

WHP Ref. No.: PR5/PR6
Last updated: February 3, 1993

CRUISE REPORT: Repeat hydrography on Line PR6:

WOCE Cruise No. 18DD9204/1
Chief Scientist: Frank Whitney
Ship: John P. Tully
Ports of Call: Patricia Bay, B.C.
Cruise Dates: September 8 to 29, 1992
Expedition Designation: 18DD9204/1

Cruise Narrative

On this Line P (PR6) cruise, we made substantial changes to our deep ocean sampling methods. For the first time, we used a General Oceanics 24 bottle Rosette and a prototype Guildline CTD (model 8737) to sample in the upper 3000 m at 7 stations along Lines P and Z. To provide more detail in intermediate waters than we have historically collected, sampling intervals were reduced from 500 m to 200 m. Below 3000 m, Niskin samplers on hydro wire sampled each 200 m.

Except for mis-tripping several samplers, the Rosette operated well. Recovery was difficult in moderate seas due to limitations of the ship's A-frame. By next spring, a larger unit will be installed, permitting us to lift the Rosette from the sea further from the ship's stern. We tested drop rates and tilt of this sampling system and found that with 300 lb of lead on the Rosette and 200 lb, 6 m below it on a bridle, we could drop at 1 m/s with very little tilt (less than 10° from horizontal).

At each hydro station, data was collected with both the Guildline 8737 and a Guildline 8705 CTD. Detailed comparisons of this and water sample data will be undertaken soon, but initial observations suggest that the new instrument will be capable of meeting our WOCE needs.

A new nutrient analyzer which was only briefly tested before our cruise operated well, except that the PO₄ colorimeter failed on the first day.

Three groups from University of B.C. sampled plankton (JGOFS Program) and trace metals at several stations, and incubated water on deck to measure uptake of NH₄, NO₃, urea and HCO₃. Other studies relating to the transport of carbon and nitrogen in the Northwest Pacific were also completed.

Poor weather hampered several of our projects, and eventually chased us in when we were less than half finished with Line R (PR5). With only a couple of days of ship time left and 55 knot winds bearing down on us, we elected to head south, away from the storm, and then sail straight home.

Cruise Summary Information

Cruise track

Three lines were planned:

1. Line P (PR6) starting at the mouth of Juan de Fuca Strait and ending at Station Papa (P26) was completed;
2. Line Z (non-WOCE) running directly north from P26 to 55 N was completed;
3. Line R (PR5) heading from P26 to the southern tip of the Queen Charlotte Islands was abandoned at R13 due to poor weather.

Table of Stations by type

Sample type:	No. stations:	Max. depth (m):
CTD casts	50	3000
Rosette/Hydro casts	8	4200
Loop samples	54	5

Floats and Drifters deployed

A drifting sediment trap line was deployed for 5 days at Station P26. Particulate materials were collected on filters for measurements of total, carbon and nitrogen fluxes.

Moorings deployed and recovered

A mooring with 5 current meters was serviced and redeployed near P20. A sequential sediment trap, moored at 3500 m near Z09 was recovered and redeployed at 3800 m near P26.

Principal Investigators

Howard Freeland	Climate change	IOS
C.S. Wong	Climate Chemistry	IOS
Ron Perkin	Physical measurements	IOS
Frank Whitney	Chemical measurements	IOS

Preliminary Results

Since we were deploying our 24 bottle Rosette for the first time on this cruise, we played with the distribution of weights on the Rosette and with the drop rate in surface and deep waters. Tilt sensors were mounted in the CTD to provide immediate information on the stability of the package during descent. Initially, we added 600 lb of lead to the legs of the Rosette and could descend at 1.0 to 1.3 m sec⁻¹ in calm seas. However, at 3000 m we were concerned with the loading on the conductor cable (in the vicinity of 3000 lb). Reducing the weight on the Rosette to 300 lb resulted in very dangerous tilts (over 45°), especially in moderate swells. The final tests were done with 300 lb on the Rosette and 200 lb on a drop line which hung below the Rosette about 6 m. With this configuration, we did not see tilts above 10° in winds to 30 kt. Our routine drop rates were about 0.5 m sec⁻¹ in the upper 200 to 300 m and 1.0 to 1.3 m sec⁻¹ at depth. We realize we must accept loads of approximately 25% of the breaking strength of the cable at this depth, and are concerned how to safely conduct vastly deeper casts.

Goals Achieved

Complete CTD survey of Lines P (PR6) and Z .
Successful Rosette casts at 7 stations on Lines P and Z.
Completion of all UBC programs for trace metal, plankton and productivity measurements.
Successful recovery and redeployment of two moorings.
Successful evaluation of Guildline Model 8737 CTD.

Problems and Goals not Achieved

Rosette mis-fires resulted in several lost samples.
Failure of one colorimeter resulted in no data for P04.
An A-frame with insufficient reach caused damage to several Niskin bottles in moderate seas (winds of 25 to 30 kt).
Storms slowed our work, and eventually stopped us from completing Line R (PR5).

Cruise Participants & Affiliations

F.A. Whitney	Nutrients	IOS
N. Hall-Patch	CTD/Rosette	IOS
B.G. Minkley	T/S/O	IOS
J. Love	Electronics/CTD casts	IOS
R. Bigham	Moorings/sampling	IOS
T.J. Soutar	Electronics	IOS
M. Davelaar	pCO ₂	IOS
D. Varela	N remineralization	DOUBC
B. McKelvey	Trace metals	DOUBC
H. McLean	Zooplankton/sampling	DOUBC
M. Robert	CTD/sampling	McGill U.

IOS - Institute of Ocean Sciences, Sidney, B.C., Canada.

DOUBC - Department of Oceanography, University of B.C., Vancouver, B.C.
McGill University, Montreal, Que.

Measurement Techniques and Calibrations

Water sampling

A General Oceanics Rosette holding 23 10 L Niskin samplers, and a Guildline Model 8737 CTD was used for routine sampling in the upper 3000 m of the water column. Below this depth, 10 L Niskin bottles with reversing thermometers were lowered on hydro wire and tripped by messenger at selected depths. The maximum depth interval was 200 m. Samples were drawn generally in the order oxygen, TCO₂, 13CO₂, alkalinity, nutrients and salinity (gases always first). A duplicate bottle was tripped on each cast to provide precision estimates on chemical analyses.

Trace metal samplers used 30 L Go-Flo samplers on Kevlar line.

Productivity, POC/N, chlorophyll and some nutrient samples were collected with 10 L Go-Flo samplers on Kevlar line.

A sea water loop consisting of an intake at 4 m, a thermosalinograph well, a pump, insulated PVC tubing and a manifold at a laboratory sink supplied water continuously to a pCO₂ equilibrator and for miscellaneous sampling.

Oxygen

An automated titration system (Brinkman Dosimat) using the micro-Winkler method (Carpenter, 1965) detected the starch end-point colorimetrically. Duplicate samples came from pairs of Niskin bottles that were tripped within 1 min. and 2 m of each other.

Depth Range (m)	Conc. Range (uM/kg)	Sp of pairs
200 to 2800	15 to 100	1.61 (k=7)

Where the standard deviation of pairs $Sp = \{(\sum d^2)/2k\}^{1/2}$, d is difference between pairs, and k is the number of pairs.

Standards were prepared as outlined in WOCE Report 73/91.

Nutrients

Samples were collected in polystyrene tubes (16 x 125 mm) and refrigerated for a maximum of 6 h before being analyzed, except for nitrite which was stored up to 20 h.

A 4 channel Technicon Autoanalyzer was assembled shortly before this cruise (our old system being on a Russian vessel at the time). Ammonium, nitrate plus nitrite, dissolved silicate and phosphate were selected as most crucial for UBC's JGOFS work and nitrite was analyzed as a separate run by disconnecting the cadmium column from the nitrate chemistry and increasing the gain on the colorimeter. During setup onboard ship, the phosphate channel would not resolve peaks, and subsequently, a colorimeter problem ended this measurement for the cruise.

Concentrated standards were prepared freshly the week before the cruise started from oven dried (80°C) reagents.

Working standards were made every 1 to 2 days by diluting 1 to 6 mL of various stock solutions to 250 mL with 3.2% NaCl (w/v in double run Milli-Q water).

Salinity

Samples were collected in glass bottles and analyzed onboard ship using a Guildline Model 8410 Portasal. The Portasal was standardized daily with IAPSO standard sea water Batch P118, 11/91.

CTD

Calibrations and Standards

The CTD probes (Models 8737 and 8705) used during this cruise are made by Guildline Instruments of Smiths Falls, Ontario, Canada. Their resolution and accuracy will be provided when data is submitted.

