

METEOR 61/1

First Weekly Report

19. – 25. 4. 2004



FS METEOR

51°27'N / 11° 45'W

METEOR cruise 61/1 started on Monday 19.4. in Lisbon. The expedition is dedicated to carbonate mound and coral research in the areas of the Porcupine Seabight and the Rockall bank west of Ireland. The scientific party comprises of 28 scientists from 7 nations. The passage to the first working area along the west coast of the Iberian Peninsula and across the Bay of Biscay took three and a half days. On Thursday afternoon (22.4.) we arrived at our first station at 51° 10'N, 11° 40'W in the Belgica Mound province where we deployed the ROBIO Lander of the OceanLab Group (University of Aberdeen).

During the first days of our expedition, we focused on biological and geological surveys over coral-covered carbonate mounds in the Belgica Mound Province. Within an area measuring 20 nm across, more than 20 mounds between 50 and 150 m in height determine the seabed topography at depths between 1000 and 600 m. These mounds are aligned in two groups. The deeper mounds at 900 to 1000 m depths were targeted in the first three working days of this leg. We visually inspected two previously unexplored carbonate mounds with the OFOS system, which we named Castor Mound and Pollux Mound, next to the well-known Therese Mound. Both mounds are about one kilometre long and around 500 m wide at the base. The OFOS coral habitat mapping carried out on Castor and Pollux yielded spectacular results that indicate the current-control on the distribution of corals and sedimentary structures. The southern flanks are rich in live coral thickets consisting of *Lophelia pertusa*, *Madrepora oculata* and gorgonian fans. At the lower slope, the thickets are confined to slope-parallel sedimentary ridges with rippled pteropod-foraminifer sands as through infill. Near the summit of the mounds, the thickets coalesce and form a 100%-cover of a dense coral framework. Hexactinellid sponges contribute significantly to the framework construction. The northern slope is structured with sedimentary ridges as well. The sand was not rippled but frequently admixed with dropstones. The octocoral abundance decreases but antipatharians become more abundant at the northern slope. Several lost gillnets with trapped coral bycatch were documented at the northern slope of Pollux Mound. Sediment samples were taken with the box-corer and van Veen-grab to further collect live organisms (Figure 1) and to further understand the sedimentary composition of carbonate mounds.



Figure 1. Van Veen grab sample from a coral thicket showing *Lophelia pertusa* (alive and dead) and silicate sponges.

Two CTD/Rosette water sampler surveys across the Galway Mound were driven in highly resolved longitudinal and a latitudinal transects and the first MOCNESS mesozooplankton hauls were also carried out in this area.

Two types of lander were deployed to study the occurrence and activity of necrophagous organisms.

The baited ROBIO lander (Robust Biodiversity lander) was deployed at 1000m. Digital still images were captured every minute for 8 hours. The images revealed the dominant scavengers were *Synphobranchus kaupi*, and lysianassid amphipods. Other organisms attending the bait were several elasmobranchs (Figure 2) and teleost fishes, *Mora moro* and *Phycis blennoides* (Figure 3). Baited small traps attached on the underside of the lander recovered a number of lysianassid amphipods. When positioned in front of a low light camera the amphipods were shown to be bioluminescent, emitting a pale blue light visible to the naked eye.



Figure 2: *Synaphobranchus kaupi* and unidentified elasmobranch at the bait.



Figure 3: *Phycis blennoide* inspecting the carcasses.

A GEOMAR Modular Lander, carrying the OceanLab instrumentation was deployed and positioned using the video launcher on Galway Mound. A low-light camera was positioned in front of a baited benthic chamber from a GEOMAR BC lander with the aim of recording bioluminescence emitted by resident organisms of a coral thicket. A total of thirteen 4-minute sequences were captured over 11 hours. The footage showed that there was not a consistent amount of bioluminescence. There was no evidence that bioluminescence is related to any feeding activity but emission of light was observed during the closing of the chamber, probably as a result of mechanical stimulation. The dominant scavengers were found to be lysianassid amphipods and *Synaphobranchus kaupi*.



Figure 4: Deployment of a GEOMAR BC-Lander carrying an OceanLab bioluminescence observatory.

An Bord sind alle wohlauf.

Es grüssen.

O. Pfannkuche & alle Fahrtteilnehmer

METEOR 61/1

Second Weekly Report

26.4. – 2. 5. 2004



FS METEOR

56°30'N / 17° 30'W

The first half of our second expedition week was dedicated again to investigations in the Belgica Mound province. All sampling gear came into action and lander work with ROBIO and BC-Lander was continued.

As one highlight of the cruise, a long-term observatory (GEOMAR Modular Lander) was deployed (Fig. 1A) video-controlled under ideal weather conditions in a coral thicket on top of Galway Mound (Fig. 1B). The system will be recovered in mid August with RV POSEIDON. The long-term observatory is equipped with a wide range of sensors, sampling and experimental gear. This includes a storage CTD, 3 acoustic current meters, a sediment trap and a stereo camera system. SAMS/Oban provided a number of optical sensors (transmissiometer, fluorometer, optical backscatter) measuring particle dynamics in 50 cm distance from the sea floor. A 300kHz ADCP heading upwards into the water column measures every 15min the current regime in 3m cells within a range of 8m to 110m above bottom. Simultaneously, a downlooking 1200kHz ADCP measures currents in 10cm cells within the first 100cm of the sediment-water interface. Another acoustic current meter equipped with a turbidity meter is mounted next to the sediment trap which samples in 8-day intervals the particle deposition. The time of this deployment will allow the assessment of strong seasonal fluctuations in the particle flux from the spring bloom to the summer situation. The stereo images taken in 3-hour intervals will be used for the analysis of structural changes on the reef as well as for the description of occurrence and activity of vagile megafauna. Benthic colonisation experiments will provide information about of the colonisation and modification of various substrates exposed on the foot plates of the lander.

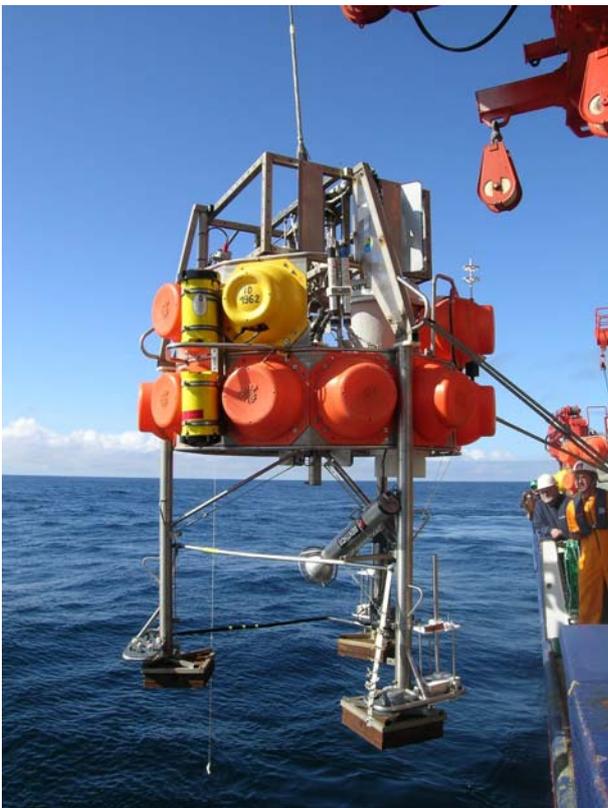


Figure 1A:
Deployment of the Deep Sea Observatory



Figure 1B:
The observatory settled in a coral thicket on the sea floor. The picture was taken from the already disconnected video-launching unit.

Our CTD surveys and water sampling focussed on the understanding of the spatial variability of ambient water masses at the carbonate mounds and their associated deep water coral ecosystems. Several series of high resolution CTD profiles were carried out focussing on two selected mounds: Thérèse Mound (51°25.70'N, 11°46.29'W) and Galway Mound (51°27.09'N, 11°45.12'W). Both sites exhibit a physiographic pattern, which is obviously controlled by the prevailing slope parallel current regime. The arrangement of the CTD profiles followed the predominantly south to north oriented current regime and perpendicular to it. The east – west temperature transects show a clear differentiation in a downslope and upslope orientation. The mounds obviously form a barrier prohibiting a mixing of the upslope and downslope bottom waters. More spectacular is the pattern of dissolved oxygen in the near bottom water, where clear differences in oxygen content were observed north and south of the mounds. Similar high resolution profiles were carried out at Kiel Mount on the SW Rockall Bank.

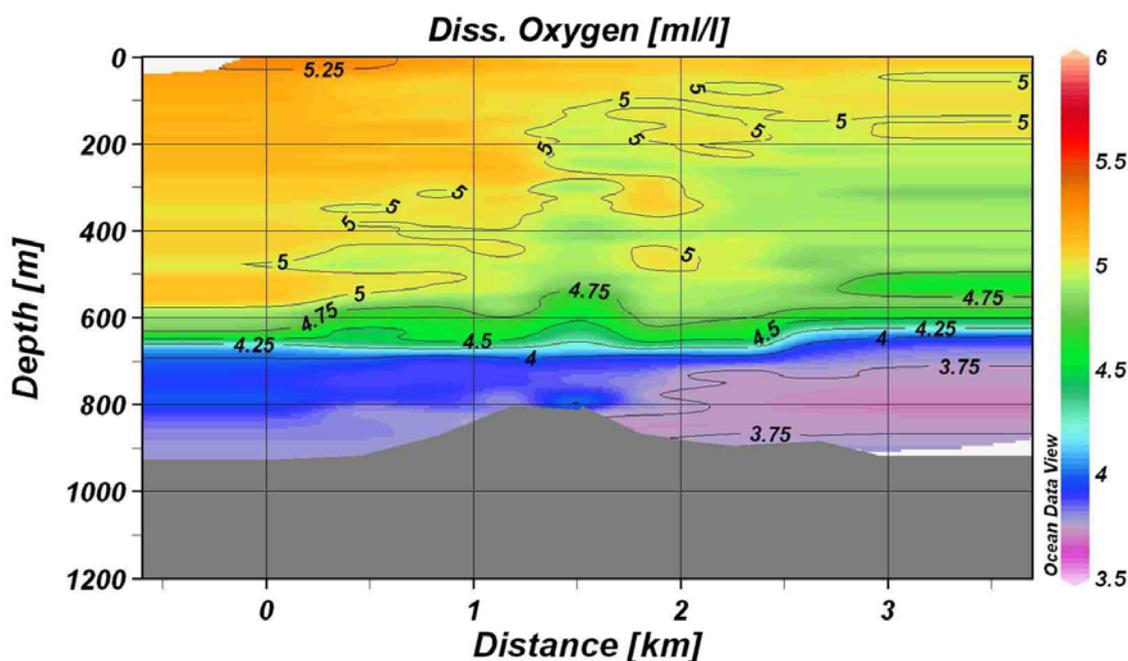


Figure 2: N-S profile of the dissolved oxygen over Galway Mound

Plankton studies by the IHF-group (University Hamburg) aimed to investigate the role of corals as potential predators for zooplankton. In this context it is of special interest to analyse the faunal composition of the bottom-near layers as well as the structure and dynamics of the diurnally migrating zooplankton of the deep scattering layer above the upper slopes and the summits of mounds. Furthermore it is analysed if spawning of corals and associated fauna takes place in spring and if this signal can be detected in surface near layers by the occurrence of eggs and larvae of these organisms.

Pelagic metazoans were collected above the slopes and the summit of Galway Mound. Standard device for the quantitative collection of zooplankton was a 1m²-MOCNESS equipped with 9 nets of 0.333 mm mesh size (Fig. 3). The net can be opened and closed sequentially and is equipped with an integrated CTD. All data are transmitted to an onboard computer. The water column was traversed by stratified oblique tows and bottom-near horizontal hauls. To investigate diel vertical migrations of the zooplankton the hauls were performed during day and night. To detect the depths and dynamics of the deep scattering layers the data of a 33kHz echo sounder were recorded during the stations.

First qualitative studies showed relatively high abundances of fish- and invertebrate larvae in all samples, one of the latter occurred in masses. Whether these are larvae of corals has to be further analysed. Several specimens of pipe fishes (Family Syngnathidae) were caught in the upper 50m during Haul 2, 3, 7. In the bottom-near layers fish larvae, decapods as well as medusae were found in greater numbers. In addition adult polychaets were caught at 120m depth.



Figure 3: Deployment of the 1m²-MOCNESS with 9 netbags.

Gravity coring was carried out to obtain records of Late Pleistocene carbonate mound development. In particular, the impact of intermediate water circulation changes and varying sediment fluxes during climatic fluctuation will be investigated. Another objective is to further constrain the area of Glacial North Atlantic Intermediate Water formation which has been suggested to have taken place in this region. We selected three sites where previous box cores, grab samples, and OFOS observations indicated recent sediments suitable for gravity coring. A 277cm and a 405 cm and long core of hemipelagic foraminiferal mud with abundant coral fragments were retrieved from the top of Pollux mound. These cores will facilitate to verify and accomplish previous records of mound growth phases during interstadial-alike climate periods. Another core from the vicinity of a buried mound retrieved 512cm of dark grey hemipelagic mud representing a long time period of off-mound sedimentation. A fourth deployment in lag deposits and sands with mega ripples on the slope terrace basin ward rimmed by mounds Galway, Therese and Pollux was not successful.



Figure 4: Handling of core SL-3 after retrieval



Figure 5: Core SL-1 from mound Pollux showing several coral fragments and baffled sediment.

During the second week of M61-1, the IPAL-Erlangen team was continuously engaged in the sediment sampling survey and in the documentation of the coral-associated fauna. With a portable high-quality image analysis system, they were able to document many bathyal molluscs alive for the first time. A highlight of the TV-grab sampling (Fig. 6) in the Belgica Mound Province was the successful sampling of a *Lophelia* limestone probably of early to mid Pleistocene age.

We finished our station work in the Belgica Mound Province on Wednesday (28.04) and steamed in north-west direction to the south-western part of the vast Rockall Bank an hitherto greatly unexplored territory. Strong headwinds retarded our approach.

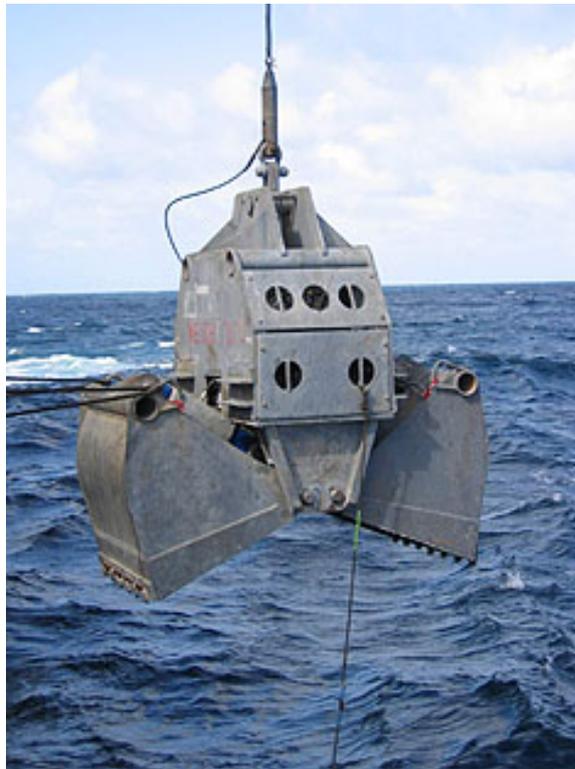


Figure 6: Deployment of the TV-grab.

At Friday 30.04. we arrived on the south-western Rockall Bank. After the deployment of the ROBIO and BC-Lander we started to ground truth peculiar seabed structures in 600m to 1000m depth. First target was a volcanic structure that pierced through the gently dipping margin of the Rockall Bank. After a mapping survey with Hydrosweep, we selected two transects for the OFOS. From the beginning on, we had the impression that this area differs largely from the better known Belgica Mound Province. The biological activity on the muddy and sandy seabed is much higher. Countless sea cucumbers and many fish species (lings, sharks and rays) are present. The rough summit of the volcanic structure, that we call now "**Kiel Mount**", is covered by mostly fossil coral thickets. OFOS documented a number of lithified carbonate sediments, or hardgrounds. Larger drop stones are colonised by huge sea fans or black corals. The mid-slope of Kiel Mount is patchily plastered with carbonate crusts that show prominent dissolution features and often are out washed beneath the crust. Sediment filled dissolution cracks are abundantly inhabited by sea pens. The sediment sampling started with two TV-grab stations and what we found was spectacular. The fossil coral framework (*Lophelia pertusa*) and attached sediment is entirely carbonatic. Solitary corals, isidid corals and stylasterids are very abundant here. Marco Taviani from ISMAR-Bologna identified several mollusc species alive that were described only from the early Pleistocene bathyal coral deposits at Messina, Sicily. To conclude, this western Rockall coral province is very different from what we know so far from the eastern Rockall Bank and Porcupine Seabight coral habitats. At a first glance, the similarity of the coral communities with the Pleistocene *Lophelia* paleo-communities of southern Italy is striking and calls for further investigations to better understand the response of coral ecosystem migration during times of global change.

Another multi-beam survey carried out further upslope revealed a multitude of interesting features. Because of the limited time we could only survey one area with the OFOS. This site was dominated by an elongated carbonate mound, which was partly covered with dense *Lophelia pertusa* thickets which were hitherto not reported for the western part of Rockall Bank. The new mound was named by our colleagues from Erlangen "**Franken Mound**"

The last working day at Rockall was dedicated to box grab and van Veen grab sampling. Station work ended at midnight. We plan to revisit the Galway Mound area on our passage to Cork (arrival 05.05) to take further bottom water samples for isotope analyses.

An Bord sind alle wohlauf.
Es grüssen
Olaf Pfannkuche und alle Fahrtteilnehmer