the variability of sediments in the study area with respect to sedimentation and transport processes.

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5.2 Benthic distribution patterns and turn-over processes

S. Brückner, M. Dickmann, C. Hasemann, K. v. Juterzenka, T. Renneberg, I. Schewe, T. Schott, N. Queric

Objectives

Objectives of the planned biological and biochemical investigations within the ARK-TIEF project are to assess large-scale distribution patterns of benthic organisms in and around channel systems crossing the eastern Greenland continental margin and the deep central Greenland Sea, and to estimate benthic processes within these areas and their relevance for the Arctic Ocean ecosystem. Based on activity and biomass data it might be possible to estimate the frequency and intensity of particle-loaded near-bottom currents within the channels, and to evaluate the quality of the suspended matter. The combination of results from optical surveys assessing distribution patterns of the larger epibenthic fauna with activity and biomass data for small sediment-inhabiting organisms from biochemical analyses will help to determine whether a channel system is "active" or "fossile".

Work at Sea

Small benthic organisms

We hypothesize that the distribution as well as the activity of small benthic organisms are corresponding to the topographic and biochemical features of channel systems in terms of depth and distance to the channel centre. Benthic microbial processes are suspected to be directly connected to the occurrence of meio- and macrofaunal organisms.

Sampling was performed by using a multicorer sampling system, allowing the investigation of an undisturbed sediment surface. A total of 11 stations were sampled in the vicinity of the channel system. Subsamples for abundance, diversity and activity of bacteria and meiofauna, as well as the biogenic sediment compostion were taken using 5 ml and 20 ml syringes with cut off ends (see also section 9). Subsamples were sectioned horizontally in 1 cm-layers and analysed separately to investigate

gradients within the sediment column. Bacterial production was measured via labelled leucine incorporation. Sediment-bound chloroplastic pigment equivalents (CPE) were determined on board to quantify organic matter input from primary production. To evaluate microbial exoenzymatic activities, esterase turn over rates were determined with the fluorogenic substrate fluorescein-di-acetate (FDA). Analyses of phospolipids and proteins will contribute to the assessment of living organisms and the proportion of detrital organic matter in the sediments. To assess the presence of traces, tracks and other "Lebenspuren" of macrofauna, a photo of each core surface was taken before sampling.

Mega-/Epifauna

The Mega-/Epifauna in the vicinity of the channel system was observed by means of the Ocean Floor Observation System (OFOS), which is suitable for seafloor imaging in water depth down to 6000 m. The OFOS frame is equipped with a still camera (Benthos), a black and white video camera (Deep-Sea Power & Light), two floodlights with 250 W each, flashes (600 W/s) and three laser pointers in a fixed distance of 52 cm from each other as a size reference. The still camera was triggered on command or timer-controlled in 30 s intervals and was loaded with Kodak Ectachrome 100 ASA film, providing up to 800 shots per track. The whole system was towed across the seafloor in a distance of approx. 1.50 m with a drift velocity of approx. 0.5 kn. The distance to the bottom has to be controlled by the winch operator, by adjusting the cable length according to the video information. To sample the epibenthic fauna and obtain reference material for the analysis of OFOS images, a small Agassiz trawl (width 1 m) had been used.

During the cruise, 7 OFOS transects have been performed. At St. 04, a first survey was made at the continental slope off Bear Island and was used to optimise the distance to the seafloor, camera specifications and timer-controlled operation and check laser performance. Overall, six transects were obtained in the main investigation area off East Greenland and will provide approx. 3050 colour slides of the sea floor. Four transects were placed across the ARKTIEF channel according to HYDROSWEEP information and PARASOUND profiles (St. 65, 69, 78, 84). St. 78 represents a profile at the central section of the channel which had been studied in 1999 by the ROV VICTOR6000 and in 2001 by the OFOS system and therefore allows an evaluation of interannual variability. To get an idea about the colonization of the deep-sea floor outside the channel, two transects were placed north and south of the central area (St. 73, 82; see Fig. 9). In the course of the transects, multicorer samples were taken inside and outside the channel to analyse small biota.

Transects across the channel covered at least the bottom of the channel, slope and the adjacent seafloor (water depth about 3000 – 3200 m; transect length 1 to 2 nm). A first impression of the benthos fauna in the vicinity of the channel system is given by video information and short pieces of photo film, which were developed on board for quality control reasons. Seafloor images revealed two species of elpidiid holothurians, crinoids, traces and calcareous test of the irregular echinoid *Pourtalesia jeffreysi*, actinaria, gastropods and small pantopods as well as a variety of traces and tracks. Some ball-shaped sediment-coloured and bright structures are thought to represent several species of deep-sea sponges (e.g., *Thenea abyssorum*). Small pieces of solid substrate (e.g dropstones) are colonized by anthozoans (Fig. 10).

Two trawl catches along the channel axis provided material of dominant epibenthic organisms (mainly elpidiid holothurians, at least three species of deep-sea sponges, pycnogonids). Image analysis and species determination will take place at the home institute.

The results of quantitative and qualitative evaluation of bacteria, meiofauna and epi-/megafaunal organisms will contribute to the knowledge on the habitat heterogenity, distribution patterns, as well as biomass and activity patterns of benthos communities in this channel system, which had become the focus of interest in 1999.

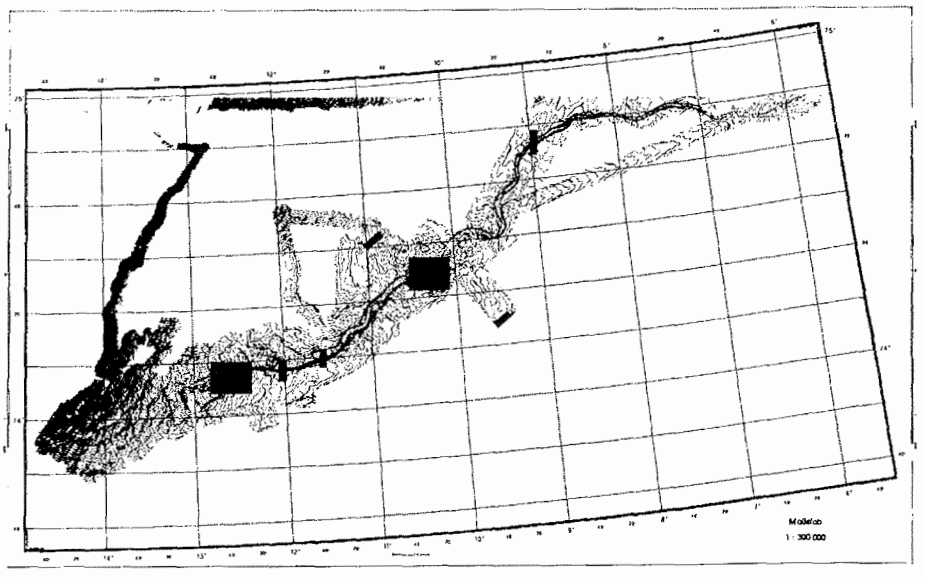

Fig. 9: Location of the sections in the ARKTIEF area where samples were taken and OFOS was deployed.
Abb. 9: Lage der Schnitte im ARKTIEF-Gebiet, auf denen Proben genommen und OFOS-Aufnahmen ausgeführt wurden.

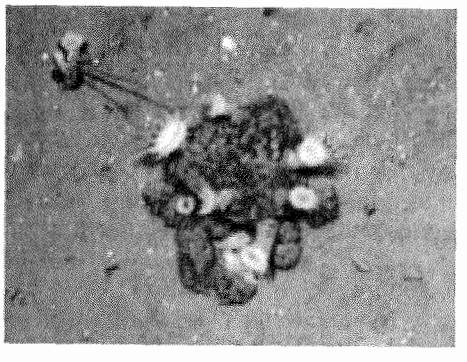

Fig. 10: Sea floor images taken with OFOS which show that solid substrate (e.g. drop stones) is colonized by anthozoans.
Abb. 10: Fotografische Aufnahmen mit OFOS, die zeigen, dass Hartsubstrate wie „drop stones" mit Anthozoen besiedelt sind.