

First report from ARK XXIV/2 [10.07. – 17.07.2009]

Friday afternoon 50 scientists, engineers, technicians and students embarked in Longyearbyen, coming from seven nations and participating the second cruise leg of RV „Polarstern“ during her 24th Arctic expedition. RV „Polarstern“ left the Adventfjord of Longyearbyen as planned at 20:00 o'clock in the evening. This cruise leg will have two main regional areas of operation with different scientific objectives. For the first nine days we will work in the so called “Hausgarten”, a deep-sea observatory west of Svalbard at 79 degrees northern latitude. “Hausgarten” comprises 16 sampling stations covering a depth range of 1000 to 5500 meters. The planned research programme contributes to long-term time-series studies at this deep-sea observatory where we investigate the impacts of climate change on the Arctic slope ecosystem through field studies, observations and models since 1999. A special feature of the “Hausgarten” observatory is its full system approach, covering physical, chemical, biological and geological processes, and including observations from the ice cover to pelagic photosynthetic production to the deep sea bacterial life. This year, we will also service a variety of deep water experiments which include different disturbance scenarios from starvation to slope erosion.

The second half of the cruise will take place further south at 72 degrees northern latitude where the Hakon Mosby Mud Volcano (HMMV) is situated at 1250 meters water depth. The HMMV is a famous chemosynthetic ecosystem of the Northern margin, where methane fuels a diverse benthic community. The dynamics of the emission of the potential greenhouse gas methane at this mud volcano are poorly understood. Thus, one aim of this part of the mission ARK XXIV/2 is the implementation of a long-term observatory on the Norwegian margin to study mud volcano eruptions. The work at both sites serves as contributions to various European research projects such as ESONET (European Seas Observatory NETwork), EMSO (European Multidisciplinary Seafloor Observatories), HERMIONE (Hotspot Ecosystem Research and Man's Impact on European Seas), HYPOX (In situ monitoring of oxygen depletion in hypoxic ecosystems of coastal and open seas, and land-locked water bodies) and CHEMECO/DIWOOD (Colonization processes in CHEMosynthetic ECOsystems) EUROCORES EURODEEP). For our work we use the ROV QUEST owned by the Centre for Environmental Sciences (MARUM) at the University of Bremen. This 4000 m depth rated vehicle is equipped with several cameras including a very modern HDTV system, two manipulator arms and other scientific tools for deep-sea intervention.

On the 11 July „Polarstern“ reached our most westerly station of this campaign in the Molloy Deep, a 5600 m deep depression in Fram Strait, our deepest Hausgarten station. Here we sampled the water column and the deep-sea sediments by means of CTD, water sampler and multicorer at different water depths along an easterly course towards Hausgarten central station. On Monday morning a free falling lander was ready for deployment there and is now doing it's pre-programmed mission over the coming twelve months. Scientists of the new EU project HYPOX are joining the cruise to continue long term oxygen measurements at the "Hausgarten". Although the water column is far from hypoxia, the “Hausgarten” was selected as one of the HYPOX observatories: Previous oxygen data seemed to indicate a significant decline of oxygen concentrations in the bottom water that may be related to climate induced changes in deep water formation in the North Atlantic - Arctic Ocean transition. Within HYPOX, research related to dynamics in oxygen concentrations and fluxes in

the Arctic will be fostered by adding long-term optode oxygen sensors to moorings, and by additional measurements of various oxygen consumption parameters in the water column and sediments. The techniques applied include in situ chamber incubations and microprofiling as well as flux measurements in retrieved cores.

At 2500 m water depth the ROV QUEST was used to take samples around different experiments, which were initiated last year. These investigate the responses of benthic communities to different disturbance scenarios. We managed to look at changes in biomass, diversity, and remineralization rates using the ROV three times this week. On Wednesday we reached our northernmost station at 79° 44' N and 4° 30' E. We had to release a 2.5 km long mooring at this location from an area widely covered by ice floes. Unfortunately our mooring was trapped in the ice and moved away in southern direction with the drifting ice. After several hours we finally succeeded to localize the ice floe under which the releaser unit was supposed to be and „Polarstern“ crushed this one into two big pieces. Seconds later one of the orange floating units popped up and we were able to pick this end of the mooring to safely recover the entire array. We were more than happy about this final result of our efforts because all measurement devices worked properly over the past twelve months, and both sediment traps (one attached close below the sea surface the other close to the seafloor at 2500 m water depth) collected sinking particles over the entire deployment period. We have finished our research activities for 2009 at Hausgarten observatory on Sunday afternoon 19 July to start our 430 miles long transit to the Hakon Mosby Mud Volcano, for the ESONET demonstration mission LOOME.



Three pictures attached

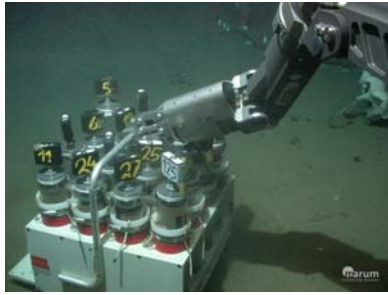
HYPOX\_LANDER:

Hypox lander equipped with oxygen optodes at the surface soon after release at Hausgarten



#### OXYGEN\_MUCROPROFILER

- Oxygen microsensors profiles measured in and next to starvation experiments. Here the benthic infauna has been closed off from sedimentation of fresh organic matter for a year.



#### PUSH\_CORE\_RACK

- ROV QUEST deploys a push core rack for the sampling of sponges and surrounding sediment fauna