

WHP Line No.: PR6  
Last Updated: Jaunary 28, 1997

CRUISE REPORT: Repeat Hydrography on Line PR6:  
WOCE Cruise No. 18DD9609/1

Chief Scientist: Philip Boyd  
Ship: John P. Tully  
Ports of Call: none  
Cruise Dates: May 6 to May 30, 1996  
Expedition Designation: 18DD9609/1

#### Cruise Narrative

Our repeat hydrography section continues to be a joint program with Canadian JGOFS.

A CTD survey along Line PR6 was completed. Salinity, oxygen and nutrients (NO<sub>3</sub> & NO<sub>2</sub>, PO<sub>4</sub> and Si) were analyzed onboard ship from rosette casts to 400 m and B-20 (bottom depth minus 20 m) at 5 stations (MP 04, MP12, MP 16, MP 20, and PRS1). DMS was analyzed in sea water at the same stations to a depth of 400 m. and at three different time periods at station PRS1. DOC/N was sampled in sea water at the same stations to 600 m and several deeper samples at station PRS1. The DON samples were analyzed onboard.

Free drifting sediment traps were deployed at MP04 to 300 m and PRS1 to 1000 m. and recovered two and six days later respectively. Sequential sediment traps were recovered and redeployed at stations MP04, MP12, MP16, MP20 and PRS1.

A transition zone survey was carried out north to south of line P from P11 to P09. Ten stations were sampled to 200 m by rosette and transmissometer. Samples were collected to 100 m for salinity, chlorophyll and nutrients.

JGOFS participants collected samples for biomass estimates at 5 stations, and incubated water to measure growth and grazing rates of various groups of plankton. A large volume in situ pumping system (J. Bishop) was successfully deployed at 6 stations.

#### Cruise Summary Information

##### Cruise track

Line PR6 starts at the mouth of Juan de Fuca Strait on the west coast of Canada, and heads almost due west for 900 n mi. The terminal station is PRS1, formerly designated Ocean Weather Station Papa (50 N, 145 W).

#### Table of Stations by type

Sample type:  
No. stations:  
Max. depth (m):

CTD casts  
28  
3000 db

Rosette/Hydro casts  
14  
4250

Loop samples  
31

5

Surface drifter

1  
1000 m

Moorings

1  
4300 m

Floats, Moorings and Drifters deployed

A mooring with an optical package and S4 current meter, both in the mixed layer, was recovered and redeployed. A surface drifter that collects temperature and barometric pressure data was deployed at station PRS1 for AES. Sequential sediment traps were recovered and redeployed at 5 stations. A free drifting string of sediment traps was deployed at P04 and P26.

Principal Investigators

Howard Freeland  
Ocean circulation  
IOS

C.S. Wong  
Climate chemistry  
IOS

Frank Whitney  
WOCE coordinator  
IOS

Philip Boyd  
JGOFS coordinator  
UBC

Goals Achieved

CTD survey of Line PR6.  
Successful Rosette casts at 5 stations on Line P.  
Completion of JGOFS sampling for plankton and productivity measurements.  
Six large volume pump stations on Line P for particulates.  
Recovery of sediment trap samples from 6 traps.

Problems and Goals not Achieved

None.

Cruise Participants & Affiliations

Tim Soutar  
Mooring coordinator  
IOS

John Love  
Watch coordinator  
IOS

Bernard Minkley  
Oxygens, watch  
IOS

Ron Bellegay  
Moorings, pCO<sub>2</sub>, watch  
IOS

Wendy Richardson  
DMS, DOC/N  
IOS

Janet Barwell-Clarke  
Nutrients, WOCE files  
IOS

Ken Morgan  
Bird, mammal Observer, Watch  
IOS

Philip Boyd  
Phytoplankton  
UBC

Robert Goldblatt  
Zooplankton biomass  
UBC

Hugh Maclean  
Watch, plankton sampling  
UBC

Nelson Sherry  
Bacteria  
UBC

Maureen Soon  
particulate 13C & 15N  
UBC

Delphine Thibault  
Zooplankton excretion  
Rimouski U.

Ken Crocker  
Mesozooplankton grazing  
Memorial U.

Paul Matthews  
Bacterial production  
Memorial U.

Jennifer Putland  
Micro-zooplankton  
Memorial U.

Jim Bishop  
pump sampling  
U. Victoria

Todd Mudge  
pump sampling  
U. Victoria

Robert Schultz  
pump sampling  
U. Victoria

IOS = Institute of Ocean Sciences, Sidney, B.C., Canada.  
UBC = University of British Columbia, Vancouver, B.C., Canada

## Measurement Techniques and Calibrations

### CTD profiles

At all stations, a Guildline 8715 CTD (S.N. 58483) coupled with a transmissometer was lowered to a maximum of 3000 m.

### Water sampling

A rosette holding a Guildline WOCE CTD (S.N. 59607) and 23-10 L polycarbonate Niskin bottles was used for most water sampling. Go-Flo bottles clamped on Kevlar hydro line were used to collect clean water for plankton studies.

At each station, samples for surface chlorophyll, salinity and nutrients, and O18 were collected from the ship's sea water loop which pumps water from about 5 m continuously into the laboratory.

### 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 P128.

### Oxygen

An automated titration system (Brinkman Dosimat and Fiber Optic Probe Colorimeter) using the micro-Winkler method (Carpenter, 1965), titrated samples to the iodine end-point. Standards were prepared as outlined in WOCE Report 73/91.

### Nutrients

Samples from hydro casts were collected in polystyrene tubes and refrigerated for a maximum of 12 h before being analyzed. Loop samples (USW) were stored up to 2 days at 4°C before being analyzed. NO<sub>3</sub>+NO<sub>2</sub>, PO<sub>4</sub> and Si were analyzed using a Technicon Autoanalyzer.

NO<sub>3</sub>+NO<sub>2</sub> samples were reduced with Cd/Cu, then complexed with sulfanilamide and N-Naphthylethylene-diamine to form an azo dye (Technicon Method No. 158-71W/B). PO<sub>4</sub> produces a molybdenum blue complex in presence of acidic molybdate and ascorbic acid (Technicon Method No. 155-71W). Dissolved Si also forms a molybdenum blue complex and oxalic acid removes PO<sub>4</sub> interference (Technicon Method 186-72W).

Concentrated standards were freshly prepared the week before the cruise from oven dried 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). Standards were checked against Acculute Standards (Anachemia Science) with good agreement (peak heights agreed to within 1%).

Silicate samples 105 to 95 (1000 to 3600 m) from Station MP16 are flagged Quality 3. The standards run as samples on this day were low. The high standard should have been 135 µM and was actually 129.2 µM and the extra high standard should have been 180 µM and was actually 175 µM. Nitrate and phosphate standards were not affected, indicating a problem with the silicate channel only.

Table. Laboratory temperatures for nutrients and salinity.

date  
temp (C)  
date

temp (C)

May 9

24.1 - 26.1

May 13

24.0 - 21.0

May 16

22.5 - 23.8

May 19

23.5

May 20

22.7 - 22.3

May 21

22.4 - 23.5

May 24

21.3 - 23.7

May 26

23.1 - 24.1

May 27

27.2 - 27.5

May 28

27.8 - 28.1

TCO<sub>2</sub>, 13C, and Alkalinity, were collected at MP04, MP12, MP16, MP20 and PRS1. Samples were fixed with HgCl<sub>2</sub> and refrigerated.

O18/O16 - samples were collected in 60 mL polyethylene bottles at stations MP04, MP12, MP16, MP20, and PRS1 and refrigerated.

JGOFS sampling - Go-flo bottles were used to collect water for POC/N, DOC/N, chlorophyll, nano- and micro-plankton and incubation experiments. At PRS1, an in situ drifter was deployed for 7 h to measure primary production rates. Deck incubations were conducted to measure growth rates of bacteria, phytoplankton and micro-zooplankton.

#### References

Carpenter, J.H. 1965. The Chesapeake Bay Institute technique for the Winkler dissolved oxygen method. *Limnol. Oceanogr.*, 10: 141-143.

Technicon Industrial Method No. 155-71W. 1973. Orthophosphate in water and seawater.

Technicon Industrial Method No. 158-71W/A. 1977. Nitrate and nitrite in water and seawater.

Technicon Industrial Method No. 186-72W/B. 1977. Silicates in water and seawater.

WOCE Report 73/91. 1991. A comparison of methods for the determination of dissolved oxygen in seawater.

