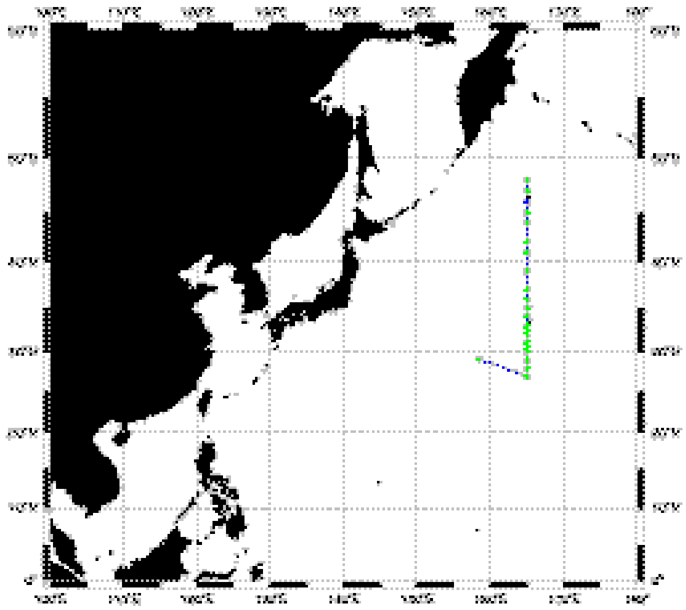


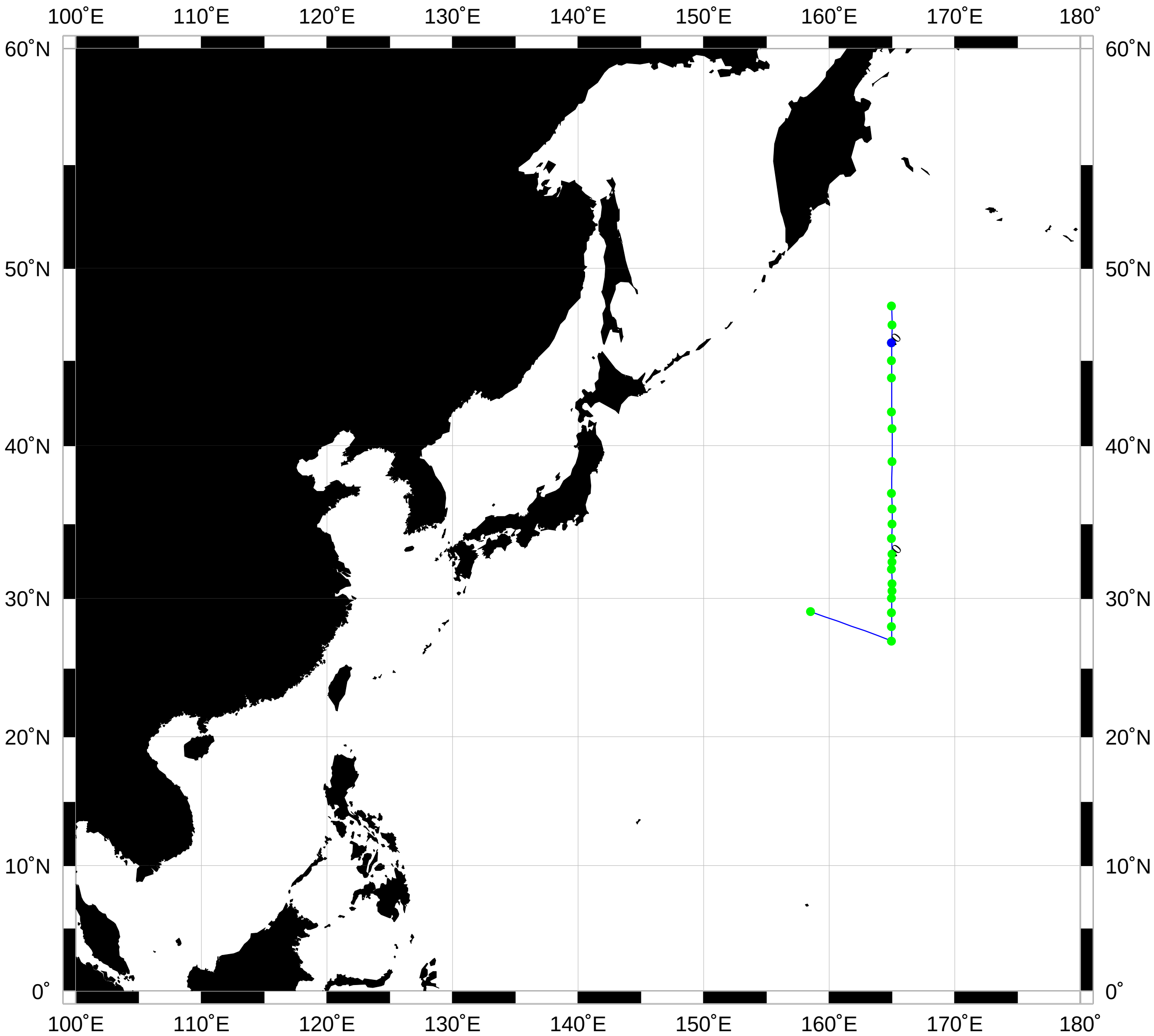
WHP Cruise Summary Information

WOCE section designation	**P13J**
Expedition designation (EXPOCODE)	**49HH932_1**
Chief Scientist(s) and their affiliation	Keisuke Taira (ORI, Univ. of Tokyo)
Dates	1993.05.13 - 1993.05.30
Ship	R/V Hakuho Maru
Ports of call	None listed
Number of stations	22
Geographic boundaries of the stations	47°59.86 N 158°32.52 E 165°9.44 E 26°59.2 N
Floats and drifters deployed	0
Moorings deployed or recovered	5
Contributing Authors	Michio Aoyama (CTD/BTL DQE)

Instructions: Click on any item to locate primary reference(s) or use navigation tools above.

Cruise Summary Information	**Hydrographic Measurements**
Description of scientific program	CTD - general
	CTD - pressure
Geographic boundaries of the survey	CTD - conductivity/salinity
Cruise track (figure)	
Description of stations	
Description of parameters sampled	**WHPO Summary**
Bottle depth distributions (figure)	
Floats and drifters deployed: None	**DQE Reports**
Moorings deployed or recovered	
	CTD
Principal Investigators for all measurements	S/O2/nutrients
Cruise Participants	
Problems and goals not achieved	
Other incidents of note: None	**Data Processing Notes**

Station locations for P13J



Produced from .sum file by WOCE-SIO

A. Cruise Narrative

A.1 Highlights

A.1.a WOCE designation P13J

A.1.b EXPOCODE 49HH932_1

A.1.c Chief Scientist

Keisuke Taira (ORI, Univ. of Tokyo)
Ocean Research Institute
University of Tokyo
15-1 Minami-Dai
1 Chome
Tokyo, Japan 164
email: taira@ori.u-tokyo.ac.jp
81-3-5351-6471 phone
81-3-5351-6418 Fax

A.1.d Ship R/V Hakuho Maru

A.1.e Ports of call

A.1.f Cruise dates May 13 to May 30, 1993 (Leg 1)

A.2 Cruise Summary Information

Figure 1 shows the track of this cruise.

A.2.a Geographic boundaries:

	47°59.86 N	
158°32.52 E		165°9.44 E
	26°59.2 N	

A.2.b Stations occupied

CTD02 casts with 24-place 12-liter rosette water sample were carried out at 19 stations. One of them was done at 29 04 N, 158 32 E as a test of the CTD system, and the others were occupied on 165E (Figure 2). CTD02 casts without water samplers were carried out at three stations on 165E (36N, 37N, 42N). Removing the samplers is due to wavy seas. The interval of CTD stations was basically 60 nautical miles. It was shortened to 30 nautical miles between 30N and 31N and between 32N and 33N, but was extended to 120 n. miles between 37N and 41N and between 42N and 44N because of stormy weather.

A.2.c Floats and drifters deployed

A.2.d Moorings deployed or recovered

We recovered five moorings of current meters at 27N, 29N, 31N, 33N and 35N on 165E, which were deployed in August 1991 in the cruise of KH-91-5 (P13C).

A.3 List of Principal Investigators

Table 1: List of Principal Investigators

Name	Measurement responsibility	Affiliation
K. Taira	CTD02, Salinity, Oxygen, Mooring	ORI, U. of Tokyo
S. Watanabe	Nutrients, CFCs, Tritium, Other chemical properties	Hokkaido Univ.

A.4 Scientific Programme and Methods

The CTD is Sea-Bird Electronics instrument equipped with a dissolved oxygen sensor. The temperature and conductivity sensors were calibrated at the Sea-Bird Electronics Inc. before the cruise. The conductivity data were moreover calibrated at sea using data from the analysis of the salinity samples collected at each station. Water samples were collected from twelve-liter Niskin bottles mounted on a General Oceanics Rosette Sampler. All of the water sample conductivity measurements and oxygen titrations were made with Portable Salinometer and an automated titration instrument soon after each cast was completed. Samples for the analysis of nutrients were collected at all CTD stations. Samples for CFCs, tritium, total carbon, alkalinity, pH, C-13, CH4, and C-14 were also collected.

Vertical distributions of potential temperature, salinity, dissolved oxygen, and potential density are shown in Figures 3 to 6.

A.5 Major Problems and Goals not Achieved

We planned initially to do CTD02 casts within the exclusive economic zone and the territorial waters of Russia to near the Kamchatka Peninsula, but could not get a permission to do it. We, then, changed the cruise plan into the observation south of 51 20 N, 165 E. However, the weather did not make us to complete even the shortened plan. The latitude of the northernmost CTD station was 48N.

CTD cast at Sta. C10 (34N, 165E) could not be lowered deeper than 3000 db because of strong current.

The General Oceanics rosette tripping mechanism was much better than our previous WOCE cruise (P13C). There were much less mis-firing and double-tripping of the water sampling bottles. To confirm the exact closing depths of Niskin bottles, we mounted ten or twelve reversing meters of pressure and temperature on the bottles. The check of the bottle-closed depth was much easier than in the previous cruise.

Another point different from our previous WOCE cruise is to almost disappear noises of CTD02 signal, due to reconstruction of the end portion of CTD wire connecting to a slip ring and renewal of the CTD system.

A.6 Other Incidents of Note

A.7 List of Cruise Participants

Table 2: List of Cruise participants

NAME	RESPONSIBILITY	AFFILIATION
Keisuke Taira	Chief Scientist/CTD Hardware/Mooring	ORI
Shoji Kitagawa	CTD Hard- and Software/Current Meter	ORI
Masaki Kawabe	Assistant to Chief Scientist/CTD Processing	ORI
Shinzou Fujio	Watch Stander/ADCP	ORI
Shuichi Watanabe	Oxygen/Nutrients/CFCs/Tritium	Hokkaido Univ.
Toshio Suga	Watch Stander	Tohoku Univ.
Syoichi Kizu	Watch Stander	Tohoku Univ.

Twenty-one graduate students, two scientists from Meteorological Agency and one WESTPAC scientist were joined this cruise for CTD watch and chemical analysis.

B. Underway Measurements

B.1 Navigation and bathymetry

B.2 Acoustic Doppler Current Profiler (ADCP)

B.3 Thermosalinograph and underway dissolved oxygen, etc

B.4 XBT and XCTD

B.5 Meteorological observations

B.6 Atmospheric chemistry

C. Hydrographic Measurements

C.1 CTD Measurements

Data Collection

Full signals of frequency, digitized 24 times per second, sent from the underwater CTD unit SBE 9 plus (Sea-Bird Electronics, Inc.) were received with the onboard unit SBE 11 plus, and were converted to output sequences of IEEE-488 (GPIB). The data collection was made with the Sea-Bird Electronics CTD operating software, SEASOFT Version 4, using an IBM-compatible personal computer JD1994DX2-66 (PROSIDE CORP.) with a 215 MByte hard disk, which was connected to the onboard unit by a GPIB cable. In addition, the signals of frequency were recorded in a SONY digital audio tape as backup data.

Calibrations and Processing

The CTD temperature sensor used during the cruise is manufactured by Sea-Bird Electronics Inc. (SBE 3) who claim a resolution of 0.0002¯C and an initial accuracy of +0.002 C. The sensor was calibrated at the Sea-Bird Electronics Inc. before the cruise. The obtained calibration coefficients were used in the CTD operating software SEASOFT.

The CTD pressure sensor used during the cruise is manufactured by Paroscientific Digiquartz (Model 4xK), and have a resolution of 0.001% of full scale and an accuracy of +0.015 % of full scale (6000 db range).

The conductivity sensor is manufactured by Sea-Bird Electronics Inc. (SBE 4) who claim a resolution of 0.0004 mmho/cm and an accuracy of +0.003 mmho/cm. The sensor was calibrated at the Sea-Bird Electronics Inc. before the cruise. The obtained calibration coefficients were used in the CTD operating software SEASOFT. Cell factors (i.e., the ratio of conductivity from water sample to that from CTD) were calculated to over calibrate the conductivity data furthermore. The cell factor is nearly 1 with a small vertical change. The depth dependence is expressed by quadratic polynomial of:

Pressure:

CF = 1.000019 - 0.7583737x10**-7 x P + 0.9613456x10**11 x P**2

The oxygen sensor is manufactured by Sea-Bird Electronics Inc. (SBE 13). The data were calibrated with the method shown in the WOCE Operations Manual (WHP Office Report WHPO 91-1, WOCE Report No. 68/91).

C.2 Salinity measurement

The water sample salinities were measured with a Guildline Portasal Model 8410 salinometer that was standardized daily with IAPSO Standard Sea Water Batch P-114. All of the salinity measurements during this cruise were made within a temperature controlled (+ 1C) laboratory maintained a little below that of the salinometer water bath.

D. Acknowledgments

E. References

F. WHPO Summary

Bottle Oxygen are not available therefore figures 3 and 4 (showing deloxy) are not available.

Several data files are associated with this report. They are the 49HH932_1.sum, 49HH932_1.hyd, 49HH932_1.csl and *.wct files. The 49HH932_1.sum file contains a summary of the location, time, type of parameters sampled, and other pertinent information regarding each hydrographic station. The 49HH932_1.hyd file contains the bottle data. The *.wct files are the ctd data for each station. The *.wct files are zipped into one file called 49HH932_1wct.zip. The 49HH932_1.csl file is a listing of ctd and calculated values at standard levels.

The following is a description of how the standard levels and calculated values were derived for the 49HH932_1.csl file:

Salinity, Temperature and Pressure: These three values were smoothed from the individual CTD files over the N uniformly increasing pressure levels. using the following binomial filter-

$$t(j) = 0.25ti(j-1) + 0.5ti(j) + 0.25ti(j+1) \quad j=2....N-1$$

When a pressure level is represented in the *.csl file that is not contained within the ctd values, the value was linearly interpolated to the desired level after applying the binomial filtering.

Sigma-theta(SIG-TH:KG/M3), Sigma-2 (SIG-2: KG/M3), and Sigma-4(SIG-4: KG/M3): These values are calculated using the practical salinity scale (PSS-78) and the international equation of state for seawater (EOS-80) as described in the UNESCO publication 44 at reference pressures of the surface for SIG-TH; 2000 dbars for Sigma-2; and 4000 dbars for Sigma-4.

Gradient Potential Temperature (GRD-PT: C/DB 10-3) is calculated as the least squares slope between two levels, where the standard level is the center of the interval. The interval being the smallest of the two differences between the standard level and the two closest values. The slope is first determined using CTD temperature and then the adiabatic lapse rate is subtracted to obtain the gradient potential temperature. Equations and Fortran routines are described in UNESCO publication 44.

Gradient Salinity (GRD-S: 1/DB 10-3) is calculated as the least squares slope between two levels, where the standard level is the center of the standard level and the two closes values. Equations and Fortran routines are described in UNESCO publication 44.

Potential Vorticity (POT-V: 1/ms 10-11) is calculated as the vertical component ignoring contributions due to relative vorticity, i.e. pv=fN2/g, where f is the coriolius parameter, N is the buoyancy frequency (data expressed as radius/sec), and g is the local acceleration of gravity.

Buoyancy Frequency (B-V: cph) is calculated using the adiabatic leveling method, Fofonoff (1985) and Millard, Owens and Fofonoff (1990). Equations and Fortran routines are described in UNESCO publication 44.

Potential Energy (PE: J/M2: 10-5) and Dynamic Height (DYN-HT: M) are calculated by integrating from 0 to the level of interest. Equations and Fortran routines are described in UNESCO publication 44.

Neutral Density (GAMMA-N: KG/M3) is calculated with the program GAMMA-N (Jackett and McDougall) version 1.3 Nov. 94.

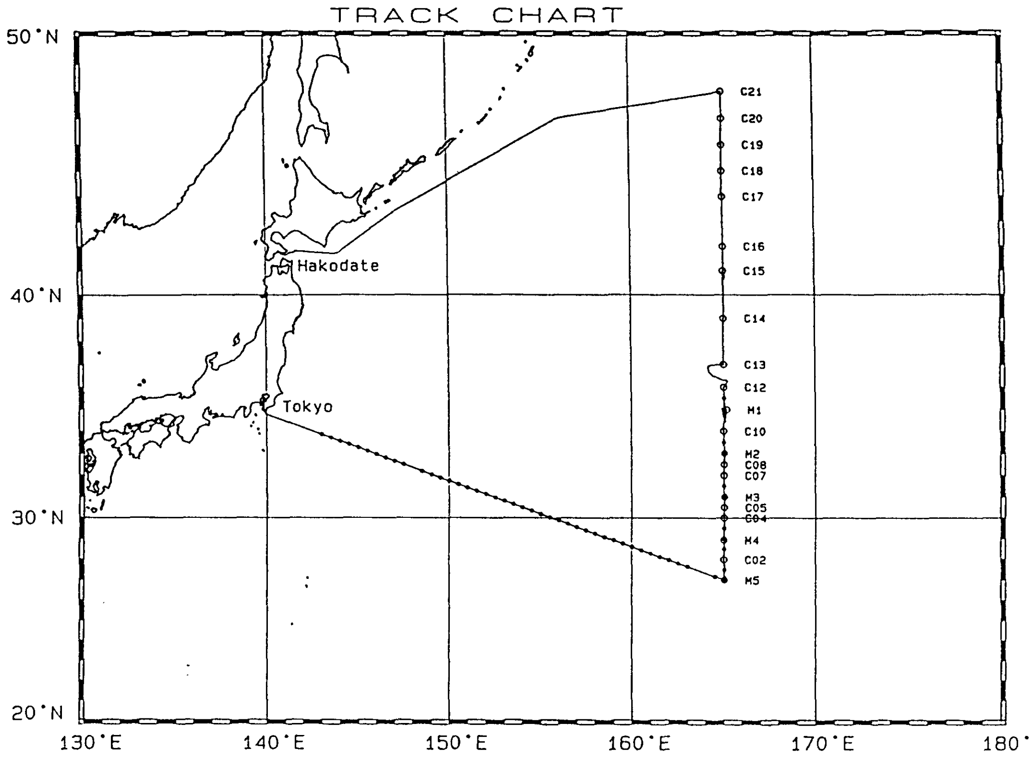


Fig. 1 Cruise track of P13N (KH-93-2 leg 1).

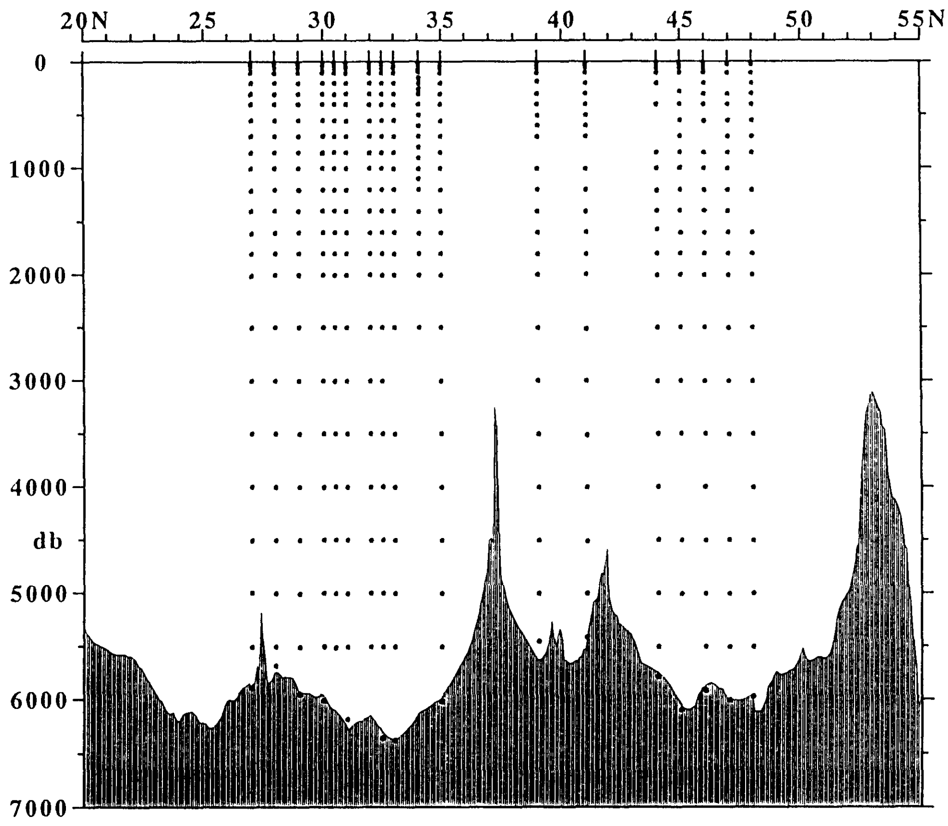


Fig. 2 Vertical section along 165°E showing the bottle depths.

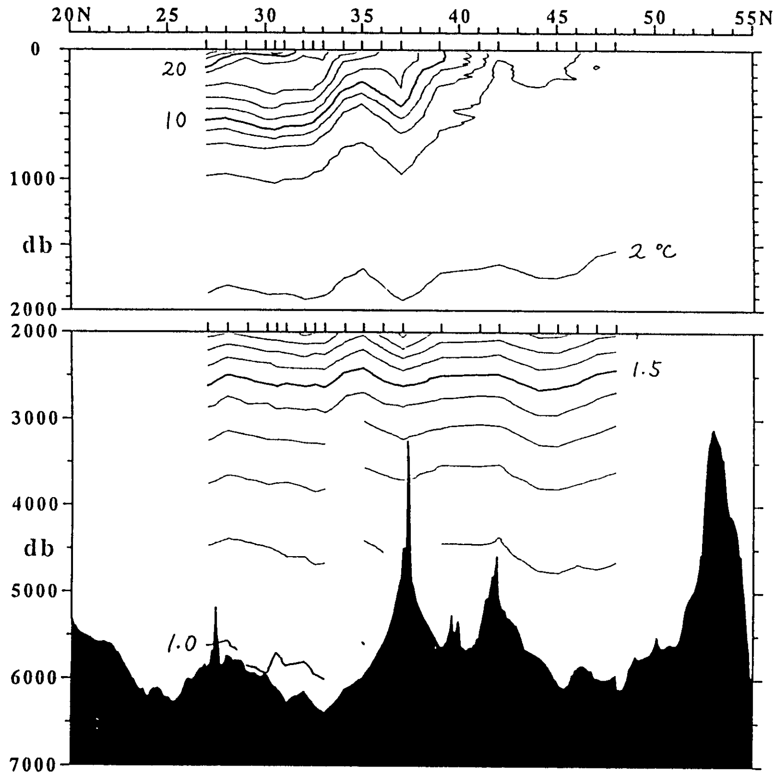


Figure 3 Vertical distribution of potential temperature along 165°E from the cruise P13J (KH-93-2 leg 1).

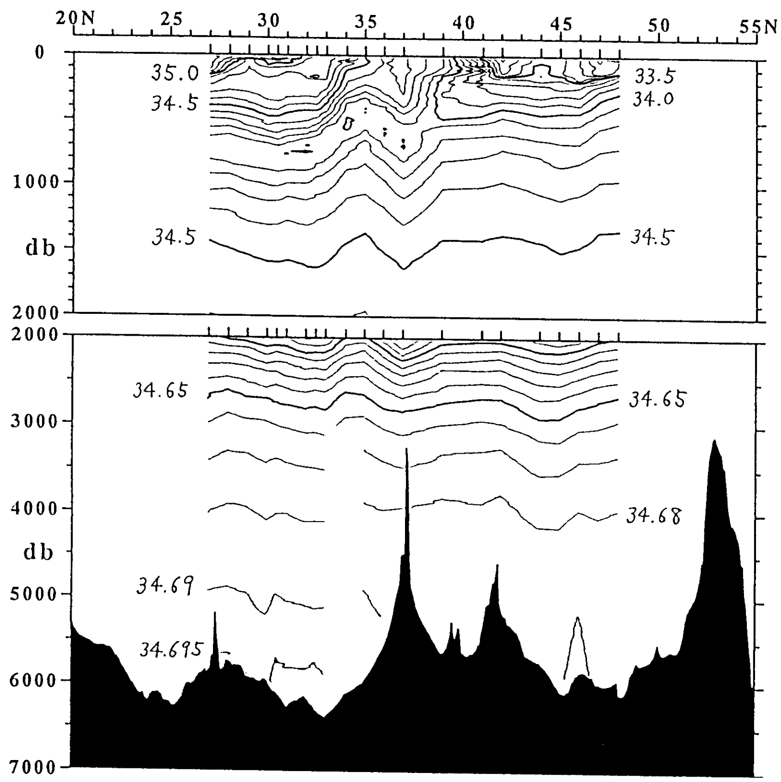


Figure 4 Vertical distribution of salinity along 165°E from the cruise P13J (KH-93-2 leg 1).

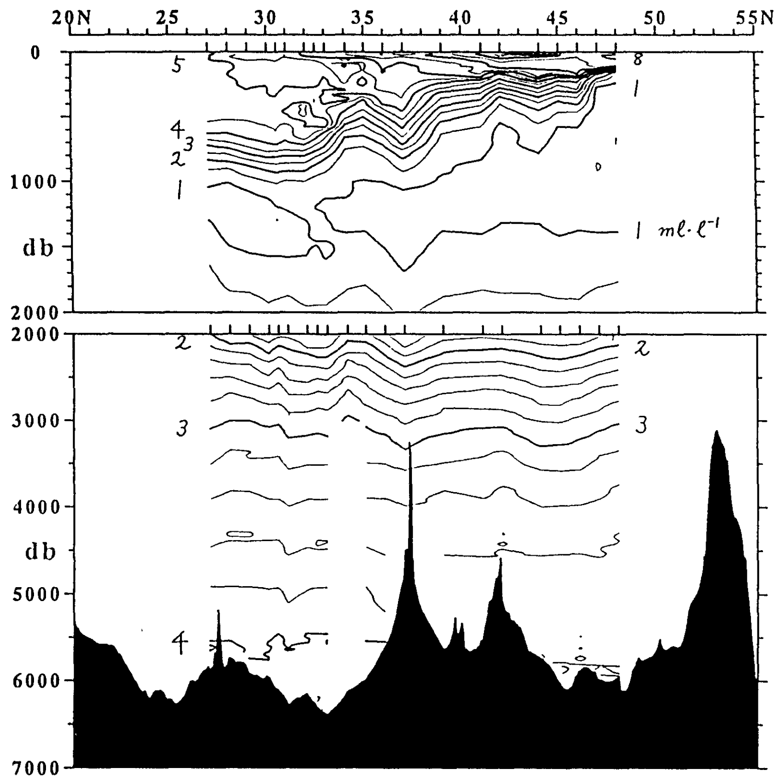


Fig. 5 Vertical distribution of dissolved oxygen along 165°E from the cruise P13N (KH-93-2 leg 1).

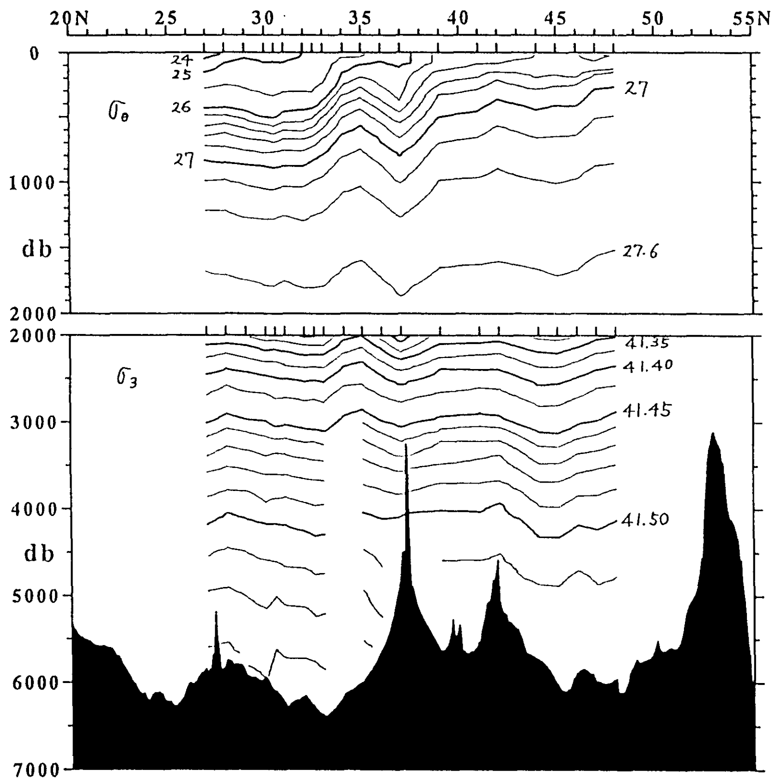


Fig. 6 Vertical distribution of potential density along 165°E from the cruise P13N (KH-93-2 leg 1). σ_θ and σ_3 are shown for less and more than 2000 db, respectively.

G. DQE REPORTS
22 May 1996

G.1 CTD DQE
(Michio Aoyama)

General:
The data quality of WOCE P13J CTD data (EXPOCODE: 49HH93/2) and the CTD salinity found in dot sea file are examined. The individual 1 dbar profiles were observed in temperature, salinity and oxygen by comparing the profiles obtained in the same basin.

The CTD salinity and oxygen calibrations are examined using the water sample data file p13j.mka. Since DQE could not get the information on 'OXYGEN' and 'OXYGN2', DQE used values at 'OXYGEN'. DQE used the water sample data flagged "2" only for the DQE work. DQE put serial number from 100 to 121 for the original stations C00 -C21 for the convenience of data treatments by DQE. Then in some of the figures presented by DQE, the station numbers are shown in serial number by DQE.

Details

CTD profiles
CTD temperature, salinity and oxygen look good.

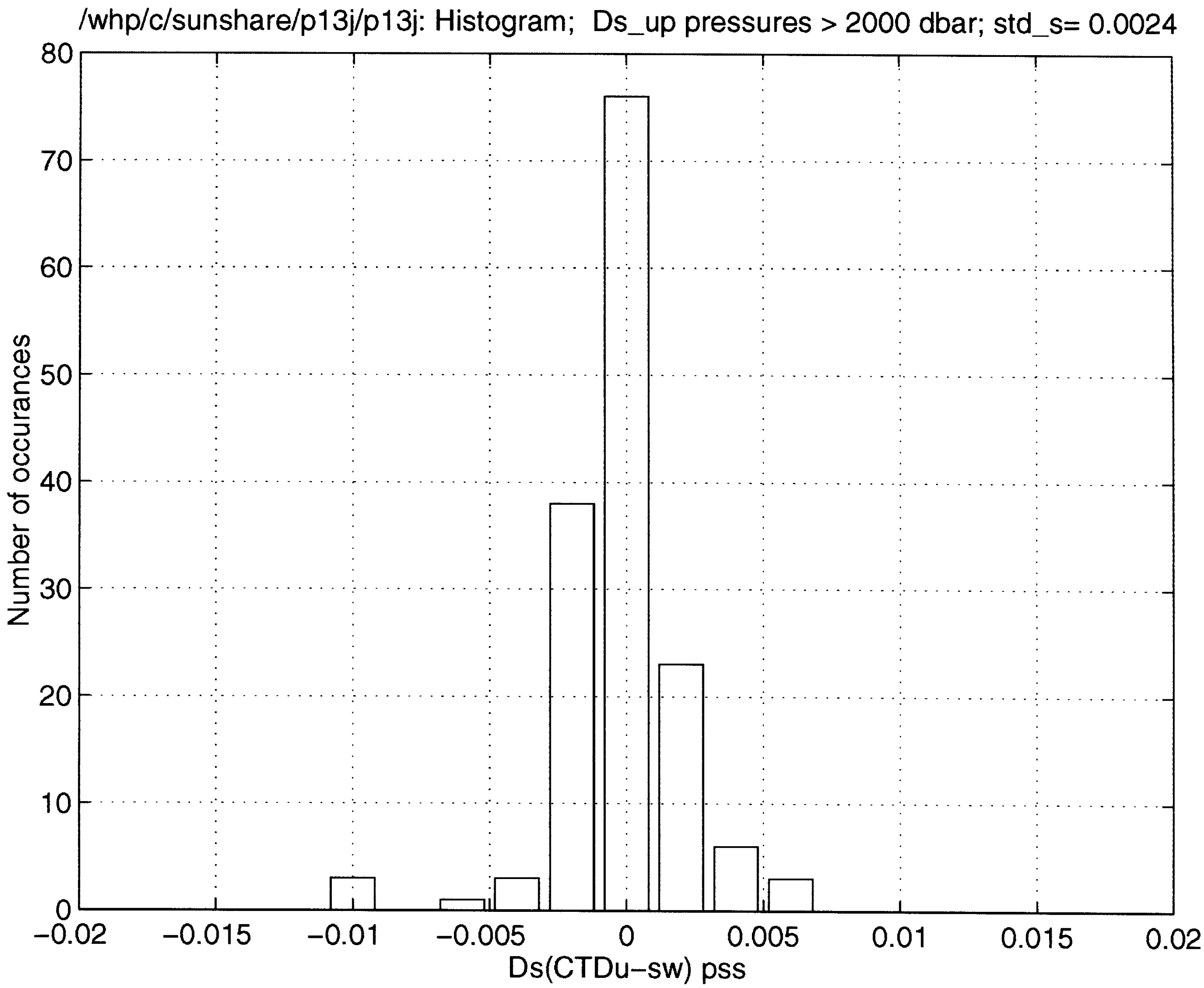
Evaluation of CTD calibrations to water samples

Salinity calibration;
The onboard calibration for salinity looks good in general. The histogram of Ds, Ds = CTD salinity in dot sea file - bottle salinity, for deeper than 2000 dbar shows an acceptable symmetric distribution. The standard deviation of Ds is 0.0024 PSS for deeper than 2000 dbar. DQE thinks that standard deviation of 0.0024 PSS is a little bit larger than one would expect from good salinometer operation and CTD salinity calibrations. DQE found some of the bottle salinity flagged "2" by the data originator should be flagged "3" or "4". These questionable/bad bottle salinity data clearly increase the standard deviation of Ds. (See DQE comments for P13J hydrographic data.) DQE observed no significant pressure dependency, however, observed station dependency. DQE suggests that further correction using a few station groupings will improve the quality of CTD salinity.

Oxygen calibration;
The onboard calibration for CTD oxygen looks good in general. The histogram of Dox, Dox = CTD oxygen in CTD files - bottle oxygen, for deeper than 2000 dbar shows an broad distribution. The standard deviation of Dox is 5.18 µmol/kg for deeper than 2000 dbar. DQE thinks that standard deviation of 5.18 µmol/kg is relatively larger than that we considering the WHP one-time survey standards for CTD data. DQE observed weak pressure dependency and clear station dependency. DQE suggests that further correction using a few station groupings or a station-depending linear trend will improve the quality of CTD oxygen.

The following are some specific problems that should be looked at:

st. C04 at bottom:	Oxygen looks very high.	Suggest flag. "3".
st. C05 at bottom:	Oxygen shows unreasonable increase.	Suggest flag. "3".



/whp/c/sunshare/p13j/p13j: Histogram; Ds_up pressures > 2000 dbar; std_s= 0.0024
Number of occurances
Ds(CTDu−sw) pss
80
70
60
50
40
30
20
10
0
−0.02
−0.015
−0.01
−0.005
0
0.005
0.01
0.015
0.02

Figure 1

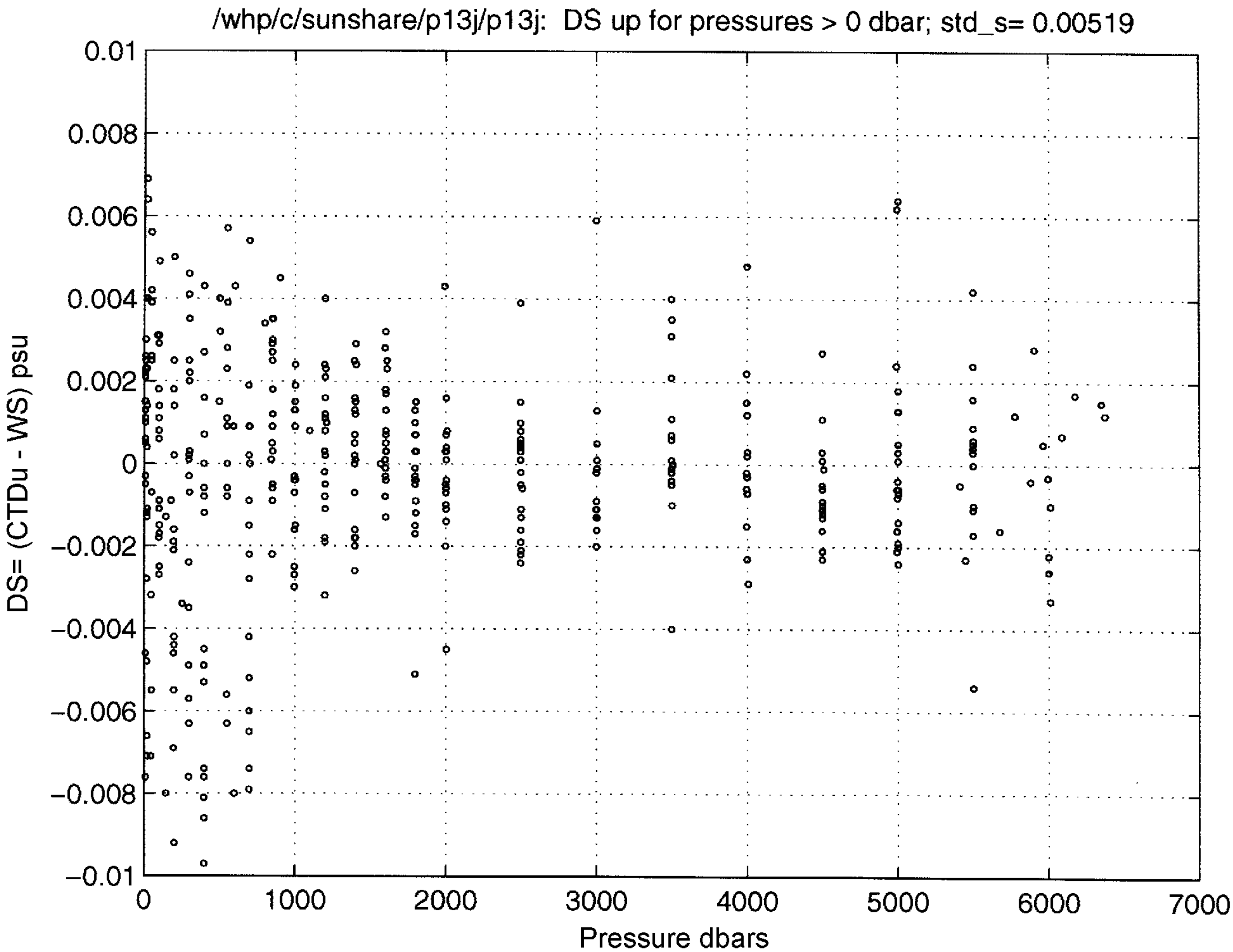
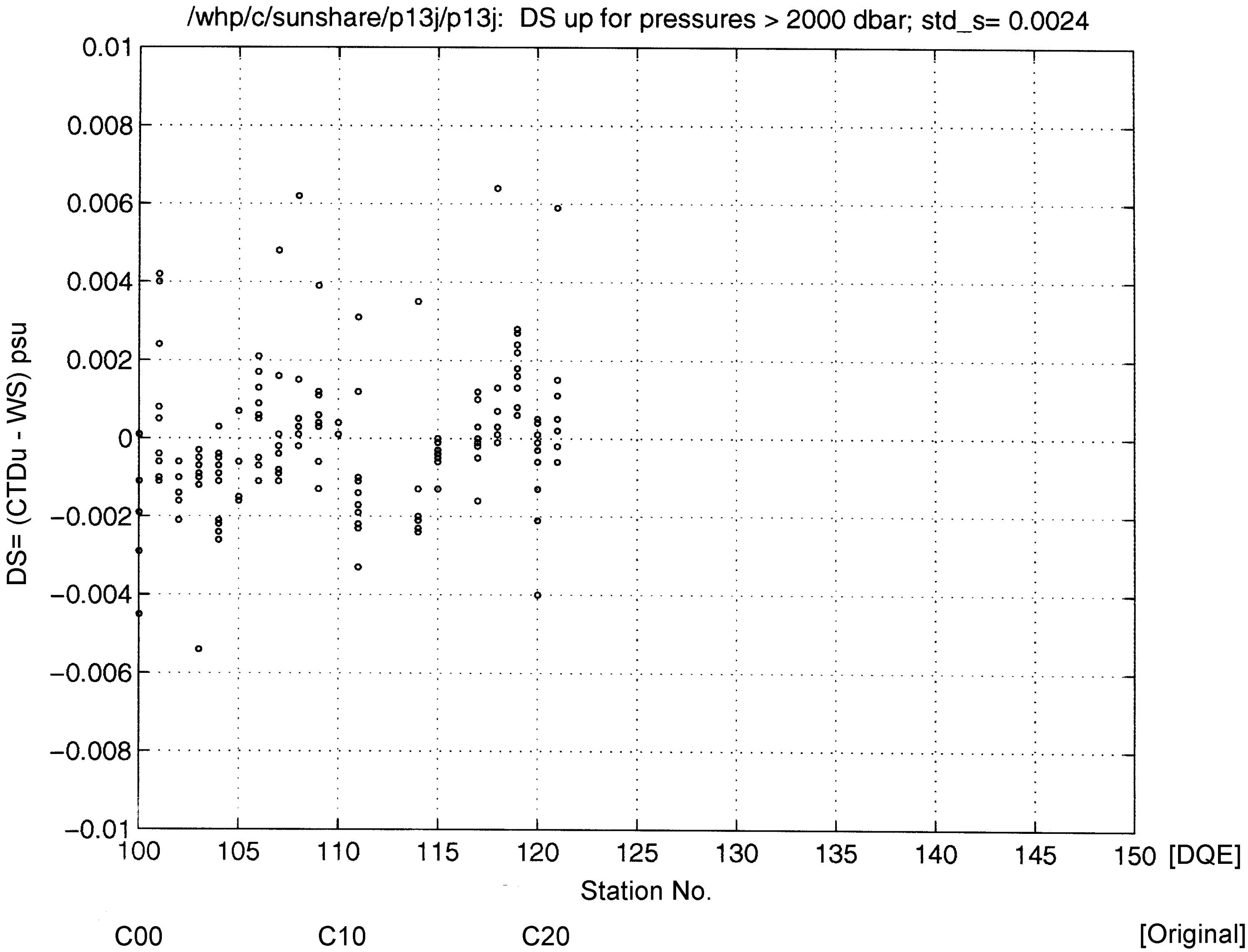

/whp/c/sunshare/p13j/p13j: DS up for pressures > 0 dbar; std_s= 0.00519
DS= (CTDu - WS) psu
Pressure dbars
0.01
0.008
0.006
0.004
0.002
0
−0.002
−0.004
−0.006
−0.008
−0.01
0
1000
2000
3000
4000
5000
6000
7000

Figure 2



/whp/c/sunshare/p13j/p13j: DS up for pressures > 2000 dbar; std_s= 0.0024
DS= (CTDu - WS) psu
0.01
0.008
0.006
0.004
0.002
0
−0.002
−0.004
−0.006
−0.008
−0.01
100
105
110
115
120
125
130
135
140
145
150 [DQE]
Station No.
C00
C10
C20
[Original]

Figure 3

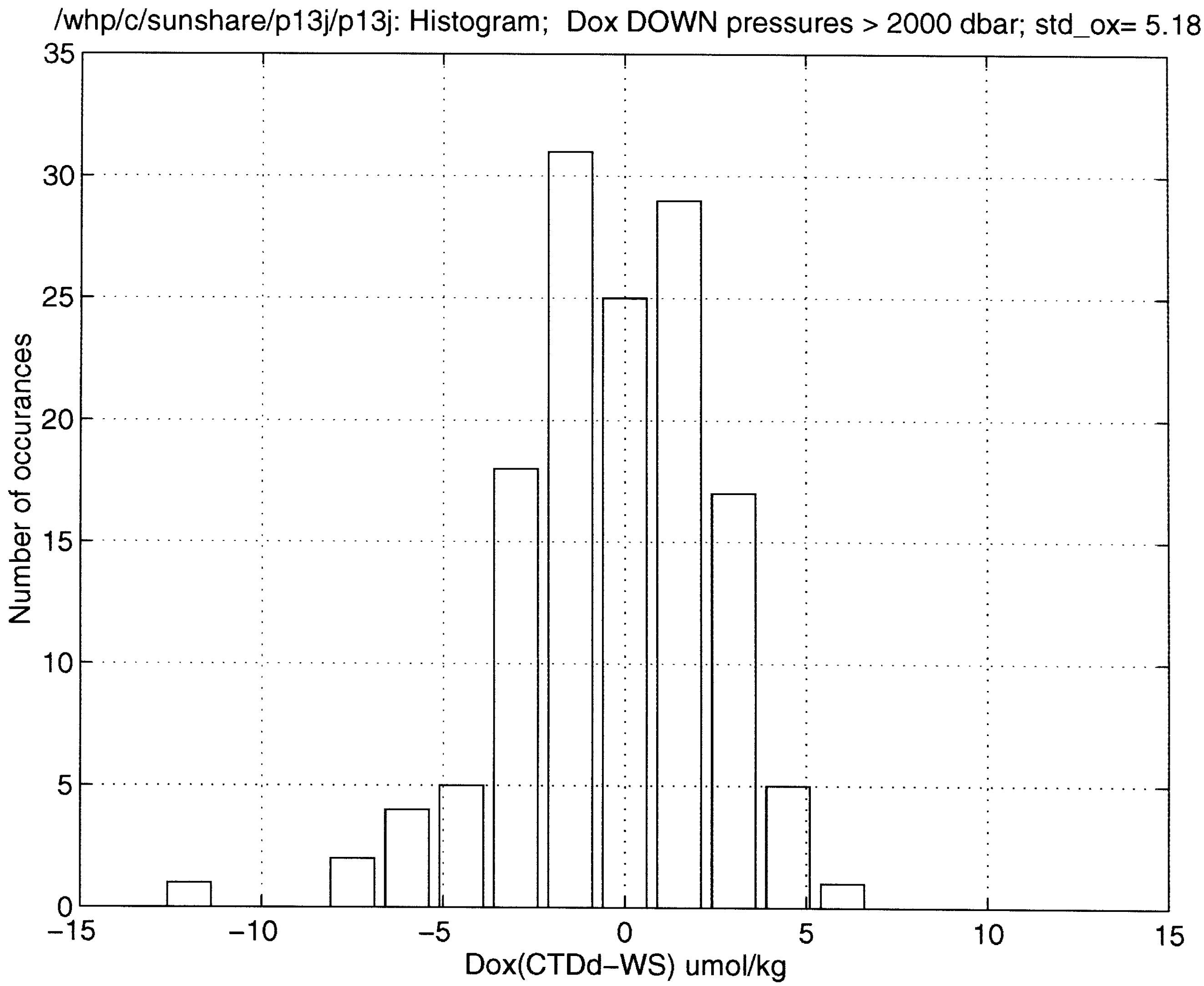

/whp/c/sunshare/p13j/p13j: Histogram; Dox DOWN pressures > 2000 dbar; std_ox= 5.18
Number of occurances
Dox(CTDd−WS) umol/kg
35
30
25
20
15
10
5
0
−15
−10
−5
0
5
10
15

Figure 4

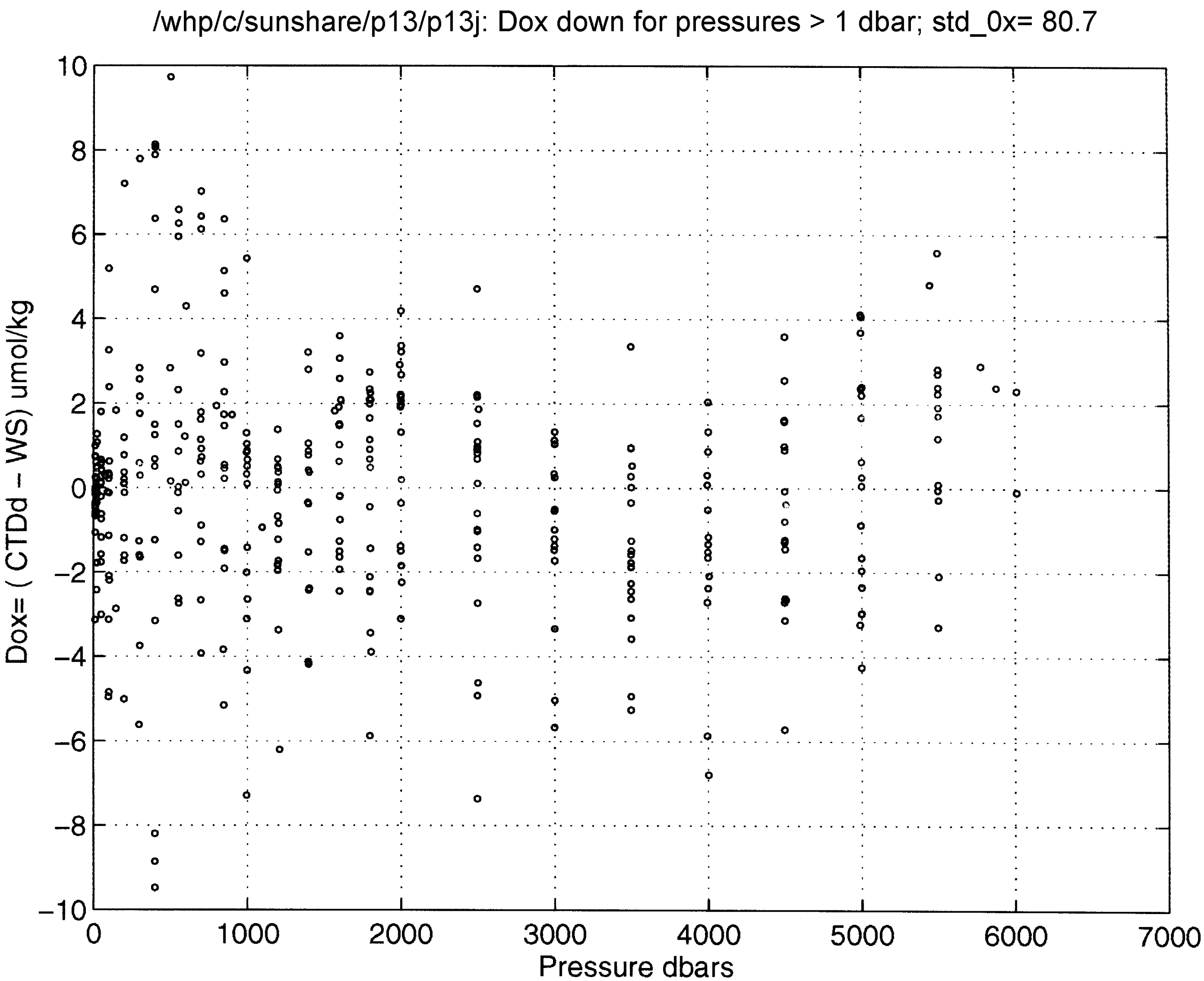
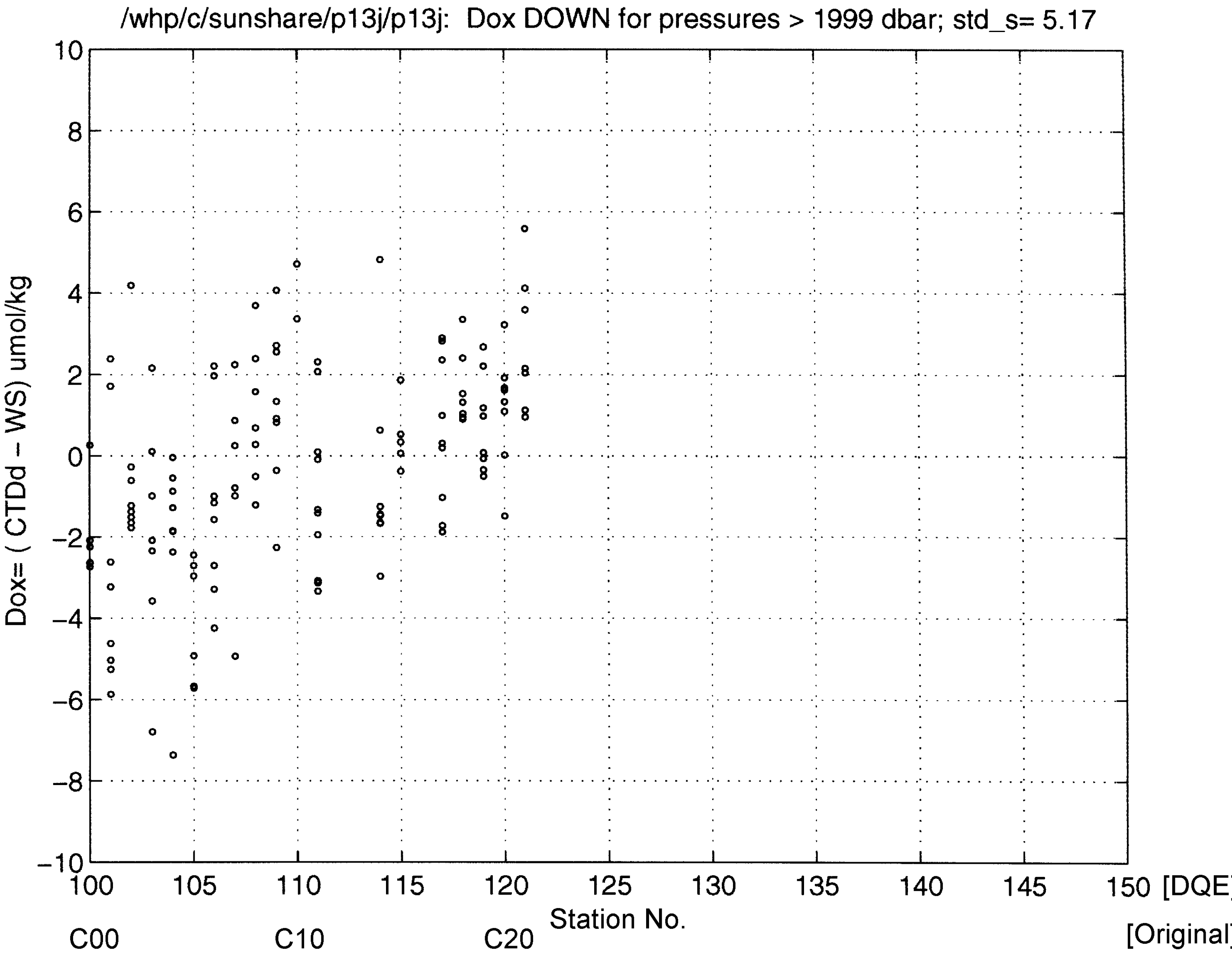

/whp/c/sunshare/p13/p13j: Dox down for pressures > 1 dbar; std_0x= 80.7
Dox= (CTDd − WS) umol/kg
Pressure dbars
10
8
6
4
2
0
−2
−4
−6
−8
−10
0
1000
2000
3000
4000
5000
6000
7000

Figure 5



/whp/c/sunshare/p13j/p13j: Dox DOWN for pressures > 1999 dbar; std_s= 5.17
Dox= (CTDd – WS) umol/kg
10
8
6
4
2
0
−2
−4
−6
−8
−10
100
105
110
115
120
125
130
135
140
145
150 [DQE]
Station No.
C00
C10
C20
[Original]

Figure 6

G.2 Hydrographic DQE

(Michio Aoyama)

The data quality of the hydrographic data of the WOCE P13J cruise (EXPOCODE: 49HH93/2) are examined. Since the nutrient data are not submitted yet at the time of DQE, DQE was done using only salinity and oxygen. The data files for this DQE work were P13J.sum and P13J.mka (this P13J.mka file is created for DQE, then it has a new column of quality 2 word) provided by WHPO.

General

The station spacing ranged from 30 nautical miles to 120 nautical miles and the sampling layer spacing was kept ca. 500 dbar in the deeper layers during this P13J cruise. Although P13J data does not meet the WOCE WHP cruise requirements on station spacing and the vertical sampling interval, P13J data will be an important part of the dataset of "WOCE one time line P13".

DQE used the data flagged "2" by data originator for this DQE work.

DQE examined 2 profiles and 3 property vs. property plots as listed below:

- salinity and oxygen profiles
- theta vs. salinity plot
- theta vs. oxygen plot
- salinity vs. oxygen plot

Bottle salinity profile looks good. Salinity vs. oxygen and theta vs. salinity plots also look reasonable. DQE thinks that most of the flags of the bottle salinity data are reliable.

Oxygen

Bottle oxygen profile looks good. Salinity vs. oxygen and theta vs. oxygen plots also look reasonable. DQE thinks that the flags of the bottle oxygen data are reliable.

The following are some specific problems that should be looked at:

STNNBR XX/CASTNO X/SAMPNO XX at XXXX dbar		
st. COO/1/6 at 3497 dbar	Bottle Salinity looks high.	Suggest flag. "3".
st. C01/1/6 at 3496 dbar	Bottle Salinity looks low.	Suggest flag. "3".
st. C01/1/2 at 5498 dbar	Bottle Salinity looks low.	Suggest flag. "3".
st. C03/1/2 at 5500 dbar	Bottle Salinity looks high.	Suggest flag. "3".
st. C05/1/7 at 2999 dbar	Bottle Salinity and oxygen look high.	Suggest flag. "3".
st. C05/1/8 at 2496 dbar	Bottle Salinity looks high.	Suggest flag. "3".
st. C07/1/5 at 3999 dbar	Bottle Salinity looks low.	Suggest flag. "3".
st. C08/1/3 at 4994 dbar	Bottle Salinity looks low.	Suggest flag. "3".
st. C11/1/5 at 3999 dbar	Bottle Salinity looks low.	Suggest flag. "3".
st. C11/1/6 at 3497 dbar	Bottle Salinity looks low.	Suggest flag. "3".

st. C14/1/6 at 35007 dbar	Bottle Salinity looks low.	Suggest flag. "3".
st. C18/1/2 at 5002 dbar	Bottle Salinity looks low.	Suggest flag. "3".
st. C20/1/6 at 3499 dbar	Bottle Salinity looks high.	Suggest flag. "3".
st. C21/1/7 at 2999 dbar	Bottle Salinity looks low.	Suggest flag. "3".

Data Processing History:

Date	Last Name	Data Type	Data Status	Summary
7/6/93	Baba	DOC	Cruise Rpt Rcvd @ WHPO	preliminary
11/26/93	Yamada	CTD	Submitted for DQE	
12/6/93	Yamada	SEA	Data rcvd @ WHPO	
5/22/96	Aoyama	CTD/S/O	DQE Report rcvd @ WHPO	
5/22/96	Aoyama	CTD/S/O	DQE Report rcvd @ WHPO	
6/12/96	Taira	CTD/S/O	DQE Report sent to PI	
6/12/96	Taira	CTD/S/O	DQE Report sent to PI	
5/8/00	Taira	DELC14	Not Measured	See note:
	Samples for C-14 were also collected, but we cannot measure them in Japan and don't have any plan to do it. (from cruise report for p13c: Chief Scientist Taira/ORI)			
5/11/00	Kawabe	CTD/BTL	Data are Public	See note:
	I and my colleagues in the Ocean Research Institute (U. of Tokyo) made WHP cruises twice: WHP P13C (1991) and P13J (1993). I already opened (at least, I believed I opened) the calibrated CTDO2 data and sample data (not including nutrients and chemical data) in P13C and P13J several years ago, by submitting the data to the WHPO and the Japan Oceanographic Data Center (JODC). I don't remember that the WHPO asked me whether "not public" or "public". This question may have sent to Dr. Taira who was the chief scientist of the cruises. Anyway, I hope to open our data in the WOCE community with non-encrypted usual style.			