

SAMS - Northern Seas programme
RRS James Clark Ross 15th June > 10th July 2003
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Acknowledgements

It gives me great pleasure to thank Chris Elliott, the officers and crew of the James Clark Ross for all their help and support which made JCR75 such an enjoyable and productive cruise.

I would also like to thank the following people for their support , Chris Hindley, John Pye and Nick Cox (BAS); The Kings Bay Company in Ny Alesund; Colin Day and Ian Waddington (UKORS); Nigel Fannin and Dave Smith (BGS); Mike Webb (NERC) and John Humphery (POL).

Finally I would like to thank the UK Hydrographic Office for providing the XBTs for the cruise.

Index

Cruise Objectives	4
Personnel	6
Cruise Track	8
Narrative	9
Station Log	17
Physical Measurements	26
Acoustic Seabed Mapping and Gravity Core Sampling	39
Coring Report	49
Geochemistry	51
KC-Lander Operations	57
Benthic Biology	65
Sula Ridge Report	71
Chemistry	75
Sediment Oxygen and Nutrient fluxes	77
Production of Dimethyl Sulphide	79
Halocarbon measurements	83
Dimethyl sulphoxide in seawater	87
Acrylic Acid measurements in seawater	90
Seawater Ammonium / Atmospheric Ammonia measurements	94
Appendix A - Cruise Objectives	
Appendix B - Mooring report from RV Lance April 2002	
Appendix C - Report on WS ESM1 loggers	

Cruise Objectives for JCR75

The cruise work will directly address the following SAMS Northern Seas programme elements:

Theme A, Question 4

- *How does bioturbation vary in response to environmental forcing and what are the consequences for redistribution of anthropogenic contaminants?*
- *How does the anthropogenic burden change along a northern transect of 4 stations (67 to 81 N)?*

Theme A, Question 5

- *To deliver an understanding of the effect of abrupt climate change and land use on fjordic/sea loch systems, which link the marine and terrestrial environments at high latitudes in Northwest Europe.*

Theme B, Question 2

- *To what extent does benthic faunal composition and size structure determine processes of carbon dynamics ?*
- *Can we link changes in regional patterns in sediment biogeochemistry with disparate patterns in benthic distributions?*

Bioturbation processes form the interface between seabed biology and geochemistry. The 'environmental forcing' referred to in the programme is likely to vary both with depth (eg. fjordic-shelf-slope-abys) and latitude (north-south gradients in intensity and interannual variability of pulsed OM input). Bioturbation therefore provides a crossover between the two main themes of the Northern Seas programme.

Work to be carried out from JCR should be seen as an essential supplement to the Wyville-Thomson work carried out on D257. To test the reality or otherwise of benthic biogeochemical 'provinces' we require comparable data from a range of sites in the water masses north and south of the WT Ridge (differences between our WTN and WTS stations does not in itself amount to a demonstration of 'provinces'). The WTS results can be put alongside existing data from previous studies in the Atlantic water mass (BENBO, SES), but at present we need more stations north of the ridge to compare with WTN.

Proposed study sites for JCR : Norwegian - Barents Sea continental margin

- Continental margin Norway - Barents Sea - Svalbard - Yermak Plateau, approx. N-S course without major undersea geographic barriers. Benthic faunal distribution therefore determined by gradients in seabed environmental conditions without confounding by biogeographic factors.
- This line also forms the approx. course of the northern 'conveyor' carrying contaminants from W. Europe to the arctic.
- Overall northwards trend in OM supply to the benthos will be one of increasingly pulsed flux and greater inter-annual variation in the timing and total supply of OM derived from water column primary production.

- Local factors superimposed on overall northwards trend, ie. winter 'outbursts' of fine-grained material off Barents Sea shelf, relative contributions of ice algae and phytoplankton on Yermak Plateau
- Data from series of sites along this N-S margin will therefore show how benthic community varies (biomass, bioturbator community structure) in response to forcing factor of OM supply, and consequences of this for sediment mixing rate, biogeochemical process rates and sediment contaminant distribution.

Four stations will form the northern transect. If time constraints or ice thickness prevents work at the Yermak Plateau, the remaining ice-free sites will still provide us with a 3-station northward transect.

1. Voring Plateau: High Priority Site: (Gravity coring Site) Nyk Drift, this site is similar in supply to other 3 northern transect sites. Alternative site: Central Plateau: Purely pelagic OM supply, no advection off shelf. Much published information on nature and distribution of benthic fauna, will facilitate interpretation of our samples. Few data on biogeochemical process rates.
2. Bear Island Fan: Not far from Voring, but receives advected material off Barents Sea shelf as well as pelagic OM flux.
3. Margin W. of Svalbard, no ice cover: No ice algae, but will receive pelagic OM and northwardly-advected material from West Spitzbergen Current (WSC)
4. Western margin of Yermak Plateau: Within influence of WSC, with additional contribution from ice algae.

Proposed study sites for JCR : Svalbard margin out from Kongsfjord

This is intended to tie in with April 2002 LSF work (post-bloom data from Kongsfjord stations). The transect will consist of four main stations, nb there are 5 main stations however the 1400m station will be completed during the execution of the northern transect.

The transect will continue out from fjord in a series of stations across the shelf (where soft sediments exist) and down continental slope. This will allow changes in benthic community and biogeochemistry to be recorded along a depth/OM supply gradient not confounded by other factors. This bathymetric transect will intersect with the N-S margin transect proposed above.

Proposed main sampling sites Kongsfjord Transect

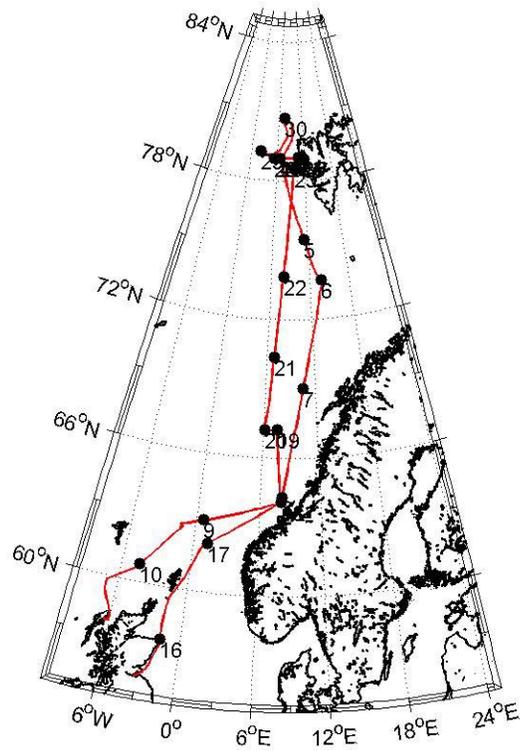
1. The inner station occupied by the lander April 2002 (station 22 141m depth N79° 0.33' E11° 54.20')
2. Mooring station April 2002 (200m depth N79 03.25' E011 17.96)
3. Station outwith fjord approximately 800 m?
4. Station 1400 m this is the same station as northern transect (count only once)
5. Fram Strait, station as far west as possible in time constraints (no further than 0°)

An array of equipment will be used during the cruise, these include CTD and a water bottle rosette, SAMS landers, BGS gravity corer, SMBA multi and mega corers, NIOZ box corer and POL bedhop camera. At the main sites all major equipment and techniques will be deployed. In addition to these main sites CTD and coring deployments may take place at intervening sites. A variety of underway measurements will be made whilst the ship is underway:- TOPAS, Multibeam, ADCP, XBT, meteorological and sea-surface measurements. There will also be mooring activity in the Kongsfjord and the Sula Ridge. A more detailed description of the Cruise objectives is given in appendix A.

PERSONNEL

ELLIOTT	Christopher	Master
PATERSON	Robert C	Ch/Off
COOLING	Kim	2/Off
GOLDING	Michael	3/Off
SUMMERS	John W	Dk/Off
WADDICOR	Charles A	R/Off
CUTTING	David J	C/Eng
KERSWELL	William R	2/Eng
ARMOUR	Gerard J	3/Eng
EADIE	Steven J	4/Eng
WRIGHT	Simon A	D/Eng
THOMAS	Norman E	Elect
OLLEY	Kenneth R	Cat/O
STEWART	George M	Bosun
WILLIAMS	David O	Bos/Mate
McGOWAN	John J M	Sea 1
BAKER	James A	Sea 1
BLABY	Marc A	Sea 1
JENKINS	Derek G	Sea 1
REES	David	Sea 1
SMITH	Sydney F	M/Man
ROBINSHAW	Mark A	M/Man
TURNER	Richard J	Ch Cook
BALDWIN-WHITE	Lawrence	2 nd Cook
PRATLEY	Clifford R	S/Stwd
LEE	Derek W	Stwd
WESTON	Kenneth	Stwd
NEWALL	James	Stwd
SHIMMIELD	Graham B	PSO
HORTOP	Sarah E	Doctor
COOPER	Patrick J	E/Eng
HINDLEY	Christopher	Logistics
ROBST	Jeremy	IT
WILLIS	Douglas	IT
BARR	Robert B	Lander
BLACK	Kenneth	Chemist
BREUER	Eric R	Geochemist
COTTIER	Finlo R	Physicist
DARROCH	Louise J	Chemist
DEAN	Rebecca	Geochemist
DERRICK	John D	Geologist
EVANS	Claire	Chemist
EZZI	Ivan	H&S/Nutrients
GRIFFITHS	Colin R	Logistics/Physicist
GUNN	Caroline N	Ice
HARVEY	Stewart M	Chemist
HOWE	John A	Geologist
HUGHES	Claire	Chemist

HUGHES	David J	Biologist
JOHNSON	Martin T	Chemist
KADNER	Susanne	Chemist
LAMONT	Peter	Biologist
LARSEN	Mona	Biologist
MORETON	Steven	Geologist
MORRI	Clara	Geologist
PEPPE	Oliver C	Lander
PROVOST	Paul G	Coring/Physicist
ROBERTS	John M	Biologist



JCR75 Cruise Track 15/6 > 10/7 2003

Narrative

- 15th June Departed Leith docks at 13.00Z, via locks, into the Firth of Forth. Most scientific personnel boarded on the 14th. A fine reception was held for friends and colleagues of the British Geological Survey and SAMS on the night of the 14th, with thanks due to the catering staff of the JCR. The waters of the Firth allowed for final stowage and equipment tie-down. A comprehensive and clear safety briefing was given by the First Officer at 16.00Z. Course was set NW along the Fife and Aberdeen-shire coast. Weather partly overcast, with bright spells; little sea - very pleasant.
- 16th June Underway for the Sula Ridge, Norway. Off the Fair Isle (59° 30.726'N 01° 25.746'W), the first shakedown CTD and bottle cast was made at 08.42Z. Water depth was only 95 m. A slack loop on the CTD wire required stoppering and re-tensioning. Water sampling protocol successfully completed. Underway at 09.41Z. The PSO delivered a general introduction to the scientific party, officers and crew, followed by some recent underwater video of the Sula Ridge.
- 17th June At 08.42Z the first CTD (59°30.726'N 01° 25.747'W) for water samples was performed, to full depth (95.6 m). Making good speed with little deterioration in the weather to the Sula Ridge (64° 05.03'N 08° 02.34'E) we arrived at 18.55Z and commenced a TOPAS survey. After some initial familiarisation with the Swath/TOPAS, a very successful survey of the Sula Ridge was completed by 21.00Z. The survey data revealed the sediment drape feature (64° 05.023'N 08° 02.260'E) on the north west flank of the ridge which was our target for sediment coring and the photolander deployment. A CTD (JCR75/5: 21.22Z) drop with oxygen sensor attached was performed, followed by two box cores (JCR75/6 and /7). The former suffered from washout due to cobbles jamming the spades, but the second was successful. Unfortunately, the deployment was marred by a finger injury to Paul Provost; an accident form and recommendations for changes in procedure has been lodged. At 00.03Z the photolander mooring deployment commenced with release at 00.53 (64° 05.055'N 08° 02.209'E). All acoustic communication with the release functioned perfectly. Immediately after release course was made for the Voring Plateau. Throughout the Sula Ridge activity the weather remained clement and shipboard operations were carried out smoothly.
- 18th June En route for the Voring Plateau a CTD/bottle cast was performed at 08.38Z (65° 30.04'N 07° 46.36'E). Interference between the EM 500 and the EM120 results in very spurious depth information. A strong recommendation is made to switch off the EM120 on station. At 17.33Z a swath/Topas survey commenced centered on station VP1. Following this 2 hour successful survey a CTD and gravity core were deployed. This first use of the BGS gravity corer was a complete success with excellent operational and handling procedures by John Derrick, BGS. After completion of sampling, we conducted a depth test on the buoyancy sphere integrity and acoustic release mechanisms for the landers (23.28Z). Unfortunately the acoustic testing was not successful, and on recovery, one release and the deck unit were found to be malfunctioning. Course was set for VP2, 2.5 hours transit to the west of VP1.
- 19th June On arrival at VP2 (67° 13.03'N 6° 05.95'E) another swath/Topas survey was run. At 05.40Z a second acoustic release was attached to the CTD to test operation at depth. The release was attached to one side of the CTD frame, rather than underneath which would prevent good acoustic reception due to shielding. This imbalance in the CTD and possible resulting rotation through the water column, was implicated in the birdcaging of the CTD conducting cable a few meters above

the package. Re-termination was required, and successfully completed. During this operation the NIOZ box corer was deployed, unfortunately resulting in sediment overpenetration, requiring a second deployment. The cause of the overpenetration was linked to the false bottom depth recording of the EM500 system which appears to be consistently recording depths of 30-50m too deep. All subsequent coring deployments will be using a pinger set at 50m above the corer.

After a successful box core, the lander in profiling mode, was made ready and successfully deployed at 67° 13.21'N 06° 05.30'E in 1440 m of water. Control systems included one acoustic modem with a back-up burn wire release. The experiment was timed for 12.30 hours duration. Thereafter a successful series of multi-coring, bed hop camera and mega corer, with one gravity core, were completed. A couple of times, minor winch alarms were noted (too fast a descent for the multi core, and the veer counter not responding). Sea state was good to moderate.

- 20th June Just after midnight (00.25Z), with good daylight, and moderate sea state (force 4), the acoustic release was triggered and the lander surfaced 25 minutes later off the starboard bow. The excellent navigation and dynamic positioning capability of the JCR, led to a successful recovery with only minor damage to the lander beacon mast. Excellent seamanship skills were demonstrated in this procedure. Once on deck and secure, the ship was repositioned for a final megacore and bed hop camera transect. Processing of the lander data revealed a complete success with 4 electrodes reporting excellent *in situ* sediment oxygen profiles. At 04.15Z, course was set due north for Svalbard. During passage, a CTD was conducted at 08.30Z to 1000 m water depth, and XBT profiles at one hour intervals. By 14.00Z the weather had deteriorated somewhat, necessitating a decrease in speed to 9 knts. For the remainder of the day, underway sampling and hourly XBTs were carried out during the northerly passage.
- 21st June With improving weather, later becoming cloudless skies, the underway speed quickly picked up again reaching 12.5-13.0 knts. Watchkeeping was now in full swing, with hourly XBT releases. A CTD with full bottle cast was deployed at 08.30Z (71° 58.25'N 07° 21.02'). Due to the fair weather, and suitable depth, a lander buoyancy test in 2984 m of water was carried out successfully. Around 17.00Z a very large school (200+) of White-beaked Dolphins was sighted. The midnight position was 73° 52.917'N, 0° 55.033'E.
- 22nd June Continued underway to Kongsfjord, Svalbard at 12.5 knts. XBTs continue to monitor the changing water masses every hour, now recording sub-zero water temperature at only 500 m water depth. A more detailed CTD profile was conducted at 08.30Z at 75° 34.41'N 08° 32.51'E down to 1000 m depth.
- 23rd June At 05.34Z Station 2 in the outer Kongsfjord (79° 03.26N 11° 18.01E) commenced with an acoustic interrogation of the mooring array deployed in April from the RV *Lance*. A signal was returned to our relief, indicating that the array was upright and some 400 m distant. The station sampling began with a box core which revealed a pebble-rich sea floor overlying dark, anoxic stiff mud with a substantial epifauna and infauna. Although recognising that a lander "Profileur" deployment would risk the fragile electrodes, it was decided to take the risk and launch in tethered mode in a water depth of 240 m. After launching, and repositioning, the water column was studied using two CTD drops, before returning to benthic sampling with the bed hop camera and the box core. After box coring repeatedly revealed the pebble aggregate surface layer, there was considerable concern over the possibility of coring with the multi- and mega-

corer. In the event, the former proved remarkably successful, although the megacorer failed to penetrate. The gravity corer was deployed at 12.32Z and recovered an excellent 3 m core followed by another bed hop camera transect. At 15.45Z we commenced the recovery of the mooring array, following an acoustically-triggered release, and good seamanship to recover the pellet line. The recovery went exceptionally smoothly with a full suite of instruments intact and in very good condition (little fouling). The sediment trap had performed excellently with a full carousel of sampling bottles recovered. Whilst waiting for the lander sample time to expire (12 hours is required), an attempt was made to deploy the underwater video camera in 230 m. Unfortunately, there appeared to be a power failure to the TV lights, and the exercise was aborted. At 19.35Z the lander was recovered using the tethered pickup. As feared, all electrodes had been damaged although readings had been taken up to the point of failure. After securing sampling gear, a swath/TOPAS track was laid out to undertake a complete survey of the Kongsfjord up to the Kongsbreen glacier front at 100 m depth. On a still evening, the JCR cruised up the fjord amidst spectacular mountain scenery with small drifting bergs to complete the first leg of the survey. Overnight the remainder of the fjord was covered producing an excellent bathymetric and sediment thickness map.

24th June The early morning continued the swath mapping, with arrival on the Ny Alesund pier at 09.20Z to allow a short visit and walk ashore for the ship's party. Chris Hindley and Doug Willis departed for Cambridge via air to Longyearbyen and on to Tromso and Oslo. We were met on the pier by Nick Cox (the Harland Hut base commander) and some of his colleagues. After a short tour of the ship and planning for the Reception on the 2nd July, the pier was left at 12.30Z for Station 1 (78° 57.47N 11° 54.84E, 355 m depth). The initial CTD and box core was followed by an autonomous mode lander drop in Profileur mode. Subsequently, the sediment coring sequence of box, multi, gravity and mega coring was undertaken.

25th June Dawn does not exist so far north at this time of year, but the early hours revealed a spectacularly crisp polar day, with small amount of orographic cloud to the north and east, and a clearing front to the south. At 3.30Z the lander was "pinged" to release ballast and surface - nothing happened. It quickly became apparent that the very soft mud characterising the sediment of the basin at KF1 has enveloped the base of the lander and was not about to release its prize. Following a planning meeting on the bridge, the Captain's plan was put into action - a bridle attached to 400 m wires fore and aft, dragged slowly across the lander site with the JCR in dynamic position mode. Rigging the appropriate wires and clump chain weights was a significant task, but everyone felt a purpose behind the operation. Dragging began mid-morning, and the skill and perseverance of the Captain and crew was rewarded with a welcome sight of the lander at the surface around 08.00Z. The relief was palpable. Another couple of hours was required to retrieve and stow the cable gear, and on recovery of the lander, it was found to be completely undamaged. A great success! The only disappointment was that the sediment had indeed been too soft and that the profiler unit had penetrated too quickly and been unable to recover any suitable data. At 11.10Z we were underway, bound for the Fram Strait and the deeper sampling of the Kongsfjord transect.

Swath and TOPAS was run as we moved out of outer Kongsfjord to the north of Prins Karls Forland. By 17.30Z we were on station over a small contourite mound on the flank of the margin slope (KF4, 1200 m, 78° 59.99N 06° 59.97E) running CTDs and the first couple of box cores. These revealed a significant dilemma;

very soft sediment with the corer overpenetrating. I moved the ship a few km to the southwest off the mound and into slightly deeper water of 1385 m depth. Here the sediment was marginally firmer, and with some lander modification (decreased ballast and increased buoyancy) I took the decision to deploy at 23.40Z (78° 57.99N 06° 43.03E). By this stage the sea state had dropped to an almost unbelievable degree - virtually as flat as a millpond with only the slightest ripple, although under a rather heavy, leaden sky. Hard to believe we were out in the Fram Strait!

26th June Coring operations, with reduced weights, began at 00.56Z, 800 m to the NNW of the lander site (78° 58.40N 06° 42.49E). After successfully completing triplicate sets of box and multi cores, we returned to the contourite mound to deploy the gravity core, preceded by a multicore to retrieve an intact sediment water interface. Back at the second ("B") site, mega coring and a bedhop camera preceded the recovery of the lander.

At 16.14Z the release was fired on the lander, closely followed by the second backup. Unfortunately, the instrument package refused to budge and a rapid meeting on the bridge concluded that the soft sediment was indeed holding on to our instruments. Unlike the station 1 in the Kongsfjord, the 1400 m of the Fram Strait was an altogether different proposition and rather different tactics were called for. A single 500 m of trawl wire was attached to a clump chain weight at either end, with one end fixed to the main trawl warp over the rear A-frame. A course was designed to "sweep" the trawl wire over the lander position, releasing it from the mud.

27th June Slow dragging of the wire had failed to produce any effect on the recalcitrant instrument package, so that by 03:00Z the attempt was halted and another approach adopted. The lander position was refixed with range finding based on the pinger signal direction as the JCR sailed a 90° box around the estimated position. This revealed a small drift of the lander during deployment and a seabed location slightly to the northwest of the release point. Another dragging operation was devised and implemented, using a more acute angle of pull, followed by encircling the position. The latter approach was borne of frustration at the lack of success, but at 10.40Z, after 18 hours, I finally called off the search and we departed for Station 5. This was a bitter decision, rather more because of the impact on our science, rather than the financial aspects of the loss (it is insured!). It had been a tiring and frustrating experience, with our interpretation of the lack of success hinging on the bottom wire flying over the lander as the wire moved upslope.

At 14.33Z we reached station 5 (78° 56.87N 05° 17.35'E) in 2,500 m of water. Sampling began with the now familiar sequence of CTD and water bottles, box, multi, gravity and mega coring with a bed hop camera. The sampling went smoothly.

28th June During the box core, there was a minor hitch on the traction winch with one of the governors. Simon Wright diagnosed the fault and swiftly attended to the situation with minimal down time. The station was completed exactly on time at 17:30Z, and we set off further west to complete a hydrographic survey search for warm core eddies above the Molloy Deep using XBTs. The evening started to brighten considerably from the north west, coinciding with our arrival at the pack ice margin (79° 14.52N 02° 15.0E; 23.22Z).

29th June In the early hours of the day, in full bright sunshine, the ship's company was treated to spectacular pack ice formation and the intensity of the polar light. We watched, mesmerised, as the JCR pushed west a little further, before setting a reciprocal course to lead us out of the pack by 03.00Z. It had been a fantastic introduction to polar sea ice for most of the scientific party. Course was then set NNE for the Yermak Plateau and the most northerly station of the cruise. XBTs continued to be launched.

By the early evening the fog has begun to roll out across the cold waters of the ice front. After clear water on a northeast heading we once more encountered the edge of the pack. Keeping the ice to port we advanced north up an open lead to record the farthest north position for the ship (although this was slightly bettered during a bed-hop camera survey as the ice moved to 80° 45.37'N). At 20:07Z station 1 on the Yermak Plateau commenced with a CTD deployment (80° 41.36'N 07° 25.55'W).

30th June YP1 continued through the grey light of the marginal ice zone. Continuing advance of the pack from the south west progressively pushed us further north, recording the highest latitude at 08:10Z. At 10:00Z the station was complete after a full set of cores and excellent sediment recovery. By now the combination of scientists and crew was working very well indeed and turnaround between gear deployments was efficient maximising down time. Course was set for station 4 in a southerly direction, again launching XBTs at one hour intervals to investigate the thermal structure of the upper water column. Station 4 was to be re-occupied to attempt a second lander recovery operation.

At 22:09Z Station 4 was reached an an initial multi-core deployment performed in order to recover cores for shipboard microelectrode and oxygen incubation studies. The lander recovery commenced with 3 locations and a pinger ranging on the lander position to refine the coordinates. When corrected for the speed of sound in these waters, a precise fix was obtained northeast of the launch site, consistent with the residual current in the Fram Strait. Simultaneous swath mapping revealed the likelihood that the lander was sitting in a break in slope at 1380 m water depth. It seemed that fate had intervened to locate the instrument in the protective crook of a soft sediment embrace on the flanks of the Svalbard margin. The sea state could not have been better with a virtual calm, albeit under overcast skies.

1st July For the second attempt, our strategy was to encircle the lander with 500 m of trawl wire, and weighted coring warp, producing a 360° laying of cable on the bottom, overlapping at the tag end. The lander hopefully would lie at the centre of the 500 m radius. At 1:40Z cable laying began and the noose tightened with a pull to the ESE. By 07:30Z optimism had evaporated into the grey mists of the arctic morning and we called off the attempt. It was clear to me that the physical location of the lander was now a very difficult proposition for any shipboard attempt at recovery. In order to prevent the loss impacting heavily on the science programme, it was important to move on and regain the sampling momentum. Accordingly, course was set due east for the outer channel of the Kongsfjord at the top of the continental slope (Station 3).

At 13:15Z after considerable swath and Topas mapping to elucidate softer sediment in the former glacial channel, Station 3 commenced with a CTD in 330 m of water (79° 01.41'N 10° 41.50'E). The sediment proved to be very fine grained and soft, requiring two attempts with the NIOZ box corer due to overpenetration. Throughout the evening coring continued in very calm seas. The

station was completed successfully just after midnight, with a full sample set and bottom camera work.

2nd July

By this stage of the cruise, the preparation for the Reception in Ny Alesund to mark the 10th anniversary of NERC's presence was in full swing. Three visitors (the NERC Chairman, Richard Hardman, the Head of Science Programmes, David Brown, and the Head of Administration at BAS, John Pye) were due to arrive on board at breakfast for a short introduction to active marine science. A reception for the Ny Alesund scientific community was arranged for the evening. In the event, fog bound delays to the VIPs travel arrangements in Oslo caused a reshuffle of the programme. Accordingly, we deployed the "Elinor" lander at Station 1 (03:20Z; 78° 57.46'N 11° 54.99'E) for a 36-hour experiment together with a gravity core, and then continued our swath survey of the Kongsfjord to include the northern branch of the Krossfjord and a CTD station. Unfortunately, the day was overcast and the mountains clad by a firm cloud base at less than 300 m height. Nevertheless, the spectacular fjord scenery and the steep flanks of the Krossfjord were obvious. We retraced our track once the Lilliehookbreen glacier seracs were in sight at the head of the fjord. By 11:45Z we were alongside the pier at Ny Alesund.

Shore leave was granted to all personnel, allowing time for souvenirs to be purchased, and the sights of Ny Alesund to be explored. Nick Cox provided considerable help and the facilities of the NERC hut for some equipment testing. However, the highlight before the Reception, was the world's most northerly football match on the 2nd July 2002, played between the Ny Alesund select team and the scientists and crew of the JCR. Unfortunately, the pitch was a little uneven, the opposition rather too skilled, and the bloody knees of the JCR XI saw a 3-0 defeat! Later the Master and NERC VIPs hosted 58 guests on the bridge of the JCR for an excellent reception. A short speech was given by David Brown thanking the scientific community and the Kings Bay Company for their assistance in hosting NERC's presence for the past 10 years. The party lasted well into the small hours!

3rd July

At 7:30Z we departed the Ny Alesund facility for the last time, and headed a short distance for Station 1. Three multicore drops were made for oxygen incubation work, followed by transit to Station 2 and the deployment of the mooring rig (13:33Z; 79° 03.44'N 11° 16.87'E; 205 m depth). Over the previous days a vain attempt had been made to elucidate a variety of problems plaguing the two fluorimeter data loggers (ESM-1s; WS Instruments). In the end it was decided not to re-deploy these instruments which was a significant blow to the overall objectives of the mooring. Nevertheless the remaining instrument packages will provide some of the highest oceanographic detail for a northern fjord. Upon successful deployment, we retraced our course (continuing to map the Kongsfjord with swath and Topas) to Station 1 and completed a successful recovery of the "Elinor" lander. By 17:30Z we were once more able to head west for a final attempt at lander recovery at Station 4. At 22.02Z we arrived on station to commence a grappling operation commencing with a ranging of the lander from a northern position.

4th July

To attempt the 3rd recovery operation it was decided to try grappling using a towing bar and four grapples. The located lander position was repeatedly raked 100 m either side and from three different directions, unfortunately without success. At 03.55Z the attempt was officially declared over and the position logged. I am grateful to the immense effort made by the Master and the officers and crew in trying to retrieve this equipment and it certainly was not for lack of

trying. Course was set south for the Bear Island Fan site. Weather conditions continued to be very favourable for science allowing good speed to be made. A short CTD deployment was undertaken at 07:40Z.

- 5th July Under very good conditions for transit, we made rapid progress to a point southwest of Bear Island (73° 39.62'N 13° 47.10'E) where a full station sampling suite commenced with a CTD at 10.50Z following a swath/Topas survey. The first box cores overpenetrated in soft mud, but this was cured by reducing the weight and setting the travel distance at a lower increment. Sea conditions continued to remain calm as we completed the station on time with a mega core at 00:18Z. The station had been completely successful in reaching the sampling objectives set.
- 6th July After midnight, course was set for the Sula Ridge. No early morning CTD was taken. By midday, we crossed into the warmer waters of the Norwegian Current. A noticeable change occurred to the air temperature, although skies remained overcast, but brightening towards evening. Swath surveying continued along the line of passage, and all the accumulated backlog of sediment cores was sieved and sectioned. The end-of-cruise entertainment began with a Quiz Night for all JR75 members.
- 7th July At 09:03Z a CTD was deployed for water samples at 67°13.03N 09°28.08W. Skies had begun to clear revealing a splendid day with good seas. All the sample backlog was processed and stowed away. Swath surveying continued, leading to the second entertainment night of a darts match between scientists and crew.
- 8th July The Sula Ridge was reached just as the sun dipped below the horizon for the briefest of Arctic nights (64°05.25N 08°02.61E; 01:08). Recovery of the photolander commenced with range finding and a diagnostic check. The releases were fired and 8 minutes later the entire package surfaced through a glass-like sea into a spectacular dawn sunrise. The subsequent recovery was completed professionally and without incident. On deck it was clear that the instrument package was performing correctly, with its timed flashguns continuing to activate. Within half an hour the hard disc had been removed and downloaded to reveal a very good set of time lapse digital sea bed images, reflecting the heterogenous nature of the seafloor. These images revealed large, rounded glacial dropstones, one of which lay directly in the line of the flashgun causing a degree of bounce-back and flare.
- After completing the lander recovery, we moved to box coring the sediment apron adjacent to the reef in the vicinity of the lander position (64° 05.02N 08° 02.24E). The first core retrieved a large dropstone which deformed the bucket; similar damage and no samples occurred at the second attempt. The final event at the Sula Ridge was a couple of bed-hop camera transects, before departing for the Faroe-Shetland Channel. That evening, the scientists and officers gathered to mutually thank each other and to celebrate with an evening meal, the PSO's open house, and a truly spectacular concert from three of the scientific party (Black, Howe and Griffiths).
- 9th July En route to the Faroe-Shetland Channel and a swath/Topas survey of the mud diapers at 62° 47.7N, 01°28.3W commissioned by the DTI via Geotek. The survey consisted of three lines forming a triangle. At the completion of the third line, the main power supply board for the Topas system expired. Without knowing the cause of this fault, it was decided to shut down the system rather than attempt a repair.

At 10:30Z a CTD was deployed for water samples at 62°38.84N 01°19.38W . The remaining XBT's were fired through the day along the axis of the Faeroe Shetland Channel.

10th July

At 02:25Z the final CTD cast was deployed at 62°38.84N 01°19.38W, A further 8 XBTs were fired during the early morning. The last XBT was fired at 0902Z. A course was now set for Stornoway. It was a fine evening as we entered the Minch, the James Clark Ross docked in Stornoway at 2103Z.

JCR75 Cruise Report

JCR75 Station Log

Date	Time	Lat	Long	Event	Depth	I/W	Bottom	O/W	Stn	Activity	Comments
16/06/02	0842	N59 30.73	W01 25.75	#1	95.6		0921	0938	SD	CTD001	Shake down
16/06/02	1437	N60 25.05	W00 27.03	#2	90					XBT001	TOPAS XBT
17/06/02	0835	N63 05.84	E04 35.90	#3	875	0842	0906	0933	UEA1	CTD002	0930 Dip
17/06/02	1855	N64 03.95	E07 56.88	#4	256	1855				XBT002	TOPAS XBT
17/06/02	2122	N64 05.19	E08 02.20	#5	285	2121	2136	2200	SULA	CTD003	O2 added
17/06/02	2241	N64 05.02	E08 02.26	#6	285	2242	2251	2257	SULA	NIOZ001	No Core
17/06/02	2305	N64 05.02	E08 02.26	#7	285	2307	2318	2225	SULA	NIOZ002	Good Core
18/06/02	0003	N64 05.01	E08 02.21	#8	286	0005	0046		SULA	LANDER	DEPLOYED
18/06/02	0838	N65 30.04	E07 46.36	#9	380	0845	0900	0921	UEA2	CTD004	
18/06/02	1733	N67 08.51	E07 29.71	#10	1287	1733				XBT003	TOPAS
18/06/02	1940	N67 11.03	E07 29.89	#11	1565	1943	2020	2056	VP1	CTD005	
18/06/02	2136	N67 11.52	E07 29.42	#12	1358	2137	2202	2230	VP1	GC001	GRAVITY
18/06/02	2328	N67 15.19	E07 28.61	#13	1510		0020			BUOYAN	CY TEST
19/06/02	0540	N67 13.03	E06 05.95	#14	1437	0540	0615		VP2	CTD006	RELEASE
19/06/02	0700	N67 13.12	E06 05.91	#15	1438	0700			VP2	CTD007	ABORT
19/06/02	0802	N67 13.02	E06 05.79	#16	1437	0803	0830	0900	VP2	NIOZ003	
19/06/02	0916	N67 13.02	E06 05.70	#17	1435	0916	0944	1012	VP2	NIOZ004	
19/06/02	1116	N67 13.21	E06 05.30	#18	1440	1116	1141		VP2	PROFILE	LANDER
19/06/02	1212	N67 13.04	E06 06.15	#19	1436	1212	-	1327	VP2	CTD008	Profile
19/06/02	1349	N67 13.01	E06 06.06	#20	1436	1349	1423	1523	VP2	Bedhop01	OK
19/06/02	1540	N67 12.85	E06 05.54	#21	1385	1545	1615	1645	VP2	NIOZ005	Good core
19/06/02	1725	N67 12.86	E06 05.53	#22	1434?	1726	1753	1819	VP2	MultiC001	Good cores
19/06/02	1835	N67 12.86	E06 05.53	#23	1433?	1837	1900	1928	VP2	MultiC002	Good cores
19/06/02	1940	N67 12.85	E06 05.54	#24	1433	1943	2014	2042	VP2	MultiC003	
19/06/02	2120	N67 12.80	E06 06.23	#25	1406	2120	2143	2212	VP2	GC002	
19/06/02	2233	N67 12.81	E06 06.25	#26	1385	2233	2259	0026	VP2	MegaC001	
20/06/02	0025			#27	1440			0105	VP2	Profilur	Recovery
20/06/02	0128	N67 13.11	E05 05.15	#28	1390	0129	0152		VP2	MegaC002	
20/06/02	0303	N67 13.09	E05 05.13	#29		0307	0335	0440	VP2	BH002	
20/06/02	0700	N67 36.49	E06 12.97	#30	1565	0702	0707		XBT	XBT004	
20/06/02	0759			#31		0801	0809		XBT	XBT005	

JCR75 Cruise Report

20/06/02	0830	N67 54.74	E06 21.22	#32	1323	0840	0904	0936	UEA3	CTD009	1000m cast
20/06/02	0954	N67 56.99	E06 22.99	#33	1374	0957	1006		XBT	XBT006	
20/06/02	1056	N68 08.89	E06 26.16	#34	1726	1101	1103		XBT	XBT007	
20/06/02	1156	N68 20.39	E06 30.39	#35	2334				XBT	XBT008	
20/06/02	1205	N68 21.96	E06 31.02	#36	2389	1212	1214		XBT	XBT009	
20/06/02	1303	N68 32.94	E06 32.70	#37	2515	1308			XBT	XBT010	
20/06/02	1404	N68 43.22	E06 34.55	#38	3000	1411	1415		XBT	XBT011	
20/06/02	1453	N68 50.48	E06 35.74	#39	3145				XBT	XBT012	
20/06/02	1457	N68 51.02	E06 35.81	#40	3153	1459			XBT	XBT013	
20/06/02	1600	N68 59.67	E06 37.47	#41	3668	1604	1608		XBT	XBT014	
20/06/02	1700	N69 08.51	E06 39.18	#42	3184	1701	1705		XBT	XBT015	
20/06/02	1800	N69 19.00	E06 40.89	#43	3220	1805	1809		XBT	XBT016	
20/06/02	1855	N69 27.54	E06 43.45	#44	3209	1853	1858		XBT	XBT017	
20/06/02	2058	N69 39.33	E06 45.01	#45	3201	2058	2107		XBT	XBT018	
20/06/02	2055	N69 49.39	E06 45.52	#46	3175	2213			XBT	XBT019	
20/06/02	2159	N70 02.11	E06 48.60	#47	3151	2210	2216		XBT	XBT020	
20/06/02	2258	N70 11.60	E06 51.40	#48	3101	2302	2307		XBT	XBT021	Good
21/06/02	0010	N70 24.80	E06 55.67	#49	3064	0015			XBT	XBT022	FAIL
21/06/02	0024	N70 27.29	E06 55.91	#50	3058	0028			XBT	XBT023	Good
21/06/02	0112	N70 36.64	E06 58.03	#51	3047	0118	0122		XBT	XBT024	Good
21/06/02	0225	N70 50.37	E07 02.40	#52	3030	0230	0233		XBT	XBT025	Good
21/06/02	0255	N70 56.42	E07 03.28	#53	3046	0255	Abort		XBT	XBT026	FAIL
21/06/02	0310	N70 58.61	E07 03.74	#54	3050	0312	0317		XBT	XBT027	Good
21/06/02	0400	N71 07.88	E07 06.62	#55	2977	0401	0405		XBT	XBT028	Good
21/06/02	0500	N71 18.73	E07 10.29	#56	2942	0500	0503		XBT	XBT029	Good
21/06/02	0600	N71 29.90	E07 13.48	#57	2919	0600	0603		XBT	XBT031	Good
21/06/02	0700	N71 42.26	E07 17.15	#58	2831	0704	0708		XBT	XBT032	
21/06/02	0800	N71 53.14	E07 20.31	#59	2780	0805	0811		XBT	XBT033	
21/06/02	0830	N71 58.25	E07 21.02	#60	2757	0858	0932		CTD	CTD010	
21/06/02	0951	N72 00.77	E07 21.65	#61	2746	0952			XBT	XBT034	Noisy
21/06/02	0955	N72 01.54	E07 21.91	#62	2743	0956	1001		XBT	XBT035	
21/06/02	1101	N72 13.40	E07 26.15	#63	2672	1103			XBT	XBT036	
21/06/02	1107	N72 14.59	E07 26.64	#64	2656	1108	1113		XBT	XBT037	
21/06/02	1204	N72 25.90	E07 30.30	#65	2585	1205	1206		XBT	XBT038	
21/06/02	1306	N72 38.40	E07 33.70	#66	2534				XBT	XBT039	

JCR75 Cruise Report

21/06/02	1404	N72 50.10	E07 36.20	#67	2479				XBT	XBT040	
21/06/02	1500	N72 02.70	E07 41.60	#68	2430	1504	1508		XBT	XBT041	
21/06/02	1600	N72 13.40	E07 42.80	#69	2473	1601	1604		XBT	XBT042	
21/06/02	1700	N73 25.77	E07 42.37	#70	2984	1726	1921		TEST	LANDER	
21/06/02	1946	N73 25.77	E07 42.37	#71	3212	1948	2031	2148	TEST	LANDER	
21/06/02	2206	N73 29.30	E07 44.37	#72	2773	2214	2217		XBT	XBT043	
21/06/02	2303	N73 40.36	E07 49.29	#73	2240	2309	2312		XBT	XBT044	
22/06/02	0003	N73 52.92	E07 55.03	#74	2223	0010	0013		XBT	XBT045	
22/06/02	0112	N74 05.96	E08 00.06	#75	2443	0116	0120		XBT	XBT046	
22/06/02	0208	N74 16.62	E08 04.59	#76	2360	0212	0215		XBT	XBT047	
22/06/02	0309	N74 29.60	E08 09.68	#77	2660	0311	0317		XBT	XBT048	
22/06/02	0409	N74 41.98	E08 14.66	#78	2558	0415	0421		XBT	XBT049	
22/06/02	0511	N74 54.75	E08 19.22	#79	3471	0516	0521		XBT	XBT050	
22/06/02	0616	N75 08.34	E08 23.73	#80	2638	0620	0626		XBT	XBT051	
22/06/02	0715	N75 20.55	E08 28.11	#81	2686	0719	0725		XBT	XBT052	
22/06/02	0800	N75 30.54	E08 32.13	#82	2580	0806	0810		XBT	XBT053	
22/06/02	0830	N75 34.41	E08 32.35	#83	2557	0834	0858		CTD	CTD011	To 1000m
22/06/02	1000	N75 39.43	E08 34.36	#84	2386	1002	1005		XBT	XBT054	
22/06/02	1100	N75 41.40	E08 39.81	#85	2369	1102	-		XBT	XBT055	Broke off
22/06/02	1110	N75 53.01	E08 40.43	#86	2369	1110	1114		XBT	XBT056	
22/06/02	1200	N75 03.42	E08 44.03	#87	2300	1203	1206		XBT	XBT057	
22/06/02	1304	N75 15.76	E08 49.12	#88	2250	1308	1311		XBT	XBT058	
22/06/02	1402	N75 27.31	E08 52.35	#89	2214	1404	1407		XBT	XBT059	
22/06/02	1500	N75 39.12	E08 58.40	#90	2264	1500	1504		XBT	XBT060	FAILURE
22/06/02	1505	N75 40.87	E08 59.16	#91	2264	1508	1511		XBT	XBT061	
22/06/02	1605	N75 52.46	E08 03.82	#92	2237	1605	1608		XBT	XBT062	
22/06/02	1700	N77 04.00	E08 08.38	#93	2202	1700	1703		XBT	XBT063	
22/06/02	1910	N77 30.90	E09 19.62	#94	1904	1910	1916		XBT	XBT064	Wrong setup
22/06/02	2019	N77 45.23	E09 25.65	#95	1276	2020	2027		XBT	XBT065	
22/06/02	2102	N77 55.16	E09 29.44	#96	-	2104	2108		XBT	XBT066	
22/06/02	2207	N78 08.56	E09 36.03	#97	-	2205	2212		XBT	XBT067	
23/06/02	0230	-	-	#98	246	0230	-		XBT	XBT068	Topas X
23/06/02	0235	N78 59.78	E10 43.33	#99	250	0235	0237		XBT	XBT069	Topas
23/06/02	0534	N79 03.26	E11 18.01		241	0534	-	0540	KF2	Acoustics	Mooring
23/06/02	0542	N79 03.25	E11 17.97	#100	240	0543	0551	0559	KF2	NBC	Good

JCR75 Cruise Report

23/06/02	0620	N79 03.25	E11 17.97	#101	240	0621	0633		KF2	lander	Moored
23/06/02	0640	N79 03.25	E11 17.97	#102	240	0645	0651	0658	KF2	CTD012	Bottom
23/06/02	0710	N79 03.25	E11 17.97	#103	240	0714	0728	0748	KF2	CTD013	Profile
23/06/02	0809	N79 03.56	E11 18.28	#104	218	0809	-	0908	KF2	BedHop	BH003
23/06/02	0929	N79 03.35	E11 18.08	#105	244	0931	0938	0944	KF2	NBC	OK
23/06/02	1005	N79 03.34	E11 18.01	#106	244	1006	1011	1017	KF2	NBC	OK
23/06/02	1048	N79 03.34	E11 18.08	#107	244	1050	1057	1106	KF2	MultiC	6 good
23/06/02	1116	N79 03.34	E11 18.08	#108	231	1116	1122	1130	KF2	MultiC	8 good
23/06/02	1141	N79 03.30	E11 18.08	#109	231	1141	1146	1154	KF2	MultiC	
23/06/02	1232	N79 03.03	E11 21.54	#110	307	-	1239	-	KF2	GC003	#GC064
23/06/02	1323	N79 03.33	E11 17.68	#111	222	1322	1328	1336	KF2	MegaC	X
23/06/02	1342	N79 03.33	E11 17.66	#112	230	1344	1349	1401	KF2	MegaC	X
23/06/02	1442	N79 03.57	E11 18.56	#113	212	1443	1447	1538	KF2	Bedhop	
23/06/02	1545	N79 03.47	E11 18.86	#114					KF2	Mooring	Recovery
23/06/02				#115					KF2	Video	Problems
23/06/02	1900	N79 03.41	E11 17.79	#116	250			1935	KF2	Lander	Recovery
24/06/02	1300	N78 57.46	E11 54.49	#117	355	1305	1314	1321	KF1	CTD014	Bottom
24/06/02	1330	N78 57.46	E11 54.49	#118	355	1334	1349	1406	KF1	CTD015	Profile
24/06/02	1424	N78 57.46	E11 54.48	#119	355	1425	1433	1441	KF1	NBC	Good
24/06/02	1515	N78 57.47	E11 53.95	#120	354	1517			KF1	Lander	Free Fall
24/06/02	1550	N78 57.46	E11 54.53	#121	355	1551	1559	1607	KF1	NBC	Good
24/06/02	1625	N78 57.46	E11 54.53	#123	355	1625	1632	1643	KF1	NBC	Good
24/06/02	1710	N78 57.46	E11 54.48	#124a	355	1710	1727	1801	KF1	BHC	bedhop
24/06/02	1900	N78 57.46	E11 54.48	#124b	355	1901	1911		KF1	MC	8/8 FULL
24/06/02	1937	N78 57.46	E11 54.49	#125	355	1937	1944	1955	KF1	MC	7/8 FULL
24/06/02	2007	N78 57.46	E11 54.49	#126	355	2008	2015	2026	KF1	MC	BIT BENT
24/06/02	2035	N78 57.46	E11 54.49	#127	355	2036	2043	2052	KF1	GC	GC#065
24/06/02	2110	N78 57.46	E11 54.49	#128	355	2111	2118	2129	KF1	MegaC	2 lost
24/06/02	2205	N78 57.46	E11 54.49	#129	355	2207	2214	2225	KF1	MegaC	2 of 3
24/06/02	2242	N78 57.46	E11 54.49	#130	355	2243	2251	2302	KF1	MegaC	3 of 3
25/06/02	0005	N78 57.46	E11 54.50	#131	355	0005	0009	0017	KF1	SAMS BC	
25/06/02	0105	N78 57.48	E11 54.49	#132	355	0105	0112	0210	KF1	BHC	bedhop
25/06/02	0105	N78 57.48	E11 53.84	#133	359	0330			KF1	LANDER	Recovery
								1019	KF1	LANDER	onboard
25/06/02	1450	N78 58.89	E07 53.71	#134	1105	1451	1454		XBT	XBT070	Topas

JCR75 Cruise Report

25/06/02	1730	N79 00.00	E06 59.98	#135	1215	1735	1800	1822	KF4A	CTD016	BOTTOM
25/06/02	1833	N79 00.16	E06 59.57	#136	1220	1836	1909	1949	KF4A	CTD017	Profile
25/06/02	2011	N79 00.00	E06 59.98	#137	1246	2015	2038	2102	KF4A	NIOZ	muddy
25/06/02		N78 57.99	E06 43.02	#138	1381			2259	KF4B	NIOZ	
25/06/02	2340	N78 57.99	E06 43.03	#139	1381	2340	0013	-	KF4B	LANDER	DEPLOYED
26/06/02	0056	N78 58.38	E06 42.49	#140	1385	0052	0121	0155	KF4B	NIOZ	
26/06/02	0210	N78 58.40	E06 42.49	#141	1385	0210	0240	0308	KF4B	NIOZ	
26/06/02	0331	N78 58.40	E06 42.47	#142	1385	0331	0400	-	KF4B	MultiC	
26/06/02	0456	N78 58.40	E06 42.47	#143	1385	0456	0526	0550	KF4B	MultiC	
26/06/02	0605	N78 58.42	E06 42.46	#144	1385	0606	0631	-	KF4B	MultiC	
26/06/02	0730	N78 58.42	E06 42.46	#145	1385	0735	0755	0818	KF4B	MultiC	
26/06/02	0901	N79 00.00	E06 56.81	#146	1226	0904	0930	0957	KF4A	MultiC	Geology Site
26/06/02	1003	N79 00.01	E06 56.84	#147	1226	1007	1031	1054	KF4A	GC066	1226 w/o
26/06/02	1155	N78 58.43	E06 42.66	#148	1352	1156	1221	-	KF4B	MegaC	1335 w/o
26/06/02	1323	N78 58.40	E06 42.73	#149	1381	-	1323		KF4B	MegaC	
26/06/02	1415	N78 58.40	E06 42.77	#150	1380	1417	1442		KF4B	BHC	
26/06/02	1612	N78 57.82	E06 43.68	#151	1422				KF4B	Lander	recovery
27/06/02	1433	N78 56.90	E05 17.35	#152	2500	1433	1516	1559	KF5	CTD018	BOTTOM
27/06/02	1610	N78 56.87	E05 17.31	#153	2500	1614	1704	1802	KF5	CTD019	PROFILE
27/06/02	1810	N78 56.87	E05 17.31	#154	2500	1810	1855	2044	KF5	BHC	bedhop
27/06/02	2120	N78 56.85	E05 17.32	#155	2498	2121	2205	2247	KF5	NIOZ	MUD
27/06/02	2311	N78 56.85	E05 17.31	#156	2498	2312	2351	0152	KF5	NIOZ	PROBLEMS
28/06/02	0230	N78 56.85	E05 17.31	#157	2465	0232	0319	0357	KF5	MultiC	W/o 2465
28/06/02	0420	N78 56.85	E05 17.31	#158	2465	0424	0500	0540	KF5	MultiC	
28/06/02	0555	N78 56.85	E05 17.31	#159	2465	0556	0630	0711	KF5	MultiC	
28/06/02	0725	N78 56.85	E05 17.31	#160	2465	0728	0805	0840	KF5	MultiC	
28/06/02	0925	N78 56.74	E05 13.59	#161	2500	0926		1115	KF5A	GC	
28/06/02	1130	N78 56.90	E05 17.83	#162	2632?	1130	1216	1255	KF5	Mega	2467 W/O
28/06/02	1313	N78 56.86	E05 17.47	#163	?	1313	1350	-	KF5	Mega	2463 W/O
28/06/02	1505	N78 56.89	E05 16.60	#164	2500?	1506	1551	-	KF5	BHC	
28/06/02	2237	N79 15.00	E02 30.00	#165	4444	2237	-	-	HS	XBTO71	
28/06/02	2322	N79 14.52	E02 15.00	#166	4142	2322	-	-	HS	XBTO72	Heavy ice
29/06/02	0003	N79 15.00	E02 09.30	#167	4270	0003			HS	XBTO72	
29/06/02	0034	N79 17.00	E02 21.30	#168	3585	0034			HS	XBTO73	
29/06/02	0056	N79 15.71	E02 29.31	#169	3930	0056			HS	XBTO74	

JCR75 Cruise Report

29/06/02	0118	N79 13.78	E02 40.19	#170	4980	0118			HS	XBT075	
29/06/02	0127	N79 13.00	E02 45.30	#171	5163	0127			HS	XBT076	
29/06/02	0137	N79 12.28	E02 50.50	#172	5462	0137			HS	XBT077	
29/06/02	0145	N79 11.57	E02 55.00	#173	5323	0145			HS	XBT078	
29/06/02	0157	N79 10.87	E03 00.00	#174	5329	0157			HS	XBT079	
29/06/02	0221	N79 09.90	E03 06.30	#175	5314	0221			HS	XBT080	
29/06/02	0230	N79 10.21	E03 11.76	#176	5172	0230			HS	XBT081	
29/06/02	0237	N79 10.43	E03 15.44	#177	5049	0237			HS	XBT082	
29/06/02	0246	N79 10.68	E03 12.00	#178	5054	0246			HS	XBT084	83?
29/06/02	0257	N79 10.35	E03 24.75	#179	5068	0257			HS	XBT085	
29/06/02	0307	N79 10.00	E03 30.00	#180	4753	0307			HS	XBT086	
29/06/02	0318	N79 09.75	E03 35.00	#181	3791	0318			HS	XBT087	
29/06/02	0417	N79 06.44	E03 36.81	#182	3323	0417			HS	XBT088	
29/06/02	0830	N79 19.27	E06 37.22	#183	1568	0834			UEA	CTD020	
29/06/02	1909	N80 41.36	E07 25.55	#184	867	1920	1941	1956	YP1	CTD021	NORTH
29/06/02	2007	N80 41.36	E07 25.53	#185	888	2008	2030	2107	YP1	CTD022	
29/06/02	2125	N80 41.36	E07 25.64	#186	886	2127	2143	2240	YP1	BH	
29/06/02	2320	N80 43.65	E07 24.66	#187	892	2320	2345	2358	YP1a	NIOZ	ICE
30/06/02	0025	N80 43.64	E07 24.60	#188		0025	0043		YP1a	NIOZ	
30/06/02	0120	N80 43.76	E07 25.72	#189	898	0120	0139	0157	YP1a	NIOZ	
30/06/02	0252	N80 45.02	E07 38.72	#190	922	0252	0309	0331	YP1b	MultiC	ICE
30/06/02	0343	N80 45.02	E07 38.74	#191		0343	0400	0418	YP1b	MultiC	
30/06/02	0429	N80 45.02	E07 38.74	#192		0429	0446	0507	YP1b	MultiC	
30/06/02	0521	N80 45.00	E07 38.72	#193	961	0521	0538	0556	YP1b	GC	
30/06/02	0600	N80 45.00	E07 38.72	#194		0600	0629	0650	YP1b	MegaC	
30/06/02	0700	N80 45.00	E07 38.72	#195		0700	0718	0735	YP1b	MegaC	
30/06/02	0810	N80 45.37	E07 40.73	#196	966	0812	0830		YP1b	BH	
30/06/02	1000	N80 44.59	E07 59.71	#197	951	1005			XBT	XBT089	FAIL
30/06/02	1005	N80 43.39	E07 59.68	#198	946	1007			XBT	XBT090	FAIL
30/06/02	1013	N80 42.90	E07 59.44	#199	930	1013			XBT	XBT091	
30/06/02	1105	N80 37.40	E08 32.25	#200	849	1105			XBT	XBT092	
30/06/02	1110	N80 36.97	E08 35.27	#201	881	1110			XBT	XBT093	
30/06/02	1210	N80 28.91	E09 09.82	#202	927	1210			XBT	XBT094	
30/06/02	1300	N80 20.26	E09 27.50	#203	620	1303			XBT	XBT095	
30/06/02	1403	N80 09.87	E09 28.41	#204	552	1411			XBT	XBT096	

JCR75 Cruise Report

30/06/02	1500	N80 00.68	E09 27.50	#205	488	1501			XBT	XBT097	
30/06/02	1600	N79 52.29	E09 20.89	#206	458	1601			XBT	XBT098	X
30/06/02	1605	N79 51.96	E09 20.61	#207	458	1605			XBT	XBT099	
30/06/02	1655	N79 43.76	E09 11.33	#208	404	1658			XBT	XBT100	
30/06/02	1805	N79 33.98	E08 40.78	#209	405	1805			XBT	XBT101	
30/06/02	1900	N79 25.36	E08 14.93	#210	285	1802			XBT	XBT102	
30/06/02	2004	N79 15.86	E07 45.83	#211	884	2005			XBT	XBT103	
30/06/02	2209	N78 58.33	E06 58.33	#212	1326	2215			KF4	MultiC	
30/06/02	2316	N78 56.24	E06 42.23	#213	1380	2316	0023	0053		Survey	
30/06/02	0140	N78 58.08	E06 42.91	#214	1380			0731		Dragging	
01/07/02	1315	N79 01.41	E10 41.50	#215	327	1317	1328	1335	KF3b	CTD023	
01/07/02	1348	N79 01.33	E10 41.52	#216	333	1349	1424	1426	KF3b	CTD024/5	
01/07/02	1435	N79 01.33	E10 41.52	#217	331	1435	1445	1523	KF3b	BHC	BHC(914)
01/07/02	1606	N79 01.34	E10 41.73	#218	343	1606	1616	1624	KF3b	NIOZ	
01/07/02	1635	N79 01.34	E10 41.68	#219	343	1637	1646	1656	KF3b	NIOZ	
01/07/02	1712	N79 01.34	E10 41.65	#220	342	1714	1722	1731	KF3b	NIOZ	
01/07/02	1755	N79 01.34	E10 41.63	#221	342	1755	1806		KF3b	NIOZ	
01/07/02	1845	N79 01.34	E10 41.62	#222	342	1848	1857		KF3b	MultiC	
01/07/02	1915			#223	342		1934		KF3b	MultiC	
01/07/02	1950			#224	342		2006	2018	KF3b	MultiC	
01/07/02	2024	N79 01.33	E10 41.63	#225	342	2025	2028	2035	KF3b	GC	GC072
01/07/02	2056	N79 01.33	E10 41.63	#226	342	2056	2100	2108	KF3b	GC	GC073
01/07/02	2120	N79 01.34	E10 41.61	#227	325	2120	2129	2139	KF3b	MegaC	
01/07/02	2146	N79 01.33	E10 41.61	#228	343	2146	2156		KF3b	MegaC	
01/07/02	2222	N79 01.33	E10 41.62	#229	343	2222	2230	2242	KF3b	MegaC	
01/07/02	2309	N79 01.33	E10 41.61	#230	333	2309	2319	0034	KF3b	BHC	Bedhop
02/07/02	0320	N78 57.46	E11 54.99	#231	365	0322	0340		KF1	LANDER	Moored
02/07/02	0610	N78 59.36	E11 46.03	#232	379	0615	0630	0640	KF1b	GC	GC074
				#233							
02/07/02	0712	N79 10.52	E11 46.67	#234	350	0711	0724	0750	KF1	CTD026	
03/07/02	0758	N78 57.38	E11 54.57	#235	366	0802	0810	0820	KF1	MultiC	
03/07/02	0827	N78 57.41	E11 54.46	#236	366	0828	0836		KF1	MultiC	
03/07/02				#237			0906		KF1	MultiC	
03/07/02	1025	N79 03.30	E11 17.75	#238	235	1030	1045	1102	KF2	CTD027	
03/07/02	1333	N79 03.44	E11 16.87	#239	205				KF2	Mooring	Deployed

JCR75 Cruise Report

03/07/02	1634	N78 57.52	E11 55.27	#240	362			1704	KF1	Elinor	Recovery
03/07/02	2202			#242				0355	KF4	3 rd attempt	Lander
04/07/02	0732	N78 17.84	E07 37.55	#243	2725	0740	0834	0930	UEA	CTD028	
05/07/02	0735	N73 57.76	E13 03.42	#244	1877	0738			XBT	XBT105	Topas XBT
05/07/02	1050	N73 39.62	E13 47.10	#245	1462	1109	1138	1204	BIF	CTD029	Bottom
05/07/02	1216	N73 39.67	E13 47.21	#246	1446	1219	1253	1331	BIF	CTD030	Profile
05/07/02	1341	N73 39.71	E13 47.26	#247	1445	1341	1408	1513	BIF	BHC	
05/07/02	1539	N73 39.64	E13 46.83	#248	1445	1541	1609	1635	BIF	NIOZ(1)	
05/07/02	1652	N73 39.61	E13 46.93	#249	1445	1655	1716	1740	BIF	NIOZ(2)	extra weight
05/07/02	1755	N73 39.61	E13 46.96	#250	1440	1757	1819	1841	BIF	NIOZ(3)	
05/07/02	1910	N73 39.61	E13 46.97	#251	1440	1910	1933		BIF	MultiC	
05/07/02	2013	N73 39.61	E13 47.00	#252	1440	2013	2036		BIF	MultiC	
05/07/02	2114	N73 39.61	E13 47.00	#253	1440	2114	2136		BIF	MultiC	
05/07/02	2209	N73 39.59	E13 46.99	#254	1440	2209	2218	2244	BIF	GC	GC076
05/07/02	2257	N73 39.59	E13 46.95	#255	1440	2257	2319	2346	BIF	MegaC	
05/07/02	2358	N73 39.59	E13 46.96	#256	1440	2359	0018		BIF	MegaC	
07/07/02	0903	N67 13.03	E09 28.08	#257	399	0906	0920	0939	UEA	CTD031	
08/07/02	0113	N64 05.25	E08 02.61	#258	286			0148	SULA	Photo	recovery
08/07/02	0212	N64 05.02	E08 02.24	#259	285	0212	0219	0228	SULA	NIOZ	ROCK
08/07/02	0238	N64 05.02	E08 02.24	#260	285	0238	0245	0255	SULA	NIOZ	WATER
08/07/02	0326	N64 05.02	E08 02.24	#261	285	0326	0334	0430	SULA	BEDHOP	
08/07/02	0509	N64 04.80	E08 01.89	#262	250	0509	0524	0620	SULA	BEDHOP	
08/07/02	1150	N63 45.71	E05 36.56	#263	450	1155			XBT	XBT106	
08/07/02	1203	N63 45.71	E05 34.52	#264	519	1213	1231	1251	UEA	CTD032	
09/07/02	1036	N62 38.84	W01 19.38	#265	1645	1039	1118		FSC(N)	CTD033	
09/07/02	1438	N62 17.18	W01 59.60	#266	1731	1438			XBT	XBT107	
09/07/02	1839	N61 40.65	W02 59.76	#267	1515	1839			XBT	XBT108	
09/07/02	2028	N61 22.15	W03 29.57	#268	1236	2028			XBT	XBT109	
09/07/02	2219	N61 43.58	W03 59.73	#269	1153	2219			XBT	XBT110	
09/07/02	2321	N60 53.32	W04 15.28	#270	1129	2321			XBT	XBT111	
10/07/02	0016	N60 44.26	W04 29.63	#271	1110	0016			XBT	XBT112	
10/07/02	0115	N60 34.71	W04 45.05	#272	1072	0115			XBT	XBT113	
10/07/02	0225	N60 25.00	W05 00.00	#273	930	0226			FSC(S)	CTD034	Pump?
10/07/02	0420	N60 20.04	W05 16.84	#274	1025	0420			XBT	XBT114	
10/07/02	0458	N60 16.00	W05 30.10	#275	1101	0458			XBT	XBT115	

JCR75 Cruise Report

10/07/02	0539	N60 11.75	W05 44.79	#276	1163	0539			XBT	XBT116	
10/07/02	0620	N60 07.42	W05 59.76	#277	1145	0620			XBT	XBT117	
10/07/02	0704	N60 02.93	W06 15.05	#278	1032	0704			XBT	XBT118	
10/07/02	0749	N59 58.37	W06 30.15	#279	~375	0744			XBT	XBT119	
10/07/02	0832	N59 53.81	W06 45.20	#280	770	0832			XBT	XBT120	
10/07/02	0902	N59 50.52	W06 55.41	#281	1000	0902			XBT	XBT121	

Physical measurements

Colin Griffiths, Finlo Cottier & Paul Provost

Mooring Activity

During JCR75 the Kongsfjord mooring was serviced. The mooring was recovered on the 23rd June 2002 at 15:45Z. The mooring was recovered in excellent condition. The sediment trap collected 18 samples, the interval for collection was 3.5 days. A full description of the deployment of this mooring from the Lance is given in Appendix B, this includes full details of the instrument setup for this mooring. All the physical instruments were successfully downloaded, rebatteried and prepared for redeployment. It soon became clear that there were problems with the ESM1 loggers. Both units had stopped prior to recovery, one instrument had only just stopped whilst the other unit had failed in early May. The instruments were downloaded, rebatteried and then setup to perform post deployment calibrations. Both units were to fail soon after. A great deal of time was spent trying to debug these instruments. The mooring deployment was delayed in the hope that the problems could be solved. It soon became obvious that there was to be no quick fix and eventually it was decided to redeploy without the ESM1 loggers and to return the instruments to UKORS as soon as we returned to the UK. A full report by Pat Cooper is included in Appendix C. The mooring was deployed in 205m water on the 3/7/02 at 1333Z. As an afternote to the mooring activity aboard JCR75, the mooring was successfully recovered from the Haakon Mosby in September 2002. All instruments recorded full data sets and it is our intention to redeploy the mooring in April 2003 from the Jan Mayen. The plan is to maintain the mooring at ~6 month intervals until eventual recovery from the Discovery in September 2003.

Sediment trap samples from the Kongsfjord Mooring



CTD

The BAS SeaBird (SBE) 9/11+ CTD was used for station-based profiling of the water column on JR75. The BAS SBE 9/11+ system consists of twin pumped temperature and conductivity sensors and a pressure transducer connected to a SBE 32 twelve-position carousel water sampler, with each position having a 10 litre Niskin bottle fitted. For the first three casts an altimeter, a transmissometer, a fluorometer and a photosynthetically active radiation (PAR) 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 not available on JR75. The raw binary data are logged to the CTD PC, a Viglen Genie 4Dx266 attached to the SBE deck unit. Data were logged using the SeaBird seasave module from the Seasoft version 4.226 set of utilities. Seasoft runs under DOS and has been configured to be accessed using a menu by typing "ctdmenu" at the DOS prompt; this menu system prompts for resetting of the PC clock, an essential step to ensure correct time-stamping of the CTD data. Calibration data are entered using the utility seacon. Sampling rate for JCR75 was set to 24 Hz, the maximum permitted with the system.

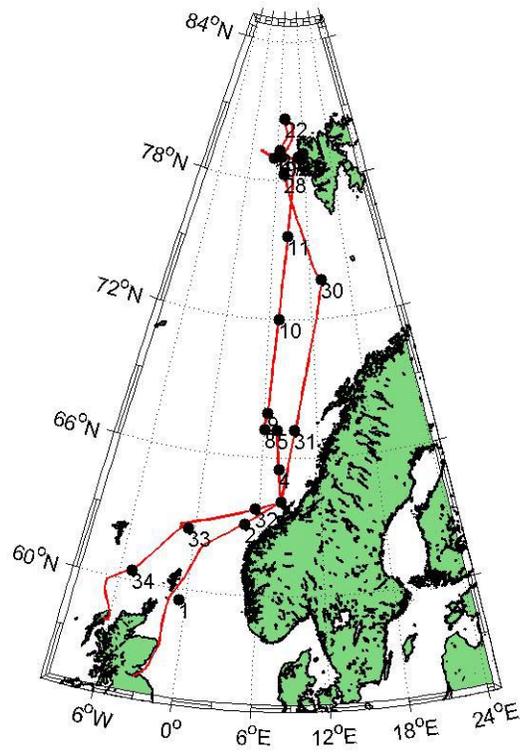
The CTD package was deployed from the midships gantry and hauled/veered on the CTD/hydro winch. The BAS swivel was not used, since the package was sufficiently compact that rotation was not deemed a likely problem. The general procedure was to power up the deck unit prior to deployment and commence logging, then lower the package to about 5 metres depth, where it was left to soak for ~5 minutes. The pumps are saltwater activated after 60 seconds using a conductivity switch, and so do not operate until the CTD is in the water. 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.

Whilst steaming daily CTD's were performed usually at 08:30Z, profiles were obtained to a maximum of 1000m with a full set of bottles fired on the upcast. Bottles were typically fired at 1000m, 500m, 250m, 100m, 50m, 40m, 30m, 20m, 10m, 5m & 2m. Special attention was given to the Chlorophyll maximum. Whilst on station, 2 CTD casts were performed, the first with the sole intention of the collection of bottom water for incubation experiments. All bottles would be fired near the bottom. The second cast was used to derive the CTD profile and collect water throughout the water column.

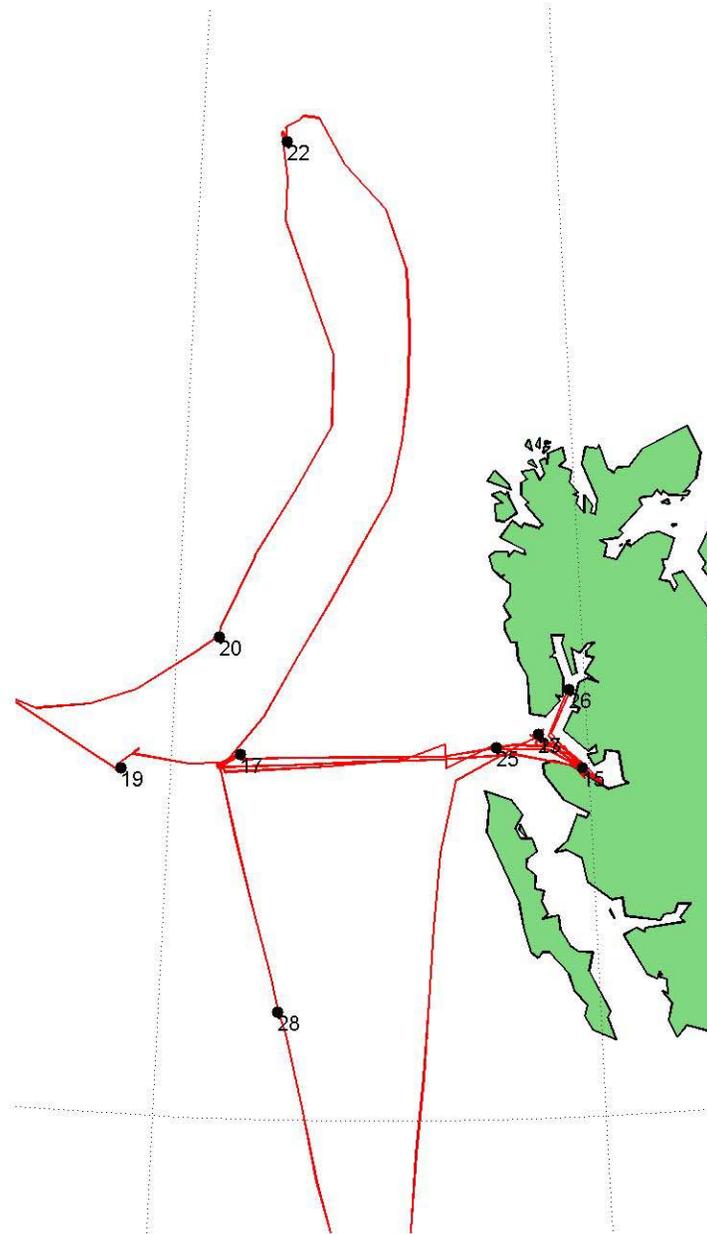
Duplicate salinity samples were usually drawn from the bottom bottle, samples were analysed back at SAMS using a Guildline 8400B. Processing of the CTD data was performed using the routines supplied by SeaBird. A batch files was written using the DOS based version 4.244 routines. The following set of routines were run to produce a bottle file and a downcast profile of 1m depth averaged values:-

```
DATCNV
ROSSUM
DATCNV
ALIGNCTD
CELLTM
FILTER
LOOPEDIT
DERIVE
BINAVG
DERIVE
ASCIIOUT
```

The system performed very well, there were slight problems with the SAMS oxygen sensor, the surface values on the downcast took a while to settle despite a 5 minute soak. The surface oxygen values in the top 10m should be treated with caution. There were also concerns on the upcast, the return cast being quite different to the downcast. On return to SAMS the O2 sensor was tested in Loch Etive in the deep hole at RE5. A calibration was derived for the downcast of the JCR75 using Winkler results from both the JCR and Etive cruises. An offset was applied to the Salinity to both sensors on the BAS CTD. No calibration was possible for the temperature sensors, both sensors were in excellent agreement with each other. The fluorometer will be calibrated once the Chlorophyll samples are worked up.



Position of CTD casts during JCR75.

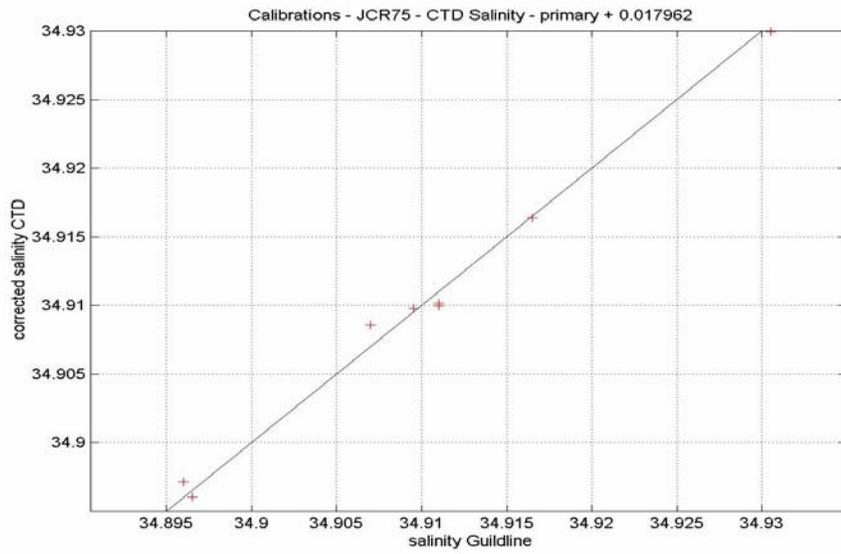


CTD casts around Spitzbergen

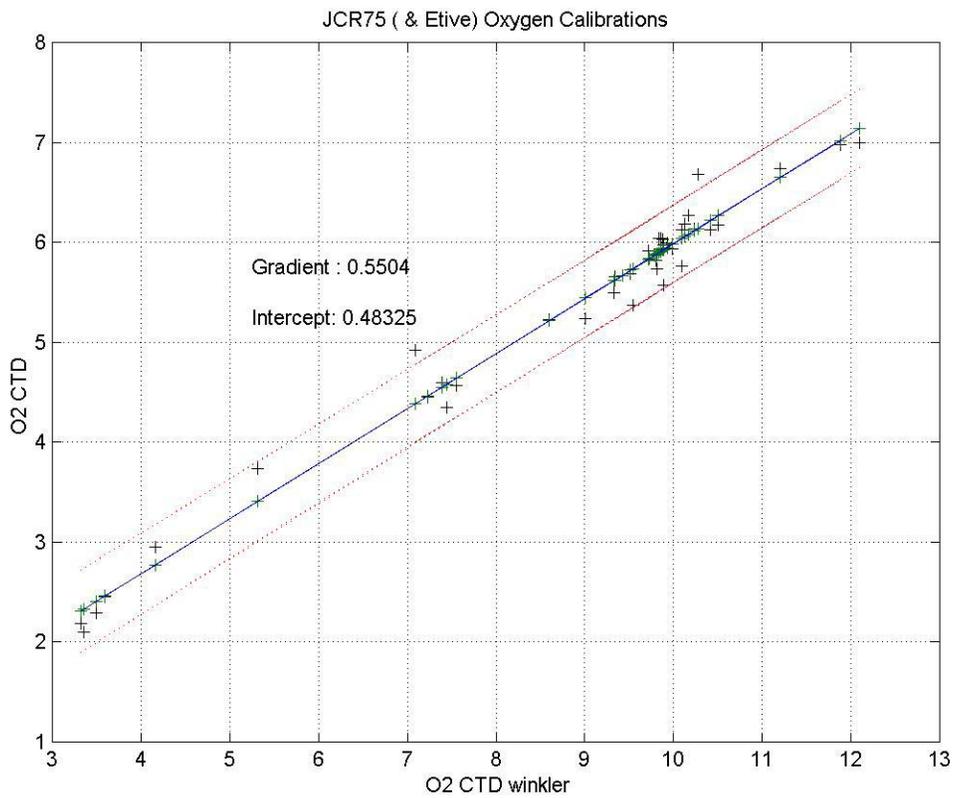
JCR75 Cruise Report

Table 1.

Instrument	Type	Serial Number	Calibration Date
Underwater Unit	SBE 9 plus	09P15759-0480	-
Deck Unit	SBE 11 plus	11P15759-0458	-
Primary Temperature	SBE 3 plus	03P2709	12-Sep-00
Primary Conductivity	SBE 4C	42255	13-Sep-00
Secondary Temperature	SBE 3 plus	03P2705	02-Jul-01
Secondary Conductivity	SBE 4C	42222	13-Sep-00
Pressure Transducer	Series 410K-105 Digiquartz pressure transducer.	67241	30-Jun-00
Altimeter	Tritech	2130.26993 90194U 3220391- 0128	-
Pylon	SBE 32		
Niskin Bottles	Ocean Test Equipment		-
Primary Pump	SBE 5 T	51813	
Secondary Pump	SBE 5 T	51807	
Fluorometer	Chelsea Mk III Aquatracka	88216	11-Jun-01
Transmissometer	Wet Labs C-Star	CST-396DR	05-Jul-01
PAR sensor	Biospherical Inc., QCD905L	7235	18-Jun-01
Oxygen sensor	SBE13	130256	15-Oct-02



CTD salinity calibrations



Oxygen calibrations

JCR75 Cruise Report

CTD cast information for JCR75

Date	Time Z	Lat	Long	Event	Depth	I/W	O/B	O/W	Stn	Activity	Comment
16/06/02	0842	N59 30.73	W01 25.75	#1	95.6		0921	0938	SD	CTD001	Shake down
17/06/02	0835	N63 05.84	E04 35.90	#3	875	0842	0906	0933	UEA1	CTD002	0930 Dip
17/06/02	2122	N64 05.19	E08 02.20	#5	285	2121	2136	2200	SULA	CTD003	O2 added
18/06/02	0838	N65 30.04	E07 46.36	#9	380	0845	0900	0921	UEA2	CTD004	Profile
18/06/02	1940	N67 11.03	E07 29.89	#11	1565	1943	2020	2056	VP1	CTD005	Profile
19/06/02	0540	N67 13.03	E06 05.95	#14	1437	0540	0615	0650	VP2	CTD006	Release
19/06/02	0700	N67 13.12	E06 05.91	#15	1438	0700	-	-	VP2	CTD007	Problems
19/06/02	1212	N67 13.04	E06 06.14	#19	1436	1212	-	1327	VP2	CTD008	Profile
20/06/02	0830	N67 54.74	E06 21.22	#32	1323	0840	0904	0936	UEA3	CTD009	1000m
21/06/02	0830	N71 58.25	E07 21.02	#60	2757	0858	0932	0928	UEA4	CTD010	1000m
22/06/02	0830	N75 34.41	E08 32.35	#83	2557	0834	0858	0928	UEA5	CTD011	1000m
23/06/02	0640	N79 03.25	E11 17.97	#102	240	0645	0651	0658	KF2	CTD012	Bottom
23/06/02	0710	N79 03.25	E11 17.97	#103	240	0714	0728	0748	KF2	CTD013	Profile
24/06/02	1300	N78 57.46	E11 54.49	#117	355	1305	1314	1321	KF1	CTD014	Bottom
24/06/02	1330	N78 57.46	E11 54.49	#118	355	1334	1349	1406	KF1	CTD015	Profile
25/06/02	1730	N79 00.00	E06 59.98	#135	1215	1735	1800	1822	KF4A	CTD016	Bottom
25/06/02	1833	N79 00.16	E06 59.57	#136	1220	1836	1909	1949	KF4A	CTD017	Profile
27/6/02	1433	N78 56.90	E05 17.35	#152	2500	1433	1516	1559	KF5	CTD018	Bottom
27/6/02	1610	N78 56.87	E05 17.31	#153	2500	1614	1704	1802	KF5	CTD019	Profile
29/06/02	0830	N79 19.27	E06 37.22	#183	1568	0834	0908	0948	UEA6	CTD020	Profile
29/06/02	1909	N80 41.36	E07 25.55	#184	867	1920	1941	1956	YP1	CTD021	Bottom
29/06/02	2007	N80 41.36	E07 25.53	#185	888	2008	2030	2107	YP1	CTD022	Profile
01/07/02	1315	N79 01.41	E10 41.50	#215	327	1317	1328	1335	KF3b	CTD023	Bottom
01/07/02	1348	N79 01.33	E10 41.52	#216	333	1349	1424	1426	KF3b	CTD024/5	Profile
02/07/02	0712	N79 10.52	E11 46.67	#234	350	0711	0724	0750	XF1	CTD026	Profile
03/07/02	1025	N79 03.30	E11 17.75	#235	235	1030	1045	1102	KF2	CTD027	Profile
04/07/02	0732	N78 17.84	E07 37.55	#243	2725	0740	0834	0930	UEA7	CTD028	Profile
05/07/02	1050	N73 39.62	E13 47.10	#245	1462	1109	1138	1204	BIF	CTD029	Bottom
05/07/02	1216	N73 39.67	E13 47.21	#246	1446	1219	1253	1331	BIF	CTD030	Profile
07/07/02	0903	N67 13.03	E09 28.08	#257	399	0906	0920	0939	UEA8	CTD031	Profile
08/07/02	1203	N63 45.71	E05 34.52	#264	519	1213	1231	1251	UEA9	CTD032	Profile
09/07/02	1036	N62 38.84	W01 19.38	#265	1645	1039	1118	1158	FSC(N)	CTD033	Profile
10/07/02	0225	N60 25.00	W05 00.00	#273	930	0226	0251	0324	FSC(S)	CTD034	Profile

Expendable Bathythermographs (XBTs)

During JR75, a number of XBT drops were made from RRS *James Clark Ross*. The drops included the following transects:

- Northward transect from Voring Plateau to Kongsfjord
- Survey of surface waters around the ice edge west of the Molly Deep
- Southward transect from Yermack Plateau to Kongsfjord
- Transect along the axis of the Faroe-Shetland Channel
- Individual drops for speed of sound data for the TOPAS/Swath system.

In all, 120 drops were made; full details are listed in the table.

Sippican T5 probes were used, having been provided by the UK Hydrographic Office. All data are to be returned to UKHO at the end of the cruise. A fixed launcher was used, sited on the port quarter and few problems were experienced other than premature failure of the wire as the sea state increased to moderate/rough. Data were logged by a Viglen IBM-type 486 PC running the Sippican WinMk12 software. After a successful drop, data were transferred to local PCs for processing using a MATLAB script developed onboard to read the *.edf files generated by the system.

Voring Plateau to Kongsfjord

This transect began at 0700Z on 20/06/02 at position N67 36.5 E006 13.0 and finished at 2200Z on 22/06/02 at position N78 08.6 E09 36.0. The transect was 600nm (700km) in water depths typically around 3000m. A total of 55 XBTs were launched in this time at hourly intervals with 85% success rate - most failures being through excessively noisy signals.

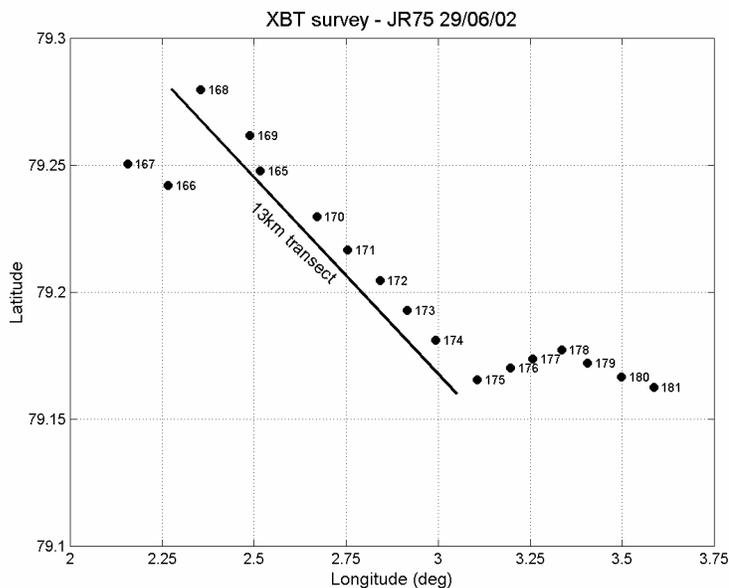
Date	Time(Z)	Lat (N)	Lon (E)	Event	XBT	Depth (m)
20/6	0659	67 36.5	06 13.0	#30	004	1565
20/6	0759	67 49.4	06 18.2	#31	005	
20/6	0954	67 57.0	06 23.0	#33	006	1374
20/6	1056	68 08.9	06 26.2	#34	007	1726
20/6	1156	68 20.4	06 30.4	#35	008	2334
20/6	1206	68 22.0	06 31.0	#36	009	2389
20/6	1303	68 32.9	06 32.7	#37	010	2515
20/6	1404	68 43.2	06 34.6	#38	011	3003
20/6	1453	68 50.5	06 35.7	#39	012	3145
20/6	1457	68 51.0	06 35.8	#40	013	3153
20/6	1600	68 59.7	06 37.5	#41	014	3068
20/6	1700	69 08.5	06 39.2	#42	015	3187
20/6	1800	69 19.0	06 40.9	#43	016	3220
20/6	1900	69 27.5	06 43.5	#44	017	3209
20/6	1958	69 39.3	06 45.0	#45	018	3201
20/6	2055	69 49.4	06 45.5	#46	019	3175
20/6	2159	70 02.1	06 48.6	#47	020	3151
21/6	2258	70 11.6	06 51.4	#48	021	3101
21/6	0010	70 24.8	06 55.7	#49	022	3064
21/6	0026	70.27.3	06 55.9	#50	023	3058
21/6	0112	70 36.6	06 58.0	#51	024	3047
21/6	0225	70 50.4	07 02.4	#52	025	3030
21/6	0300	70 56.4	07 03.3	#53	026	3046

21/6	0310	70 58.6	07 03.7	#54	027	3050
21/6	0400	71 70.9	07 6.62	#55	028	2977
21/6	0500	71 18.7	07 10.3	#56	029	2942
21/6	XBT never launched or logged				030	-
21/6	0600	71 29.9	07 13.5	#57	031	2919
21/6	0700	71 42.3	07 17.2	#58	032	2831
21/6	0800	71 53.1	07 20.3	#59	033	2780
21/6	0951	72 00.8	07 61.7	#61	034	2746
21/6	0955	72 01.6	07 21.9	#62	035	2743
21/6	1101	72 13.4	07 26.2	#63	036	2672
21/6	1107	72 14.6	07 26.6	#64	037	2656
21/6	1204	72 25.9	07 30.3	#65	038	2585
21/6	1306	72 38.4	07 33.7	#66	039	2534
21/6	1404	72 50.1	07 36.2	#67	040	2479
21/6	1500	72 02.7	07 41.6	#68	041	2430
21/6	1600	72 13.4	07 42.8	#69	042	2473
21/6	2206	73 29.3	07 44.4	#72	043	2773
21/6	2303	73 40.4	07 49.3	#73	044	2240
22/6	0003	73 52.9	07 55.0	#74	045	2223
22/6	0112	74 05.9	08 00.1	#75	046	2443
22/6	0208	74 17.6	08 04.6	#76	047	2360
22/6	0309	74 29.6	08 09.7	#77	048	2660
22/6	0409	74 42.0	08 14.7	#78	049	2558
22/6	0511	74 54.8	08 19.2	#79	050	3471
22/6	0616	75 08.3	08 23.7	#80	051	2638
22/6	0715	75 20.6	08 28.1	#81	052	2686
22/6	0800	75 30.5	08 32.1	#82	053	2580
22/6	1000	75 39.4	08 34.4	#84	054	2386
22/6	1100	75 41.4	08 39.8	#85	055	2369
22/6	1110	75 53.0	08 40.4	#86	056	2369
22/6	1200	75 03.4	08 44.0	#87	057	2300
22/6	1304	76 15.8	08 49.1	#88	058	2250
22/6	1402	76 27.3	08 52.6	#89	059	2214
22/6	1500	75 39.1	08 58.4	#90	060	2264
22/6	1505	75 40.9	08 59.2	#91	061	2264
22/6	1605	75 52.5	08 03.8	#92	062	2237
22/6	1700	77 04.0	08 08.4	#93	063	2202
22/6	1910	77 30.9	09 19.6	#94	064	1904
22/6	2019	77 45.2	09 25.6	#95	065	1276
22/6	2102	77 55.2	09 29.4	#96	066	-
22/6	2207	78 08.6	09 36.0	#97	067	-

Ice Edge survey at Molloy Deep

Warm water eddies are reported to be a persistent feature in the marginal ice zone west of the Molloy Deep. To investigate these observations of warm water lenses in this area, we planned an extensive XBT survey comprising two 30nm legs. However, ice conditions were such that the survey was limited to a much smaller area centred around N79.2 E003.0 during which 17 successful drops were made. The longest continuous transect ran NW/SE and was 11nm in length. During this time, ice observations were also made from the bridge. In the transect, three lenses of water of 4°C were detected at depths ranging from 20 - 100m. These results will be further worked up with Prof P. Wadhams of the Scott Polar Research Institute.

Date	Time(Z)	Lat (N)	Lon (E)	Event	XBT	Depth (m)
28/6	2238	79 15.0	02 30.0	#165	071	4444
28/6	2322	79 14.5	02 15.0	#166	072	4142
29/6	0003	79 15.0	02 09.3	#167	073	4270
29/6	0034	79 17.0	02 21.3	#168	074	3585
29/6	0056	79 15.7	02 29.3	#169	075	3930
29/6	0118	79 13.8	02 40.2	#170	076	4980
29/6	0127	79 13.0	02 45.3	#171	077	5263
29/6	0137	79 12.3	02 50.5	#172	078	5462
29/6	0145	79 11.6	02 55.0	#173	079	5323
29/6	0157	79 10.9	03 00.0	#174	080	5329
29/6	0221	79 09.9	03 06.3	#175	081	5314
29/6	0230	79 10.2	03 11.8	#176	082	5172
29/6	0237	79 10.4	03 15.4	#177	083	5049
29/6	0246	79 10.7	03 20.0	#178	084	5054
29/6	0257	79 10.4	03 24.7	#179	085	5068
29/6	0307	79 10.0	03 30.0	#180	086	4753
29/6	0318	79 09.7	03 35.0	#181	087	3791
29/6	0417	79 06.4	03 36.8	#182	088	3323



Yermak Plateau to Kongsfjord

A total of 11 XBTs were launched on the transit from the Yermak Plateau station heading south to Kongsfjord. The line began at 1000Z on 30/06/02 at N80 44.4 E07 59.8 and ended at 2100Z on 30/06/02 at N79 06.3 E07 18.7. This transect extends the northward transect from the Voring Plateau to Kongsfjord up to the ice edge to the north of Svalbard.

Date	Time(Z)	Lat (N)	Lon (E)	Event	XBT	Depth (m)
30/6	1000	80 44.4	07 59.8	#197	089	951
30/6	1005	80 43.4	07 59.7	#198	090	946

30/6	1013	80 42.9	07 59.4	#199	091	930
30/6	1105	80 37.4	08 32.2	#200	092	849
30/6	1110	80 37.0	08 35.3	#201	093	881
30/6	1210	80 28.9	09 09.8	#202	094	927
30/6	1303	80 20.3	09 27.5	#203	095	620
30/6	1401	80 09.9	09 28.4	#204	096	552
30/6	1500	80 00.7	09 27.5	#205	097	488
30/6	1600	79 52.3	09 20.9	#206	098	463
30/6	1605	79 52.0	09 20.6	#207	099	463
30/6	1655	79 43.8	09 11.3	#208	100	404
30/6	1805	79 33.9	08 40.7	#209	101	405
30/6	1900	79 25.3	08 14.8	#210	102	285
30/6	2000	79 15.7	07 45.5	#211	103	884
30/6	2100	79 06.3	07 18.7	#212	104	1286

Faroe-Shetland Channel

An opportunistic survey of the channel was made with the remaining XBTs.

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	Foremast
Air humidity and temperature	Rotronic MP103A-CG030-W4W	Foremast
TIR sensor (pyranometer)	Kipp & Zonen SP LITE	Foremast
TIR sensor (pyranometer)	Kipp & Zonen SP LITE	Foremast
PAR sensor	Kipp & Zonen Quantum PAR LITE	Foremast
PAR sensor	Kipp & Zonen Quantum PAR LITE	Foremast
Ultrasonic Anemometer	Solent Meteorological	Foremast

Navigational Data

Instruments used were the Trimble 4000 GPS receiver, the Sperry Mk 37 Model D Gyrocompass, the Ashtech ADU-2 GPS receiver and the GLONASS GPS (Ashtech GG24) receiver. Data from the Chernikoeff Aquaprobe Mk V Electromagnetic log and the Sperry SRD 421 Doppler log were not routinely logged; the latter of these was operational only briefly during the cruise. In addition to these instruments, a Racal Satcom received GPS SV range correction data via INMARSAT B: this was passed to the Trimble and other GPS receivers to allow them to operate in differential mode (DGPS). The Trimble 4000 in differential mode was the primary source of positional information on JCR75. The data stream from the gyrocompass constitutes the most continuous information available on ship's heading. It is involved in processing data from meteorological instrumentation (so as to derive information on true wind velocity), and in processing the Acoustic Doppler Current Profiler (ADCP) data. It is also drawn into the bestnav stream (see below) to derive positional information by dead reckoning during periods of no GPS data coverage. The ship's gyrocompass is subject to an inherent error and can oscillate for several minutes after a turn. Consequently, the Ashtec ADU-2 is used to correct errors in the gyrocompass heading prior to input of the data to the ADCP processing.

The Ashtech GG24 receiver works by accepting data from both American GPS and the Russian GLONASS satellites. This increases accessibility to satellite fixes, and hence should provide more accurate navigation data than standard GPS coverage allows. Bestnav is a processed data stream, which contains 30 second interval position data. It uses the best available data source: GPS when available, dead reckoning from the ship's gyrocompass and speed otherwise.

Vessel-Mounted Acoustic Doppler Current Profiler (VMADCP)

The acoustic Doppler current profiler (ADCP) on the RRS *James Clark Ross* is an RD Instruments 153.6 kHz unit sited in a sea chest that is recessed within the hull to afford protection from sea ice. The fluid in the sea chest is a mixture of 90% deionised water and 10% ethylene glycol, and is closed to the sea by a 33 mm thick window of Low Density PolyEthylene (LDPE). The orientation of the transducer head is offset by approximately 45° to the fore-aft direction.

For cruise JR75 the VMADCP was configured to record data in 64 x 8 m bins, in ensembles of 2 minute duration. The 'blank beyond transmit' was set to 4 m such that the centre depth of the first bin was 14 m, given the approximate transducer depth of 6 m. The system uses 17.07 firmware and version 2.48 of RDI Data Acquisition Software (DAS) run on a Viglen IBM-type 286 PC. A log was maintained of the drift of the pc clock relative to the ships clock. The two minute ensembles of data are passed via a printer buffer directly to the Level C. Data can be recovered from the PC PINGDATA files in the instance of any problems with the ship's Level C system.

Oceanographic Sensors

The underway measurements consisted of a SBE 45 thermosalinograph (Ser No. 4524698-0016) and a fluorometer 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.

Acoustic Seabed Mapping and Gravity Core Sampling

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Scottish Association for Marine Science
NERC Radiocarbon Laboratory
British Geological Survey

Objectives

This project aims to examine 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.

A 6 m-long gravity corer is used to obtain sediment records spanning that least the last glacial-interglacial cycle. Sampling stations range from deep-water sites of current-influenced sedimentation on the Western Svalbard Margin and Fram Strait to the shallower shelfal sites such as Kongsfjord, Spitsbergen and the Yermak Plateau. 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.

JR75 Gravity Core Stations

Core samples were obtained at all stations using the 6 m British Geological Survey (BGS) gravity corer (see Table 1). The corer uses a 1000 kg weight and a 6 m long, 10 cm diameter steel barrel, within which is a polycarbonate liner. The corer is deployed from the port aft area of the ship using a launching/recovery trough. The BGS 3 tonne 'free-fall' winch operated using a 5000 m plastic-coated Kevlar rope. This controls the rate of descent at about 60m/min until 30m above the seabed, where the corer was stabilised before being run in at about 20m/min. Once inboard the barrel was unbolted from the head and carried, with the aid of the Effer crane to the bench. The core cutter and catcher were removed and the polycarbonate liner pushed out of the barrel with the aid of hydraulic ram. 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. Splitting was achieved on deck using a router and cheese wire. Once split the cores were logged, and digitally photographed.

Sample recovery varied to between 3.10-3.80m, depending on the sediment type. Some core compaction is possible at the softer sediment sites (e.g. Kongsfjord). Loss of the core top was also noted, but after comparison with the multicore and box core samples, this was reduced to <10cm by running in at lower speeds (<20m/min). Initially, two core catchers were used, to prevent core catcher inversion in stiffer sediments (e.g. Voring Plateau), but this was found to be inhibiting the length of the core obtained in softer sediments, (e.g. Svalbard margin) and a single core catcher was found to provide longer cores.

Table 1 Gravity & Multicore Samples

Date & Time Recov.	Event Number & SAMS Core Number	Position	Water Depth	Total Depth	General Area	Sediment Type	Comment

JCR75 Cruise Report

18/6/02 22:30 hrs	12 GC062	67 11.52 07 29.42	1358	3.10m + CC	Nyk Drift / Norwegian Margin	Silty-clays and stiff grey clays	Contourite
20/6/02 22:15 hrs	25 GC063	67 12.80 06 06.24	1406	3.27m + CC	Central Voring Plateau	Silty-clays and stiff grey clays	
23/6/02 12:32 hrs	110 GC064	79 03.03 11 21.54	307	3.28m + CC	Kongsfjord, Svalbard Station 2	Homog., greeny- grey silt	Full of worm tubes
24/6/02 20:45 hrs	127 GC065	78 57.46 11 54.49	355	3.34m +CC	Kongsfjord off Ny Alesund, Station 1	Homog., brown / black silts	
26/6/02 09:30 hrs	146 MC066 (3 cores)	79 00.00 06 56.81	1226	0.25m 0.31m 0.34m	Svalbard Margin Drift Station 4	Homog., greeny- grey muds	
26/6/02 10:31 hrs	147 GC067	79 00.01 06 56.84	1226	3.80m + CC	Svalbard Margin Drift Station 4	Homog., greeny- grey muds	
28/6/02 10:50 hrs	161 GC068	78 56.74 05 13.59	2527	2.89m + CC	Svalbard Margin Station 5	Grey- brown muds/sand	Turbidite
30/6/02 04:46 hrs	192 MC069 (2 cores)	80 45.01 07 38.74	961	0.34m	Yermak Plateau		
30/6/02 05:21 hrs	193 GC070	80 45.00 07 38.72	961	3.39m + CC	Yermak Plateau	Homog., Grey- brown muds	
1/7/02 18:57 hrs	224 MC071 (2 cores)	79 01.33 10 41.63	342	0.25m 0.35m	Kongsfjord, Svalbard Station 3		
1/7/02 20:24 hrs	225 GC072	79 01.33 10 41.63	342	2.60m	Kongsfjord, Svalbard Station 3		Core Unsplit
1/7/02 20:56 hrs	226 GC073	79 01.33 10 41.63	342	2.80m	Kongsfjord, Svalbard Station 3	Homog., gas-rich black muds	
2/6/7/02 04:27 hrs	232 GC074	78 59.36 11 46.03	379	3.48m	Kongsfjord, Ny Alesund	Greeny- black muds & sands	Turbidite
5/7/02 19:33 hrs	251 MC075 (2 cores)	73 39.61 13 46.97	1440	0.25m 0.25m	Bear Island Fan		
5/7/02 22:18 hrs	254 GC076	73 39.51 13 44.99	1440	3.17m +CC	Bear Island Fan	Homog., brown-grey muds	Mud clasts

Multicore and box core sub-sampling for radiocarbon dating.

Obtaining undisturbed samples of surface-water interface is vital for determining the radiocarbon age of the sediment surface. That age is then used to calculate both the local marine reservoir correction that needs to be applied to core and the sedimentation rates. The shock wave caused by the narrow diameter and relative high entry speed (approximately 1m⁻⁵) of gravity corer frequently disturbs the unconsolidated surface sediment. Therefore, multicores and/or sub-samples of box cores were obtained from most sites where gravity cores were

taken. The large cross section area of the box corer (0.5 x 0.5 m) and the slower entry speed of the hydraulically-damped multi corer are both more likely to preserve undisturbed core top sediments.

Two methods of box core sub-sampling were used. Initially 38mm x 25mm box-section electrical cable conduit was pressed into the cleaned face of the box core. A cheese wire was run along the open face of the conduit to cut the sediment. The sediment filled conduit was then eased out of the box core, the lid snapped back on and the ends capped. This method worked reasonably well and did not introduce any compaction of the sediment but it did interrupt the processing of the box core for biological specimens and it proved difficult to produce a water-tight seal at the core top to retain the wettest surface sediment. After JR75 event number 156 (see table 2) off-cuts of gravity core tube liners were inserted vertically into the box core and capped once the surrounding sediment had been excavated and processed. This latter method was less disruptive to the box coring programme and although there was some compaction of the sediment it was found that it could be minimised by fitting the core liner with a plunger (made on board by J. Derrick, BGS), which was withdraw at the same rate as the tubing was inserted into the sediment.

Two different methodologies were also employed for extruding the multicore samples. Following common practice, multicores from JR75 event numbers 23, 107, and 125 were extruded and sliced at one centimetre intervals and the slices bagged and labelled individually. However, multicores from JR75 event numbers 126 onwards (see table xx.xx) were extruded whole into off-cuts of gravity core tube liner which had been cut in half lengthways. Electrical tape was used to seal the open ends of the tube liner and the core was wrapped in clingflim before being sealed in lay-flat polythene tube. The advantage of this second methodology was that the core can be split and described at a later date which will allow the multicore and gravity core samples to be correlated.

It is hoped that funding will be granted to allow 3 AMS ¹⁴C dating projects to be carried out on the cores.

- 1) Dating the onset and duration of climatic changes identified in the gravity core samples.
- 2) Dating the uppermost preserved sediment in adjacent gravity cores, box cores and multicores in order to assess the amount of sediment loss by the three different coring techniques. The results of this study will assist in the strategic planning of coring programmes on future cruises.
- 3) High-resolution (centimetre scale) dating of paired carbonate and bulk organic carbon samples from box core material to investigate the depth of active mixed layer and the carbon flux in the high Arctic.

Table 2. Multicore and box core samples taken to augment gravity core record.

JR75 Event Number	Box/Multi core	Equivalent Gravity core	Latitude	Longitude	Depth (m)	Comments
12	-	GC062			1358	No other deployments
21	Box core (NBC 868)	GC063	N67 12.85	E06 05.54	1385	
23	Multicore	GC063	N67 12.86	E06 05.53	1433	
106	Box core (NBC 878)	GC064	N79 03.34	E11 18.01	244	
107	Multicore	GC064	N79 03.34	E11 18.08	244	
125	Multicore	GC065	N78 57.46	E11 54.49	355	

146	Multicore (MC066)	GC067	N79 00.01	E06 56.81	1226	
156	Box core (NBC 899)	GC068	N78 56.85	E05 17.31	2465	
158	Multicore	GC068	N78 56.85	E05 17.31	2465	
188	Box core (NBC 907)	GC070	N80 43.64	E07 24.60	961?	
192	Multicore (MC069)	GC070	N80 45.02	E07 38.74	961?	
219	Box core (NBC 915)	GC072	N79 01.34	E10 41.68	343	
222	Multicore (MC071)	GC072	N79 01.34	E10 41.62	342	
	-	GC074				No other deployments
249	Box core (NBC925)	GC076	N73 39.61	E13 46.96	1445	
251	Multicore (MC075)	GC076	N73 39.61	E13 46.97	1440	

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 3). 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, although both systems worked well during the cruise, there are a number of issues that need to be addressed, notably those concerning the stability of the software (see section below).

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 BAS Cruise Report JR71:

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. The system also repeatedly crashed when a new survey was being prepared requiring start-up of the Operator Interface again and resetting of the bridge display. Sound velocity profiles were commonly loaded into the EM120 on average once every three days or prior to a new survey in a new area (e.g. Kongsfjord). The sound velocity profiles were gathered from the SAMS XBT sampling rather than using the EM120 sound velocity probe.

Transfer of XBT profiles into EM120

Copy **.edf** file onto floppy and insert into the EM120 machine

Login as **xbt** with pswd **simrad0**

Type: **eject floppy**

Type: **volcheck**

Type: **cp /floppy/floppy0/T*_*****.EDF .** (note space after full stop!)

Type: **eject floppy**

Stop logging and select **AML calc format profile**

Type: **java xbt T*_*****.EDF>/dev/term/b**

(A window should pop up on the EM120 machine)

Select options->show profile

File save as

Close

Enter new profile name and load up the current sound profile into the main MBES window.

Return to logging.

Cleaning EM120 data

On Neptune unit - click middle mouse button

Select **CHECK/REPLY DATA** (this brings up *Raw2Sur* dialogue box)

- **SURVEY** - select required survey from drop down box
- select **ALL LINES** or **SOME LINES**
- (if **SOME LINES** option selected select required lines from drop down box by holding down **SHIFT** key and clicking left mouse button.)
- What to do with the data? - choose **CONVERT DIRECTLY**.
- Raw data - leave as **EMX**
- **TO SURVEY** - use same name as survey name (can give file new name if required)
- **INITIATED FROM?** - select **UTM** from the list
- Leave everything else and click **OK**.

Raw2Surv info dialogue box will appear and scroll through lots of “warning check sum error messages”. Wait for data to finish processed. Click **OK**.

Cancel *Raw2Sur* dialogue box.

Click middle mouse button

Select **NEPTUNE**

From the list choose survey name given in the previous operation (above). *Neptune Survey Control* window appears.

PROCESSING - select **DEPTH CORRECTION** - select **SETUP RULES**

- click **OK** to warning dialogue box
- click **NEW** at the bottom of the window to create a new rule or click **SELECT** to select a pre-existing rule. Give a new rule a name in the **COMMENT** box at the top of the window.
- **REMOVE BEAMS** - set maximum acceptable depth which is known from the survey. All other spurious data (eg bad data generated when the ship turns during a survey) will then be removed)
- click **ACCEPT**

- click OK
- DISPLAYS - CREATE GRID** - input grid size for interpolated data (the lower the value the higher the resolution of the processed data but the less the likelihood that gaps in the swath data will be filled in).
- Dialogue boxes will appear then disappear automatically when processing complete.
- DISPLAYS - GRID DISPLAY.** Grid display window appears.
- **VIEW** - select **ANNOTATE COLOUR** from the drop down list. Set background colour to white and grid lines to black.
 - select **SHOW/HIDE**. From the options available go to **GRID CELL** and select **AS GRID**.
 - select **LAT/LONG** - choose middle option
 - to change from contour map to 3D sun illuminated representation select **GRID CELL - SUN ILLUMINATION**
 - select **SHADING PARAMETERS** - monkey about with the various options until you have something that makes everyone go "Wow!".

Converting surveys into postscript files

To convert a survey into a postscript file, enter Neptune bring up the survey, then file-plot-convert to UTM - postscript level 2 - postscript file a4 (making sure you have selected file and NOT command).

Bring up a terminal on the workstation.

Floppy disk in

Type: **eject floppy**

Type: **volcheck**

Type: **cd /data2/em120/proc/JR75_***** (filename)**

Type: **ls -l *****.ps**

Type: **compress <*****.ps> *****.ps.Z**

Type: **cp *****.ps.Z /floppy/floppy0**

Type: **eject floppy**

Your survey is then saved onto disk as a postscript file.

EM120 & Topas software

The user interface provided with both the EM120 and Neptune systems was far from intuitive. The overall stability of the software is also an issue that needs to be addressed.

EM120. Once the survey is started the EM120 seems to be fairly trouble free, providing that the minimum amount of changes are made. The main problems appear to be related to random mouse clicks, which may be made in an attempt to pan or zoom or reposition in the survey window. One such attempt caused the software to crash mid survey resulting in error messages and an inability to regain the Bridge display, without exiting the User interface and completely restarting the program. This meant that the bridge was without an echo sounder in relatively shallow water and unable to accurately gauge the beam coverage from the previous line.

TOPAS. The TOPAS system seems to be relatively stable. One problem that was encountered early on in the cruise was caused by the clock ceasing to work, which meant that data was also not recording. **The day before surveying ended (08:50 hrs 9/7/02), the TOPAS system underwent a complete breakdown. This was caused by the failure of the +50 volts power supply. No spares were carried onboard. Had this failure occurred earlier in the cruise it would have produced serious problems for core site selection and surveying.**

Neptune - Swath Bathymetry Processing. Once the data had been processed using Neptune, any unfortunate software failures were usually caused by the size of the survey and the size of the grid. An error message indicating that an environment variable (LAUNCHPAD_ADDR) can be ignored. The problem may be resolved by either increasing the size of the grid to display (i.e. 50m:50m) or by selecting only a certain number of lines for grid generation.

JCR75 Cruise Report

Table 3 JR75 EM120 Multibeam and Topas Survey Lines

Area	Date	Start time	End time	EM120 File Name	Topas File Name	Water Depth	Topas System	Sampling
NE Shetland Shelf 61N-	16/6/02 - 17/6/02	19:54	17:30	JR75	0206101332.raw to 02061707054.raw (incl)	170-860	Burst Chirp Ricker	-
Sula Ridge	17/6/02	17:30	19:05	JR75_Sula_Prep	020617170553.raw	227-251	Burst Chirp Ricker	-
Sula Ridge Survey	17/6/02	18:55	21:05	JR75_Sula	020617191529.raw	274-313	Burst	Lander & Box Core
Norwegian Margin	18/6/02	00:57	17:27	JR75_Underway2	020618005932.raw & 020618172643.raw	280-1260	Burst Chirp	-
Voring Plateau 1	18/6/02	17:49	19:36	JR75_Voring1	020618174946.raw	1321-1329	Chirp	Gravity Core GC062
Voring	19/6/02	03:10	04:20	JR75_Underway2	020619030749.raw	1331	Chirp	
Voring Plateau 2	19/6/02	04:20	05:24	JR75_Voring2	020619041830.raw	1398-1400	Chirp	Gravity Core GC063
Norwegian Margin	20/6/02- 21/6/02	04:46	17:08	JR75_Underway3	020620044049.raw	1395-3212	Chirp	Lander Testing
Norwegian Basin- Greenland Sea	21/6/02- 22/6/02	21:53	10:15	JR75_Underway5	020621215320.raw	3077-2397	Chirp	-
Bear Island - Svalbard	22/6/02- 23/6/02	11:38	02:48	JR75_Underway6	No data recorded	2310-333	Chirp Burst	-

JCR75 Cruise Report

Kongsfjord Station 2	23/6/02	03:10	05:04	JR75_Kongsfjord_st2	020623031121.raw	307	Burst	Gravity Core GC064
Kongsfjord Survey into Ny Alesund	23/6/02 24/6/02 & 25/6/02	19:51 10:24	09:04 11:45	JR75_Kongsfjord	020623195016.raw	350-50	Burst	-
Western Svalbard Margin	25/6/02	11:45		JR75_underway6	020625102019.raw	200-1500	Burst Chirp	
Western Svalbard Margin Station 4	25/6/02 - 26/6/02	11:23	17:33	JR75_Svalbard_stn4	020626112325.raw	1100-1300	Chirp	Multicore MC066 Gravity Core GC067
Western Svalbard Margin	27/6/02	10:24	12:00	JR75_Underway7	020627102329.raw	1300-2000	Chirp	
Western Svalbard Margin Station 5	27/6/02	12:00	14:27	JR75_Svalbardmargin_stn5	020627115450.raw	2000-2500	Chirp	Gravity core GC068
Molloy Deep / Fram Strait	28/6/02	18:38	09:19	JR75_FramStrait	020628184103.raw	2500-5300	Chirp	Hydrog. Survey
Northwest Svalbard Margin	29/6/02	10:09	17:39	JR75_Underway8	020629100939.raw	1137-750	Chirp Burst	
Yermak Plateau	29/6/02	17:40	19:09	JR75_Yermak_stn1	020629173946.raw	750-950	Burst	Multicore MC069 & Gravity core GC070
Yermak-Svalbard	30/6/02	09:44	21:10	JR75_underway9	020630094223.raw	200-1300	Burst Chirp	
Western Svalbard	30/6/02	21:15	01:34	JR75_Lostlander_stn4	020701080114.raw	1000-1500	Chirp	Attempt for Lander recovery

JCR75 Cruise Report

Margin								
Western Svalbard Shelf	1/7/02	08:05	10:06	JR75_Underway10	020701080114.raw	200-300	Burst	
Western Svalbard	1/7/02	10:07	13:21	JR75_Svalbardshelf_stn3	020701100514.raw	200-350	Burst	Gravity cores GC072 GC073
Kongsfjord , Svalbard	1/7/02	01:15	03:09	JR75_Kongsfjord	020702005720.raw	50-400	Burst	Gravity core GC074
Kongsfjord / Krossfjord	2/7/02	05:01		JR75_Kongsfjord	020702045328.raw	50-400	Burst	
Kongsfjord - Western Svalbard Margin	3/7/02	17:47	22:00	JR75_underway11	020703174629.raw	300-1300	Burst Chirp	Attempt for Lander recovery
Western Svalbard Margin - Bear Island	4/7/02 5/7/02	04:07	08:30	JR75_underway11	020704040657.raw 020704094433.raw	1300-2700	Chirp	
Bear Island Fan	5/7/02	08:37	11:04	JR75_BearIsland	020705083602.raw	1400-1500	Chirp	Multicore MC075 Gravity core GC076
Bear Island - N. Norway Margin	6/7/02 7/7/02	01:06	06:47	JR75_underway12	020706010544.raw 020706120455.raw 020706145202.raw	2000-300	Chirp Burst	
Norwegian Margin	7/7/02 8/7/02	06:48	01:03	JR75_underway13	020707064738.raw 020707094403.raw	300	Burst	Lander recovery Sula Ridge
Norwegian Margin	8/7/02	06:37		JR75_underway14	020708063644.raw	300	Burst	
Faeroe-Shetland Channel (Dti Survey)	9/7/02	04:45	09:08	JR75_FaeroeShetlandChannel	020709044717.raw 020709065525.raw	1300	Chirp	Complete Topas power failure 08:50 hrs END of Topas Surveying

JCR75 Cruise Report

Faeroe Shetland Channel - Wyville Thomson Ridge	9/7/02 10/7/0 2	12:20	09:27	JR75_FSCWTR	-	1300	-	-
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Coring report

Paul G. Provost

Coring apparatus

NIOZ Box Core (UKORS & SAMS)

Core size 500x500x550mm (L,W,D)

The box core was used to collect undisturbed samples for biological analysis. Sub samples were also collected from the box core in order to quantify the disturbance of the sediment surface caused by the 'bow wave' effect.

Barnett & Watson Multi corer

Core size 59x400mm (LxØ), 8 out of a possible 12 cores were set up for this cruise.

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

SAMS Modified Mega corer

Core size 110x800mm (LxØ), initially 4 cores were set up for this cruise.

The mega corer was used to collect undisturbed samples for chemical and physical analyses. The design of the mega corer is unique and incorporates the frame and firing head mechanism of the Barnett & Watson Multi corer. Up to four coring heads each containing one mega core can be fitted in this design. The firing mechanism is unique to this system. The traditional mega corer design could not be incorporated into this because of patent restrictions.

The relatively shallow cores collected using the multi and mega corers created an overlap of undisturbed sediment profiles in the top 20cm of the surface sediment that the BGS gravity corer was unable to provide due to the disturbance caused on penetration.

It has been suggested, but not quantified that the nature of action of the box core sample collection creates sufficient turbulence of the sediment-seawater interface that very fine floc material and biota can be lost from the sample. The damped action of the multi and mega corer on sediment penetration is thought not to have this effect. Hence samples that required an undisturbed sediment interface were collected using the multi and mega corer.

Method

Box corer deployment

The box corer was deployed from the vessel using the starboard midships gantry. The veer (drop) speed was up to 75 m/min to approximately 40m above seabed. The winch was stopped for approximately 30 seconds for wire to settle and then dropped at 20-30 m/min into seabed. In very soft sediments, the box corer was landed to the seabed at 10 m/min to minimise frame penetration into the sediment. Once the corer was landed onto the seabed, 5m of additional wire was paid out, and then the wire was immediately hauled to complete the mechanical action of the corer. The haul (recovery) speed was up to 75m/min.

Multi and mega corer deployment

The Multi and Mega corer was deployed from the vessel using the starboard midships gantry. The veer (drop) speed was up to 75 m/min to approximately 40m above seabed. The winch was stopped for approximately 30 seconds for wire to settle and then dropped at 20-30 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 75m/min.

Results

Box coring

30 box core deployments were made during the cruise. Of these only one failed to collect any sample (water only) and 2 further deployments collected samples that were incomplete due to rocks trapped in the spade seal. A list of box coring deployments during the cruise is described in Table 1.

Multi coring

31 multi core deployments were made during the cruise. The corer was set up to collect from only 8 of the maximum of 12 core tube positions - this allowed for redundancy of spare parts and requirements of the sampling. Every drop was successful, although on some drops less than 8 acceptable cores were collected. A list of multi coring deployments during the cruise is described in Table 2.

Mega coring

18 mega core deployments were made during the cruise. The corer was initially set up to collect from the maximum of 4 core tube positions (one made to an earlier design and three to a later design). Early on in the cruise it became apparent that the later design of the mega core heads was more successful and as a result only these were set up during the later stages. Despite this, the mega corer deployments were only sporadically successful. The success of the mega core collection would be increased if noted improvements to the firing mechanism are made and a more rigid material is used for the core tubes. A list of mega coring deployments during the cruise is described in Table 3.

Geochemistry

Eric Breuer and Rebecca Dean

Objectives

The following questions are the basis of our cruise effort for JCR 75:

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

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?*

As part of SAMS Northern Seas overall objective this first Arctic cruise will provide invaluable data on contaminant transport, sediment diagenesis, sedimentation rate, and latitudinal changes in bioturbation behaviour and lay the foundation for future research.

Methodology

Sediment geochemistry

Megacores (111 cm diameter) were collected with little to no disturbance to the sediment water interface by using a modified version of the Barnett Watson multicorer. This modification was to place four “megacore” heads onto the multicorer. Megacores were obtained from all sites for metal analyses except KF2 where a multicorer (5cm diameter) was used. Megacores for Radionuclide/Organic Matter analyses were obtained from all sites except KF2 and BIF where multicores were substituted. The substitution of megacores for multicores at these sites was due to megacorer failure. Three cores were needed at each site, 1 for metal analyses, 1 for organic matter analysis and 1 for radionuclides (^{210}Pb , ^{234}Th) and chlorophyll. Once collected, cores were sectioned at 0.5cm intervals to a depth of 10cm, 1cm intervals to 20cm depth then 2cm slices until the bottom of the core. For dissolved and solid phase metal, sample slicing and centrifugation was performed under N_2 -atmosphere (to prevent oxidation and precipitation of dissolved metals).

Oxygen profiling

In conjunction with the in-situ profiling system (see Oli’s report) a shipboard system for the measurement of oxygen microprofiles was used. Micro-electrodes with a sensing tip diameter of < 10 μm and 90% response time of 1s were used to measure oxygen concentrations in the sediment at a vertical resolution of between 50 - 250 μm . The electrodes were inserted into collected multi cores as soon as possible after collection. All stations except VP2 have shipboard oxygen profiles.

Sample stations and deployed

Station/sampling	Date	Lat/Long	Event (#)	Depth
Voring Plateau (VP2)	19/06/02	N67 12.81/ E06 06.25	Megacore (26)	1385
Kongsfjord (KF2)	23/06/02	N79 03.33/ E11 17.68	Multicore (109)/ Shipboard oxygen profile	222
Kongsfjord (KF1)	24/06/02	N78 57.46/ E11 54.49	Megacore (129)/ Shipboard oxygen profile	355
Kongsfjord (KF4B)	26/06/02	N78 58.43/ E06 42.66	Megacore/ Shipboard oxygen profile	1335
Kongsfjord (KF5)	28/06/02	N78 56.90/ E05 17.83	Megacore (162)/ Shipboard oxygen profile	2467
Yermak Plateau (YP1B)	30/06/02	N80 45.00/ E07 38.72	Megacore (194)/ Shipboard oxygen	922

			profile	
Kongsfjord (KF3b)	01/07/02	N 70 01.33/ E01 41.61	Megacore (228)/ Shipboard oxygen profile	343
Bear Island Fan (1400m)	05/07/02	N73 39.59/ E13 46.95	Megacore (#255)/multicorer (253) Shipboard oxygen profile	1440

Initial results.

Figures 1 through 7 show shipboard oxygen profiles for all stations with the exception of VP2. This is initial data that still needs to be processed with the calibration data and bottom water oxygen concentrations determined by micro-winkler titration's. The data presented on the graphs are from 3 different cores (when possible) taken from three separate drops of the multi-corer. Initial interpretation of the results indicates the expected trend seen in oxygen organic matter relationships. The shallower sites KF2, KF1 and KF3b will have expected higher inputs of fresh organic matter fuelling microbial process that will rapidly consume oxygen (Figures 1-3). Figure 1 profiles are indicative of the heterogeneity seen in shallow water with patchy distribution of organic matter and high rates of bioturbation. Data from the deeper sites indicates much deeper penetration of oxygen as a likely consequence of less organic matter reaching the seabed due to water column recycling.

Future activity

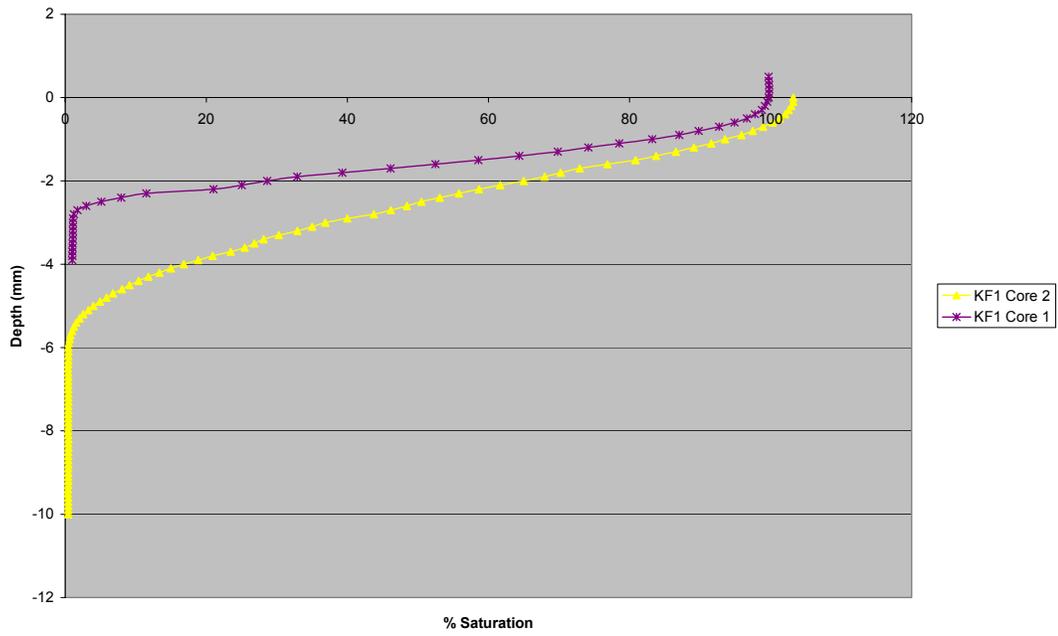
The solid phase sediment data will be used to characterise sediment type and identify major changes in type along both the latitudinal and longitudinal gradients.

The solid phase and pore water analysis of sediment cores in conjunction with oxygen data, radionuclide data and organic data will be used to determine the biogeochemical processes that are dominating the system under study and investigate the role of carbon (quantity and type) and benthic biota with respect to changing environments. This will be done for both the latitudinal gradient (change in supply but constant depth) and longitudinal gradient (change in depth and water masses). The redistribution of pollutants will also be investigated on both transects.

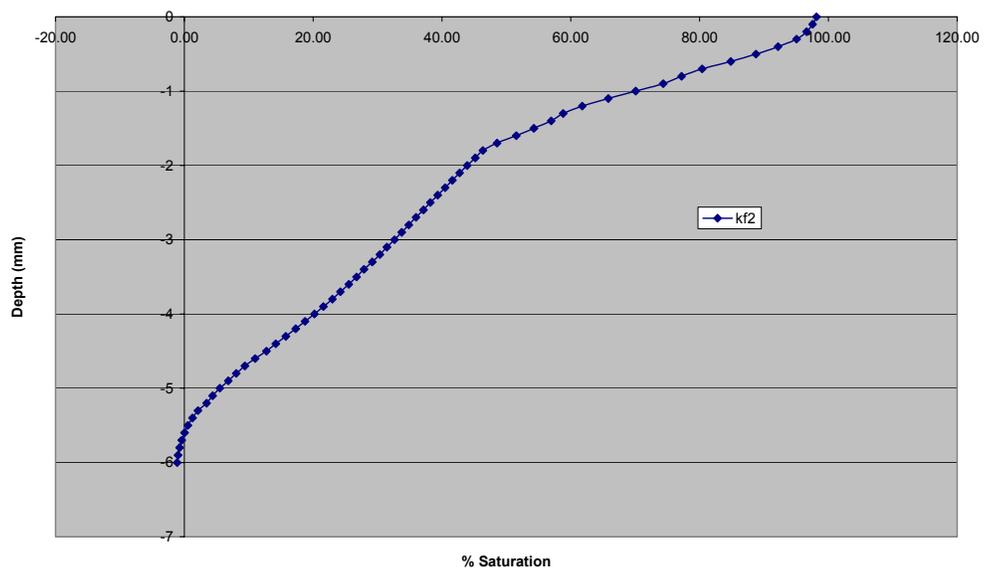
This data will be intimately linked with the biological data and flux data and will be modelled with respect to the benthic/geochemical system.

The radionuclide and chlorophyll data will provide rates of mixing on different scales, Th-234 and chlorophyll days to months and Pb-210 years. The Th-234 and chlorophyll will be targeted to the fjordic sediments where we might expect a higher concentration of biota and hence mixing.

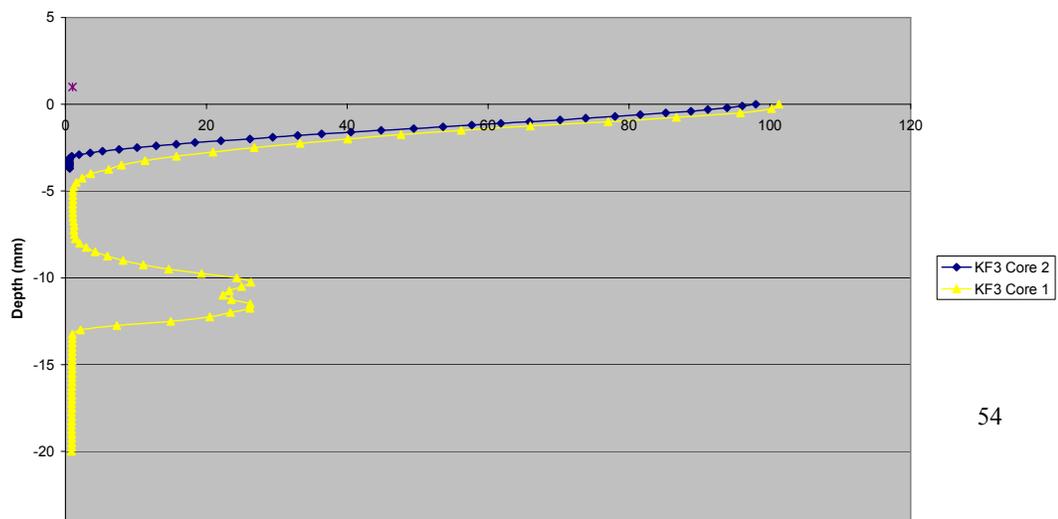
KF1



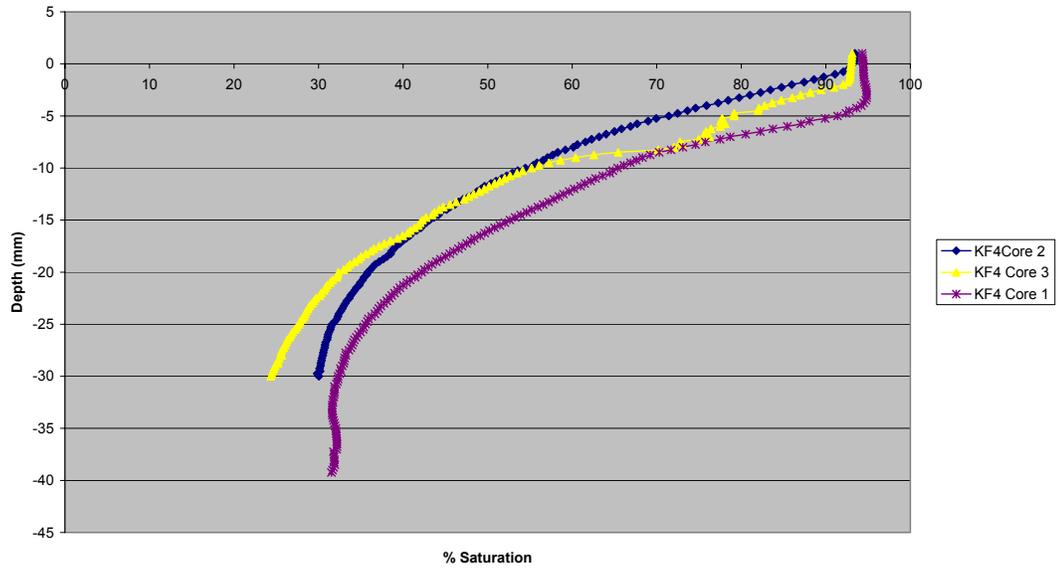
KF2



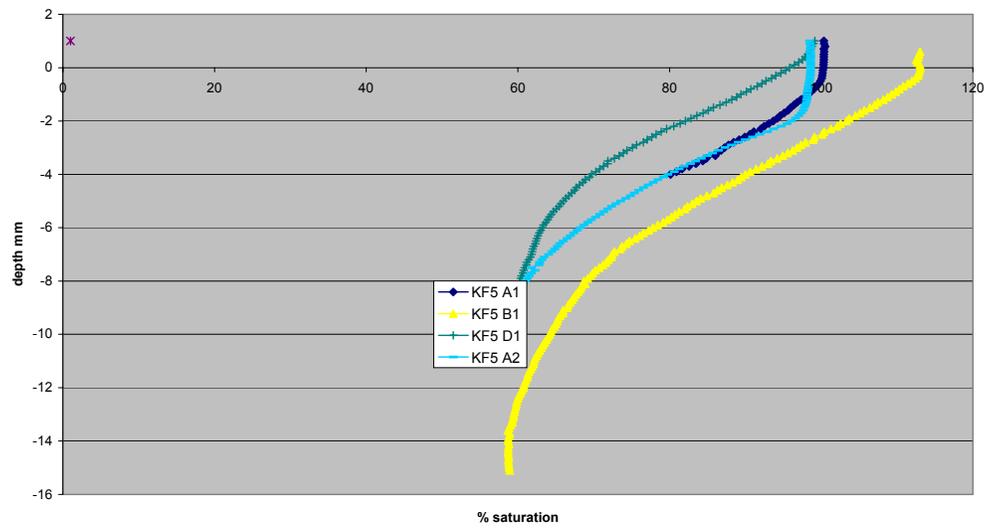
KF3 All



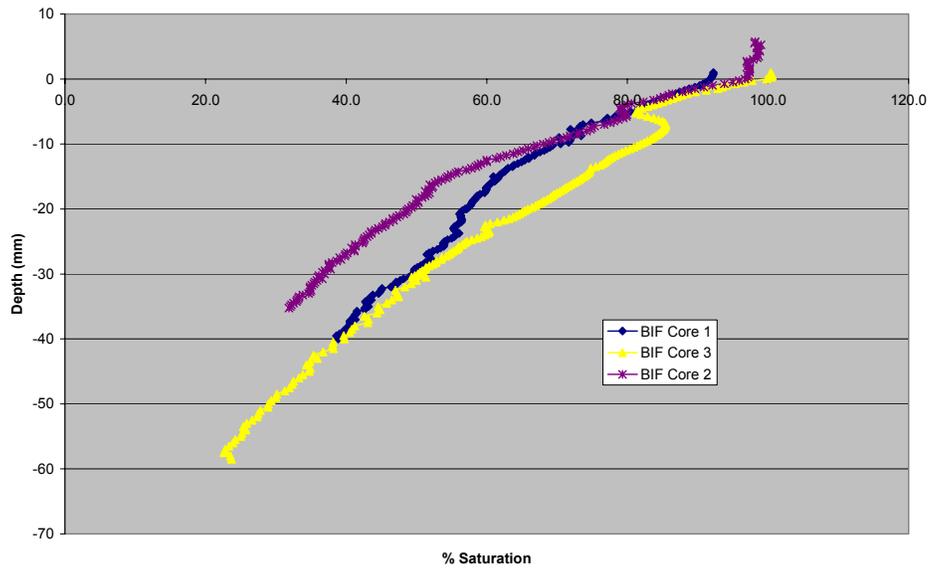
KF4 Oxygen



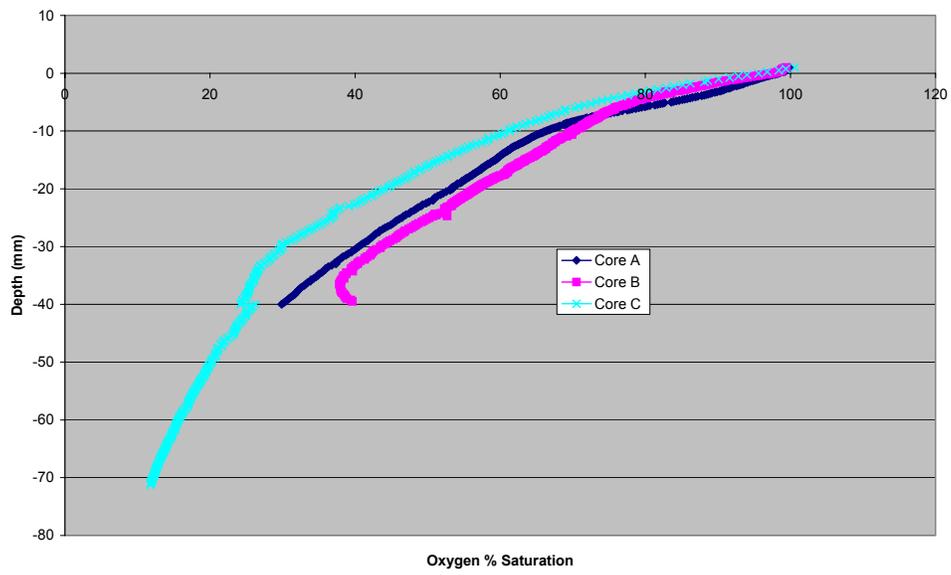
KF5



BIF Oxygen



Yermack oxygen Profiles



KC-Lander Operations on RRS James Clark Ross - JR75

Oli Peppe, Bruce Barr, Eric Breuer

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 JR75 were:

- Profilur*** System designed to measure oxygen and pH and sulphide concentrations over the sediment-water interface at very fine resolution (~ 100 µm) using micro-electrodes. On JR75 we were using oxygen micro-electrodes only.
- Elinor*** A chamber incubation system for measuring oxygen and nutrient fluxes over long deployments, using both mini-electrodes and a syringe sampling unit. The system is also capable of retrieving 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 close to those of the ambient water - an "oxystat" system.

The objectives of the cruise required the *Profilur* system to be deployed at each of the main study sites, using moored mode at the shallowest station (~ 200m) and autonomous mode at all others. The *Elinor* system was to be tested in its oxystat mode at one deep water (1400m) station as part of ongoing preparation for the Arabian Sea programme. In addition the cruise was to be used to train new personnel in the operation of the lander.

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

Early deployments in firm sediment types proved successful, but major problems were experienced with the softer muds encountered in the Kongsfjorden region, and this resulted in one of the landers being twice. Grappling proved successful the first time (in 350m) but unfortunately not the second time (in 1380m).

Pre-cruise preparation

Much of the work before this cruise was combined with ongoing preparations for the Arabian Sea programme (currently scheduled for 2003). A brief summary of the work relevant to JR75 is given below:

- A new buoyancy frame was made and tested to a modified design allowing twin Oceano acoustic releases (Type AR / RT 661) to be fitted.
- New control software was implemented, in collaboration with Unisense, to remove bugs and improve functionality.
- A prototype of the oxystat system for *Elinor* was made so that the effect of pressure on membrane permeability could be assessed.
- 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.
- New parts to complete the second autonomous system were ordered or made and then fitted.
- All buoyancy and recovery aids and instrument housings were serviced.

Pre-deployment tests

Buoyancy tests

Due to a lack of deep water early in the cruise buoyancy testing was performed in two stages. An initial test was done on one of the buoyancy frames to 1500m, just before reaching the Voring Plateau station. This test was performed lowering the full lander frame (with no instrumentation attached) over the stern using the coring wire. With a net wet weight of around 110kg the frame would sink at no more than 35 m/min or so so the test

was very slow. A fairly heavy swell almost certainly contributed to this. All buoyancy remained intact. On the way North to Svalbard we stopped in over 3000m water and tested both buoyancy frames and the spare spheres. This time the frames were lowered on their own from the starboard gantry (no instrumentation frame attached), with a 500kg clump of chain below at a speed of 70 m/min. All buoyancy remained intact.

Acoustic release tests

All acoustic releases were tested during the buoyancy tests, having first been tested on deck. The InterOcean release failed, and was found to have a broken connector pin on recovery. Oceano release S/N AR690 appeared not to be responding, but had in fact executed the release command correctly. All other releases functioned correctly. Problems were experienced with the new SAMS Oceano TT301 deck unit, later reckoned to be due to moisture in the transducer connector.

Profilur deployments

Deployment Plan

The aim was to deploy the *Profilur* system at each of the major stations along the 1400m South - North transect (Voring Plateau, Bear Island Fan, Kongsfjord, and Yermack Plateau) and at each station along the East - West Kongsfjord transect. The results would give a measure of the oxygen penetration depth and diffusive boundary layer thickness for each station, and be compared with results from ship-based measurements on retrieved cores. At all sites only oxygen micro-electrodes would be fitted, as little or no sulphide was expected, and ongoing problems with the pH electrodes precluded their use.

Details of Deployments

Deployment 062_PRF - Voring Plateau, 19/06/02 - 20/06/02, 1440m

Because of the failure of the InterOcean release during the first buoyancy test, and the inability of fitting two Oceano type releases to the old (tested) buoyancy frame, the lander was configured with one Oceano release and a burnwire as back-up ballast release. The system was fitted with 5 oxygen micro-electrodes, and the profile set-up is shown in *Fig 1*. These profile settings were a compromise between maximum measuring resolution and the time available for the deployment (only about 13 hours).

The lander was deployed using the starboard deck crane over the aft starboard side. Whilst this ensured the clearest path across deck, deploying so close to the stern significantly increased the swell hitting the lander (and therefore electrodes) during deployment and wherever possible the lander should be dropped from as close to midships as possible. It is also important to pass the trigger line for the release hook over the shackle to ensure a good upward pull.

Recovery was complicated by the fact that the pellet float became caught up under the buoyancy frame. It is presumed this happened because the lander was slightly more buoyant than usual (~95kg cf 75kg) and rose faster than the pellet sphere. (The pellet sphere was seen to be clear of the frame as the lander sank.)

4 good profiles were obtained (*Fig 2*), with one electrode broken sometime before profiling started.

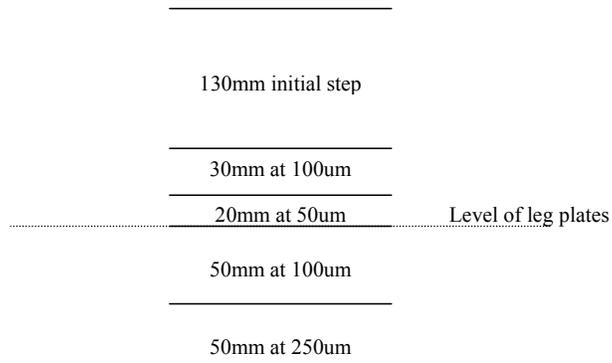


Fig 1 - Profile settings

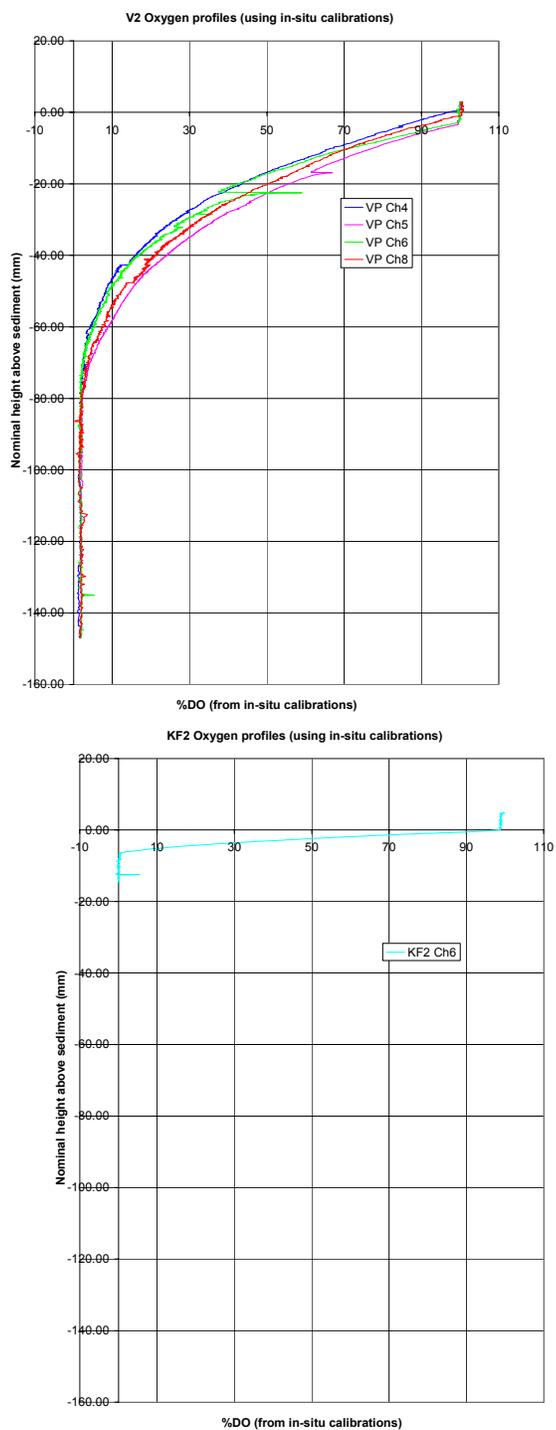


Fig 2 - Oxygen profiles from the Voring Plateau and Kongsfjorden Station 2

Deployment 063_PRF - Kongsfjord 2, 23/06/02, 245m

This deployment was made in moored configuration, using 265m of rope - a combination of 12mm Seasteel and 6mm polyester multibraid - and two surface marker floats (this length of rope was subsequently found give only just sufficient slack for recovery, given the long lead to the deck winch).

The first box core from the site showed the sediment to be covered in large pebbles (*Fig 3*) and it was acknowledged that the chances of getting electrodes back intact were slim! The electrode configuration and profiling protocol were the same as used in 062_PRF.

Not surprisingly on recovery all electrodes were broken (*Fig 4*) but fortunately one electrode survived long enough to get a complete profile (*Fig 2*) The water-bottle burnwire had not fired, and there were signs of some form of weed(?) covering the nick. The burnwire firing time had been increased to 15 mins (from normal 5 mins) to allow for the cold water temperatures.

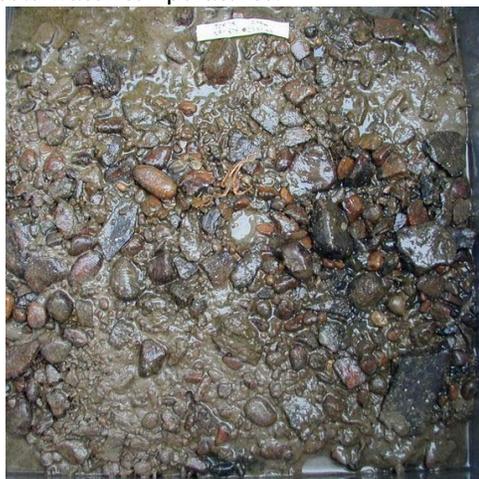


Fig 3 - Box core surface from KF2

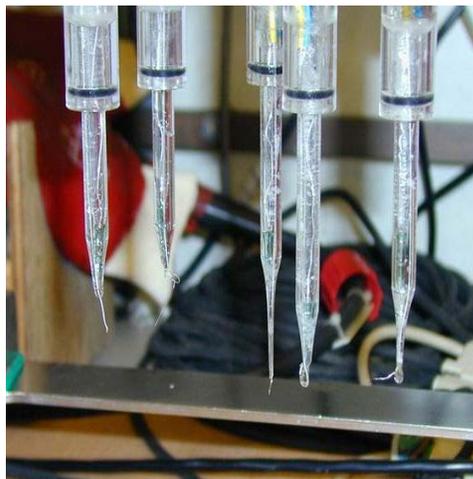


Fig 4 - Electrodes after profiling at

KF2!

Deployment 064_PRF - Kongsfjord 1, 24/06/02 - 25/06/02, 350m

Set-up identical to 062_PRF. The first box core showed mud to be fairly soft at this site, but at that stage this was not reckoned to be a problem. However we did maintain the net ascent buoyancy at 95kg, rather than reducing it to the normal 75kg as originally planned to try and avoid the problem experienced with pellet float during 062_PRF recovery.

However when we came to drop the ballast, the acoustics confirmed release, but the lander did not lift off from the sea-bed (as indicated by ranges and pinger trace). A trawl line was set up using the length of the ship to create a loop (*Fig 5 a.*) and the ship was moved sideways over the lander position using DP and thrusters. Just as we reckoned we must have missed it, it lifted off from the seabed and was recovered shortly afterwards with no sign of damage. The whole recovery operation took just under 7 hours.

Because of the depth the lander had sunk in, estimated to be between 10 and 18 cm above the leg plates, no profiles were obtained and 3 electrodes were broken. In hindsight, given the low tidal regime in Kongsfjorden and the extremely calm weather it would have been possible to moor the system in this water depth and this should undoubtedly be considered when operating in soft muds and relatively shallow waters.

Once again the burnwire had not fired, despite tests before the deployment in the cold room. A similar brown "fluff" to that observed after 063_PRF was covering the nick, under which the metal seemed completely uncorroded.

Deployment 065_PRF - Kongsfjorden 4, 25/06/02 - ?, 1380m

Because of the unreliability of the burnwire, the buoyancy frame was changed for the new one which fits two Oceano acoustic releases, thus avoiding the need for a burnwire back-up.

The mud type at this station was again very soft, though it was thought there might be a slightly stiffer layer at a shallower depth. We decided to add an extra buoyancy sphere

(maintaining the net ascent buoyancy around 100kg), lower the legs of the lander to lift the instrumentation and ballast weights higher above the sediment, and reduce the descent weight and therefore the descent speed (see

Table 1). However once again, and not entirely unexpectedly, the lander failed to lift off from the seabed when the acoustic releases were triggered. Over the next week or so three different methods of recovery were attempted and the lander position accurately surveyed. These recovery operations are described in more detail in Section 0.

Unfortunately none were successful, and the lander remains on the seabed. There is a possibility of assistance from the R/V Polarstern with the Victor ROV as they will be in the area in August.

Deployment 066_ELI - Kongsfjorden 1, 02/07/02 - 03/07/02, 350m

This deployment of the *Elinor* system had originally been designed as a test of the new oxystat system in deep water. However given the problems with the *Profilur* sticking in soft mud at the intended Kongsfjorden 4 station (1400m) this clearly couldn't go ahead. So instead we made a moored deployment at Kongsfjorden 1. We used 425m of rope - a combination of 12mm Seasteel, 6mm polyester multibraid, and 18mm polypropylene.

Because of the continuing problems we were having with burnwires, we sent the system down with the chamber lid closed, as the deployment would be completely wasted if the burnwire failed and the lid stayed open throughout. Also at the last minute the hydraulic switch for the shovel system developed a fault, and so the shovel was disabled. Lengths of 3x2 wood were lashed across the legs of the lander to create a makeshift platform to prevent the chamber sinking too far into the soft mud, and the leg height was set so that the shallow part of the chamber was actually 50mm higher than the leg plates. In hindsight this probably left too little sediment above the bottom of the chamber walls to form an effective seal.

The oxygen concentrations in the chamber were monitored at 5 minute intervals by a mini-electrode, and water samples (duplicated) were taken at 5 discrete intervals. Another mini-electrode measured the ambient oxygen concentration. Sodium bromide was injected at the end of the deployment, and a water sample taken shortly afterwards, to measure the volume of water enclosed by the chamber, and therefore the height of the sediment.

On recovery of the system, the chamber electrode was broken (it is not known how this happened), and significant electrode drift is seen in the external electrode signal. The water sampler had only taken about half the samples (the syringes appeared to be stuck - perhaps due to cold temperatures?). In short the data confirms little about the operation of the oxystat system. On a positive note all 3 burnwires had fired, however this doesn't explain the problems being experienced on earlier deployments of the *Profilur*.

Lander recovery methods

Four different methods were used to try recovering the lander. The first, successful, was only suitable for the shallow station. The other three were used at Kongsfjorden 4, in around 1400m of water.

1. 150m of wire stretched the length of the ship with a 500kg chain clump and 500m of wire up to the ship at either end. The wire was then dragged sideways along the bed. (*Fig 5 (a).*)
2. 500m of heavy wire with a 500kg chain clump at either end laid in a straight line and then pulled with the coring wire in an arc across the lander position. This was attempted twice, using different orientations of the bottom line, and different angles of pull. (*Fig 5 (b).*)
3. A circle of coring wire, radius 100m, laid around the lander position and then pulled tight. (*Fig 5 (c).*)
4. A 2.5m wide grapple system with 3 grappling hooks on 5m tails weighted with 500kg chain clump, towed backwards and forwards just off the seabed.

Good weather conditions throughout meant that the ship was able to manoeuvre using DP. A 10kHz pinger was placed on the wire to monitor the height of the gear relative to the seabed. At close ranges to the lander both the 10kHz wire pinger and the 12kHz lander pinger could be tracked using the PES on 10kHz. At greater distances (~ 1km or more) the PES had to be switched into 12kHz mode to see the lander pinger.

In order to increase our chances, a detailed swath map was made of the area, and the lander position surveyed acoustically in two ways:

1. By timing the point of closest approach using the trace of the lander pinger on the PES screen as the ship steamed a box around the estimated position
2. By triangulation using acoustic ranges from 3 points roughly 1km away from the lander. After the raw ranges given by the TT301 deck unit were adjusted to allow for the speed of sound in water in this region (1465 m/s from CTD) the horizontal range was calculated using the depth of lander, depth of transducer and Pythagoras.

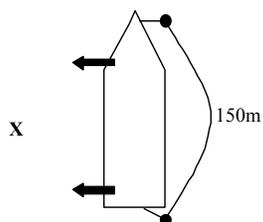


Fig 5(a)

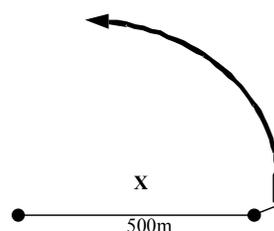


Fig 5(b)

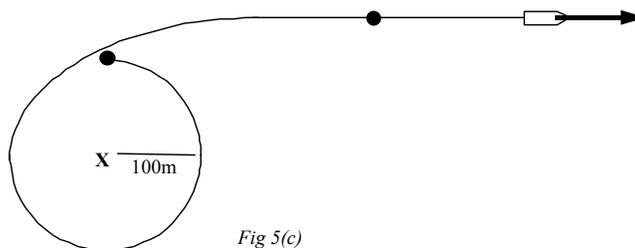


Fig 5(c)

Fig 5 - Schematics of the different methods used to try and recover the lander from soft mud.

Future plans

As a result of the problems experienced in the soft muds found at most sites during this cruise, we will be considering means of improving the lander design for use in soft mud such as:

- Inflatable lift bag to provide emergency buoyancy
- Expendable “pancake” feet
- Spool of Kevlar rope with releasable float to send up surface line.
- Means of slowing rate of descent without reducing the hold down weight.

Oxygen micro-electrode calibration procedures

An in-situ two point calibration was used. 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 lab oxygen calibrations were done before each deployment, in the cold room (around -1C) after the system had been left to stabilise for 2 hours or more The signal from electrodes in oxygenated seawater was recorded. Then sodium-dithionite was added to remove all oxygen and the signal was again recorded. No magnetic stirrer was used as the heat given off by it was warming up the calibration water!

Table 1: Deployment summary

Deployment #	062_PRF	063_PRF	064_PRF	065_PRF	066_ELI
Site	Voring Plateau (VP2)	Kongsfjorden (KF2)	Kongsfjorden (KF1)	Kongsfjorden (KF4B)	Kongsfjorden (KF1)
JR75 Event number of deployment / recovery	#18 / #27	#101 / #116	#120 / #133	#139 / not recovered	#231 / #240
Configuration	Profilur, autonomous	Profilur, moored	Profilur, autonomous	Profilur, autonomous	Elinor Oxystat, moored
Deployment date	19/06/02	23/06/02	24/06/02	25/06/02	02/07/02
Deployment time	1113Z	0616Z	1508Z	2340Z	0319Z
Deployment position	67° 13.21'N 06° 05.30'E	79° 03.26'N 11° 17.96'E	78° 57.47'N 11° 53.94'E	78° 57.98'N 06° 43.04'E	78° 57.46'N 11° 55.07'E
Deployment Water depth (m)	1439	245	354	1380	355
Recovery date	20/06/02	23/06/02	25/06/02	Not recovered	03/07/02
Recovery time	0105Z	1935Z	1020Z	n/a	1700Z
Recovery position	as deployment	as deployment	78° 57.48'N 11° 53.84'E	Best estimate pos. on seabed 78° 58.06'N 06° 42.81'E	as deployment
Time on bottom (hrs)	12.8	12.8	17.7	n/k	36.9
Weight on descent (kg)	50	n/a	48	~30	n/a
Weight on ascent (kg)	-95	n/a	-95	-100	n/a
Descent speed (m/min)	60	n/a	n/k	53	n/a
Ascent speed (m/min)	68	n/a	-70	n/k	n/a
Estimated max. penetration of electrodes or chamber into sediment (mm)	145	15 (before all electrodes broken)	180 (missed interface)	n/k	n/k (bromide sample still to be processed)

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
 Rec. pos.: position of ship when lander grappled or mooring picked up

Benthic biology

Objectives

SAMS Northern Seas Programme

Benthic biological work carried out as part of the SAMS Northern Seas Programme focused on bioturbation - the disturbance of marine sediments by animal activity - with the aim of determining how this important process varies over large-scale gradients in latitude and organic matter input in the northern North Atlantic. The aim was therefore not to comprehensively sample the entire benthic community at any of the cruise stations, but to quantify and characterize those elements of the biota (the macro- and mega-infauna) whose feeding and burrowing activities are the major contributing factors to particle and solute transport in marine sediments. Biological data will be used together with the results of geochemical analyses to provide an integrated assessment of the effects and significance of bioturbation at the study sites.

Specific objectives of biological sampling were:

- To determine the absolute abundance, biomass and depth distribution of benthic macro-infauna (defined here as animals retained on 250 μm sieve mesh) in the sediments at each study site.
- To determine the relative abundance of benthic mega-infauna at the study sites, and as far as possible to identify the taxa present, using seabed photography (and any fortuitous captures of these animals in boxcores). Mega-infauna are here defined as burrowing animals large enough to make traces (Lebensspuren) on the sediment surface visible in seabed photographs.
- To characterize the modes of bioturbation occurring at each site from functional group classification of fauna sampled directly (by coring) or indirectly (by seabed photography), and by observation of sub-surface biogenic structures present in boxcores.

Atlantic Coral Ecosystem Study (ACES)

Additional work was also conducted at the Sula Ridge off the Norwegian coast, as a contribution to the EU-funded ACES programme. This consisted of deployment of the SAMS Photolander adjacent to a reef of the cold-water corals, dominated by *Lophelia pertusa*, supplemented by additional seabed photography. The objectives and results of this work are summarized in a separate section.

Methodology

Benthic samples were collected using both types of sediment corer available on the cruise (NIOZ boxcorer and SAMS multi/megacorer). Seabed photographs were taken using the Proudman Oceanographic Laboratory (POL) 'Bedhop' camera. For all three gear types the JCR proved to be an excellent platform and all deployments were performed smoothly and efficiently.

NIOZ boxcorer

This was used with a 50 x 50 cm square box, with weighting and penetration limiter adjusted according to sediment type. After appropriate adjustments, excellent cores (ie. with undisturbed surface and overlying water retained) were obtained at all sampling stations. Two or three boxcores were taken at each station. Recovered boxcores were treated as follows:

- Core surface was sketched and photographed, conspicuous epifauna removed and fixed in formalin.
- After siphoning of the overlying water and removal of the box front panel, the core was carefully excavated by trowel. Notes were made and photographs taken of sediment stratification and any visible biogenic structures (burrows etc) encountered.
- The uppermost 10 cm of sediment from each core was retained, sieved through 500 and 250 μm mesh, and residues fixed in formalin.

- A subsample of the sediment below 10 cm depth was sieved on a coarse mesh (2 mm) to extract any larger animals. At most stations the cohesive nature of the deeper sediment made it impractical to sieve the entire box in the available time, and most was discarded after visual examination. The removal of sediment in small amounts using a trowel meant that any deeply-buried mega-infauna were very unlikely to have been missed.
- At each station a subcore (10 cm diameter) was taken from a boxcore for X-ray analysis of relict biogenic structures.

SAMS Multi/megacorer

Available time did not generally allow for dedicated corer drops for biological sampling, but at each station, 'spare' cores remaining from geochemical sampling drops were retained. Multicores used for oxygen flux measurements were also obtained after completion of incubations and used to provide additional biological data. Biota were extracted from these hydraulically-damped cores to give more detailed information on depth distribution and as a check on the sampling efficiency of the NIOZ boxcorer. Non-incubated cores were vertically sectioned at intervals of 0-2 cm, 2-5, 5-10, and then at 5 cm intervals to the base of the core. For incubated cores, only the uppermost 10 cm of sediment was preserved, as upward movement of infauna is to be expected under the conditions of oxygen stress generated by the experimental procedure.

POL Bedhop camera

The bedhop camera was deployed twice at each station where time was available. The camera was loaded with 35 mm colour transparency film, allowing a maximum of 25 exposures per deployment. Deployments were made with the ship moving on a set course at a speed of 0.5 kt. The time of each seabed contact was recorded, allowing an exact reference to the ship's positioning for each photograph. Owing to time constraints and the absence of proper darkroom facilities on board, no attempt was made to process the films on the ship. However, in every case the film had advanced through the camera correctly and neither the camera nor the flash gave any problems during setup of the system. It is anticipated that excellent seabed photographs should be obtained after onshore film processing.

Sample details

The table below briefly summarizes the biological samples collected during the cruise. The third column gives the sample number assigned in the SAMS Deep-Sea Benthic Group (DSBG) collection.

BHC = Bedhop camera; MC = Multicorer; MGC = Megacorer; NBC = NIOZ boxcorer

Station	Cruise Event	SAMS DSBG Sample No.	Nature of sample
Voring Plateau	16	NBC 866	Top 10 cm + X-ray subcore
Voring Plateau	20	BHC 867	25 seabed photos
Voring Plateau	21	NBC 868	Top 10 cm of boxcore
Voring Plateau	22	MC 869	7 x multicores
Voring Plateau	23	MC 870	8 x multicores
Voring Plateau	24	MC 871	6 x multicores
Voring Plateau	26	MGC 872	1 x megacore
Voring Plateau	28	MGC 873	1 x megacore. Core slices photographed for burrow counts

Voring Plateau	29	BHC 874	25 seabed photos
Kongsfjord S2	100	NBC 875	Top 10 cm + large fauna from > 10 cm
Kongsfjord S2	104	BHC 876	25 seabed photos
Kongsfjord S2	105	NBC 877	Top 10 cm + large fauna from > 10 cm, + vertical section for X-ray
Kongsfjord S2	106	NBC 878	Top 10 cm + large fauna from > 10 cm.
Kongsfjord S2	113	BHC 879	25 seabed photos
Kongsfjord S2	107-109	MC 880	6 non-incubated multicores + 6 used for oxygen incubation
Kongsfjord S1	119	NBC 881	Top 10 cm of boxcore
Kongsfjord S1	121	NBC 882	Top 10 cm of boxcore + X-ray subcore
Kongsfjord S1	123	NBC 883	Core surface badly disturbed. Trowelled-through for large fauna, but no sample retained
Kongsfjord S1	124	MC 885	4 x non-incubated multicores + 2 used for oxygen incubation
Kongsfjord S1	124a	BHC 884	25 seabed photos
Kongsfjord S1	125	MC 886	4 x non-incubated multicores + 2 used for oxygen incubation
Kongsfjord S1	126	MC 887	3 x non-incubated multicores + 2 used for oxygen incubation
Kongsfjord S1	128	MGC 888	1 x megacore
Kongsfjord S1	132	BHC 889	25 seabed photos
Kongsfjord S4	138	NBC 890	Top 10 cm of boxcore
Kongsfjord S4	140	NBC 891	Top 10 cm of boxcore + X-ray subcore
Kongsfjord S4	141	NBC 892	Top 10 cm of boxcore
Kongsfjord S4	142-146	MC 893	3 x non-incubated multicores + 2 used for oxygen incubation
Kongsfjord S4	142-146	MC 894	3 x non-incubated multicores + 2 used for oxygen incubation
Kongsfjord S4	142-146	MC 895	4 x non-incubated multicores + 2 used for oxygen incubation
Kongsfjord S4	149	MGC 895.1	1 x megacore
Kongsfjord S4	150	BHC 896	25 seabed photos
Kongsfjord S5	154	BHC 897	25 seabed photos
Kongsfjord S5	155	NBC 898	Top 10 cm of boxcore
Kongsfjord S5	156	NBC 899	Top 10 cm of boxcore + X-ray subcore
Kongsfjord S5	157	NBC 900	Top 10 cm of boxcore
Kongsfjord S5	158	MC 901	3 x non-incubated multicores + 2 used for oxygen incubation
Kongsfjord S5	159	MC 902	6 x non-incubated multicores + 2 used for oxygen incubation
Kongsfjord S5	160	MC 903	3 x non-incubated multicores + 2 used for oxygen incubation
Kongsfjord S5	164	BHC 904	25 seabed photos
Yermak Plat.	186	BHC 905	25 seabed photos
Yermak Plat.	187	NBC 906	Top 10 cm of boxcore
Yermak Plat.	188	NBC 907	Top 10 cm of boxcore + X-ray subcore
Yermak Plat.	189	NBC 908	Top 10 cm of boxcore
Yermak Plat.	190	MC 909	5 x non-incubated multicores + 2 used for oxygen incubation

Yermak Plat.	191	MC 910	5 x non-incubated multicores + 2 used for oxygen incubation
Yermak Plat.	192	MC 911	5 x non-incubated multicores + 2 used for oxygen incubation
Yermak Plat.	194	MGC 912	1 x megacore
Yermak Plat.	196	BHC 913	25 seabed photos
Kongsfjord S3	217	BHC 914	25 seabed photos
Kongsfjord S3	219	NBC 915	Top 10 cm + large fauna from > 10 cm, + X-ray subcore
Kongsfjord S3	220	NBC 916	Top 10 cm + large fauna from > 10 cm.
Kongsfjord S3	221	NBC 917	Top 10 cm + large fauna from > 10 cm.
Kongsfjord S3	222	MC 918	2 x multicores used for oxygen incubation
Kongsfjord S3	223	MC 919	2 x multicores used for oxygen incubation
Kongsfjord S3	224	MC 920	2 x multicores used for oxygen incubation
Kongsfjord S3	229	MGC 921	1 x megacore
Kongsfjord S3	230	BHC 922	25 seabed photos
Bear Isl. Fan	247	BHC 923	25 seabed photos
Bear Isl. Fan	248	NBC 924	Top 10 cm of boxcore
Bear Isl. Fan	249	NBC 925	Top 10 cm of boxcore + X-ray subcore
Bear Isl. Fan	250	NBC 926	Top 10 cm of boxcore
Bear Isl. Fan	251	MC 927	2 x non-incubated multicores + 2 used for oxygen incubation
Bear Isl. Fan	252	MC 928	3 x non-incubated multicores + 2 used for oxygen incubation
Bear Isl. Fan	253	MC 929	3 x non-incubated multicores + 2 used for oxygen incubation

Sample summary

Station	NIOZ boxcores	Multicores	Megacores	Seabed photos taken
Voring Plateau	2	21	2	50
Bear Island Fan	3	14	-	25
Kongsfjord Station 1	3	17	1	50
Kongsfjord Station 2	3	12	-	50
Kongsfjord Station 3	3	6	1	50
Kongsfjord Station 4	3	16	1	25
Kongsfjord Station 5	3	18	-	50
Yermak Plateau	3	21	1	50

Preliminary observations from boxcores

Voring Plateau (1400 m)

Boxcores consisted of a soft brown mud layer approx. 10 cm deep overlying a much drier, crumbly brown layer from 10-14 cm, below which softer brown sediment continued to approx. 27 cm. The deepest layer sampled comprised a soft grey mud. There were no conspicuous biogenic features at the core surface, but within the sediment clear evidence was found of two distinct burrow types described by German and Norwegian workers from stations on the Voring Plateau. The sediment of both boxcores taken on JR 75 was deeply

penetrated by high densities of very fine (approx. 1 mm diameter) vertical 'capillary' burrows constructed by the sipunculan *Golfingia* (subgenus *Nephasoma*) sp. These burrows extended the full depth of the cores (> 30 cm). In one boxcore was found the anterior end of an enteropneust worm *Stereobalanus canadensis* and a small section of its burrow. This biogenic feature occurred in the upper 10 cm of the sediment.

Bear Island Fan (1440 m)

Boxcore surfaces from this station showed high densities of polychaete tube endings with attached flocculent material. Mobile epifauna included tiny brittlestars and a small (approx. 1.5 cm long) holothurian. The sediment was brown to approx. 25 cm depth, grey below this. One large infilled horizontal burrow was found and photographed at 10-12 cm depth. High densities of much smaller horizontal burrows and some extremely fine vertical burrows were also noted.

Kongsfjord Station 1 (350 m)

The recovered sediment was an extremely soft brown mud without stones but with a thick greenish flocculent layer covering the surface. The surface and upper 10 cm of sediment was penetrated by abundant polychaete tube endings, of which the long black tubes of *Spiochaetopterus typicus* were immediately recognizable. The occurrence of large sipunculan worms at the station was demonstrated by two specimens found in the sediment adhering to the outside of the core boxes, but none were found within the cores themselves.

Kongsfjord Station 2 (240 m)

The surfaces of all three boxcores taken here showed almost 100% coverage of small pebbles, among which several species of brittlestar and other epifauna were found. The stones overlay a sticky blackish mud streaked with pale brown mottlings where oxic sediment penetrated the deeper material. This conspicuous pattern is probably attributable to bioturbation by large sipunculan worms (some individuals > 10 cm long) which occurred at high density (provisional estimate 80 m⁻²). The sipunculans found in situ occupied vertical or oblique blind-ending burrows which penetrated the sediment to 18-20 cm. Large polychaete worms, including a huge specimen of the Family Flabelligeridae were also found amongst or just below the superficial stone layer. The abundance of large macro-infauna suggests that geochemical parameters of the sediments at this station will be strongly influenced by bioturbation.

Kongsfjord Station 3 (330 m)

The sediment at this station appeared to be an organically-enriched fine mud with a thick blackish floc covering the surface. Tubes of the polychaete *Spiochaetopterus typicus* were abundant, and large maldanid polychaetes were also noted amongst the sieved fauna. It is likely that macrofaunal biomass and bioturbation intensity will prove to be high at this station.

Kongsfjord Station 4 (1400 m)

Several brittlestars were present on the surface of each boxcore collected at Station 4. Amphipods, bivalves and other smaller epifauna were also noted. The sediment was pale brown from the surface to approx. 5 cm depth, grey below this, and very soft throughout. No large burrow structures were observed during excavation, but networks of very fine 'capillary' burrows similar to those seen at the Voring Plateau station were seen in the grey sediment below 10 cm depth. Detailed examination of the sieved biota should reveal whether the organisms responsible are the same at both sites.

A large, complete specimen of the deep-sea pennatulacean (sea pen) *Umbellula* sp. was brought to the surface on the chain used in attempts to recover the KC Lander, and fragments of other individuals were recovered later. This sea pen may therefore be expected to be visible on seabed photos from the station.

Kongsfjord Station 5 (2500 m)

Boxcore surfaces at Station 5 were largely featureless, with little evidence of biological activity. The sediment was a uniform cohesive brown from the surface to approx. 32 cm

depth, with a well-marked darker brown clay extending for 2 cm below this. The deepest sediment present in the cores was grey. Excavation revealed little biogenic structure and very few organisms were visible in the sieve residues. This station may therefore prove to show the lowest bioturbation intensity of those sampled.

Yermak Plateau (880 m)

Biomass appeared to be high at this station, with boxcore surfaces showing numerous polychaete tube endings and small epifauna. Excavation also revealed much evidence of biological activity, suggesting high levels of bioturbation. Large animals found during excavation included echiuran worms (present in two out of three boxcores taken) and a very large (approx. 25 cm long) capitellid polychaete. Maldanid polychaetes could be clearly seen extending below 10 cm depth in the sediment. A horizontal burrow compatible in size with the echiurans was found at approx. 8 cm sediment depth in one core. Faecal pellets present in this burrow were sampled. Fine 'capillary' burrows similar to those seen at the Voring Plateau were also present down to at least 28 cm sediment depth.

Planned future activity

The task ahead is to process the collected material, extract the desired information on faunal composition and activity, and integrate these data with the results of sediment geochemical analyses. It is a measure of the success of JR75 that such a large volume of biological samples was collected. The major types of data to be extracted from the benthic and photographic samples are as follows:

- **Benthic samples:** Total abundance and biomass of macro-infauna. Identification of taxa to lowest level necessary for assignment to bioturbator functional group. X-ray analysis of sediment subcores.
- **Seabed photographs:** Quantification and categorization of mega-infaunal surface traces (Lebensspuren). Identification of conspicuous epifauna.

Acknowledgments

Many members of the scientific party and ship's company provided help with the biological sampling at various times, and their assistance is gratefully acknowledged. Special thanks go to Caroline Gunn (Scott Polar Research Institute) for her generous efforts in the onerous task of sediment sieving.

David J. Hughes
Peter A. Lamont
J. Murray Roberts

Sula Ridge Station Report. JR75, 17 June 2002

Objectives

- Conduct multibeam and TOPAS survey over photo lander deployment site of July 2001.
- Perform CTD.
- Collect box core sample from this site.
- Deploy photo lander next to the Sula Ridge reef.
- Recover photo lander.
- Collect second box core sample.
- Bed-hop photograph the lander site.
- Bed-hop photograph the upper portion of the Sula Ridge.

Following a four-day deployment by the Sula Ridge in 2001, the photo lander was deployed for a twenty-day period between 18 June and 8 July. The lander forms a tripod frame designed to stand on relatively flat, coral rubble areas to the side of the Sula Ridge. To locate a suitable deployment site, the area around last year's site was surveyed (see survey report) and the initial, unprocessed survey results revealed the same seabed features that had guided the first deployment (multibeam survey, Norwegian Geological Survey / IMR). Having completed the survey, a box core was taken. The first core had failed to seal correctly and dumped on deck, the corer redeployed and a second good core was recovered. When dissected, this core contained a single echiuran worm (probably *Bonellia* sp.). The feeding activity of these active bioturbators was a notable feature of the photographs from the first photo lander deployment by the Sula Ridge. The remaining top 10cm of the core were sieved (500 and 250 μ m) and preserved for macrofaunal analysis.

The lander frame was initially lifted overboard and into the water, then stopped off to allow the buoyancy sphere to be attached. The lander and buoyancy were then lowered to within 15m of the bottom. This height was confirmed by tracking the lander acoustic release pinger on the waterfall display. The gear was then released by acoustic release. After checking acoustic release diagnostics indicating that the lander frame was vertical, it was left until recovery scheduled for Monday 8 July.

Photo lander equipment list, data gathering devices only

- Benthos digital stills time-lapse camera (1 picture/60 minutes).
- Mk 5 'bathysnap' time-lapse film camera (1 picture/18 minutes).
- Camel Camera Alive time-lapse film camera (1 picture/120 minutes).
- Transmissometer, light-scattering sensor and fluorometer controlled by UMI data logger (1 minute burst sampling every 20 minutes).
- S4 recording current meter (1 minute burst sampling every 10 minutes).
- Minilogger temperature recorder (set to record every 10 minutes).

On returning to the photo lander station at 0100 on 8 July, both ranges and diagnostics to the lander releases were checked. These gave ranges of 610m and a vertical diagnostic. The lander was released at 0113 and immediately decreasing range values indicated that it had left the seabed. At 0119 the lander buoyancy was on the surface and grappled at 0132. The buoyancy sphere was on deck at 0140 on the lander was on deck at 0148, 35 minutes after it had been released from the seabed. Once on deck the system was visually inspected, any corrosion was noted and photographed and the film cameras and instruments were checked.

The box core was then deployed at the lander station. The first core hit a large dropstone (40cm diameter). This and some surrounding sediment were recovered but the box was damaged and the core partially washed out. The core was dumped on deck and the sediment retained. Encrusting sponges were sampled from the dropstone. A second core was attempted but after this also failed the decision was made to begin bed-hop photography.

The bed-hop camera was deployed on the lander site to characterise this reef zone. The ship made 0.5kt NE during the deployment. Following this, a second bed-hop deployment was made along a transect on one of the ridge features identified during the multibeam survey. This 620m long transect was from 64° 04.796N 08° 01.892E to 64° 04.952 08° 02.562E.

JCR75 Cruise Report

Activity summary from log

Date/Time	Lat Lon	Event	Depth	I/W	Bottom	O/W	Stn	Activity	Comments
17/06/02 2122	N64 05.19 E08 02.20	#5	285	2121	2136	2200	SULA	CTD003	SULA CTD + Oxy
17/06/02 2241	N64 05.02 E08 02.26	#6	285	2242	2251	2257	SULA	NIOZ001	No Core
17/06/02 2305	N64 05.02 E08 02.26	#7	285	2307	2318	2225	SULA	NIOZ002	Good Core
18/06/02 0003	N64 05.005 E08 02.209	#8	285	0005	0046		SULA	LANDER	DEPLOYED
08/07/02 0113	N64 05.25 E08 02.61	#258	286			0148	SULA	LANDER	RECOVERY
08/07/02 0212	N64 05.02 E08 02.24	#259	285	0212	0219	0228	SULA	NIOZ	ROCK
08/07/02 0238	N64 05.02 E08 02.24	#260	285	0238	0245	0255	SULA	NIOZ	WATER
08/07/02 0326	N64 05.02 E08 02.24	#261	285	0326	0334	0430	SULA	BEDHOP	
08/07/02 0326	N64 05.02 E08 02.24	#262	250	0509	0524	0620	SULA	BEDHOP	

Samples and data collected

- Multibeam and TOPAS survey, see survey report images.
- CTD data, JR75 event #5.
- Box core, JR75 event #6, portion of unsealed core retained intact, encrusting sponges on dropstone sampled (SAMS No. NBC 864).
- Box core, JR75 event #7, core dissected sieved and preserved (SAMS No. NBC 865)

Photo Lander recovery (JR75 event #258)

- 414 photos from Benthos camera (resolution good enough to make out *Bonellia proboscis*).
- Full set of readings from optical instruments.
- Current meter, speed (max 25cm/s) was recorded, but direction was faulty.
- Minilogger showed temperatures between 7.5 and 8.5°C with three interesting 'events'.
- Box core, JR75 event #259, encrusting sponge samples from dropstone.
- Bed-hop camera, JR75 event #261, lander site.
- Bed-hop camera JR75 event #262, upper portion of ridge adjacent to lander site.

Work planned on return

- Unload and process film from the other two lander cameras.
- Correct current meter speeds to 0.5m (height of optical instruments).
- Calibrate optical instruments with locally collected sediment.
- Correct optical instrument outputs using this calibration.
- Estimate levels of near bed resuspension.
- Analyse photographs and attempt to relate megafaunal activity seen with near-bed current and resuspension estimates.

Acknowledgements

All the objectives listed above were achieved during JR75 giving a very promising data set. Thanks are due to the captain and crew of the James Clark Ross especially for their efficient deployment and recovery of the Photo Lander.

Chemistry

Personnel involved: Ivan Ezzi, Kenny Black, Caroline Gunn

Activities:

Dissolved inorganic nutrients
Particulate organic carbon
Chlorophyll
Oxygen
Microbial samples

Objectives:

Dissolved inorganic nutrients (DIN)

Water samples were taken from all CTD bottles at each of the survey stations as part of the water column characterisation. Samples were taken in triplicate for onboard analysis for nitrate, phosphate, ammonia and silicate.

Equivalent analysis was carried out on sediment core pore water provided by Eric Breuer and overlying water from incubated sediment cores provided by Martyn Harvey.

Underway samples were taken from the ship's non-toxic supply at approximately six hour intervals for the major part of the cruise.

Particulate organic carbon (POC) and chlorophyll (CHL)

Water samples from the same CTD bottles as above were filtered onto glass fibre filters and stored in the -80 freezer for analysis at Dunstaffnage. Chlorophyll data will also be used for calibration of the fluorometer attached to the CTD.

Oxygen

Water samples were removed from CTD bottles as detailed in table for titration onboard. This data will be used to calibrate the SAMS oxygen sensor attached to the CTD.

Microbial samples (Ray Leakey)

Samples were collected in surface waters from CTD bottles for analysis at Dunstaffnage of microplankton, nanoplankton and bacterioplankton. The samples were preserved in both lugol's iodine and gluteraldehyde.

Oxygen determinations from CTD bottles on JCR75

Kenny Black

In order to calibrate the SAMS Seabird oxygen probe that was fitted to the BAS CTD system after CTD3, water samples were taken and determined by the Winkler method. Typically, 3 samples from 2 depths were taken. The selection of depths was made on the basis of the temperature and salinity profile generated by each cast, as the oxygen sensor output was not displayed. In general, depths were chosen in separate water masses avoiding the interface regions where possible.

Samples were analysed by a derivation of the Winkler method using an auto-titrator (ABU9 Autoburette, Radiometer, Copenhagen) as described in the SAMS Standard Operating Procedure (Brand and Dixon). Results were calculated using the spreadsheet created for the purpose under this SOP. The thiosulphate secondary standard was calibrated against an iodate primary standard on 3 occasions during the cruise in each case giving similar results (0.230M).

Results are given in the table as the mean of n determinations. Standard deviations are given where n is greater than 2. Where n=2 plus/minus errors are given.

Table Winkler method oxygen determinations carried out on JCR75 showing CTD cast number, sample depth, number of replicates (n), mean oxygen concentration (mg/l) and standard deviation (or \pm error where n=2)

<u>Cast</u>	<u>Depth</u>	<u>n</u>	<u>Mean (mg/l)</u>	<u>SD</u>
CTD1	90	5	8.951	0.021
	2	5	9.582	0.082
CTD2	600	1	9.696	
	250	3	8.980	0.015
	10	2	9.841	0.003
CTD3	200	2	8.785	0.109
	40	3	9.702	0.010
	10	3	11.574	0.047
CTD4	200	3	9.012	0.044
	10	3	9.542	0.004
CTD5	1000	3	9.814	0.069
	200	3	9.335	0.011
CTD8	1000	3	9.811	0.007
	300	3	9.518	0.006
CTD9	1000	3	9.727	0.121
	200	3	9.427	0.065
CTD10	1000	3	9.647	0.298
	250	3	9.981	0.106
CTD11	1000	3	10.091	0.020
	250	2	10.172	0.025
CTD13	220	3	10.419	0.003
	10	3	12.098	0.009
CTD15	354	3	10.510	0.008
	50	3	11.879	0.124
CTD17	1232	3	9.799	0.051
	250	3	10.237	0.160
CTD19	2527	3	9.858	0.045
	103	3	10.127	0.127
CTD20	1360	2	10.047	0.019
	100	3	9.927	0.010
CTD22	853	3	9.891	0.060
	100	2	9.995	0.076
CTD24/25	300	3	10.272	0.136
	50	3	11.203	0.050
CTD30	1459	3	9.712	0.023
	50	3	9.337	0.012
CTD33	1220	3	9.774	0.008
	40	3	8.929	0.052
CTD34	882	3	9.789	0.006
	102	3	8.544	0.017

Sediment oxygen and nutrient fluxes - Martyn Harvey

Objectives

1. To obtain a suite of measurements of the sediment oxygen demand and sediment nutrient fluxes across a latitudinal transect, whilst maintaining an approximately equal water depth at each station (as far as is possible).
2. To obtain the same measurements across a longitudinal transect, from inner fjordic (Kongsfjord) to oceanic sediments.

Methodology

The multicorer was used to collect sediment cores at each station, as shown in the table below (extracted from JR75 station log):

Date	Lat	Long	Event	Depth	Stn	Deployment
19/06/02	N67 12.86	E06 05.53	#22	1434?	VP2	1
19/06/02	N67 12.86	E06 05.53	#23	1433?	VP2	2
19/06/02	N67 12.85	E06 05.54	#24	1433	VP2	3
23/06/02	N79 03.34	E11 18.08	#107	244	KF2	1
23/06/02	N79 03.34	E11 18.08	#108	231	KF2	2
23/06/02	N79 03.30	E11 18.08	#109	231	KF2	3
24/06/02	N78 57.46	E11 54.48	#124	355	KF1	1
24/06/02	N78 57.46	E11 54.49	#125	355	KF1	2
24/06/02	N78 57.46	E11 54.49	#126	355	KF1	3
26/06/02	N78 58.40	E06 42.47	#142	1385	KF4B	1
26/06/02	N78 58.40	E06 42.47	#143	1385	KF4B	2
26/06/02	N78 58.42	E06 42.46	#144	1385	KF4B	3
26/06/02	N78 58.42	E06 42.46	#145	1385	KF4B	4
28/06/02	N78 56.85	E05 17.31	#157	2465	KF5	1
28/06/02	N78 56.85	E05 17.31	#158	2465	KF5	2
28/06/02	N78 56.85	E05 17.31	#159	2465	KF5	3
28/06/02	N78 56.85	E05 17.31	#160	2465	KF5	4
30/06/02	N80 45.02	E07 38.72	#190	922	YP1b	1
30/06/02	N80 45.02	E07 38.74	#191	nr	YP1b	2
30/06/02	N80 45.02	E07 38.74	#192	nr	YP1b	3
01/07/02	N79 01.34	E10 41.62	#222	342	KF3b	1
01/07/02	nr	nr	#223	nr	KF3b	2
01/07/02	nr	nr	#224	nr	KF3b	3
03/07/02	N78 57.38	E11 54.57	#235	366	KF1	1
03/07/02	N78 57.41	E11 54.46	#236	366	KF1	2
03/07/02	nr	nr	#237	nr	KF1	3
05/07/02	N73 39.61	E13 46.97	#251	1440	BIF	1
05/07/02	N73 39.61	E13 47.00	#252	1440	BIF	2
05/07/02	nr	nr	#253	1440	BIF	3

Two cores from each of three deployments of the multicorer (ie six in total) from each station were used to measure the sediment oxygen demand and the flux of nutrients (nitrate, phosphate, silicate and ammonium) across the sediment/water interface. After collection, the cores were placed in a tank of seawater obtained from approximately 5m above the seabed at the same site, and maintained at the bottom water temperature in the ship's constant temperature room. 10ml samples were taken from this in syringes, and fixed for Winkler titration to determine their dissolved oxygen content. The cores were sealed with submersible stirrers and incubated for approximately 24 hours (measured exactly). Samples of the water overlying the cores were taken and fixed. The difference in the dissolved oxygen content of the samples taken at the start and the end of the incubation was used to determine the sediment oxygen demand.

After the 24 hour incubation and removal of the water samples, the overlying water was aerated and the cores incubated for a further 24 hours. After this time water samples were removed, filtered through GF/F filters and refrigerated until analysis to determine the concentration of dissolved nutrients. Similar samples taken from the water in the tank at the start of the incubation provide time zero values, and thus the sediment nutrient fluxes could be determined.

Once the incubations were completed the cores were sliced and preserved for subsequent faunal analysis.

Results

The oxygen flux values obtained are presented in the table below. The nutrient flux values will not be obtained until final calibrations and corrections have been applied after the return to DML.

Station	Approx. depth (m)	Sediment Oxygen Demand ($\text{mmol m}^{-2} \text{d}^{-1}$)
VP2	1430	4.64 ± 1.65
BIF	1440	3.92 ± 0.59
YP1b	920	2.92 ± 0.88
KF1	370	14.47 ± 3.42
KF2	240	11.26 ± 2.45
KF3b	340	14.55 ± 3.59
KF4b	1390	4.25 ± 0.91
KF5	2470	3.23 ± 0.90

Sediment oxygen demand values are mean \pm s.d. (n = 6, 2 cores from each of 3 deployments of the multicorer)

How Do Marine Viruses Influence the Production of Dimethyl Sulphide? Claire Evans - UEA

Introduction

The majority of biogenic sulphur released to the atmosphere is in the form of dimethyl sulphide (DMS). DMS is believed to have significance to atmospheric chemistry and forming cloud condensation nuclei thus potentially influencing global climate. Most DMS is produced from its cellular precursor dimethylsulphonylpropionate (DMSP) found in certain species of marine phytoplankton. DMSP is enzymatically cleaved to DMS and acrylic acid via a group of isozymes generically termed DMSP lyases, which are ubiquitous among the marine microbial community. Viruses are believed to influence the S cycle primarily by lysing the phytoplankton releasing their DMSP and if present DMSP lyase. DMS may be produced directly as a result of cleavage by the hosts enzymes or indirectly by other microbes present. Viruses may also influence the cycling of DMSP and related compounds by infecting other microbes involved in S cycling.

Objectives

The aim was to increase understanding of the role of marine viruses in DMS production via a programme of monitoring relevant parameters and experiments on the natural assemblage. Attempts were also made to isolate viruses and hosts for culture and further experimental work in the lab.

Methodology

Parameters measured/samples collected

- ◆ Concentration of DMS and DMSP in the particulate and dissolved phase.
- ◆ Concentration of viruses and bacteria.
- ◆ Activity of DMSP lyase
- ◆ Collection of samples for detection of specific viruses infectious to DMSP containing phytoplankton, free and associated with the host.

Depth profiles were made as often as time and schedule permitted. Samples for concentration of S compounds, viruses and bacteria were taken in duplicate at 6 depths, usually from surface to 100 m. All other samples were taken from the chlorophyll maximum.

Analysis of DMS, DMSPp and DMSPd

Analysis of DMS and related compounds was via a triple purge and cryotrap system in combination with Shimadzu GC-14B gas chromatograph and a flame photometric detector. Data was collected and analysed on a reporting integrator, Shimadzu C-R5A. The system was calibrated using a DMSP solution of known concentration cleaved to DMS by 10 M NaOH (Fig 1).

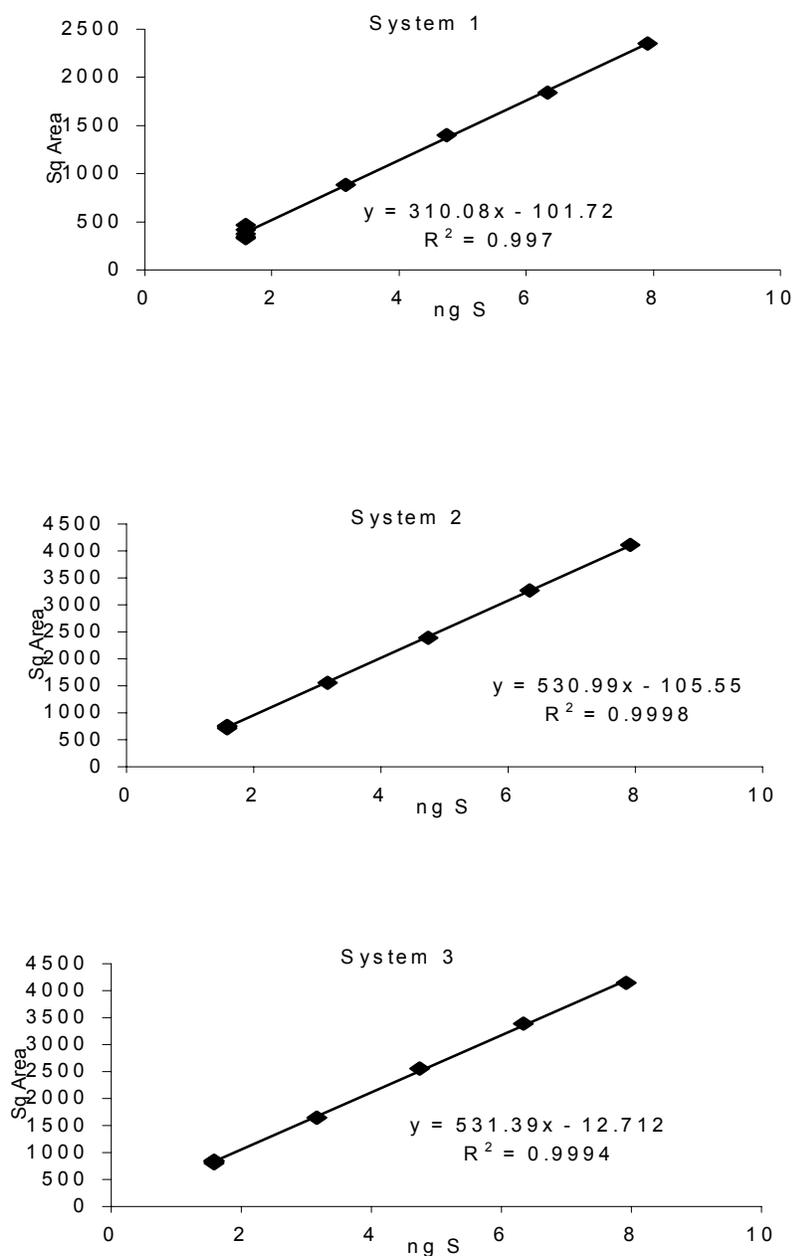


Figure 1. Calibration curves for the triple purge and trap systems.

All samples for DMS were analysed as soon as possible. Samples for DMSPp and DMSPd were preserved for later analysis.

Concentration of Viruses and Bacteria

Samples were preserved in 10% glutaraldehyde and snap frozen for later analysis in the lab by flow cytometry. Viral and bacterial enumeration will be performed on each sample at

the same time. Sample will be defrosted at room temperature, diluted 10 fold in TE buffer and heated at 65 °C for 15 min in the dark in the presence of SYBR Green I (Molecular Probes). Samples will then be analysed at medium flow rate. Green fluorescence and side scatter will be used to define the viral and bacterial populations.

Activity of DMSP lyase

Activity of DMSP lyase will be determined using a headspace analysis of DMS production. Cells were first harvested by filtration under low light condition and at ambient temperature using 0.2 µm polycarbonate membrane filters under a vacuum of <100 mm Hg. Samples were then snap frozen and stored at - 80 °C for analysis back at the lab. Samples will be defrosted in the presence of Bis-tris propane buffer pH 8.2 and sonicated to release the DMSP lyase. The resultant extract will be placed in a gas tight vial and 50 mm³ volumes of headspace periodically withdrawn through a septa using a gas tight syringe to test for the concentration of DMS. DMSP is will be added to the vials and DMS production monitored allowing the calculation of the enzymes activity. DMS concentration will be measured by direct injection on to the GC column and detection by flame photometric detector (instrument set up as detailed above). In order that any losses due to freezing be accounted for duplicate test samples were taken of which one will be stored to be analysed in the lab whilst the other was analysed on ship.

Detection of Viruses Infectious to DMSP Containing Phytoplankton

Two litters of seawater were filtered under low light condition and at ambient temperature using 0.45 µm Supor membrane filters under a vacuum of <100 mm Hg. The filters were snap frozen for later analysis in the lab. The resultant filtrate was concentrated by a VivaFlow 200 system (Viva Science) to approximately 30 ml. At a later date these samples will be used to look for the presence of specific viruses using oligonucleotide probes.

Results

Date	Time	Event	Lat	Long
19/06/2002	12:12	19	67° 13.04	06° 06.14
20/06/2002	08:30	32	67° 54.74	06° 21.22
21/06/2002	08:36	60	71° 58.83	07° 21.06
22/06/2002	08:30	83	75° 34.41	08° 32.51
23/06/2002	07:10	104		
24/06/2002	13:30	118	78° 57.46	11° 54.49
25/06/2002	18:33	136	79° 00.16	06° 59.57
27/06/2002	16:10	153	78° 56.87	05° 17.31
29/06/2002	08:30	183	79° 19.27	06° 37.22
29/06/2002	20:07	185	80° 41.36	07° 25.53
01/07/2002	13:48	216	79° 01.33	10° 41.52
02/07/2002	07:09	234	79° 10.52	11° 46.67
03/07/2002	10:25	238	79° 03.30	11° 17.75
04/07/2002	07:32	184	78° 17.84	07° 37.55
05/07/2002	12:16	246	73° 39.67	13° 47.21
07/07/2002	09:03	257	67° 13.04	09° 28.08
08/07/2002	12:10	264	68° 45.67	05° 34.52

Table 1 Details of the CTDs sampled

DMS was present in highest concentrations in the surface waters decreasing with depth. Concentrations varied from around 2 nM to 16 nM Figure 2.

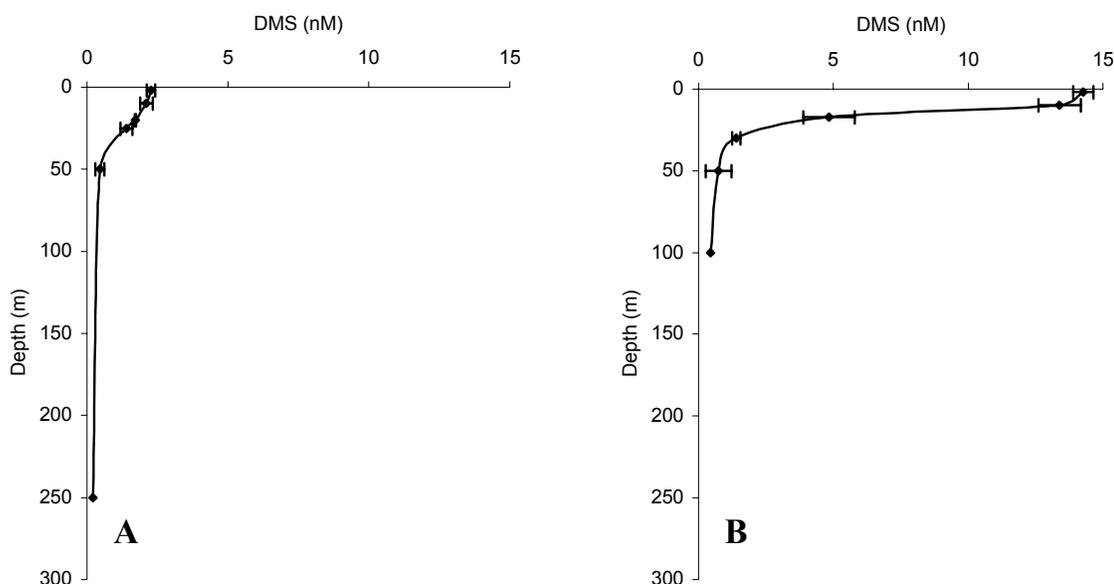


Figure 1 Depth profiles of DMS concentration taken on (a) 21-06-02 and (b) 05-07-02. Preliminary data confirms the presence of DMS in the water column. Full interpretation of the data remains impossible until the analysis of all the samples taken.

Acknowledgements

I would like to thank; all those involved in the organisation of this cruise. The UEA crew. Claire Hughes and Suza Kadner for their help with bacterial production measurements and Louise Darroch for advice on sulphur analysis. All those involved with the CTD operation. Simon for his assistance with incubator tanks and onboard seawater supply. Michael Steinke for lending me his equipment. And all the scientists, officers and crew. Special thanks to Graham Shimmield and Colin Griffiths.

Halocarbon Measurements
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Halogenated organic compounds are known to be an important source of halogens (chloride, bromide and iodide) to the atmosphere. Measurements of the halogenated organic compounds listed in table 1 were made during JCR75 using a purge-and-trap preparation system and Hewlett Packard gas chromatograph - mass spectrometer (GC-MS). The aim of these studies was to gain some understanding of the processes controlling the production of halocarbons in seawater.

Table 1 - Halocarbons analysed by GC-MS during JCR75

Compound	Molecular Formula
Methyl chloride	CH ₃ Cl
Methyl bromide	CH ₃ Br
Methyl iodide	CH ₃ I
Bromoethane	CH ₃ CH ₂ Br
Iodoethane	CH ₃ CH ₂ I
Carbon tetrachloride	CCl ₄
1-iodopropane	CH ₃ CH ₂ CH ₂ I
Dibromomethane	CH ₂ Br ₂
2-iodopropane	CH ₃ CHICH ₃
Chloriodomethane	CH ₂ ClI
Dibromochloromethane	CHBr ₂ Cl
Tetrachloroethylene	CH ₂ Cl ₄
Bromoiodomethane	CH ₂ BrI
Bromoform	CHBr ₃
Diiodomethane	CH ₂ I ₂

Sample Details

During JCR75, samples were taken for halocarbon analysis from the non-toxic seawater supply for underway sampling, CTD casts for depth profiles in interesting areas and various experiments were set up to investigate the source/ fate of halocarbons in the marine environment.

Underway Sampling

Table 2 gives the position, date and time at which samples were taken from the non-toxic supply for underway sampling. Samples were analysed in duplicate from each of these stations. Figures 1 and 2 show the distribution of two halocarbons, iodoethane (C₂H₅I, a) and dibromomethane (CH₂Br₂, b) along the JCR75 cruise track. Peaks in concentration of both iodoethane and dibromomethane, together with a suite of other halocarbons, were measured in Kongsfjord.

Table 2 - JCR75 underway halocarbon sampling stations.

Date	Time	Position
18-Jun	1300	67o15.9'N, 03o31.5'E
18-Jun	2000	67o11.0'N, 07o30.0'E
19-Jun	1000	67o13.13'N, 06o05.97'E
20-Jun	1000	67o54.75'N, 06o21.35'E
20-Jun	1727	70o23.00'N, 10o48.08'E
21-Jun	0100	70o21.33'N, 06o54.20'E
21-Jun	1100	71o29.56'N, 07o13.56'E
21-Jun	1700	73o25.40'N, 07o42.27'E
22-Jun	1000	75o34.41'N, 08o32.51'E
22-Jun	1700	76o49.84'N, 09o02.49'E
22-Jun	2240	78o03.29'N, 09o33.66'E
23-Jun	0920	79o03.42'N, 011o17.85'E
23-Jun	1345	79o03.03'N, 011o21.54'E
24-Jun	1640	78o57.47'N, 011o53.98'E
25-Jun	1400	79o00.12'N, 010o10.36'E
25-Jun	1945	79o0.158'N, 06o59.61'E
26-Jun	1540	78o 58.41'N, 06o42.73'E
27-Jun	1447	78o56.87'N, 05o17.36'E
28-Jun	1530	78o58.86'N, 05o17.47'E
28-Jun	1900	78o58.85'N, 04o54.42'E
28-Jun	2230	79o11.86'N, 02o57.19'E
29-Jun	1340	79o50.56'N, 08o02.73'E
1-Jul	1345	79o01.31'N, 10o34.88'E
1-Jul	1630	79o01.33'N, 10o41.53'E
3-Jul	1138	78o58.63'N, 11o46.45'E
4-Jul	0835	78o17.80'N, 07o38.35'E
4-Jul	1700	77o01.30'N, 09o17.08'E
4-Jul	2400	75o48.98'N, 10o54.38'E
5-Jul	1053	73o38.53'N, 13o50.50'E
5-Jul	2252	73o39.59'N, 13o47.00'E
6-Jul	1130	71o46.62'N, 12o24.14'E
6-Jul	1930	70o08.22'N, 011o13.50'E
8-Jul	0900	63o59.45'N, 07o20.65'E
8-Jul	1340	63o46.16'N, 05o34.51'E

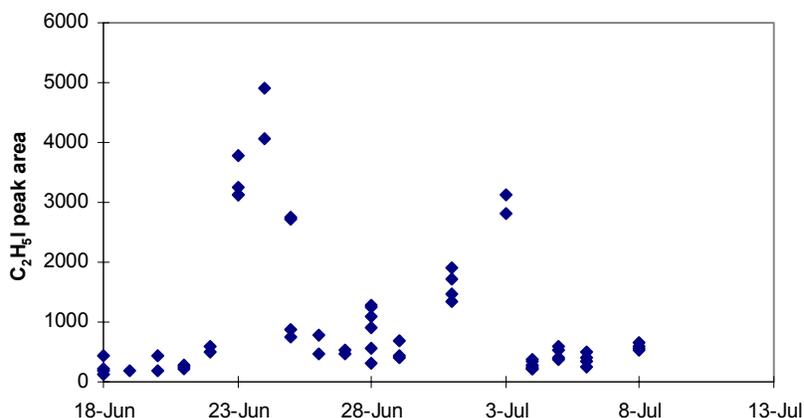


Figure 1. Distribution of iodoethane along the JCR75 cruise track.

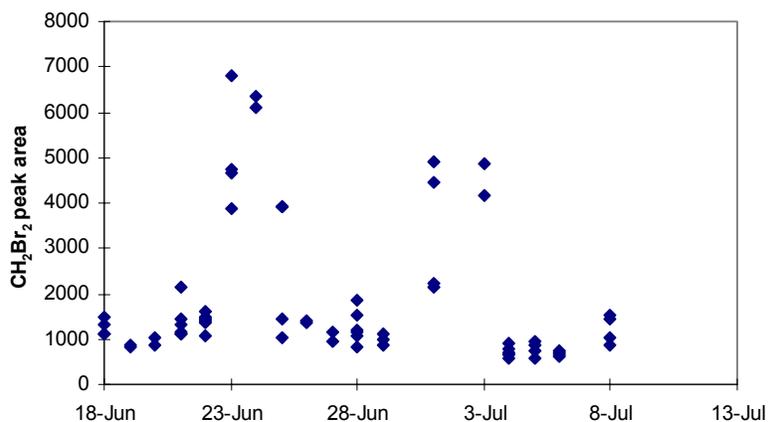


Figure 2. Distribution of dibromomethane along the JCR75 cruise track.

Depth Profiles

Halocarbon depth profiles were measured at 7 stations during JCR75, the details of which are presented in table 3.

Table 3 - JCR75 halocarbon depth profile stations

Date	Event	CTD	Coordinates
24 June	118	015	78o57N, 11o54E
25 June	136	017	Station KF4
27 June	153	019	78o57N, 05o17E Station KF5
29 June	183	020	80o41N, 07o26E Station YP1
1 July	216	024/5	79o01N, 10o42E Station KF3B
3 July		027	78o58'N, 11o46'E
4 July	184	028	78o18N, 07o34E

In general, higher concentrations of halocarbons were encountered in the upper ocean. In Kongsfjord, however, higher concentrations of some compounds were measured at depth. Figures 3 a and b are depth profiles of two compounds, methyl iodide (CH₃I) and bromoform (CHBr₃), measured in Kongsfjord.

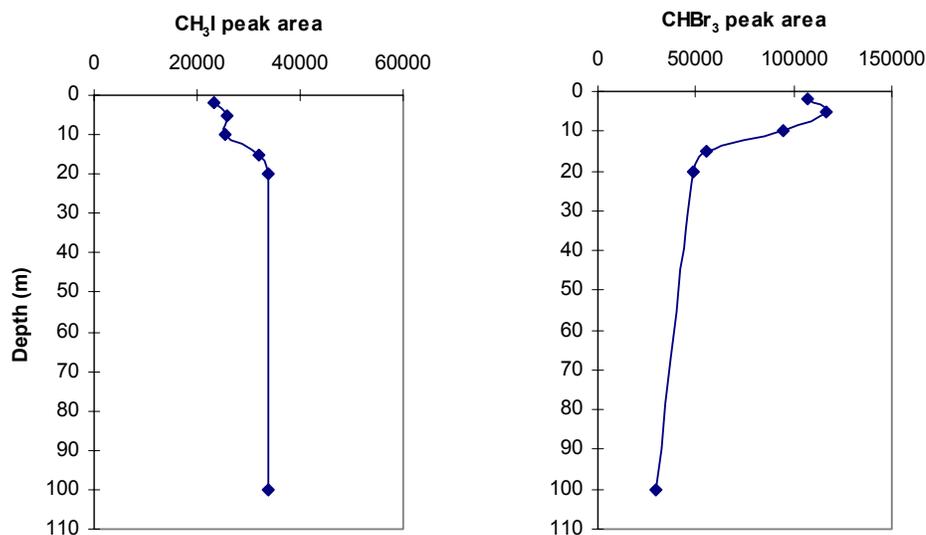


Figure 3. Depth profiles of methyl iodide (a) and bromoform (b) measured in Kongsfjord (CTD cast 015, event 118) during JCR75.

Experiments

A series of experiments were carried out during JCR75 to investigate the source/s of the halocarbons being measured in seawater. All experiments were centered around incubations carried out in glass syringes held in an on-deck tank supplied with running seawater. One positive results came from the incubation of “marine snow” collected from the top of a box core in Kongsfjord. During this incubation, high rates of methyl iodide, 2-iodopropane, 1-iodopropane and iodoethane production were observed. This result, together with those collected from other experiments, will be used to further our investigations in to the sources of halocarbons in the marine environment.

Acknowledgements

I would like to thank the following people for their help before and during JCR75 - Gill Malin, Sussanne Kadner, Louise Darroch, Claire Evans, Martin Johnson, Gareth Lee, Colin Griffiths and Graham Shimmield.

Dimethyl sulphoxide (DMSO) in seawater

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Introduction

Dimethylsulphoxide (DMSO) is an oxidized form of the climatically active trace gas dimethyl sulphide (DMS). It is a stable and ubiquitous compound, which is generally found in higher concentrations than DMS in seawater. DMSO is thought to be formed from DMS through abiotic photo- and bacterial-oxidation of DMS. Marine bacterial isolates have also been found that can reduce DMSO to DMS. Recently, DMSO has been measured in unicellular algae and it has been suggested that phytoplankton are a direct source of DMSO in seawater.

Aims

The aim of this research was to compare the distribution of dissolved DMSO in seawater (DMSOd) and intracellular DMSO (DMSOp) within the water column and with changes in phytoplankton communities, using a new method to determine DMSOp. We also aimed to establish how significant DMSOp is in the oceans and as a likely source of DMSOd.

Methods

Filtered seawater samples were (Millipore AP25 depth filters) initially pre-purged of any ambient DMS using nitrogen gas. An aliquot of this sample was then used to determine DMSO dissolved (DMSOd) using the enzyme DMSO reductase method developed by Hatton *et al.* (1994). The process was initiated by light acting on ethylenediaminetetraacetic acid to form radicals, which reduce flavin mononucleotide (FMN). FMN then acts as an electron donor to DMSO reductase, catalyzing the reduction of DMSO to DMS. The evolved DMS was pre-concentrated using a purge-and-cryotrap system, similar to that described by Turner *et al.* (1990). The trapped DMS was injected onto a Chromosil 330 packed column and analysed by a Varian 3300 gas chromatograph fitted with a flame photometric detector. Filters including cells were then placed in an alkaline buffer for several hours to degrade cells and release any intracellular DMSO. Samples were then neutralized and analysed as DMSOd as above. DMSOp was found to be removed from cells in the dark so CTD sample bottles were stored in a flow-through seawater incubator in natural sunlight before analysis. No significant changes in DMSOp concentration were observed during storage

Sample Details

DMSOd and DMSOp were sampled from CTD casts as follows

Date	Event#	CTD#	Coordinates	Comments
17.6	003	002	?	DMSOd, DMSPp. 2,5,10,20,40,50,200 m
18.6	009	004	65° 30N 07° 46E	DMSOd. 2,5,10,20,40,100,200,370m
20.6	032	009	67° 55N 06° 2E	DMSOd. 2,10,20,25,50,100,30,1000m
21.6	060	010	71° 58N 07° 21E	DMSOd, 2,10,20,25,50,250 m
22.6	083	011	75° 34N 08° 33E	Photochemistry experiment
23.6	104	013	KF2	DMSOd. 2,5,10,20,40,100 m
24.6	118	015	78° 57N 11° 54E	DMSOd. 2,5,10,15,20,100m Size fraction of DMSOp and DMSPp. Fractions, <2, 2-5, 5-20, >20µm
25.6	136	017	Station KF4	DMSOd, DMSOp at 2,5,20,50,165,250 m

26.6			78° 58N 06° 43E	Photochemistry experiment
27.6	153	019	78° 57N 05° 17E Station KF5	DMSOd, DMSOp at 2,10,20,45,100,500,1500,2400m
29.6	183	020	79° 19N 06° 37E	DMSOd, DMSOp at 2,5,10,20,30,100,500,1360m
29.6	185	022	Station YP1 80° 41N 07° 26E	DMSOd, DMSOp at 2,5,15,30,50,100m
1.7	216	024/025	Station KF3B 79° 01N 10° 42E	DMSOd, DMSOp at 2,5,10,20,50,100m
2.7	234	026	79° 11N 11° 47E	DMSOd, DMSOp at 2,5,10,40,60,100m Production of DMS and DMSOd from marine snow incubation
4.7	184	028	78° 18N 07° 34E	DMSOp, DMSOd at 2,5,10,15,50,100m
5.7	246	030	73° 40N 13° 47E	DMSOd, DMSOp at 2,5,10,17,30,100m Photochemistry experiment
7.7	257	031	67° 13N 09° 28E	DMSOp, DMSOd at 2,10,20,30,60,100m
8.7	264	032	68° 46N 05° 35E	DMSOp, DMSOd at 2,5,20,25,30,100m

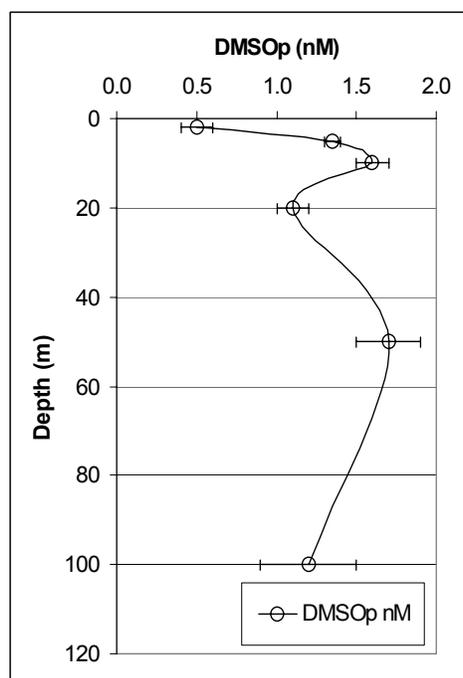
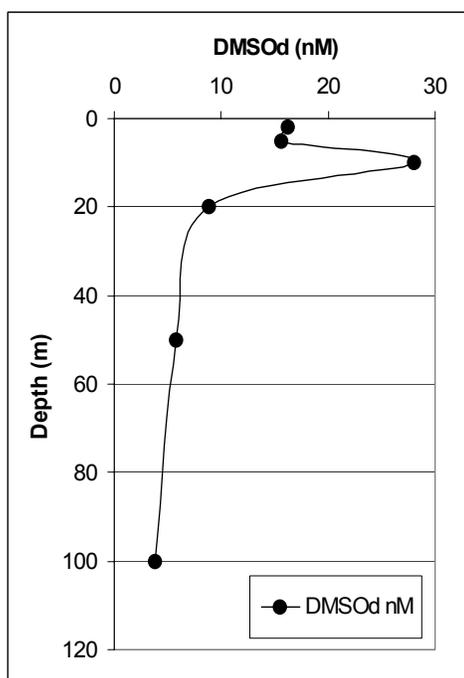
Experiments were also set up to investigate the production of DMSO in seawater from alternative pathways to phytoplankton release. We investigated the photo-oxidation of DMS to DMSO. We also analysed DMSOp in different size fractions of cells from seawater and the formation of DMS and DMSO from marine snow

Measured parameters

DMSO was determined using a GC calibrated with alkaline-hydrolysed dimethylsulphoniopropionate (DMSP). DMSOd were measured as single replicates while duplicate samples were taken for DMSOp. DMSO reductase activity was checked using a DMSO standard.

Initial results

Below are profiles of DMSOd and DMSOp from station KF3B (79° 01N 10° 42E) on 1.7.02, where the phytoplankton biomass (chlorophyll fluorescence) was ~ 1.6ug/L. Although DMSOd concentrations were high, reaching 28 nM at 10m depth, DMSOp concentrations were much lower ranging from 0.5 - 1.6 nM DMSO. DMSOd was generally found in much higher concentrations (0.5 - 60 nM) than DMSOp throughout the cruise (0-2 nM)



Future Research

Some samples for DMSOp will be analysed at UEA following the cruise. DMSOp and DMSOd will then be compared with levels of DMS and DMSP (Claire Evans, UEA) and phytoplankton chlorophyll data (Stuart Gibb, UHI). Changes in DMSOp will also be compared to other parameters such as light, temperature and salinity.

JCR 75 - ACRYLIC ACID MEASUREMENTS IN SEAWATER

SUSANNE KADNER / UEA

INTRODUCTION

Acrylic acid in the marine environment is assumed to originate mainly from the algal osmolyte Dimethylsulphoniopropionate (DMSP). The cleavage of DMSP is initiated through grazing, viral attack, lysis and/or senescence during which the enzyme DMSP-lyase is activated. This enzyme is responsible for the cleavage of DMSP in its end-products Dimethylsulphide (DMS), a sulphur gas with climate active properties, and acrylic acid.

The fate of acrylic acid is fairly unknown and many suggestions have been made about its possible roles in the marine food web. During this cruise, depth profiles showing its distribution throughout the water-column have been made.

METHODS

Acrylic acid in seawater is measured with an HPLC by direct injection of the samples. Immediately after collection, the seawater samples are acidified to pH1 with 10M H_3PO_4 . This allows the samples to be stored for at least 1 week and also inactivates the enzyme DMSP-lyase. Hereby, accidental rupture of the cells during filtration which would activate the enzyme will not alter the concentrations of acrylic acid in the dissolved phase. The samples are then filtered under a gentle vacuum (10 cm Hg) through a 0.2 μ m polycarbonate filter and collected for analysis.

The samples are analysed with an AGILENT 1100 HPLC system. The eluent is pre-mixed Milli-Q water with 0.05% H_3PO_4 (v/v) and pumped at a 1ml/min flow rate. The thermostat in the column compartment is set to heat the eluent to 40°C. The samples in the autosampler are kept at a constant temperature at 10°C until analysis. The detection wavelength was set to 205nm with a bandwidth of 10nm and the slit width opened to 16nm. The injection volume is 100 μ l. This gives a detection limit of 10nM or 1pmole in a 100 μ l injection.

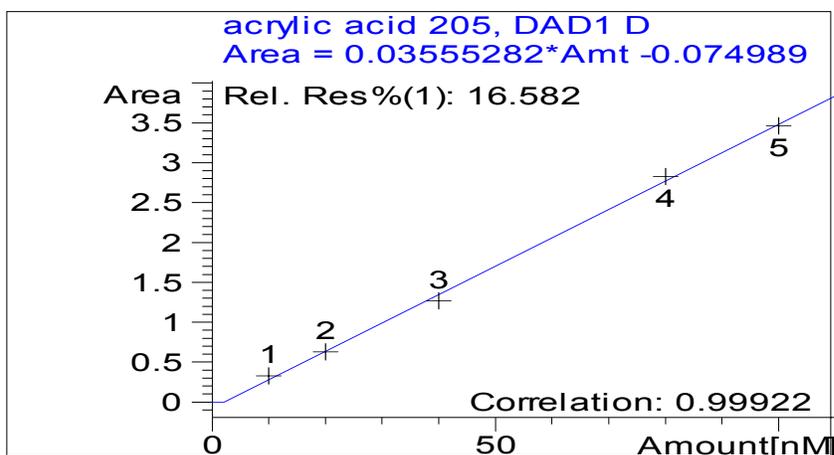


Fig. 1 Calibration curve for acrylic acid standards (10-100nM) in seawater

The instrument is calibrated by injecting different volumes of a 1 μ M acrylic acid (SIGMA Chemicals) standard, made up in 0.2 μ m filtered seawater. The calibration curve for a 10-100nM concentration range can be seen in Figure 1.

ACRYLIC ACID DEPTH PROFILES

Depth profiles were taken throughout the course of the cruise of which the profiles between the 21/6 and the 1/7 were analysed. As expected, most profiles show higher acrylic acid concentrations at the surface and the chlorophyll maximum (Table 1, Fig 2a and b). As a comparison, interesting profiles were obtained in the Kongsfjord (Table 1, Fig. 3a and b) which exhibit lower acrylic acid concentrations at the surface and increases over depth. These results will have to be interpreted in conjunction with the data obtained for DMS, DMSPd, DMSPp and the pigment analysis.

Activity	date	Latitude	Longitude	Event
CTD 010	21/06/02	N71 58.25	E07 21.02	#60
CTD 011	22/06/02	N75 34.41	E08 32.35	#83
CTD 013	23/06/02	N79 03.25	E11 17.97	#102
CTD 015	24/06/02	N78 57.48	E11 54.49	#118

Table 1 CTD cast information

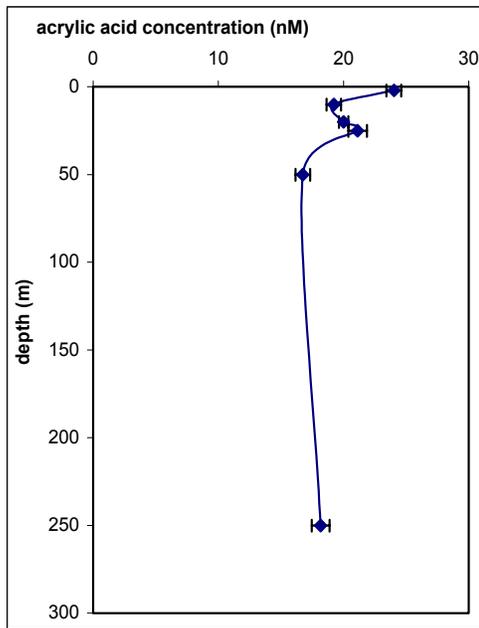


Fig 2a Depth profile for CTD 010
(N71 58.25 / E07 21.02)

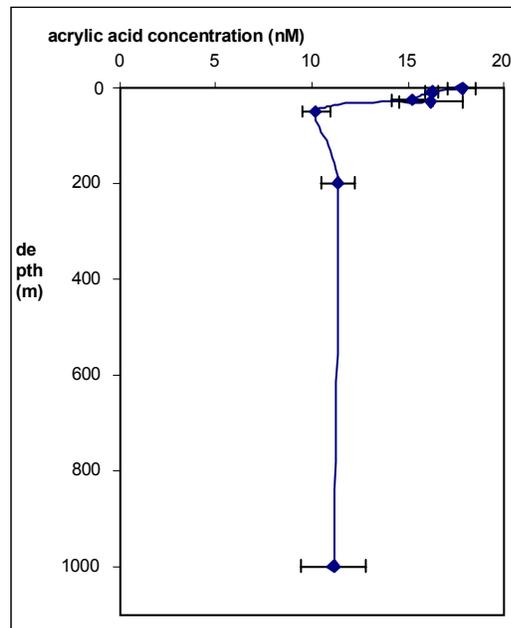


Fig. 2b Depth profile for CTD 011
(N75 34.41 / E 08 32..35)

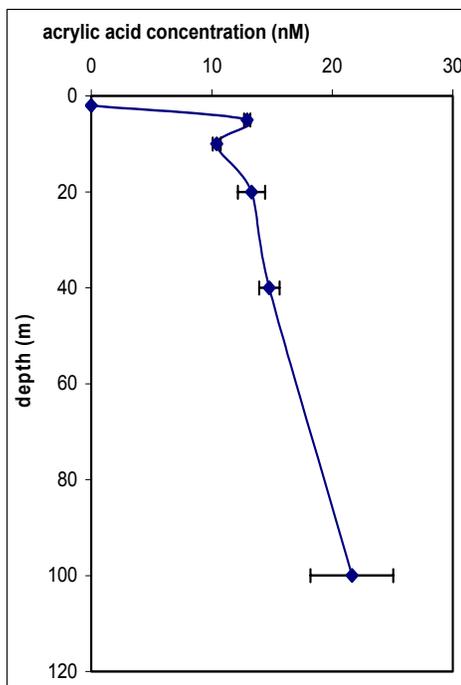


Fig. 3a Depth profile for CTD013
(N79 03.25 / E1 17.97)

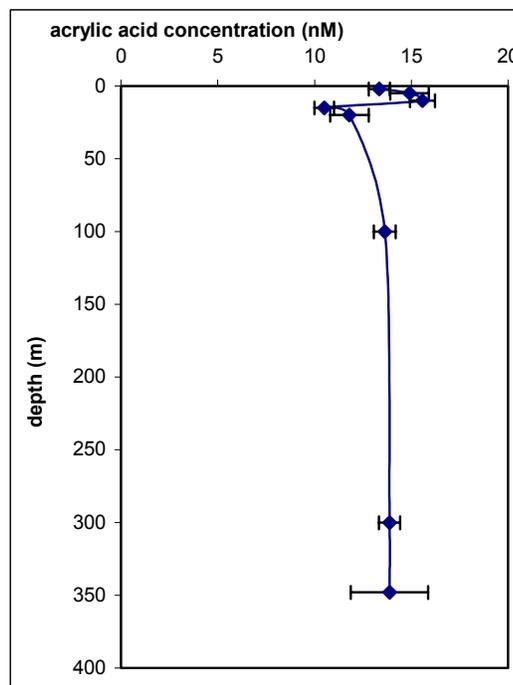


Fig. 3b Depth profile for CTD015
(N78 57.48 / E 11 54.49)

ACKNOWLEDGEMENTS

Greatest thanks to Graham Shimmiel for giving us all the opportunity to come on this cruise and to obtain a complete data set covering all the parameters important for our research at UEA. Many thanks also to the officers, Simon Wright and everyone in the crew of the RRS *James Clark Ross* for their help and support throughout the cruise. And last but not least a great thank you to everyone onboard the JCR75 who made this cruise a very enjoyable experience.

JCR 75 Seawater Ammonium / Atmospheric Ammonia measurement - Martin Johnson, UEA Norwich.

Seawater ammonium concentrations and atmospheric ammonia concentrations were measured in order to calculate the air-sea flux of ammonia. CTD ammonium profiles were also measured. This work is funded by the NERC thematic research programme, Global Nitrogen Enrichment and, as such, all data will be made available through the NERC data centre at CEH Monks Wood, Cambridgeshire.

Methods

OPA fluorimetry as outlined by Holmes *et al* (1999), was used for the analysis of seawater samples and for the assay of ammonia in the atmospheric samples. The method has been developed slightly from the Holmes method in that a smaller ratio of reagent to sample is used, reducing the baseline fluorescence and therefore the detection limit. The detection limit of the method on this cruise was approximately 10 nmol L⁻¹.

Measurement of atmospheric ammonia was achieved using filter packs - 1 PTFE filter (to catch particulate matter) and two acid coated filters to collect ammonia, in line, with air pulled through them by an air pump. Duplicate filter packs were run simultaneously, with a third set deployed without any air passing through them as a blank. The blanks, as normal with this method, were pretty high, but preparation in a glove box under nitrogen, and repeated washing of the filters with milliQ water before applying the acid reduced the blank to about 20% of the sample + blank value for an 8 hour sampling period at an atmospheric ammonia concentration of 5 nmol m⁻³. The atmospheric sampling equipment was mounted at the front of the monkey island. Sampling was only conducted when the wind was blowing at greater than 10 knots (remarkably infrequently on this cruise!) and the ship was into the wind (to prevent contamination from the funnel). Getting a power supply to the equipment was no problem - the long outdoor extension lead with waterproof sockets that was brought was adequate.

Sampling Details

Table 1: CTD Sampling

Event #	CTD #	Lat N	Long W	Date	Time
#001	1	59°30.73	01°25.75	16/6/02	0842
#005	3	59°30.73	01°25.75	17/6/02	2122
#009	4	65°30.04	07°46.36	18/6/02	0838
#019	8	67°13.04	06°06.14	19/06/02	1212
#032	9	67°54.74	06°21.22	20/06/02	0830
#060	10	71°58.23	07°21.06	21/6/02	0836
#083	11	75°34.41	08°32.51	22/6/02	0830
#104	13			23/06/02	0710
#118	15	78°57.46	11°54.49	24/6/02	1330
#136	17	79°00.16	06°59.57	25/6/02	1833
#183	20	79°19.27	06°37.22	29/6/02	0830
#185	22	80°41.36	07°25.53	29/6/02	2007
#246	30	73°39.67	13°47.21	05/07/02	1216

Table 2 - Underway seawater ammonium samples (from NTS)

Sample No.	Date	Time
nts1	19/06/2002	19:55
nts2	21/06/2002	00:00
nts3	22/06/2002	15:30
nts4	23/06/2002	10:30

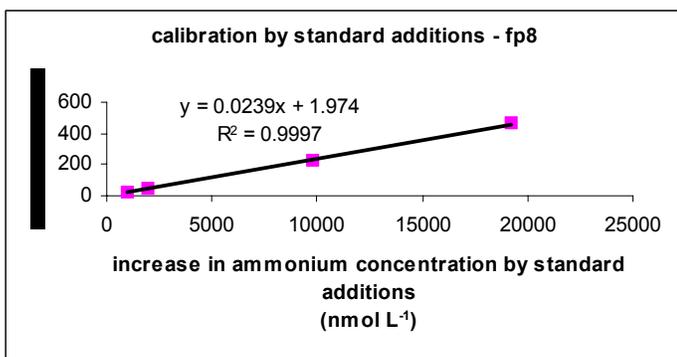
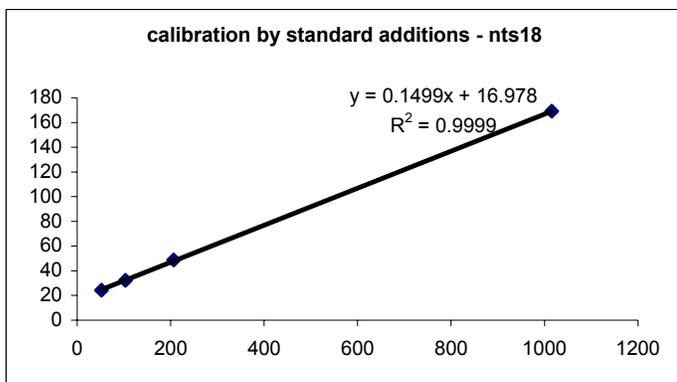
nts5	23/06/2002	14:05
nts6	23/06/2002	17:05
nts7	23/06/2002	21:10
nts8	24/06/2002	03:30
nts9	26/06/2002	12:45
nts10	26/06/2002	21:25
nts11	27/06/2002	06:55
nts12	27/06/2002	17:00
nts13	27/06/2002	21:30
nts14	28/06/2002	00:30
nts15	28/06/2002	19:40
nts16	30/06/2002	12:50
nts17	30/06/2002	19:30
nts18	04/07/2002	04:45
nts19	04/07/2002	11:21
nts20	04/07/2002	13:15
nts21	04/07/2002	22:20
nts22	05/07/2002	09:20
nts23	06/07/2002	01:24

Table 3 Atmospheric Samples

Sample No.	Start Date / Time	Finish Date / Time
fp1	19/06/2002 11:02:00	19/06/2002 21:00:00
fp2	19/06/2002 21:00:00	20/06/2002 11:40:00
fp3	20/06/2002 11:40:00	21/06/2002 00:30:00
fp4	21/06/2002 00:30:00	21/06/2002 10:15:00
fp6	23/06/2002 11:25:00	23/06/2002 22:00:00
fp7	25/06/2002 17:50:00	26/06/2002 18:00:00
fp8	27/06/2002 19:45:00	28/06/2002 01:20:00
fp9	28/06/2002 01:20:00	30/06/2002 03:15:00
fp10	30/06/2002 13:30:00	30/06/2002 21:20:00
fp11	04/07/2002 05:40:00	04/07/2002 13:40:00
fp12	04/07/2002 16:10:00	05/07/2002 00:05:00
fp13	05/07/2002 00:25:00	05/07/2002 09:45:00

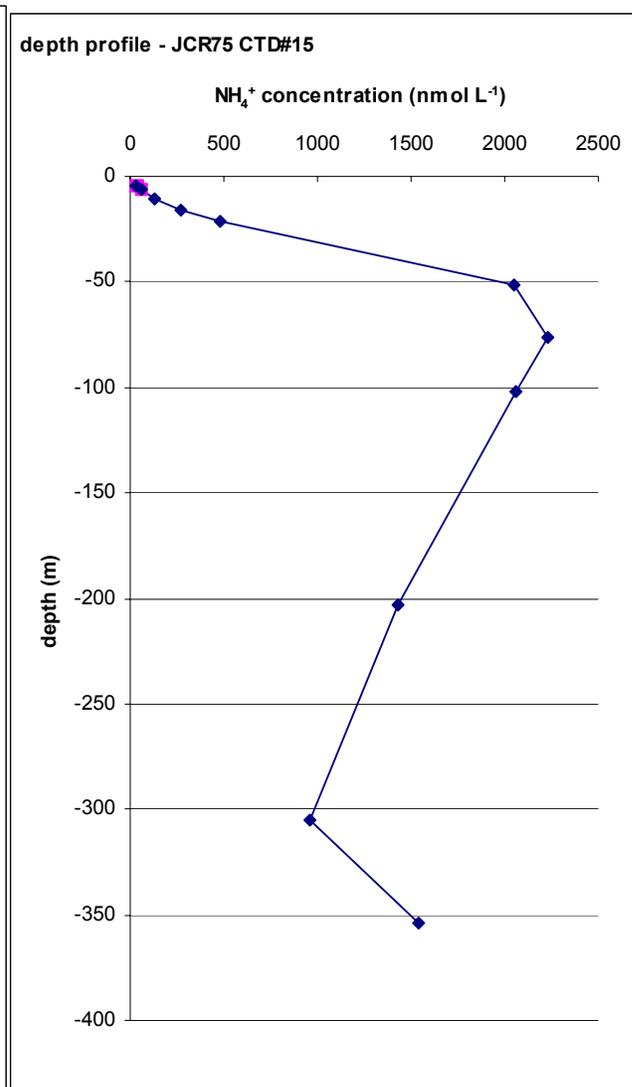
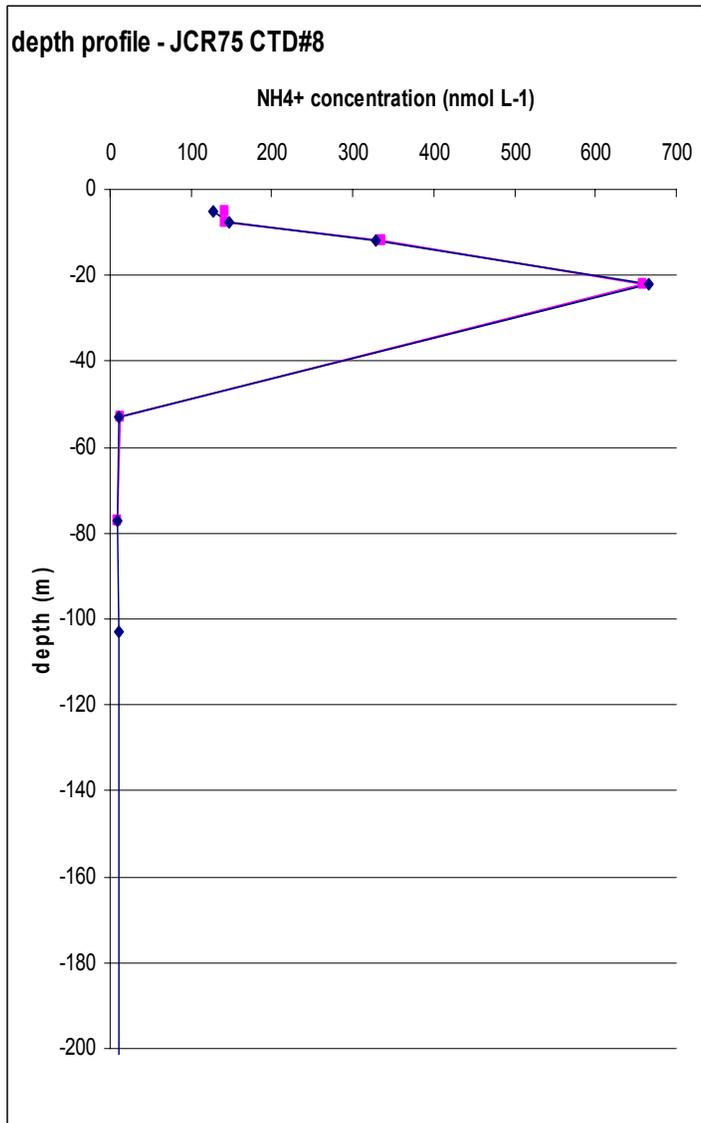
Calibration

All samples (seawater and atmospheric) were run with a set of standard additions for calibration. The response of the calibration curve was markedly different for milliQ (used for atmospheric samples) and seawater, due to the matrix effect. The advantage of standard additions for this fluorescence ammonium method is that samples do not have to be analysed within the time window of maximum fluorescence - the standard additions will lose their fluorescence at a rate proportional to the samples, so analysis can be done up to 3 days after sampling (although normally samples were run less than 24 hours after sampling). The calibrations below show 1 milliQ calibration and 1 seawater calibration.



Depth Profiles

Depth profiles from selected CTDs are presented below. Magenta points show replicates sampled separately from Niskin bottles. Replication was excellent, and comparison with auto-analyser ammonium concentrations was good (not shown here).

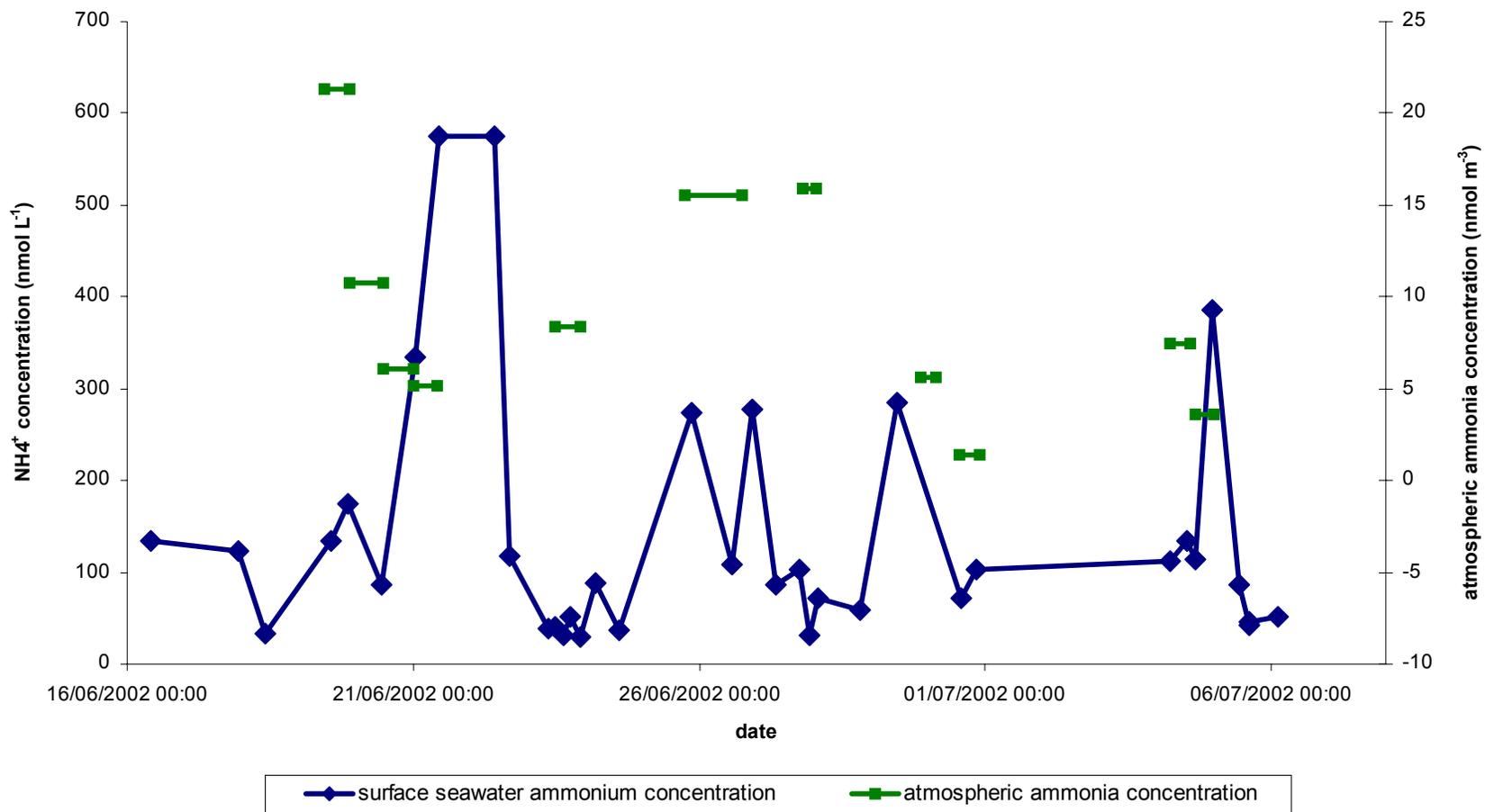


Underway and Atmospheric Sampling

Data from underway and atmospheric samples is shown below. It was surprising to see atmospheric concentrations as high as 15 nmol m^{-3} as far north as Svalbard. The atmospheric data is preliminary - errors have not been included.

JCR75 Cruise Report

JCR75 seawater ammonium / atmospheric ammonia data



Acknowledgements

Many thanks to the Officers and Crew for all their help, particularly Simon Wright, Deck Engineer and Norman Thomas, Electrical Engineer who made sampling on the monkey island possible. Also John Derrick, without whom the atmospheric work would have ground to a halt in the second week of the cruise, when the vacuum pump I was using broke down. Thank you also to all at DML for being so welcoming and helpful and for providing such an enjoyable cruise!

