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CRUISE REPORT

AMGG Cruise to the northern and eastern Svalbard margin

on R/V Helmer Hanssen, August 31st – September 12th, 2018

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Acknowledgements:
Bjørn Runar Olsen contributed with data processing and handling of acoustic data, and CTD equipment connected with this cruise. All cruise participants contributed to the collection of the data. They are all warmly thanked for their great contribution to make this cruise a great success.

This report was finalised on October 27th, 2018.

1. Summary

A total of 15 gravity cores (c. 60 m), and 31 CTD (conductivity-temperature-depth) casts were performed, 11 plankton net (no. 12 failed because the net was torn completely), 22 boxcore samples x 6 surface samples for each, searched for Siboglinid polychaetes and about half were sampled. A total of 137 lines of acoustics and seismics together were performed.

Chirp profiles and multibeam lines were acquired during transits and in surveys (mapping of new seep sites northeast of "Crater" area, seep sites in Storfjorden Trough and glacial grounding zone wedges, East Greenland Ridge, seeps in Hinlopen trough and Norske Banken, the east slope of Yermak Plateau at north 'record' on our part (81.40N), active and inactive pockmarks at Vestnesa Ridge and a small patch off PKF for WP4 .

All acoustic investigations were performed with soft-start of all instruments (Echo-sounders, deep-penetrating echosounder ('Chirp'), Multibeam echosounder and mini-airgun).

2. Objectives

The objectives of the cruise were:

- To collect CTD and water samples from the entire planned study areas for water properties and chemistry for ocean acidification studies.
- To retrieve plankton net samples for the study of planktic foraminifera and their preservation in relation to seeping of methane and ocean acidification
- To retrieve gravity-cores from active pockmarks of methane gas seepage in order to study the pore water and sediment records at new and previously investigated sites, at new sites to investigate foraminiferal-fauna assemblages in past and present environments affected by release of methane and reconstruct variations in activity of methane seeping in relation to climate and deep water temperature change
- To collect high resolution cores from contourites for bottom current variations in relation to climate change: East Greenland Ridge, Yermak Plateau and Vestnesa Ridge and their build-up by acoustic and seismic surveys
- To study new seep sites in Hinlopen Trough and Norske Banken
- To retrieve box cores for surface samples for living benthic foraminifera and the geochemistry of their shells
- To retrieve box cores at seep sites for macrofaunal studies and geochemistry to study the food chain

3. Participants

Scientific crew:

Name	Affiliation
Jan Sverre Laberg (Professor; chief scientist)	UiT
Rasmussen, Tine Lander (Professor; co-chief scientist)	UiT
Tom Arne Rydningen (Associate Professor, teaching assistant)	UiT
Siri Ofstad (phd-student teaching assistant)	UiT
Amando Lasebuda (phd-student teaching assistant)	UiT
Bjørn Runar Olsen (Engineer)	UiT

Naima El Bani Altuna (phd-student, teaching assistant) UiT
Emmelie Åström (post doc) UiT, BFE
Michael Carroll (Senior researcher) AN, UiT

Students (AMGG-GEO3144 and -8144):
Nils Willy Brückner (Phd Student)
Manuel Moser (Phd Student)
Henrikke Rokkan Iversen (master student, EKM)
Marie Elise Skjeldnes Planting (master student, EKM)
Calvin Steven Shackleton (Phd Student)
Pavel Serov (Phd Student)
Anna Sofie Kalstad (master student, EKM)
Kristine Reppen Samuelsen (master student, EKM)
Lis Allart (Phd Student)
Naima El Bani Altuna (Phd Student)

UiT = Uit, the Arctic University of Norway
AN= AkvaPlan Niva
BFE= Biology, Fisheries, Economy

4. Equipment

Acoustic equipment
- Kongsberg Maritime EM 300 multibeam echo sounder
- EdgeTech 3300-HM hull-mounted sub-bottom profiler ("Chirp"); 4*4 arrays
- Kongsberg Maritime EK60 splitbeam echsounder (18, 38 and 120 kHz)
- Mini-air-gun (*Sercel* GI)

Sediment sampling
- Gravity corer (total weight 1900 kg; 6 m steel barrel; inner diameter of steel barrel: 11 cm)
- Giant box corer (50*50*50 cm^3)
- Van Veen Grab (32 cm)

Water properties:
- CTD (Seabird 911 Plus) with compact rosette with water samplers

5. Methods

Sediment and foraminifera sampling

Sediment sampling was done by box coring and gravity coring to retrieve surface samples and sub-recent samples, respectively. For each station 4 samples for foraminifera, two of these coloured with rose Bengal. Plankton net WP2 used for sampling living planktic foraminifera.

Water properties

The water properties – temperature, salinity – were measured at every sampling station and at regular intervals using a *Seabird 911 Plus* CTD. Data collection was performed during downcasts at a speed of approximately 1.0 m/s. The data of selected CTD stations were used for records of modern water mass properties and nutrient records for ocean acidification studies. CTD stations were also taken at intervals to calculate sound-velocity profiles for calibrating the multibeam echo sounder system. Water samples were taken on a regular basis for water chemistry analyses for acidification studies.

Acoustic investigations

Seafloor mapping:
Swath-bathymetry surveys were carried out using a *Kongsberg Maritime EM 300 multibeam echo sounder*. Sound-velocity profiles of the water column for calibrating the equipment were recorded from CTD casts where necessary. Swath-bathymetry data was also collected during the transits between working areas and stations. The equipment worked well during the acquisition and the data are of good quality. Some preliminary data cleaning was performed using the software programme *Neptune* version 6.6.

Sub-bottom profiling:
High-resolution seismic profiles (Chirp), using an *EdgeTech 3300-HM* hull-mounted sub-bottom profiler, were collected along the ship tracks during the swath-bathymetry data acquisition during transits. Pulse mode and shot rate were varied, depending on the water depth. Soft start of the chirp was performed well out in the Barents Sea on day two, starting with 1% of the total effect, followed by a doubling of the effect every minute. The equipment worked well and the data are generally of good quality.

Echo-sounder flare observation
The echo-sounder installed on RV Helmer Hanssen was planned to be used to detect gas bubbles rising from seep sites at the seafloor on transits and on site surveys, e.g. PKF.

6. Educational outcome

The students were divided into two groups and all students participated in all aspects of the scientific program; the planning and retrieval of gravity-, and box-cores, Van Veen grab sampling, plankton net sampling, sampling program for living benthic and planktic foraminifera from surface samples (box-core samples) as well as in the planning of bathymetric and sub-bottom profiling programs. The students performed logging of whole cores, logging and descriptions of split cores, sieving of plankton samples with living foraminifera and sediment samples for planktic and benthic foraminifera-studies from surface sediment and overall procedures for handling of cores and samples. The also sampled macrofaunas from Van Veen grabs sampling. They participated in the stratigraphical assessment of cores and correlations of cores and correlations into a wider framework determined by the sub-bottom and bathymetric charts. Methane seep sites were also visited and sampled. Because of the very varied nature of the scientific program the students got first-hand experience with scientific sampling and data acquisition; ocean acidification and how to study the acidification processes; they learned about the extremely complicated sedimentology and morphology of slope and shelf glaciated margins. They experienced deep sea-, and shelf- environments in the Arctic and collected water samples from CTD-casts in the Arctic Ocean and eastern Barents Sea.