

MULTIDISCIPLINARY INVESTIGATIONS AT A DEEP-SEA LONG-TERM STATION IN POLAR REGIONS

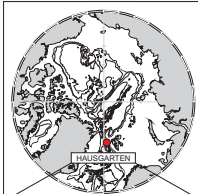
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BACKGROUND

The deep sea represents the largest ecosystem on earth. Due to its enormous dimensions and inaccessibility, the deep-sea realm is the world's least known habitat. To understand ecological ties, the assessment of temporal variabilities is essential. Only long-term investigations at selected sites, describing seasonal and interannual variations, can help to identify changes in environmental settings determining the structure, complexity, and the development of deep-sea communities. The opportunity to measure processes on sufficient time scales will also help to differentiate between natural variations and environmental changes due to anthropogenic impacts.

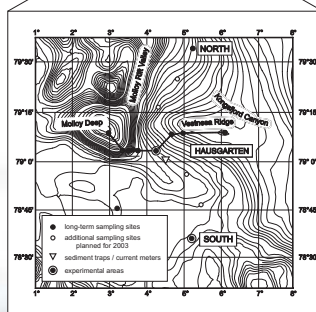


HAUSGARTEN

The AWI deep-sea long-term station "Hausgarten" was established in summer 1999 about 150 km west of Svalbard. It consists of 9 sampling sites along a depth transect between 1000 - 5500 m, which is revisited yearly to analyse seasonal and inter-annual variations in biological, geochemical and sedimentological parameters. In summer 2003, we will increase the total number of permanent stations to 15 by introducing additional sampling sites along a latitudinal transect following the 2500 m water depth isobath. Two sites at 2500 m were chosen for biological long-term experiments to study causes and effects of gradients on deep-sea biodiversity (see below).

CORE MEASUREMENTS, PART I

Pelagic Zone:
particle flux (biogenic, lithogenic), currents (speed, direction)
Near-Bottom Zone:
oxygen concentrations, nutrients (NH_4^+ , NO_3^- , PO_4^{3-} , Si, etc.), bacterial densities, near-bottom currents in high-resolution
Sediment-Water-Interface:
carbon remineralisation (oxygen microelectrodes, sediment community oxygen consumption)



CORE MEASUREMENTS, PART II

Sediments:
granulometry, porosity, organic carbon, carbonates, opal, C/N ratios, biomarker (alkenone, n-alkanes, etc.), organic matter input (phytodetrital pigments),
Benthic Organisms:
meiofauna - megafauna: densities, dispersion, biodiversity; small biota biomass estimates (phospholipids, proteins); bacterial activities, densities, biomasses



MICRO PROFILER

Microelectrodes are used in-situ to assess oxygen gradients in upper sediments layers.

CURRENT METERS

Arrays of current flags allow high resolution short time measurements above the seafloor.

REMOTELY OPERATED VEHICLE (ROV)

Within a cooperation with IFREMER we have access on the French ROV "Victor 6000" (at least) on a two-years basis. The ROV is used for a targeted sampling of organisms and sediments, and to install and maintain in-situ experiments.

FREE-FALLING SYSTEM, TYPE I

A bottom-lander equipped with a scanning sonar, cameras and baited traps is used to study the spatial and temporal attraction of benthic scavengers by large food-falls.



MOORINGS

Since summer 2000, we deploy moorings carrying sediment traps and current meters near the central "Hausgarten" station. Complementary current meter data are available from moorings deployed within the EU-project VEINS in the same area.



MULTIPLE CORER

A video-controlled MUC is used to sample virtually undisturbed surface sediments.

BOTTOM WATER SAMPLER (BWS)

BWS allows to sample near-bottom waters in order to assess interfacial solute fluxes.

AUTONOMOUS UNDERWATER VEHICLE (AUV)

In fall 2003, we will get a 3000 m deep diving AUV (Bluefin Robotics Corporation, USA). The vehicle will be used for large-scale 3-dimensional CTD tasks, for high-resolution seafloor mapping, and visual observations at the seafloor.

FREE-FALLING SYSTEM, TYPE II

A bottom-lander carrying up to four respiration chambers is used to assess remineralisation rates by the sediment-inhabiting community.

EXPERIMENTAL APPROACHES TO STUDY EFFECTS OF GRADIENTS IN PHYSICAL, CHEMICAL AND BIOLOGICAL PARAMETERS ON DEEP-SEA BIODIVERSITY

The Disturbance Experiment

Hypothesis: higher diversity in disturbed areas

- artificially produced physical disturbances at the sediment surface using the ROV
- sediment sampling after two years to assess the recovery potential and long-term effects of the sediment disruption on the diversity of the benthic community



The Food-fall Experiment

Hypothesis: large food-falls are natural disturbances

- fish bait anchored and marked at the seafloor
- deployment for different periods of time
- sediment sampling of both, influenced and control sites with regard to organisms composition, diversity, activity



The Colonisation Experiment

Hypothesis: higher diversity due to the availability of hard substrates in a soft-sediment environment

- metal frame carrying plates of stone, plastic, and wood
- plates will be removed by a ROV and investigated for sessile species depending on hard substrates



The Exclusion Experiment

Hypothesis: lower diversity due to lower spatial heterogeneity

- plastic cages (60 x 40 x 25 cm) installed at the seafloor
- exclusion of "benthic engineering" by large motile epifauna
- sediment sampling of covered areas and control sites with regard to the degree of sediment structures, species composition, diversity



The Mimic Experiment

Hypothesis: higher diversity around sponge mimics

- plastic spheres simulating sessile organisms, i.e. sponges
- mimics modify the near-bottom flow field, thus altering the erosion or sedimentation of particulate organic matter
- sampling of sediments around mimics will elucidate the relevance of biogenic structures for sediment-inhabiting microorganisms



For further informations please visit our Web-Site: <http://www.awi-bremerhaven.de/Research/ProjectGroups/DeepSea/index.html>