1. Cruise Narrative

1.1 Highlights

Expedition Designation(EXPOCODE): 49RY9206

Chief Scientist: Jun'ichi Oyama,
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Ship: R/V Ryofu Maru

Ports of Call:
Leg 1: Tokyo, Japan to Rabaul, Papua New Guinea
Leg 2: Rabaul, Papua New Guinea to Cebu, Republic of the Philippines
Leg 3: Cebu, Republic of the Philippines to Tokyo, Japan

Cruise Dates:
Leg 1: June 9, 1992 to June 25, 1992
Leg 2: June 28, 1992 to July 11, 1992
Leg 3: July 16, 1992 to July 29, 1992

1.2 Cruise Summary

Cruise Track

The cruise track and station locations are shown in Figure 1. Observations of PR4 were carried out as part of the R/V Ryofu Maru cruise RY9206 Leg 1, and those of PR2 were Leg 2 and Leg 3.

Number of Stations

A total of 27 CTD/rosette stations for PR4 and 33 stations for PR2 was occupied using a General Oceanics 12 bottle rosette equipped with 12 1.7-liter Niskin water sample bottles, and an NBIS MK III B CTD. No additional sensors were used with the CTD system.

Sampling

The following water sample measurements were made: salinity, oxygen, nitrate, nitrite and phosphate on all stations. The depths sampled were: 10, 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 400, 500, 600, 700, 800, 900, 1000, 1250, 1500, 2000, 2500, 3000, 4000 in meters at every 5 degrees in latitude. On other stations, water samples were taken at shallower depths than 1250m. Surface water samples were collected by a bucket at every station.

1.3 List of Principal Investigators

The principal investigators responsible for each parameter measured on the cruise are listed in Table 1. (All the correspondence on these data should be addressed to the Director of the Oceanographical Division, Marine Department, Japan Meteorological Agency.)

Name	Responsibility	Affiliation
I. Kaneko	CTD, S	JMA/MD
K. Fushimi	O2, Nutrients	JMA/MD

JMA/MD Marine Department, Japan Meteorological Agency

Table 1. Principal Investigators for all measurements.

2. Measurement Techniques and Calibrations

2.1 CTD

The CTD is NBIS Mark III B. An HP9000 Series 300 model 330 (Hewlette Packard) with 4 MByte of memory was used as the primary data collection device and all FSK signals of CTD data were backed up using the digital audio tape (DAT). The original sampling rate is 31.25 samples per second, however, our software gets around 20 samples per second and compress these into one tenth of collected data.

The temperature and pressure sensor were calibrated at the calibration facility of SEA Co., Ltd. before the cruise. The results are shown in Table 2.

Temperature; linear fit

Time	Bias	Slope
Pre-Cruise (1 January 1992)	+0.2265	0.999888

Pressure(increase); linear fit

Time	Bias	Slope
Pre-Cruise (6 January 1992)	-1.7815	1.000931

Table 2. CTD Calibration contents at laboratory

The conductivity sensor was calibrated at sea using data from the measurements of salinity collected at 7 stations on PR4 and 6 stations on PR2. The salinometer is Guildline Portasal model 8410 for the measurements of salinity of the water samples. We used the batch P114 of IAPSO as standard sea water to calibrate the salinometer. The calibration factor of conductivity sensor was heavily depending on the pressure, we used the third-ordered polynomial as function of pressure to correction as follows. The calibration function is determined assuming that the bias zero. The results are shown in Table 3.

$$C(correction)=Cf(P) \times C(CTD) \quad (1)$$

where

$$Cf(P)=A + B \times P + C \times P^2 + D \times P^3 \quad (2)$$

	A	B (x10^-6)	C (x10^-9)	D (x10^-13)
RY8226-8227	0.9993333	0.2621433	-.1761708	0.2331487
RY8228	0.9994312	-.1592494	0.0	0.0
RY8229-8252	0.9993333	0.2621433	-.1761708	0.2331487
RY8253-8255	0.9993255	0.1078650	-.04561513	0.0
RY8256-8263	0.9996084	-.08050009	0.0	0.0
RY8267-8273	0.9995378	0.1757140	-.135776	0.1717079
RY8274-8288	0.9995583	0.2036669	-.160198	0.2246222

Table 3. The conductivity scaling factor

The temperature in "-.SEA" and "-.CTD" files are described with the international temperature scale of 1990 (ITS-90).

2.2 Oxygen Measurements

The determination of dissolved oxygen was done by the modified version of the Winkler method described in "Kaiyo Kansoku Shishin (Manual on Oceanographic Observation)" published by the Japan Meteorological Agency(1970). The reagent blank was not subtracted. No estimation of accuracy and precision has been done.

Because no temperature data when samples were taken from bottles are recorded, it was assumed that the density of samples is 1022.156 kg/m3 (which assume the temperature for 28 degree C and salinity for 34.68) and use this value to convert from umol/l to umol/kg.

2.3 Nutrients Analyses

The nutrients analyses were done by the Technicon Auto Analyzer II described in "Kaiyo Kansoku Shishin (Manual on Oceanographic Observation)" published by the Japan Meteorological Agency(1970). No estimation of accuracy and precision has been done.

Because no temperature data while analyses are recorded, it was assumed that the density of samples is 1022.156 kg/m3 (which assume the temperature for 28 degree C and salinity for 34.68) and use this value to convert from umol/l to umol/kg.

2.4 Noted for the -.SUM, -.SEA and -.CTD files

2.4.1 -.SUM

Since the surface water samples were taken by a stainless steel water bucket, "Number of bottle" includes this bucket sampling.

2.4.2 -.SEA

Our following parameters have the less precision than the required, we describe the last digit of data as blank to meet the data format: CTD temperature, CTD salinity, oxygen and nitrates.

2.4.4 -.CTD

CTD temperature and salinity data have the less precision than the required, we describe the last digit of data as blank to meet the data format.

The number of samples averaged at the pressure level was not available because our software was not recording the number of data during data processing.

3. References

Japan Meteorological Agency, 1970: Kaiyo Kansoku Shishin (Manual on Oceanographic Observation). (in Japanese)