SVERIGES COOLASTE MYNDIGHET 25 ÅR

09

ÅRSBOK YEARBOOK

Polarforskningssekretariatet

Swedish Polar Research Secretariat











ODEN
North Pole
LOMROG
2009
Halifax 5056
Copenhagen
Stockholm
Nairobi
Norrköping
Aarhus 3776
St. Petersburg
Piteå
St. Pauli
South Pole 20004

Innehåll Content

SWEDARCTIC 2009

SWEDARCTIC 2009

Forskarrapporter Cruise Reports

LOMROG II – continued data acquisition in the area north of Greenland

Chief scientist

Christian Marcussen
Geological Survey of Denmark and Greenland (GEUS), Copenhagen
Denmark

Introduction and background

The area north of Greenland is one of three areas off Greenland where an extension of the continental shelf beyond 200 nautical miles, according to the United Nations Convention on the Law of the Sea (UNCLOS) article 76, may be substantiated. However, acquisition of the technical data required for a submission to the Commission on the Limits of the Continental Shelf (CLCS), which include geodetic, bathymetric, geophysical and geological data (Fig. 1), poses substantial logistical problems due to the severe ice conditions. More information on the Danish Continental Shelf Project is available on www.a76.dk.

The LOMROG II cruise was organized in cooperation with the Swedish Polar Research Secretariat and the Canadian Continental Shelf Project.

The main objectives of the LOMROG II cruise were:

1. Acquisition of bathymetric data on both flanks of the Lomonosov Ridge.
2. Acquisition of seismic data in the Amundsen and Makarov Basins.
3. Acquisition of gravity data along Oden's track.
4. Accommodating research projects from, Denmark, Sweden, Greenland and the USA.

The LOMROG II cruise departed from Longyearbyen, Svalbard, on July 31, and returned on September 10. Areas with extreme ice conditions close to Greenland were avoided since the icebreaker Oden operated alone.

Bathymetric data acquisition

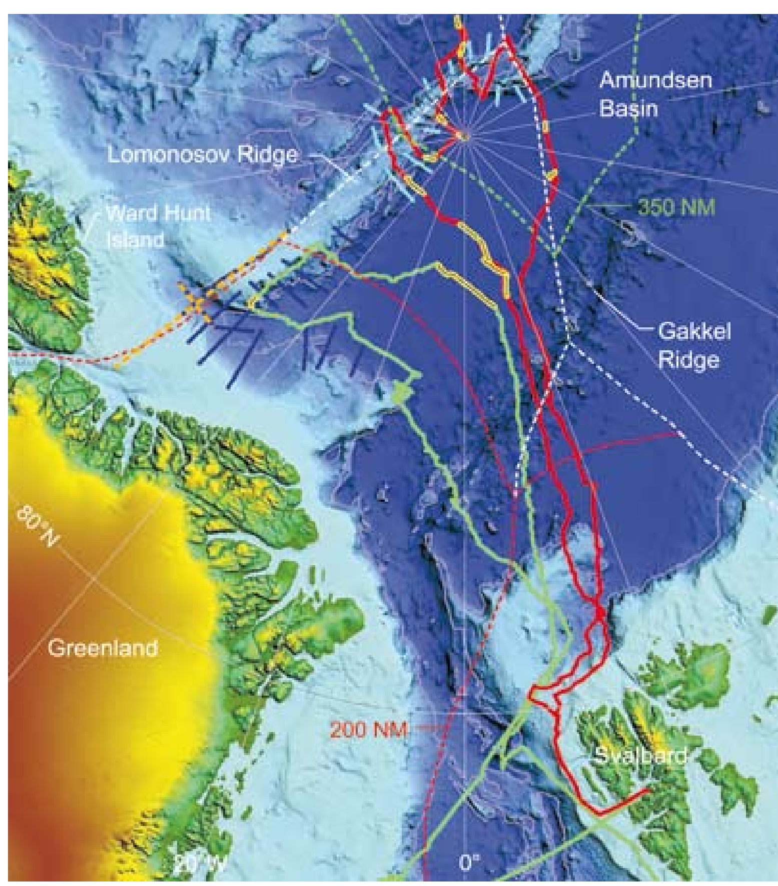
(Hell, Lamplugh, Bull, Firsov)

Highest priority was given to the acquisition of bathymetric data. Oden is equipped with a permanently mounted Kongsberg multibeam echo sounder as well as a Kongsberg chirp sonar (sub bottom profiler). During LOMROG II Oden travelled a total of 3 402 nautical miles. Multibeam bathymetric data as well as sub bottom profiler data were recorded continuously along the ship's passage.

Data quality is very dependent on the ice conditions. It is impossible to acquire high quality data during heavy ice-breaking and therefore alternative hydrographical surveying methods had to be employed in areas where high quality data was critical. During LOMROG I in 2007 the "pirouette method" was developed, where Oden would spin 360° in open water while sweeping the seabed with the multibeam.

Figure 1

Denmark's Article 76 fieldwork north of Greenland from 2006 to 2009. Orange stippled line – LORITA refraction seismic lines (2006); green line – LOMROG I ship track (2007); red line – LOMROG II ship track (2009), dark blue lines – bathymetric profiles acquired by helicopter during spring of 2009; light blue lines – bathymetric profiles acquired by helicopter from Oden during LOMROG II in 2009; yellow lines – seismic lines acquired during LOMROG I and II (2007 and 2009); white stippled lines – unofficial median lines.



Participants

Jens Blom
Nikolaj Blom
DTU CBS, Copenhagen, Denmark

Jeff S. Bowman
School of Oceanography, University of Washington, Seattle, USA

Uni L. Bull
Danish Maritime Safety Administration, Copenhagen Denmark

Nils Eriksson
Christian Schager
Sven Stenvall
Kallax Flyg AB, Sikfors

Yury Firsov
VNIIOkeangeologia, St. Petersburg Russia

Thomas Funck
John R. Hopper
Geological Survey of Denmark and Greenland (GEUS), Copenhagen Denmark

Daniella Gredin
Axel Meiton
Swedish Polar Research Secretariat

Gunnar D Hansson
Göteborg

Benjamin Hell
Markus Karasti
Ludvig Löwemark
Åsa Wallin
Department of Geology and Geochemistry, Stockholm University

Matti Karlström
Björkhagens skola, Stockholm

Mike Lamplugh
Canadian Hydrographic Services (CHS), Dartmouth, Nova Scotia Canada

Holger Lykke-Andersen
Per Trinhammer
Department of Earth Science Aarhus University, Århus, Denmark

Peter Löfwenberg
Margareta Osin-Pärnebjörk
Meteorological and Oceanographical Centre of the Swedish Armed Forces Enköping

Steffen M. Olsen
Leif Toudal Pedersen
Danish Meteorological Institute Copenhagen, Denmark

The acquisition of high quality multibeam bathymetric data covering both flanks of the Lomonosov Ridge was prioritised, enabling mapping of the foot of the continental slope (FOS) and the 2 500 m depth contour. This was achieved during 6 crossing of the Lomonosov Ridge with a distance of 10 to 55 nautical miles between profiles.

The multibeam profiles on both flanks of the Lomonosov Ridge were supplemented by a total of 96 soundings from the sea ice along 11 profiles with a distance of 5 km between soundings. The profiles were positioned parallel to Oden's track with a distance of approximately 15 nautical miles preferable on each side of the track and using the helicopter onboard Oden. A modified Reson Navisound echo sounder with an Airmar transducer was used (Fig. 4).

Seismic data acquisition

(Marcussen, Funck, Hopper, Lykke-Andersen, Trinhammer)

The second priority of the cruise was to acquire seismic data in the Amundsen and Makarov Basins on both sides of the Lomonosov Ridge (Fig. 2). In order to work successfully in the harsh conditions, the seismic equipment had to be modified. These modifications were made in cooperation with the Department of Earth Sciences at the University of Aarhus, based on previous experience with data acquisition in ice-filled waters:

- The streamer is considerably shorter than in open water. For the LOMROG II cruise, a 250 m streamer was used. This enabled deployment and recovery while the ship was stopped, which significantly decreases the risk of damage.
- The seismic source is considerably smaller and more compact than for open water surveys. This simplifies deployment and recovery if the equipment has to be brought on board quickly.
- Streamer and airguns are towed at a depth of approximately 20 m (more than twice the normal depth), below the wash from the ship's propellers, which are noise sources. A towing depth of 20 m also keeps the equipment from ice contact, where it can be pinched and damaged.
- Both airguns and streamer are connected with only one cable to the ship (the "umbilical"). This minimizes the risk of ice damage and simplifies a faster deployment and recovery.

The seismic signals are recorded as the time it takes for energy to return to the surface from a subsurface reflector. Sonobuoys were deployed along the seismic lines to record the seismic signals at larger offsets. The buoys transmit the signals back to Oden, where the data are recorded. A new deployment technique was successfully developed: a 10 m rope was attached to the parachute of the buoy in order to prevent the buoy from surfacing.

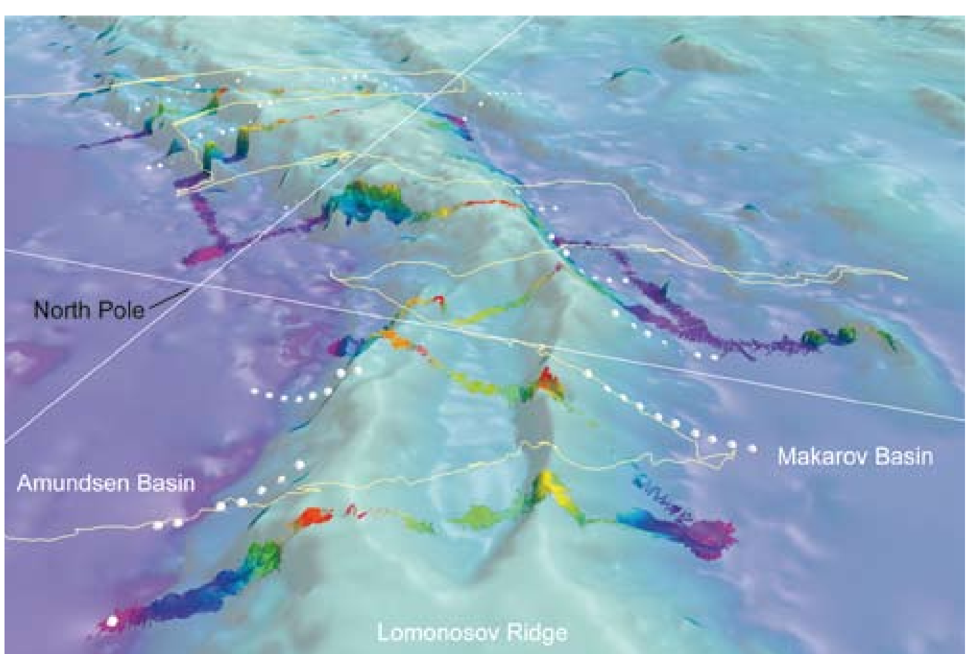


Figure 2

3D view of the area covered by new multibeam bathymetric data. The International Bathymetric Chart of the Arctic Ocean (IBCAO) is shown as background.

Oden's normal mode of operation under heavy ice conditions is to break ice at as high a speed as possible. If the ship gets stuck in the ice, normal procedure is to reverse and ram until the obstacle can be passed. However, this procedure is impossible with seismic gear behind the ship; the noise disturbs the data collection and the gear is sensitive to speed and risks getting trapped in the ice or tangled up in the propellers while reversing. To meet this challenge there are a number of options:

1. In easier ice conditions, where Oden can break ice continuously at only 3 to 4 knots, seismic data of reasonable quality can be acquired. This is a particular challenge since UNCLOS requires data to be collected at a certain density. The ice conditions often prevented us from acquiring data where needed.
2. Another option is to break a 25 nautical mile track by making two runs with Oden and subsequently acquiring the seismic data while passing through the track a third time (Fig. 5). This option, suggested by the captain and the first mate of Oden, has some obvious advantages. Data quality is superior since Oden can maintain a more steady speed while the risk of losing/damaging the seismic gear is reduced. However, it is more time consuming.
3. A third option is to use two icebreakers, as during LOMROG I in 2007. A powerful lead icebreaker breaks a track along a preplanned line. Oden trails behind acquiring seismic data. Augmented costs are partly compensated by faster and better data acquisition as well as providing the option to collect data along tracks longer than 25 nautical miles.

During the LOMROG II cruise a total of 380 km of seismic data were acquired, mostly by Oden using option 2 above. None of the seismic gear was lost in the ice and only one section of the streamer was damaged by the ice. In general data quality is better than that obtained during LOMROG I.

Gravimetric data acquisition and ice thickness measurements'

(Skourup)

Gravity measurements were carried out with a marine gravimeter of type Ultrasys Lacoste and Romberg, as on LOMROG I, mounted in the engine room close to the centre of mass of Oden (Fig. 8). The processed data yields gravity values with an accuracy and resolution that are dependent on the prevailing speed of Oden and ice conditions.

As a complement to the marine gravity data, gravity was measured on each bathymetric sounding station using an ice-dampened Lacoste & Romberg land gravimeter across the flanks of the Lomonosov Ridge (Fig. 8) and an additional 25 gravity readings were undertaken along Oden's track. At 21 of these stations the thickness of the sea ice was measured. Supplementary data was collected using electromagnetic equipment that can measure the conductivity of the subsurface, where the ocean is more saline than the sea ice and therefore a better conductor. The conductivity measurement can be converted to sea ice thickness.

Oden again provided an excellent platform for marine gravity measurements. Recordings in the ice were superior to data from many other icebreakers or even submarines, in spite of the irregular navigation with frequent course and

Participants

Henriette Skourup
DTU Space, Copenhagen, Denmark

Rasmus Swalethorp
Marine Ecology, National Environmental Research Institute, Aarhus University, Denmark

Kajsa Tönnesson
Department of Marine Ecology
University of Gothenburg

Matthias Wietz
DTU Aqua, Copenhagen, Denmark

Rickard Ånell
Armed Forces Centre for Defence Medicine, Linköping

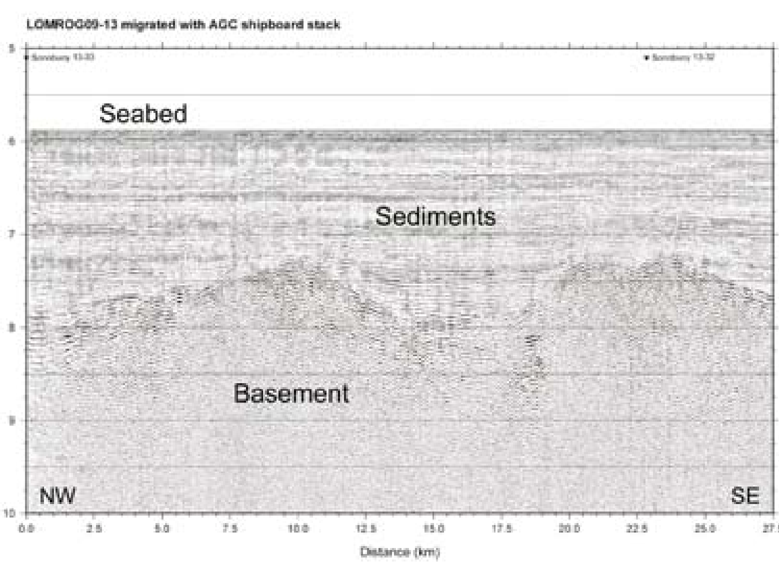


Figure 3

Seismic line acquired in the Amundsen Basin. Shipboard processing including a user defined spectral shaping filter proved to be very efficient in addressing some of the inherent noise problems of the seismic data recorded. Overall, the data quality is surprisingly good given the difficult acquisition environment with clear basement arrivals on all lines collected.

Figure 4

The Airmar 12 kHz transducer is lowered into a melt pond in order to make a bathymetric sounding.
Photo: Henriette Skourup.

Figure 5

Oden collecting seismic data along a prepared track. Photo: Thomas Funck.

speed changes. The Ultrasys Lacoste Romberg gravimeter employed proved stable and reliable with only a small drift and the gravimetric data collected will be useful both in connection with the Danish UNCLOS project, as well as an important new data contribution to the Arctic Gravity Project: http://earth-info.nga.mil/GandG/wgs84/agp/hist_agp.html.

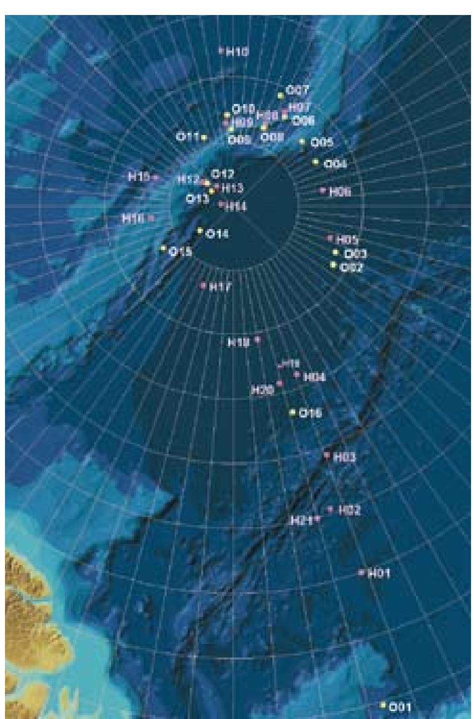


Figure 6

Station map including ship stations (yellow) and CTD stations from sea ice reached by helicopter (purple).

Oceanography – CTD measurements

(Toudal Pedersen, Olsen)

Knowledge of variations in water mass distribution along the cruise track is required for calibration of multibeam bathymetric data. The primary purpose of the oceanographic work during LOMROG II was thus to supply representative, near real time vertical profiles of sound velocity derived from CTD measurements of temperature, salinity and pressure as a function of depth. Data are collected either from the ship during stations or from 'satellite' stations on the sea ice reached by helicopter. Making optimal and synergetic use of resources, a number of add-on science projects dependent on oceanographic CTD measurements and collection of water samples accompanied the continental shelf project.

The oceanographic data acquired will contribute to the understanding of Atlantic water circulation in the Amundsen Basin in particular, and will yield an updated view of the state of the polar mixed layer and halocline structure in the area along the Lomonosov Ridge. Stations were also planned in the central region of deep exchange across the ridge as identified by the HOTRAX expedition in 2005, presumably of Canadian Basin deep water from the Makarov Basin towards the Amundsen Basin.

LOMROG I oceanographic data acquired closer to Greenland indirectly confirmed the existence of such exchange. LOMROG II data will potentially document the persistence of this exchange, partly by collecting data in the actual channels of exchange, a region also of interest to the paleoceanographic science team onboard.

In total 16 unique ship stations and 20 CTD stations on sea ice was completed (Fig. 6). Station work commenced during the transit track with relatively coarse spacing but was intensified in the study area along the Lomonosov Ridge including the intrabasin of the ridge. Ship stations made use of the onboard CTD rosette system owned by the University of Gothenburg and consisting of a 24-bottle rosette sampler equipped with 7.5-l Niskin type bottles. Ice stations were reached by helicopter where we made use of a pumped SEACAT in profiling mode in combination with a portable winch with 2 000 m non-conductive line (Fig. 7). Limited water was collected using just a single Niskin bottle by drop-messenger triggering. The portable system was supplied for the cruise by the Danish Meteorological Institute.

Microbial respiration in Arctic sea ice

(Bowman)

This project seeks to establish how large a role microbial respiration plays in determining the concentration of CO_2 within both first-year and multi-year sea ice, and thus influencing the exchange of CO_2 between sea ice and the atmosphere. Ice cores were retrieved at a total of 14 ice stations.

To measure the flux of CO_2 *in situ* a hand powered KOVACS ice core drill was used to create a hole (Fig. 9), into which a diffusion model infrared CO_2 probe with an airtight rubber gasket was inserted. The concentration of CO_2 within the headspace between the ice freeboard and the probe was monitored during the station visit at one-minute intervals.

To determine the physical characteristics an ice core was removed and drilled along its length. The interior temperature was measured through the drill holes. A second core was obtained for biological analysis. These analyses include cell count (DAPI), aerobically active cell count (CTC), community fingerprint (T-RFLP or ARISA), chlorophyll content, particulate and dissolved organic carbon and $\delta^{13}C$ values, and measurement of dissolved and particulate extracellular polysaccharide substances (EPS). A third core was obtained for incubation experiments. An atmospheric air sample was obtained at each site for carbon stable isotope analysis.

On return to Oden the ice core incubation chamber was placed in a refrigerator held at 1°C. Ice prepared at -80°C was used to lower the temperature to 0°C or slightly cooler. The concentration of CO_2 in the headspace of the incubation chamber was monitored over approximately 44 hours. Values for $\delta^{13}C$ of CO_2 produced during the incubation period will be determined to evaluate respiratory activity. Sections designated for filtration from the second core were melted in sterile filtered artificial seawater (ASW). This melting procedure maintained the salinity at around the approximate salinity of brine channels within the ice through the melting process. Once melted, the total volume of ASW and sample was determined, and measured quantities of the melt solution were filtered for each analysis.

All analyses will be conducted at the University of Washington's School of Oceanography, Seattle, USA, except for the stable isotope analysis. This analysis will be conducted at the Stable Isotope Lab of the Department of Earth and Space Sciences, University of Washington.

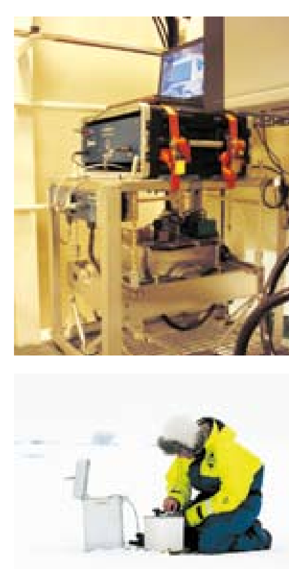
The signal from preliminary *in situ* CO_2 measurements was highly variable, with no obvious correlation to ice depth or type (first year or multiyear). As additional biological

Figure 7

CTD station on sea ice. The SBE19*plus*V2 CTD (centre) has just been retrieved. The mobile winch (blue) holds 2 000 m of synthetic rope and is powered by a generator. A Niskin-type bottle for water sampling lies in the snow. The winch is configured in boom assembly for working over the ice edge and the wire counter hangs over the open water. In the background, Kajsa Tönnesson, University of Gothenburg, is packing up her plankton nets with assistance from the helicopter pilot. Photo: Steffen M. Olsen.

Figure 8

Top: Marine gravimeter in the engine room on board Oden. Photo: Henriette Skourup. Bottom: Henriette Skourup conducting a gravity measurement on sea ice. Photo: Adam Jeppesen.



parameters become available, it is hoped to gain some understanding of the mechanisms shaping these signals. Preliminary results from the core incubations show a wide variation in signal. In all cases however, the sea ice was initially undersaturated in CO_2 and readily absorbed CO_2 from the incubation chamber head space. After equilibrium was reached an increase in CO_2 concentration within the headspace (hypothesized to be the result of microbial respiration) was apparent in most incubations. The timing and strength of this increase varied widely between cores.

Bacterial communities and bioactive bacteria

(Wietz)

This study addresses the investigation of marine bacterial communities in largely unexplored north polar habitats, as well as the isolation of *bioactive bacteria* from these locations. The term *bioactive bacteria* refers to marine bacterial strains that produce antibiotic substances inhibiting or killing other (disease-causing) microorganisms. Findings of novel bioactive bacteria would be of great value for the pharmaceutical sector as well as for food and aquaculture industries that share an increasing need for novel antibiotics in order to combat multidrug-resistant pathogens.

Raw environmental samples including water, zooplankton, sediment and sea ice were collected by standard procedures in the other projects onboard, and kindly shared with the present project for bacteria isolation and community studies.

Preparation of the raw samples for isolation of bacteria was carried out onboard, using procedures that enabled a sterile, and often freezing, storage until analysis work at DTU started.

The detailed analysis at DTU Aqua will consist of individual steps addressing (i) isolation of bacteria from environmental samples, (ii) screening of obtained isolates for bioactivity, and (iii) taxonomic, physiological and chemical characterization of selected isolates. Supporting culture-independent studies using mole-cular techniques will characterize the composition of bacteria communities at selected sites from where bioactive isolates were obtained.

Neither the cultivation of live bacteria nor molecular studies were possible aboard Oden, hence no results can be reported. Revival and screening of obtained bacteria will indicate the number of bioactive strains obtained, and allow a rating of their bioactivity. The most bioactive strains will be implemented in an ongoing multidisciplinary research project focusing on bioactive bacteria from the world's oceans. This project is based on samples from the Galathea 3 expedition, and the bioactive strains obtained during LOMROG II will represent a valuable complement to our global library of bioactive microbes that hitherto lacks strains from the high Arctic Ocean.

DNA of the polar seas

(Blom, Blom)

The overall goal of the project is to compare and establish a baseline for the genetic repertoire of microbial communities of various polar region environments: The deepest and coldest parts of the oceans, snow samples and sea ice cores.

To capture the microorganisms from the marine, snow or ice samples, the main procedure consists of a series of filtration steps. The resulting filters are re-suspended in buffer and stored at -80°C onboard Oden until the end of the cruise. From the captured microorganisms, the entire pool of DNA is extracted and sequenced using state-of-the-art high-throughput sequencing technology (454 or Solexa). The following bioinformatics analysis then allows for the identification of novel biochemical pathways, genes and enzymes that are presumed to function under high pressure, high salinity or low temperature. These findings can be correlated with the environmental and climatic parameters and also point to novel enzymes that may have use in technical industries.

For seawater sampling, the CTD-coupled water sampler was used.

Snow samples were collected from the surface of the sea ice and allowed to melt in sterile plastic bags.

Ice core samples were collected using an ice corer at each station, cut into pieces of 20–30 cm and stored in sterile plastic bags. After melting the water was filtered using the standard procedure.

Filtration of seawater or melt water from snow or ice cores was performed using the same procedure. Each bag of water was processed individually through the serial filtration setup.

After filtration of all bags from the same environment (e.g. same depth) the membrane prefilter and the cartridge filter were stored for further analysis.

A total of 18 stations were sampled. Including various depths at the same station, a total of 25 samples were obtained, including snow and ice core samples.

The stations in the Arctic Ocean were distributed along the cruise track and span water masses from both the Nansen and Amundsen Basins, separated by the Gakkel Ridge, from the Makarov Basin and from the intra-basin of the Lomonosov Ridge, thus representing a wide diversity of marine environments encountered.

The critical issue of acquiring sufficient microbial biomass, especially from the deepest samples, cannot be evaluated before additional lab tests have been done. However, the chances are high that enough microbial DNA can be extracted from the filters. In general, a volume between 28 and 168 l of water was filtered for each depth sampled.

Past environmental changes in central Arctic Ocean

(Löwemark, Karasti, Wallin, Karlström)

The Arctic plays an important role in the global climate system. Snow and ice cover in the Arctic influences Earth's albedo, controlling how much of the solar radiation is reflected back into space. Another important factor is the exchange of deep water masses between the Arctic Ocean and the North Atlantic, which is one of the fundamental components in the thermohaline circulation. To better understand how the Arctic has responded to past climatic changes, we need detailed records of environmental changes from different parts of the Arctic. On this cruise the aim was to obtain high resolution sediment records from the Lomonosov Ridge in the central Arctic that can reveal something about the deep water circulation in the Arctic basins, the sea ice history and the connection to the huge ice sheets that developed on the American and Eurasian landmasses surrounding the Arctic Ocean.

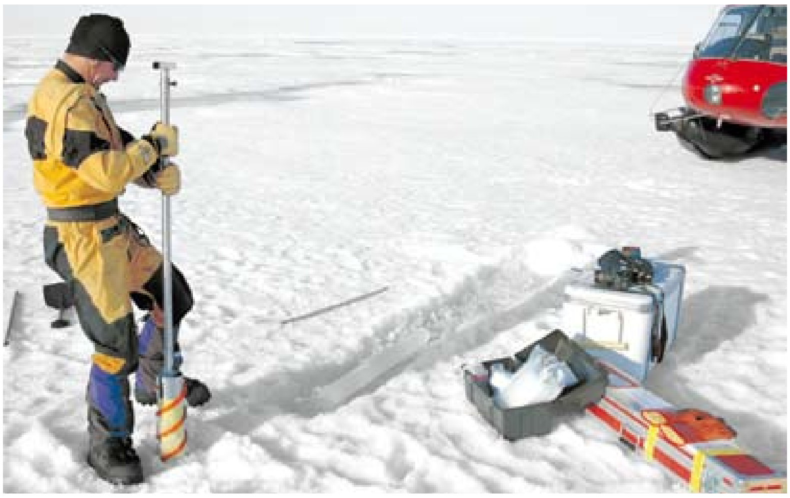


Figure 9

Ice coring procedure. A hand powered KOVACS ice corer was used to create a hole for *in situ* measurements of CO_2 flux and to obtain samples for biological analysis. To prevent contamination, cores were placed in a trench cleared of snow. Pictured: Jeff Bowman. Photo: Matthias Wietz.

The sediment cores were taken at water depths ranging from around 1 km to more than 3 km, using two different sampling devices: a gravity corer and a piston corer. The gravity corer basically consists of a steel barrel with a plastic tube inside that is lowered to the sea floor and pushed into the sediment by heavy weights. When the coring device is hoisted back to the ship, the plastic tube full of sediment can be pulled out and taken back to the lab for analysis. The piston corer is more complicated, but delivers longer and less disturbed records. The piston corer has a trigger weight attached to a release arm. When the trigger weight reaches the sea floor, the piston corer is released and falls freely for the last few meters, thereby reaching a considerably higher velocity when it impacts the sediment. To prevent deformation during penetration the piston corer is fitted with a piston that remains in a fixed position at the sea floor while the core barrel penetrates the sediment. Calculating the distance the coring device is permitted to fall freely as well as the length of the trigger weight line is crucial to obtaining good cores. During LOMROG II we had some initial problems adjusting these lengths to obtain optimal results. We also had serious problems with the winch, but despite this, 9 cores were successfully retrieved, totalling more than 45 m of sediment. The first results from our onboard observations suggest

Figure 10

Hydrobios MultiNet hanging from the A-frame at the aft-deck. The MultiNet is used for sampling mesozooplankton from five different depth intervals in the water column. Photo: Daniella Gredin.

that the Arctic Ocean was affected by massive flooding from an ice-dammed lake some 55,000 years ago. More results are forthcoming.

Zooplankton dynamics in Arctic Ocean ecology

(Tönnesson, Swalethorp)

Plankton are organisms defined as passive drifters of the sea. Through the process of photosynthesis phytoplankton convert solar energy, carbon dioxide, water and nutrients into organic compounds. Zooplankton, which constitute the next trophic level, modify the prey community through grazing and predation, and affect the benthic-pelagic coupling through sedimentation of organic aggregates. To understand how organic material and nutrients are channelled through the food web, it is important to quantify these rates.

The central Arctic Ocean is characterized by the most extreme seasonal light regimes of all marine ecosystems. In addition, the permanent sea ice cover impedes insolation. Both factors severely limit primary production and thus the food supply to higher trophic levels. The relative importance of the different components of the Arctic zooplankton community for grazing, predation and sedimentation has not yet been thoroughly investigated. Data on how these trophic interactions respond to environmental change is also required to improve our understanding of present and future structures of Arctic pelagic ecosystems.

The overall objective was to investigate zooplankton dynamics, invertebrate grazing and predation, and their role in the vertical flux. We focused on four dominant copepods: *Calanus hyperboreus, C. glacialis, Metridia longa* and *Pareuchaeta* spp. Several methods to quantify grazing and predation were used (gut fluorescence, gut content analyses and faecal pellet production) and trophic interactions were identified through fatty acid and isotopic profiling. The vertical distribution of zooplankton was investigated by multiple opening-closing net hauls from Oden (Fig. 10) and ice-borne stations reached by helicopter. In total 29 stations were sampled in the Nansen, Amundsen and the Makarov Basins crossing the Gakkel and Lomonosov Ridges. Planktons for experiments and biochemical analyses were collected from the upper 100 m and processed in the main lab on Oden.

Other activities on board Oden

A Danish media team (Martin Ramsgård and Adam Jeppesen) from Nature and Science was stationed on board Oden during the LOMROG II to document the cruise. Adam Jeppesen also carried out his own art project entitled North by Southwest (http://northbysouthwest.net), documenting the landscape of the Arctic Ocean and the life onboard Oden.

The Swedish Polar Research Secretariat invited a teacher (Matti Karlström) and a poet (Gunnar D Hansson) to join the LOMROG II cruise.

Conclusion

The LOMROG II cruise was very successful. The cruise has considerably improved the data coverage in the area north of Greenland

for the Danish Continental Shelf Project and increased our knowledge on how to operate under difficult ice conditions while acquiring bathymetric and seismic data.

The cooperation between the different science projects and the main project was excellent, a result of the optimised use of Oden's resources. In particular, the effective use of the onboard helicopter for two longer missions a day contributed to the success of LOMROG II.

The good cooperation between all crew-members of Oden and the helicopter crew is highly appreciated.

Figure 11

Oden reached the geographical North Pole on August 22 at 21:04 (UTC). The arrival at the North Pole was celebrated by raising the flags of the countries represented onboard Oden. After a glass of champagne on the bridge and a group photo on the sea ice in front of Oden, the expedition continued its scientific program. Photo: Adam Jeppesen.

LOMROG II – Datainsamling norr om Grönland

Expeditionen LOMROG II var ett forskningssamarbete mellan Danmark och Polarforskningssekretariatet som även inkluderade kanadensiska och ryska deltagare. Expeditionen är en del av datainsamlingsaktiviteterna inom det danska Kontinentalsokkelprojektet (www.a76.dk). Projektet syftar till att skaffa fram dataunderlag för att Danmark eventuellt ska kunna ställa krav på en utökad kontinentalsockel i området norr om Grönland, vilket slutligen fastslås av FN:s Havsrättskommission.

Trots att den svenska isbrytaren Oden opererade ensam i Arktiska oceanens svåraste isförhållanden lyckades man genomföra det planerade forskningsprogrammet. Det flerstrålande ekolodet samlade batymetriska data på båda sidor av Lomonosovryggen under sex passager. 380 km seismisk data samlades in i både Amundsen- och Makarov-bassängerna med hjälp av en bruten isränna. Gravimetriska data insamlades under hela expeditionen. Dessutom genomfördes 16 CTD-stationer för vattenprovtagning och 20 provtagnings- och mätstationer på havsisen. Flera biologiska och geologiska projekt ingick också i expeditionens forskningsprogram. Samarbetet mellan de olika projekten fungerade mycket smidigt vilket gjorde att Odens resurser som forskningsplattform utnyttjades optimalt.

Oden nådde den geografiska Nordpolen 22 augusti 2009 kl. 21:04 (UTC). Det var sjätte gången Oden besökte polen och tredje gången på egen hand.

Omslag Cover

Fotografer och fototillfällen
Dag Avango: nr 5, 6, 8 samt sidorna 3 och 20 – LASHIPA
Melissa Chierici: nr 23 – Oden Southern Ocean
Björn Eriksson: nr 1, 3, 4, 11, 13, 14, 19 – Oden Southern Ocean, nr 7, 24 – 25-årsjubileum
Agneta Fransson: nr 15 – Oden Southern Ocean
Daniella Gredin: nr 9, 10, 22, 26 – LOMROG II
Benjamin Hell: nr 2, 20 samt sidan 38 – LOMROG II
Adam Jeppesen: nr 18 – LOMROG II
Tomas Meijer: nr 21 – Arctic Sweden
Kajsa Tönnesson: nr 16, 17 – LOMROG II

Bild 12: Brandbergsskolan, Haninge – forskarbesök december 2009

Bild 25: Polarforskningssekretariatets framtida struktur skisserades på en servett 1983.
Med vid middagen på Grand Hôtel i Stockholm var bl.a. Anders Karlqvist och Bo J. Theutenberg.
Servetten förvaras nu i Polarforskningssekretariatets arkiv.

Redaktör
Sofia Rickberg

Produktion och grafisk form
Jerhammar & Co Reklambyrå AB

Tryck
Davidsons Tryckeri AB

Kartor del 1
Stig Söderlind

Översättning del 1
Proper English AB

Engelsk språkgranskning del 2
Amanda Roberts

Polarforskningssekretariatet
Box 50003
104 05 Stockholm

Tel 08-673 96 00
Fax 08-15 20 57

office@polar.se

www.polar.se

ISSN: 1402-2613
ISBN: 978-91-973879-9-6