CRUISE REPORT: Repeat Hydrography on Line PR6:
WOCE Cruise No. 18DD9618/1

Chief Scientist: Frank Whitney
Ship: John P. Tully
Ports of Call: none
Cruise Dates: August 12 to September 6, 1996
Expedition Designation: 18DD9618/1

Cruise Narrative
Our repeat hydrography section was a joint program with Canadian JGOFS.

A full CTD survey along Line PR6 to a depth of 3000 m was completed, with CTD casts at 29 stations and full depth rosette/hydro casts at 5 stations. Water sampling in the upper 100 m was completed at an additional 8 stations. On the return leg, a CTD section along 51 N to 1000 m was supplemented by water sampling in the upper 100 m. Salinity, oxygen and nutrients (NO3 & NO2, PO4 and Si) were analyzed onboard ship.

JGOFS participants collected samples at 5 stations for abundance and activities of bacteria, phytoplankton, micro- and meso-zooplankton and incubated water to measure growth and grazing rates of various groups of plankton. The natural abundance of stable isotopes (15N and 13C) in suspended particulate matter was also determined at these 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). Our return leg headed north from PRS1 to 51 N and ran directly east to the coast.

Table of Stations by type

Sample type:
No. stations:
Max. depth (dbar):
CTD casts
46
3007 db
Rosette/Hydro casts
33
4319
Loop samples
72
5

Floats and Drifters deployed

A profiling Alace float was recovered near at station R16.
Free drifting sediment traps were deployed at PRS1 for 4 days.
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 and along 51N.
Successful rosette casts at 5 stations on Line P.
Completion of JGOFS sampling for plankton and productivity measurements.

Problems and Goals not Achieved
none

Cruise Participants & Affiliations

Frank Whitney
Chief scientist, nutrients
IOS
Philip Boyd
phytoplankton
UBC
Edmand Fok
 Watch
IOS
Tim Soutar
watch
IOS
Wendy Richardson
Oxygen, watch
IOS
Ron Bellegay
Watch, carbonates
IOS
Doug Anderson
Watch,
IOS
Michael Bentley
Watch, seabirds
contractor
Robert Goldblatt
Zooplankton biomass
UBC
Hugh Maclean
Watch, plankton sampling
UBC
Maureen Soon
particulate 13C & 15N
UBC
Nelson Sherry
bacteria enumeration
UBC
Todd Mudge
MULVFS pump
U.Vic
Robert Schultz
MULVFS pump
U.Vic
Delphine Thibault
Zooplankton excretion
Rimouski U.
Ken Crocker
Zooplankton grazing
Memorial U.
Paul Matthews
Micro-zooplankton
Memorial U.

Julie Granger
Fe uptake
McGill U.
Maite Maldonado
bacteria respiration & production
McGill U.

Measurement Techniques and Calibrations

CTD profiles

A Guildline 8705 CTD (SN 58483) coupled with a transmissometer was lowered to a maximum of 3000 m on casts where our rosette was not used.

Water sampling

A rosette holding a Guildline 8737 CTD and 23-10 L polycarbonate Niskin bottles was used for hydro casts. Go-Flo bottles clamped on Kevlar hydro line were used to collect clean water for plankton studies.

Each rosette/hydro station consisted of two casts - a down cast and an up cast. The CTD profile is taken from the down cast. Water samplers were tripped on the up cast and CTD pressure (dbar) and CTD temperature (uncorrected) recorded from this upcast.

At each station, samples for surface chlorophyll, salinity and nutrients 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 xxx).

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 4oC before being analyzed. NO_3+NO_2, PO_4 and Si were analyzed using a Technicon Autoanalyzer.

NO_3+NO_2 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_4 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_4 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).

Table. Laboratory temperatures for nutrients.

Date	Temp (C)	Date	Temp (C)
Aug 14	30.3 to 30.9	Aug 24	29.1 to 29.3
Aug 16			

29.7 to 30.4
Aug 26
27.2 to 28.9
Aug 18
29.3 to 29.6
Aug 27
26.3 to 27.0
Aug 19
29.7 to 30.0
Aug 29
27.0 to 28.5
Aug 21
30.1 to 31.1
Aug 30
27.6 to 28.7
Aug 22
29.3 to 30.1
Sep 1
29.1
Aug 23
28.3 to 30.0
Sep 2
26.2 to 28.2

Sep 3
26.5 to 27.6

TCO2, 13C and Alkalinity - samples were collected at stations P4, P12, P16 and PRS1, fixed with HgCl2 and refrigerated.

O18/O16 - samples were collected in 60 mL polyethylene bottles 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. 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.