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Biology and ecosystem functioning of cold water coral bioherms at Mingulay (Hebrides), NE Atlantic

Cornelia Maier & shipboard scientific party

Royal Netherlands Institute for Sea Research, the Netherlands

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1. General Introduction

Deep water coral ecosystems have undergone a big scientific revival during the last two decades which led to an intensified research of these deep coral habitats (FREIWALD and ROBERTS, 2005; HOVLAND et al., 2002; ROBERTS et al., 2006; ROGERS, 1999). This scientifically newborn interest in deep water corals is partly due to new marine and fisheries technologies facilitating the discovery of deep water corals even at abyssal depths. Specifically, efforts in deep coral mound mapping and the geology of carbonate mound formation have already been a focus of extended research (FOSSÅ et al., 2002; HENRIET et al., 1998; ROBERTS et al., 2005; ROBERTS et al., 2003; VAN WEERING et al., 2003). It has however been recognized that questions with respect to deep water coral biology and ecosystem functioning are still greatly underinvestigated. This is to a great extent due to logistic constraints, where accessibility and restriction of ship time complicate representative sampling and investigation of specifically live coral specimens and coral associated fauna. It has been shown that the deep water coral reefs support an increased biodiversity of benthos organisms. However, until now the microbial abundance and diversity associated to the corals and deep water coral reefs has not been examined. There are also open questions with respect to energy demand and food supply to the deep water corals. It has been hypothesized, that deep water coral reefs are often restricted to the top of mounds where higher flow constraints allow for more particle encounter and prey capture at a given time (GENIN et al., 1986; MORTENSEN, 2000). It has also been shown that potential food sources for deep water corals consist of zooplankton as a primary source, and also phytodetritus may contribute to coral nutrition (DUINEVELD et al., 2004; KIRIAKOULAKIS et al., 2005). Previous indications of methanotrophic food supply (HOVLAND and RISK, 2003; HOVLAND and THOMSEN, 1997) could not be confirmed and the hypothesis of methanotrophy in deep water coral reefs seems no longer supported. We also know very little on growth rates of these deep reefs or calcification rates of single corals. Skeletal linear growth estimates are approximated with a range of 1-25 mm per year. These estimates are derived from indirect evidence of proxy evaluations and by studying coral growth on oil sea ridges – the latter allows estimating minimum skeletal growth of corals that have settled on this artificial substrate since deployment (ADKINS et al., 2004; BELL and SMITH, 1999; GASS and ROBERTS, 2006; MORTENSEN and RAPP, 1998). There are still a whole range of open questions regarding this fascinating ecosystem and yet it is already under great threat with deep bottom trawl and - on a more global scale - the anticipated impact of ocean acidification which may even affect the deeper cold water coral reefs more drastically than shallow water systems (FOSSÅ et al., 2002; GUINOTTE et al., 2006; ORR et al., 2005; ROGERS, 1999).

1.1. BIOSYS

(Biology and Ecosystem Functioning of deep water coral reefs, funded by NWO/ALW project no 835.20.024 and 814.01.005, 2004-2007)

A general goal within BIOSYS project is to tackle some questions with respect to biology and ecosystem functioning of deep water corals and the ecosystem. Specifically, we aim at studying the main frame building deep water coral species *Lophelia pertusa, Madrepora oculata* and the solitary coral *Desmophyllum* spp. on the organismal level. A special emphasis is on coral growth, feeding and the role, abundance and diversity of microbial associations and the importance of associated prokaryotes in supporting coral functioning or providing additional food or energy to the deep water corals. In this frame, a central question is if prokaryotes may function as (endo-)symbionts of deep water corals. Deep water corals and associated bacterial abundance and diverstity are studied at different locations to decipher general regimes related to deep water coral ecosystems and to distinguish them from site specific features (e.g. water depth, nutrients and temperature).

1.2. HERMES

(Hotspot Ecosystem Research on the Margins of European Seas, funded by EC-FP6, GOCE-CT-2005-511234-1)

HERMES is a large European project with several workpackages. During this cruise the focus of the HERMES research was in particular for Workpackage 2 (Cold Water Corals). The general scientific objective of the HERMES participants was to collect a more or less same data set on the biodiversity and functioning of the coral community as collected earlier at the coral reefs of Rockall Bank.

Benthic communities dominated by colonial deep-water or ‘cold-water’ corals, mainly *Lophelia pertusa* and *Madrepora oculata* are a common phenomenon along the European and other continental margins (see reviews Freiwald & Roberts 2005, Roberts et al 2006). The occurrence of cold water coral reefs is restricted by temperature (max 13°C), and suitable substrata in the depth range 100 - 2000 m. Cold water corals may grow as isolated thickets or as a dense carpet on topographic highs and may even form a reef structure. The extensive 3D structure of the branched skeletons of CW corals supports a high biodiversity of other organisms many of which have not yet been identified or quantified. The food sources that support the mound community are not well documented. Cold water corals themselves are reported as being generalists based on observations in culture and in situ. Recently, Kiriakoulakis et al. (2005) suggested that zooplankton forms an important part of the diet of CW corals though this was not the case in a study on CW corals on Galicia bank (Duineveld et al., 2004). Further Hovland & Thomsen (1997) proposed that cold water corals are dependent on hydrocarbon seeps for their energy. No evidence has been found so far for hydrocarbon seepage in the coral mound research areas of the NE Atlantic (Masson et al. 2003). On basis of the fact that corals grow on top of mounds, it is assumed that acceleration of bottom currents play a

role of enhancing the food supply. However actual measurements supporting these assumptions are scarce or lacking. More in general, knowledge of the organic carbon supply to the CW coral reef habitat and the carbon consumption by the organisms composing the cold water coral community is vital for constructing energy and carbon budgets and obtaining a better appreciation of the role and importance of CW coral communities on the continental margins and the oceans.

2. Cruise Objectives

2.1 BIOSYS

The second of three BIOSYS cruises lead us to relatively shallow ecosystems of deep water corals at the Mingulay reef area off the coast of Scotland (Fig. 1). In 2005, the first cruise, a joint BIOSYS/HERMES cruise led us to coral reefs of the Rockall Bank/Trough area in the NE Atlantik with coral banks ranging in depth from 500 to 800 m. During the BIOSYS cruise 2006 one intention was to compare the relatively deep corals to corals from the much shallower depth near Mingulay, where deep water coral bioherms are found in water depths as shallow as 100 m. The most abundant stony coral, *Lophelia pertusa,* was studied and experiments with living corals directly on board the research vessel were carried out in temperature-controlled cool-containers at 10°C to study microbial abundance, and microbial community stucture associated with the corals and within the gastral cavity of these corals. Further, radioisotope labeling experiments (3H-Leucine, ^{14}C-sodium bicarbonate and $^{45}CaCl_2$) were used to study microbial protein-synthesis, microbial autotrophy and coral calcification. Live coral sampling and maintenance at the NIOZ climate chambers for subsequent experiments is another task of the cruise. In begin 2006, part of the live *Lophelia pertusa* and *Madrepora oculata* kept at a NIOZ climate chamber (sampled during BIOSYS/HERMES cruise in 2005) have been transported to the Oceanium at Rotterdam Zoo where they are maintained for observation. With the option to later set-up a cold water coral bioherm show-aquarium at Rotterdam Zoo the BIOSYS 2006 cruise was joined by the curator of the Oceanium. Further, research on sponges is carried out to compare the shallow-water (80-190m) near-shore *Lophelia* reefs at Mingulay with the deep-water (550-800m) reefs at the SE Rockall bank, visited during BIOSYS/HEMES 2005 and Moundforce 2004 in the framework of establishing the degree of similarity of sponge biodiversity of NE Atlantic cold water coral bioherms. Studying the diversity patterns of sponges is one way of establishing connectivity of reef systems.

Besides the BIOSYS-related researchers, 3 scientific parties of the european HERMES project on cold water corals joined the cruise for sampling and to carry out side-scan sonar, multibeam mapping and deploy bottom Landers and moorings for measuring various parameters directly at the sea floor of cold water coral occurence.

2.2 HERMES

During this cruise the focus of the HERMES research was in particular for Workpackage 2 (Cold Water Corals). From 3 different insitutes (NIOZ, SAMS and NOC), 6 scientists involved in HERMES participated during the BIOSYS 2006 cruise, with following aims.

HERMES_NIOZ Objectives (Gerard Duineveld, Marc Lavaleye and Magda Bergman)

The general scientific objective of the HERMES participants was to collect a more or less similar data set on biodiversity and functioning of the coral community as collected earlier at deep water coral reefs of Rockall Bank.

The NIOZ input to *HERMES* WP2 focuses on the mapping (multibeam and video transects), food web complexity, community respiration and abiotic factors (currents, turbidity) influencing food supply to the coral community. These data will not only give an insight of the coral community at Mingulay Reef (150-200m depth), but eventually will also be compared with the data of a much deeper coral reef of Rockall Bank (500-900m depth) collected during HERMES/BIOSYS 2005 and HERMES 2006 cruises (van Duyl & Duineveld 2005;Duineveld et al. 2006).

The research questions tackled during this cruise were not only to find out where, why and how these corals were living here at Mingulay Reef area, but also to investigate the differences with a much deeper coral reef (Rockall Bank).

HERMES_SAMS Objectives (Andrew Davies)

SAMS had several key objectives on this cruise. (1) The collection of living coral specimens for experimental treatment in the laboratory. (2) The collection of fragments of coral polyps for genetic analysis. (3) Collection of living coral which were immediately frozen at -80 °C to preserve them for lipid analysis. (4) Collection of ground truthing data in the area to add to our existing data collection. (5) The deployment of still cameras to collect high resolution still images. (6) To assist with the deployment of SAMS optical instruments aboard the ALBEX lander. (7) To assist with the side-scan sonar survey over the area.

HERMES_NOCS Objectives (Veit Hühnerbach & Tim LeBas)

The central aim during the BIOSYS cruise was to carry out side scan sonar surveys to get a broader insight into substrate type and coral cover at the Mingulay reef area. A first focus was on the areas previously covered by multibeam surveys as described in Roberts et al (2005). New areas of interest discovered during the BIOSYS cruise together with video ground-truthing provide additional information and help deciphering side scan sonar data with respect to live versus dead coral cover and other geological features using side scan sonar.

3. Study Area - Mingulay Reefs

During the BIOSYS 2006 cruise the study site was confined to an area of 320 km^2 at the Mingulay reefs - Hebrides, NE Atlantic (coordinates). The occurrence of *Lophelia pertusa* reefs in this area were previously described in Roberts et al (2005). This is a relatively shallow cold water coral ecosystem with an approximate water depth of 100 m. The study site is relatively sheltered from open Atlantic Ocean by the island chains of the Hebrides (Fig. 1 and 2).

Fig. 1 Study site at the Mingulay reef, Hebrides.

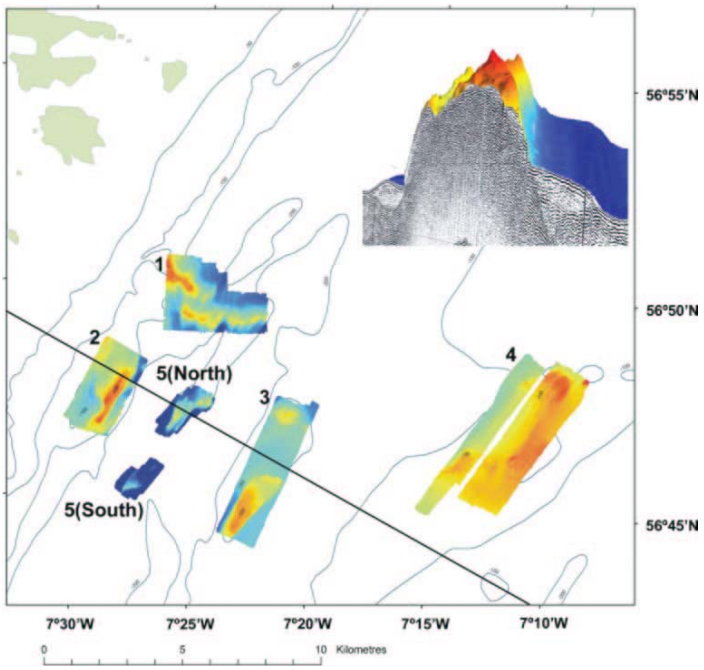

Fig. 2 Multibeam bathymetry of Survey areas at Mingulay described by Roberts et al (2005). The profile shows glacial drift deposits either side of an igneous intrusion where abundant coral mounds were found. Map from Roberts et al (2005, p. 660, Fig. 3).

4. Mapping and Video Transects

Based on the Mingulay reef area descibed in Roberts et al (2005) we extended the multibeam bathymetry and covered the areas of interest with higher resolution side scan sonar. Groundtruthing of multibeam and sidescan sonar was done by video camera systems provided by NIOZ and SAMS.

4.1. Multibeam

In 2006 Royal NIOZ acquired a new Kongsberg EM 300 multibeam echosounder for its research vessel Pelagia. The system is a 30 kHz echo sounder with a 1^o opening angle for the transmitter and a 2^o angle for the receiver. The transducers are mounted in a gondola attached along the port side of the hull. It uses 135 beams with a maximum coverage sector of 150^o. The transmit fan is split into maximum 9 individual sectors that can be steered independently to compensate for ships roll, pitch and yaw. This is in order to get the best fit of the ensonified line perpendicular to the ships track and thus a uniform coverage of the sea bed. The ships motion is registered by a Kongsberg MRU-5 reference unit and its position and heading by two GPS antennas. Motion and position is combined in a Seapath 200 ships attitude processing unit and send to the transmitter and receiver unit (TRU). The system is synchronized by means of a 1 pulse per second signal produced by the Seapath 200 which is sent to the TRU. Data from the receiver transducer and the ships attitude are combined in an acquisition computer (Kongsberg HWS 10). For data acquisition Kongsbergs' SIS (Seafloor Information System) software is used. The sound velocity profile is calculated on basis of a CTD profile obtained with a Seabird CTD system. The sound velocity near the transducers in the gondola is measured by a Reson SVP 70 sound velocity probe.

Multibeam mapping of the Mingulay Reef area (M. Bergman & shipboard scientists)

Previously a few areas of the Mingulay Reef area were multibeamed by SAMS (Roberts et al, 2005). During our cruise we used the new EM300 multibeam to make one detailed map covering and connecting the area's that were multibeamed earlier. On doing so we discovered a new reef south of Mingulay reef proper, which by its form was nicknamed "Banana Reef" (Fig. 3). Ground thruthing with boxcores and videos showed that this was a very rich coral reef. The multibeam data await further processing in the lab (e.g. backscatter) and closer comparison with other information (UW video).

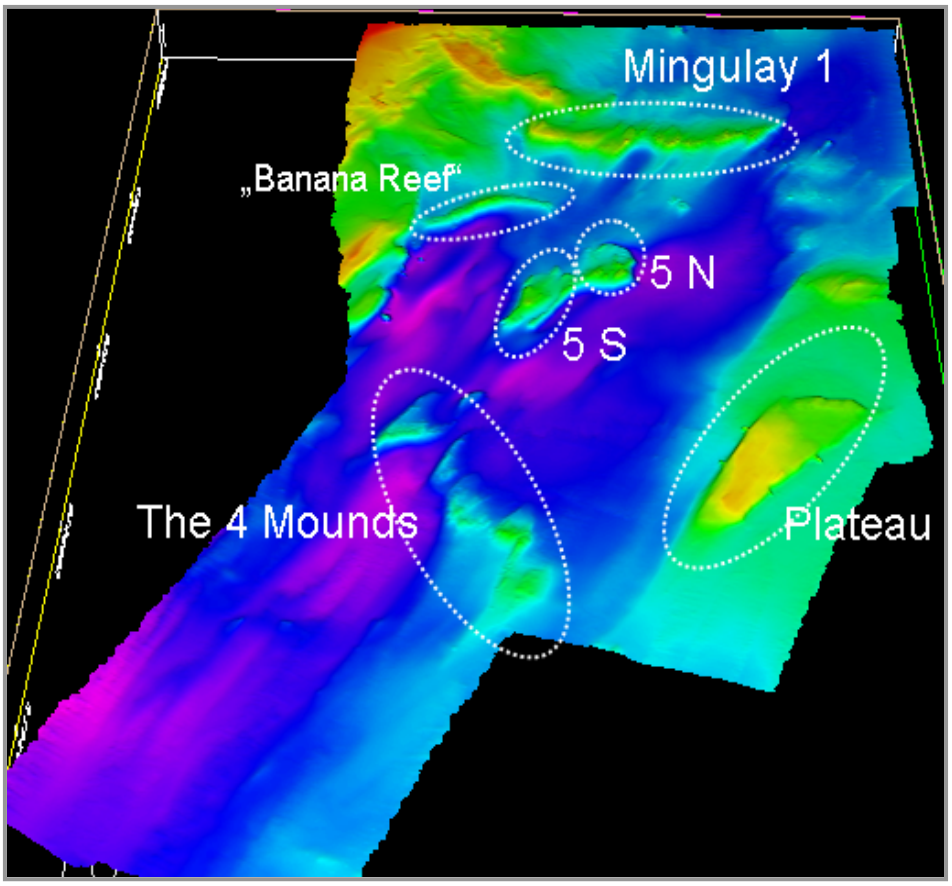

Fig. 3 Multibeam map with different mound features. Mingulay 1, 5 N, 5 S and the Plateau (Mingulay 3) have previously been described by Roberts et al (2005), while the “Banana Reef” and “the 4 Mounds” are new bathymetric features revealed by the Multibeam during BIOSYS 2005.

4.2. Sidescan Sonar Operations (Veit Huehnerbach and Tim LeBas, NOCS)

Sidescan sonar and logging system

The shallow water sidescan equipment used was an Ultra Electronics Model 3050E Widescan with a digital logging system. It is a lightweight dual frequency (100/325 kHz) high-resolution system capable of operations down to 300m water depth. The standard system provided by the National Oceanography Centre, Southampton (NOCS) consists of a sidescan sonar towfish, a Signal Processing Unit with basic image correction and gain control, and a 23cm thermal chart paper recorder (Fig. 4). The NOCS system is modified to allow full digital raw data acquisition for onboard and post-cruise ‘state-of-the-art’ image processing using PRISM software suite, developed at NOCS.

All sidescan data were recorded online digitally on a PC disk as well as paper printout. Navigation data were collected with a Furuno DGPS system located on the bridge deck and also stored on the PC.

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Fig. 4. Signal processing unit with basic image correction and gain control and thermal chart paper recorder

Winch

The winch used for this survey was a 3-phase electric oceanographic winch (380V/4kW) manufactured by Seatronics Ltd. With remote control, cable counter and approximately 850m double armoured coaxial conduction cable (Fig. 5).
The connection between sonar acquisition unit in the lab and the winch (with sidescan sonar towfish) was done with a 100m lightweight Kevlar cable.
A remote control camera on the winch allowed the operator to keep an eye on the spooling at the same time as hauling in or paying out cable. The maximum payout of cable was 660m for a water depth of approximately 250m. Lengths of cable could have been reduced if a depressor weight had been used to get the towfish sufficiently close (10-15% of the survey range used) to the seabed but none were available. Maximum speed for hauling and payout was close to 1m/s.

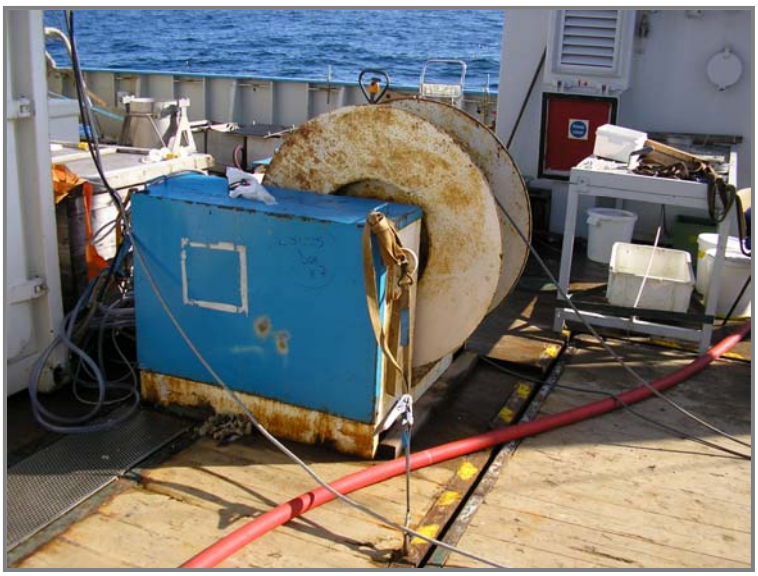


Fig. 5 Three-phase electric winch (Seatronics Ltd.) with remote control and 850 m double armoured coaxial conduction cable

Sidescan sonar survey

The survey carried out during this cruise was designed to cover the areas of interest in the time available. Following a detailed reconnaissance of existing data it was decided that lines across the reef axis with a total swath of 400m and a spacing of 300m would hopefully provide full sonar coverage of the areas. The overlap of 25% was considered sufficient to eliminate possible gaps in coverage caused by drift of the sidescan due to current activity on top of the reefs and errors in navigation (Fig. 6).
The frequency used for the main survey was 100 kHz with a long pulse to allow maximum swath width without range–dependant absorption losses.
In order to allow the repetition of lines collected during adverse wind and sea conditions (winds up to force 7 Bft and 3-4m high waves) during the first two nights, it was decided to run the sidescan operations during the nights, also to allow a maximum of time for the ground-truthing with video and camera sledge.
In total 170km of tracks were run in 50 lines, covering an area of approximately 52km^2. Almost all survey lines were designed to run from NNE to SSW against the prevailing subsurface currents which in parts were strong. The speed over ground during the sonar recordings was relatively constant at 3-4 knots. In order to save time at the end of each sonar track the towfish was not recovered but brought up to a safe height (cable out set to less than the minimum water depth) to allow the ship to steam back at 6-7 knots to the beginning of the next line. During the entire survey depth soundings from the ship's Multibeam system EM300 provided useful bathymetrical information of the coral reefs and mounds for the sonar operators 'flying' the towfish.
As mentioned earlier, the first two nights the data of the Mingulay 1 area were influenced by strong winds and a high swell which caused the towfish to roll and pitch slightly, because the sonar fish was not decoupled from the winch cable and so the ship's pitching movements were transmitted through to the fish. Therefore, the survey lines of this area were repeated during the second half of the cruise when the seastate had improved significantly. Spare time also allowed running a high-resolution line (325 kHz) across a bathymetric height named "Banana-Reef" (Fig. 6), and a repetition survey over one of the "Four Mounds" in the South of the area.

First results

The full extent of the coral reef chain at areas Mingulay 1 and 5 was covered with high-resolution sidescan imagery. The sonographs clearly show the extent of the coral reef structure. First results from the sonar backscatter indicate that the area of living coral (very high/high backscatter, see also Fig. 7) is smaller than previously suggested from Multibeam data. Most framework consists of dead coral, partly sediment covered (medium/low backscatter), surrounded by muddy/silty background sediment (low/very low backscatter). This was confirmed by underwater video transects in the area.

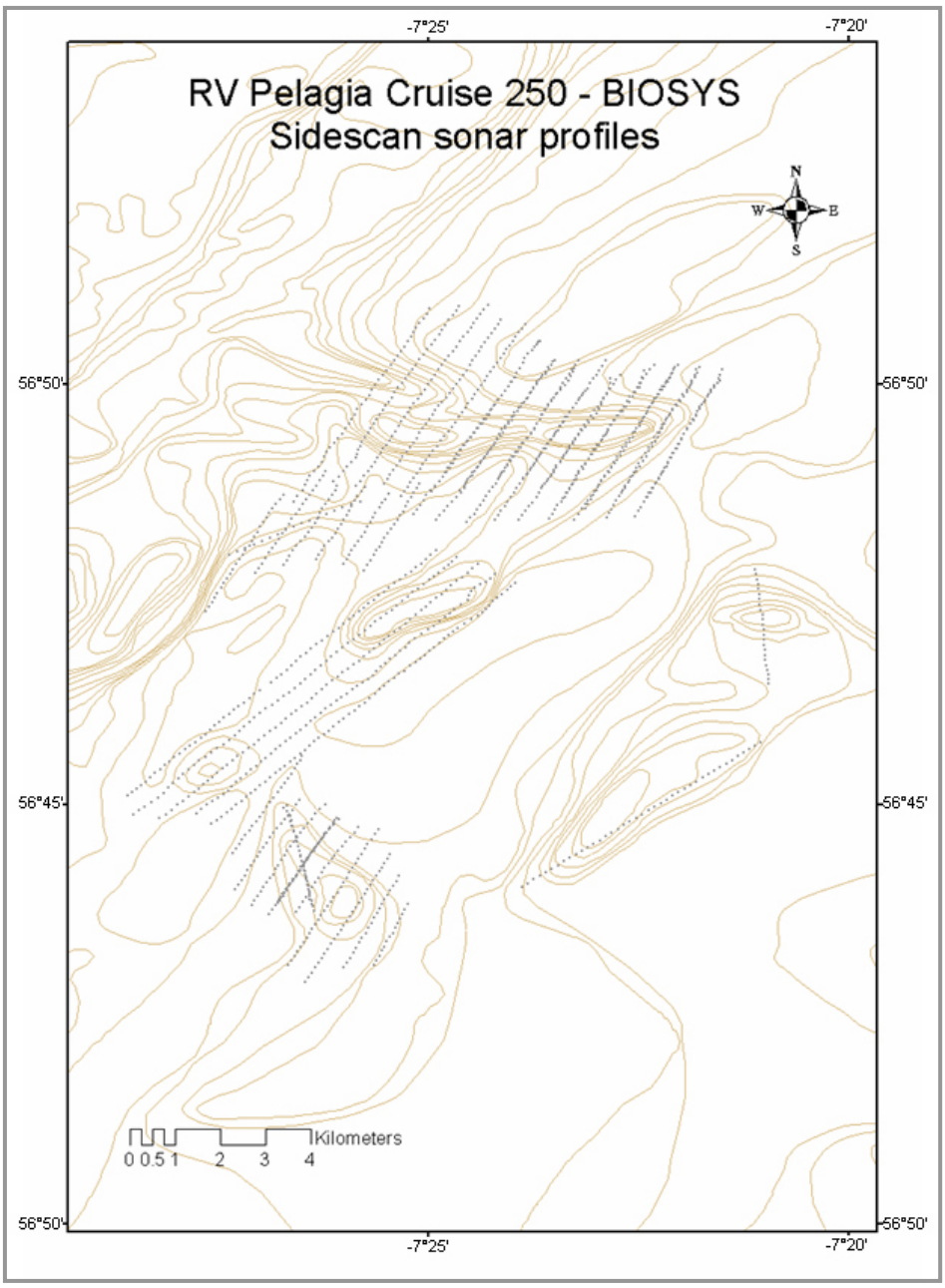


Fig. 6 Transect lines of main areas of interest covered by sidescan sonar surveys

The area around "Banana-Reef" was different in the way that much more high backscatter live coral returns were seen in the sonar imagery. These findings were also clearly seen in the ground-truthing video profiles. In all three areas – "Mingulay 1 and 5", as well as "Banana-Reef" a strong current on top of the reef chain was detected causing the sonar fish to roll slightly. This was not the case in the "Four Mounds" area in the South, where individual disconnected patches of (possibly dead) coral framework and small amounts of live coral were found. The survey lines over the "Four Mounds" also revealed outcropping bedrock formations on the seabed that were not covered by a sediment layer. The single line crossing over the two morphological heights toward the

East of the area did not reveal any coral cover at all, but more features of geological origin (outcrops) instead as well as trawl markings in the surrounding sediments.

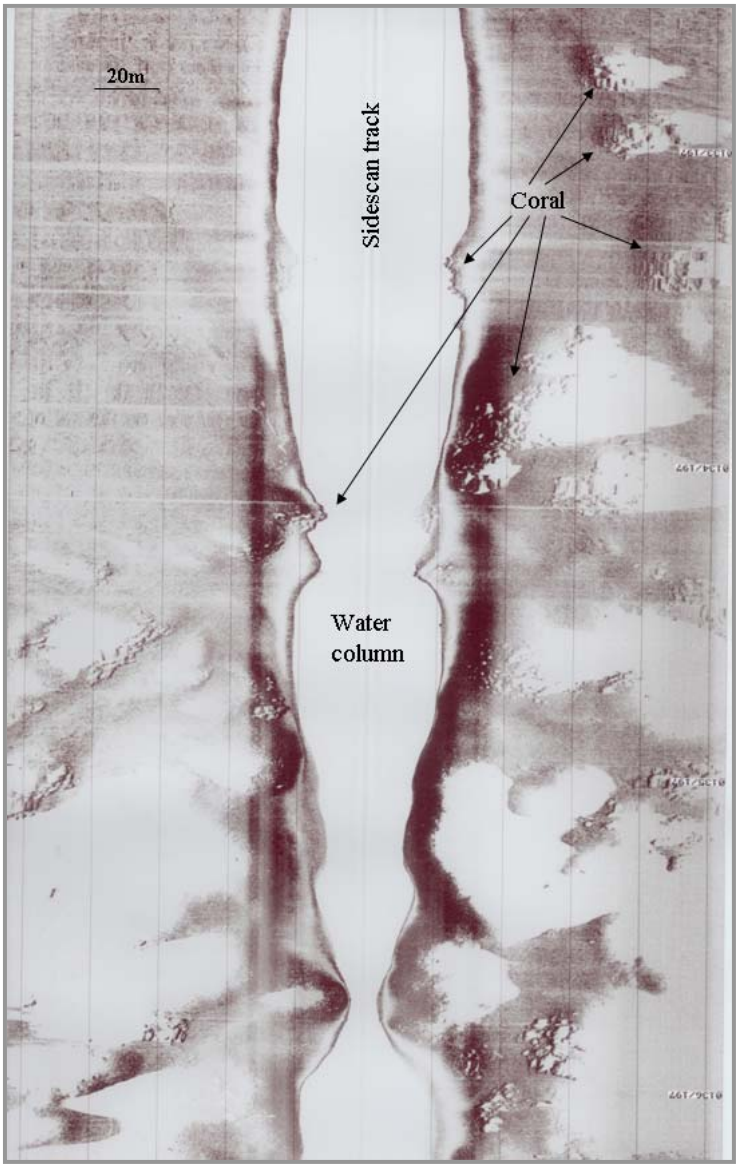


Fig. 7 Side scan imagery.
Sonographs show area of living coral with very high or high backscatter.

4.3 Video Monitoring

Video-transects to monitor substrate cover at different mound locations (Fig. 8) were carried out and served several purposes: (1) Groundtruthing: the video transects help elucidate particular features detectable in multibeam and sidescan sonar bathymetry specifically with respect to live coral abundance. (2) Benthos composition (Fig. 9): Using video transects a wider area can be covered with respect to live and dead coral abundance, benthos and substrate composition at respective monitoring sites and (3) Determination of sampling areas: the videotransects were also used to decide on prospective sampling locations for live corals using the relatively small box corer are best or to actually avoid live coral areas when using the triangular dredge to sample for benthos composition at a larger scale.

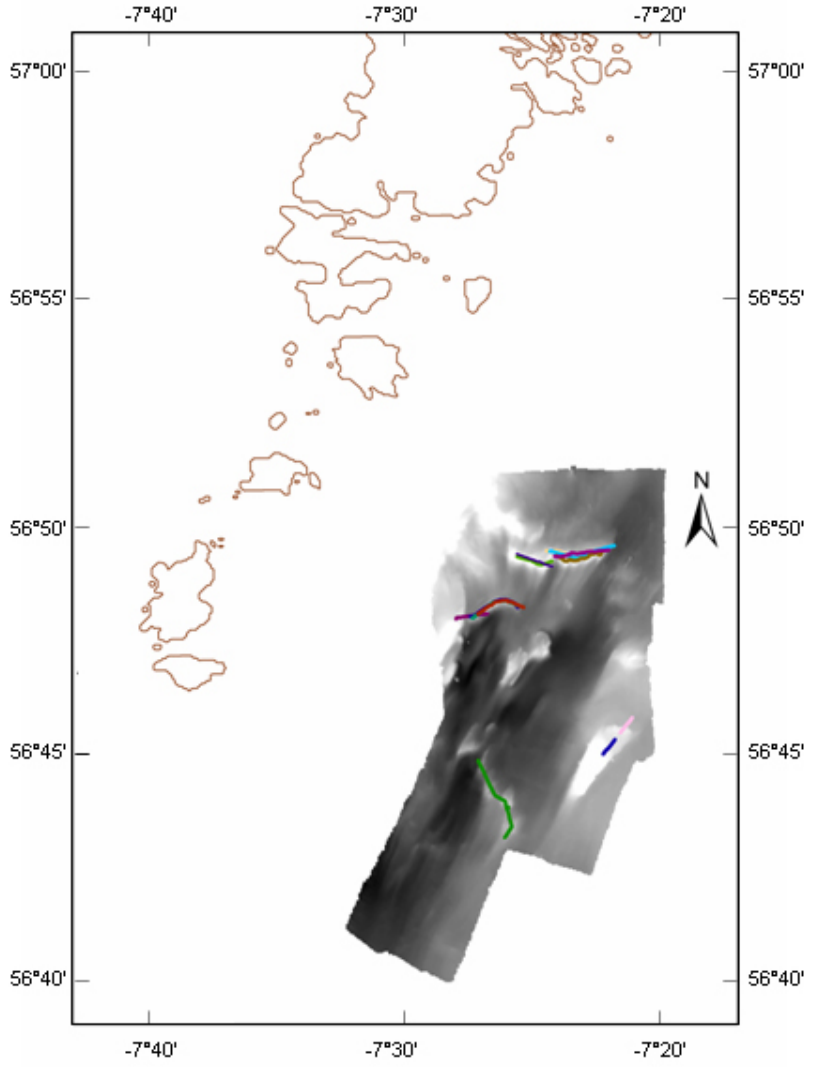


Fig. 8 – Monitoring of cold water coral ecosystems. Colored lines mark the videotransects carried out at different mound locations during BIOSYS 2006. The coordinates of begin and end of video-transects are given in Appendix-I.

For video monitoring 2 systems were used: either the NIOZ "Hopper Camera" or the SAMS Bowtech™ Umbilical Video System. The NIOZ Hopper camera consists of a heavy drop frame holding a digital video camera with a logger, power-supply, modem, UW Lights, altimeter and a set of parallel Octopus™ laser pointers. The latter was used to approximate absolute distance or size of objects independent of camera distance to bottom substrate. The camera system is connected to an electric cable that allows transmission of altimeter readings (continuous) and video images (every second). The drop frame also holds a black and white photo camera (Benthos™) for taking high resolution pictures of selected features. The NIOZ Hopper frame had some draw back specifically at the relatively turbid waters at Mingulay reefs where poor visibility forced the winch operator to get the camera closer to the bottom substrate. Because the NIOZ Hopper frame is relatively large it could not easily be manoeuvred close to the corals without the risk of damaging these. The delay of 1-2 seconds and the partly poor quality of the online pictures added to the problems in properly manoeuvring the NIOZ Hopper camera. Therfore we switched to the much smaller video frame of SAMS (from Sta. 66 onward). The SAMS video system consists of a much smaller frame and is equipped a Bowtech™ Umbilical Video System which can be held at approximately 1-5 metres above the sea floor by a winch. The operator has real time video and is thus able to move more precisely above coral mounds and reef structures depending on drift and speed of the ship. The system was also outfitted with a Photosea™ Strobe and Camera unit, and the parallel Oktopus™ lasers from the NIOZ Hopper Camera were adjusted to the SAMS Video system. Videos were captured to MiniDV tapes for future analyses of bottom structure.

Fig. 9 Video capture of *Lophelia pertusa* thickets at "Banana Reef". The SAMS video system shows location of monitoring site with geographic coordinates, time and date of videorecording. The HERMES_NIOZ Oktopus™ lasers indicate an approximate distance of 30 cm.

5. Sampling Equipment

5.1 CTD

During the cruise the CTD-rosette sampler was equipped with 22 Noex bottles of 12 liter, a Seabird™ 911 CTD with auxiliary sensors for oxygen, turbidity (Seapoint) sensor and fluorescence (Chelsea Aqua 3). Data were acquired using the SeaBird SBEdata Processing –Win 32 software. The principal activities involving the CTD-rosette were Yo-Yo-series at the same spot (Stn 90-113, and Stn 131-168) and two transects (Stns 13 and 14).

5.2 Water Box

A 1000 L water box (WK14) was used to take large volumes of water close to the bottom. The galvanized rectangular box of 200 cm high supported by a ca 50 cm high frame (Fig. 10) is lowered to the bottom with widely opened upper and lower lids (ca 70 by 70 cm) allowing the water to pass freely. The lids close simultaneously by a mechanical release when touching the bottom. This bottom water was sampled for bacterial abundance and composition, virus like particle abundance, bacterial production, ultra-filtration for concentration of prokaryotes and viruses, inorganic nutrients, total organic matter (TOC), particulate organic matter (POC) and stable isotopes. The water box was also used to collect bottom water for aquarium experiments, radioisotope incubations and to refresh the water of storage tubs containing living organisms. Samples from the near-bottom water for the analysis of phytopigments and lipids of particulate organic matter were collected using the SAPS system (Chapter 6).

5.3 Triangular Dredge

To collect fish and larger invertebrates for food web analysis and taxonomy we used a triangular dredge. The dredge consists of a triangular iron frame holding a nylon net with mesh size of 2 cm. Weights (10 kg) are attached to two corners of the triangle to keep the dredge upright. The underside of the net is protected by a rubber mat. The dredge was used sparingly (only two times), with a short bottom contact (few minutes), a low ground speed (1-1.5 knots) and a minimum of cable length (1.5x the depth) and only at "open" areas for the obvious reasons not to damage the reef itself.

Fig. 10. Triangular dredge after deployment. Most prominent is the coral debris and the sponge *Spongosorites coralliopha*

5.4 Box corer

Bottom samples were taken with a NIOZ boxcore (K18) equipped with a stainless steel cylindrical core of 50 cm in diameter and 55 cm height and a trip valve sealing the box. Boxcores (BX), which were taken during the cruise with date/time, coordinates and depth are listed in Appendix-I. When the boxcore came on deck, the valve was carefully opened and the overlying water was siphoned off.

The seawater was used for experiments/measurements after it was decided that the boxcore was well taken (penetration of ca 10-50 cm in the bottom). Seawater samples were taken for microbe abundance and composition, heterotrophic bacterial production, inorganic nutrients, total and dissolved organic matter and stable isotopes. The surface of the boxcore sample was photographed (Appendix-#) and a description of the species composition and other characteristics were made (e.g. height of sediment and/or dead coral skeleton layer, Appendix-#). We distinguished between 'slaughter' and 'biodiversity' boxcores. The 'slaughter' boxcores were sorted for living macro-organisms and sampled to assess free-living and coral/sponge-associated microorganisms. If 'slaughter' cores contained life corals, these were immediately transferred to the cold container (9°C) for experiments. Of selected 'slaughter' cores the underlying sediment was sampled with an acrylic corer and sliced for later analysis of organic carbon and phytopigments. The 'Biodiversity' boxcores were sieved over nested 0.5 and 1 mm sieves and all live organisms and skeletal material were stored for later analyses (formalin or freezer) and biomass estimates.

Fig. 11 Deployment of boxcore. After sampling the box corer is place on board, the lid that seals the boxcore during transport through the water column is opened first to siphon off overlying ambient bottom water for different analyses (prokaryotes, productivity, nutrients, TOC etc). Only then is the boxcore opened to further examine the benthos composition retrieved from the sea floor.

5.5. SAMS Videograb

SAMS has developed sensitive video assisted sampling techniques to strongly target sampling. Using a Bowtech™ Umbilical Video System attached to a van Veen grab, a camera relays images back to the surface operator who can control the height of the grab over the seafloor (Fig. 12). On sighting coral, the operator can trigger the grab and retrieve the living coral specimens. Although the videograb has great advantages with respect to the fact, that sampling can be very pointedly, the disadvantage for several BIOSYS related questions (e.g. coral-associated prokaryotes) was the fact that the grab can not hold and transport ambient seawater along with the benthos sample. Also the contains of the videograb cannot be normalized to bottom area as is possible with the box corer and does thus not allow for quantification of benthos substrate. Nevertheless, the video grab is the instrument of first choice when aiming at single target organisms such as live corals or big sponges since in calm seas it causes least damage to the reef.

Fig. 12 ***Left*** Online control and operation during deployment of video grab. The small monitor shows the van Veen grab above the seafloor. ***Right*** Van Veen grab is hauled on deck after sampling. The containts of the grab are emptied into the tub to subsequently process the sample.

6. BIOSYS Methods and Preliminary Results

6.1. Seawater Chemistry

We collected samples from the boxcore and waterbox for the measurement of dissolved inorganic nitrogen and phosphorous (NUTS, Appendix IV)), dissolved organic nitrogen and phosporous (DON/DOP), total organic carbon (TOC) and dissolved inorganic carbon (DIC). The NUTS were directly processed on board R/V Pelagia.. The DON/DOP samples were filtered over a 0.2 µm Acrodisc and stored at –20°C, TOC was taken with a syringe and directly injected into a glass vial (15 ml), fixed with 8-10 drops concentrated phosphoric acid, sealed air-tight and stored at +4°C. For DIC a glass vial containing 20 µL saturated HgCl was carefully filled to the rim with seawater filtered over a 0.2 µm Acrodisc and stored at +4°C.

6.2. Particle Size Fractions

To estimate if bacteria or viruses are a potential food source for the deep water corals, we concentrated viruses and bacteria from bottom water using ultra-filtration to determine stable isotopic composition of 3 size classes with particulate matter of >1.5 µm, bacteria >0.2 µm and viruses >100 kDa. Approximately 400 L of seawater sampled by the waterkist were prefiltered through a 20 µm Nitex net and subsequently ultra-filtered over a 0.2 µm cartridge and over a 100 kDa cartridge to obtain bacterial and viral concentrates. The retentate containing all particle size classes above 0.2 µm was then pre-filtered over a precombusted GF/C glass fibre filter (Whatman, nominal pore size 1.5 µm) and was then filtered onto a 0.2 µm Anodisc filter (Whatman). The retentate containing the virus concentrate was filtered directly over a 0.02 µm Anodisc filter (Whatman). All filters were oven dried at 60 °C to later analyse for stable isotopic composition of bulk sample and amino acids and to compare to the isotopic signature in deep water corals.

6.3. Microbial Abundance and Diversity

One of the main goals of BIOSYS is to study the microbial community structure and activity in deep coral reefs and the role of microbes in the functioning and nutrition of the corals. We aim at comparing several different deep water coral reef ecosystems to further elucidate the physiological and nutritional requirements of the deep water corals *Lophelia pertusa* and *Madrepora oculata* and the solitary corals *Desmophyllum* spp. We have already been studying the Rockall Trough and Rockall Bank area during a joint BIOSYS/HERMES cruise in 2005 [vanDuyl & Duineveld 2005] and during HERMES 2006 which took place directly prior to the BIOSYS 2006 cruise. We mainly investigate the microbial abundance, diversity and productivity in the ambient seawater, the deep water corals and some sponges. We carried out an experiment where we sampled the seawater of the gastral cavity, seawater directly in contact with the polyp and ambient seawater (coelenteric fluid) to compare bacterial abundance and diversity of the gastral fluid to that surrounding the coral. This should shed light on the question if *Lophelia pertusa* is capable of "bacterial gardening". Other samples were collected to asses the role of allelochemicals from corals as defence system against bacteria. Radioisotope labelling of *L. pertusa* with 14C-bicarbonate or 3H-Leucine was carried out to estimate the contribution of auto- and or heterotrophic microorganisms to the coral metabolism.

We took seawater samples to determine microbial abundance and diversity from seawater of the waterbox, boxcore and CTD. Different sampling protocols were followed to determine bacteria, archaea and virus abundance. Seawater samples for analyses a) to e) from boxcores were prefiltered over a 0.8 µm polycarbonate membrane to remove suspended sediment. Some controls were taken without pre-filtration for comparison.

a) DAPI staining: For DAPI (4,6-diamidino-2-phenylindole) staining we used 5 ml of seawater. Seawater samples were fixed with glutaraldehyde and stained with DAPI, filtered onto a µm pore size black polycarbonate membrane filter, embedded in

immersion oil on a object slide and stored at –20°C. Counts will be done using an epifluorescence microscope.

b) Sample fixation for CARDFISH by adding formaldehyde to 20 ml seawater and fixation for 1 h at 4°C, the fixed sample was filtered on a µm pore size white polycarbonate membrane filter and stored at –20°C until further processing.

c) SYBRGreen I staining: 2 ml seawater sample were filtered over a 0.02 µm Anodisc filter (Whatman) to collect both bacteria and viruses, the filter was place on top of the stain SYBRGreen I and stained for 15 minutes. The filter was blotted dry and placed in a glycerol/PBS mix onto a glass slide and stored at –20°C. Counts will be done using an epifluorescence microscope.

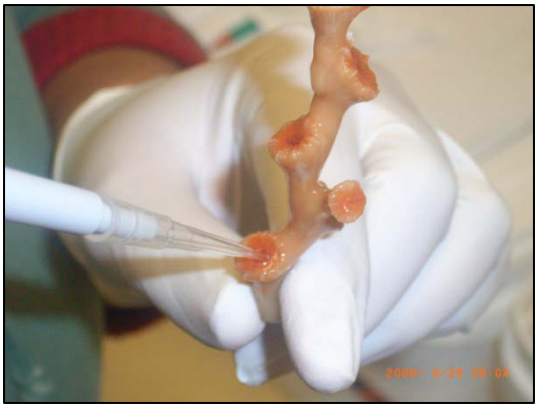
d) Flow Cytometry: to determine bacteria and virus abundance by flow cytometry 1 ml seawater sample was fixed with glutaraldehyde for 10 minutes, flash frozen in liquid nitrogen and stored at –80°C.

e) DGGE/TRFLP for microbial diversity – Cells from 2 L of seawater were subsequently filtered onto a 0.8 µm and 0.2 µm polycarbonate filter and filters were frozen at –80°C for analyses of bacterial and archaeal diversity using denaturing gradient gel electrophoresis (DGGE) (LOV) or Terminal restriction fragment length polymorphisms (TRFLP) (NIOZ). Bacteria on the tissue of corals and sponges were taken using cotton sticks and frozen at –80°C. Also, pieces of specimen were frozen.

f) Bacteria from ambient seawater and deep water corals were isolated on marine agar plates that were incubated in 10°C climate controlled containers.

6.4. Bacterial Gardening Experiments

We wanted to elucidate if deep water corals may "garden" bacteria in their gastral cavity by providing them with nutrients that are scarce in ambient seawater as shown in earlier studies for temperate corals (HERNDL and VELIMIROV, 1985; HERNDL et al., 1985). We sampled the coelenteric fluid (CF), the seawater directly overlying the polyp of the coral (OW) and ambient seawater (SW) (Fig. 13). We hypothesize that if corals are able to garden bacteria as surplus food the abundance of bacteria has to be higher in the gastral fluid than in ambient seawater, and has to decrease after reaching a certain threshold value indicating digestion by the coral. We took samples from coral and seawater directly from boxcores.



Additionally, we set up an experimental time series with *Lophelia pertusa* branches in ultra-filtered seawater (free of bacteria and viruses) and *L. pertusa* kept in natural seawater. We then sampled during a period of 32 hours in various time steps to determine the abundance of bacteria and viruses as well as bacterial diversity in these microcosms. Due to the small size of the gastral cavity of the corals, we consistently sampled 5 µL of seawater overlying the polyp (^{1}OW), coelenteric fluid (^{2}CF) and "ambient" seawater (^{3}SW) were pipetted onto a 0.02

µm Anodisc and vacuum-filtered. This experiment was also run during the previous HERMES cruise with *Lophelia pertusa* collected from dredge sampling of the Rockall area (Haas mound).

The contours of the 5µL spots were lined with a pencil to later determine the surface area of the 5 µL droplet (Fig. 14). This is necessary to recalculate the concentration of bacteria and viruses by relating counts and surface area to the sample volume. The filter was stained with SYBRGreen I (1:250 dilution medium: Glycerol/PBS antifadent) and frozen at –20°C.

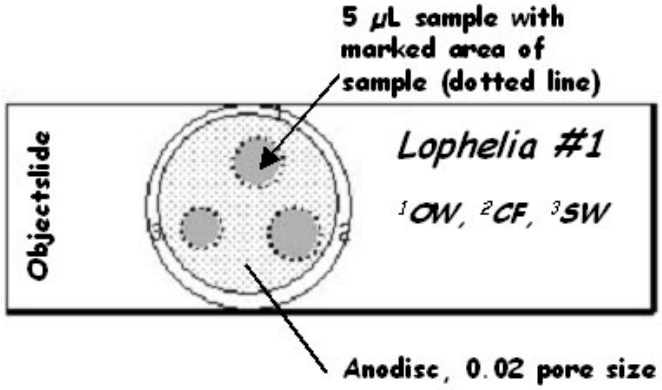


Fig. 14: Preparation of small volume samples to determine bacteria and virus numbers of the seawater overlying the polyp (1, OW) of *L. pertusa*, coelenteric fluid (2, CF) of the two coral species *M. oculata* and *L. pertusa* and of ambient seawater (3, SW).

6.5. Microbial Auto- and Heterotrophic Productivity

Similar to experiments carried out during the BIOSYS/HERMES cruise 2005, we conducted several radioisotope labeling experiments to determine seawater productivity and to investigate auto- and heterotrophic microbial activity in prokaryotes associated with the coral *Lophelia pertusa.*

Seawater

Seawater collected from CTD, box corer or water box was incubated with either ^{3}H-Leucine (15nM hot and 15nM cold Leucine) or ^{14}C-sodium bicarbonate (50 µCi ml^{-1}) and incubated for 5 or 24 hours, respectively. Seawater was filtered over a 0.2 µm polycarbonate filter. For ^{3}H samples, filters were washed using ice-cold TCA to precipitate proteins. Samples of ^{14}C incubations were fumed with concentrated HCl in an excicator to release CO_2. Samples were stored at -20°C until scintillation counting at the NIOZ.

Lophelia pertusa

To assess productivity of coral associated prokaryotes, small branches of *L. pertusa* collected at Mingulay were labeled with ^{14}C-sodiumbicarbonate or ^{3}H-Leucine. As a control, several samples were treated with 2.5 ml / 30 ml formaldehyde to kill coral and bacteria prior to experiment. To assess microbial activity in seawater used for radioisotope labeling a set of samples were labeled without *L. pertusa* and run in parallel.

Fig. 15 Microcolonies of *L. pertusa* (left) used for radioisotope labeling experiments and set-up of incubation using 50 ml Greiner tubes.

Heterotrophic microbial productivity

Lophelia pertusa samples were incubated for 5 hours at 8-10°C with ^{3}H-Leucine (final concentration was 15 nM of hot and cold Leucine, each) and at the end the experiment was stopped by adding 2.5 ml formaldehyde. Seawater was filtered over a 0.2 µm polycarbonate filter. Coral tissue was dissolved by boiling the coral pieces in 10 ml of 2 N NaOH for at least 20 minutes. A subsample was neutralized with concentrated HCl and vacuum-filtered over a 0.2 µm polycarbonate filter. To precipitate proteins, the filter was rinsed twice with ice-cold TCA and finally rinsed with MilliQ water. The filters were frozen at -20°C and stored for later scintillation analyses in the radioisotope lab at NIOZ.

Autotrophic microbial productivity

The coral samples were incubated for 24 hours with ^{14}C-sodium bicarbonate (50 µCi ml^{-1}). After rinsing samples in filtered seawater the tissue was removed from the coral by heating samples for at least 20 minutes in 2 N NaOH. Skeletons were crunched beforehand to facilitate tissue removal. To release CO_2, filters were fumed for 20 minutes with concentrated HCl and stored at -20°C.

Scintillation counting

For measuring radioactivity in samples Ultima Gold XR scintillation liquid was added to samples and decay was counted in a Wallace 1211 Rack Beta scintillation counter using an external standard and corrected for quenching. For ^{3}H results from measurements of mean blanks (corals/prokaryotes killed prior to adding ^{3}H label) were subtracted from mean results. Blanks of ^{14}C labeling experiments were neglectable and not subtracted from results (Fig. 16).

Results on seawater and coral productivity

Radioisotope labeling with ^{3}H-Leucine revealed contradictory results for experiments conducted during this cruise with *L. pertusa* collected at Rockall Bank and at Mingulay while the order of magnitude for Mingulay corals and incubations carried out during the BIOSYS/HERMES cruise 2005 is comparable(Fig. 16). The general picture indicates that heterotrophic production rate in prokaryotes associated to *L. pertusa* lies between 500-600 µg carbon per sample and day while carbon production in seawater used for incubation is an order of magnitude lower with less than 50 µg carbon per incubation and per day produced. The big exception was the Rockall 2006 sample where microbial heterotrophic production in the seawater used for incubations was extremely high and even higher than the microbial production in coral tissue. This was due to the fact that background productivity in samples incubated without coral was even twice as high as in the coral treatment (data not shown). It was thus astonishing, that productivity of the seawater used for incubation was actually lower when *L. pertusa* was present. This result can hint at either corals feeding on the fastly growing bacteria or *L. pertusa* excreting substances that can inhibit bacterial growth.

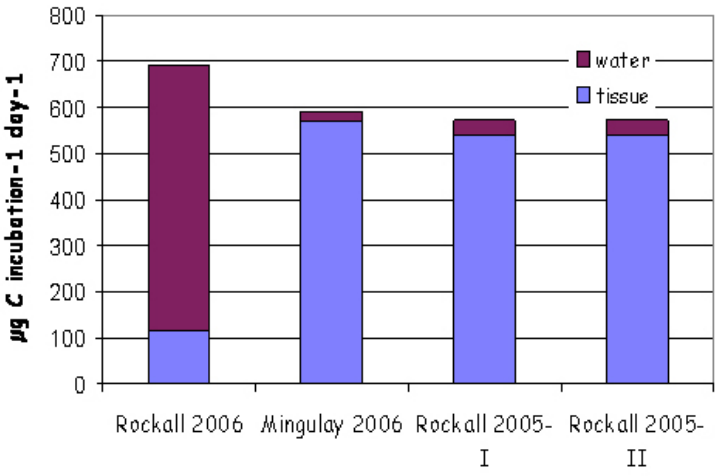


Fig. 16 Heterotrophic microbial protein synthesis in *L. pertusa* and seawater assessed by ^{3}H-Leucine labeling. Coral samples were derived from Rockall Bank in the previous HERMES cruise (Rockall 2006) and from Mingulay reefs (Mingulay 2006). Results from labeling experiments conducted during HERMES/BIOSYS 2005 are also shown (Rockall 2005-I and II) and correspond to the results obtained from corals collected at Mingulay.

^{14}C-bicarbonate fixation by prokaryotes associated to corals was slightly above that of incubation seawater (Fig. 17). However, the ^{14}C fixation in coral incubations greatly exceeded that of prokaryotic chemoautotrophy of seawater without corals, showing clearly that Bacteria or Archaea appear to play a pronounced role in chemoautotrophic carbon fixation in *L. pertusa.* The results also show, that chemoautotrophic carbon fixation is almost 4 orders of magnitude lower than heterotrophic carbon fixation.

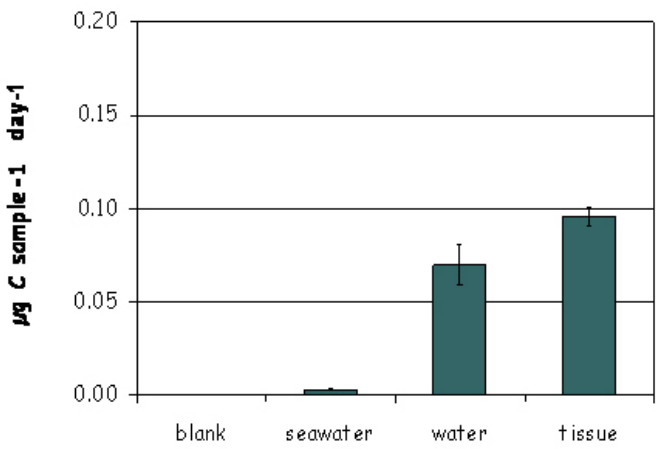


Fig. 17 Chemoautotrophic carbon fixation in prokaryotes associated to *L. pertusa* and in seawater assessed by ^{14}C-sodium bicarbonate labeling. Coral samples were derived from Mingulay reefs (Mingulay 2006). The blank was neglectable and was not subtracted from samples. Seawater (without corals), Water (seawater with corals) and tissue (coral tissue dissolved in 2N NaOH).

6.6. Calcification Rate of *Lophelia*

To estimate calcification rate of *L. pertusa* branches were labeled with $^{45}CaCl_2$. Thirty µL of ^{45}Ca label were added to 30 ml of sample (45.9µCi/30 ml). To controls, 2.5 ml formaldehyde was added prior to labeling experiments. Samples were incubated for 24 h at in situ temperature. After 24 hours, corals were rinsed twice in unlabeled filtered seawater for 1 hour. Whole colonies (containing tissue and skeleton) were immediately frozen at -20° C until further analyses. Also, skeletons of ^{14}C-sodium bicarbonate labeling (5.6.2) were frozen at -20°C for later determination of ^{14}C-DIC incorporation into the coral skeletons.

6.7. Report on the Porifera of Mingulay (Rob van Soest)

As was done in previous cruises, sponges were removed from the samples, identified and preserved in alcohol 96% for further studies and comparisons ashore. A few coral blocks and bunches of branches were preserved *in toto* for further studies ashore.

Sponge samples obtained

A total of 228 samples consisting of one or more specimens of a given species were secured from 20 boxcore attempts, 21 videograb and 2 dredge attempts. A total of 70 species were found (see Appendix with list of species). Larger specimens were photographed before preservation in alcohol. The richest sample was a dredge at Banana Reef, yielding 20 species.

At the request of Fleur van Duyl, small fragments of 9 species, *Spongosorites coralliophaga*, *Characella pachastrelloides*, *Forcepia forcipis*, *Aplysilla rosea*, *Hemigellius* cf.*fayalensis*, *Mycale lingua*, *Myxilla (Myxilla) rosacea*, *Phakellia ventilabrum* and *Stryphnus ponderosus*, were cut off from the main body with fresh knife

blades and subsequently stored in liquid nitrogen (bucket 5) immediately after collection. The samples are intended for ATP activity measurements.

Boxcore samples vs Video-grab samples

Video-grab sampling, although defective in being non-quantitative, was not very less efficient in collecting sponges, in comparison to boxcores. Species richness was generally low in boxcores averaging 6.2 species (counting only those that contained sponges) and likewise in video-grabs, averaging 3.6 species. However, both retrieved about equal numbers of species (BX: 44 species in 20 attempts, VG: 37 species in 21 attempts). Boxcores obtained on average larger numbers of specimens.

Comparison of Mingulay and Rockall Bank reef sponges

Of the 70 species of Mingulay, 30 were shared with Rockall Bank reefs (43%). A number of striking differences are apparent:

- Rockall Bank diversity is 35% higher than Mingulay (based on 43 sample attempts vs. 84 at Rockall Bank)
- Rockall Bank sample diversity is approx. 25-30% higher than that of Mingulay (based on average species richness of boxcore samples)
- there are no Hexactinellida in Mingulay reefs
- very few Calcarea (2 species) compared to Rockall Bank
- in contrast to Rockall Bank, Mingulay has several slimy encrusting or massive species
- of the dominant species in Rockall Bank reefs *(Higginsia thielei, Cyamon spinispinosum, Hexadella dedritifera*), only *Hexadella* was found in a modest frequency at Mingulay.
- a good proportion (approx. 25%) of Mingulay sponges occur also in shallow-water habitats along the coasts of the British Isles, whereas Rockall Bank species are all truly bathyal sponges.
- none of the excavating sponges are shared between the two reef locations
- the blue thinly encrusting *Hymedesmia (Hymedesmia)* occurring in both systems are different species (Rockall: *H.(H.) curvichela*, Mingulay: *H.(H.) paupertas*).

The following features are shared between the two systems:

- sponges occur only occasionally on live corals (see photo)
- predominance of thin crusts and highly siliceous masses (although the latter are less pronounced in Mingulay)
- dominance of *Hymedesmia* species
- relative commonness of *Plocamionida ambigua*, *Hexadella dedritifera* and *Spongosorites coralliophaga.*

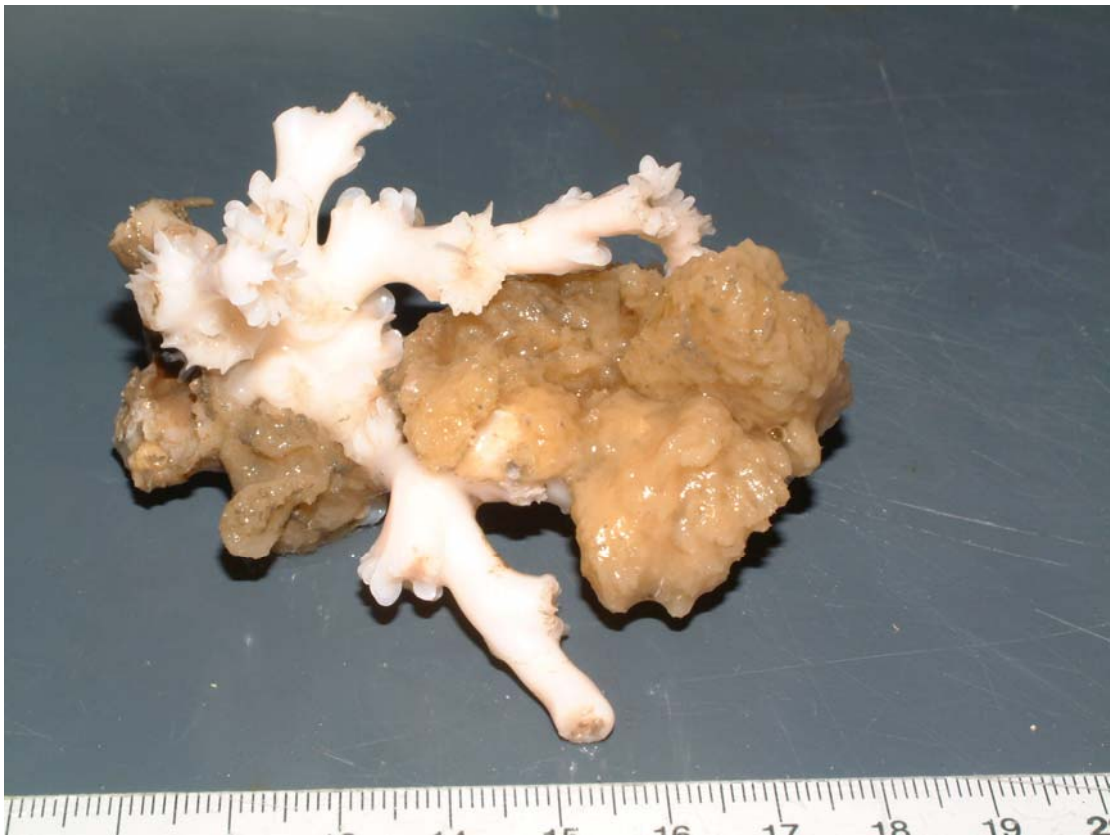


Fig. 18 The sponge *Myxilla (Myxilla) rosacea* overgrowing live *Lophelia pertusa* coral

New or interesting records:

- *Antho (Antho) brattegardi* was only once described from Norway
- *Hymedesmia (Hymedesmia) macrosigma* has not been recorded since its first description in 1910 from deep water S of Iceland.
- *Crella (Pytheas) derma*, a rare Arctic-Boreal species was found to occur quite commonly. Possibly it is a senior synonym of *C.(P.) akraleitae* described from the Far Oer. *Crella* species of the boreal region are in need of revision.
- *Clathria (Microciona) elliptichela* & *C.(M.) bitoxa* were hitherto known only from Scandinavia (Sweden and Norway, respectively).
- Remarkably, the intertidal and shallow sublittoral species *Haliclona (Reniera) cinerea* appeared to be one of the more common sponges in the Mingulay reefs.
- Similarly remarkable is the record of the intertidal and sublittoral *Pachymatisma johnstonia* from the Mingulay reef. The species is white in Mingulay, contrasting with the dark grey coloured specimens (‘elephant sponge’) in shallow water. No spicular differences were observed, so identity seems certain.
- A species of *Spirastrella* was identified provisionally as *S. cunctatrix*, which is so far known only from the Mediterranean.

Species list (* indicates not found at Rockall Bank)

Demospongiae: Astrophorida
*Stryphnus ponderosus**
Characella pachastrelloides
Poecillastra compressa
*Pachymatisma johnstonia**
*Geodia atlantica**
*Geodia nodastrella**
Thrombus abyssi

Hadromerida
*Pione vastifica**
*Cliona celata**
Radiella sarsi
Sphaerotylus capitatus
Protosuberites incrustans
*Protosuberites denhartogi**
*Paratimea constellata**
*Spirastrella cf. cunctatrix**

Poecilosclerida
*Antho (Antho) brattegardi**
*Antho (Antho) inconstans**
*Clathria (Clathria) barleei**
*Clathria (Microciona) armata**
Clathria (Microciona) atoxa
Clathria (Microciona) basifixa
*Clathria (Microciona) bitoxa**
*Clathria (Microciona) elliptichela**
*Clathria (Microciona) gradalis**
*Clathria (Microciona) strepsitoxa**
Iophon piceus
Eurypon clavatum
*Eurypon coronula**
Eurypon lacazei
*Raspailia (Raspailia) virgultosa**
Forcepia forcipis
*Lissodendoryx (Ectyodoryx) atlantica**
*Crella (Pytheas) derma**
*Hymedesmia (Hymedesmia) paupertas**
Hymedesmia (Hymedesmia) helgae
*Hymedesmia (Hymedesmia) levis**
Hymedesmia (Hymedesmia) proxima
*Hymedesmia (Hymedesmia) derma**
*Hymedesmia (Hymedesmia) dubia**
Hymedesmia (Hymedesmia) rugosa
*Hymedesmia (Hymedesmia) peachi**
*Hymedesmia (Hymedesmia) macrosigma**
Hymedesmia (Stylopus) coriacea
Plocamionida ambigua
*Melonanchora emphysema**
Myxilla (Myxilla) fimbriata
*Myxilla (Myxilla) rosacea**
Desmacella incornata
Mycale (Mycale) lingua
Mycale (Carmia) fascibula

Halichondrida
*Phakellia ventilabrum**
Acanthella erecta
*Hymeniacidon kitchingi**
Spongosorites coralliophaga

Haplosclerida
*Haliclona (Haliclona) urceolus**
*Haliclona (Haliclona) spec.**
*Haliclona (Reniera) cinerea**
Haliclona (Gellius) flagellifera
*Haliclona (Rhizoniera) indistincta**
*Cladocroce spatula**
*Hemigellius cf. fayalensis**

Dictyoceratida
Dysidea fragilis
*Pleraplysilla spinifera**

Dendroceratida
*Aplysilla rosea**
Chelonaplysilla arenosa
Spongionella pulchella

Halisarcida
*Halisarca dujardini**

Verongida
Hexadella dedritifera

Calcarea: Calcinea
Clathrina reticulum

Calcaronea
*Aphroceras ensata**

6.8. Collection and Maintenance of Live Animals (Michaël Laterveer)

A cooperation between BIOSYS and Rotterdam Zoo has been initiated in begin of 2006. Part of the cold water corals kept since 2005 in a climate room at NIOZ have been transported to the Oceanium at Rotterdam Zoo. Since it appears that the cold water corals can be kept at good condition in the aquarium the ultimate goal is to establish a cold water coral aquarium for public access in the coming year. Therefore this year's cruise was used to collect more cold water corals and other fauna associated with these deep bioherms. *Lophelia pertusa* and other animals from box corer and dredge that were not used in other experiments or analyses were maintained alive in the temperature-regulated containers at around 10°C. Directly after the cruise, the animals were transported from Texel to Rotterdam and are now under observation to see which of the animals are well suitable for maintaining in the aquarium and to establish a good environment for the different groups to set up the cold water coral aquarium. This cooperation is profitable to both parties with BIOSYS gaining from the aquarium expertise of Rotterdam Zoo, and Rotterdam Zoo getting access to the fauna of the deep coral reefs. The common ultimate goal is to broaden public awareness for this intriguing but barely known ecosystem.

7. HERMES Methods / Preliminary Results

7.1. NIOZ _ HERMES (G. Duineveld, M. Lavaleye, M. Bergman)

7.1.1 Shipboard respiration measurements

The respiration of a selection of species from boxcore and dredge samples was measured on the ship in a thermo-controlled incubator. The set-up consisted of a storage tank (ca 1 m^3), a Zephyr cooling machine, and incubation vessels of varying volume (5 - 35 liter) and size. We used acrylic or Delrin vessels that were sealed with a lid containing a magnetic stirrer and PreSens™ optical oxygen mini-sensor and temperature probe. Latter were connected to a PreSens™ Fibox Single Channel Oxygen Meter and PC onto which the data were stored. Temperature and oxygen readings were stored every minute. Organisms were incubated in near-bottom water collected with a large volume sampler (1000L water box). The oxygen consumption of the bottom water ('blank') was measured prior to incubating the organisms. At the start and end of each incubation, a 60 ml water sample was taken from the incubation vessel for chemical determination (Winkler titration) of the O_2-concentration. The readings of the oxygen sensor were calibrated with the Winkler data. Respiration by the organism(s) was calculated from the linear decline of the oxygen signal recorded by the O_2-sensor, the water volume in the incubation vessel, and correction for 'blank' consumption.

By combining such measurements with the density of the organisms, we intend to make an estimate of areal respiration (C-consumption) for the entire community. While in soft deep-sea sediment latter quantity can be directly measured with incubation chambers that are inserted in the sediment, the dense coral cover at Rockall Bank does not permit such measurements.

In 2005 (cruise 64PE238) and 2006 (cruise 64PE249) a series of measurements was made on board of the ship of coral ecosystem of Rockall Bank, inluding live and dead corals (*Lophelia* and *Madrepora*) and common taxa (e.g. *Cidaris*, sponges like *Spongosorites*). During the present cruise this series we measured in a same a choice of comparable animals, of course also including live and dead corals (*Lophelia pertusa*). In the lab the respiration data will be standardized with regard to volume, dry weight and ash-free dry weight of the organisms in question.

For estimating areal community respiration of the coral community, biomass estimates ($W.m^{-2}$) of the principal taxa in the community are required. Especially important is having a realistic estimate of the quantities of living and dead coral per m^2. For this purpose boxcores were sorted in live and dead coral and the volumes were measured on board. Because the surface area of a boxcore is relatively small (0.25 m^2), we will make a attempt to estimate live and dead coral cover from images made with our tethered video system. The two parallel laserpointers (30 cm apart) on the videosystem will enable us to make accurate estimates of the image size despite the vertical movement of the system due to swell.

7.1.2. In situ Stand-Alone Pumping System (SAPS)

In order to obtain large volume filtered samples of the near-bottom water, we used an Challenger Oceanic™ Stand-Alone Pumping System (SAPS). The SAPS were loaded with 2 pre-combusted GF/F filters (293 mm diameter) on top of each other which were pressed down with a firm synthetic raster all to prevent tearing of the filters. The pumps were build into the landers, with the inlet about 1 m above the bottom. As the SAPS were programmed to pump for an hour just before the recovery of the landers we managed to filter near bottom water *in situ* and get thses still fresh on board. The pumping efficiency of the SAPS was 600-650 L h^{-1}. After recovery of the SAPS, the loaded GF/F filters were deep-frozen at -80°C.

7.1.3. Benthic lander and mooring deployments

The two available benthic ALBEX landers were deployed for short periods during the cruise at various stations on top or near the coral reefs. When deployed, landers were attached to an acoustic releaser and cable to the ship and lowered to ca 1 m above the seafloor from which position they were released. This was for accurate positioning of the lander and to prevent tilting and sliding of the lander in the uneven terrain. The ALBEX landers consist of an alu tripod equipped with 12 glass Benthos™ floats, two Benthos™ acoustic releasers and a single 250 kg ballast weight necessary for deployment and recovery. An Argos buoy, radio beacon, flash light and large orange flag are attached to locate it after surfacing.

Fig. 19 Deployment of benthic ALBEX lander.

Each lander carried the following instruments: 1) OBS (Optical Back Scattering - Seapoint™) at 1 m above the seafloor for measuring particle density in the water column within a few centimeters of the instrument; 2) Fluorometer (Seapoint™) at 1 m ab for measuring fluorescent particles in the water column. The data of the fluorometer and OBS were connected with a NIOZ-built datalogger which also recorded temperature and tilt; 3) A Technicap™ PPS 4/3 sediment trap with 50 cm2 opening and 2 vials (weekly samples). The opening of the trap is at level with the top of the lander at about 2.5 m ab. Glutaraldehyde (4%) was used as a preservative; 4) Nortek Aquadopp™ current meter attached the outside of the frame at 1 m ab. The Aquadopp was set at a blanking distance of 1.3 m from the lander frame, and records current speed, direction, and temperature; 5) SAPS (see above); 6) Digital time-lapse video camera`s one directed at the seafloor around the lander, another at a bait (mackerel) to identify predators. One of the landers was equipped with an additional instrument package owned by Dunstaffnage Lab of SAMS (Scotland) consisting of transmissometer (WetLabs), OBS and Fluorometer. The package was mounted at 0.5 m ab. Data will be compared to those of the NIOZ instruments for consistency and signs of transport or resuspension of particles close to the seafloor. To collect fish and larger invertebrates for food web analysis and taxonomy baited traps were attached to the landers.

In addition to the landers, 2 moorings were deployed twice to get extra informations on currents, turbidity and fluorescence. The moorings were composed of a bottom weight, 2 acoustic releasers, FSI™ current meter (3DACM), and OBS-Fluoro-and tiltmeter connected to a datalogger. The mooring was held upright by 13 Benthos floats. The current meter and logger were placed at 2.5 m above the seafloor.

In total we did 5 mooring and 3 lander deployments. The duration of the deployment for the moorings was 2-4 days. The landers were only deployed for one day.

Fig. 20 Deployment of mooring. To the cable a FSI™ current meter, the OBS-Fluorometer, tiltmeter and baited traps were attached.

First results of our current meter showed that the tidal cycle is semidiurnal. The current speed at 250 cm above bottom commonly had peaks twice a day up to 60 cm.s^{-1} The temperature on the Mingulay Reef varied between 9.4 and 10.4°C, the colder water coming from the south (Atlantic Ocean) while the slightly warmer was coming from the North form the shallower area between the Hebrides and Scotland. The temperature and the fluorescence signal were correlated positively, meaning that a high temperature also gave a high fluorescence signal.

Macrobenthic biodiversity and food web (M. Lavaleye, G. Duineveld)

A total of 30 boxcore attempts were made, 27 of which were successful i.e. they contained material from the seabed. Every successful boxcore sample was photographed and described in terms of penetration depth, sediment composition, fauna content and other features. A compilation of the photos of boxcore numbers is shown in Appendix-II. Descriptions of the boxcores including organisms are presented in Appendix-III. After inspection and description of the contents of the core, the sample was designated either as a 'biodiversity' or as a "slaughter' boxcore.

A total number of 6 'biodiversity' boxcores were collected that had sufficient penetration and showed no signs of flushing (sta. 17, 29, 30, 46, 61 and 118). Representative animals from these samples were photographed alive on board. The sample was sliced into two parts, namely the top 10 cm and the layer of 10 to 20 cm depth. Both layers were separately washed over nested 1 and 0.5 mm sieves and than preserved in formalin.

Species density and biomass of the macrobenthic fauna in these cores will be determined after identification and weighing in the lab. Despite growing data on species richness in cold water coral communities, surprisingly little information is available on numerical abundances or (total) biomass. Such data are important for making comparisons between communities across the continental slope in order to assess the relative importance of zones with cold water corals.

A suite of species were collected from 'slaughter' boxcores (plus dredge samples, see section 3.2.) for analysis of their isotopic signatures ($\delta^{15}N$, $\delta^{13}C$). The objectives of this analysis are 1) to identify the trophic position and role of the deep-water corals within coral community 2) to get insight into the principal food sources of the community and the corals, and 3) to make comparisons with communities higher and lower on the continental margin. In order to value differences in isotopic signatures between organisms in a community, it is necessary to have information on the entire food web ranging from primary suspended matter to top predators. Therefore, in addition to organisms we also collected samples from the sediment and suspended particulate matter in the bottom water. All samples collected for this purpose were stored in the –80°C freezer.

Striking of the boxcore samples that almost all cores contained the colonial anemone (Epizoanthus couchi). On the video's we they appeared also clearly with their white tentacles expanded. In the beginning we even mistakenly believed it to be *Lophelia pertusa*. The most peculiar animals which we caught several times with the boxcores were large *Cerianthus*. The largest obvious difference with the fauna of Rockall Bank was that we did not catch any *Madrepora oculata*.

Dredge and Trawling (Marc Lavaleye)

The triangular dredge was used two times (both in/or near the coral area, sta. 63 and 182). Both attempts were successful. The first dredge (sta.63) was done at the "Banana Reef" at a very small "smooth" spot of about 40 m wide. The catch was quite successful with a lot of live *Lophelia pertusa*, many starfishes (*Porania*), one spider crab, lots of other crabs (*Munida*, *Galathea)* and shrimps (*Pandalus montagui)*, several large tunicates, bivalves (*Chlamys*), anemones, polychaetes (Sabellidae and *Eunice norvegica*) and even a fish (*Gaidropsaurus*). The second dredge (sta. 182) was carried out near the corals where we had spotted a lot of sponges. And indeed we caught a lot of coral rubble with many large clumps of yellow *Spongosorites*. The catch further contained lots of brittle stars, some starfishes (*Porania, Henricia*), crabs (*Munida, Galathea, Inachus, Ebalia*, *Xantho*), shrimps (*Pandalus montagui*), bivalves (*Hiatella arctica, Chlamys tigrinus*), anemones and colonial anemones (*Epizoanthus couchi*) and hydroids (*Nemertesia*). Peculiar were the 1 cm rounded eggs with a blueberry color of which we don't know yet the maker. Next to the corals, which were used by almost all participants, other epifauna was collected for taxonomic purposes (sponges, biodiversity), stable isotope analyses (foodweb research) and incubations (oxygen consumption measurements).

7.2. SAMS_HERMES (Andrew Davies)

7.2.1. Groundtruthing

(*see* Video Monitoring, chapter 4.1.3)

7.2.2. Living Coral Sampling

The distribution of living coral in the Mingulay area is patchy, large banks of dead coral framework are often capped of a few colonies several metres wide. This makes sampling difficult, SAMS has developed sensitive video assisted sampling techniques to strongly target sampling. Using GIS multibeam maps of the area, sample sites are selected that are abundant with coral. Using a Bowtech™ Umbilical Video System attached to a van Veen grab, a camera relays images back to the surface operator who can control the height of the grab over the seafloor. On sighting coral, the operator can trigger the grab and retrieve the living coral specimens.

Living corals are stored in a mobile chilled aquarium to 9 °C with water circulation. 20 % of the water is changed daily, replaced with chilled local seawater, salinity is 35 ppm. Genetic samples are selected from a single fragment of coral (consisting of 1-2 polyps) per grab sample taken. The samples are stored in 99 % Ethanol for future analysis. Frozen samples are coral clumps with 5-15 polyps, and are stored at -80 °C.

All objectives of SAMS were fulfilled and surpassed during the BIOSYS cruise.

7.3. NOCS_HERMES (Veit Hühnerbach & Tim LeBas)

(*see* Sidescan sonar/mapping, chapters 2.2 and 4.1.2.)

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Scientific party and crew of RV Pelagia during BIOSYS cruise 2006

Royal Netherlands Institute for Sea Research (NIOZ): Sander Asjes, Magda Bergman, Lorendz Boom, Gerard Duineveld, Jan Hegeman, Marc Lavaleye, Conny Maier (Chief Scientist), Marielle Rietkerk and Jan van Ooyen
University of Amsterdam, NL: Rob van Soest
Ozeanium, Rotterdam Zoo, NL: Michaël Laterveer
University of Oldenburg, Germany: Anne Großkurth (MSc student, "Diplomandin")
Universtiy of Wales, UK: Craig M: Robertson (BSc student)
Scottish Association for Marine Science (SAMS), UK: Andy Davies
National Ocanography Center, Southampton (NOCS), UK: Veit Huehnerbach and Tim LeBas

Crew - R/V Pelagia: John Dresken, John Ellen (Master), Klaas Kikkert, Marcel de Kleine, Sjaak Maas, Bert Puyman(1st officer), Maarten Snippe (2nd officer), Roel van der Heide, Ron van der Slikke and Jose Vittoria

APPENDIX I - 64PE250 - Logbook

Station/ Track	Cast/ Action	Date/ Time	Type	Event	Lat	Lon	Depth	Remarks
1	1	Jul 09 2006 07:18:24	CTD	Begin	56.8176	-7.4011	214	
1	1	Jul 09 2006 07:22:06	CTD	Bottom	56.8174	-7.4016	214	
1	1	Jul 09 2006 07:30:42	CTD	End	56.8171	-7.4011	214	
2	1	Jul 09 2006 08:02:47	Water box	Sluiten	56.8172	-7.4018	213	
2	2	Jul 09 2006 09:21:59	Water box	Sluiten	56.8174	-7.4016	213	
3	1	Jul 09 2006 09:55:30	Boxcore (50 cm diameter)	Bottom	56.8274	-7.396	173	
4	1	Jul 09 2006 10:22:26	Boxcore (50 cm diameter)	Bottom	56.827	-7.3882	184	
5	1	Jul 09 2006 10:58:40	Boxcore (50 cm diameter)	Bottom	56.8243	-7.3841	159	
6	1	Jul 09 2006 13:38:02	Video Transect	Begin	56.8317	-7.383	194	Ming 1
6	1	Jul 09 2006 14:44:36	Video Transect	End	56.8166	-7.3943	10	
7	1	Jul 09 2006 15:33:19	Boxcore (small)	Bottom	56.8231	-7.398	144	Videograb (position doubtful)
7	2	Jul 09 2006 16:27:36	Boxcore (50 cm diameter)	Bottom	56.8232	-7.3967	147	Videograb
8	1	Jul 09 2006 19:29:05	Side scan sonar	Begin track	56.8531	-7.3864	166	mb line 0013
8	1	Jul 09 2006 19:53:18	Side scan sonar	End track	56.8361	-7.398	199	cancelled
8	2	Jul 09 2006 21:05:52	Side scan sonar	Begin track	56.8368	-7.3983	200	mb line 0014 (continued first line)
8	2	Jul 09 2006 21:39:44	Side scan sonar	End track	56.8061	-7.4206	211	
8	3	Jul 09 2006 22:30:06	Side scan sonar	Begin track	56.8376	-7.392	204	mb line 0015
8	3	Jul 09 2006 23:05:13	Side scan sonar	End track	56.8063	-7.415	102	
8	4	Jul 10 2006 00:09:27	Side scan sonar	Begin track	56.8376	-7.3871	200	mb line 0016
8	4	Jul 10 2006 00:49:11	Side scan sonar	End track	56.8022	-7.4116	208	
8	5	Jul 10 2006 01:27:37	Side scan sonar	Begin track	56.8374	-7.3819	197	mb line 0017
8	5	Jul 10 2006 02:02:37	Side scan sonar	End track	56.8058	-7.4038	195	
8	6	Jul 10 2006 02:42:26	Side scan sonar	Begin track	56.8366	-7.3774	199	mb line 0018
8	6	Jul 10 2006 03:16:39	Side scan sonar	End track	56.8058	-7.3991	194	
9	1	Jul 10 2006 08:01:19	Boxcore (small)	Bottom	56.8227	-7.3989	143	Videograb failed
10	1	Jul 10 2006 09:12:02	Boxcore (50 cm diameter)	Bottom	56.8272	-7.3964	174	
11	1	Jul 10 2006 09:39:55	Boxcore (50 cm diameter)	Bottom	56.8272	-7.3964	174	
12	1	Jul 10 2006 10:25:48	Video Transect	Begin	56.8248	-7.4322	167	
12	1	Jul 10 2006 11:30:14	Video Transect	End	56.8186	-7.4017	210	
13	1	Jul 10 2006 12:47:13	CTD	Begin	56.8312	-7.4139	140	
13	1	Jul 10 2006 12:50:51	CTD	Bottom	56.8311	-7.4138	137	
13	1	Jul 10 2006 12:54:50	CTD	End	56.831	-7.4134	134	
13	2	Jul 10 2006 13:07:50	CTD	Begin	56.8272	-7.4163	144	
13	2	Jul 10 2006 13:11:47	CTD	Bottom	56.8269	-7.416	144	
13	2	Jul 10 2006 13:15:35	CTD	End	56.8272	-7.4165	145	
13	3	Jul 10 2006 13:25:38	CTD	Begin	56.8241	-7.4173	137	
13	3	Jul 10 2006 13:28:18	CTD	Bottom	56.8239	-7.4171	134	
13	3	Jul 10 2006 13:31:58	CTD	End	56.8236	-7.4168	130	
13	4	Jul 10 2006 13:39:35	CTD	Begin	56.8223	-7.4181	112	
13	4	Jul 10 2006 13:42:07	CTD	Bottom	56.8223	-7.4182	112	
13	4	Jul 10 2006 13:50:34	CTD	End	56.8219	-7.4179	110	
13	5	Jul 10 2006 14:15:30	CTD	Begin	56.8206	-7.4191	135	
13	5	Jul 10 2006 14:18:07	CTD	Bottom	56.8207	-7.4191	135	
13	5	Jul 10 2006 14:22:17	CTD	End	56.8204	-7.4192	137	
13	6	Jul 10 2006 14:34:04	CTD	Begin	56.8186	-7.4197	179	
13	6	Jul 10 2006 14:37:28	CTD	Bottom	56.8182	-7.42	184	
13	6	Jul 10 2006 14:41:47	CTD	End	56.8181	-7.4202	185	
13	7	Jul 10 2006 14:52:19	CTD	Begin	56.8145	-7.4212	199	
13	7	Jul 10 2006 14:55:47	CTD	Bottom	56.8148	-7.4211	199	
14	1	Jul 10 2006 15:22:39	CTD	Begin	56.8317	-7.3983	184	
14	1	Jul 10 2006 15:26:04	CTD	Bottom	56.8317	-7.3983	184	
14	1	Jul 10 2006 15:30:09	CTD	End	56.8317	-7.3983	184	
14	2	Jul 10 2006 15:40:46	CTD	Begin	56.8283	-7.3976	187	
14	2	Jul 10 2006 15:46:23	CTD	Bottom	56.8283	-7.398	186	
14	2	Jul 10 2006 15:50:56	CTD	End	56.8283	-7.3981	186	
14	3	Jul 10 2006 15:57:37	CTD	Begin	56.8251	-7.3984	149	
14	3	Jul 10 2006 16:00:44	CTD	Bottom	56.825	-7.3986	152	
14	3	Jul 10 2006 16:04:18	CTD	End	56.825	-7.399	153	
14	4	Jul 10 2006 16:13:15	CTD	Begin	56.8229	-7.399	143	
14	4	Jul 10 2006 16:15:55	CTD	Bottom	56.8229	-7.399	141	
14	4	Jul 10 2006 16:21:49	CTD	End	56.8228	-7.3993	148	
14	5	Jul 10 2006 16:38:30	CTD	Begin	56.8204	-7.4002	190	
14	5	Jul 10 2006 16:42:04	CTD	Bottom	56.8203	-7.4001	190	
14	5	Jul 10 2006 16:46:06	CTD	End	56.8204	-7.4	190	
14	6	Jul 10 2006 16:54:47	CTD	Begin	56.8175	-7.401	215	
14	6	Jul 10 2006 16:58:56	CTD	Bottom	56.8173	-7.4014	203	
14	6	Jul 10 2006 17:03:32	CTD	End	56.8173	-7.4013	217	
14	7	Jul 10 2006 17:12:40	CTD	Begin	56.814	-7.4024	216	
14	7	Jul 10 2006 17:16:17	CTD	Bottom	56.814	-7.4026	214	
14	7	Jul 10 2006 17:22:00	CTD	End	56.8139	-7.4025	213	
15	1	Jul 10 2006 18:15:44	Multibeam	Begin track	56.7857	-7.4278	142	Line 0019 mingulay-1
15	1	Jul 10 2006 18:56:34	Multibeam	End track	56.8523	-7.4286	137	
15	2	Jul 10 2006 19:02:30	Multibeam	Begin track	56.8525	-7.4331	128	Line 0020
15	2	Jul 10 2006 20:05:03	Multibeam	End track	56.7853	-7.4336	225	
15	3	Jul 10 2006 20:14:00	Multibeam	Begin track	56.7863	-7.4378	234	line 0021

APPENDIX I - 64PE250 - Logbook

Station/ Track	Cast/ Action	Date/ Time	Type	Event	Lat	Lon	Depth	Remarks
15	3	Jul 10 2006 20:59:33	Multibeam	End track	56.8526	-7.438	105	
15	4	Jul 10 2006 21:08:03	Multibeam	Begin track	56.852	-7.4433	101	line 0022
15	4	Jul 10 2006 22:03:10	Multibeam	End track	56.7856	-7.4437	235	
15	5	Jul 10 2006 22:11:19	Multibeam	Begin track	56.7856	-7.4479	243	line 0024
15	5	Jul 10 2006 22:57:58	Multibeam	End track	56.8524	-7.4478	91	
15	6	Jul 10 2006 23:02:42	Multibeam	Begin track	56.8525	-7.4535	86	line 0025
15	6	Jul 10 2006 23:52:20	Multibeam	End track	56.7858	-7.4529	246	
15	7	Jul 10 2006 23:58:06	Multibeam	Begin track	56.7859	-7.4579	268	Line 0026
15	7	Jul 11 2006 00:42:22	Multibeam	End track	56.8524	-7.4581	76	
15	8	Jul 11 2006 00:48:01	Multibeam	Begin track	56.8522	-7.4628	75	Line 0027
15	8	Jul 11 2006 01:40:55	Multibeam	End track	56.7856	-7.463	259	
15	9	Jul 11 2006 01:46:16	Multibeam	Begin track	56.7859	-7.4676	151	Line 0028
15	9	Jul 11 2006 02:26:59	Multibeam	End track	56.8524	-7.4678	51	
15	10	Jul 11 2006 02:32:25	Multibeam	Begin track	56.8521	-7.4728	56	Line 0029
15	10	Jul 11 2006 03:20:39	Multibeam	End track	56.7856	-7.4729	159	
15	11	Jul 11 2006 03:44:51	Multibeam	Begin track	56.7829	-7.4737	151	Line 0030
15	11	Jul 11 2006 04:20:15	Multibeam	End track	56.7831	-7.363	156	
15	12	Jul 11 2006 04:25:47	Multibeam	Begin track	56.7806	-7.3617	149	Line 0031
15	12	Jul 11 2006 05:14:33	Multibeam	End track	56.7805	-7.4731	135	
15	13	Jul 11 2006 05:20:38	Multibeam	Begin track	56.7776	-7.474	154	Line 0032
15	13	Jul 11 2006 05:58:06	Multibeam	End track	56.7775	-7.3624	151	
15	14	Jul 11 2006 06:02:22	Multibeam	Begin track	56.775	-7.3606	159	Line 0033
15	14	Jul 11 2006 06:35:37	Multibeam	End track	56.7751	-7.4439	244	
16	1	Jul 11 2006 07:23:14	Boxcore (50 cm diameter)	Bottom	56.8272	-7.3965	176	
17	1	Jul 11 2006 07:48:17	Boxcore (50 cm diameter)	Bottom	56.8272	-7.3965	175	
18	1	Jul 11 2006 08:40:14	Video Transect	Begin	56.8221	-7.3998	150	
18	1	Jul 11 2006 09:41:09	Video Transect	End	56.8239	-7.3647	217	
19	1	Jul 11 2006 10:40:50	Boxcore (small)	Bottom	56.8234	-7.3982	148	Video grabber failed
20	1	Jul 11 2006 11:10:43	Boxcore (small)	Bottom	56.8234	-7.3977	139	Video grabber
20	2	Jul 11 2006 12:44:44	Boxcore (small)	Bottom	56.8239	-7.3956	137	Video grabber
20	3	Jul 11 2006 13:12:54	Boxcore (small)	Bottom	56.8251	-7.3966	156	Video grabber
20	4	Jul 11 2006 14:15:37	Boxcore (small)	Bottom	56.824	-7.3972	145	Video grabber
20	5	Jul 11 2006 14:46:03	Boxcore (small)	Bottom	56.824	-7.3972	150	Video grabber
20	6	Jul 11 2006 15:06:22	Boxcore (small)	Bottom	56.824	-7.3975	146	Video grabber
20	7	Jul 11 2006 16:06:34	Boxcore (small)	Bottom	56.8233	-7.3943	137	Video grabber - failed
20	8	Jul 11 2006 16:29:21	Boxcore (small)	Bottom	56.8232	-7.3948	128	Video grabber
21	1	Jul 11 2006 18:16:38	Mooring deployment	Deployment	56.82	-7.4086	119	
22	1	Jul 11 2006 19:08:44	Side scan sonar	Begin track	56.8365	-7.3723	210	line0034
22	1	Jul 11 2006 19:43:34	Side scan sonar	End track	56.8063	-7.3928	175	
22	2	Jul 11 2006 20:32:54	Side scan sonar	Begin track	56.8359	-7.3682	214	line 0035
22	2	Jul 11 2006 21:05:11	Side scan sonar	End track	56.8063	-7.3877	202	
22	3	Jul 11 2006 21:58:57	Side scan sonar	Begin track	56.8358	-7.3632	217	line 0036
22	3	Jul 11 2006 22:31:03	Side scan sonar	End track	56.8061	-7.3816	215	
22	4	Jul 11 2006 23:16:49	Side scan sonar	Begin track	56.8353	-7.3587	228	Line 0037
22	4	Jul 11 2006 23:48:56	Side scan sonar	End track	56.8063	-7.3761	214	
22	5	Jul 12 2006 00:32:30	Side scan sonar	Begin track	56.8365	-7.3948	201	Line 0038
22	5	Jul 12 2006 01:08:29	Side scan sonar	End track	56.8071	-7.4199	205	
23	1	Jul 12 2006 02:51:01	Multibeam	Begin track	56.7719	-7.4729	245	Line 0039
23	1	Jul 12 2006 03:28:58	Multibeam	End track	56.7719	-7.3608	162	
23	2	Jul 12 2006 03:37:00	Multibeam	Begin track	56.7692	-7.3608	161	Line 0040
23	2	Jul 12 2006 04:23:40	Multibeam	End track	56.7692	-7.4729	226	
23	3	Jul 12 2006 04:28:28	Multibeam	Begin track	56.7665	-7.4729	235	Line 0041
23	3	Jul 12 2006 05:04:57	Multibeam	End track	56.7665	-7.3607	157	
23	4	Jul 12 2006 05:11:43	Multibeam	Begin track	56.7638	-7.3617	157	Line 0042
23	4	Jul 12 2006 05:55:04	Multibeam	End track	56.7638	-7.4734	235	
23	5	Jul 12 2006 05:59:55	Multibeam	Begin track	56.7609	-7.473	212	Line 0043
23	5	Jul 12 2006 06:36:46	Multibeam	End track	56.7611	-7.3605	120	
24	1	Jul 12 2006 08:15:51	Boxcore (small)	Bottom	56.8232	-7.3982	146	Videograbber
25	1	Jul 12 2006 08:33:59	Boxcore (small)	Bottom	56.8232	-7.398	149	Videograbber
26	1	Jul 12 2006 09:47:54	Boxcore (small)	Bottom	56.822	-7.3955	119	Videograbber
27	1	Jul 12 2006 10:23:04	Boxcore (small)	Bottom	56.8229	-7.3976	146	Videograbber
28	1	Jul 12 2006 11:03:14	Boxcore (small)	Bottom	56.8219	-7.3964	131	videograbber
29	1	Jul 12 2006 12:38:08	Boxcore (50 cm diameter)	Bottom	56.8273	-7.396	178	
30	1	Jul 12 2006 13:11:16	Boxcore (50 cm diameter)	Bottom	56.8177	-7.4003	209	
31	1	Jul 12 2006 14:39:01	Video Transect	Begin	56.801	-7.4533	160	abc position doubtful at times
31	1	Jul 12 2006 15:41:04	Video Transect	End	56.8041	-7.4206	214	
32	1	Jul 12 2006 16:11:16	Boxcore (50 cm diameter)	Bottom	56.8307	-7.4051	185	
32	2	Jul 12 2006 16:34:30	Boxcore (50 cm diameter)	Bottom	56.8307	-7.4052	187	
33	1	Jul 12 2006 17:38:04	Multibeam	Begin track	56.7569	-7.4687	246	Line 0044
33	1	Jul 12 2006 18:31:19	Multibeam	End track	56.6873	-7.5288	247	
33	2	Jul 12 2006 18:39:10	Multibeam	Begin track	56.6838	-7.5148	240	Line 0045
33	2	Jul 12 2006 19:23:51	Multibeam	End track	56.7533	-7.4546	233	
33	3	Jul 12 2006 19:37:05	Multibeam	Begin track	56.7515	-7.4382	242	line 0046
33	3	Jul 12 2006 20:25:51	Multibeam	End track	56.679	-7.4996	223	
33	4	Jul 12 2006 20:37:42	Multibeam	Begin track	56.6741	-7.482	200	line 0047

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Station/ Track	Cast/ Action	Date/ Time	Type	Event	Lat	Lon	Depth	Remarks
33	4	Jul 12 2006 21:30:24	Multibeam	End track	56.753	-7.4196	234	
33	5	Jul 12 2006 21:57:54	Multibeam	Begin track	56.7605	-7.4779	220	line 0048
33	5	Jul 12 2006 22:15:08	Multibeam	End track	56.7496	-7.4313	235	
33	6	Jul 12 2006 22:27:14	Multibeam	Begin track	56.7463	-7.4065	219	line 0049
33	6	Jul 12 2006 22:47:40	Multibeam	End track	56.7179	-7.4288	202	
33	7	Jul 12 2006 22:58:08	Multibeam	Begin track	56.7155	-7.4122	179	line 0050
33	7	Jul 12 2006 23:17:11	Multibeam	End track	56.743	-7.3916	148	
33	8	Jul 12 2006 23:23:49	Multibeam	Begin track	56.7424	-7.3922	142	Line 0051
33	8	Jul 12 2006 23:39:31	Multibeam	End track	56.7523	-7.4302	236	
33	9	Jul 12 2006 23:48:59	Multibeam	Begin track	56.755	-7.4151	230	Line 0052
33	9	Jul 13 2006 00:09:33	Multibeam	End track	56.7506	-7.3605	164	
33	10	Jul 13 2006 00:15:04	Multibeam	Begin track	56.7542	-7.3608	130	Line 0053
33	10	Jul 13 2006 00:28:44	Multibeam	End track	56.7541	-7.3906	182	
33	11	Jul 13 2006 00:37:09	Multibeam	Begin track	56.7573	-7.385	169	Line 0054
33	11	Jul 13 2006 00:45:47	Multibeam	End track	56.7572	-7.3602	128	
33	12	Jul 13 2006 00:54:21	Multibeam	Begin track	56.7484	-7.361	167	Line 0055
33	12	Jul 13 2006 01:06:36	Multibeam	End track	56.7484	-7.3933	184	
33	13	Jul 13 2006 01:11:16	Multibeam	Begin track	56.745	-7.3921	185	Line 0056
33	13	Jul 13 2006 01:20:34	Multibeam	End track	56.7441	-7.3669	167	
33	14	Jul 13 2006 01:29:21	Multibeam	Begin track	56.7418	-7.3759	166	Line 0057
33	14	Jul 13 2006 01:36:40	Multibeam	End track	56.7417	-7.3892	100	
33	15	Jul 13 2006 01:45:34	Multibeam	Begin track	56.7402	-7.3885	96	Line 0058
33	15	Jul 13 2006 02:07:15	Multibeam	End track	56.7125	-7.3981	189	
33	16	Jul 13 2006 02:14:29	Multibeam	Begin track	56.711	-7.3902	189	Line 0059
33	16	Jul 13 2006 02:39:47	Multibeam	End track	56.7505	-7.3609	163	
33	17	Jul 13 2006 02:39:53	Multibeam	Begin track	56.7508	-7.3608	162	Line 0060 + 0061
33	17	Jul 13 2006 03:41:41	Multibeam	End track	56.8527	-7.3599	188	
33	18	Jul 13 2006 03:47:19	Multibeam	Begin track	56.8525	-7.3553	185	Line 0062 + 0063
33	18	Jul 13 2006 04:50:51	Multibeam	End track	56.7499	-7.3548	170	
33	19	Jul 13 2006 04:55:40	Multibeam	Begin track	56.7502	-7.3469	171	Line 0064 + 0065
33	19	Jul 13 2006 05:55:52	Multibeam	End track	56.8527	-7.3477	193	
33	20	Jul 13 2006 06:02:06	Multibeam	Begin track	56.8524	-7.3397	204	Line 0066
33	20	Jul 13 2006 06:30:06	Multibeam	End track	56.8061	-7.3406	190	
34	1	Jul 13 2006 07:54:45	Video Transect	Begin	56.8024	-7.4443	212	
34	1	Jul 13 2006 09:00:11	Video Transect	End	56.8085	-7.4213	198	
35	1	Jul 13 2006 09:57:48	Boxcore (small)	Bottom	56.8068	-7.4324	149	Video grabber failed
36	1	Jul 13 2006 10:25:35	Boxcore (small)	Bottom	56.8067	-7.431	153	video grabber
37	1	Jul 13 2006 10:55:31	Boxcore (small)	Bottom	56.8068	-7.4309	155	video grabber
38	1	Jul 13 2006 12:57:19	Boxcore (small)	Bottom	56.8056	-7.426	155	video grabber
39	1	Jul 13 2006 13:36:19	Boxcore (small)	Bottom	56.8069	-7.4277	178	video grabber
40	1	Jul 13 2006 14:39:44	Boxcore (small)	Bottom	56.8062	-7.4308	160	video grabber
41	1	Jul 13 2006 15:28:59	Boxcore (small)	Bottom	56.8069	-7.4298	166	video grabber
42	1	Jul 13 2006 16:05:01	Video Transect	Begin	56.7892	-7.4133	121	
42	1	Jul 13 2006 16:59:31	Video Transect	End	56.7796	-7.4335	146	
43	1	Jul 13 2006 17:55:10	Mooring recovery	Recovery	56.821	-7.4066	126	
44	1	Jul 13 2006 18:52:05	Side scan sonar	Begin track	56.8453	-7.3974	194	Line 0068
44	1	Jul 13 2006 19:29:58	Side scan sonar	End track	56.8112	-7.422	200	
44	2	Jul 13 2006 20:14:14	Side scan sonar	Begin track	56.8459	-7.4024	192	line 0069
44	2	Jul 13 2006 20:51:14	Side scan sonar	End track	56.8127	-7.4261	197	
44	3	Jul 13 2006 21:33:55	Side scan sonar	Begin track	56.8483	-7.4055	179	line 0070
44	3	Jul 13 2006 22:13:27	Side scan sonar	End track	56.8116	-7.4319	182	
44	4	Jul 13 2006 23:03:14	Side scan sonar	Begin track	56.8487	-7.4107	174	line 0071
44	4	Jul 13 2006 23:41:52	Side scan sonar	End track	56.8133	-7.4362	179	
44	5	Jul 14 2006 00:25:53	Side scan sonar	Begin track	56.8485	-7.4164	166	line 0072
44	5	Jul 14 2006 01:06:41	Side scan sonar	End track	56.8093	-7.444	184	
45	1	Jul 14 2006 03:10:40	Multibeam	Begin track	56.8525	-7.3403	203	Line 0073
45	1	Jul 14 2006 03:49:08	Multibeam	End track	56.9197	-7.3403	150	
45	2	Jul 14 2006 03:57:28	Multibeam	Begin track	56.919	-7.3524	117	Line 0074
45	2	Jul 14 2006 04:38:20	Multibeam	End track	56.8522	-7.3526	187	
45	3	Jul 14 2006 04:44:59	Multibeam	Begin track	56.8519	-7.3645	198	Line 0075
45	3	Jul 14 2006 05:24:55	Multibeam	End track	56.9192	-7.3649	79	
45	4	Jul 14 2006 05:33:31	Multibeam	Begin track	56.919	-7.3772	99	Line 0076
45	4	Jul 14 2006 06:15:31	Multibeam	End track	56.8524	-7.3774	208	
46	1	Jul 14 2006 07:24:06	Boxcore (50 cm diameter)	Bottom	56.8178	-7.4007	214	
47	1	Jul 14 2006 07:54:20	Boxcore (50 cm diameter)	Bottom	56.8052	-7.4418	137	failed
48	1	Jul 14 2006 08:01:26	Boxcore (50 cm diameter)	Bottom	56.8054	-7.4419	127	
49	1	Jul 14 2006 09:36:35	Boxcore (small)	Bottom	56.8071	-7.4303	168	Video grabber
50	1	Jul 14 2006 09:59:07	Boxcore (small)	Bottom	56.8065	-7.4307	163	Video grabber
51	1	Jul 14 2006 10:24:30	Boxcore (small)	Bottom	56.8066	-7.4306	157	videograbber
52	1	Jul 14 2006 10:42:11	Boxcore (small)	Bottom	56.8066	-7.4306	156	video grabber
53	1	Jul 14 2006 11:04:31	Boxcore (small)	Bottom	56.8065	-7.4305	155	Video grabber
54	1	Jul 14 2006 13:15:06	Boxcore (small)	Bottom	56.8064	-7.4314	157	video grabber
55	1	Jul 14 2006 14:24:00	Mooring deployment	Deployment	56.8214	-7.3818	129	
56	1	Jul 14 2006 15:14:38	Video Transect	Begin	56.8008	-7.454	160	
56	1	Jul 14 2006 17:14:47	Video Transect	End	56.8048	-7.4244	182	

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Station/ Track	Cast/ Action	Date/ Time	Type	Event	Lat	Lon	Depth	Remarks
57	1	Jul 14 2006 18:40:12	Side scan sonar	Begin track	56.8001	-7.4152	209	Line 0077/0078
57	1	Jul 14 2006 19:42:17	Side scan sonar	End track	56.7505	-7.4777	236	
57	2	Jul 14 2006 20:52:22	Side scan sonar	Begin track	56.7987	-7.4113	203	line 0079
57	2	Jul 14 2006 21:52:21	Side scan sonar	End track	56.7476	-7.4757	236	
57	3	Jul 14 2006 22:56:14	Side scan sonar	Begin track	56.7974	-7.4069	201	line 0080 /0081
57	3	Jul 14 2006 23:58:41	Side scan sonar	End track	56.7458	-7.4718	231	
57	4	Jul 15 2006 00:54:15	Side scan sonar	Begin track	56.7955	-7.4036	229	Line 0082 / 0083
57	4	Jul 15 2006 01:55:30	Side scan sonar	End track	56.747	-7.4642	253	
57	5	Jul 15 2006 02:54:56	Side scan sonar	Begin track	56.794	-7.3992	245	line 0084 /0085
57	5	Jul 15 2006 04:00:20	Side scan sonar	End track	56.7434	-7.463	261	
58	1	Jul 15 2006 05:04:47	Multibeam	Begin track	56.8516	-7.3897	184	Line 0086
58	1	Jul 15 2006 05:43:09	Multibeam	End track	56.9192	-7.3895	83	
58	2	Jul 15 2006 05:48:00	Multibeam	Begin track	56.919	-7.3832	92	Line 0087 (fill-in)
58	2	Jul 15 2006 05:59:11	Multibeam	End track	56.8991	-7.3834	139	
58	3	Jul 15 2006 06:13:53	Multibeam	Begin track	56.9193	-7.3959	82	Line 0088
58	3	Jul 15 2006 06:50:44	Multibeam	End track	56.8524	-7.4045	176	
59	1	Jul 15 2006 07:28:56	Water box	Sluiten	56.8052	-7.4418	140	failed
60	1	Jul 15 2006 07:37:37	Water box	Sluiten	56.8053	-7.442	126	
61	1	Jul 15 2006 07:56:13	Boxcore (50 cm diameter)	Bottom	56.8057	-7.4419	118	
62	1	Jul 15 2006 08:20:10	Boxcore (50 cm diameter)	Bottom	56.8059	-7.4418	131	
63	1	Jul 15 2006 09:29:47	Triangular Dredge	Start vieren	56.8069	-7.4348	151	
63	1	Jul 15 2006 09:39:08	Triangular Dredge	Stop vieren	56.8066	-7.4317	159	
63	1	Jul 15 2006 09:39:14	Triangular Dredge	Start halen	56.8066	-7.4317	157	
64	1	Jul 15 2006 13:17:24	Mooring deployment	Deployment	56.824	-7.3839	153	
65	1	Jul 15 2006 13:49:20	Water box	Sluiten	56.8059	-7.4414	127	
65	2	Jul 15 2006 14:55:44	Water box	Sluiten	56.8052	-7.4419	134	
66	1	Jul 15 2006 16:11:13	Video Transect	Begin	56.8013	-7.455	160	
66	1	Jul 15 2006 18:17:24	Video Transect	End	56.8042	-7.4245	175	
67	1	Jul 15 2006 19:39:29	Side scan sonar	Begin track	56.8133	-7.4188	196	
67	1	Jul 15 2006 19:57:57	Side scan sonar	End track	56.7964	-7.4295	208	
67	2	Jul 15 2006 20:36:30	Side scan sonar	Begin track	56.8111	-7.4248	198	
67	2	Jul 15 2006 20:52:02	Side scan sonar	End track	56.7968	-7.4341	217	
67	3	Jul 15 2006 21:29:17	Side scan sonar	Begin track	56.8126	-7.4295	186	
67	3	Jul 15 2006 21:45:41	Side scan sonar	End track	56.798	-7.4391	242	
67	4	Jul 15 2006 22:20:34	Side scan sonar	Begin track	56.8125	-7.4349	184	
67	4	Jul 15 2006 22:37:23	Side scan sonar	End track	56.797	-7.4453	255	
67	5	Jul 15 2006 23:21:40	Side scan sonar	Begin track	56.8126	-7.4393	175	
67	5	Jul 15 2006 23:39:14	Side scan sonar	End track	56.7956	-7.451	246	
67	6	Jul 16 2006 00:20:12	Side scan sonar	Begin track	56.8114	-7.4455	185	
67	6	Jul 16 2006 00:45:14	Side scan sonar	End track	56.788	-7.461	238	
67	7	Jul 16 2006 01:29:00	Side scan sonar	Begin track	56.8096	-7.4317	184	
67	7	Jul 16 2006 01:44:49	Side scan sonar	End track	56.799	-7.4574	202	
68	1	Jul 16 2006 07:27:39	Boxcore (50 cm diameter)	Bottom	56.8027	-7.4485	154	
69	1	Jul 16 2006 07:55:51	Boxcore (50 cm diameter)	Bottom	56.8043	-7.4447	138	
70	1	Jul 16 2006 09:05:03	CTD	Begin	56.8045	-7.4243	181	
70	1	Jul 16 2006 09:08:45	CTD	Bottom	56.8041	-7.4244	179	
70	1	Jul 16 2006 09:13:38	CTD	End	56.8043	-7.4245	180	
71	1	Jul 16 2006 09:29:23	CTD	Begin	56.8058	-7.4265	168	
71	1	Jul 16 2006 09:32:23	CTD	Bottom	56.8055	-7.4261	159	
71	1	Jul 16 2006 09:40:06	CTD	End	56.8062	-7.424	184	
72	1	Jul 16 2006 10:01:58	CTD	Begin	56.8022	-7.454	171	
72	1	Jul 16 2006 10:04:56	CTD	Bottom	56.8016	-7.4545	163	
72	1	Jul 16 2006 10:09:32	CTD	End	56.8012	-7.4549	171	
73	1	Jul 16 2006 19:15:53	ALBEX lander deployment	Deployment	56.8059	-7.4284	164	Albex nr 3
74	1	Jul 16 2006 20:05:01	Side scan sonar	Begin track	56.8347	-7.3994	193	
74	1	Jul 16 2006 20:30:24	Side scan sonar	End track	56.8118	-7.4162	196	
74	2	Jul 16 2006 21:12:17	Side scan sonar	Begin track	56.8377	-7.3919	207	
74	2	Jul 16 2006 21:41:12	Side scan sonar	End track	56.8121	-7.4106	195	
74	3	Jul 16 2006 22:09:13	Side scan sonar	Begin track	56.8361	-7.3878	212	
74	3	Jul 16 2006 22:33:06	Side scan sonar	End track	56.8149	-7.4025	217	
74	4	Jul 16 2006 23:11:52	Side scan sonar	Begin track	56.832	-7.3854	193	
74	4	Jul 16 2006 23:31:46	Side scan sonar	End track	56.8139	-7.3982	185	
75	1	Jul 17 2006 07:43:58	Boxcore (50 cm diameter)	Bottom	56.8054	-7.4422	118	failed
76	1	Jul 17 2006 07:59:56	Boxcore (50 cm diameter)	Bottom	56.8053	-7.4423	125	failed
77	1	Jul 17 2006 08:09:13	Boxcore (50 cm diameter)	Bottom	56.8055	-7.4421	117	
78	1	Jul 17 2006 09:15:55	Water box	Sluiten	56.8059	-7.4415	129	
79	1	Jul 17 2006 09:49:01	CTD	Begin	56.8305	-7.3804	195	
79	1	Jul 17 2006 09:53:52	CTD	Bottom	56.8303	-7.3801	195	
79	1	Jul 17 2006 09:58:42	CTD	End	56.8307	-7.3801	194	
80	1	Jul 17 2006 10:05:46	CTD	Begin	56.8276	-7.381	182	
80	1	Jul 17 2006 10:08:41	CTD	Bottom	56.8277	-7.3798	181	
80	1	Jul 17 2006 10:12:40	CTD	End	56.8287	-7.3784	193	
81	1	Jul 17 2006 10:29:40	Mooring recovery	Recovery	56.8216	-7.3813	130	
82	1	Jul 17 2006 10:44:51	CTD	Begin	56.824	-7.3807	151	
82	1	Jul 17 2006 10:48:11	CTD	Bottom	56.8243	-7.3812	155	

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Station/ Track	Cast/ Action	Date/ Time	Type	Event	Lat	Lon	Depth	Remarks
82	1	Jul 17 2006 10:51:45	CTD	End	56.825	-7.3809	159	
83	1	Jul 17 2006 10:58:16	CTD	Begin	56.8211	-7.3811	137	
83	1	Jul 17 2006 11:00:27	CTD	Bottom	56.8214	-7.3814	130	
83	1	Jul 17 2006 11:09:18	CTD	End	56.8221	-7.3807	133	
84	1	Jul 17 2006 12:28:48	CTD	Begin	56.8194	-7.382	158	
84	1	Jul 17 2006 12:31:51	CTD	Bottom	56.8194	-7.382	157	
84	1	Jul 17 2006 12:35:14	CTD	End	56.8193	-7.3818	158	
85	1	Jul 17 2006 12:45:15	CTD	Begin	56.8164	-7.3827	180	
85	1	Jul 17 2006 12:48:30	CTD	Bottom	56.8164	-7.383	177	
85	1	Jul 17 2006 12:52:14	CTD	End	56.8164	-7.383	178	
86	1	Jul 17 2006 13:02:22	CTD	Begin	56.8136	-7.3839	190	
86	1	Jul 17 2006 13:05:46	CTD	Bottom	56.8134	-7.3841	189	
86	1	Jul 17 2006 13:11:24	CTD	End	56.8134	-7.3838	189	
87	1	Jul 17 2006 13:58:44	Mooring deployment	Deployment	56.8139	-7.3822	188	
88	1	Jul 17 2006 18:55:52	ALBEX lander recovery	Recovery	56.8066	-7.4289	155	Albex nr.3
89	1	Jul 18 2006 08:02:24	ALBEX lander deployment	Deployment	56.8216	-7.3819	136	
90	1	Jul 18 2006 08:13:56	CTD	Begin	56.8214	-7.3824	134	
90	1	Jul 18 2006 08:16:45	CTD	Bottom	56.8214	-7.3825	134	
90	1	Jul 18 2006 08:24:07	CTD	End	56.8216	-7.3823	135	
91	1	Jul 18 2006 08:45:00	CTD	Begin	56.8179	-7.3815	176	
91	1	Jul 18 2006 08:48:27	CTD	Bottom	56.818	-7.3822	174	
91	1	Jul 18 2006 08:52:33	CTD	End	56.8177	-7.3822	175	
92	1	Jul 18 2006 08:59:53	CTD	Begin	56.8134	-7.3832	189	
92	1	Jul 18 2006 09:03:23	CTD	Bottom	56.8136	-7.3826	189	
92	1	Jul 18 2006 09:07:04	CTD	End	56.8138	-7.3821	189	
93	1	Jul 18 2006 09:31:51	CTD	Begin	56.8289	-7.3832	187	
93	1	Jul 18 2006 09:33:32	CTD	Bottom	56.8287	-7.3832	187	
93	1	Jul 18 2006 09:37:03	CTD	End	56.8288	-7.3829	187	
94	1	Jul 18 2006 09:47:48	CTD	Begin	56.8256	-7.3818	166	
94	1	Jul 18 2006 09:51:12	CTD	Bottom	56.8257	-7.3824	168	
94	1	Jul 18 2006 09:54:28	CTD	End	56.8256	-7.3829	166	
95	1	Jul 18 2006 10:01:56	CTD	Begin	56.821	-7.3817	134	
95	1	Jul 18 2006 10:04:56	CTD	Bottom	56.8211	-7.3819	138	
95	1	Jul 18 2006 10:07:33	CTD	End	56.8212	-7.3821	138	
96	1	Jul 18 2006 10:17:04	CTD	Begin	56.8176	-7.382	177	
96	1	Jul 18 2006 10:20:09	CTD	Bottom	56.8178	-7.3814	178	
96	1	Jul 18 2006 10:23:36	CTD	End	56.818	-7.3819	175	
97	1	Jul 18 2006 10:31:05	CTD	Begin	56.8133	-7.3824	189	
97	1	Jul 18 2006 10:34:43	CTD	Bottom	56.8136	-7.3823	189	
97	1	Jul 18 2006 10:38:42	CTD	End	56.8135	-7.3824	189	
98	1	Jul 18 2006 11:00:53	CTD	Begin	56.8288	-7.3819	191	
98	1	Jul 18 2006 11:07:00	CTD	Bottom	56.8289	-7.3826	190	
98	1	Jul 18 2006 11:09:28	CTD	End	56.8289	-7.3826	190	
99	1	Jul 18 2006 11:21:06	CTD	Begin	56.8256	-7.3826	167	
99	1	Jul 18 2006 11:24:07	CTD	Bottom	56.8255	-7.3824	166	
99	1	Jul 18 2006 11:28:20	CTD	End	56.8254	-7.3823	166	
100	1	Jul 18 2006 11:36:07	CTD	Begin	56.8217	-7.3826	136	
100	1	Jul 18 2006 11:38:38	CTD	Bottom	56.8214	-7.3826	134	
100	1	Jul 18 2006 11:42:52	CTD	End	56.8213	-7.3825	138	
101	1	Jul 18 2006 12:00:20	CTD	Begin	56.8212	-7.3824	138	
101	1	Jul 18 2006 12:03:14	CTD	Bottom	56.8213	-7.3823	138	
101	1	Jul 18 2006 12:06:16	CTD	End	56.8214	-7.3824	137	
102	1	Jul 18 2006 12:15:24	CTD	Begin	56.8213	-7.3824	138	
102	1	Jul 18 2006 12:17:50	CTD	Bottom	56.8213	-7.3824	138	
102	1	Jul 18 2006 12:20:43	CTD	End	56.8214	-7.3824	137	
103	1	Jul 18 2006 12:33:22	CTD	Begin	56.8213	-7.3823	138	
103	1	Jul 18 2006 12:35:51	CTD	Bottom	56.8213	-7.3822	138	
103	1	Jul 18 2006 12:38:56	CTD	End	56.8213	-7.3825	137	
104	1	Jul 18 2006 12:53:39	CTD	Begin	56.8212	-7.3824	138	
104	1	Jul 18 2006 12:56:32	CTD	Bottom	56.8212	-7.3823	138	
104	1	Jul 18 2006 13:00:00	CTD	End	56.8213	-7.3823	137	
105	1	Jul 18 2006 13:08:26	CTD	Begin	56.8212	-7.3821	138	
105	1	Jul 18 2006 13:10:59	CTD	Bottom	56.8213	-7.3823	137	
105	1	Jul 18 2006 13:14:41	CTD	End	56.8213	-7.3825	136	
106	1	Jul 18 2006 13:22:13	CTD	Begin	56.8213	-7.3822	137	
106	1	Jul 18 2006 13:25:08	CTD	Bottom	56.8213	-7.3819	135	
106	1	Jul 18 2006 13:29:37	CTD	End	56.8213	-7.3823	138	
107	1	Jul 18 2006 13:35:24	CTD	Begin	56.8213	-7.3824	137	
107	1	Jul 18 2006 13:37:37	CTD	Bottom	56.8213	-7.3824	137	
107	1	Jul 18 2006 13:45:52	CTD	End	56.8214	-7.3824	137	
108	1	Jul 18 2006 14:14:27	CTD	Begin	56.8211	-7.3828	135	
108	1	Jul 18 2006 14:17:30	CTD	Bottom	56.8212	-7.3823	137	
108	1	Jul 18 2006 14:21:28	CTD	End	56.8214	-7.3821	137	
109	1	Jul 18 2006 14:33:17	CTD	Begin	56.8175	-7.3823	176	
109	1	Jul 18 2006 14:36:00	CTD	Bottom	56.8177	-7.382	176	

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Station/ Track	Cast/ Action	Date/ Time	Type	Event	Lat	Lon	Depth	Remarks
109	1	Jul 18 2006 14:39:59	CTD	End	56.8173	-7.382	178	
110	1	Jul 18 2006 14:50:26	CTD	Begin	56.8133	-7.3828	188	
110	1	Jul 18 2006 14:53:19	CTD	Bottom	56.8134	-7.3827	188	
110	1	Jul 18 2006 14:57:53	CTD	End	56.8132	-7.382	188	
111	1	Jul 18 2006 15:31:21	CTD	Begin	56.8286	-7.3832	186	
111	1	Jul 18 2006 15:34:10	CTD	Bottom	56.8287	-7.3825	186	
111	1	Jul 18 2006 15:37:45	CTD	End	56.8287	-7.383	186	
112	1	Jul 18 2006 15:48:33	CTD	Begin	56.8255	-7.3822	165	
112	1	Jul 18 2006 15:51:15	CTD	Bottom	56.8256	-7.3824	166	
112	1	Jul 18 2006 15:54:15	CTD	End	56.8256	-7.3824	166	
113	1	Jul 18 2006 16:05:43	CTD	Begin	56.8214	-7.3823	136	
113	1	Jul 18 2006 16:08:05	CTD	Bottom	56.8215	-7.3822	136	
113	1	Jul 18 2006 16:17:52	CTD	End	56.8215	-7.3823	136	
114	1	Jul 18 2006 16:41:49	Water box	Sluiten	56.8059	-7.4413	128	
115	1	Jul 18 2006 18:17:04	Side scan sonar	Begin track	56.7595	-7.4418	237	
115	1	Jul 18 2006 18:37:24	Side scan sonar	End track	56.7408	-7.4552	247	
115	2	Jul 18 2006 19:16:23	Side scan sonar	Begin track	56.7506	-7.4425	231	
115	2	Jul 18 2006 19:35:58	Side scan sonar	End track	56.7322	-7.4558	279	
115	3	Jul 18 2006 20:23:31	Side scan sonar	Begin track	56.7495	-7.4376	237	
115	3	Jul 18 2006 20:45:39	Side scan sonar	End track	56.7292	-7.452	213	
115	4	Jul 18 2006 21:19:44	Side scan sonar	Begin track	56.7464	-7.435	233	
115	4	Jul 18 2006 21:39:58	Side scan sonar	End track	56.7273	-7.449	201	
115	5	Jul 18 2006 22:11:47	Side scan sonar	Begin track	56.7445	-7.431	231	
115	5	Jul 18 2006 22:30:10	Side scan sonar	End track	56.7275	-7.4437	195	
115	6	Jul 18 2006 23:04:35	Side scan sonar	Begin track	56.7444	-7.4269	230	
115	6	Jul 18 2006 23:33:44	Side scan sonar	End track	56.7174	-7.4449	184	
115	7	Jul 19 2006 00:10:56	Side scan sonar	Begin track	56.74	-7.4242	221	
115	7	Jul 19 2006 00:39:44	Side scan sonar	End track	56.7139	-7.4416	197	
115	8	Jul 19 2006 01:42:56	Side scan sonar	Begin track	56.7348	-7.4227	215	
115	8	Jul 19 2006 02:01:58	Side scan sonar	End track	56.7167	-7.4341	196	
115	9	Jul 19 2006 02:31:46	Side scan sonar	Begin track	56.7303	-7.4205	208	
115	9	Jul 19 2006 02:45:30	Side scan sonar	End track	56.7175	-7.4277	205	
116	1	Jul 19 2006 07:16:03	ALBEX lander recovery	Recovery	56.8214	-7.3823	135	
117	1	Jul 19 2006 07:41:56	Mooring recovery	Recovery	56.8233	-7.3844	147	
118	1	Jul 19 2006 08:13:10	Boxcore (50 cm diameter)	Bottom	56.806	-7.4295	161	
119	1	Jul 19 2006 09:08:29	Boxcore (50 cm diameter)	Bottom	56.8059	-7.429	129	
120	1	Jul 19 2006 09:47:03	Video Transect	Begin	56.8223	-7.4238	92	crest hopping
120	1	Jul 19 2006 11:00:55	Video Transect	End	56.8204	-7.4017	113	
121	1	Jul 19 2006 12:36:09	Video Transect	Begin	56.8224	-7.3983	145	crest hopping
121	1	Jul 19 2006 14:27:35	Video Transect	End	56.8238	-7.3685	125	
122	1	Jul 19 2006 15:03:29	Water box	Sluiten	56.8059	-7.4413	122	
123	1	Jul 19 2006 16:18:29	Boxcore (50 cm diameter)	Bottom	56.8059	-7.429	162	
124	1	Jul 19 2006 18:05:13	Mooring deployment	Deployment	56.8199	-7.4085	117	
125	1	Jul 19 2006 18:46:57	Side scan sonar	Begin track	56.8313	-7.3711	196	Line 7
125	1	Jul 19 2006 19:11:16	Side scan sonar	End track	56.8085	-7.3856	204	
125	2	Jul 19 2006 19:58:37	Side scan sonar	Begin track	56.8357	-7.3636	214	line 8
125	2	Jul 19 2006 20:23:54	Side scan sonar	End track	56.8114	-7.3785	215	
125	3	Jul 19 2006 21:12:27	Side scan sonar	Begin track	56.8337	-7.3592	229	line 9
125	3	Jul 19 2006 21:36:17	Side scan sonar	End track	56.8107	-7.3732	229	
125	4	Jul 19 2006 22:17:47	Side scan sonar	Begin track	56.8339	-7.3805	197	line 5
125	4	Jul 19 2006 22:40:11	Side scan sonar	End track	56.813	-7.3939	185	
125	5	Jul 19 2006 23:16:34	Side scan sonar	Begin track	56.8354	-7.3741	204	line 6
125	5	Jul 19 2006 23:41:47	Side scan sonar	End track	56.811	-7.3898	187	
125	6	Jul 20 2006 00:08:40	Side scan sonar	Begin track	56.795	-7.3515	189	line SM
125	6	Jul 20 2006 00:32:04	Side scan sonar	End track	56.772	-7.3489	157	
125	7	Jul 20 2006 00:50:18	Side scan sonar	Begin track	56.7621	-7.351	160	line TM
125	7	Jul 20 2006 01:30:46	Side scan sonar	End track	56.7331	-7.3988	167	
126	1	Jul 20 2006 07:18:18	Boxcore (50 cm diameter)	Bottom	56.8032	-7.4471	143	
127	1	Jul 20 2006 07:38:03	Boxcore (50 cm diameter)	Bottom	56.8033	-7.4471	82	
128	1	Jul 20 2006 09:21:26	Video Transect	Begin	56.824	-7.4016	129	
128	1	Jul 20 2006 11:15:23	Video Transect	End	56.8252	-7.3625	113	
129	1	Jul 20 2006 12:57:29	Video Transect	Begin	56.7512	-7.3714	109	
129	1	Jul 20 2006 13:29:50	Video Transect	End	56.7563	-7.3635	129	
130	1	Jul 20 2006 14:30:11	ALBEX lander deployment	Deployment	56.8242	-7.3686	123	
131	1	Jul 20 2006 14:38:45	CTD	Begin	56.8238	-7.369	122	JOJO station
131	1	Jul 20 2006 14:41:44	CTD	Bottom	56.8239	-7.3691	129	.
131	1	Jul 20 2006 14:46:00	CTD	End	56.8237	-7.3692	123	
132	1	Jul 20 2006 14:46:32	CTD	Begin	56.8237	-7.3694	126	
132	1	Jul 20 2006 14:48:59	CTD	Bottom	56.8237	-7.3696	129	
132	1	Jul 20 2006 14:51:51	CTD	End	56.8238	-7.3692	123	
133	1	Jul 20 2006 14:52:43	CTD	Begin	56.8238	-7.3692	123	
133	1	Jul 20 2006 14:55:21	CTD	Bottom	56.8239	-7.3695	126	
133	1	Jul 20 2006 14:57:47	CTD	End	56.8235	-7.3693	122	
134	1	Jul 20 2006 14:59:18	CTD	Begin	56.8235	-7.3693	122	
134	1	Jul 20 2006 15:01:03	CTD	Bottom	56.8236	-7.3692	121	

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Station/ Track	Cast/ Action	Date/ Time	Type	Event	Lat	Lon	Depth	Remarks
134	1	Jul 20 2006 15:04:09	CTD	End	56.8238	-7.3691	126	
135	1	Jul 20 2006 15:05:07	CTD	Begin	56.8238	-7.3692	127	
135	1	Jul 20 2006 15:07:55	CTD	Bottom	56.8237	-7.3691	122	
135	1	Jul 20 2006 15:10:46	CTD	End	56.8237	-7.3692	122	
136	1	Jul 20 2006 15:11:43	CTD	Begin	56.8237	-7.3691	122	
136	1	Jul 20 2006 15:15:02	CTD	Bottom	56.8239	-7.3691	127	
136	1	Jul 20 2006 15:17:50	CTD	End	56.8238	-7.3692	123	
137	1	Jul 20 2006 15:18:42	CTD	Begin	56.8237	-7.3693	124	
137	1	Jul 20 2006 15:21:12	CTD	Bottom	56.8237	-7.3695	129	
137	1	Jul 20 2006 15:24:04	CTD	End	56.8237	-7.3695	126	
138	1	Jul 20 2006 15:24:49	CTD	Begin	56.8238	-7.3695	126	
138	1	Jul 20 2006 15:27:20	CTD	Bottom	56.8238	-7.3693	125	
138	1	Jul 20 2006 15:30:25	CTD	End	56.8239	-7.3692	127	
139	1	Jul 20 2006 15:31:13	CTD	Begin	56.8239	-7.3692	128	
139	1	Jul 20 2006 15:33:18	CTD	Bottom	56.8238	-7.3692	124	
139	1	Jul 20 2006 15:36:25	CTD	End	56.8237	-7.3692	121	
140	1	Jul 20 2006 15:37:18	CTD	Begin	56.8237	-7.3693	124	
140	1	Jul 20 2006 15:39:41	CTD	Bottom	56.8237	-7.3693	125	
140	1	Jul 20 2006 15:42:30	CTD	End	56.8238	-7.3692	123	
141	1	Jul 20 2006 15:43:10	CTD	Begin	56.8238	-7.3692	125	
141	1	Jul 20 2006 15:45:43	CTD	Bottom	56.8238	-7.3692	125	
141	1	Jul 20 2006 15:48:26	CTD	End	56.8237	-7.3692	122	
142	1	Jul 20 2006 15:49:05	CTD	Begin	56.8238	-7.3692	123	
142	1	Jul 20 2006 15:52:02	CTD	Bottom	56.8238	-7.3692	124	water samples
142	1	Jul 20 2006 15:55:51	CTD	End	56.8237	-7.3691	121	
143	1	Jul 20 2006 16:11:00	CTD	Begin	56.8237	-7.3693	124	
143	1	Jul 20 2006 16:13:50	CTD	Bottom	56.8237	-7.3692	121	
143	1	Jul 20 2006 16:16:26	CTD	End	56.8237	-7.3691	121	
144	1	Jul 20 2006 16:17:13	CTD	Begin	56.8237	-7.3691	121	
144	1	Jul 20 2006 16:19:39	CTD	Bottom	56.8238	-7.369	121	
144	1	Jul 20 2006 16:22:01	CTD	End	56.8238	-7.3691	126	
145	1	Jul 20 2006 16:22:53	CTD	Begin	56.8238	-7.3692	126	
145	1	Jul 20 2006 16:25:15	CTD	Bottom	56.8238	-7.3693	124	
145	1	Jul 20 2006 16:27:45	CTD	End	56.8237	-7.3692	121	
146	1	Jul 20 2006 16:28:19	CTD	Begin	56.8237	-7.3692	124	
146	1	Jul 20 2006 16:31:02	CTD	Bottom	56.8238	-7.3692	126	
146	1	Jul 20 2006 16:33:28	CTD	End	56.8238	-7.369	123	
147	1	Jul 20 2006 16:34:24	CTD	Begin	56.8238	-7.3691	123	
147	1	Jul 20 2006 16:36:50	CTD	Bottom	56.8237	-7.3691	121	
147	1	Jul 20 2006 16:39:00	CTD	End	56.8236	-7.3691	120	
148	1	Jul 20 2006 16:40:38	CTD	Begin	56.8237	-7.3692	123	
148	1	Jul 20 2006 16:43:10	CTD	Bottom	56.8238	-7.3691	125	
148	1	Jul 20 2006 16:45:34	CTD	End	56.8238	-7.3691	127	
149	1	Jul 20 2006 16:46:34	CTD	Begin	56.8238	-7.3691	126	
149	1	Jul 20 2006 16:48:55	CTD	Bottom	56.8238	-7.3691	125	
149	1	Jul 20 2006 16:51:25	CTD	End	56.8238	-7.3691	121	
150	1	Jul 20 2006 16:52:18	CTD	Begin	56.8238	-7.3691	122	
150	1	Jul 20 2006 16:54:50	CTD	Bottom	56.8238	-7.3691	125	
150	1	Jul 20 2006 16:57:17	CTD	End	56.8238	-7.3692	125	
151	1	Jul 20 2006 16:58:10	CTD	Begin	56.8238	-7.3691	123	
151	1	Jul 20 2006 17:00:18	CTD	Bottom	56.8237	-7.369	121	water samples
151	1	Jul 20 2006 17:04:30	CTD	End	56.8238	-7.3691	124	
152	1	Jul 20 2006 17:29:11	CTD	Begin	56.8238	-7.3691	124	
152	1	Jul 20 2006 17:31:25	CTD	Bottom	56.8238	-7.369	123	
152	1	Jul 20 2006 17:34:16	CTD	End	56.8238	-7.369	123	
153	1	Jul 20 2006 17:34:55	CTD	Begin	56.8238	-7.369	125	
153	1	Jul 20 2006 17:37:04	CTD	Bottom	56.8238	-7.369	126	
153	1	Jul 20 2006 17:39:48	CTD	End	56.8238	-7.3691	123	
154	1	Jul 20 2006 17:40:34	CTD	Begin	56.8238	-7.3691	123	
154	1	Jul 20 2006 17:42:35	CTD	Bottom	56.8237	-7.3689	122	
154	1	Jul 20 2006 17:45:16	CTD	End	56.8238	-7.369	127	
155	1	Jul 20 2006 17:46:20	CTD	Begin	56.8238	-7.369	127	
155	1	Jul 20 2006 17:48:32	CTD	Bottom	56.8238	-7.3691	126	
155	1	Jul 20 2006 17:51:13	CTD	End	56.8238	-7.3691	128	
156	1	Jul 20 2006 17:52:05	CTD	Begin	56.8238	-7.369	126	
156	1	Jul 20 2006 17:54:12	CTD	Bottom	56.8238	-7.369	125	
156	1	Jul 20 2006 17:57:04	CTD	End	56.8238	-7.369	127	
157	1	Jul 20 2006 17:58:23	CTD	Begin	56.8238	-7.3691	126	
157	1	Jul 20 2006 18:00:46	CTD	Bottom	56.8238	-7.3692	125	
157	1	Jul 20 2006 18:03:41	CTD	End	56.8238	-7.3692	126	
158	1	Jul 20 2006 18:04:24	CTD	Begin	56.8238	-7.3692	125	
158	1	Jul 20 2006 18:06:43	CTD	Bottom	56.8237	-7.3692	121	
158	1	Jul 20 2006 18:09:21	CTD	End	56.8237	-7.3691	121	
159	1	Jul 20 2006 18:10:07	CTD	Begin	56.8237	-7.3691	122	
159	1	Jul 20 2006 18:12:50	CTD	Bottom	56.8238	-7.369	128	

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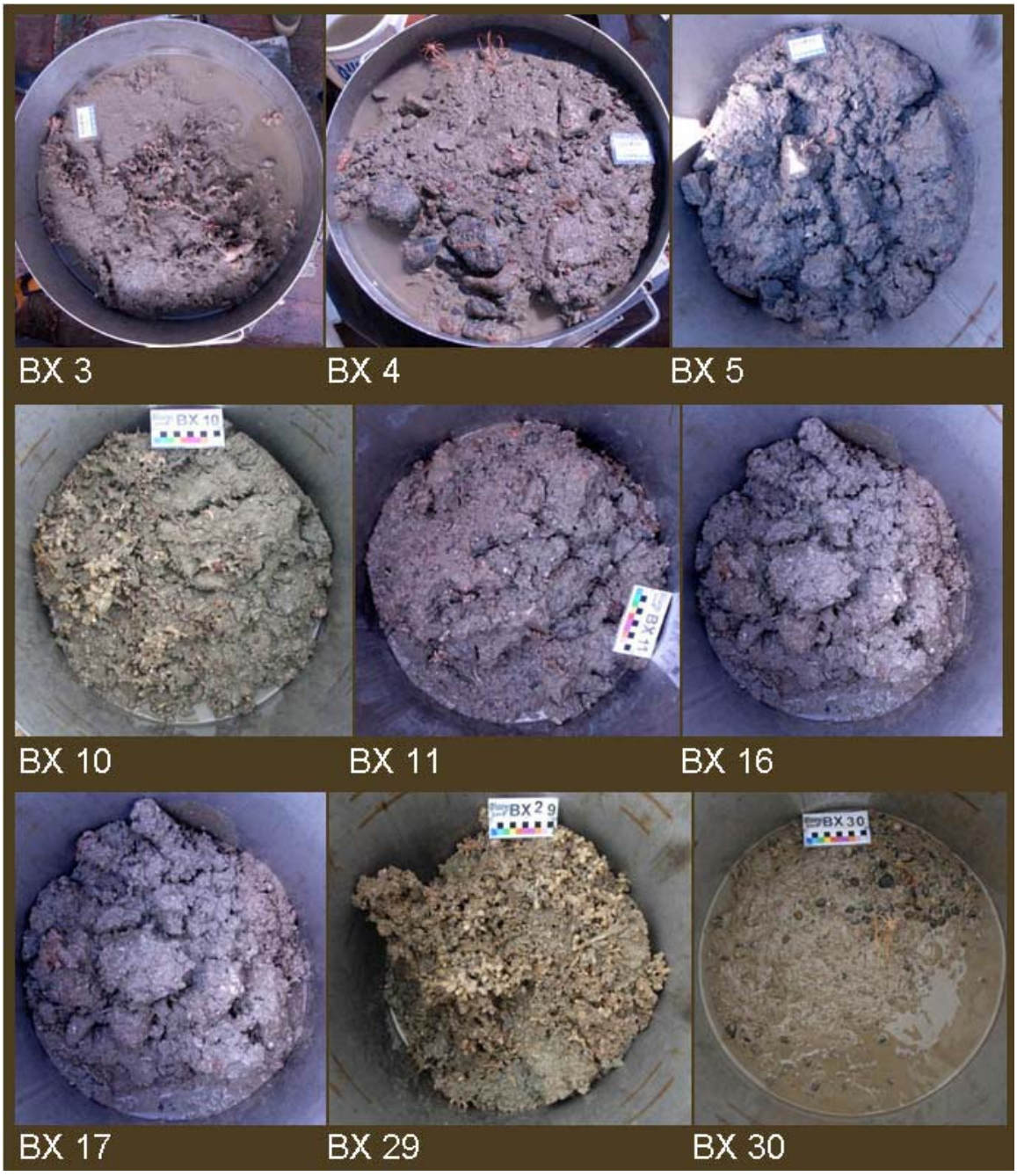
Station/ Track	Cast/ Action	Date/ Time	Type	Event	Lat	Lon	Depth	Remarks
159	1	Jul 20 2006 18:15:39	CTD	End	56.8238	-7.369	125	
160	1	Jul 20 2006 18:16:44	CTD	Begin	56.8239	-7.3691	127	
160	1	Jul 20 2006 18:18:50	CTD	Bottom	56.8238	-7.3691	125	
160	1	Jul 20 2006 18:21:40	CTD	End	56.8238	-7.3691	123	
161	1	Jul 20 2006 18:22:28	CTD	Begin	56.8238	-7.369	122	
161	1	Jul 20 2006 18:24:36	CTD	Bottom	56.8238	-7.3692	122	
161	1	Jul 20 2006 18:27:30	CTD	End	56.8238	-7.3691	125	
162	1	Jul 20 2006 18:28:41	CTD	Begin	56.8238	-7.3691	126	
162	1	Jul 20 2006 18:30:51	CTD	Bottom	56.8238	-7.3692	125	
162	1	Jul 20 2006 18:33:44	CTD	End	56.8238	-7.3691	122	
163	1	Jul 20 2006 18:34:31	CTD	Begin	56.8238	-7.3691	122	
163	1	Jul 20 2006 18:36:52	CTD	Bottom	56.8238	-7.3693	127	
163	1	Jul 20 2006 18:39:17	CTD	End	56.8238	-7.3692	125	
164	1	Jul 20 2006 18:39:52	CTD	Begin	56.8238	-7.3693	127	
164	1	Jul 20 2006 18:41:50	CTD	Bottom	56.8238	-7.3693	126	
164	1	Jul 20 2006 18:44:09	CTD	End	56.8237	-7.3691	121	
165	1	Jul 20 2006 18:44:56	CTD	Begin	56.8238	-7.369	121	
165	1	Jul 20 2006 18:47:19	CTD	Bottom	56.8238	-7.3692	124	
165	1	Jul 20 2006 18:49:31	CTD	End	56.8238	-7.3692	125	
166	1	Jul 20 2006 18:51:26	CTD	Begin	56.8238	-7.3692	125	
166	1	Jul 20 2006 18:53:36	CTD	Bottom	56.8238	-7.3691	122	
166	1	Jul 20 2006 18:55:54	CTD	End	56.8238	-7.3692	125	
167	1	Jul 20 2006 18:56:41	CTD	Begin	56.8238	-7.3692	125	
167	1	Jul 20 2006 18:58:54	CTD	Bottom	56.8238	-7.3692	122	
167	1	Jul 20 2006 19:01:24	CTD	End	56.8237	-7.3689	119	
168	1	Jul 20 2006 19:01:53	CTD	Begin	56.8236	-7.3688	119	
168	1	Jul 20 2006 19:04:09	CTD	Bottom	56.8237	-7.3687	120	water samples
168	1	Jul 20 2006 19:07:44	CTD	End	56.8241	-7.3694	124	
169	1	Jul 20 2006 20:25:51	Side scan sonar	Begin track	56.7464	-7.4355	232	
169	1	Jul 20 2006 20:44:03	Side scan sonar	End track	56.7298	-7.447	198	
169	2	Jul 20 2006 21:30:13	Side scan sonar	Begin track	56.7466	-7.4353	232	
169	2	Jul 20 2006 21:47:09	Side scan sonar	End track	56.7308	-7.4464	196	
169	3	Jul 20 2006 22:25:07	Side scan sonar	Begin track	56.7463	-7.4355	232	
169	3	Jul 20 2006 22:43:20	Side scan sonar	End track	56.7294	-7.4474	199	
169	4	Jul 20 2006 23:23:01	Side scan sonar	Begin track	56.7493	-7.4452	223	
169	4	Jul 20 2006 23:43:25	Side scan sonar	End track	56.7298	-7.4398	187	
169	5	Jul 21 2006 00:18:08	Side scan sonar	Begin track	56.7494	-7.4446	226	
169	5	Jul 21 2006 00:39:10	Side scan sonar	End track	56.7286	-7.4394	187	
170	1	Jul 21 2006 07:23:14	Water box	Sluiten	56.8029	-7.4469	158	
171	1	Jul 21 2006 07:48:12	Boxcore (50 cm diameter)	Bottom	56.8033	-7.4467	144	
172	1	Jul 21 2006 08:04:55	Boxcore (50 cm diameter)	Bottom	56.8034	-7.4468	144	
173	1	Jul 21 2006 09:39:40	Video Transect	Begin	56.7499	-7.4521	237	Part 1
173	1	Jul 21 2006 11:14:55	Video Transect	End	56.7325	-7.4343	151	
174	1	Jul 21 2006 12:38:49	Video Transect	Begin	56.7324	-7.4341	154	Part 2
174	1	Jul 21 2006 13:32:13	Video Transect	End	56.7222	-7.4361	176	
175	1	Jul 21 2006 14:23:34	Video Transect	Begin	56.8009	-7.4641	121	
175	1	Jul 21 2006 15:42:04	Video Transect	End	56.8023	-7.4432	231	
176	1	Jul 21 2006 16:05:19	Mooring recovery	Recovery	56.8194	-7.4096	118	
177	1	Jul 21 2006 16:31:26	Mooring recovery	Recovery	56.8137	-7.3821	189	
178	1	Jul 21 2006 18:12:31	ALBEX lander recovery	Recovery	56.8237	-7.3698	125	
179	1	Jul 22 2006 07:20:24	Boxcore (50 cm diameter)	Bottom	56.8033	-7.4467	145	
180	1	Jul 22 2006 07:44:55	Boxcore (50 cm diameter)	Bottom	56.8034	-7.4467	144	
181	1	Jul 22 2006 08:26:54	Water box	Sluiten	56.8242	-7.3679	126	
182	1	Jul 22 2006 09:24:14	Triangular Dredge	Start vieren	56.8243	-7.3686	128	
182	1	Jul 22 2006 09:32:10	Triangular Dredge	Stop vieren	56.8241	-7.3702	137	
182	1	Jul 22 2006 09:36:43	Triangular Dredge	Start halen	56.8238	-7.3727	134	
183	1	Jul 22 2006 10:28:00	Video Transect	Begin	56.8242	-7.4042	140	
183	1	Jul 22 2006 11:13:21	Video Transect	End	56.8231	-7.3928	87	
184	1	Jul 22 2006 11:19:11	Video Transect	Begin	56.8229	-7.394	130	
184	1	Jul 22 2006 11:30:17	Video Transect	End	56.8241	-7.3998	130	
185	1	Jul 22 2006 13:37:03	Video Transect	Begin	56.8242	-7.4035	131	
185	1	Jul 22 2006 14:12:28	Video Transect	End	56.8233	-7.3935	135	
186	1	Jul 22 2006 14:16:47	Video Transect	Begin	56.8233	-7.3938	133	
186	1	Jul 22 2006 14:47:20	Video Transect	End	56.8246	-7.4023	135	
187	1	Jul 22 2006 14:48:40	Video Transect	Begin	56.8244	-7.4019	132	
187	1	Jul 22 2006 15:20:06	Video Transect	End	56.823	-7.392	140	
188	1	Jul 22 2006 16:06:43	Video Transect	Begin	56.7589	-7.3595	125	
188	1	Jul 22 2006 16:51:31	Video Transect	End	56.7639	-7.3521	163	
*								

Appendix II- 64PE250 - Boxcore Fotos



Appendix II- 64PE250 - Boxcore Fotos

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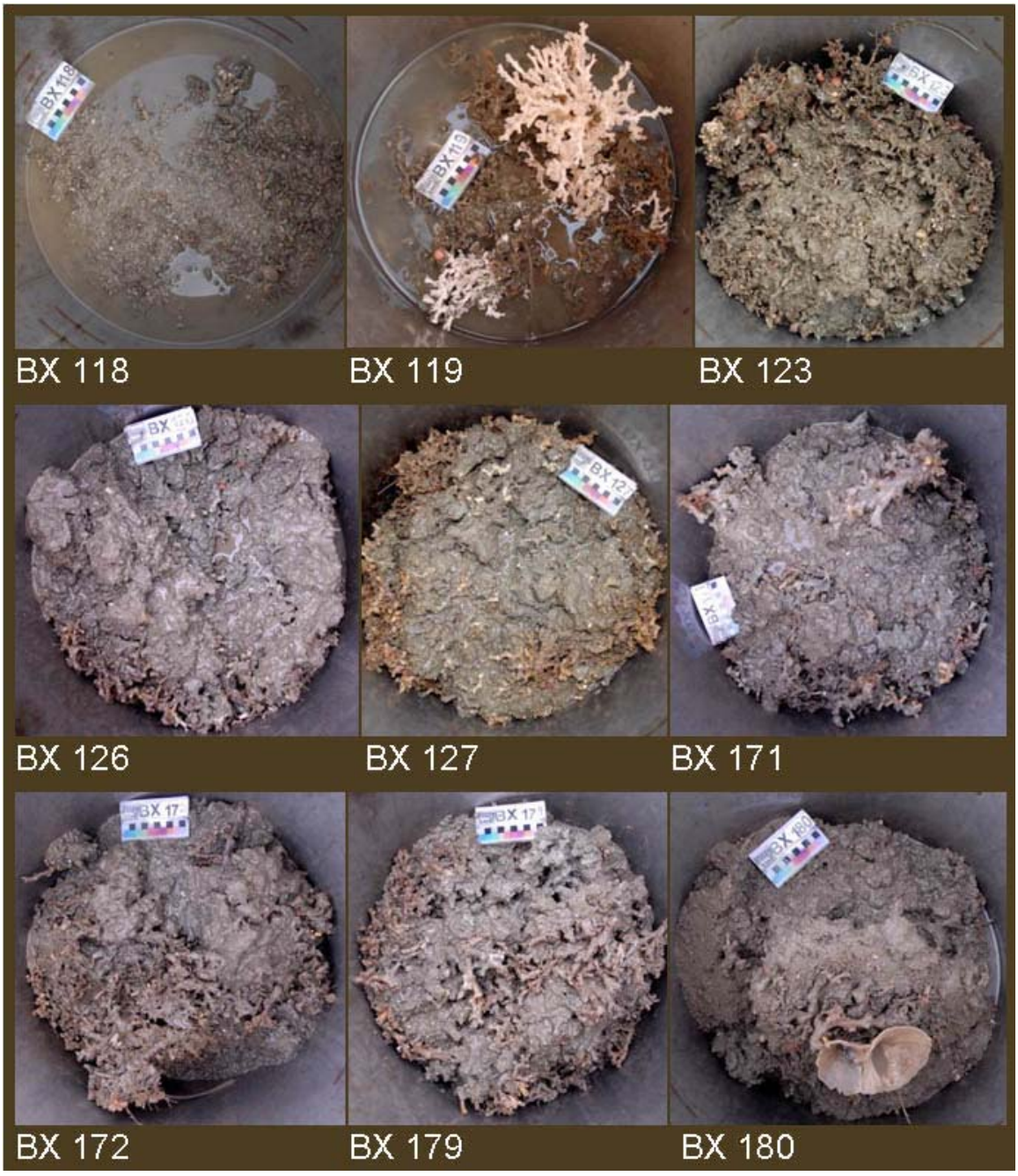


Appendix III - 64PE250 - Boxcore Description

Boxcore samples	**50cm diameter**	BX03	BX04	BX05	BX10	BX11	BX16	BX17	BX29	BX30
Foraminifera	calcareous									
	large sack like									
Porifera	unidentified	>4	>>	+	>(3 spec)	>			10	
	blue sponge	+								
	lether like	+								
	Hymedesmia (blue and yellow)								+	
	Crella sp.								+	
	Haliclona sp.									
	Phakelia									
	Acinella									
Hydroida	branched	>20				1	1	>	10	
	Nemertesia									
	Tubularia				1				1	
Anthozoa	Epizoanthus	6			>>	4		2	30%	
	Lophelia pertusa									
	orange Actiniaria				1					
	Thelmatactis									
Crustacea	Amphipoda	+								1
	Pandalus montagui/Processa								1	1
	Galathea/Munida	7+	>6	5+	5	3	2	20	2	2
	Pagurus spec.									1
	Ebalia							1		
	Atelecyclus rotundatus									
	Xantho pilipes									
	Inachus ?									
Polychaeta	unidentified									
	Sabellidae	2	2	>>	>				>	1
	Serpulidae	1	6	1	3		1	1	>	
	Filograna									
	Amphinomidae		1							
	Lanice sp.		1			3				
	Ampharetidae									
	Eunice norvegica									
	Amphitrite									
Mollusca	Polyplacophora									
	Scaphopoda									
	Anomia	2								
	Chlamys									
Brachiopoda										
Bryozoa	unidentified	+	>1	+	2			3 spec.		
	Sertella	1								
	Flustra				3				3	
Crinoidea			2	4						1
Ophiuroidea	smal orange		1	2	1	2		1		
	Ophiothrix									
Asteroidea	Porania									
Holothuroidea	Holothuria forskalli									
Tunicata	solitary		>>	>						
	Dendrodoa							+		
Dead Material										
Lophelia pertusa		>	>>		>	>	>	25%	80%	+
Bivalvia				+		+				
	Nucula		+	+						
Gastropoda										
shark egg capsule					1					
Rocks			>>	>		>				small
Sediment							mud			mud
Shell debris								+		
Penetration depth (cm)		42-47	49-51	21-27	22-35	11-13	5	24-34	18-35	25
Height of corals (cm)		4						6		
Surface disturbed				yes	yes	yes	yes, open		20%	
Photos		13	10	3	2	3	2	3	3	3

Appendix III - 64PE250 - Boxcore Description

Boxcore samples	**50cm diameter**	BX32	BX33	BX46	BX47	BX61	BX62	BX68
Foraminifera	calcareous	>> on rocks	>> on rocks	>> on rocks				
	large sack like			5	2			
Porifera	unidentified				2	few		
	blue sponge							
	lether like							
	Hymedesmia (blue and yellow)							
	Crella sp.							
	Haliclona sp.				+			
	Phakelia						+?	
	Acinella							
Hydroida	branched				few	10	+	+
	Nemertesia							
	Tubularia				>	2	+	
Anthozoa	Epizoanthus				>10	7	5	
	Lophelia pertusa							
	orange Actiniaria							
	Thelmatactis							
Crustacea	Amphipoda		1					
	Pandalus montagui/Processa			1				
	Galathea/Munida	3	5	1	10	8	5	1
	Pagurus spec.							
	Ebalia	1						
	Atelecyclus rotundatus							
	Xantho pilipes							
	Inachus ?							
Polychaeta	unidentified							
	Sabellidae	2				few		1
	Serpulidae			1	4			
	Filograna							
	Amphinomidae							
	Lanice sp.	>5						
	Ampharetidae		5					
	Eunice norvegica							1
	Amphitrite							
Mollusca	Polyplacophora	2		1				
	Scaphopoda		1					
	Anomia			1				
	Chlamys			1				
Brachiopoda		1						
Bryozoa	unidentified	>> on rock	>> on rock	5	>10	10	+	+
	Sertella							
	Flustra						1	
Crinoidea		3	3					
Ophiuroidea	smal orange	3						
	Ophiothrix			3				
Asteroidea	Porania							
Holothuroidea	Holothuria forskalli						1	
Tunicata	solitary					1		
	Dendrodoa							
Dead Material								
Lophelia pertusa					50%	few	+	few
Bivalvia						+		
	Nucula							
Gastropoda								
shark egg capsule								
Rocks		small +1(25cm)	small+1 (20cm)	small				
Sediment				mud	mud	sand	mud	mud
Shell debris								
Penetration depth (cm)		33	20	31-35	?	26	0-10	0-5
Height of corals (cm)						5		
Surface disturbed			yes				yes	yes
Photos		3	3	3	3	4	3	1

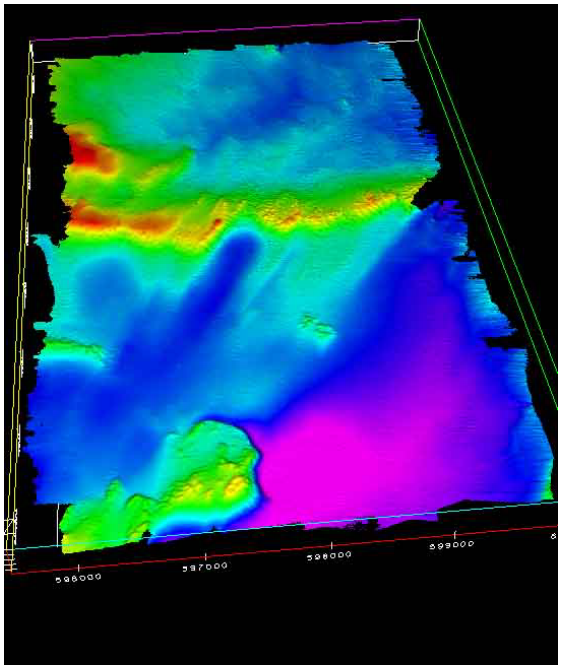
BX69	BX77	BX118	BX119	BX123	BX126	BX127	BX171	BX172	BX179	BX180
		+			+					
few			+	few			+	few	+	
										+
	1					1				
							2	2		
										2
+	+	few	few	+	+	+	few	3	+	+
										2
	+	+		3	3			3		
	5	5		>10	>10	>10	4	>10		10
			4 (80%)							
		+	2	>10						
			2							
				1						
1	5	10	+	3	3	5	10	5	3	5
		1								
			3			1	2	2		
				1						
		+		4	4	4	+	+		
	+		>>	>>	+	+	+	6	+	
										1 group
										1
			1							
+	+	few	few	+	+	+	+	>>	+	+
			4	2						
1			+	>10		+	1			
				2				1?	1	
				3				+		
few	+	+ (small)	+	+ (big)	+	+	+	+	+	+
								+		+
mud					mud	mud	mud	mud	mud	sandy, mud
		+								
?	5 cm	34	22	?	20	20	0-10	18	20	25
			30							
yes,on deck	yes			yes	yes	yes	yes	yes	yes	yes
1	2	5	7	6	2	2	2	3	2	6

Appendix IV - 64PE250 - Inorganic Nutrients

STATION	Phosphate [µmol/L]	Ammonium [µmol/L]	Nitrite [µmol/L]	Nitrate [µmol/L]
WK2	0.698	0.14	0.085	10.38
CTD13-4-3	0.240	0.97	0.162	0.83
CTD13-4-1	0.627	0.41	0.711	8.30
CTD14-4-1	0.699	0.14	0.554	9.70
BC-16	0.694	0.23	0.391	9.13
BC-29	0.704	0.18	0.179	9.07
BC-30	0.703	0.16	0.307	9.70
BC-32	0.660	0.37	0.579	7.99
VF1	0.643	0.99	0.141	10.56
BC-47	0.481	0.40	0.297	5.12
WK-60	0.598	0.14	0.204	8.49
BC-61	0.742	0.57	0.176	9.23
WK-65	0.592	0.18	0.436	7.91
WK-66 (65-2?)	0.469	0.31	0.449	5.51
BC-68	0.860	0.23	0.260	9.72
CTD70-1	0.733	0.12	0.086	10.60
CTD71-9	0.106	0.15	0.044	0.03
CTD71-6	0.249	0.22	0.390	1.72
CTD71-1	0.711	0.12	0.109	10.28
CTD72-1	0.640	0.12	0.270	8.97
WK-78	0.645	0.13	0.210	8.96
CTD83-12	0.078	0.12	0.038	0.02
CTD83-8	0.210	0.12	0.232	0.60
CTD83-1	0.712	0.11	0.079	10.34
CTD90-11	0.082	0.15	0.029	0.05
CTD90-1	0.694	0.15	0.134	10.04
CTD107-1	0.691	0.15	0.134	9.94
CTD113-18	0.057	0.14	0.021	0.00
CTD113-7	0.680	0.14	0.122	9.70
WK-114	0.478	0.17	0.144	5.75
BC-77	1.226	1.62	0.095	9.40
BC-118	0.717	0.27	0.127	8.95
BC-119	0.705	0.40	0.126	8.48
WK-122	0.651	0.17	0.088	8.91
BC-126	0.847	0.51	0.195	7.74
CTD142-1	0.590	0.18	0.238	8.13
CTD151-1	0.604	0.14	0.223	8.36
CTD168-5	0.022	0.16	0.019	0.00
CTD168-4	0.651	0.14	0.136	9.34
WK-170	0.499	0.20	0.077	6.56
WK-181	0.656	0.17	0.101	9.27
BC-172	1.022	0.64	0.122	9.41
BC-180	0.805	0.34	0.075	9.80

Sunday, 9th July 2006 (Conny Maier, NIOZ, the Netherlands)

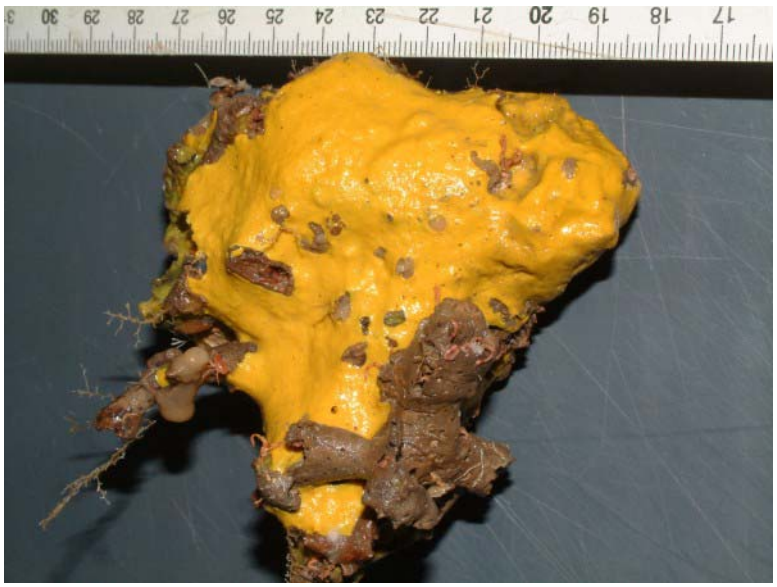
The first „real“ working day after parting from Oban comes to an end. The crew and half of the scientific party have already joined the previous HERMES cruise to the Rockall Bank. Nevertheless, it is a new start and the whole atmosphere somehow changes with being in a different study area and with „new“ people and some new tasks on board RV Pelagia. We are definetly happy, that John Dresken, our cook, stayed on as we already enjoyed great meals during the previous cruise prepared by him. It took us about 7 hours to get out here and we started with a Multi Beam Survey of our research area over night. From this Magda generated an impressive map of our first target area. The first morning here was rewarded with sunshine and a beautiful sight onto Mingulay, Barra and some other smaller islands. We started the day with a CTD to „feed“ the multibeam and with taking a waterbox. Anne, one of our new faces, got accustomed to filtering almost 500 L of seawater to retain virus and bacteria concentrates as well as particulate matter for stable isotopic analyses, microbial abundance and microbial diversity and Jan H. did the first trials with bacterial production. Also, the water from the waterbox was used to refill the cooling devices to keep living corals or animals. We then did our first videosurvey over the coral area which was followed by the deployment of boxcores outside the coral area. The last task was the „try out“ of the video grab brought on board by Andy from SAMS at Oban. This small grab is equipped with a videosystem, so at real time the seafloor can be seen and the sampling of living coral can be done in more precisely than with our boxcorer. However, it turned out that the videograb is not the most easy tool since it triggers relatively fast. This means that if by accident it touches the seaflor, it closes and has to be hauled on board again to be re-opened and newly deployed. Well, we are only at the beginning of the cruise, so usually this kind of shortcomings can be improven by some of the more technically oriented brains on board and so I‘m sure the efficiency of the video grab can be improven soon.



Multibeam Picture

Monday, 10th July 2006 (Rob van Soest, UvA, the Netherlands)

We have just completed a second working day at sea (and indeed some of us worked all night doing a sidescan sonar). Today's program very much followed the course of yesterday's: boxcoring, a video-grab attempt and a Hopper transect in the morning, all largely succesfull. In the afternoon with the weather unfortunately becoming a bit unfavourable (heavy rain showers and a growing swell make life aboard not quite the pleasure it used to be) we ran some CTDs. Perhaps an introduction of myself is in order as I am not a NIOZ worker. I am a scientist at the Zoological Museum of the University of Amsterdam recruited for the BIOSYS project as a Porifera (sponges) taxonomist. My contribution to the project is the identification of sponges and the study of their biodiversity in bathyal coral reefs. Sponges are filter feeders and thus responsible for capturing food particles brought to the reefs by currents. Presumably, sponges and other sessile filterfeeders pass on the biomass they have captured along the food chain through being consumed by predators such as gastropods and echinoderms, but such relationships are still largely unknown. Sponges also harbour countless – partly symbiotic – prokaryotes, with a probable multitude of functions, making them interesting and important inhabitants of the coldwater coral reef system. Several scientists in the BIOSYS project are studying the role of these symbionts in the coldwater reef system. Finally, some sponges break down the corals by boring holes in the limestone skeletons, so they probably contribute to reef degradation. My own scientific interest is focused on discovering patterns of sponge diversity in the coldwater reefs over local and regional spatial scales (a fancy way of saying that I want to know how different close-by reefs are and how similar distant reefs are, and of course why this is the case). I have already studied the sponges of Rockall Bank and Porcupine Bank, and at present we are at Mingulay. These three locations will be compared and emerging patterns will be explained by the abiotic and biotic differences between these locations. So far, I identified more than 150 species during BIOSYS cruises. Needless to say, I enjoy the work, the friendship on board, and the cook John !



The sponge *Spongosorites coralliophaga*

Tuesday, 11th July 2006 (Andy Davies, SAMS, UK)

Sampling the deepest reaches of the sea is a challenging business. Yet, even shallow waters can pose difficult when your targets are sparsely distributed and the currents are strong. Onboard the Pelagia we are using video-assisted sampling techniques to collect living specimens of the coral *Lophelia pertusa*. Forming large colonies, these corals can grow into large three-dimensional reefs which provide habitat for a wide variety of different species. These reefs develop over many hundreds and perhaps thousands of years, with the dead skeleton providing hard substrate for new growth. Some of these reefs have been found off the coast of Scotland and although smaller in scale than *Lophelia* reefs found off the coast of Norway they are still fascinating.

Depths between 130 and 160 metres in the Sea of Hebrides does not sound incredibly deep, but these areas are characterised by strong currents and strong swell if the wind is blowing up from the North Atlantic. Using the video-grab we can strongly target our sample collection, the small van Veen grab provides valuable samples for living coral experiments, microbiology, genetics and radio-isotope research with a minimal amount of physical damage to the coral reefs. Unfortunately, as ever we have to stop for a sumptuous dinner provided by our very own Gordon Ramsey sound-a-like and Jamie Oliver look-a-like… John Dresken.

The videograb team - from left Jose, Roel, Ron, Craig, Lorendz, Sjaak and Andy

Wednesday, 12th July 2006 (Craig Robertson, University of Wales, UK)

Half awake, I arrive on deck to begin the day's activities. Last nights wind ensured a restless sleep for many of us and as a result I think our intake of caffeine has increased a little.

Video grab sampling is the first order of the day. Andy is convinced today will yield the first live coral sample. We have faith in him! Meanwhile Klaas has spotted that perhaps the Van Veen grab is not performing as it should, or maybe not to strict Dutch standards and sets out to develop a new trigger release. We hear from him several hours later with an elaborate plan.
Roel takes elected as chief pilot of the video sampler. A courageous position; demanding mind bending concentration against the elements. On his left Andy sits, as navigator and me on the right; as principle motivator. It takes longer than we think but after a few crash and burn attempts we hit the jackpot – we crown Roel as KING of the winch and all is well on the high seas again.

Last nights multibeam reveals a possible new coral area and we speed off to investigate the alien terrain. A video transect later shows a rich habitat with dense patches of coral on the slopes. - the smell of a Nature paper comes in on the passing wind? Speaking of wind; by late afternoon it begins to drop and by
early evening the sea is mirror like with a few lazy birds bobbing along. We are joined soon after by 30 or so dolphins who ride the bow wave followed by some hungry gannets diving for snacks. There is talk of the BAS ship R.V. James Clack Ross joining us at Mingulay to test the ISIS R.O.V. and we start thinking of how useful that could be, but are then distracted by dinner. John the cook thinks he is cooking for the army but what is worse is that we eat as if we are the army! "Eating helps the ships ballast" he said.

Dolphins riding the box

Thursday, 13th July 2006 (Anne Großkurth, University of Oldenburg, Germany)

Today we started with the "hopper camera". The hopper camera is called like that, cause it "hoppers" over the ground. In the early beginning of its use scientists took videos of the sea-floor; but they could only see the pictures afterwards. They actually could not see or know at which depth the camera was while they deployed it, so they let it "hopper" over the ground. Nowadays, the pictures from the sea floor can be seen with a delay of only 2 seconds aboard the ship. The camerasystem is equipped with an altimeter to watch the height of the camera above the ground. This reduces the "hoppering" of the cameraframe over the ground. "Banana-reef" is a word we heard a lot the last days. Magda who is in charge of the Multibeam discovered it a few days ago on the newly created maps. We filmed it with the hopper camera and took samples with the videograb described earlier in the diary.
Until now the catch of living corals was a bit disappointing, but I predicted a lucky day for today. The first videograbs provided only dead coral but showed a lot of other living bottom organisms (benthos) like Galathea – a small reddish shrimp-like crab.
But finally it was a lucky day! Several of the crew tried to "drive the crane" and finally Ron was very successful with one real full catch. So I could take many swabs and make an extract of the coral *Lophelia pertusa.* I am looking at the bacterial community on the coral surface. I compare it to bacteria on stones or on dead corals. We suppose that the living corals can defend themselves against bacterial films or overgrowth by other organisms. We expect less bacteria living on the corals compared to other surfaces like stones or dead corals. To find out if the corals have antibacterial products I am getting extracts of coral tissue. Back home in the lab I will examine whether the coral extract inhibits the growth of bacteria that live on other substrate or in the seawater.
"Back home in the lab means at the University in Oldenburg. There I am a student of marine environmental science at the ICBM (Institute for Chemistry and Biology of the Sea). I am one of the "new faces" on board and this is also my first „real" cruise. So I really enjoy to discover what different kind of research is done here on board; everything dealing with the deep water corals - and yes, the meals of John Dresken...He serves us rich meals in a frequency that never leaves us hungry. Even though we are offshore there is such a big choice and variety of different salads, soups, vegetable, deserts, fruits and, and, and... Amazing – still wondering how somebody can organize and plan this for seneral weeks at sea without the possibility of going shopping in between.

Sampling of bacteria on coral and sponge surface

Friday, 14th July 2006 (Marc Lavaleye, NIOZ, the Netherlands)

To avoid we are being spoiled our cook John didn't make pancakes today, but anyway the day starts well with sun and a clear view on the mountainous islands nearby. With my binocular I discover a few white houses on the bigger island Barra. The boxcore coming up is the best seen so far, as without draining the water from the sample we can see through the over standing crystal clear water that it is completely undisturbed. The surface of the muddy core is covered with small stones, a few brittle stars crawl over the surface and tiny squad lobster raise their claws towards you in nonsense defence. It will be a biobox. So with Mariella I carefully sieve all the mud over a set of sieves and everything larger than 0.5 mm will be preserved in formalin. Sieving 100 kilos of mud doesn't seem to be the best of jobs, but now on the aftdeck in the sun it is not bad at all. We even have to be careful not to get sunburned! I do this work to get an idea of the biodiversity (how many species), the numbers and the biomass of the animals living in the mud and in and on the corals. As the boxcore takes samples with a surface of a quarter of a square meter we can quantify these figures. By comparing these figures with none coral areas will give an insight in how rich these deep coral reefs are. Because of the hard corals or stones the boxcore samples are often a bit disturbed. Then other people take their chances and extract organisms for identification (sponges), to keep alive (Blijdorp Zoo), or for microbiology research. I too collect a whole score of different animals for analyses of the stable isotopes of carbon and nitrogen. In this way the place of a species within the food web can be determined, in other words it tells us if it is e.g. a carnivore or algae eater.
After boxcoring it is videograbbing, and we are rather successful. The first time a big block of old coral is grabbed from Banana Reef. Two times we hit the jackpot and get live white corals on board. Everybody is excited and needs a sample of the coral for their research. I myself liked the catch with 20 old egg capsules and one live one of a deep sea shark, the Blackmouthed dogfish. The end of the day is filled with videoing Banana Reef. This time we use Andy's video and camera system that sits in a smaller frame. With a group of people we sit cramped in the CTD-room with our eyes fixed on the small monitor that shows us the sea bottom directly down under online. The water seems to be much clearer now and we get beautiful pictures with large green fan worms, red speckled starfishes, orange anemones, white corals and a monk fish.

Inspection of boxcore content

Saturday, 15th July 2006 (Michael Laterveer, Rotterdam Zoo, the Netherlands)

The day starts with a clear bright morning. The seagulls are flying in formation on the leeward side of the Pelagia. Their silhouettes are painted against a blue sky. The ship is completing the last miles of a side-scan transect. We are now blessed with a calm sea. It helped me overcome my seasickness and it makes working onboard a ship a real pleasure.

What is a zoo person doing on the biosys cruise? Rotterdam Zoo has a large aquarium, The Oceanium, and two of the main goals of the zoo are nature conservation and applied scientific research. My focus is to see how a public aquarium and a scientific research institute like the NIOZ can mutually benefit from each others expertise. The long term keeping of deepwater corals in a public exhibit would be the ultimate goal for the zoo. Such a coldwater coral aquarium can become an ambassador for the protection of these deep reefs.

After breakfast we start with two boxcores. As may be expected in the vicinity of reef structures the bottom is not flat. Beside this the substrate contains various sized rocks, the result is that the boxcore sample is often disturbed. Typically a boxcore sample will contain bryozoans, hydroids, tubeworms, anemones (Epizoanthus sp.), brittlestars and a small crustacean called Galathea. In some areas the feather stars (crinoids) are very abundant. Care is taken not to take a boxcore directly from the living coral reef. Dead coral, Lophelia pertusa, is however almost always present in the boxcore samples taken near the reef. To get a larger sample of the bottom fauna today a dredge will be made. A triangular shaped opening of approximately 2 meter wide with a small net is towed along the bottom for 50 meters. The tow is made by hauling in the winch while the ship is stationary. Despite the small area the net is completely full. Although a previously made video transect did not show any living coral colonies in the area targeted for this dredge, living coral is part of the catch. The processing of the material brought up with the dredge takes the rest of the day. Rob van Soest does not leave his microscope before all the sponge-material is examined. Mark Lavaleye and Marielle Rietkerk rinse every singe piece of material, hour after hour, and collect the animals for stable isotope and biodiversity analyses. The living coral material is used for various bacterial swaps and oxygen measurements. The care of the already stressed corals and few other animals which survived the dredge takes all my attention. Getting the animals out of the sun in cold fresh water. The corals produce mucus to protect themselves. But at the same time the overproduction of mucus pollutes the water. Three water refreshments are necessary before the corals seem stable. ‘HHHEEEtthh EEten stAAAAAAAT WEER VOOr UUUUUUU KLAAR’ sounds over the intercom. Even if you are Dutch you would not understand the words, but everybody understands it nevertheless: DINNER. John’s burling call is a joy for all and the next 30 minutes will be pleasure for our taste buds !

The triangular dredge

Sunday, 16th July 2006 (Marielle Rietkerk (volunteer)

The first week on the Pelagia is over. I have been working at the Royal NIOZ for more than three years and somehow never set a foot on the ship. I asked Conny if I could help out since I'm without a job now and it turns out to be a great experience! Great food, good weather, nice view on the Mingulay islands and a nice crew. The wake-up calls from Bert come earlier and earlier every morning, at least that's how its feels… Same this morning. No time to have a shower and with a sleepy head and tiny little eyes I try to eat my bowl with yoghurt. After 2 minutes my breakfast time is finished, it's 8 o'clock and the working day starts. I swear to myself that this evening I will go to bed early (as always). When I check the program for today I see that there is a lot of box-coring on the program. Since I helped Marc the last few days with sieving the material that comes up from the seafloor I saw myself already in my rain trousers on the back of the ship all day (somehow I can't manage to keep myself dry…). Not a bad job, considering the weather is pretty nice and the morning view on the islands is stunning. I am a bit surprised though, because Marc told me it would be a quiet day today, and now the program is filled with box-coring. Ah well… We took 3 box-cores before lunch, but they weren't too good. The 1st one failed to close and the 2nd one came up in a strange twist. Luckily the crew is very skilled, they fixed the problem and the 3rd one came up successfully. So after sieving a little bit it was time for a big break during lunch, since it is a Sunday today. The cook is very busy, so with a few people we help him to get ready in time. But something strange is happening, when I look out of the windows in the galley, I see land very close by. Nobody seems to now what's happening and even Conny seems to be surprised. Not entirely the truth I learn later… But hey, its lunch time, what is more important: my favourite dish made by John the cook or some stupid land? The answer is simple…
After lunch, somehow we have mysteriously landed at a bay from one of the islands, "Bagh Bhatarsaigh" to be exact. We have a marvellous view on a sandy white beach and I suspect we are not going to box-core here all day… What we are going to do is to employ the rib and have a nice walk on the island! Andy goes first, to scare of any people we might encounter. It works, after a few minutes the second party of people can go on land. Sander and I decide to climb the "mountain". At the top we have a great (windy) few on the Pelagia lying in the bay and we see more sandy white beaches with clear blue sea water. If I didn't know any better I could think we were in a tropical area. I think that's what Anne, Veit and Craig had in mind when they took a swim. Not for me, I guess the water temperature is below 15 degrees. So after a great midday on land we're back on the Pelagia now. I see a satisfied grin on a lot faces during dinner, but maybe that is my interpretation and tomorrow back to sieving some seafloor again…

Crew starting the island discovery

Wednesday, 19th July 2006 (Jan Hegeman, NIOZ, the Netherlands)

This morning as usual the day started with calm but foggy weather. Later the fog disappeared and the sun is shining brightly now. This does not mean that it became warm since temperature seldom reaches the 15°C. Lorendz started the day by improving Pelagia's pancake eating record with getting down 10 of the pancakes regularly prepared for breakfast. He commented that the last one did not taste as good as the first one. As anyone onboard I'm doing my own special part within the research tasks. My task is the work with radioisotopes. That is done to measure the growth rate of bacteria in seawater and in corals and the uptake of radioactive carbon and calcium by the coral tissue and skeleton. For that reason Conny provides me with living corals that I „feed" with radioactively labeled substrate. The corals are killed after some hours of incubation with formaldehyde. The corals are then heated in sodiumhydroxite to dissolve the tissue which is then filtered and stored for later measurements of radioactivity that was „consumed" by either bacteria or corals. Finally Conny has the difficult task to calculate the growth rates. Because the rest of the people on board of Pelagia are afraid of radioactivity I am locked up in a container as far away as possible on the back of the ship. I am only let out for having a meal. This explains why I am always very pale after a Pelagia cruise. But nevertheless I am having a good time and as usual I will have gained a few kilograms when this expedition comes to an end which is due to the excellent food prepared by John.

Jan's attempt to escape his isotope container

Thursday, 20th July 2006 (Veit Huehnerbach (NOCS, UK)

For me the day usually starts at 10:30 or 11 in the morning. After having a shower, I get myself a cup of tea and sneak into the lab to watch the biologists' underwater camera runs or have a look at the different species of animals or types of muddy stuff they bring up on deck with their sampling devices. This is very important for me as a geologist, because the biologists' work is ground-truthing what I have been seeing during my night shifts. Together with a colleague, I start working soon after dinner, around 8 PMh until about 4 AM. We operate a sidescan sonar, a fish-like instrument that is being towed behind the ship. This sonar sends out pulses of sound toward the seabed. Depending on the seabed morphology and sediment type, different amounts of sound are scattered back to the sonar vehicle. This returning sound is then converted into grey scales and continuously displayed as a kind of aerial photograph as the survey profile continues. All the profiles together make an acoustic map of the seafloor in a fast and economic way (which is also a reason why we work during the night). On these maps we can then distinguish areas of living cold-water corals, dead coral framework and background sediment (mostly mud), as well as all other types of sediment and bedrock geology exposed on the seabed.
Operating the sonar can be quite demanding as we 'fly' the sonar only about 10-20m above the seafloor. The only control of 'flying' is by hauling in or paying out cable from the winch to which the sonar is attached. Since some coral reef structures sit on top of mounds several tens of meters high, one has to have a constant look at the multibeam to know when the seabed rises in order to avoid hitting the ground. The ship speed also has to be watched all the time, because, for example, when the ship slows down the cable sinks to the bottom and the sonar height has to be compensated by hauling in cable.
Anyway, enough of the technicalities. My day continues with a culinary delight created by John, the chef de cuisine. Other people call it just lunch, but it is more than that. One has to be here to taste and enjoy it.
After lunch I prepare for the coming night shift. First I have a chat with Conny and Andy, setting the frame for the new survey, then we calculate new survey track lines and hand them to the bridge. After this I have time off: drink more tea, eat biscuits and try to enjoy the Scottish summer until John serves another one of his masterpieces on a plate (dinner).
And after dinner, we get ready again on deck to deploy the sidescan sonar for another exciting watch into the unknown… even if it is all absolutely flat terrain and boring muddy seafloor for hours without change, not many people have experienced and seen this before on the seabed in the area, apart from us. It is exactly this circumstance that makes the sidescan survey so exciting, as you never really know what is down there to be seen and found.

The sidescan winch

Saturday/Sunday, 22/23 July 2006 by Conny Maier, NIOZ

On our last day out at Mingulay we had a full program of work with boxcore, dredge and videotransects until dinner. Luckily, we did not have to clean and pack already before arriving at Oban since some of us will stay on Pelagia during the 3 day transit back to Texel. This will give us ample time for cleaning up. So, after dinner, we started the 9 hour transit to Oban, where we entered the harbour by 8 AM on the 23rd of July. The "sidescanners", Veit and Tim, are the first to load their equipment and winch onto their truck and to leave early for Southampton. Together with collegues, Andy takes his 'Coral Hotel' including live *Lophelia* collected at Mingulay to SAMS. For the last time John Dresken prepares a Sunday reception lunch and Murray Roberts (SAMS) and his family „sacrifice" their Sunday to meet us at Pelagia and discuss some aspects of the cruise during our short stay at Oban. After a joint dinner, we are ready to take off again for the 3-day transit back to Texel, or like Lorendz, Jan (van Ooyen), Rob and Michael to take the plane from Glasgow the next morning. When Pelagia is all set to leave we realize that Craig is still on board despite the fact that he should have gotten off as well. Last preparations to take some small coral branches to Bangor for experiments took him longer than expected and so he has to climb the reling because the gangway is already hauled in. With Craig on the "other side" Pelagia can finally take off for Texel. A last farewell salute with the „potato gun" after we had already gained some distance to the harbor made a couple of the many spectators on the pier at Oban jump up. So, the BIOSYS cruise is at its end and we have to say a big thank you to the captain + crew of Pelagia that made working and sampling such a smooth and fun operation. Also, we wish lots of luck to John Dresken, who will start a new enterprise with a restaurant "the Pollux" in Amsterdam.

John Dresken's farewell with a drink to years of experience as a ship's cook!