DISCOVERY 257
21ST September > 9th October 2002
Clyde > Clyde

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OVERVIEW

The cruise was delayed by 24 hours due to mechanical problems with the 10T winch system and the Starboard lifeboat aft davit. The first 3 days were spent in the Clyde fulfilling OAERRE objectives. The weather was good for the first week but from the 28th onwards we had to work in between the depressions. The 1st and 2nd October were completely lost to the weather, it was during these two days that we had hoped to occupy the Ellett line stations. There was no slack in the program to make up for the lost day at the beginning of the cruise.

CRUISE OBJECTIVES

1. **To compare water column and benthic biogeochemical processes in two adjacent deep-sea regions physically separated by a major seabed topographic feature - the Wyville-Thomson Ridge.**

2. **To occupy the Ellett line CTD stations from Sound of Mull to Rockall including the deployment of deep moorings 'F' & 'M'.**

?? The Wyville-Thomson (W-T) Ridge provides a natural 'experiment' allowing us to test the existence of biogeochemical 'provinces' in the deep sea.
?? Sites north and south of the ridge share a common surface water mass (same surface productivity, similar downward OM flux?). Strongly contrasting sub-surface hydrography and benthic environments.

??	Study sites: -	WTN	N60º16'	W06º56'	1180m
		WTS	N59º43'	W07º10'	1090m

PHYSICS

?? Ellett Line CTD stations severely disrupted by weather, only 1G, 2G, 4G, 6G, 7G, 9G, 10G,F & M occupied.
?? Deep-water moorings deployed at stations 'F' and 'M' on Ellett Line. Design life of 2 years, planned recovery on Discovery 2003.
?? W-T Ridge & F-S Channel: 3 moorings deployed from Discovery and recovered by RV 'Scotia' in mid October 2001. ADCP's & miniloggers returned good data. Problems with Aanderaa RCM's and Inter-Ocean S4's.
?? W-T Ridge: planned 13-hour CTD stations north and south of ridge prevented by bad weather.

WATER COLUMN GEOCHEMISTRY

Rationale: Does benthic POC flux differ at WTN and WTS?

Vertical profiles of particulate and dissolved matter combined with measurement of particle-reactive natural radionuclides (Po-210, Pb-210) give estimates of particle residence time and

downward flux of POC. Relate estimates to Pb-210 and POC data from sediment cores at the two sites.

?? Water column at each site sampled by CTD at 11 depth intervals from 5 - 1100 m. Analysis continuing

?? Plankton samples also taken for analysis of distribution of toxic diatom species

BENTHIC GEOCHEMISTRY

Rationale: Comparison of sediment mixing rates, carbon cycling,
Oxygen fluxes and trace metal profiles north and south of the ridge, using *in situ* and remote sampling techniques.

LANDER DEPLOYMENTS

In situ measurement of sediment redox and pH profiles

?? Deployed once at each WT station. Fitted with 5 x oxygen and 1 x pH electrodes.

?? WTN: 3 good oxygen profiles obtained, with fine-scale resolution of sediment-water interface. No change seen in pH signal.

?? WTS: 5 good oxygen profiles obtained, but sediment-water interface not resolved as finely as at WTN (lander sinking too far into sediment).

SHIPBOARD CORE INCUBATIONS

Measurement of sediment oxygen uptake rates and nutrient fluxes

?? 6 cores per station collected by multicorer, incubated at bottom water ambient temperature.

?? Oxygen uptake rates, mmol O_2 m^{-2} d^{-1}

WTN:2.34 ± 0.31 (at 0 - 1^{o} C)
WTS:3.56 ± 0.61 (at 7.6 ^{o} C)

CORE PROFILE ANALYSES

Cores required for profile measurements of radionuclides (Pb-210, Th-234), lipids, chlorophyll, solid phase and pore water trace metals. Triplicate samples sought for estimation of sediment patchiness.
Results to be interpreted together with lander *in situ* data for estimation of biogeochemical fluxes.
Planned to use DML megacorer as main sampling gear, but proved largely unsuccessful in sediment types encountered. Most samples obtained from multicores.

?? **WTN:** sediment very sandy with gravel lenses at ~ 10 cm depth, but spatially quite variable, some finer patches.
Samples obtained: 1 x megacore, 4 x multicores. Data obtained on all parameters.

?? **WTS:** compact fine silty sand. No subsurface gravel.
Samples obtained: 2 x multicores, used for lipid/chlorophyll and radionuclide analysis. Sampling severely limited by bad weather.

BENTHIC BIOLOGY

Objectives:

?? To compare the benthic fauna at each site: numbers, biomass, trophic categories, and community size fractionation. Estimate benthic community carbon demand.

?? Assess relative importance of bioturbation at each site. Use results in interpretation of geochemical data.

?? Methods: Boxcore excavation, sieving of fauna from box- and multicores, seabed photography.

WTN

?? 98 seabed photos obtained. High density of stalked sponges, brittlestars, sea spiders.
?? 4 boxcores examined. Very little evidence of burrows or other biogenic structures.
?? Quantitative samples obtained for meiofauna (3 x multicores) and macrofauna (9 x multicores, plus semi-quantitative data from boxcores).
?? Results from 2 multicores processed so far suggest low faunal density, i.e. ~ 5600 macrofauna s.s. m^{-2}

WTS

?? 23 seabed photos obtained. Possibly more biogenic topography than at WTN. Xenophyophores on sediment surface.
?? 2 boxcores examined. Much more biogenic structure than at WTN. Large sipunculan, sea pen, worm tubes.
?? Quantitative samples obtained for meiofauna (3 x multicores) and macrofauna (6 x multicores, 2 x boxcores)

SUMMARY OF D257 HITS & MISSES

	Ellett Line
Hydrography	Inner Shelf stations + F & M
Diatom sampling	Yes (shelf stations)
Moorings	Yes (F & M)

		WTN	**WTS**
Physics	Moorings (WT1, 2&3)	Yes	Yes
	12-hr CTDs	No	No
Water column geochemistry	Radionuclides + CHN	Yes	Yes
	Diatom sampling	Yes	Yes
Benthic geochemistry	Lander oxygen profiles	Yes	Yes
	Core incubations	Yes	Yes
	Lipid/chl profiles	Yes (n = 2)	Yes (n = 1)
	Radionuclides	Yes (n = 2)	Yes (n = 1)
	Pore water metals	Yes (n =1)	No
	Solid phase metals	Yes (n =1)	No
Benthic biology	Seabed photos	Yes (n = 98)	Yes (n = 23)
	Trawled megafauna	No	No
	Macrofauna	Yes	Yes
	Meiofauna	Yes	Yes
	Boxcore analysis	Yes (n = 4)	Yes (n = 2)
	Coral trawling	Added bonus	