Preliminary report
May 15, 1995

A. Cruise narrative
A.1 Highlights

A.1.a WOCE designation: PR20
A.1.b EXPOCODE 21OR257/1

A.1.c Chief Scientist: Cho-Teng Liu
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A.1.d Ship: Ocean Reseracher
A.1.e Ports of Call: Kaohsiung Harbor, Taiwan
A.1.f Cruise Dates: October 11 to October 15, 1990

A.2 Cruise Summary

A.2.a Geographic boundaries
A.2.b Total number of stations
A.2.c Floats and drifters deployed
A.2.d Moorings deployed or recovered

A.3 List of Principal Investigators

Table 1: List of Prinicipal Investigators

Name	Responsibility	Institution*
LIU, Cho-Teng	calibration, processing and interpretation of CTD and ADCP data	NTU
PAI, Su-Cheng	collection, analysis and interpretation of water sample data	NTU
CHEN, Chen-Tung Arthur	developing skills for collecting C-14 samples for one-time survey	NSYSU
LIU, Kon-Kee:	collection, analysis and interpretation of water sample data	AS

*See Table 2 for list of Institutions

Table 2: List of Institutions

Abbreviation	Institutions
NTU	National Taiwan University Taipei, Taiwan, ROC 10764
NSYSU	National Sun Yat-sen University Kaohsiung, Taiwan, ROC
AS	Academia Sinica

Taipei, Taiwan ROC 10764

A.4 Scientific Programme and Methods

The ship R/V Ocean Researcher 1 left Kaohsiung Harbor in souther Taiwan at 10:30 am of 1990 October 11. After leaving the harbor for two nm, we re-installed the ADCP in the Moon Pool near the center of the ship, which is near the front part of the aft deck. We first sailed southwestward to recover a month-long current meter mooring, then sailed to the first hydrographic station of PR20. The weather was warm but very windy (northeasterly winter monsoon), the sea state was so rough that the ship was sailing at 6 - 8.5 knots only, vs. 12.5 knots when the swell is low. It improved near the end of PR20 section.

During the first four CTD stations, the wire angle was relatively large because of the rough sea. This seems to correlate with the anomalous CTD distribution and the derived geostrophic velocity near this region. Besides, other problems are

(1) the conductivity data made jumps at st. 12-14 near 825 m depth, but they behave well afterwards. All CTD data at st. 12-14 below the jump were thrown out in post processing. After the cruise, SBEI found a crack in the conductivity sensor. Every few stations, the water samples were taken for salinity calibration;

(2) the DO data behaved abnormally since the first station due to bad contact to the underwater unit. The connector was replaced and put back to work from station 10;

(3) the effect of southwestward wind (winter monsoon) results 0.6-0.9 knots ship drift towards west to northwestward, rather than northward along Kuroshio.

In addition to the WOCE hydrographic survey of repeated sections, we also tried

(1) improving our skill of water analysis in order to meet the requirement for one time survey;

(2) taking some water samples for heavy metal analysis;

(3) taking CTD sections near PCM1 line NE of Taiwan, for the design of mooring locations.

A.5 Major Problems and Goals not achieved

A.6 Other Incidents of Note

A.7 List of Cruise Participants

Table 3: List of Cruise Participants

Name	Responsiblity	Institution*
LIU, Cho-Teng	chief scientist	NTU
PAI, Su-Cheng	chief chemist	NTU
GONG, Gwo-Ching	nitrate analysis, chemical hydrography	NTU
	data processing	NTU
LIN, Sheng-Fon	CTD data processing	NTU
YANG, Chung-Cheng	silicate analysis	NTU
JENG, Kwung-Lung	phosphate analysis	NTU
KUO, Ting-Yu	dissolved oxygen analysis	NTU
CHEN, Hung-Yu	trace metal	NTU
KUO, Jing-Sen	pH analysis	NSYSU
CHENG, Li-Lin	alkalinity analysis	NSYSU

*See Table 2 for list of Institutions

B. Underway Measurements
B.1 Navigation and bathymetry
B.2 Acoustic Doppler Current Profiler (ADCP)
B.3 Thermosalinograph and underway dissolved oxygen, fluorometer, etc
B.4 XBT and XCTD
B.5 Meteorological observations
B.6 Atmospheric chemistry

C. Hydrographic Measurements

D. Acknowledgments

E. References

Unesco, 1983. International Oceanographic tables. Unesco Technical Papers in Marine Science, No. 44.

Unesco, 1991. Processing of Oceanographic Station Data, 1991. By JPOTS editorial panel.

F. WHPO Summary

Several data files are associated with this report. They are the OR257.sum, OR257.hyd, OR257.csl and *.wct files. The OR257.sum file contains a summary of the location, time, type of parameters sampled, and other pertient information regarding each hydrographic station. The OR257.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 OR257wct.zip. The OR257.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 OR257.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 bouyancy frequency (data expressed as radius/sec), and g is the local acceleration of gravity.

Bouyancy 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, Processing of Oceanographic station data.

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

G. Data Quality Evaulation

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