R/V Chofu Maru Cruise NC9310

1 Cruise Narrative

1.1 Highlights

Expedition Designation	Chofu Maru Cruise NC9310
Chief Scientist	Yoshisuke Tomiyama, NMO
Ship	R/V Chofu Maru
Port of Call	Ishigaki
Cruise Dates	Leg 2: October 29 to November 2, 1993 Leg 3: November 6 to November 11, 1993

1.2 Cruise Summary

Observations of PR19 were carried out as a part of the R/V Chofu Maru Cruise NC9310 Leg 2 and Leg 3. The ship sailed from Naha at 0500 UTC on 29 October 1993. By 2202 UTC on 29 October, the ship was at the first station of a section PR19. When the observation at NS-6 on a section PR19 finished at 2246 UTC on 30 October, we interrupted the observation of PR19 by the Typhoon 9323 was approaching, and the ship sailed for Ishigaki. The ship returned to the station NS-5 at 1444 UTC on 6 November and restarted the observation. The observations of PR19 finished at 1135 UTC on 8 November.

The cruise track and station locations are shown in Figure 1. Water sampling on the cruise included measurements of salinity both by CTD and by water bottle samples, CTD temperature, bottle sample oxygen determination, and nutrients (nitrates, nitrites, and phosphates).

1.3 Principal Investigators for All Measurements

The principal investigators for all the parameters measured on the cruise are listed in Table 1.

Table 1. Principal Investigators for All Measurements

Name	Responsibility	Affiliation
T. Tomiyama	CTD,S	NMO
K. Kimura	O2,Nutrients	NMO

1.4 List of Cruise Participants

The cruise participants are listed in Table 2.

Table 2. Cruise Participants

Name	Responsibility	Affiliation
NC9310 Leg 2	Naha to Ishigaki	29 Oct. to 2 Nov.
NC9310 Leg 3	Ishigaki to Naha	6 Nov. to 11 Nov.

Y. Tomiyama	Chief Scientist, CTD,S,O2	NMO
M. Suzuki	CTD Hardware	NMO
N. Nagai	O2	NMO
H. Daimon	CTD software	NMO
T. Shimizu	O2,Nutrients	NMO
J. Jifuku	O2,Nutrients	NMO
T. Chagihira	CTD Software	NMO
S. Shiraishi	S	NMO
S. Wakaki	Maritime Meteorology	NMO
T. Tashiro	Maritime Meteorology	NMO

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2. CTD

The NBIS Mark III B CTD (6500 dbar sensor without oxygen sensor) mounted on the 12 x 1.7 Liter General Oceanics rosette multisampler frame was used for all of the vertical CTD work. At some stations of which depth are deeper than 1,000 meters, the PREUSSAG acoustic pinger was mounted on 10 meters above the frame. At other shallower stations, the package was lowered to the depth of 95 percents of the bottom depth without the acoustic pinger.

The performance of the CTD and multisampler was good throughout the cruise.

The details of the data collection and data processing methods are described in "CTD Full Sampling and Data Processing Method Used at Nagasaki Marine Observatory". These methods were based on Millard and Yang (1992).

The results of the laboratory calibration for the temperature and pressure are shown in Table 3.

Table 3. CTD calibration constants at laboratory

Temperature; linear fit

	Time	Bias	Slope
Pre -Cruise	6 Oct. 1993	0.0063225	1.0000818

Pressure increasing (0-6500 dbar range); linear fit

	Time	Bias	Slope
Pre -Cruise	6 Oct. 1993	0.9742484	1.0000864

Pressure decreasing (0-6500 dbar range); linear fit

	Time	Bias	Slope
Pre -Cruise	6 Oct. 1993	-3.8425722	1.0009821

The conductivity scaling factors are derived from a linear fit of CTD data to water sample data and were used for the final data load. These factor are given in Table 4. The salinity determination of the water samples was with the Guildline AUTOSAL 8400A. Standard Seawater batch of P121 was used to standardize the AUTOSAL. The precision of the salinity determination of the water samples was 0.0004 PSS on leg2 and 0.0004 PSS on leg3 derived from the standard deviation of the twenty-five and thirty-six water samples collected from the same bottle respectively.

Table 4. The conductivity scaling factor; linear fit

Station No.	Bias	Slope
NS-8 - NS-6	-0.004339	1.000458
NS-5 - IS-13	0.001325	1.000328

A temperature time lag was decided the CTD time constant decision program, time lag was 0.192 seconds. The ITS-90 scale was used for the temperature and potential temperature.

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3. Oxygen measurements

The determination of dissolved oxygen was done by the modified version of the Winkler method described in "Kaiyou kansoku shishin (Manual of Oceanographic Observation)" published by the Oceanographical Society of Japan (1970). The reagent blank was not subtracted. The results of the estimation of precision are shown in Table 5. No estimation of accuracy has been made.

Table 5. The precision of oxygen analyses by three analysts

	Sample Number	Average umol/l	One sigma umol/l	precision %
Analyst A	10	203.1	1.16	0.57
Analyst B	10	203.9	0.27	0.13
Analyst C	10	204.0	0.86	0.42
Analyst D	10	203.9	0.40	0.20

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4. Nutrient analyses

The nutrients analyses were done by the Technicon Auto Analyzer II described in "Kaiyou kansoku shishin (Manual of Oceanographic Observation)" published by the Oceanographical Society of Japan (1970).

Sampling for nutrients followed that for dissolved oxygen on average 10-20 minutes after the casts were on deck. Samples were drawn into 10 cm3 glass, narrow mouth, screw-capped bottles. Then they were immediately introduced on the sampler tray of the Technicon Auto Analyzer II for the analysis and generally the analyses were begun within one hour after the casts were on deck. If the delays were anticipated to be more than one hour, the samples were refrigerated. Samples were refrigerated and stored up to one hour on stations NS-7,NS-2,NS-1 and all of IS-line.

The precision of the onboard Nitrate and Nitrite analyses estimated from the standard deviation of the five samples from the same working standard solution on each analysis are shown in Table 6. The precision of the onboard Phosphate analysis estimated from the standard deviation of the four samples from the same working standard solutions are also shown in Table 5. The concentrations of the working standard of nitrate, nitrite and phosphate were 40 umol/l, 2 umol/l and 3 umol/l, respectively. No estimation of accuracy have been made.

Table 6. The median and the range (in the parentheses) of the precision of the onboard nutrients analyses.

Nitrate	Nitrite	Phosphate	unit:%
0.187	0.129	0.381	
(0.051-1.924)	(0.035-2.146)	(0.063-3.797)	

The concentrations in umol/kg of oxygen, nitrate, nitrite and phosphate were converted from the concentrations in umol/l using the density calculated from the room temperature and salinity of the water samples. The laboratory temperature for each station are given in Table 7

Table 7. Laboratory temperature for each station.**********

Station	Temp.	Station	Temp.	Station	Temp.
NS-8	31.6	NS-7	30.4	NS-6	31.9
NS-5	30.4	NS-4	30.7	NS-3	30.8
NS-2	31.7	NS-1	31.1		
IS-1	30.6	IS-2	30.7	IS-3	30.9
IS-4	31.1	IS-5	31.0	IS-6	30.8
IS-6a	29.9	IS-6b	29.8	IS-7	29.8
IS-7'	31.5	IS-8	31.5	IS-9	31.6
IS-10	31.6	IS-11	31.1	IS-12	31.1
IS-13	31.1				

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5. Notes for the --.SUM,--.SEA and --.CTD files

The first 2 characters of the file name of --.SUM, --.SEA and --.CTD files are NC for R/V Chofu Maru of Nagasaki Marine Observatory. These characters are followed by the last two digits of year, the month and character R (R for PR18) or character S (S for PR19) for the --.SUM and --.SEA files. In addition, the leg of the cruise is appended in the file name of --.SEA files. For the --.CTD files The characters NC are followed by the unique station number and the cast number given in the Comments.

The file names of the --.SUM and --.SEA for this cruise are as follows;

NC9310S.SUM,
NC9310S2.SEA

5.1 --.SUM

Since some of the water depth of the cast were not recorded, we leave the column of them blank.

Since the surface water samplings were by a stainless steel water bucket, "Number of bottles" includes this bucket sampling.

The unique station numbers given by the Japan Meteorological Agency with the cast numbers, which are used as the --.CTD files name, are given in the "Comments".

5.2 --.SEA

We leave "the sample number (SAMPNO)" blank because the sample numbers are different among the salinity, oxygen and nutrients on our assignments.

Since the surface water samplings were by a stainless steel water bucket, we leave the column of "The Bottle Number (BTLNBR)" at the surface layer blank.

All water sample quality flags for the oxygen during this cruise were "3" because the precision did not exceed the WOCE standard of 0.1% and no estimation of accuracy has been made.

5.3 --.CTD

The files name were given in the Comments of --.SUM files.

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6.GPS

Standard deviation of the position data by the GPS system are shown in Table 8. The position data were good throughout the cruise.

Table 8. Standard deviation of the position data

Date	Port	Standard deviation	
		Latitude	Longitude
Nov. 5	Ishigaki	43.6m	20.3m
Nov.14	Naha	24.3m	20.2m

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7. References

Aoyama,M, S.Saito, T.Kobuchi and S.Shiraishi, 1993: CTD full Sampling and Data Processing Method Used at Nagasaki Marine Observatory. (Draft)

Millard,R and Keqi Yang, 1992: CTD Calibration and Processing Methods used by Woods Hole Oceanographic Institution. (Draft)

Oceanographical Society of Japan, 1970: Kaiyou kansoku shishin (Manual of Oceanographic Observation). Ed. by the Japan Meteorological Agency. (in Japanese)