IFM-GEOMAR REPORT

IFM-GEOMAR
Leibniz-Institut für Meereswissenschaften
an der Universität Kiel

FS Poseidon
Fahrtbericht / Cruise Report POS 316

Carbonate Mounds and Aphotic Corals in the NE-Atlantic

Reykjavik-Lissabon
03.08. – 17.08.2004

Berichte aus dem Leibniz-Institut
für Meereswissenschaften an der
Christian-Albrechts-Universität zu Kiel

Nr. 3
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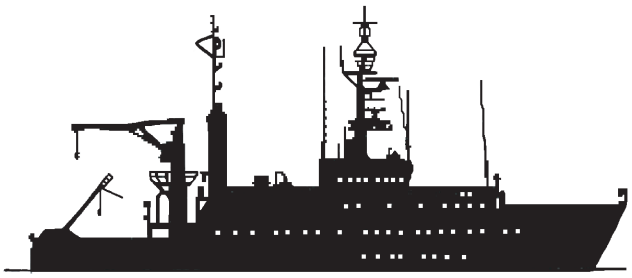

Edited by
Olaf Pfannkuche & Christine Utecht

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Abstract

POSEIDON No. 316 was a multidisciplinary cruise addressing biological, geological and hydrographical scientific objectives in the carbonate mound and aphotic coral province west of Ireland in the eastern Porcupine Seabight and at the western Rockall Bank. The main objective was to investigate the interrelation between the rich aphotic coral ecosystems found in these regions and diurnal and seasonal processes in the ambient hydro-dynamical and depositional regime as these factors seem to bias the conditions of coral growth and reproduction. The cruise started in Reykjavik and ended in Lisbon and continued our 2004 investigations in the Irish carbonate mound province with FS METEOR (M61 leg 1, 18. 4- 5.5 2004). Our scientific work is embedded in the "ESF-DFG" Moundforce project of the EUROMARGINS Programme. Together with the previous M61 cruise, the POSEIDON activities document Germany´s strong scientific and logistic support for the success of this challenging programme. Investigations are also designed as a preparatory cruise for the EU-project HERMES (Hotspot Ecosystem Research on the Margins of European Seas; start 1.4. 2005). The institutions participating in POSEIDON 316 are partners in HERMES Work Package 2 "Coral Reef and Carbonate Mound Systems".

1. Objectives

Recent scientific explorations along the European ocean margin proofed the existence of a deep-water coral ecosystem belt stretching from northern Norway to NW Africa and extending into the Mediterranean Sea. Two colonial stone coral species, *Lophelia pertusa* and *Madrepora oculata*, have the potential to construct impressive reef frameworks similar to their tropical cousins, or, are essentially involved in the formation of the spectacular carbonate mounds e.g. off Ireland. Aside these structural aspects, deep-water coral ecosystems attract a yet unknown number of associated species that live permanently or temporarily there with many of them of economic importance. This important biological resource, however, is in places severely exploited and under threat. Amongst a suite of human impacts to the deep coral ecosystems, demersal trawling creates by far the strongest destruction potential.

We are just at the beginning to understand the functional role and the dynamics of the key species. Most intense occurrences are concentrated in areas where a complex seabed topography such as banks, ridges, seamounts, canyon systems and fjords exert a physical control on the deep current flow such as by the generation of topographically-guided filaments, current acceleration and density-driven convection. In this respect, the coral ecosystem acts as a benthic recorder of ocean circulation, nutrition and carbon flow.

The distribution of deep-water coral/ carbonate mound ecosystems at the Irish Atlantic frontier is applied to understand the structure, functioning and dynamics under the particular trophic system of the NADR (North Atlantic Drift, sensu Longhurst 1995). The trophic state of the coral settled areas is mainly seasonally eutrophic with largely pulsed particle exports from the upper mixed in late spring and early autumn. Main questions addressed were:

What is the influence of the NADR biogeochemical conditions on the biodiversity, functioning and dynamics of the coral/carbonate mound ecosystem thriving under this trophic situation at present and in the past? Global change and the reaction of marine ecosystems are addressed by investigating the change of biodiversity which occurred in deep-water coral ecosystems during the last glacial-interglacial cycle. While the now vigorously growing coral reefs in Scandinavian waters started to develop in a formerly glaciated environment just at the end of the Termination IB. the geologic history of the coral-capped carbonate mounds off Ireland probably extends back over the past 2 Million years.

References

Longhurst, A. (1995) Seasonal cycles of pelagic production and consumption. Progress in Oceanography *36*: 77-167.

2. Research Programme

Coral covered carbonate mounds of the Belgica Mound Province (BMP), north-eastern Porcupine Seabight and of the western Rockall Bank (WRB) were the targets of POSEIDON cruise 316 (Fig. 1), which continued the work of the participating groups of METEOR cruise 61/1 (18. 4- 5.5. 2004).

The following objectives were addressed during POS 316:

- Water mass distribution and characteristics in the carbonate mound province.

Carbonate mounds occur in a dynamic slope environment impacted by a strong tidal-driven hydrodynamic regime. CTD measurements determined the small scale spatial variability of water masses in the carbonate mound and deep water coral realm. A series of high-resolution CTD profiles across Galway Mound and Thérèse Mound (BMP) and across Kiel Mount (Rockall Bank) were carried out.
Water close to the seafloor, was sampled with the Rosette water sampler combined with the CTD to study stable isotope composition,

- Long-term benthic boundary layer processes in a living coral environment.

A long-term observatory (GEOMAR Modular Lander) instrumented by IFM-GEOMAR and SAMS was deployed on the Galway Mound in April 2004 (METEOR Cruise 61-1) and was recovered during POSEIDON Cruise 316 to monitor the near seabed current-, CTD-regime and particle dynamics (sediment trap) in a living coral ecosystem and to take time lapse stereo-photos of benthic activity (IFM-GEOMAR). SAMS estimated near-bed particle dynamics by integrating optical instruments and a data logger into the GEOMAR lander.

- Habitat structure and biodiversity on carbonate mounds.

The species diversity and habitat structure of the cold-water coral ecosystem is still poorly explored. This is especially true for the macrofauna that is generally not visible on underwater photographs or video documentation taken from ROVs, OFOS or manned submersibles. We continued our work from M61-1 to sample macrofauna with the box-corer and to document the fauna alive after sampling.

- Paleo-environmental reconstruction of carbonate mounds.

So far very little data exist that help to understand the ancient history of carbonate mounds and their biota. Box- and gravity coring on targeted mounds and off-mound areas was carried out to analyse the role of corals in mound formation and the general understanding of deposited sedimentary sequences and their accumulation rates during the glacial-interglacial transition. Recent discoveries of cemented carbonate strata or crusts answered why the often steep-inclined slopes of the mound do not collapse or become eroded with time. Despite the ambient cool water and great depths, precipitation of carbonate crusts or hard grounds is a common process even in the NE-Atlantic, but the questions of what drives carbonate diagenesis and when does it happen are still unresolved.

3. Participants & Participating Institutions

Participants

1.	Pfannkuche Olaf, Dr.	chief scientist,	IFM-GEOMAR
2.	Beck, Tim	benthos taxonomy	IPAL
3.	Beuck, Lydia	documentation, mapping	IPAL
4.	Maier, Edith	benthos sample processing	IPAL
5.	Queisser, Wolfgang	sampling gear technology	IFM-GEOMAR
6.	Rüggeberg, Andres, Dr.	physical oceanography	IFM-GEOMAR
7.	Schiemer, Isabell	benthos sample processing	IPAL
8.	Schönfeld, Joachim, Dr.	paleo-oceanography	IFM-GEOMAR
9.	Sturm, Arne, Dr.	physical oceanograhy	IFM-GEOMAR
10.	Türk, Mathias	electronics	IFM-GEOMAR
11.	Vertino, Agostina, Dr.	benthos taxonomy	IPAL

Institutions

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Leibniz-Institut für Meereswissenschaften, an der Universität Kiel, Germany

IPAL
Institut für Paläontologie, Universität Erlangen, Germany

4. Narrative

O. Pfannkuche

Tuesday, 03-08-04

POSEIDON Cruise No. 316 started at 09:00h when the vessel left Reykjavik harbour (Fig 1). We headed to the southwest to our first station in the Islandic EEZ at 61°37'N; 22°48'W after circumnavigating the Keflavik Peninsula. At this position we attempted to dredge an oceanographic mooring which was deployed in July 2000 during POS- 261 but had failed so far to surface after several acoustic release trials on previous cruises.

Wednesday, 04-08-04

We reached the mooring site at 09:55h. Three unsuccessful dredging attempts (Stat 486#1-3) were made until 15:31h. Afterwards the ship progressed in south-easterly direction towards the Iceland Basin. Strong winds from southern direction reduced the ship's speed.

Thursday, 05-08-04

We reached our next station (487) at the utmost border of the Islandic EEZ at 60°N,; 20° 58.549´W in the morning, where we launched an APEX float. Shortly afterwards we left Icelandic waters and headed to the next station at 58°N, 18°.50´W . Headwinds and wave heights increased during the day further retarding our progress.

Friday, 06-08-04

The next APEX float was successfully launched near the Hatton Bank in the morning (Stat. 488). We reached our first benthic working area in the Irish EEZ in the afternoon. Station work started with a highly resolved CTD/Rosette transect across Kiel Mount on the south-western Rockall Bank (Stat. 489-497).

Thursday, 10-08-04

The CTD/Ro transect across Kiel Mount was finished in the early morning. This was followed by a series of box grabs and a gravity corer cast in the Kiel Mount area (Stat. 499-505). Station work ended in the evening when POSEIDON started the transit to the second benthic working area in the Irish EEZ the Belgica Mound Province in the eastern Porcupine Seabight.

Sunday, 08-08-04
We continued our transit to the Belgica Mound Province. During the passage we encountered a storm with strong headwinds, which reduced our advance significantly.

Monday, 09-08-04
We continued our transit to the Belgica Mound Province. Meanwhile the storm had turned into a gale with head winds up to Beaufort 9 reducing our speed to less than 3kn.

Tuesday, 10-08-04
During the night the gale ceased. We reached our next working station at Galway Mound in the late morning. Our first operation was the successful retrieval of the benthic observatory DOS (instrumented Lander) which was deployed on a coral thicket during METEOR Cruise 61-1 in late April 2004 (Stat. 506). The afternoon and early evening was dedicated to a series of box grab samples (Stat. 507-511) in the area of the Challenger Mound (southern part of the Belgica Mound Province). The rest of the day and the whole night was spent with two series of CTD/Ro casts across Galway Mound in latitudinal and longitudinal orientation (Stat. 512-521)

Wednesday, 11-08-04
The CTD/Ro series was finished in the early morning. This was followed by two successful gravity corer cast in the vicinity of Galway Mound (Stat. 522-523). The afternoon and early evening was dedicated again to box grab sampling in the same area, which included sampling at the gravity corer sites (Stat. 524-529). During the evening and night we continued our latitudinal CTD/Ro transects from the previous night by adding further deeper stations (west of Galway Mound) and from the area of the shallower Poseidon Mound (Stat. 530-538).

Thursday, 12-08-04
With Station No 538 (CTD/Ro) ended the scientific sampling programme in the Irish EEZ respectively of expedition POS 316. After some preparation POSEIDON left the Belgica Mound Province in the course of the morning and started its voyage to Lisbon (Portugal).

Friday, 13-08-04
We continued our passage to Lisbon

Saturday, 14-08-04
Our passage to Lisbon went on

Sunday, 15-08-04
Our voyage to Lisbon proceeded under pleasant weather conditions

Monday, 16-08-4
We reached Lisbon in the evening and finished our voyage

Tuesday, 17-08-04
The scientific party disembarked at mid day after the discharge of the scientific equipment in the course of the morning.

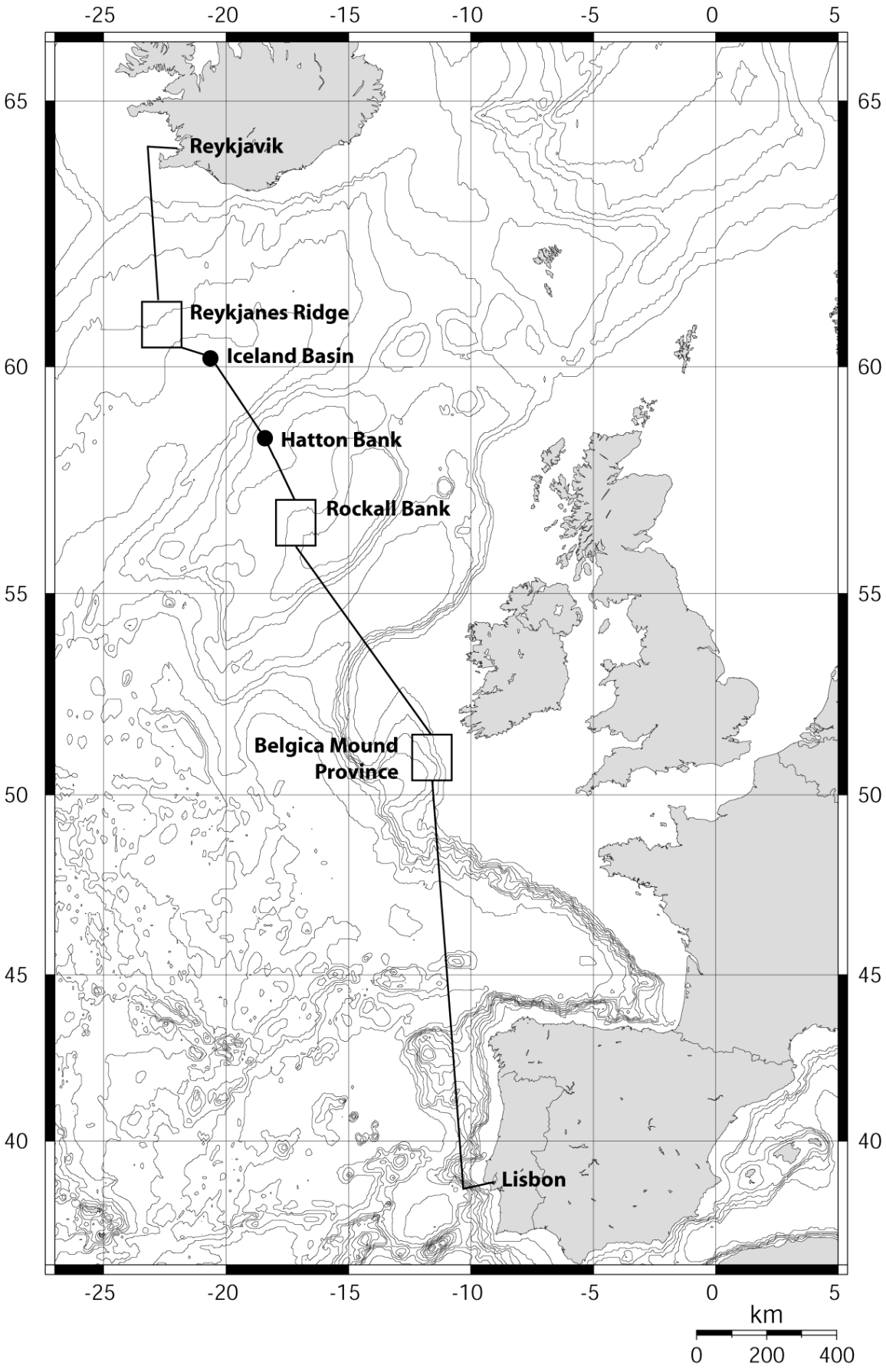

Figure 1: Cruise track and working areas of Poseidon Cruise 316.

5. Results

5.1 CTD/Ro transects at Kiel Mount and in the Belgica Mound Province

A. Rüggeberg, A. Sturm, J. Schönfeld

Objectives

A total of twenty-eight CTD/Rosette water sampler casts were carried out during POS 316. The purpose of these measurements was to perform transects across the carbonate mound structures Galway Mound and Poseidon Mound of the Belgica Mound Province at the eastern slope of the Porcupine Seabight, and across the volcanic structure Kiel Mount at the western slope of Rockall Bank, that has been discovered and mapped on METEOR cruise M61/1. The profiles were carried out at same positions as during cruise M61/1 (April/May 2004) and M61/3 (June 2004) to determine seasonal differences and to re-assess the small-scaled variability close to the mounds.

Description of the System

We used a SeaBird 911+ CTD with a 12x10l bottle rosette water sampler. Pre-cruise laboratory calibrations of the temperature and pressure sensors were performed. Both yielded coefficients for a linear fit. In-situ measurements for calibrating the oxygen sensor were carried out using the titration method of Winkler (see below).

Performance and Station Overview

The overall performance of the CTD was very good. Though the recording computer worked without problems, downcast profiles showed spikes in all data between 100 and 300 m water depth, which were not replicated on upcast measurements. Therefore, only upcast measurements were cosidered for further processing of data because they showed no systematic offset to downcast and, more important, no error measurements between 100–300 m. The data were processed using software SBE Data Processing Version 5.30a (ftp://ftp.halcyon.com/pub/seabird/out) and Ocean Data View mp-Version 2.0 (http://www.awi-bremerhaven.de/GEO/ODV) for visualisation. Table 1 summarizes the log sheets for the individual CTD casts. Water samples were taken at stations 10 m above seafloor (bottom alarm) and within the water column for stable isotope, dissolved inorganic carbon (DIC) and Sr isotope analyses, as well as on-board measurements of pH and dissolved oxygen.

Oxygen Sensor Calibration

The CTD oxygen data have been validated onboard with water samples by iodometric oxygen titration according to the Winkler method (Grasshoff et al., 1983; see: http://www.geomar.de/zd/labs/labore_umwelt/Meth_deutsch.html#Sauerstoff). Immediately after the collection, the water samples were filled into volume-calibrated, 100-ml Winker-bottles and the oxygen was fixed with 0.5 cm^3 manganese-II-chloride and 0.5 cm^3 alkaline iodide. The bottles were shaken and stored cooled for several hours.
Prior to titration, 1 cm^3 H_2SO_4 (9 M) was added, the bottles were shaken to dissolve the Mn-hydroxides, and the sample was poured into a 400-ml beaker. We titrated with sodium thiosulfate (0.02 M), which has been calibrated prior to analyses. We titrated until a light yellowish colour appeard. At this point, 1 cm^3 zinc iodid solution was added and titration was continued until the blue colour disappeard. The oxygen content was calculated from the thiosulfate consumption using the standard formula:

O_2 [ml/l] = (a * f * 112) / (b - 1)
a = consumption of thiosulphate solution (cm^3)
b = volume of the sample bottle (cm^3)
f = calibration factor of the thiosulphate solution (0.998)

Figure 2 shows the comparison between dissolved oxygen contents of CTD and Winkler-Titration for all measurement during this cruise. The correlation is very good (R = 0.98) and the resulting formula was used to calibrate the CTD data.

$$CTD_{oxy}\ (ml/l) = -0.132 + 0.803 \bullet Titr_{oxy}$$

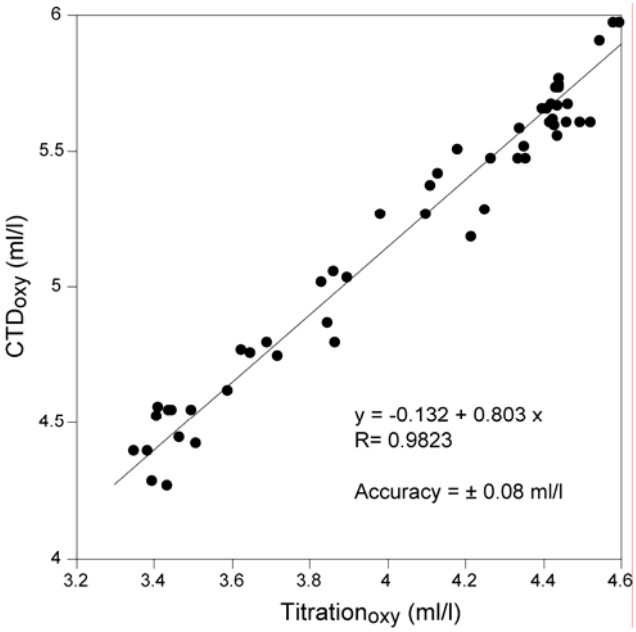

Figure 2:
Comparison of O_2 measurements from CTD and Winkler-Titration exhibits a very good correlation. The formula within the figure was used to calibrate CTD data, which presents an accuracy of ± 0.08 ml/l.

First Results

Hydrography around Kiel Mount, SW Rockall Bank

Along the western slope of the Rockall Bank, CTD/Ro casts were performed at Kiel Mount. Nine CTD profiles were arranged in NS- and EW-direction across Kiel Mound at water depths between 850 and 1150 m (Fig. 3).

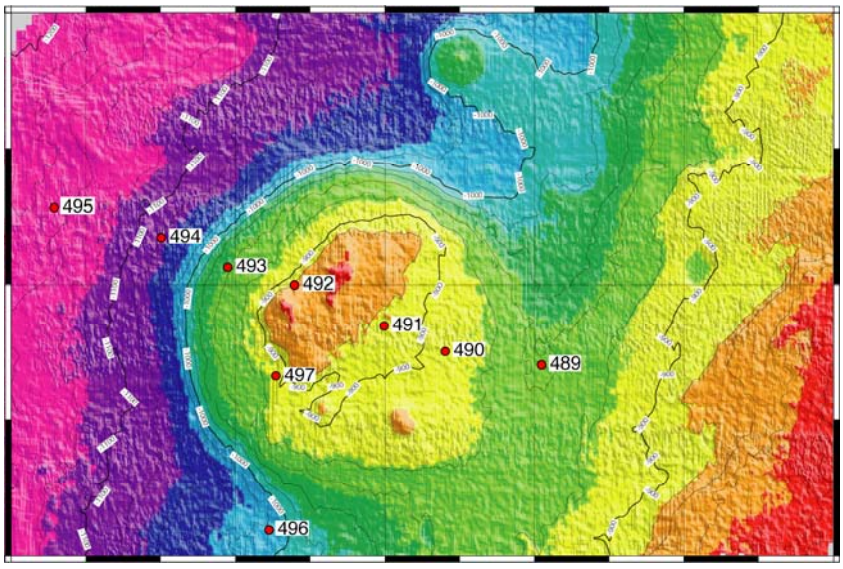

Figure 3:
Location of CTD profiles across Kiel Mount, SW Rockall Bank. The W–E profile is illustrated in Figure 4.

The profiles of temperature, salinity and dissolved oxygen show well stratified water masses. They exhibit maximum values at the surface, decreasing continuously with depth (Fig. 4). Only dissolved oxygen displays a minimum between 700 and 900 m water depth on top of Kiel Mount.

The distribution of water masses is similar to profiles already performed in April 2004 during cruise M61/1. The temperature of the Surface Water (SW) decreases from 13.5° to 11°C, while salinity increases towards the seasonal thermocline at around 60 m water depth (Fig. 5). Below the thermocline temperature and salinity of the North Atlantic Central Water (NACW) decrease continuously. Between 700 m and 900 m salinity shows small excursions towards higher values. This corresponds to the well-pronounced minimum in dissolved oxygen (Fig. 4) with values of 4.5 ml/l indicating a contribution of a water mass of southern origin, probably the Mediterranean Outflow Water (MOW). Decreasing temperature and salinity, but increasing dissolved oxygen below 900 m water depth may indicate the influence of well-ventilated Iceland Scotland Ridge Overflow Water from the Norwegian Sea.
The main seasonal differences of water mass properties is the formation of a warm summer surface layer of ~50 m. The sea surface temperature increased from 10.7°C in April and 11.8°C in June to 13.5°C in August 2004. In greater depth below 600 m seasonal changes were very small and may be driven by internal tides.

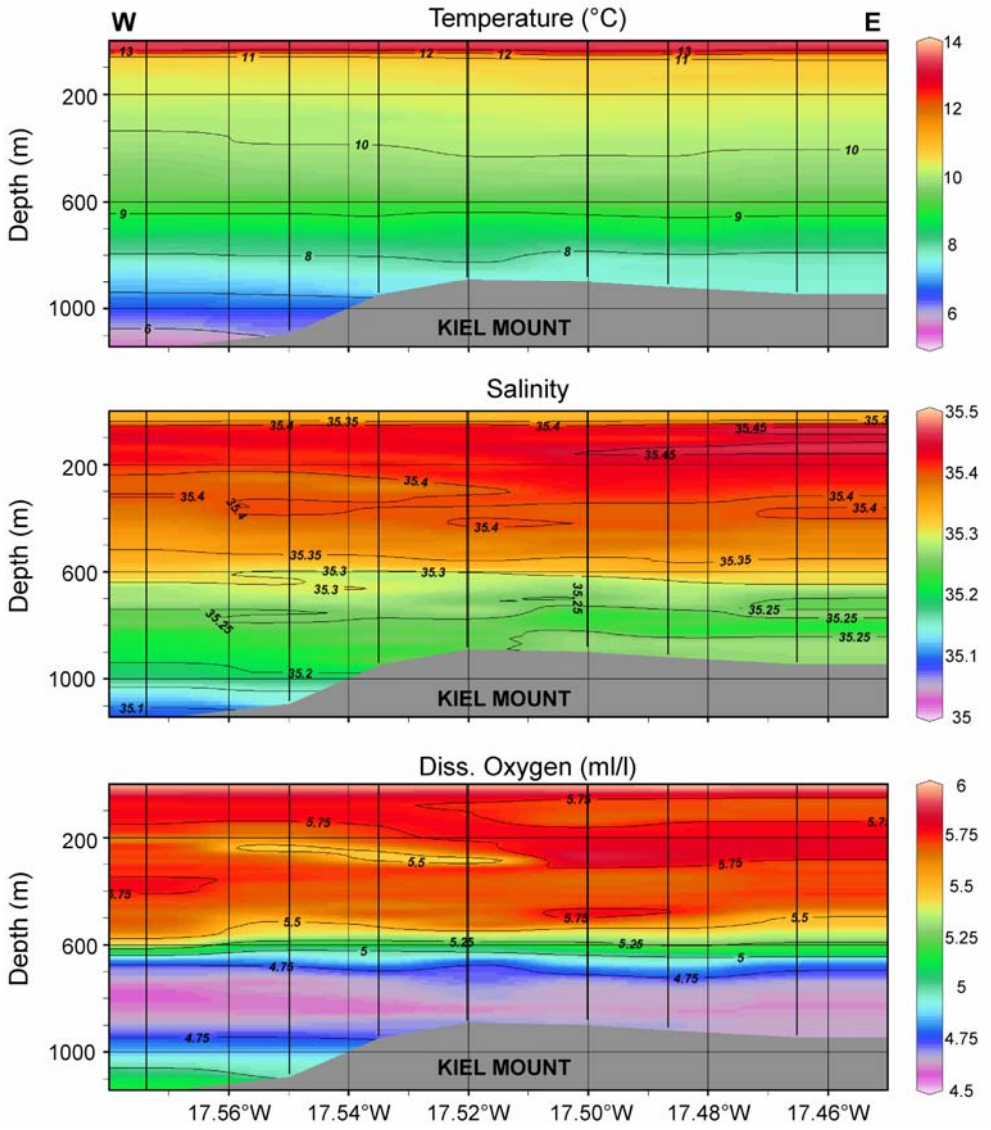

Figure 4: Profiles of temperature (top), salinity (centre) and dissolved oxygen (bottom) across Kiel Mount in west-east direction.

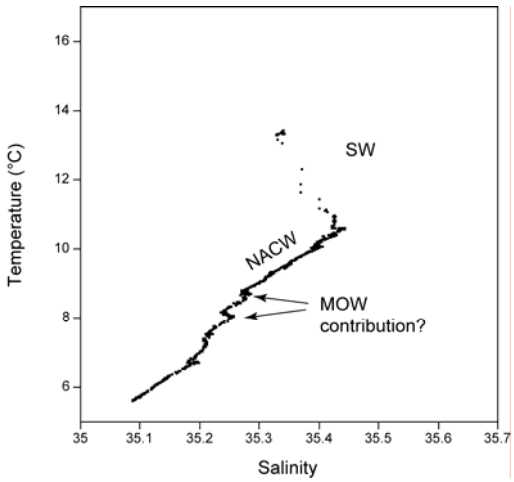

Figure 5:
TS-plot of a selected CTD profile of Kiel Mount area.
SW = Surface Water,
MOW = Mediterranean Outflow Water,
NACW = North Atlantic Central Water.

Hydrography of the Belgica Mound Province (Galway Mound, Poseidon Mound)

19 CTD/Ro casts in the Belgica Mound Province were driven around Galway Mound and Poseidon Mound (Fig. 6).

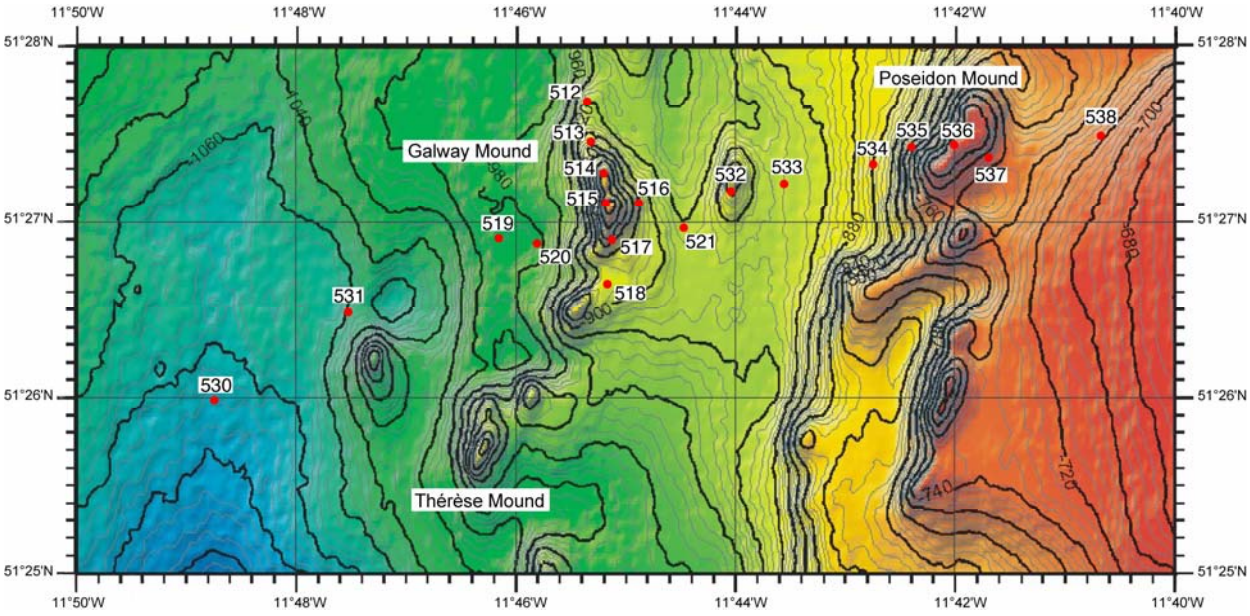

Figure 6: Location of CTD profiles across Galway Mound and Poseidon Mound, Belgica Mound Province. The E–W profile across the whole region is illustrated in Figure 8, the N-S profile across Galway Mound in Figure 9.

The distribution of water masses is similar in all profiles but differs significantly from the SW Rockall Bank area (Fig. 7). Temperature, salinity and dissolved oxygen show maximum values at the surface, indicating the presence of warm, well-ventilated Surface Waters (SW) with a summer thermocline at ~50 m water depth. The Eastern North Atlantic Water (ENAW) exhibits a linear, uniform distribution down to a salinity minimum at around 700 m. The influence of Mediterranean Outflow Water (MOW) is depicted in the salinity increase to maximum values of 35.5 at 900 m water depth. This water mass is less characteristic in temperature, but shows a low dissolved oxygen content of 4.3 ml/l (Fig. 8).

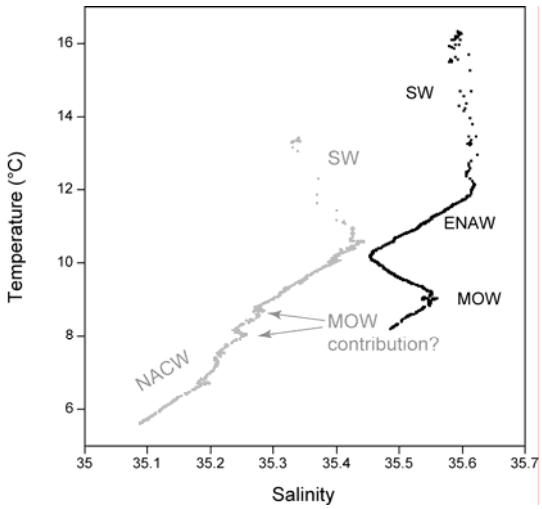

Figure 7:
TS-plot of a selected profile of the Belgica Mound Province (black) in comparison to the Kiel Mount profile (grey).
SW = Surface Water,
ENAW = Eastern North Atlantic Water,
MOW = Mediterranean Outflow Water with a salinity maximum at ~900 m water depth.

The W-E profile is perpendicular to the general current regime (Fig. 8). The salinity maximum and dissolved oxygen minimum of the MOW is clearly visible between 800 and 1000 m water depth, covering the top and upper flanks of Galway Mound. The top and flanks of Poseidon Mound further east are already under the influence of ENAW due to its shallower position. Underwater investigations during POSEIDON cruise 292 in summer 2002 showed, that this mound is covered with a dropstone pavement and abundant fossil coral framework, but a living cold-water coral ecosystem was not detected.
A distinct pattern emerges in the distribution of dissolved oxygen in the bottom waters. Figure 9 shows the N-S profile of dissolved oxygen across Galway Mound. The oxygen content between 800 and 950 m depth is elevated by 0.2–0.3 ml/l to the north of the mound than south. This significant feature was already identified during cruise M61/1 in April and cruise M61/3 in June 2004, indicating that the dense coral ecosystem on top and the southern flank of Galway Mound may effect locally enhanced oxygen consumption.

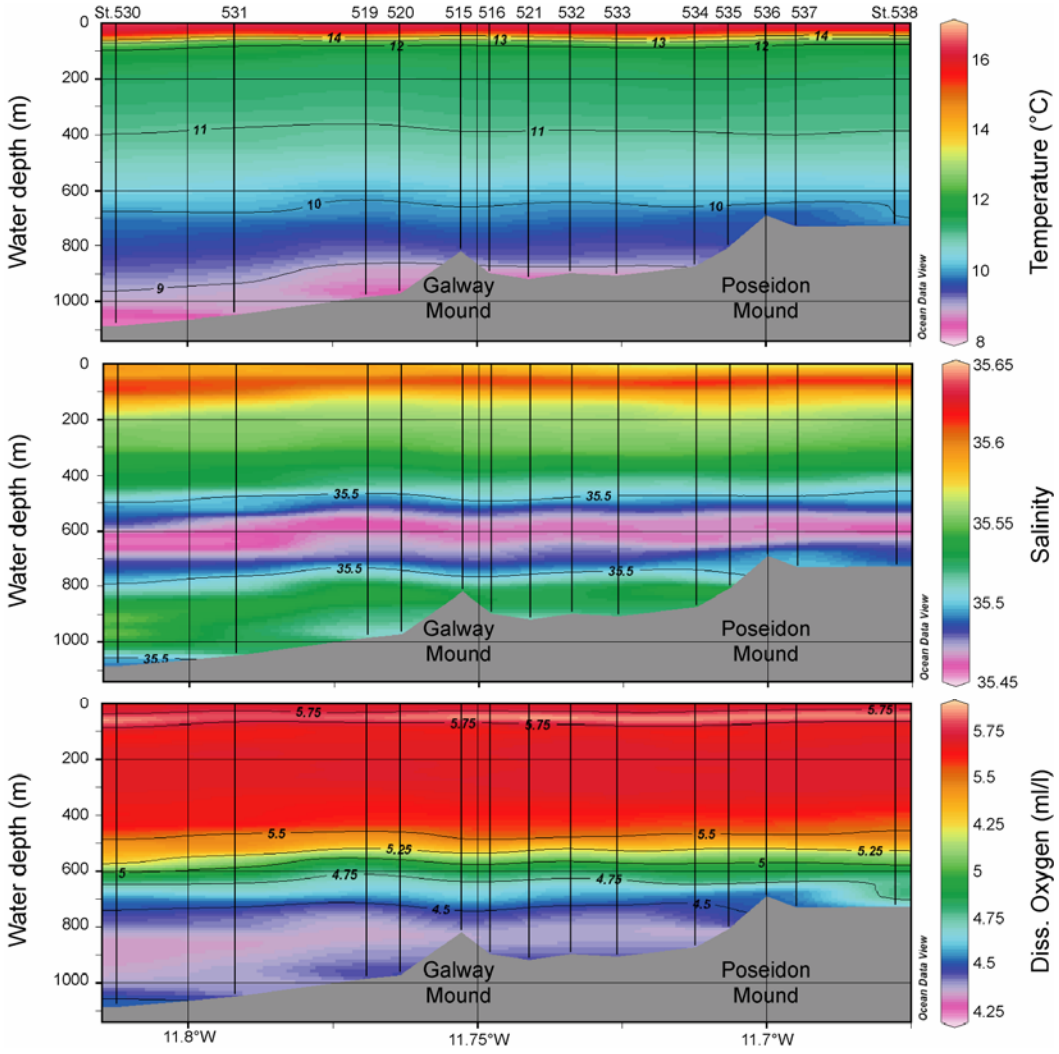

Figure 8: W-E profile of temperature (top), salinity (centre) and dissolved oxygen (bottom) across the Belgica Mound Province (see stations in figure 5). MOW appears below 700 m water depth as indicated by increasing salinity and decreasing oxygen content, influencing the coral ecosystem on Galway Mound.

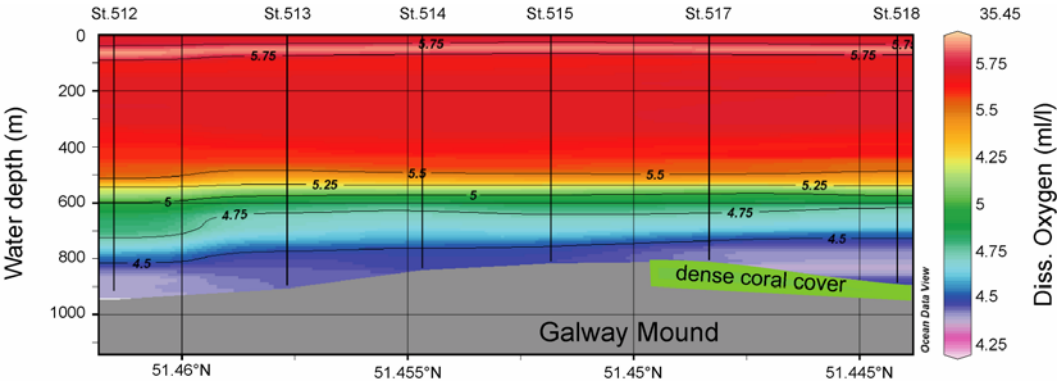

Figure 9: N-S profile of dissolved oxygen across Galway Mound (N = left, S = right). Lower oxygen concentrations occur on top and the southern flank, where a dense coral ecosystem was identified.

References:

Grasshoff, K., Ehrhardt, M., Kremling, K., 1983. Methodes of Seawater Analysis, Verlag Chemie GmbH

Table 1: Information on all CTD casts during POS 316 including area description and water samples.

POS 316-	gear #	Lat. (°N)	Long. (°W)	Water depth (in m)	Area	Sampling depth of water samples (in db) for analysis of $\delta^{18}O/\delta^{13}DIC$	Sr	Oxygen calib.	pH
489	CTD 1	56°41.41	17°27.91	946	East of Kiel Mount	947	947	947, 927, 878, 797, 729, 650, 575, 501, 444, 270, 119, 25	947, 927, 878, 797, 729, 650, 575, 501, 444, 270, 119, 25
490	CTD 2	56°41.51	17°29.20	918	Eastern foot of Kiel Mount	918	918	918, 877, 827, 776,728, 516, 461, 396, 292, 190, 109, 24	–
491	CTD 3	56°41.7	17°30.01	898	Eastern flank of Kiel Mount	898	898	898, 889, 860	–
492	CTD 4	56°42.00	17°31.21	890	Top of Kiel Mount	890	890	–	–
493	CTD 5	56°42.13	17°32.10	950	Western flank of Kiel Mount	950	950	–	950
494	CTD 6	56°42.35	17°32.99	1095	Western foot of Kiel Mount	1095	1095	–	–
495	CTD 7	56°42.57	17°34.42	1154	West of Kiel Mount	1154	1154	1154, 1021, 917, 832, 729, 652, 607, 542, 352, 135, 25	1154
496	CTD 8	56°40.19	17°31.55	1021	South of Kiel Mount	1029	1029	–	–
497	CTD 9	56°41.33	17°31.46	906	Southern flank of Kiel Mount	905, 832, 723, 623, 532, 346, 283, 207, 157, 74, 17	905	905, 832, 723, 623, 532, 346, 283, 207, 157, 74, 17	905, 832, 723, 623, 346, 283, 207, 157, 74, 17
512	CTD 10	51°27.60	11°45.34	923	North of Galway Mound	922	922	922, 809, 702, 610, 531, 453, 269, 35	922, 809, 702, 610, 531, 453, 269, 35
513	CTD 11	51°27.46	11°45.31	862	Northern foot of Galway Mound	908	908	–	908
514	CTD12	51°27.28	11°45.19	842	Northern flank of Galway Mound	842	842	–	842
515	CTD13	51°27.11	11°45.17	784	Top of Galway Mound	818, 731, 594, 530, 466, 345, 119, 28	818, 731, 594, 530, 466, 345, 119, 28	818, 731, 594, 530, 466, 345, 119, 28	818, 731, 594, 530, 466, 345, 119
516	CTD14	51°27.11	11°44.87	899	Eastern flank of Galway Mound	899	899	–	899
517	CTD15	51°26.9	11°45.12	851	Southern flank of Galway Mound	812	812	–	812
518	CTD16	51°26.65	11°45.16	888	Southern foot of Galway Mound	896	896	896, 809, 719, 637, 529, 439, 296, 132, 26	896
519	CTD17	51°26.91	11°46.15	982	West of Galway Mound	986	986	986, 888, 674, 545, 494, 383, 133, 27	986, 888, 674, 545, 494, 383, 133, 27
520	CTD18	51°26.88	11°45.80	870	Western flank of Galway Mound	972	972	–	–
521	CTD19	51°26.97	11°44.46	906	East of Galway Mound	920	920	–	920
530	CTD20	51°25.99	11°48.74	1079	West of Galway Mound, deepest Station	1088	1088	1088, 945, 633, 586, 478, 362, 70, 28	1088, 945, 633, 586, 478, 362, 70, 28
531	CTD21	51°26.44	11°47.52	1051	West of Galway Mound, little depression	1050	1050	–	1050
532	CTD22	51°27.18	11°44.03	870	Top of Pentilisea Mound	898	898	898, 652, 576, 510, 449, 273, 54, 23	898, 652, 576, 510, 449, 273, 54, 23
533	CTD23	51°27.22	11°43.55	900	West of Poseidon Mound	908	908	–	908
534	CTD24	51°27.3	11°42.63	853	Western foot of Poseidon Mound	875	875	–	875
535	CTD25	51°27.39	11°42.39	747	Western flank of Poseidon Mound	807	807	–	807
536	CTD26	51°27.44	11°42.00	677	Top of Poseidon Mound	691	691	691, 658, 621, 524, 473, 328, 50	691, 658, 621, 524, 473, 328, 50
537	CTD27	51°27.37	11°41.73	707	Eastern flank of Poseidon Mound	732	732	–	732
538	CTD28	51°27.49	11°40.66	716	East of Poseidon Mound	728	728	728, 590, 322, 39	728, 590, 322, 205, 39

5.2 Retrieval of the Deep-Sea Observation System (DOS)

O. Pfannkuche, M. Türk, W. Queisser, J. Schönfeld

Objectives

The Deep-Sea Observation System (DOS) of the GEOMAR Lander family (Pfannkuche & Linke 2003) was deployed on Galway Mound (BMP) during METEOR Cruise M61-1 on 25. April 2004 (Fig. 10) to monitor the oceanographic control parameters for azooxanthellate coral ecosystems in combination with megabenthic biological activity

The long-term observatory was equipped with a wide range of sensors, sampling and experimental gear (Tab. 2). This included a storage CTD, three acoustic current meters, a sediment trap and a stereo camera system. SAMS/Oban deployed a number of optical sensors (transmissiometer, fluorometer, optical backscatter) in 50 cm distance from the seafloor. A 300 kHz ADCP heading upwards into the water column measured every 15 min the current regime in 3-m cells within a range of 7.6 to 110 m above bottom. Simultaneously, a downlooking 1200 kHz measured currents in 10-cm cells within the first 100 cm of the sediment-water interface. Another acoustic current meter equipped with a turbidity meter was mounted next to the sediment trap which sampled in 8-day intervalls the particle deposition.
Furthermore, the lander was equipped with tableaus containing various substrates for colonisation experiment. They comprised a variety of natural hard and soft substrates mounted to the footplates of the lander. We chose dropstone-alike beach pebbles of limestones, basalts, and granite as well as living and dead coral fragments. Soft substrates include carbonate sand, silty terrigenous sand, and mud. The hard substrates and sediments were sterilised and stripped for epizoans before deployment.

Table 2: Equipment and settings of the DOS Lander

Equipment	**Stereo-Camera**	**Trap**	**ADCP**	**ADCP**	**MAVS-3**	**CTD**
Model S/N	Benthos 055(B)+056(A)	KUM	RDI 0779	RDI 1015	Nobska 10107	SBE16plus 1484
Specs	30m film with 850 frames	13 sample cups	300KHz	1200 kHz	C/T/D/Turbidity	C/T/Digiquartz
Settings	200ASA / f = 11 / 0.8-1.8	8 day interval	84MB / 42V	74MB / 42V	64MB / 14.13V	8MB / 13.5V
	183min interval		15min ensemble interval		15min burst interval	10min interval
Position	downlooking	uplooking	uplooking	downlooking	uplooking	downlooking
Height [cm]	164	275	258	164	286	164
Alignment			groove towards DOS-Lander		hole away from DOS	

Equipment		**Optical package**	**(SAMS)**	
Model S/N	UMI-datalogger 2145	C-star transmiss. 561DR	WETLABS LSS 341	Fluorometer AFLT-030
Specs		turbidity		chlorophyll
Settings	512kb / 12V			
	triggers sensors for a 60sec burst every 60min with 15sec delay			
Position	horizontal	horizontal	horizontal	horizontal
Height [cm]		50	50	50
Alignment		parallel to crossbar	away from DOS	away from DOS

Results

The DOS was retrieved under ideal weather conditions on 10. Aug. 2004 (Fig. 11). Acoustic contact to the release system could be made immediately and the release was triggerd after the first acoustic release command. The recovery of the floating lander went smoothly.

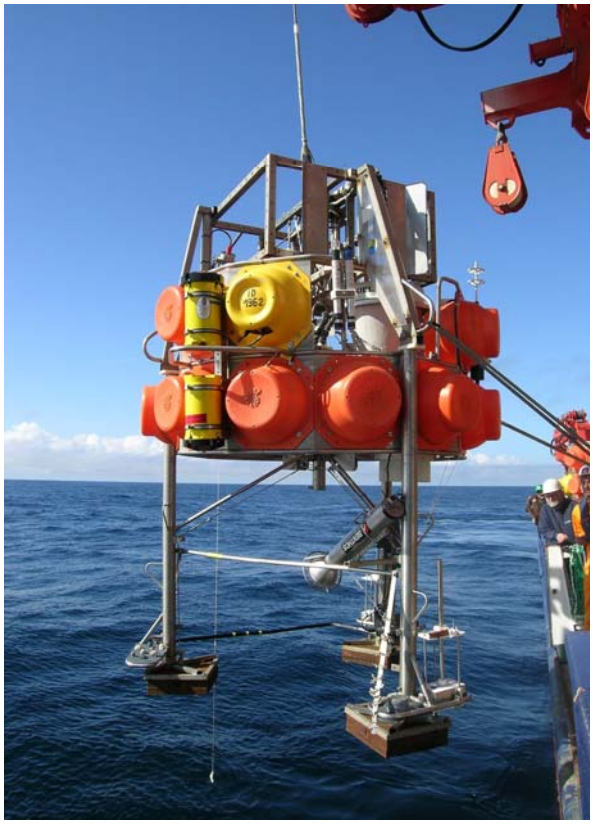

Figure 10:
Deployment of the DOS Lander from METEOR, April 2004

Figure 11:
Recovery of the DOS Lander with POSEIDON on 10. Aug. 2004

A first inspection of the lander showed that all systems had worked well including a successful sampling of the sediment trap (Fig. 12 and 13). The whole lander was covered with a greenish-brown slime and small settling organisms were found on the metal parts near to the sea bed and on part of experiment substrata (see below).

The sensors systems were witched off. The data were read out in the homelabs.

Figure 12:
Sample tray of the DOS sediment trap

Figure 13:
13 filled sample cups (8 days sampling intervals) indicating seasonal changes in particle deposition.

The camera system was heavily corroded (Fig. 14) and further inspection proofed that all pressure vessels were flooded through holes obviously produced by biofouling and galvanic reactions. The films could be removed in the home lab and could be partly processed. The pictures showed that the lander was placed in a coral thicket with abundant megafauna (Fig. 15).

Figure 14:
The heavily corroded video camera with discrete holes in the pressure cylinder.

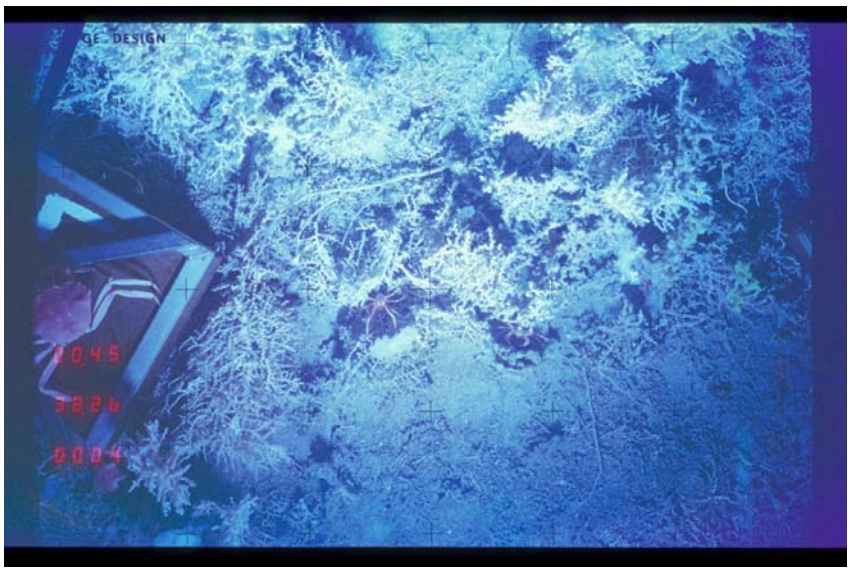

Figure 15:
Picture from the time lapse camera series showing a crab on one of the DOS anchor weights , abundant living Madrepora and Lophelia (corals), sponges and a a decapod crustacean (Munida).

Benthic colonisation experiments yielded different success. The soft substrates were lost on recovery of the lander due to technical problems of the benthic colonzation chambers. The hard substrates were successfully recovered. The pebbles depicting artificial dropstones were inhabited by at least one epizoan per object. Ferrigenous sandstones and basalts were preferred but limestones were avoided (Fig. 16). Coral fragments, PVC and stainless-steel construction parts were also recruited by epizoans. A first examination revealed that two different hydroids and a small bivalve, *Delectopecten vitreus* were common. Benthic foraminifera were also recorded, among them *Discanomalina coronata*, *D. semipunctata*, *Planulina ariminensis*, *Cibicides lobatulus*, *Epistominella rugosa*, and *Cibicides refulgens*. This fauna is typical for deep high-energy environments in the northeastern Atlantic (Schönfeld, 1997; 2002), and it has been recorded in sediment cores from the Belgica Province (Rüggeberg et al., submitted).

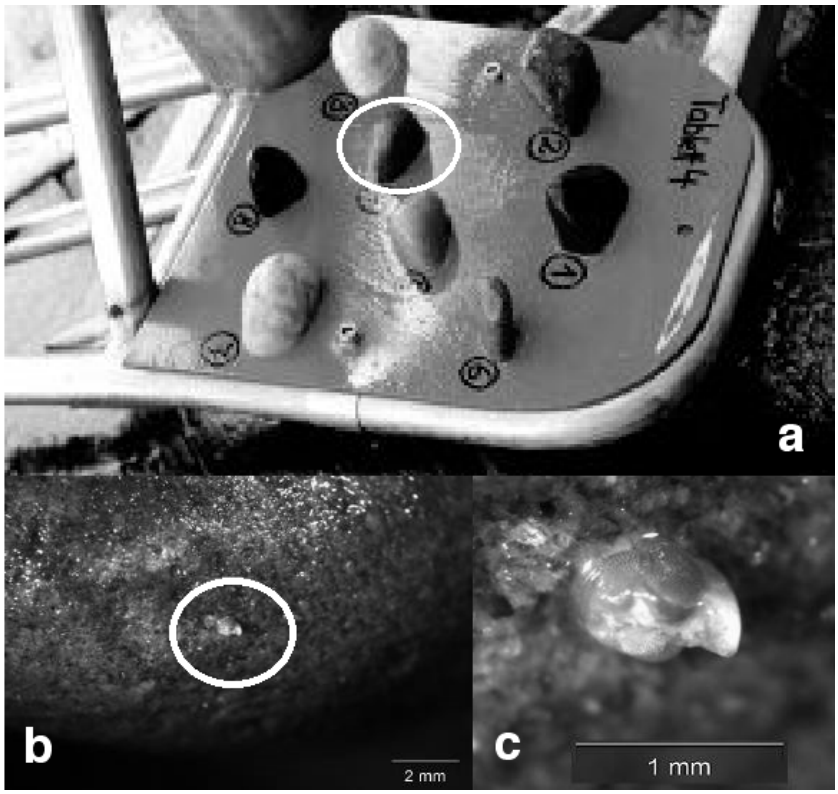

Figure 16: Recruitment of an artificial substrate by *Discanomalina semipunctata*. A: Tray with different pebbles simulating dropstones that was mounted to the footplates of the DOS lander. Basalts are black, limestones white and sandstones are grey. Pebble 5, a reddish ferrigenous sandstone is encircled. B, C: close-up of pebble 5 with *Discanomalina semipunctata* attached on the summit of the substrate.

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5.3 Sediment sampling and processing

L. Beuck

Objectives

The geological sampling on POS 316 had several goals. First, we attempted to accomplish the regional sample grids in the Belgica Mound province and around Kiel Mount, Rockall, that were obtained on two previous cruises with METEOR in spring 2004. We followed the HERMES strategy in that an ecosystem hotspot, for instance a carbonate mound, is to be sampled directly and should be crossed by a slope-parallel and a perpendicular traverse of sampling stations. The top of Kiel Mount was re-sampled (Fig. 17), and a traverse of box core stations to the north of the structure extends the existing information. We focused in the Belgica Mound Province on a slope-parallel chain of shallow structures named "Noses" southwards of Poseidon Mound up to the Challenger Mound area. We also performed a slope-perpendicular transect of box-core stations crossing Poseidon, Pentesilea, Little Galway and Castor Mounds (Fig. 18).

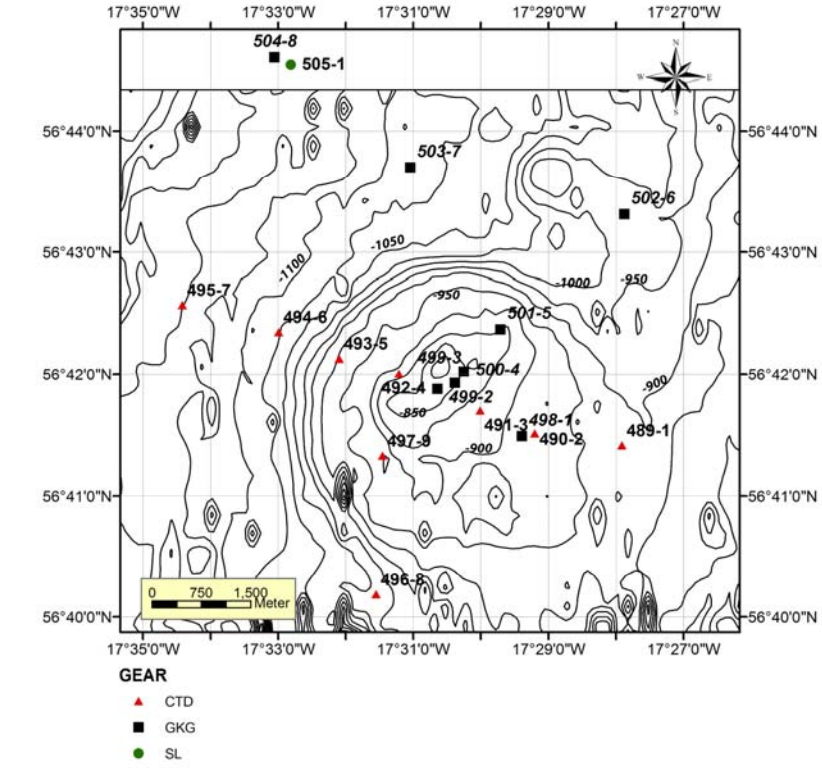

Figure 17: Box corer and gravity corer stations at Kiel Mount

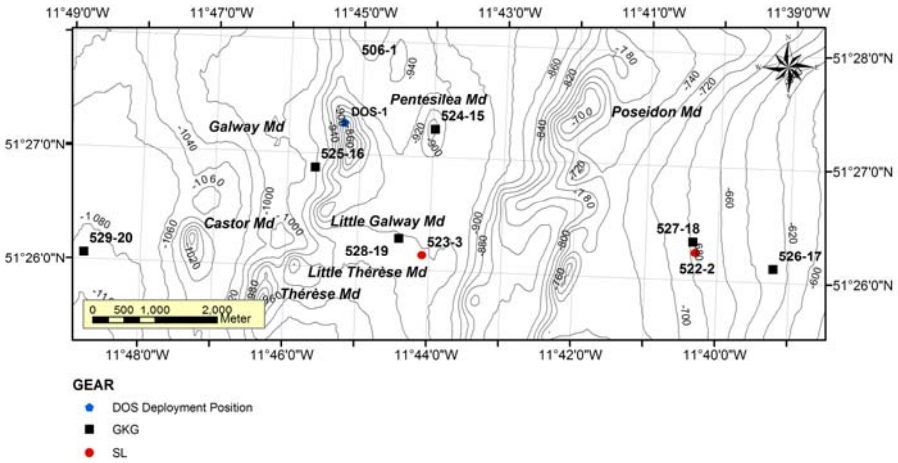

Figure 18: Box corer and gravity corer stations in the Belgica Mound Province

Sampling and sample processing

Box core sampling

A a modified USNEL spade corer was deployed at 20 stations at Kiel Mount and in the Belgica Mound province recovering 50 x 50 x 50 cm of surface sediments. When on board, the lids were opened for a first assesment of sample quality and decision for subsequent procedures. The overlying water was carefully sucked off, and once the sediment surface was stable, the box was dismounted and moved to a sheltered place for surface sampling and description. The box with the remaining sediment or coral rubble was washed afterwards through a 0.5 mm mesh to collect macrofossils.The description of box core samples including the inventory of dead and living animals is given in Chapter 7. The inventory of living makroinvertebrates is given in Chapter 5.4.

Sampling procedure for foraminiferal studies

Foraminiferal studies require largely undisturbed sediment surfaces and a representative coverage of different microhabitats. First, we sampled the uppermost centimetre on box core surfaces. We used a frame of 87,6 cm^2 that was pushed into the sediment at two different places. A representative coverage of different microenvironments on the sediment surface was attempted. The sediment was carefully removed with a spoon. A 1 cm - gauge on the inner side of the frame helped to keep the required depth level. The final sample volume was marked on the vial, and the surface sample was immediately conserved and stained with a solution of 2 grams Rose Bengal in 1 litre Ethanol (technical quality, 98%) (Lutze and Altenbach 1991; Murray and Bowser 2000). This sample will be used to study the living, shallow epi- and endobenthic foraminifers, and the dead assemblage in the surface sediment.

A representative suite of elevated hard-substrates like dropstones, coral debris or mollusc shells were carefully removed from the sediment surface of box cores and conserved in Rose Bengal - Ethanol too. These objects will be examined for attached epibenthic foraminifers (Oschmann 1990; Schönfeld 1997, 2002). Staining facilitates the recognition of living specimens, as it has been proven that empty tests of *Placopsilina confusa* and *Cibicides refulgens* still stick to the host after reproduction. Particular attention was paid for a careful handling of these objects to not destroy the "mudline" of fine, adherent sediment that will serve as zero level for the attachment height of epizoans. After surface sampling and removal of elevated objects, a 10 cm^3 syringe sample was taken from the surface close to the frame. This sample will be used to analyse the organic carbon and chlorine content of the surface sediment. The lid of the box corer was opened and the section was described too. An archive box covering the near-surface strata was taken as reference.

A different sampling scheme was followed once the box corer recovered coral rubble. As the original texture or framework was mostly disarranged due to sampling, a zero level could not be defined. However, interstitial sediment was sometimes present around coral fragments in the lower part of the box core. The soft, upper levels of this interstitial sediment were scraped off with a spoon and were conserved in Rose Bengal - Ethanol. A representative variety of hard-substrates were removed from different places of the coral framework and

conserved in Rose Bengal - Ethanol too. The height of certain substrates above the mudline of interstitial sediment could be determined in two box cores. Here we took level-defined hard-substrate samples from 1-2 cm, 6 cm, 11-14 cm, and from 2-3 cm and 3-6 cm above the interstitial sediment surface. Preference was given to pieces that show overgrowth by foraminifera (mostly large specimens of *Cibicides lobatulus* or *C. refulgens*), hydroids, crinoids or incrusting sponges.

Gravity coring

We used a conventional gravity corer with a tube length of 6 m and a head weight of 1.5 tons. Three gravity cores with a total length of 1079 cm were recovered from three stations. A 70 cm core from foraminiferal sands overlying stiff, brown mud was recovered to the north of Kiel Mount (PO315-505). A 480 and a 529 cm long gravity core were retrieved from the upper slope above Poseidon Mound (PO316-522) and from the terrace between Galway/Terese and Poseidon Mound chains (PO316-523). These off-mound cores contain stiff mud with a thin, probably recent sand layer on top. The cores were cut into one-metre sections and stored under ambient temperature conditions. Opening, description and sampling on board was dismissed, as MST-logging in the home laboratory is to be done before opening. On arrival at Lisbon, the cores were transported refridgerated to Kiel.

First Results

Sediment distribution

The box core samples accomplished information on sediment distribution that were obtained on the previous M61/1 and M61/3 cruises. The sedimentary data were supported on a local scale by OFOS-observations.

The sea floor to the southeast of Kiel Mount is covered with a thin veneer of foraminiferal fine sand overlying silty medium sand to sandy clay. Only a few, small dropstones were found on the sediment surface. The foraminiferal sand shows extensive ripple fields on the southern and western rise of Kiel Mount. These ripples were probably formed by the strong, southward flow of Iceland Faroe Overflow water. The north face of Kiel Mount shows coarse sand with abundant, large dropstones and coral debris in places. The coarser grain size points to a much higher sediment-water interaction on the northern side of Kiel Mount. Slabs of endurated sediment and basalt outcrops were recorded with OFOS observations on the summit of this structure. A silty medium sand with common dropstones covers a sandy clay with sponge mats and spiculitic ooze to the north of Kiel Mount (Figure 19). Sponge mats were previously only reported from the Icelandic Sea, British Columbia, and Antarctica. They depict a highly diverse shallow- to intermediate water, polar community in a stable environment dominated by biological factors (Molina-Cruz 1991; Anderson 2001). This appearently fossil occurrence at Rockall Plateau supports the southward shift of polar environments during the last Glacial (CLIMAP 1981) even though a tongue of relatively warm subpolar surface waters may have prevailed in this particular area (Pflaumann et al. 2003).

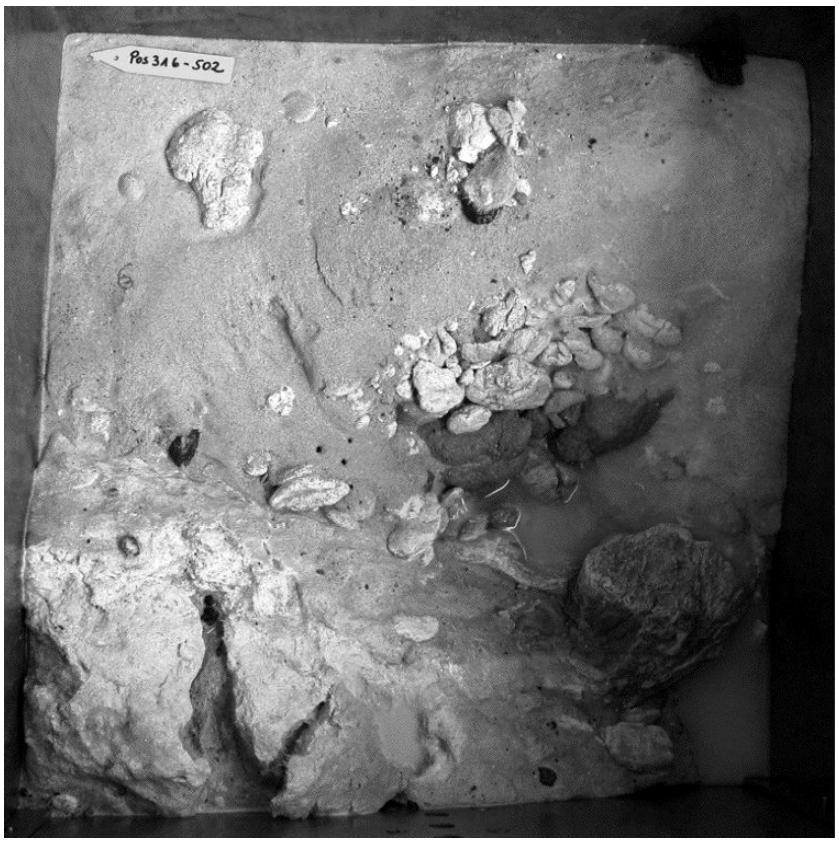

Figure 19:
Foraminiferal medium sand covering fossil sponge mats in sandy clay to the north of Kiel Mount, Rockall Plateau (Station PO316-502). Note the pebbles of reworked spiculitic ooze at the base of the sand veneer. Surface area: 50 x 50 cm.

The surface sediments in the Belgica Mound Province show principally two different facies belts. The upper slope above 660 to 700 m is covered by a firm, sharp, fine to medium sand above a homogenous clay named "Porcupine Mud" (Figure 20). The sand may be silty in the vicinity of shallow bioherms called "noses". Ice-rafted detritus is rare to common. The thickness of the sand veneer increases from a few centimetres up to 20 cm towards shallower water depths. The terrace to the west of the “noses” is covered with biodetritic medium to coarse sand which is overlying Porcupine Mud (Figure 21). Ice-rafted detritus is common to abundant, and the pebbles increase in size northwards. Immediately to the north of carbonate mounds, the dropstones may form gravel-lag pavements. This pattern is probably due to the activity of strong tidal currents. The biodetritic sand shows the greatest thickness of up to 15 cm in local depressions between smaller Carbonate Mounds. The veneer of coarse sand thins out at depths below the outer chain of Galway to Térese Mound, and the abundance of IRD increases too. Living corals and coral debris was only encountered on or in the immediate vicinity of mound structures (see also Chapter 7, Chapter 5.4).

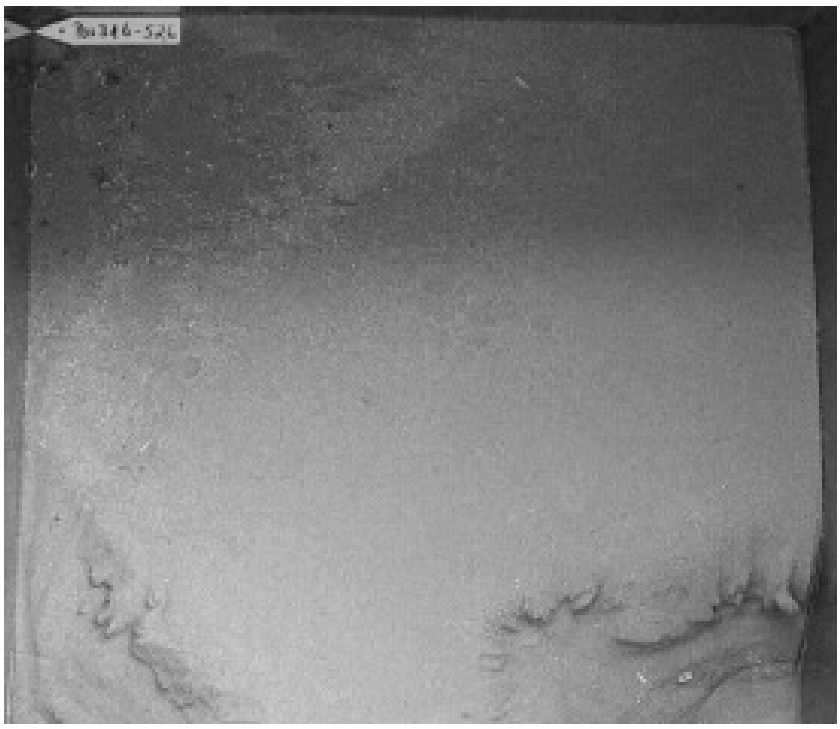

Figure 20:
Firm fine to medium sand from the upper slope to the southeast of Poseidon Mound, Belgica Province (Station PO316-526).

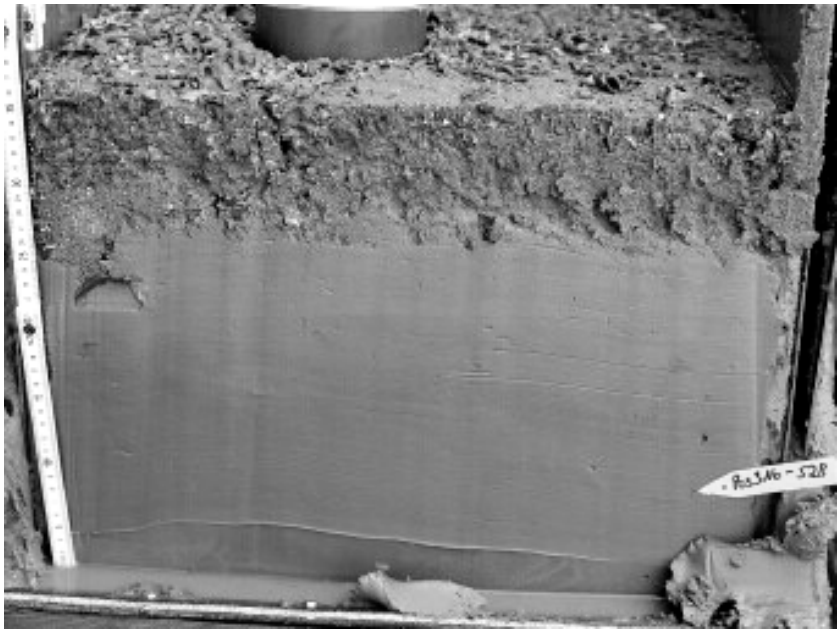

Figure 21:
Biodetritic medium to coarse sand with ice-rafted detritus overlying Porcupine Mud to the east of Little Galway Mound, Belgica Province (Station PO316-528).

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5.4. Fauna and Taxonomy: Some biological aspects of POS316

T. Beck, A. Vertino, E. Meier, I. Schiemer and L. Beuck

Ojectives

The biodiversity of the cold-water coral ecosystem is still poorly explored. This is especially true for the macrofauna generally not visible on underwater photographs or video documentation.
Different seafloor video and photo surveys carried out with the Quest-ROV and the OFOS sledge during Meteor Cruises M61-1 and M61-3 in 2003, as well as previous campaigns with the ROV Victor (IFREMER) have advanced the knowledge about different facies reflecting characteristic patterns in the distribution of coral populations in the area of the study sites of POS 316 cruise. These surveys have also allowed visualising important aspects of the megafauna associated to the cold-water coral ecosystem.
POS316 provided the unique opportunity to improve the set of benthos samples, urgently needed as groundtruthing for a reliable interpretation of the existing video and photo data and for the detailed analysis of the macrofauna diversity. The samples taken in the three study areas Kiel Mount (Western Rockall Bank), Northern Belgica Mound Province (BMP) and the Southern Belgica Mound Province, including Challenger Mound helped, to develop a dense set of groundtruthing data and brought up an important number of macrofaunal invertebrates. Of particular interest during the sampling campaign of POS 316 were the often-underrepresented background sediments as well in the closest proximity of the mounds and far off-mound stations. Due to the sampling on different mound structures, the knowledge about deep-water coral habitats in the BMP has been greatly improved. In the Northern BMP, one mound structure has been sampled for the first time. The samples from the Pentesilea Mound, situated almost half-way between Galway Mound and Poseidon Mound, allow for the first time to link the environmental situation of the healthy, densely coral-covered Galway Mound in the West and the dead eroded Poseidon Mound in the East. In the southern part of the BMP a designated IODP coring site, the Challenger Mound, has been included in the sampling programme.

Methods

The living invertebrate fauna was collected by IPAL for taxonomic investigations. Various kinds of samples taken from the different box corer stations are listed in the detailed box corer protocols (Chapter 7). From all boxcores with sufficient penetration depth, the sediment column was sampled using archive liners (∅ 10cm).
The remaining sediment column was sieved stratigraphically in slices following the sedimentary units over a series of sieves with > 4mm, 2mm, 0.5mm, and 0.2 mm mesh size. All sieved fractions were kept under seawater. After several hours in the ships refrigerators (4°C) all samples were examined under the microscope. Thereby all living animals (or at least a representative number of specimen), were picked. Samples of smaller grain size, containing a large number of remaining living animals were then entirely preserved in 70% ethanol. Samples from underlying sediments or without any apparent animal life were rinsed with freshwater and air-dried. All sample material was examined on board and preliminary protocol lists are presented in Table 3. Preliminary species inventories are listed in Table 4.

All living animals were kept alive in refrigerators for further documentation. A photographic documentation system was applied to take digital images of the living animals. This time-consuming work showed to be of utmost importance as many taxa loose important diagnostic features once they are dead and fixed. The IPAL documentation system consists of a computer-guided digital camera system mounted on a stereo microscope. The ANALYSIS software package provided a multitude of different photographic features. Specimens larger than 3 cm were documented with an ordinary digital camera. After its documentation each specimen was preserved separately in 70% ethanol for further taxonomic evaluation. The taxonomic groups not covered by the expertise of scientists present onboard of RV Poseidon, the documented specimens were kept separately and will be sent to specialists.
Of major interest is the in situ documentation of all kind of epifauna. In the present context especially the in situ documentation of epifauna on coral framework allows to get more information about the species association and distribution pattern of specific substrates. Due to the fact that the studied coral habitats are not easily accessible, the knowledge about the details of particular habitat and the animals living there is still very limited. Even more limited is the knowledge about species ecology and behaviour. Some of the species sampled on POS 316 are documented alive for the first time.

Results

The benthic sampling rendered 20 boxcore samples in both study areas. Six of them contained living corals or dead coral framework indicating at least the proximity of cold-water coral occurrences. With 14 boxcores, the different background facies was sampled: namely the dropstone facies known to occur frequently in the BMP in areas between the mounds and in the channels flanking the mounds (Foubert et al. 2005), the sand facies mostly present on the eastern flanks of the mounds and partly burrowing the shallower mounds in the eastern part of the BMP (De Mol et al. 2002; Van Rooij et al. 2003; Foubert et al. 2005). Sampling at Kiel Mount concentrated on sandy-muddy background facies. One sample close to the summit contained few coral fragments.

Kiel Mount survey

During Meteor Cruise M61-1 in 2004, this new coral province located at the deeper margin of the Western Rockall Bank has been studied for the first time. The Kiel Mount has been identified as a conical submarine volcanic cone at 1100 to 900 m depth, probably of Paleogene age (Freiwald pers. comm.). The preliminary work on samples from M61-1 revealed the necessity to increase the number of samples from this area, both in terms of sedimentology and biology. Five of the samples taken in the Kiel Mount area consisted of fine to medium sand with large number of planktonic foraminiferans. The high number of Amphipoda was striking. In sample POS-316-498 more than 30 specimens belonging to at least 4 species were caught (Fig. 22a-d).
For crustaceans in general and for amphipods in particular, a documentation of living specimen is very important for identification as they loose many characteristics when dead or preserved. Besides numerous amphipods, several other soft bottom inhabitants were recorded. Echiurids (Fig. 23a) and thanaidacean crustaceans (Fig. 23b) were the most common features, followed by locally very abundant xenophyophorids (Fig. 23c). Amongst the records of a probably subfossil fauna, the abundant presence of very dense layers of sponge

spicules has to be highlighted. In sample POS 316 – 502 parts of the sediment were almost entirely build up by sponge spicules. All surface samples revealed a large number of otoliths indicating a enhanced sedimentation.

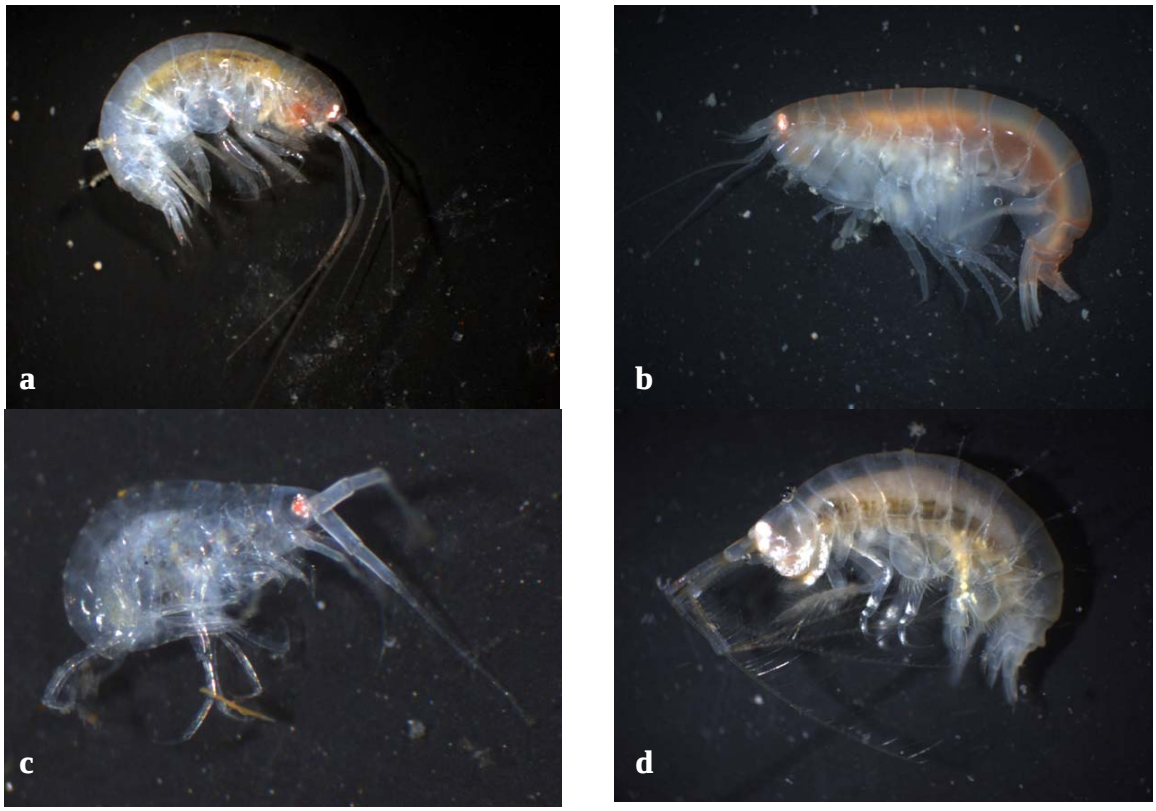


Figure 22 a-d: Four not yet identified amphipod species caught in the sample POS-316-498, specimens 3-6 mm.

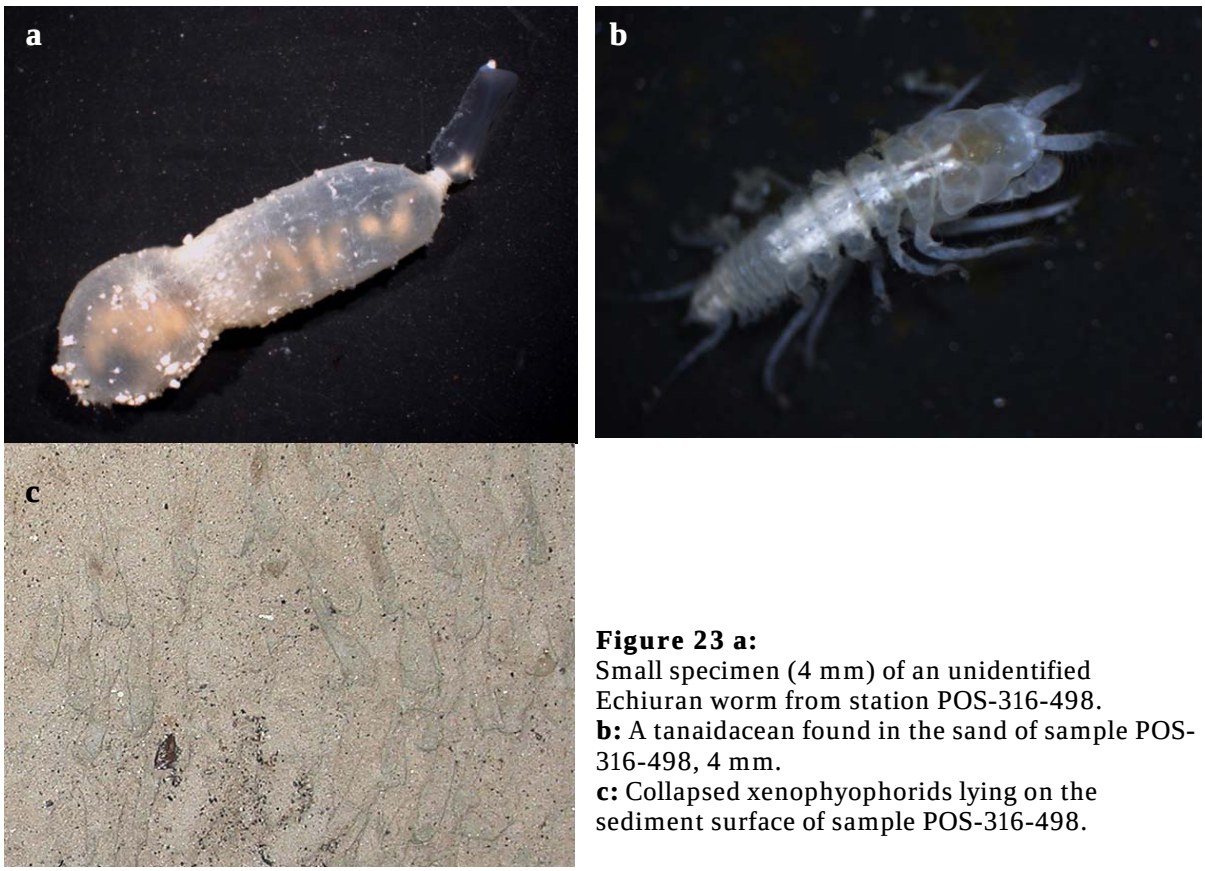


Figure 23 a:
Small specimen (4 mm) of an unidentified Echiuran worm from station POS-316-498.
b: A tanaidacean found in the sand of sample POS-316-498, 4 mm.
c: Collapsed xenophyophorids lying on the sediment surface of sample POS-316-498.

The only sample containing coral fragments on the sediment surface was sample POS-316–501. The fauna caught with this sample differs considerably from the other Kiel Mount samples. Ophiurids, stalked crinoids, gastropods and holothurians (*Psolus* spp.) dominated the fauna of this sample. The dead coral fragments *(Madrepora oculata, Lophelia pertusa* and *Desmophyllum cristagalli*) as well as fragments of hexactinellid sponges (*Aphrocallistes bocagei*) were frequently settled by sessile organisms such as hydroids, sponges and bryozoans. The above-mentioned holothurians seem to belong to two different species of the genus *Psolus* (Fig. 24a+b). Both are well adapted to live in high current environments with a limpet like creeping behaviour. The two supposed species are easily distinguishable by the different ramification type of their tentacles.

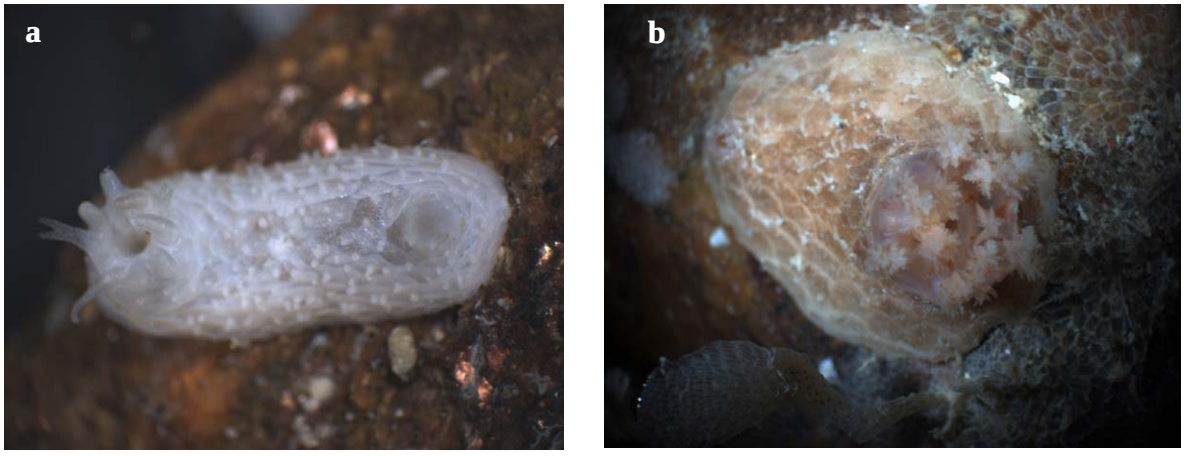


Figure 24 a: "Incrusting" holo-thurian *Psolus* sp. from Kiel Mount sample POS316–501, 3.5 cm.
b: Small *Psolus* sp. attached to a drop-stone from sample POS316–501, specimen 1.9 cm

Beside several encrusting species of Bryozoa two very characteristic species settled on dropstones and coral fragments. The stalked *Beania* sp. (Fig. 25a) is a species so far not reported for any of the samples from the present study area. The lobed colonies of *Chartella papyracea* (Fig. 25b) are repeatedly found in samples containing coral fragments.

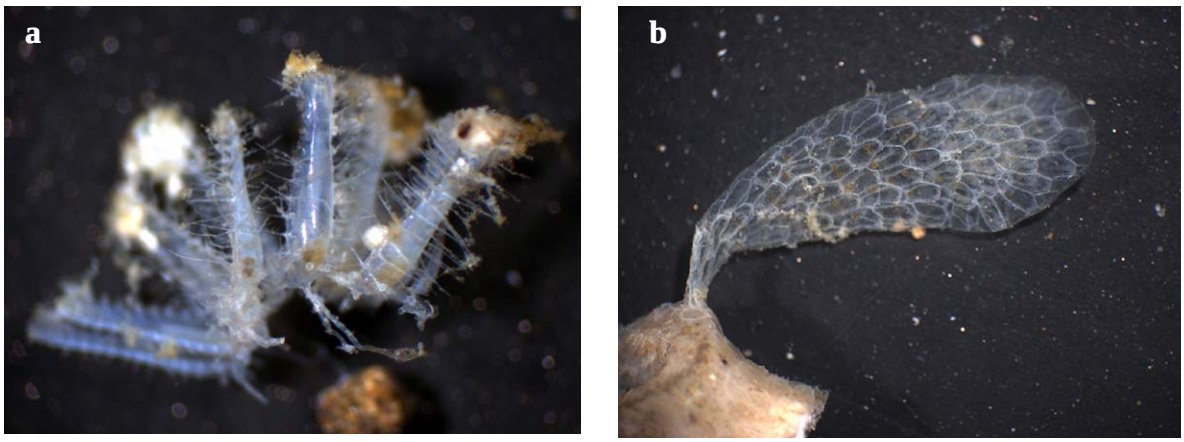


Figure 25 a: Several zooids of a stalked *Beania* sp. (bryozoan) 2.5 mm.
b: A lobed colony of the bryozoan species *Chartella papyracea* attached to a coral fragment, 1.2 cm high.

Several species of ophiurids were found to sit on and in between the coral skeletons, the most abundant species was *Ophiacantha abyssicola*.

Northern BMP survey:

The studied area is located at the eastern margin of the northern Porcupine Seabight ranging from upslope of the Poseidon Mound in the East to the deep trough near Castor Mound in the West. Our work in this area included samplings of mound structures and other seabed features that were previously explored by ROV, towed camera but were not sampled before. The Mound structures sampled are the Pentesilea Mound (51°27.182N/11°44.026W) and western flank of Galway Mound (Fig. 18). Other Seabed features sampled were supposed drift sediments upslope a shallower mound ridge and sediment flats in between the mound structures of the deeper parts of Southern BMP.
These ground truthing samples gave new insights in the sedimentary processes and the biology in the study area. The samples POS 316-526 and POS 316-527 taken from the supposed drift sediments at water depths of 623 m and 674 m both showed fine to medium sand at their surface. Many specimens of the scaphopod species *Cadulus jeffreysii* (Fig. 26a), different species of amphipod crustaceans, several gastropods of the species *Pyrunculus ovatus* (Fig. 26b), cumaceans (Fig. 26c) and polychaetes inhabited these mobile sands.

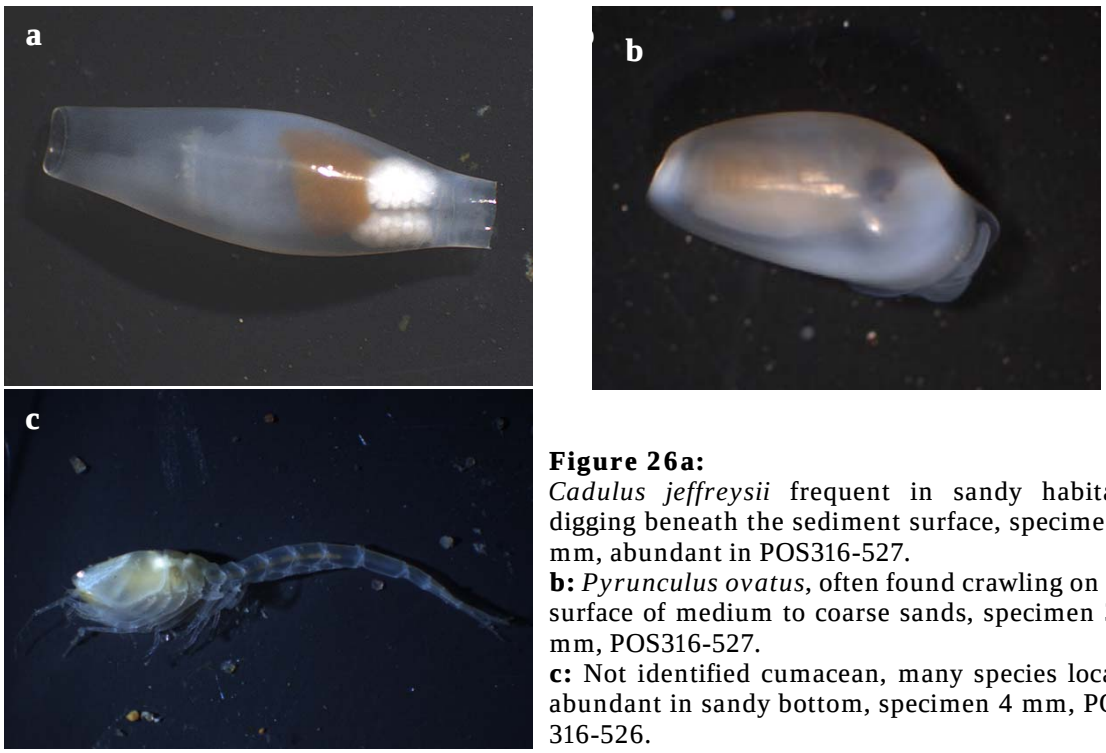


Figure 26a:
Cadulus jeffreysii frequent in sandy habitats, digging beneath the sediment surface, specimen 4 mm, abundant in POS316-527.
b: *Pyrunculus ovatus*, often found crawling on the surface of medium to coarse sands, specimen 3-4 mm, POS316-527.
c: Not identified cumacean, many species locally abundant in sandy bottom, specimen 4 mm, POS-316-526.

Sample POS 316-526 revealed several soft bottom living echinoderms, namely the starfish *Luidia* sp. (Fig. 27a) and the irregular sea urchin *Echinocyamus pusillus* (Fig. 27b). Due to the presence of some dropstones in sample POS 316-527, also several sessile organisms such as bryozoans, hydrozoans and agglutinating foraminifera were found. The analysis of sieved sediments from deeper parts of the core revealed some well-preserved fragments of the solitary soft-bottom inhabiting scleractinian *Fungiacyathus fragilis*. This species shows a semi-cosmopolitan distribution and is characteristic for bathyal depths.

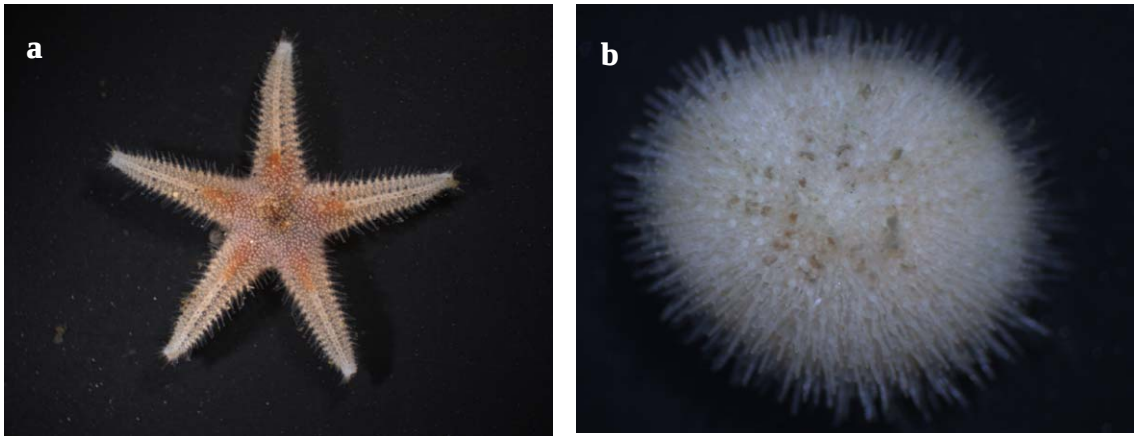


Figure 27 a: Starfish of the genus *Luidia*, normally found camouflaged beneath the sediment surface, juvenile specimen 1.8 cm, POS316-526.
b: Irregular sea urchin *Echinocyamus pusillus*, frequently found on sandy bottom, specimen 6mm, POS316-526.

The surface samples from sediment plains in the vicinity of the mounds (POS 316 – 528 and POS 316 – 529), both from a water depth exceeding 900 m, can be attributed to the dropstone facies see above. Both samples also contained coral fragments, which were mostly of sub-fossil to fossil appearance. In sample POS 316 – 529 only fragments of *Madrepora oculata* were found, whereas in POS 316 –

528 also degrated fragments of *Lophelia pertusa* were present. In both samples the dropstones and the coral fragments were settled by a multitude of sessile animals. The balanid species *Verruca stroemia*, cyclostome bryozoans, hydrozoans and a sponge were the most frequent epifauna on the coral fragments and the dropstones. The vagile fauna in sample POS 316 – 528 is characterised by the presence of abundant echiuran worms and living gastropods (*Scissurella* sp. and *Amphissa acutecostata*) as well as the galatheid crustacean *Munida sarsi*.Several species such as *Pliobothrus symmetricus*, *Pedicularia sicula* – a parasitic gastropod feeding on *Pliobothrus* - and the bivalve *Limopsis minuta* reflect the presence of rather high current speed in the dropstone-dominated habitats.
The boxcore samples from the western flank of Galway Mound (POS 316 – 525) and from top of Pentesilea Mound (POS 316–524) exhibit prolific coral growth. With several specimens of *Acanthogorgia* sp. and an unidentified stoloniferous species, octocorals are also contribute to the construction of this three-dimensional habitat. In both samples, several specimens of the hexactinellid sponge *Aphrocallistes bocagei* dead and alive provide abundant substrate for other animals to settle, as for example a yellow incrusting sponge (not to confuse with living Aphrocallistes, which is whitish).
In both samples, a diverse association of scleractinians was documented. Always present was the coral-associated polychaete *Eunice norvegica*. Beside the colonial scleractinian species *Lophelia pertusa* and *Madrepora oculata* (Fig. 28a), also several specimens of the solitary *Desmophyllum cristagalli* and *Caryophyllia sarsiae* (Fig. 28b) have been reported.
The living scleractinian association in sample POS-316–525 is clearly dominated by *Lophelia pertusa*. Next to *Lophelia,* also *Caryophyllia sarsiae* preferably settles on dead *Madrepora*-framework, which represents the most abundant substratum in this sample. It is noteworthy that *Lophelia pertusa* is only represented by a morphotype showing unusually stout corallites (Fig. 28c).

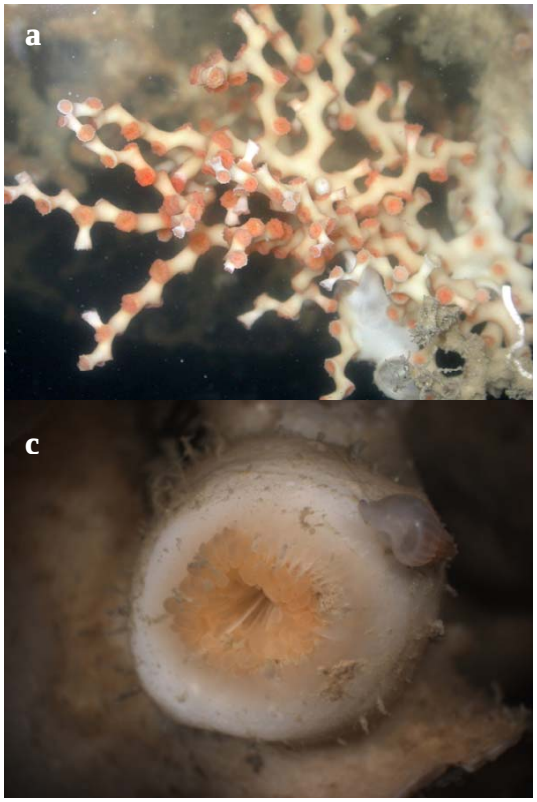


Figure 28 a:
Colony of *Madrepora oculata* morphotype with reddish soft parts, entire colony >15 cm, POS316–524.
b: The solitary sclaractinian *Caryophyllia sarsiae* with soft parts retracted, diameter 2.3 cm, POS-316-525.
c: Aspect of an abnormally stout colony of *Lophelia pertusa* with *Amphissa acutecostata* close to the theca, diameter of the corallite 1,2 cm, POS-316-525.

From the very abundant small epifauna present on the dead coral fragments especially the high abundance of komokiaceans and the very dense coverage with the pterobranch *Rhabdopleura normani* are to be highlighted.
As a life form between epi- and endofauna the anemone *Fagesia* sp. was found with several species settling in sponge borings in dead coral fragments (Fig. 29). A preliminary study at the IPAL on some of these specimens contradicts the hypothesis that this species could be a bioeroding cnidarian (pers comm. Max Wisshak).

Figure 29:
The Anemone *Fagesia* sp. was found to inhabit sponge cavities in coral fragments, specimen 4 mm, sample POS316–525.

The vagile fauna comprises many species of various groups, amongst them several polychaete species such as abundant scale worms and a characteristic species attributed to the family Hecionidae.
In contrast to POS316–525, the scleractinian association of POS316–524 from Galway Mound does not comprise living specimens of *Lophelia pertusa*, whereas living *Madrepora oculata* is by far the dominating feature of this sample. *Desmophyllum cristagalli* as well as *Caryophyllia sarsiae* are also present. The dead coral framework is densely covered with epifauna (sponges, bryozoans, hydrozoans, octocorals, komokiaceans and others). Several crustaceans have been caught in this sample amongst them one so far unidentified isopod and one squat lobster (*Munida sarsi*) (Fig 30a).
Of particular interest is the presence of a pygnogonid species (Fig.30b) not found elsewhere during POS 316.

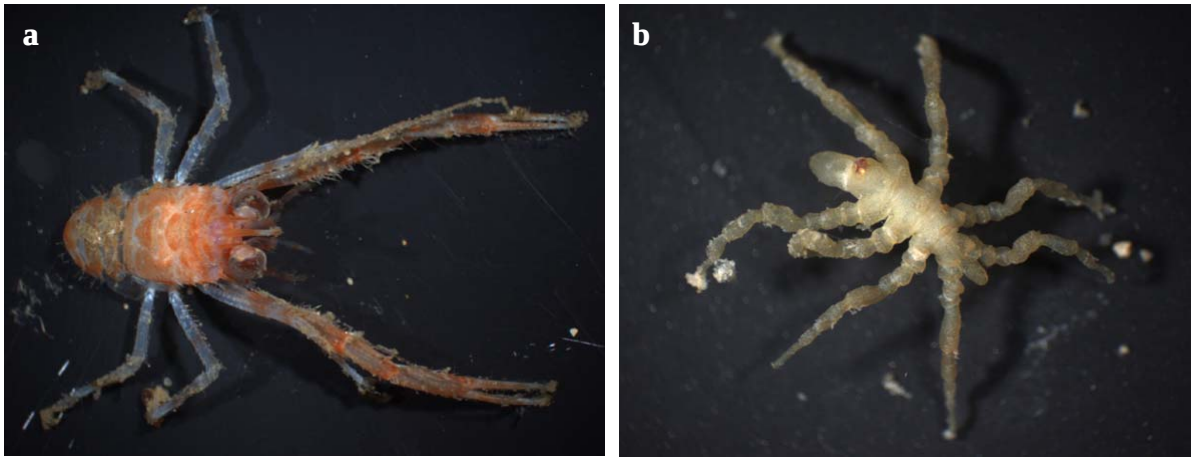


Figure 30 a: A squat lobster (*Munida sarsi*) caught in sample POS316–524, 4 cm.
b: Unidentified pycnogonid found on Aphrocallistes fragments in sample POS316–524, specimen 4mm.

Five boxcores were taken in the southern BMP. The prime target was the Challenger Mound, which is a designated IODP coring site. One sample was taken at the south-western flank. For detailed on-mound off-mound comparison one sample was taken from the deep base of the contourite channel separating Challenger Mound from the shallower mound cluster in the East. The mounds of this shallower mound cluster are aligned almost north to south and marked by prominent escarpments. Two of them, Joe's Nose and another escarpment further south were sampled with one boxcore each. The channel separating these two mounds was sampled at its base with one boxcore.

The sample POS316 – 507 from Challenger Mound, one of the southernmost mounds in the BMP, only comprised a few living animals. Many coral fragments were present at the surface but only few *Madrepora oculata* were alive. All specimens of *Lophelia pertusa*, *Desmophyllum cristagalli* and *Caryophyllia sarsiae* were only recorded dead. A larger *Madrepora* fragment was settled by the octocoral *Antothela grandiflora*. Two specimen of a solitary tunicate (?*Mogula* sp.) were attached to dead coral fragments. During the preliminary analysis of the samples on board, the large polychaete *Eunice norvegica* was observed actively attaching branches of living *Madrepora* to its parchment-like tube (Fig. 31). This polychaete is known to be closely associated to cold-water coral species like *Lophelia* and *Madrepora* and its tubes are frequently found overgrown by coral aragonite.

Figure 31:
The large polychaete *Eunice norvegica* has been observed attaching branches of living *Madrepora oculata* to its parchment-like tube, specimen 15 cm long.

The sample POS306-508-2 from the contourite channel close to Challenger Mound only contained few animals mostly living infauna in the well sorted medium sand at the surface of the boxcore. Several specimens of the gastropod *Pyrunculus ovatus* were found crawling on the sand. Three scaphopods (*Cadulus jeffreysi*) were observed digging beneath the sediment surface.
A very young specimen of *Luidia* sp. was found camouflaged under the sediment.

The sample taken from the channel in between the two shallower escarpments was retrieved with the lid of the boxcore damaged and open. The surface was washed off, with only some dropstones remaining, of which one was settled by a holothurian (*Psolus* sp.) indicating that it was originally placed on the sediment surface.

The two samples taken from the escarpments differed considerably. The sample POS 316-510 from Joe's Nose was taken from a sandy facies, known to bury the

eastern side of these mounds (De Mol 2002), whereas POS316-509 was taken west of the top and brought up dead and living cold-water corals.
POS316-510 only contained few badly preserved fragments of cold-water corals only sparsely settled by sponges and a stoloniferous octocoral species. The vagile fauna mainly consisted in sipunculids and gastropods. The limpet *Propilidium exiguum* and other gastropods such as *Amphissa acutecostata* were found crawling on the coral fragments.

The sample POS 316-509 from an unnamed mound structure north of Joe's Nose revealed a very rich and healthy cold-water coral associated fauna.
The coral association seems to be dominated by live Madrepora oculata. Octocorals are very diverse in this sample. The preliminary identifications revealed at least 4 species. Three species of gorgonians, two large growing species (*Acanthogorgia* cf. *armata* (Fig. 32a) and *Placogorgia* cf. *graciosa*) and one colony of a very small *Swiftia* sp. (Fig.32b) were caught. A stolonial octocoral already mentioned from other samples was present growing on dead-coral fragments (Fig.32c). The vagile fauna of this sample showed to be very characteristic due to the presence of a large number of juvenile echinoids, most probably freshly settled, and the large number of juvenile squat lobsters (>10 specimens). Also the co-occurrence of the two carnivorous crabs *Monadaeus couchi* and *Bathynectes maravignae* has to be noted. *Bathynectes* has already been observed feeding on squat lobsters. The caught specimen of *Monadaeus couchi*, was kept alive for the remaining time on board and became the mascot of the biology group.
Abundant living molluscs have been collected from this sample, extraordinary frequent were rather common species like *Amphissa acutecostata* (gastr.), *Chlamys sulcata* (biv.) and *Alvania cimicoides* (gastr.). Buried in the fine sand between coral fragments a tube anemone (*Cerianthus* sp.) was collected.

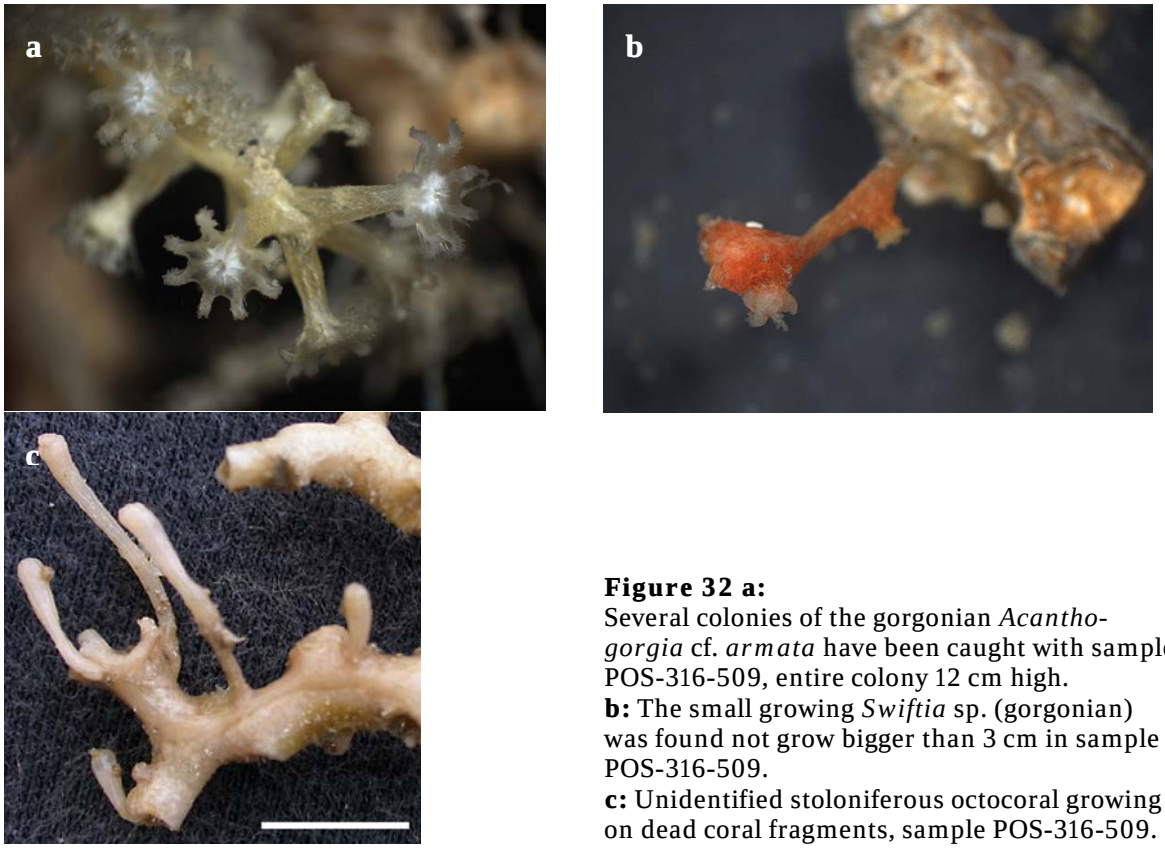


Figure 32 a:
Several colonies of the gorgonian *Acantho-gorgia* cf. *armata* have been caught with sample POS-316-509, entire colony 12 cm high.
b: The small growing *Swiftia* sp. (gorgonian) was found not grow bigger than 3 cm in sample POS-316-509.
c: Unidentified stoloniferous octocoral growing on dead coral fragments, sample POS-316-509.

Preliminary Conclusions

The samples collected during POS316 yielded a large number of some times unexpected macrofauna specimens. They represent a further step towards a better understanding of the carbonate mound province at the Irish Atlantic Frontier. Due to the low number of samples from each working area, the comparability is low when based only on the collections from this cruise. However, in combination with samples collected recently on the cruises M61-1 and M61-3, the POS316samples represent a valuable data set enabling high-resolution comparison and analysis, especially in the BMP. The samples from the designated IODP site are also completing a set of samples already taken in preparation of the IODP Programme with RV Marion Dufresne in 2003. To further elucidate the distributional patterns of the cold-water coral species in the BMP, the POS316 samples are included in the already existing set of samples from the area.
It was possible to document numerous invertebrates of which many certainly are documented alive for the first time although the analysis of the living fauna on board is very time consuming. All images taken will be sent together with the specimens to taxonomists specialised on the different groups not covered by the expertise of the IPAL-Team.

Table 3: Preliminary species inventory POS 316

Sample Station	Study Area	Handpicked animals	sieved 4mm	sieved 2mm	sieved 1mm	sieved 0.5mm
POS 316-498 [surface]	Kiel Mount	living animals: 4 ? Species of Amphipods!, 1 Tanaidacea, Oligochaetes, hemit crab, Xenophyophorida dead animals: *Eumetula arctica*, *Yoldiella* sp., *Solariella/ Magarites*, *Brookesena turrita* (First record south of Iceland!).	?compacted foraminiferan mud, dropstones, 1 fossil *Amphissa* sp.	3 *Amphissa* dead, *Yoldiella*, dropstone pebbles, otholith, *Limatula* sp., *Delectopecten vitreus*, *Bassiliopsis* sp., *Laiocochlis* sp.	*Eumetula arctica*, *Nucula* sp., *Yoldiella* sp., otoliths, *Limatula* sp., dropstone pebbles, lots of Xenophyophora, *Bathyarca grenophia.*	sponge spicules
POS 316-498 [bottom]	Kiel Mount		*Cuspidaria cuspidata* *Cardiomya* sp., *Cylopecten*, *Bathyarca frielei*, few Isidiidae sp., ?compacted foraminiferan mud, very few shells: brachiopods, ?*Crania* sp., *Batyarca frielei*, *Putzeysia* ?, *Astarte sulcata*, *Limatula* sp., very few Aphrocallistes, strange sponge!	*Limatula* sp., *Cardiomya* sp., *Cuspidaria* sp., *Isidiidae* sp., xxx *Solariella* sp., *Yoldiella* sp., *Nucula* sp., *Cyclopecten*, *Platidia* ?, *Cylichna* sp.	dropstone pebbles, foraminifera, many Isidiid corals, bryozoa, sponge spicules, *Eulimella* sp., *Eumetula arctica* common, *Limatula* sp., *Limopsis* sp., *Bathyarca* sp., *Yoldiella* sp., *Malletia* sp., *Cuspidaria* sp., *Cirsonella romettensis.*	many dropstone pebbles, foraminifera, sponge spicules common, sea uchin spines (*Echinus* sp.), juv. *Eumetula arctica*, *Yoldiella* sp., *Skenea areolata*, *Verticordia* sp., *Nucula* sp., *Eulimella* sp., *Chrysallida hoeisaeteri*! First record south of Iceland!
POS 316-499-2	Kiel Mount		mainly dead *Madrepora*, dropstones, few Aphrocallistes, *Desmophyllum*, *Bathylasma*, many *Delectopecten* and *Heteranomia*, *Limopsis* sp., *Astarte sulcata*, *Chlamys sulcata*	*Heteranomia* abundant, *Puncturella* sp., *Yoldiella messanensis*, xx *Amphissa* sp., *Asperaca nodulosa*, xxx *Delectopecten*, *Pyrunculus ovatus*, *Scissurelle umbilicata*, *Cryptonatica affinis*, *Chlamys culcata*, *Nucula* sp., *Limopsis crenata*, *Limopsis* sp., *Cuspidaria* sp.	dropstone pebbles, dead coral fragments, mainly *Madrepora*, abundant otoliths, *Aphrocallistes* fragments, sea urchin spines and fragments *(Echinus/Cidaris)*, Isidiid corals, abundant otoliths, Scaphopods: *Dentalium* sp., *Cadulus propinquus*, *Amphissa acutecostata* not abundant, *Eumetula arctica*, *Eulimella* sp., *Cisonella romettensis* frequent, *Anatoma umbilicata*, *Capulus ungaricus*, *Torellia* cf. *delicata*, *Trochaclis* sp., *Pyrunculus ovatus*, *Cryptonatica affinis*, *Hemiaclis ventricosa*, *Morvillia undata* (nach Sars), *Limopsis* sp., *Astarte sulcata*, tanaidacean crustaceans.	foraminifera, fine dropstone pebbles, *Amphissa acutecostata*, *Delectopecten vitreus….*

Sample Station	Study Area	Handpicked animals	sieved 4mm	sieved 2mm	sieved 1mm	sieved 0.5mm
POS 316-500	Kiel Mound		dropstones, xenophyophorida, buccinid fragments, *Dentalium* sp., carbonate hardground	abundant dropstone pebbles, several *Amphissa acutecostata*, many otoliths, *Pyrunculus ovatus, Chlamys sulcata.*		
POS 316-501	Kiel Mount	stalked crinoids!, abundant porifera, Bryozoa, Hydrozoen, *Spirotropis monterosatoi*, stalked sponge, tube-living amphipods, polychaetes, *Psolus* (2 species), Kamptozoa, scaleworms, nemertini, abundant *Amphissa acutecostata.*	dropstones, dead *Madrepora oculata, Desmophyllum, Pliobothrus,* Aphrocallistes, encrusting bryozoa, *Bathyarca frielei, Limopsis* sp. *Cyclopecten* sp., *Chlamys sulcata, Calliostoma* cf. *occidentiale,* many *Volutomitra groenlandica, Bathylasma, Verruca,* Sertulariid bryozoa, *Bathyarca grenophia.*	xxx living *Amphissa* sp., *Limopsis* sp., *Bathyarca* sp., *Cirsonella* sp., *Pyrunculus ovatus, Haloceras carinata,* fossil *Laiocochlis* sp., *Cuspidaria cuspidata, Delectopecten, Limopsis* sp., 1 *Calliostoma* sp., *Heteranomia squamula.*	*Torellia* sp., many otoliths, *Amphissa* sp., *Crisonella* sp., living *Aclis/ Hemiaclis!, Cerithiella* sp., Puncturella *noachina, Bathyarca* sp., *Ancistrobasis reticulata*, very few *Asperarca nodulosa, Pyrunculus* sp., *Trochaclis* sp., *Notolimea crassa, Eumetula* sp., *Skenea* sp., 3 living *Pyrunculus ovatus.*	abundant dropstone pebbles, foraminifera and sea urcin spines, *Skenea areolata, Amphissa acutecostata, Hemiaclis* sp., *Cerithiella metula.*
POS 316-503 (surface)	Kiel Mount	giant *Dentalium, Pholadomya* / *Verticordia* ????, *Laiocochlis sinistrata*, buccinid gastropod.	dropstones, sponge spicules, Aphrocallistes, many encrusting bryozoa, brachiopoda, scaphopods, *Cryptonatica affinis, Limatula subauriculata, Delectopecten vitreus, Cyclopecten* sp., *Limopsis cristata, Puncturella noachina, Torellia delicata, Calliotropis ottoi*!!	few sample material; dropstones and sponge needles, Aphrocallistes, many *Amphissa* sp., several turrids!!, *Cadulus propinquus, Nucula* sp. *Laiocochlis sinsistrata, Torellia delicata, Dacrydium* sp., *Verticordia* sp., *Cyclopecten* sp., *Limatula subauriculata, Limopsis* sp., *Morvillia undata, Diaphana* sp., *Cuspidaria* sp.	abundant sponge spicules, dropstone pebbles, abundant pelagic gastropods, mostly pteropods, *Cerithiella metula, Eumetula arctica, Hemiaclis ventrosus , Dacrydium* sp., *Cryptonatica affinis, Cirsonella romettensis, Retigyra* sp. (Tjarnoeia *monterosatoi*), *Laiocochlis sinistrata, Verticordia* sp., *Cadulus jeffreysi, Limatua subauriculata, Skenea trochoides, Torellia delicata, Skenea basistriata, Benthonella tenella, Cadulus propinquus, Cuspidaria cuspidata,* Eulimidae gen. et spec. indet, *Limopsis* sp.	abundant sponge spicules, *Cadulus jeffreysi* abundant, *Amphissa acutecostata* abundant, *Skenea trochoides, Pristigloma guilonardi.*

Sample Station	Study Area	Handpicked animals	sieved 4mm	sieved 2mm	sieved 1mm	sieved 0.5mm
503 (bottom)	Kiel Mount		sponge spicules!! Very few shells. *Limopsis* sp., few Aphrocallistes fragments.	abundant dropstones, many mollusca, many Aphrocallistes, many Bryozoa, Isidiidae, sea urchin spines, abundant *Amphissa acutecostata*, several buccinid species, several turrid species, *Laiocochlis sinistrata*, **Cerithiella metula**, *Limatula subauriculata*, *Limopsis* sp., 1, *Asperarca nodulosa*, *Cuspidaria cuspidata*, *Verticordia* sp., *Cardiomya costellata*, *Cyclopecten* sp., *Dacrydium* sp., *Cylichna* sp., *Basilissopsis watsoni*, *Eumetula arctica*, *Scissurella umbilicalis*, abundant *Iothia fulva*, *Verticordia* sp., *Trophon echinatus*, *Margarites* spp., *Hemiaclis ventricosa*, *Torellia delicata*, *Nucula* sp., *Yoldiella* sp., *Bathyarca frielei.*	dropstone pebbles, abundant sponge spicules, many pteropod shells, Isidiid corals and sea urchin spines common, several turrid gastropods, *Cadulus propinquus*, *Cadulus jeffreysi*, *Eumetula arctica*, *Cerithiella metula*, *Torellia delicata*, *Hemiaclis ventricosa*, *Margarites* sp., *Diaphana* sp., *Brookesena turrita*, *Iothia fulva*, *Cirsonella romettensis*, *Skenea* sp., *Bathyarca frielei*, *Yoldiella* sp., *Cuspidaria* sp., *Dacrydium* sp., *Astarte sulcata*, *Limatula subauriculata*, *Verticordia* sp.	foraminifera ooze, pteropods, dropstone pebbles, sponge spicules, abundant *Cadulus jeffreysi*, *Eumetula arctica*, *Margarites* sp., *Chrysallida hoeisaeteri*, *Eulimella* sp., *Retigyra* sp. bzw. *Tjarnoeia* .
504 [surface]	Kiel Mount		dropstones, very few to no epifauna, 1 *Nucula* sp., 1 *Puncturella noachina*, polychaete tubes	very few shells:1 *Limopsis* sp., several *Limatula* sp., *Solariella* sp., *Scissurelle umbilicata*, *Verticordia* sp., *Nucula* sp., *Yoldiella messanensis*, many otoliths, dropstone pebbles	mud pellets, dropstone pebbels, sponge spiculae, very few shells: *Skenea basistriata*, abundant *Limatula* sp., *Malletia* sp., 1 living *Yoldiella* sp.	dropstone pebbles, sponge spicules, *Thyasira* sp., *Margarites* sp., *Yoldiella* sp., *Trochaclis* sp.
504 (bottom)	Kiel Mount	many dropstones, ?compacted foram mud, buccinid columella, *Echinus* spines, *Cuspidaria cuspidata*, *Malletia* sp., *Nucula* sp., *Limatula* cf. *subauriculata*, *Verruca* sp., *Verticordia* sp., *Pholadomya loveni* frag., *Magarites cinerea*, large scaphopod.	dropstone pebbles, very few Aphrocallistes fragments, few Isidiid fragments, 1 scaphopod gen. et spec. indet, *Cuspidaria cuspidata*, *Cardiomya costellata*, *Limatula subauriculata*, *Nucula* sp., *Yoldiella* sp., *Malletia* sp., *Limopsis* sp., *Bathyarca frielei*, *Limopsis* sp., *Yoldiella philippiana*, *Verticordia* sp., *Puncturella noachina*, *Basilissopsis watsoni* fossil, *Margarites* sp., *Cylichna cylindracea*, *Cryptonatica affinis*, *Crenilabrum exilis.* Brachiopoda ?*Platidia* sp., Cirripedia, *Verruca* sp., indet stalked Cirriped.		mud pellets, dropstone pebbels, few sponge spiculae, *Nucula* sp., *Cerithiella metula*, *Basilissopsis watsoni*, *Margarites* sp., *Cuspidaria* sp., *Yoldiella* sp., *Malletia* sp., *Delectopcten vitres* rare, *Dacrydium* sp., *Trochaclis* sp.	many dropstone pebbles, foraminifera, sponge spicules common, sea uchin spines (*Echinus* sp.), juv. *Eumetula arctica*, *Malletis* sp., *Cadulus* sp.

Sample Station	Study Area	Handpicked animals	sieved 4mm	sieved 2mm	sieved 1mm	sieved 0.5mm
POS 316-506	Galway Mound	Epifauna, biofilm, hydrozoans (spp.), Amphipods, 1 Plathelminthes, *Actinia* 1 sp.				
POS 316-507	Challenger Mount, Southern BMP	*Eunice norvegica*, polychaetes, Amphipods, Ophiurids, *Anthothelia*, regular and irregular sea urchins, scale worms, hydrozoans, bryozoans, *Asperaca nodulosa*, *Delectopecten vitreus*, *Spirotropis monterosatoi*, Tunicates (*Mogula*?).	living and dead *Madrepora* dominating, *Lophelia pertusa*, very few Aphrocallistes, rare Bathylasma, *Chlamys islandica*, *Asperarca nodulosa*, *Hiatella arctica*, *Amphissa acutecostata*, *Heteranomia squamula*, *Delectopecten vitreus*, *Spirotropis monterosatoi*.	Dead coral fragments dominated by *Madrepora*, very few dropstones, *Amphissa acutecostata*, *Heteranomia squamula*, *Asperarca nodulosa*, *Chlamys sulcata*, *Delectopecten vitreus*, *Cardiomya costellata* fragment, *Alvania cimicoides*, naticid gastropod, *Pyrunculus ovatus*.		
POS 316-508-1	Challenger Mount, Southern BMP	dropsone with foraminifera, polychaetes, Komokiazea				
POS 316-508-2	Challenger Mount, Southern BMP	abundant *Cadulus jeffreysi*, starfish *Astropecten*, amphipods (tube-living), abundant echiuran worms, irregular sea urchins, *Echinocyamus pusillus*, living *Pyrunculus ovatus*, tube living polychaetes.	Echinoid fragments, *Dentalium* sp., *Puncturella* sp.	dropstones and echinoid fragments, many pteropods, mainly *Clio* sp., abundant *Limopsis* sp., *Yoldiella messanensis*, *Anatoma umbilicalis*, *Cardiomya costellata*, *Abra* sp., *Yoldiella* sp.	very abunndant dropstone pebbles, many otoliths, few shells, *Pyrunculus ovatus*, *Yoldiella messanensis*, few *Amphissa acutecostata*, *Alvania cimicoides*, *Yoldiella* sp.	
POS 316-509	Challenger Mount, Southern BMP	*Monadaeus couchi*, abundant living A*mphissa acutecostata*, scale worm, hecionid worm, Sipunculids, ophiurids, picnogonid, *Cadulus jeffreysi*, several amphipod species, *Hanleyia* sp., *Alvania cimicoides*, isopods, *Munna* sp, *Acanthogorgia*, *Paramuricea*?, *Swiftia* sp., *Monadeua couchi*, *Munida sarsi*, *Cerianthus* sp., *Bathynectes maravignae*, hecionid worm.		almost no dropstones, dead coral fragments, mainly *Madrepora*, *Amphissa acutecostata* and *Heteranomia squamula* abundant, *Asperarca nodulosa*, *Strobiligera* sp., many branched bryozoans Hornera ?, Delectopecten vitreus, Bathyarca philippiana, Calliostoma sp., Echinocyamus pusillus, Strobiligera sp., Torellia sp. frag.,		

Sample Station	Study Area	Handpicked animals	sieved 4mm	sieved 2mm	sieved 1mm	sieved 0.5mm
POS 316-510	Challenger Mount, Southern BMP	*Limopsis*, scale worm, *Munida sarsi*, octocoral, barnacle plates, branched hydrozoans, sponge, Amphipods, hardground, *Amphissa acutecostata*, sipunculids, *Propilidium exiguum.*	dropstones many barnacle plates, very few fossil corsl fragments, *Limopsis* sp., *Asperarca nodulosa, Bathyarca philippiana, Astarte sulcata, Hiatella arctica.*	dropstones, many coral fragments, *Stenocyathus vermiformis, Limopsis* sp., *Pyrunculus ovatus*, A*mphissa acutecostata, Astarte sulcata, Asperarca nodulosa, Delectopecten vitreus, Cryptonatica affinis, Heteranomia squamula*. Only Heteranomia and *Asperarca* seemed to be not fossil.	dropstones, abundant coral fragments, many *Cadulus jeffreysi* (alive), *Amphissa acutecostata* and *Pyrunculus ovatus, Yoldiella* sp., *Yoldiella messanensis, Limopsis aurita*.	
POS 316-524	Galway Mound, Northern BMP	living *Madrepora,* hecionid polychaetes, *Pliobathrus symmetricus*, scal worm, *Chlamys sulcata, Eunice norvegica*, Verruca Zoanthids, stoloniferous octocorals, bryozoa, hydrozoa, sipunculids, abundant *Rhabdopleura normani.*	Dead and living coral fragments, *Desmophyllum* fragments, no dropstones, Barnacle plates (*Bathylasma*?), *Asperarca nodulosa, Chlamys* sp.!?, many *Emarginula* sp., *Asperarca nodulosa, Heteranomia squamula, Trophonopsis clathratus, Strobiligera brychia, Calliostoma leptophyma, Cantrainea peloritana, Delectopecten vitreus, Cadiomya costellata, Crania anomala.*	large number of Aphrocallistes fragments, coral fragments, diverse malacofauna, many *Amphissa acutecostata, Heteranomia squamula, Delectopecten vitreus, Asperarca nodulosa, Anatoma umbilicalis, Strobiligera* sp., several epitoniid gastropods,	large number of Aphrocallistes fragments, coral fragments, very diverse malacofauna dominated by: *Amphissa acutecostata, Alvania jeffreysi, Alvania cimicoides.* Also common *Asperarca nodulosa, Heteranomia squamula, Fissurisepta granulosa*, I*phitus tuberatus, Anatoma umbilicalis, Talassia dagueneti, Pyrunculus ovatus, Delectopecten vitreus, Yoldiella messanensis, Torellia* sp., several eulimid and epitoniid gastropods.	
POS 316-525	Galway Mound, Northern BMP			Dead coral fragments mainly *Madrepora*, many Aphrocallistes fragments, *Asperarca nodulosa, Delectopecten vitreus, Amphissa acutecostata, Claviscala richardi, Stenocyathus vermiformis, Abra* sp., *Ancistrobasis reticulata, Cylindriscala* sp, *Profundisepta* sp, *Bathyarca philippiana.*	Dead coral fragments mainly *Madrepora*, many Aphrocallistes fragments, abundant *Alvania jeffreysi, Pyrunculus ovatus, Amphissa acutecostata, Delectopecten vitreus, Asperarca nodulosa, Iphitus tuberatus, Asperarca* nodulosa, *Trochaclis* sp., several skeneid gastropods, *Cantrainea* ? peloritana, *Alvania cimicoides, Strobiligera* sp., *Fissurisepta* sp.	
POS 316-526	Galway Mound, Northern BMP	several species of irregular sea urchins, *Cadulus jeffreysi*, several polychaetes,*Leptaxinus*, Isopoda , Amphipoda, nemertine, sand Amphipod, *Astropecten*, cumacaeans.	sample consisting in dropstone pebbles (1-2mm), volcanoclastica, very few shells, buccinid fragment, *Bathyarca frielei, Poromya neaeroides, Leptaxinus incrassatus*, scaphopod fragment.			

Sample Station	Study Area	Handpicked animals	sieved 4mm	sieved 2mm	sieved 1mm	sieved 0.5mm
POS 316-527 (surface)	Galway Mound, Northern BMP	Dropstones with abundant epifauna (cyclostome bryozoans, hydrozoans, foraminiferans), abundant echiurans, scale worms, 4 living *Cadulus jeffreysi*, cumaceans, sipunculids, *Verruca*, Amphipods, *Cylichna* sp., actinians, turrid species,	dropstones, extremely few shells, *Limopsis* sp., *Astarte* sp., naticid gastropod.	dropstones, very few shells, living: *Limopsis*, turrid gastropod only dead: *Anatoma umbilicalis*, Cylichna sp. *Pyrunculus ovatus*, *Poromya neaeroides*, *Bathyarca frielei*, rolled shallow water bivalves, fossil *Amphissa acutecostata*, *Astarte sulcata*, *Spirotropis monterosatoi*, *Heteranomia squamula*, *Anatoma umbilicalis.*	dropstones, few shells, mainly pteropod fragments, *Yoldiella philippiana*, *Leptaxinus incrassatus*, *Cadulus jeffreysi*, *Alvania cimicoides*, *Poromya neaeroides*, naticid gastropods, *Amphissa acutecostata*, *Yoldiella messanensis*, *Asperarca nodulosa*, *Astarte sulcata*, *Anatoma* sp (! not umbilicalis), *Alvania cimicoides*, otoliths.	
POS 316-527 (lower part)	Galway Mound, Northern BMP		dropstones, abundant *Chondrithes* burrows (pyrit), many shells, highly diverse fossil malacofauna, many pyritic fossils, clearly bivalve dominated malacofauna.		dropstones, abundant *Chondrithes* burrows (pyrit), many shells, highly diverse fossil malacofauna, many pyritic fossils, many different crustaceans (pyritic) (Tanaidacea?).	
POS 316-528 (surface)	Galway Mound, Northern BMP	Ophiurids, Nudibranch, several amphipod species, abundant *Amphissa acutecostata*, numerous nematods, large Komokiazeans, *Scissurella* sp., echiuran worms, *Munida sarsi*, polychaetes, oligochaetes.	dead *Madrepora* oculata dominating, few *Lophelia pertusa*, few Aphrocallistes, many barnacle plates (*Bathylasma* ?) and dropstones, *Neptunea antiqua*, *Volutomitra groenlandica*, numerous *Pedicularia sicula*, *Amphissa acutecostata*, *Cranopsis* sp., *Asperarca nodulosa*, *Chlamys sulcata*, *Puncturella noachina*, frequent *Limopsis* sp., *Cryptonatica affinis*, I*othia fulva*, *Diodora* sp., 2 brachiopod species.	dropstones, abundant barnacle plates, coral fragments, mostly *Madrepora*, many *Amphissa acutecostata*, *Pedicularia sicula*, *Limopsis* sp., I*othia fulva*, few *Pliobathrus* fragments, few *Asperarca nodulosa*, *Pyrunculus ovatus*, *Anatoma umbilicalis*, *Volutomitra groenlandica*, *Echinocyamus pusillus*, *Puncturella noachina*, *Epitonium* sp. fragment.		
POS 316-528 (middle)	Galway Mound, Northern BMP		Dropstones, barnacle plates, *Delectopecten* fragment.	dropstones, *Chondrithes* burrowings, regular and irregular sea urchin remains, *Amphissa acutecostata* and barnacle plates. Few *Madrepora oculata* fragments, 1 *Bathyarca frielei*.	dropstones, *Chondrithes* burrowings, regular and irregular sea urchin remains, 1 *Bathyarca frielei*, *Amphissa acutecostata* (few fossil), *Pyrunculus ovatus*, *Alvania jeffreysi*, *Iphitus tuberatus.*	

Sample Station	Study Area	Handpicked animals	sieved 4mm	sieved 2mm	sieved 1mm
POS 316-528 (lowest)	Galway Mound, Northern BMP		dropstones, barnacle plates.	dropstones, pyritic *Chondrithes* burrowings, very few shells, *Amphissa acutecostata*, *Yoldiella* sp, *Mohnia* sp. juv., *Trophonopsis* sp.	dropstones, pyritic *Chondrithes* burrowings, very few shells mostly unrecognizable, 1 eulimid gastropod.
POS 316-529 (surface)	Galway Mound, Northern BMP		dropstones, barnacle plates (*Bathylasma*?), very few shells, Verruca, fossil naticid gastropod, fossil: *Puncturella noachina*, *Limopsis* sp, buccinid, *Dentalium* sp., few pteropod shells.	dropstone pebbles, few shells, frequent pteropods *(Clio* spp.), *Detalium* sp., *Amphissa acutecostata*, naticid gastropod, *Limopsis* sp., frequent *Anatoma umbilicata*, 1 *Heteranomia squamula*, *Pyrunculus ovatus*, *Roxania* sp., *Puncturella noachina*, 1 *Yodiella* sp.	dropstone pebbles, many pteropod shells mainly *Limacina* spp., numerous otoliths, *Yoldiella messanensis*, *Iothia fulva*, *Amphissa acutecostata*, *Benthonella tenella*, *Hanleyia* sp.
POS 316-529 (lower part)	Galway Mound, Northern BMP			few dropstone pebbles, abundant *Chondrithes* burrows (pyrit), worm tubes!! Dropstones intermixed with shallow water bivalve fragments (rolled), wood, fishbones, *Malletia* sp., *Limatula subauriculata*, *Colus* sp., *Scaphander punctostriatus*, several turrid species, *Cerithiella metula*, !? Living *Limopsis* sp., acteonid gastropod, *Colus* sp., Thyasirid bivalve, several agglutinated Ostracod.	Mainly build up of abundant *Chondrithes* burrows (pyrit), rolled shallow water bivalve fragments, *Cylichna* sp., *Malletia* sp., *Auricularia*? sp., *Limatula subauriculata*, *Pyrunculus ovatus*, *Retusa* sp., *Cerithiella metula*, abundant ostracod shells (elongated), fish bones, abundant pteropod shells (*Clio* and *Limacina*).

Inventory of coral species POS 316

POS 316 - CORALS	KIEL MOUNT										BELGICA PROVINCE																				
											PM	Challenger Mound					Galway Mound														
Station number	**498**		**499**	**500**	**501**	**502**	**503**		**504**		**507**	**508/2**			**509**	**510**	**524**	**525**		**526**	**527**		**528**			**529**		
Box core portion	L	U					L	U	L	U		L	M	U				L	U		L	U	L	M	U	L	M	U
Scleractinia																															
Fungiacyathus fragilis G. O. Sars, 1872																					C										
Fungyacyathus marenzellleri (Vaughen, 1996)										R																					
Madrepora oculata Linnaeus, 1758			A	R	C						A				R* A	R	C* A	A	A				A	R	R	R	R	R			
Caryophyllia sarsiae Zibrowius, 1974			C		R						R						R* R	C	C C												
?Caryophyllia sp.										R																					
Caryophyllia ?seguenzae Duncan, 1873		R						R																							
Desmophyllum cristagalli Milne Edwards & Haime, 1848	R		C		R						R				C		R* R	R	R												
Lophelia pertusa (Linnaeus, 1758)			C		R			R		R	R				C	R	C	C	C* R				C								
Aulocyathus atlanticus Zibrowius, 1980			R	R	R																										
Indeterminate caryophylliids	R						R			R																					
Flabellum macandrewi Gray, 1849																					R										
Indeterminate flabellids		R		R				R																							
Stenocyathus vermiformis (Pourtalès, 1868)															R	R		C	R* C												
Dendrophyllia cornigera (Lamarck, 1816)																C															
?Balanophyllia cellulosa Duncan, 1873																R															
Indeterminate dendrophylliids			R																												
Stylasterina																															
Pliobothrus symmetricus Pourtalès, 1868			R		R												C* R		R				R								
Stylaster erubescens britannicus Zibrowius & Cairns, 1992			R		R																										
Stylaster sp.																R															
Octocorallia																															
Anthothela grandiflora (Sars, 1856)											R*																				
Acanthogorgia armata Verrill, 1878															R*		C*														
Swiftia ?rosea																	R*														
Paramuricea placomus (Linnaeus, 1758)															C*		R*														
Keratoisis sp.			C i					R i															R i								
Indeterminate isidids	C i b	R i			R i			R b		R i																					
Stoloniferous															C*		C*														

PM. Pentesilea Mound

U: Upper part of the box core

M: Middle part of the box core

L: lower part of the box core

A: abundant

C: common

R: rare

i: octocoral internodes; b: octocoral basal parts

* : living specimens Black: dead, fossil specimens

6. Acknowledgements

The coastal states Iceland and Ireland granted working permissions in their EEZ which is gratefully acknowledged.

We thank the master and crew of RV Poseidon for their dedicated assistance who substantially contributed to the success of the cruise

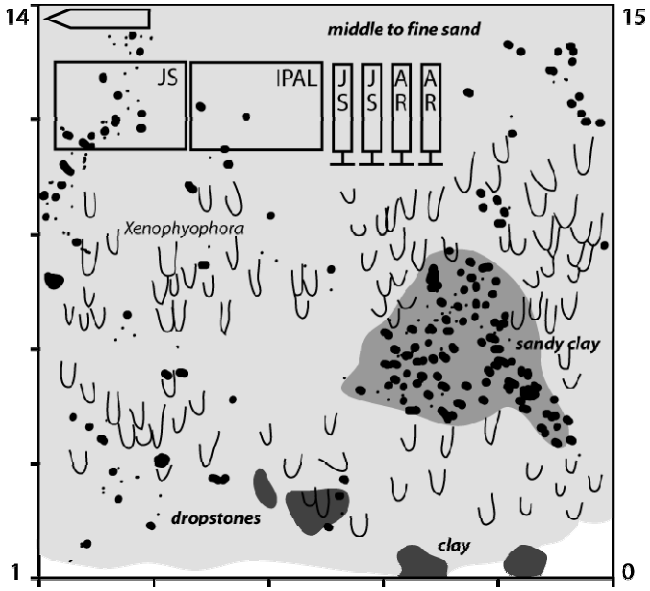
7. Box core descriptions

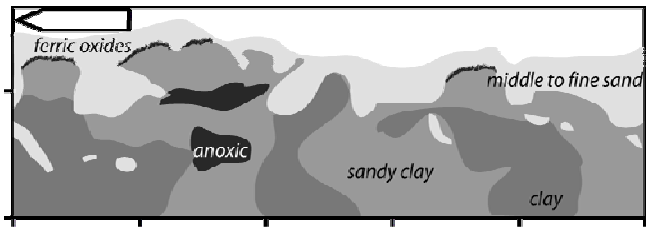
L. Beuck, J. Schönfeld

See overleaf

POS 316 – 498

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
7.8.2004	6:57:24	56°41.487N	17°29.393W	906 m	7.6 °C	15 cm





Sediment surface

Sediment: Middle to fine sand, well rounded, with abundant planktonic foraminifera.
Colour: light grey (HUE 2.5Y7/2).
Structures: Surface is strongly washed.
Morphology: Smooth, long-ranging undulations.
Organisms: *Pagurus* sp., *polychaete* tubes, *Xenophyophora*, holothurians, worm tubes not further specified.

Sediment succession

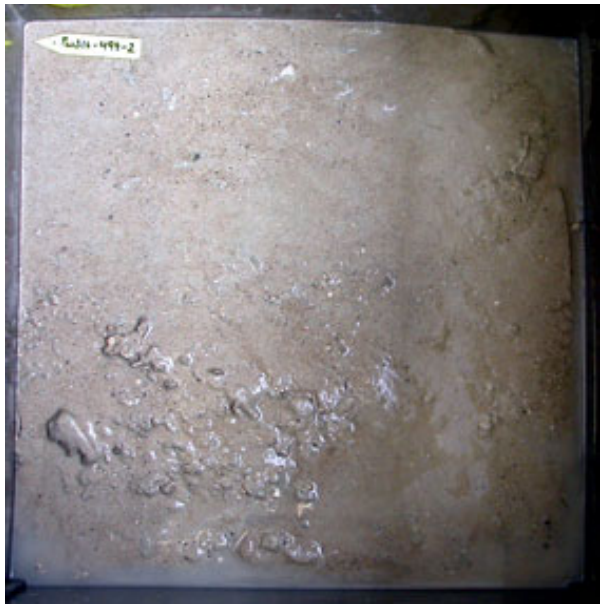
Strata: 1) 0 to 2 cm, in places up to 6 cm: middle to fine sand, with abundant planktonic foraminifera as above.
2) sandy clay, plastic, sand-sized components are irregularily distributed and may be enriched in patches. A dashed horizons of ferric oxides is visible.
Colour: 1) light grey (HUE 2.5Y7/2), 2) pale yellow (HUE2.5Y7/3).
Structures: Top of the second, clay unit is strongly bioturbated with burrows filled with sand from above.
Bioturbation: Indistinct mottles and burrows from above of 1 to 5 cm in diameter.
Fossils: not encountered.

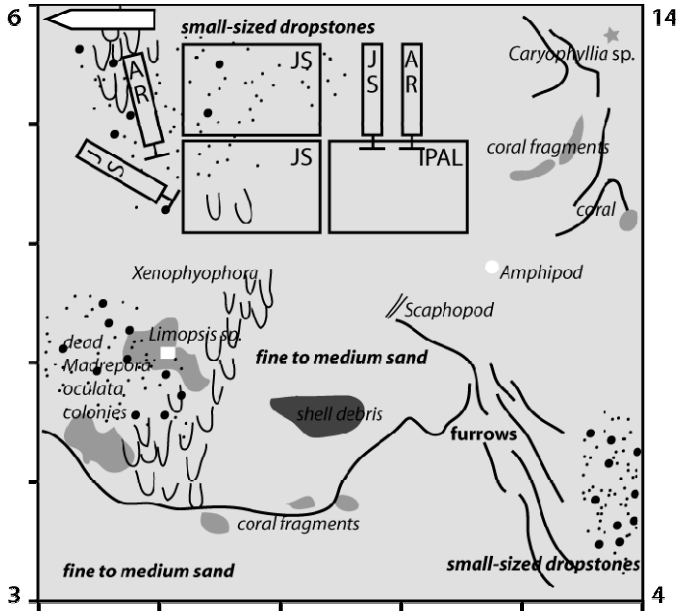
Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** 2 x JS, 2 x AR; 10 cm ø tube: none; Archive box: none

POS 316 – 499

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
7.8.2004	10:21:50	56°41.877N	17°30.643W	824 m	8 °C	6 cm





Sediment surface

Sediment: Fine to medium sand, sharp, with abundant foraminifera, shell debris, and other biodetritus.
Colour: Light grey (HUE 2.5Y7/2).
Structures: Patchy distribution of corals, dropstones, and biotubation traces.
Morphology: Planar.
Organisms: Xenophyophora, polychaete tubes, scaphopods, dead *Madrepora oculata*, *Limopsis* sp., dead *Caryophyllia* sp., amphipods.

Sediment succession

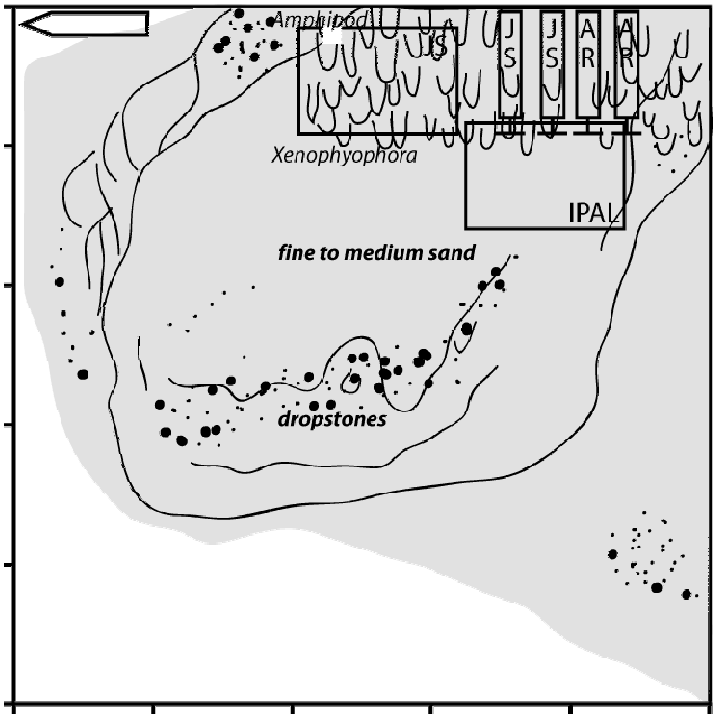
Strata: 1) 0 to 3 cm: fine to medium sand (see as above); 2) silty medium sand with pebbles, most likely dropstones; a horizon of ferric oxides is visible.
Colour: White (HUE 2.5Y8/1).
Structures: Top of the second clay unit is strongly bioturbated with burrows filled with sand from above.
Bioturbation: Indistinct mottles and burrows from above to 5 cm in diameter.
Fossils: *Madrepora oculata*; Bivalve fragment.

Samples

100 cm²: IPAL; **87.6 cm²:** 2 x JS; 1 colony fragment of *Madrepora oculata*: JS; **10 cm²:** 2 x JS, 2 x AR; 10 cm ø tube: none; Archive box: none

POS 316 – 500

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
7.8.2004	11:23:00	56°42.021N	17°30.254W	850 m	-	4 cm



Sediment surface

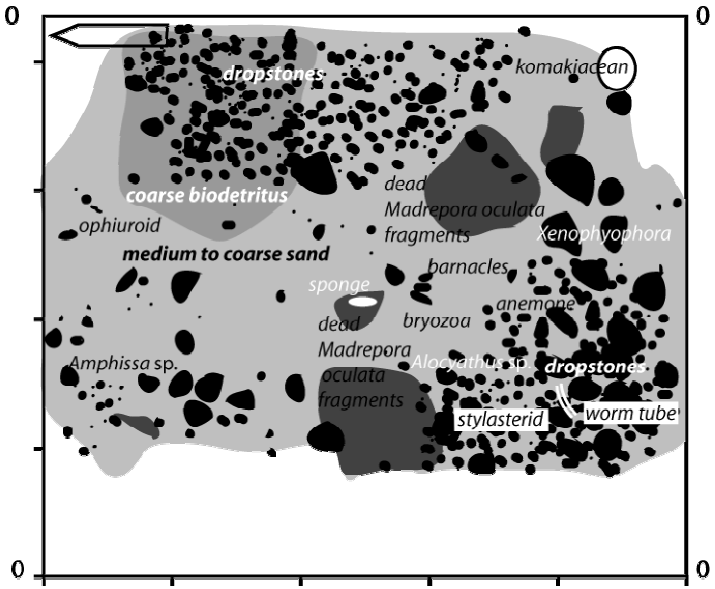
Sediment: Fine to medium sand with abundant foraminifera, also pteropods debris, biodetritus, and dropstones.
Colour: Light brownish gray (HUE 2.5Y6/2).
Structures: Stongly washed.
Morphology: Smooth, probably long-ranging undulations.
Organisms: Xenophyophora, amphipods.

Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** 2 x JS, 2 x AR; 10 cm ø tube: none; Archive box: none

POS 316 – 501

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
7.8.2004	12:55:00	56°42.369N	17°29.711W	878 m	12.4 °C	5 cm



Sediment surface

Sediment: Medium coarse sand of biodetritus, with abundant planktonic foraminifera and IRD; several large dropstones of 2 to 5 cm in diameter.
Colour: pale brown (HUE 10YR6/3).
Structures: Surface is stongly washed; components are patchy distributed.
Morphology: Planar.
Organisms: Komakiaceae, *Aphrocallistes bocagei*, ophiuroids, *Amphissa acutecostata*, dead *Alocyathus* sp., dead *Madrepora oculata*, dead stylasterid, bryozoa, anemone.

Sediment succession

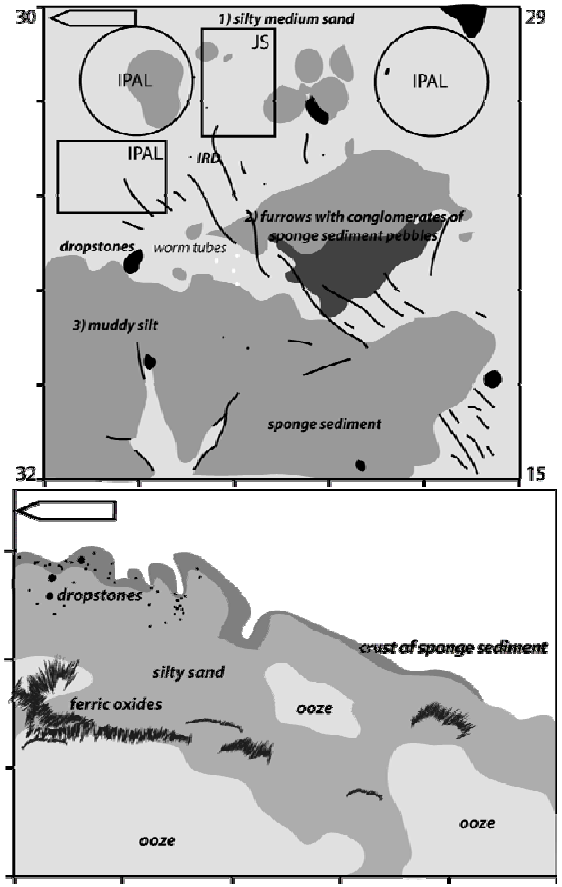
Strata: No change of sediment with depth.

Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** 1 x JS, 1 x AR; 10 cm ø tube: none; Archive box: none

POS 316 – 502

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
7.8.2004	14:04:30	56°43.309N	17°27.874W	993 m	7.1 °C	32 cm



Sediment surface

Sediment: 1) Silty medium sand with long, wool-alike like sponge spicules; 2) pebbles of plastic to putty-alike consistency; 3) sponge sediment of putty to hardened muddy silt.
Colour: 1) Very pale brown (HUE 10YR8/2); 2a) and 3) light bluish gray (HUE Gley 8/1); 2b) grayish brown (HUE 10YR5/2).
Structures: Surface is washed.
Morphology: Undulated sand veneer with an amplitude of up to 2.5 cm; concentration of conglomerates of sponge sediment pebbles in erosion furrows.
Organisms: Not encountered**.**

Sediment succession

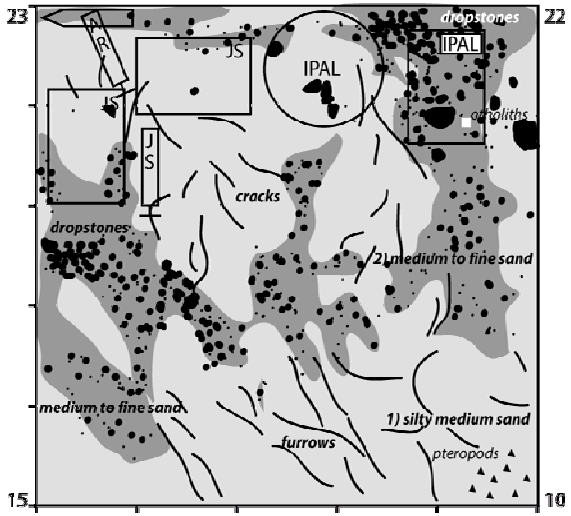
Strata: 1) 0 to 2 cm: crust of sponge sediment with dropstones; 2) 3 to 16 cm: silty medium sand with ferric oxides; 3)17 to 32 cm: muddy silt ooze of plastic to putty alike consistency.
Colour: 1) And 3) light bluish gray (HUE Gley 8/1); 2) very pale brown (HUE 10YR8/2).
Structures: Horizons tilted and ooze sediment blocks are patchy distributed; top is bioturbated, and enriched with small dropstones.
Bioturbation: Burrow in the upper horizon are up to 5 cm in diameter.
Fossils: Not encountered.

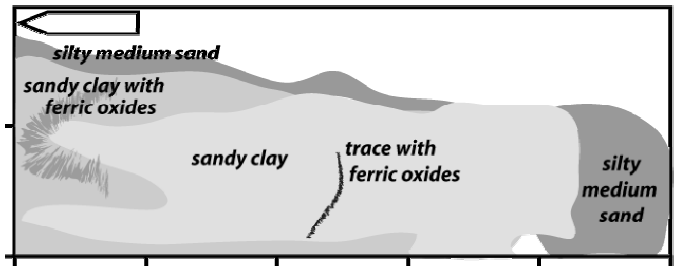
Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** none; 10 cm ø tube: 2 x IPAL; Archive box: none

POS 316 – 503

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
7.8.2004	15:10:00	56°43.701N	17°31.045W	1086 m	6.5 °C	23 cm





Sediment surface

Sediment: 1) Silty medium sand stabilized by sponge spicules; 2) patchy veneer of medium to fine sands, sharp, with abundant otholiths, and IRD with a diameters of 0.1 to 2 cm in verage. Some dropstones are > 3cm in diameter.
Colour: 1) White (HUE 2.5Y8/1).
Structures: Erosion furrows, partly covered with dropstones.
Morphology: Tilted.
Organisms: Pteropods, agglutinated worm tubes.

Sediment succession

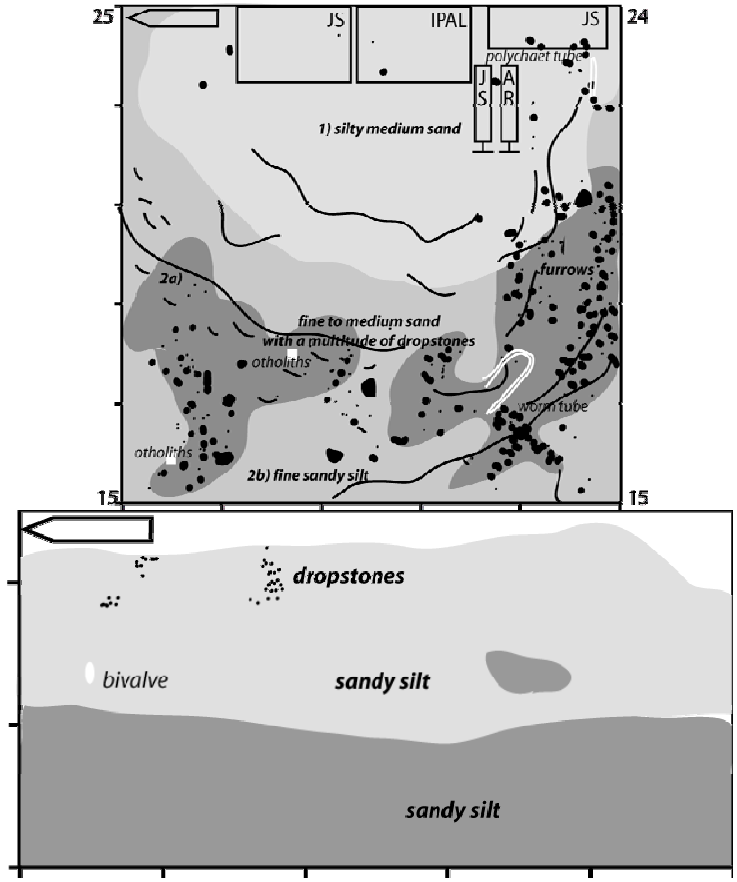
Strata: 1) 0 to 2 cm: silty medium sand, (see above); 2) 3 to 7 cm: sandy clay with ferric oxides; 3) 8 to17 cm: sandy clay with a trace, which is partly enriched in ferric oxides.
Colour: Light brownish gray (HUE 10YR6/2).
Structures: Patchy distribution of sandy clay with variable sand and clay proportions.
Bioturbation: Burrows are up to 2 cm in diameter.
Fossils: Not encountered.

Samples

100 cm²: IPAL; **87.6 cm²:** 2 x JS; **10 cm²:** JS; AR; 10 cm ø tube: IPAL; Archive box: none

POS 316 – 504

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
7.8.2004	16:15:43	56°44.601N	17°33.058W	1175 m	-	25 cm



Sediment surface

Sediment: 1) Silty medium sand; 2) fine sandy silt; 3) fine to medium sand with IRD.
Colour: 2a) Light yellowish brown (HUE 2.5Y6/3); 1) and 2b) light gray (HUE 2.5Y7/2).
Structures: Bioturbation with a variety of horizontal traces, partly washed; some vertical burrow openings.
Morphology: Tilted with erosion fans.
Organisms: Polychaetees, otholiths, shell fragments.

Sediment succession

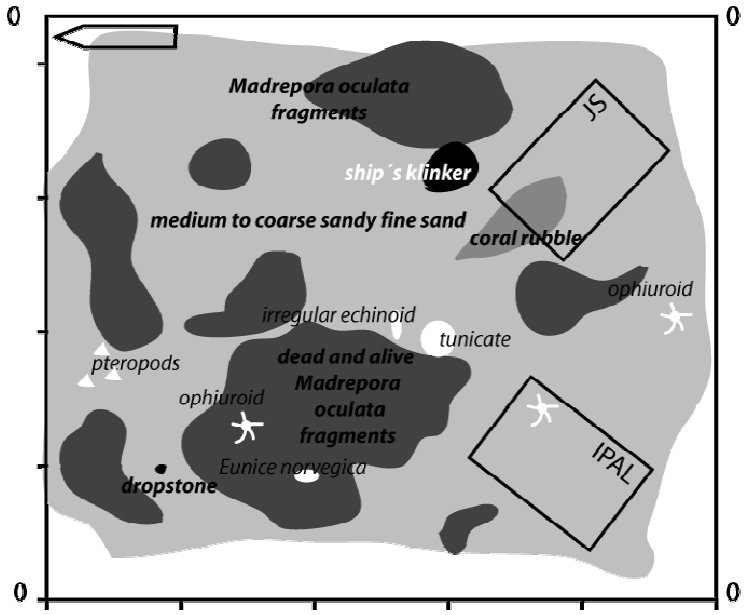
Strata: 0 to14 cm: homogeneous sandy silt, patchy, bioturbated, dropstones are enriched in vertical burrows; 14 to 25 cm: sandy silt, mottled bioturbated, dropstones rare.
Colour: Light brownish gray (HUE10YR6/2).
Structures: Mottled with variable sand and clay proportions.
Bioturbation: Traces are up to 2 cm in diameters.
Fossils: One bivalve.

Samples

100 cm²: IPAL; **87.6 cm²:** 2 x JS; **10 cm²:** JS; AR; 10 cm ø tube: none; Archive box: JS

POS 316 – 507

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
10.8.2004	13:34:00	51°22.513N	11°43.243W	817 m	-	3 cm



Sediment surface

Sediment: Medium to coarse sand.
Colour: Weak red (HUE 2.5Y5/2).
Structures: Surface is strongly washed.
Morphology: Planar; coral fragments are patchy distributed.
Organisms: *Madrepora oculata*, tunicate, ophiuroids, irregular echinoids, *Eunice norvegica*.

Sediment succession

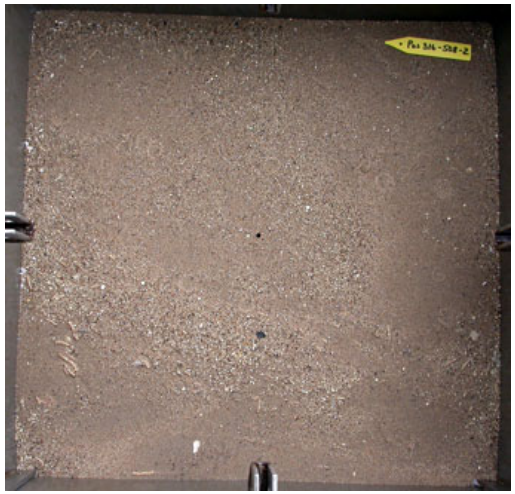
Strata: No change of sediment composition and structures with depth.

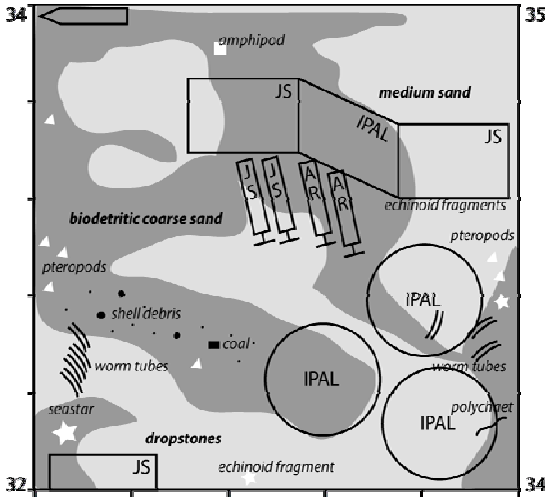
Samples

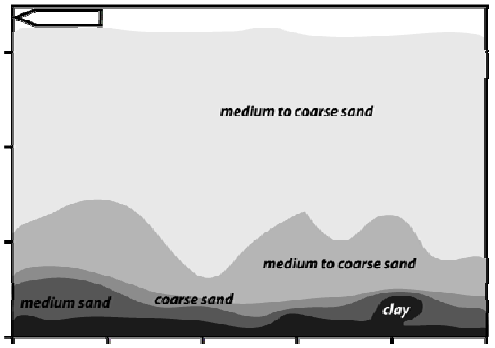
100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** none; 10 cm ø tube: none; Archive box: none

POS 316 – 508-2

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
10.8.2004	15:52:00	51°22.440N	11°42.581W	837 m	9.3 °C	35 cm







Sediment surface

Sediment: Medium sand.
Colour: Very pale brown (HUE 10YR7/4).
Structures: Round patches of medium sand with a seam of coarse sand; probably relicts of ripple marks.
Morphology: Planar; medium sand patches are elevated by roughly 1 cm.
Organisms: Pteropods, echinoid fragments, bivalve debris, agglutinated worm tubes, seastar, amphipods, and scaphopods.

Sediment succession

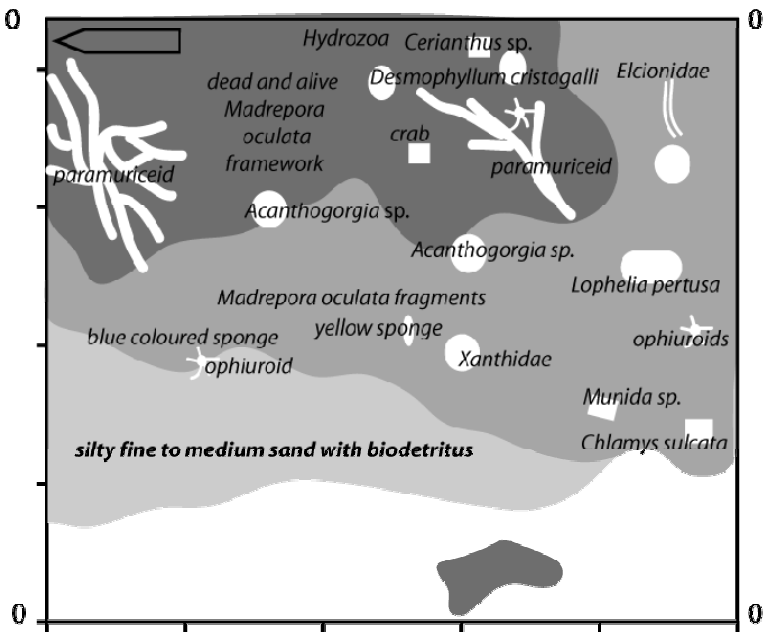
Strata: 1) 0 to 21 cm: medium to coarse sand; 2) 21 to 26 cm: brown medium to coarse sand; 3) 27 to 29 cm: coarse sand; 4) 29 to 32cm: coarse sand; 5) 32 to 35 cm: clay.
Colour: 1) Very pale brown (HUE 10YR7/4); 2) grayish brown (HUE 2.5Y5/2); 3) light olive brown (HUE 2.5Y5/3); 4) grayish brown (HUE 2.5Y5/2).
Structures: Boundaries of horizons are sinuously.
Bioturbation: Not visible.
Fossils: Not encountered.

Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** 2 x JS, 2 x AR; 10 cm ø tube: none; Archive box: none

POS 316 – 509

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
10.8.2004	17:14:00	51°23.522N	11°41.701W	691 m	13.3 °C	7 cm



Sediment surface

Sediment: Silty fine to medium sand, sharp, with abundant biodetritus.
Colour: light olive brown (HUE 2.5Y5/3).
Structures: none.
Morphology: Planar, even though tilted by coring.
Organisms: *Cidaris* spines, *Chlamys sulcata*, ophiuroids, Xanthidae, *Acanthogorgia sp.*, Hydrozoa, Paramuriceidae, some dead *Hiatella arctica*, seastar, *Swiftia* sp.?, stoloniferous, Elcionidae, dead *Desmophyllum cristagalli*, crabs, Munidae, blue coloured sponges, dead *Madrepora oculata*, dead *Lophelia pertusa*, *Cerianthus sp*, Xanthidae, yellow sponge.

Sediment succession

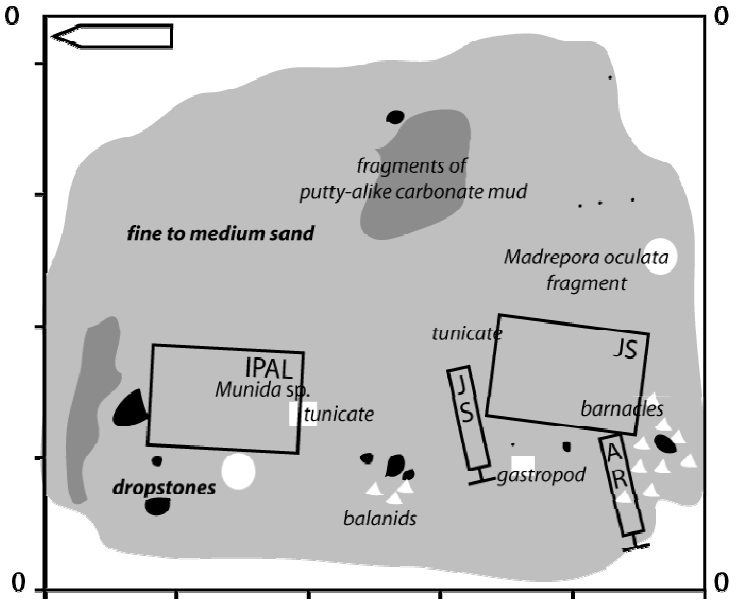
Strata: No change of sediment composition with depth.

Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** none; 10 cm ø tube: none; Archive box: none

POS 316 – 510

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
10.8.2004	18:13:00	51°24.300N	11°41.246W	635 m	-	5 cm



Sediment surface

Sediment: Sharp fine to medium sand.
Colour: Light brownish grey (HUE 2.5Y6/2).
Structures: Surface is strongly washed.
Morphology: Planar.
Organisms: *Balanids, gastropods, Munidae, tunicate,* dead *Madrepora oculata*.

Sediment succession

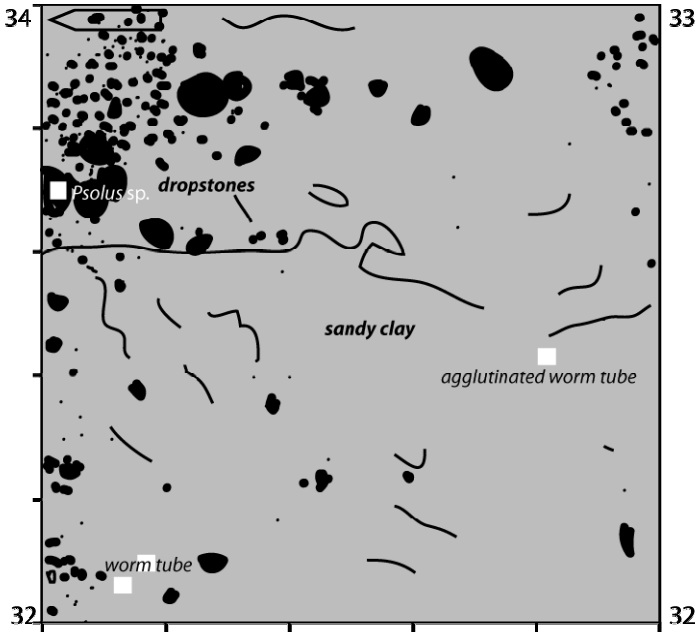
Strata: 1 to 2 cm below surface: enriched with barnacle plates.

Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** JS, AR; 10 cm ø tube: none; Archive box: none

POS 316 – 511

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
10.8.2004	18:59:00	51°23.743N	11°41.896	795 m	9.7 °C	36 cm

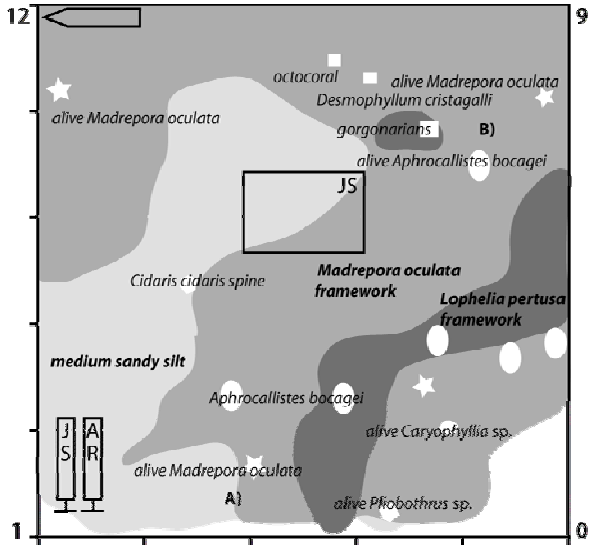


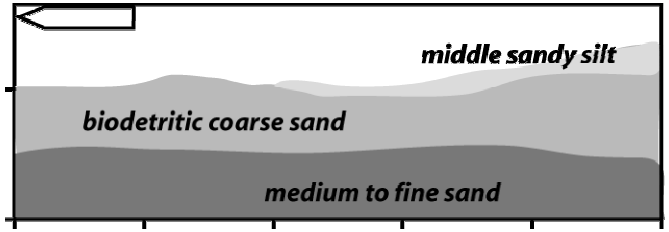
Sediment surface
Sediment: sandy clay with patches of dropstones.
Colour: Weak red (HUE 2.5Y5/2).
Structures: Surface is strongly washed.
Morphology: Smooth, long-ranging undulations.
Organisms: *Psolus* sp., worm tubes, agglutinated worm tube.
Remarks: Lids of box-corer were open on recovery. The surface is washed off, and the present face is therefore considered to represent an unknown level in the sediment succession. It was decided not to be sampled.

Samples
100 cm²: none; **87.6 cm²:** JS; **10 cm²:** JS, AR; 10 cm ø tube: none; Archive box: none

POS 316 – 524

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
11.8.2004	13:17:00	51°27.250N	11°43.974W	860 m	9.7 °C	12 cm





Sediment surface

Sediment: Medium silt with abundant biodetritus.
Colour: Light olive brown (HUE 2.5Y5/3).
Structures: Patchy distribution of coral framework.
Morphology: Tilted to the front.
Size of living colonies: *Madrepora oculata:* A) 19 cm in total, upper 11 cm are alive. B) 30 cm in total, upper 11 cm alive.
Organisms: Pteropods, *Caryophyllia* sp., *Pliobothrus* sp., octocorals, *Lophelia pertusa*, gorgonarians, *Madrepora oculata*, *Cidaris* spines, *Desmophyllum cristagalli*, *Aphrocallistes bocagei.*

Sediment succession

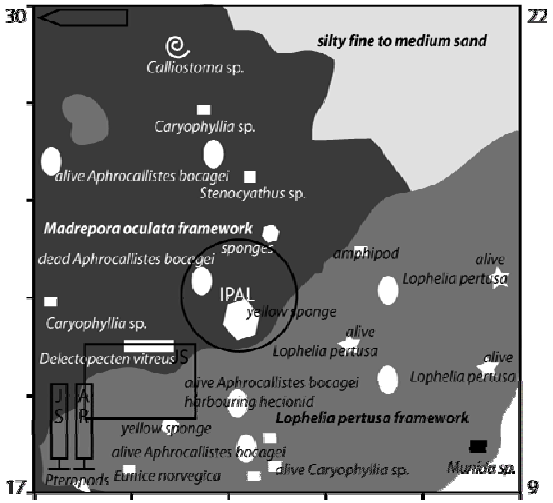
Strata: 0 to 2 cm: medium sandy silt; 2 to 5 cm: biodetritic coarse sand; 5 to 12 cm: medium to fine sand.
Colour: 1) and 2) see above; 3) light olive brown (HUE 2.5Y5/3).
Structures: Upper horizon lenticular.
Bioturbation: Not visible.
Fossils: Not encountered.

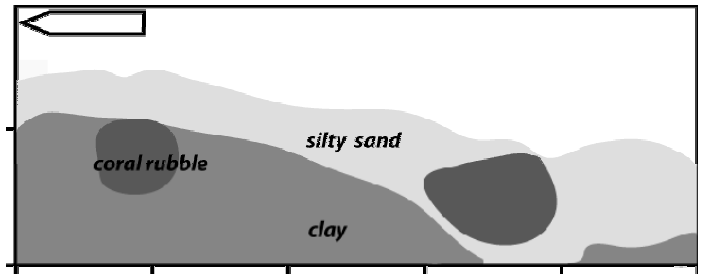
Samples

100 cm²: none; **87.6 cm²:** JS; **10 cm²:** JS, AR; 10 cm ø tube: none; Archive box: none

POS 316 – 525

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
11.8.2004	14:25:00	51°26.878N	11°45.617W	1039 m	9.3 °C	30 cm





Sediment surface

Sediment: Silty fine to medium sand.
Colour: Light brownish gray (HUE 2.5Y6/2).
Structures: Irregularly distribution of coral framework.
Morphology: Upper part strongly washed, and tilted to lower right corner.
Organisms: Yellow sponges are very abundant in the skeleton of *Aphocallistes bocagei*, amphipods, *Delectopecten vitreus*, *Caryophyllia* sp., dead and alive *Lophelia pertusa*, dead and alive *Madrepora oculata*, dead *Stenocyathus* sp., Hecionid in *Aphrocallistes bocagei*, *Eunice norvegica*, *Munida* sp., several sponges.

Sediment succession

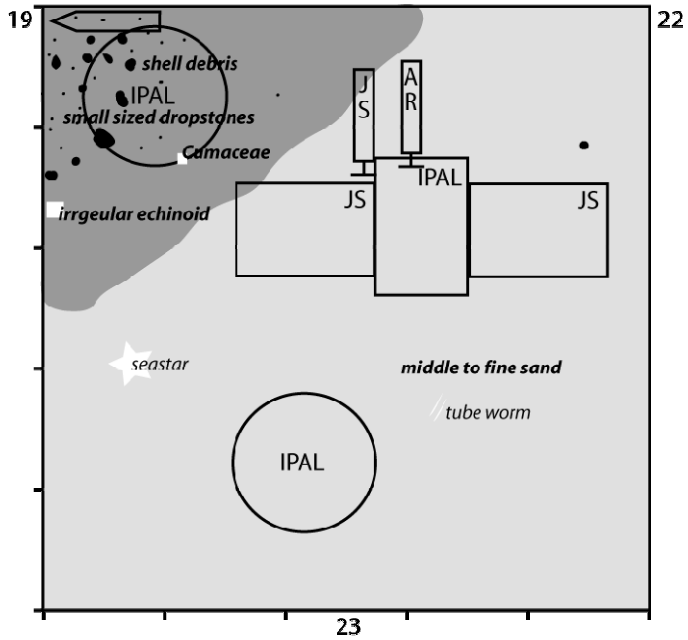
Strata: 1) 0 to 3 cm: silty sand with clusters of coral rubble; 2) 3 to 13 cm: homogenous clay.
Colour: 1) See above; 2) grayish brown (HUE 2.5Y5/2).
Structures: Patchy distribution of coral rubble.
Bioturbation: Gradual transition between bed 1 and 2 is effected by bioturbation.
Fossils: *Madrepora oculata*.

Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** JS, AR; 10 cm ø tube: IPAL; Archive box: none

POS 316 – 526

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
11.8.2004	15:38:00	51°26.125N	11°39.221W	623 m	11 °C	23 cm



Sediment surface

Sediment: Sharp, medium to fine sand with spots of biodetritus.
Colour: Light grey (HUE 2.5Y7/2).
Structures: Fine shell debris is enriched in the upper left corner.
Morphology: Planar, slightly tilted.
Organisms: *Seastar, irregular echinoid, Cumaceae, worm tube.*

Sediment succession

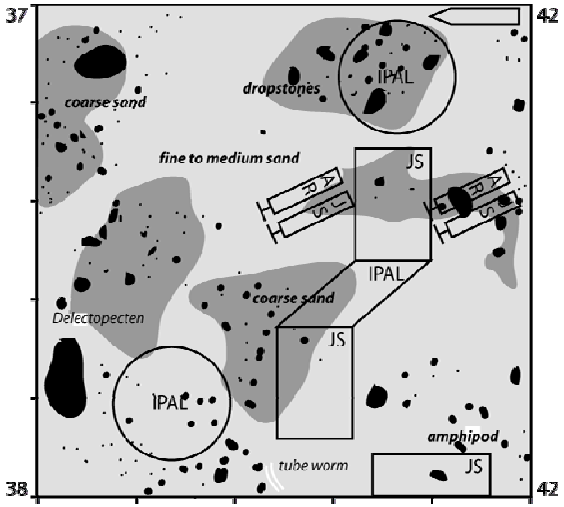
Strata: No change of sediment with depth.

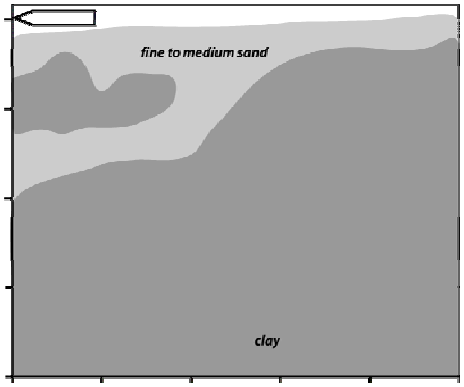
Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** JS, AR; 10 cm ø tube: 2 x IPAL; Archive box: none

POS 316 – 527

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
11.8.2004	16:25:00	51°26.343N	11°40.346W	674 m	-	42 cm





Sediment surface

Sediment: Fine to medium sand, sharp, with a patchy, thin veneer of coarse sand.
Colour: HUE 2.5Y5/4.
Structures: Parallel ridges, biodetritic coarse sand and dropstones are concentrated in depressions between the ridges.
Morphology: Undulated sand veneer with an amplitude of up to 2 cm.
Organisms: *Cadulus jeffreysi* abundant, Cumaceae, amphipods, arenaceous foraminifera, *Delectopecten vitreus.*

Sediment succession

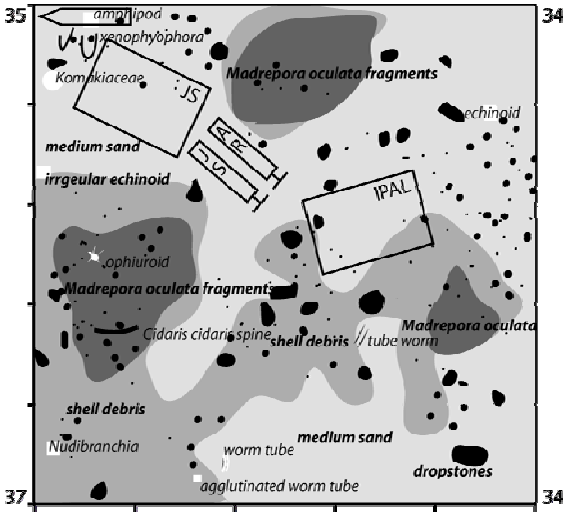
Strata: 1) 0 to 5 cm: Fine to medium sand. 2) 5 to 42 cm: clay with a burrow.
Colour: 1) see above, 2) HUE 2.5Y3/2.
Structures: Top of bed 2 is irregular due to bioturbation.
Bioturbation: The burrow is 7 cm in diameter and filled with sediment from above. The direction of the burrow parallels the surface.
Fossils: Not encountered.

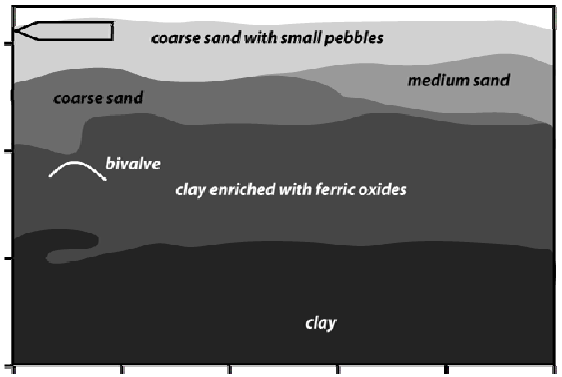
Samples

100 cm²: IPAL; **87.6 cm²:** 2 x JS; **10 cm²:** 2 x JS, 2 x AR; 10 cm ø tube: 2 x IPAL; Archive box: JS

POS 316 – 528

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
11.8.2004	17:29:00	51°26.282N	11°44.424W	916 m	13.8 °C	37 cm





Sediment surface

Sediment: 1) medium sand with pebbles, sharp; 2) coarse sand with small pebbles and shell debris.
Colour: 1) HUE 10YR5/4.
Structures: Coarse sand is concentrated in depressions which are patchy distributed.
Morphology: Undulated sand veneer with an amplitude of up to 3 cm.
Organisms: Amhipod tubes, balanids, Nudibranchia, agglutinated worm tube, Xenophyophora, Komakiaceae, dead *Madrepora oculata*, ophiuroids, *Cidaris cidaris* spine, echinoid, pteropods, *Amphissa* sp.

Sediment succession

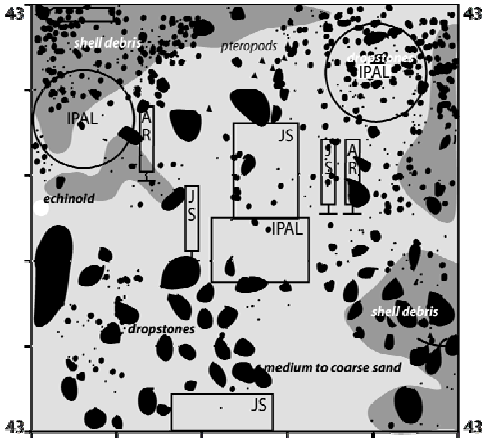
Strata: 1) 0 to 6 cm: coarse and with small pebbles and coal fragments; 2) 6 to 15 cm: interfingering lenes of medium and coarse sand; 3) 15 to 25 cm: brownish clay enriched in ferric oxides. Bivalve shell fragment occurs in this bed; 4) 25 to 37 cm: homogeneous, dark grey clay.
Colour: 1) see above; 3) HUE 10YR5/3; 4) HUE 10YR5/1.
Structures: The colour change between both clay horizons is irregular.
Bioturbation: Not visible.
Fossils: Bivalve.

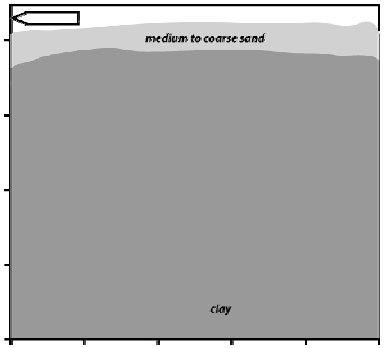
Samples

100 cm²: IPAL; **87.6 cm²:** JS; **10 cm²:** JS, AR; 10 cm ø tube: none; Archive box: none

POS 316 – 529

Date	Time	Latitude	Longitude	Water Depth	Sediment -	Recovery
11.8.2004	18:50:00	51°26.068N	11°48.782W	1077 m	8.1 °C	43 cm





Sediment surface

Sediment: Medium to coarse sand with dropstones, shell debris, and pteropods, the pebbles are well rounded.
Colour: HUE 2.5Y6/3.
Structures: None.
Morphology: Planar.
Organisms: Pteropods, echinoid.

Sediment succession

Strata: 1) 0 to 4 cm: see above; 2) 4 to 43 cm: homogeneous, dark gray clay.
Colour: 1) See above; 2) HUE 10YR5/1.
Bioturbation: Not visible.
Fossils: Not encountered.

Samples

100 cm²: IPAL; **87.6 cm²:** 2 x JS; **10 cm²:** 2 x JS, 2 x AR; 10 cm ø tube: 2 x IPAL; Archive box: JS

Length of label: 9,4 cm

8. Station list

Stat.	Gear	No.	Area	Date	Start	Coordinates		Depth	at depth	Coordinates		Depth	end stat.	Coordinates		
					Time (UTC)	Lat. °N	Long. °W	(m)	Time (UTC)	Lat. °N	Long. °W	(m)	Time (UTC)	Lat. °N	Long. °W	Depth (m)
486#1	Dredge	1	Reykjanes Ridge	04.08.04	09:55:00	61:37.015	22:47.593	1806					11:56:00	61:36.868	22:47.667	1806
486#2	Dredge	2	Reykjanes Ridge	04.08.04	11:56:50	61:36.868	22:47.667	1806					13:39:03	61:36.408	22:47.839	1813
486#3	Dredge	3	Reykjanes Ridge	04.08.04	13:55:42	61:36.960	22:47.698	1806					15:31:27	61:36.482	22:47.463	1812
487	Apex Float	1	Iceland Basin	05.08.04	08:41:53	60:00.090	20:58.549	2787					08:50:00	60:00.000	20:58.5	2817
488	Apex Float	2	Hatton Bank	06.08.04	06:30:00	58:00.000	18:50.14	824					06:39:00	57:59.758	18:49.718	823
489	CTD/ Ro	1	East of Kiel Mount	06.08.04	17:40:00	56:41.21	17:27.93	940	18:05:00	56:41.41	17:27.91	939	18:40:00	56:41.60	17:27.84	950
490	CTD/ Ro	2	Eastern Foot of Kiel Mount	06.08.04	19:00:00	56:41.31	17:29.07	900	19:30:00	56:41.51	17:29.20	918	20:20:00	56:41.72	17:29.30	906
491	CTD/ Ro	3	E Flank of Kiel Mount	06.08.04	20:45:00	56:41.64	17:29.035	894	21:07:00	56:41.698	17:30.009	898	22:41:00	56:41.737	17:29.847	896
492	CTD/ Ro	4	Top of Kiel Mount	06.08.04	22:01:00	56:41.909	17:31.255	825	22:23:00	56:42.004	17:31.214	890	22:46:00	56:42.109	17:31.059	877
493	CTD/ Ro	5	W Flank of Kiel Mount	06.08.04	23:02:00	56:42.054	17:32.129	941	23:24:00	56:42.128	17:32.099	950	23:50:00	56:42.144	17:32.109	945
494	CTD/ Ro	6	W Foot of Kiel Mount	07.08.04	00:15:00	56:42.246	17:33.254	1095	00:38:00	56:42.346	17:32.994	1095	01:04:00	56:42.575	17:32.670	1043
495	CTD/ Ro	7	West of Kiel Mount	07.08.04	01:32:00	56:42.442	17:34.512	1149	01:57:00	56:42.567	17:34.421	1154	02:40:00	56:42.63	17:34.37	1150
496	CTD/ Ro	8	South of Kiel Mount	07.08.04	03:07:00	56:40.136	17:31.604	1021	03:29:00	56:40.185	17:31.552	1021	03:53:00	56:40.356	17:31.508	1020
497	CTD/ Ro	9	S Flank of Kiel Mount	07.08.04	04:20:00	56:41.220	17:31.221	900	04:41:00	56:41.325	17:31.457	906	05:13:00	56:41.432	17:31.679	918
498	GKG	1	Kiel Mount	07.08.04	06:18:18	56:41.205	17:29.002	911	06:57:24	56:41.487	17:29.393	906	07:33:00	56:41.786	17:29.753	905
499-1	GKG	2	Kiel Mount	07.08.04	09:08:02	56:41.818	17:30.177	873	09:23:56	56:41.928	17:30.384	853	09:41:56	56:42.046	17:30.664	829
499-2	GKG	3	Kiel Mount	07.08.04	10:01:20	56:41.725	17:30.290	880	10:21:50	56:41.877	17:30.643	824	10:43:52	56:42.044	17:31.012	866
500	GKG	4	Kiel Mount	07.08.04	11:04:27	56:41.852	17:29.911	885	11:23:00	56:42.021	17:30.254	850	12:14:00	56:42.680	17:31.261	956
501	GKG	5	Kiel Mount	07.08.04	12:37:58	56:42.190	17:29.430	890	12:55:00	56:42.369	17:29.711	878	13:16:55	56:42.641	17:30.102	925
502	GKG	6	Kiel Mount	07.08.04	13:48:24	56:43.138	17:27.476	994	14:04:30	56:43.309	17:27.874	993	14:27:38	56:43.601	17:28.503	987
503	GKG	7	Kiel Mount	07.08.04	14:49:00	56:43.374	17:30.655	1074	15:10:00	56:43.701	17:31.045	1086	15:35:02	56:44.058	17:31.537	1105
504	GKG	8	Kiel Mount	07.08.04	15:57:25	56:44.369	17:32.618	1160	16:15:43	56:44.601	17:33.058	1175	16:50:00	56:45.030	17:33.730	1204
505	SL	1	Kiel Mount	07.08.04	18:12:00	56:44.500	17:32.749	1168	18:22:09	56:44.541	17:32.813	1170	18:55:00	56:44.763	17:33.231	1180
506	DOS	1	Galway Mound	10.08.04	09:45:00	51:27.542	11:45.253	908	10:00:00	51:27.8	11:45.1	921	10:31:00	51:27.735	11:45.276	917
507	GKG	9	Challenger Mound	10.08.04	13:18:50	51:22.482	11:43.248	826	13:34:00	51:22.513	11:43.243	817	13:55:00	51:22.371	11:43.011	842
508-1	GKG	10	Challenger Mound	10.08.04	14:22:30	51:22.764	11:42.915	839	14:37:00	51:22.651	11:42.633	833	14:55:05	51:22.472	11:42.342	833
508-2	GKG	11	Challenger Mound	10.08.04	15:34:00	51:22.6	11:42.5	833	15:52:00	51:22.440	11:42.581	837	16:09:00	51:22.296	11:42.627	848
509	GKG	12	Challenger Mound	10.08.04	17:00:00	51:23.7	11:41.6	721	17:14:00	51:23.522	11:41.701	691	17:32:00	51:23.288	11:41.786	755
510	GKG	13	Challenger Mound	10.08.04	17:59:54	51:24.486	11:41.103	649	18:13:00	51:24.300	11:41.246	635	18:26:33	51:24.150	11:41.416	666

Stat.	Gear	No.	Area	Date	Start	Coordinates		Depth	at depth	Coordinates		Depth	end stat.	Coordinates		
					Time (UTC)	Lat. °N	Long. °W	(m)	Time (UTC)	Lat. °N	Long. °W	(m)	Time (UTC)	Lat. °N	Long. °W	Depth (m)
511	GKG	14	Challenger Mound	10.08.04	18:46:00	51:23.861	11:41.879	756	18:59:00	51:23.743	11:41.896	795	19:21:05	51:23.532	11:41.965	769
512	CTD/ Ro	10	North of Galway Mound	10.08.04	20:10:00	51:27.668	11:45.281	910	20:29:00	51:27.597	11:45.337	923	21:12:00	51:27.618	11:45.349	905
513	CTD/ Ro	11	N foot of Galway Mound	10.08.04	21:23:00	51:27.520	11:45.274	887	21:27:00	51:27.457	11:45.305	862	22:04:00	51:27.379	11:45.272	824
514	CTD/ Ro	12	N flank of Galway Mound	10.08.04	22:12:00	51:27.345	11:45.206	811	22:29:00	51:27.283	11:45.191	842	22:47:00	51:27.227	11:45.134	824
515	CTD/ Ro	13	Top of Galway Mound	10.08.04	23:04:00	51:27.164	11:45.138	791	23:23:00	51:27.109	11:45.167	784	00:15:00	51:26.870	11:45.213	860
516	CTD/ Ro	14	E Flank of Galway Mound	11.08.04	00:38:00	51:27.177	11:44.900	854	00:56:00	51:27.107	11:44.872	899	01:20:00	51:27.075	11:45.279	795
517	CTD/ Ro	15	S Flank of Galway Mound	11.08.04	01:32:00	51:27.017	11:45.198	793	01:48:00	51:26.9	11:45.117	851	02:08:00	51:26.733	11:45.013	885
518	CTD/ Ro	16	S Foot of Galway Mound	11.08.04	02:26:00	51:26.775	11:45.183	881	02:46:00	51:26.647	11:45.163	888	03:28:00	51:26.333	11:45.230	918
519	CTD/ Ro	17	West of Galway Mound	11.08.04	03:48:00	51:27.034	11:46.038	980	04:08:00	51:26.911	11:46.146	982	04:50:00	51:26.83	11:46.133	981
520	CTD/ Ro	18	W Flank of Galway Mound	11.08.04	05:13:00	51:27.082	11:45.680	954	05:33:00	51:26.881	11:45.801	970	05:53:00	51:26.602	11:45.979	969
521	CTD/ Ro	19	East of Galway Mound	11.08.04	06:20:00	51:27.181	11:44.319	911	06:44:00	51:26.965	11:44.463	912	06:58:00	51:26.660	11:44.753	894
522	SL	2	Belgica Mound Province	11.08.04	08:15:00	51:26.2	11:40.3	676	08:27:00	51:26.246	11:40.306	672	08:49:00	51:26.373	11:40.220	668
523	SL	3	Belgica Mound Province	11.08.04	09:44:00	51:26.1	11:49.1	1075	09:59:00	51:26.14	11:44.095	1072	10:28:00	51:26.135	11:49.164	1070
524	GKG	15	Galway Mound	11.08.04	13:03:00	51:27.116	11:44.094	880	13:17:00	51:27.250	11:43.974	860	13:34:00	51:27.361	11:43.781	901
525	GKG	16	Galway Mound	11.08.04	14:11:00	51:26.780	11:45.705	957	14:25:00	51:26.878	11:45.617	1039	14:42:00	51:26.962	11:45.690	958
526	GKG	17	Galway Mound	11.08.04	15:22:00	51:26.161	11:39.488	638	15:38:00	51:26.125	11:39.221	623	15:51:00	51:26.035	11:39.181	622
527	GKG	18	Galway Mound	11.08.04	16:14:00	51:26.368	11:40.373	675	16:25:00	51:26.343	11:40.346	674	16:42:00	51:26.3	11:40.4	675
528	GKG	19	Galway Mound	11.08.04	17:14:55	51:26.322	11:44.492	914	17:29:00	51:26.282	11:44.424	916	17:51:00	51:26.194	11:44.296	918
529	GKG	20	Galway Mound	11.08.04	18:33:00	51:26.095	11:48.953	1074	18:50:00	51:26.068	11:48.782	1077	19:14:00	51:26.085	11:48.485	1074
530	CTD/ Ro	20	W of Galway M; deepest station	11.08.04	19:40:00	51:26.081	11:49.032	1075	20:01:00	51:25.991	11:48.742	1079	20:25:00	51:25.946	11:48.313	1074
531	CTD/ Ro	21	W of Galway M; little depression	11.08.04	20:51:00	51:26.444	11:47.524	1044	21:11:00	51:26.487	11:47.253	1051	21:30:00	51:26.588	11:46.899	1060
532	CTD/ Ro	22	Top of little Mound between GM&PM	11.08.04	22:03:00	51:27.193	11:44.265	900	22:21:00	51:27.182	11:44.026	870	22:46:00	51:27.109	11:43.705	899
533	CTD/ Ro	23	W of Poseidon Mound	12.08.04	23:38:00	51:27.238	11:43.726	900	23:56:00	51:27.216	11:43.547	900	00:14:00	51:27.297	11:43.263	894
534	CTD/ Ro	24	W foot of Poseidon Mound	12.08.04	00:26:00	51:27.331	11:42.949	871	00:42:00	51:27.333	11:42.739	852	01:00:00	51:27.337	11:42.632	843
535	CTD/ Ro	25	W Flank of Poseidon Mound	12.08.04	01:10:00	51:27.389	11:42.525	779	01:28:00	51:27.426	11:42.378	747	01:44:00	51:27.488	11:42.312	757
536	CTD/ Ro	26	Top of Poseidon Mound	12.08.04	01:57:00	51:27.35	11:42.044	679	02:12:00	51:27.437	11:42.003	677	02:53:00	51:27.273	11:41.769	729
537	CTD/ Ro	27	E Flank of Poseidon Mound	12.08.04	02:59:00	51:27.338	11:41.727	716	03:13:00	51:27.373	11:41.694	707	03:33:00	51:27.352	11:41.608	729
538	CTD/ Ro	28	East of Poseidon Mound	12.08.04	03:51:00	51:27.497	11:40.691	719	04:06:00	51:27.493	11:40.658	716	04:41:00	51:27.445	11:40.474	698

List of Gear: Dredge; Apex Float; CTD/ Ro = Conductivity/ Temperature/ Density probe; GKG = Box Corer; SL = Gravity Corer; DOS = Deep Sea Observation Lander

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No.	Title
1	RV Sonne Fahrtbericht / Cruise Report SO 176 & 179 MERAMEX I & II (Merapi Amphibious Experiment) 18.05.-01.06.04 & 16.09.-07.10.04. Ed. by Heidrun Kopp & Ernst R. Flueh, 2004, 206 pp. In English
2	RV Sonne Fahrtbericht / Cruise Report SO 181 TIPTEQ (from The Incoming Plate to mega Thrust EarthQuakes) 06.12.2004.-26.02.2005. Ed. by Ernst R. Flueh & Ingo Grevemeyer, 2005, 533 pp. In English
3	RV Poseidon Fahrtbericht / Cruise Report POS 316 Carbonate Mounds and Aphotic Corals in the NE-Atlantic 03.08.–17.08.2004. Ed. by Olaf Pfannkuche & Christine Utecht, 2005, 64 pp. In English

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