JR 127 Cruise Report

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 $\delta^{18}O$ 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

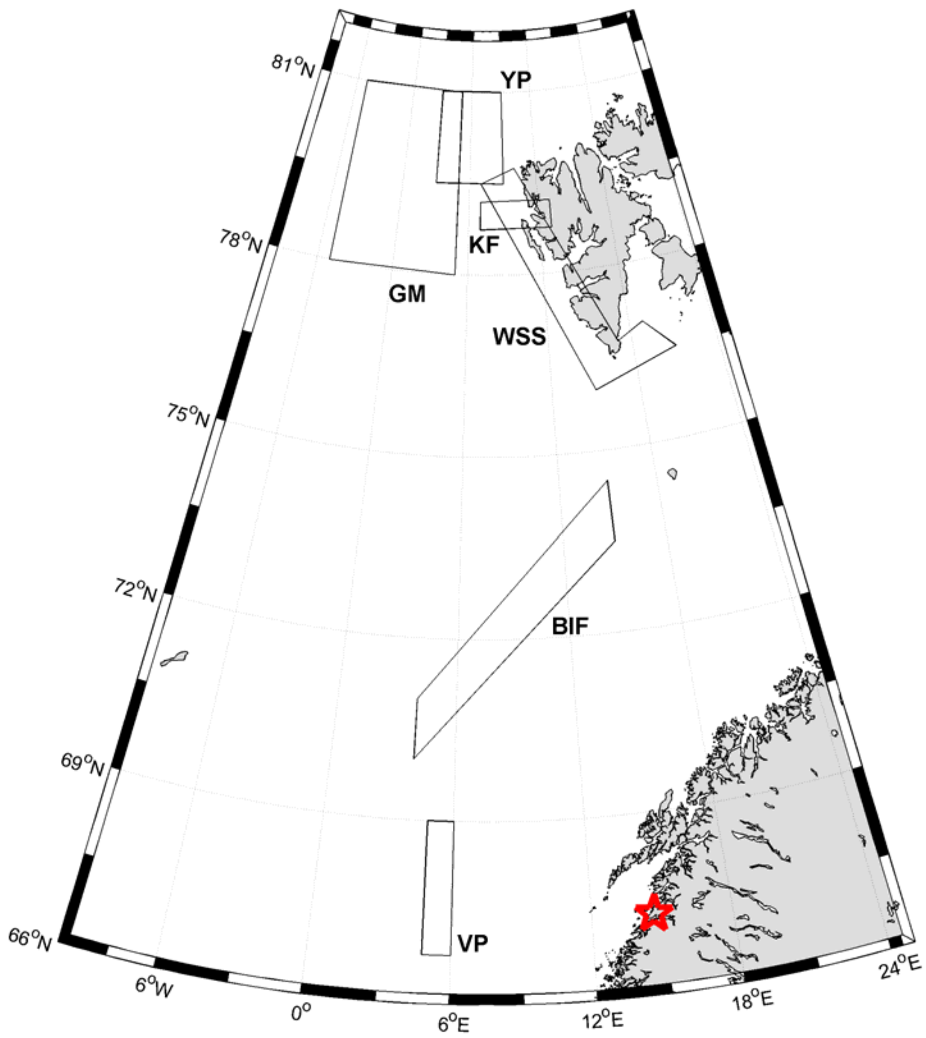

Figure 1: Sampling Sites for JCR 127.

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
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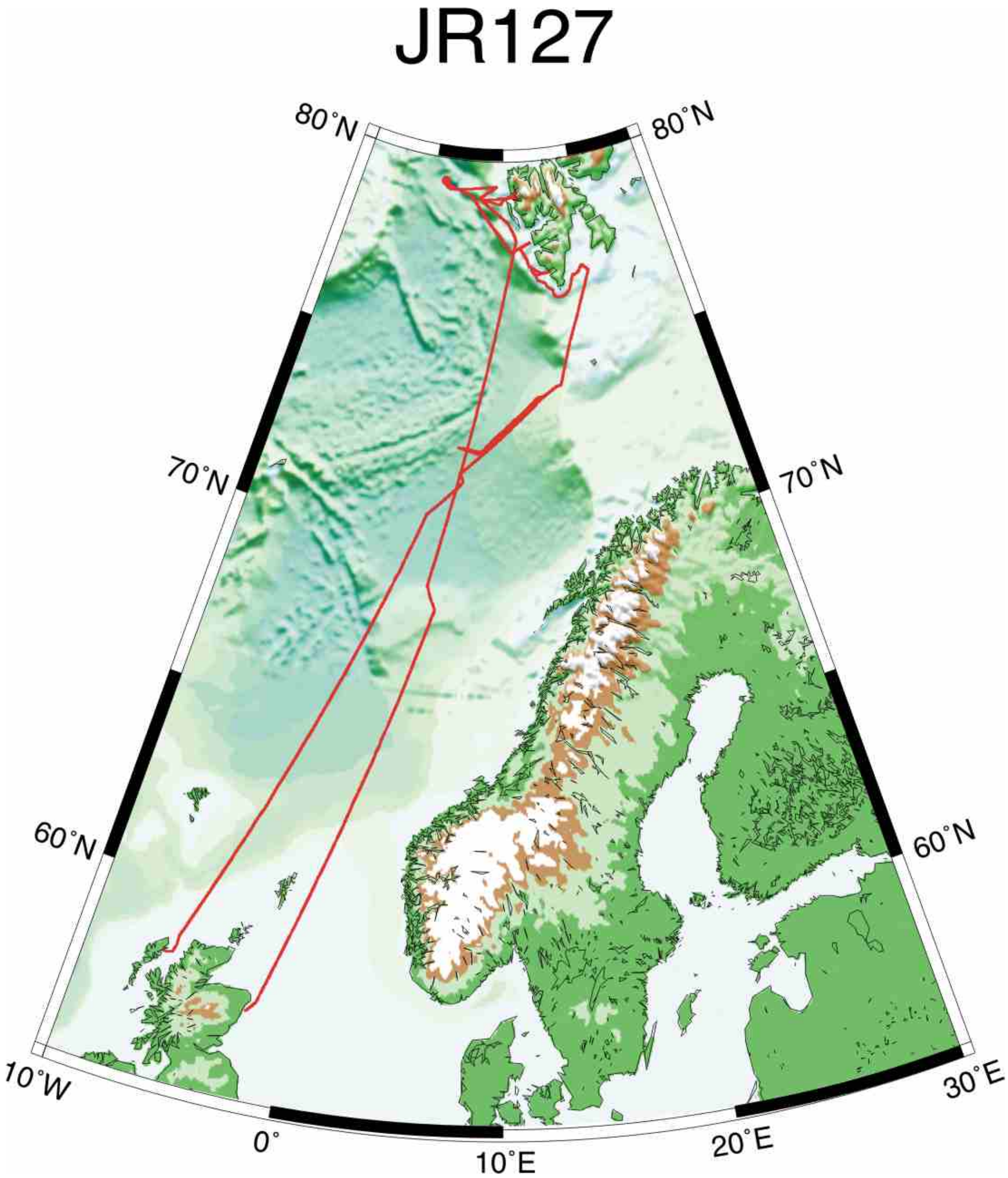
HOWE	John A	Geologist
LAMONT	Peter	Biologist
McKINLAY	Susan	Geochemist
MORRIS	Peter	Swath
MUIR	Heather	Chemist
NICKELL	Lois	Biologist
PROVOST	Paul	Physicist
REYNOLDS	Saul	Landers
VARE	Lindsay	Geochemist
VENABLES	Emily	Physicist
WILSON	Charlie	Geologist



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 Date	Start Time (Z)	Stop Date	Stop Time (Z)	Data
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 Date	Start Time (Z)	Stop Date	Stop Time (Z)	Data
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]

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[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.

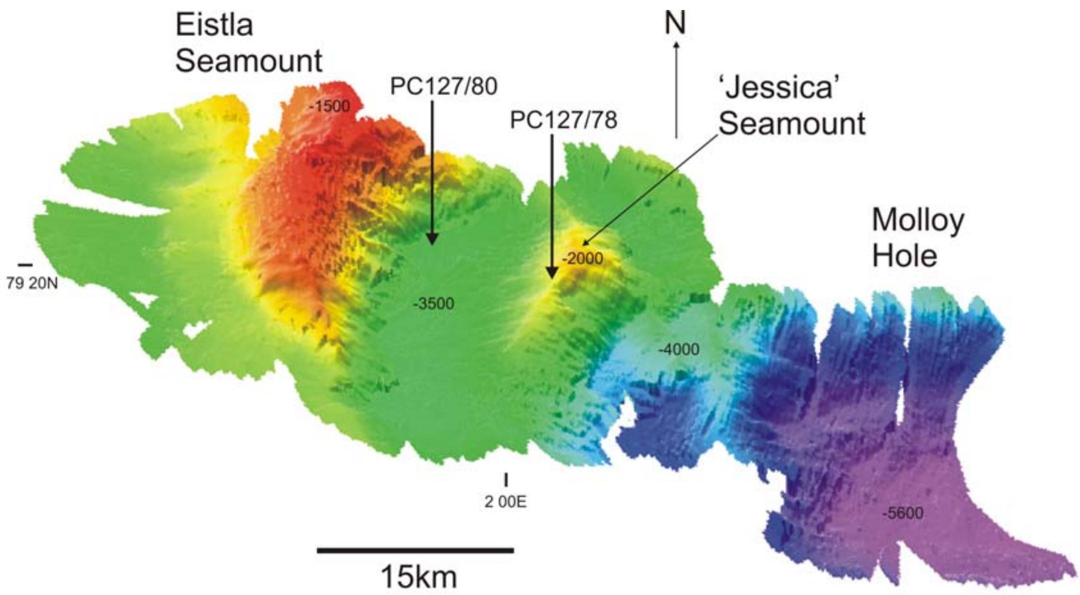


Figure 1: Sun-illuminated multibeam bathymetry, viewed from the south, of the basin to the east of the Eistla seamount, Molloy Ridge, Fram Strait. The basin is bounded at its eastern extent by a small un-named feature, informally termed the 'Jessica' seamount. Location of the two piston cores, 78 and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

<u>National Oceanography Centre – Coring Equipment</u>

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 17:47 hrs	78 91.31 12 27.20	12	>50	Ice Collection	Ice S11	Kongsfjord, Svalbard Central basin
14/9/05 17:47 hrs	78 91.54 12 25.09	13	>50	CTD		Kongsfjord, Svalbard Central basin
14/9/05 17:47 hrs	78 91.54 12 25.09	13	>50	Ice Collection	Ice S13	Kongsfjord, Svalbard Central basin
14/9/05 17:53 hrs	78 92.46 12 18.89	14	29	CTD	Surface Water Sample	Kongsfjord, Svalbard Central basin
14/9/05 17:53 hrs	78 92.46 12 18.89	14	29	Ice Collection	Ice S14	Kongsfjord, Svalbard Central basin
14/9/05 18:04 hrs	78 93.28 12 12.52	15	>50	CTD	Surface Water Sample	Kongsfjord, Svalbard Central basin
14/9/05 18:04 hrs	78 93.28 12 12.52	15	>50	Ice Collection	Ice S15	Kongsfjord, Svalbard Central basin
14/9/05 18:14 hrs	78 94.05 12 06.15	16	>50	CTD	Surface Water Sample	Kongsfjord, Svalbard Central basin
14/9/05 18:14 hrs	78 94.05 12 06.15	16	>50	Ice Collection	Ice S16	Kongsfjord, Svalbard 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 17/09/05 - 18/09/05	1300 1606	0108 2012	JR127_BIF	050901105633.raw to 050906223737.raw (incl) 050917160637.raw to 050918201201.raw (incl)	967 - 3231m	Burst Chirp	
West Svalbard Shelf	07/09/05 - 10/09/05 16/09/05 - 17/09/05	1116 0548	0811 1605	JR127_WSvalb	050907113324.raw to 050910075103.raw (incl) 050916044601.raw to 050917141053.raw (incl)	45 - 1051m 66 - 3461m	Burst Chirp	
Fram Strait	10/09/05 - 11/09/05 12/09/05 - 14/09/05	1221 2220	0839 0229	JR127_FramStrait jr127_fram2	050910121840.raw to 050911080707.raw (incl) 050912220326.raw to 050914004137.raw (incl)	356 - 5094m 204 - 5586m	Burst Chirp 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) 1 Megacore (RN/Chl a) 1 Megacore (SP-TM) 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) 1 Megacore (RN/Chl a) 1 Megacore (SP-TM) 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) 1 Megacore (SP-TM) 1 Megacore (PW-DOC)	
KF4/#82,84	78° 58.43 N / 06° 42.67 E	13/09/05	1 Megacore (PW-TM/NUTS) 1 Megacore (RN/Chl a) 1 Megacore (SP-TM) 1 Megacore (PW-DOC)	1361 m
VP 2/#133,134	68° 02.02 N / 05° 13.64 E	19/09/05	1 Megacore (PW-TM/NUTS) 1 Megacore (RN/Chl a) 1 Megacore (SP-TM) 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 luminaphor e	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 -1°C 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 -1°C.

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 -80°C for later sorting at SAMS. Some samples were sorted onboard for macrofauna and individual animals placed in eppendorf tubes before storing at -80°C.
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):

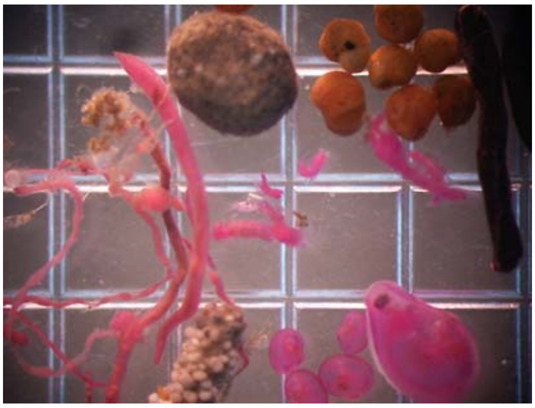
No large surface features were observed in either of the two boxcores. There was an absence of borrows, tubes or visible surface fauna.

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

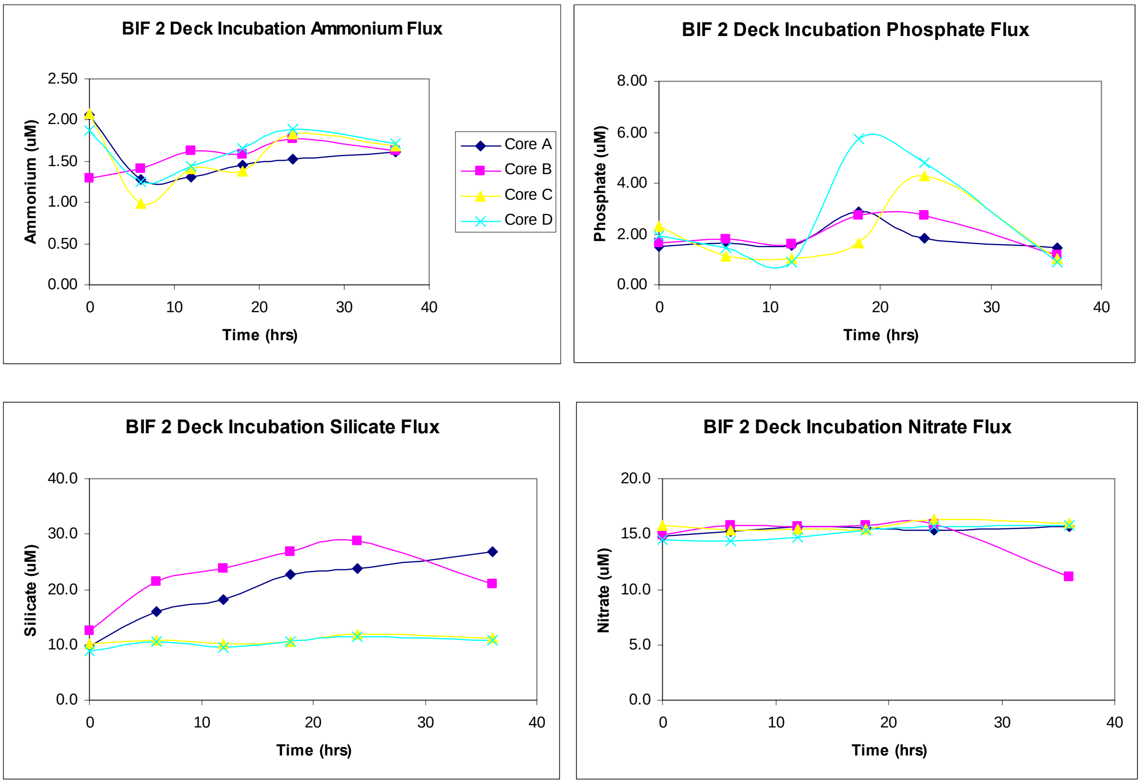
Date	Time (GMT)	Latitude	Longitude	Event	Depth (m)	Station	Activity
04/09/05	1114	73°40.18'N	13°47.24'E	#23	1457	BIF2	ELINOR deployment
06/09/05	1212	73°40.01'N	13°46.88'E	#27	1457	BIF2	ELINOR recovery

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	

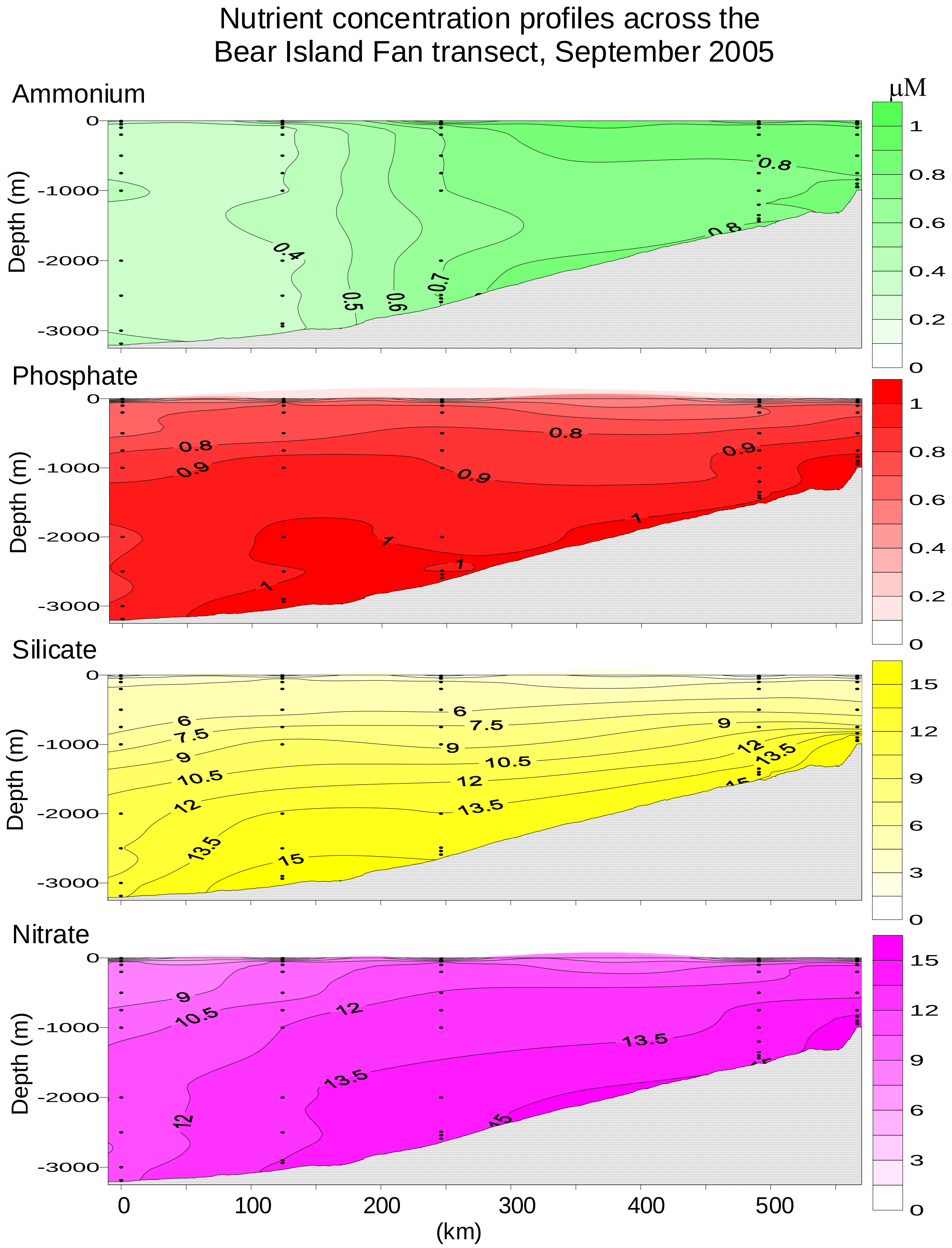
			1	422	NH4,PO4,SiO3,NO3	1200	1200	
WSS 8c	61	33	11	5	NH4,PO4,SiO3,NO3	1200	600	
			9	20	NH4,PO4,SiO3,NO3	1200	600	
			7	30	NH4,PO4,SiO3,NO3	1200	600	
			5	50	NH4,PO4,SiO3,NO3	1200	600	
			3	80	NH4,PO4,SiO3,NO3	1200	600	
			1	118	NH4,PO4,SiO3,NO3	1200	600	
WSS 8i	76		12	15	NH4,PO4,SiO3,NO3	1200	600	
			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
Ammonium
Phosphate
Silicate
Nitrate
Depth (m)
µM
(km)
0
100
200
300
400
500
-1000
-2000
-3000

Figure 1

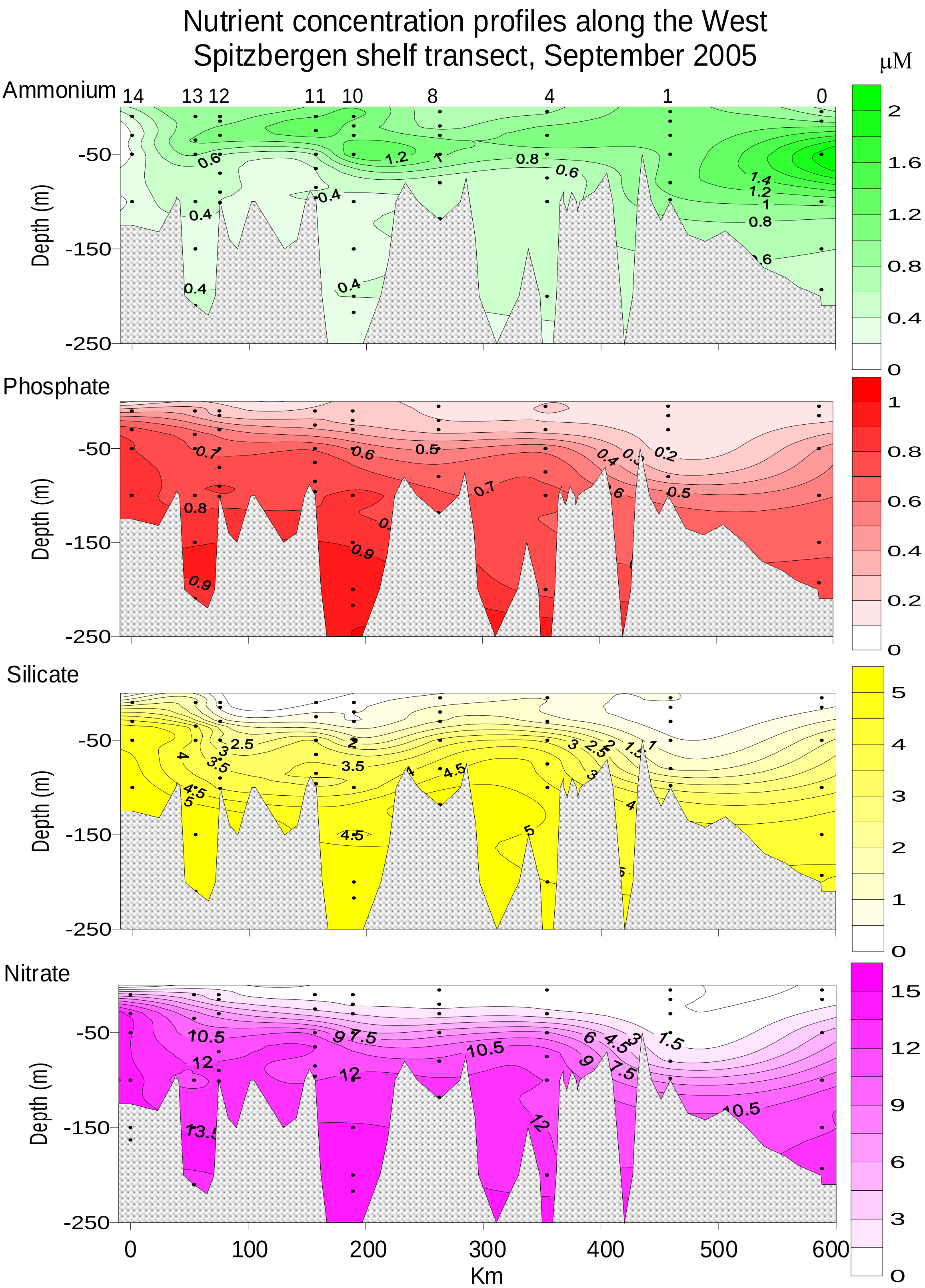

Nutrient concentration profiles along the West Spitzbergen shelf transect, September 2005
µM
Ammonium
14
13 12
11 10
8
4
1
0
Phosphate
Silicate
Nitrate
Depth (m)
-50
-150
-250
0
100
200
300
400
500
600
Km

Figure 2

Nutrient concentration profiles across the
Kongsfjord firth transect, September 2005

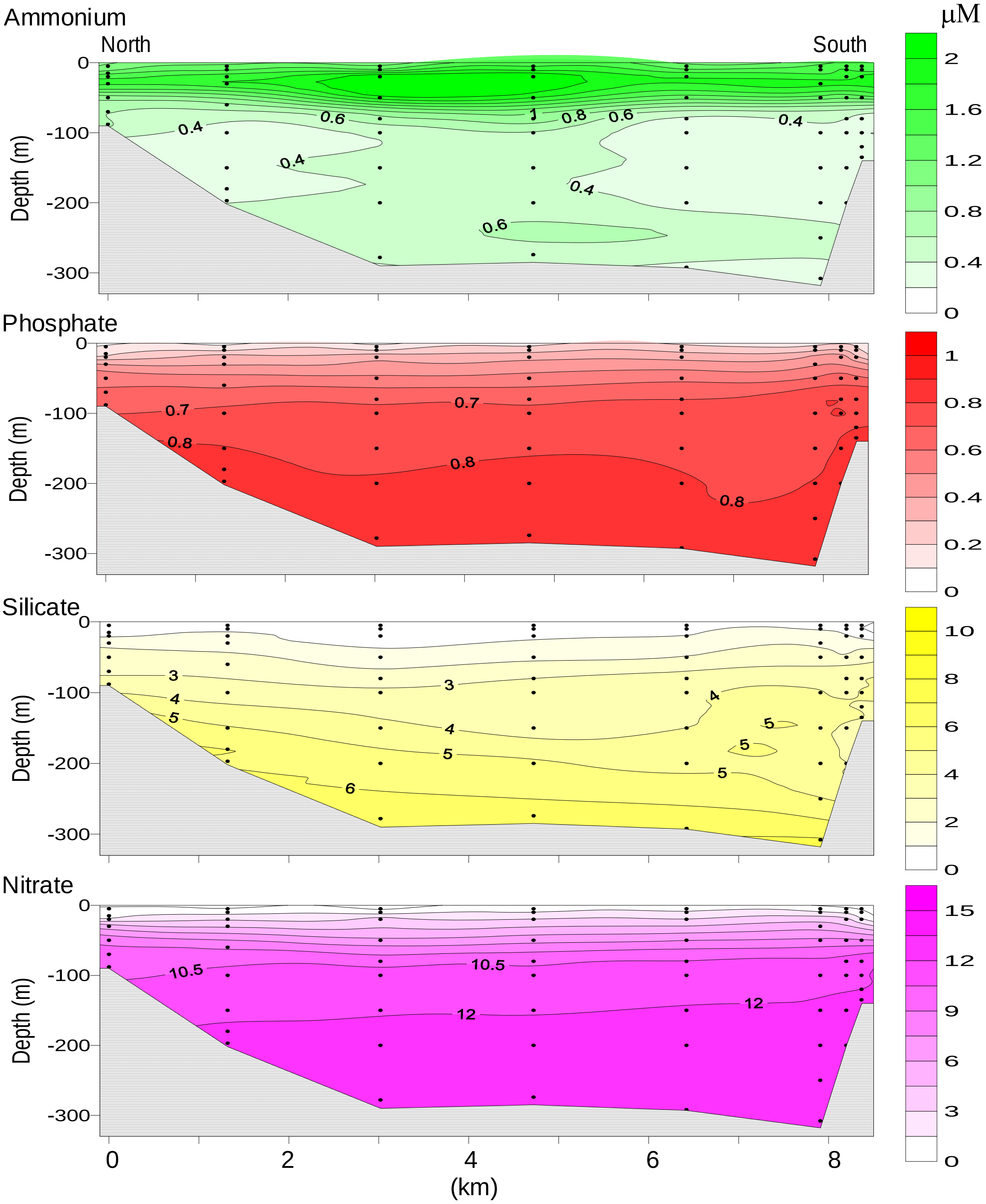


Figure 3

Sediment Pore Water Nutrient Profiles

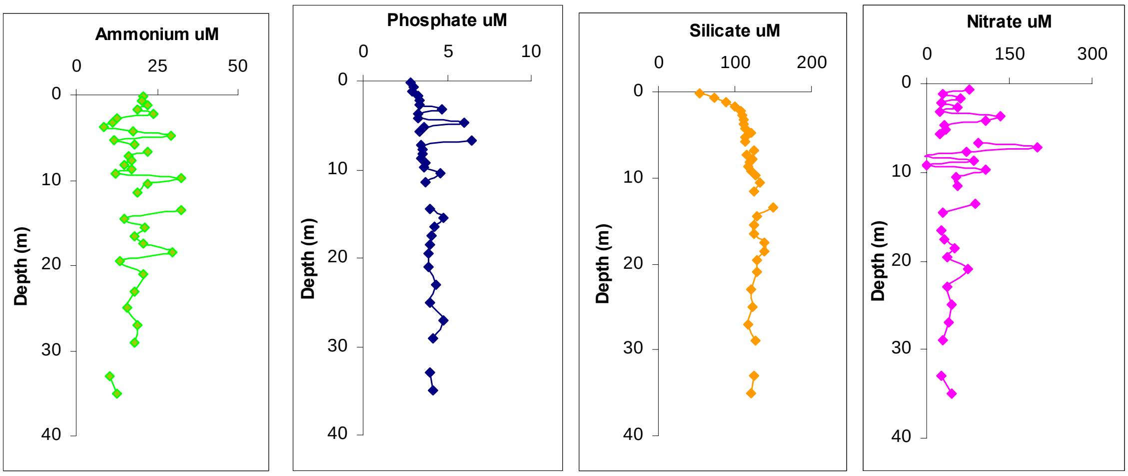


Figure 4 Station BIF6

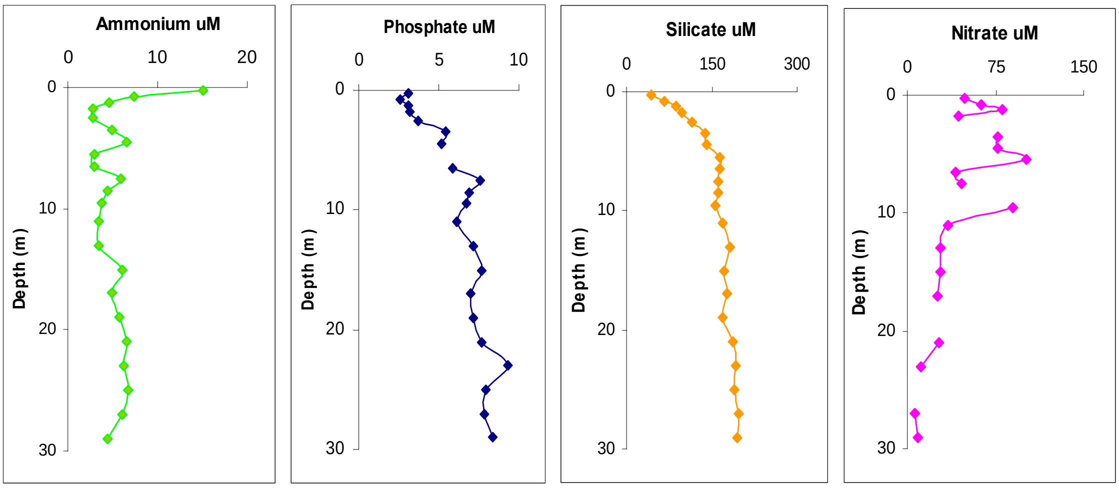


Figure 5 Station BIF2

Sediment Pore Water Nutrient Profiles (cont.)

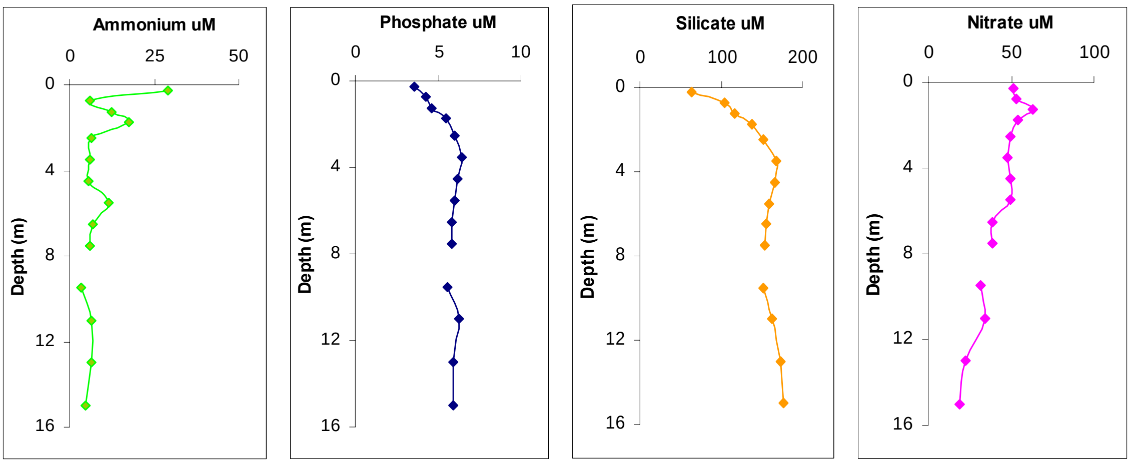


Figure 6 Station BIF1

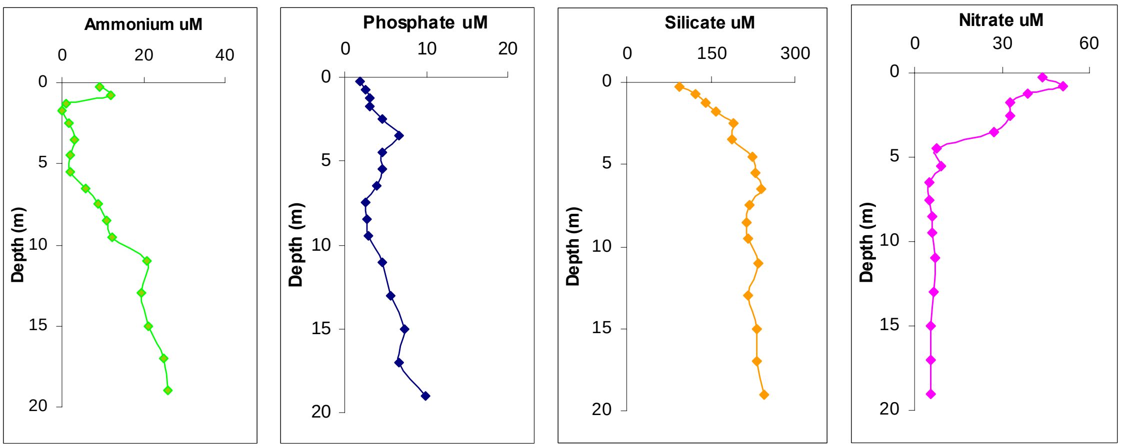


Figure 7 Station KF4

Sediment Pore Water Nutrient Profiles (cont.)

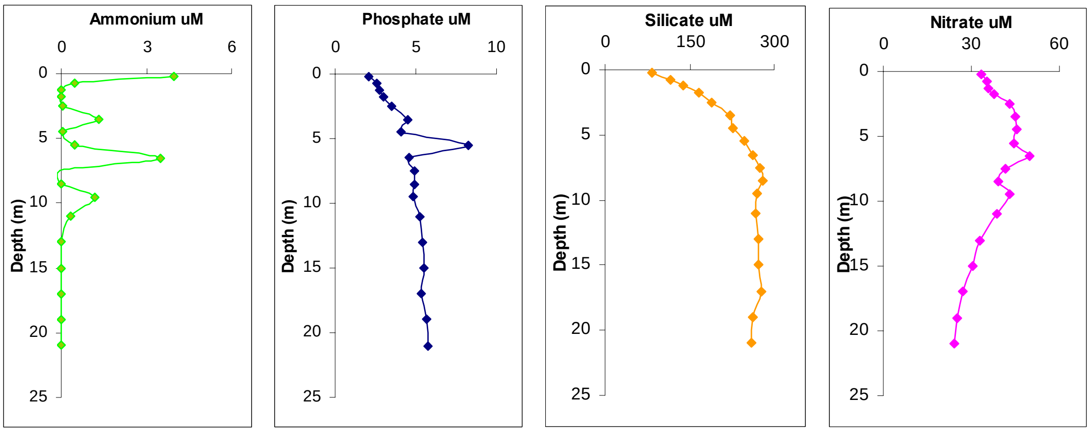


Figure 8 Station VP2

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.