607
2010

Berichte
zur Polar-
und Meeresforschung

Reports
on Polar and Marine Research

The Expedition of the Research Vessel "Polarstern" to the Arctic in 2009 (ARK-XXIV/2)

Edited by
Michael Klages
with contributions of the participants

HELMHOLTZ
GEMEINSCHAFT

ALFRED-WEGENER-INSTITUT FÜR
POLAR- UND MEERESFORSCHUNG
In der Helmholtz-Gemeinschaft
D-27570 BREMERHAVEN
Bundesrepublik Deutschland

ISSN 1866-3192

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Editor in charge:
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Die "Berichte zur Polar- und Meeresforschung" (ISSN 1866-3192) werden ab 2008 ausschließlich als Open-Access-Publikation herausgegeben (URL: http://epic.awi.de).

Since 2008 the "Reports on Polar and Marine Research" (ISSN 1866-3192) are only available as web based open-access-publications (URL: http://epic.awi.de)

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Please cite or link this item using the identifier
hdl:10013/epic.34196 or http://hdl.handle.net/10013/epic.34196

ISSN 1866-3192

ARK-XXIV/2

9 July 2009 - 3 August 2009

Longyearbyen - Reykjavik

Chief Scientist

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Coordinator

Eberhard Fahrbach

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1. EXPEDITION ARK-XXIV/2: FAHRTVERLAUF UND ZUSAMMENFASSUNG

Michael Klages
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Der Fahrtabschnitt ARK-XXIV/2 (Longyearbyen – Reykjavik) des Forschungsschiffes *Polarstern* begann mit dem Verlassen des Liegeplatzes im Adventfjord vor Longyearbyen am frühen Abend des 9. Juli. Zuvor waren 50 Wissenschaftlerinnen und Wissenschaftler aus sieben Nationen über den Nachmittag hinweg neu zugestiegen. Für die wissenschaftlichen Arbeiten während des Fahrtabschnitts war die Verfügbarkeit eines ferngelenkten Unterwasserfahrzeugs, einem so genannten ROV (Remotely Operated Vehicle), erforderlich. Zum zweiten Mal nach 2007 war daher das Tiefseefahrzeug QUEST des Zentrums für marine Umweltwissenschaften (MARUM) der Universität Bremen mit an Bord von *Polarstern*.

Die Fahrt führte zunächst zum sogenannten AWI-*HAUSGARTEN*, einem Tiefseeökosystem auf 79 Grad nördlicher Breite und 4 Grad östlicher Länge, an dem das Alfred-Wegener-Institut bereits seit 1999 mit einem Observatorium Langzeitbeobachtungen durchführt. Das Observatorium besteht aus sechzehn Einzelstationen, die sich über einen Tiefenbereich von 1000 bis 5500 Metern erstrecken. Auf dem Weg zur zentralen *HAUSGARTEN*-Station musste *Polarstern* zunächst lockeres Meereis durchfahren, das dann aber zunehmend dichter wurde. Letztlich hat die Eisbedeckung die Forschungsarbeiten an der Zentralstation und auf den weiter westlich gelegenen tiefen Stationen im Molloy Deep (5500 m) dann aber nur mäßig in der Stationsplanung beeinflusst. Standardgeräte wie Multicorer, CTD und Rosette konnten problemlos eingesetzt werden. Alle im Jahr zuvor ausgebrachten verankerten Geräte konnten erfolgreich geborgen, und zwei neue Verankerungen sowie zwei Freifall-Lander für ein Jahr neu ausgebracht werden.

Die zweite Hälfte des Fahrtabschnitts diente der Installation eines Langzeit-Observatoriums am norwegischen Kontinentalrand zur Untersuchung von Schlammvulkanismus. Der Håkon-Mosby-Schlammvulkan liegt in 1250 m Wassertiefe in der SW Barentssee und ist ein ausgewähltes Untersuchungsgebiet der EU – Projekte ESONET, HERMIONE und MARBEF, sowie des ESF EUROCORES EuroDeep Vorhabens CHEMECO. Schlamm, Gas und Porenwässer steigen aus einer Tiefe von 3 km unter dem Meeresboden auf und bilden einen aktiven Schlammvulkan mit einem Durchmesser von 1,5 Kilometern, der seit vielen Jahren erhebliche Mengen an Methan in die Hydrosphäre entlässt. PARASOUND – Profilfahrten während der diesjährigen Expedition zeigten erheblichen Gasausstrom an mehreren Stellen, Temperaturmessungen mit der Temperaturlanze führten uns zum Zentrum der höchsten Aktivität, an dem in 1,5 Metern unter der Sedimentoberfläche rund 30 Grad Celsius gemessen wurden; in 3 Metern Sedimenttiefe sogar annähernd 35 Grad. Wichtigstes Teilziel der Arbeiten am Håkon-Mosby-Schlammvulkan war das Ausbringen von LOOME (LOng term Observations of Mud volcano Eruptions) – einem Langzeitobservatorium zur Beobachtung der Schlammvulkanaktivität. Frühere Untersuchungen des MPI, AWI und IFREMER am HMMV hatten gezeigt, dass die Geschwindigkeit des Fluidflusses nicht nur die Verteilung der chemosynthetischen Gemeinschaften, sondern auch die Stabilität des Hydratsystems und die Emission von Methan kontrolliert. Die erste Langzeitmessung der Sedimenttemperatur von September 2005 bis Juni 2006 zeigte verschiedene Eruptionsereignisse an, bei denen die Sedimenttemperaturen sich während weniger Tage um mehrere Grade änderten. Mit der Installation eines Observatoriums ist es nun möglich, geologische, physikalische, chemische und biologische Parameter kontinuierlich im Verbund zu messen, um so Schlammvulkanismus zu verstehen und Eruptionen sowie Veränderungen des Meeresbodens vorherzusagen, und deren Auswirkungen auf Gasemissionen und benthische Gemeinschaften zu überprüfen.

Am 30. Juli um 2 Uhr morgens wurden die letzten Stationsarbeiten für den Expeditionsabschnitt ARK-XXIV/2 beendet. *Polarstern* nahm anschließend Kurs auf den Hafen von Reykjavik, der am Morgen des 3. August erreicht wurde.

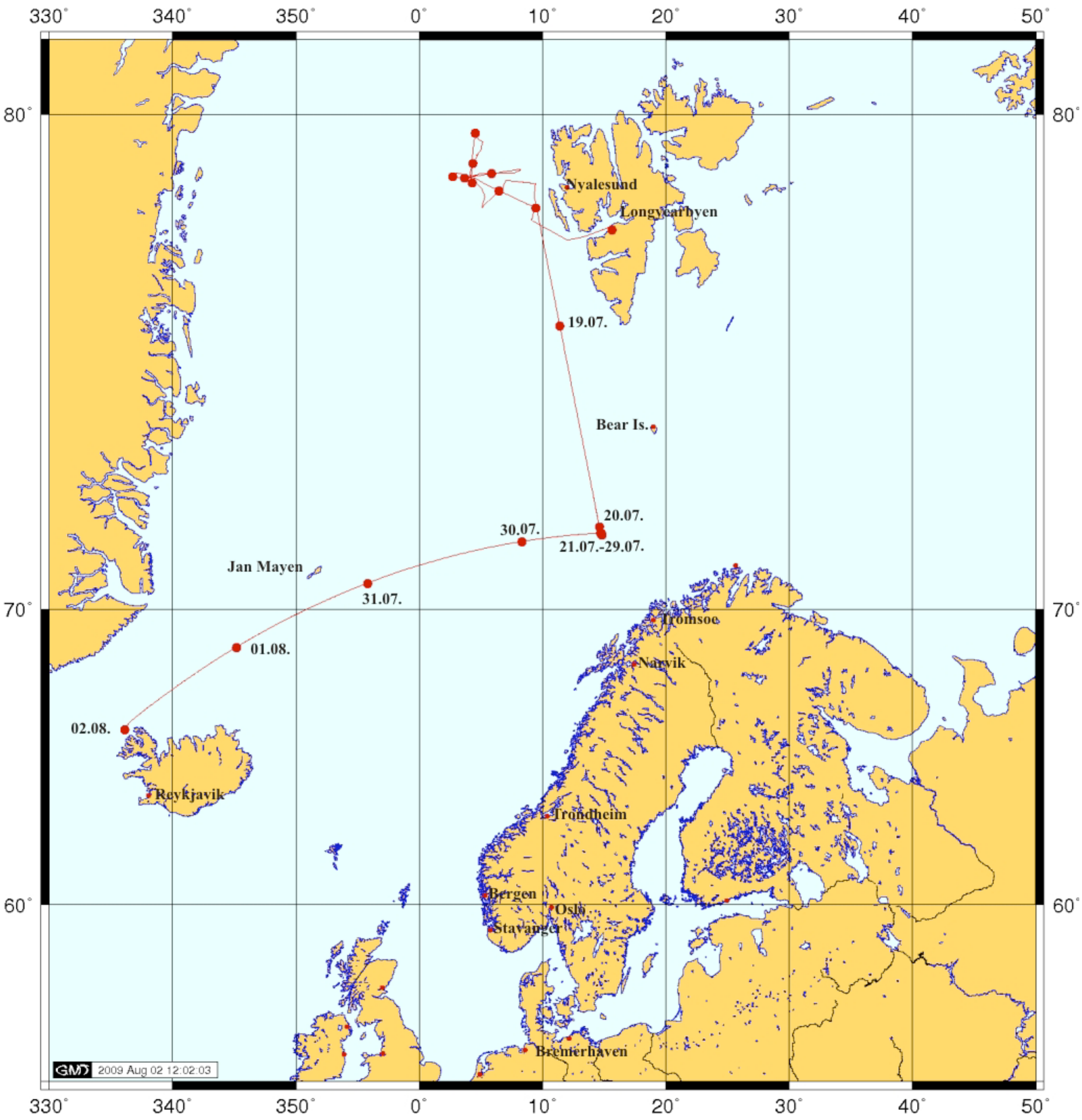

Abb. 1: Fahrtroute des FS Polarstern während der Expedition ARK-XXIV/2
Fig. 1: Track of RV Polarstern during the expedition ARK-XXIV/2

CRUISE NARRATIVE AND SUMMARY

The cruise leg ARK-XXIV/2 (Longyearbyen – Reykjavik) of *Polarstern* began in the early evening of 9 July leaving the Adventfjord of Svalbard. During the afternoon of that day 50 scientists, engineers, technicians and students coming from seven nations embarked onboard the vessel. The availability of a Remotely Operated Vehicle (ROV) was essential for the planned scientific work. Therefore, the deep sea robot QUEST from the Center for Marine Environmental Research (MARUM) at the University Bremen was onboard of *Polarstern* for the second time after 2007.

The work at sea started first at the AWI–*HAUSGARTEN*, a deep-sea observatory west of Svalbard at 79 degrees northern latitude and 4 degrees eastern longitude. Here, long-term studies and *in-situ* experiments have been carried out by the Alfred Wegener Institute since 1999. The observatory consists of 16 sampling stations covering a depth range of 1,000 to 5,500 meters. The ice conditions were moderate and had no impact on our station planning, except some influence at the central station and the most westerly stations at water depths between 5,000 and 5,500 m in the Molloy Deep. However, standard gears such as Multicorer, CTD, and water sampler (Rosette) could be used without problems.

During the second half of the cruise leg the implementation of a long-term observatory on the Norwegian margin was done. There, the Håkon Mosby Mud Volcano (HMMV) located at a water depth of 1,250 m on the SW Barents Sea slope is a priority target within the ESONET project. It is also a key site of the EU projects HERMIONE, MARBEF and the ESF EuroDeep programme CHEMECO. Liquified mud, gas, and geofluids rising from a subseafloor depth of at least 3 kilometres, form a highly active mud volcano with a diameter of 1,5 kilometer characterized by permanent gas emission. PARASOUND profiles conducted during the cruise leg gave evidence for considerable gas emissions at various sites of the HMMV and temperature lance measurements across the inner part of the mud volcano helped us to locate the active centre of the HMMV. Here we measured temperatures at 1.5 m below seafloor of 30° Celsius, and an even higher temperature of 35° Celsius at 3 m sediment depth. Therefore, an important task of our work at HMMV was the installation of a long term observatory called LOOME (LOng term Observations of Mud volcano Eruptions), because earlier investigations of MPI, AWI and IFREMER at HMMV have shown that fluid flow rates do not only control the distribution of chemosynthetic communities, but at the same time the stability of the hydrate system and gas emission. The first long-term measurement of sediment temperatures from September 2005 to June 2006 yielded evidence of several eruptive events, indicated by abrupt temperature increases of several degrees of Celsius within a few days. With the implementation of a long-term observatory it is envisaged to monitor the temporal variability at HMMV to follow the sequence of events before, during and after an eruption and to analyze their effects on gas hydrate stability, seafloor morphology and the distribution and colonization patterns of benthic communities.

On 30 July at 02:00 in the morning the last station work during cruise leg ARK-XXIV/2 had been finished. *Polarstern* set sail towards the harbour of Reykjavik on Iceland, which was reached in the early morning of 3 August.

2. WEATHER CONDITIONS

Christian Kreutzmann
DWD Deutscher Wetterdienst

On 9 of July in 2009 the expedition ARK-XXIV/2 started in Longyearbyen/Svalbard under influence of high atmospheric pressure with two high pressure areas across north-eastern Greenland and Barents Sea as well as a northward shifting bridge of high pressure across Svalbard. During *Polarstern's* approach to the working area at 78.4°N9°W, we got wind around 3 Bft (Beaufort) from different directions with simultaneous wind-sea below 0.5 m. Shallow fog patches passed over the 5° C cold sea surface.

11.07.–18.07.2009 research area HAUSGARTEN around 79°N 4°E
The firstly predominant high pressure area across East-Greenland showed temporary intensification up to 1032 hPa. Along its south-eastern flank, light to moderate wind turned rapidly to northerly directions until 11 July with a temporary increase up to 6 Bft within next days. A near-surface temperature inversion of 8 degrees developed with bases between 50 and 150 m AGL (above ground level) and tops between 400 and 600 m AGL. Shallow fog patches passed again between base of inversion and sea surface.

On 11 July, a westward moving low pressure area developed north of Lofoten with no significant influence on the area *HAUSGARTEN*. With that, ridge of Greenland high pressure area north of Svalbard (1,025 hPa) was able to pass southward over *Polarstern* from 15 July on. Afterwards influence of low atmospheric pressure prevailed in cruise area: A low pressure area was initialized across Karelia on 14 July, it deepened to a gale (985 hPa) and was steered towards peninsula Nowaja Semlja until 16 July. Afterwards it turned to northwest and came under the frontal side of a south-westward moving upper-level low pressure area, which became predominant for the remaining expedition ARK-XXIV/2 from that time on.

During 15 and 16 July, light to moderate northerly wind turned to west-northwest from time to time. It freshened up rapidly under increasing influence of low atmospheric pressure with forces of 5 or 6 Bft between 16 and 18 July. At the same time, the near-surface temperature inversion was reduced. Influx of humid cold air masses was combined with increase of cloudiness from 15 July on: Thick fog banks passed und we observed occasionally light rainfall. There was a significant gradient of sea-surface temperatures between +6 and -1.8° C in the research area *HAUSGARTEN*. Waves were damped in compact ice floes west of 5°E, but there was a wind-sea between 0.5 and 2 m in open sea dependent on wind forces and distance to the ice.

19.07.–30.07.2009 transit route and research area Håkon Mosby Mud Volcano nearby 72°N 14.7°E

The furthermore predominant upper-level low pressure area moved from the sea area north of Nowaja Semlja via *Polarstern* towards Iceland and steered low-level low pressure areas counter-clockwise around its centre. The accessory surface field of atmospheric pressure shows that by the 21st of July, gale across Nowaja Semlja was heading towards central Barents Sea via cyclonic track east of Svalbard, Bear Island and *Polarstern*. Afterwards another weaker low pressure area moved along the same track with one day delay and with filling east of Svalbard already on 20 July. The continual fresh to strong wind from north-northwest showed several peaks up to 7 Bft during transit to Håkon Mosby Mud Volcano on 19 and 20 July. Simultaneously, sea state became rough with waves up to 3 m. Afterwards north-northwest wind abated for a short time, but a field of swell came from the north with significant waves around 3.5 m and single waves up to 5 m. It developed under influence of a storm west of Svalbard and delayed use of the dive–robot ROV QUEST.

Wide extended low stratus originated from turbulent mixing of air masses during transit route. But with approach to Håkon Mosby Mud Volcano, rising sea surface temperatures up to 10° C produced temporary more unstable atmospheric conditions with spotty rain showers.

On 21 July, there was a cyclogenesis in the cold northerly air supply across Framstrait close to the ice edge. This new low pressure area developed to a central low along its south-southeastern track close west of Håkon Mosby Mud Volcano in the early 22 July. During 21 and 22 July, light to moderate wind turned to easterly and farther to southerly directions with simultaneously increase up to 5 to 6 Bft. Wind-sea and swell of 2 m came from opposite directions for a time.

Within the next days, the low pressure area west of Håkon Mosby Mud Volcano weakened and the steering upper-level low pressure area entered the higher troposphere across Iceland. It shifted southward a little on 26 July. Then a new lower-level storm system from central North Atlantic also became almost stationary close south of Iceland. Along the frontal eastern side of this wide horizontal and vertical low pressure system, further lows were brought from Great Britain and Scandinavia to Iceland via Norwegian Sea. Accessory weak and westward shifting frontal troughs with some rain passed HMMV area occasionally between 23 and 29 July. A wide high pressure area across North Pole did intensify up to 1035 hPa already during the transit route to HMMV, afterwards it shifted southward towards Nowaja Semlja and weakened slowly.

With high atmospheric pressure to the northeast and low atmospheric pressure to the southwest, we got very variable easterly winds between 3 and 6 Bft from 23 to 27 July. The corresponding wind-sea was between 0.5 and 2.5 m. From 24 July on, persistent short-wave swell around 2.5 m came from the area north of North Cape. Significant peaks up to 4 m hampered use of ROV QUEST again on 26 and 27 July. Marked advection of warm air masses caused a significant stabilization of atmospheric conditions. An inversion with a temperature increase of 8 degrees between sea surface and 450 m above ground developed until the 25 July. We registered noticeable 17° C at the top of the inversion and increasing humidity near the bottom. Ground fog entered Håkon Mosby Mud Volcano from northeast in the early 26 July and moved off only on 27 July.

Differences in atmospheric pressure weakened on 28 July, easterly winds abated. A new intensifying high pressure area developed across Mid-Norway in the course of the 29 July and it passed Håkon Mosby Mud Volcano during the following night on its way towards Svalbard. We got temporary freshening westerly wind up to 4 Bft along the northern flank of this high during the 29 July. At the same time, influx of cool air masses reduced the described marked temperature inversion. But stratification of air masses remained stable with the result of new fog patches from 29 July on. *Polarstern* departed the HMMV area with light and variable winds on 30 July at about 00 UTC. Until then, easterly swell weakened again down to 1.5 m.

30.07.–03.08. transit route to Reykjavik/Iceland
The almost stationary high pressure areas close southwest of Svalbard and across central Greenland intensified. The furthermore dominating upper-level low pressure area remained stationary close south of Iceland. Lower atmospheric levels between Irminger Sea, southern Norwegian Sea and central Scandinavia were dominated by several centres of low atmospheric pressure. *Polarstern* sailed in a freshening easterly and later north-easterly wind with peaks of 6 Bft southeast and south of island Jan Mayen (from 31.07. until morning of 01.08.) as well as close off Northwest-Iceland (02.08.). Significant veering and weakening winds were only possible during passage of a filling low pressure area in the course of 1 August. Wind-sea and swell increased up to 3 m during the periods of strong wind. Frontal fringes brought a mostly overcast transit with fog patches and temporary rain.

3. INTRODUCTION TO THE REMOTELY OPERATED VEHICLE (ROV) „QUEST“ AND SUMMARY OF DIVE OPERATIONS DURING CRUISE LEG ARK-XXIV/2

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[1)] MARUM
[2)] FIELAX GmbH

Objectives and work at sea

The deepwater ROV (remotely operated vehicle) QUEST used during ARK-XXIV/2 aboard *Polarstern* is installed and operated by MARUM, Center for Marine Environmental Sciences at the University of Bremen, Germany. The QUEST ROV is based on a commercially available 4,000 m rated deepwater robotic vehicle designed and built by Schilling Robotics, Davis, USA. Since installation at MARUM in May 2003, it was designed as a truly mobile system specially adapted to the requirements of scientific work aboard marine research vessels for worldwide operation. Today, QUEST has a total record of 235 dives during 21 expeditions, including this cruise.

During ARK-XXIV/2, QUEST performed a total of 9 dives to depths between 1,250 and 2,432 m. During the first two dives, a compensation leak reduced bottom time to only 4 hours. For dives 230 through 235, QUEST was operated by a team of 9 pilots/technicians on a 24 hour basis. Overall, a resulting mean bottom time of 10.5 hrs was achieved, ranging from 3.8 to 15.1 hours bottom time per deployment. A total of 94.33 hrs bottom time (117 hrs total dive time) was achieved during the entire cruise (see Table 3.1). Detailed data for the individual dives are listed within the dedicated scientific chapters of this report, below. The crew was prepared to cope with long dives, as well as regular intermediate dive and maintenance operations round the clock. A turn-over time of 8 hrs could be regularly maintained, with one exception due to an umbilical termination.

Dive operations included sediment and specimen sampling, *in-situ* measurements, different instrument deployments and recoveries at depth as well as re-positioning and sensor installation of the LOOME autonomous mud volcano observatory with 8 sensor strings up to 100 m length across the seafloor. In addition, dive tasks included the regular intervention with the MPI COLOSSOS elevator system. For the first time, a new setup for heavy instrument recovery was used very successfully to recover two 3 t-moorings, including the simultaneous deployment of QUEST and an additional ship's wire with a USBL tracked recovery gear. Prior to any dive operations, QUEST's brand new umbilical cable had to be deployed with a dummy weight for initial balancing of factory induced forces within the cable, down to almost 4,500 m water depth. More than 80 internal turns could be balanced during this deployment.

Close cooperation between ROV team and ships crew on deck and bridge allowed a smooth and professional handling during all deployment and recovery situations. During diving, this cooperation allowed precise positioning and navigation of both ship and ROV, which was essential for accurate sampling and intervention work such as lift handling, instrument deployment and mooring recovery with an additional ships wire. The ROV team is very grateful for this kind of steady support from the entire ships crew during the cruise.

QUEST System description
The total QUEST system weighs about 45 tons (including the vehicle, control van, workshop van, electric winch, 5,000 m umbilical, and transportation vans) and can be transported in four standard ISO 20-foot vans. A MacArtney Cormac electric driven storage winch is used to manage up to 5,000 m of 17.6 mm NSW umbilical cable.

The QUEST vehicle uses a Doppler velocity log (DVL, 1200 kHz) to perform underwater dynamic positioning, computer controlled displacement, and other automatic control functions. The combination of 60 kW propulsion power with DVL - based autopilot functions provides exceptional positioning capabilities at depth. Designed and operated as a free-flying vehicle, QUEST system exerts such precise control over the electric propulsion system that the vehicle maintained relative positioning accuracy within decimeters. Although these data were not used for absolute navigation, they are an essential tool for vehicle control during flight and dynamic positioning on the seafloor, especially during situations with higher currents or difficult morphology. Absolute GPS-based positioning is performed using the shipboard IXSEA Posidonia USBL positioning system. Performance of the USBL system reached an absolute accuracy in the range of 10 - 20 m, which was slightly worse than during previous cruises.

The QUEST SeaNet telemetry and power system provides a convenient way to interface all types of scientific equipment, with a current total capacity of 16 video channels and 60 RS-232 data channels. The SeaNet connector design allows easy interface to third-party equipment, particularly to prototype sensor and sampling devices, by combining power-, data-, video-distribution plus compensation fluid transport all through one single cable-connector setup. This ease of connection is especially important in scientific applications, where equipment suites and sensors must be quickly changed between dives. When devices are exchanged, existing cables can be kept in place, and are simply mapped to the new devices, which can consist of video, data, or power transmission equipment.

The QUEST control system provides transparent access to all RS-232 data and video channels. The scientific data system used at MARUM feeds all ROV- and ship-based science and logging channels into a commercial, adapted real-time database system (DAVIS-ROV). During operation, data and video including HD are distributed in real time to minimize crowding in the control van. Using the existing ship's communications network, sensor data can be distributed by the real-time database via TCP/IP from the control van into various client laboratories, regardless of the original raw-data format and hardware interface. This allows topside processing equipment to perform data interpretation and sensor control from any location on the host ship.

Additionally, the pilot's eight-channel video display is distributed to client stations into the labs and bridge on the ship via simple CAT7 cable. This allows the simple setup of detailed, direct communication between the lab and the ROV control van. Thus, information from the pilot's display is distributed to a large number of scientists.

Scientific data management

Post-cruise data archival will be hosted by the information system PANGAEA at the World Data Center for Marine Environmental Sciences (WDC-MARE), which is operated on a long-term base by MARUM and the Alfred Wegener Institute for Polar and Marine Research, Bremerhaven (AWI).

As a new approach for dive participation in the lab, computers were setup in the ship's winch control room to improve the access to both online CTD and intentionally other sensor data as well as extended planning and dive tracking using GIS. In accordance to GIS data preparation using ArcGIS Version 9.1 by the science party, the software tool MIMOSA developed at IFREMER was successfully used to display and follow ROV and ship tracks upon GIS based map layers in real time.

FIELAX provided the dive log management at each ROV station which included the maintenance of the Mimosa online dive tracking software and the Alamer dive log software. After each dive, the processing of the navigation was performed consisting of filtering, smoothing and interpolating, to achieve a reliable navigation data set. The post-processing included also the georeferencing of all images taken both, with the Alamer software and the high resolution still camera. After processing dive plots, dive summaries and dive operation lists were created. Finally all minifilm images (the camera picture, which is stored every five seconds as minifilm image) are combined in a video (MPEG4 Video Codec), where each image is shown for one second. This results in a documentation of the dive in quick motion.

QUEST internal equipment and online tooling

The space inside the QUEST 5 toolskid frame allows installation of mission-specific marine science tools and sensors. The initial vehicle setup includes two manipulators (7-function and 5-function), 7 colour video cameras, a digital still camera (Insite SCORPIO, 3.3 Mega-Pixel), a light suite (with various high-intensity discharge lights, HMI lights, lasers, and low-power dimmable incandescent lights), a Sea&Sun online CTD, a tool skid with draw-boxes, and an acoustic beacon finder. Total lighting power is almost 3 kW, total additional auxiliary power capacity is 8 kW. In addition, the permanently installed Kongsberg 675 kHz Type 1071 forward looking Scanning Sonar head provided acoustic information of bottom morphology and was used for detection of gas emissions.

Video Setup, HDTV and vertical imaging
Continuous PAL video footage was continuously recorded on two MiniDV tapes with two colour-zoom cameras (Insite PEGASUS or DSPL Seacam 6500). In order to gain a fast overview of the dive without the need of watching hours of video, video is frame-grabbed and digitized at 5 s intervals, covering both PAL and HD video material. For the first time (dives 230 - 235), a 2 channel continuous mpeg4 digital grabber was successfully tested and allowed to provide the digitized copy of PAL video feeds to the science party at the end of the cruise, eliminating the need for the tedious work of tape copy on land.

For extremely detailed video close up filming, a near-bottom mounted broadcast quality (>1000 TVL) 3CCD HDTV 14 x Zoom video camera was used (Insite Zeus). Spatial Resolution of this camera is 2.2 Mega-Pixel at 59.94 Hz interlaced. Recording was performed on demand onto tapes in broadcast-standard digital Sony HDCAM format, using uncompressed 1.5 Gbit HD-SDI transmission over a dedicated fibre-optic connection. Image display takes place on an HD 46" TFT display screen inside the control van, providing excellent close-up view and covering the full dynamic range of the camera. Distribution of the cameras HDTV video signal was performed through dedicated cabling into the science lab, allowing real-time display on a 26" HD TFT screen at full resolution.

As a standard still image camera, an Insite Scorpio Digital Still camera was used, providing 3.3. Mega-Pixel spatial image resolution and highly corrected underwater optics.

For the task of video mosaicking and vertical downward viewing, a broadcast quality downward looking camera with dedicated corrected underwater optics – Insite ATLAS - was installed for the second time in this functionality on the toolskid in conjunction with one high power HID wide angle flood light. Orientation of light and camera was adjusted in order to gain a large angle between optical axes. Thus, reduced backscatter allowed clear imagery from up to 7 meters above seafloor.

During ARK-XXIV/2 the following scientific equipment was handled with QUEST:

ROV based tools, installed on vehicle:
- ROV interchangeable draw-box baskets
- Sea and Sun CTD real-time probe with turbidity sensor
- Pushcores, max. 16 in drawbox
- INSINC incubation pushcores, max. 8 in drawbox (MPI)
- Autonomous temperature loggers on frame and T-lance (IFREMER)
- Hand-Nets
- Acoustic Beacon markers
- Simple site markers
- Autoclave pressure tight samplers in dedicated drawboxes (AWI)
- Hydraulic cable cutter
- Simple "Freddy" knife for manipulator operations
- CLSI inductive realtime data modem (IFREMER)

In-situ instruments and gear handled/maintained/collected by vehicle:

- AWI 16 pushcore racks
- AWI seafloor cage installation
- MPI Lift system COLOSSOS
- MPI Benthic Chamber
- MPI Benthic Microprofiler
- MPI RCM autonomous current profiler
- MPI wood colonization experiment recovery
- MPI wood box sample container
- MPI Insinc seafloor stand
- IFREMER AIM camera system
- IFREMER Trac colonization experiment recovery
- ESONET LOOME frame and sensor strings
- MARUM device recovery gear with steelwire/hook assembly (mooring recovery on ships wire)

Tab. 3.1: Dive operations during ARK 24/2

DIVE LOG Summary: ARK-24/2
Times
UTC

No.	Dive No.	Date	Site PS/74		Depth (m)	Time Launch	Time Start (Bottom)	Time End (Bottom)	Time Recovery	Bottom Time	Total Dive Time	Bottom hours	Total Dive hours
1	227	13.07.2009	111-2		2432	18:38	20:24	23:51	01:11	03:27	06:33	**3,45**	**6,55**
2	228	14.07.2009	115-1		2429	16:21	17:56	21:55	23:22	03:59	07:01	**3,98**	**7,02**
3	229	16.07.2009	122-1		2432	17:03	18:34	04:05	05:37	09:31	12:34	**9,52**	**12,57**
4	230	22.07.2009	145-1		1260	04:17	05:21	17:22	18:30	12:01	14:13	**12,02**	**14,22**
5	231	23.07.2009	169-1		1260	16:07	17:07	06:45	07:50	13:38	15:43	**13,63**	**15,72**
6	232	24.07.2009	172-1		1260	18:56	20:51	06:20	07:06	09:29	12:10	**9,48**	**12,17**
7	233	25.07.2009	176-1		500	17:04	17:24	17:24	17:46	00:00	00:42	**0,00**	**0,70**
7a	233	25.07.2009	176-1		1260	20:16	21:09	13:00	13:56	15:51	17:40	**15,85**	**17,67**
8	234	27.07.2009	183-1		1260	15:14	16:15	07:20	08:16	15:05	17:02	**15,08**	**17,03**
9	235	28.07.2009	187-1		1260	18:05	19:16	06:35	08:16	11:19	14:11	**11,32**	**14,18**
				Max. Dive depth (m):	**2432**				Mean bottom time per dive (hrs):	**10,48**	Total hours:	**94,33**	**117,82**

4. WEST SVALBARD GAS SEEPS

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IFM-GEOMAR

Objectives

Large amounts of methane are stored in the form of submarine gas hydrates, but their occurrence is limited to the pressure- and temperature-range of the gas hydrate stability zone (GHSZ). Dissolved or free methane gas rising from deeper sediment layers towards the seafloor may be bound in the form of gas hydrates within the GHSZ. An increase in ambient temperature or a decrease in pressure leads to a shift of the GHSZ and may cause gas hydrate dissociation, resulting in the release of the bound methane. Within the water column, aerobic oxidation of methane contributes to ocean acidification. If the released methane reaches the atmosphere, it will increase the green-house effect. Rapid climate changes in Earth history have been associated with the dissociation of gas hydrate reservoirs, but the role of gas hydrates as a buffer in the global methane cycle is still poorly understood.

Due to the relatively low temperatures prevailing at shallow water depths, submarine gas hydrates in the Arctic are close to the stability limit and therefore particularly sensitive to increasing seawater temperatures as a consequence of global climate change. Repeated oceanographic surveys have revealed that the bottom water temperature on the continental slope west of Svalbard has increased by approximately 1° C over the last 30 years. This temperature increase corresponds to a shift of the gas hydrate stability limit from approximately 366 m to 399 m water depth and is accompanied by a retreat of the GHSZ in the near-surface sediments. The discovery of numerous gas seeps at water depths between 150 and 400 m west of Svalbard during the JR211 cruise of the *RRS James Clark Ross* in August/September 2008 suggests that submarine gas hydrates may be dissociating in response to regional bottom water warming.

The objective for this cruise was to conduct *in-situ* measurements of the sediment temperature distribution and the thermal conductivity in the seabed at selected locations close to the estimated water depth of the gas hydrate stability limit in order assess the retreat of the GHSZ and will help to estimate the potential release of methane from gas hydrate dissociation in the future.

Work at sea

In-situ measurements of sediment temperature and thermal conductivity were obtained using a standard violin-bow type heat flow probe, manufactured by FIELAX GmbH, Bremerhaven. The instrument is equipped with 22 temperature sensors distributed over an active length of 5.85 m. Measuring at a resolution of 0.0006° C the sensors were calibrated to a precision of 0.002° C. Additional sensors for acceleration, tilt, and water temperature help to control the measurements. All data was transmitted from the probe to the winch control room in real time via the ship's cable.

Prior to the first *in-situ* temperature measurement, the sensor string was calibrated at 950 m water depth. The heat flow probe stations were located on a transect line from 462 to 358 m water depth, crossing the assumed outcrop of the GHSZ at around 400 m. The positions are listed in Table 4.1. At each station, the sediment temperature profile was measured during the first 7 minutes after penetration. Subsequently, a heat pulse was emitted from a heater wire along the entire active length of the probe and the decay of the heat in the sediment was recorded for another 7 minutes in order to measure the thermal conductivity. In spite of 500 kg of extra weights that were added to the 1,000 kg of the heat flow probe itself, penetration was rather poor and varied between around 4 m at the deep end of the transect and 1 m at the shallow end.

Preliminary results

The raw data obtained from the temperature and conductivity measurements will be processed and analyzed in detail after the cruise. Preliminary results show that the bottom water temperature increases from 2.852° C at the deepest station to 3.231° C at the shallowest station. Two stations at the deep end of the transect fall within the GHSZ and two stations at the shallow end of the transect are clearly outside the GHSZ. The temperature profile at the 409 m station in the middle of the transect line is likely to cross the stability limit at around 2 to 3 m sediment depth and shows some irregularities at the lower end, which could point to the presence of gas hydrates in the sediment. A more detailed interpretation requires information on porewater salinity and a detailed time series of water temperature changes in the area during the past decade.

Tab. 4.1: Heat flow probe stations on the continental margin west of Svalbard

Station	Date	Time	Latitude	Longitude	Water depth [m]
PS74/0097-1	11/07/2009	07:00	78° 24.83' N	9° 5.78' E	1007
PS74/0098-1	11/07/2009	09:00	78° 34.94' N	9° 18.15' E	462
PS74/0099-1	11/07/2009	10:07	78° 35.24' N	9° 23.06' E	427
PS74/0100-1	11/07/2009	10:57	78° 35.36' N	9° 25.15' E	409
PS74/0101-1	11/07/2009	11:42	78° 35.52' N	9° 27.21' E	387
PS74/0102-1	11/07/2009	12:26	78° 35.61' N	9° 28.63' E	358

5. IMPACT OF CLIMATE CHANGE ON ARCTIC MARINE ECOSYSTEMS

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Objectives

The marine Arctic has played an essential role in the history of our planet over the past 130 million years and contributes considerably to the present functioning of the Earth and its life. The past decades have seen remarkable changes in key arctic variables, including a decrease in sea-ice extent and sea-ice thickness, changes in temperature and salinity of arctic waters, and associated shifts in nutrient distributions. Since arctic organisms are highly adapted to extreme environmental conditions with strong seasonal forcing, the accelerating rate of recent climate change challenges the resilience of arctic life. The stability of a number of arctic populations and ecosystems is probably not strong enough to withstand the sum of these factors which might lead to a collapse of subsystems.

To detect and track the impact of large-scale environmental changes in a the transition zone between the northern North Atlantic and the central Arctic Ocean, and to determine experimentally the factors controlling deep-sea biodiversity, the Alfred-Wegener-Institute for Polar and Marine Research (AWI) established the deep-sea long-term observatory *HAUSGARTEN*, which constitutes the first, and until now only open-ocean long-term station in a polar region.

HAUSGARTEN observatory in the eastern Fram Strait includes 16 permanent sampling sites along a depth transect (1,000 - 5,500 m) and along a latitudinal transect following the 2,500 m isobath crossing the central *HAUSGARTEN* station (Fig. 5.1). Multidisciplinary research activities at *HAUSGARTEN* cover almost all compartments of the marine ecosystem from the pelagic zone to the benthic realm, with some focus on benthic processes. Regular sampling as well as the deployment of moorings and different free-falling systems (bottom-lander) which act as local observation platforms, have taken place since the observatory was established in summer 1999. To determine the factors controlling deep-sea biodiversity, a number of biological short- and long-term experiments are carried out using a Remotely Operated Vehicle (ROV).

Our work during ARK-XXIV/2 included the sampling of benthic stations on the continental shelf off Svalbard for the international project KONGHAU (“Impact of climate change on Arctic marine community structures and food webs”), co-financed by the EU Integrated Project HERMES ("Hotspot Ecosystem Research on the Margins of European Seas") and the Norwegian oil company Statoil Hydro. KONGHAU combines data collected over the past 10 years from time-series work at Kongsfjord and *HAUSGARTEN*.

Work at sea

Virtually undisturbed sediment samples have been taken using a video-guided multiple corer (MUC) at 13 *HAUSGARTEN* stations along a bathymetric (1,000 – 4,000 m water depth) and a latitudinal transect in 2,500 m water depth as well as two stations at 230 and 1,200 m water depth within the framework of the KONGHAU project. Due to technical problems and time restraints the three *deepest HAUSGARTEN* stations (4,000, *5,000*, and 5,500 m water depth) could not be sampled.

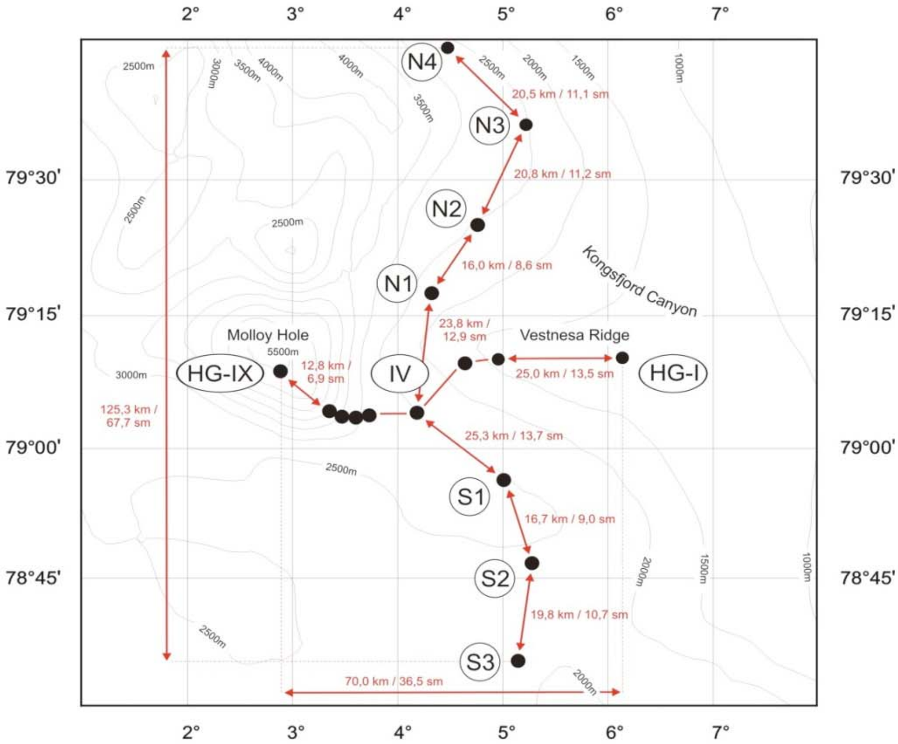

Fig. 5.1: Map with the sixteen sampling stations at Hausgarten

Various biogenic sediment compounds will be analysed to estimate the input of organic matter from phytodetritus sedimentation, benthic activities (e.g. bacterial exoenzymatic activity), and the total biomass of the smallest sediment-inhabiting organisms (size range: bacteria to meiofauna). Additional sediments were preserved in 4 % formalin to assess densities and distribution patterns of meiofaunal organisms. Other sediment samples retrieved by the MUC will be used to analyse bacterial cell numbers, RNA, DNA, and to conduct fluorescent *in-situ* hybridization (FISH) analyses. The microbial community structure and their variability along the *HAUSGARTEN* depth transect will be determined by ARISA (a molecular fingerprinting method). The application of statistical methods will allow correlation of shifts in the community structure with environmental parameters to explain causes of structural changes. Using another fingerprint method, the terminal restriction fragment length polymorphism method (T-RFLP), the functional gene diversity will be determined, compared and correlated to environmental factors. These microbiological analyses contribute to the long-term ecological change assessment at the *HAUSGARTEN* observatory. Results will help to describe ecosystem changes in the benthal of the Arctic Ocean.

The ROV QUEST (MARUM, University Bremen) was used to sample two experiments, a disturbance and a starvation experiment, that were installed in summer 2008 at the central *HAUSGARTEN* station (2,500 m water depth). Experiments were carried out to study causes and effects of physical, chemical and biological gradients at the deep seafloor and their implication for benthic biodiversity. Altogether we carried out three dives taking a total of 21 push corers by means of the ROVs manipulator.

The bottom-lander based disturbance experiment was conducted to simulate enhanced macro- and megafauna perturbations and to study shifts in biodiversity of the small sediment-inhabiting biota in response to physical disturbance and changing biogeochemical condition within the upper sediment layers. The bottom-lander frame was equipped with three disturber units carrying plough-shaped rakes to perturbate surface sediments down to 10 cm depth at different frequencies (i.e. once a month, two times a month, and once every week). Four sediment samples have been taken from each of the three disturbed areas, and three samples were taken as controls in close vicinity to the lander frame.

The ROV was also used to retrieve three sediments samples from surface sediments covered by a 4 m² cage with solid lids, preventing the sedimentation of particulate organic matter, which represents the main food/energy source for benthic organisms. Three samples taken outside the cage serve as a control for this starvation experiment.

Push-corer samples from both experiments were sub-sampled by means of small plastic syringes to separately analyse parameters like bacterial activity, chloroplastic pigments, organic carbon contents, lipids, proteins, granulometry and the small sediment inhabiting biota (bacteria and meiofauna). Most of the sub-samples have been stored for later analyses. Bacterial activity and chloroplastic pigments were analysed onboard.

The expedition was also used to start another bottom-lander based biological long-term experiment. So-called colonisation-cores filled with azoic, organically-enriched artificial sediments were mechanically inserted in surface sediments to study the attraction of “plain” sediments to meiofauna organisms, focussing on nematode communities. The lander equipped with a current-meter and an integrated optical oxygen sensor (optode) was deployed at the shallowest *HAUSGARTEN* site (HG-1;

1,280 m); the experiment will be terminated in summer 2010 by recovering the free-falling device.

Another bottom-lander supporting a current meter, an optode, and a small sediment trap at 2.5 m above ground had been deployed for one year at the central *HAUSGARTEN* site (HG-IV; 2500 m). Results from the optode measurements at HG-I and HG-IV will contribute to the EU-project HYPOX which aims at *in-situ* monitoring of oxygen depletion in hypoxic ecosystems of coastal and open seas, and locked water bodies.

Preliminary Results

First results from biochemical analyses carried out on board *Polarstern* confirmed that the three disturber units used in the disturbance experiment sufficiently reworked the upper sediment layers. Compared to samples from the control site showing decreasing values in pigment concentrations and bacterial activity, sediments from the disturbed areas exhibited a more or less homogenous distribution within the uppermost 5 cm of the sediments. Further analyses of the samples, including the assessment of distribution and diversity patterns of meiofaunal organisms within the disturbed areas, will be done at the home lab. Preliminary results from the starvation experiment show that compared to the control sediments, food quality and bacterial activity underneath the cage is already slightly reduced.

6. PRODUCTION, FATE AND AGGREGATION OF ORGANIC MATTER IN A CHANGING ARCTIC OCEAN

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Objectives

Based on the awareness, that global change has increasingly changed marine ecosystems, we intend to determine the effects of higher temperature and CO_2 on the plankton structure, production, fate and aggregation of extracellular organic matter in the Arctic Ocean. Incubation experiments with arctic marine bacterioplankton communities will be performed to observe temperature- and CO_2-related effects on the concentration and composition of exopolymer substances. Furthermore, secondary effects on the formation of organic aggregates will be investigated by bubble absorption onboard. Biogeochemical and microbiological measurements in combination with investigations of the microbial diversity are necessary to determine future changes in the origin and the turnover of organic matter during production and decomposition processes in the Arctic Ocean. Our overarching goal is to contribute to a better understanding of the direction and strength of biogeochemical and microbial feedback processes in the future ocean. The investigations are conducted in close cooperation with E. Nöthig and I. Peeken (AWI) in the AWI *HAUSGARTEN*, studying plankton ecology and sedimentation of organic matter in a changing Arctic ocean.

Work at sea / preliminary results

At the *HAUSGARTEN* stations seawater samples were collected by CTD/rosette sampler at different depths according to the station table (see contribution of E. Bauerfeind) to determine the impact of microbial processes on aggregation and sedimentation in cooperation with project N-326 (M. Klages, AWI). Analyses of samples include biogeochemical parameters (dissolved organic carbon (DOC), dissolved organic nitrogen (DON), dissolved and total polysaccharides (DCHO/CHO), dissolved and total amino acids (DAA/AA), transparent exopolymer particles (TEP), Coomassie stainable particles (CSP) and microbiological parameters (bacterial cell numbers, bacterial DNA, bacterial production (incorporation of ^{3}H-Thymidine and ^{3}H-Leucine, activity of extracellular enzymes). Beside of the microbial activity measurements, samples were preserved, kept refrigerated (4° C) or frozen (-20° C / -80° C) for further analyses in the home laboratory.

Furthermore, a perturbation experiment with arctic marine bacterioplankton was performed to determine the impact of increasing temperature and CO_2 on the microbial turn-over of exopolymers. Secondary effects on the formation of organic aggregates were investigated by bubble absorption. Seawater was collected by CTD/Rosette at the most southern *HAUSGARTEN* station S3 (78°36.45’ N, 5°4.23’ E) in the peak of Chl a concentration (depth: 30 m). Before manipulation of temperature and pH, the seawater was filtrated (1.2 μm) and concentrated from 100L to 50L by ultrafiltration (10 kDa). After manipulation of seawater chemistry, seawater was incubated for 4 days at two different temperatures. Subsequently the formation of organic aggregates was investigated by bubbling air into the seawater for 12h. Subsamples were collected for the same parameters like in the field (see above).

The studies on microbiological production and fate of organic matter are going to be complemented by an assessment of eukaryotic primary production and its origin. Therefore, samples have been taken for the analysis of parameters that provide information on eukaryotic primary production and phytoplankton diversity. This involved the preparation of filters for the measurement of chlorophyll a (Chl a), particulate organic carbon (POC), particulate organic nitrogen (PON), particle absorbance (PAB), and molecular genetic analysis (DNA). In the latter case, the samples have been fractionated by filtration into three different size fractions (> 10 μm, 3 – 10 μm, 0.4 – 3 μm). Additionally, samples have been fixed for phytoplankton characterization by flow cytometry. All filters and the fixed samples are frozen at -80° C and will be analysed subsequent to this cruise in the laboratory.

The samples were taken from 4 - 6 different depths with a CTD/rosette sampler at the *HAUSGARTEN* stations and at one station (72°10.15’ N, 14°37.84’ E) 10 nautical miles outside of the Håkon Mosby Mud Volcano. In the following, samples were collected from a depth of 8 - 10 m taking advantage of a membrane-pump installed at the bow of *Polarstern*. This involved a regular sampling in the area of the Håkon Mosby Mud Volcano on a daily basis, while the samples on the transit to Iceland were taken every 3 hours.

7. CTD AND WATER-COLUMN SAMPLES

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Work at sea

The CTD *(*conductivity-temperature-depth) measurements were carried out using a Sea-Bird Electronics, Inc. SBE 911plus system. The unit was equipped with sensors for temperature (SBE3+), conductivity (SBE04C) and pressure (Digiquartz 410K-105) along with additional sensors for fluorescence (8060 Haardt) and transmission (CST-814DR). The underwater unit was attached to a SBE 32 carousel water sampler with room for 24 Niskin 12l-bottles. The complete system worked properly throughout the entire cruise, except for the transmissiometer. First, no data were recorded, below 600 m water depth. After a cable had been exchanged, the transmission signal improved, but in irregular intervals the signal got lost. Salinity samples were collected for later analysis and calibration of conductivity at home. In total 21 CTD casts were carried out, 16 in the AWI *HAUSGARTEN* working area and five additional casts in the Håkon Mosby Mud Volcano working area. The data were also used for calculating sound velocity profiles needed for the echosounder systems and the Posidonia underwater positioning system.
At all stations in the *HAUSGARTEN* area CTD profiles from the surface to the seafloor were carried out and water samples were taken from the entire water column at the positions of the sediment trap moorings and at the stations KH and V12 (see Tab. 7.1). At the other stations samples were taken from the surface to 100 – 120 m.

6 - 7 samples were taken in the upper layer, starting at 10 m and sampling depths were chosen in a way to get at least 1 sample from the depth of the fluorescence maximum and in steps of 10 - 20 m above and below the depth of the fl-max., till the depth were the fluorescence signal vanished. At the mooring positions samples were also taken in 500 m intervals down to the seafloor and 10 m above the seafloor. Water samples were taken for the analyses of 24 different parameters (Table 7.2) that will be further processed after the return to laboratory. For details see contribution by K. Metfies and M. Wurst.

Preliminary results

The CTD profiles of the upper 200 m in the *HAUSGARTEN* area show the influence of ice and meltwater in the central *HAUSGARTEN* (79°N/4°W) indicated by water temperatures of < 2 – 3° C and salinities of 33 - 34 in the upper 50 m. Temperatures at the northern *HAUSGARTEN* stations were higher with 4 – 5° C and salinity varying between 34 and 35 in near surface layer. This indicates the presence of Atlantic water masses in the regions. Thus indicating that the ice we observed drifted into the region shortly before we reached the area of observation.

In the eastern region of the *HAUSGARTEN* and on the shelf of Svalbard temperatures and salinities indicated the dominance of warm Atlantic water masses. Atlantic water also shaped the characteristics of the surface layer in the southern *HAUSGARTEN* area.

Tab. 7.1: CTD-station in the AWI-*HAUSGARTEN* where water samples were taken

Date	Station PS 74/	Latitude N	Longitude E	WT	Ice (%)
11.07.2009	104 HG IV (Hol 1)	79°4.03'	4°11.77'	2447 m	50%
12.07.2009	106 HG VI	79°3.57'	3°34.60'	3489 m	10% - 20%
12.07.2009	107 HG III	79°6.75'	4°33.87'	1838 m	30%
13.07.2009	108 HG II	79°7.80'	4°54.27'	1550 m	0%
13.07.2009	109 HG I	79°8.05'	6°5.74'	1284 m	0%
14.07.2009	112 HG VII	79°3.53'	3°28.88'	3988 m	0%
15.07.2008	116 HG N4	79°43.76'	4°28.70'	2731 m	30% - 50%
16.07.2009	118 HG N3	79°36.08'	5°10.16'	2783 m	10% - 20%
16.07.2009	119 N2	79°24.72'	4°39.63'	2785 m	0%
16.07.2009	120 N1	79°16.95'	4°19.84'	2389 m	0%
17.07.2009	125 HG IV (Hol 2)	79°0.42'	4°20.18'	2604 m	0%
17.07.2009	127 HG S1	78°55.03'	5°0.13'	2637 m	0%
18.07.2009	128 HG S2	78°46.87'	5°19.97'	2469 m	0%
18.07.2009	129 HG S3	78°36.45'	5°4.23'	2339 m	0%
18.07.2009	132 KH	79°1.86'	7°0.13'	1306 m	0%
19.07.2009	133 V12	78°58.91'	9°25.50'	227 m	0%
20.07.2009	134 HMV	72°10.15'	14°37.84'	1155 m	0%

Fluorescence profiles showed a maximum in 40 - 50 m in the northern region, indicating the presence of greater amounts of phytoplankton in this depths. In contrast to this the fluorescence yielded the highest values within the top 30 - 40 m in the southern area. In the central *HAUSGARTEN* no maxima were observed, but fluorescence values were at a medium level from the surface to ~50 m. Below this depth fluorescence decreased to low values and usually was at the limit of detection at ~100 m. Only at a few stations fluorescence was detectable to a depth of 120 down to 130 m.

Tab. 7.2: List of 24 different parameters to be analyzed for water samples collected at *HAUSGARTEN*

	Chl_a	POC/N	bPSI	Seston	PAB	HPLC	DMSP	Flow	U.möhl	Nutrients	^{15}N Isotope	DNA (PP)
PS 74/ 104 HG IV (Hol1)	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 106 HG VI	x	x			x	x	x	x	x			x
PS 74/ 107 HG III	x					x	x	x	x			x
PS 74/ 108 HG II	x					x	x	x	x			x
PS 74/ 109 HG I	x	x			x	x	x	x	x			x
PS 74/ 112 HG VII	x	x			x	x	x	x	x			x
PS 74/ 116 HG N4	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 118 HG N3	x	x			x	x	x	x	x			x
PS 74/ 119 HG N2	x	x			x	x	x	x	x			x
PS 74/ 120 HG N1	x	x				x	x	x	x			x
PS 74/ 125 HG IV (Hol 2)		x	x	x						x	x	
PS 74/ 127 HG S1	x	x				x	x	x	x			x
PS 74/ 128 HG S2	x	x				x	x	x	x			x
PS 74/ 129 HG S3	x	x				x	x	x	x			x
PS 74/ 132 KH	x	x			x	x	x	x	x	x	x	x
PS 74/ 133 V12	x	x			x	x	x	x	x	x	x	x
PS 74/ 134 HM	x	x			x	x	x	x	x			x

Tab. 7.2 (cont.): List of 24 different parameters to be analyzed for water samples collected at *HAUSGARTEN*

	DCHO	TCHO	DAA	TAA	DOC	TEP color	TEP micro	CSP	Flow Bact.	Enzym activity	Bact. product.	DNA (Bact)
PS 74/ 104 HG IV (Hol1)	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 106 HG VI												
PS 74/ 107 HG III	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 108 HG II	x	x	x	x	x	x	x	x	x			x
PS 74/ 109 HG I												
PS 74/ 112 HG VII												
PS 74/ 116 HG N4	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 118 HG N3	x	x	x	x	x	x	x	x	x			x
PS 74/ 119 HG N2	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 120 HG N1	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 125 HG IV (Hol 2)	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 127 HG S1	x	x	x	x	x	x	x	x	x			x
PS 74/ 128 HG S2	x	x	x	x	x	x	x	x	x			x
PS 74/ 129 HG S3	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 132 KH	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 133 V12	x	x	x	x	x	x	x	x	x	x	x	x
PS 74/ 134 HM												

8. SEDIMENTARY PROCESSES AND INTERACTIONS AT *HAUSGARTEN*

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Objectives

The major food source for deep sea organisms is the organic matter that sinks out of the productive layer and finally reaches the sediments of the deep sea. This transfer of organic carbon is governed by a variety of processes within the upper water column, as well as by the composition of the plankton community. The composition of the primary producers in the Arctic might change in the near future due to the effect of global warming. To get insights into the amount and composition of the sedimenting material measurements have been performed by means of moored sediment traps since 1999/2000 in the AWI *HAUSGARTEN*.

Work at Sea

During the ARK-XXIV/2 cruise 2 deep sea moorings equipped with sediment traps and current meters that had been deployed during the *Polarstern* cruise ARK-XXIII/2 in 2008, were successfully recovered. The mooring positions at water a depth of ~ 2,500–2,700 m are indicated in the map (Fig 5.1). Seasonally resolved samples of the traps were obtained from ~300 m below sea surface and 150 m above the seafloor in the central *HAUSGARTEN* (HG IV) and also by the traps at the northern mooring position (N3) during the period July 2007 to July 2008. No sample was obtained from the trap located in 1,200 m. In the central *HAUSGARTEN* region a benthic lander was recovered, that was also equipped with a sediment trap and which sampled successfully. At the central *HAUSGARTEN* position a mooring with 3 sediment traps and 3 current meters was redeployed at 79°00.43'N and 04°20.05'E. The planned mooring at 79°44'N (N4) could not be deployed.

Preliminary results

An impression of sedimentation during 2008/9 can be obtained from the amount of material collected in the sampling bottles. (Fig.8.1). This figure shows the sampling jars from the sediment trap in a the central *HAUSGARTEN* in ~230 m. A seasonal sedimentation pattern can be deduced, with larger amounts of material collected shortly after the deployment at the end of July and August 2008. The amount of material collected stayed at an elevated level until October, decreased afterwards and stayed at a low amount until May/June 2009.

Beginning in June 2009 an increasing tendency of the flux till the end of the mooring period in July can be noted in both depths. More detailed information on the sedimentation amount and composition of the sedimented matter will be obtained after biochemical and microscopic analyses in the laboratory.

07.08 08.08 09.08 10.08 11.08 01.09 02.09 03.09 05.09 06.09 07.09

Fig. 8.1: Sampling jars of the sediment trap moored in 230 m depth at 79°44'N

9. DIVERSITY AND ECOLOGICAL ASPECTS OF DEEP-SEA PORIFERA (SPONGES) IN THE CENTRAL *HAUSGARTEN* SITE

Dorte Janussen
Senckenberg

Objectives

Porifera play a significant ecological role as active filter feeders and contribute significantly to the nutrients flow and the pelago-benthic coupling (e.g. Pile & Young 2006). Especially in the deep sea, sponges are also important as providers of hard substrates and habitats for other animals. Hasemann (2006) proved a high positive correlation between occurrences of small sponges, *Tentorium semisuberites*, and the diversity of nematodes in sediments below and in close vicinity of the sponge settlements. Sponge assemblages thus are important factors for the diversity and abundance within benthic communities, both in terms of mega-, macro- and meiofauna (Kunzmann 1996).

The AWI *HAUSGARTEN* in Fram Strait is probably the best investigated deep-sea area, both in terms of physical, biogeochemical, and faunistic parameters. However, for the characterization and understanding of sponge communities and their role in the ecosystem, we are still in need of detailed mapping data and taxonomic-phylogenetical investigations. Also the phylogenetic relations of the *HAUSGARTEN* sponge fauna to those of other deep-sea regions, and its role in the food web, are little known.

Results from ANDEEP-SYSTCO campaigns in the Antarctic Weddell Sea revealed an unexpected high diversity of many animal taxa, including the Porifera, at bathyal and abyssal depths (Brandt et al. 2007). A distinctive abyssal Porifera fauna could be distinguished, but the distribution of the sponge assemblages is found to be very patchy in diversity and abundance (Janussen & Tendal 2007, Janussen et al. 2004). Based on these first results, a DFG-project (JA 1063/14-1, WO 896/9; DFG SPP 1158) was launched with the main focus on Polar deep-sea sponge taxa characterized by high diversity, wide distribution and relatively high abundances in both the Antarctic and Arctic Oceans. The aim is to understand better the phylogenetic relationships, evolutionary history and functional ecology of Porifera communities in the Polar seas. For this purpose, a directed sampling effort and ecological observations, e.g. by UW photography, of North and South Polar deep-sea sponges are required.

Scientific purposes of the sponge research project during the ARK-XXIV/2-expedition were following:

- Characterization of sponge assemblages within different *HAUSGARTEN* stations, observation of their bathymetric and ecological characteristics and if possible the boundaries or gradients between them.

- Documentation and sub-sampling of the collected sponges, their preliminary identification and immediate fixation/freezing for taxonomy, molecular biology (incl. barcoding), and stable isotopes.

- Zoogeographic and phylogenetic comparisons of Arctic with Antarctic deep-sea sponge faunas, e g. to clarify the unresolved status of allegedly cosmopolitan and bipolar genera (such as *Acanthascus*, *Bathydorus*, *Caulophacus, Polymastia*, *Suberites*, *Tentorium*, *Cladorhiza*, *Chondrocladia*).
- To achieve a better understanding of the colonization and origin of the present sponge faunas in the Polar deep seas.

Work at sea

During this expedition, the collection of sponges was performed as planned mainly by the ROV QUEST, and a few specimens were collected by the Multicorer (MUC). The quality of the sponges sampled by ROV and MUC is very high with little mechanical disturbance or pollution. In addition, ROV sampling can be linked directly with *in-situ* photos of the sponges. Because the exact identification of sponges is possible only by skeletal and histological preparations (which requires the specimens or at least a sample), photo-identification sponges normally is uncertain at best. However, it is possible to significantly improve this method by linking the UW-photography with sampling of the specimens, as we did during this cruise, and to use this knowledge for later photo identifications. Originally, several dives were planned at different HG stations, but due to technical problems the first two dives (# 227 and # 228) were interrupted, before the sponge sampling had begun. Therefore, only during the dive # 229 in *HAUSGARTEN* IV, the central *HAUSGARTEN* station at 2,500 m depth sponge collection successfully took place. Larger sponges were photographed and collected with a manipulator, all together seven sponge complexes (i.e. several sponges sitting together on one substrate), were gathered this way. We then spent considerable time (about one hour) searching the sea bottom closely for smaller sponges, but we did not find any of the small species (Polymastiidae and *Thenea* spp.), which could have been expected in this area, so we ended up taking three pushcores, of which only one actually contained a sponge. After collection, the sponges were sorted and photographed in the lab. Subsamples were taken immediately, some were frozen at -20° C for stable isotopes, and others were fixated in RNA later and 100 % Ethanol for genetics. Samples of the larger sponge were fixated in 4 % formaldehyde for histology and for the possibility of later collection of the meiofauna in the sponges.

The surface sediments of MUC cores from different *HAUSGARTEN* and Håkon Mosby Mud Volcano stations were examined closely for sponges, but without any success, except two specimens from *HAUSGARTEN* stations N2 and N3. At station PS 74/131, the first centimetre of surface sediments from MUC cores was washed out carefully, but no sponges could be found. What looked like small sponges in the sediment turned out to be large agglutinating foraminifera, *Archimerismus subnodosus*, associated with deep-sea miliolid foraminifera, *Pyrgo rotalina* (Foram. det. by Jutta Wollenburg). The sponge taxa collected during this cruise are listed in Table 9.1.

Preliminary results

As known from earlier OFOS (Ocean Floor Observation System) and other observations, the central *HAUSGARTEN* site (HG-IV) at 2,500 m is dominated by large sponges of the genera *Caulophacus* and *Cladorhiza*; the latter are carnivore sponges, found in high densities and large body sizes unique for the family Cladorhizidae. However, the actual number of sponge species, especially of the smaller taxa, which are involved in this association, is so far unknown. During ARK-XXIII/2 (2008), we found this *Caulophacus-Cladorhiza* assemblage to be a bathymetrically limited zone: In an attempt to trawl in this area, because of heavy ice conditions we had to run the AGT not at 2,500 m, but at 2,700 m depth, and we ended up with a totally different Porifera association. It consisted exclusively of abundant small sponge species of the genera *Tentorium*, *Polymastia* and *Thenea* (Janussen 2009). One of the remarkable results of ROV dive #229 is actually, what we did not find: Intensive survey of the sea floor (we parked the ROV at several locations and searched the bottom in high resolution), failed to detect one single specimen of the above three taxa, which occur so abundantly 200 m further down. This tells us something about the strict sponge zonation in *HAUSGARTEN*; a phenomenon which we also observe in deep Weddell Sea (Janussen & Tendal 2007), for reasons which are still far from being understood.

Tab. 9.1: Taxa and numbers of Porifera collected by MUC and by ROV

Porifera taxon	Gear, depth, station no.	Position	v.-no.; Remarks
Hexactinellida: *Caulophacus* sp.	MUC, 2787 m PS 74/118-2	79°36.24`N 05°10.07`E; N3	v.2: dead stalk
Demospongiae: *Tentorium semisuberites*	MUC, 2545 m PS 74/119-2	79°24.60`N 04°41.45`E; N2	v.1: 1 small specimen on stone
Hexactinellida: *Caulophacus* cf.*arcticus*	ROV, 2504-2468 m dive 229, by manipulator	79°48.50`N 04 °84.60`E	v.3: 4 *Caulophacus* specimens + other sponges on a dead *Caulophacus* stalk
- " -	- " -	- " -	v.3, #1, #2: 2 big specimens
Hexactinellida: *Caulophacus* cf.*arcticus*	ROV, 2504-2468 m dive 229, by manipulator	79°48.50`N 04 °84.60`E	v.3, #3, #4: 2 juvenile spec.

Porifera taxon	Gear, depth, station no.	Position	v.-no.; Remarks
- " -	- " -	- " -	v.4: 1 big *Caulophacus* sitting on another dead stalk
Juvenile Hexactinellida	ROV, 2504-2468 m dive 229, by manipulator	79°48.50`N 04°84.60`E	v.3, #10a: 1 other juvenile
Calcarea: *Guancha* sp. n.	- " -	- " -	v.3, #10b: 6 small specimens sitting on dead stalk
Demospongiae: *Cladorhiza* cf. *gelida*	- " -	- " -	v.5: 1 large specimen sitting on stone
Chalina sp.	- " -	- " -	v.5a: Thin crusts on and between dead *Cladorhiza*- stalks; isodictyal, unispic.
Gelloides cf. *plexa*	- " -	- " -	v.7: 1 on stone; *in vivo* obs. with round oscular pores
Tedania sp. 1	- " -	- " -	v.6: 1 ultra-thin incrusting sp. on stone, together with 4 actinians
Tedania sp. 2	ROV, dive 229 Pushcore no.8	79°48.52`N 04°84.62`E	v.9: 1 thin incrusting on stone together with 1 actinian, same sp. as v.6?

The dense aggregation of large Cladorhizidae and Hexactinellida specimens certainly plays a crucial role in the local ecosystem of this HG-IV area. Not only are Hexactinellida efficient filter-feeders of picoplankton, such as bacteria, and thus contribute significantly to the pelago-benthic nutrition transfer (Pile & Young 2006). They also provide habitats, and sometimes food as well, for other benthic animals, such as crustaceans, polychaetes and nematodes, and their rigid or semi-rigid skeletons deliver hardgrounds for the settlement of larvae. In the deep sea the scarcity of hard substrates is a severe limiting factor for most populations of sessile animals, including sponges. As we observed during ROV dive #229, the rigid stalks of dead *Caulophacus* specimens function as important elevated hardgrounds for actinians, crinoids, and for other sponges. According to our photo observations, the competition for these substrates is hard (Fig. 9.1). The sponge complex on such a dead stalk, which we collected, consisted of larger and juvenile *Caulophacus* specimens, another hexactinellid (not yet identified) and six small calcarean sponges, obviously the same species which was commonly observed during the dive #229, sitting on, or hanging from, stones and dead stalks. They belong to a new species of the calcarean genus *Guancha*; this species is part of the North Atlantic abyssal fauna of Calcarea and has been found also as part of the pioneer fauna at a hydrothermal vent on the Mid Oceanic Ridge (Schander et al., in press). The dense aggregations of big *Cladorhiza* specimens obviously play an important role as predators of the small crustaceans, e. g. Copepodes (Vacelet & Boury-Esnault 1995). Although the dead *Cladorhiza* skeletons are also colonized, mainly by another sponge, *Chalina* sp., this, however, does not apply to the stalks of *Caulophacus*. Furthermore, we observed an association of actinians sitting on stones together with an ultra-thin incrusting sponge, *Tedania* sp. (preliminary identification).

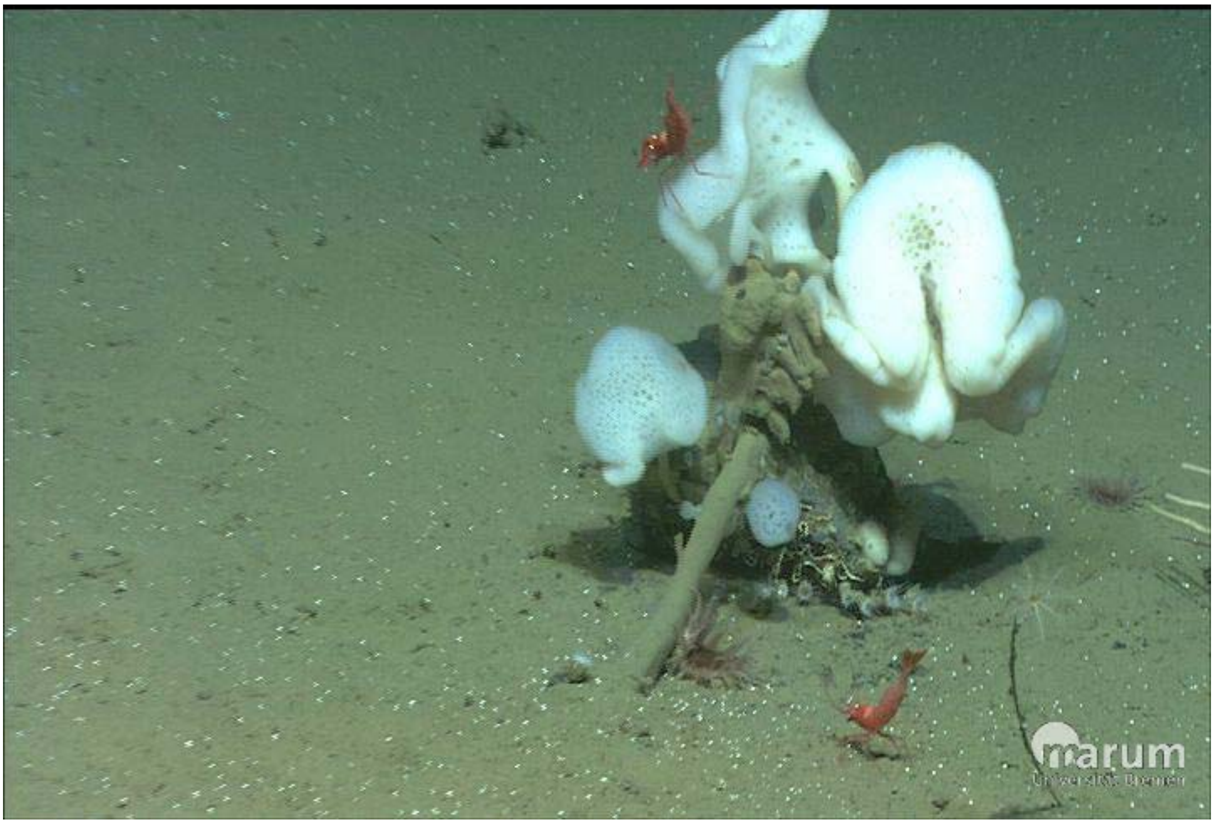

Fig. 9.1: Dense settlements on a dead Caulopacus stalks show the importance of siliceous sponge skeletons as substrates for other deep-sea animals (ROV Dive #229, HG-IV, 2,500 m. Copyright: MARUM University of Bremen)

With the detailed observation and directed sampling by the ROV QUEST, it was possible during this expedition to discover new faunal elements within the HG-IV sponge associations. These dense aggregations of large *Caulophacus* and *Cladorhiza* spp. themselves are an extraordinary phenomenon, which needs further research. Furthermore, we could confirm the strictly separated nature of the sponge communities within the *HAUSGARTEN*, as indicated already in 2008 by the results of OFOS films and the benthic catches during ARK-XXIII/2. After the return of *Polarstern* with the sampled material, the sponges will be taxonomically identified (some ambiguous cases need clarification), molecular phylogeny and barcoding as well as stable C and N isotopes are done in cooperation with the working group of G. Wörheide (Munic Univ.).

Further field studies, collection and *in-situ* photo documentation of the *HAUSGARTEN* Porifera assemblage, including those *HAUSGARTEN* stations not yet studied with focus sponges during this or the former cruise, will help us to achieve a better understanding of the role played by Porifera and the nature of sponge zonation in *HAUSGARTEN* - and consequently also elsewhere in deep-sea benthic communities.

Acknowledgements

The author thanks Michael Klages, Thomas Soltwedel and the AWI Deep-sea Group for good cooperation and for the possibility to participate in this expedition. Thanks are due also to Volker Ratmeyer and the ROV QUEST team, as well as to the captain and crew of *Polarstern*. Deutsche Forschungsgemeinschaft is acknowledged for financing a research project on Polar sponges (JA 1063/14-1) and CeDAMar for support of the travel costs to Norway, and back from Iceland.

References

Brandt, A., Brix, S., Brökeland, W., Cedhagen T., Choudhury, M., Cornelius, N., Danis, B., Mesel, I. De, Diaz R., Gillan, D., Hilbig, B., Howe, J., Janussen, D., Kaiser, S., Linse, K., Malyutina, M., Brandao, S., Pawlowski, J., Raupach, M., Gooday, A., Vanreusel, A. 2007: The Southern Ocean deep sea: first insights into biodiversity and biogeography.- Nature, 447, 307-311.

Hasemann, C. 2006: Small-scale heterogeneity in the Arctic deep-sea: Impact of small coldwater-sponges on the diversity of benthic nematode communities.- Berichte zur Polarforschung, 527, 1-294.

Janussen, D. (2009): Agassiz Trawl deployments: Report of the Porifera (sponges) collected in the Fram Strait and South of Belgica Bank (NE Greenland).- In Kattner, G. (Ed.), ARKXXIII/2-Expedition Cruise report. Reports on polar and marine research: 48-52.

Janussen, D. & Tendal, O. S. 2007: Diversity and distribution of Porifera in the bathyal and abyssal Weddell Sea and adjacent areas.- Deep-Sea Research, II, 54 (16/17), 1864-1875.

Janussen, D, Tabachnick K. R. & Tendal O. S 2004: Deep-sea Hexactinellida (Porifera) of the Weddell Sea.- Deep-Sea Research, Part II, 51/14-16, 1857-1882.

Kunzmann, K. 1996: Associated fauna of selected sponges (Hexactinellida and Demospongiae) from the Weddell Sea, Antarctica.- Berichte zur Polarforschung, 210, 1-93.

Pile, A. J., and C. M. Young. 2006: The natural diet of a hexactinellid sponge: benthic-pelagic coupling in a deep-sea microbial food web.- Deep-Sea Research I, 53:1148-1156.

Schander C, Rapp HT, Kongsrud JA, Bakken T, Berge J, Cochrane S, Oug E, Byrkjedal I, Cedhagen T, Fosshagen A, Gebruk A, Larsen K, Nygren A, Obst M, Plejel F, Stöhr S, Todt C, Warén A, Handler-Jacobsen S, Kuening R, Levin L, Mikkelsen NT, Petersen KK, Thorseth I, Pedersen RB. in press: The fauna of the hydrothermal vents on the Mohn Ridge (North Atlantic). Marine Biology Research. - In press.

Vacelet, J., Boury-Esnault, N. 1995. Carnivorous sponges. - Nature 373, 333-335.

10. LOOME DEPLOYMENT AND AUXILIARY MEASUREMENTS ON THE HÅKON MOSBY MUD VOLCANO

We report on the deployment of LOOME (Chapter 10.1, Table 10.1), and auxiliary measurements including detailed T-mapping (Chapter 10.2, Tables 10.4, 10.5), sampling for geochemical and microbial analyses (10.3, Table 10.2), flux measurements by benthic chamber (Chapter 10.3, Table 10.3), primary production measurements (10.3, Table 10.1), and microsensor measurements (10.3, Table 10.1), and a study on degradation of terrestrial material (10.4, Table 10.6). The tables with sample and deployment locations are presented at the end of this chapter.

All measurements and experiments were technically successful, and await further analyses. The scientists are deeply indebted to the expert engineers and technicians.

10.1 LOOME deployment (LOng term Observations of Mud volcano Eruptions)

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Objectives

Recent studies with T-measurements identified a relatively small area, with a diameter of ca 50 m, with strongly elevated activity. A 9 months' deployment of a temperature lance showed 2 times sudden and drastic temperature changes, indicating eruptions. This phenomenon has strong consequences for our understanding of the volcano, and its associated ecosystem. LOOME (Long-term Observatory On Mudvolca no Eruptions) is a demonstration mission from the ESONET EU (European Seas Observatory Network) network of excellence. The aim of LOOME is to detect the events leading to, during and after a mud volcano eruption. The observatory is an array of instruments, aimed to measure downwards (geo-acoustics, deep T measurements), surface phenomena (T-strings and sensors measuring DO, pH and ORP), and sensors for the water column (turbidity, pressure, T, salinity, DO, and gasflares by scanning sonar). Additionally, a camera is positioned to register dynamics in faunal behaviour and abundance, as well to visualize gas bubbles. With exception of the OBS, the camera and the 15 m T-lance, the sensors are connected to the frame of LOOME, where all data are collected. Especially the sensors measuring surface phenomena are expected to suffer damage or loss upon an eruption, thus we will save the data from the eruption, by storing them on the frame. The observatory is designed from light, flexible and non-corrosive material.

Work at sea

The deployment of LOOME was performed by lowering the frame by winch, followed by positioning of the surface sensors across the most active site by ROV. The frame is placed on an inactive slab of hydrates, eastwards and adjacent to the hot spot. The camera was placed near the frame by the ROV, the T-lance was placed by winch at the western border of the active site. The positioning of the frame and sensors (Table 10.1) by ROV went as planned and no difficulties were encountered. A compliment for the engineers who designed and prepared the observatory and its instruments. The data from the T-string across the active site were read via a CLSI to which the ROV can dock. First data confirmed the functioning of LOOME and that it is placed on the hot spot indeed. Next year we will recover the frame and sensors, and hope to have a data set describing one or more eruptions.

Tab. 10.1: Positions of measurements and deployments

Positions LOOME	**Dive**	**Latitude N**	**Longitude E**	**Remark**
old piezometer	231	72 00.5547	14 72.6332	in hydrates
old T-lance	231	72 00.5547	14 72.6332	in hydrates
new T-lance	235	72 00.4027	14 73.6848	west side hot spot
new OBS	235	72 00.3867	14 72.4517	200 west of hot spot, sensor does not touch sediment
LOOME frame	232	72 0.324	14 43.5607	
T-string	232	72 0.276	14 43.602	
T-lance	232	72 0.2989	14 43.5900	middle hot spot
C-string 17m	232	72 0.3116	14 43.5576	border hydrates-hot spot
C-string 35m	232	72 0.3038	14 43.5840	
C-string 50m	232	72 0.294	14 43.5900	
C-string 67m	232	72 0.2878	14 43.5960	
C-string 84m	232	72 0.2765	14 43.5883	
C-string 100m	232	72 0.27	14 43.6084	
camera	233	72 00.312	14 43.6259	border hydrates and hot spot
INSINC 13C DIC in	233	72 0.3103	14 43.5552	26.07.2009 02:38
INSINC 13C DIC out	235			28.07.2009 21:41
INSINC 13C DIC on deck	235			29.07.2009 06:18

Positions LOOME	Dive	Latitude N	Longitude E	Remark
positions microprofiler				
1	233	72 0.294	14 43.5722	hot spot
2	233	72 0.309	14 43.5420	Beggiatoa
3	233	72 0.2639	14 43.5709	end T-string
1	235	72 0.3091	14 43.5960	Beggiatoa mat
2	235	72 0.246	14 43.6206	geographic center
3	235	72 0.3	14 43.5721	hot spot

10.2 *In-situ* sediment and water temperature observations at Håkon Mosby Mud Volcano

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Objectives

The ascent of warm mud and fluids at mud volcanoes creates temperature anomalies close to the seafloor. Analyzing these anomalies provides information on the nature and strength of the mud volcano activity and helps to understand the relationship between fluid seepage, mud expulsion and the distribution of benthic communities. Repeated measurements at selected locations, long-term observation of sediment temperature changes and integration of geochemical observations are essential in order to understand the dynamics of the mud volcano activity.

Numerous sediment temperature measurements obtained during previous cruises helped to identify an area with persistent high seepage rates close to the geometrical centre of HMMV. However, recent long-term temperature observations and repeated measurements with a short temperature lance operated by an ROV along a transect crossing this active centre suggest large fluctuations in the seepage rates.

The main objective during ARK-XXIV/2 was to compile a map of near-seabed sediment temperatures using a winch-operated standard heat-flow probe and an ROV-operated short temperature probe in order to identify the area with the highest seepage rates, the so-called "hot spot" of the mud volcano. In addition, bottom water temperature data recorded during the ROV dives are will be analyzed to map emissions of warm fluids into the water column.

Work at sea

In-situ sediment temperature measurements and thermal conductivity measurements were obtained using a standard violin-bow type heat flow probe, manufactured by FIELAX GmbH, Bremerhaven. The instrument is equipped with 22 temperature sensors distributed over an active length of 5.85 m. Measuring at a resolution of 0.0006° C the sensors were calibrated to a precision of 0.002° C. Additional sensors for acceleration, tilt, and water temperature help to control the measurements. At each station, the heat flow probe remained in the sediment for an initial period of 7 minutes in order for the sensors to adjust to ambient sediment temperature. At selected stations, thermal conductivity measurements were obtained by shooting a heat pulse along the entire length of the sensor string and recording the decay of the heat in the sediment during an additional period of 7 minutes. During all measurements, the data was transmitted from the probe to the winch control room in real time via the ship's cable. The positions of all 36 stations of the heat flow probe are listed in Table 10.2.

Tab. 10.2: Sediment temperature measurements using the heat flow probe

Station PS74	Date	Time	Latitude N	Longitude E
139a-1	21/07/2009	01:59	72°00.450'	14°44.022'
139b-1	21/07/2009	03:21	72°00.386'	14°43.937'
148-1	22/07/2009	20:26	72°00.353'	14°43.625'
149-1	22/07/2009	21:02	72°00.304'	14°43.600'
150-1	22/07/2009	21:42	72°00.346'	14°43.632'
151-1	22/07/2009	22:03	72°00.297'	14°43.538'
152-1	22/07/2009	22:27	72°00.296'	14°43.583'
153-1	22/07/2009	22:47	72°00.325'	14°43.576'
154-1	23/07/2009	00:00	72°00.284'	14°43.574'
155-1	23/07/2009	00:27	72°00.218'	14°43.568'
156-1	23/07/2009	00:56	72°00.148'	14°43.541'
157-1	23/07/2009	01:12	72°00.182'	14°43.316'
158-1	23/07/2009	01:31	72°00.160'	14°43.292'
159-1	23/07/2009	02:03	72°00.124'	14°43.197'
160-1	23/07/2009	03:29	72°00.440'	14°43.393'
161-1	23/07/2009	04:04	72°00.332'	14°43.505'
162-1	23/07/2009	04:35	72°00.283'	14°43.593'
163-1	23/07/2009	04:46	72°00.281	14°43.658'
164-1	23/07/2009	05:06	72°00.310'	14°43.600'
165-1	23/07/2009	05:15	72°00.285'	14°43.573'
166-1	23/07/2009	05:25	72°00.269'	14°43.680'
191-1	29/07/2009	15:40	72°00.139'	14°44.026'
192-1	29/07/2009	16:09	72°00.189'	14°43.940'
193-1	29/07/2009	16:29	72°00.189'	14°42.940'
194-1	29/07/2009	17:02	72°00.231'	14°43.787'
195-1	29/07/2009	17:20	72°00.260'	14°43.733'
196-1	29/07/2009	17:44	72°00.274'	14°43.470'
197-1	29/07/2009	18:31	72°00.231'	14°43.405'
198-1	29/07/2009	18:55	72°00.207'	14°43.407'
199-1	29/07/2009	19:22	72°00.217'	14°43.278'
200-1	29/07/2009	19:49	72°00.210'	14°43.104'
201-1	29/07/2009	20:22	72°00.190'	14°42.909'
202-1	29/07/2009	20:55	72°00.177'	14°42.669'
203-1	29/07/2009	22:03	72°00.390'	14°43.384'
204-1	29/07/2009	22:53	72°00.393'	14°44.201'
205-1	29/07/2009	23:10	72°00.268	14°44.009'

A short temperature lance with 8 sensors and an autonomous central data logger was intended for *in-situ* measurements at shallow sediment depths during dives of the ROV QUEST. Unfortunately, the lance was broken during testing before the first ROV dive on HMMV and could not be repaired. Instead, an improvised short lance equipped with two autonomous temperature loggers was used during three dives, but due to the more difficult handling of the replacement, the upper sensor was broken repeatedly, such that no profiles but only single temperature measurements at depths of around 40 cm were obtained. The positions of 10 *in-situ* temperature measurements using the ROV-operated probe are listed in Table 10.3.

Tab. 10.3: Sediment temperature measurements during ROV dives

PS74/	Dive	Pangea ID	Date	Time	Latitude N	Longitude E
145-1	230	ARK-24/2_145-1_TST1	22/07/2009	17:00:47	72°00.296'	14°43.611'
169-1	231	ARK-24/2_169-1_TST1	23/07/2009	18:33:08	72°00.300'	14°43.584'
169-1	231	ARK-24/2_169-1_TST2	23/07/2009	18:40:33	72°00.300'	14°43.573'
169-1	231	ARK-24/2_169-1_TST3	24/07/2009	04:38:16	72°00.312'	14°43.614'
169-1	231	ARK-24/2_169-1_TST4	24/07/2009	04:54:23	72°00.312'	14°43.617'
169-1	231	ARK-24/2_169-1_TST5	24/07/2009	05:09:44	72°00.306'	14°43.641'
169-1	231	ARK-24/2_169-1_TST6	24/07/2009	05:56:27	72°00.264'	14°43.584'
176-1	233	ARK-24/2_176-1_TST1	26/07/2009	00:09:24	72°00.294'	14°43.560'
176-1	233	ARK-24/2_176-1_TST2	26/07/2009	03:14:53	72°00.309'	14°43.556'
176-1	233	ARK-24/2_176-1_TST3	26/07/2009	07:04:39	72°00.262'	14°43.560'E

The temperature of the bottom water was recorded at an interval of 5 seconds during each ROV on HMMV dive using an autonomous temperature logger mounted on the frame of the ROV. The resulting temperature time series will be georeferenced using the ROV navigation data.

Preliminary results

The equilibrium temperatures for all *in-situ* sediment temperature measurements will be calculated by extrapolation from the recorded data. Preliminary results of the data obtained from the heat flow probe reveal the highest sediment temperatures close to the geometrical centre of the mud volcano and thus confirm the location of the hot spot identified during previous cruises. However, the very high sediment temperatures of more than 30° C at less than 2 m below the seabed exceed the range of previous observations by several degrees, which suggests that the Håkon Mosby Mud Volcano has been unusually active in the recent past.

The bottom water temperatures recorded during the ROV dives are around -0.8° C and are most likely influenced by variations due to changing currents. Detailed statistical analyses of the time series with respect to ROV navigation will reveal whether seepage from the mud volcano is sufficiently high to create a temperature anomaly in the bottom water.

10.3 Biogeochemical and microbiological studies at HMMV

Volker Asendorf[1], Antje Boetius[1], Dirk de Beer[1], Marianne Jacob[1], Petra Pop Ristova[1], Rafael Stiens[1], Erika Weiz[1], Frank Wenzhöfer[1], Ulrich Hoge[2]

[1]MPI MM
[2]Alfred-Wegener-Institut, Bremerhaven

Objectives

Microbially mediated anaerobic oxidation of methane (AOM) with sulfate as electron acceptor is the major biogeochemical process at cold seep ecosystems, resulting in carbonate and sulfide production. At the Håkon Mosby Mud Volcano, differences in fluid flow velocity determine the upward methane flux and the downward sulfate penetration into the sediment, causing different colonization patterns. During the cruise ARK-XXIV/2 we focused mainly on sampling of the area surrounding the LOOME observatory, including the hot spot area, the close by edge of the mud flow covered by dense, white Beggiatoa mats (Table 10.4), as well as the southern boundaries of the hot spot muds and the geographical center of the HMMV. The main questions for biogeochemical and ecological investigations carried out at MPI are:

- Where are the hot spots of methane efflux and turnover at the HMMV?
- How much methane is oxidized in the hot spot sediments?
- What are the dominant microbial populations in the fresh mud flow and do they change over time?
- What are the rates of methane conversion and primary production?

Work at sea

Our methods for examining the sediment and its colonization by microorganisms concentrated on rate measurements of AOM and sulfate reduction, as well as porewater extractions and sampling for microbial diversity patterns. Multicorer and pushcore samples taken by the ROV were used to extract porewater, measure methane oxidation and sulfate reduction rates, and for sampling the microbial assemblages. Porewater was fixed for measuring H_2S, SO_4^{2-}, nutrients and Dissolved Inorganic Carbon (DIC). Sediment was sampled to measure the concentration of methane in the sediment. The Insinc (*in-situ* incubator, MPI) device was used to measure sulfate reduction under *in-situ* conditions at the hot spot area. To measure sulfate reduction and methane oxidation rates, replicate sub cores (Ø 2.5 cm) were sampled immediately from the sediments after their recovery. Radiotracer labelled substrate was injected in 1 cm intervals through small, silicon sealed holes. Sediments were incubated with either $14CH_4$ or $35SO_4^{2-}$ for 12 hrs at *in-situ* temperature under anaerobic conditions and then fixed in NaOH and Zn-Ac, respectively, for further measurements of remaining substrate and product activity. For bacterial counts, 2.5 ml of sediment volume were fixed in 9 ml of 2 % formalin in seawater for 2 – 4 h. These samples await further analyses in the home laboratory. Subsamples for fluorescent *in-situ* hybridization (FISH) were taken, washed and fixed in 2 ml of a 1:1 (v:v) solution of Et-OH:1*PBS (50 % final concentrations) to be kept at –20 °C until further analyses in the home laboratory. For DNA/RNA methods, fresh sediment was frozen at –20 °C and -80 °C until further analysis in Bremen. Furthermore we sampled grey mats from the hummocky siboglinid habitat for an assessment of the diversity of sulfide oxidizing bacteria.

Tab. 10.4: Biogeochemical sampling

Mission PS74	Gear/ Dive	Date	Site description	Longitude N	Latitude E	Depth m	Investigations
136	TV-MUC	20.07.2009	Pogonophora site	72° 00.274'	014° 43.058'	1265	AOM, SRR, DNA, Porosity, Porewater, Nutrients, DIC, AODC, FISH, Sulfate/Sulfide, Methane, RNA
168	TV-MUC	23.07.2009	Central site	72° 00.285'	014° 43.575'	1265	AOM, SRR, DNA, Porosity, Porewater, Nutrients, DIC, AODC, FISH, Sulfate/Sulfide, Methane, RNA, Cultivation (IFREMER)
169	ROV Dive 231	23.07.2009	Central site	72° 00.30'	014° 43.58'	1282	AOM, SRR, DNA, Porosity, Porewater, Nutrients, DIC, AODC, FISH, Sulfate/Sulfide, Methane, RNA, Cultivation (IFREMER)
172	ROV Dive 232	24.07.2009	White Bacterial mat (near the hotspot)	72° 00.31'	014° 43.58'	1280.5	AOM, SRR, DNA, Porosity, Porewater, Nutrients, DIC, AODC, FISH, Sulfate/Sulfide, Methane, RNA
176	ROV Dive 233	25.07.2009	Grey bacterial Mat	72° 0.36'	014° 43.725	1282	whole Push Core will be taken home
189	TV-MUC	29.07.2009	Central site	72° 0.24'	014° 43.50'	1282	Cultivation (IFREMER)

The grey mats were found previously to host an enormous variety of giant sulfide oxidizing bacteria, including Beggiatoa and Thiomargarita populations. These very large bacteria oxidize sulfide to sulfur and sulfate, using either nitrate or oxygen. Furthermore, we sampled different sites of the fresh hot spot mud flow and the surrounding center sediments for further cultivation studies at IFREMER.

Microprofiles

Dirk de Beer[1], Petra Pop Ristova[1], Frank Wenzhöfer[1], Ulrich Hoge[2]
[1]MPI MM
[2]Alfred-Wegener-Institut, Bremerhaven

During this cruise the first successful microprofile measurements were conducted in the hot spot, where earlier attempts failed due to the very irregular and soft sediments. The microsensor measurements (for positions see Table 10.1), were focused on the hot spot, Beggiatoa mats and the geographical center. The results showed in the hot spot a strong T-gradient, a low pH, absence of free sulfide and no clear redox signal. Under Beggiatoa mats the pH gradient is less pronounced, and high sulfide levels were detected. In the geographical center, earlier thought to be the most geologically active spot, the T- and pH gradients were lower than the hot spot. Interestingly, the strongest ORP effects were found in the Beggiatoa mats, due to the sulfide production. According to these measurements, Beggiatoa mats are a more reduced environment than the active- and the geographic center. The volcano expels an acidic, methane rich and sulfate free liquid, which cannot react with ORP sensors.
To investigate the oxygen consumption as well as the small-scale variability of the oxygen distribution within the sediment a free-falling lander was deployed at a reference site (N 71°0.26, E 14°43.58, water depth 1,285 m). The lander was equipped with 11 oxygen microsensors. The sensor array is able to move vertically (100 - 200 μm steps) as well as horizontally (x-axis: 4.5 cm steps and y-axis: 20 cm steps) to cover an area of approx. 1,500 cm^2. Additionally still pictures of the investigated area were taken over the measurement time of approx. 20 hours.

Primary production

Dirk de Beer, Rafael Stiens, Volker Asendorf
MPI MM

In-situ ^{13}C DIC incubations were made with INSINC, placed in Beggiatoa mats (Table 10.1). These chemoautotrophic communities are the basis of the food web in the volcano, and the source of the rich benthic community. The samples were fixed on board and will be analysed further.

The hypothesis was tested that the abundant life in the deep sea volcanoes can be detected by elevated bioluminescence of the benthic and near surface organisms. Using a photon counter, equipped with a filter wheel, the production of light and its rough spectrum, in and around the Håkon Mosby Mud Volcano was studied.

Transects were made across the volcano were made from SE to NW, and SW to NE. The photon counter was trawled at 15 - 20 m from the sea bottom, measuring without light filters. At ecologically interesting sites 1 hour long spectra were measured. Vertical profiles of luminescence were made, from the hot spot upwards while staying in the gas flare, and upstream of the mud volcano, both from the bottom to 200 – 150 m depth, where the sensor became saturated. The light levels near the seafloor were so low (less than 105 per minute), that photon counting reaches the limits of statistical soundness. Light events came in bursts. However, it was evident that the wave lengths were below 600 nm, and, surprisingly, a large fraction of the light is in the UV range, below 400 nm. An elevated near-benthic bioluminescence was observed down-stream of the mud volcano, but in the mud volcano and upstream of the volcano bioluminescence is low. The vertical profiles confirmed a relatively low benthic luminescence in the volcano. Closer to the surface light increased, a constant and high level of bioluminescence was observed from 1,000 to 400 m depth, above which downwelling light was dominant. Thus sunlight in these regions reaches 400 meter depth. Luminescence was identical in the methane plume and the reference site. We concluded that bioluminescence detection by trawling seems not useful to detect cold seeps. It is still of interest to design a system that can detect light from the seafloor, e.g. by 24 hour observatories.

Benthic Chamber – in-situ *investigations of total oxygen, methane and sulfide fluxes*
Frank Wenzhöfer, Petra Pop-Ristova, Volker Asendorf
MPI MM

Benthic chambers follow the total exchange of solutes through the sediment water interface over time in an enclosed water volume overlying the sediment. Therefore small support frames, capable of being operated by ROV's, are equipped with a circular (ID 19 cm) chamber to cover a larger area. The O_2 and H_2S concentration of the enclosed water is followed continuously by mini-electrodes and optodes while other compounds (DIC, methane, nutrients) will be analyzed on retrieved water samples taken at pre-programmed time intervals during the incubation.

The benthic chamber was successfully deployed 3 times during this cruise (Table 10.5). We were able to measure the total oxygen consumption as well as methane release from the hot center area and Beggiatoa site.

Tab. 10.5: Chamber measurements

Dive	Site	Position	
		Longitude	Latitude
# 233	Hot spot	N 72° 00.2972	E 014° 43.5778
# 234	Hot spot	N 72° 00.2588	E 014° 43.5769
# 235	Beggiatoa mat	N 72° 00.3120	E 014° 43.5840

10.4 Degradation of terrestrial matter

Larval settling

Amandine Nunes-Jorge
University Paris

Objectives

The participation of UMR 7138 in the ARK-XXIV/2 cruise fits into two research projects: DIWOOD and CHEMECO. They aim to study the colonization of sunken wood in order to describe the degradation of wood, the diversity of the associated fauna and its dynamic, and also the influence of physico-chemical factors on these ecosystems. In the frame of these two programmes, the AMEX French research team has been developing colonization devices called CHEMECOLIs (**chem**osynthetic **e**cosystem **co**lonization device for **l**arvae of **i**nvertebrates) which were deployed and recovered in several reduced ecosystems such as hydrothermal vents (Mid- Atlantic Ridge), whale falls (Japan) and cold seeps (Håkon Mosby Mud Volcano, Eastern Mediterranean sea). They are cylindrical plastic nets which mesh allows only the larvae to come in, covered by PVC rings containing three kinds of substrates: wood cubes, carbonates cubes and grass. The objectives for this cruise was to recover some CHEMECOLIs and sample some Pogonophorans. Deployment and retrieval dates are summarized in Table 10.6.

Work at sea

We recovered the CHEMECOLIs H1 to H3 which had been deployed in 2007 in a pogonophoran field, and recovered during this cruise. They were sorted out to dispatch the substrates into different fixatives depending on the analysis to perform later. The diversity of free and symbiotic bacteria will be investigated by Fluorescence In-situ Hybridization (FISH). Diversity and morphological analyses of macroorganisms will also be performed. Eventually, observations of the decomposition of wood under Scanning and Transmission Electronic Microscope (SEM and TEM) will be made. We also sampled pogonophorans to investigate the reproduction and dispersion of these organisms by MUC and push cores. They were sorted out from the sediment and preserved to analyse their morphology and their eggs and symbiotic bacteria contents.

Preliminary results

From the exterior the pine cubes seemed not degraded with their shape quite equal as the one they had before the deployment. However, inside the cubes lived a lot of teredinids bivalves. These bivalves are able to “eat” wood thanks to symbiotic bacteria. The wood cubes are usually more degraded than the grass. It wasn’t the case here since there was almost no grass left in the colonizer. Some tubes, probably from polychaete, were also found. They were made of mud and grass fibres.

The pogonophorans collected were *Sclerolinum contortum* and *Oligobrachia haakonmosbiensis*. The curly anterior parts of *Sclerolinum contortum* appeared like numerous knots at the surface of the sediment, what made their individualization impossible. The rest of their body, straight, was deeply inserted in the sediment. Unfortunately there was no success in removing any of them from their tube and no eggs and larvae could be collected or observed.

Tab. 10.6: Wood colonization and degradation experiments

Sample	Depth (m)	Latitude N	Longitude E	
H1-3 Chemecoli	1259	72° 00.33	14° 43.22	deployed 1/7/2007, retrieved 20/7/2009 dive 231
PC	1259	72° 00.33	14° 43.22	next to Chemecoli, Pogonophorans
MUC	1259	72° 00.28	14° 43.36	Pogonophorans
Wood 1	1259	72° 00.39	14° 43.63	deployed 1/7/2007, retrieved 20/7/2009
Wood 2	1259	72° 00.38	14° 43.1	deployed 1/7/2007, retrieved 20/7/2009

Wood colonization

Petra Pop Ristova
MPI MM

Objectives

Sunken woods, similar to whale carcasses provide concentrated packages of high-quality organic carbon to the seafloor. Even though these organic falls are unpredictable in time and space, yet they are quickly located and colonized by specialized opportunistic faunas. Degradation processes can lead to oxygen depletion, followed by anaerobic degradation and development of reducing conditions with high concentrations of sulphide. Such environmental conditions favour establishment of chemosynthetic communities. Smith et al. (1989) proposed a hypothesis that these wood-related chemosynthetic communities could, in an evolutionary context, act as stepping-stones in the adaptation and dispersal of chemoautotrophic communities found at hydrothermal vents and cold seeps. Up to date, the microbial diversity on large organic falls has not been extensively studied and very little is known about the structure of the microbial communities found on wood falls. Important questions are: When and how do sulphidic environments develop? Which microorganisms colonize the wood and what is the function of microbial communities in the wood degradation? Comparing sunken woods deployed in different oceans and in various habitats we would try to answer some of the above questions.

Work at sea

Sunken wood samples from the Håkon Mosby Mud Volcano were recovered during this cruise. The two wood parcels were deployed in 2007 (Table 10.7). Wood parcels consist of one large log (200 cm length and 30 cm diameter) and 10 smaller logs (25 x 30 cm x 10 - 15 cm) of Douglas fir. The wood parcels were sampled with the help of the ROV. On board the recovered woods were stored in seawater at 0° C and subsampling was carried out at *in-situ* temperature of 4° C. From each wood log, 6 subsamples were taken, 3 from the surface (0 – 2 cm) and 3 from the inside wood (2 - 4 cm). Furthermore, wood subsamples were fixed for different molecular analyses e.g. automated ribosomal intergenic spacer analysis (ARISA) Fluoresence *In-situ* Hybridization (FISH) and Acridine Orange Direct Counts (AODC) in the home laboratory. First observations revealed that both woods were highly degraded and had low macrofaunal diversity. The whole inner part of the woods was crowded with siphon shells of bivalves, most probably Xylophaga sp.

Reference

Smith C.R, Kukert H., Wheatcroft R.A, Jumars P.A. and Deming J.W. 1989 Vent fauna on whale remains. Nature 341: 27-28

11. CULTURE EXPERIMENTS ON THE $\delta^{13}C$ VALUES RECORDED IN TESTS OF BENTHIC FORAMINIFERA FROM METHANE SOURCES AT THE HÅKON MOSBY MUD VOLCANO (HMMV)

Jutta Wollenburg, Reinhold Petereit, Christopher Brons-Illing
Alfred-Wegener-Institut, Bremerhaven

Objectives

Whether the $\delta^{13}C$ value recorded in tests of benthic foraminifera is a valid tool for identifying potential sources of submarine methane release to the atmosphere is heavily discussed and will be verified by our project. Our strategy includes (1) to sample and examine the isotopic signature of live benthic foraminifers and environmental water mass properties from the Håkon Mosby Mud Volcano, (2) to retrieve live benthic foraminifers under *in-situ* conditions using a newly developed autoclave system allowing methane–related cultivation experiments under original pressure conditions and (3) to run similar experiments on mesocosms kept under atmospheric pressure. During the experiments each aquarium (autoclaves and mesocosms) will be flushed by either 99 % $\delta^{13}C$- or > 99 % $\delta^{12}C$-methane enriched bottom water to study the influence of methane on the $\delta^{13}C$ values of calcareous benthic foraminiferal test.

Work at sea/preliminary results

We have successfully operated and filled 3 autoclaves with samples from siboglinoid tube worm (pogonophora) fields, that our now cultured at an *in-situ* pressure of 128 - 130 bar. For comparison, additionally 18 multiple core liners were transferred into mesocosms and are now cultured under atmospheric pressure. Analyses on newly formed tests will start approximately 6 months after the expedition. The obtained results will be compared to results of comparable experiments from July 2007 to March 2009.

12. TESTING OF AN AUTONOMOUS UNDERWATER VEHICLE (AUV) AND A NEWLY DEVELOPED WATER SAMPLER AT THE HAUSGARTEN AND HÅKON MOSBY MUD VOLCANO (HMMV)

Ulrich Hoge[1], Michael Klages[1], Sascha Lehmenhecker[1], Thorben Wulff[1], Kimberly Shourn[2]

[1] Alfred-Wegener-Institut
[2] Bluefin Robotics MA, USA

Objectives

In 2008 the AUV from the AWI was updated with an Kearfott Initial Navigation System (INS). Major aims of the AUV operations on ARK-XXIV/2 cruise were, (1) to test and to study the behaviour of the INS high latitudes e.g. arctic regions, (2) to practise mission planning, (3) to test and train launch and recovery procedures of the AUV.

An additional purpose of the AUV test operations was to study a newly developed water sample collector. The sample collector is integrated in the payload section of the AUV and offers the possibility to gather a maximum of eleven samples (each 220 ml). The water samples are enclosed under high purity conditions and returned to the surface by the AUV to allow further scientific analysis. The particular goal concerning the sample collector was to prove its applicability under the harsh conditions of a polar deep sea environment.

Work at sea/preliminary results

We had 3 dives during the cruise at *HAUSGARTEN* area and 2 at the Håkon Mosby Mud Volcano (HMMV). The first dive (PS74/110-1) was a test to check for ground faults. The second (PS74/114-1) was a pressure test. For this purpose the AUV was lowered to a seven hundred meter depth using one of shipboard winches. The AUV was held at a seven hundred meter depth for an hour before recovery. No ground faults occurred during the depth test and all other systems components worked properly.

Due to high sea state the third dive (PS74/130-1) had to be stopped, because the vehicle was unable to collect GPS data. At the fourth dive (PS74/173-1) the recovery caused a damage to the tailcone, this damage had occurred during the launch. The intention of the last dive (PS74/114-1) was to descend to 500 m in a spiral shaped track, followed by a 1,000 m trackline (heading 230°) and to ascend back to surface with spiral performance. Even though we improved the launch and recovery procedure. The first impression of the data produced by the INS showed a good reliability. After these missions the function of the software was improved. Loading bathymetry charts processed onboard by FIELAX personnel into the mission planner were successful.

Based on these experiences the best procedure was determined for future operations on *Polarstern*.

The AUV and the sample collector completed three dives down to a maximum depth of 700 meters.

Due to difficulties in electronics the actual collecting of sample material was successfully executed once (PS74/0114-1). In this particular dive, water samples were collected at a depth of 500 meters.

During the tests, neither low temperatures nor the pressure caused any kind of noticeable negative effects on the sample collector. All functional tests were finished satisfactory.

The samples will be further analysed lateron at the institute (dissolved organic carbon, inorganic dissolved nutrients).

Date	Time	Station PS74	Latitude N	Longitude E
7/13/2009 (start)	07:36:00	110-1	79° 11.30'	8° 10.27'
7/13/2009 (end)	09:24:59	110-1	79° 12.16'	8° 09.67'
7/14/2009 (start)	11:51:00	114-1	79° 03.67'	3° 39.72'
7/14/2009 (end)	14:37:59	114-1	79° 03.88'	3° 39.59'
7/18/2009 (start)	12:18:00	130-1	78° 51.53'	6° 28.65'
7/18/2009 (end)	13:00:59	130-1	78° 51.21'	6° 30.94'
7/25/2009 (start)	07:44:00	173-1	72° 00.34'	14° 43.56’
7/25/2009 (end)	08:02:59	173-1	72° 00.23'	14° 43.92'
7/28/2009 (start)	12:00:00	186-1	71° 57.64'	14° 49.81'
7/28/2009 (end)	13:26:59	186-1	71° 56.73'	14° 49.40'

APPENDIX

A.1 PARTICIPATING INSTITUTIONS

A.2 CRUISE PARTICIPANTS

A.3 SHIP'S CREW

A.4 STATION LIST

A.1 PARTICIPATING INSTITUTIONS

Abkürzung	**Beruf / Profession**
AWI	Alfred-Wegener-Institut für Polar- und Meeresforschung in der Helmholtz-Gemeinschaft Postfach 12 01 61 27515 Bremerhaven /Germany
Bluefin Robotics	Bluefin Robotics Bluefin Robotics Corporation 237 Putnam Avenue Cambridge, MA 02139 / USA
DWD	Deutscher Wetterdienst Geschäftsbereich Wettervorhersage Seeschifffahrtsberatung Bernhard Nocht Str. 76 20359 Hamburg / Germany
FIELAX	FIELAX Gesellschaft für wissenschaftliche Datenverarbeitung mbH Schifferstraße 10 – 14 27568 Bremerhaven / Germany
IFM-GEOMAR	Leibniz Institute für marine Sciences, University of Kiel Wischhofstrasse 1 – 3, 24148 Kiel/ Germany
IFREMER	Institut français de la mer BP 70 29280 Plouzane / France
Laeisz	Reederei F. Laeisz (Bremerhaven) GmbH Brückenstrasse 25 27568 Bremerhaven / Germany
MARUM	MARUM - University of Bremen Leobener Strasse 28359 Bremen / Germany
MPI MM	Max Planck Institute for Marine Microbiology Celsiusstr. 1 28359 Bremen / Germany

Abkürzung	Beruf / Profession
Senkenb.	Forschungsinstitut und Naturmuseum Senckenberg Marine Evertebraten Senckenberganlage 25 D-60325 Frankfurt a.M. / Germany
University Paris	Université Pierre et Marie Curie Equipe Adaptation et évolution en milieux extrêmes UMR 7138 UPMC CNRS IRD MNHN laboratoire Systématique Evolution Adaptation Bâtiment A 2ème étage salle 214A quai St Bernard 75252 Paris cedex 05 / France

A.2 CRUISE PARTICIPANTS

Name	Vorname/ First Name	Institut/ Institute	Beruf / Profession
Albrecht	Sebastian	Fielax	technical assistant
Asendorf	Volker	MPI Bremen	engineer
Bauerfeind	Eduard	AWI	biologist
Blandin	Jerome	Ifremer Plouzane	engineer
Boetius	Antje	MPI Bremen	biologist
Brons-Illing	Christopher	AWI	student, maritime technol.
de Beer	Dirk	MPI Bremen	biologist
Dillon	Melanie	Fielax	geophysist
Feseker	Tomas	IfM GEOMAR	geologist
Händel	Nicole	AWI	engineer
Harmengies	Francois	Ifremer Plouzane	engineer
Hasemann	Christiane	AWI	biologist
Hoge	Ulrich	AWI	engineer
Jacob	Marianne	MPI Bremen	biologist
Janussen	Dorte	Senckenberg	biologist
Klages	Michael	AWI	biologist
Kopiske	Eberhard	MARUM	physicist
Kreutzmann	Christian	DWD	meteorologist
Legrand	Julien	Ifremer Plouzane	engineer
Lehmenhecker	Sascha	AWI	engineer
Licht	Annika	AWI	apprentice
Lochthofen	Normen	AWI	engineer
Mai (Mr.)	Hoang Anh	MARUM	mechanician
Metfies	Katja	AWI	biologist
Meyer	Jörn Patrick	MPI Bremen	technical assistant
Nunes-Jorge	Amandine	UMPC Paris	biologist
Olonscheck	Dirk	AWI	student apprentice

Name	Vorname/ First Name	Institut/ Institute	Beruf / Profession
Petereit	Reinhold	AWI	metalworker
Pop Ristova	Petra	MPI Bremen	biologist
Ratmeyer	Volker	MARUM	geologist
Rehage	Ralf	MARUM	technician
Reuter	Christian	MARUM	geologist
Reuter	Michael	MARUM	technician
Sablotny	Burkhard	AWI	engineer
Schkel	Vitali	MARUM	student physics
Shourn	Kim	BluefinRobotics	technician
Siegmund	Ann-Kristin	Fielax	technician
Simon	Stephanie	AWI	student, biology
Soltwedel	Thomas	AWI	biologist
Sonnabend	Hartmut	DWD	technician
Stiens	Rafael	MPI Bremen	technician
Viehweger	Marc Simon	MPI Bremen	technician
von Deylen	Christopher	Sleepingr.Musik	composer
Weiz	Erika	MPI Bremen	technician
Wenzhöfer	Frank	MPI Bremen	biologist
Wetzel	Gero	IfM GEOMAR	engineer
Wollenburg	Jutta	AWI	geologist
Wulff	Thorben	AWI	engineer
Wurst	Mascha	AWI	environment. scientist
Zarrouk	Marcel	MARUM	engineer

A.3 SHIP'S CREW

No.	Name	Rank
01.	Schwarze, Stefan	Master
02.	Ettlin, Margrith	1.Offc.
03.	Krohn, Günter	Ch. Eng.
04.	Fallei, Holger	2.Offc./L.
05.	Peine, Lutz G.	2.Offc.
06.	Dugge, Heike	3.Offc.
07.	Heine, Werner	Doctor
08.	Hecht, Andreas	R.Offc.
09.	Minzlaff,Hans-Ulrich	2.Eng.
10.	Sümnicht, Stefan	2.Eng.
11.	Schaefer, Marc	3.Eng.
12.	Scholz, Manfred	Elec Eng.
13.	Dimmler, Werner	ELO
14.	Himmel, Frank	ELO
15.	Muhle, Helmut	ELO
16.	Winter, Andreas	ELO
17.	Loidl, Reiner	Boatsw.
18.	Reise, Lutz	Carpenter
19.	Bäcker, Andreas	A.B.
20.	Brickmann, Peter	A.B.
21.	Guse, Hartmut	A.B.
22.	Hagemann, Manfred	A.B.
23.	Scheel, Sebastian	A.B.
24.	Schmidt, Uwe	A.B.
25.	Wende, Uwe	A.B.
26.	Winkler,Michael	A.B.
27.	Preußner, Jörg	Storek.
28.	Elsner, Klaus	Mot-man
29.	Pinske, Lutz	Mot-man
30.	Schütt, Norbert	Mot-man
31.	Teichert, Uwe	Mot-man
32.	Voy, Bernd	Mot-man
33.	Müller-Homburg, R.-D	Cook
34.	Silinski, Frank	Cooksmate
35.	Völske, Thomas	Cooksmate
36.	Jürgens, Monika	1. Stewardess

No.	Name	Rank
37.	Wöckener, Martina	Stwdss/Kr
38.	Czyborra, Bärbel	2.Stwdess
39.	Gaude, Hans-Jürgen	2.Steward
40.	Huang, Wu-Mei	2.Steward
41.	Möller, Wolfgang	2.Steward
42.	Silinski, Carmen	2.Stwdess
43.	Yu, Kwok Yuen	Laundrym
44.	Junge, Johannes	Apprent.
45.	Schliffke, Benyamin	Apprent.

A.4 ABSTRACTS HMMV DIVES # 230 - 235

Dive 230

The objectives of this dive were to locate the LOOME deployments from the Jan Mayen Mission in 2008, including the IFREMER T lance, Piezometer and the University of Tromsø OBS. With the help of the sonar we could rapidly locate both the T lance and Piezometer, which were only 2 m apart. Also, a sample of siboglinid tubeworms and their associated fauna was taken for autoclave sampling. At the end of the dive, the IFREMER T lance was recovered by the ship's winch with the help of QUEST. Unfortunately, the Piezometer was dragged away from its mooring site and could not be recovered during this dive.

Dive 231

This dive was dedicated to reconnaissance tasks, foremost the identification of a place for the deployment of LOOME in the vicinity of the hot spot north of the geographical center. The hot spot sediments were sampled with push cores, surface temperature measurements were carried out with the T stick. Also the "Chemecoli" experiments were recovered in the wood box, and two more pushcores were sampled next to the experiments. To decide on the angle of the LOOME sonar we searched for free gas by using the sonar of QUEST. Very close to this area, gas ebullition was observed along a ca 1 m deep trough between the fresh mud flow and the old seafloor. Very slowly, single gas bubbles emerge from holes in the seafloor. The trough was covered with a bacterial mat and marked for the deployment of the long term camera, the bacterial mats were sampled with pushcores. The boundaries of the fresh mud flow were investigated during an overflight, combined with additional T stick measurements. A large mud structure (ca 1.5 m) was observed which was formed by gas hydrate and gas bubbles emanating from the sediments.

Dive 232

Dive 232 was dedicated to the deployment of the LOOME observatory. The ROV QUEST repositioned LOOME to the chosen site after cutting off deployment weights, and directed the sonar for a 180° overview of the southern section of the HMMV where several gas flares were detected during this cruise. Eight sensor strings of up to 100 m length were paid out afterwards across the hot spot towards the geographical center of the HMMV. Finally, the underwater communication tests with

COSTOFF were carried out. The remainder of the dive was used to produce high quality documentation by HD video and digital photography of the entire observatory and the surrounding environment. Furthermore, the bacterial mats close to the observatory were sampled by push coring. Also we spent some time to search for the piezometer but could not locate it.

Dive 233

We deployed the IFREMER AIM long-term camera 15 m away from the LOOME control node, facing the bacterial mat covered trough where gas bubbles emanate from under the mud flows. After a few problems with positioning and the underwater programming, the camera was finally started. INSINK was used to measure autotrophic carbon uptake into bacterial biomass close to the camera site. Furthermore, we used the lift to deploy the benthic chamber on the hot spot area, and the profiler for measurements at the hot spot area, the end of the LOOME strings and the bacterial mat. The OBS was searched north of its deployment spot but was not located during this dive.

Dive 234

During dive 234 we planned to sample for several experiments, namely the two sunken-wood experiments deployed in 2007, as well as two more cores for the high pressure cultivation of foraminifera associated to the siboglinid tubeworms. In addition, another benthic chamber measurement was carried out at the end of the LOOME sensor strings close to the southern boundary of the fresh mud flow. On the way to the wood sampling we found the piezometer mooring, so another highlight of the dive was its recovery by the joint ship – ROV operation. The new long term T lance mooring of IFREMER was found and filmed by the ROV (center of the HMMV).

Dive 235

The final dive at LOOME was dedicated to a further testing of the function of the long term camera AIM, as well as further measurements with the profiler and the benthic chamber. The profiler was repeated at the bacterial mats, the hot spot site and was also placed close to the geometric center of the HMMV. The benthic chamber was incubated on the bacterial mats. We also achieved two short videomosaicks in the north south direction to investigate the seafloor structure associated with the fresh mud flow. The hot spot was sampled with INSINKS and the long term INSINK incubation on the bacterial mats was recovered. Also the new OBS deployment was found.

A.5 STATION LIST PS 74

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
11.07.2009	05:43:00	PS74/0097-1	HF	78° 24.52' N	9° 6.22' E	1015
11.07.2009	05:57:00	PS74/0097-1	HF	78° 24.72' N	9° 5.91' E	1011
11.07.2009	06:04:00	PS74/0097-1	HF	78° 24.81' N	9° 5.74' E	1009
11.07.2009	06:36:00	PS74/0097-1	HF	78° 24.77' N	9° 5.90' E	1007
11.07.2009	07:00:00	PS74/0097-1	HF	78° 24.83' N	9° 5.78' E	1007
11.07.2009	07:07:00	PS74/0097-1	HF	78° 24.84' N	9° 5.78' E	1006
11.07.2009	07:24:59	PS74/0097-1	HF	78° 24.81' N	9° 5.87' E	1006
11.07.2009	08:50:00	PS74/0098-1	HF	78° 34.95' N	9° 18.18' E	462
11.07.2009	09:00:00	PS74/0098-1	HF	78° 34.94' N	9° 18.15' E	462
11.07.2009	09:15:00	PS74/0098-1	HF	78° 34.94' N	9° 18.10' E	463
11.07.2009	09:28:59	PS74/0098-1	HF	78° 34.95' N	9° 17.93' E	468
11.07.2009	09:58:00	PS74/0099-1	HF	78° 35.23' N	9° 22.90' E	428
11.07.2009	10:07:00	PS74/0099-1	HF	78° 35.24' N	9° 23.06' E	427
11.07.2009	10:20:00	PS74/0099-1	HF	78° 35.24' N	9° 23.06' E	427
11.07.2009	10:24:00	PS74/0099-1	HF	78° 35.23' N	9° 22.99' E	427
11.07.2009	10:30:59	PS74/0099-1	HF	78° 35.24' N	9° 23.17' E	426
11.07.2009	10:50:00	PS74/0100-1	HF	78° 35.38' N	9° 25.14' E	408
11.07.2009	10:57:00	PS74/0100-1	HF	78° 35.36' N	9° 25.15' E	410
11.07.2009	11:10:00	PS74/0100-1	HF	78° 35.37' N	9° 25.15' E	409
11.07.2009	11:14:00	PS74/0100-1	HF	78° 35.37' N	9° 25.15' E	409
11.07.2009	11:20:59	PS74/0100-1	HF	78° 35.37' N	9° 25.22' E	408
11.07.2009	11:37:00	PS74/0101-1	HF	78° 35.53' N	9° 27.20' E	388
11.07.2009	11:42:00	PS74/0101-1	HF	78° 35.52' N	9° 27.21' E	387
11.07.2009	11:57:00	PS74/0101-1	HF	78° 35.52' N	9° 27.17' E	389
11.07.2009	12:00:00	PS74/0101-1	HF	78° 35.51' N	9° 27.19' E	389
11.07.2009	12:06:59	PS74/0101-1	HF	78° 35.48' N	9° 27.20' E	388
11.07.2009	12:21:00	PS74/0102-1	HF	78° 35.62' N	9° 28.56' E	-
11.07.2009	12:26:00	PS74/0102-1	HF	78° 35.61' N	9° 28.63' E	358
11.07.2009	12:38:00	PS74/0102-1	HF	78° 35.61' N	9° 28.58' E	360
11.07.2009	12:42:00	PS74/0102-1	HF	78° 35.63' N	9° 28.58' E	359
11.07.2009	12:58:59	PS74/0102-1	HF	78° 35.44' N	9° 28.60' E	362
11.07.2009	19:20:00	PS74/0103-1	LANDER	79° 4.62' N	4° 6.17' E	2508
11.07.2009	19:58:00	PS74/0103-1	LANDER	79° 4.71' N	4° 7.33' E	2490
11.07.2009	20:22:01	PS74/0103-1	LANDER	79° 4.56' N	4° 5.53' E	2515
11.07.2009	20:22:59	PS74/0103-1	LANDER	79° 4.56' N	4° 5.53' E	2515
11.07.2009	20:54:00	PS74/0104-1	CTD/RO	79° 4.08' N	4° 11.56' E	2449
11.07.2009	21:18:00	PS74/0104-1	CTD/RO	79° 4.03' N	4° 11.77' E	2448

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
11.07.2009	21:23:00	PS74/0104-1	CTD/RO	79° 3.97' N	4° 11.83' E	2450
11.07.2009	21:42:59	PS74/0104-1	CTD/RO	79° 3.93' N	4° 11.64' E	2454
12.07.2009	00:06:00	PS74/0105-1	CTD/RO	79° 8.05' N	2° 50.04' E	5577
12.07.2009	01:29:00	PS74/0105-1	CTD/RO	79° 7.93' N	2° 48.90' E	5578
12.07.2009	01:55:00	PS74/0105-1	CTD/RO	79° 7.80' N	2° 49.22' E	5569
12.07.2009	03:17:00	PS74/0105-1	CTD/RO	79° 7.38' N	2° 49.29' E	5512
12.07.2009	03:18:59	PS74/0105-1	CTD/RO	79° 7.37' N	2° 49.31' E	5512
12.07.2009	03:32:00	PS74/0105-2	MUC	79° 7.97' N	2° 48.42' E	5575
12.07.2009	04:55:00	PS74/0105-2	MUC	79° 7.84' N	2° 47.39' E	5531
12.07.2009	05:07:00	PS74/0105-2	MUC	79° 7.86' N	2° 47.12' E	5527
12.07.2009	06:56:59	PS74/0105-2	MUC	79° 7.35' N	2° 47.18' E	5454
12.07.2009	07:05:00	PS74/0105-3	ROV	-	-	-
12.07.2009	07:06:00	PS74/0105-3	ROV	79° 7.33' N	2° 47.22' E	5453
12.07.2009	09:13:00	PS74/0105-3	ROV	79° 6.59' N	2° 45.58' E	5461
12.07.2009	09:28:00	PS74/0105-3	ROV	79° 6.50' N	2° 45.42' E	5457
12.07.2009	11:44:00	PS74/0105-3	ROV	79° 5.49' N	2° 41.19' E	5018
12.07.2009	11:44:59	PS74/0105-3	ROV	79° 5.49' N	2° 41.19' E	5018
12.07.2009	13:34:00	PS74/0106-1	CTD/RO	79° 3.61' N	3° 34.75' E	3494
12.07.2009	13:58:00	PS74/0106-2	HN	79° 3.57' N	3° 34.60' E	3471
12.07.2009	13:59:00	PS74/0106-1	CTD/RO	79° 3.57' N	3° 34.60' E	3489
12.07.2009	14:03:00	PS74/0106-2	HN	79° 3.52' N	3° 34.57' E	3498
12.07.2009	14:04:59	PS74/0106-2	HN	79° 3.51' N	3° 34.54' E	3489
12.07.2009	14:20:59	PS74/0106-1	CTD/RO	79° 3.48' N	3° 34.31' E	3516
12.07.2009	14:29:00	PS74/0106-3	MUC	79° 3.58' N	3° 35.24' E	3436
12.07.2009	15:23:00	PS74/0106-3	MUC	79° 3.42' N	3° 34.27' E	3535
12.07.2009	15:24:00	PS74/0106-3	MUC	79° 3.42' N	3° 34.25' E	3564
12.07.2009	16:36:59	PS74/0106-3	MUC	79° 3.09' N	3° 33.49' E	3555
12.07.2009	18:28:00	PS74/0107-1	CTD/RO	79° 6.61' N	4° 36.42' E	1873
12.07.2009	19:10:00	PS74/0107-1	CTD/RO	79° 6.75' N	4° 33.87' E	1839
12.07.2009	19:42:59	PS74/0107-1	CTD/RO	79° 6.74' N	4° 32.82' E	2011
12.07.2009	20:02:00	PS74/0107-2	MUC	79° 6.52' N	4° 35.87' E	1881
12.07.2009	20:36:00	PS74/0107-2	MUC	79° 6.50' N	4° 35.99' E	1895
12.07.2009	20:37:00	PS74/0107-2	MUC	79° 6.49' N	4° 36.00' E	1896
12.07.2009	21:18:59	PS74/0107-2	MUC	79° 6.48' N	4° 36.35' E	1913
12.07.2009	21:54:00	PS74/0108-1	CTD/RO	79° 7.80' N	4° 54.18' E	1550
12.07.2009	22:28:00	PS74/0108-1	CTD/RO	79° 7.79' N	4° 54.27' E	1550
12.07.2009	22:55:59	PS74/0108-1	CTD/RO	79° 7.82' N	4° 54.25' E	1547
12.07.2009	23:04:00	PS74/0108-2	MUC	79° 7.79' N	4° 54.20' E	1551
12.07.2009	23:38:00	PS74/0108-2	MUC	79° 7.83' N	4° 54.16' E	1547
12.07.2009	23:39:00	PS74/0108-2	MUC	79° 7.83' N	4° 54.19' E	1547

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
13.07.2009	00:08:59	PS74/0108-2	MUC	79° 7.85' N	4° 54.41' E	1542
13.07.2009	01:43:00	PS74/0109-1	CTD/RO	79° 8.03' N	6° 6.10' E	1286
13.07.2009	02:15:00	PS74/0109-1	CTD/RO	79° 8.05' N	6° 5.74' E	1284
13.07.2009	02:40:59	PS74/0109-1	CTD/RO	79° 8.16' N	6° 5.74' E	1285
13.07.2009	02:47:00	PS74/0109-2	MUC	79° 8.09' N	6° 5.80' E	1285
13.07.2009	03:10:00	PS74/0109-2	MUC	79° 8.07' N	6° 5.79' E	1285
13.07.2009	03:38:59	PS74/0109-2	MUC	79° 8.08' N	6° 5.48' E	1283
13.07.2009	04:23:00	PS74/0109-3	LANDER	79° 8.02' N	6° 5.59' E	1282
13.07.2009	04:24:00	PS74/0109-3	LANDER	79° 8.03' N	6° 5.60' E	1282
13.07.2009	04:24:59	PS74/0109-3	LANDER	79° 8.03' N	6° 5.60' E	1282
13.07.2009	07:36:00	PS74/0110-1	AUV	79° 11.30' N	8° 10.27' E	676
13.07.2009	07:40:00	PS74/0110-1	AUV	79° 11.30' N	8° 10.18' E	677
13.07.2009	07:52:00	PS74/0110-1	AUV	79° 11.38' N	8° 9.93' E	676
13.07.2009	08:15:00	PS74/0110-1	AUV	79° 11.55' N	8° 9.86' E	676
13.07.2009	08:16:00	PS74/0110-1	AUV	79° 11.56' N	8° 9.86' E	667
13.07.2009	08:45:00	PS74/0110-1	AUV	79° 11.98' N	8° 10.77' E	660
13.07.2009	08:48:00	PS74/0110-1	AUV	79° 12.01' N	8° 10.71' E	651
13.07.2009	08:53:00	PS74/0110-1	AUV	79° 12.07' N	8° 10.75' E	632
13.07.2009	09:20:00	PS74/0110-1	AUV	79° 12.19' N	8° 9.73' E	645
13.07.2009	09:20:01	PS74/0110-1	AUV	79° 12.19' N	8° 9.73' E	645
13.07.2009	09:24:59	PS74/0110-1	AUV	79° 12.16' N	8° 9.67' E	654
13.07.2009	14:26:00	PS74/0111-1	COLOSSOS	79° 4.92' N	4° 8.09' E	2468
13.07.2009	17:31:00	PS74/0111-1	COLOSSOS	79° 4.95' N	4° 7.56' E	2475
13.07.2009	18:06:59	PS74/0111-1	COLOSSOS	79° 4.88' N	4° 7.54' E	2479
13.07.2009	18:38:00	PS74/0111-2	ROV	79° 4.89' N	4° 7.54' E	2479
13.07.2009	18:38:01	PS74/0111-2	ROV	79° 4.89' N	4° 7.54' E	2479
13.07.2009	18:44:00	PS74/0111-2	ROV	79° 4.90' N	4° 7.53' E	2478
13.07.2009	20:42:00	PS74/0111-2	ROV	79° 4.91' N	4° 7.77' E	2473
13.07.2009	22:21:00	PS74/0111-2	ROV	79° 4.93' N	4° 7.73' E	2472
13.07.2009	23:51:00	PS74/0111-2	ROV	79° 4.99' N	4° 8.08' E	2464
13.07.2009	23:51:01	PS74/0111-2	ROV	79° 4.99' N	4° 8.08' E	2464
14.07.2009	01:00:00	PS74/0111-2	ROV	79° 5.01' N	4° 7.62' E	2471
14.07.2009	01:11:59	PS74/0111-2	ROV	79° 4.81' N	4° 7.19' E	2489
14.07.2009	02:12:00	PS74/0112-1	CTD/RO	79° 3.58' N	3° 28.64' E	3997
14.07.2009	03:32:00	PS74/0112-1	CTD/RO	79° 3.53' N	3° 28.88' E	3989
14.07.2009	04:32:59	PS74/0112-1	CTD/RO	79° 3.69' N	3° 28.40' E	4002
14.07.2009	04:38:00	PS74/0112-2	MUC	79° 3.66' N	3° 28.44' E	4003
14.07.2009	05:38:00	PS74/0112-2	MUC	79° 3.63' N	3° 28.40' E	4006
14.07.2009	07:04:59	PS74/0112-2	MUC	79° 3.61' N	3° 28.57' E	4001
14.07.2009	07:30:00	PS74/0113-1	CTD/RO	79° 3.77' N	3° 39.41' E	3132

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
14.07.2009	08:40:00	PS74/0113-1	CTD/RO	79° 3.76' N	3° 39.47' E	3127
14.07.2009	09:30:59	PS74/0113-1	CTD/RO	79° 3.74' N	3° 39.36' E	3128
14.07.2009	09:40:00	PS74/0113-2	MUC	79° 3.79' N	3° 39.44' E	3118
14.07.2009	09:48:00	PS74/0113-2	MUC	79° 3.79' N	3° 39.42' E	3126
14.07.2009	09:54:00	PS74/0113-2	MUC	79° 3.79' N	3° 39.42' E	3122
14.07.2009	10:40:00	PS74/0113-2	MUC	79° 3.81' N	3° 39.57' E	3106
14.07.2009	10:41:00	PS74/0113-2	MUC	79° 3.81' N	3° 39.58' E	3119
14.07.2009	11:35:59	PS74/0113-2	MUC	79° 3.78' N	3° 39.62' E	3120
14.07.2009	11:51:00	PS74/0114-1	AUV	79° 3.67' N	3° 39.72' E	3121
14.07.2009	11:51:01	PS74/0114-1	AUV	79° 3.67' N	3° 39.72' E	3121
14.07.2009	12:50:00	PS74/0114-1	AUV	79° 3.75' N	3° 39.62' E	3114
14.07.2009	13:50:00	PS74/0114-1	AUV	79° 3.79' N	3° 39.35' E	3123
14.07.2009	13:50:01	PS74/0114-1	AUV	79° 3.79' N	3° 39.35' E	3123
14.07.2009	14:37:59	PS74/0114-1	AUV	79° 3.88' N	3° 39.59' E	3117
14.07.2009	16:21:00	PS74/0115-1	ROV	79° 4.84' N	4° 7.79' E	2476
14.07.2009	17:56:00	PS74/0115-1	ROV	79° 4.98' N	4° 8.34' E	2461
14.07.2009	17:56:01	PS74/0115-1	ROV	79° 4.98' N	4° 8.34' E	2461
14.07.2009	21:55:00	PS74/0115-1	ROV	79° 5.00' N	4° 8.36' E	2459
14.07.2009	21:55:01	PS74/0115-1	ROV	79° 5.00' N	4° 8.36' E	2459
14.07.2009	23:13:00	PS74/0115-1	ROV	79° 5.01' N	4° 8.20' E	2466
14.07.2009	23:22:59	PS74/0115-1	ROV	79° 4.82' N	4° 7.86' E	2474
15.07.2009	04:04:00	PS74/0116-1	CTD/RO	79° 43.76' N	4° 29.47' E	2734
15.07.2009	05:02:00	PS74/0116-1	CTD/RO	79° 43.63' N	4° 28.70' E	2731
15.07.2009	05:47:59	PS74/0116-1	CTD/RO	79° 43.69' N	4° 28.01' E	2710
15.07.2009	06:00:00	PS74/0116-2	MUC	79° 43.20' N	4° 28.84' E	2776
15.07.2009	06:46:00	PS74/0116-2	MUC	79° 43.04' N	4° 29.21' E	2802
15.07.2009	07:32:59	PS74/0116-2	MUC	79° 42.90' N	4° 29.02' E	2820
15.07.2009	10:14:00	PS74/0117-1	MOR	79° 44.14' N	4° 32.27' E	2764
15.07.2009	11:45:00	PS74/0117-1	MOR	79° 44.26' N	4° 31.33' E	2737
15.07.2009	11:52:00	PS74/0117-1	MOR	79° 44.14' N	4° 31.72' E	2762
15.07.2009	11:58:00	PS74/0117-1	MOR	79° 44.02' N	4° 31.95' E	2771
15.07.2009	12:01:00	PS74/0117-1	MOR	79° 43.98' N	4° 32.05' E	2774
15.07.2009	12:54:00	PS74/0117-1	MOR	79° 42.94' N	4° 32.17' E	2650
15.07.2009	12:58:00	PS74/0117-1	MOR	79° 42.91' N	4° 32.18' E	2811
15.07.2009	13:08:00	PS74/0117-1	MOR	79° 42.91' N	4° 33.37' E	2802
15.07.2009	13:12:00	PS74/0117-1	MOR	79° 42.85' N	4° 33.37' E	2796
15.07.2009	13:47:00	PS74/0117-1	MOR	79° 44.22' N	4° 31.77' E	2755
15.07.2009	13:47:01	PS74/0117-1	MOR	79° 44.22' N	4° 31.77' E	2755
15.07.2009	13:52:00	PS74/0117-1	MOR	79° 44.18' N	4° 31.90' E	2764
15.07.2009	14:00:00	PS74/0117-1	MOR	79° 44.11' N	4° 32.14' E	2765

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
15.07.2009	14:19:00	PS74/0117-1	MOR	79° 44.40' N	4° 30.35' E	2696
15.07.2009	14:22:00	PS74/0117-1	MOR	79° 44.38' N	4° 30.34' E	-
15.07.2009	15:07:00	PS74/0117-1	MOR	79° 45.29' N	4° 34.55' E	2497
15.07.2009	15:10:00	PS74/0117-1	MOR	79° 45.30' N	4° 34.73' E	-
15.07.2009	15:14:00	PS74/0117-1	MOR	79° 45.30' N	4° 34.99' E	-
15.07.2009	16:08:00	PS74/0117-1	MOR	79° 44.08' N	4° 24.36' E	2640
15.07.2009	16:18:00	PS74/0117-1	MOR	79° 43.95' N	4° 24.41' E	2654
15.07.2009	16:42:00	PS74/0117-1	MOR	79° 43.56' N	4° 33.29' E	2785
15.07.2009	16:45:00	PS74/0117-1	MOR	79° 43.56' N	4° 33.35' E	-
15.07.2009	16:50:00	PS74/0117-1	MOR	79° 43.55' N	4° 33.53' E	-
15.07.2009	17:28:00	PS74/0117-1	MOR	79° 41.93' N	4° 35.70' E	2822
15.07.2009	17:31:00	PS74/0117-1	MOR	79° 41.91' N	4° 35.94' E	-
15.07.2009	17:33:00	PS74/0117-1	MOR	79° 41.90' N	4° 36.08' E	-
15.07.2009	17:48:00	PS74/0117-1	MOR	79° 41.49' N	4° 35.96' E	-
15.07.2009	17:48:01	PS74/0117-1	MOR	79° 41.49' N	4° 35.96' E	-
15.07.2009	17:51:00	PS74/0117-1	MOR	79° 41.45' N	4° 36.03' E	-
15.07.2009	18:01:00	PS74/0117-1	MOR	79° 41.57' N	4° 37.48' E	-
15.07.2009	18:04:00	PS74/0117-1	MOR	79° 41.57' N	4° 37.57' E	-
15.07.2009	18:10:00	PS74/0117-1	MOR	79° 41.49' N	4° 37.88' E	-
15.07.2009	18:26:00	PS74/0117-1	MOR	79° 41.04' N	4° 34.86' E	-
15.07.2009	18:30:00	PS74/0117-1	MOR	79° 41.07' N	4° 34.85' E	-
15.07.2009	18:31:00	PS74/0117-1	MOR	79° 41.07' N	4° 34.89' E	-
15.07.2009	18:51:00	PS74/0117-1	MOR	79° 41.66' N	4° 41.16' E	-
15.07.2009	18:52:00	PS74/0117-1	MOR	79° 41.65' N	4° 41.23' E	-
15.07.2009	18:58:00	PS74/0117-1	MOR	79° 41.56' N	4° 41.58' E	-
15.07.2009	19:17:00	PS74/0117-1	MOR	79° 41.55' N	4° 38.32' E	-
15.07.2009	19:17:01	PS74/0117-1	MOR	79° 41.55' N	4° 38.32' E	-
15.07.2009	19:50:00	PS74/0117-1	MOR	79° 40.47' N	4° 39.42' E	-
15.07.2009	19:51:00	PS74/0117-1	MOR	79° 40.47' N	4° 39.43' E	-
15.07.2009	19:54:00	PS74/0117-1	MOR	79° 40.43' N	4° 39.44' E	-
15.07.2009	20:07:00	PS74/0117-1	MOR	79° 40.37' N	4° 39.33' E	-
15.07.2009	20:07:01	PS74/0117-1	MOR	79° 40.37' N	4° 39.33' E	-
15.07.2009	20:16:00	PS74/0117-1	MOR	79° 40.41' N	4° 42.16' E	-
15.07.2009	20:16:01	PS74/0117-1	MOR	79° 40.41' N	4° 42.16' E	-
15.07.2009	20:18:00	PS74/0117-1	MOR	79° 40.39' N	4° 42.26' E	-
15.07.2009	20:38:00	PS74/0117-1	MOR	79° 40.34' N	4° 41.91' E	-
15.07.2009	20:45:00	PS74/0117-1	MOR	79° 40.30' N	4° 42.19' E	-
15.07.2009	20:45:01	PS74/0117-1	MOR	79° 40.30' N	4° 42.19' E	-
15.07.2009	20:56:00	PS74/0117-1	MOR	79° 40.13' N	4° 43.70' E	-
15.07.2009	21:32:00	PS74/0117-1	MOR	79° 39.64' N	4° 44.35' E	-

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
15.07.2009	21:33:00	PS74/0117-1	MOR	79° 39.63' N	4° 44.36' E	-
15.07.2009	21:42:00	PS74/0117-1	MOR	79° 39.56' N	4° 44.63' E	-
15.07.2009	21:43:00	PS74/0117-1	MOR	79° 39.55' N	4° 44.67' E	-
15.07.2009	22:11:00	PS74/0117-1	MOR	79° 39.29' N	4° 44.59' E	-
15.07.2009	22:35:00	PS74/0117-1	MOR	79° 39.08' N	4° 45.03' E	2921
15.07.2009	22:38:59	PS74/0117-1	MOR	79° 39.04' N	4° 45.13' E	2922
15.07.2009	23:34:00	PS74/0118-1	CTD/RO	79° 36.24' N	5° 10.10' E	2785
16.07.2009	00:30:00	PS74/0118-1	CTD/RO	79° 36.08' N	5° 10.16' E	2788
16.07.2009	01:13:59	PS74/0118-1	CTD/RO	79° 36.08' N	5° 10.28' E	2787
16.07.2009	01:26:00	PS74/0118-2	MUC	79° 36.22' N	5° 10.38' E	2783
16.07.2009	02:10:00	PS74/0118-2	MUC	79° 36.24' N	5° 10.07' E	2787
16.07.2009	02:55:59	PS74/0118-2	MUC	79° 36.10' N	5° 8.38' E	2807
16.07.2009	04:24:00	PS74/0119-1	CTD/RO	79° 24.51' N	4° 41.75' E	2541
16.07.2009	05:20:00	PS74/0119-1	CTD/RO	79° 24.72' N	4° 39.63' E	2554
16.07.2009	06:00:59	PS74/0119-1	CTD/RO	79° 24.72' N	4° 38.23' E	2555
16.07.2009	06:24:00	PS74/0119-2	MUC	79° 24.62' N	4° 42.01' E	2545
16.07.2009	07:09:00	PS74/0119-2	MUC	79° 24.60' N	4° 41.45' E	2545
16.07.2009	07:50:59	PS74/0119-2	MUC	79° 24.61' N	4° 41.08' E	2547
16.07.2009	08:56:00	PS74/0120-1	CTD/RO	79° 16.84' N	4° 20.31' E	2390
16.07.2009	09:48:00	PS74/0120-1	CTD/RO	79° 16.95' N	4° 19.84' E	2398
16.07.2009	10:30:59	PS74/0120-1	CTD/RO	79° 16.99' N	4° 19.81' E	2400
16.07.2009	10:37:00	PS74/0120-2	MUC	79° 16.99' N	4° 19.77' E	2401
16.07.2009	11:14:00	PS74/0120-2	MUC	79° 17.00' N	4° 19.75' E	2401
16.07.2009	11:15:00	PS74/0120-2	MUC	79° 17.00' N	4° 19.75' E	2401
16.07.2009	11:55:59	PS74/0120-2	MUC	79° 17.00' N	4° 19.76' E	2401
16.07.2009	13:30:00	PS74/0121-1	MUC	79° 3.92' N	4° 11.07' E	2461
16.07.2009	14:10:00	PS74/0121-1	MUC	79° 3.89' N	4° 10.92' E	2464
16.07.2009	14:49:59	PS74/0121-1	MUC	79° 3.95' N	4° 10.60' E	2466
16.07.2009	17:03:00	PS74/0122-1	ROV	79° 4.76' N	4° 7.99' E	2479
16.07.2009	18:34:00	PS74/0122-1	ROV	79° 4.97' N	4° 8.09' E	2465
16.07.2009	18:34:01	PS74/0122-1	ROV	79° 4.97' N	4° 8.09' E	2465
17.07.2009	03:53:00	PS74/0111-1	COLOSSOS	79° 4.96' N	4° 8.15' E	2465
17.07.2009	03:56:00	PS74/0111-1	COLOSSOS	79° 4.96' N	4° 8.17' E	2465
17.07.2009	04:05:00	PS74/0122-1	ROV	79° 5.03' N	4° 8.19' E	2462
17.07.2009	04:05:01	PS74/0122-1	ROV	79° 5.03' N	4° 8.19' E	2462
17.07.2009	04:42:00	PS74/0111-1	COLOSSOS	79° 5.13' N	4° 8.36' E	2462
17.07.2009	05:22:00	PS74/0122-1	ROV	79° 5.16' N	4° 8.63' E	2457
17.07.2009	05:37:59	PS74/0122-1	ROV	79° 5.13' N	4° 8.89' E	2448
17.07.2009	06:55:00	PS74/0111-1	COLOSSOS	79° 4.22' N	4° 7.72' E	2503
17.07.2009	07:14:59	PS74/0111-1	COLOSSOS	79° 4.20' N	4° 6.99' E	2513

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
17.07.2009	07:46:00	PS74/0123-1	LANDER	79° 4.74' N	4° 8.78' E	2470
17.07.2009	08:22:00	PS74/0123-1	LANDER	79° 4.69' N	4° 8.48' E	2478
17.07.2009	08:39:00	PS74/0123-1	LANDER	79° 4.85' N	4° 7.94' E	2474
17.07.2009	08:43:00	PS74/0123-1	LANDER	79° 4.78' N	4° 7.93' E	2479
17.07.2009	08:44:00	PS74/0123-1	LANDER	79° 4.75' N	4° 7.94' E	2481
17.07.2009	08:44:59	PS74/0123-1	LANDER	79° 4.75' N	4° 7.94' E	2481
17.07.2009	10:04:00	PS74/0124-1	MOR	79° 0.23' N	4° 20.16' E	2615
17.07.2009	10:07:00	PS74/0124-1	MOR	79° 0.25' N	4° 20.02' E	2610
17.07.2009	10:24:00	PS74/0124-1	MOR	79° 0.01' N	4° 20.50' E	2614
17.07.2009	10:41:00	PS74/0124-1	MOR	79° 0.20' N	4° 20.17' E	2610
17.07.2009	10:42:00	PS74/0124-1	MOR	79° 0.19' N	4° 20.17' E	2611
17.07.2009	10:46:00	PS74/0124-1	MOR	79° 0.11' N	4° 20.00' E	2619
17.07.2009	10:50:01	PS74/0124-1	MOR	79° 0.02' N	4° 19.89' E	2617
17.07.2009	11:14:00	PS74/0124-1	MOR	78° 59.61' N	4° 18.92' E	2639
17.07.2009	11:22:00	PS74/0124-1	MOR	78° 59.58' N	4° 18.64' E	2638
17.07.2009	11:44:00	PS74/0124-2	MOR	78° 59.44' N	4° 18.32' E	2651
17.07.2009	11:44:59	PS74/0124-1	MOR	78° 59.44' N	4° 18.32' E	2651
17.07.2009	11:48:00	PS74/0124-2	MOR	78° 59.36' N	4° 18.35' E	2648
17.07.2009	11:53:59	PS74/0124-2	MOR	78° 59.28' N	4° 18.17' E	2652
17.07.2009	12:12:00	PS74/0125-1	CTD/RO	79° 0.43' N	4° 20.03' E	2605
17.07.2009	13:06:00	PS74/0125-1	CTD/RO	79° 0.42' N	4° 20.18' E	2604
17.07.2009	13:50:59	PS74/0125-1	CTD/RO	79° 0.47' N	4° 19.80' E	2605
17.07.2009	14:35:00	PS74/0125-2	MOR	79° 0.39' N	4° 20.19' E	2605
17.07.2009	14:38:00	PS74/0125-2	MOR	79° 0.39' N	4° 20.19' E	2605
17.07.2009	14:53:00	PS74/0125-2	MOR	79° 0.43' N	4° 20.11' E	2604
17.07.2009	14:57:00	PS74/0125-2	MOR	79° 0.43' N	4° 20.11' E	2604
17.07.2009	15:16:00	PS74/0125-2	MOR	79° 0.42' N	4° 20.13' E	2604
17.07.2009	15:42:00	PS74/0125-2	MOR	79° 0.42' N	4° 20.10' E	2605
17.07.2009	15:48:00	PS74/0125-2	MOR	79° 0.43' N	4° 20.09' E	2605
17.07.2009	16:06:00	PS74/0125-2	MOR	79° 0.43' N	4° 20.01' E	2605
17.07.2009	16:21:00	PS74/0125-2	MOR	79° 0.45' N	4° 20.04' E	2604
17.07.2009	16:31:00	PS74/0125-2	MOR	79° 0.43' N	4° 20.10' E	2604
17.07.2009	16:37:00	PS74/0125-2	MOR	79° 0.43' N	4° 20.12' E	2604
17.07.2009	17:09:00	PS74/0125-2	MOR	79° 0.43' N	4° 20.05' E	2605
17.07.2009	17:12:59	PS74/0125-2	MOR	79° 0.44' N	4° 20.03' E	2605
17.07.2009	17:56:00	PS74/0126-1	LANDER	79° 4.69' N	4° 7.07' E	2501
17.07.2009	17:57:00	PS74/0126-1	LANDER	79° 4.68' N	4° 7.03' E	2495
17.07.2009	17:58:59	PS74/0126-1	LANDER	79° 4.68' N	4° 7.00' E	2501
17.07.2009	19:36:00	PS74/0127-1	CTD/RO	78° 55.03' N	4° 59.80' E	2639
17.07.2009	20:30:00	PS74/0127-1	CTD/RO	78° 55.03' N	5° 0.13' E	2637

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
17.07.2009	21:14:59	PS74/0127-1	CTD/RO	78° 55.03' N	5° 0.03' E	2638
17.07.2009	21:30:00	PS74/0127-2	MUC	78° 55.03' N	5° 0.02' E	2638
17.07.2009	22:11:00	PS74/0127-2	MUC	78° 55.05' N	5° 0.07' E	2637
17.07.2009	22:12:00	PS74/0127-2	MUC	78° 55.05' N	5° 0.07' E	2637
17.07.2009	22:55:59	PS74/0127-2	MUC	78° 55.03' N	5° 0.23' E	2637
18.07.2009	00:03:00	PS74/0128-1	CTD/RO	78° 46.83' N	5° 19.81' E	2471
18.07.2009	00:55:00	PS74/0128-1	CTD/RO	78° 46.87' N	5° 19.97' E	2469
18.07.2009	01:34:59	PS74/0128-1	CTD/RO	78° 46.84' N	5° 20.04' E	2466
18.07.2009	01:41:00	PS74/0128-2	MUC	78° 46.81' N	5° 19.99' E	2466
18.07.2009	02:23:00	PS74/0128-2	MUC	78° 46.81' N	5° 19.66' E	2473
18.07.2009	03:08:59	PS74/0128-2	MUC	78° 46.78' N	5° 19.54' E	2473
18.07.2009	04:21:00	PS74/0129-1	CTD/RO	78° 36.40' N	5° 4.24' E	2339
18.07.2009	05:09:00	PS74/0129-1	CTD/RO	78° 36.45' N	5° 4.23' E	2339
18.07.2009	05:48:59	PS74/0129-1	CTD/RO	78° 36.40' N	5° 4.33' E	2339
18.07.2009	05:58:00	PS74/0129-2	MOR	78° 36.40' N	5° 4.31' E	2339
18.07.2009	06:14:00	PS74/0129-2	MOR	78° 36.36' N	5° 4.33' E	2339
18.07.2009	06:18:00	PS74/0129-2	MOR	78° 36.37' N	5° 4.30' E	2339
18.07.2009	06:22:00	PS74/0129-2	MOR	78° 36.35' N	5° 4.30' E	2340
18.07.2009	06:27:00	PS74/0129-2	MOR	78° 36.31' N	5° 4.57' E	2340
18.07.2009	06:28:00	PS74/0129-2	MOR	78° 36.31' N	5° 4.62' E	2340
18.07.2009	06:42:00	PS74/0129-2	MOR	78° 36.23' N	5° 5.26' E	2340
18.07.2009	06:44:00	PS74/0129-2	MOR	78° 36.17' N	5° 5.25' E	2341
18.07.2009	06:45:00	PS74/0129-2	MOR	78° 36.15' N	5° 5.23' E	2341
18.07.2009	06:46:01	PS74/0129-2	MOR	78° 36.13' N	5° 5.21' E	2341
18.07.2009	06:46:59	PS74/0129-2	MOR	78° 36.13' N	5° 5.21' E	2341
18.07.2009	07:06:00	PS74/0129-3	MUC	78° 36.40' N	5° 4.47' E	2340
18.07.2009	07:42:00	PS74/0129-3	MUC	78° 36.48' N	5° 4.38' E	2340
18.07.2009	08:20:59	PS74/0129-3	MUC	78° 36.45' N	5° 4.17' E	2340
18.07.2009	08:26:00	PS74/0129-4	MOR	78° 36.46' N	5° 4.21' E	2340
18.07.2009	08:32:00	PS74/0129-4	MOR	78° 36.47' N	5° 4.25' E	2340
18.07.2009	08:34:00	PS74/0129-4	MOR	78° 36.47' N	5° 4.25' E	2340
18.07.2009	08:35:00	PS74/0129-4	MOR	78° 36.47' N	5° 4.25' E	2340
18.07.2009	08:40:01	PS74/0129-4	MOR	78° 36.47' N	5° 4.21' E	2340
18.07.2009	08:40:59	PS74/0129-4	MOR	78° 36.47' N	5° 4.21' E	2340
18.07.2009	12:00:00	PS74/0130-1	AUV	78° 51.64' N	6° 27.37' E	1996
18.07.2009	12:18:00	PS74/0130-1	AUV	78° 51.53' N	6° 28.65' E	1970
18.07.2009	12:31:00	PS74/0130-1	AUV	78° 51.45' N	6° 29.54' E	1954
18.07.2009	12:53:00	PS74/0130-1	AUV	78° 51.34' N	6° 31.09' E	1926
18.07.2009	12:53:01	PS74/0130-1	AUV	78° 51.34' N	6° 31.09' E	1926
18.07.2009	12:58:00	PS74/0130-1	AUV	78° 51.25' N	6° 31.01' E	1929

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
18.07.2009	13:00:59	PS74/0130-1	AUV	78° 51.21' N	6° 30.94' E	1931
18.07.2009	15:48:00	PS74/0131-1	MUC	78° 54.94' N	6° 46.41' E	1534
18.07.2009	16:17:00	PS74/0131-1	MUC	78° 54.98' N	6° 46.28' E	1534
18.07.2009	16:44:59	PS74/0131-1	MUC	78° 54.98' N	6° 46.31' E	1534
18.07.2009	17:33:00	PS74/0132-1	CTD/RO	79° 1.78' N	6° 59.98' E	1303
18.07.2009	18:03:00	PS74/0132-1	CTD/RO	79° 1.86' N	7° 0.13' E	1306
18.07.2009	18:26:59	PS74/0132-1	CTD/RO	79° 1.85' N	7° 0.36' E	1307
18.07.2009	18:36:00	PS74/0132-2	MUC	79° 1.83' N	7° 0.15' E	1305
18.07.2009	18:58:00	PS74/0132-2	MUC	79° 1.79' N	7° 0.01' E	1304
18.07.2009	19:26:59	PS74/0132-2	MUC	79° 1.86' N	7° 0.77' E	1308
18.07.2009	22:33:00	PS74/0133-1	CTD/RO	78° 58.92' N	9° 25.51' E	227
18.07.2009	22:43:00	PS74/0133-1	CTD/RO	78° 58.91' N	9° 25.50' E	227
18.07.2009	22:50:59	PS74/0133-1	CTD/RO	78° 58.92' N	9° 25.54' E	227
18.07.2009	22:57:00	PS74/0133-2	MUC	78° 58.92' N	9° 25.53' E	227
18.07.2009	23:07:00	PS74/0133-2	MUC	78° 58.92' N	9° 25.48' E	227
18.07.2009	23:08:00	PS74/0133-2	MUC	78° 58.92' N	9° 25.47' E	227
18.07.2009	23:15:59	PS74/0133-2	MUC	78° 58.92' N	9° 25.47' E	227
20.07.2009	11:54:00	PS74/0134-1	CTD/RO	72° 10.10' N	14° 37.46' E	1159
20.07.2009	12:02:00	PS74/0134-2	HN	72° 10.10' N	14° 37.64' E	1159
20.07.2009	12:05:00	PS74/0134-2	HN	72° 10.14' N	14° 37.64' E	1157
20.07.2009	12:11:59	PS74/0134-2	HN	72° 10.16' N	14° 37.67' E	1156
20.07.2009	12:21:00	PS74/0134-1	CTD/RO	72° 10.15' N	14° 37.84' E	1155
20.07.2009	12:40:59	PS74/0134-1	CTD/RO	72° 10.14' N	14° 38.06' E	1154
20.07.2009	14:00:00	PS74/0135-1	CTD/RO	72° 0.42' N	14° 43.93' E	1279
20.07.2009	14:34:00	PS74/0135-1	CTD/RO	72° 0.14' N	14° 44.41' E	1286
20.07.2009	15:54:00	PS74/0136-1	MUC	72° 0.29' N	14° 43.33' E	1281
20.07.2009	15:56:59	PS74/0135-1	CTD/RO	72° 0.29' N	14° 43.28' E	1280
20.07.2009	16:01:00	PS74/0136-1	MUC	72° 0.28' N	14° 43.22' E	1283
20.07.2009	16:25:00	PS74/0136-1	MUC	72° 0.29' N	14° 42.96' E	1281
20.07.2009	16:27:00	PS74/0136-1	MUC	72° 0.29' N	14° 43.00' E	1280
20.07.2009	16:50:00	PS74/0136-1	MUC	72° 0.27' N	14° 43.27' E	1281
20.07.2009	16:57:59	PS74/0136-1	MUC	72° 0.24' N	14° 43.33' E	1283
20.07.2009	17:22:00	PS74/0137-1	MUC	72° 0.28' N	14° 43.36' E	1284
20.07.2009	17:30:00	PS74/0137-1	MUC	72° 0.28' N	14° 43.36' E	1282
20.07.2009	17:59:00	PS74/0137-1	MUC	72° 0.27' N	14° 42.88' E	1282
20.07.2009	18:01:00	PS74/0137-1	MUC	72° 0.26' N	14° 42.89' E	1281
20.07.2009	18:18:00	PS74/0137-1	MUC	72° 0.21' N	14° 43.42' E	1283
20.07.2009	18:26:59	PS74/0137-1	MUC	72° 0.26' N	14° 43.56' E	1282
20.07.2009	19:08:00	PS74/0138-1	PHC	71° 59.85' N	14° 45.13' E	1284
20.07.2009	19:16:00	PS74/0138-1	PHC	71° 59.86' N	14° 45.03' E	1283

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
20.07.2009	19:44:00	PS74/0138-1	PHC	71° 59.93' N	14° 44.69' E	1287
20.07.2009	20:06:00	PS74/0138-1	PHC	71° 59.92' N	14° 44.55' E	1286
20.07.2009	23:34:00	PS74/0138-1	PHC	72° 0.65' N	14° 42.42' E	1294
20.07.2009	23:35:00	PS74/0138-1	PHC	72° 0.66' N	14° 42.40' E	1293
20.07.2009	23:53:00	PS74/0138-1	PHC	72° 0.63' N	14° 42.62' E	1293
21.07.2009	00:13:59	PS74/0138-1	PHC	72° 0.67' N	14° 42.88' E	1291
21.07.2009	00:40:00	PS74/0139-1	HF	72° 0.50' N	14° 43.96' E	1284
21.07.2009	01:14:00	PS74/0139-1	HF	72° 0.48' N	14° 43.97' E	1283
21.07.2009	01:59:00	PS74/0139-1	HF	72° 0.45' N	14° 43.90' E	1281
21.07.2009	02:15:00	PS74/0139-1	HF	72° 0.44' N	14° 43.96' E	1280
21.07.2009	02:20:00	PS74/0139-1	HF	72° 0.43' N	14° 43.97' E	1280
21.07.2009	02:43:00	PS74/0139-1	HF	72° 0.41' N	14° 43.96' E	1283
21.07.2009	02:51:00	PS74/0139-1	HF	72° 0.48' N	14° 43.98' E	1281
21.07.2009	02:57:00	PS74/0139-1	HF	72° 0.47' N	14° 44.11' E	1286
21.07.2009	03:01:00	PS74/0139-1	HF	72° 0.48' N	14° 44.05' E	1282
21.07.2009	03:21:00	PS74/0139-1	HF	72° 0.40' N	14° 43.96' E	1279
21.07.2009	03:39:00	PS74/0139-1	HF	72° 0.42' N	14° 43.96' E	1279
21.07.2009	03:39:01	PS74/0139-1	HF	72° 0.42' N	14° 43.96' E	1279
21.07.2009	04:01:00	PS74/0139-1	HF	72° 0.37' N	14° 43.80' E	1279
21.07.2009	04:12:59	PS74/0139-1	HF	72° 0.33' N	14° 43.81' E	1279
21.07.2009	07:18:00	PS74/0140-1	MUC	72° 0.20' N	14° 43.77' E	1283
21.07.2009	07:24:00	PS74/0140-1	MUC	72° 0.14' N	14° 43.85' E	1281
21.07.2009	07:59:00	PS74/0140-1	MUC	72° 0.18' N	14° 43.86' E	1283
21.07.2009	08:00:00	PS74/0140-1	MUC	72° 0.18' N	14° 43.86' E	1283
21.07.2009	08:00:01	PS74/0140-1	MUC	72° 0.18' N	14° 43.86' E	1283
21.07.2009	08:23:00	PS74/0140-1	MUC	72° 0.13' N	14° 44.06' E	1283
21.07.2009	08:25:59	PS74/0140-1	MUC	72° 0.11' N	14° 44.12' E	1281
21.07.2009	08:56:00	PS74/0141-1	MUC	72° 0.15' N	14° 43.92' E	1285
21.07.2009	09:02:00	PS74/0141-1	MUC	72° 0.13' N	14° 43.90' E	1286
21.07.2009	09:51:00	PS74/0141-1	MUC	72° 0.16' N	14° 43.77' E	1283
21.07.2009	09:52:00	PS74/0141-1	MUC	72° 0.17' N	14° 43.74' E	1285
21.07.2009	09:55:00	PS74/0141-1	MUC	72° 0.18' N	14° 43.66' E	1284
21.07.2009	09:57:00	PS74/0141-1	MUC	72° 0.19' N	14° 43.64' E	1286
21.07.2009	09:58:00	PS74/0141-1	MUC	72° 0.19' N	14° 43.65' E	1286
21.07.2009	10:30:59	PS74/0141-1	MUC	72° 0.21' N	14° 43.75' E	1284
21.07.2009	10:46:00	PS74/0142-1	MUC	72° 0.20' N	14° 43.71' E	1284
21.07.2009	11:19:00	PS74/0142-1	MUC	72° 0.19' N	14° 43.70' E	1285
21.07.2009	11:20:00	PS74/0142-1	MUC	72° 0.19' N	14° 43.71' E	1285
21.07.2009	11:48:59	PS74/0142-1	MUC	72° 0.28' N	14° 44.30' E	1287
21.07.2009	13:33:00	PS74/0143-1	PHC	71° 59.97' N	14° 44.64' E	1285

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
21.07.2009	13:35:00	PS74/0143-1	PHC	71° 59.97' N	14° 44.63' E	1286
21.07.2009	14:03:00	PS74/0143-1	PHC	71° 60.00' N	14° 44.36' E	1287
21.07.2009	14:17:00	PS74/0143-1	PHC	72° 0.04' N	14° 44.21' E	1287
21.07.2009	19:04:00	PS74/0143-1	PHC	72° 0.40' N	14° 43.32' E	1276
21.07.2009	19:05:00	PS74/0143-1	PHC	72° 0.41' N	14° 43.32' E	1275
21.07.2009	19:28:00	PS74/0143-1	PHC	72° 0.40' N	14° 43.41' E	1280
21.07.2009	19:29:00	PS74/0143-1	PHC	72° 0.40' N	14° 43.42' E	1279
21.07.2009	19:29:01	PS74/0143-1	PHC	72° 0.40' N	14° 43.42' E	1279
21.07.2009	19:30:59	PS74/0143-1	PHC	72° 0.40' N	14° 43.43' E	1280
21.07.2009	21:14:00	PS74/0144-1	HS_PS	72° 0.32' N	14° 44.56' E	1286
21.07.2009	22:58:00	PS74/0144-1	HS_PS	72° 0.32' N	14° 42.25' E	1296
21.07.2009	23:00:00	PS74/0144-1	HS_PS	72° 0.34' N	14° 42.27' E	1292
22.07.2009	00:06:00	PS74/0144-1	HS_PS	72° 0.33' N	14° 44.47' E	1287
22.07.2009	00:17:00	PS74/0144-1	HS_PS	72° 0.39' N	14° 44.63' E	1287
22.07.2009	01:26:00	PS74/0144-1	HS_PS	72° 0.39' N	14° 42.42' E	1292
22.07.2009	01:30:00	PS74/0144-1	HS_PS	72° 0.41' N	14° 42.54' E	1292
22.07.2009	02:19:00	PS74/0144-1	HS_PS	72° 0.40' N	14° 44.34' E	1287
22.07.2009	02:31:00	PS74/0144-1	HS_PS	72° 0.46' N	14° 44.40' E	1286
22.07.2009	03:38:00	PS74/0144-1	HS_PS	72° 0.48' N	14° 42.56' E	1291
22.07.2009	03:43:00	PS74/0144-1	HS_PS	72° 0.47' N	14° 42.68' E	1292
22.07.2009	03:49:59	PS74/0144-1	HS_PS	72° 0.47' N	14° 42.78' E	1293
22.07.2009	04:17:00	PS74/0145-1	ROV	72° 0.33' N	14° 43.38' E	1282
22.07.2009	05:21:00	PS74/0145-1	ROV	72° 0.37' N	14° 43.67' E	1279
22.07.2009	10:45:00	PS74/0146-1	HF	72° 0.36' N	14° 43.62' E	1281
22.07.2009	10:58:00	PS74/0146-1	HF	72° 0.36' N	14° 43.63' E	1280
22.07.2009	11:38:00	PS74/0146-1	HF	72° 0.36' N	14° 43.65' E	1281
22.07.2009	11:59:00	PS74/0146-1	HF	72° 0.35' N	14° 43.64' E	1282
22.07.2009	12:33:00	PS74/0146-1	HF	72° 0.36' N	14° 43.63' E	1281
22.07.2009	12:45:00	PS74/0146-1	HF	72° 0.37' N	14° 43.61' E	1281
22.07.2009	12:54:00	PS74/0146-1	HF	72° 0.40' N	14° 43.66' E	1280
22.07.2009	13:44:59	PS74/0146-1	HF	72° 0.36' N	14° 43.67' E	1281
22.07.2009	14:36:00	PS74/0147-1	HF	72° 0.35' N	14° 43.67' E	1282
22.07.2009	15:06:00	PS74/0147-1	HF	72° 0.37' N	14° 43.61' E	1280
22.07.2009	16:39:00	PS74/0147-1	HF	72° 0.39' N	14° 43.62' E	1279
22.07.2009	17:04:59	PS74/0147-1	HF	72° 0.39' N	14° 43.70' E	1282
22.07.2009	17:22:00	PS74/0145-1	ROV	72° 0.39' N	14° 43.65' E	1281
22.07.2009	18:30:01	PS74/0145-1	ROV	72° 0.38' N	14° 44.07' E	1282
22.07.2009	18:30:02	PS74/0145-1	ROV	72° 0.38' N	14° 44.07' E	1282
22.07.2009	18:30:59	PS74/0145-1	ROV	72° 0.38' N	14° 44.07' E	1282
22.07.2009	19:50:00	PS74/0148-1	HF	72° 0.32' N	14° 43.79' E	1281

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
22.07.2009	20:14:00	PS74/0148-1	HF	72° 0.32' N	14° 43.64' E	1283
22.07.2009	20:26:00	PS74/0148-1	HF	72° 0.32' N	14° 43.57' E	1283
22.07.2009	20:41:00	PS74/0148-1	HF	72° 0.33' N	14° 43.58' E	1283
22.07.2009	20:44:59	PS74/0148-1	HF	72° 0.32' N	14° 43.59' E	1283
22.07.2009	21:02:00	PS74/0149-1	HF	72° 0.28' N	14° 43.53' E	1284
22.07.2009	21:02:01	PS74/0149-1	HF	72° 0.28' N	14° 43.53' E	1284
22.07.2009	21:10:00	PS74/0149-1	HF	72° 0.28' N	14° 43.53' E	1285
22.07.2009	21:11:59	PS74/0149-1	HF	72° 0.28' N	14° 43.54' E	1284
22.07.2009	21:12:00	PS74/0150-1	HF	72° 0.28' N	14° 43.54' E	1285
22.07.2009	21:36:00	PS74/0150-1	HF	72° 0.30' N	14° 43.54' E	1284
22.07.2009	21:36:01	PS74/0150-1	HF	72° 0.30' N	14° 43.54' E	1284
22.07.2009	21:40:00	PS74/0150-1	HF	72° 0.30' N	14° 43.54' E	1269
22.07.2009	21:42:00	PS74/0150-1	HF	72° 0.29' N	14° 43.53' E	1284
22.07.2009	21:47:00	PS74/0150-1	HF	72° 0.29' N	14° 43.53' E	1285
22.07.2009	21:49:59	PS74/0150-1	HF	72° 0.29' N	14° 43.52' E	1284
22.07.2009	22:01:00	PS74/0151-1	HF	72° 0.28' N	14° 43.45' E	1284
22.07.2009	22:03:00	PS74/0151-1	HF	72° 0.28' N	14° 43.48' E	1285
22.07.2009	22:03:01	PS74/0151-1	HF	-	-	-
22.07.2009	22:09:00	PS74/0151-1	HF	72° 0.28' N	14° 43.49' E	1285
22.07.2009	22:13:59	PS74/0151-1	HF	-	-	-
22.07.2009	22:24:00	PS74/0152-1	HF	72° 0.27' N	14° 43.48' E	1284
22.07.2009	22:27:00	PS74/0152-1	HF	72° 0.28' N	14° 43.50' E	1285
22.07.2009	22:37:00	PS74/0152-1	HF	72° 0.28' N	14° 43.49' E	1285
22.07.2009	22:38:59	PS74/0152-1	HF	72° 0.27' N	14° 43.48' E	1285
22.07.2009	22:45:00	PS74/0153-1	HF	72° 0.28' N	14° 43.48' E	1285
22.07.2009	22:47:00	PS74/0153-1	HF	72° 0.28' N	14° 43.46' E	1285
22.07.2009	22:57:00	PS74/0153-1	HF	72° 0.26' N	14° 43.47' E	1285
22.07.2009	23:00:59	PS74/0153-1	HF	72° 0.26' N	14° 43.44' E	1282
22.07.2009	23:36:00	PS74/0154-1	HF	72° 0.26' N	14° 43.41' E	1285
23.07.2009	00:00:00	PS74/0154-1	HF	72° 0.25' N	14° 43.41' E	1286
23.07.2009	00:14:00	PS74/0154-1	HF	72° 0.25' N	14° 43.44' E	1285
23.07.2009	00:17:59	PS74/0154-1	HF	72° 0.24' N	14° 43.41' E	1285
23.07.2009	00:25:00	PS74/0155-1	HF	72° 0.21' N	14° 43.34' E	1286
23.07.2009	00:27:00	PS74/0155-1	HF	72° 0.20' N	14° 43.34' E	1285
23.07.2009	00:39:00	PS74/0155-1	HF	72° 0.19' N	14° 43.30' E	1284
23.07.2009	00:41:59	PS74/0155-1	HF	72° 0.19' N	14° 43.31' E	1284
23.07.2009	00:53:00	PS74/0156-1	HF	72° 0.16' N	14° 43.23' E	1284
23.07.2009	00:56:00	PS74/0156-1	HF	72° 0.16' N	14° 43.23' E	1283
23.07.2009	01:03:00	PS74/0156-1	HF	72° 0.16' N	14° 43.24' E	1284
23.07.2009	01:05:59	PS74/0156-1	HF	72° 0.16' N	14° 43.24' E	1272

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
23.07.2009	01:10:00	PS74/0157-1	HF	72° 0.15' N	14° 43.19' E	1284
23.07.2009	01:12:00	PS74/0157-1	HF	72° 0.15' N	14° 43.20' E	1284
23.07.2009	01:18:00	PS74/0157-1	HF	72° 0.14' N	14° 43.21' E	1284
23.07.2009	01:21:59	PS74/0157-1	HF	72° 0.13' N	14° 43.20' E	1284
23.07.2009	01:24:00	PS74/0158-1	HF	72° 0.14' N	14° 43.22' E	1284
23.07.2009	01:26:00	PS74/0158-1	HF	72° 0.14' N	14° 43.22' E	1285
23.07.2009	01:27:00	PS74/0158-1	HF	72° 0.15' N	14° 43.21' E	1284
23.07.2009	01:29:00	PS74/0158-1	HF	72° 0.15' N	14° 43.21' E	1285
23.07.2009	01:30:00	PS74/0158-1	HF	72° 0.15' N	14° 43.21' E	1285
23.07.2009	01:31:00	PS74/0158-1	HF	72° 0.15' N	14° 43.21' E	1284
23.07.2009	01:43:00	PS74/0158-1	HF	72° 0.16' N	14° 43.22' E	1283
23.07.2009	01:45:59	PS74/0158-1	HF	72° 0.15' N	14° 43.20' E	1271
23.07.2009	01:54:00	PS74/0159-1	HF	72° 0.09' N	14° 43.10' E	1284
23.07.2009	01:55:00	PS74/0159-1	HF	72° 0.09' N	14° 43.11' E	1284
23.07.2009	01:56:00	PS74/0159-1	HF	72° 0.10' N	14° 43.11' E	1283
23.07.2009	01:58:00	PS74/0159-1	HF	72° 0.10' N	14° 43.12' E	1283
23.07.2009	01:58:01	PS74/0159-1	HF	72° 0.10' N	14° 43.12' E	1283
23.07.2009	01:58:02	PS74/0159-1	HF	72° 0.10' N	14° 43.12' E	1283
23.07.2009	01:59:00	PS74/0159-1	HF	72° 0.10' N	14° 43.10' E	1283
23.07.2009	02:03:00	PS74/0159-1	HF	72° 0.09' N	14° 43.05' E	1284
23.07.2009	02:16:00	PS74/0159-1	HF	72° 0.10' N	14° 43.10' E	1284
23.07.2009	02:20:59	PS74/0159-1	HF	72° 0.09' N	14° 43.09' E	1283
23.07.2009	03:29:00	PS74/0160-1	HF	72° 0.42' N	14° 43.26' E	1281
23.07.2009	03:40:00	PS74/0160-1	HF	72° 0.42' N	14° 43.25' E	1281
23.07.2009	03:43:59	PS74/0160-1	HF	72° 0.41' N	14° 43.25' E	1281
23.07.2009	04:02:00	PS74/0161-1	HF	72° 0.32' N	14° 43.49' E	1284
23.07.2009	04:04:00	PS74/0161-1	HF	72° 0.33' N	14° 43.50' E	1283
23.07.2009	04:16:00	PS74/0161-1	HF	72° 0.33' N	14° 43.53' E	1283
23.07.2009	04:20:59	PS74/0161-1	HF	72° 0.33' N	14° 43.48' E	1282
23.07.2009	04:33:00	PS74/0162-1	HF	72° 0.28' N	14° 43.69' E	1283
23.07.2009	04:35:00	PS74/0162-1	HF	72° 0.28' N	14° 43.69' E	1250
23.07.2009	04:42:00	PS74/0162-1	HF	72° 0.27' N	14° 43.73' E	1284
23.07.2009	04:44:00	PS74/0163-1	HF	72° 0.27' N	14° 43.72' E	1284
23.07.2009	04:44:59	PS74/0162-1	HF	72° 0.27' N	14° 43.72' E	1284
23.07.2009	04:46:00	PS74/0163-1	HF	72° 0.27' N	14° 43.70' E	1284
23.07.2009	04:52:00	PS74/0163-1	HF	72° 0.27' N	14° 43.69' E	1283
23.07.2009	04:54:59	PS74/0163-1	HF	72° 0.26' N	14° 43.68' E	1284
23.07.2009	05:03:00	PS74/0164-1	HF	72° 0.31' N	14° 43.66' E	1282
23.07.2009	05:06:00	PS74/0164-1	HF	72° 0.29' N	14° 43.64' E	1284
23.07.2009	05:11:00	PS74/0164-1	HF	72° 0.27' N	14° 43.65' E	1284

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
23.07.2009	05:13:00	PS74/0165-1	HF	72° 0.27' N	14° 43.67' E	1284
23.07.2009	05:13:59	PS74/0164-1	HF	72° 0.27' N	14° 43.67' E	1284
23.07.2009	05:15:00	PS74/0165-1	HF	72° 0.27' N	14° 43.69' E	1284
23.07.2009	05:21:00	PS74/0165-1	HF	72° 0.27' N	14° 43.73' E	1284
23.07.2009	05:22:00	PS74/0166-1	HF	72° 0.26' N	14° 43.75' E	1283
23.07.2009	05:22:59	PS74/0165-1	HF	72° 0.26' N	14° 43.75' E	1283
23.07.2009	05:25:00	PS74/0166-1	HF	72° 0.26' N	14° 43.74' E	1284
23.07.2009	05:32:00	PS74/0166-1	HF	72° 0.25' N	14° 43.76' E	1284
23.07.2009	05:32:01	PS74/0166-1	HF	72° 0.25' N	14° 43.76' E	1284
23.07.2009	05:56:00	PS74/0166-1	HF	72° 0.18' N	14° 43.78' E	1284
23.07.2009	06:12:59	PS74/0166-1	HF	72° 0.10' N	14° 43.97' E	1284
23.07.2009	06:42:00	PS74/0167-1	PHC	72° 0.79' N	14° 44.79' E	1272
23.07.2009	07:09:00	PS74/0167-1	PHC	72° 0.78' N	14° 44.58' E	1276
23.07.2009	07:26:00	PS74/0167-1	PHC	72° 0.64' N	14° 44.31' E	1280
23.07.2009	10:50:00	PS74/0167-1	PHC	71° 59.80' N	14° 42.54' E	1297
23.07.2009	10:55:00	PS74/0167-1	PHC	71° 59.80' N	14° 42.54' E	1297
23.07.2009	11:20:59	PS74/0167-1	PHC	71° 59.84' N	14° 43.01' E	1292
23.07.2009	13:18:00	PS74/0168-1	MUC	72° 0.31' N	14° 43.57' E	1285
23.07.2009	13:49:00	PS74/0168-1	MUC	72° 0.28' N	14° 43.45' E	1285
23.07.2009	13:50:00	PS74/0168-1	MUC	72° 0.29' N	14° 43.46' E	1285
23.07.2009	14:09:00	PS74/0168-2	HN	72° 0.23' N	14° 43.53' E	1286
23.07.2009	14:18:00	PS74/0168-2	HN	72° 0.27' N	14° 43.62' E	1286
23.07.2009	14:19:59	PS74/0168-2	HN	72° 0.28' N	14° 43.64' E	1285
23.07.2009	14:36:00	PS74/0168-1	MUC	72° 0.19' N	14° 43.91' E	1284
23.07.2009	14:44:59	PS74/0168-1	MUC	72° 0.21' N	14° 43.93' E	1284
23.07.2009	16:07:00	PS74/0169-1	ROV	72° 0.33' N	14° 43.59' E	1282
23.07.2009	17:07:00	PS74/0169-1	ROV	72° 0.30' N	14° 43.68' E	1282
24.07.2009	06:45:00	PS74/0169-1	ROV	72° 0.30' N	14° 43.69' E	1282
24.07.2009	07:47:00	PS74/0169-1	ROV	72° 0.22' N	14° 43.88' E	1284
24.07.2009	07:48:00	PS74/0169-1	ROV	72° 0.21' N	14° 43.88' E	1284
24.07.2009	07:50:59	PS74/0169-1	ROV	72° 0.20' N	14° 43.88' E	1283
24.07.2009	08:38:00	PS74/0170-1	PHC	72° 0.38' N	14° 43.67' E	1280
24.07.2009	08:44:00	PS74/0170-1	PHC	72° 0.37' N	14° 43.67' E	1281
24.07.2009	09:02:00	PS74/0170-1	PHC	72° 0.40' N	14° 43.66' E	1280
24.07.2009	09:31:00	PS74/0170-1	PHC	72° 0.38' N	14° 43.70' E	1280
24.07.2009	11:00:00	PS74/0170-1	PHC	72° 0.22' N	14° 43.25' E	1285
24.07.2009	11:00:01	PS74/0170-1	PHC	72° 0.22' N	14° 43.25' E	1285
24.07.2009	11:00:59	PS74/0170-1	PHC	72° 0.22' N	14° 43.25' E	1285
24.07.2009	13:33:00	PS74/0171-1	LANDER	72° 0.32' N	14° 43.57' E	1284
24.07.2009	16:01:00	PS74/0171-1	LANDER	72° 0.28' N	14° 43.69' E	1285

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
24.07.2009	16:42:00	PS74/0171-1	LANDER	72° 0.39' N	14° 43.94' E	1282
24.07.2009	17:14:00	PS74/0171-1	LANDER	72° 0.28' N	14° 43.49' E	-
24.07.2009	17:37:59	PS74/0171-1	LANDER	72° 0.27' N	14° 44.33' E	1287
24.07.2009	18:56:00	PS74/0172-1	ROV	72° 0.28' N	14° 43.95' E	1279
24.07.2009	20:51:00	PS74/0172-1	ROV	72° 0.35' N	14° 43.38' E	1281
25.07.2009	06:14:00	PS74/0172-1	ROV	72° 0.37' N	14° 43.46' E	1281
25.07.2009	06:20:00	PS74/0172-1	ROV	72° 0.38' N	14° 43.45' E	1281
25.07.2009	06:20:01	PS74/0172-1	ROV	72° 0.38' N	14° 43.45' E	1281
25.07.2009	07:06:00	PS74/0172-1	ROV	72° 0.37' N	14° 43.39' E	1281
25.07.2009	07:14:59	PS74/0172-1	ROV	72° 0.35' N	14° 43.44' E	1281
25.07.2009	07:44:00	PS74/0173-1	AUV	72° 0.34' N	14° 43.56' E	1282
25.07.2009	07:50:00	PS74/0173-1	AUV	72° 0.31' N	14° 43.68' E	1282
25.07.2009	07:52:00	PS74/0173-1	AUV	72° 0.30' N	14° 43.71' E	1283
25.07.2009	07:53:00	PS74/0173-1	AUV	72° 0.29' N	14° 43.74' E	1282
25.07.2009	08:00:00	PS74/0173-1	AUV	72° 0.24' N	14° 43.91' E	1283
25.07.2009	08:00:01	PS74/0173-1	AUV	72° 0.24' N	14° 43.91' E	1283
25.07.2009	08:02:59	PS74/0173-1	AUV	72° 0.23' N	14° 43.92' E	1282
25.07.2009	10:24:00	PS74/0174-1	HS_PS	72° 0.46' N	14° 42.73' E	1293
25.07.2009	11:15:00	PS74/0174-1	HS_PS	72° 0.46' N	14° 44.34' E	1273
25.07.2009	11:22:00	PS74/0174-1	HS_PS	72° 0.53' N	14° 44.24' E	1286
25.07.2009	11:45:00	PS74/0174-1	HS_PS	72° 0.52' N	14° 43.14' E	1293
25.07.2009	11:49:00	PS74/0174-1	HS_PS	72° 0.54' N	14° 43.15' E	1292
25.07.2009	12:24:00	PS74/0174-1	HS_PS	72° 0.54' N	14° 44.19' E	1286
25.07.2009	12:29:00	PS74/0174-1	HS_PS	72° 0.60' N	14° 44.13' E	1283
25.07.2009	12:45:00	PS74/0174-1	HS_PS	72° 0.60' N	14° 43.34' E	1290
25.07.2009	12:53:00	PS74/0174-1	HS_PS	72° 0.62' N	14° 43.40' E	1290
25.07.2009	13:34:59	PS74/0174-1	HS_PS	72° 0.62' N	14° 44.54' E	1283
25.07.2009	13:59:00	PS74/0175-1	COLOSSOS	72° 0.31' N	14° 43.64' E	1284
25.07.2009	16:03:00	PS74/0175-1	COLOSSOS	72° 0.31' N	14° 43.67' E	-
25.07.2009	16:27:59	PS74/0175-1	COLOSSOS	72° 0.37' N	14° 44.23' E	1282
25.07.2009	17:04:00	PS74/0176-1	ROV	72° 0.33' N	14° 43.15' E	1282
25.07.2009	17:24:00	PS74/0176-1	ROV	72° 0.33' N	14° 43.27' E	1282
25.07.2009	17:46:00	PS74/0176-1	ROV	72° 0.34' N	14° 43.75' E	1282
25.07.2009	20:16:00	PS74/0176-1	ROV	72° 0.36' N	14° 43.30' E	1281
25.07.2009	21:09:00	PS74/0176-1	ROV	72° 0.34' N	14° 43.43' E	1282
25.07.2009	21:09:01	PS74/0176-1	ROV	72° 0.34' N	14° 43.43' E	1282
26.07.2009	13:00:00	PS74/0176-1	ROV	72° 0.31' N	14° 43.85' E	1281
26.07.2009	13:05:00	PS74/0176-1	ROV	72° 0.34' N	14° 43.85' E	1282
26.07.2009	13:56:00	PS74/0176-1	ROV	72° 0.33' N	14° 43.79' E	1282
26.07.2009	14:03:59	PS74/0176-1	ROV	72° 0.30' N	14° 43.70' E	1282

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
26.07.2009	14:07:00	PS74/0175-1	COLOSSOS	72° 0.28' N	14° 43.53' E	-
26.07.2009	14:31:00	PS74/0175-1	COLOSSOS	72° 0.28' N	14° 43.56' E	-
26.07.2009	15:00:59	PS74/0175-1	COLOSSOS	72° 0.43' N	14° 43.61' E	1282
26.07.2009	15:42:00	PS74/0177-1	HF	72° 0.21' N	14° 43.42' E	1285
26.07.2009	15:52:00	PS74/0177-1	HF	72° 0.21' N	14° 43.41' E	1285
26.07.2009	15:57:00	PS74/0177-1	HF	72° 0.21' N	14° 43.39' E	1285
26.07.2009	16:56:00	PS74/0177-1	HF	72° 0.22' N	14° 43.54' E	1285
26.07.2009	17:12:00	PS74/0177-1	HF	72° 0.28' N	14° 43.58' E	-
26.07.2009	17:13:00	PS74/0177-1	HF	72° 0.28' N	14° 43.58' E	-
26.07.2009	17:34:59	PS74/0177-1	HF	72° 0.28' N	14° 44.27' E	1286
26.07.2009	18:18:00	PS74/0178-1	MUC	72° 0.26' N	14° 42.78' E	1283
26.07.2009	18:24:00	PS74/0178-1	MUC	72° 0.25' N	14° 42.83' E	1282
26.07.2009	18:49:00	PS74/0178-1	MUC	72° 0.29' N	14° 42.95' E	1283
26.07.2009	19:34:00	PS74/0178-1	MUC	72° 0.29' N	14° 43.47' E	1284
26.07.2009	19:40:59	PS74/0178-1	MUC	72° 0.29' N	14° 43.42' E	1283
26.07.2009	20:16:00	PS74/0179-1	COLOSSOS	72° 0.27' N	14° 43.77' E	1284
26.07.2009	22:42:00	PS74/0179-1	COLOSSOS	72° 0.27' N	14° 43.43' E	-
26.07.2009	22:44:00	PS74/0179-1	COLOSSOS	72° 0.26' N	14° 43.40' E	-
26.07.2009	23:05:59	PS74/0179-1	COLOSSOS	72° 0.29' N	14° 43.67' E	1284
26.07.2009	23:32:00	PS74/0180-1	HS_PS	72° 0.29' N	14° 44.47' E	1287
26.07.2009	23:58:00	PS74/0180-1	HS_PS	72° 0.24' N	14° 42.35' E	1290
27.07.2009	00:00:00	PS74/0180-1	HS_PS	72° 0.24' N	14° 42.38' E	1292
27.07.2009	01:07:00	PS74/0180-1	HS_PS	72° 0.24' N	14° 44.51' E	1288
27.07.2009	01:29:00	PS74/0180-1	HS_PS	72° 0.22' N	14° 42.16' E	1293
27.07.2009	02:57:00	PS74/0180-1	HS_PS	72° 0.20' N	14° 44.62' E	1288
27.07.2009	03:22:00	PS74/0180-1	HS_PS	72° 0.19' N	14° 42.22' E	1292
27.07.2009	04:23:00	PS74/0180-1	HS_PS	72° 0.18' N	14° 44.47' E	1288
27.07.2009	04:49:00	PS74/0180-1	HS_PS	72° 0.16' N	14° 42.18' E	1293
27.07.2009	05:52:00	PS74/0180-1	HS_PS	72° 0.15' N	14° 44.51' E	1288
27.07.2009	06:26:00	PS74/0180-1	HS_PS	72° 0.11' N	14° 42.21' E	1293
27.07.2009	07:53:59	PS74/0180-1	HS_PS	72° 0.10' N	14° 44.39' E	1288
27.07.2009	08:34:00	PS74/0181-1	PHC	72° 0.80' N	14° 42.35' E	1294
27.07.2009	08:55:00	PS74/0181-1	PHC	72° 0.78' N	14° 42.45' E	1292
27.07.2009	08:55:01	PS74/0181-1	PHC	72° 0.78' N	14° 42.45' E	1292
27.07.2009	09:58:00	PS74/0181-1	PHC	72° 0.80' N	14° 42.52' E	1293
27.07.2009	09:58:01	PS74/0181-1	PHC	72° 0.80' N	14° 42.52' E	1293
27.07.2009	12:00:59	PS74/0181-1	PHC	72° 0.82' N	14° 42.69' E	1292
27.07.2009	13:30:00	PS74/0182-1	MUC	72° 0.26' N	14° 42.96' E	1281
27.07.2009	13:39:00	PS74/0182-2	HN	72° 0.26' N	14° 42.89' E	1281
27.07.2009	13:42:00	PS74/0182-2	HN	72° 0.27' N	14° 42.96' E	1282

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
27.07.2009	13:47:59	PS74/0182-2	HN	72° 0.28' N	14° 42.96' E	1282
27.07.2009	14:03:00	PS74/0182-1	MUC	72° 0.34' N	14° 43.18' E	1281
27.07.2009	14:57:59	PS74/0182-1	MUC	72° 0.20' N	14° 43.05' E	1282
27.07.2009	15:14:00	PS74/0183-1	ROV	72° 0.17' N	14° 43.36' E	1282
27.07.2009	16:15:00	PS74/0183-1	ROV	72° 0.27' N	14° 43.62' E	1285
28.07.2009	05:05:00	PS74/0184-1	HF	72° 0.33' N	14° 43.77' E	1283
28.07.2009	05:56:00	PS74/0184-1	HF	72° 0.34' N	14° 43.84' E	1283
28.07.2009	05:56:01	PS74/0184-1	HF	72° 0.34' N	14° 43.84' E	1283
28.07.2009	05:58:00	PS74/0184-1	HF	72° 0.34' N	14° 43.82' E	1283
28.07.2009	06:30:59	PS74/0184-1	HF	72° 0.34' N	14° 43.85' E	1283
28.07.2009	06:40:00	PS74/0184-1	HF	72° 0.33' N	14° 43.82' E	1283
28.07.2009	06:54:59	PS74/0184-1	HF	72° 0.34' N	14° 43.83' E	1282
28.07.2009	06:58:00	PS74/0179-1	COLOSSOS	72° 0.35' N	14° 43.84' E	1282
28.07.2009	07:14:00	PS74/0179-1	COLOSSOS	72° 0.35' N	14° 43.83' E	1282
28.07.2009	07:16:00	PS74/0179-1	COLOSSOS	72° 0.35' N	14° 43.82' E	1282
28.07.2009	07:20:00	PS74/0183-1	ROV	72° 0.34' N	14° 43.85' E	1282
28.07.2009	07:37:00	PS74/0179-1	COLOSSOS	72° 0.34' N	14° 43.85' E	1282
28.07.2009	07:42:00	PS74/0179-1	COLOSSOS	72° 0.34' N	14° 43.85' E	1282
28.07.2009	08:10:00	PS74/0183-1	ROV	72° 0.35' N	14° 43.83' E	1283
28.07.2009	08:10:01	PS74/0183-1	ROV	72° 0.35' N	14° 43.83' E	1283
28.07.2009	08:16:59	PS74/0183-1	ROV	72° 0.37' N	14° 43.76' E	1281
28.07.2009	08:54:59	PS74/0179-1	COLOSSOS	72° 0.21' N	14° 44.93' E	1282
28.07.2009	09:24:00	PS74/0185-1	LANDER	71° 59.01' N	14° 45.44' E	1290
28.07.2009	09:24:59	PS74/0185-1	LANDER	71° 59.01' N	14° 45.44' E	1290
28.07.2009	12:00:00	PS74/0186-1	AUV	71° 57.64' N	14° 49.81' E	1211
28.07.2009	12:11:00	PS74/0186-1	AUV	71° 57.41' N	14° 49.94' E	1214
28.07.2009	12:14:00	PS74/0186-1	AUV	71° 57.36' N	14° 49.97' E	1214
28.07.2009	12:16:00	PS74/0186-1	AUV	71° 57.32' N	14° 49.99' E	1215
28.07.2009	12:24:00	PS74/0186-1	AUV	71° 57.14' N	14° 49.83' E	1191
28.07.2009	12:38:00	PS74/0186-1	AUV	71° 57.06' N	14° 49.73' E	1223
28.07.2009	12:50:00	PS74/0186-1	AUV	71° 56.97' N	14° 49.63' E	1225
28.07.2009	13:05:00	PS74/0186-1	AUV	71° 56.87' N	14° 49.62' E	1227
28.07.2009	13:12:00	PS74/0186-1	AUV	71° 56.82' N	14° 49.77' E	1225
28.07.2009	13:21:00	PS74/0186-1	AUV	71° 56.72' N	14° 49.41' E	1229
28.07.2009	13:24:00	PS74/0186-1	AUV	71° 56.73' N	14° 49.40' E	1229
28.07.2009	13:26:59	PS74/0186-1	AUV	71° 56.73' N	14° 49.40' E	1229
28.07.2009	15:17:00	PS74/0187-1	COLOSSOS	72° 0.28' N	14° 43.27' E	1283
28.07.2009	17:27:00	PS74/0187-1	COLOSSOS	72° 0.32' N	14° 43.52' E	-
28.07.2009	17:51:59	PS74/0187-1	COLOSSOS	72° 0.30' N	14° 43.56' E	1284
28.07.2009	18:05:00	PS74/0188-1	ROV	72° 0.26' N	14° 43.58' E	1285

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
28.07.2009	19:16:00	PS74/0188-1	ROV	72° 0.28' N	14° 43.55' E	1284
29.07.2009	06:28:00	PS74/0187-1	COLOSSOS	72° 0.34' N	14° 43.29' E	1282
29.07.2009	06:29:00	PS74/0187-1	COLOSSOS	72° 0.34' N	14° 43.29' E	1282
29.07.2009	06:33:00	PS74/0187-1	COLOSSOS	72° 0.33' N	14° 43.29' E	1282
29.07.2009	06:33:01	PS74/0187-1	COLOSSOS	72° 0.33' N	14° 43.29' E	1282
29.07.2009	06:35:00	PS74/0188-1	ROV	72° 0.33' N	14° 43.25' E	1102
29.07.2009	06:56:00	PS74/0187-1	COLOSSOS	72° 0.36' N	14° 43.12' E	1281
29.07.2009	08:14:00	PS74/0188-1	ROV	72° 0.39' N	14° 43.12' E	1282
29.07.2009	08:14:01	PS74/0188-1	ROV	72° 0.39' N	14° 43.12' E	1282
29.07.2009	08:16:59	PS74/0188-1	ROV	72° 0.39' N	14° 43.12' E	1281
29.07.2009	08:50:59	PS74/0187-1	COLOSSOS	72° 0.18' N	14° 46.70' E	1263
29.07.2009	09:18:00	PS74/0185-1	LANDER	71° 58.92' N	14° 46.13' E	1284
29.07.2009	09:20:00	PS74/0185-1	LANDER	71° 58.94' N	14° 45.99' E	1285
29.07.2009	09:37:00	PS74/0185-1	LANDER	71° 58.90' N	14° 45.85' E	1285
29.07.2009	09:59:59	PS74/0185-1	LANDER	71° 58.83' N	14° 46.02' E	1284
29.07.2009	10:54:00	PS74/0189-1	MUC	72° 0.29' N	14° 43.47' E	1282
29.07.2009	11:27:00	PS74/0189-1	MUC	72° 0.24' N	14° 43.50' E	1282
29.07.2009	11:27:01	PS74/0189-1	MUC	72° 0.24' N	14° 43.50' E	1282
29.07.2009	11:28:00	PS74/0189-1	MUC	72° 0.24' N	14° 43.53' E	1282
29.07.2009	11:54:59	PS74/0189-1	MUC	72° 0.24' N	14° 43.51' E	1283
29.07.2009	12:07:00	PS74/0190-1	CTD/RO	72° 0.24' N	14° 43.47' E	1284
29.07.2009	12:44:00	PS74/0190-1	CTD/RO	72° 0.28' N	14° 43.29' E	1282
29.07.2009	13:10:59	PS74/0190-1	CTD/RO	72° 0.26' N	14° 43.29' E	1284
29.07.2009	14:58:00	PS74/0191-1	HF	72° 0.16' N	14° 44.09' E	1283
29.07.2009	15:06:00	PS74/0191-1	HF	72° 0.15' N	14° 44.13' E	1283
29.07.2009	15:21:00	PS74/0191-1	HF	72° 0.16' N	14° 44.09' E	1280
29.07.2009	15:40:00	PS74/0191-1	HF	72° 0.15' N	14° 43.89' E	1285
29.07.2009	15:55:00	PS74/0191-1	HF	72° 0.16' N	14° 43.94' E	1282
29.07.2009	15:55:59	PS74/0191-1	HF	72° 0.16' N	14° 43.94' E	1282
29.07.2009	15:56:00	PS74/0192-1	HF	72° 0.15' N	14° 43.94' E	1284
29.07.2009	16:06:00	PS74/0192-1	HF	72° 0.20' N	14° 43.82' E	1285
29.07.2009	16:09:00	PS74/0192-1	HF	72° 0.20' N	14° 43.83' E	1285
29.07.2009	16:15:00	PS74/0192-1	HF	72° 0.19' N	14° 43.85' E	1283
29.07.2009	16:16:59	PS74/0192-1	HF	72° 0.19' N	14° 43.85' E	1285
29.07.2009	16:19:00	PS74/0193-1	HF	72° 0.22' N	14° 43.86' E	1284
29.07.2009	16:27:00	PS74/0193-1	HF	72° 0.23' N	14° 43.59' E	1285
29.07.2009	16:29:00	PS74/0193-1	HF	72° 0.23' N	14° 43.61' E	1284
29.07.2009	16:39:00	PS74/0193-1	HF	72° 0.22' N	14° 43.65' E	1285
29.07.2009	16:40:59	PS74/0193-1	HF	72° 0.22' N	14° 43.64' E	1285
29.07.2009	16:46:00	PS74/0194-1	HF	72° 0.25' N	14° 43.59' E	1285

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
29.07.2009	17:00:00	PS74/0194-1	HF	72° 0.26' N	14° 43.82' E	1284
29.07.2009	17:02:00	PS74/0194-1	HF	72° 0.25' N	14° 43.80' E	1285
29.07.2009	17:07:00	PS74/0194-1	HF	72° 0.27' N	14° 43.81' E	1284
29.07.2009	17:08:59	PS74/0194-1	HF	72° 0.27' N	14° 43.80' E	1283
29.07.2009	17:11:00	PS74/0195-1	HF	72° 0.27' N	14° 43.77' E	1284
29.07.2009	17:20:00	PS74/0195-1	HF	72° 0.25' N	14° 43.60' E	1284
29.07.2009	17:25:00	PS74/0195-1	HF	72° 0.27' N	14° 43.58' E	1285
29.07.2009	17:27:59	PS74/0195-1	HF	72° 0.26' N	14° 43.58' E	1284
29.07.2009	17:28:00	PS74/0196-1	HF	72° 0.26' N	14° 43.59' E	1284
29.07.2009	17:42:00	PS74/0196-1	HF	72° 0.27' N	14° 43.35' E	1284
29.07.2009	17:44:00	PS74/0196-1	HF	72° 0.27' N	14° 43.35' E	1284
29.07.2009	17:51:00	PS74/0196-1	HF	72° 0.29' N	14° 43.31' E	1282
29.07.2009	17:52:59	PS74/0196-1	HF	72° 0.29' N	14° 43.32' E	1284
29.07.2009	18:00:00	PS74/0197-1	HF	72° 0.24' N	14° 43.62' E	1284
29.07.2009	18:31:00	PS74/0197-1	HF	72° 0.22' N	14° 43.31' E	1284
29.07.2009	18:40:00	PS74/0197-1	HF	72° 0.22' N	14° 43.32' E	1285
29.07.2009	18:41:59	PS74/0197-1	HF	72° 0.22' N	14° 43.32' E	1284
29.07.2009	18:45:00	PS74/0198-1	HF	72° 0.21' N	14° 43.32' E	1284
29.07.2009	18:52:00	PS74/0198-1	HF	72° 0.20' N	14° 43.32' E	1283
29.07.2009	18:55:00	PS74/0198-1	HF	72° 0.19' N	14° 43.31' E	1282
29.07.2009	19:03:00	PS74/0198-1	HF	72° 0.20' N	14° 43.31' E	1284
29.07.2009	19:04:59	PS74/0198-1	HF	72° 0.20' N	14° 43.31' E	1284
29.07.2009	19:06:00	PS74/0199-1	HF	72° 0.20' N	14° 43.29' E	1284
29.07.2009	19:22:00	PS74/0199-1	HF	72° 0.20' N	14° 43.20' E	1283
29.07.2009	19:28:00	PS74/0199-1	HF	72° 0.20' N	14° 43.19' E	1284
29.07.2009	19:29:59	PS74/0199-1	HF	72° 0.21' N	14° 43.19' E	1283
29.07.2009	19:30:00	PS74/0200-1	HF	72° 0.20' N	14° 43.19' E	1284
29.07.2009	19:48:00	PS74/0200-1	HF	72° 0.19' N	14° 43.02' E	1282
29.07.2009	19:49:00	PS74/0200-1	HF	72° 0.19' N	14° 43.02' E	1281
29.07.2009	19:55:00	PS74/0200-1	HF	72° 0.20' N	14° 43.01' E	1280
29.07.2009	19:56:59	PS74/0200-1	HF	72° 0.19' N	14° 43.02' E	1280
29.07.2009	19:57:00	PS74/0201-1	HF	72° 0.19' N	14° 43.03' E	1280
29.07.2009	20:12:00	PS74/0201-1	HF	72° 0.17' N	14° 42.79' E	1284
29.07.2009	20:14:00	PS74/0201-1	HF	72° 0.18' N	14° 42.79' E	1284
29.07.2009	20:14:01	PS74/0201-1	HF	72° 0.18' N	14° 42.79' E	1284
29.07.2009	20:16:00	PS74/0201-1	HF	72° 0.17' N	14° 42.80' E	1283
29.07.2009	20:18:00	PS74/0201-1	HF	72° 0.18' N	14° 42.83' E	1284
29.07.2009	20:19:00	PS74/0201-1	HF	72° 0.17' N	14° 42.84' E	1283
29.07.2009	20:20:00	PS74/0201-1	HF	72° 0.17' N	14° 42.84' E	1285
29.07.2009	20:22:00	PS74/0201-1	HF	72° 0.17' N	14° 42.83' E	1282

Date	Time	Station	Gear	PositionLat	PositionLon	Depth [m]
29.07.2009	20:22:01	PS74/0201-1	HF	72° 0.17' N	14° 42.83' E	1282
29.07.2009	20:22:02	PS74/0201-1	HF	72° 0.17' N	14° 42.83' E	1282
29.07.2009	20:35:00	PS74/0201-1	HF	72° 0.18' N	14° 42.82' E	1284
29.07.2009	20:37:00	PS74/0202-1	HF	72° 0.18' N	14° 42.82' E	1283
29.07.2009	20:37:59	PS74/0201-1	HF	72° 0.18' N	14° 42.82' E	1283
29.07.2009	20:53:00	PS74/0202-1	HF	72° 0.16' N	14° 42.58' E	1290
29.07.2009	20:55:00	PS74/0202-1	HF	72° 0.16' N	14° 42.59' E	1288
29.07.2009	21:07:00	PS74/0202-1	HF	72° 0.17' N	14° 42.58' E	1289
29.07.2009	21:09:59	PS74/0202-1	HF	72° 0.17' N	14° 42.57' E	1290
29.07.2009	21:31:00	PS74/0203-1	HF	72° 0.30' N	14° 43.40' E	1283
29.07.2009	21:49:00	PS74/0203-1	HF	72° 0.39' N	14° 43.43' E	1280
29.07.2009	22:03:00	PS74/0203-1	HF	72° 0.38' N	14° 43.32' E	1279
29.07.2009	22:08:00	PS74/0203-1	HF	72° 0.36' N	14° 43.27' E	1282
29.07.2009	22:11:00	PS74/0203-1	HF	72° 0.36' N	14° 43.25' E	1281
29.07.2009	22:30:59	PS74/0203-1	HF	72° 0.35' N	14° 44.18' E	1281
29.07.2009	22:33:00	PS74/0204-1	HF	72° 0.33' N	14° 44.31' E	1284
29.07.2009	22:53:00	PS74/0204-1	HF	72° 0.29' N	14° 44.12' E	1281
29.07.2009	22:58:00	PS74/0204-1	HF	72° 0.29' N	14° 44.12' E	1281
29.07.2009	22:59:00	PS74/0204-1	HF	72° 0.28' N	14° 44.12' E	1281
29.07.2009	23:00:59	PS74/0204-1	HF	72° 0.28' N	14° 44.13' E	1281
29.07.2009	23:08:00	PS74/0205-1	HF	72° 0.24' N	14° 43.90' E	1283
29.07.2009	23:10:00	PS74/0205-1	HF	72° 0.24' N	14° 43.89' E	1284
29.07.2009	23:19:00	PS74/0205-1	HF	72° 0.23' N	14° 43.83' E	1285
29.07.2009	23:21:00	PS74/0205-1	HF	72° 0.22' N	14° 43.78' E	1284
30.07.2009	00:00:59	PS74/0205-1	HF	72° 0.22' N	14° 44.20' E	1283

Abbreviations

AUV	Autonomous Underwater Vehicle
COLOSSOS	Lift system
CTD/RO	Conductivity-Temperature-Depth / Rosette
HF	Heat Flow (temperature lance)
HN	Hand Net
HS_PS	Hydrosweep - PARASOUND
Lander	Free falling Lander
MOR	Mooring
MUC	Multicorer
PHC	Photon Counter
ROV	Remotely Operated Vehicle

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