# JR 127 Cruise Report

25.4.05, 25.8-21.9, Jnr 05/8450

RRS James Clark Ross

Stornoway > Aberdeen

29th August > 22nd September 2005

**Acknowledgements**

It gives me great pleasure to thank Jerry Burgan, the officers and crew of the James Clark Ross for all their help and support which made JR127 such an enjoyable and productive cruise.

I would also like to thank the following for all their support, Chris Hindley (BAS); The Polish Research Station, Hornsund; The Kings Bay Company, Ny Alesund; Colin Day, Ian Waddington & Jason Scott (UKORS, NOCS) and Mike Webb (NERC).

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## Cruise Objectives

### 1. Relevance to SAMS Northern Seas Programme

JCR 127 is the second SAMS cruise to the Arctic directed at NSP objectives, the first being JCR 75 in summer 2002. Most of the proposed study areas for JCR 127 have been sampled during past expeditions including extensive bathymetric surveys, geochemical and biological sediment coring and seabed photography. These data have provided the basis for the approximate locations of stations to be visited during JCR 127. In addition, there are a series of new stations selected in response to emerging science directions that are relevant to the NSP.

Therefore, science activities and output will contribute to delivery of the NSP objectives through:

- Enhancing existing data sets through revisiting previous sites.
- Acquisition of complementary data from new locations.
- Closer interdisciplinarity in addressing NSP questions.
- Strengthening international links in the region.

### *1.1 Main science aims of the JCR 127*

We aim to advance our knowledge and understanding of the linked physical, biogeochemical and geologic processes occurring in Northern Latitudes that address directly questions in the NSP. This will be achieved through an increased interdisciplinary approach to planning, acquisition, interpretation and publication and will be based on data and knowledge gained on JCR 75.

Principal investigations include:

- Processes of shelf and fjord exchange
- Chemical gradients in high latitude shelf waters (nutrients)
- Changes in faunal composition and size
- Animal-sediment interactions
- Contaminant redistribution in sediments ($^{206}Pb/^{207}Pb$, $^{210}Pb$ Hg and Cd)
- Contaminant transport (SPM, $^{206}Pb/^{207}Pb$)
- Carbon cycling within sediments ( $\delta^{13}C$ and $^{234Th}$)
- Particle transport in the Arctic environment (radionuclide tracers)
- Identification of water masses ($\delta^{18}O$)
- Investigation of productivity/palaeo-productivity (solid phase and dissolved Ba)
- Retrieval of palaeo records from shelf and oceanic cores

The cruise work will directly address the following programme elements:

Theme A, Question 1 *Where and how is energy dissipated in fjords?*

Theme A, Question 4 *How does bioturbation vary in response to environmental forcing and what are the consequences for redistribution of anthropogenic contaminants?*

Theme A, Question 5 *Are deep-sea proxy-indicators of environmental and climatic change applicable to high resolution sedimentary records in fjordic environments?*

Theme B, Question 1 *What are the roles of physical submarine features in driving carbon flow through the benthic biosphere at the northern European continental margin?*

Theme B, Question 2 *To what extent do benthic faunal composition and size structure determine processes of carbon dynamics and biogeochemical provinces at the benthic boundary?*

***1.2 Theme A, Q1*** **Where and how is energy dissipated in fjords.**

**1.2.1 Exchange and energy propagation processes in high latitude fjords**

1. Recover and redeploy moorings in the outer part of Kongsfjorden to link with mooring data from UNIS to investigate propagation of waves through the fjord and water mass exchange phenomena.
2. Complete cross and along fjord CTD transects in conjunction with ADCP measurements to quantify cross-fjord gradients, geostrophic circulation and fjord shelf communication. These measurements will provide a basis for cross-disciplinary linkage.

**1.2.1 Cross shelf exchange – heat transport and ecological consequences**

1. Quantify the extent of heat transport onto the West Spitsbergen Shelf from the West Spitsbergen Current to estimate latitudinal losses. This links to changes in ecological function in the region.
2. Investigate the change in water mass properties along the West Spitsbergen Shelf to determine the transport and modification processes.

***1.3 Theme A, Q4*** **How does bioturbation vary in response to environmental variables and what are the consequences for redistribution of anthropogenic contaminants?**

**1.3.1 Rapid bioturbation and bioirrigation in response to addition of phytodetritus**

1. To quantify the impact of bioturbation style and rate on electron acceptor, and thereby carbon diagenesis and burial …, seeking explicitly to compare rates under post-bloom episodes within northern and temperate waters.
2. To examine the behavioural response to chemical cues of fresh phytodetritus, the impact of organic microenvironments on pollutant redistribution, and the potential effect on metal lability induced by increased bioirrigation in response to changing bottom water conditions.
3. Recover cores along a depth transect (BIF) and compare different tracers of biodiffusion (eg $^{210}$Pb, $^{234}$Th and Chl-a) to determine, mixing and biodiffusion rates. These rates will be related to the benthic community present at each depth.

**1.3.2 The importance of bioturbation and organic matter degradation on controlling metal cycling within Northern latitudes.**

1. Relation to water depth and geographical variability. Correlations between DOC, Nutrient, oxygen and metal fluxes with relation to bio- mixing coefficients.
2. Bioturbation response to environmental forcing and effects on geochemical fluxes (contaminant redistribution).
3. Recovery of sediment cores to utilise stable Pb isotopes in determining sources and transport of pollutants to the Svalbard area ( expansion of on-going work)

***1.4 Theme A, Q5:*** **Are deep-sea proxy-indicators of environmental and climatic change applicable to high resolution sedimentary records in fjordic environments?**

1. High-resolution records of Arctic environmental change from fjordic and shelf sediments.

2. Kongsfjorden water and sediment samples for isotopic signatures and modern benthic foraminifera assemblages.
3. Continuation of the Kongsfjorden & surrounding shelf multibeam survey. Extend the existing survey (JR75 2002) onto shelf and complete the southern margins of the outer fjord.
4. Use proxies (eg Ba etc) to reconstruct palaeo productivity.
5. Use of U ranium isotopes to investigate changes in salinity.

***1.5 Theme B, Q1:*** **What are the roles of physical submarine features in driving carbon flow through the benthic biosphere at the northern European continental margin?**

1. Coring sites of current-influenced sedimentation for evidence of records of thermohaline variability. The contourite sediments, deposited in regions with high background of ice-rafted debris (IRD), will be examined in the context of foraminifera and geochemistry.
2. Continuation of the Svalbard Shelf and Molloy Deep survey – extending onto the Fram Strait survey of 2002.
3. Sampling of specific sites for water column $^{210}$Po, $^{210}$Pb and sediment coring; to determine particle flux from the euphotic zone and investigating advective vs lateral transport of particles in deeper water ( This will be linked with the □$^{18}$O and spm studies)

***1.6 Theme B, Q2. To what extent do benthic faunal composition and size structure determine processes of carbon dynamics and biogeochemical provinces at the benthic boundary?***

**1.6.1 Organic carbon oxidation rates in sediments**

1. Relation to water depth and geographical variability;
2. Relation to oxygen uptake rates and determination of respiration quotients, providing information on the composition of organic matter being degraded.
3. Recover sediment cores for analysis of amount and type ($^{13}$C/$^{12}$C, CHN and lipids?)

**1.6.2 $CaCO_3$ dissolution rates in sediments**

1. Relation to water depth and geographical variability.
2. Proportion of benthic DIC flux being due to org. C oxidation and to $CaCO_3$ dissolution. Pathways / mechanisms for $CaCO_3$ dissolution - through org. C oxidation (metabolic $CO_2$ dissolving $CaCO_3$) or through undersaturation of bottom water with respect to calcite and aragonite.

**1.6.3 To what extent do benthic faunal composition and size structure determine processes of carbon dynamics and biogeochemical provinces at the benthic boundary?**

1. Imprint of metazoan biodiversity in mediating carbon cycling and burial.
2. Structure and vertical distribution of benthic communities, with particular emphasis on poorly sampled megafauna, at sites along a northern latitudinal gradient.
3. Intensity of mixing and depth of mixed layer at selected sites.

4. Deployment of Elinor chamber at 3 stations on BIF transect with the addition of labelled carbon ( comparison of sediment C ratios)
5. Detailed $^{234}$Th measurements
6. Investigation of metal biogeochemistry linked to organic carbon cycling (Elinor chamber deployed 3 times at same site (KF4) to determine variability and metal fluxes)

**2. Proposed main sampling sites (Figure 1)**

**Voring Plateau (VP)**
**Bear Island Fan (BIF)**
**Margin W. of Svalbard, no ice cover (WSS)**
**Kongsfjorden (KF)**
**Yermak Plateau (YP)**
**Fram Strait/Greenland Margin (GM)**

**Summary of wire time required at each station site. The safe time is 2x the estimated wire time. No calculation of steaming times has been undertaken.**

| Station | Wire Time | | Safe Time | |
|---|---|---|---|---|
| | hours | days | hours | days |
| VP | 37 | 1.5 | 74 | 3 |
| BIF | 71.5 | 3 | 143 | 6 |
| BIF (landers) | 171 | 7 | | |
| WSS | 31.7 | 1.3 | 63.4 | 2.6 |
| KF | 67 | 2.8 | 134 | 5.6 |
| YP | 20 | 0.9 | 40 | 1.8 |
| GM | 41.2 | 1.7 | 82.4 | 3.4 |
| TOTALS | **267.4** | **11.2** | **534.8** | **22.4** |
| Including lander | 438.4 | 18.2 | 876.8 | 36.4 |

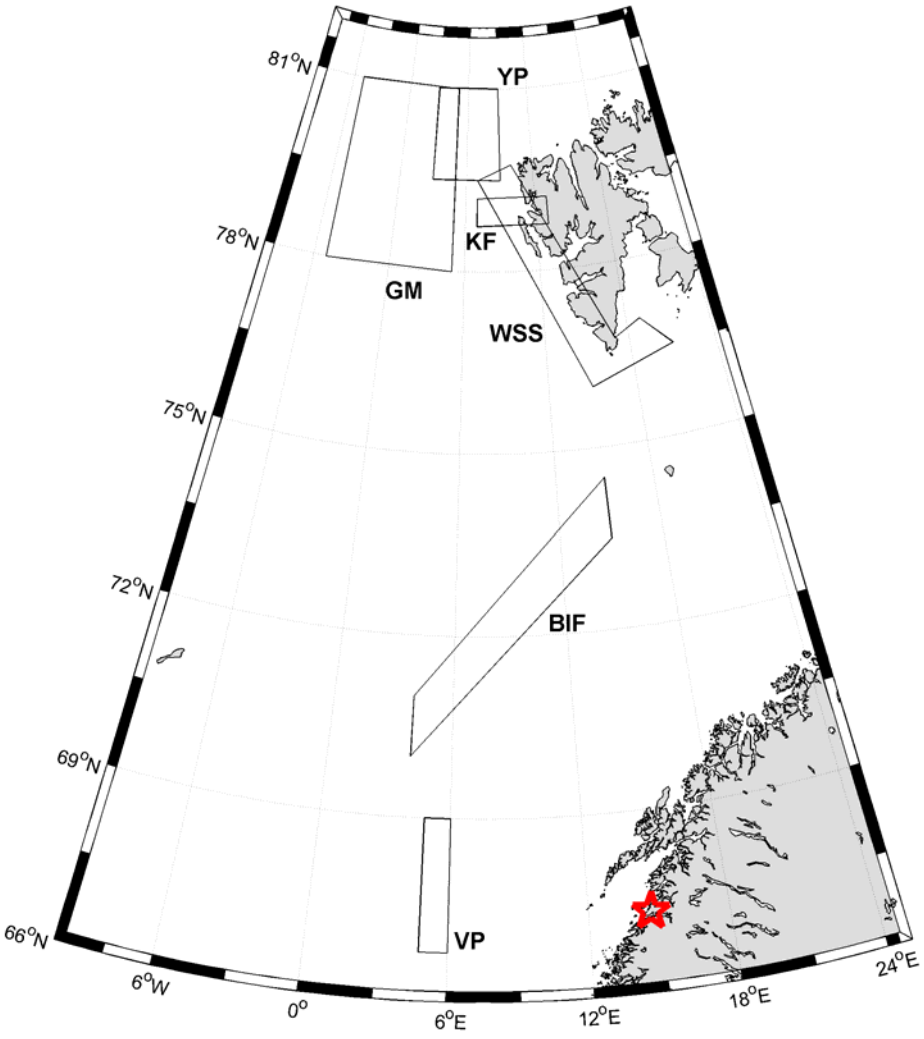
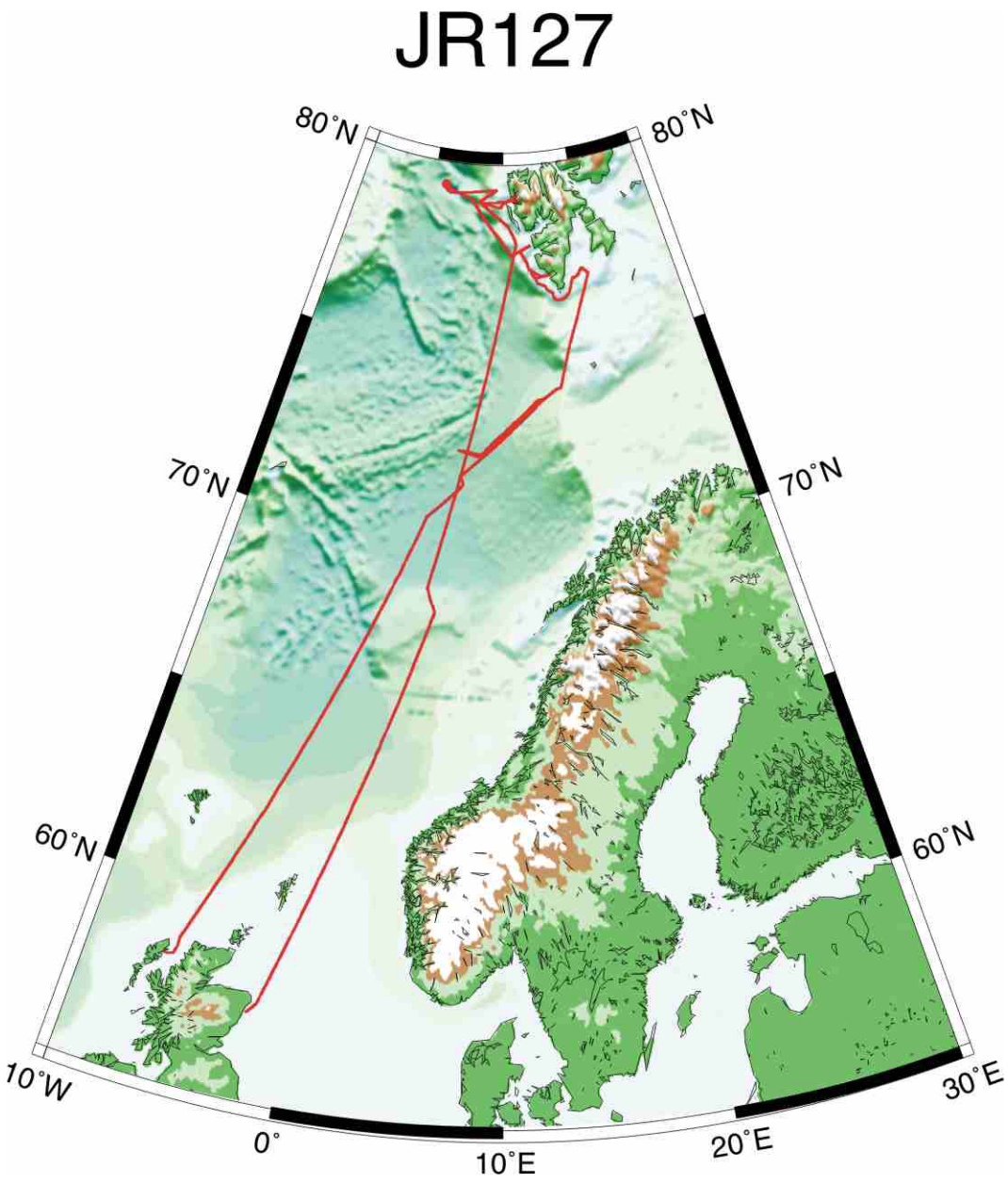



**Figure 1: Sampling Sites for JCR 127.**

**Personnel**

| | | |
|---|---|---|
| BURGAN | Michael J S | Master |
| LIDDELL | Andrew R | Ch/Off |
| HANDY | Christopher R | 2nd/Off |
| COX | Joanna L | 3rd Off |
| SUMMERS | John W | Deck Officer |
| GLOSTEIN | Michael E P | R/O |
| ANDERSON | Duncan E | CH/Eng |
| SMITH | Colin | 2nd/Eng |
| STEVENSON | James S | 3rd/Eng |
| BALFE | Thomas | 4th/Eng |
| TREVETT | Doug P | Deck Eng |
| ROWE | Anthony K | Elec |
| LANG | Colin | Bosun |
| PECK | David J | B' Mate |
| BOWEN | Albert M | SG1 |
| CHAPPELL | Kelvin E | SG1 |
| RAPER | Ian | SG1 |
| DALE | George A | SG1 |
| HOLMES | Kevin J | SG1 |
| MACKASKILL | Angus I | MG1 |
| SMITH | Bruce D | MG1 |
| HUNTLEY | Ashley A | Ch/Cook |
| LEE | Jamie E | 2nd Cook |
| JONES | Lee J | Snr' Steward |
| GREENWOOD | Nicholas R | Steward |
| RAWORTH | Graham | Steward |
| WEIRS | Michael | Steward |
| SHIMMIELD | Graham B | PSO |
| COOPER | Patrick J | E/Eng |
| EDMONSTON | Johnnie | IT |
| RUSSELL | Russell | Medic |
| PHIPPS | Richie | M/Eng |
| SMITH | Kevin | M/Eng |
| BLACK | Kenneth D | Chemist |
| BRAND | Timothy | Chemist |
| BREUER | Eric | Geochemist/Landers |
| COTTIER | Finlo | Physicist |
| COX | Suzie | Geochemist |
| DOIG | Katie | Geochemist |
| GRIFFITHS | Colin R | Physicist/Logistics |
| HARVEY | Stewart M | Chemist |
| HOWE | John A | Geologist |
| LAMONT | Peter | Biologist |
| McKINLAY | Susan | Geochemist |
| MORRIS | Peter | Swath |
| MUIR | Heather | Chemist |
| NICKELL | Lois | Biologist |
| PROVOST | Paul | Physicist |
| REYNOLDS | Saul | Landers |
| VARE | Lindsay | Geochemist |
| VENABLES | Emily | Physicist |
| WILSON | Charlie | Geologist |




Cruise Track JR127 Stornoway > Ny Alesund > Aberdeen

## Cruise Narrative

29th August The main scientific complement joined three SAMS staff who had participated in the shakedown leg from Portsmouth, following a substantial refit to the JCR. Departed Stornoway at 17.06Z, into the north Minch. A comprehensive and clear safety briefing was given by the Purser at 18.30Z. Course was set NE to the west of Shetland. A poor forecast of Force 11 from the SW was predicted. All scientific gear was safely stowed and secured. The landers were taken down and stowed for safety.

30th August Underway for the Bear Island Fan, Norway. The predicted severe storm did not materialise. A long following sea and Force 6/7 was experienced, allowing novice seagoing scientists to find their sea legs. A fire drill and fire extinguisher briefing was given at 9.30Z. The remainder of the day was spent unpacking scientific equipment and carrying out calibrations and tests. A safety briefing was given by the PSO to the scientific staff. All shipboard facilities were performing well.

31st August Underway for Bear Island Fan, Norway. Weather conditions good with a moderating sea and wind. Continuation of equipment preparation. Entering the Faroe-Shetland Channel, a shakedown CTD was performed at 12.50Z (65.9373N, 0.2804E). A science briefing for the ship's company was given at 18.00Z, covering the general oceanography of the Arctic, the specific objectives of the cruise, and some historical notes to Svalbard and the Fram Strait region.

1st Sept Underway for Bear Island Fan. Weather conditions were good with a slight sea. In the late morning the sun came through for the first time. At 14.31Z the first science deployment for the cruise took place in 3,300 m of water. The NIOZ box corer was successful, even if slightly overfull (70.5000 N 3.9987 E). After a small adjustment to the penetration stops, a second successful box core was obtained from 3173 m depth (70.5006 N, 3.9987 E). As the corer was recovered inboard a coupling on the starboard gantry parted covering the corer and personnel in hydraulic oil. The crew acted swiftly to prevent spillage to sea, and subsequently for the clear-up and decontamination. At 21.45 Z the lander buoyancy and releases were deep tested on the coring warp to 3,000 m depth.

2nd Sept On station at BIF 6. The first megacorer deployment took place (70.5019 N, 3.9993 W) resulting in 5 good cores from a possible 8. Further improvements in the weather allowed us to deploy the first lander package for JR127 at 05:06Z (70.501 N, 4.0028 E). The configuration used was the Profileur, equipped with oxygen and resistivity electrodes. During deployment the nylon strop snagged in the Argos beacon, requiring it be cut free. Whilst the lander was on the sea bed two megacores, with eight tubes each, were deployed 1 Nm away (70.4969 N, 3.9511E). Both drops were completely successful with all 8 tubes containing perfect cores for biological sampling. Following a deep CTD drop for the full water column, two further drops were made to 750 m and 11 m depth. In each case the entire rosette was fired at a single depth for Ra-226 samples (120 litres required). At 16:46 Z the lander release was triggered from the deck unit, and lift off from the seabed was quickly verified. With good seamanship the lander was safely brought on board at 17:58. The remainder of the day was spent deploying three successful CTD drops to full depth to collect nutrients, salinity, $\delta^{18}O$ samples and suspended particulate matter (SPM).

3rd Sept On station at BIF 6. Work continued with CRD drops until 01:11, followed by a megacore (deployment #18, 70.4987 N, 4.0025 E ). At 03:33 the JCR departed station BIF 6 for BIF 5. Around 09:00Z it became clear that station BIF 5 was

already occupied! A fleet (12) Icelandic trawlers in close formation were fishing directly over the station. Radio communication established they were fishing a mid water depths rather than on the seabed, however we moved BIF 5 a few Nm to the NW. JCR moved on station at 10:31Z, with a first CTD deployment at 10:53Z (#18 71.6329 N, 6.3952 E) down to a depth of 2938 m. Three megacores followed (#19,#20,#21) with decreasing success in the number of cores obtained (6, 5 and 4, respectively out of a possible 8). At the end of the station work was undertaken on the closing mechanism in readiness for station BIF 2. To allow for the 48 hour lander deployment and core incubations required at station BIF 2, the JCR departed at 19.32 for 15 hours transit at 11.5 knts.

4th Sept En route for station BIF 2 in 1400 m of water. In order to maximise the time for lander deployments and accomplish other objectives on the Bear Island Fan transect it was decided to move quickly to BIF 2, deploy the Elinor incubation lander, and collect cores for 48 hour shipboard incubation experiments. At 11.23 the Elinor lander was successfully deployed at 73.6696 N, 13.7871 E, in 1420 m water depth. Modifications to the crane release mechanism (wooden toggle) worked well. This was followed by two successful megacore deployments for incubation cores. At 14.50, the JCR moved off station, heading SW to Station BIF 4. Throughout the passage weather forecasting indicated a deepening depression centered on Station 4. We were heading for the eye of the storm!

5th Sept En route for station BIF 4 in ~2500 m of water. Weather conditions rapidly deteriorating with deepening and advancing low pressure system. At 22.05 (72.1644 N, 8.0105 E) a full depth CTD was performed, given that the sea state was still reasonable for gear handling. However, by midnight the weather situation had deteriorated further, and additional sampling was considered unsafe.

6th Sept En route for station BIF 2. With the poor weather conditions, and the inability to continue sampling at BIF 4, it was decided to head NE back to BIF 2 in readiness for lander recovery at midday. For twelve hours we experienced poor weather conditions but with signs of amelioration. At midday it was decided that conditions had improved sufficiently for recovery to take place. At 12:22 the lander release was triggered, followed by safe ascent and recovery. Unfortunately, the Elinor chamber failed to return the box core with the chamber. Overlying water was 90% sampled with only two failed syringe samplers. The video camera failed to record images of the deployment. Two CTDs and three megacorers were carried out with good success and improving weather conditions. At 20:18, the JCR departed BIF 2 for BIF 1, the final station on the Bear Island Fan transect. The proposed Station BIF 1 (73.9148 N, 15.0747 E) was reached at 22:50, and a successful megacore deployed. However, the water depth was rather deeper (1300 m) than expected, so the decision was taken to move a few miles NE.

7th Sept Underway to new station BIF 1 at 73.9578 N, 15.5829 E, 1000 m water depth, 8.7 NM ENE of the original BIF 1. Following some remedial work on the meagacorer, four successful deployments were carried out, followed by six CTD drops for nutrients, Suspended Particulate Matter (SPM), and radionuclides ($^{226}$Ra, $^{210}$Pb and $^{210}$Po). Weather conditions now significantly improved, and success in sampling allowed some lost time to be regained. At 11.30 the Bear Island Fan transect was completed, apart from incomplete sampling at Station 4, and no Station 3. If time allows, these will be sampled on the return leg. A northerly course was set for SW Spitsbergen and Storfjord.

8th Sept En route for SW Spitsbergen (Svalbard) with good, if overcast, weather conditions. At 5:26, station WSS 0 in the large, open Storfjorden was reached

(77.0747 N, 19.3943 E). The objective of the station was to recover CTD and core samples representing the location of cold, dense deep water formation. Unfortunately, the operation of the starboard gantry resulted in another hydraulic failure. Several hours were spent making successful repairs and cleaning up the minor spill. A CTD and successful (4 tubes) megacorer were completed by 10:47. It had been planned to pay a courtesy call to the Polish research station at Hornsund later that afternoon. The delays resulted in replanning, and the visit was scheduled for the following morning, following a VHF call to the Base Commander, Andrew Grotha. Course was set for station WSS 1 (Sorkappbanken, 76.4677 N 15.7492 E) in 100 m of water for a CTD drop as part of the West Spitsbergen Shelf section. Following successful deployment, stations WSS 2 and 3 (Hornsund, 76.6781 N, 14.9199 E; and Hornsundbanken 76.9004 N, 13.8295 E) were also successfully completed for CTD drops. At 23:02 the JCR occupied station WSS 4 (Bredjupet, 77.0496 N, 13.3908 E) for multiparameter sampling.

9th Sept On station, WSS 4 (Bredjupet), 420 m. CTD sampling continued successfully, culminating with a magacorer at 3:53, 77.0494 N, 13.3783 E. At 04:08 the JCR was underway, retracing her course to the entrance of Hornsund fjord. At 7:10, under DP, the tender was launched just off the Polish station at Hornsund. On the beach, we welcomed Andrew Grotha and eight colleagues, transporting them back to the JCR for a late breakfast and tour of the ship. For the remainder of the morning, two runs ashore allowed the scientific and ship's crew to visit the station. We were all impressed at the standard of the facilities, and warmness of the Polish welcome. There are definitely opportunities for future collaboration. Gifts were exchanged and with a sincere thanks for the hospitality we reboarded the JCR at 11:35. At this time the MV *Nordsyssel* (Sysselman's vessel) arrived with a helicopter. No contact was established between us. Under good weather conditions and calm sea, re gained the N-S transect on the west Spitsbergen shelf at station 5 (14:49: 77.1667 N, 13.1139 E Bellsundbanken). After a further two stations (WSS 6 and 7) off Bellsund fjord in 100-275 m of water, a major E-W cross-shelf and slope transect commenced. Station WSS 8c (Isfjordbanken, 125 m depth, 77.6503 N 12.1182 E) marks the cross over point between the two transects. A multiparameter set of CTD drops ensured that sufficient water was collected for nutrients, SPM, $\delta^{18}O$ measurements, Ra and Pb/Po. At 23.00 the JCR moved off station to commence the transect at the eastern end.

10th Sept Underway to Station WSS 8a1c (Isfjordbanken, 50 m depth, 77.8009 N 13.49635 E). With arrival on station at 01:22 we started the E-W transect from the shallow water of the west Spitsbergen shelf. Heading west, we completed 9 CTD stations in progressively deeper water. By 10:42, the weather had started to deteriorate significantly. At WSS 8i (480 m depth; 77.5508 N, 11.0166 E), the decision to abandon the transect was made by the PSO. On the last CTD drop, the wire snatch from the top of the wave bent the bridle arm, requiring the one spare arm to be installed. With a poor weather forecast for the entire west coast of Svalbard, it was clear that the only available option was a significant change of cruise plan, and a transit to the central Fram Strait to tackle some of the piston core objectives. Within the Fram Strait the pack ice was being driven south on NNW winds. It was anticipated that quieter conditions could be found at, or just within, the advancing pack. The question was, how far south would the ice have migrated relative to our station objectives?

11th Sept Underway to central Fram Strait, heading into Force 9-10 and heavy seas. At 8:25 the JCR encountered pack ice for the first time on the cruise. The ice front was quite broken, and immediately the sea state improved, although the wind was unabated. Swath and Topas survey work was difficult with the ice noise, and necessary course corrections. It was clear that early cruise

objectives on the East Greenland shelf were unachievable within the ice conditions found. Careful reviewing of existing data suggested a good target to be some small seamounts NW of the Molloy Deep on the Molloy transform fault complex. Throughout the rest of the day, swath and Topas data were collected and processed in near real time, revealing to excellent sites of sediment drift deposits, possibly without too much debris flow material. Weather conditions continued to be poor rendering outside working conditions at –35°C with wind chill. However, a major highlight of the evening was the sighting of two polar bears picking out in the vessel's searchlights.

12th Sept Swath mapping, central Fram Strait. At 5.18 and at station PC1, 79.3114N, 2.0066E, 3147 m water depth, the first piston core of the cruise was deployed. Unfortunately, ice conditions were difficult and it was impossible for the vessel to achieve the target position. It was decided to abandon the attempt and reposition. At 9.23 a new position (79.3498 N, 2.2077 E) was achieved. Despite the prevailing ice conditions, good seamanship and expert core handling, allowed work to progress resulting in a successful core. At 16.24 a second core (PC2, 79.3346 N, 1.8207 E, 3402 m depth) was recovered from a basin, NW of the small seamount. At 20.11, and after another visit from a single polar bear, the JCR moved off station and headed east out of the pack ice for the north end of the west Spitsbergen shelf transect and to commence the Kongsfjord transect.

13th Sept Underway for WSS transect, some evidence of improving weather. At 4.50, station WSS14 (79.3005 N, 9.1979 E) was occupied for a CTD cast. Afterwards, course was set SW to KF 4 to commence the Kongsfjord transect, starting with megacores, followed by two lander deployments. At 8:48, the first megacore at 78.9739 N, 6.7112 E took place successfully followed by the lander deployment (Profileur) at 12.38. The Elinor was released from the surface at 13.18. Both deployments took place without drama, although a weight bucket release rod on Elinor snapped and needed to be replaced quickly. This was followed by 6 CTD drops for multiparameter biogeochemistry and a plankton net. At 20:55, the JCR departed for WSS13, heading east towards the Kongsfjord. Swath bathymetry tracks were devised to ensure overlapping and contiguous data collection with the 2002 survey.

14th Sept Midnight, coincided with arrival on station WSS13 (78.9663 N, 9.3992 E, 216 m depth). After completion of the CTD, the JCR continued to head into the Kongsfjord with improving weather conditions. Dawn showed the extent of snowfall over the past 3 days, with an early arrival of winter to NW Svalbard! Megacore site, MC 2 (333 m 79.0227N, 10.6915 E) was successfully completed, followed by stations MC6, MC4 and MC3, moving progressively towards Ny Alesund. At 7:50, a piston core was deployed successfully at 79.0101 N, 11.3890 E in 390 m of water. At 10.00 we commenced recovery of a mooring placed by SAMS in 2004. All went according to plan and by 10.43, the recovery was complete with all instruments intact. Moving onto the nearby station PC1 at 11.10 another piston core was undertaken. In the meantime a small shore party visited Kings Bay Company, and the Norwegian Polar Institute to collect some mooring equipment and to make arrangements for the following day. By now the weather had cleared to reveal the best day of the cruise so far – blue skies and fresh snow produced a memorable vista around the Kongsfjord. During the afternoon, two activities were undertaken. The ship's tender and RIB set off for the head of Kongsfjord to collect meltwater data from the glacier and samples of glacier ice, whilst the JCR undertook a CTD transect, N-S across the fjord to the west of Ny Alesund. The tender returned to the JCR at 19:15 having conducted a minitransect away from the Kongsbreen glacier. The CTD N-S transect continued through midnight.

15th Sept CTD transect, Kongsfjord in good weather conditions. At 2.22, the transect was complete, and the first of a suite of mega and piston coring began. MC 1 at 78.9580 N, 11.9064 E took place in 358 m of water. The sediment contained coarse lithic fragments resulting in poor core recovery for the first time in the cruise. Unfortunately, some time was lost trying to effect a cure, but at 7.33 a piston core was deployment at PC4 on the outer Kongsfjord bank. For the previous 24 hours this location had been occupied by 3-4 Norwegian shrimp boats, showing that benthic trawling activity in the Kongsfjord is quite prevalent in certain locations. Again, the piston core worked well with a full 12 m barrel. On recovery, the JCR headed back into the fjord to begin deployment of a multi-instrument mooring on the northeast margin. At 11.23 the mooring deployment took place at 79.0201 N, 11.7739 E. With expert handling from both deck and scientists, the mooring was completed at 12.48. By now the weather had begun to deteriorate again with overcast conditions and a little light snow. For the afternoon, a shore call at Ny Alesund was planned. Moving alongside at 14.00 there was an opportunity for all scientists and crew to visit the scientific village of Ny Alesund and purchase some souvenirs. The highlight was a guided tour of the new Marine Laboratory facilities in which SAMS has a part share. At 16.30, our Norwegian colleagues came aboard for a short guided tour and some social interaction. By 18.00, the JCR had cast off, and quickly undertook a final piston core station at PC2 (79.1993 N, 11.7829 E, 374 m depth) under the skies of a most amazing sunset (cumulus lenticularis). After a megacore at MC5, we returned to the mooring location to conduct a single CTD to obtain parameters for later instrument calibration.

16th Sept Mooring location, Kongsfjord, conducting CTD for instrument calibration. At 1.03, the CTD was completed, and we moved off to station WSS 12 to complete the northern end of the West Spitsbergen Shelf transect. By 4.28, the CTD was complete and station KF 4 was returned to for lander recovery. By this time the weather conditions were again deteriorating, and fingers were crossed for a safe set of lander operations. The Profileur was attempted first, and at 8.39 was safely on deck. The heavier Elinor lander, was released from the seabed successfully at 8.52 (unlike in 2002 when it remained firmly attached!). Recovery was slightly more problematic with a snagged pellet float line not allowing a clean grapple and lift. However, with good seamanship, Elinor was on deck at 9.28. The lander operation was successful for water samples from the incubation chamber, and camera operation, but unfortunately it failed to recover a core. At 15.11, the JCR was on station at WSS 11 78.3328 N, 10.6291 E for a shallow water CTD station. By 17.52, WSS 10 further south, had also been completed, but the sea state was rising quite fast. Nevertheless, we continued south towards WSS 9, but that eveing it was clear that continued operations would put the CTD system at risk. With little time spae for the important Voring Plateau stations, the decision was taken to cancel the outstanding CTD station on the WSS E-W transect, and set course south for the Voring Plateau, allowing maximum time for these stations.

17th Sept Underway for the Voring Plateau at 11.5 knts, weather conditions reasonable. Throughout the day for the 2.5 day transit time south, the weather steadily improved. By early evening, and in the vicinity of the Bear Island Fan transect, we were experiencing some of the best sea conditions of the cruise (somewhat infuriatingly).

18th Sept Underway for the Voring Plateau at 11.5 knts, with increasing sea state, and some prediction of poorer weather ahead. Good progress was made throughout the day with a following sea. At 20.30, the JCR approached station VP5 in over 3,000 meters of water at the southern end of the Norwegian Basin. The CTD was deployed at 68.6311 N, 4.5481 E. At 23:00 the first of three megacores at VP5 was deployed.

19th Sept On station at VP5, continuing successful megacoring. The sediment type was ideal for good cores with over 90% recovery rate from the 8 core barrels. At 05:55 coring operations were complete and the JCR proceeded SSE towards VP2 in 1400 m of water. At 09.06, the 1400 m contour was reached at a position NNW of the original planned position. In the light of a poor weather forecast, it was decided to stop the ship and commence coring and CTD operations. This new station was located at 68.0336 N, 5.2272 E, and was marked by five successful, sequential megacore deployments for biology, deck incubations and geochemistry. At 15:17 the first of two CTDs was deployed, but the weather conditions had begun to deteriorate as predicted. The second CTD, completed at 18.08, marked the cessation of science deployments for the cruise given the increasing risk to equipment and deck staff. With over 80% of science station objectives complete, it was clear that setting a course for Aberdeen was the appropriate action. For the rest of the evening the worsening weather made for uncomfortable conditions aboard.

20th Sept Underway for Aberdeen, under poor conditions and strong winds from the NNW. By midday conditions had ameliorated, and lab experiments could progress. By the early evening scientific watches were stood down, and cruise reports were begun.

21st Sept Underway for Aberdeen at 11 knts. Weather conditions moderate. The day was spent completing experiments and writing up science logs and plotting up data. Preparation for the end of cruise party was high on the agenda. At 18.00, the Captain and PSO formally thanked all the ship's complement and scientists for all their hard work on JR127, and the overall success of the cruise despite the weather conditions.

22nd Sept Underway for Aberdeen at 11 knts. Overnight strong winds (Force 8) swung around to the south-south west. The air temperatures became noticeably warmer, and most thoughts turn to home. The PSO and Dr Navarro disembarked by pilot launch at 15.00 in Aberdeen harbour, leaving the rest of the science party to transit to Immingham and the way home. JR127 was declared a success.

## JR127 Station Log

| Date | Time (GMT) | Latitude | Longitude | Event | Depth | I/W (GMT) | Bottom (GMT) | O/W (GMT) | Station | Activity | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 31/08/05 | 1247 | 65°56.23'N | 00°16.82'E | #1 | 3074 | 1251 | 1300 | 1307 | TEST | CTD 001 | SHAKEDOWN (200m) |
| 01/09/05 | 1420 | 70°30.00'N | 03°59.90'E | #2 | 3210 | 1431 | 1533 | 1621 | BIF 6 | NIOZ 001 | |
| 01/09/05 | 1650 | 70°30.00'N | 03°59.93'E | #3 | 3210 | 1650 | 1748 | 1835 | BIF 6 | NIOZ 002 | Hydraulic Fluid Leak |
| 01/09/05 | 2140 | 70°30.09'N | 03°59.93'E | #4 | 3210 | 2145 | 1600 | 2318 | BIF 6 | LANDER | ELINOR |
| 01/09/05 | 2348 | 70°30.12'N | 03°59.97'E | #5 | 3211 | 2348 | 0045 | 0147 | BIF 6 | LANDER | PROFILUR |
| 02/09/05 | 0232 | 70°30.11'N | 03°59.96'E | #6 | 3211 | 0232 | 0334 | 0435 | BIF 6 | MEGA 001 | 5 CORES |
| 02/09/05 | 0500 | 70°30.08'N | 04°00.20'E | #7 | 3208 | 0505 | | | BIF 6 | LANDER | DEPLOYED |
| 02/09/05 | 0643 | 70°29.82'N | 03°57.00'E | #8 | 3213 | 0645 | 0746 | 0842 | BIF 6 | MEGA 002 | 8 CORES |
| 02/09/05 | 0915 | 70°29.83'N | 03°57.11'E | #9 | 3211 | 0915 | 1016 | 1113 | BIF 6 | MEGA 003 | 8 CORES |
| 02/09/05 | 1136 | 70°29.82'N | 03°57.11'E | #10 | 3212 | 1136 | 1235 | 1347 | BIF 6 | CTD 002 | Full Depth |
| 02/09/05 | 1501 | 70°29.83'N | 03°57.11'E | #11 | 3212 | 1507 | 1520 | 1534 | BIF 6 | CTD 003 | 750m max depth |
| 02/09/05 | 1606 | 70°29.83'N | 03°57.11'E | #12 | 3212 | 1609 | 1610 | 1615 | BIF 6 | CTD 004 | 11m |
| 02/09/05 | 1630 | 70°30.20'N | 04°00.09'E | #13 | 3208 | | 1643 | | BIF 6 | LANDER | RELEASED |
| 02/09/05 | 1800 | 70°29.92'N | 04°00.15'E | #14 | 3208 | | | 1800 | BIF 6 | LANDER | RECOVERED |
| 02/09/05 | 1820 | 70°29.92'N | 04°00.15'E | #15 | 3213 | 1820 | 1916 | 2008 | BIF 6 | CTD 005 | 3000m |
| 02/09/05 | 2047 | 70°29.92'N | 04°00.15'E | #16 | 3211 | 2047 | 2142 | 2242 | BIF 6 | CTD 006 | 3000m |
| 02/09/05 | 2313 | 70°29.92'N | 04°00.15'E | #17 | 3211 | 2313 | 0006 | 0110 | BIF 6 | CTD 007 | Full Depth SPM 10m |
| 03/09/05 | 0129 | 70°29.92'N | 04°00.15'E | #18 | 3211 | 0129 | 0223 | 0320 | BIF 6 | MEGA 004 | 4 CORES |
| 03/09/05 | 1041 | 71°37.97'N | 06°23.59'E | #19 | 2968 | 1052 | 1147 | 1250 | BIF 5 | CTD008 | 2923 w/o |
| 03/09/05 | 1308 | 71°37.97'N | 06°23.71'E | #20 | 2968 | 1308 | 1402 | 1455 | BIF 5 | MEGA 005 | 6 CORES |
| 03/09/05 | 1513 | 71°37.97'N | 06°23.71'E | #21 | 2967 | 1515 | 1608 | 1658 | BIF 5 | MEGA 006 | 5 CORES |
| 03/09/05 | 1725 | 71°37.97'N | 06°23.71'E | #22 | 2964 | 1727 | 1818 | 1911 | BIF 5 | MEGA 007 | 4 CORES |
| 04/09/05 | 1114 | 73°40.18'N | 13°47.24'E | #23 | 1457 | 1123 | 1150 | | BIF 2 | LANDER | ELINOR DEPLOYED |
| 04/09/05 | 1219 | 73°41.20'N | 13°48.26'E | #24 | 1461 | 1222 | 1251 | 1320 | BIF 2 | MEGA 008 | 8 CORES 1444 w/o |
| 04/09/05 | 1335 | 73°40.79'N | 13°48.28'E | #25 | 1461 | 1337 | 1406 | 1433 | BIF 2 | MEGA 009 | 8 CORES |
| 05/09/05 | 2200 | 72°09.86'N | 08°00.64'E | #26 | 2626 | 2205 | 2254 | 2349 | BIF 4 | CTD 009 | |
| 06/09/05 | 1212 | 73°40.01'N | 13°46.88'E | #27 | 1457 | | | 1254 | BIF 2 | LANDER | ELINOR RECOVERED |
| 06/09/05 | 1317 | 73°40.21'N | 13°47.62'E | #28 | 1457 | 1317 | 1344 | 1421 | BIF 2 | CTD 010 | Nutrients, O2, dO2 |
| 06/09/05 | 1516 | 73°40.21'N | 13°47.63'E | #29 | 1457 | 1511 | 1544 | 1618 | BIF 2 | CTD 011 | SPM |
| 06/09/05 | 1635 | 73°40.21'N | 13°47.64'E | #30 | 1457 | 1630 | 1701 | 1730 | BIF 2 | MEGA 010 | 7 CORES |
| 06/09/05 | 1756 | 73°40.21'N | 13°47.63'E | #31 | 1457 | 1756 | 1823 | 1852 | BIF 2 | MEGA 011 | 8 CORES |
| 06/09/05 | 1909 | 73°40.21'N | 13°47.64'E | #32 | 1456 | 1911 | 1937 | 2008 | BIF 2 | MEGA 012 | 8 CORES |
| 06/09/05 | 2306 | 73°54.89'N | 15°04.47'E | #33 | 1311 | 2310 | 2337 | 0004 | BIF 1 | MEGA 013 | 8 CORES 1296 w/o |
| 07/09/05 | 0106 | 73°57.47'N | 15°34.97'E | #34 | 969 | 0113 | 0131 | 0152 | BIF 1 | MEGA 014 | 8 SHORT 957 w/o |
| 07/09/05 | 0205 | 73°57.47'N | 15°34.97'E | #35 | 969 | 1223 | 0240 | 0301 | BIF 1 | MEGA 015 | 8 SHORT 956 w/o |
| 07/09/05 | 0320 | 73°57.46'N | 15°34.96'E | #36 | 970 | 1322 | 0343 | 0409 | BIF 1 | MEGA 016 | 4 tubes removed so 4 longer cores 956 w/o |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 07/09/05 | 0420 | 73°57.46'N | 15°34.96'E | #37 | 970 | 1421 | 0442 | 0506 | BIF 1 | MEGA 017 | 4 CORES 956 w/o |
| 07/09/05 | 0521 | 73°57.46'N | 15°34.96'E | #38 | 970 | 1524 | 0548 | 0618 | BIF 1 | CTD 012 | SPM |
| 07/09/05 | 0646 | 73°57.46'N | 15°34.96'E | #39 | 970 | 0646 | 0647 | 0653 | BIF 1 | CTD 013 | Ra (10m) |
| 07/09/05 | 0732 | 73°57.47'N | 15°34.97'E | #40 | 968 | 0732 | 0755 | 0812 | BIF 1 | CTD 014 | Ra (bottom) |
| 07/09/05 | 0839 | 73°57.47'N | 15°34.97'E | #41 | 967 | 0841 | 0854 | 0906 | BIF 1 | CTD 015 | Ra (500m) |
| 07/09/05 | 0932 | 73°57.47'N | 15°34.96'E | #42 | 970 | 0934 | 0954 | 1018 | BIF 1 | CTD 016 | Pb / Po |
| 07/09/05 | 1033 | 73°57.47'N | 15°34.96'E | #43 | 969 | 1035 | 1056 | 1124 | BIF 1 | CTD 017 | Nutrients |
| 08/09/05 | 0525 | 77°04.48'N | 19°23.66'E | #44 | NO PROFILE HERE | | | | WSS 0 | CTD 018 | Hydraulic Fluid Leak |
| 08/09/05 | 0948 | 76°48.22'N | 18°08.17'E | #45 | 207 | 0954 | 1006 | 1016 | WSS 0* | CTD 019 | Nutrients etc |
| 08/09/05 | 1029 | 76°48.22'N | 18°08.19'E | #46 | 206 | 1031 | 1039 | 1039 | WSS 0* | MEGA 018 | 4 CORES /4 |
| 08/09/05 | 1600 | 76°28.11'N | 15°44.88'E | #47 | 104 | 1605 | 1612 | 1622 | WSS 1 | CTD 020 | Strong current |
| 08/09/05 | 1647 | 76°27.98'N | 15°44.48'E | #48 | 104 | 1649 | 1635 | 1704 | WSS 1 | CTD 021 | Pb/Po |
| 08/09/05 | 1849 | 76°40.71'N | 14°55.32'E | #49 | 250 | 1852 | 1900 | 1906 | WSS 2 | CTD 022 | Profile |
| 08/09/05 | 2126 | 76°53.99'N | 13°49.81'E | #50 | 106 | 2132 | 2138 | 2142 | WSS 3 | CTD 023 | Profile |
| 08/09/05 | 2301 | 77°02.98'N | 13°23.44'E | #51 | 434 | 2301 | 2313 | 2332 | WSS 4 | CTD 024 | Nutrients and O2 |
| 09/09/05 | 0007 | 77°02.96'N | 13°22.70'E | #52 | 435 | 0010 | 0011 | 0014 | WSS 4 | CTD 025 | Ra shallow 5m |
| 09/09/05 | 0043 | 77°02.96'N | 13°22.67'E | #53 | 436 | 0044 | 0051 | 0057 | WSS 4 | CTD 026 | Ra mid 200m |
| 09/09/05 | 0123 | 77°02.96'N | 13°22.67'E | #54 | 434 | 0124 | 0134 | 0144 | WSS 4 | CTD 027 | Ra deep |
| 09/09/05 | 0211 | 77°02.96'N | 13°22.72'E | #55 | 437 | 0211 | 0220 | 0235 | WSS 4 | CTD 028 | Pb/Po 400m |
| 09/09/05 | 0300 | 77°02.96'N | 13°22.69'E | #56 | 443 | 0311 | 0313 | 0328 | WSS 4 | CTD 029 | SPM |
| 09/09/05 | 0340 | 77°02.96'N | 13°22.69'E | #57 | 443 | 0342 | 0354 | 0406 | WSS 4 | MEGA 019 | 430m |
| 09/09/05 | 1501 | 77°09.99'N | 13°08.84'E | #58 | 122 | 1505 | 1512 | 1517 | WSS 5 | CTD 030 | Profile |
| 09/09/05 | 1625 | 77°21.00'N | 12°52.70'E | #59 | 241 | 1631 | 1644 | 1651 | WSS 6 | CTD 031 | Profile |
| 09/09/05 | 1753 | 77°29.96'N | 12°30.12'E | #60 | 98 | 1756 | 1802 | 1807 | WSS 7 | CTD 032 | Profile |
| 09/09/05 | 1909 | 77°38.99'N | 12°07.05'E | #61 | 128 | 1916 | 1922 | 1936 | WSS 8c | CTD 033 | Nutrients/O2/$^{18}$O/SPM |
| 09/09/05 | 2005 | 77°39.02'N | 12°07.05'E | #62 | 127 | 2006 | 2010 | 2014 | WSS 8c | CTD 034 | Ra 10m |
| 09/09/05 | 2058 | 77°39.02'N | 12°07.05'E | #63 | 127 | 2057 | 2104 | 2110 | WSS 8c | CTD 035 | Ra bottom |
| 09/09/05 | 2144 | 77°39.00'N | 12°07.01'E | #64 | 127 | 2146 | 2150 | 2154 | WSS 8c | CTD 036 | Ra 50m |
| 09/09/05 | 2234 | 77°39.19'N | 12°07.21'E | #65 | 128 | 2235 | 2240 | 2248 | WSS 8c | CTD 037 | Pb/Po |
| 10/09/05 | 0125 | 77°48.06'N | 12°25.77'E | #66 | 47 | 0133 | 0137 | 0140 | WSS 8a1 | CTD 038 | Profile |
| 10/09/05 | 0220 | 77°45.97'N | 12°09.84'E | #67 | 54 | 0224 | 0225 | 0228 | WSS 8a2 | CTD 039 | Profile |
| 10/09/05 | 0315 | 77°43.49'N | 12°47.21'E | #68 | 107 | 0319 | 0327 | 0330 | WSS 8b1 | CTD 040 | Profile |
| 10/09/05 | 0400 | 77°41.68'N | 12°30.18'E | #69 | 108 | 0406 | 0412 | 0415 | WSS 8b2 | CTD 041 | Profile |
| 10/09/05 | 0510 | 77°37.69'N | 11°52.68'E | #70 | 145 | 0519 | 0529 | 0532 | WSS 8d | CTD 042 | Profile |
| 10/09/05 | 0600 | 77°36.34'N | 11°38.58'E | #71 | 204 | 0600 | 0608 | 0613 | WSS 8e | CTD 043 | Profile |
| 10/09/05 | 0645 | 77°34.66'N | 11°19.25'E | #72 | 307 | 0649 | 0658 | 0706 | WSS 8g | CTD 044 | Profile |
| 10/09/05 | 0725 | 77°34.17'N | 11°15.57'E | #73 | 335 | 0727 | 0738 | 0746 | WSS 8h | CTD 045 | Profile |
| 10/09/05 | 0825 | 77°33.06'N | 11°00.78'E | #74 | 482 | 0827 | 0840 | 0859 | WSS 8i | CTD 046 | SPM |
| 10/09/05 | 0918 | 77°33.02'N | 11°00.81'E | #75 | 486 | 0920 | 0937 | 0952 | WSS 8i | CTD 047 | Pb/Po |
| 10/09/05 | 1009 | 77°33.02'N | 11°00.89'E | #76 | 482 | 1010 | 1023 | 1041 | WSS 8i | CTD 048 | Nutrients |
| 11/09/05 | 2003 | 79°16.52'N | 01°42.94'E | #77 | 3207 | 2004 | - | 2014 | PL 1 | Plankton | Plankton |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12/09/05 | 0611 | 79°18.67'N | 02°00.37'E | #78 | 3147 | 0612 | ABORT | 0743 | PC 1 | Piston Core | Jessica Seamount |
| 12/09/05 | 1005 | 79°20.81'N | 02°11.80'E | #79 | 2674 | 1005 | 1206 | 1325 | PC 1 | Piston Core | Good pull out +3T |
| 12/09/05 | 1602 | 79°20.30'N | 01°49.50'E | #80 | 3402 | 1616 | 1735 | 1830 | PC 2 | Piston Core | Pull out +5T |
| 13/09/05 | 0445 | 79°18.02'N | 09°11.77'E | #81 | 170 | 0451 | 0459 | 0508 | WSS 14 | CTD 049 | Nutrients/$^{18}$O/bio SBE19 |
| 13/09/05 | 0823 | 78°58.43'N | 06°42.67'E | #82 | 1361 | 0849 | 0917 | 0945 | KF 4 | MEGA 020 | 1334m 5 cores |
| 13/09/05 | 2011 | 78°58.43'N | 06°42.66'E | #83 | 1361 | 1001 | 1028 | 1058 | KF 4 | MEGA 021 | 6 cores |
| 13/09/05 | 1120 | 78°58.43'N | 06°42.66'E | #84 | 1363 | 1120 | 1147 | 1216 | KF 4 | MEGA 022 | 1335 w/o 8 cores |
| 13/09/05 | 1232 | 78°58.43'N | 06°42.67'E | #85 | 1357 | 1239 | - | - | KF 4 | PROFILUR | DEPLOYED |
| 13/09/05 | 1316 | 78°58.39'N | 06°42.63'E | #86 | 1359 | 1318 | - | - | KF 4 | ELINOR | DEPLOYED |
| 13/09/05 | 1350 | 78°58.39'N | 06°42.64'E | #87 | 1362 | 1358 | 1400 | 1403 | KF 4 | CTD 050 | Ra 10m |
| 13/09/05 | 1440 | 78°58.39'N | 06°42.63'E | #88 | 1363 | 1441 | 1510 | 1534 | KF 4 | CTD 051 | Ra deep |
| 13/09/05 | 1609 | 78°58.39'N | 06°42.63'E | #89 | 1366 | 1611 | 1622 | 1633 | KF 4 | CTD 052 | Ra 500m |
| 13/09/05 | 1658 | 78°58.39'N | 06°42.65'E | #90 | 1365 | 1700 | 1725 | 1753 | KF 4 | CTD 053 | Pb/Po |
| 13/09/05 | 1812 | 78°58.39'N | 06°42.65'E | #91 | 1365 | 1813 | 1840 | 1912 | KF 4 | CTD 054 | SPM full profile |
| 13/09/05 | 1915 | 78°58.39'N | 06°42.65'E | #92 | 1365 | 1915 | - | 1924 | KF 4 | PL 2 | Plankton net |
| 13/09/05 | 1937 | 78°58.39'N | 06°42.62'E | #93 | 1364 | 1940 | 2006 | 2039 | KF 4 | CTD 055 | Nutrients |
| 14/09/05 | 0000 | 78°57.98'N | 09°23.93'E | #94 | 216 | 0002 | 0010 | 0021 | WSS 13 | CTD 056 | Nutrients |
| 14/09/05 | 0239 | 79°01.35'N | 10°41.48'E | #95 | 333 | 0242 | 0252 | 0303 | MC 2 | MEGA 023 | 4 heads used + SBE 19 |
| 14/09/05 | 0349 | 79°02.45'N | 11°02.92'E | #96 | 279 | 0349 | 0400 | 0412 | MC 6 | MEGA 024 | 4 heads used + SBE 19 |
| 14/09/05 | 0450 | 79°03.05'N | 11°21.88'E | #97 | 352 | 0455 | 0508 | 0522 | MC 3 | MEGA 025 | 1.2 t |
| 14/09/05 | 0550 | 79°00.75'N | 11°25.34'E | #98 | 359 | 0550 | 0607 | 0620 | MC 4 | MEGA 026 | 1.12 t |
| 14/09/05 | 0743 | 79°00.60'N | 11°23.34'E | #99 | 390 | 0751 | 0803 | 0814 | PC | Piston Core | |
| 14/09/05 | 1007 | 78°57.44'N | 11°49.37'E | #100 | 170 | - | 1007 | 1037 | S2b | MOORING | RECOVERED |
| 14/09/05 | 1113 | 78°57.65'N | 11°53.83'E | #101 | 358 | 1117 | 1126 | 1206 | PC | Piston Core | |
| 14/09/05 | 1513 | 78°58.59'N | 11°32.41'E | #102 | 110 | 1514 | 1521 | 1532 | XKF A | CTD 057 | New Station Names |
| 14/09/05 | 1551 | 78°58.68'N | 11°32.56'E | #103 | 235 | 1553 | 1602 | 1613 | XKF B | CTD 058 | Nutrients $^{18}$O Salinity |
| 14/09/05 | 1708 | 79°01.76'N | 11°48.86'E | #104 | 90 | 1711 | 1718 | 1726 | XKF C | CTD 059 | Nutrients $^{18}$O Salinity |
| 14/09/05 | 1746 | 79°01.36'N | 11°45.81'E | #105 | 202 | 1747 | 1756 | 1807 | XKF D | CTD 060 | Nutrients $^{18}$O Salinity |
| 14/09/05 | 1935 | 79°00.71'N | 11°42.36'E | #106 | 290 | 1940 | 1951 | 2004 | XKF E | CTD 061 | Nutrients |
| 14/09/05 | 2028 | 79°00.07'N | 11°39.17'E | #107 | 285 | 2030 | 2041 | 2050 | XKF F | CTD 062 | Nutrients $^{18}$O |
| 14/09/05 | 2110 | 79°59.40'N | 11°35.54'E | #108 | 293 | 2114 | 2122 | 2135 | XKF G | CTD 063 | Nutrients |
| 14/09/05 | 2156 | 78°58.82'N | 11°32.75'E | #109 | 318 | 2201 | 2212 | 2225 | XKF H | CTD 064 | Nutrients |
| 14/09/05 | 2257 | 78°58.82'N | 11°32.81'E | #110 | 319 | 2259 | 2308 | 2323 | XKF H | CTD 065 | SPM |
| 14/09/05 | 2352 | 78°58.82'N | 11°32.81'E | #111 | 317 | 2353 | 2354 | 2356 | XKF H | CTD 066 | Ra 10 |
| 15/09/05 | 0029 | 78°58.82'N | 11°32.81'E | #112 | 317 | 0030 | 0035 | 0041 | XKF H | CTD 067 | Ra 250 |
| 15/09/05 | 0115 | 78°58.82'N | 11°32.81'E | #113 | 317 | 0116 | 0119 | 0124 | XKF H | CTD 068 | Ra 150 |
| 15/09/05 | 0158 | 78°58.82'N | 11°32.81'E | #114 | 317 | 0200 | 0209 | 0221 | XKF H | CTD 069 | Pb |
| 15/09/05 | 0315 | 78°57.48'N | 11°54.38'E | #115 | 358 | 0318 | 0331 | 0344 | MC 1 | MEGA 027 | + SBE 19 |
| 15/09/05 | 0415 | 78°57.48'N | 11°54.38'E | #116 | 358 | 0415 | - | 0440 | MC 1 | MEGA 028 | Poor cores |
| 15/09/05 | 0500 | 78°57.48'N | 11°54.38'E | #117 | 358 | 0500 | 0514 | 0528 | MC 1 | MEGA 029 | |
| 15/09/05 | 0728 | 79°01.34'N | 11°41.61'E | #118 | 332 | 0728 | 0744 | 0754 | PC | Piston Core | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15/09/05 | 1123 | 79°01.21'N | 11°46.45'E | #119 | 220 | 1123 | 1248 | - | S3 | MOORING | DEPLOYMENT |
| 15/09/05 | 1956 | 79°11.95'N | 11°46.96'E | #120 | 374 | 2011 | 2020 | 2115 | PC 2 | Piston Core | |
| 15/09/05 | 2340 | 78°59.34'N | 11°46.06'E | #121 | 373 | 2345 | 2356 | 0008 | MC 5 | MEGA 030 | |
| 16/09/05 | 0042 | 79°01.18'N | 11°46.15'E | #122 | 217 | 0046 | 0056 | 0103 | mooring | CTD 070 | ~100m away Chl a |
| 16/09/05 | 0405 | 78°48.70'N | 09°38.14'E | #123 | 104 | 0412 | 0419 | 0427 | WSS 12 | CTD 071 | Nutrients |
| 16/09/05 | 0803 | 78°58.25'N | 06°42.05'E | #124 | 1360 | - | 0809 | 0830 | KF 4 | LANDER | Profilur recovered |
| 16/09/05 | 0850 | 78°58.25'N | 06°42.05'E | #125 | 1360 | - | 0852 | 0930 | KF 4 | LANDER | Elinor recovered |
| 16/09/05 | 1510 | 78°19.97'N | 10°37.73'E | #126 | 104 | 1516 | 1523 | 1532 | WSS 11 | CTD 072 | Nutrients / Bio |
| 16/09/05 | 1655 | 78°07.89'N | 11°06.69'E | #127 | 223 | 1658 | 1706 | 1716 | WSS 10 | CTD 073 | Nutrients |
| 16/09/05 | 1729 | 78°07.89'N | 11°06.69'E | #128 | 223 | 1731 | 1739 | 1749 | WSS 10 | CTD 074 | SPM |
| 18/09/05 | 2046 | 68°37.78'N | 07°32.71'E | #129 | 2940 | 2047 | 2140 | 2239 | VP 5 | CTD 075 | Nutrients / Bio |
| 18/09/05 | 2258 | 68°37.56'N | 04°35.69'E | #130 | 2921 | 2301 | 2359 | 0124 | VP 5 | MEGA 031 | 6 Cores |
| 18/09/05 | 0143 | 68°37.54'N | 04°35.81'E | #131 | 2924 | 0147 | 0236 | 0330 | VP 5 | MEGA 032 | 5 Cores |
| 18/09/05 | 0350 | 68°37.53'N | 04°35.81'E | #132 | 2918 | 0350 | 0439 | 0525 | VP 5 | MEGA 033 | 7 Cores |
| 19/09/05 | 0914 | 68°02.02'N | 05°13.64'E | #133 | 1423 | 0920 | 0950 | 1014 | VP 2a | MEGA 034 | BIO (1401) 8 Cores |
| 19/09/05 | 1030 | 68°02.01'N | 05°13.64'E | #134 | 1418 | 1031 | 1058 | 1126 | VP 2a | MEGA 035 | BIO 8 Cores |
| 19/09/05 | 1141 | 68°02.02'N | 05°13.63'E | #135 | 1424 | 1142 | 1208 | 1235 | VP 2a | MEGA 036 | 1401 w/o 7.5 Cores |
| 19/09/05 | 1247 | 68°02.02'N | 05°13.64'E | #136 | 1424 | 1249 | 1315 | 1342 | VP 2a | MEGA 037 | 7 Cores |
| 19/09/05 | 1350 | 68°02.02'N | 05°13.64'E | #137 | 1423 | 1405 | 1431 | 1458 | VP 2a | MEGA 038 | |
| 19/09/05 | 1514 | 68°02.02'N | 05°13.64'E | #138 | 1423 | 1517 | 1545 | 1617 | VP 2a | CTD 076 | Nutrients/SPM |
| 19/09/05 | 1701 | 68°02.02'N | 05°13.64'E | #139 | 1420 | 1704 | 1731 | 1806 | VP 2a | CTD 077 | Po/Pb (bottle problems) |

## Physical Measurements

Finlo Cottier, Paul Provost, Emily Venables & Colin Griffiths

CTD

The BAS SeaBird (SBE) 9/11+ CTD was used for station-based profiling of the water column on JR127. The BAS SBE 9/11+ system consisted of twin pumped temperature and conductivity sensors, a pressure transducer and a SBE 32 twelve-position carousel water sampler, with each position having a 10 litre OTE bottle. An altimeter, a transmissometer, a fluorometer, a photosynthetically active radiation (PAR) sensor and oxygen sensor were also mounted to the system. Details of the sensor types, serial numbers and calibration dates are given in Table 1. The BAS SBE35 deep ocean standards thermometer was also attached to the CTD. The sampling rate was 24 Hz.

The CTD package was deployed from the midships gantry and hauled/veered on the CTD/hydro winch. The BAS conducting swivel was used. The general procedure was to power up the deck unit prior to deployment and commence logging, then lower the package to about 10 metres depth, where it was left to soak for ~2 minutes. The pumps are saltwater activated after 60 seconds using a conductivity switch, and so do not operate until the CTD is in seawater. With the word display on the deck unit set to "E", the least significant digit on the display denotes pumps active (1) or pumps inactive (0). The soaking ensures the pumps are running when the cast starts and that the CTD system has had some time to adjust to the water temperature from the atmospheric temperature. After soaking the CTD was brought to the surface, the winch wireout zeroed, and the CTD lowered to about 10 metres above the seabed using the altimeter to judge the approach. Winch speeds in the top 100m were 0.5 m/s, below that 1 m/s.

Calibration samples for salinity, oxygen and chlorophyll were taken during the cruise. Processing of the CTD data was performed using the Seasoft routines supplied by SeaBird. A batch files was written using the DOS based version 4.244 routines. The following set of routines were run to produce a bottle file and a downcast profile of 1m depth averaged values:-

DATCNV – run on both profiles to search for bottle firing ranges
ROSSUM – obtain bottle files
DATCNV – rerun on down profile skipping past the soak period
ALIGNCTD – not run, alignment performed by the hardware
CELLTM – Default values used
FILTER – prefilter pressure channel ahead of Loopedit
LOOPEDIT – remove reversals in downcast profile
BINAVG – calculate 1m depth bins
DERIVE – derive salinity, density & potential temperature
ASCIIOUT – output in user friendly ASCII format for plotting

Calibrations were obtained for both salinity and oxygen. The temperature sensors were both in excellent agreement with the reference thermometer.
The fluorometer will be calibrated once the Chlorophyll samples are worked up.

# JR127 CTD Log

| Date | Time (GMT) | Latitude | Longitude | Event | Depth (m) | I/W (GMT) | Bottom (GMT) | O/W (GMT) | Station | CTD No | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 31/08/05 | 1247 | 65°56.23'N | 00°16.82'E | #1 | 3074 | 1251 | 1300 | 1307 | TEST | CTD 001 | SHAKEDOWN (200m) |
| 02/09/05 | 1136 | 70°29.82'N | 03°57.11'E | #10 | 3212 | 1136 | 1235 | 1347 | BIF 6 | CTD 002 | Full Depth |
| 02/09/05 | 1501 | 70°29.83'N | 03°57.11'E | #11 | 3212 | 1507 | 1520 | 1534 | BIF 6 | CTD 003 | 750m max depth |
| 02/09/05 | 1606 | 70°29.83'N | 03°57.11'E | #12 | 3212 | 1609 | 1610 | 1615 | BIF 6 | CTD 004 | 11m |
| 02/09/05 | 1820 | 70°29.92'N | 04°00.15'E | #15 | 3213 | 1820 | 1916 | 2008 | BIF 6 | CTD 005 | 3000m |
| 02/09/05 | 2047 | 70°29.92'N | 04°00.15'E | #16 | 3211 | 2047 | 2142 | 2242 | BIF 6 | CTD 006 | 3000m |
| 02/09/05 | 2313 | 70°29.92'N | 04°00.15'E | #17 | 3211 | 2313 | 0006 | 0110 | BIF 6 | CTD 007 | Full Depth SPM 10m |
| 03/09/05 | 1041 | 71°37.97'N | 06°23.59'E | #19 | 2968 | 1052 | 1147 | 1250 | BIF 5 | CTD008 | 2923 w/o |
| 05/09/05 | 2200 | 72°09.86'N | 08°00.64'E | #26 | 2626 | 2205 | 2254 | 2349 | BIF 4 | CTD 009 | |
| 06/09/05 | 1317 | 73°40.21'N | 13°47.62'E | #28 | 1457 | 1317 | 1344 | 1421 | BIF 2 | CTD 010 | Nutrients, O2, dO2 |
| 06/09/05 | 1516 | 73°40.21'N | 13°47.63'E | #29 | 1457 | 1511 | 1544 | 1618 | BIF 2 | CTD 011 | SPM |
| 07/09/05 | 0521 | 73°57.46'N | 15°34.96'E | #38 | 970 | 1524 | 0548 | 0618 | BIF 1 | CTD 012 | SPM |
| 07/09/05 | 0646 | 73°57.46'N | 15°34.96'E | #39 | 970 | 0646 | 0647 | 0653 | BIF 1 | CTD 013 | Ra (10m) |
| 07/09/05 | 0732 | 73°57.47'N | 15°34.97'E | #40 | 968 | 0732 | 0755 | 0812 | BIF 1 | CTD 014 | Ra (bottom) |
| 07/09/05 | 0839 | 73°57.47'N | 15°34.97'E | #41 | 967 | 0841 | 0854 | 0906 | BIF 1 | CTD 015 | Ra (500m) |
| 07/09/05 | 0932 | 73°57.47'N | 15°34.96'E | #42 | 970 | 0934 | 0954 | 1018 | BIF 1 | CTD 016 | Pb / Po |
| 07/09/05 | 1033 | 73°57.47'N | 15°34.96'E | #43 | 969 | 1035 | 1056 | 1124 | BIF 1 | CTD 017 | Nutrients |
| 08/09/05 | 0525 | 77°04.48'N | 19°23.66'E | #44 | NO PROFILE HERE | | | | WSS 0 | CTD 018 | Hydraulic Fluid Leak |
| 08/09/05 | 0948 | 76°48.22'N | 18°08.17'E | #45 | 207 | 0954 | 1006 | 1016 | WSS 0* | CTD 019 | Nutrients etc |
| 08/09/05 | 1600 | 76°28.11'N | 15°44.88'E | #47 | 104 | 1605 | 1612 | 1622 | WSS 1 | CTD 020 | Strong current |
| 08/09/05 | 1647 | 76°27.98'N | 15°44.48'E | #48 | 104 | 1649 | 1635 | 1704 | WSS 1 | CTD 021 | Pb/Po |
| 08/09/05 | 1849 | 76°40.71'N | 14°55.32'E | #49 | 250 | 1852 | 1900 | 1906 | WSS 2 | CTD 022 | Profile |
| 08/09/05 | 2126 | 76°53.99'N | 13°49.81'E | #50 | 106 | 2132 | 2138 | 2142 | WSS 3 | CTD 023 | Profile |
| 08/09/05 | 2301 | 77°02.98'N | 13°23.44'E | #51 | 434 | 2301 | 2313 | 2332 | WSS 4 | CTD 024 | Nutrients and O2 |
| 09/09/05 | 0007 | 77°02.96'N | 13°22.70'E | #52 | 435 | 0010 | 0011 | 0014 | WSS 4 | CTD 025 | Ra shallow 5m |
| 09/09/05 | 0043 | 77°02.96'N | 13°22.67'E | #53 | 436 | 0044 | 0051 | 0057 | WSS 4 | CTD 026 | Ra mid 200m |
| 09/09/05 | 0123 | 77°02.96'N | 13°22.67'E | #54 | 434 | 0124 | 0134 | 0144 | WSS 4 | CTD 027 | Ra deep |
| 09/09/05 | 0211 | 77°02.96'N | 13°22.72'E | #55 | 437 | 0211 | 0220 | 0235 | WSS 4 | CTD 028 | Pb/Po 400m |
| 09/09/05 | 0300 | 77°02.96'N | 13°22.69'E | #56 | 443 | 0311 | 0313 | 0328 | WSS 4 | CTD 029 | SPM |
| 09/09/05 | 1501 | 77°09.99'N | 13°08.84'E | #58 | 122 | 1505 | 1512 | 1517 | WSS 5 | CTD 030 | Profile |
| 09/09/05 | 1625 | 77°21.00'N | 12°52.70'E | #59 | 241 | 1631 | 1644 | 1651 | WSS 6 | CTD 031 | Profile |
| 09/09/05 | 1753 | 77°29.96'N | 12°30.12'E | #60 | 98 | 1756 | 1802 | 1807 | WSS 7 | CTD 032 | Profile |
| 09/09/05 | 1909 | 77°38.99'N | 12°07.05'E | #61 | 128 | 1916 | 1922 | 1936 | WSS 8c | CTD 033 | Nutrients/O2/$^{18}$O/SPM |
| 09/09/05 | 2005 | 77°39.02'N | 12°07.05'E | #62 | 127 | 2006 | 2010 | 2014 | WSS 8c | CTD 034 | Ra 10m |
| 09/09/05 | 2058 | 77°39.02'N | 12°07.05'E | #63 | 127 | 2057 | 2104 | 2110 | WSS 8c | CTD 035 | Ra bottom |
| 09/09/05 | 2144 | 77°39.00'N | 12°07.01'E | #64 | 127 | 2146 | 2150 | 2154 | WSS 8c | CTD 036 | Ra 50m |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 09/09/05 | 2234 | 77°39.19'N | 12°07.21'E | #65 | 128 | 2235 | 2240 | 2248 | WSS 8c | CTD 037 | Pb/Po |
| 10/09/05 | 0125 | 77°48.06'N | 12°25.77'E | #66 | 47 | 0133 | 0137 | 0140 | WSS 8a1 | CTD 038 | Profile |
| 10/09/05 | 0220 | 77°45.97'N | 12°09.84'E | #67 | 54 | 0224 | 0225 | 0228 | WSS 8a2 | CTD 039 | Profile |
| 10/09/05 | 0315 | 77°43.49'N | 12°47.21'E | #68 | 107 | 0319 | 0327 | 0330 | WSS 8b1 | CTD 040 | Profile |
| 10/09/05 | 0400 | 77°41.68'N | 12°30.18'E | #69 | 108 | 0406 | 0412 | 0415 | WSS 8b2 | CTD 041 | Profile |
| 10/09/05 | 0510 | 77°37.69'N | 11°52.68'E | #70 | 145 | 0519 | 0529 | 0532 | WSS 8d | CTD 042 | Profile |
| 10/09/05 | 0600 | 77°36.34'N | 11°38.58'E | #71 | 204 | 0600 | 0608 | 0613 | WSS 8e | CTD 043 | Profile |
| 10/09/05 | 0645 | 77°34.66'N | 11°19.25'E | #72 | 307 | 0649 | 0658 | 0706 | WSS 8g | CTD 044 | Profile |
| 10/09/05 | 0725 | 77°34.17'N | 11°15.57'E | #73 | 335 | 0727 | 0738 | 0746 | WSS 8h | CTD 045 | Profile |
| 10/09/05 | 0825 | 77°33.06'N | 11°00.78'E | #74 | 482 | 0827 | 0840 | 0859 | WSS 8i | CTD 046 | SPM |
| 10/09/05 | 0918 | 77°33.02'N | 11°00.81'E | #75 | 486 | 0920 | 0937 | 0952 | WSS 8i | CTD 047 | Pb/Po |
| 10/09/05 | 1009 | 77°33.02'N | 11°00.89'E | #76 | 482 | 1010 | 1023 | 1041 | WSS 8i | CTD 048 | Nutrients |
| 13/09/05 | 0445 | 79°18.02'N | 09°11.77'E | #81 | 170 | 0451 | 0459 | 0508 | WSS 14 | CTD 049 | Nutrients/$^{18}$O/bio SBE19 |
| 13/09/05 | 1350 | 78°58.39'N | 06°42.64'E | #87 | 1362 | 1358 | 1400 | 1403 | KF 4 | CTD 050 | Ra 10m |
| 13/09/05 | 1440 | 78°58.39'N | 06°42.63'E | #88 | 1363 | 1441 | 1510 | 1534 | KF 4 | CTD 051 | Ra deep |
| 13/09/05 | 1609 | 78°58.39'N | 06°42.63'E | #89 | 1366 | 1611 | 1622 | 1633 | KF 4 | CTD 052 | Ra 500m |
| 13/09/05 | 1658 | 78°58.39'N | 06°42.65'E | #90 | 1365 | 1700 | 1725 | 1753 | KF 4 | CTD 053 | Pb/Po |
| 13/09/05 | 1812 | 78°58.39'N | 06°42.65'E | #91 | 1365 | 1813 | 1840 | 1912 | KF 4 | CTD 054 | SPM full profile |
| 13/09/05 | 1937 | 78°58.39'N | 06°42.62'E | #93 | 1364 | 1940 | 2006 | 2039 | KF 4 | CTD 055 | Nutrients |
| 14/09/05 | 0000 | 78°57.98'N | 09°23.93'E | #94 | 216 | 0002 | 0010 | 0021 | WSS 13 | CTD 056 | Nutrients |
| 14/09/05 | 1513 | 78°58.59'N | 11°32.41'E | #102 | 110 | 1514 | 1521 | 1532 | XKF A | CTD 057 | New Station Names |
| 14/09/05 | 1551 | 78°58.68'N | 11°32.56'E | #103 | 235 | 1553 | 1602 | 1613 | XKF B | CTD 058 | Nutrients $^{18}$O Salinity |
| 14/09/05 | 1708 | 79°01.76'N | 11°48.86'E | #104 | 90 | 1711 | 1718 | 1726 | XKF C | CTD 059 | Nutrients $^{18}$O Salinity |
| 14/09/05 | 1746 | 79°01.36'N | 11°45.81'E | #105 | 202 | 1747 | 1756 | 1807 | XKF D | CTD 060 | Nutrients $^{18}$O Salinity |
| 14/09/05 | 1935 | 79°00.71'N | 11°42.36'E | #106 | 290 | 1940 | 1951 | 2004 | XKF E | CTD 061 | Nutrients |
| 14/09/05 | 2028 | 79°00.07'N | 11°39.17'E | #107 | 285 | 2030 | 2041 | 2050 | XKF F | CTD 062 | Nutrients $^{18}$O |
| 14/09/05 | 2110 | 79°59.40'N | 11°35.54'E | #108 | 293 | 2114 | 2122 | 2135 | XKF G | CTD 063 | Nutrients |
| 14/09/05 | 2156 | 78°58.82'N | 11°32.75'E | #109 | 318 | 2201 | 2212 | 2225 | XKF H | CTD 064 | Nutrients |
| 14/09/05 | 2257 | 78°58.82'N | 11°32.81'E | #110 | 319 | 2259 | 2308 | 2323 | XKF H | CTD 065 | SPM |
| 14/09/05 | 2352 | 78°58.82'N | 11°32.81'E | #111 | 317 | 2353 | 2354 | 2356 | XKF H | CTD 066 | Ra 10 |
| 15/09/05 | 0029 | 78°58.82'N | 11°32.81'E | #112 | 317 | 0030 | 0035 | 0041 | XKF H | CTD 067 | Ra 250 |
| 15/09/05 | 0115 | 78°58.82'N | 11°32.81'E | #113 | 317 | 0116 | 0119 | 0124 | XKF H | CTD 068 | Ra 150 |
| 15/09/05 | 0158 | 78°58.82'N | 11°32.81'E | #114 | 317 | 0200 | 0209 | 0221 | XKF H | CTD 069 | Pb |
| 16/09/05 | 0042 | 79°01.18'N | 11°46.15'E | #122 | 217 | 0046 | 0056 | 0103 | mooring | CTD 070 | ~100m away Chl a |
| 16/09/05 | 0405 | 78°48.70'N | 09°38.14'E | #123 | 104 | 0412 | 0419 | 0427 | WSS 12 | CTD 071 | Nutrients |
| 16/09/05 | 1510 | 78°19.97'N | 10°37.73'E | #126 | 104 | 1516 | 1523 | 1532 | WSS 11 | CTD 072 | Nutrients / Bio |
| 16/09/05 | 1655 | 78°07.89'N | 11°06.69'E | #127 | 223 | 1658 | 1706 | 1716 | WSS 10 | CTD 073 | Nutrients |
| 16/09/05 | 1729 | 78°07.89'N | 11°06.69'E | #128 | 223 | 1731 | 1739 | 1749 | WSS 10 | CTD 074 | SPM |
| 18/09/05 | 2046 | 68°37.78'N | 07°32.71'E | #129 | 2940 | 2047 | 2140 | 2239 | VP 5 | CTD 075 | Nutrients / Bio |
| 19/09/05 | 1514 | 68°02.02'N | 05°13.64'E | #138 | 1423 | 1517 | 1545 | 1617 | VP 2a | CTD 076 | Nutrients/SPM |
| 19/09/05 | 1701 | 68°02.02'N | 05°13.64'E | #139 | 1420 | 1704 | 1731 | 1806 | VP 2a | CTD 077 | Po/Pb (bottle problems) |

Table 1 - BAS CTD SBE 9/11+ Sensor Configuration

| Instrument | Type | Serial Number | Calibration Date |
|---|---|---|---|
| Primary Temperature | SBE 3 plus | 03P4235 | 23-Jun-05 |
| Primary Conductivity | SBE 4C | 42222 | 23-Jun-05 |
| Secondary Temperature | SBE 3 plus | 03P2709 | 15-May-05 |
| Secondary Conductivity | SBE 4C | 42255 | 23-Jun-05 |
| Pressure Transducer | SBE 09P | 35716-0771(93686) | 15-Apr-04 |
| Thermometer | SBE35 | 0051 | 29-Apr-05 |
| Fluorometer | Chelsea Mk III Aquatracka | 88216 | 21-Jun-04 |
| Transmissometer | Wet Labs C-Star | CST-846DR | 05-Jul-01 |
| PAR sensor | Biospherical Inc., QCD905L | 7235 | 18-Jun-01 |
| Oxygen sensor | SBE43 | 0242 | 31-May-05 |

Acoustic Doppler Current Profiler (ADCP)

A recently installed 75 kHz ADCP unit was operated throughout most of the cruise. The instrument was commissioned on the previous cruise by an RDI engineer and ship staff to integrate the navigation streams. During installation, the unit was mis-aligned by 60.08 degrees. The operation of the unit was switched between bottom-track and water-track mode according to water depth. Initial post processing was done using VM-DAS. No detailed assessment of instrument performance was made during the cruise though additional information was obtained from D. Shoosmith and M. Meredith at BAS HQ. The only apparent problem with the instrument was the quality of the transformed data whilst the ship was on station with Dynamic Positioning giving unexpectedly large current magnitudes. Raw beam data, Long Term Average, Short Term Average and Navigation files were recorded for post-cruise processing.

Mooring Operations

Mooring Recovery
14 September 2005
Start 1035Z

A single point mooring had been deployed in August 2004 from the Norwegian research vessel Håkon Mosby. The acoustic release was fired and recovery was completed from the A-frame in good conditions. Three minilogs and a 300 kHz ADCP were recovered, all with good data. On 10 October 2004 the ADCP appeared to have reset itself to a default condition but continued to record data. Details of the mooring are given in the Table A.

Mooring Deployment
15 September 2005
Start 1250Z

A single point mooring with a multi-parameter array of instruments was deployed from the A-frame anchor first into 210 m water on the north side of Kongsfjorden. This mooring was primarily contracted by Norwegian Polar Institute in support of their MariClim project. Details of instrument arrangements are given in Table B. The mooring is due for recovery during spring/summer 2006 using Norwegian vessels.

Pre-deployment Tests:

Sediment Trap – Each unit was re-batteried and carousel and motors were run. A retaining pin was found to be missing which prevented the carousel from engaging with the motor. This was fitted and secured. The methodology for sediment trap sample preservation has been taken from JGOFS Protocols 1994. The method involves the use of formaldehyde (or the product Formaline, which is 40% formaldehyde). The sampling schedule for the sediment traps is given in Table C.

Fluorometers – Loggers and fluorometers were deployed and tested at SAMS on 10 August 2004. They were again tested for operation on the ship prior to deployment. All tests were good.

ADCP – The 300kHz unit recovered the previous day showed problems during set-up for redeployment. The cause could not be identified and so this instrument was not deployed.

Table A

## MOORING DESIGN SHEET

| | | | | | |
|---|---|---|---|---|---|
| **Mooring Location:** | Kongsfjorden Outer Basin | | | | |
| **Mooring ID:** | Deployment 5 | | | | |
| **Latitude:** | **78 57.443 N** | **Deployed:** | Date | Time (Z) | Ship |
| **Longitude:** | **011 49.365 E** | | 23 August 2004 | 02:00 | Hakon Mosby |
| **Water Depth (m):** | **170** | | | | |
| | | **Recovered:** | Date | Time (Z) | Ship |
| **Mooring Length (m):** | 133 | | 14 September 2005 | 10:07 | JCR (JR127) |
| **Distance to Surface (m):** | 37 | | | | |

SCOTTISH ASSOCIATION for MARINE SCIENCE

| Hardware | Instrument | S/N | Parameters | Length | HAB | Depth | ΔT | Duration | Start | | Stop | | Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Date | Time (Z) | Date | Time (Z) | |
| 40' S-S Sphere | | | | 1 | 132 | 38 | | | | | | | |
| LL Chain | | | | 3 | 129 | 41 | | | | | | | |
| Wire (50m part 2) | | | | 30 | 99 | 71 | | | | | | | |
| | Minilog | 5234 | T | 0 | 99 | 71 | 60 | | 22-Aug-04 | 23:00 | 14-Sep-05 | 11:00 | ✓ |
| Wire (50m part 1) | | | | 20 | 79 | 91 | | | | | | | |
| Wire | | | | 20 | 59 | 111 | | | | | | | |
| | Minilog | 5233 | T | 0 | 59 | 111 | 60 | | 22-Aug-04 | 23:00 | 14-Sep-05 | 11:00 | ✓ |
| Wire | | | | 20 | 39 | 131 | | | | | | | |
| | ADCP (300kHz) | 1032 | UVW | 1 | 38 | 132 | 20 | | 23-Aug-04 | 06:00 | 14-Sep-05 | 06:00 | 2 Files |
| Wire (30m part 2) | | | | 25 | 13 | 157 | | | | | | | |
| | Minilog | 5232 | T | | 13 | 157 | 60 | | 22-Aug-04 | 23:00 | 14-Sep-05 | 11:00 | ✓ |
| Wire (30m part 1) | | | | 5 | 8 | 162 | | | | | | | |
| | Acoustic release | 226 | | 1 | 7 | 163 | | | | | | | |
| LL Chain | | | | 7 | 0 | 170 | | | | | | | |
| Anchor clump | | | | 0 | 0 | 170 | | | | | | | |

Table B Overleaf

## MOORING DESIGN SHEET

SCOTTISH ASSOCIATION for MARINE SCIENCE

| | | | | | |
|---|---|---|---|---|---|
| **Mooring Location:** | Kongsfjorden Outer Basin | | | | |
| **Mooring ID:** | MariClim 1 | | | | |
| **Latitude:** | **79 01.2095 N** | **Deployed** | Date | Time (Z) | Ship |
| **Longitude:** | **011 46.4537 E** | | 15 September 2005 | 12:50 | JCR (JR127) |
| **Water Depth (m):** | **210** | | | | |
| | | **Recovered** | Date | Time (Z) | Ship |
| **Mooring Length (m):** | 186.5 | | | | |
| **Distance to Surface (m):** | 23.5 | | | | |

| Hardware | Instrument | S/N | Parameters | Length | HAB | Depth | ΔT | Duration | Start | | Stop | | Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Date | Time (Z) | Date | Time (Z) | |
| Pellets | | | | 0 | 186.5 | 23.5 | | | | | | | |
| | Minilog | 7324 | TP | 0 | 186.5 | 23.5 | 16 | 364 d | 14-Sep-05 | 00:00 | | | |
| Pick-up Line | | | | 5 | 181.5 | 28.5 | | | | | | | |
| 40' S-S Sphere | | | | 1 | 180.5 | 29.5 | | | | | | | |
| Chain | | | | 1.5 | 179 | 31 | | | | | | | |
| | S4 | 1264 | UV | 1 | 178 | 32 | 60 | | 15-Sep-05 | 08:00 | | | |
| | Minilog | 5232 | T | 0 | 178 | 32 | 45 | 341 d | 14-Sep-05 | 00:00 | | | |
| | Fluorometer | | TFP | 1 | 177 | 33 | 360 | | 15-Sep-05 | 03:00 | | | |
| | MicroCat | 1124 | TSP | 0 | 177 | 33 | 12 | | 14-Sep-05 | 00:00 | | | |
| Wire (30m part 3) | | | | 12 | 165 | 45 | | | | | | | |
| | Minilog | 7326 | T | 0 | 165 | 45 | 12 | 364 d | 14-Sep-05 | 00:00 | | | |
| Wire (30m part 2) | | | | 10 | 155 | 55 | | | | | | | |
| | Minilog | 7329 | T | 0 | 155 | 55 | 12 | 364 d | 14-Sep-05 | 00:00 | | | |
| Wire (30m part 1) | | | | 7 | 148 | 62 | | | | | | | |
| | Minilog | 7325 | T | 0 | 148 | 62 | 16 | 364 d | 14-Sep-05 | 00:00 | | | |
| | Fluorometer | | TFP | 1 | 147 | 63 | 360 | | 15-Sep-05 | 03:00 | | | |
| Wire (50m part 4) | | | | 9 | 138 | 72 | | | | | | | |
| | Minilog | 7331 | T | 0 | 138 | 72 | 12 | 364 d | 14-Sep-05 | 00:00 | | | |
| Wire (50m part 3) | | | | 10 | 128 | 82 | | | | | | | |
| | Minilog | 7335 | T | 0 | 128 | 82 | 12 | 364 d | 14-Sep-05 | 00:00 | | | |
| Wire (50m part 2) | | | | 20 | 108 | 102 | | | | | | | |
| | MicroCat | 2166 | STP | 0 | 108 | 102 | 12 | | 14-Sep-05 | 00:00 | | | |
| Wire (50m part 1) | | | | 10 | 98 | 112 | | | | | | | |
| | S4 | 1473 | UV | 1 | 97 | 113 | 60 | | 15-Sep-05 | 08:00 | | | |
| Chain | | | | 1 | 96 | 114 | | | | | | | |
| Sed Frame (upper) | | | | 1 | 95 | 115 | | | | | | | |
| | Minilog | 8956 | T | 0 | 95 | 115 | 45 | 341 d | 14-Sep-05 | 00:00 | | | |
| | Sed Trap | 11262-02 | | 0 | 95 | 115 | 1mth - 2wk | | | | | | |
| Sed Frame (lower) | | | | 2.5 | 92.5 | 117.5 | | | | | | | |
| Wire (40m part 2) | | | | 20 | 72.5 | 137.5 | | | | | | | |
| | Minilog | 7337 | T | 0 | 72.5 | 137.5 | 12 | 364 d | 14-Sep-05 | 00:00 | | | |
| Wire (40m part 1) | | | | 20 | 52.5 | 157.5 | | | | | | | |
| | Minilog | 2637 | TP | 0 | 52.5 | 157.5 | 60 | 341 d | 14-Sep-05 | 00:00 | | | |
| Buoyancy | | | | 2.5 | 50 | 160 | | | | | | | |
| Wire (20m part 2) | | | | 10 | 40 | 170 | | | | | | | |
| | Minilog | 1106 | T | 0 | 40 | 170 | 12 | 364 d | 14-Sep-05 | 00:00 | | | |
| Wire (20m part 1) | | | | 10 | 30 | 180 | | | | | | | |
| Sed Frame (upper) | | | | 1 | 29 | 181 | | | | | | | |
| | Minilog | 4793 | T | 0 | 29 | 181 | 60 | 341 d | 14-Sep-05 | 00:00 | | | |
| | Sed Trap | 11262-03 | | 0 | 29 | 181 | 1mth - 2wk | | | | | | |
| Sed Frame (lower) | | | | 2.5 | 26.5 | 183.5 | | | | | | | |
| Wire | | | | 20 | 6.5 | 203.5 | | | | | | | |
| | MicroCat | 1125 | STP | 0 | 6.5 | 203.5 | 12 | | 14-Sep-05 | 00:00 | | | |
| Chain | | | | 1.5 | 5 | 205 | | | | | | | |
| | Acoustic release | ???? | | 1 | 4 | 206 | N/A | N/A | N/A | N/A | | | |
| LL Chain | | | | 4 | 0 | 210 | | | | | | | |
| Anchor clump | | | | 0 | 0 | 210 | | | | | | | |

Table C

Sediment Trap Sampling Scheme for both Units as follows:-

| BOTTLE | DATE | TIME (Z) |
|---|---|---|
| 1 | 09/16/2005 | 00:00:00 |
| 2 | 10/16/2005 | 00:00:00 |
| 3 | 11/16/2005 | 00:00:00 |
| 4 | 12/16/2005 | 00:00:00 |
| 5 | 01/16/2006 | 00:00:00 |
| 6 | 02/16/2006 | 00:00:00 |
| 7 | 03/16/2006 | 00:00:00 |
| 8 | 03/23/2006 | 00:00:00 |
| 9 | 03/30/2006 | 00:00:00 |
| 10 | 04/06/2006 | 00:00:00 |
| 11 | 04/13/2006 | 00:00:00 |
| 12 | 04/20/2006 | 00:00:00 |
| 13 | 04/27/2006 | 00:00:00 |
| 14 | 05/03/2006 | 00:00:00 |
| 15 | 05/10/2006 | 00:00:00 |
| 16 | 05/17/2006 | 00:00:00 |
| 17 | 05/24/2006 | 00:00:00 |
| 18 | 05/31/2006 | 00:00:00 |
| 19 | 06/07/2006 | 00:00:00 |
| 20 | 06/13/2006 | 00:00:00 |
| 21 | 07/13/2006 | 00:00:00 |
| 22 | 08/13/2006 | 00:00:00 |

Meteorological Sensors

A suite of measurements were recorded during the cruise. The data was time stamped by the ships clock and recorded on the ships computing system.

Details of the suite of instruments used are listed below.

| Instrument | Make | Location |
|---|---|---|
| Digital Barometer | Vaisala PTB210 Classe B | Logger rack |
| Digital Barometer | Vaisala PTB210 Classe B | Logger rack |
| Air humidity and temperature | Rotronic MP103A-CG030-W4W 28552 023 | Foremast |
| Air humidity and temperature | Rotronic MP103A-CG030-W4W 18109 036 | Foremast |
| TIR sensor (pyranometer) | Kipp & Zonen SP LITE 011403 | Foremast |
| TIR sensor (pyranometer) | Kipp & Zonen SP LITE 032374 | Foremast |
| PAR sensor | Kipp & Zonen Quantum PAR LITE 010224 | Foremast |
| PAR sensor | Kipp & Zonen Quantum PAR LITE 030335 | Foremast |
| Ultrasonic Anemometer | Solent Meteorological | Foremast |

Oceanographic Sensors
The underway measurements consisted of a SBE 45 thermosalinograph (Ser No. 4524698-0018) and a fluorometer (Ser No 6456 RTX) connected to the ship's non-toxic pumped seawater supply. Calibration samples were taken for both Chl and salinity.

Simrad EA500 Bathymetric Echo Sounder
The Simrad EA500 echo sounder was run continually during the cruise. It soon became clear that there was interference with the swath/TOPAS systems. This problem is still being investigated and any data from this system must be treated with caution.

SCS Logging System

Instruments logged during JR127 were as follows:-

| Sensor name | levc credat names |
|---|---|
| Glonass | gps_glos |
| GPS-ADU | gps_ash |
| Trimble | gps_nmea |
| Anemometer | anemom |
| TSSHRP | tsshrp |
| Oceanlogger | oceanlog |
| Emlog | em_log |
| Dopperlog | dop_log |
| Simrad-ea500 | sim500 |
| Simrad-em120 | em120 |
| Winch | winch |
| Truewind-spd | |
| Truewind-dir | |
| Seatex | seatex |
| Minipack | Minipack |
| gyro | gyro |
| | Relmov |
| | bestnav |
| | Bestdrf |

## Acoustic Seabed Mapping, Piston Core and Ice Sampling

John A. Howe[1], Suzanne Cox[1], Charlie Wilson[1], Peter Morris[2], Kevin Smith[3] and Richard Phipps[3]

[1]Scottish Association for Marine Science, Oban, UK
[2]Consultant, Cambridge, UK
[3]UKORS, National Oceanography Centre, Southampton, UK

Objectives

These projects build on the work conducted on JR75 and aim to examine sediment pathways and the signal of climatic amelioration from high-latitude marine sediments using sediment texture and geochemistry. Utilising the high sedimentation rates of the Polar North Atlantic (3-100 cm/ky) climatic events can be detected at a high temporal resolution allowing the timing and onset of events such as deglaciation and its relationship to sediment supply and productivity to be examined. During this cruise opportunistic sampling of a seamount in the Fram Strait, could potentially reveal insights into the high-latitude depositional setting and sedimentation pathways on an active oceanic ridge in a gateway setting. Kongsfjord was also sampled and the multibeam bathymetry extended. The post-Little Ice Age basins, identified during JR75 in Krossfjord were also sampled. A 12m-long piston corer is used to obtained sediment records spanning that least the last glacial-interglacial cycle. Core site selection involved a short acoustic survey (TOPAS and EM120 Multibeam) to identify key areas of current influenced sedimentation. Post-cruise analysis will entail sediment texture (laser Particle Size Analysis), microfaunal and geochemical (organic and inorganic) analysis.

Summary of Work

Specifically there were five main science aims of the cruise:

*Coring – Using UKORS 12m Piston Corer + Trigger Core & SAMS megacore*

(a) Coring depostional deep-water basins of current-influenced sedimentation (either: West Spitsbergen Current, East Greenland Current or Norwegian Sea Deep-Water) for evidence for records of thermohaline variability. The contourite sediments are deposited in regions with high background of ice-rafted debris (IRD). Sedimentation will be examined in the context of foraminifera and geochemistry. This aim was not met due to ice and weather conditions, however opportunistic sampling of the basins surrounding the Eistla seamount may prove fruitful with two cores consisting of fine-grained hemipelagites and turbdities (Figure 1) (see Table 1 for details)

(b) High-resolution records of Arctic environmental change from fjordic and shelf sediments. This objective was fully met, including a core from the Little Ice Age delta in Krossfjorden.

(c) Kongsfjord water and sediment samples for isotopic signatures and modern benthic foraminifera assemblages. This objective was fully met with extensive sediment and ice samples from the fjordic (see Tables 2 and 3)

*Seabed Mapping – Using JCR EM120 Multibeam and TOPAS systems*

(d) Continuation of the Kongsfjord & surrounding shelf multibeam survey. Extend existing survey (JR75 2002) onto shelf and complete the southern margins of the outer fjord (west of Ny Alesund). This objective was partially achieved with the Kongsfjord survey completed but the surrounding shelf only partially surveying due to weather conditions.

(e) Continuation of the Svalbard Shelf and Molloy Deep survey – extending onto the Fram Strait survey of 2002. This survey was fully met with the region surrounding the Eistla seamount fully surveyed, complementing the AWI 1987 survey.

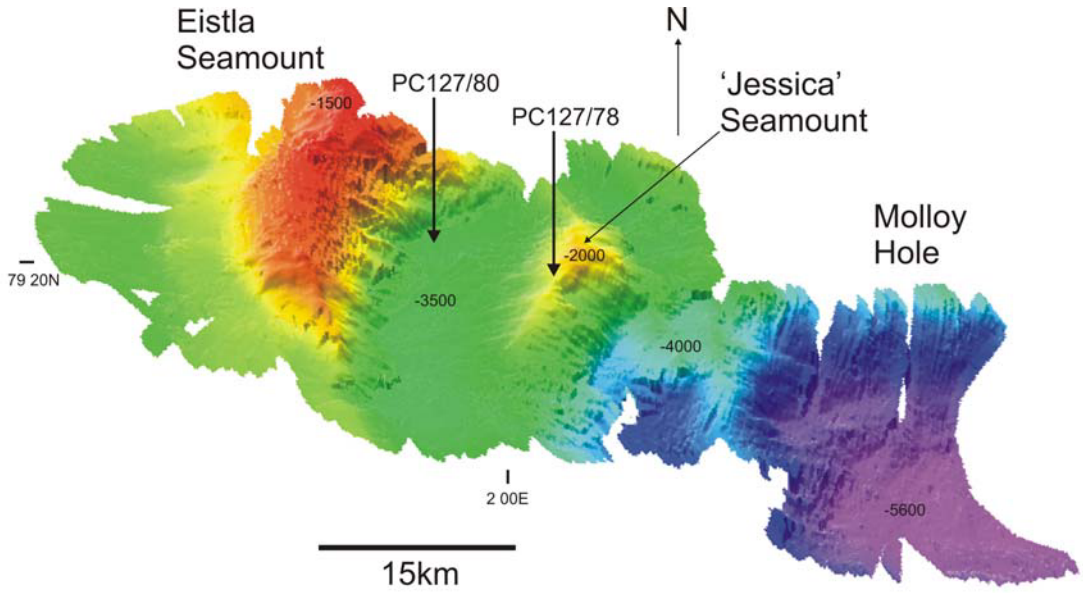



Figure 1: Sun-illuminated multibeam bathymetry, viewed from the south, of the basin to the east of the Eistla seamount, Molloy Ridge, Fram Strait. The basin is bounded at its eastern extent by a small un-named feature, informally termed the 'Jessica' seamount. Location of the two piston cores, 78 and 80 is also indicated.

National Oceanography Centre – Coring Equipment

The equipment supplied for coring by NOC consisted of two separate systems. These were nominally as follows:-

(a) The Nioz box corer
(b) The "Driscol" type piston corer.

**Piston Core Stations**

Core samples were obtained at six stations using the UKORS standard 'Driscol' piston coring suite with trigger core (see Table 1). The corer uses a 1400kg bomb with either a 9m or a 12m long, steel barrel, in 3m bolted sections. Within the barrels are polycarbonate liner inside which runs the piston and wire. The corer is deployed from the starboard main gantry using the UKORS piston core bucket and two winches. The rate of descent was controlled by the winchman at about 60m/min until 100m above the seabed, where the corer was stabilised before being run in at about 20m/min. Freefall and trigger lengths were calculated using the "Driscol" formula for the indicated barrel lengths. Some adjustment was made to these lengths to increase the core length obtained. Once inboard the barrels were unbolted, core cutter and catcher were removed and the polycarbonate liner pushed out of the barrel in 3m sections and capped. The core was then measured and sliced on deck into 1m sections. Following sectioning, the complete core was passed through a Bartington MS2 magnetic susceptibility loop in the ships' wet lab prior to splitting at 2cm resolution. Splitting was achieved on deck using a router and cheese wire. Once split the cores were logged.
Sample recovery was very good and varied between 6.37-10.78m, depending on the sediment type and barrel length. Some core top loss and compaction is possible at the softer sediment sites (e.g. Kongsfjord). Gas was also a problem at the fjodic stations, the core caps being pushed off by the expanding sediment from escaping hydrogen sulphide gas. Rigging and derigging the corer was conducted very smoothly, sometimes under very trying weather conditions. An experience of an unusual nature involved the use of this equipment within the ice fields to the north of Spitzbergen. The main problem being the build up of ice on the core barrels and collars. The ice formed a "skin" on the components,

externally and internally, approximately 8mm thick this obviously had to be removed before construction of the individual components of the corer and did cause some delay. Sized plastic end caps fitted to these components should alleviate this problem. Another problem encountered occurred on recovery of the equipment in the very low temperatures of the area. The piston barrels were washed with a high pressure water gun to remove mud deposits and allow removal of the collar grub screws. It was found that the collars and grub screws would freeze into place in a very short time and hinder removal. No mechanical problems arose during the deployments made with this equipment with no damage or loss being experienced.

NIOZ Box Corer.

The Nioz box corer was deployed only twice at a water depth of approximately 3200 metres. Both deployments were made with the corer fitted with a 500mm square bucket. The weight of the corer was reduced by the removal of three complete "paired rings" of lead weights. The depth of allowable penetration of the bucket was also reduced by 200mm on the central column of the corer.
Two full cores were recovered from the two deployments made. The corer functioned as expected without any problems or damage being encountered.

Table 1: Piston Core Samples

| Date & Time on Seabed | Event/ Core Number | Position | Water Depth | Recovery PC & TC | Barrel Length & Bomb Weight | Trigger Length & Free Fall Distance. | Sediment Type | Area & Comment |
|---|---|---|---|---|---|---|---|---|
| 12/9/05 12:06hrs | 127/78 | 79˚19.6388N 02˚ 08.9769E | 2713m | 6.37m PC + CC 0.67m TC + CC | 9m 1400kg | 14 m TL 4m FFD | Turbidites & hemipelagites | Molloy Ridge. NW flank of un-named seamount east of Eistla seamount. |
| 12/9/05 17:35hrs | 127/79 | 79˚ 20.2988N 01˚ 49.4968E | 3402m | 8.45m PC+CC 1.04m TC + CC | 9m 1400kg | 14m TL 4m FFD | Turbidites & minor slumps | Molloy Ridge Basin E. of Eistla seamount |
| 14/9/05 0803hrs | 127/99 | 79˚ 00.5988N 11˚ 23. 3374E | 388m | 6.87m PC + CC 0.38m TC + CC | 9m 1400kg | 14m TL 4m FFD | Organic, gas-rich muds | Kongsfjord Outer – deepest basin |
| 14/9/05 11:26hrs | 127/101 | 78˚ 57.6513N 11˚ 53.8299E | 356m | 10.78m PC + CC 0.45m TC + CC | 12m 1400kg | 18m TL 5.5m FFD | Organic, gas-rich muds | Kongsfjord Inner – off Ny Alesund |
| 15/9/05 07:44hrs | 127/118 | 79˚ 01.3397N 10˚ 41.6133E | 332m | 10.60m PC + CC 0.50m TC + CC | 12m 1400kg | 18m TL 5.5m FFD | Organic, gas-rich muds | Kongsfjordrenna, inner shelf |
| 15/9/05 20:20hrs | 127/120 | 79˚ 11.9493N 11˚ 46.9643E | 371m | 8.50m PC + CC 0.65m | 12m 1400kg | 18m TL 5.8m FFD | Gray sandy clays | Krossfjord liner imploded, some core |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | TC + CC | | | | loss |

Mega Cores

Obtaining undisturbed samples of surface-water interface is vital for quantifying and characterising the present day foraminiferal assemblage within Kongsfjorden. The second aim was to collect undisturbed sediment to calculate recent sedimentation rates. Two cores were taken at each site: one of which was extruded, sliced and bagged for subsequent geochemical analysis; from the second core the uppermost 5 cm was extruded, sliced and preserved in alcohol for the foraminiferal study (Table 2).

Table 2: Megacore samples

| Date & Time Recovery | SAMS Core Number | Position | Water Depth | Core Length Sampled | General Area | Comment |
|---|---|---|---|---|---|---|
| 14/9/05 03:03 hrs | MC127/95a/2 | 79 01.35 10 41.48 | 333 | 0.05 m | Kongsfjord, Svalbard Station 3 | Sliced |
| 14/9/05 03:03 hrs | MC127/95b/2 | 79 01.35 10 41.48 | 333 | 0.30 m | Kongsfjord, Svalbard Station 3 | Sliced |
| 14/9/05 04:12 hrs | MC127/96/6/1 | 79 02.449 11 02.926 | 279 | 0.05 m | Kongsfjord, Svalbard Kongsfjordrenna | Sliced |
| 14/9/05 04:12 hrs | MC127/96/6/2 | 79 02.449 11 02.926 | 279 | 0.30 m | Kongsfjord, Svalbard Kongsfjordrenna | Sliced |
| 14/9/05 05:22 hrs | MC127/97/3/1 | 79 03.046 11 21.881 | 352 | 0.05 m | Kongsfjord, Svalbard Station 2 | Sliced |
| 14/9/05 05:22 hrs | MC127/97/3/2 | 79 03.046 11 21.881 | 352 | 0.30 m | Kongsfjord, Svalbard Station 2 | Sliced |
| 14/9/05 06:20 hrs | MC127/98/4/1 | 79 00.750 11 25.343 | 359 | 0.05 m | Kongsfjord, Svalbard Fjord Mouth | Sliced |
| 14/9/05 06:20 hrs | MC127/98/4/2 | 79 00.750 11 25.343 | 359 | 0.30 m | Kongsfjord, Svalbard Fjord Mouth | Sliced |
| 15/9/05 03:47 hrs | MC127/115/1/1 | 78 57.481 11 54.380 | 358 | 0.05 m | Kongsfjord, Svalbard Station 1 | Sliced |
| 15/9/05 03:47 hrs | MC127/115/1/2 | 78 57.481 11 54.380 | 358 | 0.30 m | Kongsfjord, Svalbard Station 1 | Sliced |
| 15/9/05 23:56 hrs | MC127/121/5/1 | 78 59.339 11 46.064 | 373 | 0.05 m | Kongsfjord, Svalbard Outer basin | Sliced |
| 15/9/05 23:56 hrs | MC127/121/5/2 | 78 59.339 11 46.064 | 373 | 0.08m | Kongsfjord, Svalbard Outer basin | Sliced |

Small Boat Work

A small boat from the JCR was utilised for sampling the shallow inner fjord sites within Kongsfjorden. CTD profiles together with ice and water samples were collected in a transect from the glacier front out to the central basin of the fjord. The objective was to sample the plume water of Kronebreen glacier and glacial ice to characterise the glacial oxygen isotopic signatures present within the fjord environment (Table 3).

Table 3: Small boat work, CTD and ice sampling stations

| Date & Time | Position | Station Number | Water Depth | Activity | Sample Collected | General Area |
|---|---|---|---|---|---|---|
| 14/9/05 15:45 hrs | 78 89.03 12 48.12 | 1 | 77 | CTD | NIO Water samples at 2m, 37m, 75m | Kongsfjord, Svalbard Inner basin |
| 14/9/05 15:45 hrs | 78 89.03 12 48.12 | 1 | 77 | Ice Collection | Ice S1 | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:15 hrs | 78 89.07 12 48.72 | 2 | 88 | CTD | NIO Water samples at 2m, 45m, 85m | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:15 hrs | 78 89.07 12 48.72 | 2 | 88 | Ice Collection | Ice S2 | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:32 hrs | 78 89.28 12 46.49 | 3 | >50 | CTD | Surface Water Sample | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:32 hrs | 78 89.28 12 46.49 | 3 | >50 | Ice Collection | Ice S3 | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:40 hrs | 78 89.52 12 44.28 | 4 | >50 | CTD | Surface Water Sample | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:40 hrs | 78 89.52 12 44.28 | 4 | >50 | Ice Collection | Ice S4 | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:48 hrs | 78 89.65 12 41.92 | 5 | >50 | CTD | Surface Water Sample | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:48 hrs | 78 89.65 12 41.92 | 5 | >50 | Ice Collection | Ice S5 | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:57 hrs | 78 89.87 12 39.83 | 6 | >50 | CTD | Surface Water Sample | Kongsfjord, Svalbard Inner basin |
| 14/9/05 16:57 hrs | 78 89.87 12 39.83 | 6 | >50 | Ice Collection | Ice S6 | Kongsfjord, Svalbard Inner basin |
| 14/9/05 17:05 hrs | 78 90.09 12 37.81 | 7 | >50 | CTD | Surface Water Sample | Kongsfjord, Svalbard Inner basin |
| 14/9/05 17:05 hrs | 78 90.09 12 37.81 | 7 | >50 | Ice Collection | Ice S7 | Kongsfjord, Svalbard Inner basin |
| 14/9/05 17:15 hrs | 78 90.38 12 35.85 | 8 | 30 | CTD | Surface Water Sample | Kongsfjord, Svalbard Inner basin |
| 14/9/05 17:15 hrs | 78 90.38 12 35.85 | 8 | 30 | Ice Collection | Ice S8 | Kongsfjord, Svalbard Inner basin |
| 14/9/05 17:25 hrs | 78 90.58 12 33.55 | 9 | 10 | CTD | | Kongsfjord, Svalbard Inner basin sill |
| 14/9/05 17:25 hrs | 78 90.58 12 33.55 | 9 | 10 | Ice Collection | Ice S9 | Kongsfjord, Svalbard Inner basin sill |
| 14/9/05 17:35 hrs | 78 90.84 12 31.49 | 10 | 35 | CTD | Surface Water Sample | Kongsfjord, Svalbard Inner basin sill |
| 14/9/05 17:35 hrs | 78 90.84 12 31.49 | 10 | 35 | Ice Collection | Ice S10 | Kongsfjord, Svalbard Inner basin sill |
| 14/9/05 17:40 hrs | 78 91.09 12 29.35 | 11 | >50 | CTD | | Kongsfjord, Svalbard Central basin |
| 14/9/05 17:40 hrs | 78 91.09 12 29.35 | 11 | >50 | Ice Collection | Ice S11 | Kongsfjord, Svalbard Central basin |
| 14/9/05 | 78 91.31 | 12 | >50 | CTD | Surface Water | Kongsfjord, Svalbard |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17:47 hrs | 12 27.20 | | | | Sample | Central basin |
| 14/9/05<br>17:47 hrs | 78 91.31<br>12 27.20 | 12 | >50 | Ice<br>Collection | Ice S11 | Kongsfjord, Svalbard<br>Central basin |
| 14/9/05<br>17:47 hrs | 78 91.54<br>12 25.09 | 13 | >50 | CTD | | Kongsfjord, Svalbard<br>Central basin |
| 14/9/05<br>17:47 hrs | 78 91.54<br>12 25.09 | 13 | >50 | Ice<br>Collection | Ice S13 | Kongsfjord, Svalbard<br>Central basin |
| 14/9/05<br>17:53 hrs | 78 92.46<br>12 18.89 | 14 | 29 | CTD | Surface Water<br>Sample | Kongsfjord, Svalbard<br>Central basin |
| 14/9/05<br>17:53 hrs | 78 92.46<br>12 18.89 | 14 | 29 | Ice<br>Collection | Ice S14 | Kongsfjord, Svalbard<br>Central basin |
| 14/9/05<br>18:04 hrs | 78 93.28<br>12 12.52 | 15 | >50 | CTD | Surface Water<br>Sample | Kongsfjord, Svalbard<br>Central basin |
| 14/9/05<br>18:04 hrs | 78 93.28<br>12 12.52 | 15 | >50 | Ice<br>Collection | Ice S15 | Kongsfjord, Svalbard<br>Central basin |
| 14/9/05<br>18:14 hrs | 78 94.05<br>12 06.15 | 16 | >50 | CTD | Surface Water<br>Sample | Kongsfjord, Svalbard<br>Central basin |
| 14/9/05<br>18:14 hrs | 78 94.05<br>12 06.15 | 16 | >50 | Ice<br>Collection | Ice S16 | Kongsfjord, Svalbard<br>Central basin |

Acoustic Seabed Mapping

Seabed mapping was achieved using the RRS James Clark Ross EM120 multibeam system, running in parallel with the TOPAS sub-bottom profiling system (Table 4). These two systems provide detailed data of the seabed morphology (EM120 Multibeam) and the sediment geometry and acoustic character (TOPAS). Both systems were operated continuously throughout the cruise, with surveys conducted both underway and detailed surveying of each station prior to sampling. Overall, both systems worked well during the cruise.

Sub-Bottom Profiling using TOPAS

An updated version of TOPAS was supplied by BAS for the cruise, version 2.1.2, this was found to work very well using the settings stated below, as outlined in SAMS Cruise Report from JR75:

Sampling rates of 10kHz, trace length 400ms, file size 10MB. Swell OFF, dereverb OFF and stacking OFF.

*In deep-water (>1000m).* Chirp source, 15 ms pulse length, 1.5-5kHz, level 85%; bandpass filter settings 1400-1600/4900-5100 Hz. Manual triggering, generally 2000 msec. Gain 20-25 dB depending on water depth, seabed type and weather. Processing: filter ON, deconv ON (1pmm), TVG ON, scale 3000%.

*In shallow-water (<1000m).* Burst source, period 2, level 100%, secondary frequency 2800 Hz. SSU triggering, ping interval set to 0. Gain 10-20 dB depending on water depth, seabed type and weather. Processing: filter ON, AVC ON, scale 2000%.

EPC Chart recorder settings; TOPAS on channel A, 0.5 second sweep, 0 delay, threshold about 1/3 turn clockwise from minimum, trigger level 0, gain 10 (max), sweep direction left to right, print polarity +/- (centre setting). Takeup was left ON, scale lines ON, mark/annotate OFF, chart drive internal (centre setting), 100 LPI, contrast centre setting.

EM120 Multibeam seabed mapping

The EM120 multibeam system performed, on the whole, very well throughout the cruise. Seabed bathymetric maps could be produced within 20 minutes of a survey ending in some cases, this was especially important when the bridge needed core positions and sampling stations as soon as possible after a survey. Only in rougher weather and whilst turning did the system perform less well with drop-outs and spurious depth readings commonly encountered. Sound velocity profiles were gathered from the ship's CTD rather than using the EM120 sound velocity probe.

Sound velocity profiles used for converting swath data from time to depth can be derived in 3 main ways on the JCR

1. From running the sound velocity probe (SVP)
2. from an XBT record
3. from a CTD record

Velocities are usually derived from XBTs as these are quick and easy to run and do not involve stopping the ship. No XBTs were run on JR127 however

On JR127 the first velocity profile used was derived from an SVP run made on the previous cruise in the Rockall trough area. When new velocities were required, and as no CTDs were planned for some time, we attempted to use some old velocity profiles obtained on the 2002 Arctic cruise (JR75). When these were loaded into the EM120 the machine hung with no pings occurring. On reloading the SVP velocity profile pinging resumed normally.

After some experimentation it became obvious that all the old XBT derived velocity profiles which had been used on earlier cruises seemed to have too many points (~900). On changing the number of points value in the velocity profile header to 500 and reloading it the EM120 pinged, but rather infrequently. With the number of points set to 300 the instrument pinged normally. As a new version of the EM120 operating system had just been loaded on the previous cruise it seems possible that the way in which velocities are handled has changed.

Later in the cruise, when CTDs started to be run, sound velocity profiles were calculated from these as appropriate . There is a new EM120 menu which allows velocity profiles from CDTs to be pulled in over the network rather than resorting to transfer on floppies via the Neptune machine. This did not seem to work with the available CTD datafiles leading to the suspicion that a further, undocumented formatting step is required between acquisition and uploading. In the event it proved that a simple alternative was to take the ascii CDT file and use a text editor to chop out everything except the depth and sound velocity columns and add a suitable header and a few tailing values down to 12000m. After this the file could be ftp'd directly into the shared directory of the em120 computer ready for use. Once again it was found that if more than about 300 points were used the EM120 hung.

**NEPTUNE Hints**
A check list for simple swath editing

***In the main Neptune window***

Select the lines you want to edit either by clicking on them on the screen or by using **edit - selections**
Draw a Box round the selected lines using **edit -blocks - create single block**
Select this box so that it turns yellow
Click **processing - data cleaning** The Binstat window should appear containing the lines to be edited

***In the Binstat window***

select **view - show/hide** then select points as pixels deselect cells (if ticked)
select **processing - create grid** - accept the grid value shown
select **processing rules - get global default** – (change this as required) – **apply - ok**
click with left mouse button somewhere on the displayed lines. A point should appear on the screen
select **processing - correlation plot**. The correlation plot window opens

In the Correlation plot window

Edit points ( draw invisible box using central mouse button and control key) round unwanted points. Selected points turn black

NB. You may prefer to use **auto on valid** rather than the default **auto on all**
Type a negative number of points , e.g. N = -20 if you want to move backwards

When editing is completed ( or at any time for that matter)

***In the Binstat window***

**save -ok**

To see your masterwork:

***In the main Neptune window***

Regrid the survey: **displays -create grid** on Main window
Display it: **displays-grid display**

**Table 4: JR127 EM120 Multibeam and Topas Survey Lines**

| Area | ***Date*** | Start Time | End Time | EM120 File Name | Topas File Name | Water Depth | Topas System | Sampling |
|---|---|---|---|---|---|---|---|---|
| Hebrides – Dumshaf Abyssal Plain | 29/08/05 – 01/09/05 | 1939 | 1259 | ***jr127a*** | 050829174717.raw to 050901105633.raw (incl) | 77-3516m | Chirp Burst | |
| Bear Island Fan | 01/09/05 – 07/09/05<br><br>17/09/05 – 18/09/05 | 1300<br><br>1606 | 0108<br><br>2012 | JR127_BIF | 050901105633.raw to 050906223737.raw (incl)<br><br>050917160637.raw to 050918201201.raw (incl) | 967 - 3231m | Burst Chirp | |
| West Svalbard Shelf | 07/09/05 – 10/09/05<br><br>16/09/05 – 17/09/05 | 1116<br><br>0548 | 0811<br><br>1605 | JR127_WSvalb | 050907113324.raw to 050910075103.raw (incl)<br><br>050916044601.raw to 050917141053.raw (incl) | 45 – 1051m<br><br>66 - 3461m | Burst Chirp | |
| Fram Strait | 10/09/05 – 11/09/05<br><br>12/09/05 – 14/09/05 | 1221<br><br>2220 | 0839<br><br>0229 | JR127_FramStrait<br><br>jr127_fram2 | 050910121840.raw to 050911080707.raw (incl)<br><br>050912220326.raw to 050914004137.raw (incl) | 356 - 5094m<br><br>204 - 5586m | Burst Chirp<br><br>Burst Chirp | |
| Molloy Ridge Survey | 11/09/05 – 12/09/05 | 0839 | 2220 | JR127_ATLA | 050911080707.raw – 050912220306.raw (incl) | 1682 - 5592m | Chirp | Piston Cores (PC127/78 & 127/79) Trigger Cores (TC127/78 & 127/79) |
| Kongsfjörd | 14/09/05 | 0310 | 0445 | JR127_Kongsfjord0 | 050914004137.raw – | 60 - | Burst | Piston Cores |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| renna, Kongs and Krossfjörd Survey | - 16/09/05 | | | 5 | 050916040130.raw (incl) | 536m | | (PC127/99, 127/101, 127/118 & 127/120) Trigger Cores (TC127/99, 127/101, 127/118 & 127/120) |
| Voring Plateau | 18/09/05 - 19/9/05 | 2021 | 1930 | jr127_voring | 050918201201.raw - | 3000-1200m | Chirp | |

## Coring report

Paul G. Provost

### *Coring apparatus*

Bowers and Connelly Mega corer
Core size 110x800mm (LxØ).

The mega corer was used to collect undisturbed surface sediment samples for biological, chemical and physical analyses.

The relatively shallow cores collected using the mega corer created an overlap of undisturbed sediment profiles in the top layers of the surface sediment that the UKORS piston corer was unable to provide due to the disturbance caused on penetration. The hydraulically damped action of the mega corer on sediment penetration is thought retain the very fine floc material and biota that can be lost from the sample caused by the turbulence at the sediment-seawater interface by other corers (for example, the box corer).

### *Method*

The mega corer was deployed from the vessel using the starboard midships gantry. The veer (drop) speed was between 60 - 65 m/min to approximately 50m above seabed. The winch was stopped for approximately 30 seconds for wire to settle and then dropped at 15-25 m/min into seabed. In very soft sediments, the corer was landed to the seabed at 10 m/min to minimise frame penetration into the sediment. Once the corer had landed onto the seabed, 10-15m of additional wire was paid out (depending on sea conditions) and the corer was allowed to rest on the seabed for 2 minutes to allow the hydraulic firing action of the corer to complete. The wire was then hauled to recover the corer. Therefore in total the corer sat for approximately 3 minutes on the seabed. The haul (recovery) speed was up to 65m/min.

At all of the MC sites in the Kongsfjord area a SeaBird SBE 19 hand held CTD was fitted vertically to the mega corer frame to measure the near-bed water characteristics for the sediment collected.

### *Results*

38 mega core deployments were made during the cruise. The corer was set up to collect from the maximum of 8 core tube positions at all the stations except MC2 where only 4 heads were used to increase sediment depth penetration. Every drop was successful producing acceptably undisturbed cores, although on some drops less than 8 acceptable cores were collected.

## Geochemistry

Eric Breuer and Susan McKinlay

Marine Geochemistry (sediment geochemistry)
The geochemistry objectives for JCR 127 were to obtain sediment solid phase samples for trace metals (TM), radionuclides (RN) and Chlorophyll a (Chl a) and pore water samples for nutrients, dissolved organic carbon (DOC), sulphide and TM. In addition to the above, we also utilized benthic in-situ sampling platforms (see Lander report). These results will then be combined with the benthic results to ascertain the role of the benthos in the burial efficiency of carbon and the resultant impact on the biogeochemical cycling of trace elements in the Arctic.

General aims:
The collection of 2 Megacore barrels for porewater extraction. Barrel 1) Extract porewater and divide into appropriate vials for the following analyses: TM and sulphide analysis. Barrel 2) Extract porewater and divide into appropriate vials for the following analyses: DOC and nutrient analysis.
Collection of a mega core for RN (210 Pb, 234 Th) and Chl a.
When possible collect a spare mega core for the analysis of solid phase metals.

Methodology

Megacorer

The Megacorer performed very well during the cruise:
No modifications other than varying the ballast load and number of tubes deployed were required to recover good quality cores from all sites sampled.

Bottom water oxygen concentrations
Bottom water oxygen concentrations were obtained from all sites cored by using either one of the following or a combination of the three: water collected from megacore overlying water, mini niskin bottles attached to the landers and from normal niskins attached to the CTD (see Nickell and Harvey report for more details).

Sediment geochemistry
111 cm diameter cores (megacores) were collected with little to no disturbance to the sediment water interface by using a Bowers and Connelly megacorer. Once collected, cores for metal, chl a and radionuclides were sectioned at 0.5 cm intervals to a depth of 10 cm, 1 cm intervals to 20 cm depth then 2 cm slices until the bottom of the core. For dissolved metal, sample slicing and centrifugation was performed under N2-atmosphere. Porewater DOC and nutrients were sliced at 0.5 cm until 2 cm, 1 cm until 10 cm the 2 cm slices until 20cm. See Table 1 for station details.

Note: Porewater nutrients were taken from the trace metal core at the initial station at the start of the cruise. However due to possible contamination leading to spurious nitrate peaks the nutrients were obtained from the DOC core for the remainder of the trip.

Table 1. Sample stations/event numbers

| Station/sampling | Location | Date | Event | Depth |
|---|---|---|---|---|
| BIF 6/#9 | 70° 29.83 N / 03° 57.11 E | 02/09/05 | 1 Megacore (PW-TM/NUTS)<br>1 Megacore (RN/Chl a)<br>1 Megacore (SP-TM)<br>1 Megacore (PW-DOC) | 3211m |
| BIF 5/#20 | 71° 37.97 N / 06° 23.71 E | 03/09/05 | 1 Megacore (SP-TM) | 2968m |
| BIF 2/#25 | 73° 40.79 N / 13° 48.28 E | 04/09/05 | 1 Megacore (PW-TM/NUTS)<br>1 Megacore (RN/Chl a)<br>1 Megacore (SP-TM)<br>1 Megacore (PW-DOC) | 1461m |
| BIF 1/#35,36 | 73° 57.47 N / | 07/09/05 | 1 Megacore (PW-TM/NUTS) | 970m |

| | | | | |
|---|---|---|---|---|
| | 15° 34.97 E | | 1 Megacore (RN/Chl a)<br>1 Megacore (SP-TM)<br>1 Megacore (PW-DOC) | |
| KF4/#82,84 | 78° 58.43 N /<br>06° 42.67 E | 13/09/05 | 1 Megacore (PW-TM/NUTS)<br>1 Megacore (RN/Chl a)<br>1 Megacore (SP-TM)<br>1 Megacore (PW-DOC) | 1361 m |
| VP 2/#133,134 | 68° 02.02 N /<br>05° 13.64 E | 19/09/05 | 1 Megacore (PW-TM/NUTS)<br>1 Megacore (RN/Chl a)<br>1 Megacore (SP-TM)<br>1 Megacore (PW-DOC) | 1423m |

Geochemical Core Inventory

Geochemical Core Processing Inventory BIF 6

Protocol: T-metal/nutrients/sulphides PW
Event: 9 Date: 02/09/05
Locality: 70° 29.83 N / 03° 57.11 E
Initial length: 30cm
Processed length: 40cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: DOC PW
Event: 9 Date: 02/09/05
Locality: 70° 29.83 N / 03° 57.11 E
Initial length: 30cm
Processed length: 20cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: RN/Chl a
Event: 9 Date: 02/09/05
Locality: 70° 29.83 N / 03° 57.11 E
Initial length: 30cm
Processed length: 20cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: Trace metal solid phase
Event: 9 Date: 02/09/05
Locality: 70° 29.83 N / 03° 57.11 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Geochemical Core Inventory BIF 5
Protocol: Trace metal solid phase
Event: 20 Date: 03/09/05
Locality: 71° 37.97 N / 06° 23.71 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Geochemical Core Inventory BIF 2

Protocol: T-metal/sulphides PW
Event: 25 Date: 04/09/05
Locality: 73° 40.79 N / 13° 48.28 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: DOC/nutrients PW
Event: 25 Date: 04/09/05
Locality: 73° 40.79 N / 13° 48.28 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: RN/Chl a
Event: 25 Date: 04/09/05
Locality: 73° 40.79 N / 13° 48.28 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: Trace metal solid phase
Event: 25 Date: 04/09/05
Locality: 73° 40.79 N / 13° 48.28 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Geochemical Core Inventory BIF 1

Protocol: T-metal/sulphides PW
Event: 35 Date: 07/09/05
Locality: 73° 57.47 N / 15° 34.97 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: DOC/nutrients PW
Event: 36 Date: 07/09/05
Locality: 73° 57.46 N / 15° 34.96 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: RN/Chl a
Event: 36 Date: 07/09/05
Locality: 73° 57.46 N / 15° 34.96 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Geochemical Core Inventory KF4

Protocol: T-metal/sulphides PW
Event: 82 Date: 13/09/05
Locality: 78° 58.43 N / 06° 42.67 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: DOC/nutrients PW
Event: 84 Date: 13/09/05
Locality: 78° 58.43 N / 06° 42.66 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: RN/Chl a
Event: 82 Date: 13/09/05
Locality: 78° 58.43 N / 06° 42.67 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Geochemical Core Inventory VP2

Protocol: T-metal/sulphides PW
Event: 133 Date: 19/09/05
Locality: 68° 02.02 N / 05° 13.64 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: DOC/nutrients PW
Event: 133 Date: 19/09/05
Locality: 68° 02.02 N / 05° 13.64 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: RN/Chl a
Event: 133 Date: 19/09/05
Locality: 68° 02.02 N / 05° 13.64 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

Protocol: Solid Phase trace metal core
Event: 134 Date: 19/09/05
Locality: 68° 02.01 N / 05° 13.64 E
Initial length: 30cm
Processed length: 30cm
Bottom water Temp: 0.5°C
Remarks/Core description:

## KC-Lander Operations

Eric Breuer & Saul Reynolds

Introduction

The KC-Lander is a modular benthic lander system that can be used either autonomously or moored. SAMS have two systems that can be set up with any of four different instrument configurations. The two configurations used on JCR 127 were:

Profilur: A system designed to measure oxygen, pH and sulphide concentrations within the sediment at very fine resolution (~ 25-100 um) using micro-electrodes. On JCR 127 we were using oxygen micro-electrodes only.

Elinor: A chamber incubation system for measuring oxygen, trace metal and nutrient fluxes over long deployments, using optodes and a syringe sampling unit. The system is also designed to retrieve a small box core. Further developments have been made to the Elinor chamber at SAMS to enable oxygen levels in the chamber to be maintained to those of the ambient water – an "oxystat" system.

The objectives of the cruise required the Profilur system to be deployed four times: at Bear Island Fan 3 times (3300 (BIF 6), 1400 (BIF 2) and 100m (BIF 1)) and Kongsfjord 1 time (1400m (KF4)) and the Elinor system to be deployed at the same 4 stations with the addition of 2 extra deployments to be made at KF4, all Elinor deployments were to use the "oxystat" system.

A summary of the lander configuration and the deployment and recovery times and positions for each deployment is given in Table 1

Pre-cruise preparation

Substantial developments and modifications to both the lander platform and the instrumentation were performed prior to this project.

The Elinor shovel system and syringe sampler were overhauled, including the strengthening of the shovel closure by inclusion of a spacer to pretension the spring. The Elinor chamber module was overhauled to rectify the problems experienced with the shovel hydraulics not working below 300m. A leaky bleed valve was identified and repaired. Further modifications were made to improve the bleeding /cocking system. However it wasn't possible to test the system in water deeper than 300m.
A second camera system was built for the landers to enable a camera to be permanently fitted to the Profilur and Elinor.
An oxystat system was developed for the Elinor chamber, enabling oxygen levels to be maintained close to the ambient level using a semi-permeable silicone membrane.
The ballast arrangement of the lander was re-designed to allow for deployments in the soft muds.
Hardware and software developments were made to enable the sediment surface to be detected on the Profilur system using a resistivity probe.
New control software was implemented, in collaboration with Unisense A/S, to remove bugs and improve functionality.
A new buoyancy frame was made and tested to a modified design allowing twin Oceano acoustic releases to be fitted.

Deck operations
All operations were effected by inclement weather. This weather caused delays and ultimately the cancelling of lander drops at BIF 1 (100m) and allowing enough time for only 1 deployment at KF4. All autonomous recoveries were made using the starboard midships crane with a few minor problems due to the inclement weather causing tangling of the pellet line and it catching on the masts or under the frame. It is thought that a swivel where the line attaches to the lander, or thicker line (14mm as opposed to 8mm?), might help. Special thanks must go to the JCR deck crew for their invaluable assistance during lander operations.

Autonomous mode

Ballast, buoyancy and releases
Autonomous mode was used at all stations. We started at the deepest station (BIF 6; 3300m) where we deployed the Profilur and worked back up the slope to deploy the Elinor at BIF 2 (1400m). We then proceeded to the Svalbard margin and deployed the Profilur and Elinor once at KF4.

The ballast used was a steel plate with a steel bin on top, filled with between 30 – 60kg of steel shot, depending on the instrument configuration and hold down force / descent speed required. This new ballast arrangement, which uses disposable steel foot plates rather than the original fixed aluminium feet, proved reliable, and not too difficult to rig. However altering the height of lander legs is a bit difficult once the ballast is fitted.

Buoyancy used was 17" Benthos glass spheres. These were tested to 3300m at the start of the cruise. Nine spheres were fitted to the Profilur frame plus one 10" pellet and 12 spheres fitted to the Elinor frame (3 lashed on) plus one 10" pellet.

Releases used were Oceano (RT861 and AR861 type) two each on the Elinor and Profilur system. The releases were all tested to 3300m at the start of the cruise.

Deployment and recovery
The lander was deployed and recovered over the starboard rail using the starboard mid-ships crane, and, during recovery, with the ship coming off the wind to put the lander in its lee. This proved successful, allowing the lander to be cleared away from the ship's side much further forward. Despite one or two knocks no significant damage was sustained. Two problems encountered were; 1) the release hook was stiff and difficult to operate which led to problems in smooth deployment. After the first drop it was decided to move to the "toggle" method of release. This entailed putting a double loop of the lifting strop over a tapered piece of wood, when the weight eased off the lander entering the water the wood was removed and the lander was then freefalling. Upon recovery we had difficulties with the pellet line. On two recoveries the pellet spheres got caught up in the masts once and under the lander on one occasion. This was a random event exacerbated by wind and wave conditions.
Equipment description and protocols

Profilur System
The Profilur system uses micro-electrodes to obtain high resolution oxygen profiles across the sediment-water interface. The instrumentation consists of a precision controlled motor rack on which is mounted a computer housing with the micro-electrodes attached to the bottom, spaced approx. 35mm apart. The system was fitted with 5 oxygen and 1 resistivity electrode for all deployments. After a period of around 3 hours on the bottom to allow the temperature to equalise and electrode signals to settle, the electrodes were moved to within a few cm of the sediment surface in a single step, and then driven into the sediment in steps of between 50 and 250 μm. The electrodes were left at each step for 10s prior to recording 3 measurements (at 1s sample interval). A temperature logger (Richard Brancker TR1050) is fitted to the frame about 0.5m above bottom to record water temperature at 10s intervals throughout the deployments.

Oxygen electrodes are miniaturised Clark-type micro-electrodes with tip diameters of around 25 μm. The electrodes were calibrated using a two point in-situ calibration. Water bottles on the lander were used to take samples of the overlying water to give the oxygen concentration using winkler titration. The zero oxygen point was taken from the asymptote of the electrode signal. As a back-up and to assess the stability of the electrodes, lab oxygen calibrations were done at the start and end of each station in the CT lab (set to the bottom water temperature) after the system had been left to stabilise for 2 hours or more. A 100% DO value was obtained from bubbling air through bottom water and then sodium-dithionite was added to remove all oxygen and obtain a zero point. A magnetic stirrer was only used once sodium-dithionite was added (for a minute or so), as the heat given off by the unit warms up the calibration water.

The resistivity probe was fitted 10mm or so below the oxygen electrode tips, to detect the sediment surface and trigger high resolution profiling.

The new camera system was used on the Profilur for deployments at BIF 6. This proved an invaluable tool in assessing the real position of the electrodes relative to the sediment, and in giving an idea of the overall surface topography and faunal activity. At the other sites the camera was moved onto the Elinor system.

Elinor system

The Elinor system consists of a PTFE coated titanium chamber which sits partially below the level of the lander feet and so is driven into the sediment as the frame lands on the seabed. The chamber is 30 x 30cm across, and the water column enclosed above the sediment is normally between 10 – 15cm, giving an overlying water volume of 9 – 13 l and a maximum core depth of around 20cm. The chamber is sealed at the top by a lid which is open during deployment and landing, in order to minimise the bow wave, and then falls closed when released by a computer controlled burnwire. A magnetic cruciform stirrer is used to mix the chamber water during the incubation, at a speed of 15 RPM. Fitted to the lid are two oxygen mini-electrodes and a pH mini-electrode which monitor conditions inside the chamber during the experiment. A third oxygen electrode is fitted to the computer to monitor ambient oxygen levels. A water sampling port is fitted to the lid, and water can be withdrawn from the chamber by a syringe sampling system controlled by the computer. There are 15 plastic syringes, nominally capable of taking 55ml each, three of which can be used to inject rather than withdraw if required. On withdrawing samples, chamber water is replaced by ambient bottom through a valve in the lid. A spring driven hydraulic shovel system is used to recover the sediment in the chamber at the end of the deployment. This is fired using a burnwire at the end of the incubation period which releases a hydraulic valve. The burnwire also triggers the closure of 3 small water bottles to provide bottom water for oxygen electrode calibrations. A temperature logger (Richard Brancker TR1050) is fitted to the frame about 0.5m above bottom to record water temperature at 10s intervals throughout the deployments. A camera can be fitted in various places around the frame, and was used at KF4 (at previous sites it was fitted to the Profilur).

Oxystat system
In addition to the above components, for this cruise an oxystat system was used. This consists of a rack of 40m of silicone tubing (0.125" id, 0.188" od, Cole Parmer 06411-64), which is permeable to oxygen, located on the frame outside the chamber. The chamber water is continuously circulated through this "gill" at 300ml/min using a Seabird SBE5T deep-sea pump. As the water passes through the tubing, oxygen diffuses from the ambient water across the tube wall and into the chamber water. Thus the oxygen level inside the chamber is maintained close to the ambient level.

Elinor experimental modes
The Elinor system was used in the following modes:
Mode 1 Oxystatted incubation with 13C labelled slurry injection for measurement of bioturbation.
Mode 2 Oxystatted incubation for trace metal fluxes.

Generic Elinor protocols
Water sampling Trace metal samples were collected using coils of PTFE tubing holding 30ml. Because the overall id is more constant with the coils, less flushing is required to ensure no mixing of the sample. These coils were connected to the chamber port and the syringes with lengths of Versilic silicone tubing (3mm id, 5mm od). All tubing and vials were acid washed and then primed with Milli-Q water prior to deployment.
Optodes An Aanderaa Oxygen optode (type 3830, with analogue adapter type 3966) was used to measure chamber oxygen concentrations. Oxygen measurements were made at 5 minute intervals throughout the deployment. Bottom water was collected and processed for DO using the winkler method (see Harvey oxygen protocols) for oxygen calibrations, and laboratory calibrations were also performed between most deployments (see Profilur description for calibration details).
Oxystat The gill was primed with Milli-Q water prior to deployment, and then ambient water was pumped through it for 5 minutes prior to the lid closing at start of incubation.

Volume The volume of overlying water can be calculated using a dilution method. We injected 60ml of 2M KBr solution a water sample was taken for bromide concentration analysis.

All deployments on both landers benefited from a camera system during this cruise.

Technical summary
This cruise was blessed with relatively few technical failures. What follows are a few notes on the various troubles experienced.

Profilur

Communication between the artica computer and the laptop occurred on our last drop (KF4). The error "floating point error" occurred for both the Profilur and the Elinor. Different laptops along with updated software were tried. Unfortunately the artica computer will have to be taken back and the data extracted there.

Elinor

The bowtech camera failed on the first deployment. After this we swapped over the bowtec camera that was on the profiler onto the Elinor. The camera will be taken back to the lab and fixed.
As with the profiler the communication between laptop and artica was experiencing difficulty. The first set of data from BIF 2 we were able to download but the optode data from KF4 we were not. We will take the artica back to SAMS and extract the data there.

Water sampler
New springs were used and consistently good water samples were obtained on every deployment (largely >50ml, always >40ml).

Lid closure
The video camera gives evidence that the lid may not have closed and sealed immediately at KF4. However we have valuable video footage which will enable us to pinpoint the exact sealing time.

Mud retrieval
The hydraulic shovel system was extensively overhauled prior to the cruise, and got good cores in the shallow sites. However on this cruise no mud was retrieved. The camera showed that the problem is likely to be a pressure effect as the shovel didn't close until after the lander left bottom. The system was checked over and all air was bled from the system. However despite all efforts no mud was recovered. The problem is certainly not due to air in the system as throughout the cruise the system was carefully bled and checked for air. Thus the problem must be something to do with pressure or temperature on the hydraulic system, and needs further investigation. Note that the problem is not due to mud type, as at KF4 the shovel didn't even close as far as the sediment surface before stopping.

Optodes

An Aanderaa optode was fitted (see Elinor protocols) to measure ambient oxygen. The sensors proved easy to interface to the Elinor electronics, giving an analogue output (special option) between 0 –5 V which was fed directly into one of the analogue channels on the lander controller.

Table 1: Deployment summary

| Deployment # | 130_prf | 131_eli | 132_prf | 133_eli |
|---|---|---|---|---|
| Site | BIF 6 | BIF2 | KF4 | KF4 |
| Configuration | 5 oxygen electrodes | Elinor, oxystat, c13 and luminaphore | Profilur 5 oxygen electrodes | Elinor, oxystat, trace metals |
| Comments on data & samples obtained | Good oxygen profiles | No mud retrieved. Good water samples and optode data. | Data stuck in artica (floating point error) | Good optode data, no mud but good water samples |
| Deployment date | 02/09/05 | 04/09/05 | 13/09/05 | 13/09/05 |
| Deployment time (UTC) | 0505z | 1123z | 1239z | 1318z |
| Deployment position | 70°30.08N 04°00.20E | 73°40.18N 13°47.24E | 78°58.43N 06°42.67E | 78°58.39N 06°42.63E |
| Deployment Water depth | 3300m | 1400m | 1450m | 1450m |
| Recovery date | 02/09/05 | 06/09/05 | 16/09/05 | 16/09/05 |
| Recovery time | 1800z | 1254z | 0830z | 0930z |
| Event number | 14 | 27 | 124 | 125 |

Note: Dep. time: time system reset prior to deployment
Dep. pos.: position of ship when lander released, or mooring released
Rec. time: time lander completely in-board

## Benthic biology

Mark Shields & Peter Lamont

### *Objectives*

#### SAMS Northern Seas Programme

Benthic biological work for the second cruise of SAMS Northern Seas Programme once again focused on bioturbation. During JCR 75 a comprehensive set of samples had been collected along a latitudinal transect. The aim was to determine how bioturbation varied over large-scale gradients in latitude and organic matter input in the northern North Atlantic. For JCR127 the aim to expand on the data from JCR75 and determine how the local taxonomic composition of macrofaunal communities changes within the specific geographical region of the northern North Atlantic in relation to depth, latitude and organic matter input. Biological data can be linked with the geochemical studies to produce an integrated investigation determining the significance of bioturbation within the region.

Specific objectives of the cruise were:

- To determine how the local taxonomic and functional group composition of macrofaunal communities, drawn from a common species pool, change within specific geographical regions in relation to depth, latitude and contrasting organic matter input.
- To determine the major contributors to bioturbation within the specific geographical regions.
- To determine the geographical distribution of sipunculan worms (*Nephasoma* sp.) associated with the deep capillary burrows.
- To determine if recently proposed contrasts between the continental margin and abyssal plain environments for the rapid burial of organic matter hold true when experimental comparisons are made within a single ocean basin.

#### Methodology

Benthic samples were collected using the mega-corer at each of the identified stations for the quantitative analysis of the macrofauna community. Two NIOZ boxcores samples were collected at the first station visited; this was 3300m water depth in the Dumshaf Basin, the deepest station along the Bear Island Fan transect.

*NIOZ* boxcorer:
This was deployed with a 50x50cm square box fitted. Weighting and penetration limiter was adjusted after the first deployment and an excellent undisturbed core was obtained on the second drop. The recovered boxcores were carefully dissected in search of any burrow structures and large members of the benthic community. Any burrow structures identified were carefully tracked and photographed. The 0-2cm sediment horizon was retained from the second core, fixed in 4% buffered formaldehyde and subsequently washed through a sieve of 250µm mesh size before storing in 70% ethanol mix.

*SAMS Megacorer:*
At each station three replicate drops of the megacorer provided the required samples for biological analysis. From each drop 4 cores were retained from varying positions on the megacorer for quantitative and spatial analysis of the macrofauna community. All cores were sliced at 0-2, 2-5, 5-10, 10-15 and 15-20cm sediment depth horizons at each station. At VP2 station cores were sliced at additional sediment depth horizons of 20-25 and 25-

30cm. All samples were fixed in 4% buffered formaldehyde. Samples collected along the Bear Island Fan transect were later washed through a 250µm using filtered sea water. Fractions retained in the sieve were preserved in an ethanol mix consisting of 70% ethanol and stored for sorting back at SAMS laboratory. Time did not allow for sieving of samples collected at the Vøring Plateau.

*Incubations:*
At each of the four incubation stations an additional four cores were retained from two of the three replicate mega corer drops for biological analysis. Two cores were retained for each drop, one core for the incubation experiment the other core for background $^{13}C$ levels. Incubation cores were placed immediately in the cold room at a temperature of -1ºC and after 4 hours the equivalent to 1g C $m^2$ of $^{13}C$ labelled diatoms, *Thalassiosira rotula*, was added to each incubation core. The incubation was then allowed to run for 36 hours to permit the uptake of the labelled diatoms by the benthic community within the cores. Air was pumped constantly into the cores to maintain oxygen saturation of the water column and the temperature was maintained at -1ºC.

At the end of the 36 hours incubation period cores were then sliced at 0-1, 1-2, 2-3, 3-5, and 5-10cm horizons. At VP2 station additional horizons were sliced at 10-15 and 15-20cms. Background $^{13}C$ level cores were sliced immediately once onboard the ship and were not incubated. All cores were washed as soon as possible with seawater through a 250µm sieve and each fraction was frozen at -80ºC for later sorting at SAMS. Some samples were sorted onboard for macrofauna and individual animals placed in eppendorf tubes before storing at -80ºC.
To prevent contamination of cores retained for background $^{13}C$ levels two separate sets of sieves, extruders and slicers were used, one set for background cores and the other for incubated cores.

Sample details
The table lists a brief summary of biological samples collected during the cruise. The third column indicates the sampling gear deployed: NBC = NIOZ boxcorer; MGC = megacorer. The fourth column indicates the sample number assigned in the SAMS Deep-Sea Benthic Group (DSBG) collection.

| Ship No. | Depth (m) | Gear | DSBG No. | Date (yymmdd) | Notes |
|---|---|---|---|---|---|
| #2 | 3210 | NBC | 1171 | 05.09.01 | BIF6, dissected & photographed |
| #3 | 3210 | NBC | 1172 | 05.09.01 | BIF6, 0-2 cm retained, core dissected & photographed |
| #6 | 3211 | MGC | 1173 | 05.09.02 | BIF6, cores II(a), III(b), I(c), VII(d) @ 2,3,5,5,5 cm; V for incubation |
| #7 | 3211 | MGC | 1174 | 05.09.02 | BIF6 cores II(a),IV(b), III(c), IV(d) @ 2,3,5,5,5cm; I & VI for incubation |
| #8 | 3211 | MGC | 1175 | 05.09.02 | BIF6 cores I(a), VIII(b), IV(c) II(d), @ 2,3,5,5,5cm |
| #20 | 2968 | MGC | 1176 | 05.09.03 | BIF5 cores II(a), IV(b), V(c), VII(d) @ 2,3,5,5,5cm |
| #21 | 2967 | MGC | 1177 | 05.09.03 | BIF5cores I(a), II(B), IV(c), V(d) @ 2,3,5,5,5cm |
| #22 | 2964 | MGC | 1178 | 05.09.03 | BIF5 cores I(a), III(b), V(c), VII(d) @ 2,3,5,5,5cm |
| #30 | 1457 | MGC | 1179 | 05.09.06 | BIF2 cores I(a),II(b),IV(c),VII(d) @ 2,3,5,5,5cm |
| #31 | 1457 | MGC | 1180 | 05.09.06 | BIF2 cores III(a),VI(b),VII(c),VIII(d) @ 2,3,5,5,5cm |
| #32 | 1456 | MGC | 1181 | 05.09.06 | BIF2 cores II(a),IV(b),VI(c),VII(d) @ 2,3,5,5,5cm |

| Ship No. | Depth (m) | Gear | DSBG No. | Date (yymmdd) | Notes |
|---|---|---|---|---|---|
| #34 | 969 | MGC | 1182 | 05.09.07 | BIF1 cores I(a),II(b),VI(c),V(d) short cores - @2,3cm |
| #35 | 969 | MGC | 1183 | 05.09.07 | BIF1 cores I(a),II(b),III(c),IV(d) @ 2,3cm+ depending on depth; |
| #36 | 970 | MGC | 1184 | 05.09.07 | BIF1 cores II(a,13cm),IV(b,17cm),VI(c),VIII(d) @2,3cm |
| #130 | 2921 | MGC | 1185 | 05.09.18 | VP5 cores II(a),V(b),VI(c),VII(d)@2,3,5,5,5cm I & III for incubation |
| #131 | 2924 | MGC | 1186 | 05.09.18 | VP5 cores IV(a),VI(b),VII(c),VIII(d)@2,3,5,5,5cm |
| #132 | 2918 | MGC | 1187 | 05.09.18 | VP5 cores II(a),IV(b),VI(c)VIII(d)@2,3,5,5,5cm: III & VII for incubation |
| #133 | 1423 | MGC | 1188 | 05.09.19 | VP2 cores II(a),IV(b),VI(c)VIII(d)@2,3,5,5,5; V & VII for incubation |
| #134 | 1418 | MGC | 1189 | 05.09.19 | VP2 cores I(a),II(b),V(c)VIII(d)@ 2,3,5,5,5: VI & VII for incubation |
| #135 | 1424 | MGC | 1190 | 05.09.19 | VP2 cores II(a),III(b),IV(c), V(d)@2,3,5,5,5,5,5cm |

Station summary

| Stations | NIOZ Boxcorer Drops | Megacorer Drops | Incubation Experiment |
|---|---|---|---|
| Bear Island Fan 1 | - | 3 | - |
| Bear Island Fan 2 | - | 3 | Yes |
| Bear Island Fan 5 | - | 3 | - |
| Bear Island Fan 6 | 2 | 3 | Yes |
| Vøring Plateau 2 | - | 3 | Yes |
| Vøring Plateau 5 | - | 3 | Yes |

Initial Observations

Bear Island Fan 1 (970m):

Sediment was very compact resulting in a very low penetration of the megacorer core tubes when all eight heads were attached. Small stones on surface and many ophiuroids present in each core.

Bear Island Fan 2 (1460m):

Amphipod tubes could be observed in the majority of cores. Glass sponge collected in MGC1179.

Bear Island Fan 5 (2970m):

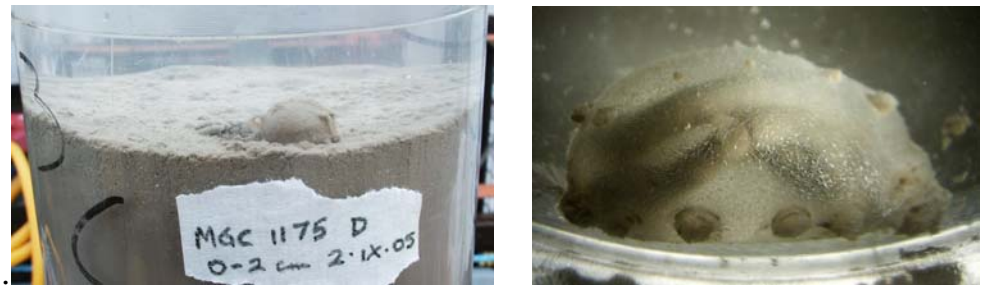
There was a dense layer of coccolithophores at ~19cm sediment depth in each core.

Bear Island Fan 6 (3210m):

No large surface features were observed in either of the two boxcores. There was an absence of borrows, tubes or visible surface fauna.

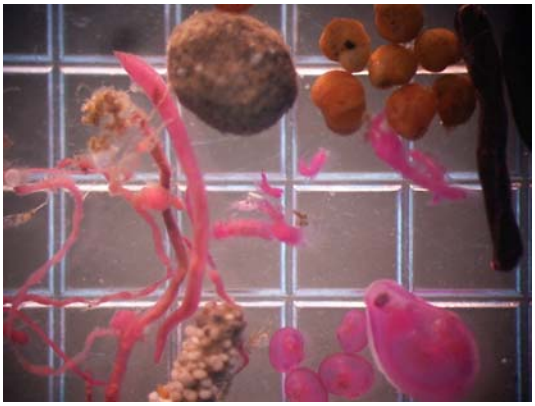
## Boxcore #2

A 12 mm holothurian probably *Elpidia glacialis* was present in one megacore (deployment #8 core II)




*Elpidia glacialis* (?) in situ in megacore and in profile, cleaned.

A preliminary examination of the 0-2 cm layer from the second boxcore yielded many juvenile bivalves but comparitively few polychaetes.



Some sorted macrofauna from 0-2 cm
Boxcore #3
Scale grid = 2 mm squares

The sediment was the normal soft, light brown from 0-9cm becoming grey from 9 cm down to c13.5 cm. At 13.5 cm there was a distinct, dark grey layer of denser material averaging one centimetre in thickness below which was light brown sediment to the limit of the core penetration. Megacores that penetrated deeper than this showed the presence of a second dark grey layer at about 37 cm. A small, dry sample of the first grey sediment layer was retained from the boxcore.

Boxcore #3

Voring Plateau 2 (1400m):

Small, fine burrows were observed especially at this 1400 m station. These extended downcore to greater than 20 cm so a 20-25 and 25-30 cm horizons were retained from one core. Due to adverse weather sampling at VP5 was not

straightforward and the imprint of the megacorer frame tube was observed on one core (deployment #131).

Planned future activity

Once back at SAMS laboratory, megacorer samples will be examined and all desired quantitative and qualitative data extracted. Total abundance and biomass of macrofauna will be obtained. Individual animals will be identified to lowest taxonomic level necessary to assign to functional groups. Cores from incubation experiments will be analysed for $^{13}C$ content and potential major bioturbators identified. All biological data will be integrated with geochemical analysis data.

Acknowledgements

Firstly, thank you to the whole crew of the JCR for all the help provided during the cruise. Throughout the cruise many members of the scientific party provided invaluable help with the collection of the biological samples; this assistance was vital and is greatly appreciated, you know who you are and thank you.

**Natural Uranium series radionuclides, $Po^{210}$, $Pb^{210}$ and $Ra^{226}$**

Katie Doig

*Introduction*

The natural uranium series radionuclides $Pb^{210}$, $Po^{210}$ and $Ra^{226}$ are widely used to determine particulate flux movements within the water column. Pb and Po are particle reactive radionuclides that are readily scavenged at different rates from the water column by biogenic components. The secular equilibrium that is set up from the decay of $Pb^{210}$ to $Po^{210}$ is altered by the concentration and advection of particulate material leading to a deficit of Po compared to its parent $Pb^{210}$. The deficit can be interpreted as a particle residence time and particle flux movement.

Comparison of the total water column inventory of $Pb^{210}$ in both particulate and dissolved forms with the total water column inventory of its conservative parent $Ra^{226}$ often shows a $Pb^{210}$ deficit. This deficit can be compared with the $Pb^{210}$ inventory of the underlying sediment. Good comparison denotes a largely downward particulate material movement at the site whereas poor comparison may denote lateral advective movement of material out of the area (water deficit > sediment inv.) or advective movement into the area (water deficit < sediment inv.).

**Polonium - 210 and Lead - 210**

*Methodology*

Water samples of 18-20 litres are required for each sample. These were collected using a CTD, which was fitted with twelve ~10 litre bottles and can thus collect from six depths. The CTD bottles were fired and the required depth and returned to the surface where the samples were emptied into 25 litre containers.

The Particulates were then filtered through a 142 mm, 0.45 μm Asypor filter. A compressed air pump was used to pump the sample thought the filter housing and a flow meter was used to determine the volume of sample. The filter was then stored in a centrifuge tube marked with the station and depth and marked particulate.

The sample filtrate was then acidified with conc. HCL (40 mls) to a pH of ~ 1.5 and spiked with radiogenic $Po^{208}$ (0.02 Bq per 100 μl) and stable $Pb^{206}$ (0.5 ml: 2000 ppm) made from a solution of Lead (II) nitrate.

After a minimum of 24 hours to allow for equilibration, the isotopes were then chemically extracted by precipitating with the addition of Cobalt nitrate (10mg in 0.5ml) and 1g (pre-weighed) of ammonium pyrrolydine dithiocarbamate (APDC). The addition of the two chemicals forms a green precipitate with the intrinsic $Pb^{210}$ and $Po^{210}$ and the added spikes. This is left for a minimum of 30 minutes and then collected on 3μm 142mm Asypor filters using an electric pump. The filter it labelled with sample identification and marked dissolved.

The filters will then be returned to the laboratory and processed further. They will be digested and the isotopes auto deposited onto silver discs and counted by alpha spectroscopy. The $Po^{210}$, $Pb^{210}$ and stable lead can then be determined and inventories calculated.

*Samples*

| Station | Event No. | CTD No. | Bottle No. | Depth (m) | Radionuclide |
|---|---|---|---|---|---|
| BIF 6 | #16 | CTD 006 | 1 | 3055.4 | Po/Pb |
| | #16 | CTD 006 | 2 | 3055.4 | Po/Pb |
| | #16 | CTD 006 | 3 | 2028.5 | Po/Pb |
| | #16 | CTD 006 | 4 | 2028.5 | Po/Pb |
| | #16 | CTD 006 | 5 | 749.5 | Po/Pb |
| | #16 | CTD 006 | 6 | 749.5 | Po/Pb |
| | #16 | CTD 006 | 7 | 505.4 | Po/Pb |
| | #16 | CTD 006 | 8 | 505.4 | Po/Pb |
| | #16 | CTD 006 | 9 | 105.3 | Po/Pb |
| | #16 | CTD 006 | 10 | 105.3 | Po/Pb |
| | #16 | CTD 006 | 11 | 11.4 | Po/Pb |
| | #16 | CTD 006 | 12 | 11.4 | Po/Pb |
| BIF 1 | #42 | CTD 016 | 1 | 966 | Po/Pb |
| | #42 | CTD 016 | 2 | 966 | Po/Pb |
| | #42 | CTD 016 | 3 | 762 | Po/Pb |
| | #42 | CTD 016 | 4 | 762 | Po/Pb |
| | #42 | CTD 016 | 5 | 508 | Po/Pb |
| | #42 | CTD 016 | 6 | 508 | Po/Pb |
| | #42 | CTD 016 | 7 | 102 | Po/Pb |
| | #42 | CTD 016 | 8 | 102 | Po/Pb |
| | #42 | CTD 016 | 9 | 52 | Po/Pb |
| | #42 | CTD 016 | 10 | 52 | Po/Pb |
| | #42 | CTD 016 | 11 | 12 | Po/Pb |
| | #42 | CTD 016 | 12 | 12 | Po/Pb |
| WSS 0 | #45 | CTD 019 | 1 | 196 | Po/Pb |
| | #45 | CTD 019 | 2 | 196 | Po/Pb |
| | #45 | CTD 019 | 3 | 152 | Po/Pb |
| | #45 | CTD 019 | 4 | 152 | Po/Pb |
| | #45 | CTD 019 | 5 | 101 | Po/Pb |
| | #45 | CTD 019 | 6 | 101 | Po/Pb |
| | #45 | CTD 019 | 7 | 51 | Po/Pb |
| | #45 | CTD 019 | 8 | 51 | Po/Pb |
| | #45 | CTD 019 | 9 | 15 | Po/Pb |
| | #45 | CTD 019 | 10 | 15 | Po/Pb |
| | #45 | CTD 019 | 11 | 5 | Po/Pb |
| | #45 | CTD 019 | 12 | 5 | Po/Pb |
| WSS 1 | #48 | CTD 021 | 1 | 97 | Po/Pb |
| | #48 | CTD 021 | 2 | 97 | Po/Pb |
| | #48 | CTD 021 | 3 | 80 | Po/Pb |
| | #48 | CTD 021 | 4 | 80 | Po/Pb |
| | #48 | CTD 021 | 5 | 50 | Po/Pb |
| | #48 | CTD 021 | 6 | 50 | Po/Pb |
| | #48 | CTD 021 | 7 | 30 | Po/Pb |
| | #48 | CTD 021 | 8 | 30 | Po/Pb |
| | #48 | CTD 021 | 9 | 15 | Po/Pb |
| | #48 | CTD 021 | 10 | 15 | Po/Pb |
| | #48 | CTD 021 | 11 | 5.7 | Po/Pb |
| | #48 | CTD 021 | 12 | 5.7 | Po/Pb |
| WSS 4 | #55 | CTD 028 | 1 | 405 | Po/Pb |
| | #55 | CTD 028 | 2 | 405 | Po/Pb |
| | #55 | CTD 028 | 3 | 304 | Po/Pb |
| | #55 | CTD 028 | 4 | 304 | Po/Pb |
| | #55 | CTD 028 | 5 | 202 | Po/Pb |
| | #55 | CTD 028 | 6 | 202 | Po/Pb |

| | | | | | |
|---|---|---|---|---|---|
| | #55 | CTD 028 | 7 | 101 | Po/Pb |
| | #55 | CTD 028 | 8 | 101 | Po/Pb |
| | #55 | CTD 028 | 9 | 50.6 | Po/Pb |
| | #55 | CTD 028 | 10 | 50.6 | Po/Pb |
| | #55 | CTD 028 | 11 | 25.7 | Po/Pb |
| | #55 | CTD 028 | 12 | 25.7 | Po/Pb |
| WSS 8c | #65 | CTD 037 | 1 | 119 | Po/Pb |
| | #65 | CTD 037 | 2 | 119 | Po/Pb |
| | #65 | CTD 037 | 3 | 81 | Po/Pb |
| | #65 | CTD 037 | 4 | 81 | Po/Pb |
| | #65 | CTD 037 | 5 | 50 | Po/Pb |
| | #65 | CTD 037 | 6 | 50 | Po/Pb |
| | #65 | CTD 037 | 7 | 31 | Po/Pb |
| | #65 | CTD 037 | 8 | 31 | Po/Pb |
| | #65 | CTD 037 | 9 | 21 | Po/Pb |
| | #65 | CTD 037 | 10 | 21 | Po/Pb |
| | #65 | CTD 037 | 11 | 5 | Po/Pb |
| | #65 | CTD 037 | 12 | 5 | Po/Pb |
| WSS 8i | #75 | CTD 047 | 1 | 487 | Po/Pb |
| | #75 | CTD 047 | 2 | 487 | Po/Pb |
| | #75 | CTD 047 | 3 | 405 | Po/Pb |
| | #75 | CTD 047 | 4 | 405 | Po/Pb |
| | #75 | CTD 047 | 5 | 304 | Po/Pb |
| | #75 | CTD 047 | 6 | 304 | Po/Pb |
| | #75 | CTD 047 | 7 | 203 | Po/Pb |
| | #75 | CTD 047 | 8 | 203 | Po/Pb |
| | #75 | CTD 047 | 9 | 101 | Po/Pb |
| | #75 | CTD 047 | 10 | 101 | Po/Pb |
| | #75 | CTD 047 | 11 | 15 | Po/Pb |
| | #75 | CTD 047 | 12 | 15 | Po/Pb |
| KF 4 | #90 | CTD 053 | 1 | 1323 | Po/Pb |
| | #90 | CTD 053 | 2 | 1323 | Po/Pb |
| | #90 | CTD 053 | 3 | 1017 | Po/Pb |
| | #90 | CTD 053 | 4 | 1017 | Po/Pb |
| | #90 | CTD 053 | 5 | 502 | Po/Pb |
| | #90 | CTD 053 | 6 | 502 | Po/Pb |
| | #90 | CTD 053 | 7 | 102 | Po/Pb |
| | #90 | CTD 053 | 8 | 102 | Po/Pb |
| | #90 | CTD 053 | 9 | 51 | Po/Pb |
| | #90 | CTD 053 | 10 | 51 | Po/Pb |
| | #90 | CTD 053 | 11 | 12 | Po/Pb |
| | #90 | CTD 053 | 12 | 12 | Po/Pb |
| XKF H | #114 | CTD 069 | 1 | 304 | Po/Pb |
| | #114 | CTD 069 | 2 | 304 | Po/Pb |
| | #114 | CTD 069 | 3 | 252 | Po/Pb |
| | #114 | CTD 069 | 4 | 252 | Po/Pb |
| | #114 | CTD 069 | 5 | 151 | Po/Pb |
| | #114 | CTD 069 | 6 | 151 | Po/Pb |
| | #114 | CTD 069 | 7 | 101 | Po/Pb |
| | #114 | CTD 069 | 8 | 101 | Po/Pb |
| | #114 | CTD 069 | 9 | 50 | Po/Pb |
| | #114 | CTD 069 | 10 | 50 | Po/Pb |
| | #114 | CTD 069 | 11 | 10 | Po/Pb |
| | #114 | CTD 069 | 12 | 10 | Po/Pb |
| VP 2a | #139 | CTD 077 | 1 | 1373 | Po/Pb |
| | #139 | CTD 077 | 2 | 1371 | Po/Pb |
| | #139 | CTD 077 | 3 | 1017 | Po/Pb |

| | | | | | |
|---|---|---|---|---|---|
| | #139 | CTD 077 | 4 | 1017 | Po/Pb |
| | #139 | CTD 077 | 5 | 1753 | Po/Pb |
| | #139 | CTD 077 | 6 | 1753 | Po/Pb |
| | #139 | CTD 077 | 7 | 104 | Po/Pb |
| | #139 | CTD 077 | 8 | 104 | Po/Pb |
| | #139 | CTD 077 | 9 | 51 | Po/Pb |
| | #139 | CTD 077 | 10 | 51 | Po/Pb |
| | #139 | CTD 077 | 11 | 12 | Po/Pb |
| | #139 | CTD 077 | 12 | 12 | Po/Pb |

**Radium - 226**

*Methodology*

Water samples of 100 - 120 litres were required for analysis of $Ra^{226}$ in the water column at selected depths. This required all of the twelve bottles on the CTD to be fired at the required depth this allowed only three samples to be taken at each station, as a CTD drop was required for each sample. Samples were taken from the top of the water column corresponding to the chlorophyll maximum, from the bottom and from the middle. The middle sample was chosen to be in a different water mass if possible from the bottom sample.
The radium was scavenged out of the seawater by filtering it through 2 pre-prepared manganese oxide coated 10" wound polypropylene filter cartridges. The volume of the water filtered was recorded with a volume logger and the filters were marked with station, date, depth and the order the filter was in the filtration rig.

The filters will then be processed further the extract the radium and counted using gamma spectroscopy.

*Samples*

| Station | Event No. | CTD No. | Bottle No. | Depth (m) | Radionuclide |
|---|---|---|---|---|---|
| BIF 6 | #11 | CTD 003 | All | 762 | Radium |
| | #12 | CTD 004 | All | 12 | Radium |
| | #15 | CTD 005 | All | 3064 | Radium |
| BIF 1 | #39 | CTD 013 | All | 11 | Radium |
| | #40 | CTD 014 | All | 960 | Radium |
| | #41 | CTD 015 | All | 508 | Radium |
| WSS 4 | #52 | CTD 025 | All | 5.2 | Radium |
| | #53 | CTD 026 | All | 202 | Radium |
| | #54 | CTD 027 | All | 416 | Radium |
| WSS 8c | #62 | CTD 034 | All | 10 | Radium |
| | #63 | CTD 035 | All | 118 | Radium |
| | #64 | CTD 036 | All | 50 | Radium |
| KF 4 | #87 | CTD 050 | All | 10 | Radium |
| | #88 | CTD 051 | All | 1321 | Radium |
| | #89 | CTD 052 | All | 503 | Radium |
| XKF H | #111 | CTD 066 | All | 9.5 | Radium |
| | #112 | CTD 067 | All | 252 | Radium |
| | #113 | CTD 068 | All | 151 | Radium |

**Oxygen Isotopes**

*Introduction*

*Methodology*

Salinity bottles were used to collect approximately 200 ml of water sample from each of the selected depths. Samples were taken at the same depths as nutrients were taken. The glass salinity bottles were filled so there was no air gap and sealed. Unfortunately the bottles proved to be not strong enough to take the pressure when the water warmed up, some cracked and some samples were lost. Then a small gap of air was left to allow for some expansion when the water warmed.

*Samples*

| Station | Event No. | CTD No. | Bottle No. | Depth (m) | Isotope |
|---|---|---|---|---|---|
| BIF 6 | #10 | CTD 002 | 1 | 3253.8 | $\delta^{18}O$ |
| | #10 | CTD 002 | 2 | 3062.5 | $\delta^{18}O$ |
| | #10 | CTD 002 | 3 | 2548.2 | $\delta^{18}O$ |
| | #10 | CTD 002 | 4 | 2036.6 | $\delta^{18}O$ |
| | #10 | CTD 002 | 5 | 1016.5 | $\delta^{18}O$ |
| | #10 | CTD 002 | 6 | 763.0 | $\delta^{18}O$ |
| | #10 | CTD 002 | 7 | 508.4 | $\delta^{18}O$ |
| | #10 | CTD 002 | 8 | 205.1 | $\delta^{18}O$ |
| | #10 | CTD 002 | 9 | 103.6 | $\delta^{18}O$ |
| | #10 | CTD 002 | 10 | 52.4 | $\delta^{18}O$ |
| | #10 | CTD 002 | 11 | 13.9 | $\delta^{18}O$ |
| | #10 | CTD 002 | 12 | 7.7 | $\delta^{18}O$ |
| BIF 5 | #19 | CTD 008 | 1 | 2947.2 | $\delta^{18}O$ |
| | #19 | CTD 008 | 2 | 2909.5 | $\delta^{18}O$ |
| | #19 | CTD 008 | 3 | 2548 | $\delta^{18}O$ |
| | #19 | CTD 008 | 4 | 2037 | $\delta^{18}O$ |
| | #19 | CTD 008 | 5 | 1016 | $\delta^{18}O$ |
| | #19 | CTD 008 | 6 | 762 | $\delta^{18}O$ |
| | #19 | CTD 008 | 7 | 508 | $\delta^{18}O$ |
| | #19 | CTD 008 | 8 | 204 | $\delta^{18}O$ |
| | #19 | CTD 008 | 9 | 103 | $\delta^{18}O$ |
| | #19 | CTD 008 | 10 | 53 | $\delta^{18}O$ |
| | #19 | CTD 008 | 11 | 28 | $\delta^{18}O$ |
| | #19 | CTD 008 | 12 | 7 | $\delta^{18}O$ |
| BIF 4 | #24 | CTD 009 | 1 | 2644 | $\delta^{18}O$ |
| | #24 | CTD 009 | 2 | 2590 | $\delta^{18}O$ |
| | #24 | CTD 009 | 3 | 2538 | $\delta^{18}O$ |
| | #24 | CTD 009 | 4 | 2038 | $\delta^{18}O$ |
| | #24 | CTD 009 | 5 | 1018 | $\delta^{18}O$ |
| | #24 | CTD 009 | 6 | 762 | $\delta^{18}O$ |
| | #24 | CTD 009 | 7 | 510 | $\delta^{18}O$ |
| | #24 | CTD 009 | 8 | 206 | $\delta^{18}O$ |
| | #24 | CTD 009 | 9 | 103 | $\delta^{18}O$ |
| | #24 | CTD 009 | 10 | 54 | $\delta^{18}O$ |
| | #24 | CTD 009 | 11 | 45 | $\delta^{18}O$ |
| | #24 | CTD 009 | 12 | 14 | $\delta^{18}O$ |
| BIF 2 | #28 | CTD 010 | 1 | 1459 | $\delta^{18}O$ |
| | #28 | CTD 010 | 2 | 1423 | $\delta^{18}O$ |

| | | | | | |
|---|---|---|---|---|---|
| | #28 | CTD 010 | 3 | 1345 | $\delta^{18}O$ |
| | #28 | CTD 010 | 4 | 1218 | $\delta^{18}O$ |
| | #28 | CTD 010 | 5 | 1015 | $\delta^{18}O$ |
| | #28 | CTD 010 | 6 | 761 | $\delta^{18}O$ |
| | #28 | CTD 010 | 7 | 507 | $\delta^{18}O$ |
| | #28 | CTD 010 | 8 | 203 | $\delta^{18}O$ |
| | #28 | CTD 010 | 9 | 102 | $\delta^{18}O$ |
| | #28 | CTD 010 | 10 | 51 | $\delta^{18}O$ |
| | #28 | CTD 010 | 11 | 41 | $\delta^{18}O$ |
| | #28 | CTD 010 | 12 | 11 | $\delta^{18}O$ |
| BIF 1 | #43 | CTD 017 | 1 | 966 | $\delta^{18}O$ |
| | #43 | CTD 017 | 2 | 955 | $\delta^{18}O$ |
| | #43 | CTD 017 | 3 | 915 | $\delta^{18}O$ |
| | #43 | CTD 017 | 4 | 864 | $\delta^{18}O$ |
| | #43 | CTD 017 | 5 | 762 | $\delta^{18}O$ |
| | #43 | CTD 017 | 6 | 508 | $\delta^{18}O$ |
| | #43 | CTD 017 | 7 | 204 | $\delta^{18}O$ |
| | #43 | CTD 017 | 8 | 102 | $\delta^{18}O$ |
| | #43 | CTD 017 | 9 | 52 | $\delta^{18}O$ |
| | #43 | CTD 017 | 10 | 32 | $\delta^{18}O$ |
| | #43 | CTD 017 | 11 | 22 | $\delta^{18}O$ |
| | #43 | CTD 017 | 12 | 11 | $\delta^{18}O$ |
| WSS 0 | #45 | CTD 019 | 2 | 196 | $\delta^{18}O$ |
| | #45 | CTD 019 | 4 | 152 | $\delta^{18}O$ |
| | #45 | CTD 019 | 6 | 101 | $\delta^{18}O$ |
| | #45 | CTD 019 | 8 | 51 | $\delta^{18}O$ |
| | #45 | CTD 019 | 10 | 15 | $\delta^{18}O$ |
| | #45 | CTD 019 | 12 | 5 | $\delta^{18}O$ |
| WSS 1 | #48 | CTD 021 | 2 | 97 | $\delta^{18}O$ |
| | #48 | CTD 021 | 4 | 80 | $\delta^{18}O$ |
| | #48 | CTD 021 | 6 | 50 | $\delta^{18}O$ |
| | #48 | CTD 021 | 8 | 30 | $\delta^{18}O$ |
| | #48 | CTD 021 | 10 | 15 | $\delta^{18}O$ |
| | #48 | CTD 021 | 12 | 5.7 | $\delta^{18}O$ |
| WSS 4 | #51 | CTD 024 | 1 | 427 | $\delta^{18}O$ |
| | #51 | CTD 024 | 2 | 415 | $\delta^{18}O$ |
| | #51 | CTD 024 | 3 | 354 | $\delta^{18}O$ |
| | #51 | CTD 024 | 4 | 304 | $\delta^{18}O$ |
| | #51 | CTD 024 | 5 | 202 | $\delta^{18}O$ |
| | #51 | CTD 024 | 6 | 101 | $\delta^{18}O$ |
| | #51 | CTD 024 | 7 | 76 | $\delta^{18}O$ |
| | #51 | CTD 024 | 8 | 51 | $\delta^{18}O$ |
| | #51 | CTD 024 | 9 | 31 | $\delta^{18}O$ |
| | #51 | CTD 024 | 10 | 5.7 | $\delta^{18}O$ |
| WSS 8c | #61 | CTD 033 | 2 | 117 | $\delta^{18}O$ |
| | #61 | CTD 033 | 4 | 81 | $\delta^{18}O$ |
| | #61 | CTD 033 | 6 | 51 | $\delta^{18}O$ |
| | #61 | CTD 033 | 8 | 31 | $\delta^{18}O$ |
| | #61 | CTD 033 | 10 | 21 | $\delta^{18}O$ |
| | #61 | CTD 033 | 12 | 5 | $\delta^{18}O$ |
| WSS 8i | #76 | CTD 048 | 1 | 462 | $\delta^{18}O$ |
| | #76 | CTD 048 | 2 | 447 | $\delta^{18}O$ |
| | #76 | CTD 048 | 3 | 407 | $\delta^{18}O$ |
| | #76 | CTD 048 | 4 | 356 | $\delta^{18}O$ |

| | | | | | |
|---|---|---|---|---|---|
| | #76 | CTD 048 | 5 | 306 | $\delta^{18}O$ |
| | #76 | CTD 048 | 6 | 255 | $\delta^{18}O$ |
| | #76 | CTD 048 | 7 | 204 | $\delta^{18}O$ |
| | #76 | CTD 048 | 8 | 153 | $\delta^{18}O$ |
| | #76 | CTD 048 | 9 | 103 | $\delta^{18}O$ |
| | #76 | CTD 048 | 10 | 052 | $\delta^{18}O$ |
| | #76 | CTD 048 | 11 | 033 | $\delta^{18}O$ |
| | #76 | CTD 048 | 12 | 018 | $\delta^{18}O$ |
| WSS 14 | #81 | CTD 049 | 2 | 163 | $\delta^{18}O$ |
| | #81 | CTD 049 | 4 | 150 | $\delta^{18}O$ |
| | #81 | CTD 049 | 6 | 100 | $\delta^{18}O$ |
| | #81 | CTD 049 | 8 | 50 | $\delta^{18}O$ |
| | #81 | CTD 049 | 10 | 30 | $\delta^{18}O$ |
| | #81 | CTD 049 | 12 | 10 | $\delta^{18}O$ |
| KF 4 | #93 | CTD 055 | 1 | 1365 | $\delta^{18}O$ |
| | #93 | CTD 055 | 2 | 1220 | $\delta^{18}O$ |
| | #93 | CTD 055 | 3 | 1016 | $\delta^{18}O$ |
| | #93 | CTD 055 | 4 | 762 | $\delta^{18}O$ |
| | #93 | CTD 055 | 5 | 508 | $\delta^{18}O$ |
| | #93 | CTD 055 | 6 | 204 | $\delta^{18}O$ |
| | #93 | CTD 055 | 7 | 103 | $\delta^{18}O$ |
| | #93 | CTD 055 | 8 | 83 | $\delta^{18}O$ |
| | #93 | CTD 055 | 9 | 52 | $\delta^{18}O$ |
| | #93 | CTD 055 | 10 | 32 | $\delta^{18}O$ |
| | #93 | CTD 055 | 11 | 17 | $\delta^{18}O$ |
| | #93 | CTD 055 | 12 | 8 | $\delta^{18}O$ |
| WSS 13 | #94 | CTD 056 | 2 | 213 | $\delta^{18}O$ |
| | #94 | CTD 056 | 4 | 151 | $\delta^{18}O$ |
| | #94 | CTD 056 | 6 | 101 | $\delta^{18}O$ |
| | #94 | CTD 056 | 8 | 50 | $\delta^{18}O$ |
| | #94 | CTD 056 | 10 | 35 | $\delta^{18}O$ |
| | #94 | CTD 056 | 12 | 10 | $\delta^{18}O$ |
| XKF B | #103 | CTD 058 | | | $\delta^{18}O$ |
| XKF C | #104 | CTD 059 | | | $\delta^{18}O$ |
| XKF D | #105 | CTD 060 | | | $\delta^{18}O$ |
| XKF F | #107 | CTD 062 | | | $\delta^{18}O$ |
| VP 5 | #129 | CTD 075 | 1 | 2952 | $\delta^{18}O$ |
| | #129 | CTD 075 | 2 | 2849 | $\delta^{18}O$ |
| | #129 | CTD 075 | 3 | 2542 | $\delta^{18}O$ |
| | #129 | CTD 075 | 4 | 2035 | $\delta^{18}O$ |
| | #129 | CTD 075 | 5 | 1009 | $\delta^{18}O$ |
| | #129 | CTD 075 | 6 | 507 | $\delta^{18}O$ |
| | #129 | CTD 075 | 7 | 203 | $\delta^{18}O$ |
| | #129 | CTD 075 | 8 | 104 | $\delta^{18}O$ |
| | #129 | CTD 075 | 9 | 52 | $\delta^{18}O$ |
| | #129 | CTD 075 | 10 | 33 | $\delta^{18}O$ |
| | #129 | CTD 075 | 11 | 11 | $\delta^{18}O$ |
| VP 2a | #138 | CTD 076 | 2 | 1420 | $\delta^{18}O$ |
| | #138 | CTD 076 | 3 | 1373 | $\delta^{18}O$ |
| | #138 | CTD 076 | 4 | 1219 | $\delta^{18}O$ |
| | #138 | CTD 076 | 5 | 1015 | $\delta^{18}O$ |
| | #138 | CTD 076 | 6 | 761 | $\delta^{18}O$ |
| | #138 | CTD 076 | 7 | 507 | $\delta^{18}O$ |
| | #138 | CTD 076 | 8 | 204 | $\delta^{18}O$ |

| | | | | | |
|---|---|---|---|---|---|
| | #138 | CTD 076 | 9 | 102 | $\delta^{18}O$ |
| | #138 | CTD 076 | 10 | 52 | $\delta^{18}O$ |
| | #138 | CTD 076 | 11 | 32 | $\delta^{18}O$ |
| | #138 | CTD 076 | 12 | 12 | $\delta^{18}O$ |

**Rapid bioturbation and bioirrigation in response to addition of phytodetritus**

Lois Nickell & Martyn Harvey

Biological enhancement of particle and solute movement in response to environmental drivers can have critical implications for the burial and remineralisation of organic carbon in the marine environment. At more northerly latitudes, input of organic carbon is highly seasonally pulsed and it is possible that organisms show rapid behavioural adaptation to exploit this ephemeral resource. Changes in organism activity will result in alteration of particle and solute processing rates with consequent changes in sediment geochemistry and associated fluxes.

In this project we have examined rates of these processes and the influence of addition of organic phytodetritus through the use of multiple tracers in ship-board core incubations. Bioturbation rates (Db) will be estimated using luminophores incorporation into sediments whilst bioirrigation (Ds) will be estimated using the conservative tracer Br. This has previously been shown to be an effective method for determination of solute transport rates (Martin & Banta, 1992; Green & Aller, 2001; Green et al., 2002). Benthic sediment oxygen demand has also also been measured as a further indication of changes in organism behaviour and activity rate. Recent work (Berg et al., 2001) suggested that bioirrigation rates are more sensitive to changes than particle movement rates and may be more useful in assessing responses of benthic communities. This work will examine the ratios between these parameters to establish whether there are differences in the rates of changes between processes at different stations and latitudes.

**Specific Objectives**

To examine the bioturbatory and bioirrigatory responses of organisms at stations along a latitudinal transect to carbon enrichment
To examine the benthic community respiratory response to the addition of organic carbon
To measure nutrient fluxes in carbon enriched and control sediment cores

**Materials & Methods**

Megacores were recovered from four out of a proposed six stations; Bear Island Fan, Kongsfjord outer, Kongsfjord inner and Voring Plateau. Unfortunately it was not possible to access the planned Yermack Plateau or Greenland Margin stations. Details of megacore stations are given in Table 1.

Table 1. Extract from JR127 Event Log showing which megacores drops were used in incubation experiments

| Date | Time (GMT) | Latitude | Longitude | Event | Depth (m) | Station | Incubation |
|---|---|---|---|---|---|---|---|
| 04/09/05 | 1219 | 73°41.20'N | 13°48.26'E | #24 | 1461 | BIF2 | A |
| 04/09/05 | 1335 | 73°40.79'N | 13°48.28'E | #25 | 1461 | BIF2 | A |
| 06/09/05 | 1756 | 73°40.21'N | 13°47.63'E | #31 | 1457 | BIF2 | A1 |
| 06/09/05 | 1909 | 73°40.21'N | 13°47.64'E | #32 | 1456 | BIF2 | A1 |
| 13/09/05 | 0823 | 78°58.43'N | 06°42.67'E | #82 | 1361 | KF4 | B |
| 13/09/05 | 2011 | 78°58.43'N | 06°42.66'E | #83 | 1361 | KF4 | B |
| 15/09/05 | 0415 | 78°57.48'N | 11°54.38'E | #116 | 358 | MC1 | C |
| 15/09/05 | 0500 | 78°57.48'N | 11°54.38'E | #117 | 358 | MC1 | C |
| 19/09/05 | 1141 | 68°02.02'N | 05°13.63'E | #135 | 1424 | VP2a | D |
| 19/09/05 | 1350 | 68°02.02'N | 05°13.64'E | #137 | 1423 | VP2a | D |

Eight cores were recovered from two megacore drops at each station. These were immediately installed onto an incubation rig in the RSS JCR cold room at -1 ºC (equivalent to ambient bottom water temperature) aerated to maintain oxygen saturation, covered in black plastic to exclude light and allowed to settle for 4-6 hours.

Two linked experiments were then carried out. The first was designed to examine the bioturbatory and bioirrigatory responses of benthic organisms to addition of phytodetitus. Potassium bromide (KBr) was added to the overlying water of four cores and allowed to mix. These cores also received a pulsed addition of approximately 0.5 g of luminophores (particle sizes 63-106 μm) and 2 received a know weight of freeze dried algal carbon in the form of the diatom *Thalassiosira rotula*, equivalent to approximately 1g Cm-2 yr-1, a figure previously used to approximate a settling spring bloom in a deep sea setting (Aberle & Witte, 2003). After an initial particle settling period of 15 minutes the first sample was taken from each core, consisting of 40 ml of water drawn from approx. 5-10 cm above the sediment surface using a glass syringe. Samples were extracted at T0, 6, 12, 18, 24, 36, 48, and in one incubation, at 12 hour intervals beyond up to 132 hours. Water was filtered through GF/F filters and 1 ml reserved for bromide analysis whilst the rest was refrigerated until analysis to determine the concentration of dissolved nutrients (nitrate, phosphate, silicate and ammonium).

At the end of the incubation period, cores were sliced (0.5 cm slices to 2 cm, 1 cm slices 2-10 cm) with a rind being removed from each slice to minimize the effects of smearing, bagged and refrigerated. These will subsequently be centrifuged to remove pore water for bromide analysis to evaluate the flux of Br into the sediment caused by diffusive and organism driven processes and the remainder will be examined for luminophore content to determine rates of particle incorporation.

The second, parallel, experiment sought to determine changes in benthic community metabolism in response to carbon addition. Four cores were installed onto the rig and sealed and mixed gently with magnetic stirrers. Oxygen electrodes were inserted through the core tops to enable continuous measurement of oxygen decline throughout the incubation. Two cores received a pulsed addition of diatom algal carbon at time zero, as above. Water samples (10 ml) were withdrawn at T0, T18 and T36, the end of the incubation. These were fixed and subsequently Winkler titrated to determine the dissolved oxygen content, from which rates of sediment oxygen demand could be calculated and compared to data from the oxygen electrodes.

On completion of the incubation, the top 10 cm of each core was retained and preserved in 10 % formalin for subsequent faunal biomass analysis.

**ELINOR Chamber Deployments**

In addition to the above experiments, lander deployments were envisaged to complement this work giving in situ data on organism responses to algal enrichment. Two drops were planned, one where luminophores and $^{13}C$ labelled algae were added to the ELINOR benthic chamber and a second where no algal enrichment was to be provided. Potassium bromide was also added at the beginning of the incubation to allow flux into sediment to be assessed, comparing theoretical diffusion with potential enhancement by organism activity in response to the algae. The first deployment went ahead and Table 2 gives details of station location, etc. Unfortunately, no sediment was recovered and thus only periodic samples taken of overlying water could be used for Br analysis (refer to section on Landers for details of sample times throughout the deployment). Oxygen data were also collected and water samples were fixed for Winkler titrations to compare with data collected from within the chamber by an oxygen optode. Bad weather prevented the second deployment of the ELINOR chamber.

Table 2. Extract from JR127 Event Log showing Lander deployment/ recovery

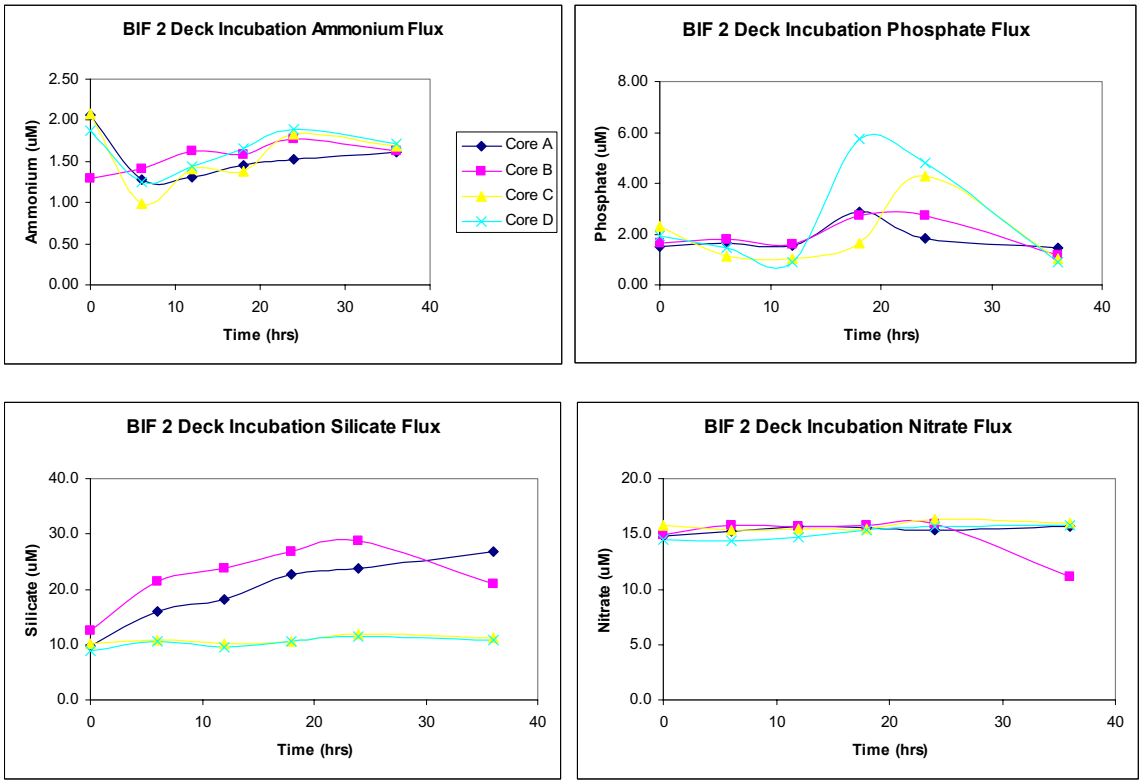
| Date | Time (GMT) | Latitude | Longitude | Event | Depth (m) | Station | Activity |
|---|---|---|---|---|---|---|---|
| 04/09/05 | 1114 | 73°40.18'N | 13°47.24'E | #23 | 1457 | BIF2 | ELINOR deployment |
| 06/09/05 | 1212 | 73°40.01'N | 13°46.88'E | #27 | 1457 | BIF2 | ELINOR recovery |

**Results**

Samples collected for luminophore and Br analysis will be analysed on return to SAMS. Winkler titrations for dissolved oxygen determinations were completed aboard. The preliminary results indicate an increase in benthic community respiration rate in the enriched cores, suggesting a rapid response (i.e. within 36 hours) to the added $C_{org}$. This appears to be particularly marked at Station MC1 (Kongsfjord).

Nutrients were analysed aboard for all but the last station at Voring Plateau (VP2a). Preliminary flux data measured during incubations of cores from Bear Island Fan 2 are shown in Fig 1.

Figure 1. Nutrient fluxes measured from ship board core incubations at BIF2 (uncorrected for overlying water volumes). Legend applies to all four graphs.




Other parameters measured at each station will be useful in the interpretation of data, including $D_b$ measurements calculated from the radioisotope $^{234}Th$ from cores taken at the same stations. Benthic community information will also be available (see section on benthic faunal analysis by Mark Shields) which will aid in the interpretation of results from

these experiments. In addition, comparison of data with previous work from a Scottish Sea loch will give insight to the changing nature of organism responses at varying latitudes.

**The microbial community**

Nuria Navarro

The aim was to increase understanding of the role of the microbial loop in the Arctic waters. The microbial loop is a micro-food chain that works within (or alongside) the classical food chain. In the microbial loop the smallest organisms, the heterotrophic bacteria and picoplankton, are key to maintaining the flux of carbon and energy within marine ecosystems. They consume dissolved organic carbon (DOC) that cannot be directly ingested by larger organisms. In this process, bacteria also release nutrients that facilitate phytoplankton growth. When these marine bacteria are later eaten by micrograzers such as flagellates and ciliates, the formerly "lost" carbon and energy is recycled back into the marine food web.

**Methodology**
Samples were collected at the stations show in Table 1.

- *Dissolved organic carbon (DOC) concentration.*

Samples for DOC analysis (10 ml) were immediately filtered through a pre-combusted (450 °C for a minimum of 4 h) GF/F filter and collected in ashed glass ampoules. Samples were preserved by adding 30 µl of 85% orthophosphoric acid before flame-sealing the ampoules. The DOC analysis will be performed at the lab using Pt-catalyzed high temperature combustion on a TOC analyser.

- *Abundance and biomass of heterotrophic bacteria.*
  Samples of 1.2 ml for bacteria counts were fixed with 1% glutaraldehyde (final), incubated for 10 min in the dark and stored at –80 °C. In the lab, bacterial samples will be thawed, stained with Syto13 (Molecular Probes) at 5 µM (diluted in DMS) in the dark for 10 min and run through a flow cytometer. Bacteria with apparent high DNA (HDNA) content will be separated from bacteria with apparent low DNA (LDNA) content. The relative abundance of HDNA and LDNA bacteria provides a rough indication of the 'actively metabolizing' versus the 'less actively metabolizing' bacteria in the community.

- *Abundance and biomass of picoplankton (Synechococcus, Prochlorococcus and eukaryotic picoplankton).*
  1.2 ml samples were fixed with 1% glutaraldehyde (final), allowed to fix for 10 min. in the dark and then stored at –80 °C. Samples at the lab will be unfrozen and run through a flow cytometer. *Synechococcus* are detected by their signature in a plot of orange fluorescence (FL2) vs. red fluorescence (FL3). *Prochlorococcus* have a lower FL3 signal and no FL2 signal. Eukaryotic picoplankton have higher FL3 signals and no FL2 signals.

- *Identification of bacterial groups by FISH (Fluorescence in situ hybridization)*
  5 ml samples were fixed with 2% formaldehyde (final) and stored at -80° C. Samples at the lab will be analyzed by Keith Davidson (SAMS)

Table 1.- Water samples collected for analysis of DOC concentration, bacterial abundance and biomass, picoplankton abundance and biomass and FISH.

| Date | Time (GMT) | Latitude | Longitude | Event | Depth | I/W (GMT) | Bottom (GMT) | O/W (GMT) | Station | Activity | Sampling depths (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 02/09/05 | 1136 | 70°29.82'N | 03°57.11'E | #10 | 3212 | 1136 | 1235 | 1347 | BIF 6 | CTD 002 | 5, 11, 50, 100 |
| 05/09/05 | 2205 | 72°09.86'N | 08°00.64'E | #26 | 2626 | 2205 | 2254 | 2349 | BIF 4 | CTD 009 | 10, 40, 50, 100 |
| 06/09/05 | 1317 | 73°40.21'N | 13°47.62'E | #28 | 1457 | 1317 | 1344 | 1421 | BIF 2 | CTD 010 | 10, 40, 50, 100 |
| 08/09/05 | 0948 | 76°48.22'N | 18°08.17'E | #45 | 207 | 0954 | 1006 | 1016 | WSS 0* | CTD 019 | 5, 15, 50, 100 |
| 08/09/05 | 2301 | 77°02.98'N | 13°23.44'E | #51 | 434 | 2301 | 2313 | 2332 | WSS 4 | CTD 024 | 5, 30, 50, 75 |
| 09/09/05 | 1909 | 77°38.99'N | 12°07.05'E | #61 | 128 | 1916 | 1922 | 1936 | WSS 8c | CTD 033 | 5, 20, 50, 80 |
| 10/09/05 | 1009 | 77°33.02'N | 11°00.89'E | #76 | 482 | 1010 | 1023 | 1041 | WSS 8i | CTD 048 | 15, 30, 50, 100 |
| 13/09/05 | 0445 | 79°18.02'N | 09°11.77'E | #81 | 170 | 0451 | 0459 | 0508 | WSS 14 | CTD 049 | 10, 30, 50, 100 |
| 13/09/05 | 1937 | 78°58.39'N | 06°42.62'E | #93 | 1364 | 1940 | 2006 | 2039 | KF 4 | CTD 055 | 10, 35, 50, 100 |
| 14/09/05 | 0000 | 78°57.98'N | 09°23.93'E | #94 | 216 | 0002 | 0010 | 0021 | WSS 13 | CTD 056 | 10, 35, 50, 100 |
| 14/09/05 | 2156 | 78°58.82'N | 11°32.75'E | #109 | 318 | 2201 | 2212 | 2225 | XKF H | CTD 064 | 5, 30, 50, 100 |
| 16/09/05 | 1510 | 78°19.97'N | 10°37.73'E | #126 | 104 | 1516 | 1523 | 1532 | WSS 11 | CTD 072 | 10, 25, 50, 96 |
| 18/09/05 | 2046 | 68°37.78'N | 04°35.69'E | #129 | 2940 | 2047 | 2140 | 2239 | VP 5 | CTD 075 | 10, 30, 50, 100, 200, 500, 1000, 2000, 2500, 2800 |
| 19/09/05 | 1514 | 68°02.02'N | 05°13.64'E | #138 | 1423 | 1517 | 1545 | 1617 | VP 2a | CTD 076 | 10, 30, 50, 100, 200, 500, 750, 1000, 1200, 1350, 1398 |

**Algal Phytoplankton and Zooplankton Net Sample Collection**

The aim was to collect living phytoplankton and zooplankton from different latitudes, maintain them on ship and return them to SAMS for the isolation of pure cultures to augment the polar holdings of the Culture Collection of Algae and Protozoa (CCAP).

**Methodology**

We have collected plankton from 2 stations (Table 1). The net was lowered by hand into the sea until rope fully extended. The net was slowly hauled back up through the water column. The contents of the chamber were emptied into a beaker and poured through a 100 micron mesh (to eliminate zooplankton) into another beaker.

*Phytoplankton*:
The contents of the chamber were dispensed into 4 bottles containing sterile culture media:
- 1 pipetteful into bottle 1
- 2 pipettefuls into bottle 2
- 5 pipettefuls into bottle 3
- remainder into bottle 4

(1 pipetteful ~ 2ml)

*Zooplankton*:
The contents of the chamber were dispensed into 3 tissue culture flasks with sterile culture media (ASWP= Artificial Seawater Protozoa) containing wheat grains, adding different volumes:
- 1 ml into bottle 1
- 1 ml into bottle 2
- 2 ml into bottle 3

Phytoplankton bottles were stored in a cold room (4 °C) with light, with the lid slightly loosened to allow gas exchange. Zooplankton tissue culture flasks were stored in the cold room without light.

Table 1.- Net sample collection of phytoplankton and zooplankton.

| Date | Time (GMT) | Latitude | Longitude | Event | Depth | Station |
|---|---|---|---|---|---|---|
| 11/09/05 | 2003 | 79°16.52'N | 01°42.94'E | #77 | 3207 | PL 1 |
| 13/09/05 | 1915 | 78°58.39'N | 06°42.65'E | #92 | 1365 | KF 4 |

## Water Column Parameters
## Pore water studies
## Core incubation studies

Tim Brand

*Rational*
Basic water column parameters of nutrients, algal pigments and particulate carbon and nitrogen were collected to establish latitudinal variation in phytoplankton quantity and suspended organic mass and to examine these features in relation to the nutrient status of the water. Furthermore, the nutrient status of the water will be viewed in conjunction with its physical hydrography. These water parameters were collected from the three major sampling transects; Bear island Fan (BIF), West Spitzbergen Shelf (WSS) and Voring Plateau, (VP). In addition three minor transects were studied for these parameters; Across Kongsfjord entrance (XKF) (8 stations), west of Kongsford (2 stations) and west of station WSS 8 (2 stations). (Only nutrients were collected at the XKF stations).

Nutrient samples were also measured from sediment pore waters to gain insight into the early diagenetic status of the core, to calculate remineralisation rates using diagenetic models (in conjunction with solid and dissolved phase carbon species) and to assess upward effluxes of the nutrients into the overlying water. This is discussed more fully in a separate chapter, (Breuer and McKinlay). The upward efflux of nutrients was also measured in the overlying water of ship-board incubated sediment cores. These measured rates will be compared to theoretical rates determined using diffusion laws and sediment porosity measurements. A fuller discussion of this subject is given a separate chapter (Nickel and Harvey). At one site, BIF 2 in-situ incubated sediment nutrients were collected using the ELINOR chamber configuration on the benthic lander. (Breuer)

*Water Column Particulate Parameters*
Water samples, collected using a Seabird CTD, were filtered for algal pigments, chlorophyll a,b and c, phaeophytin a, and for particulate organic carbon and nitrogen. The samples were collected from the CTD bottles using 5l polythene canisters and transferred to volume calibrated polycarbonate bottles which were inverted and inserted directly into Swinnex filter holders. The filters holders sit on a vacuum drain tube and the water is filtered through filters in the holders. The filtration rig was designed and built at SAMS. Whatman filters GF/F, (25mm dia) were used for the pigments and Gelman AE pre-combusted 13mm dia. filters were used for the POC/N. Both sets of filters were stored at -80C after collection.
Pigment samples will be measured using HPLC fluorimetry in isocratic mode. Particulate organic carbon and nitrogen will measured using a LECO combustion elemental analyzer.

*Water Column Dissolved Nutrients*
Water samples were collected in acid cleaned (10%HCl) 250ml bottles for on-board nutrient analysis of ammonium, phosphate, silicate and nitrate. In some cases nitrite was also analysed. The samples were analysed within 24hrs of collection. The samples were analsyed using a Lachate 'QuikChem 8000' instrument using Lachate methods; 31-107-06-1-B Ammonium, 31-107-04-1-A Nitrate, 31-115-01-1-I Phosphate and 31-114-27-1-A Silicate. Samples were run in triplicate and salt corrected by re-running a selected sample without critical reagents in the carrier stream. The salt effect was subtracted from each of the sample nutrient concentrations.

*Water Column Dissolved Oxygen*
Water samples were collected from a selected number of depths and CTD casts so that a comprehensive calibration of the CTD oxygen probe could be made. Samples were collected in designated oxygen samples bottles and analysed by Winkler titration using an automatic Radiometer auto-titrator.

A full list of water column parameters collected and or analysed on board is shown in Table 1 below

*Preliminary observations of CTD nutrient profiles*

Three CTD transects showing nutrients profiles are shown in Figures 1 to 3
Figure 1 shows the nutrient status of the Bear Island Fan transect. Phosphate, silicate and nitrate all appear to show a slight shallowing of higher concentrations moving north-west up the fan, with the contours appearing to following to some degree the bathymetry of the sea floor. These nutrients were in all cases depleted in the surface waters compared to the underlying deeper waters. Ammonium concentrations, whilst also increasing in concentration moving up slope do so with a more identifiable horizontal gradient. Highest ammonium concentrations were found in the surface waters.

The West Spitzbergen Shelf transect in Figure 2 shows a shallowing of nutrient rich waters further north with surfaces water of stations WSS0 to WSS 12 showing almost completion depletion. Ammonium concentrations are highest at the southerly stations and appear to inversely match the depth zones of nitrate, phosphate and silicate depletion. At the most northerly stations on the transect, WSS13 and 14, ammonium concentrations rapidly decrease whilst the concentrations of the other nutrients increase.

The Across Kongsfjord transect in Figure 3 shows high surface ammonium concentrations with a 'Surfer Software' interpolated maxima just to the north of the centre of the transect. The other nutrients all show an increase in concentration with depth but appear also to show subtle differences between north and south across the transect. Nitrate and phosphate show a very slight rise in the concentration contours moving south across the transect. The deeper waters show silicate, on the other hand appear to decrease in concentration moving south across the transect although the surface waters, albeit in a rather undulating fashion appear similar from north to south.
*Preliminary Observations of pore water nutrient profiles*

Figure 4 shows the nutrient pore water profiles from station BIF 6. Ammonium and nitrate profiles appear quite spiky and possible contamination cannot be ruled out. Phosphate shows an almost linear profile with depth with a minor drop in concentration at the surface. Silica too shows a linear profile with depth but with a more marked decrease in concentration in the top 5 cm.
BIF2 in Figure 5 shows good quality data from all nutrients and shows near stable ammonium concentrations with depth but a sharp rise in the top few centimeters. Nitrate shows a decrease with depth whilst silicate and phosphate show a greater rise in concentration compared to BIF6
BIF1, the shallowest station on the transect, Figure 6, shows similar concentrations and behaviors of nutrients to station BIF2
KF4 shows a more marked decrease in nitrate and subsurface increase in ammonium compared to the stations at Bear island fan. Concentrations and profile shapes for phosphate and silicate show similar profiles to the Bear Island fan cores but with slightly elevated silica concentrations.
VP2 in figure 8 shows depletion in ammonium concentrations with depth and a rise and subsequent fall in nitrate concentration. Concentration and profile shape of the silicate and phosphate are comparable to the other stations although subsurface silicate concentrations, compared to all other stations, are at their highest.

Details of sediment core locations used for pore water nutrient studies are given elsewhere (Mckinlay)

Table 1 CTD water collected parameters

| Station | Event No | CTD Cast | CTD bottle No. | Depth (m) | Nutrients | Pigments Vol. filtered (ml) | POC/N Vol filtered (ml) | Dissolved oxygen |
|---|---|---|---|---|---|---|---|---|
| BIF 6 | 10 | 2 | 12 | 5 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | Triplicate |
| | | | 11 | 11 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | |
| | | | 10 | 50 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 9 | 100 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 8 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 7 | 500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 750 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 1000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 2000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 2500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 3000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 3186 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | Triplicate |
| BIF5 | 18 | 8 | 12 | 5 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | Triplicate |
| | | | 11 | 25 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | |
| | | | 10 | 50 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 9 | 100 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 8 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 7 | 500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 750 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 1000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 2000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 2500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 2900 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 2938 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | Triplicate |
| BIF4 | 26 | 9 | 12 | 10 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | |
| | | | 11 | 40 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | |
| | | | 10 | 50 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 9 | 100 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 8 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 7 | 500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 750 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 1000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | Triplicate |
| | | | 4 | 2000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 2490 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2 | 2540 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 2591 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | Triplicate |
| BIF 2 | 28 | 10 | 12 | 10 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | Triplicate |
| | | | 11 | 40 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | |
| | | | 10 | 50 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 9 | 100 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 8 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 7 | 500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 750 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 1000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 1200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 1350 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 1400 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 1436 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | Triplicate |
| BIF 1 | 43 | 17 | 12 | 10 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | Triplicate |
| | | | 11 | 20 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 600 | |
| | | | 10 | 30 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 9 | 50 | NH4,PO4,SiO3,NO3, NO2 | 1200 | 1200 | |
| | | | 8 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 7 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 750 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | | NH4,PO4,SiO3,NO3 | 1200 | 1200 | Triplicate |
| WSS 0 | 45 | 19 | 12 | 5 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 10 | 15 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 8 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 150 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 193 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| WSS 1 | 47 | 20 | 11 | 5 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 9 | 15 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 7 | 30 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 80 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 98 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| WSS 4 | 51 | 24 | 10 | 5 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 9 | 30 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 8 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 7 | 75 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 300 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 350 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 410 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 | 422 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| WSS 8c | 61 | 33 | 11 | 5 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 9 | 20 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 7 | 30 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 5 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 3 | 80 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 1 | 118 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| WSS 8i | 76 | | 12 | 15 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 11 | 30 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 10 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 9 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 8 | 150 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 7 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 250 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 300 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 350 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 400 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 440 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 454 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| WSS14 | 81 | 49 | 11 | 10 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 9 | 30 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 7 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 150 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 163 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| KF 4 | 93 | 55 | 12 | 10 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 11 | 35 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 10 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 9 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 8 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 7 | 500 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 6 | 750 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 5 | 1000 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 4 | 1100 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 3 | 1200 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 2 | 1300 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 1 | 1350 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| WSS13 | 94 | 56 | 11 | 10 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 9 | 35 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 7 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 5 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 3 | 150 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 1 | 210 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| XKF a | 102 | 57 | 10 | 5 | NH4,PO4,SiO3,NO3 | | | |
| | | | 7 | 10 | NH4,PO4,SiO3,NO3 | | | |
| | | | 6 | 20 | NH4,PO4,SiO3,NO3 | | | |
| | | | 5 | 50 | NH4,PO4,SiO3,NO3 | | | |
| | | | 4 | 80 | NH4,PO4,SiO3,NO3 | | | |
| | | | 3 | 100 | NH4,PO4,SiO3,NO3 | | | |
| | | | 2 | 120 | NH4,PO4,SiO3,NO3 | | | |
| | | | 1 | 135 | NH4,PO4,SiO3,NO3 | | | |
| XKF b | 103 | 58 | 9 | 5 | NH4,PO4,SiO3,NO3 | | | |
| | | | 8 | 10 | NH4,PO4,SiO3,NO3 | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 7 | 20 | NH4,PO4,SiO3,NO3 | | | |
| | | | 6 | 50 | NH4,PO4,SiO3,NO3 | | | |
| | | | 5 | 80 | NH4,PO4,SiO3,NO3 | | | |
| | | | 4 | 100 | NH4,PO4,SiO3,NO3 | | | |
| | | | 3 | 150 | NH4,PO4,SiO3,NO3 | | | |
| | | | 2 | 200 | NH4,PO4,SiO3,NO3 | | | |
| | | | 1 | 227 | NH4,PO4,SiO3,NO3 | | | |
| XKF c | 104 | 59 | 7 | 5 | NH4,PO4,SiO3,NO3 | | | |
| | | | 6 | 15 | NH4,PO4,SiO3,NO3 | | | |
| | | | 5 | 20 | NH4,PO4,SiO3,NO3 | | | |
| | | | 4 | 30 | NH4,PO4,SiO3,NO3 | | | |
| | | | 3 | 50 | NH4,PO4,SiO3,NO3 | | | |
| | | | 2 | 70 | NH4,PO4,SiO3,NO3 | | | |
| | | | 1 | 88 | NH4,PO4,SiO3,NO3 | | | |
| XKF d | 105 | 60 | 9 | 5 | NH4,PO4,SiO3,NO3 | | | |
| | | | 8 | 10 | NH4,PO4,SiO3,NO3 | | | |
| | | | 7 | 20 | NH4,PO4,SiO3,NO3 | | | |
| | | | 6 | 30 | NH4,PO4,SiO3,NO3 | | | |
| | | | 5 | 60 | NH4,PO4,SiO3,NO3 | | | |
| | | | 4 | 100 | NH4,PO4,SiO3,NO3 | | | |
| | | | 3 | 150 | NH4,PO4,SiO3,NO3 | | | |
| | | | 2 | 180 | NH4,PO4,SiO3,NO3 | | | |
| | | | 1 | 197 | NH4,PO4,SiO3,NO3 | | | |
| XKF e | 106 | 61 | 9 | 5 | NH4,PO4,SiO3,NO3 | | | |
| | | | 8 | 10 | NH4,PO4,SiO3,NO3 | | | |
| | | | 7 | 20 | NH4,PO4,SiO3,NO3 | | | |
| | | | 6 | 50 | NH4,PO4,SiO3,NO3 | | | |
| | | | 5 | 80 | NH4,PO4,SiO3,NO3 | | | |
| | | | 4 | 100 | NH4,PO4,SiO3,NO3 | | | |
| | | | 3 | 150 | NH4,PO4,SiO3,NO3 | | | |
| | | | 2 | 200 | NH4,PO4,SiO3,NO3 | | | |
| | | | 1 | 278 | NH4,PO4,SiO3,NO3 | | | |
| XKF f | 107 | 62 | 9 | 5 | NH4,PO4,SiO3,NO3 | | | |
| | | | 8 | 10 | NH4,PO4,SiO3,NO3 | | | |
| | | | 7 | 20 | NH4,PO4,SiO3,NO3 | | | |
| | | | 6 | 50 | NH4,PO4,SiO3,NO3 | | | |
| | | | 5 | 80 | NH4,PO4,SiO3,NO3 | | | |
| | | | 4 | 100 | NH4,PO4,SiO3,NO3 | | | |
| | | | 3 | 150 | NH4,PO4,SiO3,NO3 | | | |
| | | | 2 | 200 | NH4,PO4,SiO3,NO3 | | | |
| | | | 1 | 274 | NH4,PO4,SiO3,NO3 | | | |
| XKF g | 108 | 63 | 9 | 5 | NH4,PO4,SiO3,NO3 | | | |
| | | | 8 | 10 | NH4,PO4,SiO3,NO3 | | | |
| | | | 7 | 20 | NH4,PO4,SiO3,NO3 | | | |
| | | | 6 | 50 | NH4,PO4,SiO3,NO3 | | | |
| | | | 5 | 80 | NH4,PO4,SiO3,NO3 | | | |
| | | | 4 | 100 | NH4,PO4,SiO3,NO3 | | | |
| | | | 3 | 150 | NH4,PO4,SiO3,NO3 | | | |
| | | | 2 | 200 | NH4,PO4,SiO3,NO3 | | | |
| | | | 1 | 292 | NH4,PO4,SiO3,NO3 | | | |
| XKF h | 109 | 64 | 9 | 5 | NH4,PO4,SiO3,NO3 | | | |
| | | | 8 | 10 | NH4,PO4,SiO3,NO3 | | | |
| | | | 7 | 30 | NH4,PO4,SiO3,NO3 | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 6 | 50 | NH4,PO4,SiO3,NO3 | | | |
| | | | 5 | 100 | NH4,PO4,SiO3,NO3 | | | |
| | | | 4 | 150 | NH4,PO4,SiO3,NO3 | | | |
| | | | 3 | 200 | NH4,PO4,SiO3,NO3 | | | |
| | | | 2 | 250 | NH4,PO4,SiO3,NO3 | | | |
| | | | 1 | 308 | NH4,PO4,SiO3,NO3 | | | |
| Mooring | 122 | 70 | 10 | 25 | | 1200 | | |
| | | | 9 | 30 | | 1200 | | |
| | | | 8 | 35 | | 1200 | | |
| | | | 7 | 40 | | 1200 | | |
| | | | 6 | 45 | | 1200 | | |
| | | | 5 | 50 | | 1200 | | |
| | | | 4 | 55 | | 1200 | | |
| | | | 3 | 60 | | 1200 | | |
| | | | 2 | 65 | | 1200 | | |
| | | | 1 | 70 | | 1200 | | |
| WSS12 | 123 | 71 | 7 | 10 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 6 | 15 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 5 | 30 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 70 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 90 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 101 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| WSS11 | 126 | 72 | 6 | 10 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 5 | 25 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 4 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 65 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 85 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 96 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| WSS10 | 127 | 73 | 8 | 10 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 7 | 20 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 6 | 30 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 150 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 217 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| VP5 | 129 | 75 | 11 | 10 | NH4,PO4,SiO3,NO3 | 1200 | 600 | Triplicate |
| | | | 10 | 30 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 9 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 8 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 7 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 1000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 2000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 2500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 2800 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 1 | 2900 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | Triplicate |
| VP2 | 137 | 76 | 12 | 10 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 11 | 30 | NH4,PO4,SiO3,NO3 | 1200 | 600 | |
| | | | 10 | 50 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 9 | 100 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 8 | 200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 7 | 500 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 6 | 750 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 5 | 1000 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 4 | 1200 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 3 | 1350 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |
| | | | 2 | 1398 | NH4,PO4,SiO3,NO3 | 1200 | 1200 | |

*For the record: 0.38 tonnes of water were filtered and 500 samples (water, incubation and pore water) were analysed for nutrients, 390 of which were analysed in triplicate*

Nutrient concentration profiles across the
Bear Island Fan transect, September 2005

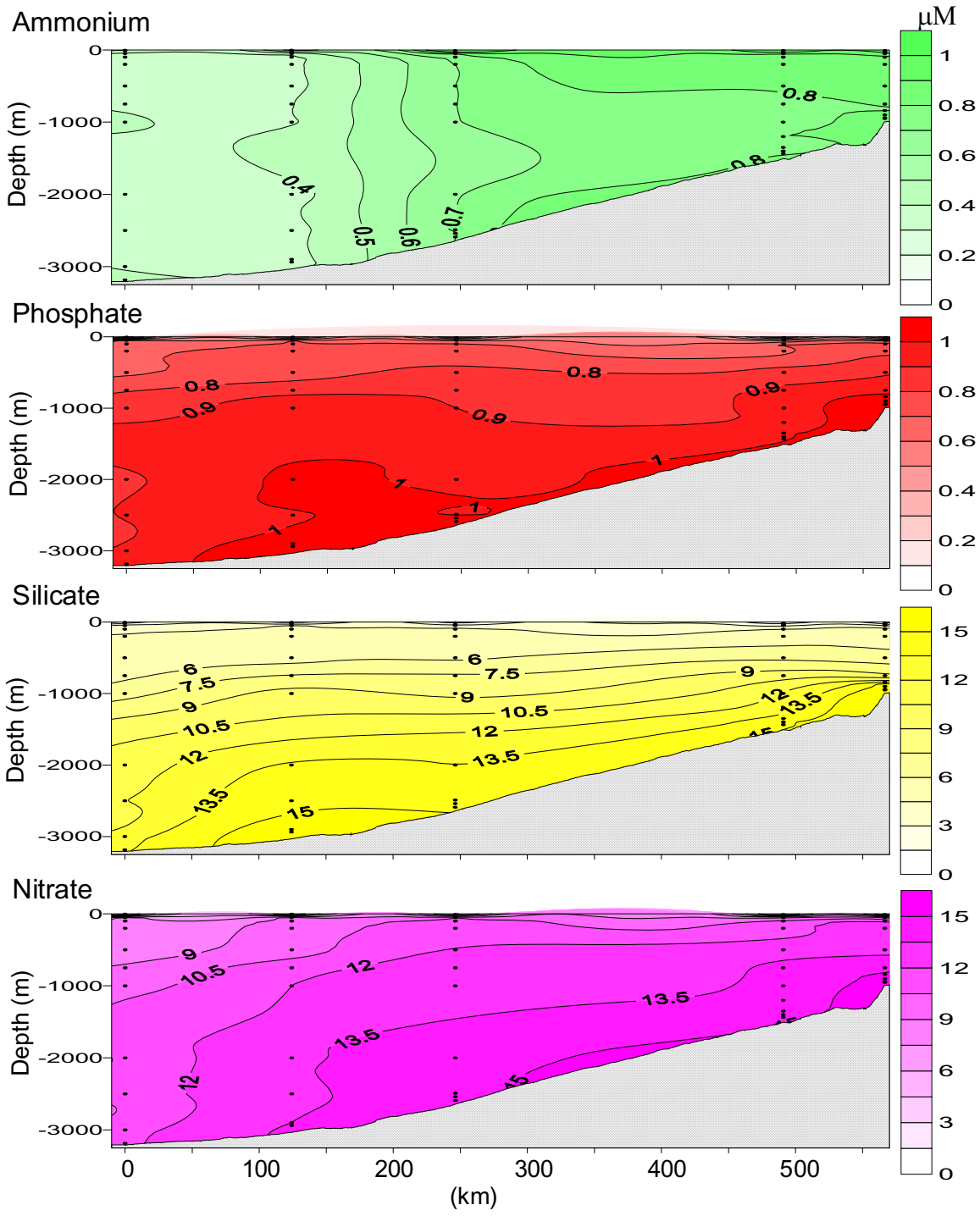



Figure 1

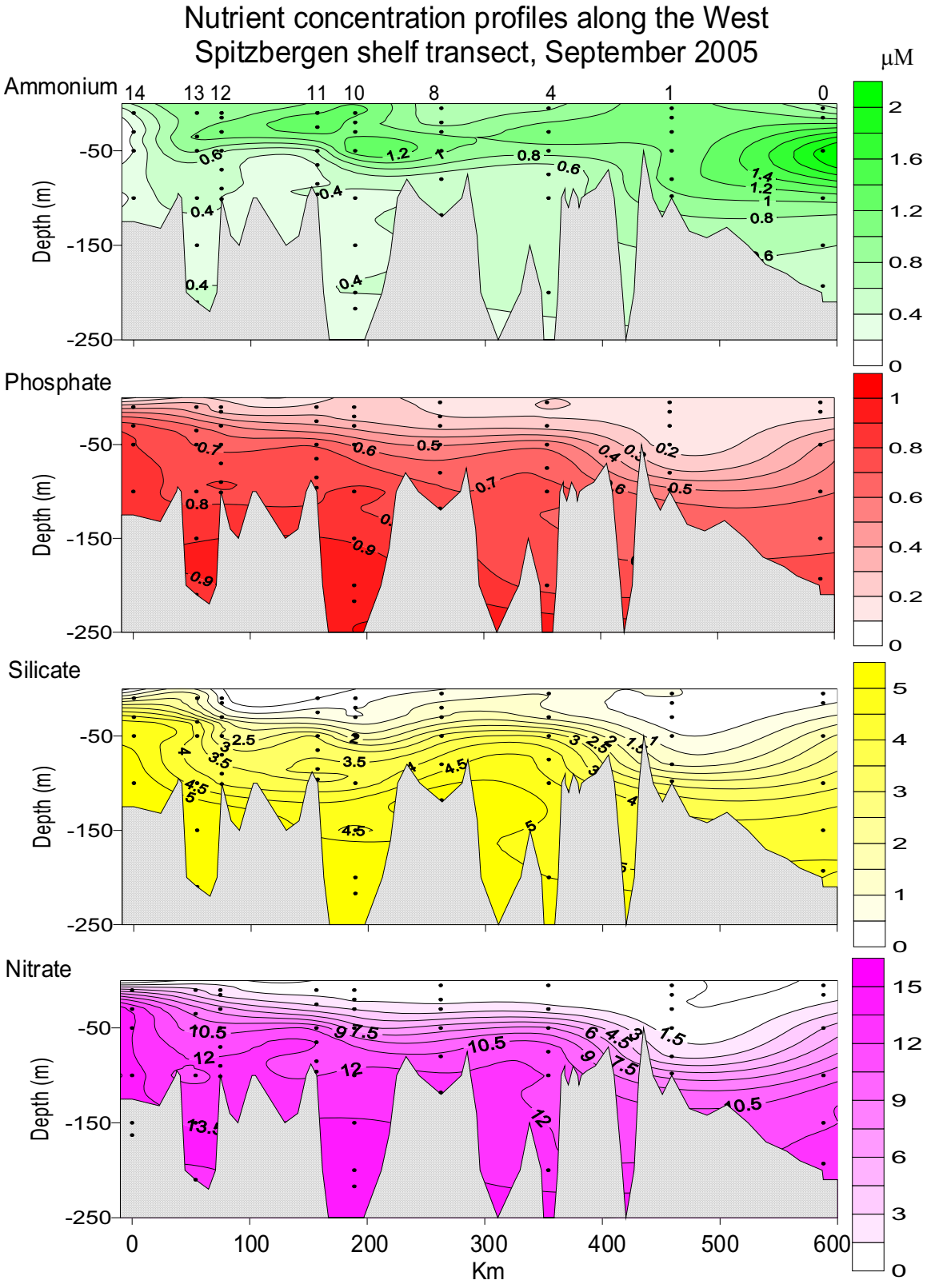

Nutrient concentration profiles along the West Spitzbergen shelf transect, September 2005
µM
Ammonium
Phosphate
Silicate
Nitrate
Depth (m)
-50
-150
-250
14 13 12 11 10 8 4 1 0
0 100 200 300 400 500 600
Km

Figure 2

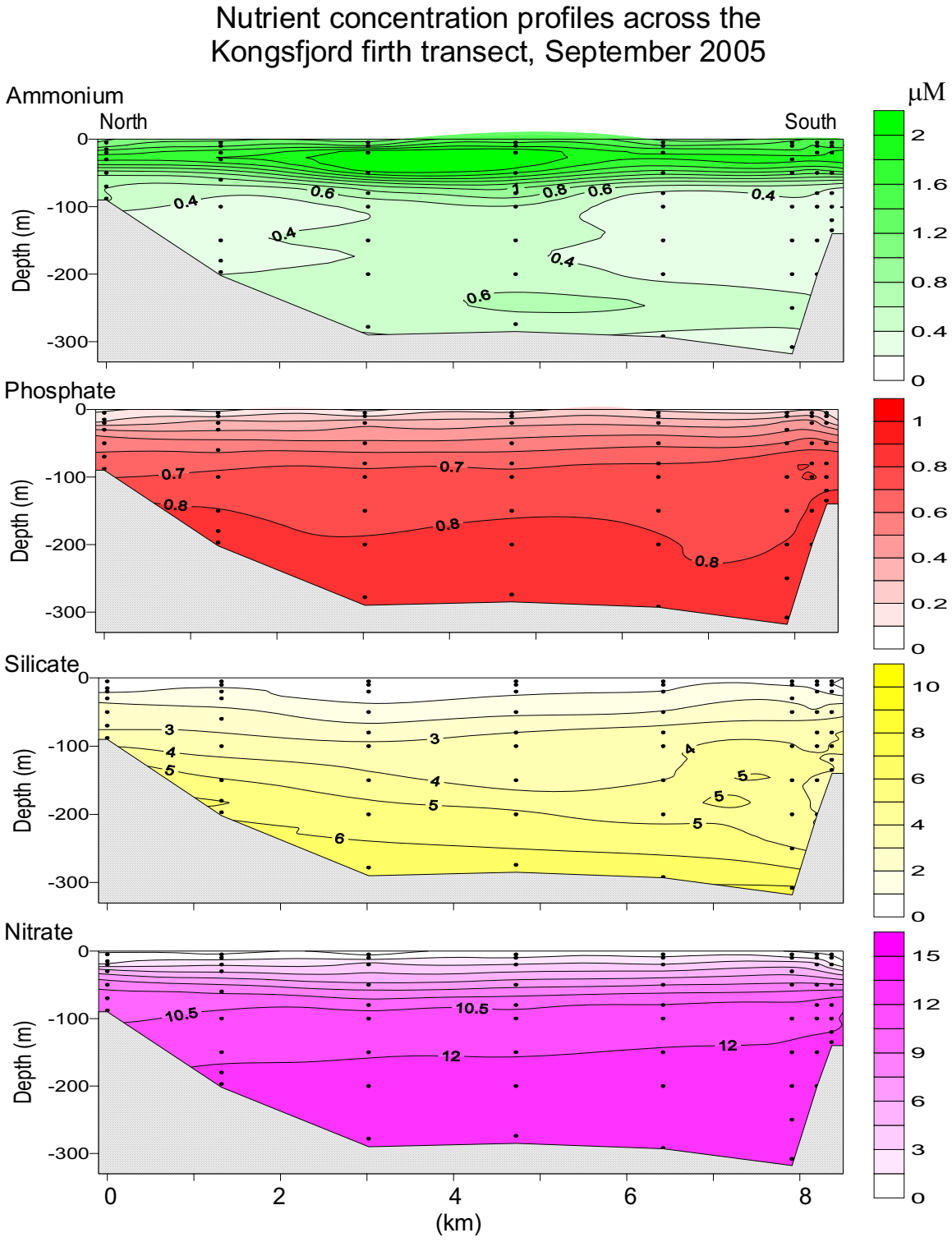

Nutrient concentration profiles across the
Kongsfjord firth transect, September 2005
Ammonium
North
South
µM
Depth (m)
Phosphate
Silicate
Nitrate
(km)

Figure 3

Sediment Pore Water Nutrient Profiles

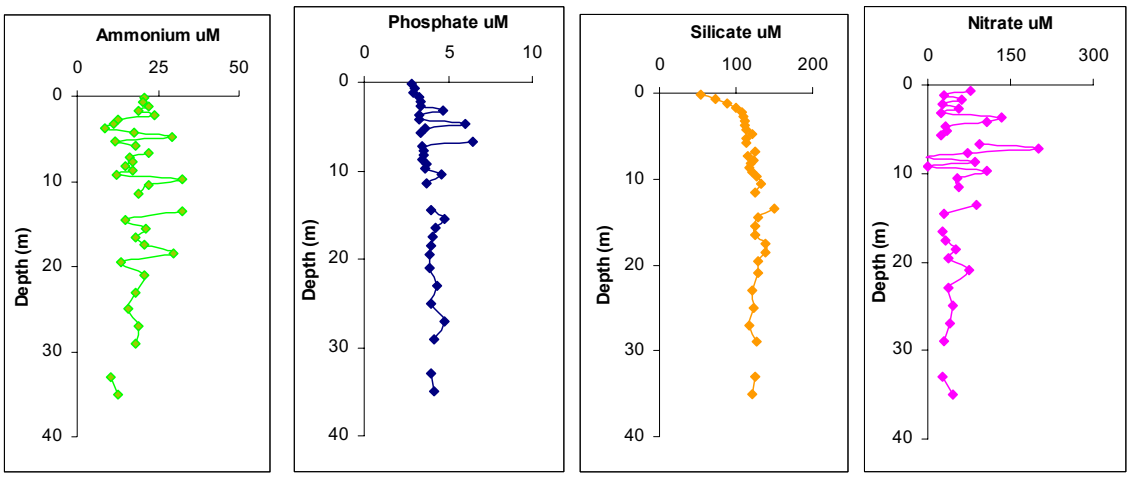



Figure 4 Station BIF6

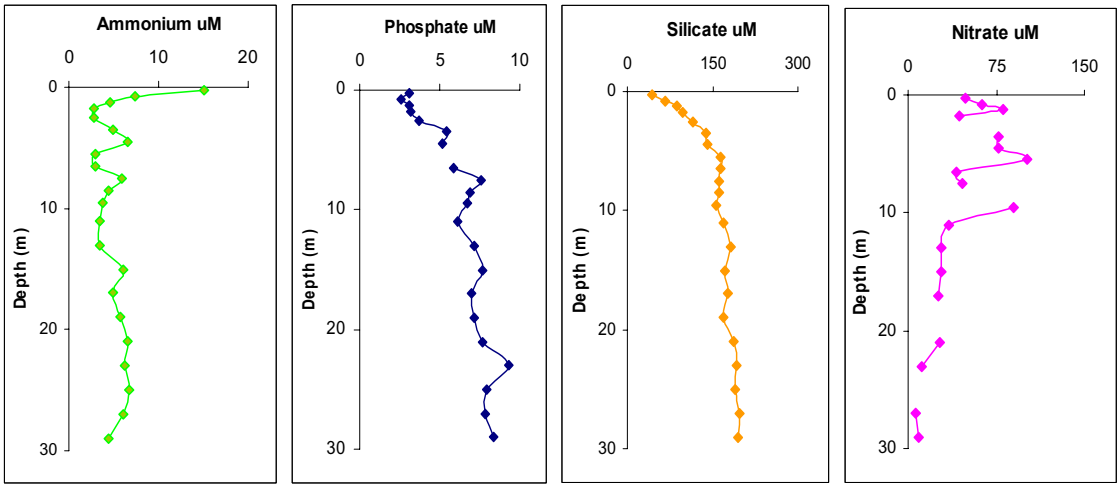



Figure 5 Station BIF2

Sediment Pore Water Nutrient Profiles (cont.)

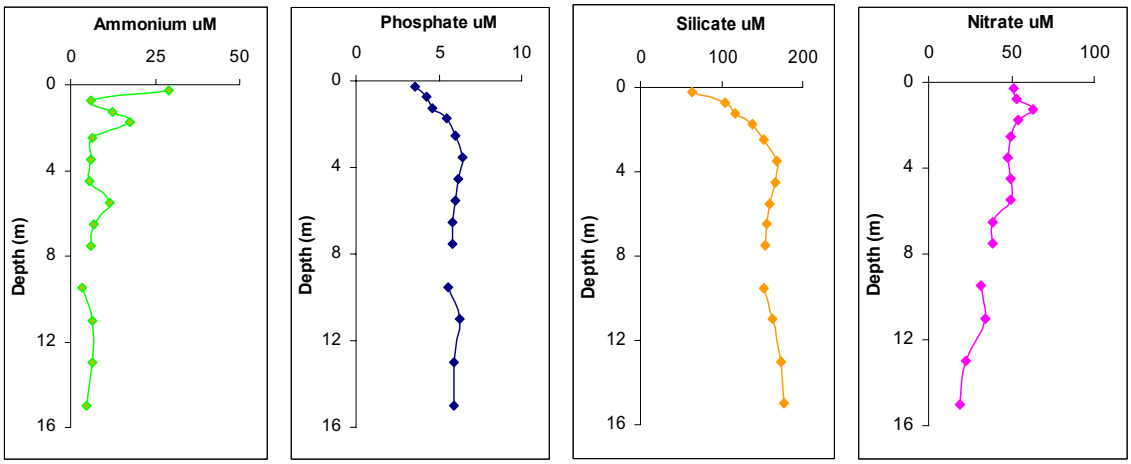



Figure 6 Station BIF1

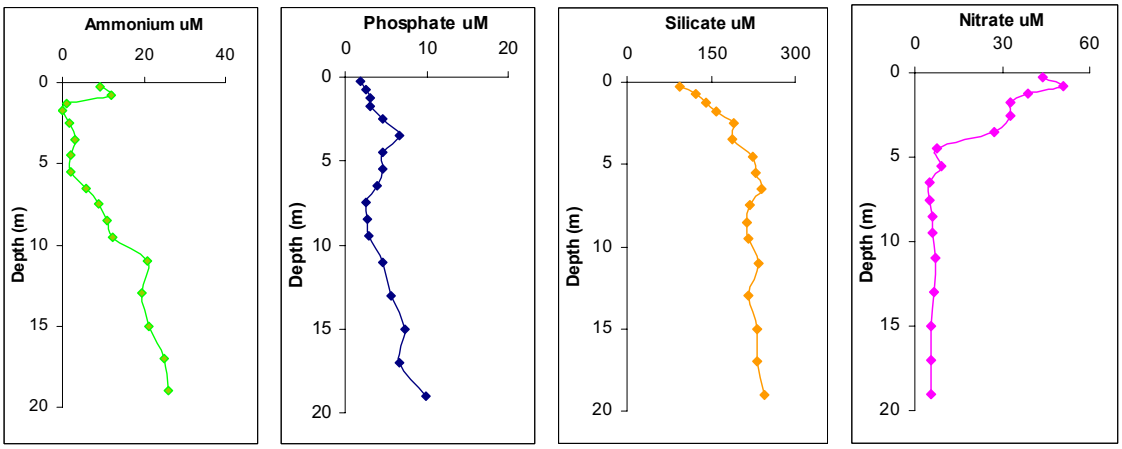



Figure 7 Station KF4

Sediment Pore Water Nutrient Profiles (cont.)

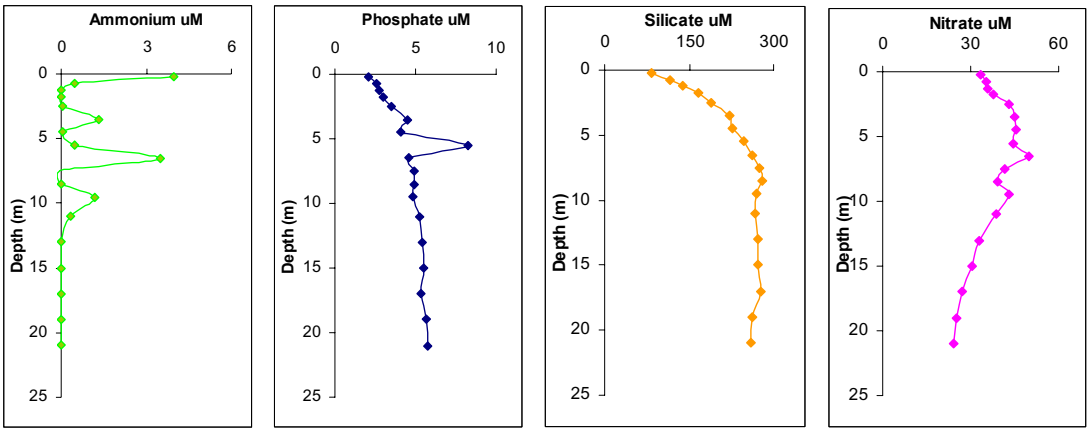



Figure 8 Station VP2

## Fatty Acids

Kenny Black & Heather Muir

**Aquapharm Bacterial Samples**
These were plated and incubated according to instructions given by Aquapharm. At the end of the cruise these will be returned to Aquapharm and SAMS will not be involved in further analyses.

**Fatty Acid Analysis**
Analysis of lipids in sediments can be used to assess quality and quantity of the organic matter present, and to provide information on original source (Carrie, Mitchell & Black, 1998).

However, extraction of lipids from bulk sediments integrates all internal components of the system i.e. detritus, bacteria, meio- and macro-benthos. Thus. it is possible that a large proportion of the lipid in a sediment core resides in living tissue, perhaps in a large macrobenthic individual, and this may obscure the detrital signal when lipids are reprocessed or differentially retained by animals.

At each station sampled, mega cores were sectioned at 20cm sediment depth (or to full depth if less) and either bagged whole and frozen with overlying water or sieved sequentially through 1 and 0.25 mm sieves with the material retained bagged and frozen. Occasionally larger organisms were stored separately for possible later identification.

Post-cruise, frozen samples will be lipid extracted and transesterified to yield fatty acid methyl esters then analysed by GC and GCMS. The results will allow determination of the partitioning of sedimentary lipid between large macrofauna, small macrofauna and detritus, microbes and meiobenthos. The depth transect will allow analysis of how the OM supply gradient influences this partitioning.

The proposed partitioning of lipids in sedments has not previously been done and offers interesting insights into the lipid metabolism of sediments and a relatively simple but potentially high impact publication.

Carrie, R., Mitchell, L. and Black, K. (1998). Seasonal fatty acid fluctuations on the Hebridean Shelf Edge. *Organic Geochemistry* **29,** 1583-1593.

**Chl/Rad and Alkenones**
Cores were sliced at 0.5cm resolution to 10cm, 1cm resolution from 10 – 20cm and 2 cm beyond that. Core length was not recorded but will be estimated from geochemistry cores at the same stations where this information was recorded. All samples were bagged and frozen.

Depth resolved measurements of sediment chlorophyll has been used to estimate Bioturbation rates in cores from Loch Creran (Nickell et al., 2003), Arctic (JR75, in prep.) and the Red Sea (Black et al. in prep). These measurements will give us further information on Bioturbation rates in the Arctic but at a time further from the spring bloom when chlorophyll concentrations will likely be lower but animal activity higher (due to increased temperature). The measured rates will also be used to compare with those measured from the incubation experiments carried out on board by Nickell, Harvey and Sheilds.

Alkenones, derived from cocolithophores, are preserved in the sediment and may provide temperature proxies. This has not previously been done at SAMS but method development is underway. If successful, results can be used to alongside geological data collected by Howe.

Nickell, L. A., Black, K. D., Hughes, D. J., Overnell, J., Brand, T., Nickell, T. D., Breuer, E. and Harvey, S. M. (2003) Bioturbation, sediment fluxes and benthic community structure around a salmon cage farm in Loch Creran, Scotland. *Journal of Experimental Marine Biology and Ecology* 285, 221-233.

**Table Sample list**

| Station | Event No | Depth (m) | Sample Type | Notes |
|---|---|---|---|---|
| BIF 6 | 8 | 3213 | Fatty acid analysis | |
| | 8 | 3213 | Fatty acid analysis (sieved) | |
| | 8 | 3213 | Chl/Rad | |
| | 9 | 3211 | Fatty acid analysis | |
| | 9 | 3211 | Fatty acid analysis (sieved) | |
| | 9 | 3211 | Aquapharm sample plated (surface sediment) | |
| | 9 | 3211 | Aquapharm sample stored (sediment from 25cm) | |
| BIF 5 | 20 | 2968 | Chl/Rad | |
| BIF 2 | 24 | 1461 | Fatty acid analysis | |
| | 24 | 1461 | Fatty acid analysis (sieved) | |
| | 25 | 1461 | Fatty acid analysis | |
| | 25 | 1461 | Fatty acid analysis (sieved) | |
| | 25 | 1461 | Chl/Rad | |
| | 28 | 1457 | Aquapharm sample plated (surface water (10m depth) | |
| | 28 | 1457 | Aquapharm sample plated (deep water (1436m depth) | |
| BIF 1 | 33 | 1311 | Fatty acid analysis | short core (approx 10cm) |
| | 33 | 1311 | Fatty acid analysis (sieved) | short core (approx 10cm) |
| | 33 | 1311 | Chl/Rad | |
| | 33 | 1311 | Aquapharm sample plated (polychaete worm) | |
| | 36 | 970 | Fatty acid analysis | short core (approx 10cm) |
| | 36 | 970 | Fatty acid analysis (sieved) | short core (approx 10cm) |
| WSS 0 | 46 | 206 | Alkenones | |
| | 46 | 206 | Chl/Rad | |
| WSS 4 | 57 | 443 | Fatty acid analysis | |
| | 57 | 443 | Fatty acid analysis (sieved) | |
| | 57 | 443 | Fatty acid analysis | |
| | 57 | 443 | Fatty acid analysis (sieved) | |
| | 57 | 443 | Alkenones | |
| | 57 | 443 | Chl/Rad | |
| KF 4 | 83 | 1361 | Fatty acid analysis | |
| | 83 | 1361 | Fatty acid analysis (sieved) | |
| | 84 | 1363 | Fatty acid analysis | |
| | 84 | 1363 | Fatty acid analysis (sieved) | |
| | 84 | 1363 | Alkenones | |
| | 84 | 1363 | Chl/Rad | |
| MC 6 | 96 | 279 | Alkenones | |
| MC 1 (KF 1) | 115 | 358 | Fatty acid analysis | |
| | 115 | 358 | Fatty acid analysis (sieved) | |
| | 116 | 358 | Alkenones | Possibly |

| Station | Event No | Depth (m) | Sample Type | Notes |
|---|---|---|---|---|
| | | | | used for Chl too. |
| MC 5 | 121 | 373 | Fatty acid analysis | Short core (approx 13cm) |
| | 121 | 373 | Fatty acid analysis (sieved) | Short core (approx 13cm) |
| | 121 | 373 | Alkenones | Possibly used for Chl too. |
| VP 5 | 131 | 2924 | Chl/Rad | |
| VP 2 | 134 | 1418 | Fatty acid analysis | |
| | 134 | 1418 | Fatty acid analysis (sieved) | |
| | 135 | 1424 | Chl/Rad | |
| | 136 | 1424 | Fatty acid analysis | |
| | 136 | 1424 | Fatty acid analysis (sieved) | |
| | 137 | 1423 | Fatty acid analysis | |
| | 137 | 1423 | Fatty acid analysis | |
| | 137 | 1423 | Alkenones | |
| | 137 | 1423 | Alkenones | |
| | | | | |
| | | | | |
| Sample Type | | | | |
| Fatty acid analysis = top 20cm bagged and frozen | | | | |
| Fatty acid analysis (sieved) = top 20cm sieved and fractions collected in 1000um and 250um mesh | | | | |
| Alkenones = samples sliced at 0.5cm intervals to 10cm, 1cm to 20cm, 2cm to bottom | | | | |
| Chl/Rad = samples sliced at 0.5cm intervals to 10cm, 1cm to 20cm, 2cm to bottom | | | | |
| Aquapharm sample plated = serial dilutions of sample and plated onto range of agar plates | | | | |
| Aquapharm sample stored = sample stored in plastic test tube for analsyis at lab | | | | |

## Fate and Pathways of pollutants to the Svalbard Area, Arctic

Lindsay Vare

**Introduction**

The aim of the PhD is to determine the main pathways and ultimate fate of various pollutants in the Arctic Environment. Metals (cadmium, lead and mercury) and organic pollutants (polycyclic aromatic hydrocarbons (PAHs) and organic pesticides) will be analysed. Cores have previously been collected from JCR75 and a trip via land to Ny Ålesund in March 2004.

The JCR127 cruise had three main objectives;

1. To collect a sediment core from Storfjorden for metal analysis. To investigate further lead concentrations in different water masses
2. To obtain two sediment cores from Kongsfjorden for organic analysis. To look at differences in organic contaminants along a longitudinal transect.
3. To look at the spatial and temporal variability of suspended particulate material (SPM) within the Svalbard area.

**Methods**

1. The cores shown in table 1 were collected for metal analysis using a Bowers and Connelly mega-corer (111cm diameter). Once collected the cores were sectioned at 0.5cm depths down to 10cm, 1cm intervals until 20cm and 2cm slices thereafter. The samples were stored in pre-labelled plastic bags and kept frozen in the –80°C freezer.
2. The cores shown in table 2 were obtained for organic analysis. Again they were collected using the mega-corer. The cores were sectioned at a lower resolution of 1cm intervals to 10cm and then 2cm slices until the bottom of the core. To avoid plastic contamination the samples were sliced using a metal slice and stored frozen in small glass jars.
3. The SPM sites are displayed in table 3. At each site, between 6 and 12 depths were separately collected using a SeaBird 911plus CTD and carousel. Onboard, up to 11 litres of seawater from each depth were filtered through pre-weighed Nuclepore filters (0.4µm, for multi-element analysis). The filtering system was set up to filter 8 samples at a time using a nitrogen pressure system. Upon completion the filters were rinsed with approximately 10ml of Millipore water. The total volume of water filtered was measured.

**Table 1 Cores collected for metal analysis.**

| Station | Depth | Event number | MEGA | Date | Lat (N) | Long (E) |
|---|---|---|---|---|---|---|
| WSS0 | 206m | #46 | MEGA18 | 08/09/2005 | 76 48.22 | 18 08.19 |
| | | | | | | |
| WSS4 | 443m | #57 | MEGA19 | 09/09/2005 | 77 02.96 | 13 22.69 |
| VP5 | 2921m | #130 | MEGA31 | 18/09/2005 | 68 37.56 | 04 35.69 |
| VP2a | 1423m | #133 | MEGA34 | 19/09/2005 | 68 02.02 | 05 13.64 |

**Table 2 Cores collected for organic analysis.**

| Station | Depth | Event number | MEGA | Date | Lat (N) | Long (E) |
|---|---|---|---|---|---|---|
| KF1 (MC1) | 358m | #115 | MEGA27 | 15/09/2005 | 78 57.48 | 11 54.38 |
| KF4 | 1361m | #82 | MEGA20 | 13/09/2005 | 78 58.43 | 06 42.67 |

***Table 3*** ***SPM Stations***

| Station | Depth | filter depths | Event number | CTD number | Date | Lat (N) | Long (E) |
|---|---|---|---|---|---|---|---|
| BIF1 | 970m | 5m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 10m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 25m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 50m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 100m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 200m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 300m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 400m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 500m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 750m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 900m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF1 | 970m | 967m | #38 | CTD012 | 07/09/2005 | 73 57.46 | 15 34.96 |
| BIF2 | 1540m | 5m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 10m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 25m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 50m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 100m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 200m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 500m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 750m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 1000m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 1200m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 1400m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF2 | 1540m | 1540m | #29 | CTD011 | 06/09/2005 | 73 40.21 | 13 47.63 |
| BIF6 | 3183m | 5m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 10m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 50m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 100m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 200m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 300m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 500m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 750m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 1000m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 2000m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 3000m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| BIF6 | 3183m | 3183m | #16 | CTD007 | 03/09/2005 | 70 29.92 | 04 00.15 |
| WSS1 | 106m | 5m | #47 | CTD020 | 08/09/2005 | 76 28.11 | 15 44.88 |
| WSS1 | 106m | 15m | #47 | CTD020 | 08/09/2005 | 76 28.11 | 15 44.88 |
| WSS1 | 106m | 30m | #47 | CTD020 | 08/09/2005 | 76 28.11 | 15 44.88 |
| WSS1 | 106m | 50m | #47 | CTD020 | 08/09/2005 | 76 28.11 | 15 44.88 |
| WSS1 | 106m | 80m | #47 | CTD020 | 08/09/2005 | 76 28.11 | 15 44.88 |
| WSS1 | 106m | 98m | #47 | CTD020 | 08/09/2005 | 76 28.11 | 15 44.88 |
| WSS4 | 443m | 5m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| WSS4 | 443m | 15m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| WSS4 | 443m | 30m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| WSS4 | 443m | 50m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| WSS4 | 443m | 80m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **WSS4** | 443m | 100m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| **WSS4** | 443m | 150m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| **WSS4** | 443m | 200m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| **WSS4** | 443m | 250m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| **WSS4** | 443m | 300m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| **WSS4** | 443m | 400m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| **WSS4** | 443m | 443m | #56 | CTD029 | 09/09/2005 | 77 02.96 | 13 22.69 |
| **WSS8/8c** | 128m | 5m | #61 | CTD033 | 09/09/2005 | 77 38.99 | 12 07.05 |
| **WSS8/8c** | 128m | 20m | #61 | CTD033 | 09/09/2005 | 77 38.99 | 12 07.05 |
| **WSS8/8c** | 128m | 30m | #61 | CTD033 | 09/09/2005 | 77 38.99 | 12 07.05 |
| **WSS8/8c** | 128m | 50m | #61 | CTD033 | 09/09/2005 | 77 38.99 | 12 07.05 |
| **WSS8/8c** | 128m | 80m | #61 | CTD033 | 09/09/2005 | 77 38.99 | 12 07.05 |
| **WSS8/8c** | 128m | 128m | #61 | CTD033 | 09/09/2005 | 77 38.99 | 12 07.05 |
| **WSS8i** | 482m | 10m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 30m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 50m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 80m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 100m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 150m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 200m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 250m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 300m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 350m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 400m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS8i** | 482m | 482m | #74 | CTD046 | 10/09/2005 | 77 33.06 | 11 00.78 |
| **WSS10** | 223m | 10m | #128 | CTD074 | 16/09/2005 | 78 07.89 | 11 06.69 |
| **WSS10** | 223m | 30m | #128 | CTD074 | 16/09/2005 | 78 07.89 | 11 06.69 |
| **WSS10** | 223m | 50m | #128 | CTD074 | 16/09/2005 | 78 07.89 | 11 06.69 |
| **WSS10** | 223m | 80m | #128 | CTD074 | 16/09/2005 | 78 07.89 | 11 06.69 |
| **WSS10** | 223m | 100m | #128 | CTD074 | 16/09/2005 | 78 07.89 | 11 06.69 |
| **WSS10** | 223m | 150m | #128 | CTD074 | 16/09/2005 | 78 07.89 | 11 06.69 |
| **WSS10** | 223m | 200m | #128 | CTD074 | 16/09/2005 | 78 07.89 | 11 06.69 |
| **WSS10** | 223m | 217m | #128 | CTD074 | 16/09/2005 | 78 07.89 | 11 06.69 |
| **KF4** | 1365m | 5m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 15m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 30m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 50m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 80m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 100m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 200m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 500m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 750m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 1000m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 1200m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **KF4** | 1365m | 1365m | #91 | CTD054 | 13/09/2005 | 78 58.39 | 06 42.65 |
| **XKFH** | 319m | 5m | #110 | CTD065 | 14/09/2005 | 78 58.82 | 11.32.81 |
| **XKFH** | 319m | 15m | #110 | CTD065 | 14/09/2005 | 78 58.82 | 11.32.81 |
| **XKFH** | 319m | 30m | #110 | CTD065 | 14/09/2005 | 78 58.82 | 11.32.81 |
| **XKFH** | 319m | 50m | #110 | CTD065 | 14/09/2005 | 78 58.82 | 11.32.81 |
| **XKFH** | 319m | 80m | #110 | CTD065 | 14/09/2005 | 78 58.82 | 11.32.81 |
| **XKFH** | 319m | 100m | #110 | CTD065 | 14/09/2005 | 78 58.82 | 11.32.81 |
| **XKFH** | 319m | 150m | #110 | CTD065 | 14/09/2005 | 78 58.82 | 11.32.81 |
| **XKFH** | 319m | 200m | #110 | CTD065 | 14/09/2005 | 78 58.82 | 11.32.81 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **XKFH** | 319m | 319m | #110 | CTD065 | 14/09/2005 | 78 58.82 | 11.32.81 |
| **VP2a** | 1398m | 10m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 30m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 50m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 100m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 200m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 500m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 750m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 1000m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 1200m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 1350m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 1398m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |
| **VP2a** | 1398m | 1398m | #137 | CTD076 | 19/09/2005 | 68 02.02 | 05 13.65 |

**Future activities.**

On return to the laboratory, various methods of analysis will be undertaken.

1. The cores for metal interpretation will be freeze dried and ground, with a calculation of weight and dry weight. 0.1g of the sediment will be used for a closed vessel microwave digestion using a combination of acids ($HNO_3$, HCl and HF). An array of metal concentrations will be determined by ICP-MS and ICP-OES. $^{206/207}$Pb isotopic ratios will be determined using ICP-MS. Cores will also be analysed for particle size, CHN, and sediment accumulation rates.
2. Organic pollutants will be analysed using GC-MS. Samples will be extracted via a Soxhlet extraction using various solvents. This will be followed by a silica gel-alumina cleanup procedure. Identification of organic pesticides and PAHs will be both qualitative and quantitative.
3. For the SPM filters a leaching procedure will be conducted with $HNO_3$. Various metals will be examined using ICP-MS, concentrating on total lead concentrations and stable lead isotope ratios.