 290 280 270 260 250
5198 5294 5390 5486 5582 5678 5774 5870 5966 6062 6158 6254 6350 6446 6542
5246 5342 5438 5534 5630 5726 5822 5918 6014 6110 6206 6302 6398 6494 6590
NO. of BIN

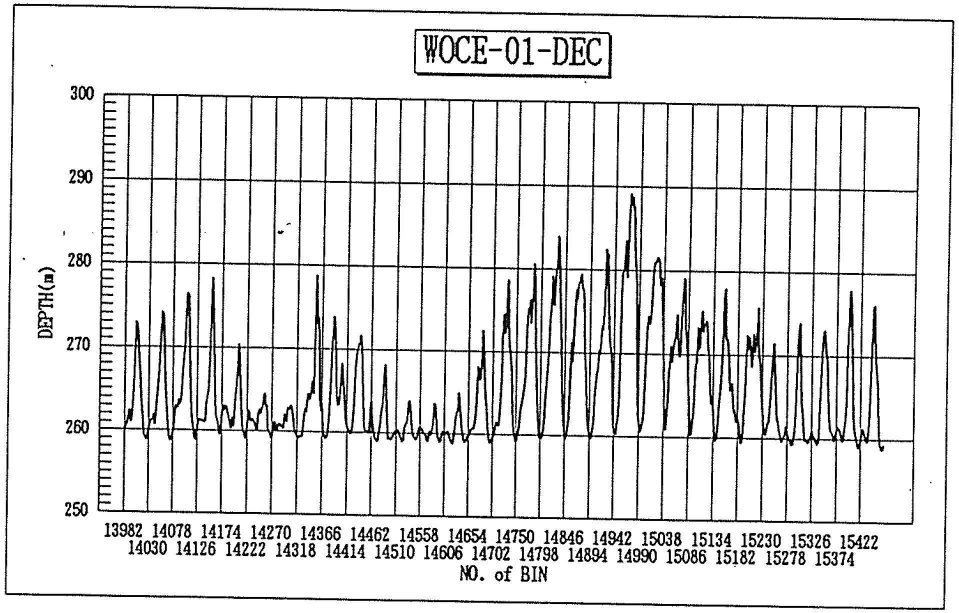

WOCE-01-JUL
DEPTH(m)
300 290 280 270 260 250
6638 6734 6830 6926 7022 7118 7214 7310 7406 7502 7598 7694 7790 7886 7982 8078
6686 6782 6878 6974 7070 7166 7262 7358 7454 7550 7646 7742 7838 7934 8030
NO. of BIN

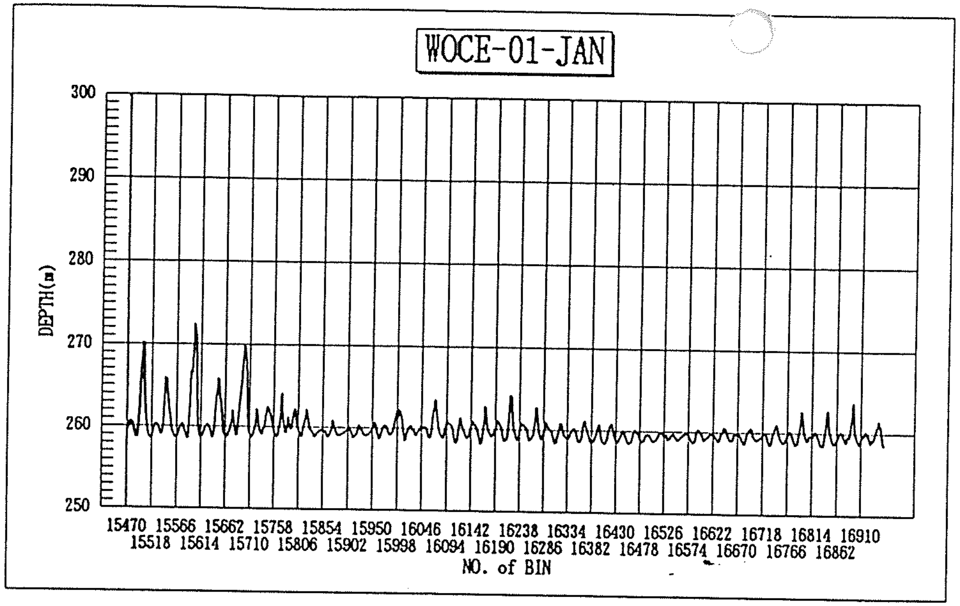

WOCE-01-AUG
DEPTH(m)
310 300 290 280 270 260 250
8126 8222 8318 8414 8510 8606 8702 8798 8894 8990 9086 9182 9278 9374 9470 9566
8174 8270 8366 8462 8558 8654 8750 8846 8942 9038 9134 9230 9326 9422 9518
NO. of BIN

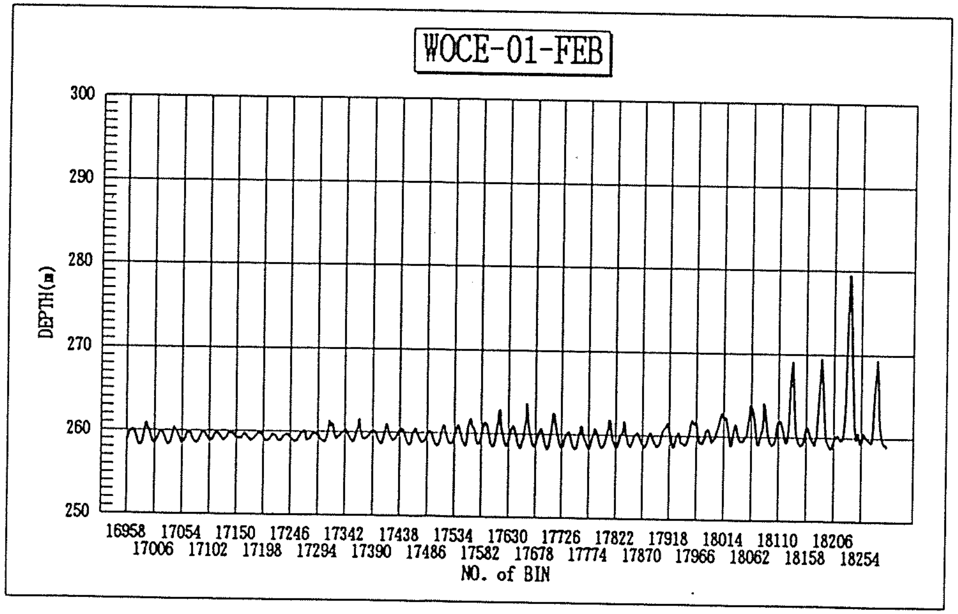

WOCE-01-SEP
DEPTH(m)
300 290 280 270 260 250
9614 9710 9806 9902 9998 10094 10190 10286 10382 10478 10574 10670 10766 10862 10958
9662 9758 9854 9950 10046 10142 10238 10334 10430 10526 10622 10718 10814 10910 11006
NO. of BIN

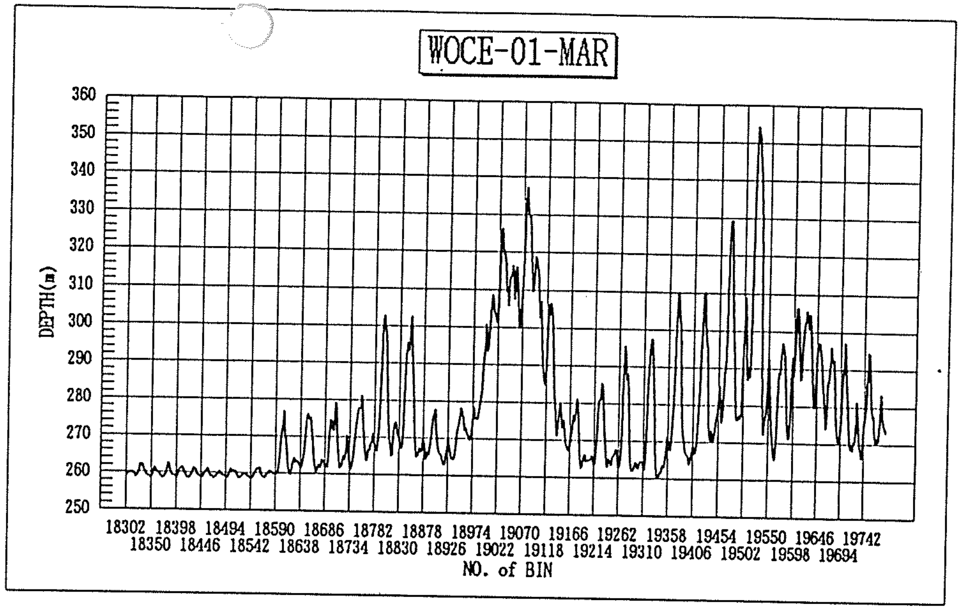

WOCE-01-OCT
DEPTH(m)
300
290
280
270
260
250
11054 11150 11246 11342 11438 11534 11630 11726 11822 11918 12014 12110 12206 12302 12398 12494
11102 11198 11294 11390 11486 11582 11678 11774 11870 11966 12062 12158 12254 12350 12446
NO. of BIN

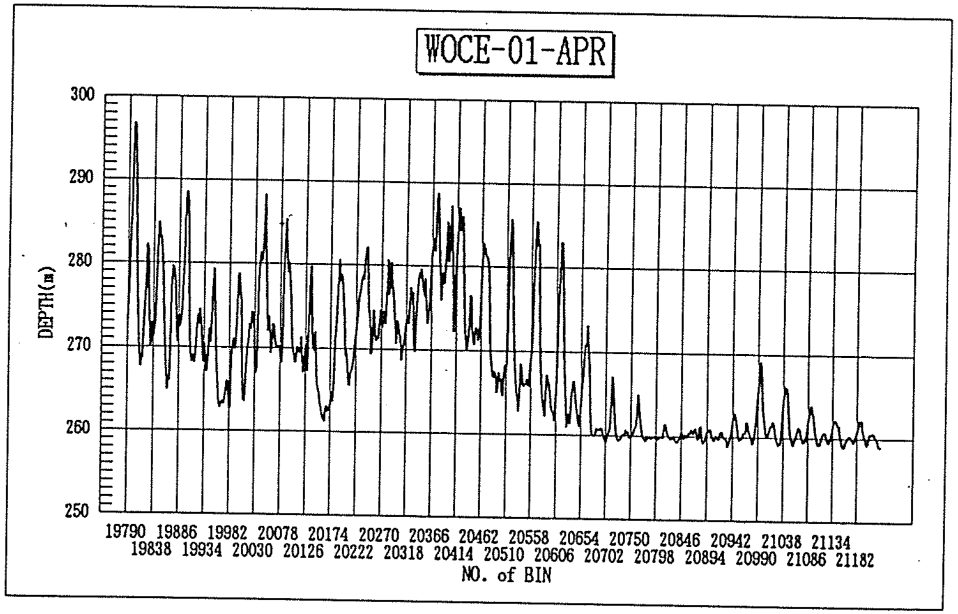

WOCE-01-NOV
DEPTH(m)
320
310
300
290
280
270
260
250
12542 12638 12734 12830 12926 13022 13118 13214 13310 13406 13502 13598 13694 13790 13886
12590 12686 12782 12878 12974 13070 13166 13262 13358 13454 13550 13646 13742 13838 13934
NO. of BIN

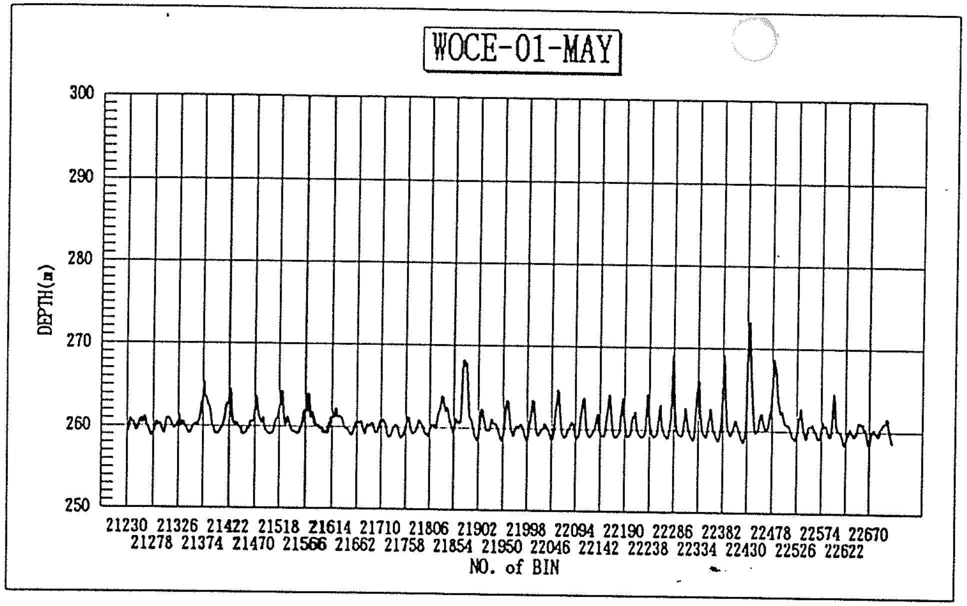

WOCE-01-DEC
DEPTH(m)
300
290
280
270
260
250
13982 14078 14174 14270 14366 14462 14558 14654 14750 14846 14942 15038 15134 15230 15326 15422
14030 14126 14222 14318 14414 14510 14606 14702 14798 14894 14990 15086 15182 15278 15374
NO. of BIN

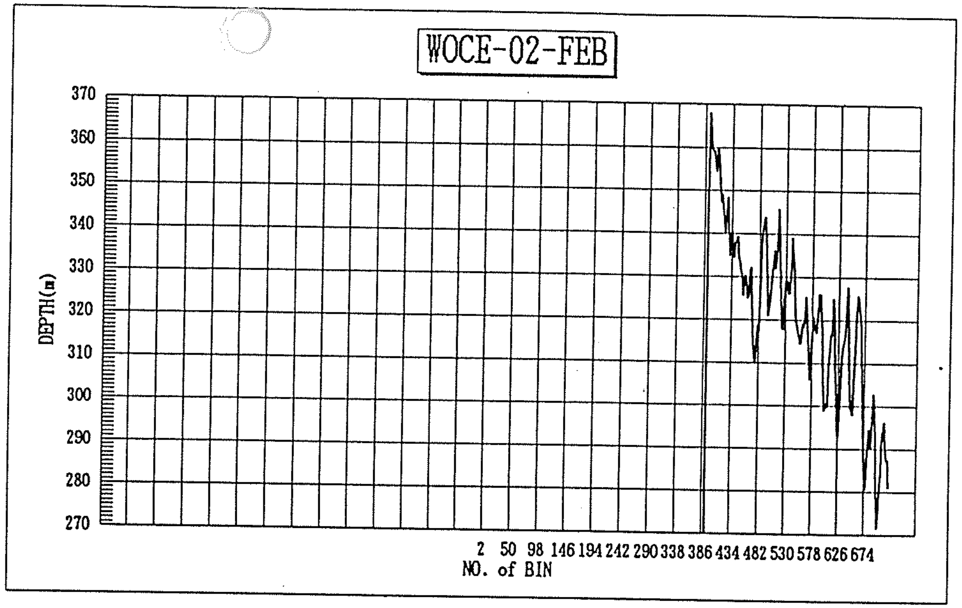

WOCE-01-JAN
DEPTH(m)
NO. of BIN

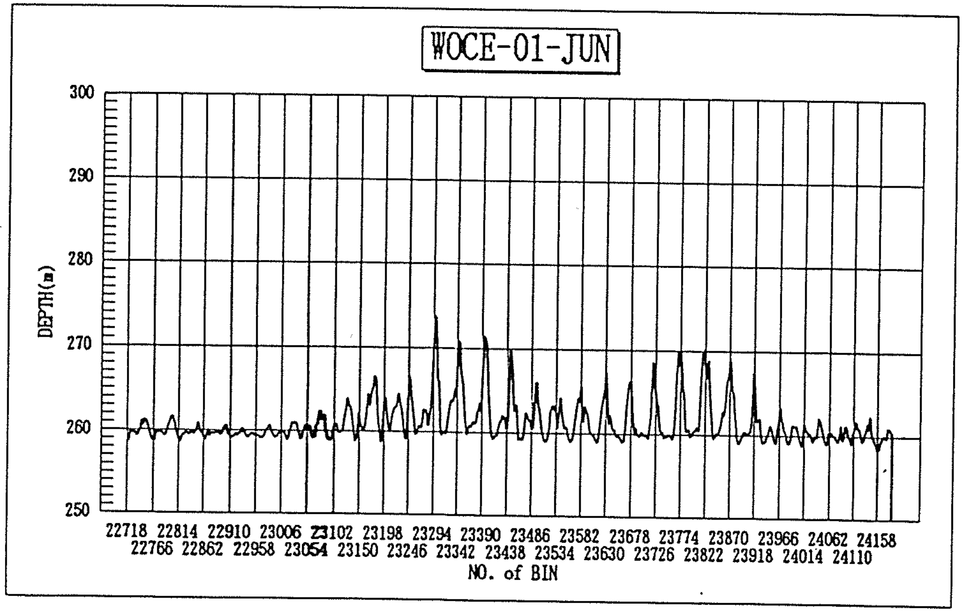

WOCE-01-FEB
DEPTH(m)
NO. of BIN

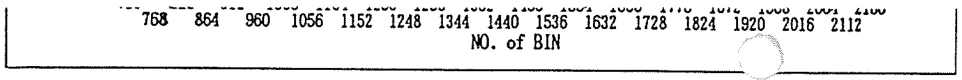

WOCE-01-MAR
DEPTH(m)
NO. of BIN


WOCE-01-APR
DEPTH(m)
NO. of BIN


WOCE-01-MAY
DEPTH(m)
300
290
280
270
260
250
21230 21326 21422 21518 21614 21710 21806 21902 21998 22094 22190 22286 22382 22478 22574 22670
21278 21374 21470 21566 21662 21758 21854 21950 22046 22142 22238 22334 22430 22526 22622
NO. of BIN


WOCE-02-FEB
DEPTH(m)
370
360
350
340
330
320
310
300
290
280
270
2 50 98 146 194 242 290 338 386 434 482 530 578 626 674
NO. of BIN


WOCE-01-JUN
DEPTH(m)
300
290
280
270
260
250
22718 22814 22910 23006 23102 23198 23294 23390 23486 23582 23678 23774 23870 23966 24062 24158
22766 22862 22958 23054 23150 23246 23342 23438 23534 23630 23726 23822 23918 24014 24110
NO. of BIN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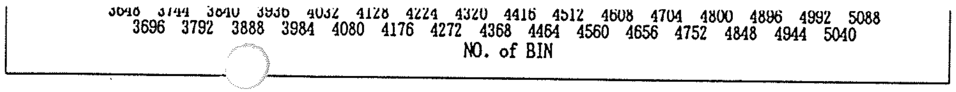
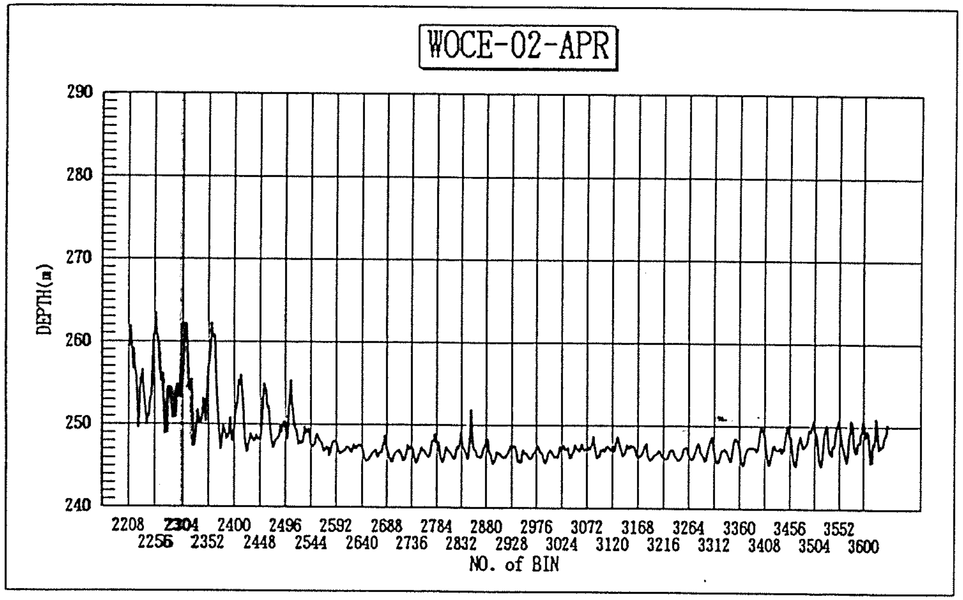
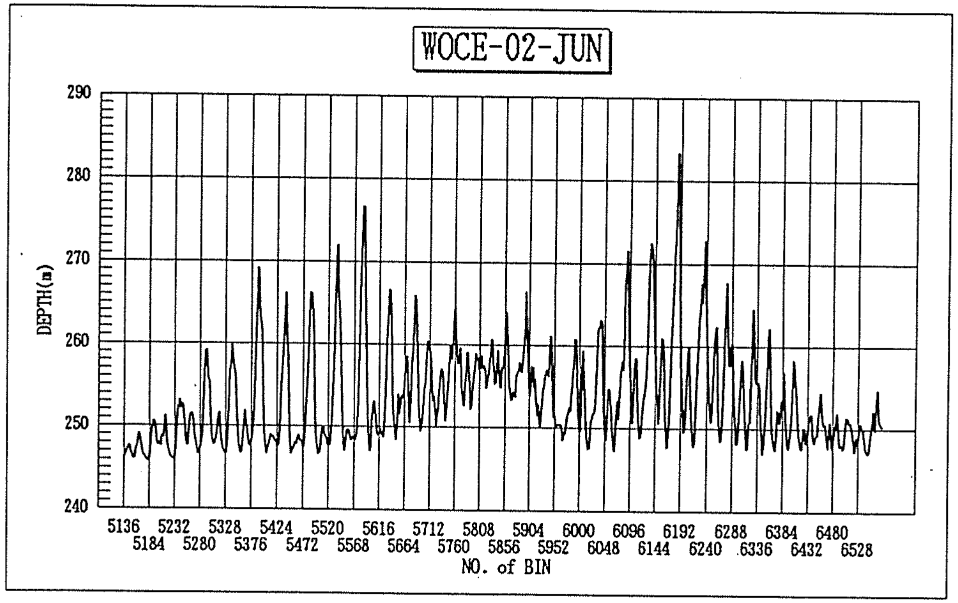
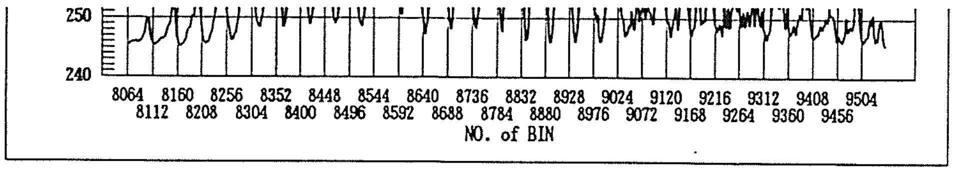
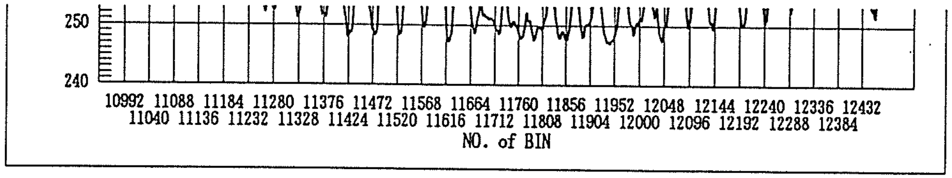
NO. of BIN


3696 3792 3888 3984 4080 4176 4272 4368 4464 4560 4656 4752 4848 4944 5040
NO. of BIN

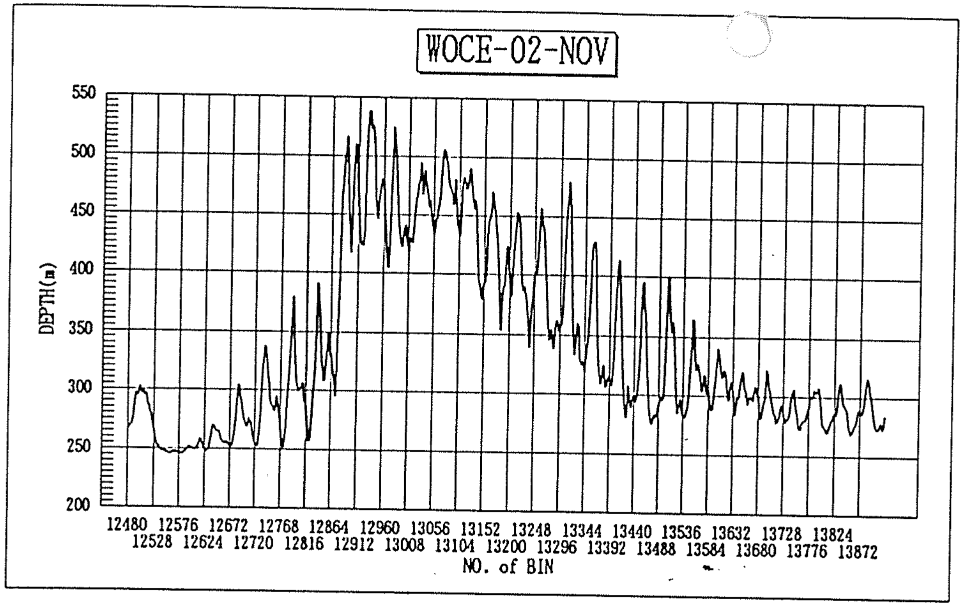

WOCE-02-APR
DEPTH(m)
290
280
270
260
250
240
2208 2304 2400 2496 2592 2688 2784 2880 2976 3072 3168 3264 3360 3456 3552
2256 2352 2448 2544 2640 2736 2832 2928 3024 3120 3216 3312 3408 3504 3600
NO. of BIN

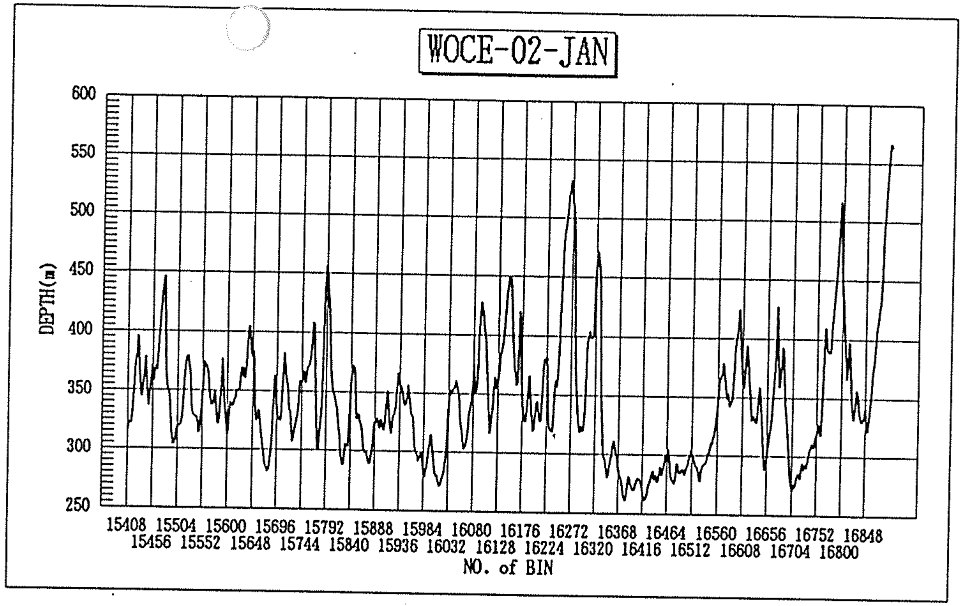

WOCE-02-JUN
DEPTH(m)
290
280
270
260
250
240
5136 5232 5328 5424 5520 5616 5712 5808 5904 6000 6096 6192 6288 6384 6480
5184 5280 5376 5472 5568 5664 5760 5856 5952 6048 6144 6240 6336 6432 6528
NO. of BIN

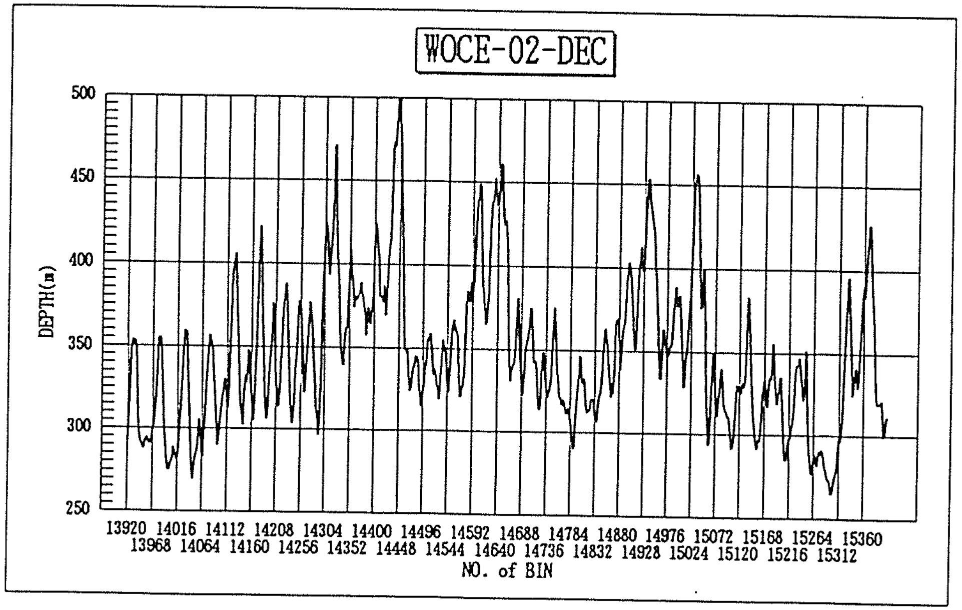

250
240
8064 8160 8256 8352 8448 8544 8640 8736 8832 8928 9024 9120 9216 9312 9408 9504
8112 8208 8304 8400 8496 8592 8688 8784 8880 8976 9072 9168 9264 9360 9456
NO. of BIN

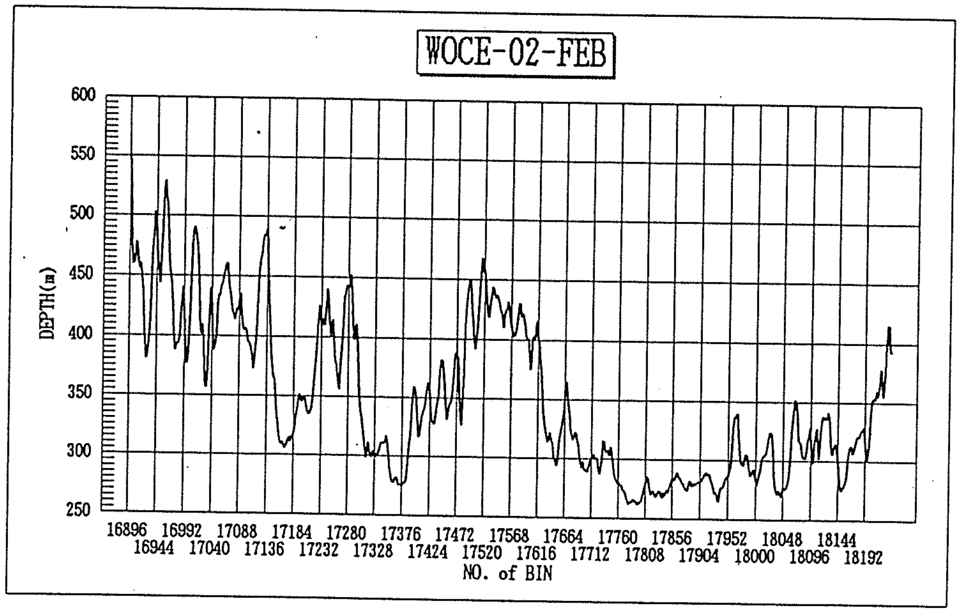

250
240
10992 11088 11184 11280 11376 11472 11568 11664 11760 11856 11952 12048 12144 12240 12336 12432
11040 11136 11232 11328 11424 11520 11616 11712 11808 11904 12000 12096 12192 12288 12384
NO. of BIN

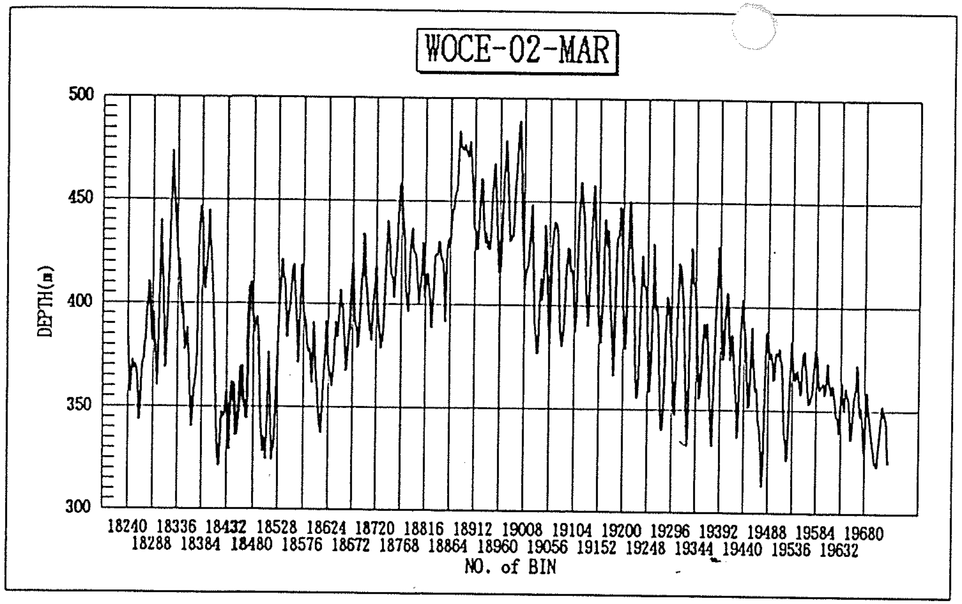
7.15

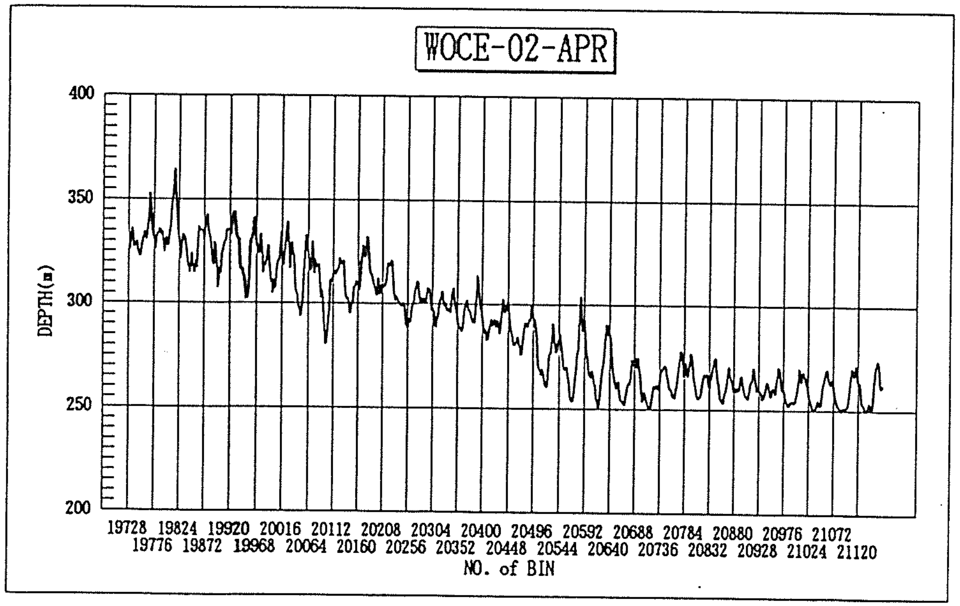

WOCE-02-NOV
550
500
450
400
350
300
250
200
DEPTH(m)
12480 12576 12672 12768 12864 12960 13056 13152 13248 13344 13440 13536 13632 13728 13824
12528 12624 12720 12816 12912 13008 13104 13200 13296 13392 13488 13584 13680 13776 13872
NO. of BIN

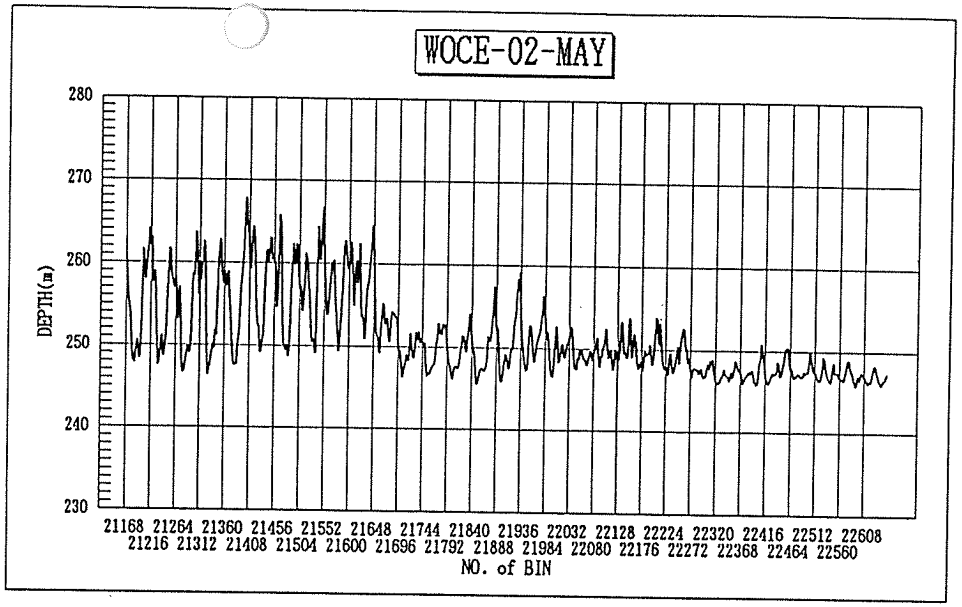

WOCE-02-JAN
600
550
500
450
400
350
300
250
DEPTH(m)
15408 15504 15600 15696 15792 15888 15984 16080 16176 16272 16368 16464 16560 16656 16752 16848
15456 15552 15648 15744 15840 15936 16032 16128 16224 16320 16416 16512 16608 16704 16800
NO. of BIN

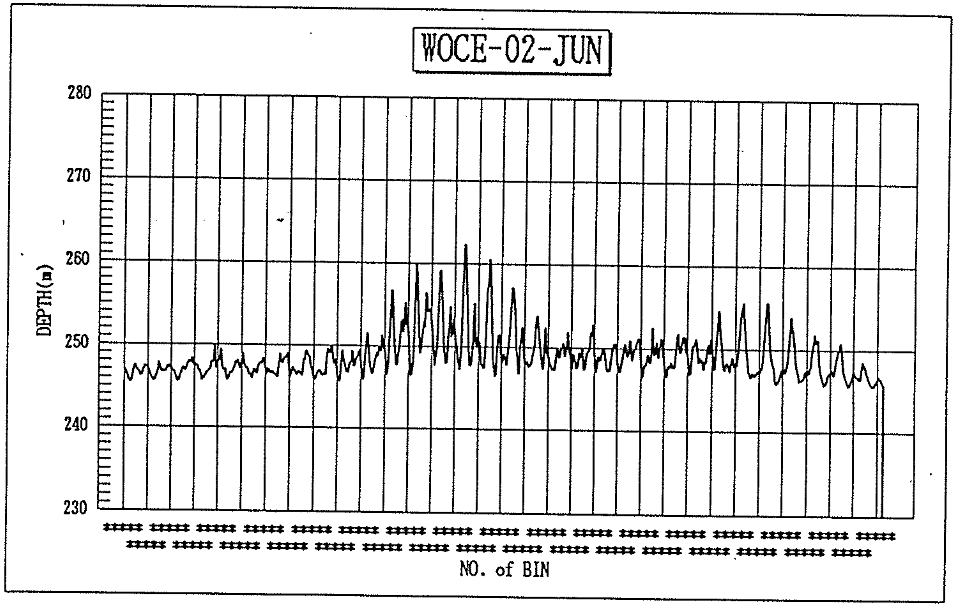

WOCE-02-DEC
500
450
400
350
300
250
DEPTH(m)
13920 14016 14112 14208 14304 14400 14496 14592 14688 14784 14880 14976 15072 15168 15264 15360
13968 14064 14160 14256 14352 14448 14544 14640 14736 14832 14928 15024 15120 15216 15312
NO. of BIN

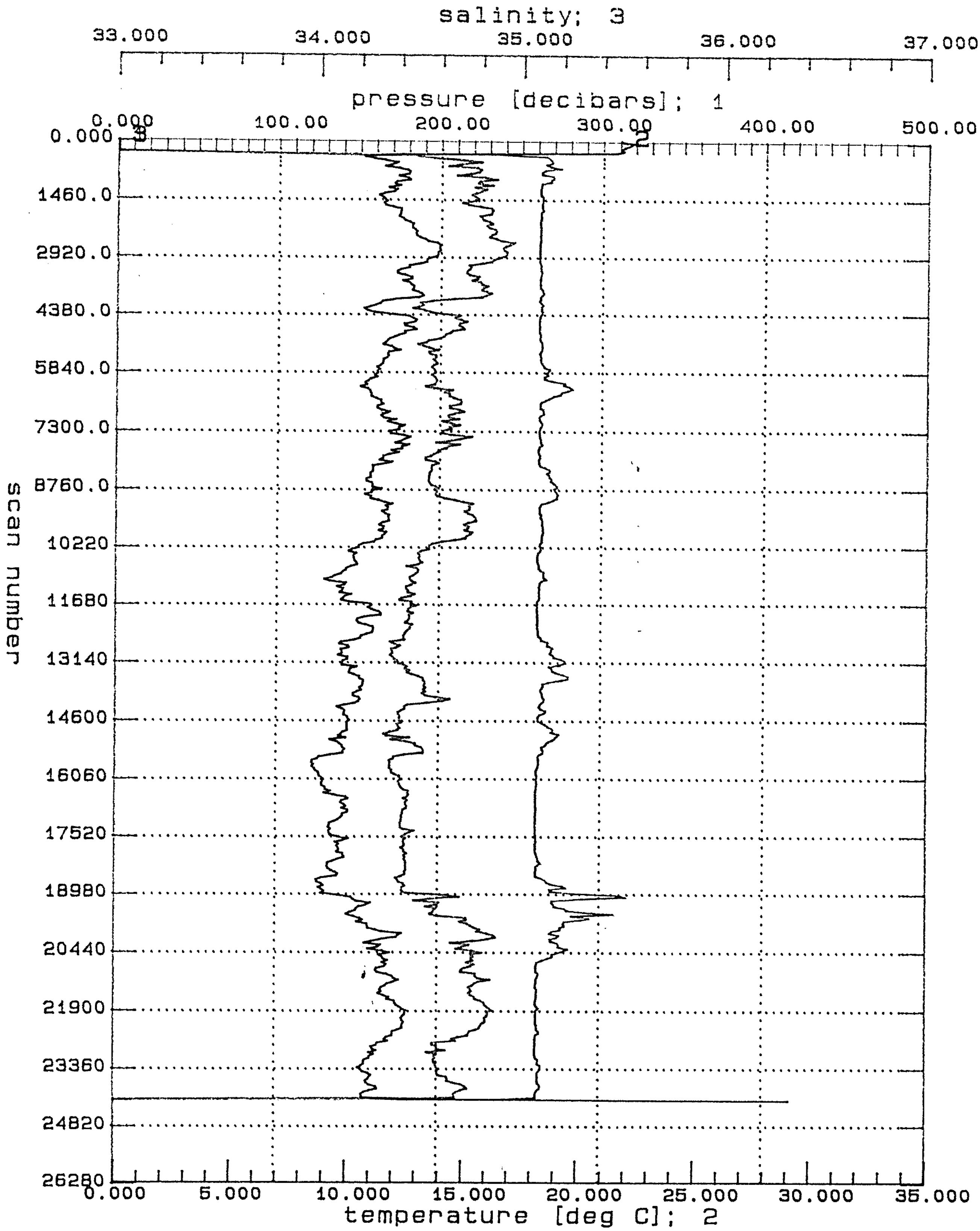

WOCE-02-FEB
600
550
500
450
400
350
300
250
DEPTH(m)
16896 16992 17088 17184 17280 17376 17472 17568 17664 17760 17856 17952 18048 18144
16944 17040 17136 17232 17328 17424 17520 17616 17712 17808 17904 18000 18096 18192
NO. of BIN


WOCE-02-MAR
500
450
400
350
300
DEPTH(m)
18240 18336 18432 18528 18624 18720 18816 18912 19008 19104 19200 19296 19392 19488 19584 19680
18288 18384 18480 18576 18672 18768 18864 18960 19056 19152 19248 19344 19440 19536 19632
NO. of BIN

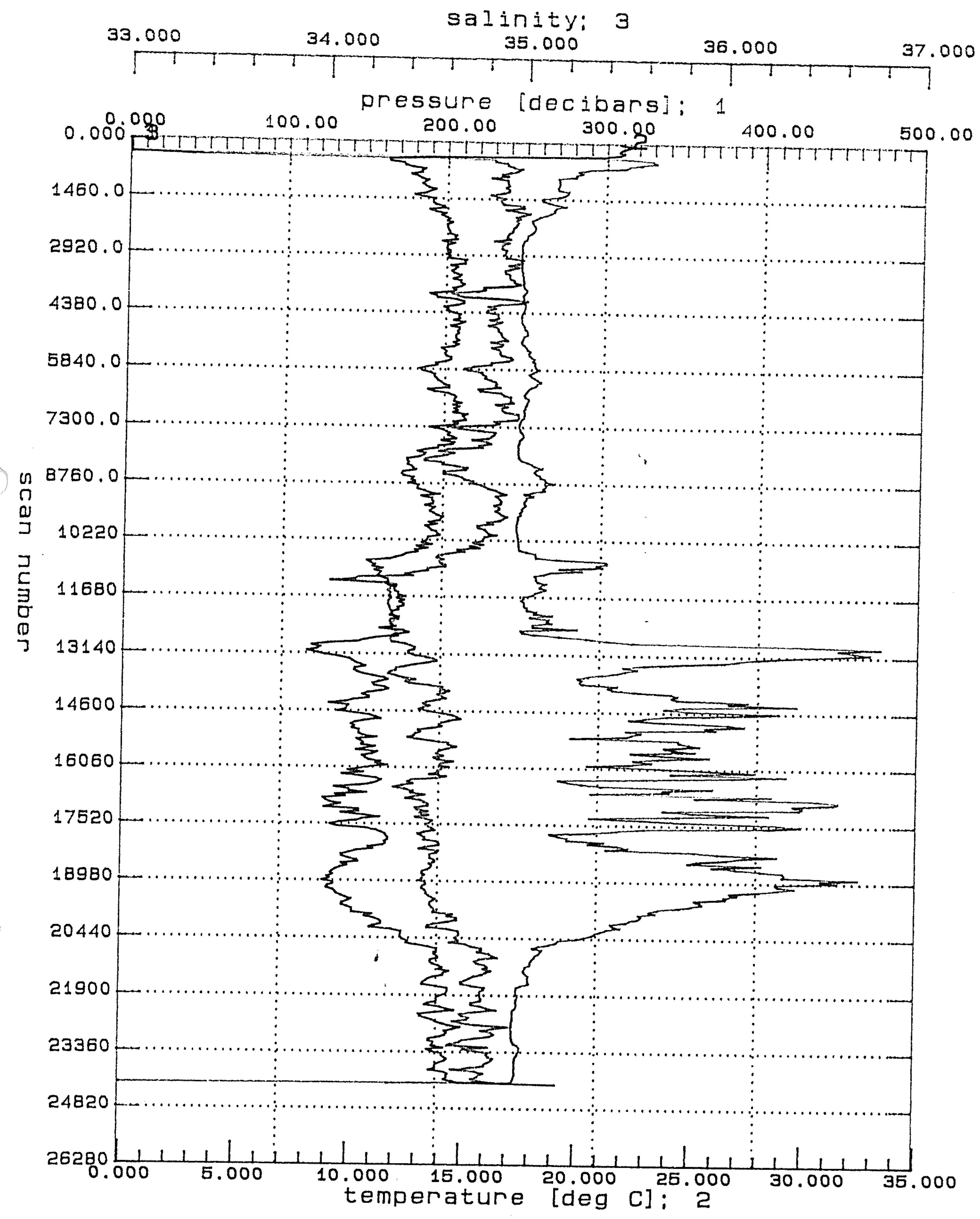

WOCE-02-APR
400
350
300
250
200
DEPTH(m)
19728 19824 19920 20016 20112 20208 20304 20400 20496 20592 20688 20784 20880 20976 21072
19776 19872 19968 20064 20160 20256 20352 20448 20544 20640 20736 20832 20928 21024 21120
NO. of BIN


WOCE-02-MAY
280
270
260
250
240
230
DEPTH(m)
21168 21264 21360 21456 21552 21648 21744 21840 21936 22032 22128 22224 22320 22416 22512 22608
21216 21312 21408 21504 21600 21696 21792 21888 21984 22080 22176 22272 22368 22464 22560
NO. of BIN


WOCE-02-JUN
280
270
260
250
240
230
DEPTH(m)
NO. of BIN



K9505W1D.CNV: TOCS K9505 moored CTD on WOCE buoy deployed 19



K9505W2D.CNV: TOCS K9505 moored CTD on WOCE buoy deployed 19

国際気象：小山様　黒田 JAMSTEC

DEPLOYMENT & RECOVERY

MOORING No. 950708-00138E

PROJECT	TOCS	TIME	
AREA		RECORDER (D)	Y. KURODA
POSITION	0°, 138°E	(R)	
DEPTH	3910m		
PERIOD	9. July. 1995 ~	NAVIGATION SYSTEM :	WGS84
No.of DAYS	370		

LENGTH : 3625 m DEPTH of BUOY : 285 m BUOYANCY : kg

ACOUSTIC RELEASER

TYPE	BENTHOS upper	TYPE	BENTHOS bottom
S/N	692	S/N	663
RECEIVE F.	13.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	14.0 kHz	TRANSMIT F.	13.5 kHz
ENABLE C.	E	ENABLE C.	C
RELEASE C.	D	RELEASE C.	B
BATTERY	2 years	BATTERY	2 years
TEST on DECK	ok	TEST on DECK	OK

DEPLOYMENT

DATE 8 July 1995 UTC SHIP Kaiyo CRUSE No. K9505

WEATHER cloud CONDITIONS wave 0.6m 6.8s DIR. of WIND 100° VEL. of WIND 0.5m/s

DEPTH 3910 m DEPTH of A.R. 3756 m DESCEND. RATE 2.7 m/s BUOY :

POS. of STRT 0° 01.278S 138° 01.394E 21:35 HOR.RANGE m

POS. of DEP. 0° 01.240S 138° 01.924E 22:59 SINKER 22:59 DISAPPEAR. :

POS. of MOORING 0° 01.252S 138° 01.907E LANDING 23:23

NOTE

Local Time : 9 July 95 06:35 start

Current 1.5~2KT 280°

Rain 22:40

~~H 536 324°~~

SSBL

TIME	S/R	DEPTH
23:04:20		931
:05:21		1114
06:57		1415
12:27		2380
23:00		3762 着底
25:01		3756

RECOVERY

DATE SHIP CRUSE No.

WEATHER CONDITIONS DIR. of WIND VEL. of WIND

START of RELEASE : FINISH of RELEASE :

POS. of DISCOVERY ° ° ASCENDING RATE m/s

DIRECTION ° DISTANCE m

NOTE

SSBL

TIME	S/R	DEPTH

7.19

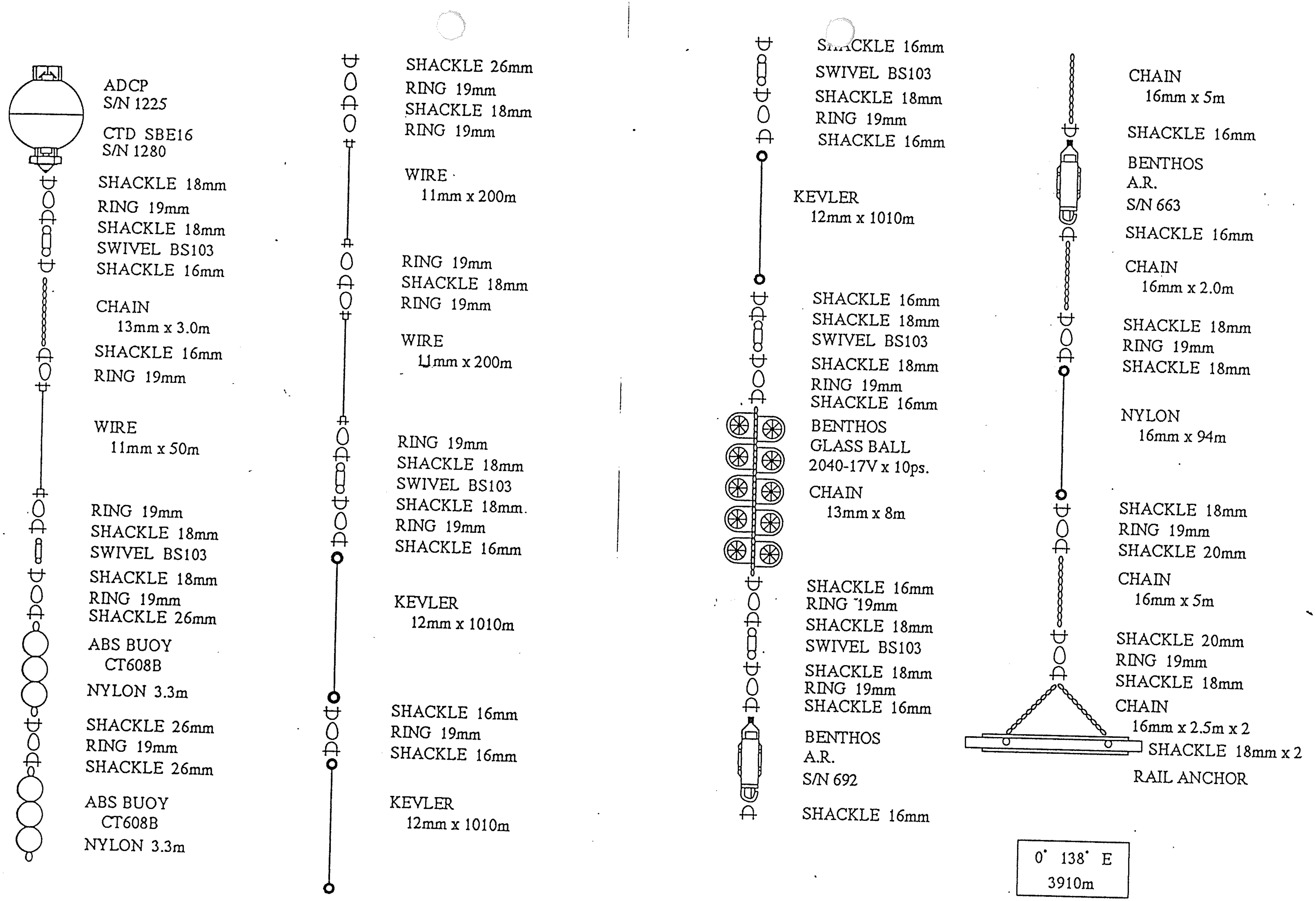
TIME RECORD

MOORING NO. : 950708-00138E

		DEPLOYMENT		RECOVERY (Date :)	
		START : 21 : ~~00~~32 FINISH : 22 : 59		START : FINISH :	
ITEMS	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP	1225	21 : 35	with CTD 1280		
WIRE	50m	21 : 35 ~21 : 41	Aフレーム トラブル		
ABS BUOY	3	21 : 42			
〃	3	21 : 42			
WIRE	200m	21:43 ~ 21:45			
〃	200 m	21:48 ~ 21:50			
KEVLER	1010m	21:52 ~ 22:07			
〃	1010m	22:09 ~ 22:28			
〃	1010 m	22:29 ~ 22:47			
GLASS BALL	10	22 : 52			
A. R.	1	22 : 52	692		
〃	1	22 : 53	663		
NYLON	94m	22:53 ~ 22:54			
SINKER		22 : 59			

L.T. 6:00 AM Depth of Water 3910 m

開始してすぐ Aフレームの不調


ADCP
S/N 1225
CTD SBE16
S/N 1280
SHACKLE 18mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 16mm
CHAIN
13mm x 3.0m
SHACKLE 16mm
RING 19mm
WIRE
11mm x 50m
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 26mm
ABS BUOY
CT608B
NYLON 3.3m
SHACKLE 26mm
RING 19mm
SHACKLE 26mm
ABS BUOY
CT608B
NYLON 3.3m
SHACKLE 26mm
RING 19mm
SHACKLE 18mm
RING 19mm
WIRE
11mm x 200m
RING 19mm
SHACKLE 18mm
RING 19mm
WIRE
11mm x 200m
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm.
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 1010m
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 1010m
SHACKLE 16mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 1010m
SHACKLE 16mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
BENTHOS
GLASS BALL
2040-17V x 10ps.
CHAIN
13mm x 8m
SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
BENTHOS
A.R.
S/N 692
SHACKLE 16mm
CHAIN
16mm x 5m
SHACKLE 16mm
BENTHOS
A.R.
S/N 663
SHACKLE 16mm
CHAIN
16mm x 2.0m
SHACKLE 18mm
RING 19mm
SHACKLE 18mm
NYLON
16mm x 94m
SHACKLE 18mm
RING 19mm
SHACKLE 20mm
CHAIN
16mm x 5m
SHACKLE 20mm
RING 19mm
SHACKLE 18mm
CHAIN
16mm x 2.5m x 2
SHACKLE 18mm x 2
RAIL ANCHOR
0° 138° E
3910m

7.21

DEPLOYMENT & RECOVERY

MOORING No. 950710-2.5S142E

PROJECT	TOCS	TIME	
AREA		RECORDER (D)	KURODA
POSITION	2°-30S	(R)	
DEPTH	3440m		
PERIOD		NAVIGATION SYSTEM :	WGS84
No.of DAYS			

LENGTH : m DEPTH of BUOY : m BUOYANCY : kg

ACOUSTIC RELEASER

TYPE	BENTHOS	TYPE	BENTHOS
S/N	664	S/N	664
RECEIVE F.	13.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	14.5 kHz	TRANSMIT F.	14.0 kHz
ENABLE C.	G, 1	ENABLE C.	D
RELEASE C.	F	RELEASE C.	C
BATTERY	2 years	BATTERY	2 years
TEST on DECK	OK	TEST on DECK	OK

DEPLOYMENT

DATE 10 July 1995 UTC SHIP KAIYO CRUSE No. K9505

WEATHER Cloud CONDITIONS Wave H. 0.5m T 7.5s DIR. of WIND 150 VEL. of WIND 1m.

DEPTH 3436 m DEPTH of A.R. 3265 m DESCEND. RATE 2.7 m/s BUOY :

POS. of STRT 02° 28.421 S 141° 57.722E 21:10 HOR.RANGE m

POS. of DEP. 02° 28.667S 141° 58.350E 22:10 SINKER 22:09 DISAPPEAR. 22:21

POS. of MOORING 02° 28.623 S 141° 58.282E LANDING 22:30

NOTE Start Local 06:10 11 July 95
134m Nylon Rope

SSBL

TIME	S/R	DEPTH
22:16:19	664	1117
16:48		1212
17:36		1356
22:24:32		2472
24:56		2538
30:30		3250
30:31		3230

着底 by SSBL

RECOVERY

DATE SHIP CRUSE No.

WEATHER CONDITIONS DIR. of WIND VEL. of WIND

START of RELEASE : FINISH of RELEASE :

POS. of DISCOVERY ° ° ASCENDING RATE m/s

DIRECTION ° DISTANCE m

NOTE
134m Nylon Rope

SSBL

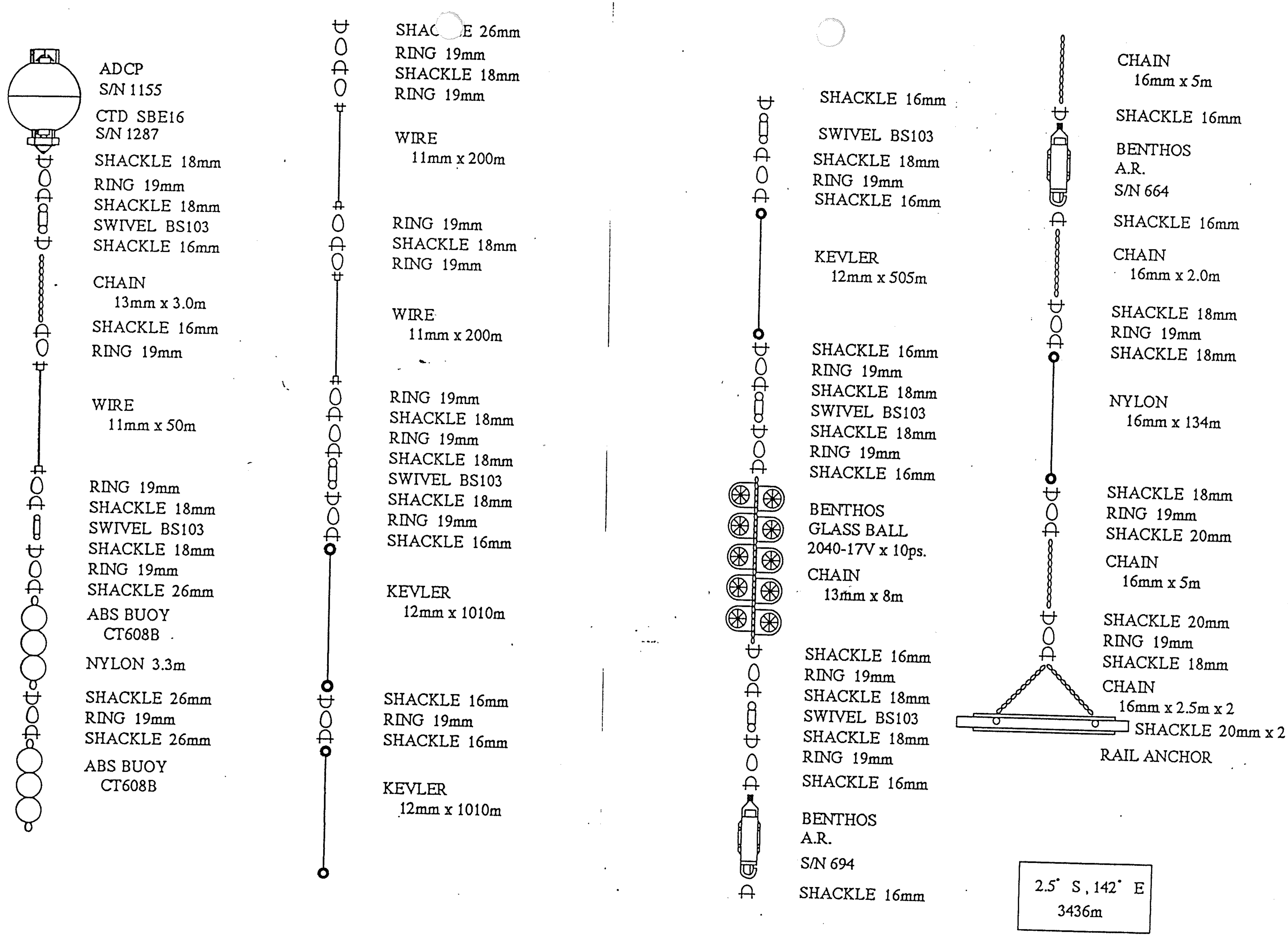
TIME	S/R	DEPTH

TIME RECORD

MOORING NO. :950710-25S142E

		DEPLOYMENT		RECOVERY (Date:)	
		START: 21:09 FINISH: 22:09		START: FINISH:	
ITEMS	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP	1155	21:11	CTD 1287		
WIRE	50m	~21:13			
ABS BUOY	3	21:13			
"	3	21:14			
WIRE	200m	21:14 ~ 21:18			
"	200m	21:20 ~ 21:22			
KEVLER	1000m	21:24 ~ 21:33			
"	1000m	21:35 ~ 21:46			
"	500m	21:48 ~ 21:54			
GLASS BALL	10	21:59			
A. R.	694	~~21~~ 22:00	14.5 G, F		
"	664	~~21~~: 22:00	14.0 D, C		
NYLON	134m	22:00 ~ 22:02			
ANCHOR		22:09			

Depth of Water : ~~3460~~ m
3440


ADCP
S/N 1155
CTD SBE16
S/N 1287
SHACKLE 18mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 16mm
CHAIN
13mm x 3.0m
SHACKLE 16mm
RING 19mm
WIRE
11mm x 50m
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 26mm
ABS BUOY
CT608B
NYLON 3.3m
SHACKLE 26mm
RING 19mm
SHACKLE 26mm
ABS BUOY
CT608B
SHACKLE 26mm
RING 19mm
SHACKLE 18mm
RING 19mm
WIRE
11mm x 200m
RING 19mm
SHACKLE 18mm
RING 19mm
WIRE
11mm x 200m
RING 19mm
SHACKLE 18mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 1010m
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 1010m
SHACKLE 16mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 505m
SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
BENTHOS
GLASS BALL
2040-17V x 10ps.
CHAIN
13mm x 8m
SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
BENTHOS
A.R.
S/N 694
SHACKLE 16mm
CHAIN
16mm x 5m
SHACKLE 16mm
BENTHOS
A.R.
S/N 664
SHACKLE 16mm
CHAIN
16mm x 2.0m
SHACKLE 18mm
RING 19mm
SHACKLE 18mm
NYLON
16mm x 134m
SHACKLE 18mm
RING 19mm
SHACKLE 20mm
CHAIN
16mm x 5m
SHACKLE 20mm
RING 19mm
SHACKLE 18mm
CHAIN
16mm x 2.5m x 2
SHACKLE 20mm x 2
RAIL ANCHOR
2.5° S , 142° E
3436m

DEPLOYMENT & RECOVERY

MOORING No. 950711-2S142E

PROJECT	TOCS	TIME	
AREA		RECORDER (D)	KURODA
POSITION	2°S 142°E	(R)	
DEPTH	3609		
PERIOD		NAVIGATION SYSTEM :	WGS 84
No.of DAYS			

LENGTH : 3327 m DEPTH of BUOY : 278 m BUOYANCY : kg

ACOUSTIC RELEASER

UPPER		BOTTOM	
TYPE	Benthos	TYPE	Benthos
S/N	689	S/N	665
RECEIVE F.	13.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	13.5 kHz	TRANSMIT F.	14.0 kHz
ENABLE C.	B	ENABLE C.	F
RELEASE C.	A	RELEASE C.	D
BATTERY	2years	BATTERY	2years
TEST on DECK	✓	TEST on DECK	✓

DEPLOYMENT

DATE 11 July 95 01:33 UTC SHIP Kaiyo CRUSE No. K9505

WEATHER bc CONDITIONS DIR. of WIND WSW VEL. of WIND 1.7 m/s

DEPTH 3609 m DEPTH of A.R. 34 m DESCEND. RATE m/s BUOY :

POS. of STRT 02° 00.194S 141° 59.084E 01:33 HOR.RANGE m

POS. of DEP. 01° 59.993S 142° 00.060E 02:38 SINKER : DISAPPEAR. :

POS. of MOORING 2° 00.079S 141° 59.907E LANDING :

NOTE 11 July 95 10:31 start

H 1156
B 2742
A 3443

02-00.105S
142-00.537E) ship
3:02

SSBL	TIME	H 8/R kHz	DEPTH
	02:35:30	508	716
	02:39:45	976	1471
	02:44:29		2155
	02:47:03		2554
	02:55:00		3434

RECOVERY

DATE SHIP CRUSE No.

WEATHER CONDITIONS DIR. of WIND VEL. of WIND

START of RELEASE : FINISH of RELEASE :

POS. of DISCOVERY ° ° ASCENDING RATE m/s

DIRECTION ° DISTANCE m

NOTE

SSBL	TIME	S/R	DEPTH

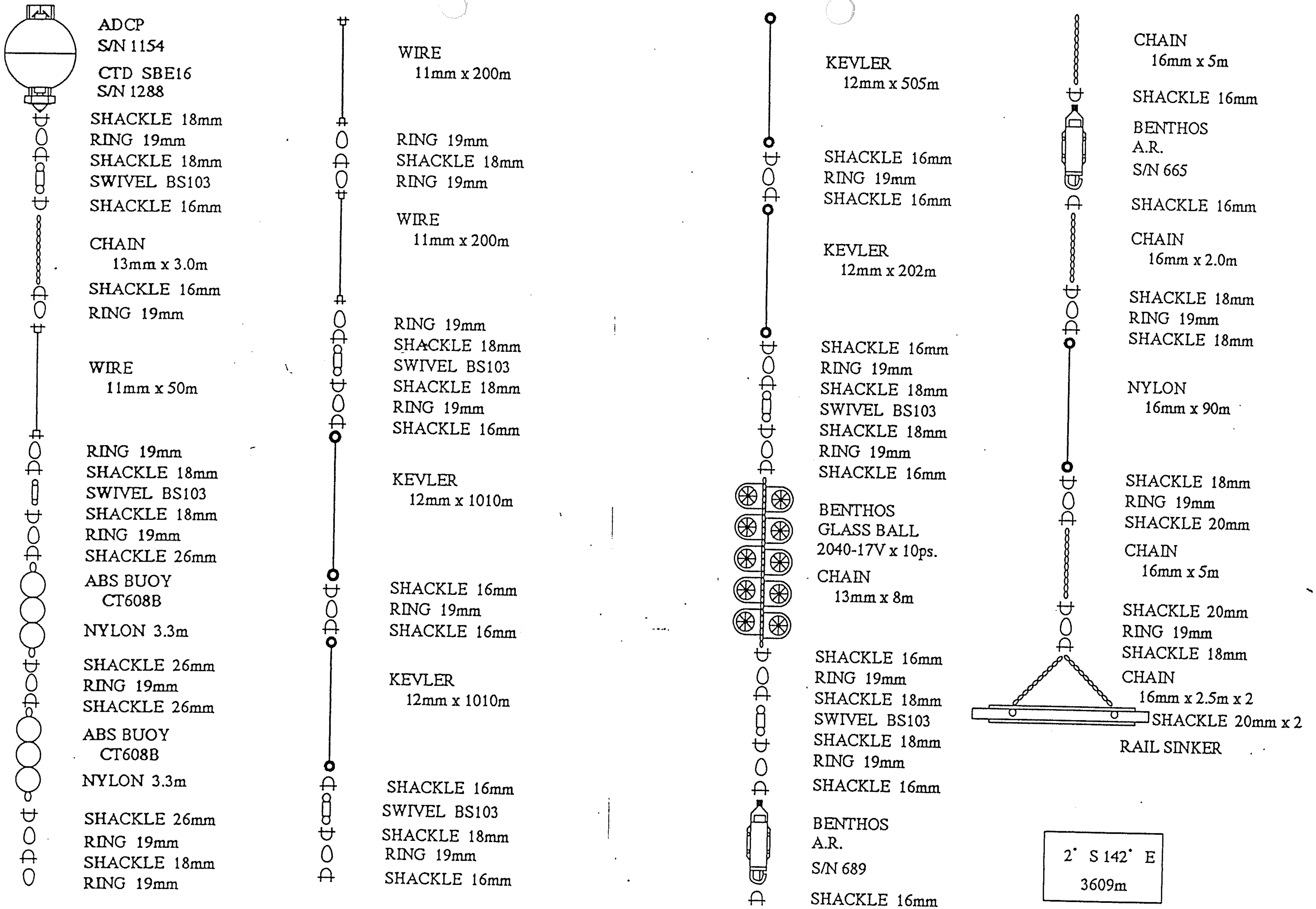
7.25

TIME RECORD

MOORING NO: 950711-2S142E

		DEPLOYMENT		RECOVERY (Date:)	
		START : 01 : 31		START :	
		FINISH : 02 : 31		FINISH :	
ITEMS	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP	1154	01 : 33	CTD 1288		
WIRE	50m	~01 : 35			
ABS BUOY	3	01 : 36			
〃	3	01 : 36			
WIRE	200m	01:37~01:40			
〃	200m	01:42~01:44			
KEVLER	1000m	01:46~01:58			
〃	1000m	02:00~02:09			
〃	500m	02:10~02:16	中古?		
〃	200m	02:17~02:20			
GLASS BALL	10	02 : 24			
A. R.	689	02 : 25	13.5 B, A		
〃	665	02 : 25	14.0 F, D		
NYLON	90m	02:25~02:26			
ANCHOR		02 : 31			

Depth of Water : 3610 m
Nylon Cut : 10m (100m から)


ADCP
S/N 1154
CTD SBE16
S/N 1288
SHACKLE 18mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 16mm
CHAIN
13mm x 3.0m
SHACKLE 16mm
RING 19mm
WIRE
11mm x 50m
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 26mm
ABS BUOY
CT608B
NYLON 3.3m
SHACKLE 26mm
RING 19mm
SHACKLE 26mm
ABS BUOY
CT608B
NYLON 3.3m
SHACKLE 26mm
RING 19mm
SHACKLE 18mm
RING 19mm
WIRE
11mm x 200m
RING 19mm
SHACKLE 18mm
RING 19mm
WIRE
11mm x 200m
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 1010m
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 1010m
SHACKLE 16mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 505m
SHACKLE 16mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 202m
SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
BENTHOS
GLASS BALL
2040-17V x 10ps.
CHAIN
13mm x 8m
SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
BENTHOS
A.R.
S/N 689
SHACKLE 16mm
CHAIN
16mm x 5m
SHACKLE 16mm
BENTHOS
A.R.
S/N 665
SHACKLE 16mm
CHAIN
16mm x 2.0m
SHACKLE 18mm
RING 19mm
SHACKLE 18mm
NYLON
16mm x 90m
SHACKLE 18mm
RING 19mm
SHACKLE 20mm
CHAIN
16mm x 5m
SHACKLE 20mm
RING 19mm
SHACKLE 18mm
CHAIN
16mm x 2.5m x 2
SHACKLE 20mm x 2
RAIL SINKER
2° S 142° E
3609m

DEPLOYMENT & RECOVERY

MOORING No. 950719-00156E

PROJECT	TOCS	TIME	
AREA	Western Pacific	RECORDER (D)	Ando. 95/07/19.
POSITION	0°N, 156°E	(R)	
DEPTH	1957m		
PERIOD	1year.	NAVIGATION SYSTEM :	WGS84
No.of DAYS			

LENGTH : 1675 m DEPTH of BUOY : 270 m BUOYANCY : kg

ACOUSTIC RELEASER

TYPE	Benthos (Upper)	TYPE	Benthos (Lower)
S/N	690	S/N	667
RECEIVE F.	13.0 kHz	RECEIVE F.	13.0 kHz
TRANSMIT F.	13.5 kHz	TRANSMIT F.	14.5 kHz
ENABLE C.	C	ENABLE C.	G
RELEASE C.	B	RELEASE C.	H
BATTERY	2years	BATTERY	2years
TEST on DECK	yes	TEST on DECK	yes

DEPLOYMENT

DATE 95/07/18 SHIP Kaiyo CRUSE No. K9505

WEATHER bc CONDITIONS calm. DIR. of WIND SSE VEL. of WIND 1.

DEPTH 1,959 m DEPTH of A.R. 1,764 m DESCEND. RATE m/s BUOY :

POS. of STRT 0°00.320S ; 156°04.177E HOR.RANGE m

POS. of DEP. 0°00.045S , 156°05.051E SINKER ~~30~~ 31 :35 DISAPPEAR. :

POS. of MOORING 00°00.010S. 156°05.133E. LANDING 21:46

NOTE

起こしていない690と同じ13.5kHzの信号が出た。

SSBL	TIME	~~S/R~~ H/R	DEPTH
	21:36		130
	21:38		512
	21:~~42~~ 41:38		~~209~~ 1101
	21:44:16		1480
	21:46:10		1725
	21:47:55	704	1727

RECOVERY

DATE SHIP CRUSE No.

WEATHER CONDITIONS DIR. of WIND VEL. of WIND

START of RELEASE : FINISH of RELEASE :

POS. of DISCOVERY ° ° ASCENDING RATE m/s

DIRECTION ° DISTANCE m

NOTE

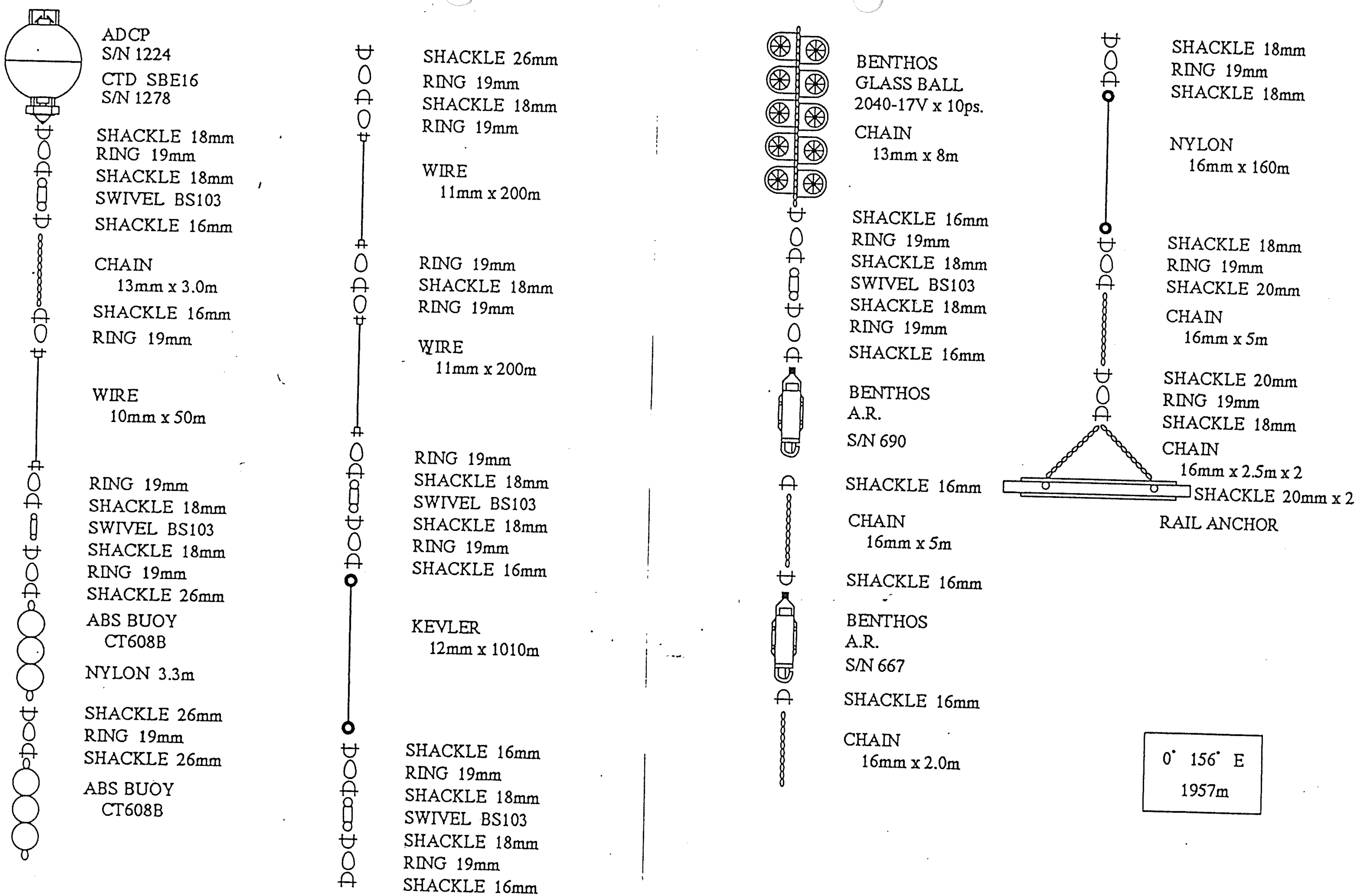
SSBL	TIME	S / R	DEPTH

TIME RECORD

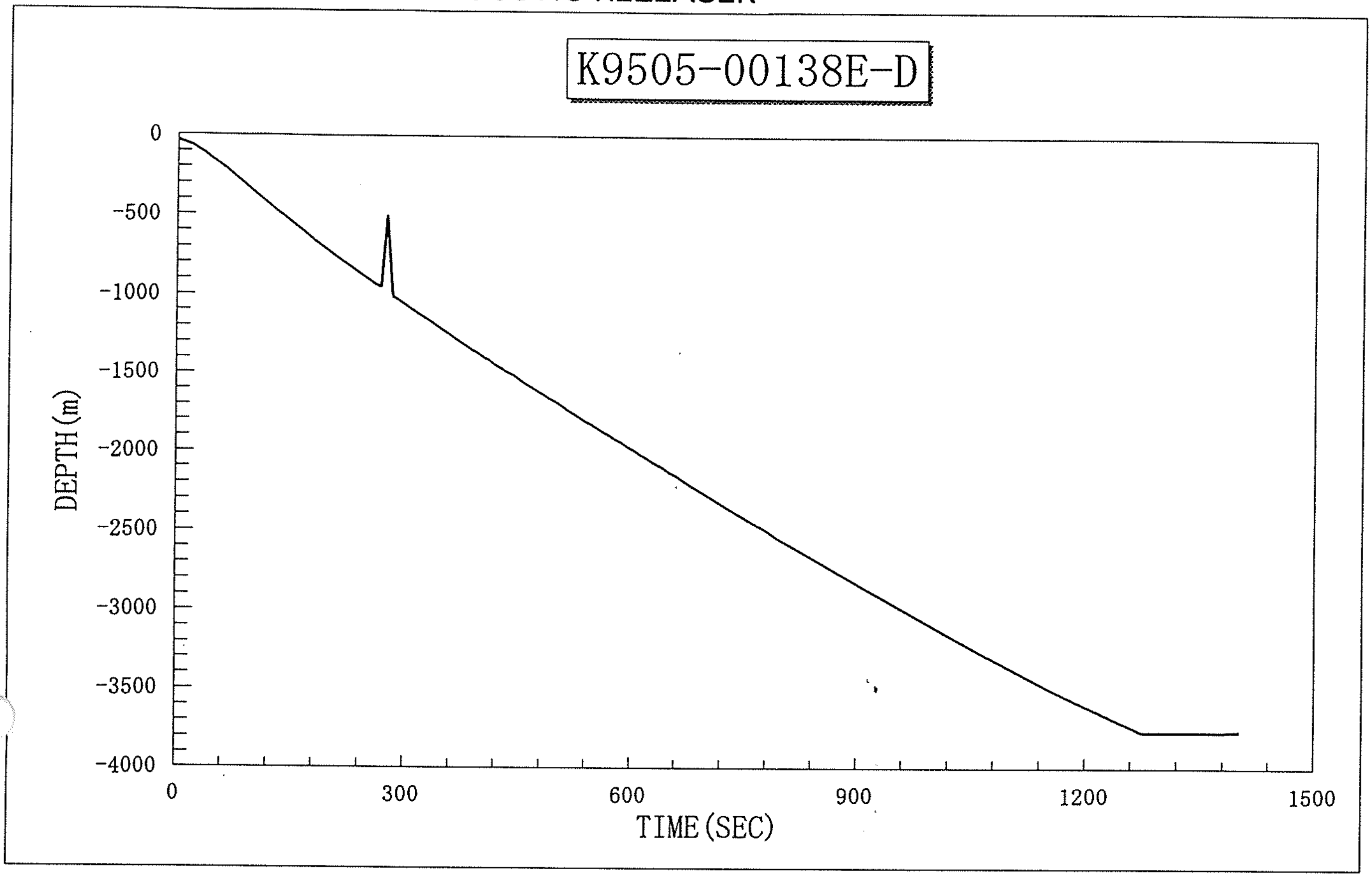
MOORING NO.: 950719-00156E

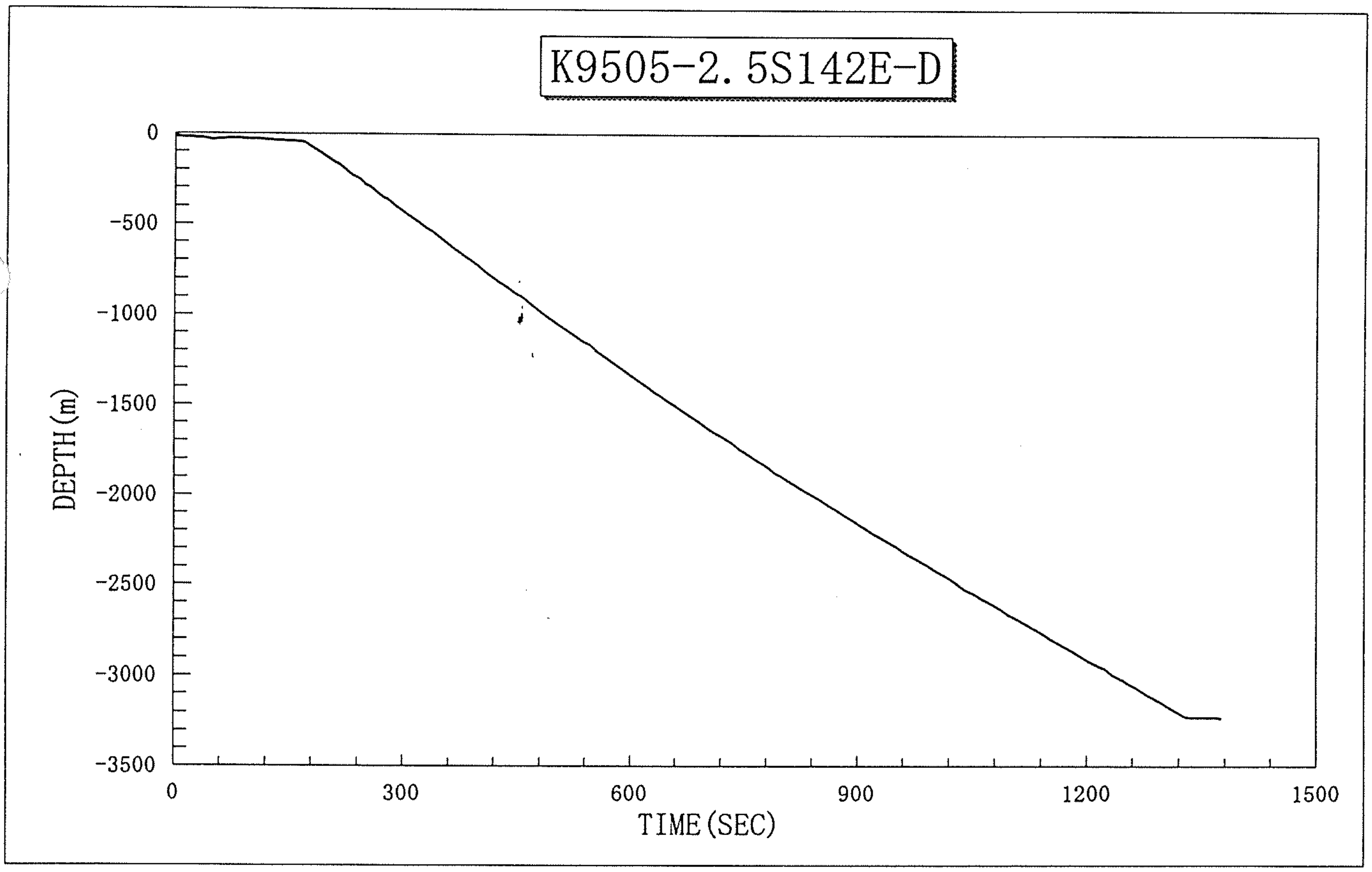
		DEPLOYMENT		RECOVERY (Date:)	
		START: 20:53		START:	
		FINISH: 21:35		FINISH:	
ITEMS	S/N etc.	TIME	MEMO	TIME	MEMO
ADCP	1224	20:56	CTD 1278		
WIRE	50m	20:57~20:58			
ABS BUOY	~~3~~ 2	20:58			
〃	~~3~~ 2	〃			
〃	2	〃			
WIRE	200m	20:58~21:01			
〃	200m	21:03~21:05			
KEVLER	1010m	21:07~21:20			
GLASS BALL	10	21:26			
A.R.	690	21:27	13.5 C, B		
〃	667	21:28	14.5 G.F		
NYLON ROPE	160m	21:28~21:30			
ANCHOR		21:35			

7. 30


ADCP
S/N 1224
CTD SBE16
S/N 1278
SHACKLE 18mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 16mm
CHAIN
13mm x 3.0m
SHACKLE 16mm
RING 19mm
WIRE
10mm x 50m
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 26mm
ABS BUOY
CT608B
NYLON 3.3m
SHACKLE 26mm
RING 19mm
SHACKLE 26mm
ABS BUOY
CT608B
SHACKLE 26mm
RING 19mm
SHACKLE 18mm
RING 19mm
WIRE
11mm x 200m
RING 19mm
SHACKLE 18mm
RING 19mm
WIRE
11mm x 200m
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
KEVLER
12mm x 1010m
SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
BENTHOS
GLASS BALL
2040-17V x 10ps.
CHAIN
13mm x 8m
SHACKLE 16mm
RING 19mm
SHACKLE 18mm
SWIVEL BS103
SHACKLE 18mm
RING 19mm
SHACKLE 16mm
BENTHOS
A.R.
S/N 690
SHACKLE 16mm
CHAIN
16mm x 5m
SHACKLE 16mm
BENTHOS
A.R.
S/N 667
SHACKLE 16mm
CHAIN
16mm x 2.0m
SHACKLE 18mm
RING 19mm
SHACKLE 18mm
NYLON
16mm x 160m
SHACKLE 18mm
RING 19mm
SHACKLE 20mm
CHAIN
16mm x 5m
SHACKLE 20mm
RING 19mm
SHACKLE 18mm
CHAIN
16mm x 2.5m x 2
SHACKLE 20mm x 2
RAIL ANCHOR
0° 156° E
1957m

DESCENDING SPEED OF ACOUSTIC RELEASER





SBE SEA-BIRD ELECTRONICS, INC
1808 - 136th Place NE, Bellevue, Washington 98005 USA
Telephone: (206) 643-9866 FAX: (206) 643-9954 Telex: 292915 SBEI UR

Service Report

SBE Job Number: 11634 Date: 23 March 1995

Customer: EMS

Customer Identified Problem:

1. Calibrations required for SBE 16 SEACAT, s/n 167423-1284.
   Calibrate temperature, conductivity, and pressure sensors.

2. Calibrations and repairs required for SBE 16 SEACAT, s/n 167423-1285.
   Calibrate temperature, conductivity, and pressure sensors.
   Investigate possible pressure sensor problem. Customer claims the pressure sensor jumped 100 meters after the first month of deployment.

3. Calibrate SBE 3 temperature sensors, s/n 1207 and 1523.

4. Calibrate SBE 4 conductivity sensors, s/n 960 and 1148.

5. Calibrate SBE 13 DO sensor, s/n 130257.

Problems Found:

1. There were no problems found.

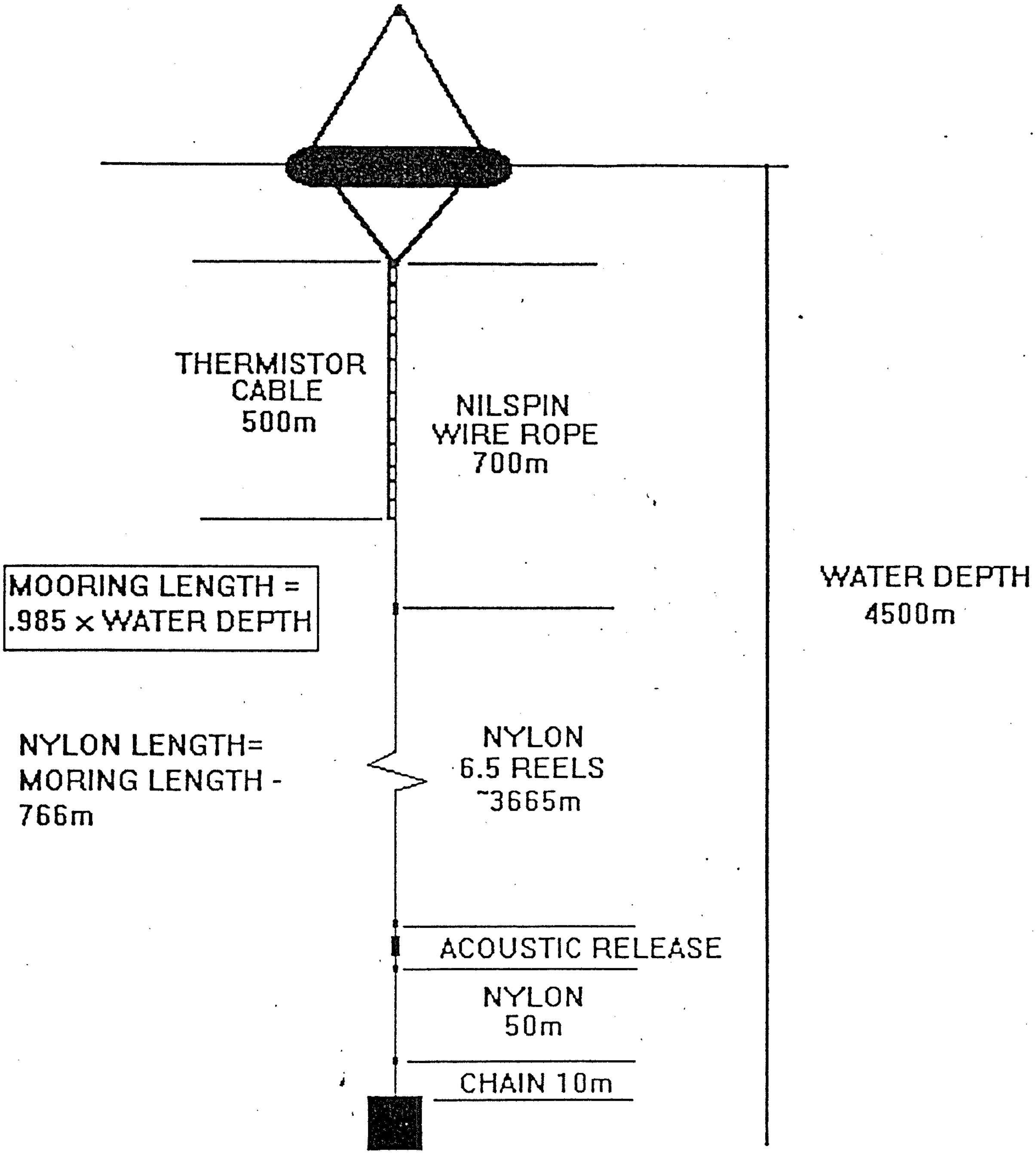
Repairs Performed:

1. Calibrations performed on SBE 16 SEACAT, s/n 167423-1284.
   Calibrated temperature, conductivity, and pressure sensors.

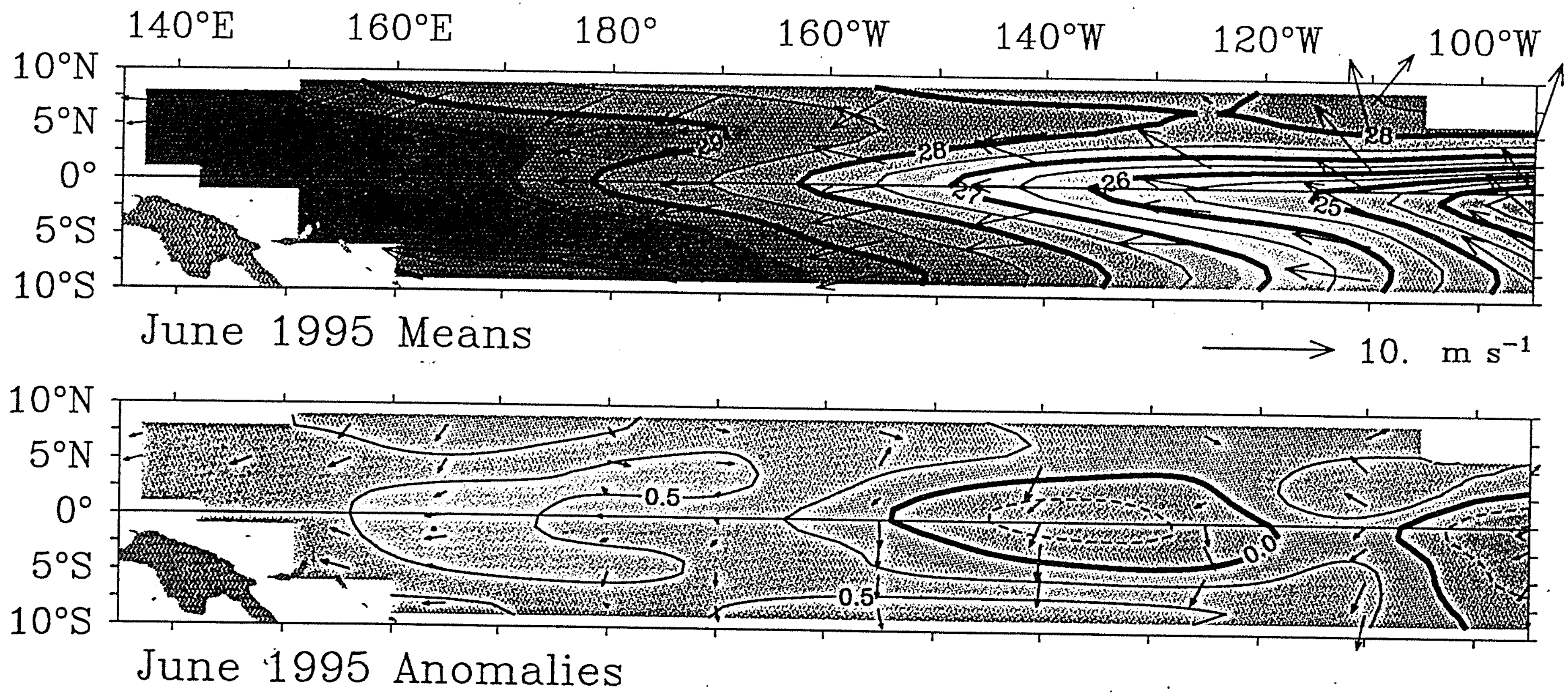
2. Calibrations and repairs performed on SBE 16 SEACAT, s/n 167423-1285.
   Calibrated temperature, conductivity, and pressure sensors.
   Tested and inspected pressure sensor and pressure sensor plumbing.

3. Calibrations and modifications SBE 3 temperature sensors, s/n 1207 and 1523.
   Post calibrated sensors.
   Installed thermistor terminal modifications
   Recalibrated temperature sensors.

4. Calibrations performed on SBE 4 conductivity sensors, s/n 960 and 1148.
   Post calibrated sensors.


THERMISTOR
CABLE
500m
NILSPIN
WIRE ROPE
700m
MOORING LENGTH =
.985 x WATER DEPTH
WATER DEPTH
4500m
NYLON LENGTH=
MORING LENGTH -
766m
NYLON
6.5 REELS
~3665m
ACOUSTIC RELEASE
NYLON
50m
CHAIN 10m

TAO Monthly Mean SST (°C) and Winds ($m\ s^{-1}$)



TAO Project Office/PMEL/NOAA

SUMMARY REPORT

Djoko Hartoyo and Ali

INTRODUCTION

1. Background

The Tropical Ocean Climate Study cruise have been carried out by Research Vessel KAIYO in Tropical Western Pacific within and outside Economic Exclusive Zone Indonesia on July 1995. This survey activity based on The Implementing arrangement between BPPT (Agency for the Assessment and Application of Technology) and JAMSTEC (Japan Marine Science and Technology Center) signed in April 5th, 1995 by Shin-ichi Ishii (executive Director JAMSTEC) and Prof. MT. Zen (Deputy Chairman for Natural Resources Development, BPP Teknologi).

2. Purpose

The main purpose of TOCS cruise is to observe Physical Oceanographic condition in the Western Pacific to archive a better understanding of Ocean-atmosphere interaction affecting on the ENSO phenomena. This mechanism is very important to predict anomaly of ENSO. The long purpose for this study that the data base could be process with numeric modeling to make clear the mechanism of ENSO phenomena.

3 Time duration and field

Tropical Ocean Climate Study cruise was done on July 1st, 1995 to July 27th, 1995. The area consists as Pacific Ocean, Indonesia EEZ Northern Irian and Talaud long 2.40 South to 5.00 degree North and 127.00 to 156.00 degree East.

SURVEY ACTIVITY

The Tropical Ocean Climate Study cruise activity contains as follow :

1. CTD (Conductivity, Temperature, Depth) observation

Fifty stations CTD including the 5 liter -- 45 stations rosette water sampler with SBE 9 plus CTD were used in TOCS cruise. The wire was a single conductor 10,6 mm Steel rope manufactured by Rochester cables and the winch was built by Tsurumi Seiki Japan.

2. Subsurface ADCP and Current (Woce) Moorings

Four-subsurface moorings were deployed at (0, 138E), (2.30 S, 142 E), (2 S, 142 E), (0, 156 E). Two-subsurface moorings were recovered at (4.1N, 127.30 E) and (3.10 N, 128.27E). We have tried to recover one from two WOCE moorings at 3.27 N, 127.52 E with tangle system, unfortunately the recovery was failed. The mooring system is design to obtain the variability of the equatorial current. Each mooring was equipped with Acoustic Doppler Current Profiler at 300 meters, one CTD SBE 16 at just below the ADCP. Two Benthos Acoustic releases used to release ADCP buoy from sinker on the recovery.

3. Atmospheric Sonde

Fifty-eight of atmospheric sonde were done every 6 hour to measure for upper air temperature, wind speed and direction, humidity and pressure of air. The sensor omega launched to air with balloon that contain Helium gas, the data transmitted real time to receiver at the container on board

4. Dissolved Oxygen Measurement

Measurement of dissolved oxygen was done on 45-positions in CTD station with direct measurement by sensor that be attach on CTD system and water sampler with Carpenter method automated potentiometric titration and Electrode measurement.

5. ATLAS and PROTEUS Surface Buoys

Four-surface buoys were deployed at (0,147 E), (2S,156E), (0,156E), (2N,156E), (5N, 156E) and two ATLAS buoys have recovered at 2S, 156E and 5N, 156E, one ATLAS buoy and one Proteus buoy recovery were failed at 2S, 156E and 0,156E. The ATLAS moorings are designed to obtain surface meteorological data and subsurface water temperature.

CONCLUSION

The recovery and deployment of ADCP subsurface buoys and ATLAS surface buoys have finished succesfully, unfortunately two recoveries of WOCE buoys were failed. Fifty stations CTD sampling including water sampling for dissolved oxygen and Salinity were measured every one degree along 127 to 156 East Longitude and 6 North to 2.30 South Latitude.

SUGGESTION

We found the important data during the TOCS cruise, unfortunately some important location like Northern Sulawesi didn't include in this observation. We would like to suggest to JAMSTEC and BPPT could discuss concerning wide observation in Indonesian Water of course with Baruna Jaya Research Vessel. Just information, the fourth of Oceanographic and Fisheries Research Vessel Baruna Jaya will arrive to Jakarta from France on December 1995

ACKNOWLEDGMENT

Finally The Tropical Ocean Climate Study cruise have been done succesfully. We would like to thank JAMSTEC for funding our trip and all expenses, our director, Dr., Indroyono Soesilo and Project Manager R/V Baruna Jaya Dipl. Ing. Basri M. Ganie for appointing us to participate in TOCS 9505, Cruise. Chief Scientist Yoshifumi Kuroda and Kentaro Ando and Technical Staffs Captain Hitoshi Tanaka and crew members of Research Vessel Kaiyo.

10. Participants List

Yoshifumi Kuroda	Japan Marine Science and Technology Center (JAMSTEC) 2-15, Natsushima, Yokosuka, Japan Tel.0468-66-3811
Kentaro Ando	JAMSTEC
Humio Mitsudera	JAMSTEC
Koichi Takao	Nippon Marine Enterprises Ltd. (NME) 14-1, Ogawa-cho, Yokosuka, Kanagawa, Japan Tel. 0468-24-4611
Hiroshi Yamamoto	NME
Atsuo Ito	NME
Mitsuru Hayashi	NME
Masayuki Fujisaki	NME
Takehiko Shiribiki	Sanyo Techno Marine Co. LTD (Sanyo) 15-10, Kofune-cho, Nihonbashi, Chuo, Tokyo, Japan Tel. 03-3666-3240
Keiko Komine	Sanyo
Iwao Ueki	Tokai University 3-20-1, Orito, Shimizu, Shizuoka, Japan Tel. 0543-34-0411
Braham Lakoni	DISHIDROS. TNI. AL. Ancol Timur, Jakarta Indonesia
Djoko Hartoyo	Bandan Pengkajian dan Penerapan Teknologi (BPPT) Jl M.H. Thamrin No.8 Jakarta Indonesia10340 Tel 62-21-316-9706
Ali Alkatiri	BPPT
David Zimmerman	Pacific Marine Enviromental Laboratory (PMEL) 7600 Sandpoint way NE Seattle WA, 98115, USA Tel. 206-526-6728
Anne Nimershen	PMEL

Kaiyo Crew Members

Captain	Hitoshi Tanaka
Chief Officer	Yukinori Orita
Second Officer	Kazunori Fujiwara
Third Officer	Takafumi Aoki
Chief Engineer	Toshihiro Kimura
First Engineer	Kimio Matsukawa
Second Engineer	Mitsuhiro Ueki
Third Engineer	Kazunori Noguchi
Chief Radio Officer	Tokinori Nasu
Second Radio Officer	Masatomo Takahashi
Boatswain	Munemasa Konishi
Able Seaman	Yoshinori Kasahara
Able Seaman	Masayoshi Matsumoto
Able Seaman	Yoshiaki Kawamura
Able Seaman	Masatsugu Hamaoka
Sailor	Takashi Kiyohara
Sailor	Tomohiro Ishizaki
No.1 Oiler	Kazuhiko Uesugi
Oiler	Akira Kajitani
Oiler	Hideki Kubo
Oiler	Seiichi Matsuda
Oiler	Yoshinori Kawai
Chief Steward	Yoichi Suzuki
Steward	Kyuji Tada
Steward	Yoshitarō Tamiya
Steward	Sueto Sasaki
Steward	Isao Matsumoto
Jr. Third Officer	Takashi Yamamoto

CONTENTS

K９５０５かいよう観測航海要約

パラオ-ケビエン　（黒田）

１９９５年（平成７年）６月３０日にかいようはパラオでＰＭＥＬのブイ資材を積み込み、その日の１３時に出港した。７月１日にはCTD観測を開始した。７月２日はミンダナオ南方海域のＣＴＤ観測を続けた。７月３日にはWOCEプロジェクトでタラウド島とモロタイ島の間に設置した２つのＡＤＣＰブイを回収した。４日には１９９２年１０月に設置し、１９９４年２月に回収に失敗した係留系の回収を掃海作業により試みたが過剰な張力（常時２.２トン以上）のため断念した。なお４日および５日に１９９４年２月に設置した２つのマーカーブイは回収した。６日にはゾンデによる高層気象観測を開始した。７日からハルマヘラ島沖から２Nに沿った測線で、８日には138Eに沿った測線でCTD観測を行った。９日には0,138Eに、11日にはニューギニアの北の沿岸域の 2-30S,142E および2S,142EにADCP係留系を設置した。１２日には赤道沿いのＣＴＤ測線に戻り、１３日には0,147EのATLASブイの修理を行った。１４日にはケビエンに入港した。この航海中弱い東風が卓越し、波もなく非常に静穏な海況であった。しかし、ほとんどのコースで逆か潮となり観測時間の不足に悩まされた。結局、後半の日程との関係もあり、０，１４２Ｅで設置回収予定のＡＤＣＰブイは半年間係留を延長し来年２月に回収設置することとした。

ケビエンーグアム（安藤）

7月１６日にケビエンを出港し１７日午後に2S、１５６ＥのATLASブイの回収を行った。１８日午前には同地点で設置を行い、赤道に向かった。１９日早朝より表面ブイが流失したPROTEUSブイの海中部の回収を試みるが、切り離されるものの海上まで浮上せずに断念した。また、同日に、ADCP係留系を５マイル東に設置し、更に、ATLASブイをその５マイル東に設置した。この回収ができなかったために１８時間ほど余裕が生じた。翌２０日に２NのATLASブイの設置地点に行くが表面ブイがないことが判明した。明らかに海底付近に系が存在していることは切り離し装置の信号わかった。切り離し装置付近の補助フロートと系の全長および重さの関係から表面ブイが系についている場合海面まで浮上せず、ついていない

場合のみ浮上することがわかった（回収作業が危険にならない）ので、切り離しを行った。残念ながら系は海面まで浮上せず海面から１８００メートルで止まったため、回収は断念した。また、同日に、このポイントから５マイル東に新たにATLASブイを設置した。

７月２１日は、CTDのみの作業とし、５Nに向けて航走した。２２日に早朝よりATLASブイの回収および設置を行い、午後に最後のCTDを行ったのちグアムに向けた。

Time Table K9505

30/06/95 Local Time (-9=UTC)
0800-1100 Loading PMEL buoy gear
1300 Depart Palau
ADCP measurements started
1500 Safety education
1800 General meeting
01/07/95 Local Time (-9=UTC)
1100 Fire drill
1540-1653 06-00.373N,130-00.061E CTD01 CTD measurement started
02/07/95 Local Time (-9=UTC)
Continuation of CTD measurements
03/07/95 Local Time (-9=UTC)
0558-0812 Recovery WOCE ADCP mooring at 4-1.2N,127-30.6E
1500-1652 Recovery WOCE ADCP mooring at 3-10.7N,128-27.3E
04/07/95 Local Time (-9=UTC)
0556-0637 Marker buoy recovery at 3-12.6N,127-52.87E
0746-1054 Test for recovery operation by a towed line
1110-1140 Safety meeting
1302-1623 Recovery operation by a towed line at 3-12.2N,128-26.8E
(No recovery, failed)
05/07/95 Local Time (-9=UTC)
0553-0626 Marker buoy recovery at 3-27.7N,127-52.8E
Continuation of CTD measurements
06/07/95 Local Time (-9=UTC)
0836 Started atmospheric sounding at 2N,129-20E
Continuation of CTD measurements
07/07/95 Local Time (-9=UTC)
Continuation of CTD measurements and atmospheric sounding along 2N
08/07/95 Local Time (-9=UTC)
Continuation of CTD measurements and atmospheric sounding along 2N and 138E
09/07/95 Local Time (-9=UTC)
0635-0759 Subsurface ADCP mooring deployment at 0-01.2S,138-01.9E
(Depth=3910m)

Continuation of CTD measurements and atmospheric sounding along
10/07/95 Local Time (-9=UTC)
Continuation of CTD measurements at 2-40S, 2-30S along 142E and atmospheric sounding

11/07/95 Local Time (-9=UTC)
0610-0710 Subsurface ADCP mooring deployment at 2-28.6S,141-58.2E (Depth=3436m)
1033-1131 Subsurface ADCP mooring deployment at 2-00.0S,141-59.9E (Depth=3609m)
Continuation of CTD measurements and atmospheric sounding along the equator
12/07/95 Local Time (-9=UTC)
Continuation of CTD measurements and atmospheric sounding along the equator
13/07/95 Local Time (-9=UTC)
0800-0930 ATLAS surface buoy repair at 0,147E
0815 Last atmospheric sounding at 0,147E in the first leg
Continuation of CTD measurements
14/07/95 Local Time (-10=UTC)
0559-0635 Last CTD measurement at 2S,150E in the first leg
1300 Arrived at Kavieng
15/07/95 Local Time (-10=UTC)
Bunkering
16/07/95 Local Time (-10=UTC)
0900 Departed Kavieng
1300 General meeting
17/07/95 Local Time (-10=UTC)
1000 Started first atmospheric sounding (sonde) for the second leg (every six hours)
1400-1800 ATLAS surface buoy recovery at 2S,156E
18/07/95 Local Time (-10=UTC)
0600-0900 ATLAS buoy deployment
0900 CTD 43 (2S,156E), first measurement for the second leg started
Continuation of atmospheric sounding by sonde
1944-2104 Seabeam for bottom topography & shipboard ADCP calibration
19/07/95 Local Time (-10=UTC)

0600-0615 PROTEUS (0,156E) recovery trial - stacked
0630-0745 JAMSTEC ADCP (0,156-05E) deployment
0815-0830 Retrial of recovering PROTEUS - failed
0930-1200 ATLAS deployment (0,156-10E)
Continuation of CTD measurements
Continuation of atmospheric sounding by sonde
1330-1350 Retrial of recovering PROTEUS

20/07/95 Local Time (-10=UTC)

0600-0615 ATLAS (2N,156E) recovery trial - surface buoy not found position confirmed
0800-1000 ATLAS (2N,156E) deployment
1100 Preparation meeting for recovery
1300 Retrial of recovering the ATLAS
Continuation of atmospheric sounding by sonde

21/07/95 Local time (-10=UTC)

0900-1700 Continuation of CTD measurements at 3N and 4N
Continuation of atmospheric sounding by sonde

22/07/95 Local Time (-10=UTC)

0600-0830 Recovery of the 5N ATLAS
1030-1200 Deployment of the 5N ATLAS
1300-1430 Last CTD cast and washing wire
Continuation of atmospheric sounding by sonde

23-24/07/95 Local Time(-10=UTC)

Cruising to GUAM
1000 Last atmospheric sounding

25/07/95 Local Time(-10=UTC)

1300 Arrival at GUAM

WOCE中層流速計係留系の回収報告

平成７年７月
海洋観測研究部

１目的

平成４年度受託研究’フィリピン東方海域における流量の観測研究’、及び平成年度受託研究’インドネシア通過流の観測研究’の一環としてインドネシア経済水域に設置した６系統の係留系の回収について述べる。

２日程

平成７年７月３日ー４日　（’熱帯赤道域の観測研究’航海中）

３使用船舶

かいよう

４　係留系設置点

A:掃海流速計係留系　3-12.22N,128-26.89E 2340m
B: 掃海流速計係留系　3-27.44N,127-52.96E 2237m
C: ADCP係留系　4-1.23N,127-30.63E 2580m
D: ADCP係留系　3-10.79N,128-27.367E 2264m
E: マーカー係留系　3-12.66N,128-26.68E 2340m
F: マーカー係留系　3-27.78N,127-52.87E 2237m

５　回収作業参加者

海洋観測研究部　副主幹　黒田芳史
研究員　安藤健太郎
研究員　三寺史夫
日本海洋事業　高尾宏一、山本博、伊藤淳雄、林美鶴、藤崎正行
田中等船長　以下乗組員
三洋テクノマリン　尻引武彦
作業補助　植木厳

６　実施内容

７月３日
WOCEプロジェクトでタラウド島とモロタイ島の間に設置した２つのＡＤＣＰブイを回収した。

７月４日
掃海作業試験
掃海作業本番の前にからみ索の繰りだし、巻き上げ試験を行った。この試験では参考資料２のうちからみ索先端のチェーンが１本であり、曳航索下端のアンカーは450kgとした。からみ索はすべて投入し曳航索を深度500mまで繰りだした。そのあと1.5kts および3kts で曳航した。この試験では、掃海作業の手順、人員の配置、危険範囲、張力計の作動確認、トランスポンダの受信、曳航時の索の挙動、曳航時の操船等の事項について作業者間で周知確認した。

試験の直後行った安全検討会において問題点としてつぎのようなことが上げられた。
ー係留系が絡んだ後、からみ索を回収の時に張力計がついたブロックがひとつしかなく常時張力を監視できない。（片方でできるところまでやる）
ー1.5kts および2.5 ktsと潮流が強く曳航索が流されてしまう。（からみ索先端チェーンおよび曳航索下端アンカーの重量を増す）
ー張力計に時間ドリフトがある。A フレームクレーンに取付けられたブロックを通る曳航索の角度が大きいときに誤差が大きい。（300-700kg の誤差を見込んで作業をすすめる）
ーからみ索先端のトランスポンダの受信がとぎれることがある。（曳航時にトランスポンダが後方になびくためと考えられ、できるだけ上を向くように１点ではなく２点で索取りする。）
ー1.5kts および2.5 ktsと潮流が強く船が流されシミレーションのように円形に航跡を描くことは不可能である。むりに対水速度を上げれば曳航索、からみ索が浮き上がってしまうと考えられる。（むりに円形を描くことをせず、潮に立ててからみ索を展開し、目標点の上流から巻くようにする。）

掃海作業

１３：２０より１９９２年１０月に設置し、１９９４年２月に回収に失敗したWOCE係留系（3-12.2N、128-26.8E)の掃海作業を開始した。表層で北北西向きの１．５から２．５ノットの強い流れがあった。からみ索を展開し曳航中は0.8tで推移した曳航索の張力が１４：５５に２ｔ近くまで上がった。何かが索にからまったものとみて巻き上げを開始した。巻き上げ中安全基準の２．２ｔを越えたので一度中断し、ウインチ係留索を繰りだした。その後、船に後進をかけできるだけ係留索を鉛直に保ち再度巻き上げを開始した。からみ索先端のトランスポンダからの信号で海底から１００m程度上昇したが、常時２．２ｔの張力が懸かるようになった。それ以降徐徐に巻き上げるも 15:56に２．５ｔに達した。これ以上の作業は危険と判断し船長と協議の上、曳航索をゆるめ張力が0.8tとなったところで上甲板で上部にストッパーを取ったうえ切断した。曳航索は３５００mであり、１３００m程度切断したので、以降計画していた係留系の回収掃海作業を断念した。

その他

なお４日および５日に１９９４年２月に設置した音響切り離し装置を使った２つのマーカーブイは回収した。

まとめ

今回の回収作業で絡んだものが目的の係留系であるとすれば、以下のように推測される。この掃海作業の前の航海で通常の切り離し装置による回収が試みられた。切り離し信号が正常に切り離したことを伝えてきたが浮上しなかった。今回、曳航索の張力が2.5tを越えたことから水中重量1.57tのコンクリート製のアンカーが切り離されていなかったと考えられる。設置時にアンカーが着底したとき係留系のオーバーシュートが起きアンカー直上のワイヤーロープによりが入り切り離し装置あるいはその上のガラス玉フロートに絡まってしまったと推測される。また、系の設計では約800kg程度の正味の重量しか懸からないはずであるのに、2.5tもの張力を生じたことから、係留系上部のプラスチックブイは切れて流れたものと推測される。この様な張力のかかった状態では、もしも海面まで上げてきたとしても取り込むことは不可能であったといえる

今回、結局回収することができず失敗に終わったわけであるが、海中の物体をからめることができたのであり、からみ索のシステムとしては非常にうまく働いたと言える。
問題点としては、このからみ索自体の回収も手間がかかり、物体をからめたあと船上に取り込むところは

非常に困難で危険な作業が残ることは確かである。

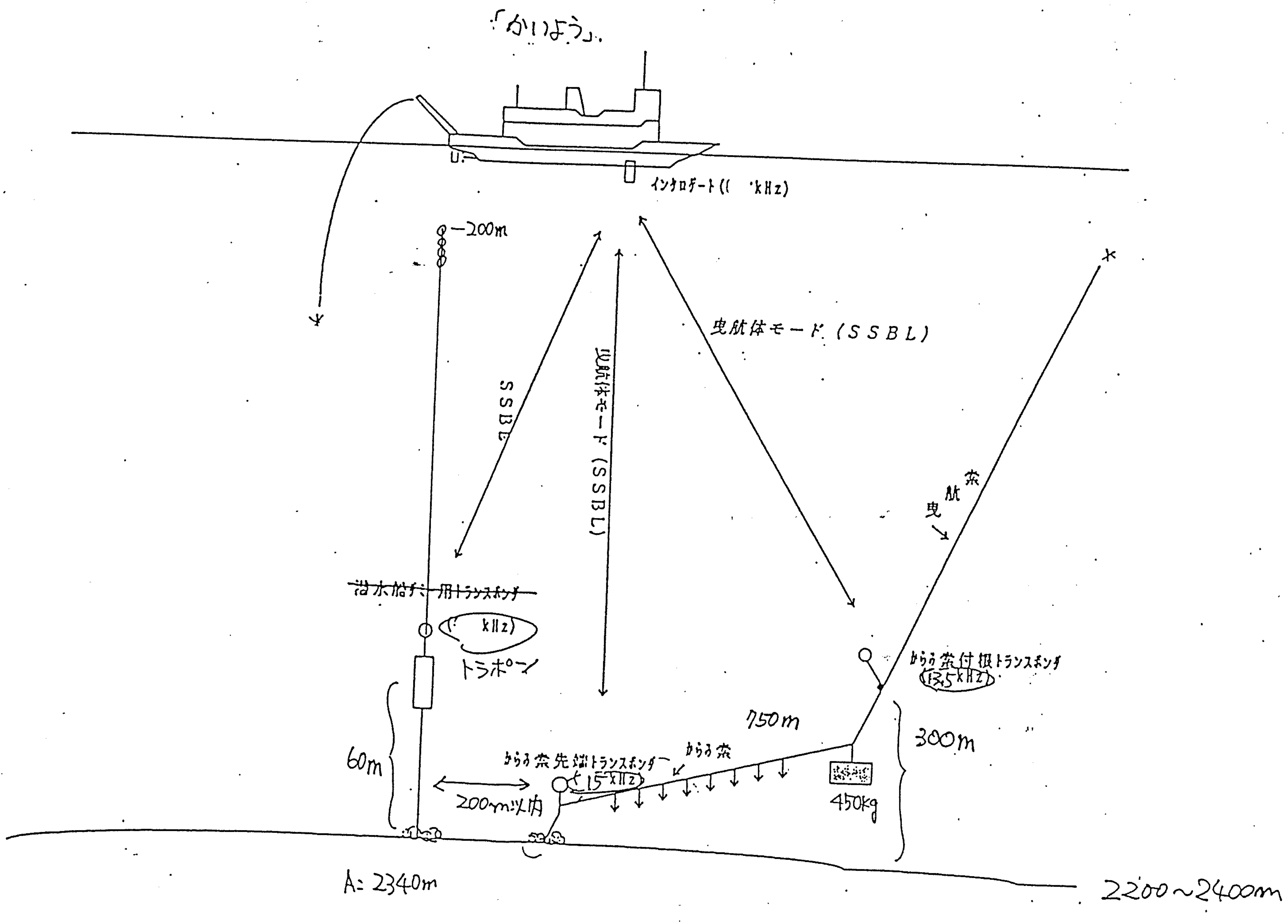
謝辞
今回のからみ索のシステムは”よこすか”搭載の”しんかい6500”の外部救難装置を原型にしたものである。今回のからみ索の挙動のシミレーションをやっていただいた野本昌夫主幹、貴重な助言を得ました高川真一主幹に感謝致します。また、6000m ウインチの使用に際し助言いただいた、門馬大和主幹、網谷やすたか副主幹に感謝致します。最後に、この掃海作業を安全に実行するために長期間に渡り審議いただき、貴重な助言、意見をいただいた、係留系信頼性検討部会委員長の倉田俊夫前深海開発技術部長および田崎正幸深海開発技術部長をはじめ各委員の方々に感謝します。

参考資料１　からみ索システム
参考資料２　からみ索
参考資料３　トランスポンダ軌跡および”かいよう”の航跡
参考資料３　作業記録
参考資料４　張力計データ記録
参考資料５　海象、気象記録
参考資料６　WOCE係留系

参考写真１　からみ索
a,ロープおよびスマル
b,トランスポンダ
ｃ, ウインチおよび曳航索
ｄ,アンカー
参考写真２　張力計
参考写真３　からみ索の展開作業
参考写真４　係留索の切断

A3.03

参考資料1　からみ索システム



A3.04

参考資料２　からみ索

納入品

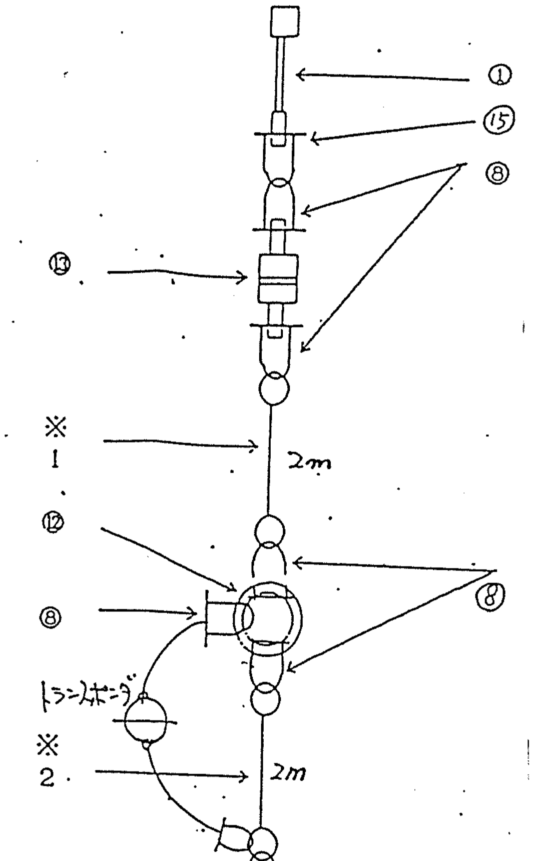
番号	品名	仕様	引張強さ	数量	備考
①	ハイテクロンＮロープ	16㎜, 3500m両端シンブル加工	１１．４ｔｆ	１	
②	ダンラインＳＰクロスロープ	26㎜, 450m両端シンブル加工	１０．３	１	比重０．９１
③	〃	26㎜, 300m 〃	〃	１	〃
④	〃	26㎜, 10m 〃	〃	１	〃
⑤	スマル	ＨＴ－１（両端アイ）	——	２	
⑥	重錘	４５０～７５０kg	——	１	
⑦	チェーン	１９㎜×２２ｍ	——	１	
⑧	シャックル	ＳＢ－２０	２．５	９	
⑨	〃	ＳＢ－２２	３．０	３	
⑩	〃	ＳＢ－２４	３．６	６	
⑪	〃	ＢＣ－２２	３．０	１	
⑫	リング	２２㎜　内径１００	２．５	４	
⑬	スイベル	ＡＢ－１０３	３．０	３	
⑭	カップリング	ＨＣ－３．２	３．２	１	
⑮	長シャックル	４ｔ	４．０	１	

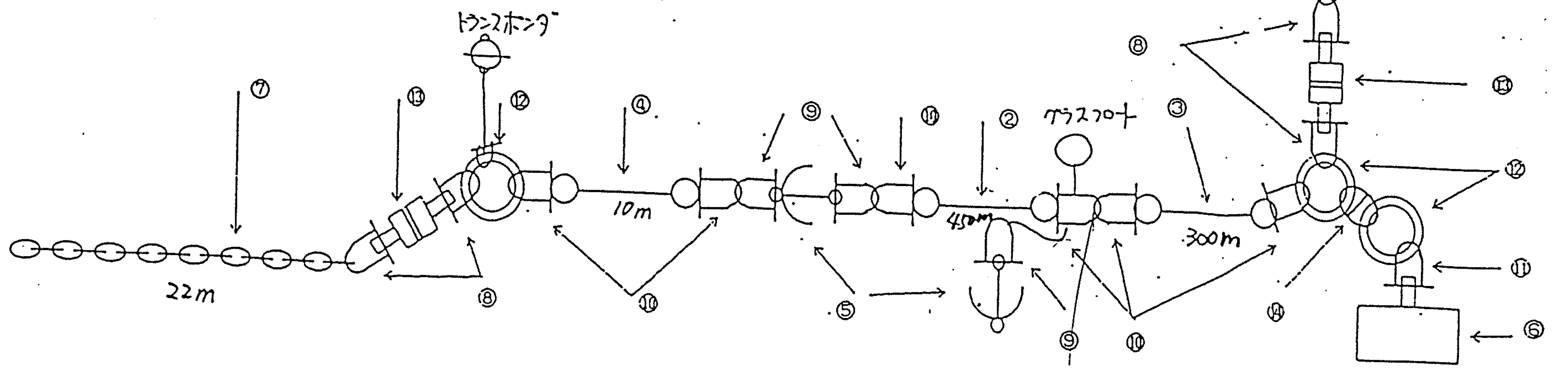
海洋技術センター様支給品

※１	ワイヤロープ	１８㎜，　２ｍ	１５．１	１	
※２	〃	１４㎜，　２ｍ	９．１５	１	

注１　⑤～⑮の付属品は各数量×２組の納入とします

注２　⑤～⑮の引張強さは仕様荷重、以外は破断荷重です



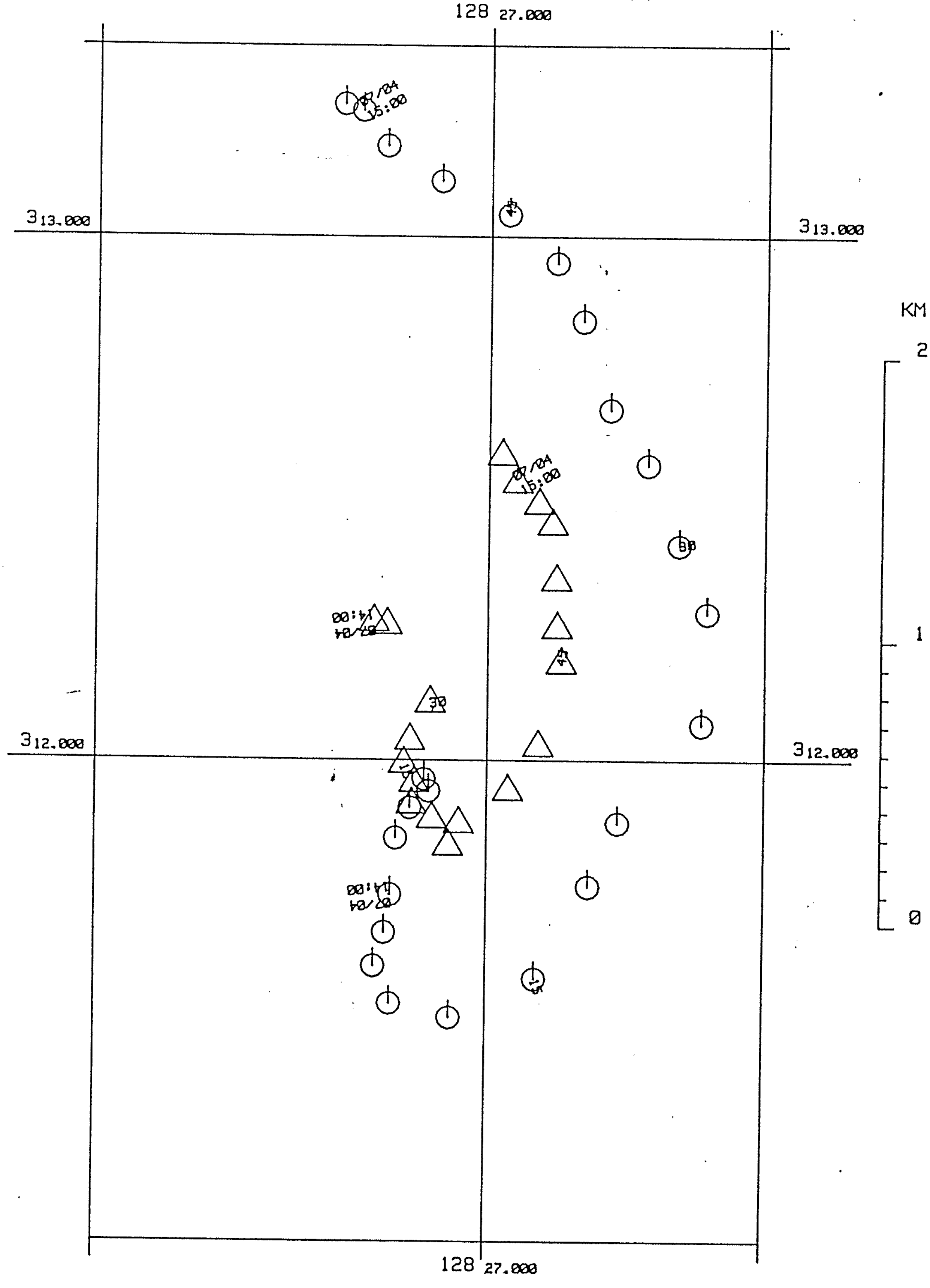


A3.05

参考資料3　トランスポンダ軌跡および"かいよう"の航跡

(1/ 20000 LAT. 3 0N)

Start 95/07/04 13:50 End 95/07/04 15:03



Center Lat 3-12.220N Lon 128-26.890E　　Center Select REFP

A3,06

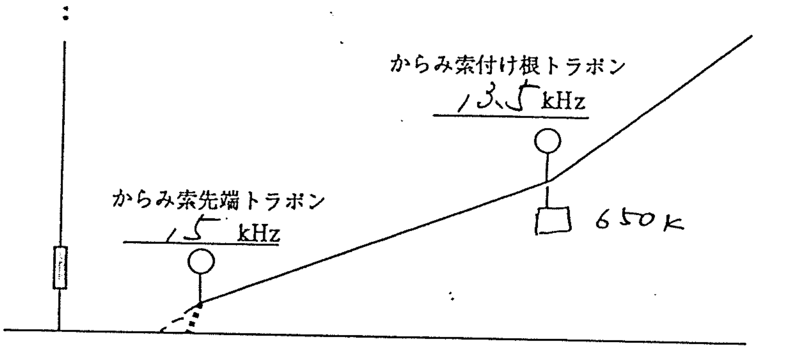
TOCS K9505

掃海作業記録

参考資料3　作業記録

記録者名　林 美鵙

目標位置
N 03-12.22
E 128-26.89



LOCAL (-9=UTC)

事　項	1995年7月4日 時　刻	位　置　　メモ
展開開始	13 02	N 03-12.203N　対水 1.5Kt. E 128-26.806E
からみ索先端 トラポン着水	13 05 〃	(D：水深　H：水平きょり　B：方位)
スバル・フロート着水	13 16	
からみ索付け根 トラポン着水	13 22 〃	深度　水平距離　方位
先端トラポン 着底 (2310m)	13 41	13 49 先端 D 2294 H 550 B 344 着底ずみ つけ根 D 1825 H 445 B 345 降下中
つけ根トラポン2000m 展開終了	13 52	先端 D 2294 H 680 B 349 つけ根 D 2020 H 542 B 357
曳航開始	14 06	03-11.555N, 128-26.807E 先端 D 2283 H 1330 B 357 つけ根 D 1767 H 992 B 002
第一周		
~~第二周~~		
~~第三周~~		
~~第四周~~		
曳航終了	14 54	03-13.28N, 128-26.071E 先端 D 2069 H 1995 B 161 つけ根 D 1184 H 1713 B 155
引き上げ開始	14 55	15 10 先端 D 2069 H 1407 B 165 つけ根 D 1343 H 884 B 163 15 25 先端 D 2091 H 867 B 179 つけ根 D 1253 H 554 B 183
~~引き上げ終了~~		
引き上げ再開	15 31	
引き上げ中止	15 56	03-12.787N, 128-27.048E 先端 D 2000 H 214 B 324 つけ根 D 1100 H 146 B 320
切断	16 23	03-12.677N, 128-27.059E 先端 D 2134 H 165 B 000 つけ根 D 1269 H 125 B 358

参考資料4　張力計データ記録

TOCS K9505　　　　　　　　　　　　記録者多三寺&尻引&植木

掃海時テンションメータ記録　　1995年7月4日

LOCAL　本番掃海

時刻	ロードセル読み		kg	作業内容
		mV		
12:58		007		OFF SET
13:21	90°	0.67	750	水面
13:39	100°	0.60	850	先端トラポン着底 2280m
14:05	135°	0.30	550	船左旋回
14:20	135°	0.28	550	右回頭
14:25	150°	0.27	700	船ゆっくり左回頭
14:28	150°	0.38	1050	船左回頭停止
14:38	140°	0.55	1300	
14:40	140°	0.62	1500	左回頭
14:40	140°	0.70	1550	
14:41	140°	0.75	1850	
14:51	100°	1.57	2100	ゆっくり左回頭
14:54	100°	1.54	2050	←揚収開始
14:55	120°	0.66	1100	
14:59	120°	1.22	2100	スロー巻き
15:10	100°	1.70	2250	
15:20	90°	2.00	2450	巻き停止、船、潮に立てる。
15:23	90°	2.12	2550	ケーブル出す。
15:25	90°	1.42	1700	
15:28	100°	1.84	2500	
15:30	90°	0.55	600	少しづつ巻く。
15:40	90°	1.78	2200	
15:51	90°	1.95	2400	トラポン少しづつ上昇
15:56	100°	1.85	2500	揚収中止、切断決定
16:15	90°	1.66	2000	切断準備
16:17	100°	0.70	850	くり出しStop.、Aフレームふり込み
16:23	110°	0.78	1100	切断

TOCS K9505

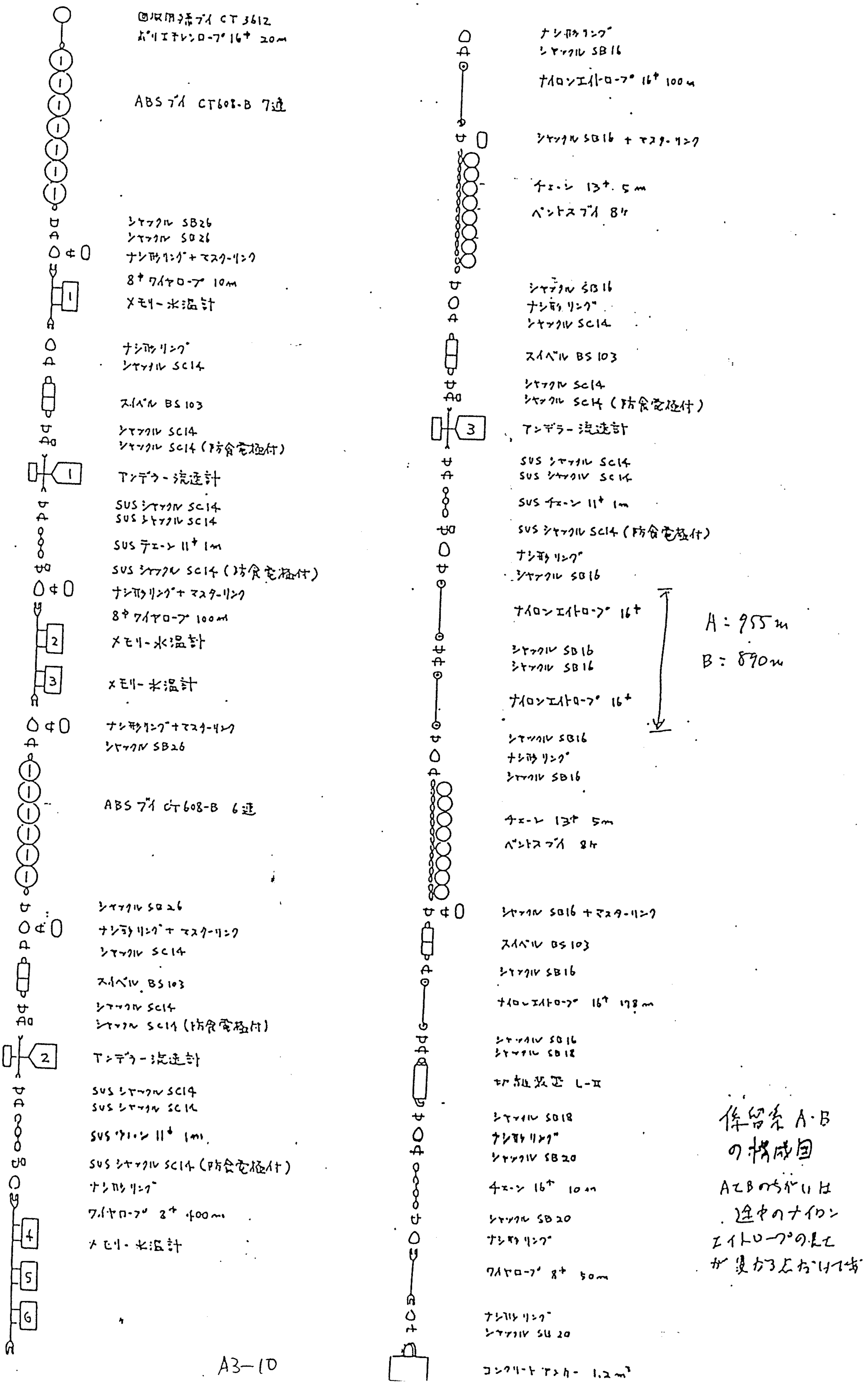
記録者名　林

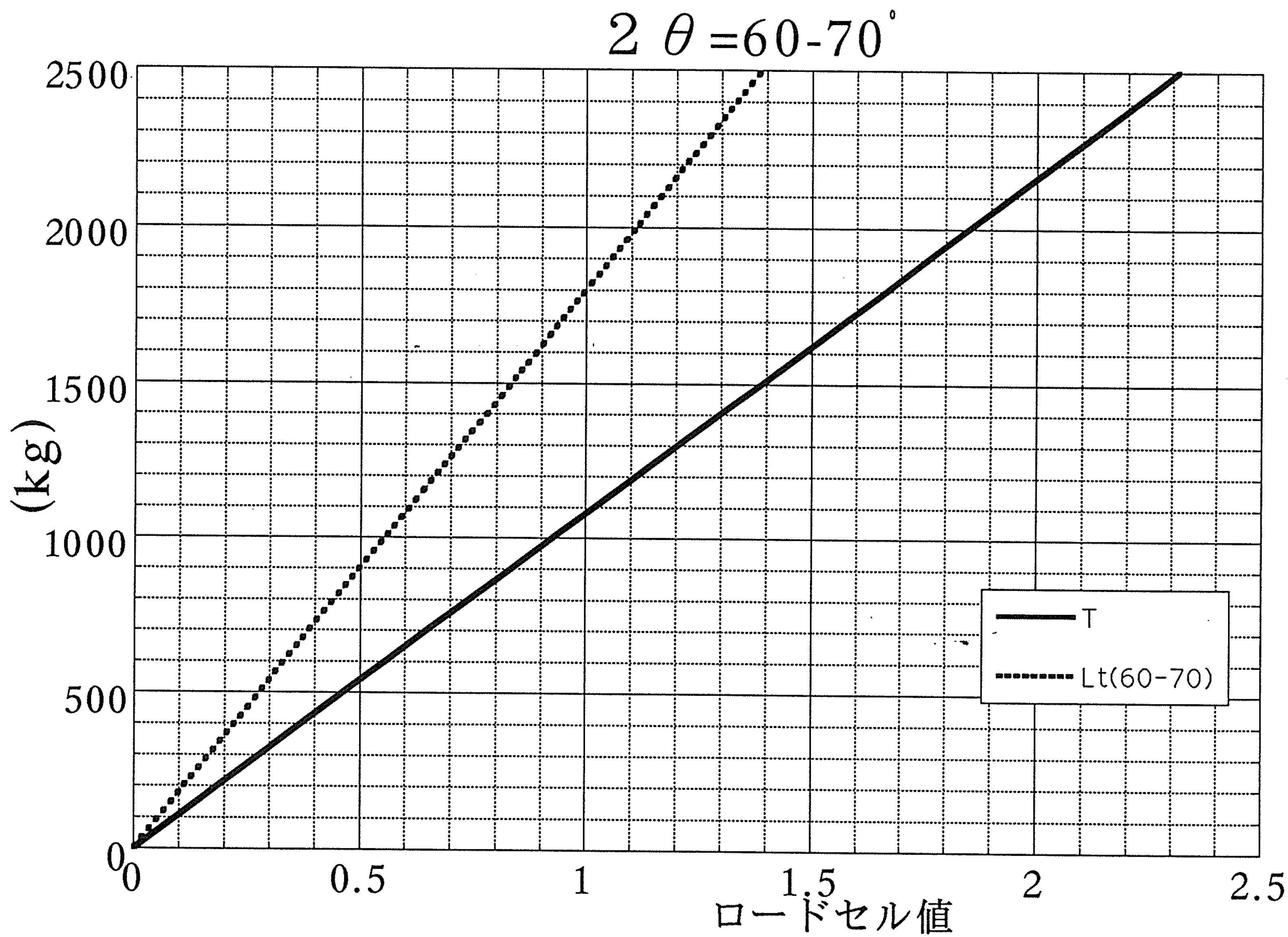
掃海時海象・気象記録

1995年7月4日

時刻 LOCAL	流速/流向 C層 20m (kt deg)	流速/流向 A層 80m	風速/風向	メモ
13 03	1.3/009	1.4/074		000 170 4m/s 1.5 kt
13 30	1.3/014	1.5/056		160 030 4m/s 1.5 kt
13 06	2.0/341	1.1/013		
13 30	1.0/349	0.6/010		350 2.0m/s 100 1.2kt
14 00	2.0/332	1.0/358		330 1.5m/s 130 2.3kt
15 30	2.0/345	1.5/350		160 080 2kt 1.5kt

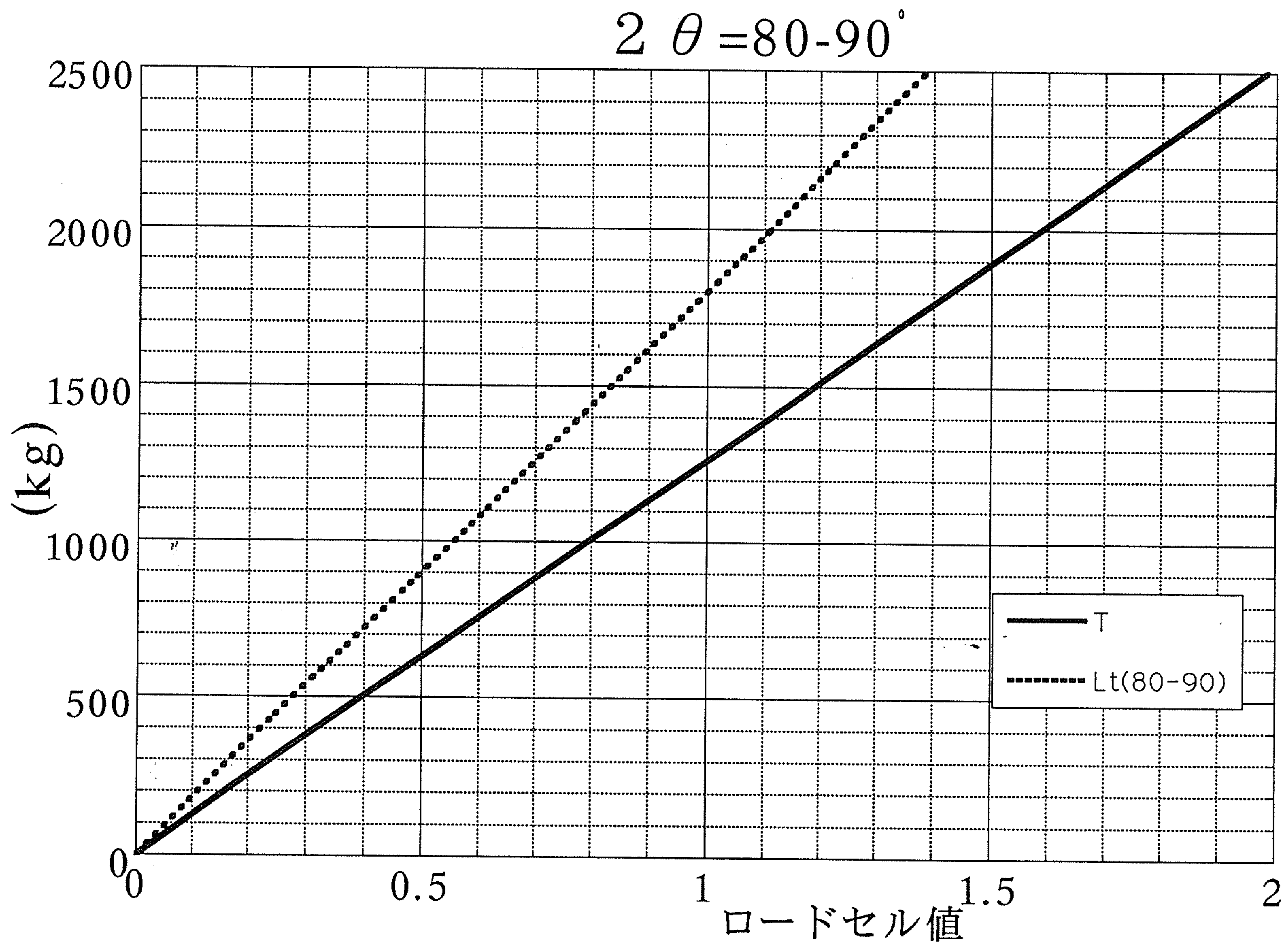
参考資料6　WOCE係留系



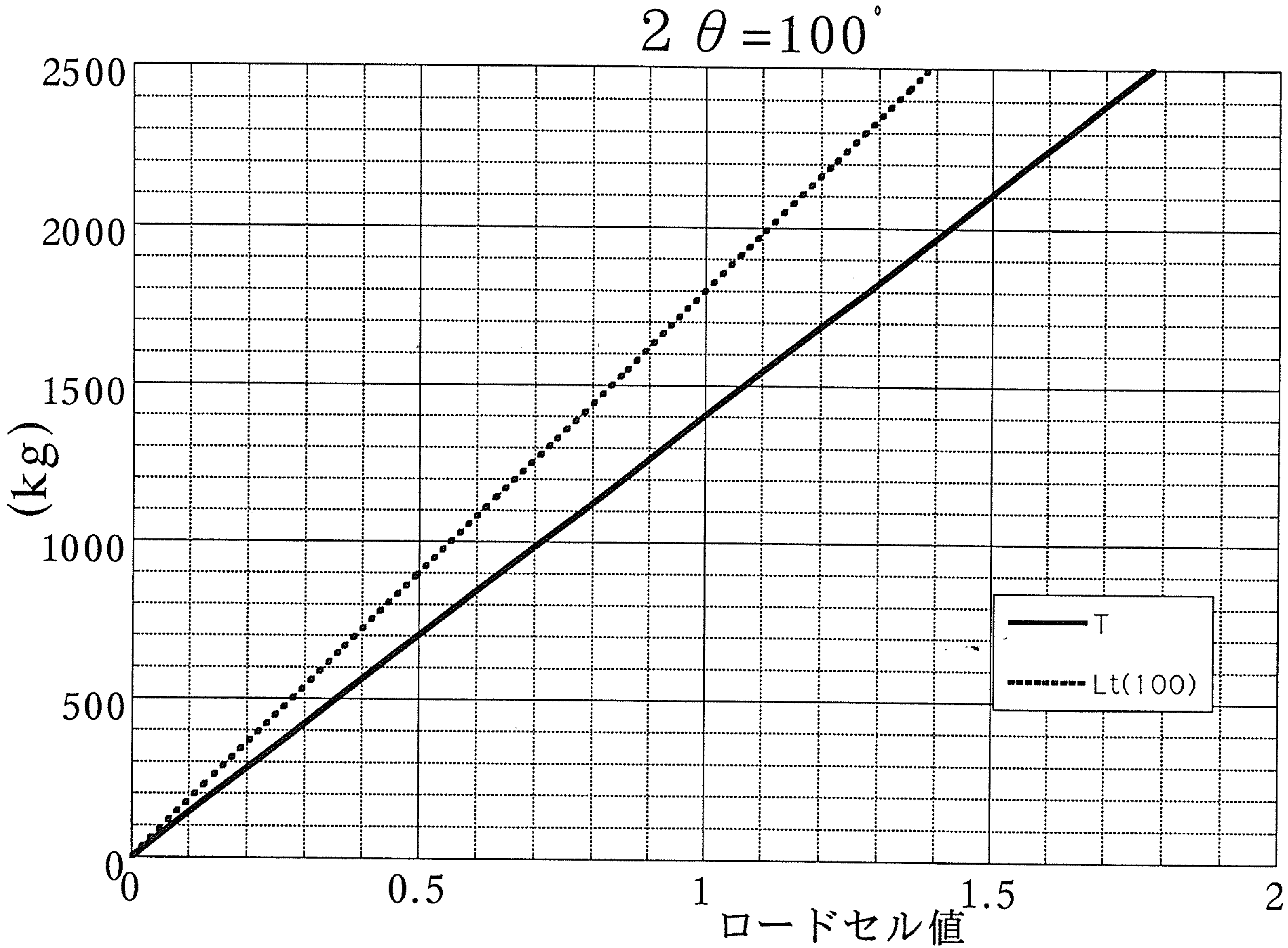


2 θ =60-70°
2500
2000
1500
1000
500
0
(kg)
0
0.5
1
1.5
2
2.5
ロードセル値
T
Lt(60-70)

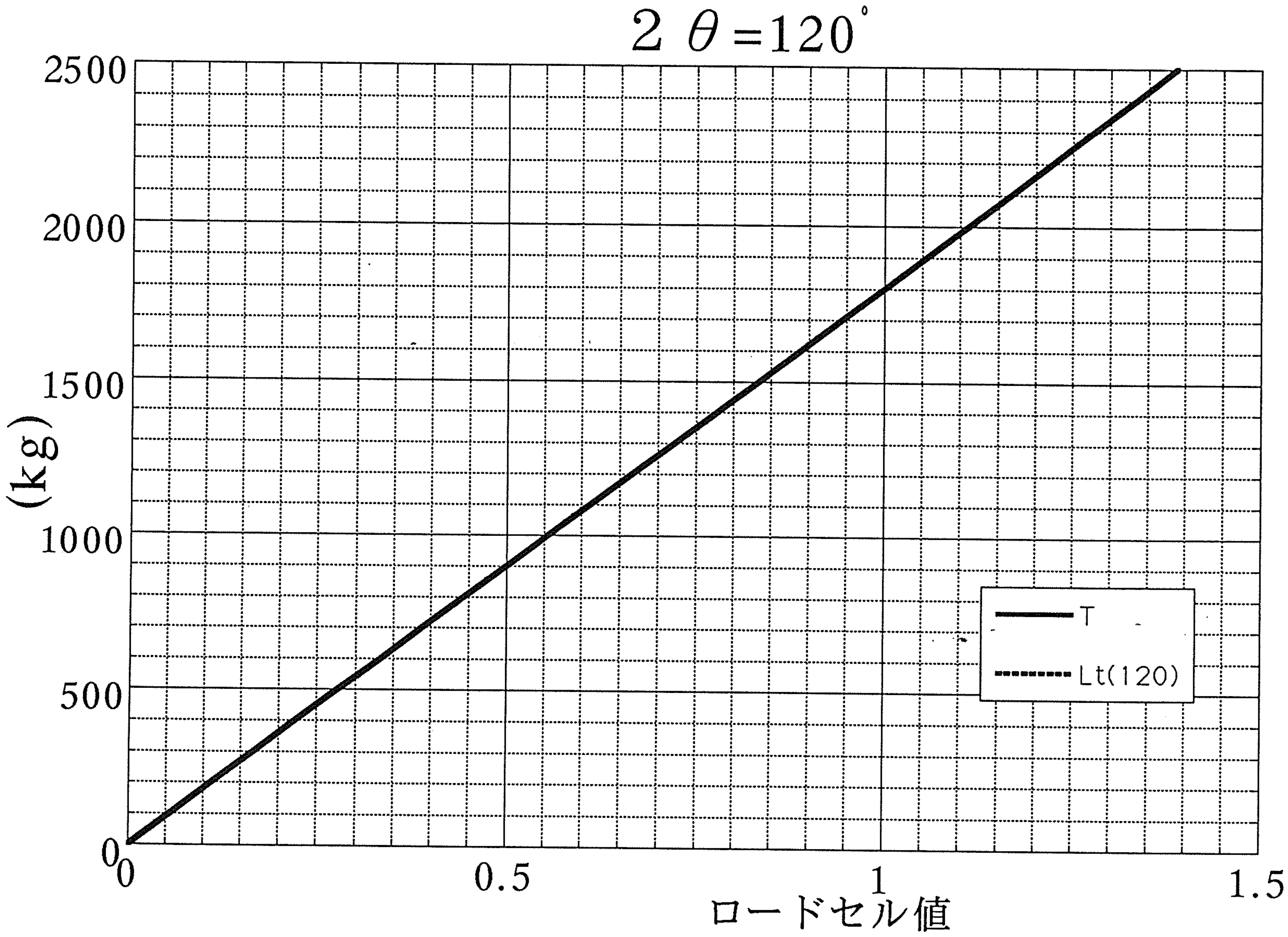
A3-11



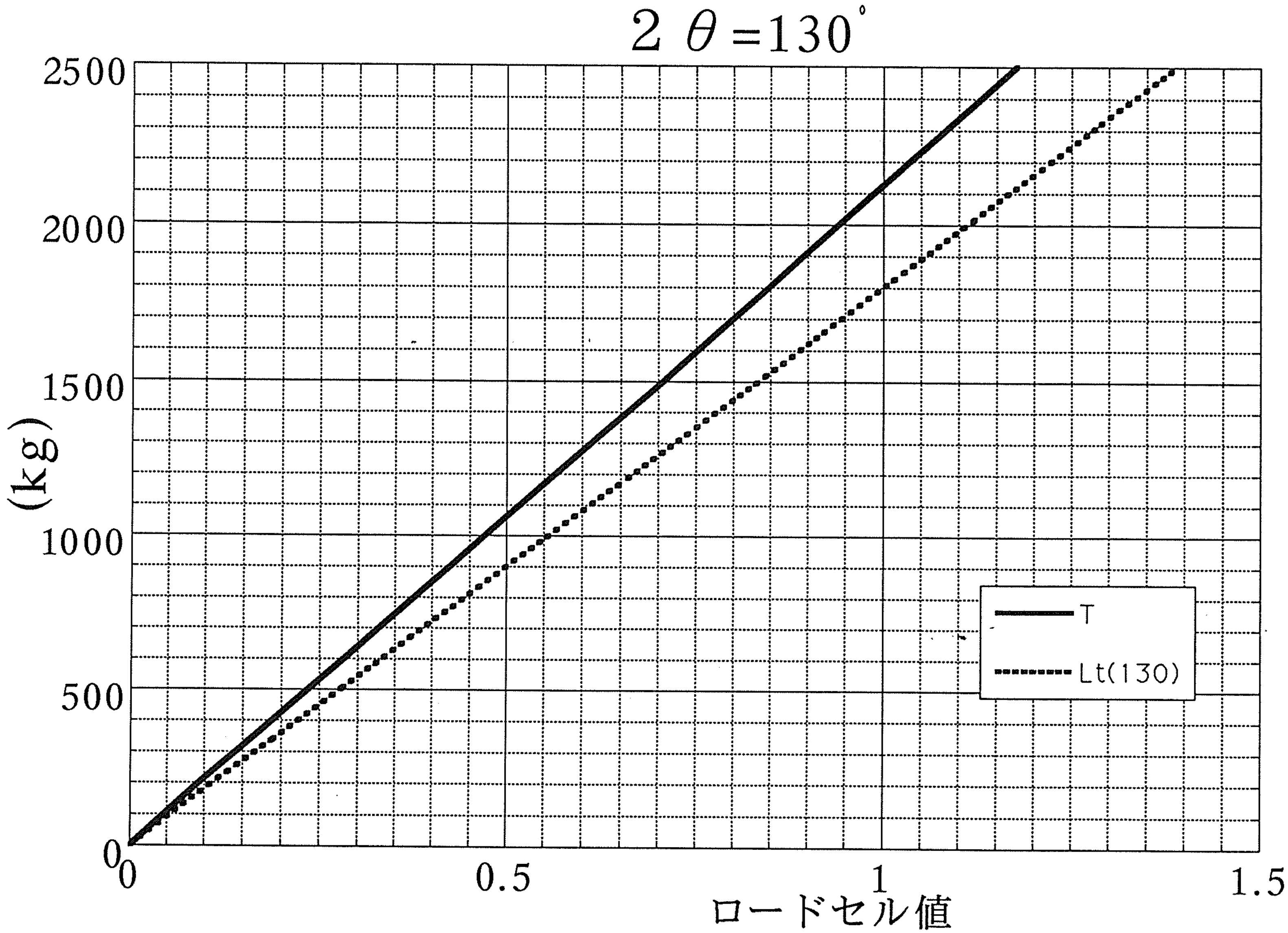
A3, 12



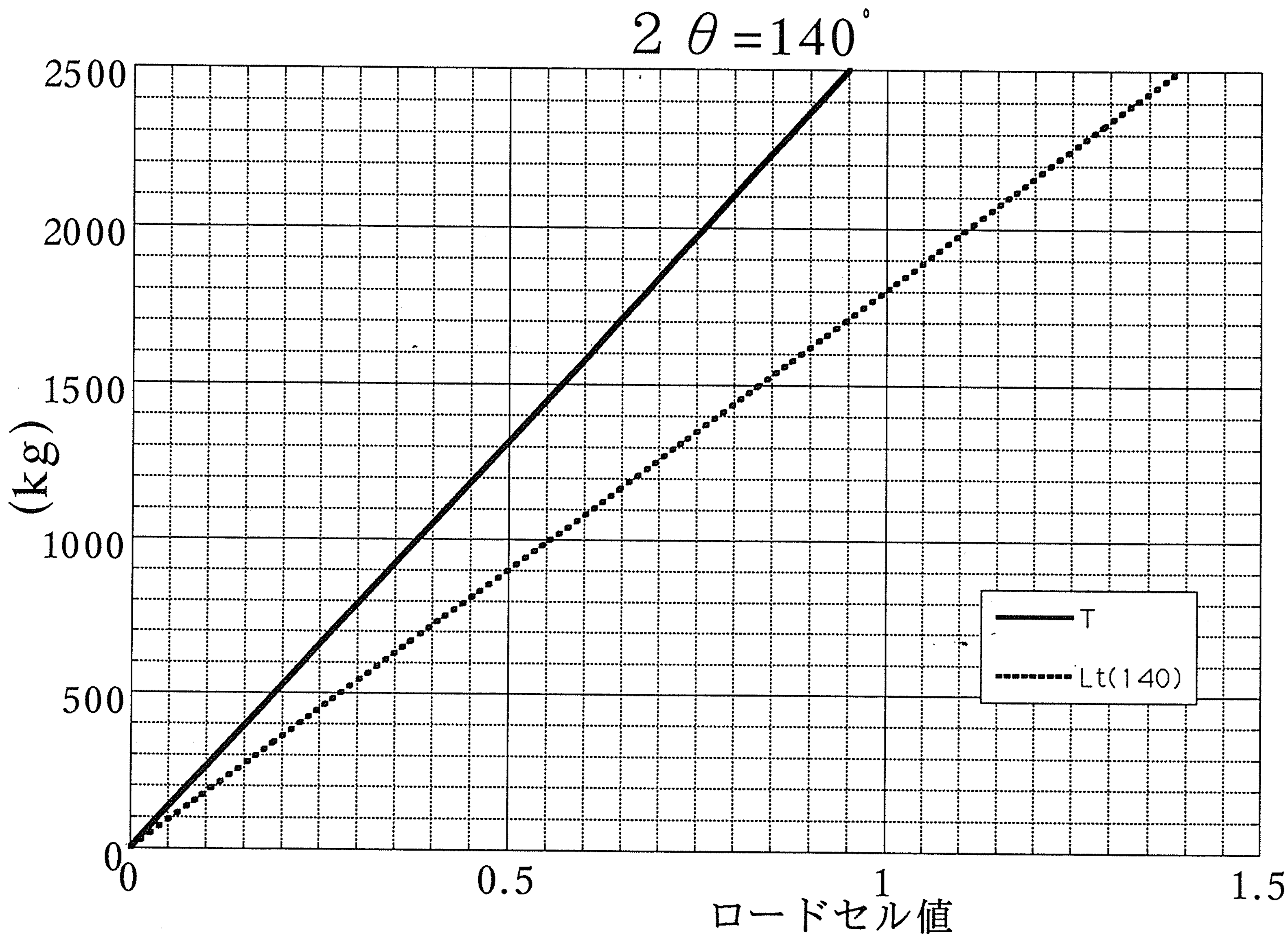
A3.13



A3.14

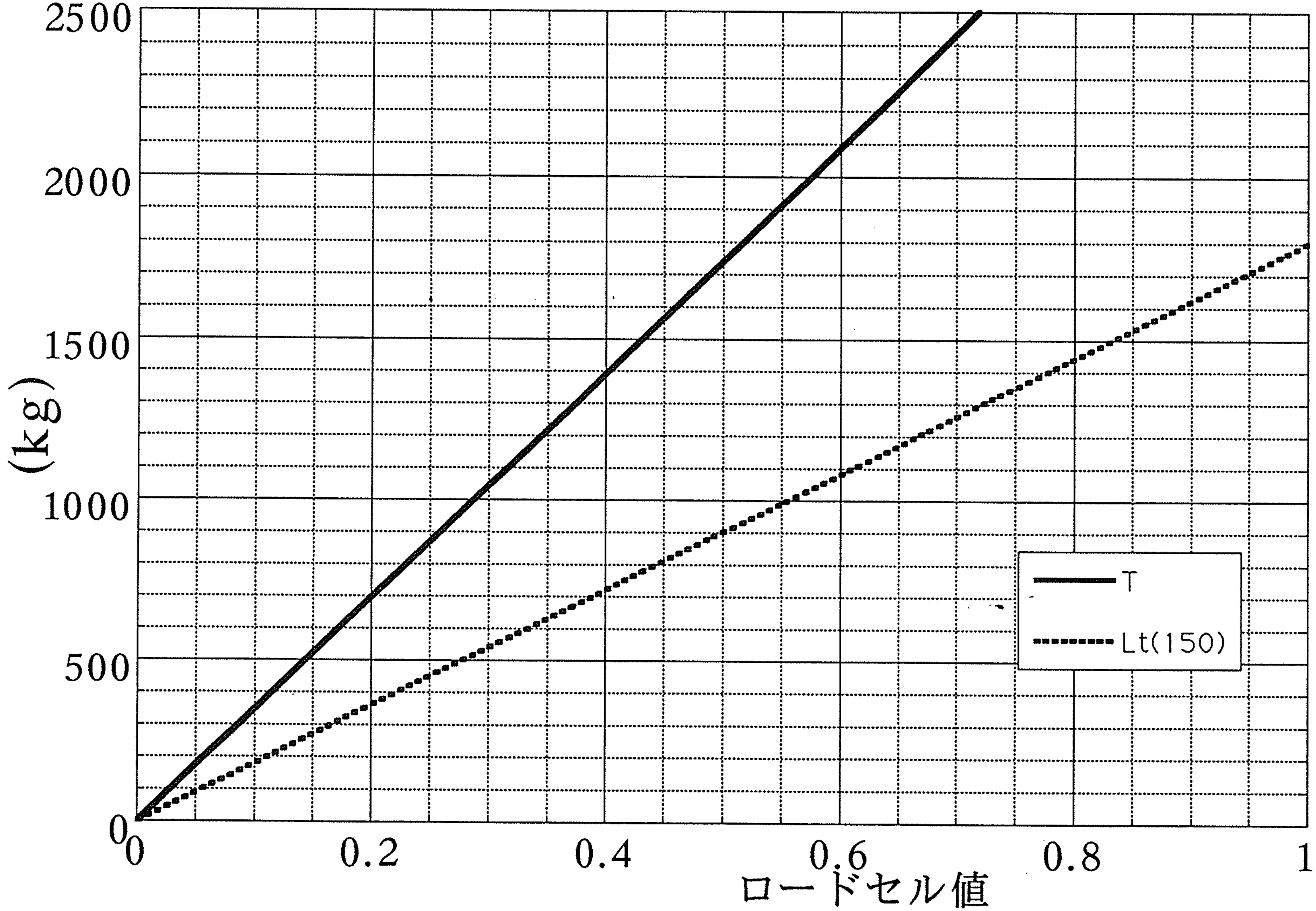


A3.15

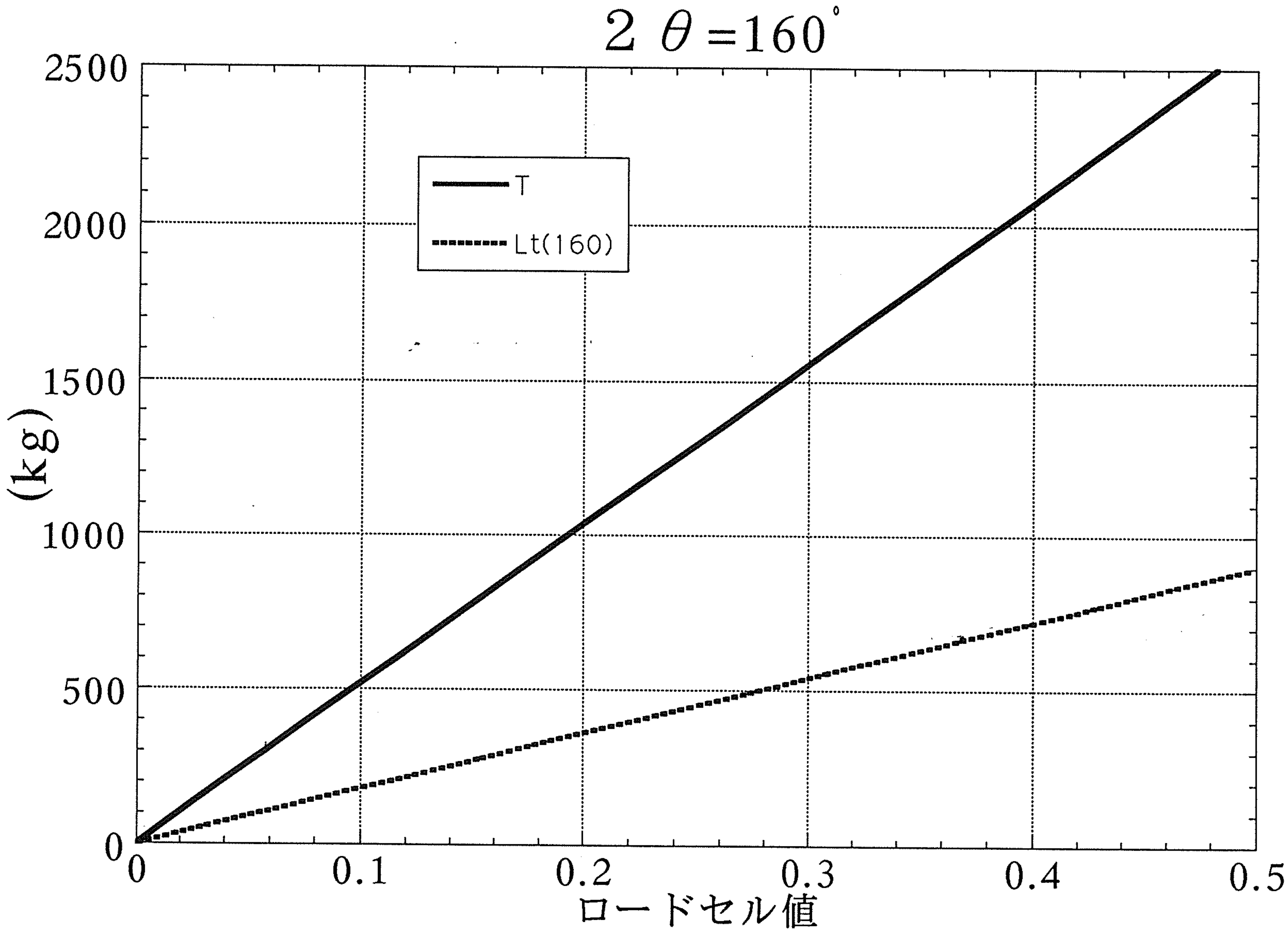


A3.16

2 θ=150°

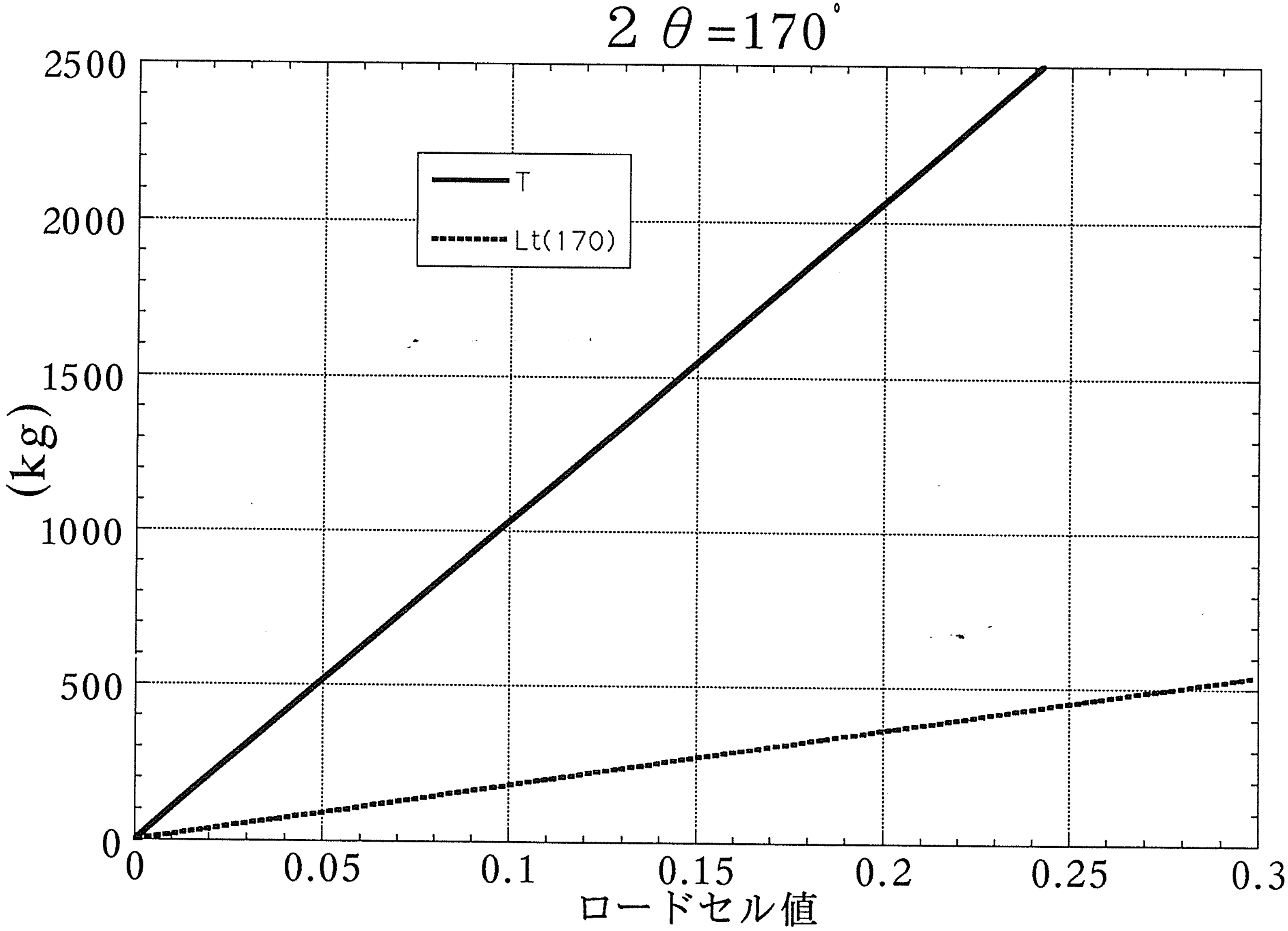


A3.17



2 θ=160°
2500
2000
1500
1000
500
0
(kg)
T
Lt(160)
0
0.1
0.2
0.3
0.4
0.5
ロードセル値

A3.18


2θ=170°
2500
2000
1500
1000
500
0
(kg)
T
Lt(170)
0
0.05
0.1
0.15
0.2
0.25
0.3
ロードセル値

A3.19

	T	rc(0)	Lt(0)	rc(60-70)	Lt(60-70)	rc(80-90)	Lt(80-90)	rc(100)	Lt(100)	rc(120)	Lt(120)	rc(130)	Lt(130)	rc(140)	Lt(140)	rc(150)	Lt(150)	rc(160)	Lt(160)	rc(170)	Lt(170)
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	100.00	0.11111	200.00	0.092593	166.67	0.079365	142.86	0.071225	128.21	0.055556	100.00	0.047081	84.746	0.038052	68.493	0.028785	51.813	0.019290	34.722	0.0096956	17.452
2	200.00	0.22222	400.00	0.18519	333.33	0.15873	285.71	0.14245	256.41	0.11111	200.00	0.094162	169.49	0.076104	136.99	0.057571	103.63	0.038580	69.444	0.019391	34.904
3	300.00	0.33333	600.00	0.27778	500.00	0.23810	428.57	0.21368	384.62	0.16667	300.00	0.14124	254.24	0.11416	205.48	0.086356	155.44	0.057870	104.17	0.029087	52.356
4	400.00	0.44444	800.00	0.37037	666.67	0.31746	571.43	0.28490	512.82	0.22222	400.00	0.18832	338.98	0.15221	273.97	0.11514	207.25	0.077160	138.89	0.038782	69.808
5	500.00	0.55556	1000.0	0.46296	833.33	0.39683	714.29	0.35613	641.03	0.27778	500.00	0.23540	423.73	0.19026	342.47	0.14393	259.07	0.096451	173.61	0.048478	87.260
6	600.00	0.66667	1200.0	0.55556	1000.0	0.47619	857.14	0.42735	769.23	0.33333	600.00	0.28249	508.47	0.22831	410.96	0.17271	310.88	0.11574	208.33	0.058173	104.71
7	700.00	0.77778	1400.0	0.64815	1166.7	0.55556	1000.0	0.49858	897.44	0.38889	700.00	0.32957	593.22	0.26636	479.45	0.20150	362.69	0.13503	243.06	0.067869	122.16
8	800.00	0.88889	1600.0	0.74074	1333.3	0.63492	1142.9	0.56980	1025.6	0.44444	800.00	0.37665	677.97	0.30441	547.95	0.23028	414.51	0.15432	277.78	0.077564	139.62
9	900.00	1.0000	1800.0	0.83333	1500.0	0.71429	1285.7	0.64103	1153.8	0.50000	900.00	0.42373	762.71	0.34247	616.44	0.25907	466.32	0.17361	312.50	0.087260	157.07
10	1000.0	1.1111	2000.0	0.92593	1666.7	0.79365	1428.6	0.71225	1282.1	0.55556	1000.0	0.47081	847.46	0.38052	684.93	0.28785	518.13	0.19290	347.22	0.096956	174.52
11	1100.0	1.2222	2200.0	1.0185	1833.3	0.87302	1571.4	0.78348	1410.3	0.61111	1100.0	0.51789	932.20	0.41857	753.42	0.31664	569.95	0.21219	381.94	0.10665	191.97
12	1200.0	1.3333	2400.0	1.1111	2000.0	0.95238	1714.3	0.85470	1538.5	0.66667	1200.0	0.56497	1016.9	0.45662	821.92	0.34542	621.76	0.23148	416.67	0.11635	209.42
13	1300.0	1.4444	2600.0	1.2037	2166.7	1.0317	1857.1	0.92593	1666.7	0.72222	1300.0	0.61205	1101.7	0.49467	890.41	0.37421	673.58	0.25077	451.39	0.12604	226.88
14	1400.0	1.5556	2800.0	1.2963	2333.3	1.1111	2000.0	0.99715	1794.9	0.77778	1400.0	0.65913	1186.4	0.53272	958.90	0.40299	725.39	0.27006	486.11	0.13574	244.33
15	1500.0	1.6667	3000.0	1.3889	2500.0	1.1905	2142.9	1.0684	1923.1	0.83333	1500.0	0.70621	1271.2	0.57078	1027.4	0.43178	777.20	0.28935	520.83	0.14543	261.78
16	1600.0	1.7778	3200.0	1.4815	2666.7	1.2698	2285.7	1.1396	2051.3	0.88889	1600.0	0.75330	1355.9	0.60883	1095.9	0.46056	829.02	0.30864	555.56	0.15513	279.23
17	1700.0	1.8889	3400.0	1.5741	2833.3	1.3492	2428.6	1.2108	2179.5	0.94444	1700.0	0.80038	1440.7	0.64688	1164.4	0.48935	880.83	0.32793	590.28	0.16482	296.68
18	1800.0	2.0000	3600.0	1.6667	3000.0	1.4286	2571.4	1.2821	2307.7	1.0000	1800.0	0.84746	1525.4	0.68493	1232.9	0.51813	932.64	0.34722	625.00	0.17452	314.14
19	1900.0	2.1111	3800.0	1.7593	3166.7	1.5079	2714.3	1.3533	2435.9	1.0556	1900.0	0.89454	1610.2	0.72298	1301.4	0.54692	984.46	0.36651	659.72	0.18422	331.59
20	2000.0	2.2222	4000.0	1.8519	3333.3	1.5873	2857.1	1.4245	2564.1	1.1111	2000.0	0.94162	1694.9	0.76104	1369.9	0.57571	1036.3	0.38580	694.44	0.19391	349.04
21	2100.0	2.3333	4200.0	1.9444	3500.0	1.6667	3000.0	1.4957	2692.3	1.1667	2100.0	0.98870	1779.7	0.79909	1438.4	0.60449	1088.1	0.40509	729.17	0.20361	366.49
22	2200.0	2.4444	4400.0	2.0370	3666.7	1.7460	3142.9	1.5670	2820.5	1.2222	2200.0	1.0358	1864.4	0.83714	1506.8	0.63328	1139.9	0.42438	763.89	0.21330	383.94
23	2300.0	2.5556	4600.0	2.1296	3833.3	1.8254	3285.7	1.6382	2948.7	1.2778	2300.0	1.0829	1949.2	0.87519	1575.3	0.66206	1191.7	0.44367	798.61	0.22300	401.40
24	2400.0	2.6667	4800.0	2.2222	4000.0	1.9048	3428.6	1.7094	3076.9	1.3333	2400.0	1.1299	2033.9	0.91324	1643.8	0.69085	1243.5	0.46296	833.33	0.23269	418.85
25	2500.0	2.7778	5000.0	2.3148	4166.7	1.9841	3571.4	1.7806	3205.1	1.3889	2500.0	1.1770	2118.6	0.95129	1712.3	0.71963	1295.3	0.48225	868.06	0.24239	436.30
26	2600.0	2.8889	5200.0	2.4074	4333.3	2.0635	3714.3	1.8519	3333.3	1.4444	2600.0	1.2241	2203.4	0.98935	1780.8	0.74842	1347.2	0.50154	902.78	0.25208	453.75
27	2700.0	3.0000	5400.0	2.5000	4500.0	2.1429	3857.1	1.9231	3461.5	1.5000	2700.0	1.2712	2288.1	1.0274	1849.3	0.77720	1399.0	0.52083	937.50	0.26178	471.20
28	2800.0	3.1111	5600.0	2.5926	4666.7	2.2222	4000.0	1.9943	3589.7	1.5556	2800.0	1.3183	2372.9	1.0654	1917.8	0.80599	1450.8	0.54012	972.22	0.27148	488.66
29	2900.0	3.2222	5800.0	2.6852	4833.3	2.3016	4142.9	2.0655	3717.9	1.6111	2900.0	1.3653	2457.6	1.1035	1986.3	0.83477	1502.6	0.55941	1006.9	0.28117	506.11
30	3000.0	3.3333	6000.0	2.7778	5000.0	2.3810	4285.7	2.1368	3846.2	1.6667	3000.0	1.4124	2542.4	1.1416	2054.8	0.86356	1554.4	0.57870	1041.7	0.29087	523.56
31	3100.0	3.4444	6200.0	2.8704	5166.7	2.4603	4428.6	2.2080	3974.4	1.7222	3100.0	1.4595	2627.1	1.1796	2123.3	0.89234	1606.2	0.59799	1076.4	0.30056	541.01
32	3200.0	3.5556	6400.0	2.9630	5333.3	2.5397	4571.4	2.2792	4102.6	1.7778	3200.0	1.5066	2711.9	1.2177	2191.8	0.92113	1658.0	0.61728	1111.1	0.31026	558.46
33	3300.0	3.6667	6600.0	3.0556	5500.0	2.6190	4714.3	2.3504	4230.8	1.8333	3300.0	1.5537	2796.6	1.2557	2260.3	0.94991	1709.8	0.63657	1145.8	0.31995	575.92
34	3400.0	3.7778	6800.0	3.1481	5666.7	2.6984	4857.1	2.4217	4359.0	1.8889	3400.0	1.6008	2881.4	1.2938	2328.8	0.97870	1761.7	0.65586	1180.6	0.32965	593.37
35	3500.0	3.8889	7000.0	3.2407	5833.3	2.7778	5000.0	2.4929	4487.2	1.9444	3500.0	1.6478	2966.1	1.3318	2397.3	1.0075	1813.5	0.67515	1215.3	0.33934	610.82
36	3600.0	4.0000	7200.0	3.3333	6000.0	2.8571	5142.9	2.5641	4615.4	2.0000	3600.0	1.6949	3050.8	1.3699	2465.8	1.0363	1865.3	0.69444	1250.0	0.34904	628.27
37	3700.0	4.1111	7400.0	3.4259	6166.7	2.9365	5285.7	2.6353	4743.6	2.0556	3700.0	1.7420	3135.6	1.4079	2534.2	1.0651	1917.1	0.71373	1284.7	0.35874	645.72
38	3800.0	4.2222	7600.0	3.5185	6333.3	3.0159	5428.6	2.7066	4871.8	2.1111	3800.0	1.7891	3220.3	1.4460	2602.7	1.0938	1968.9	0.73302	1319.4	0.36843	663.18
39	3900.0	4.3333	7800.0	3.6111	6500.0	3.0952	5571.4	2.7778	5000.0	2.1667	3900.0	1.8362	3305.1	1.4840	2671.2	1.1226	2020.7	0.75231	1354.2	0.37813	680.63
40	4000.0	4.4444	8000.0	3.7037	6666.7	3.1746	5714.3	2.8490	5128.2	2.2222	4000.0	1.8832	3389.8	1.5221	2739.7	1.1514	2072.5	0.77160	1388.9	0.38782	698.08

A3.20

	T	rc(0)	Lt(0)	rc(60-70)	Lt(60-70)	rc(80-90)	Lt(80-90)	rc(100)	Lt(100)	rc(120)	Lt(120)	rc(130)	Lt(130)	rc(140)	Lt(140)	rc(150)	Lt(150)	rc(160)	Lt(160)	rc(170)	Lt(170)
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	100.00	0.11111	200.00	0.092593	166.67	0.079365	142.86	0.071225	128.21	0.055556	100.00	0.047081	84.746	0.038052	68.493	0.028785	51.813	0.019290	34.722	0.0096956	17.452
2	200.00	0.22222	400.00	0.18519	333.33	0.15873	285.71	0.14245	256.41	0.11111	200.00	0.094162	169.49	0.076104	136.99	0.057571	103.63	0.038580	69.444	0.019391	34.904
3	300.00	0.33333	600.00	0.27778	500.00	0.23810	428.57	0.21368	384.62	0.16667	300.00	0.14124	254.24	0.11416	205.48	0.086356	155.44	0.057870	104.17	0.029087	52.356
4	400.00	0.44444	800.00	0.37037	666.67	0.31746	571.43	0.28490	512.82	0.22222	400.00	0.18832	338.98	0.15221	273.97	0.11514	207.25	0.077160	138.89	0.038782	69.808
5	500.00	0.55556	1000.0	0.46296	833.33	0.39683	714.29	0.35613	641.03	0.27778	500.00	0.23540	423.73	0.19026	342.47	0.14393	259.07	0.096451	173.61	0.048478	87.260
6	600.00	0.66667	1200.0	0.55556	1000.0	0.47619	857.14	0.42735	769.23	0.33333	600.00	0.28249	508.47	0.22831	410.96	0.17271	310.88	0.11574	208.33	0.058173	104.71
7	700.00	0.77778	1400.0	0.64815	1166.7	0.55556	1000.0	0.49858	897.44	0.38889	700.00	0.32957	593.22	0.26636	479.45	0.20150	362.69	0.13503	243.06	0.067869	122.16
8	800.00	0.88889	1600.0	0.74074	1333.3	0.63492	1142.9	0.56980	1025.6	0.44444	800.00	0.37665	677.97	0.30441	547.95	0.23028	414.51	0.15432	277.78	0.077564	139.62
9	900.00	1.0000	1800.0	0.83333	1500.0	0.71429	1285.7	0.64103	1153.8	0.50000	900.00	0.42373	762.71	0.34247	616.44	0.25907	466.32	0.17361	312.50	0.087260	157.07
10	1000.0	1.1111	2000.0	0.92593	1666.7	0.79365	1428.6	0.71225	1282.1	0.55556	1000.0	0.47081	847.46	0.38052	684.93	0.28785	518.13	0.19290	347.22	0.096956	174.52
11	1100.0	1.2222	2200.0	1.0185	1833.3	0.87302	1571.4	0.78348	1410.3	0.61111	1100.0	0.51789	932.20	0.41857	753.42	0.31664	569.95	0.21219	381.94	0.10665	191.97
12	1200.0	1.3333	2400.0	1.1111	2000.0	0.95238	1714.3	0.85470	1538.5	0.66667	1200.0	0.56497	1016.9	0.45662	821.92	0.34542	621.76	0.23148	416.67	0.11635	209.42
13	1300.0	1.4444	2600.0	1.2037	2166.7	1.0317	1857.1	0.92593	1666.7	0.72222	1300.0	0.61205	1101.7	0.49467	890.41	0.37421	673.58	0.25077	451.39	0.12604	226.88
14	1400.0	1.5556	2800.0	1.2963	2333.3	1.1111	2000.0	0.99715	1794.9	0.77778	1400.0	0.65913	1186.4	0.53272	958.90	0.40299	725.39	0.27006	486.11	0.13574	244.33
15	1500.0	1.6667	3000.0	1.3889	2500.0	1.1905	2142.9	1.0684	1923.1	0.83333	1500.0	0.70621	1271.2	0.57078	1027.4	0.43178	777.20	0.28935	520.83	0.14543	261.78
16	1600.0	1.7778	3200.0	1.4815	2666.7	1.2698	2285.7	1.1396	2051.3	0.88889	1600.0	0.75330	1355.9	0.60883	1095.9	0.46056	829.02	0.30864	555.56	0.15513	279.23
17	1700.0	1.8889	3400.0	1.5741	2833.3	1.3492	2428.6	1.2108	2179.5	0.94444	1700.0	0.80038	1440.7	0.64688	1164.4	0.48935	880.83	0.32793	590.28	0.16482	296.68
18	1800.0	2.0000	3600.0	1.6667	3000.0	1.4286	2571.4	1.2821	2307.7	1.0000	1800.0	0.84746	1525.4	0.68493	1232.9	0.51813	932.64	0.34722	625.00	0.17452	314.14
19	1900.0	2.1111	3800.0	1.7593	3166.7	1.5079	2714.3	1.3533	2435.9	1.0556	1900.0	0.89454	1610.2	0.72298	1301.4	0.54692	984.46	0.36651	659.72	0.18422	331.59
20	2000.0	2.2222	4000.0	1.8519	3333.3	1.5873	2857.1	1.4245	2564.1	1.1111	2000.0	0.94162	1694.9	0.76104	1369.9	0.57571	1036.3	0.38580	694.44	0.19391	349.04
21	2100.0	2.3333	4200.0	1.9444	3500.0	1.6667	3000.0	1.4957	2692.3	1.1667	2100.0	0.98870	1779.7	0.79909	1438.4	0.60449	1088.1	0.40509	729.17	0.20361	366.49
22	2200.0	2.4444	4400.0	2.0370	3666.7	1.7460	3142.9	1.5670	2820.5	1.2222	2200.0	1.0358	1864.4	0.83714	1506.8	0.63328	1139.9	0.42438	763.89	0.21330	383.94
23	2300.0	2.5556	4600.0	2.1296	3833.3	1.8254	3285.7	1.6382	2948.7	1.2778	2300.0	1.0829	1949.2	0.87519	1575.3	0.66206	1191.7	0.44367	798.61	0.22300	401.40
24	2400.0	2.6667	4800.0	2.2222	4000.0	1.9048	3428.6	1.7094	3076.9	1.3333	2400.0	1.1299	2033.9	0.91324	1643.8	0.69085	1243.5	0.46296	833.33	0.23269	418.85
25	2500.0	2.7778	5000.0	2.3148	4166.7	1.9841	3571.4	1.7806	3205.1	1.3889	2500.0	1.1770	2118.6	0.95129	1712.3	0.71963	1295.3	0.48225	868.06	0.24239	436.30
26	2600.0	2.8889	5200.0	2.4074	4333.3	2.0635	3714.3	1.8519	3333.3	1.4444	2600.0	1.2241	2203.4	0.98935	1780.8	0.74842	1347.2	0.50154	902.78	0.25208	453.75
27	2700.0	3.0000	5400.0	2.5000	4500.0	2.1429	3857.1	1.9231	3461.5	1.5000	2700.0	1.2712	2288.1	1.0274	1849.3	0.77720	1399.0	0.52083	937.50	0.26178	471.20
28	2800.0	3.1111	5600.0	2.5926	4666.7	2.2222	4000.0	1.9943	3589.7	1.5556	2800.0	1.3183	2372.9	1.0654	1917.8	0.80599	1450.8	0.54012	972.22	0.27148	488.66
29	2900.0	3.2222	5800.0	2.6852	4833.3	2.3016	4142.9	2.0655	3717.9	1.6111	2900.0	1.3653	2457.6	1.1035	1986.3	0.83477	1502.6	0.55941	1006.9	0.28117	506.11
30	3000.0	3.3333	6000.0	2.7778	5000.0	2.3810	4285.7	2.1368	3846.2	1.6667	3000.0	1.4124	2542.4	1.1416	2054.8	0.86356	1554.4	0.57870	1041.7	0.29087	523.56
31	3100.0	3.4444	6200.0	2.8704	5166.7	2.4603	4428.6	2.2080	3974.4	1.7222	3100.0	1.4595	2627.1	1.1796	2123.3	0.89234	1606.2	0.59799	1076.4	0.30056	541.01
32	3200.0	3.5556	6400.0	2.9630	5333.3	2.5397	4571.4	2.2792	4102.6	1.7778	3200.0	1.5066	2711.9	1.2177	2191.8	0.92113	1658.0	0.61728	1111.1	0.31026	558.46
33	3300.0	3.6667	6600.0	3.0556	5500.0	2.6190	4714.3	2.3504	4230.8	1.8333	3300.0	1.5537	2796.6	1.2557	2260.3	0.94991	1709.8	0.63657	1145.8	0.31995	575.92
34	3400.0	3.7778	6800.0	3.1481	5666.7	2.6984	4857.1	2.4217	4359.0	1.8889	3400.0	1.6008	2881.4	1.2938	2328.8	0.97870	1761.7	0.65586	1180.6	0.32965	593.37
35	3500.0	3.8889	7000.0	3.2407	5833.3	2.7778	5000.0	2.4929	4487.2	1.9444	3500.0	1.6478	2966.1	1.3318	2397.3	1.0075	1813.5	0.67515	1215.3	0.33934	610.82
36	3600.0	4.0000	7200.0	3.3333	6000.0	2.8571	5142.9	2.5641	4615.4	2.0000	3600.0	1.6949	3050.8	1.3699	2465.8	1.0363	1865.3	0.69444	1250.0	0.34904	628.27
37	3700.0	4.1111	7400.0	3.4259	6166.7	2.9365	5285.7	2.6353	4743.6	2.0556	3700.0	1.7420	3135.6	1.4079	2534.2	1.0651	1917.1	0.71373	1284.7	0.35874	645.72
38	3800.0	4.2222	7600.0	3.5185	6333.3	3.0159	5428.6	2.7066	4871.8	2.1111	3800.0	1.7891	3220.3	1.4460	2602.7	1.0938	1968.9	0.73302	1319.4	0.36843	663.18
39	3900.0	4.3333	7800.0	3.6111	6500.0	3.0952	5571.4	2.7778	5000.0	2.1667	3900.0	1.8362	3305.1	1.4840	2671.2	1.1226	2020.7	0.75231	1354.2	0.37813	680.63
40	4000.0	4.4444	8000.0	3.7037	6666.7	3.1746	5714.3	2.8490	5128.2	2.2222	4000.0	1.8832	3389.8	1.5221	2739.7	1.1514	2072.5	0.77160	1388.9	0.38782	698.08

A3.21

「かいよう」船上における溶存酸素の分析

分析担当：三洋テクノマリン株式会社　尻引　武彦 & 小峯　佳子

目　的

・ＤＯﾒｰﾀｰによる溶存酸素の測定
・Winkler 滴定法によるＤＯﾒｰﾀｰの溶存酸素値の補正
・ＤＯﾒｰﾀｰとＣＴＤ－ＤＯｾﾝｻｰの溶存酸素値の比較

使用機器

ＤＯﾒｰﾀｰ：東亜電波工業株式会社 ﾎﾟｰﾀﾌﾞﾙ溶存酸素計 DO - 25A
　　　　　東亜電波工業株式会社 隔膜型ｶﾞﾙﾊﾞﾆ電池式酸素電極
滴定装置：ﾒﾄﾛｰﾑ社 716DMS （ 10 ml ｼﾘﾝｼﾞ）
　　　　　ﾒﾄﾛｰﾑ社 白金電極
CTD-DO
SENSOR：SEA-BIRD ELECTRONICS, INC. SBE 13 (BECKMAN)
実験器具：EPPENDOLFF 1000μℓ
　　　　　OPTIFIX 1000μℓ
　　　　　ﾒﾄﾛｰﾑ社 ﾄﾞｼﾞﾏｯﾄﾋﾞｭﾚｯﾄ(20mℓ ｼﾘﾝｼﾞ)

試　薬

(1) ＤＯﾒｰﾀｰ
　ｸｴﾝ酸三ﾅﾄﾘｳﾑ二水和物溶液（東亜電波工業株式会社 R-5C)
　亜硫酸ﾅﾄﾘｳﾑ溶液 (10g/100mℓ)

(2) Winkler 滴定法

$MnCl_2 \cdot 4H_2O$ 溶液	(600g/1ℓ)
NaI-NaOH 溶液	((NaI:600+NaOH:320g)/1ℓ)
H_2SO_4 溶液	(280mℓ/1ℓ)
$Na_2S_2O_3 \cdot 5H_2O$ 溶液	(176g/5ℓ)
KiO_3 溶液	(1.78g/5ℓ)

採　水

ﾛｯｾﾞﾀ式採水器を揚収後、５ℓﾆｽｷﾝ採水器の漏れを調べてから採水を開始した。

はじめに、ＤＯﾒｰﾀｰ用の約100mℓのＤＯﾋﾞﾝに採水しそれと同時に採水時の水温を測定しながらＤＯﾋﾞﾝの容量の２～３倍の量の海水をｵｰﾊﾞｰﾌﾛｰさせ気泡が入らないようにふたをした。

つぎに、１測点につき約３～４層選びWinkler用の採水を行った。ＤＯﾋﾞﾝは、Green and Carrit(1966)もとに改良した容量約180mℓのＢＯＤﾋﾞﾝを使用した。前述と同様に採水時の水温を測定しながら、ﾋﾞﾝ容量の２～３倍の海水をｵｰﾊﾞｰﾌﾛｰさせ、その後、$MnCl_2$溶液１mℓとNaI-NaOH 溶液１mℓを順に加え、ふたをし約30回ぐらい振った。実験室に持ち帰ったのち、さらに振り溶液を撹拌した。

分 析

(1) ＤＯﾒｰﾀｰによる分析

ＤＯﾒｰﾀｰの０-100％調整は、毎測点ごと行った。０％溶液は、10％亜硫酸ﾅﾄﾘｳﾑ溶液で、100％溶液として約30分間ﾊﾞﾌﾞﾘﾝｸﾞした酸素飽和溶液を使用した。（東亜、取扱説明書）

測定は、酸素電極をＤＯﾋﾞﾝに気泡が入らないように挿入し、ｽﾀｰﾗｰを回転させ測定値が安定したら記録を行った。（約30秒） 各ｻﾝﾌﾟﾙ毎にＣＴＤの塩分のﾃﾞｰﾀｰをDOﾒｰﾀｰに入力し塩分補正を行った。

(2) Winkler 滴定

採水後、30分から１時間後測定を開始した。

ﾋﾞﾝのふたの回りをよくふき取ったのちふたを開け、H_2SO_4 １mℓ添加し少量の水でふたを洗浄する。次に、ﾃﾌﾛﾝ製ｽﾀｰﾗｰﾁｯﾌﾟをいれ撹拌し沈殿が解けたのを確認した後滴定を開始した。

終点の計算は、N88BASIC で作成したﾌﾟﾛｸﾞﾗﾑを用いた。

標定及び試薬ﾌﾞﾗﾝｸ測定は、１日１回海水ｻﾝﾌﾟﾙの測定を行う前に行った。

再 現 性

同一のﾆｽｷﾝ採水器から２回採水し、分析した時の溶存酸素濃度の差は、それぞれ以下のようになる。

	ﾃﾞｰﾀｰ数	平均値 mℓ/ℓ	標準偏差 mℓ/ℓ（２σ）	最大濃度に対する割合 %
ＤＯﾒｰﾀｰ	142	0.008	0.016	0.35(Max 4.60)
Winkler 滴定	69	0.0110	0.0220	0.46(Max 4.749)

測定結果

(1) 滴定法によるＤＯﾒｰﾀｰの溶存酸素濃度の補正

ＤＯﾒｰﾀｰによる溶存酸素濃度とWinkler滴定法による溶存酸素濃度をﾌﾟﾛｯﾄしたものを、Fig. 1に示す。このﾃﾞｰﾀｰの数は、N=237 である。これより、回帰分析を行い一次回帰式を求めると次の式になる。

$$Y = 0.111 + 0.988 \times X \qquad (N=237)$$

$$R = 0.997$$

Y：Winkler滴定法による溶存酸素濃度(mℓ/ℓ)

X：ＤＯﾒｰﾀｰによる溶存酸素濃度(mℓ/ℓ)

この式を用いて、ＤＯﾒｰﾀｰの溶存酸素濃度を補正したものを Table 1 に示す。

(2) ＣＴＤ-ＤＯとＤＯﾒｰﾀｰの溶存酸素濃度の比較

ＣＴＤ-ＤＯとＤＯﾒｰﾀｰ（補正済み）の溶存酸素濃度をﾌﾟﾛｯﾄしたものを、Fig. 2に示す。このﾃﾞｰﾀｰの数は、N=516 である。これより、回帰分析を行い一次回帰式を求めると次の式になった。

$$Y = -0.734 + 1.297 \times X \qquad (N=516)$$

$$R = 0.971$$

Y：ＤＯﾒｰﾀｰによる溶存酸素濃度(mℓ/ℓ)

X：ＣＴＤ-ＤＯの溶存酸素濃度(mℓ/ℓ)

また、ＣＴＤ－ＤＯとＤＯﾒｰﾀｰの溶存酸素の値の差の絶対値の平均値と標準偏差は、以下の通りになった。

|（ＣＴＤ-ＤＯ）-（ＤＯﾒｰﾀｰ）| 平 均 値 ＝0.227 （mℓ/ℓ）

標準偏差 ＝0.229 （mℓ/ℓ）

（3）各測線ごとの溶存酸素濃度のｺﾝﾀ図をFig.3に示し、測点をFig.4に示す。

Line 1: STN. 1, 2, 3, 4

Line 2: STN. 4, 5, 6, 7, 8, 9,10,11

Line 3: STN.12,13,14,15,16,17,18,19,20,21

Line 4: STN.21,22,23,24,25

Line 5: STN.30,29,31,32,33,34,35

Line 6: STN.25,26,27,28,35,36,37,38,39,40

Line 7: STN.40,41,42

これらのｺﾝﾀ図は、Table 1に示した補正後の溶存酸素濃度の値を使用して作成した。

（4）鉛直ﾌﾟﾛﾌｧｲﾙを、以下の図番号に示す。

Fig.5 ： ＣＴＤ-ＤＯとＤＯﾒｰﾀｰ(未補正)の溶存酸素濃度（mℓ/ℓ）

Fig.6 ： ＣＴＤ-ＤＯとＤＯﾒｰﾀｰ(未補正)と滴定法の溶存酸素濃度（mℓ/ℓ）

STN. 4, 12, 17, 19, 25, 30, 40 のみ

Fig.7 ： 密度σ_tとＤＯﾒｰﾀｰ(未補正)の溶存酸素濃度（mℓ/ℓ）

Fig.8 ： ＣＴＤ-ＤＯとＤＯﾒｰﾀｰ(補正済み)の溶存酸素濃度（mℓ/ℓ）

（図表は、クルーズレポート中 英 参照）

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Ｋ９５－０５　ＴＯＣＳ
係留作業等における問題点について

（１）ケーブル巻き取り機について

・今回作業中に一度故障したため、現在の巻き取り機を予備として新しい巻き取り機を購入する。
・新しい巻き取り機には、ケーブルの着脱の際使用するジャッキの取り付けが容易な設計である。
・ＡＤＣＰ用、ＡＴＬＡＳ用の軸棒が２本づつ必要。現在、軸棒が１本であるため、ケーブルを巻き取ってから、もしくは繰り出してから次の作業へと移っているが、軸棒が２本あれば前もって用意ができるのでスムーズに作業が行える。
・現在の巻き取り機にはチェーンカバーがないが、安全面を考慮するとチェーンカバーが必要である。

（２）ＡＤＣＰについて

・現在、ＡＤＣＰブイの移動には、木製のパレットを使用しているが作業効率を考えると車輪付きの専用の台が必要。

（３）ＡＴＬＡＳについて

・表層ブイの組立ては、専用の台がないためブイが傾いた状態で作業を行っているが、組立用の台があれば、作業しやすくなる。

（４）ＣＴＤについて

・ＣＴＤ用の同軸ケーブルが錆びているので交換が望まれる。

（５）ニスキンボトルについて

・採水の際、何度かＯリングがはずれてリークすることがあったので、Ｏリングの交換が必要である。
・ニスキンボトルのゴム、転倒温度・圧力計のゴムの劣化が見られるため交換が必要である。

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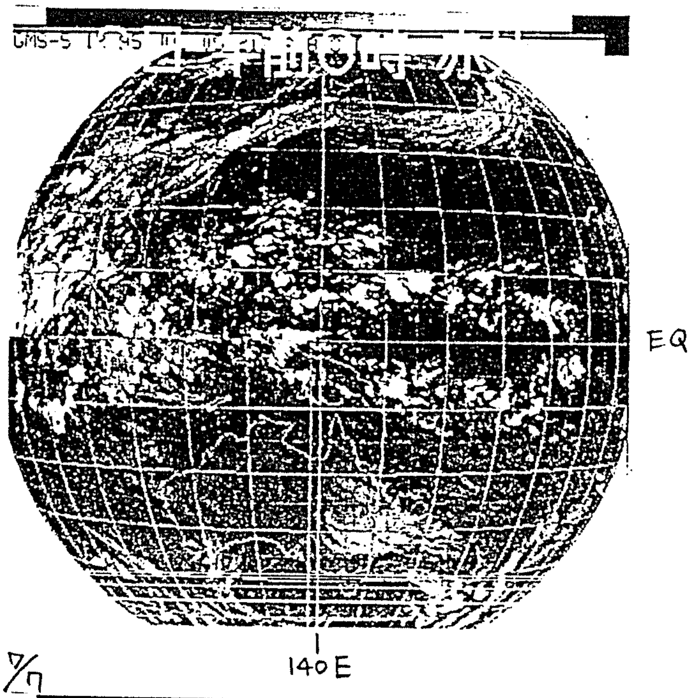

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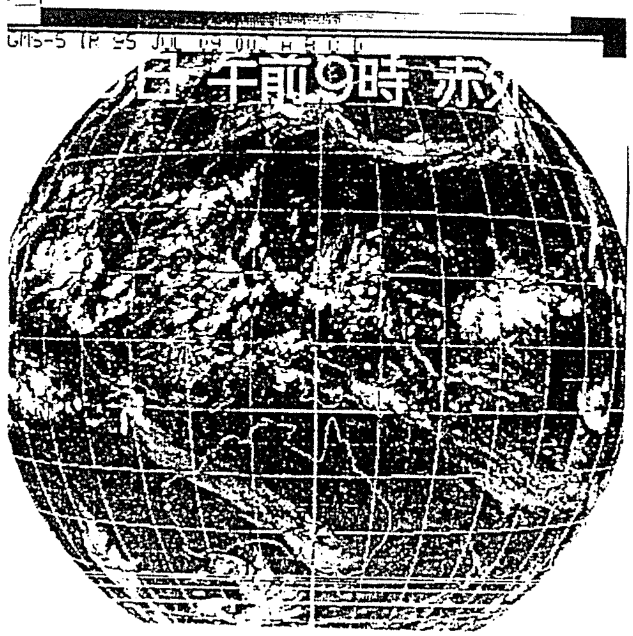

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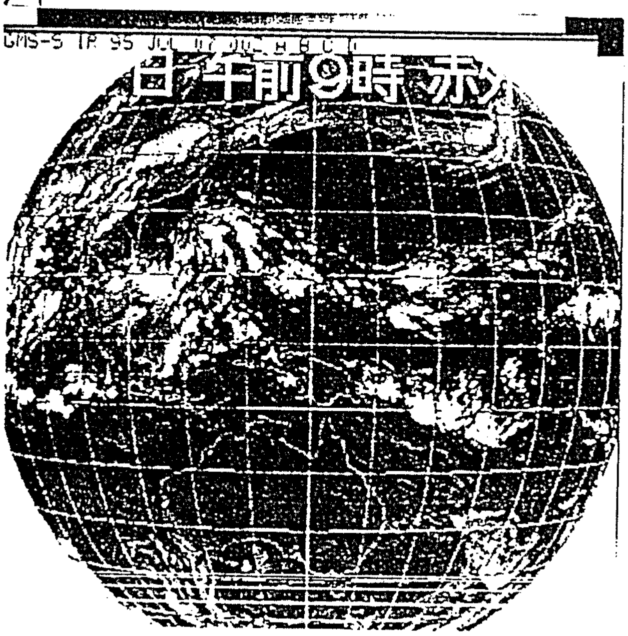

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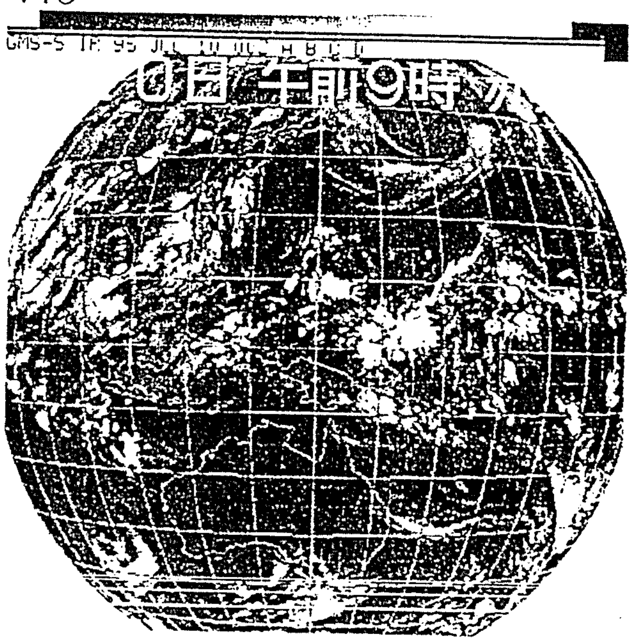

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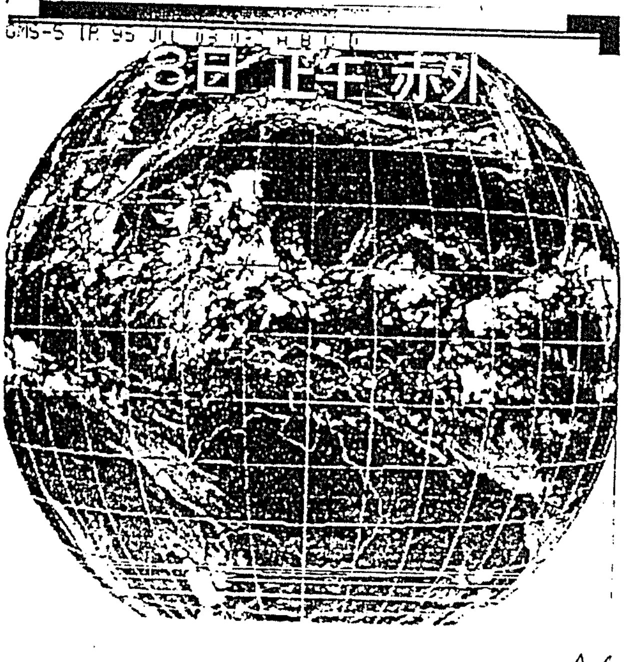

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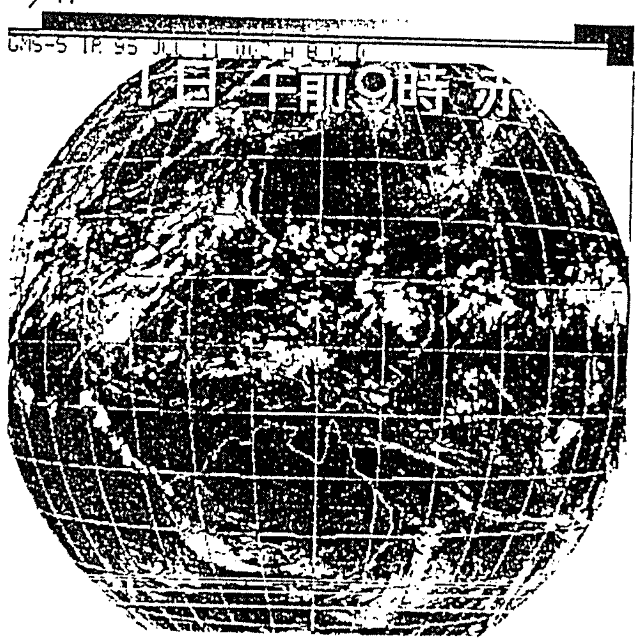

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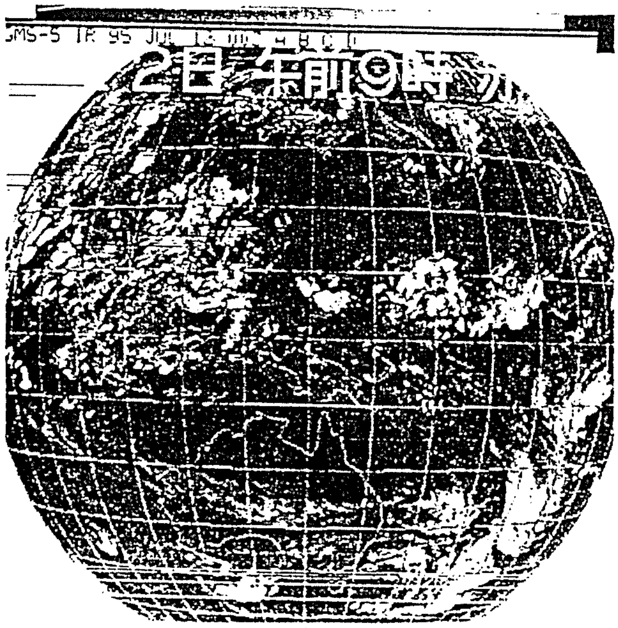

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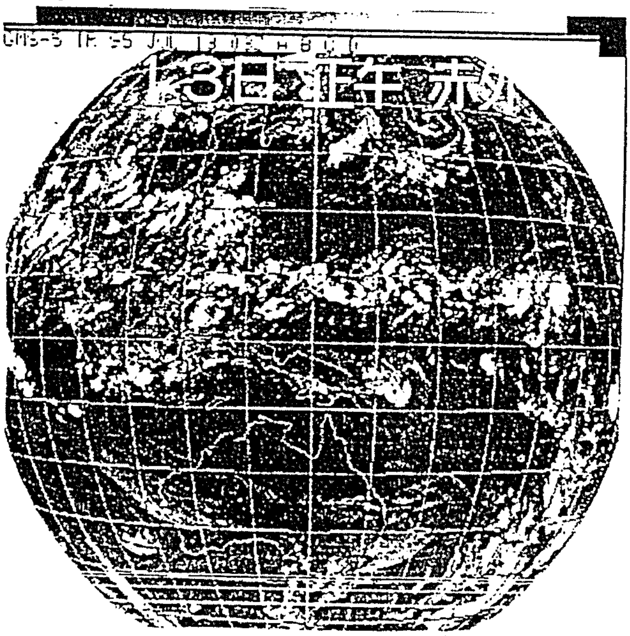

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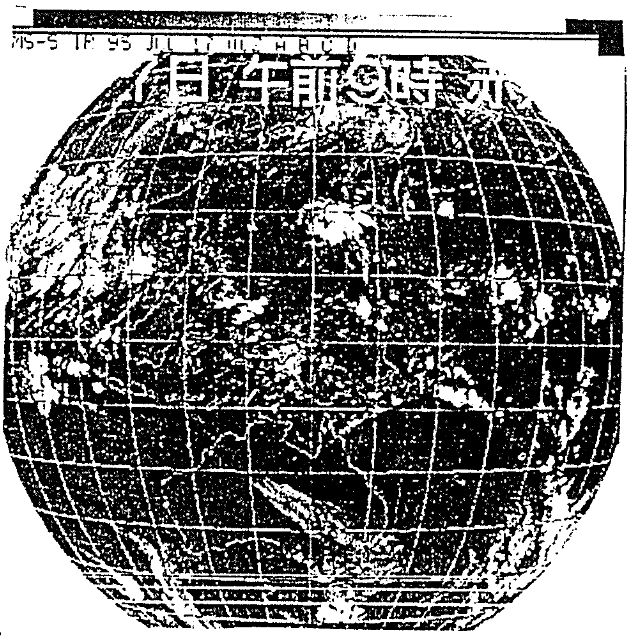

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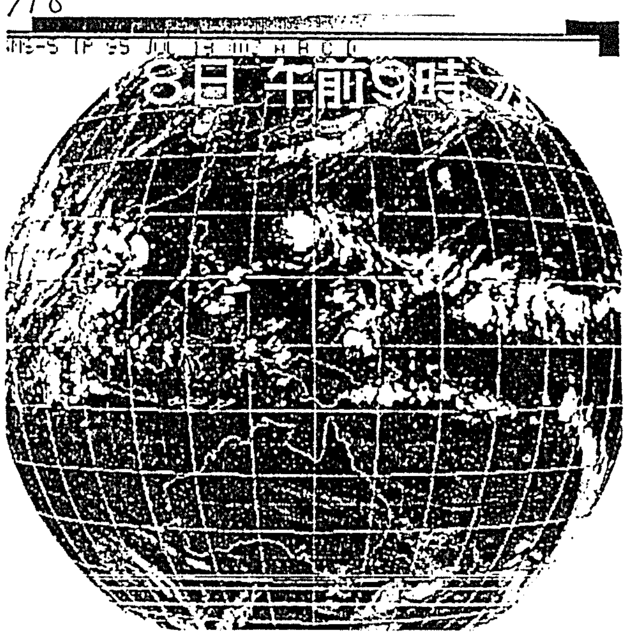

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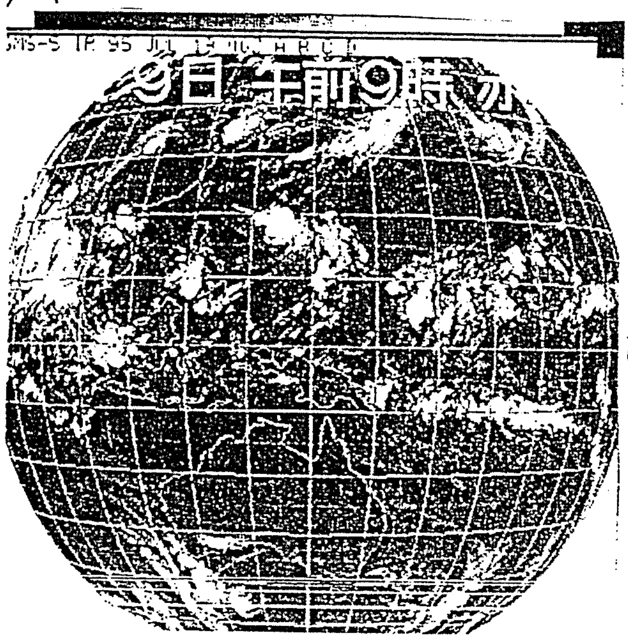

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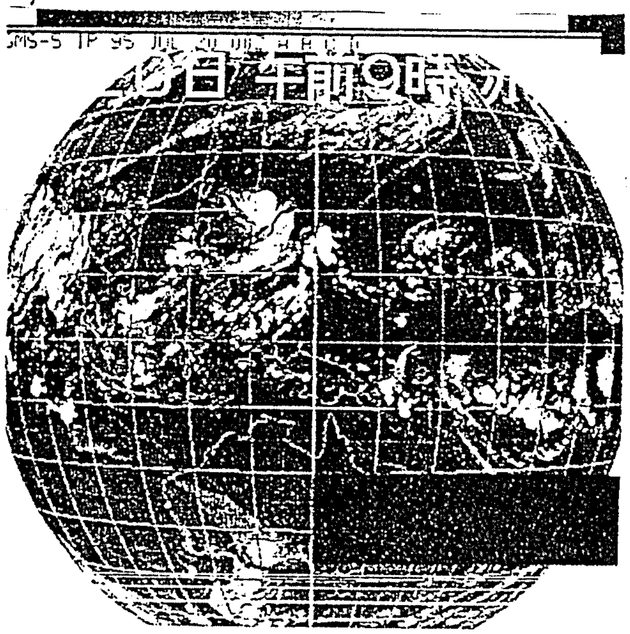

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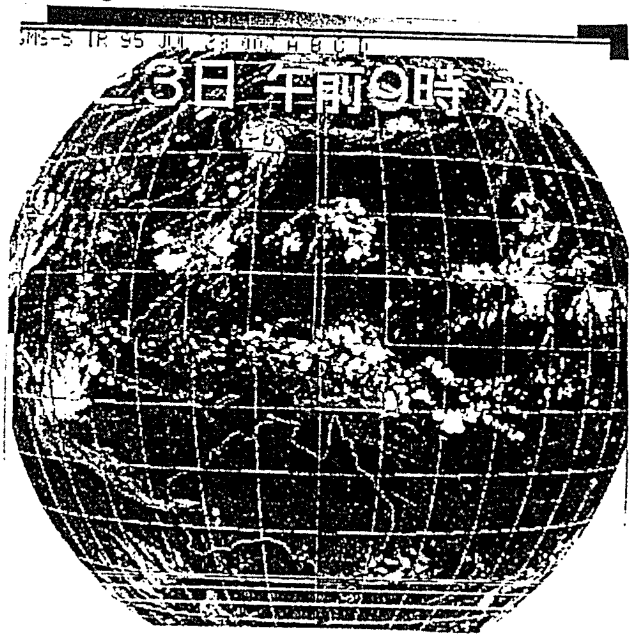

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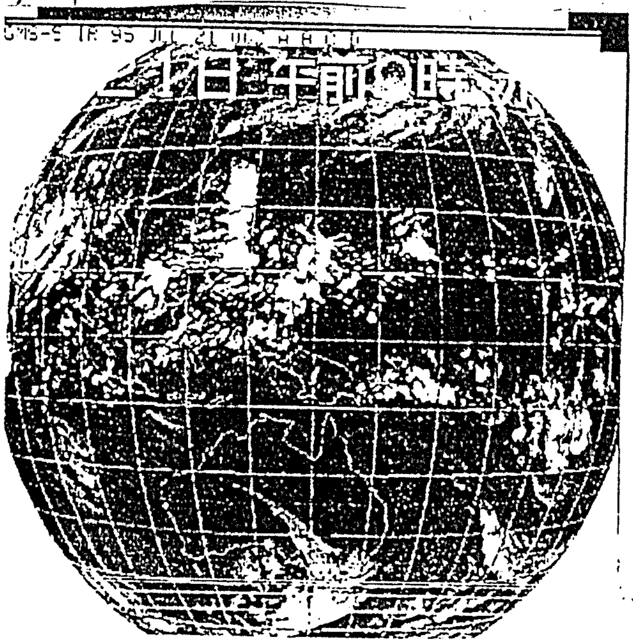

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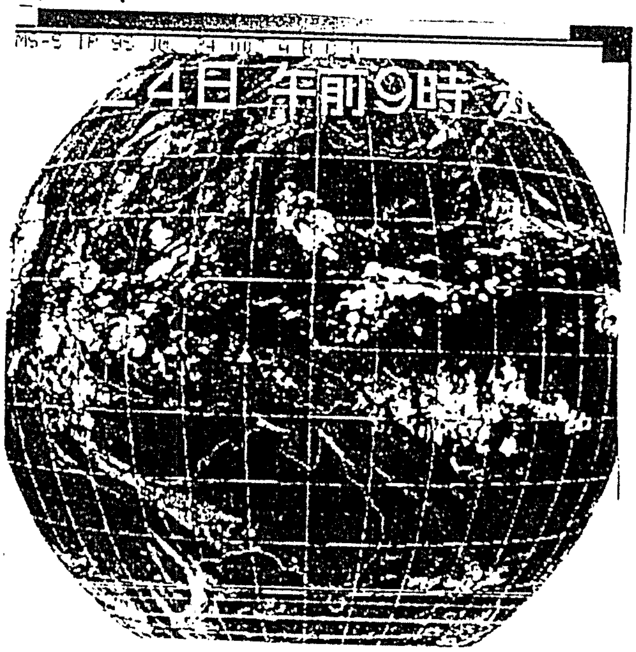

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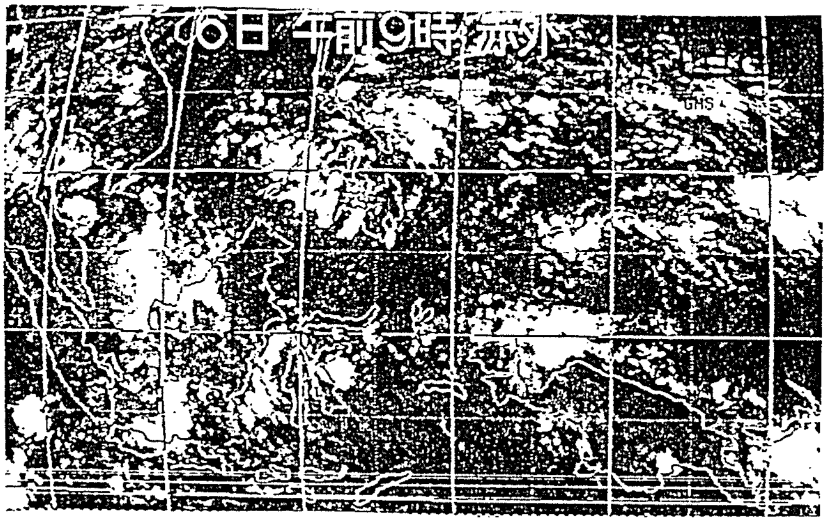

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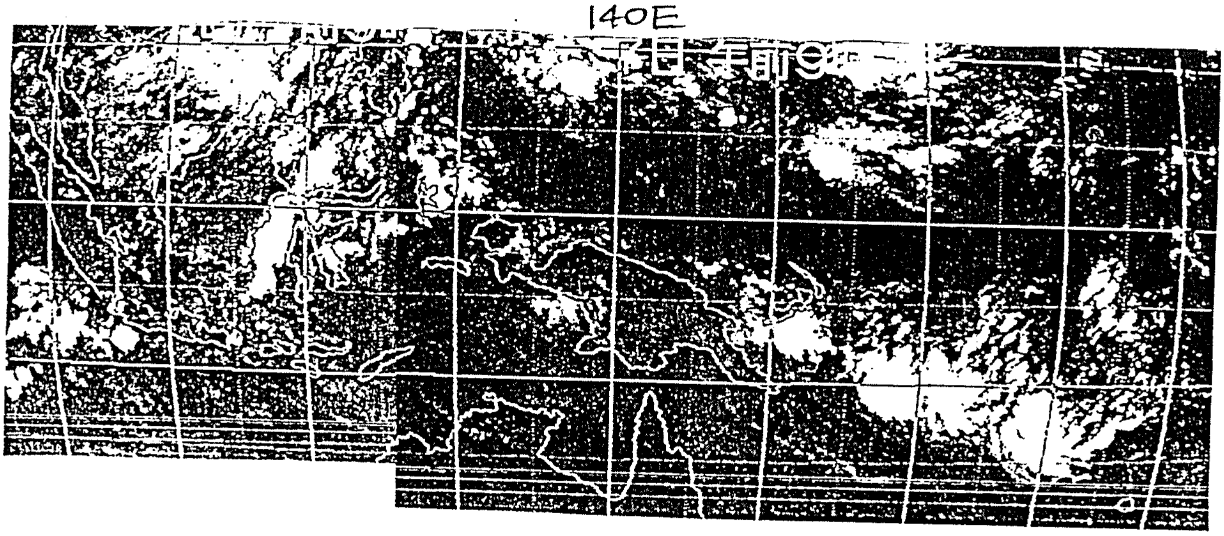

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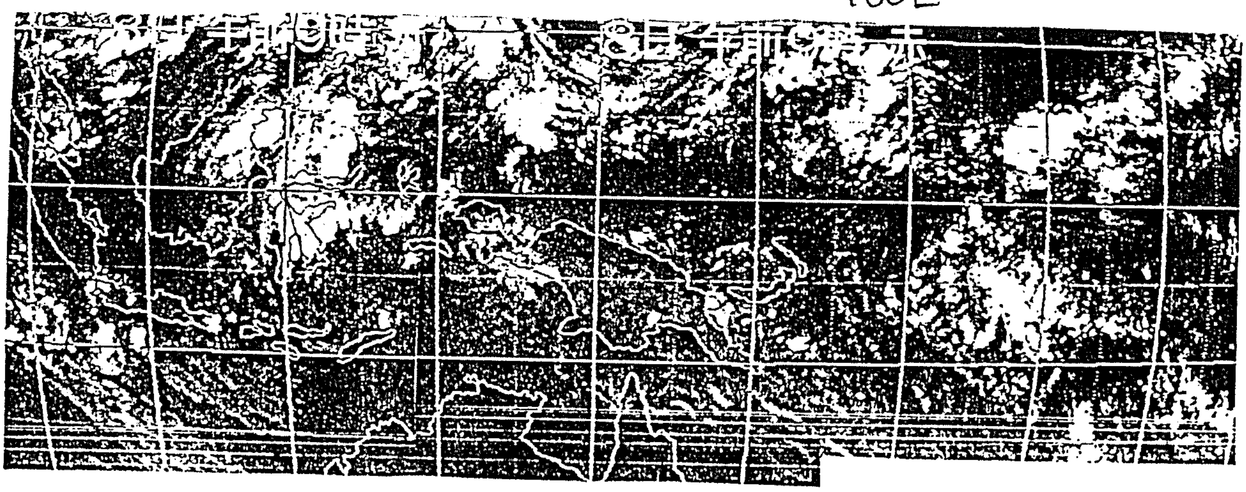

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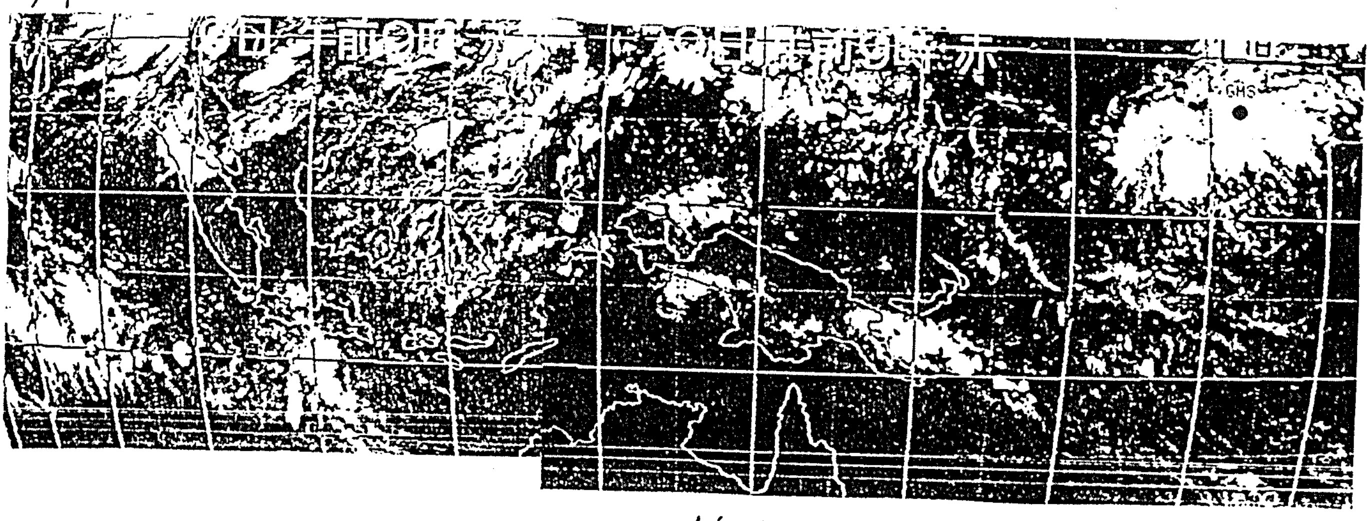

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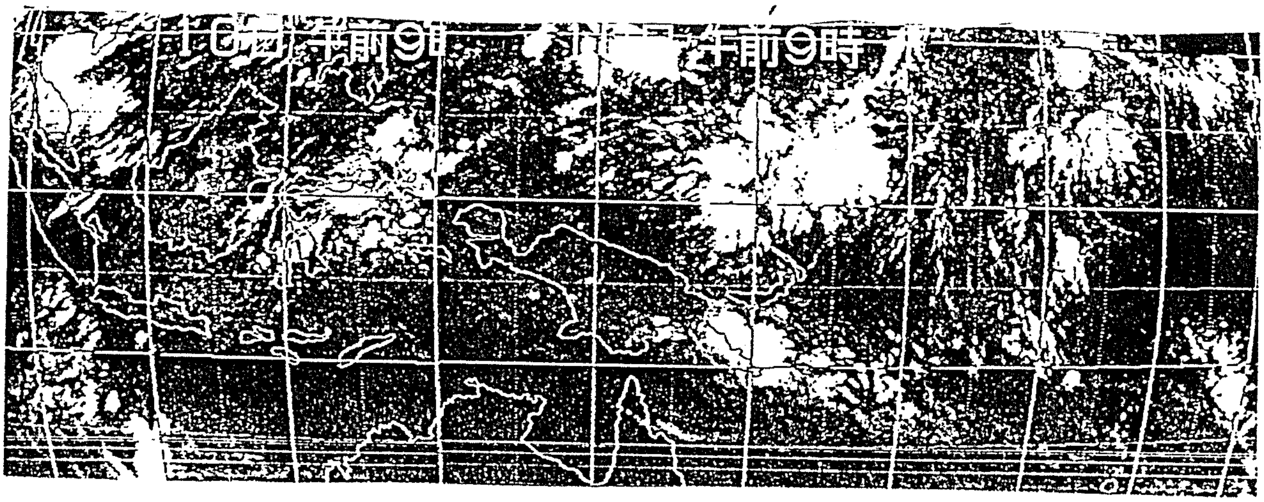

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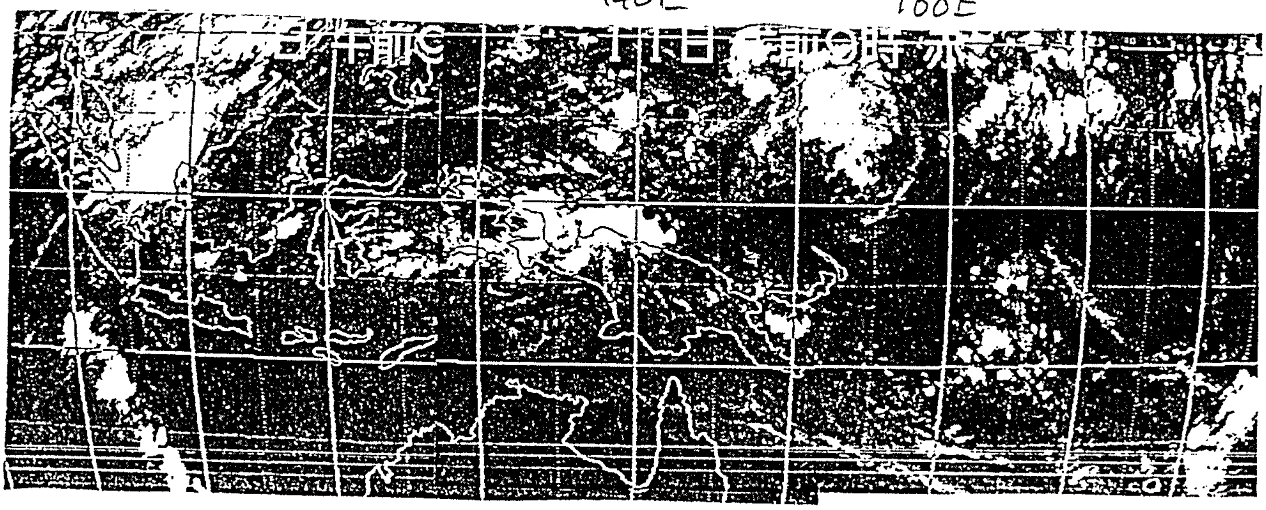

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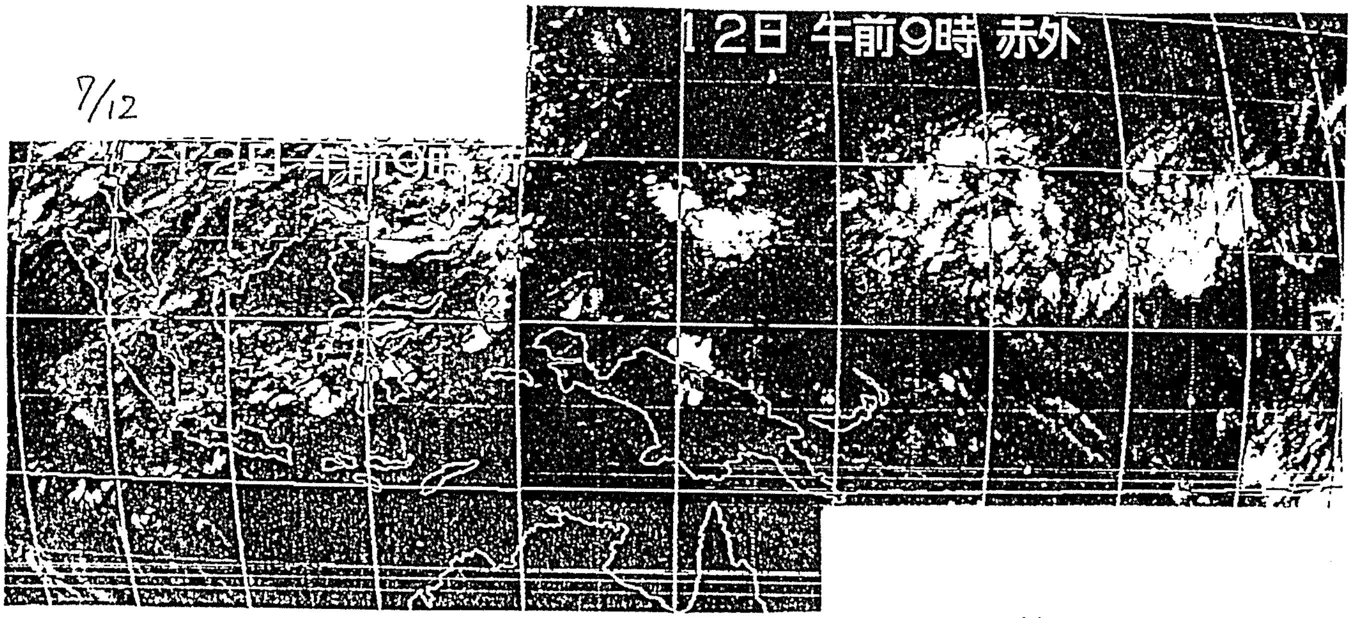

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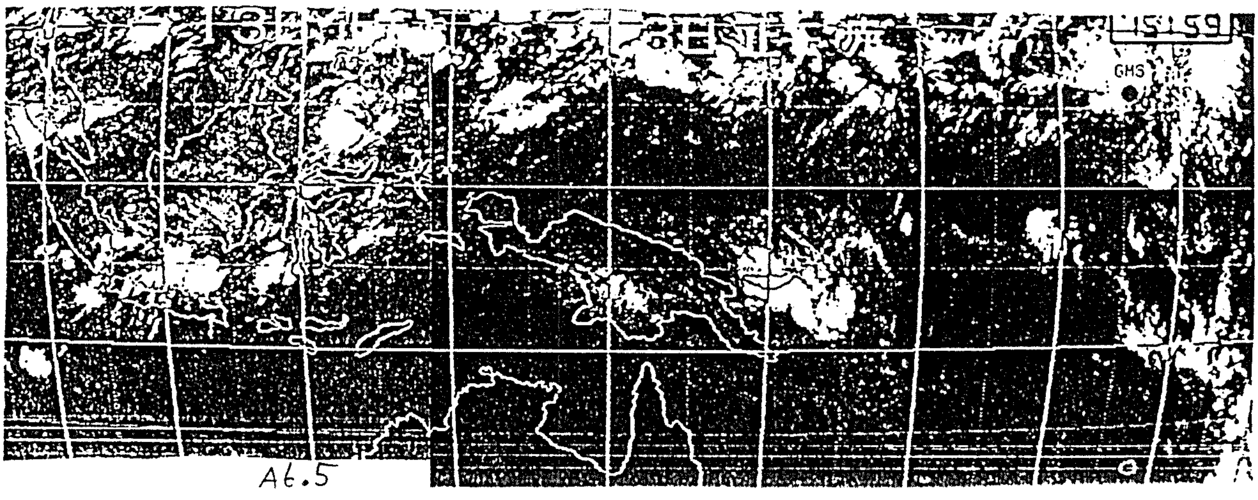

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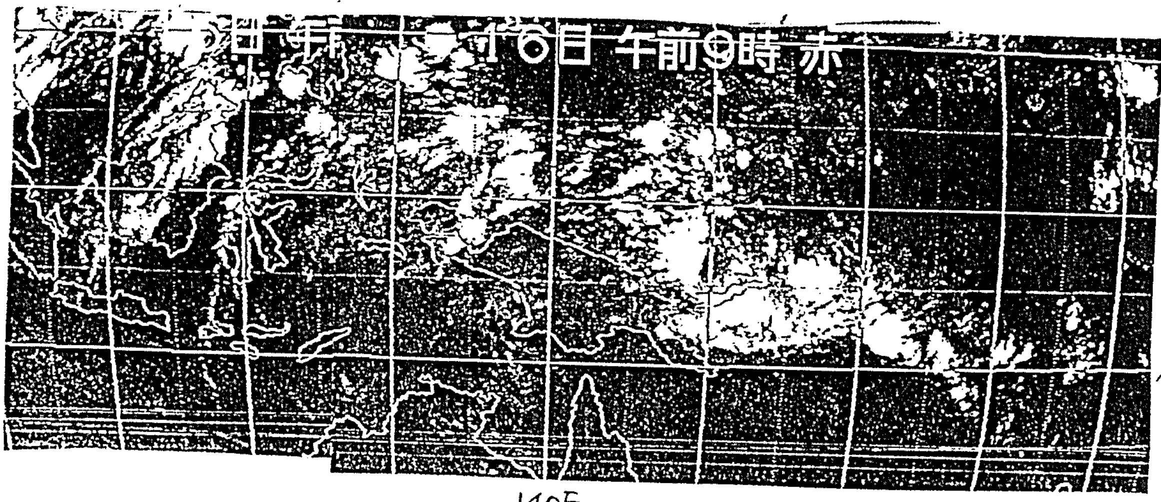

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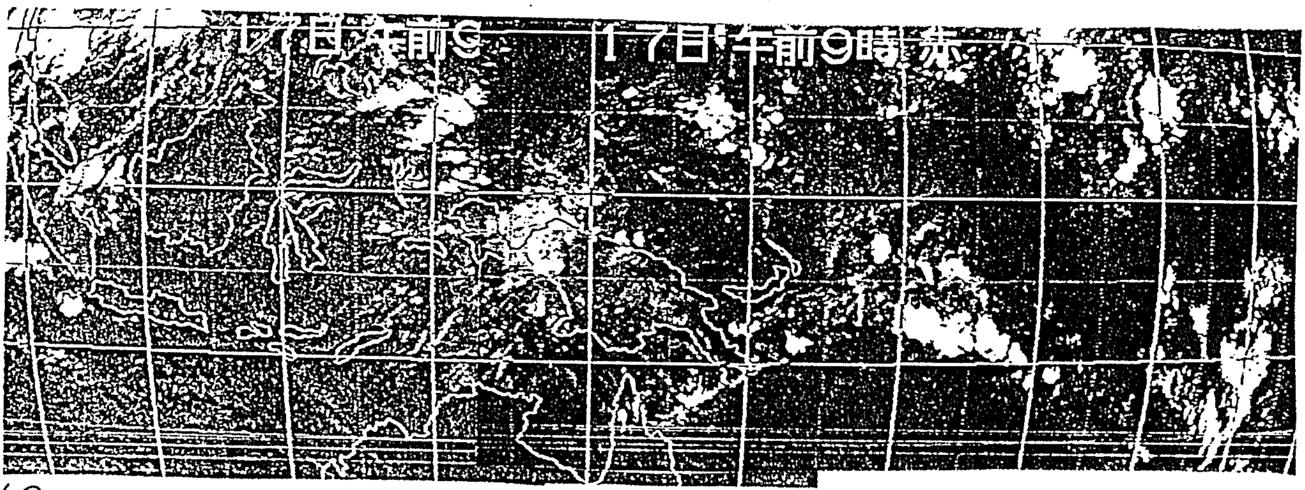

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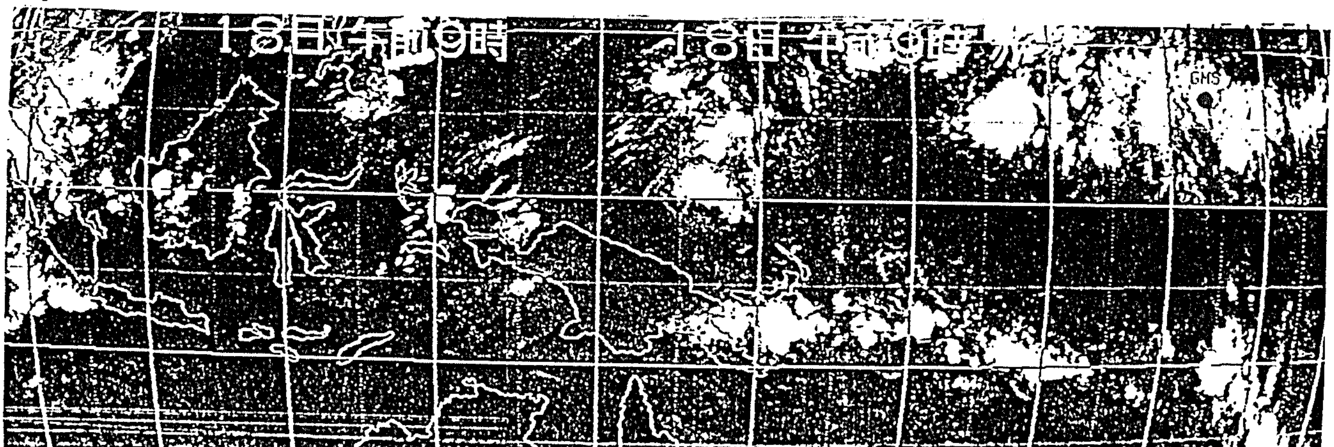

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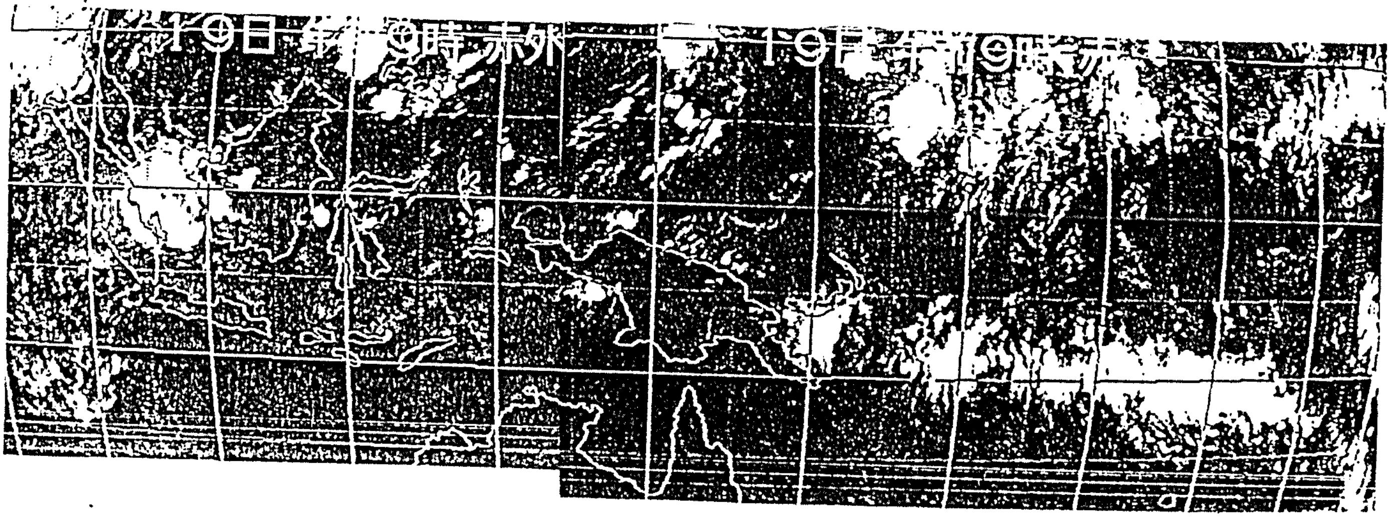

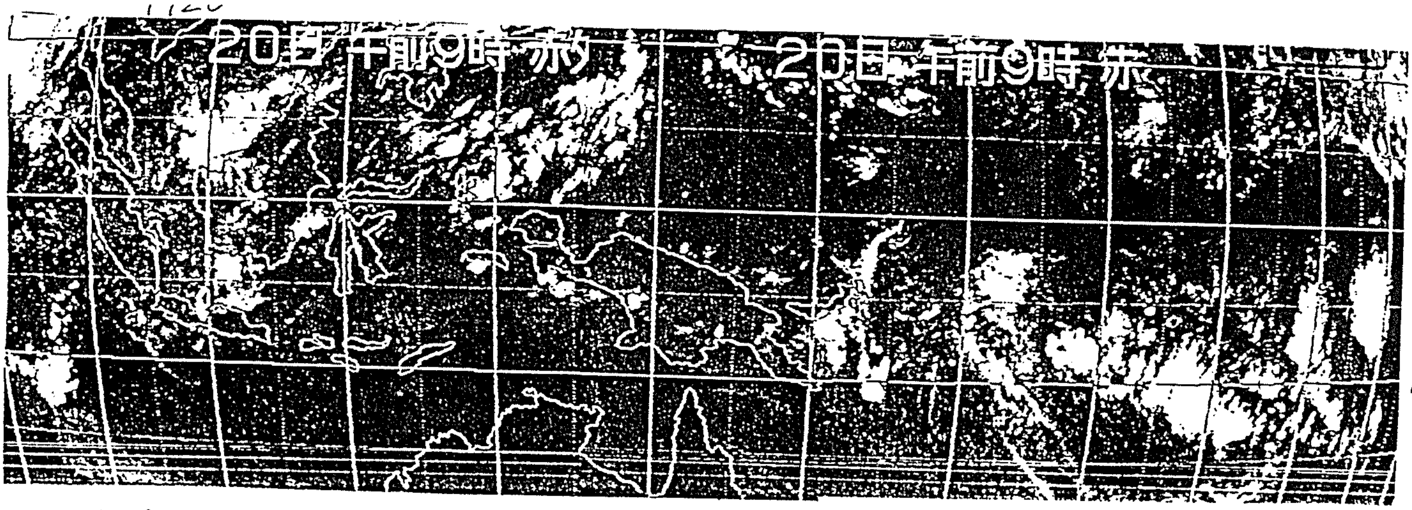

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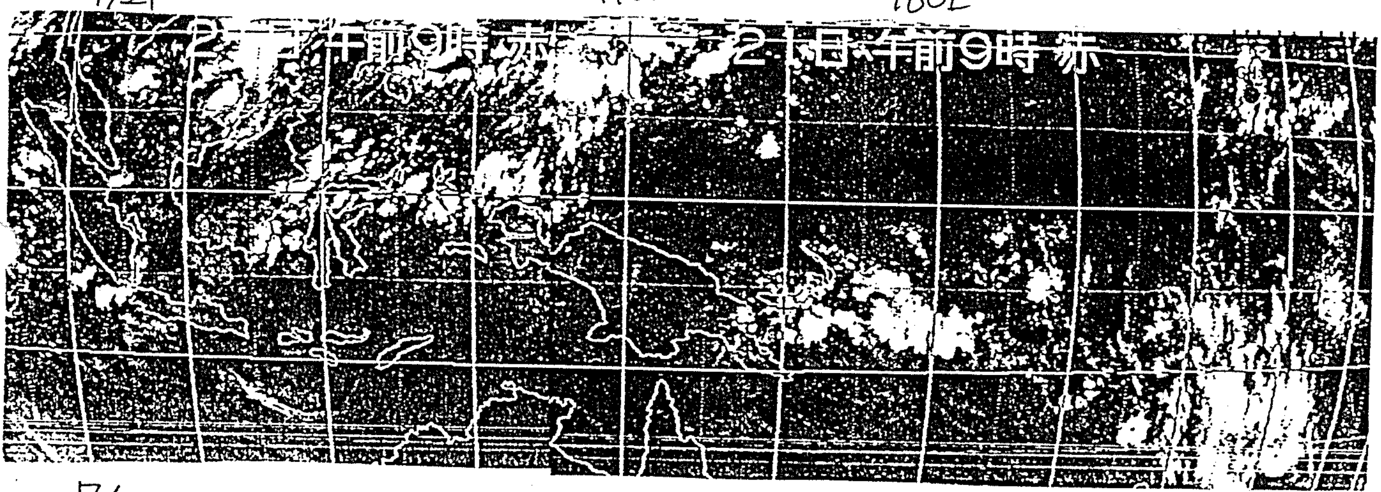

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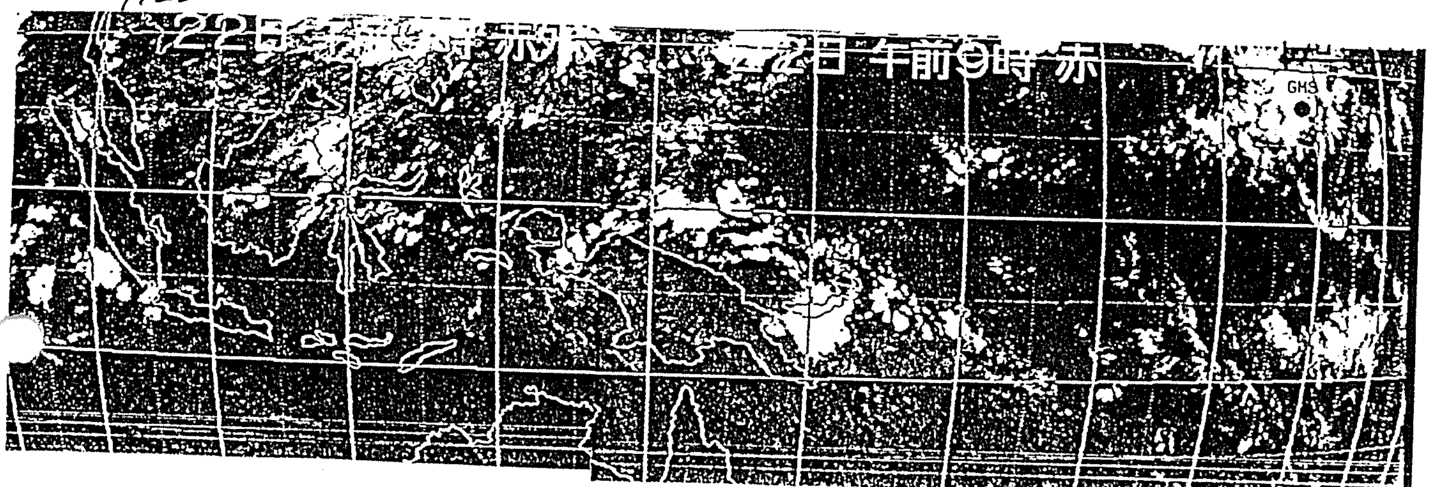

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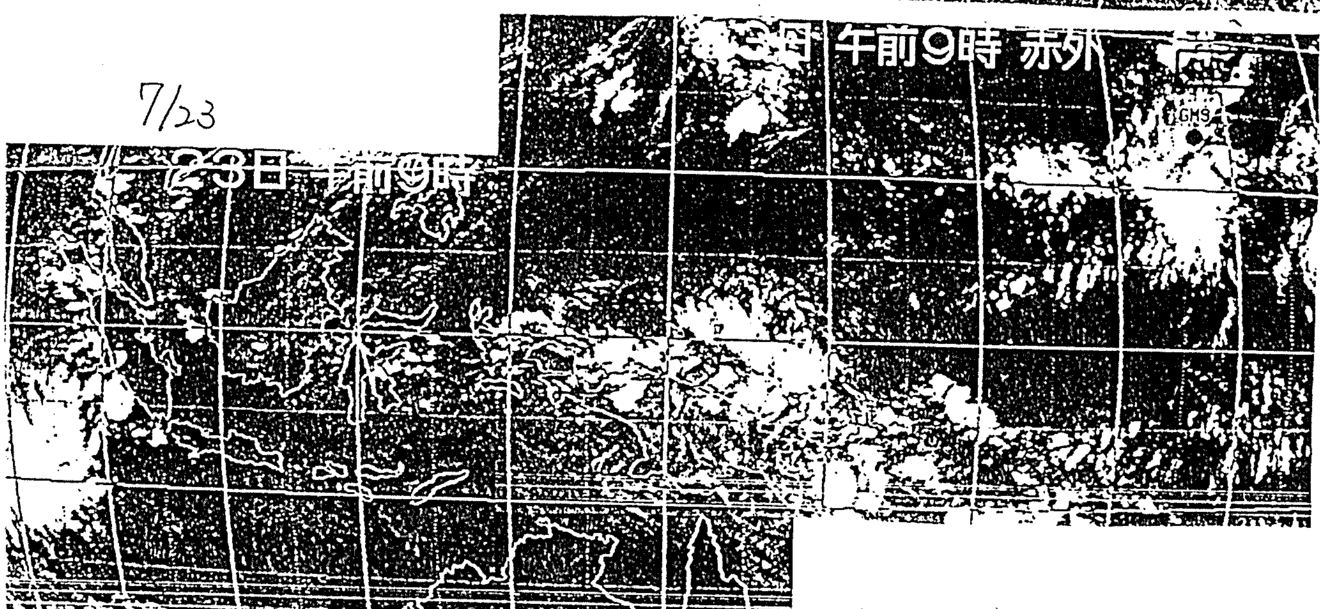

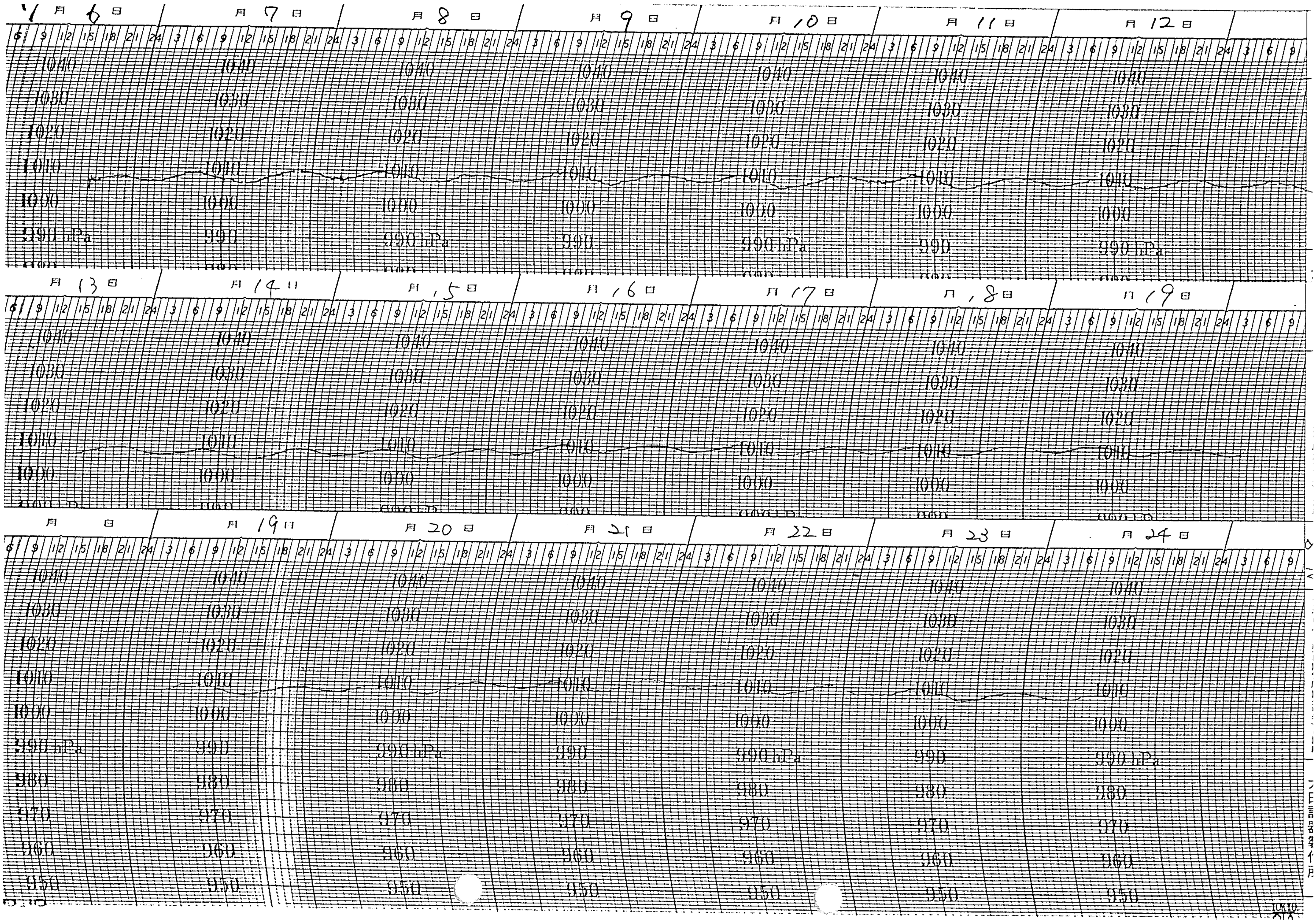
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