ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR-
UND MEERESFORSCHUNG

687
2015

Berichte
zur Polar- und Meeresforschung

Reports on Polar and Marine Research

The Expedition PS85 of the Research Vessel POLARSTERN to the Fram Strait in 2014

Edited by
Ingo Schewe
with contributions of the participants

HELMHOLTZ
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Titel: Eisbeprobung in der Framstraße zur Untersuchung geochemischer Proxies im Rahmen des vom BMBF finanzierten Deutsch-Russischen multidisziplinären Projektes “Transdrift: The Transpolar System of the Arctic Ocean” (Foto von Antje Wildau, Christian-Albrechts-Universität zu Kiel, 20. Juni 2014).

Cover: Dirty ice sampling in the Fram Strait for investigating geochemical proxies in the frame of the BMBF-funded German-Russian multidisciplinary research project “Transdrift: The Transpolar System of the Arctic Ocean” (Picture taken by Antje Wildau, Christian-Albrechts-Universität zu Kiel, 20th of June 2014).

The Expedition PS85 of the Research Vessel POLARSTERN to the Fram Strait in 2014

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Please cite or link this publication using the identifiers
hdl:10013/epic.44988 or http://hdl.handle.net/10013/epic.44988 and
doi:10.2312/BzPM_0687_2015 or http://doi.org/10.2312/BzPM_0687_2015

ISSN 1866-3192

PS85

(ARK-XXVIII/2)

5 June 2014 - 03 July 2014

Bremerhaven – Tromsø

Chief scientist
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Coordinator
Rainer Knust

Contents

1. ZUSAMMENFASSUNG UND FAHRTVERLAUF

Ingo Schewe
Alfred-Wegener-Institut

Werftzeit wurden die beiden geplanten *Polarstern* Expeditionen PS84 und PS85 zu einer Expedition (PS85) zusammengelegt. Dabei wurden die beiden Forschungsprogramme kombiniert und insgesamt um drei Wochen gekürzt. Auch die Anzahl der beteiligten Wissenschaftlerinnen und Wissenschaftler musste deutlich reduziert werden. Die *Polarstern* Expedition PS85 (ARK-XXVIII/2) startete daher erst am 06. Juni 2014 in Bremerhaven.

Die Arbeiten der Expedition konzentrieren sich auf drei Haupt-Arbeitsgebiete in der arktischen Framstrasse zwischen Grönland und Spitzbergen in einem Korridor zwischen 77°20‘ N und 79°50‘ N. Das erste Gebiet befand sich auf dem Grönländischen Schelf auf der süd-westlichen Seite des Norske Ore Trough. Hier wurde durch die AWI-Ozeanographie in Kooperation mit der Universität Delaware ein neues Mooring-Array ausgelegt, um die bodennahe Rezirkulation von warmem Wasser aus der Framstraße in dieser Region zu untersuchen. Das zweite Hauptarbeitsgebiet war der sogenannte ozeanographische 78°-Schnitt, welcher die Framstraße bei 78°50'N von etwa 10° W bis 9° E quert und aus einer ganzen Reihe von CTD und Mooring-Stationen seit 1997 besteht. Das dritte Arbeitsgebiet befand sich am Tiefsee Langzeit-Observatorium HAUSGARTEN, in welchem seit 1999 die längerfristigen ökologischen Veränderung in der östlichen Framstraße und deren möglicher Zusammenhang mit dem fortschreitenden Klimawandel untersucht werden. In diesem Jahr wurden diese Untersuchungen im Rahmen des durch die HGF geförderten Infrastrukturprogrammes FRAM erstmals auch auf die westliche Seite der Framstraße komplementär ausgedehnt und neue benthische Stationen und Verankerungen in der Nähe des 78°-Schnitts am Grönländischen Kontinentalhang angelegt.

Insbesondere die zweite Hälfte der Expedition auf dem 78°-Schnitt und im HAUSGARTEN war durch ungewöhnlich starken Eisgang geprägt. Um größere Verzögerungen im Programm durch schwierige Eisfahrt und Rammen zu vermeiden, wurde das Arbeitsprogramm in enger Abstimmung mit der Schiffsführung mehrfach angepasst. Aufgrund der schwierigen Eissituation und immer wieder aufkommendem starken Nebels war es schließlich auch nicht möglich einige ozeanographische, sowie eine HAUSGARTEN-Mooring zu bergen. Allerdings konnten alle Moorings und Lander wie geplant ausgelegt werden.

Insgesamt kann der Gesamtverlauf der Expedition trotz der genannten erheblichen Einschränkungen als sehr erfolgreich bezeichnet werden.

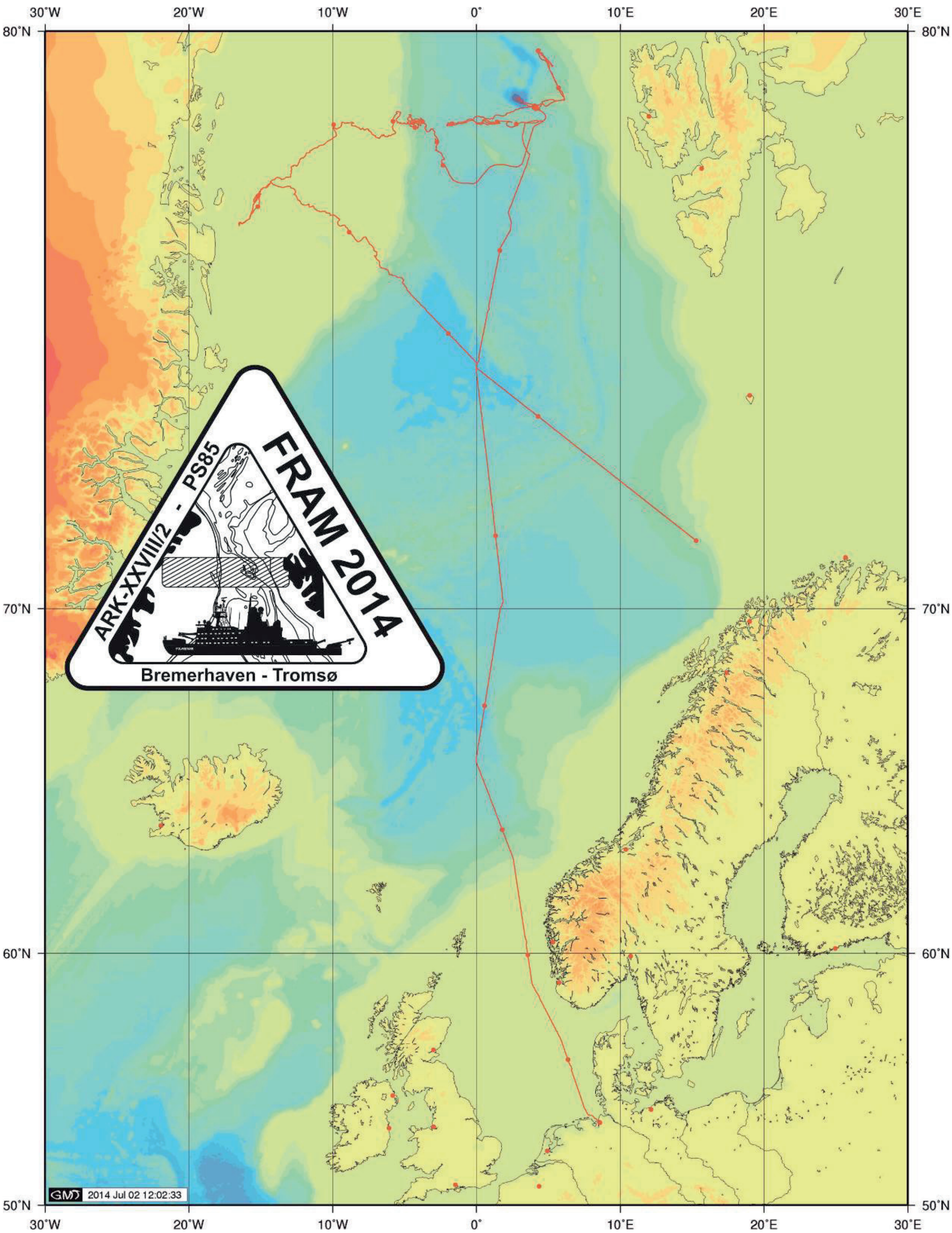

Abb. 1.1: Kurs der Polarstern Reise PS85 (ARK-XXVIII/2)

Fig. 1.1: Cruise track of Polarstern during the expedition PS85 (ARK-XXVIII/2)

ITINERARY AND SUMMARY

The planned *Polarstern* expeditions PS84 and PS85 had to be consolidated into only one expedition PS85 (ARK-XXVIII/2). Due to technical problems the planned layover at the dockyard had to be prolonged. For this reason both research programmes had to be combined into one cruise leg and shortened by three weeks. Correspondingly the number of participating scientists had to be significantly reduced. Due to these reasons the *Polarstern* expedition PS85 (ARK-XXVIII/2)started in Bremerhaven on 6 June 2014.

The activities in the Fram Strait were concentrated to three main working-areas between Greenland and Svalbard in a corridor between 77°20' N and 79°50' N. The first area was located on the Greenland Shelf on the south-westerly opening of the Norske Ore Trough. Here AWI oceanography deployed - in cooperation with colleagues from the university Delaware - a new shallow water mooring array to investigate the near bottom circulation of warm water from the Fram Strait. The second working area was the so called oceanographic '78°-transect'. It crosses the Fram Strait at 78°50' N between 10°W and 9° E and has been sampled by CTD sections and moorings since 1997. The third working area was the deep-sea longterm-observatory HAUSGARTEN, where since 1999 longterm ecological changes of the eastern Fram Strait in relation to Global Change have been investigated. This year those studies were extended to the western Fram Strait on the East-Greenland slope. Here complementary investigations will be performed in the frame of the HGF-financed infrastructure-project FRAM (Frontiers in Arctic Marine Monitoring) and benthic stations and moorings like in the HAUSGARTEN deployed.

Especially the second half of the expedition at the '78°-transect' was dominated by an unusual heavy ice situation. In close cooperation with the ship's command the working programme was repeatedly adjusted to avoid extended time lags due to difficult passages through the ice or due to the necessity of ramming.. Due to the ice situation and foggy conditions at the end it was impossible to recover some oceanographic mooring and one mooring at HAUSGARTEN. However a significant number of moorings were recovered and all planned mooring and landers deployed at least.

At large the expedition can be considered to have been very successful despite the aforementioned substantial restrictions.

2. WEATHER CONDITIONS

Dipl.-Met. Christian Paulmann, Juliane Hempelt DWD

The first leg was a transit from Bremerhaven to the way point 75°N 00°E. In consequence of an almost stationary storm low west of Ireland, it was a really calm transit: After our departure from Bremerhaven in the evening of June 6, we sailed with sunny conditions in a moderate north-westerly air current on the back side of a low pressure area (1015 hPa) across the Skagerrak. That low was filling along its easterly track and a new belt of high pressure across the eastern North Sea was establishing between two highs 1021 hPa across the southern Baltic States and Iceland. So wind was abating already during the night to June 7.

During the next days, that belt of high pressure was shifting to the east. A northward shifting frontal trough of the above mentioned central low west of Ireland was passing our cruising area 'Utsira' in the course of June 8, combined with an increasing south-southeasterly wind up to 4 Bft in front of that trough and south-southwesterly winds up to 5 Bft after its passage. That wind was triggered by an intermediate high 1020 hPa, which developed across the eastern North Sea at the back side of the trough. Simultaneously, more humid air masses with temporary fog patches were entering our sailing area off 'Svinöy' during the night to June 9. During June 10, wind was abating, cloud bases were dropping and new banks of fog were passing. Simultaneously, a high across Greenland was intensifying up to 1035 hPa. In the night to June 11 east of Jan Mayen, we came on the eastern flank of an associated ridge with a light north-easterly current, with inflow of dry air and fog dissipation.

At the same time, a low 1013 hPa developed in the lee of Northeast-Greenland near 80°N 20°W. It was moving southeast via the Framstrait towards the North Cape until June 12. We was sailing on its southern flank on June 11 and on its back western side on June 12. Wind was backing west for a time with subsequent freshening up to 5 Bft. For the first time since Bremerhaven, significant wave heights increased up to 1.5 m. Additionally, a flood of cold polar air with embedded light snow showers was approaching.

During next days, a storm low 988 hPa was weakening along its south-eastern track from the North Pole via the sea areas close east of Svalbard to the Barents Sea. A strong north-westerly wind with stormy gusts and snow showers were forecasted for our planned research area 'Hausgarten'. Due to really better weather conditions close east of Greenland, it was decided to change the course and to go to coastal Greenland at 78°N 16°W from June 12 on. Later on June 12, another south-eastward shifting ridge of the Greenland-high was passing the *Polarstern*. Consequently, the weakening wind was backing to southwest, snow showers were fading away rapidly.

In the afternoon of June 12, we sighted first ice floes near 76°N 03°W. Between Bremerhaven and the first research area near 78°N 16°W, air was cooling step by step from +17°C down to -4°C. From June 12 until June 13, the base of a significant 7 degrees low-level temperature inversion was dropping down to the surface. Humid and cold air was caught below that inversion, together with dropping cloud bases and upcoming both fog and light snowfall from the night to June 13 till subsequent noon. Numerical weather models couldn't represent that thin inversion as well as the closed cloud cover, near-surface air was 6 degrees colder than modelled. On June 13, *Polarstern* was sailing along the south-westernmost edge of the above mentioned North-Pole storm low with an occasionally freshening westerly wind, which was veering northwest and pushing the fog eastward.

Starting from a new high 1025 hPa around Jan Mayen, a new associated ridge established across our sailing area in the night to June 14. Subsequently, wind was backing and abating. From June 14 until June 16, that ridge was slowly shifting east towards Svalbard. Hence from noon of June 13 until late June 16, it was really sunny, another dropping temperature inversion brought the temperatures up to +5°C. From June 15 on, southerly wind was increasing up to 4 Bft on the western flank of the ridge. At the same day, research off eastern Greenland was finished with a subsequent transit to the new research area along 78.8°N between 10°W and the 'Hausgarten'. Mid and upper level advection of warm air masses caused the near-surface temperature inversion to intensify up to 10 degrees and to thicken up to 1,500 m from June 16 on. The 12 UTC atmospheric sounding at 79°N 10°W showed +10 to +12°C between 700 m and 2,200 m AMSL (Above Mean Sea Level)!

An upper-level (at 10 to 11 km) Jetstream established between East-Canada, North-Greenland and Svalbard due to strong horizontal thermal differences. Two new low pressure areas1005 hPa developed across Northeast-Greenland below the frontal right entrance of an embedded jet maximum, they were moving southeast across the Framstrait and Svalbard from June 16 until 18. From the evening of June 16 on, *Polarstern* was sailing on the back side of those lows. Wind was turning to northerly and later north-westerly directions and was freshening up to 4 to 5 Bft, accompanied with mid- and high-level advection of colder air masses. Fog was passing in the night to June 17. New low-level clouds with drizzle were approaching later on June 17, but a great part of the drizzle was evaporating inside of the dry boundary layer.

On June 18, a storm low 993 hPa across the Kara Sea started to move north towards Franz-Josef-Land and the North-Pole. Freshening northerly winds brought a new flood of cold polar air and light snowfall during the morning. On June 19, a new high at 76°N 12°W off coastal East-Greenland with an associated northward extending ridge intensified. Therefore, gradually weakening winds was backing northwest. From the afternoon of June 18 until June 19, many patches of low-level clouds were passing with an excellent visibility even poor contrasts below.

During June 20, another associated ridge was extending towards Svalbard and Franz-Josef-Land. We got a very stable meteorological situation, called Omega-Situation (Greek letter Omega-like shape of the upper-level current). Until June 21, mostly light wind on the back of the high pressure zone was turning to south-westerly or southerly directions with subsequent freshening (5 Bft). The low cloud bases were further dropping down to the surface with fog banks, visibilities partly about 800 m and upcoming freezing drizzle. From now on, the research focus was shifted to the 'Hausgarten' area (79 to 80°N, 02 to 06°E) near the ice edge. From June 23 on, very mild and still moister air masses came to the mid- and upper-tropospheric levels. Thus, a significant 8 degree low-level temperature inversion with temperatures up to +7°C between 1 and 2 km AMSL was developing until June 26. Fog and freezing drizzle became more frequent. During that period until June 25, the predominant high off East-Greenland was further intensifying up to 1028 hPa and was shifting southeast towards the central Norwegian Sea, as well as the associated ridge was developing into a separate high 1023 hPa east of Svalbard.

Research at the 'Hausgarten' area was finished on June 26. Afterwards, research was continued along 78.8°N east of 03°W. One week before that, there had been no possibility to work there due to the difficult ice situation. Also from June 26 on, a weak low 1012 hPa across Southeast-Greenland was slowly moving northeast via the Framstrait to Svalbard, an associated frontal trough sent a new flood of mild and humid air to our cruising area. Long-running fog occurred from the evening of June 26 until the morning of June 29, partly with visibilities strictly below 500 m. During that period, near-surface air temperature was increasing up to +4°C. Only for

13 hours on June 29, we saw lifting fog and breaking clouds, caused by lee-effects west of Svalbard with freshening easterly winds on the northern flank of the approaching low. But already during the evening of June 29, easterly wind was further backing and dense fog came back. That dense fog was prevailing until the morning of July 1.

During the morning of June 30, research at 78.8°N 04°E finished, afterwards the transit back to Tromsø via waypoint 75°N 00°E started: On June 30, *Polarstern* was sailing on the back side of the remaining Svalbard-low with firstly fresh northerly winds. Simultaneously, new intermediate highs established off Mid-Norway (1020 hPa) and off East-Greenland (1015 hPa) with a belt of high pressure in between. On July 1, the sailing area was situated inside of that belt of high pressure with calming winds, dissipating fog, lifting cloud bases and upcoming 1m-swell from the west. From July 1 until July 3, a deepening storm low across the Irminger Sea was moving east to the sea areas east of Iceland. We came on its easternmost frontal side on the late July 2, coupled with temporary breaking clouds, east-northeastward backing winds and gradually increasing wind force up to 5 Bft. Those conditions with increasing wave heights up to 1.5 m continued until our arrival at Tromsø in the morning of July 3. Statistics of various other weather parameters are displayed in Fig. 2.1.

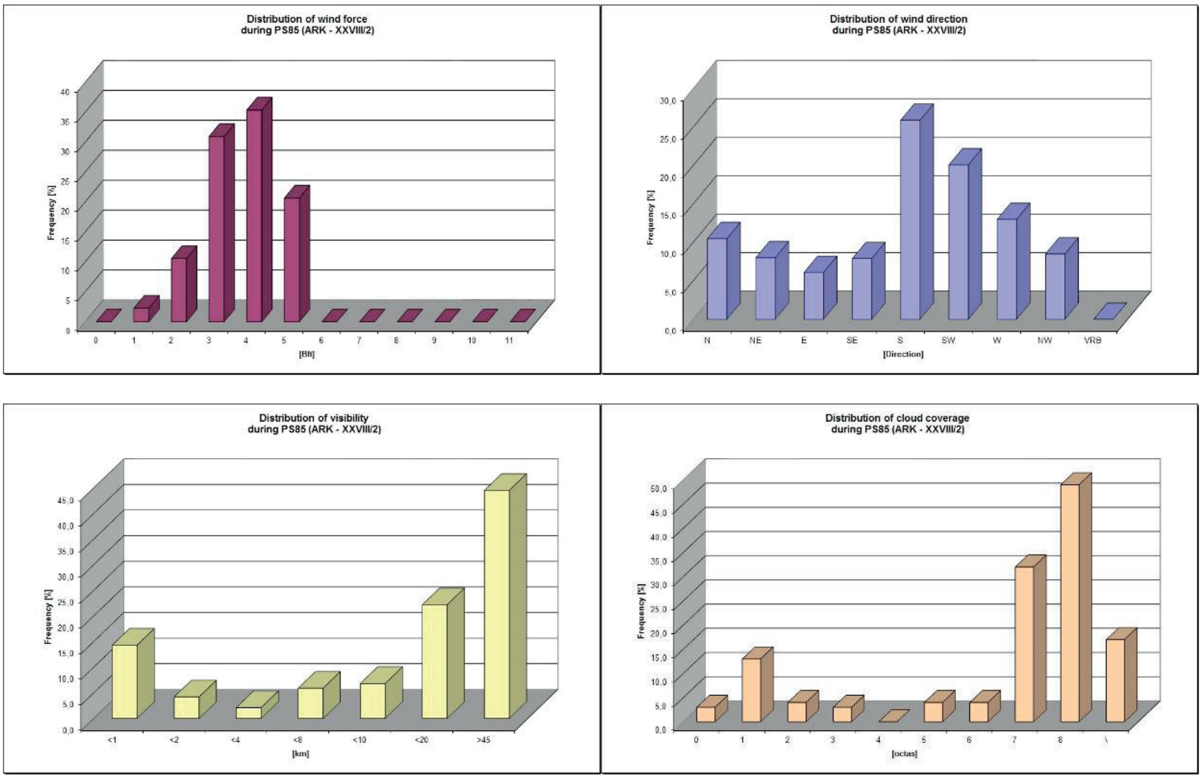

Fig. 2.1: Statistics of various weather parameter

3. MEASUREMENTS OF THE ARCTIC ATMOSPHERIC BOUNDARY LAYER USING A WIND LIDAR

Svenja Kohnemann[1], Günther Heinemann (not on board)   [1]Univ. Trier

Grant No: AWI_PS85_01

Objectives

The representation of the atmospheric boundary layer (ABL) in the Arctic is a major challenge for numerical weather forecast models and regional climate models. Reference data sets are rare, particularly over the ocean areas. The group of the University of Trier performed measurements of vertical and horizontal profiles of wind, turbulence and aerosols in the Fram Strait area. In this area, the knowledge of wind profiles is of great interest, since the coupling of the ocean and sea-ice surface with the ABL (and the free atmosphere above) determines the wind-driven sea-ice export of the Arctic.

Work at sea

To measure the wind, turbulence and aerosols of the ABL in the Fram Strait area, a Doppler wind LIDAR was used for the first time on the ship. The operational principle of the wind lidar is an outgoing laser beam that is backscattered at aerosol and cloud particles. Thereby, the resulting frequency change of the light is measured (Doppler effect). The lidar can operate with a maximum range of 10 km and operates at a wavelength of 1.5 µm with a pulse rate of 20 kHz. The instrument is eye-saved.

On board of the *Polarstern*, the instrument was installed on the starboard side on the lower part of the upper deck. An Attitude Heading Reference System (AHRS) was used to measure the ship's movement and orientation, which is needed to correct the single laser beams by the inclination angles of the ship's movement. Both instruments could measure continuously for 24 h a day during the cruise. However, weather conditions like fog and conditions with low aerosol concentration restricted the measurements.

The data sets that could be measured during the time on board differ in weather and ice conditions as well as in the measurement area due to the cruise of the ship. That means the measurements are taken along the ship route or at a certain station over time.

The system was typically programmed to perform 5 min time sequences consisting of constant elevation, scanning azimuth scans (VAD) at (1°,) 25°, 50° and 75° elevation angles, followed by a vertical slice scan of fixed azimuth, varying elevation (RHI), and then a 1-min zenith stare period.

During station times, the programme ran on a rotating basis with a horizontal scan (PPI) sequence of 15 min in 1° and 5° elevation angles oriented towards the ocean and ice border.

Upper-air soundings by radiosondes were performed in addition to the routine upper air soundings at 4:30 and 11:00 UTC to verify the measured lidar data.

Preliminary (expected) results

The wind lidar was used for the first time on a ship in the Arctic. Therefore, firstly the instrument needed to be installed properly including the technical settings and the decision of the best location for the lidar based on the measurement focus (Fig. 3.1). Additionally, the measurement programme had to be adapted to the surrounding area. These implementations were satisfactory, except from a small time shift between the lidar and the AHRS. However, the time shift can be corrected in the analysis.

The expected measurement results of the LIDAR system are vertical and horizontal profiles of wind, turbulence and aerosols.

In general, one of the main expected results is to see the transition of the boundary layer structure (e.g wind speed velocity and turbulence) between the open water and ice covered areas. In the vertical it is of interest to detect the low level jet (LLJ= wind maximum in the lower part of the atmosphere) and to determine the boundary layer height.

Thus, the data from the conical scans will be used to analyse the boundary layer profiles of horizontal wind speed and direction, turbulence intensity and aerosols. The elevation scans provide information about the horizontal boundary layer structure and the mixing height, and the zenith stare data will be used to derive average zenith vertical aerosol backscatter profile and velocity variance (Tucker et al., 2009).

Fig. 3.1: Doppler LIDAR on the starboard side of upper deck.

Data management

The data are saved at the servers of the Environmental Meteorology Department of the University of Trier. The validated wind of profiles of the lidar will be made available via the online data base Pangaea (www.pangaea.de). The additional radiosonde data are archived by AWI.

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4. INVESTIGATION OF EMERGING PERSISTENT ORGANIC POLLUTANTS AND CARBON NANOPARTICLES IN THE NORTH ATLANTIC AND THE ARCTIC

Zhiyong Xie[1], Franziska Heydebreck[1] (not on board), Ralf Ebinghaus[1] (not on board)
[1]HZG

Grant No: AWI_PS85_02

Objectives

Persistent organic pollutants (POPs) can be transported into the Arctic via atmosphere, ocean current and rivers. Once occurring in the Arctic, the POPs are subject to a variety of processes in the Arctic environment such as degradation, settling, exchange with the atmosphere, adjective transport, water-sediment recycling, bioaccumulation, etc. These processes affect the fate of organic pollutants in the Arctic ecosystem. There are now a few studies for the long-range transport of classic persistent organic pollutants such as PCBs and HCHs from Asia, European and North American continents into the Arctic, while the occurrence and transport pathways of emerging organic pollutants are still not well understood. Additionally climate change may significantly influence the transport and environment fate of organic pollutants in the Arctic. This project is focused on studies of the distribution and atmospheric transport of emerging organic pollutants such as perfluoroalkyl substances (PFASs), perfluorophosphate surfactants (PAPs), brominated flame retardants (BFRs), Organophosphate esters (OPEs), current use pesticides (CUPs) and Carbon nanoparticles in the North Atlantic and the Arctic.

Carbon nanoparticles, i.e. fullerenes have been engineered for use in numerous applications, including personal care products, textiles and microelectronics. The occurrence of fullerenes in the air over Mediterranean revealed that nanoparticles can be transported via the atmosphere from industrial and urban sources to remote oceans.

Per- and polyfluorinated organic compounds such as perfluorocarboxylic and sulfonic acids, perfluoro alkyl sulfonamide and N-substituted sulfonamides (PFASs), and fluorotelomer alcohols (FTOHs) are substances that have been extensively used and applied in industrial and consumer products in the past 50 years due to their surface-active properties and thermal as well as chemical stability. Among these substances are perfluorooctanoate (PFOA) and perfluorooctanesulfonate (PFOS). PFOA and PFOS are toxic, persistent, bioaccumulative and ubiquitously distributed, even in remote locations such as the Arctic or the Antarctica.

Brominated flame retardants (BFRs), particularly polybrominated diphenyls (PBDEs), tetrabromobisphenol A (TBBPA) and hexabromocyclododecane (HBCD) have been used in a number of commercial application to prevent fire with world production more than 200,000 metric tons each year. Levels of BFRs seem to be increasing in environment and humans in the past 30 years. Trace levels have been determined in the air and polar bear in the Arctic.

Organophosphate esters (OPEs) are used on large scale as additive flame-retardant agents, plasticizers or both in diverse products, such as application in plastic material, lubricants, and electronic goods. The production and use of brominated flame retardants (BFRs) have been gradually phased out in the United States (US) and European Union (EU) due to their persistence, bioaccumulation and toxicity to animals and humans, currently many new flame retardants are developed as substitutes of BFR. Consequently, the consumption of OPEs has increased continually. The annual European consumption of OPs as FRs was 91,000 tonnes in 2006 (www.efra.com). The global consumption of OPEs amounted to 500,000 tons in 2011, and expected to reach 680,000 tons in 2015. Synthesized OPEs distribute evenly between chlorinated and nonchlorinated OPEs, such as TCPP, TCEP, TDCPP, TBP, TEHP, TPP and TBEP. A number of studies have been carried out on the toxic effects of OPEs on human and aquatic organisms. It is shown that OPE can bind to estrogen receptors in cell, and thus are capable of interacting with hormone systems. TCEP is included in the European Commission second priority list, while TCPP and TDCPP are included in the fourth priority list. They are also listed as EU high production volume (HPV) chemicals together with TPP, TBP and TBEP. These lead OPEs gaining research priority within the environmental research community.

The Arctic is an important indicator region for the sustainable relevance of persistent, bio-accumulative and toxic chemical substances. Most parts of the Arctic are very remote with few activities that constitute local sources of POPs.

For the 2014 cruise PS85 (ARK-XXVIII/2), the proposed project is focused on the determination of PFASs, PAPs, alternative BFRs, OPFRs, and carbon nanoparticles in surface waters and air from the Western Svalbard to Eastern Greenland Sea. The aim of the project is to characterize the distribution of ePOPs in the atmosphere and sea water of the Arctic Ocean and evaluate the air–sea gas exchange process intervening in the transport of ePOPs into arctic region. Data from arctic snowpack, surface seawater and paired air samples will be used to estimate recession and redistribution for ePOPs among different environmental compartments, discover the flow of persistent organic pollutants via air-water or air-snow interaction in the Arctic.

Work at sea

Air samples were collected using a high-volume air sampler operating at a constant flow rate of 500 L min^{-1}. The ship-borne air samples are collected on the upper deck of *Polarstern* (Fig. 4.1). Typical air sample volume is 400 - 900 m^3. The high volume air sampler consists of a high

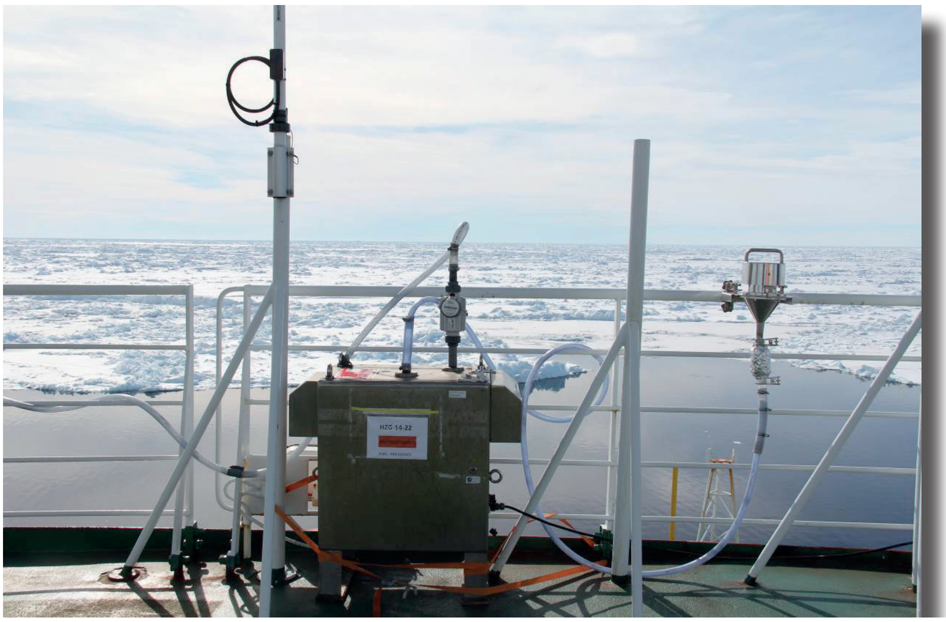

Fig. 4.1: High volume air sampling operated aboard Polarstern during PS85 (ARK-XXVIII/2)

volume pump, a digital flow meter, a metal filter holder and a PUF/XAD-2 column. A glass fiber filter (GF/F, diameter, 150 mm; pore size, 0.7 mm) is used to collect atmospheric particles.

Tab. 4.1 represent samples collected from 60°N to 79°N using PUF/XAD-2 columns. Spatial distribution of air samples has been shown in Fig. 4.2. Additionally two passive air samplers were deployed next to the air pump from 8.6 to 28. 6. 2014 to confirm the background of ship emission during this cruise. Field blanks are prepared by shortly espousing the columns to the sampling site. Air samples are stored at 0°C in a cooling room.

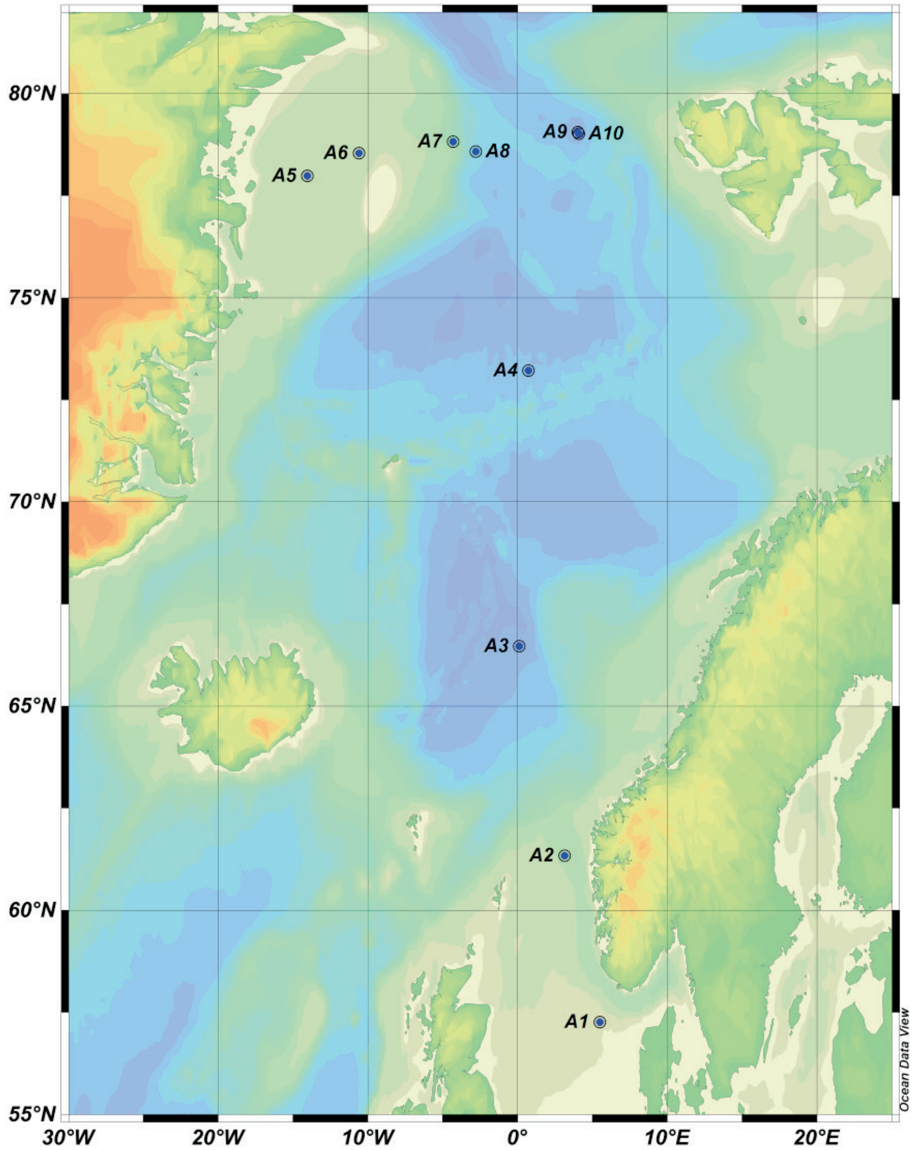

Fig. 4.2: Average sampling positions of high-volume air samples during PS85 (ARK-XXVIII/2)

Seawater samples are collected using both Keel *in-situ* Pump (KISP) and 1 liter sea water for solid-phase extraction. *In-situ* pump was connected to the sea water intake system (stainless steel pipe/Klauss pump) of *Polarstern* (11 m depth). A glass cartridge packed with PAD-2 or PAD-3 is used to enrich the analytes in the dissolved phase, and a glass fibre filter (GF/C, pore size 1.2 µm) is used to collect suspended particular matters (SPMs). Each sample continually ran for ~20 hours to achieve a sample volume of 500 -900 l (**Tab.** 4.2). Moreover, twenty-seven 1-L seawater samples are collected in PP bottles for the determination of ionic PFASs across the North Atlantic and the Arctic (**Tab.** 4.3). PAD-3 columns and PP bottles are stored at 0°C, and the filter samples are stored at -20 °C in a cooling room, respectively. Spatial distribution of the high-volume seawater samples and 1-L PP bottle seawater samples are shown in Fig. 4.3 and 4.4, respectively.

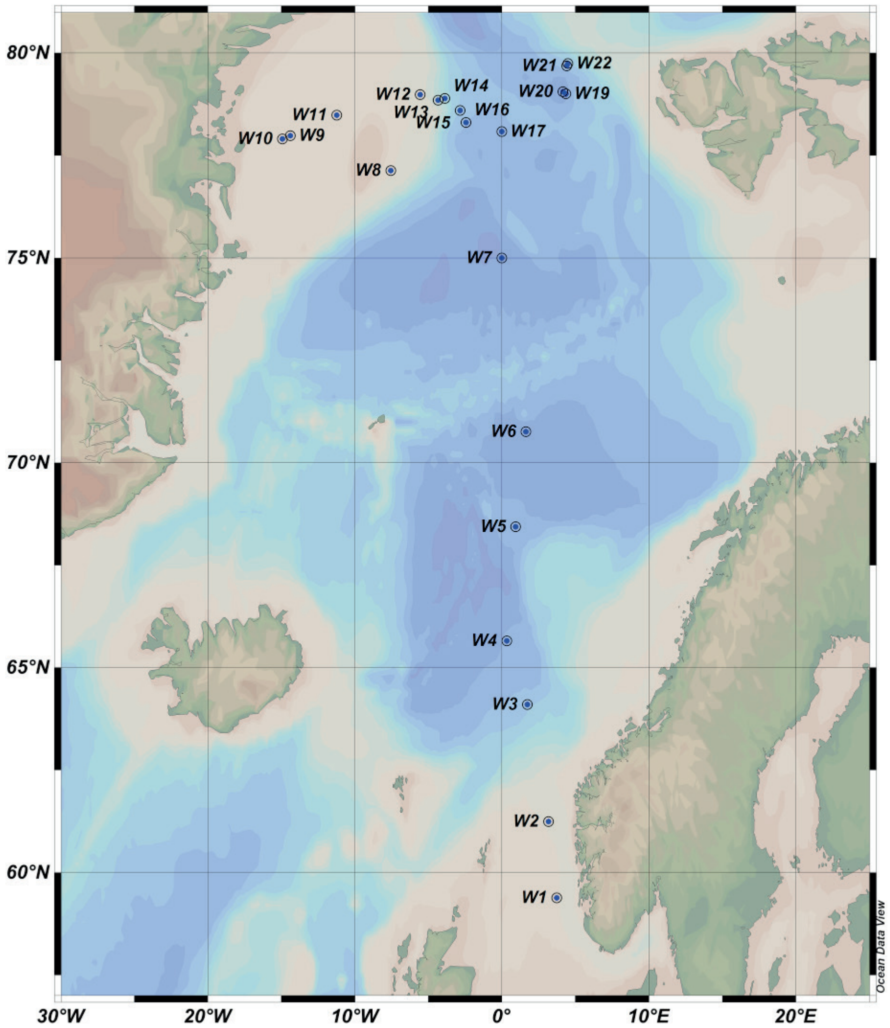

Fig. 4.3: Sampling positions of high-volume seawater samples during PS85 (ARK-XXVIII/2)

Fifteen snow samples have been collected on the Arctic ice using 10-L stainless steel barrels with helicopter and boat (Fig. 4.5). One litre of melting snow water from each snow sample were extracted with solid-phase extraction for the determination of ionic PFASs, and two litre of melting snow water from each sample will be extracted with organic solvent (DCM/Hexane) for the determination of neutral PFCs, BFRs, OPE and currently used pesticides in snow.

Surface sediments have been sampled with a multi-core sampler across the transit from east Greenland Sea to the west Svalbard along 79°N (Fig. 4.6).

Preliminary (expected) results

The samples are further handled in a clean-lab at HZG. PUF/XAD-2, PAD-3 columns and GF filters are spiked with an internal standard mixture as surrogates, and extracted with MX-Soxhlet for 16 h using DCM. All extracts were added 10 mL of hexane and concentrated to 1 mL by rotary evaporation, and following with nitrogen evaporator (Barkey gmbH, Germany) down to 150 µl. After injection for determination of neutral PFASs, the samples were further cleaned on a 2.5 g 10 % water deactivated silica gel column, eluted with 15 mL of hexane (F1), 20 mL of hexane/diethyl ether (3:1 v/v) (F2), 20 mL of acetone/DCM (1:1 v/v) (F3). F2 and F3 were combined for the determination of OPEs and CUPs. 2-L melt snow water samples were liquid-liquid extracted using 50 mL DCM for three times. These water samples are concentrated down to 150 µL and directly injected to GC-MS without further purification. 500 pg $^{13}C_6$-PCB 208 was added into each sample as injection standard.

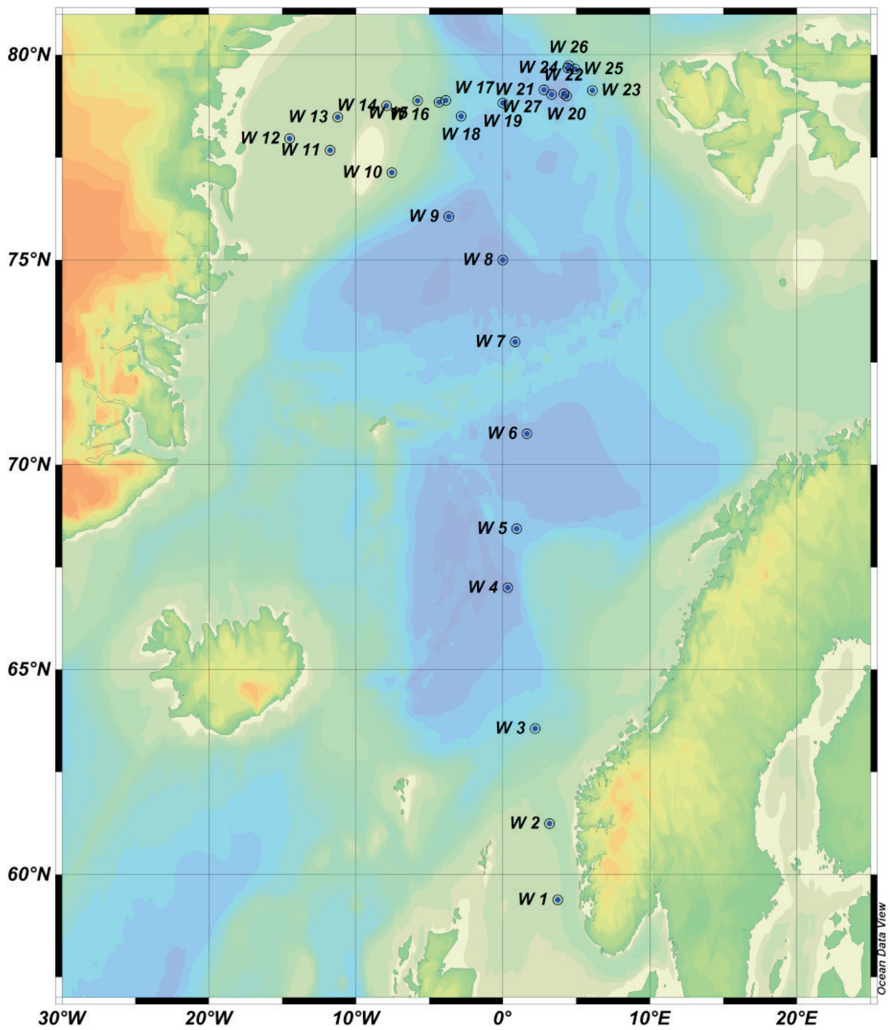

Fig. 4.4: Sampling positions of 1-L seawater samples during PS85 (ARK-XXVIII/2)

1-L seawater samples are extracted with Oasis Wax cartridges. The cartridges are dried for 30 minutes, and then eluted using 5 mL acetonitrile following with 5 mL 0.1 % ammonium hydroxide in methanol for the determination of ionic PFASs and PAPs. 20 ng of the Injection standards (i.e. d5-EtFOSAA and [13C6]-3,4-dichlorophenol, 10 µL of a 2 µg mL-1 solution) were spiked to the final extract.

Neutral PFASs are quantified by an Agilent 6890 gas chromatography (GC) coupled to a 5,973 mass spectrometer (MS) using positive chemical ionization mode (PCI). BFR and CUPs are determined by GC-MS using negative chemical ionization mode (NCI), respectively, and OPEs are determined by GC-MS using electron impact mode (EI). Ionic PFASs and PAPs are detected using liquid chromatography coupled with tandem mass spectrometers (LC-MS/MS). Carbon nanomaterial are analyzed using LC-MS/MS as well.

By combining integrated atmospheric samples and the collections of reprehensive seawater as well as snow samples across different regions of the arctic, findings are sought as to determine air-water/snow exchange and setting flux of these organic pollutants. Data and feedback from this project may improve models to predict the environmental progression and assess the effect of climate change on the long-range transport and the fate of the ePOPs in the marine and Arctic ecosystem.

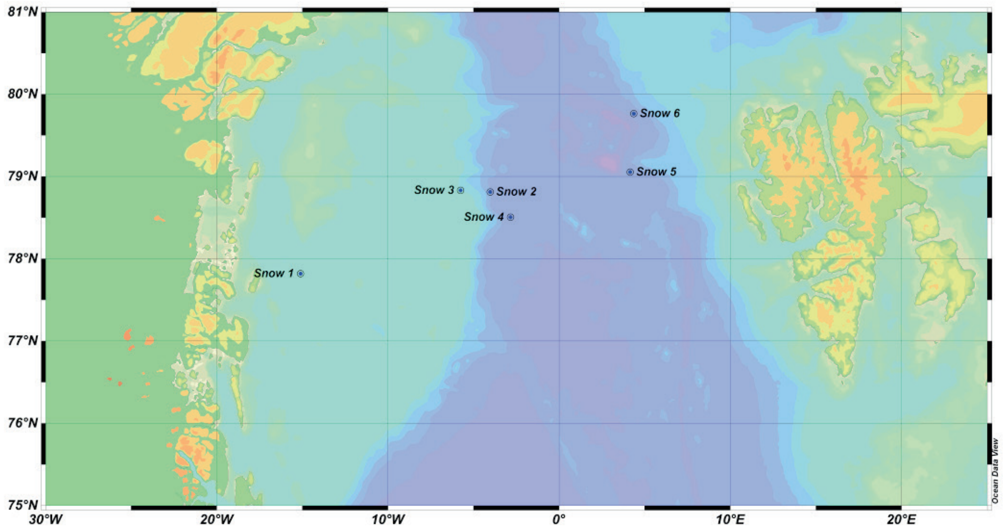

Fig. 4.5: Sampling positions of snow samples during PS85 (ARK-XXVIII/2)

Data management

The finally processed data will be submitted to the PANGAEA data library. The unrestricted availability from PANGAEA will depend on the required time and effort for achievement of individual datasets and its status of scientific publication.

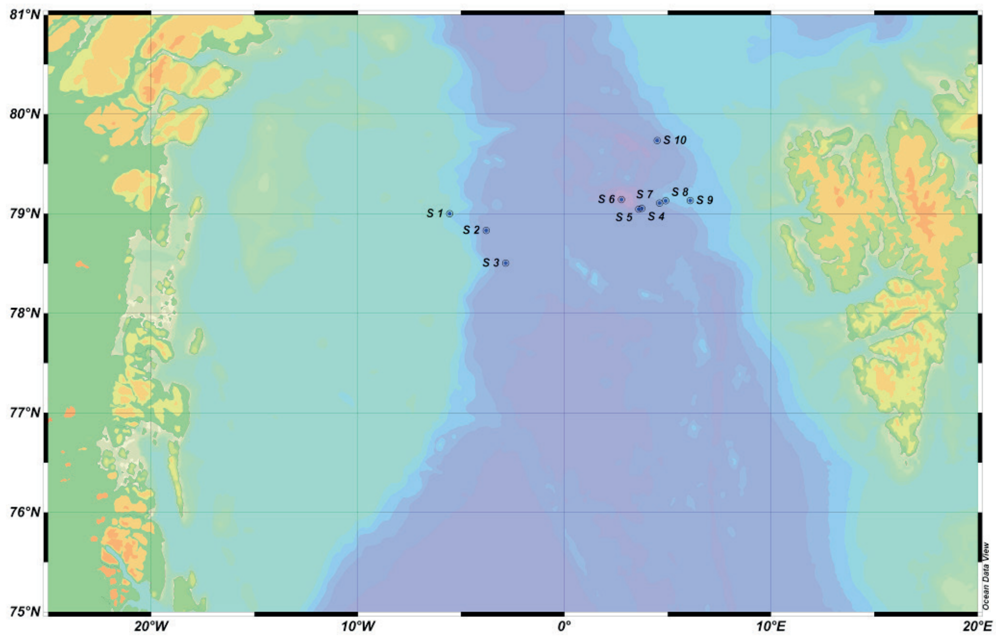

Fig. 4.6: Sampling positions of sediment samples during PS85 (ARK-XXVIII/2)

Tab. 4.1: High-volume air samples for determination of neutral PFASs, BFRs, CUPs, OPE and carbon materials in the atmosphere ("-" means west and south for longitude and latitude)

Station	Date	Latitude	Longitude	Volume (m3)	Ta (°C)
PS85 A1	07.06.14	57.26	5.49	331	14.6
PS85 A2	08.06.14	61.34	3.14	338	12.9
PS85 A3	10.06.14	66.47	0.12	435	8.9
PS85 A4	11.06.14	73.21	0.74	931	0.8
PS85 A5	14.06.14	77.98	-14.04	775	-0.1
PS85 A6	16.06.14	78.54	-10.60	692	3
PS85 A7	18.06.14	78.82	-4.30	694	-2.3
PS85 A8	20.06.14	78.58	-2.79	729	-0.7
PS85 A9	22.06.14	79.06	4.03	607	0.4
PS85 A10	24.06.14	79.02	4.10	568	-0.4

Tab. 4.2: High-volume seawater samples for determination of neutral PFASs, BFRs, CUPs and OPE ("-" means west and south for longitude and latitude)

Station	Date	Lati-tude	Longi-tude	Volume (L)	Tw (°C)	Salinity (‰)
PS85 W1	08.06.14	59.38	3.73	500	14.55	29.48
PS85 W2	08.06.14	61.24	3.17	500	13.95	32.01
PS85 W3	09.06.14	64.10	1.73	500	10.35	35.22
PS85 W4	09.06.14	65.65	0.33	500	9.85	35.11
PS85 W5	10.06.14	68.44	0.94	500	8.68	35.14
PS85 W6	11.06.14	70.76	1.64	700	7.41	35.15
PS85 W7	12.06.14	75.00	0.00	800	2.04	34.84
PS85 W8	13.06.14	77.13	-7.55	800	-1.29	31.9
PS85 W9	14.06.14	77.98	-14.38	700	-0.43	31.2
PS85 W10	15.06.14	77.90	-14.94	400	-0.2	31.25
PS85 W11	16.06.14	78.48	-11.23	800	-0.77	31.65
PS85 W12	17.06.14	78.98	-5.56	450	-1.41	31.02
PS85 W13	18.06.14	78.85	-4.34	900	-1.45	30.81
PS85 W14	19.06.14	78.89	-3.87	800	-1.59	31.86
PS85 W15	20.06.14	78.60	-2.84	750	-1.6	33.94
PS85 W16	21.06.14	78.30	-2.45	500	-1.44	33.68
PS85 W17	21.06.14	78.08	0.00	500	2.98	34.79
PS85 W18	22.06.14	79.00	4.34	900	1.35	33.79
PS85 W19	23.06.14	79.01	4.36	700	2.12	34.11
PS85 W20	24.06.14	79.05	4.14	900	1.36	33.7
PS85 W21	25.06.14	79.69	4.41	900	-1.36	33.2
PS85 W22	26.06.14	79.74	4.50	800	-1.35	33.35

Tab. 4.3: 1-L seawater samples for determination of ionic PFASs and PAPs ("-" means west and south for longitude and latitude)

Station	date	Latitude	Longitude	Tw	Salinity	pH
PS85 W 1	08.06.14	59.38	3.73	14.55	29.48	7.63
PS85 W 2	08.06.14	61.24	3.17	13.95	32.5	7.6
PS85 W 3	09.06.14	63.56	2.20	11.88	33.92	7.66
PS85 W 4	10.06.14	67.00	0.34	8.74	35.13	7.65
PS85 W 5	10.06.14	68.44	0.95	8.68	35.14	7.65
PS85 W 6	11.06.14	70.76	1.65	7.41	35.15	7.71
PS85 W 7	11.06.14	73.00	0.83	3.08	34.73	7.52
PS85 W 8	12.06.14	75.00	0.00	2.04	34.84	7.61
PS85 W 9	12.06.14	76.06	-3.69	0.54	33.51	7.75
PS85 W 10	13.06.14	77.13	-7.56	-1.29	31.9	7.49
PS85 W 11	13.06.14	77.67	-11.75	-1.33	31.62	7.52
PS85 W 12	14.06.14	77.96	-14.51	-0.55	31.41	7.52
PS85 W 13	16.06.14	78.48	-11.23	-0.77	31.65	7.53
PS85 W 14	16.06.14	78.76	-7.92	-1.41	31.23	7.49
PS85 W 15	17.06.14	78.88	-5.80	-1.12	31.04	7.49
PS85 W 16	18.06.14	78.85	-4.34	-1.45	30.81	7.48
PS85 W 17	19.06.14	78.89	-3.87	-1.59	31.86	7.49
PS85 W 18	20.06.14	78.50	-2.84	-1.57	33.89	7.58
PS85 W 19	21.06.14	78.83	0.00	2.98	34.79	7.68
PS85 W 20	22.06.14	79.00	4.33	1.32	33.8	7.75
PS85 W 21	23.06.14	79.15	2.80	-1.05	33.21	7.8
PS85 W 22	24.06.14	79.06	4.14	1.36	33.7	7.75
PS85 W 23	24.06.14	79.13	6.10	0.85	33.35	7.75
PS85 W 24	25.06.14	79.69	4.41	-1.36	33.2	7.8
PS85 W 25	25.06.14	79.66	4.90	-1.08	33.03	7.81
PS85 W 26	26.06.14	79.74	4.50	-1.35	33.35	7.79
PS85 W 27	26.06.14	79.03	3.32	-0.24	33.2	7.79

5. PHYSICAL OCEANOGRAPHY

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Grant No: AWI_PS85_03

Background and objectives

The work of the Physical Oceanography group on-board supports a long-term effort to monitor and quantify the variability of oceanic fluxes through the Fram Strait.

The Arctic Ocean is a semi-enclosed marginal sea with the Bering Strait, the Canadian Arctic Archipelago, and the Barents Sea being three shallow connections to the world oceans. The Fram Strait is the only deep strait (2,700 m), thereby allowing for the exchange of intermediate and deep waters between the Arctic Ocean and the Nordic Seas, which are in turn a marginal sea of the North Atlantic. Atlantic origin water is cooled throughout the cyclonic boundary current circulation in the Nordic Seas and enters the Arctic through the Barents Sea and the eastern Fram Strait. The temperature and other properties of the inflowing warm and salty Atlantic Water (AW) change in response to interannual variability, to large scale-, multi-year climate patterns, such as the North Atlantic Oscillation, and to global climate change. The sum of these effects can be measured in the Fram Strait before AW enters the Arctic Ocean, where it participates in the formation of the halocline north of Svalbard and forms a mid-depth cyclonic boundary current. Cooling, freezing, sea-ice melt, mixing with Pacific origin water, and the addition of large amounts of river runoff in the Arctic modify the inflowing water before it exits through the western Fram Strait. Thus observations of the outflow from the Arctic make it possible to monitor the effects of many processes in the Arctic Ocean.

The complicated topography in the Fram Strait leads to a horizontal splitting of the inflowing branches of AW. Additionally, some of the AW participates in a westward flow called the recirculation that then turns southward to exit the Fram Strait back to the Nordic Seas. The southward flowing cold and very fresh East Greenland Current is responsible for a large part of the liquid freshwater export from the Arctic and most of the solid freshwater export in the form of sea-ice. This freshwater has the potential to impact convection in the Nordic Seas and the northern North Atlantic and in turn the meridional overturning circulation.

Since 1997, AWI and the Norwegian Polar Institute have maintained a mooring array across the Fram Strait to monitor the fluxes of volume, heat and freshwater into and out of the Arctic Ocean through this gateway.

Typical signatures and patterns of geochemical tracers, such as oxygen isotopes, allow to quantify the freshwater composition by source. In combination with nitrate and phosphate concentration, we can identify water from continental runoff and precipitation, water from ice melt and formation, and Pacific Water.

The western half of the Fram Strait is taken up by the extremely wide East Greenland shelf. A major outlet glacier has its terminus at 79°30’N on the shelf. A complicated trough system dominates the shelf in front of the glacier. Norske Trough extends southward from the glacier terminus. This is one of the least accessible areas in the northern hemisphere and few observations exist at this point in time. In particular, the bathymetry of the trough system is largely unsurveyed, and it is not established if warm AW circulates in the trough system and reaches the outlet glacier, where it might lead to basal melting.

Next to the dramatic retreat of sea ice, the strongest climatic signal of the Arctic Ocean and the Nordic Seas in the past decade are changes in temperature and salinity. While additional heat and salt are advected northwards from the subpolar North Atlantic into the Nordic Seas, a strong accumulation of fresh water has been observed in the past decades in the Arctic Ocean. The aim of a glider programme, starting this summer in the western Nordic Seas, is to observe whether the increasing amount of freshwater reaches the inner basins of the Nordic Seas and thus dampens vertical mixing and intermediate to deep water renewal during winter. This might lead to a slow-down of the northern branch of the meridional overturning circulation.

Work at sea

The work of the Physical Oceanography group on-board entailed measuring vertical profiles of temperature, salinity and ocean current velocity. To study variability and distribution of temperature and salinity in regions and time not covered by our expedition, we deployed and recovered instrumentation moored at the seafloor, and deployed drifters and gliders for autonomous measurements. For the analysis of freshwater sources, we obtained water samples to determine the oxygen isotope after the cruise. A summary of the work is depicted in the maps in Figs 5.1 and 5.2.

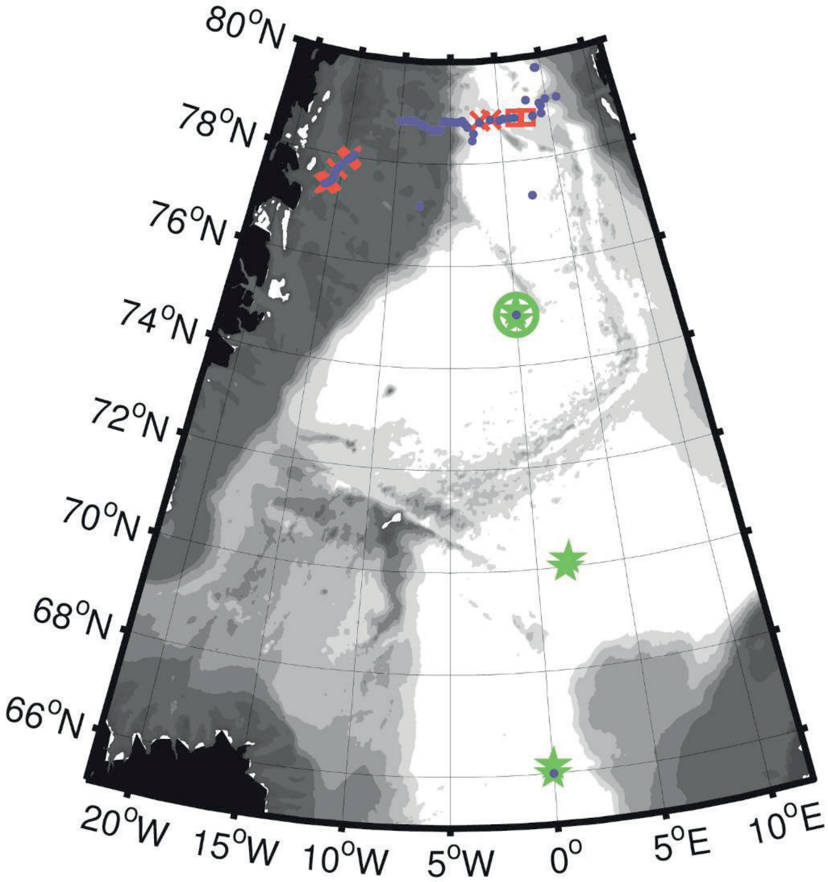

Fig. 5.1: Geographic map summarising the work undertaken by the Physical Oceanography group during the expedition

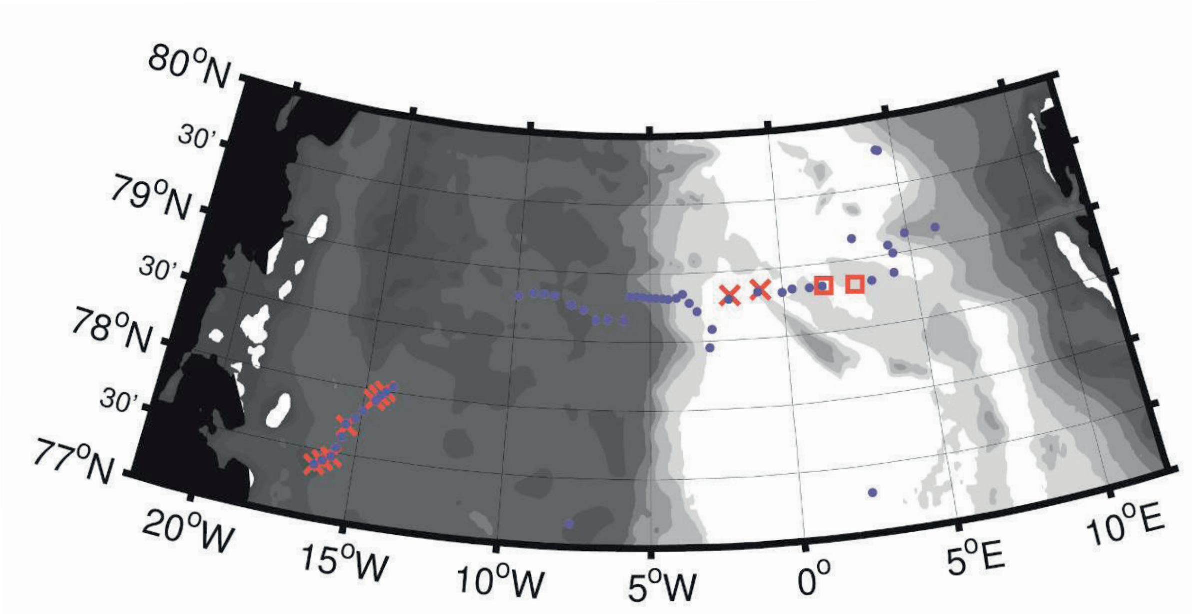

Fig. 5.2: Geographic map summarising the work undertaken by the Physical Oceanography group during the expedition

To obtain temperature and salinity profiles we used a Conductivity Temperature Depth (CTD) sonde mounted in a rosette with 22 bottles (12 l each) for water sampling (bottles #1-21 and #24 were mounted). Only for stations 465-01 and 470-01 two additional bottles were mounted outside the frame and attached to the central hooks to be fired simultaneous with two other bottles, respectively. This was only done at two stations due to demand for large sample volumes, as it poses additional risk of the bottles being damaged during deployment of the rosette next to the ship. The CTD contained dual sensors for temperature and conductivity, one sensor for pressure and one for oxygen. A fluorometer for chl a fluorescence, a beam transmissometer, a downward looking altimeter and a bottom detector (rope and weight) were also attached to the frame and connected to the coaxial cable. As the altimeter was working well throughout the cruise and the bottom detector did not give a reliable signal near the bottom, the rope and weight were disconnected and the bottom detector disabled early on in the cruise. Details of the sensors can be found in Table 5.1. The primary temperature sensor was changed once during the cruise due to erroneous measurements. We determined the salt content of 41 water samples, taken at selected stations, using the Optimare Precision Salinometer on-board *Polarstern* and standard seawater from Ocean Scientific International. These measurements will be used later to calibrate the conductivity sensors. Likewise, we determined oxygen in water samples from 12 stations using a titration method for later calibration of the oxygen sensor.

Seven moorings with 75 khZ acoustic Doppler current profilers (ADCP) were deployed in the Norske Trough to observe the circulation with focus on the warm subsurface AW layer. Due to the limited ship time available for the expedition and the difficulty in breaking into fast-ice, the moorings were deployed along the fast-ice edge from 77° 23.388' N 16° 17.832' W northeastward to about 77° 59.850 ' N 14° 18.612' W. Five moorings from the University of Delaware (USA) were designed to observe temperature and salinity at one point near the seafloor and profiles of current velocity in the water column above. The torsionally rigid mooring design is particularly suited to regions where the horizontal component of the magnetic field strength vector is small (Münchow and Melling, 2007). The two AWI moorings measure temperature and salinity in other parts of the water column: one AWI mooring has a temperature / salinity sensor in the interface between the warm AW and Polar Surface Water whereas the other, in collaboration of AWI with the Norwegian Polar Institute, measures temperature and salinity at several depths near this interface (temperature salinity sensor chain) and at one depth in the Polar Surface Water. We planned to recover six moorings in the central and western Fram Strait and redeploy the two westernmost ones. Heavy ice conditions and time constraints allowed us to recover only two moorings along the 78º 50' N line with two subsequent deployments. A list of deployed and recovered moorings with devices is given in Tables 5.2 and 5.3. The remaining moorings are planned to be recovered / deployed during expeditions later in 2014 and in 2015.

Tab. 5.1: Sensors used on the rosette with serial numbers. The primary temperature sensor was changed from station 473-06 until the end of the cruise.

CTD-sonde	**SBE 911+**	**7396**
CTD-sensors Temperature	SBE3 (until stn. 473-01)	pri. 4918 / sec. 5104
	(from stn. 473-06)	pri. 5027 / sec. 5104
Conductivity	SBE4	pri. 1199 / sec. 3549
Pressure	Digiquartz 410K-134	0287
altimeter	Benthos PSA-916	1229
oxygen	SBE43	0743
transmissiometer	WET Labs C-Star	1220
fluorometer chlorophyll a	WET Labs ECO-AFL/FL	1853
rosette	SBE 32	718 (OZE-Rosette)
winch	**EL 32.1**	

CTD stations were taken in the Norske Trough along the line of mooring deployments and on the standard transect along 78° 50' N, from 10º W to about 5º E. Heavy ice conditions forced *Polarstern* to deviate from the transect: stations between 8º and 6º W were about …. South of the transect, and we had to interrupt this transect around 4º W, turning southeastward. CTD work resumed later at the locations of other instrument casts and mooring deployments at the TransDrift deployment sites and in the HAUSGARTEN area. We eventually returned to the 78º 50' N transect, where we carried out CTD casts at and between mooring positions between about 2º W and 4º E. Further stations along the transect in the east were skipped due to limited shiptime. In total, 52 CTD profiles were taken. CTD profiles along parts of the transect not covered by our expedition will be done by other expeditions later in 2014.

We measured profiles of ocean current velocity in the upper 300 m while underway with a vessel-mounted Acoustic Doppler Current Profiler (VMADCP). The RDI Ocean Surveyor instrument (150 kHz) was mounted at an angle of 45 degree in the 'Kastenkiel' of FS *Polarstern*. Apart from some test periods the instrument was configured in narrowband mode and set up to use 4 m bin size covering a range from 15m to about 200 - 300 m depending on sea state, ice conditions, ship's speed and backscatter signals. By applying a new command file in the system settings the ping rate was increased from 3 s to 1.1 s. In shallow shelf areas two tests with changes in the configurations were carried out: first, configurations in broadband mode using 2 and 3 m bin sizes were tested. Second, a configuration in broadband mode with bottom track pings (one bottom track ping for each water track ping) was applied during a 22 h long section. The setup of navigational input was used from the vessel's GPS system. It worked almost flawlessly, except for some short events, when the communication from the GPS was lost. Problems to resolve velocities occurred due to low backscatter and shallow water depths. Furthermore interferences with other acoustic signals from the vessel's Doppler log (79 kHz) and especially during periods when the sediment echolot PARASOUND (18 hKz) was switched on degraded the velocity data. The multibeam echosounder HYDROSWEEP (15.5kHz) and acoustic signals to release moorings might have also affected the velocity data. The software VmDas (Teledyne RD Instruments) was used to set the ADCP's operating parameters and to record the data. Finally the Ocean Surveyor data conversion was done using Matlab (Mathworks) routines last changed by Tim Fischer in April 2012 (osheader.m, osdatasip.m, osrefine.m). Our setup allows standard calibrations for misalignment angle and scaling constants (Joyce, 1989) as well as an evaluation of the instrument's performance after calibration coefficients are derived. This method gave a misalignment angle of -44.18 degrees and a velocity scaling factor of 1.0225.

Tab. 5.2: Details of mooring deployments

Mooring	Latitude Longitude	Water Depth (m)	Instrument Type	Serial Number	Instrument Depth
F 9-12	78°51.20 N 00°49.26 W	2603 m	SBE 37 ADCP RCM 8 SBE37 RCM 8	10491 15082 11890 10950 9763	55 225 226 227 1479
F 10-13	78°49.72 N 01°59.06 W	2653 m	SBE 37 ADCP RCM 11 SBE 37 RCM 11 SBE 37 Nortek SBE 37	10961 15083 20 10952 458 7690 6252 218	57 248 249 250 550 755 1512 2650
Belgica 1-1	77°55.51 N 14°38.87 W	456 m	SBE 37 ADCP SBE 37	10940 6240 9632	
Belgica 2-1	77°59.85 N 14°18.61 W	250 m	SBE 37 DL7 ADCP SBE 37	10941 1649 3813 10939	
Belgica 3-1	**77°57.79 N** **14°30.12 W**	401,9 m	ADCP SBE 37	3194 2932	401,9 m
Belgica 4-1	**77°42.55 N** **15°26.52 W**	369,1 m	ADCP SBE 37	3654 2921	369,1 m
Belgica 5-1	**77°23.39 N** **16°17.83 W**	172,6 m	ADCP SBE37	3656 2917	172,6 m
Belgica 6-1	**77°25.54 N** **16°02.75 W**	272,6m	ADCP SBE 37	3751 2927	272,6m
Belgica 7-1	**77°27.92 N** **15°46.52 W**	303,1 m	ADCP SBE 37	3655 2925	303,1 m

Table 5.3: Details of mooring recoveries

Mooring	Latitude Longitude	Water Depth (m)	Instrument Type	Serial Number	Instru-ment Depth
F 8 - 13	78°49.37 N 02°45.33 E	2466 m	SBE 16 ADCP RCM 8 SBE16 RCM 8 RCM 8 RCM 8	2415 14950 9785 1979 10872 9182 9185	71 272 273 274 781 1522 2458
F 15 - 9	78°50.12 N 01°35.08 E	2495 m	SBE 16 ADCP RCM 8 SBE 16 RCM 7 RCM 11 RCM 8	2416 14971 11613 2421 8403 619 10503	64 246 247 248 755 1531 2487

Data analysis for the use of bottom track pings was carried out with separate software by Andreas Münchow: preliminary analyses with these time-limited data, averaged into 2-minute ensembles (with spike removal enabled using the histogram of each 2 minute ensemble), reveal that (a) the vmADCP tracks the bottom well to depths of about 620-m, (b) the transducers are aligned -44.35 degrees from the ship's co-ordinate system, (c) vmADCP velocity data should be scaled by 1.036604. The calibration minimizes discrepancies between GPS-derived and vmADCP derived ship velocity vectors. Comparing these two independent measures after calibration further reveals that vmADCP data errors without bottom tracking exceed 0.15 m/s about 10% of the time. This error estimate from the short operation with bottom track pings prompts for further testing of the vmADCP setup and processing software in the future.

During CTD casts, we obtained full-depth profiles of ocean current velocity using an upward and downward looking lowered ADCP (LADCP) mounted on the rosette at the positions of bottles 21 and 22. The 150 kHz RDI WorkHorse ADCPs were set to ping every second. In the upper water column in the presence of sufficient scatterers, 27 bins of 4 m height resulted in about 100 m vertical sampling. At depth, due to lack of scatterers, only a few of the depth bins returned good data. The CTD rosette's maximum vertical speed was set at 1 m/s to accommodate the LADCP data acquisition.

Water samples to determine the ratio of the oxygen isotopes ^{18}O to ^{16}O were taken at 38 stations. The samples will be analysed after the cruise in an isotope laboratory at the AWI in Bremerhaven.

On the transit from Bremerhaven to the Fram Strait altogether 6 autonomous profiling drifters (”ARGO floats“) were deployed in the deep basins of the Nodic Seas (Norwegian Basin, Lotofen Basin and Greenland Sea; see Table 5.4). They measure temperature and salinity profiles from 2000m depth to the surface every ten days. The measurements contribute to the hydrographic monitoring of the Nordic Seas with Argo floats that started in 2001.

Near the cruise on the transit back to Tromsø Seagliders SG127 and MK558 were deployed in the Greenland Sea (Table 5.4). The gliders capture hydrographic sections between the inner Greenland Sea Basin and the East Greenland Current. Along the section dives of 500 to 1,000 m depth are carried out continuously to record temperature and salinity profiles. The data is transmitted via Iridium satellites when the gliders return to the surface after each dive. The gliders are monitored and remotely steered by glider pilots at the AWI in Bremerhaven. Their mission lasts approximately 3 months.

Tab. 5.4: Details of autonomous instrument deployments

Argo floats							
WMO-Nr.	**Ser. Nr.**	**Date**	**Time (UTC)**	**Position**		**Depth (m)**	**Comments**
6902015	7043	2014/06/10	02:47	65°59.83'N	0°01.02'W	3061	CTD: 401-01
6902016	7044	2014/06/10	03:50	66°09.65'N	0°00.00'W	3143	CTD: 402-01
6901908	6956	2014/06/11	02:16	69°59.97'N	1°38.74'E	3267	-
6901907	6955	2014/06/11	03:16	70°08.95'N	1°51.04'E	3261	-
6901236	6954	2014/06/12	06:50	74°54.95'N	0°00.04'E	3758	-
6901235	6953	2014/06/12	07:49	75°04.89'N	0°00.03'E	3754	with O2 sensor
Glider							
SG127		2014/06/30	23:15	74°59.65'N	0°00.38'W		
MK558		2014/07/01	02:13	74°59.70'N	0°00.68'W		

Preliminary results

The Norske Trough section (Figs 5.3 and 5.4) shows the previously observed layer of warm, saline water of Atlantic origin underneath a fresh and cold layer of Polar Surface Water (Schneider and Budeus, 1995; Rudels et al., Journal of Marine Systems 2005). The warm AW had about the same temperature as we observed in the East Greenland Current at the 78º 50' N section. The LADCP and VMADCP data are not yet finally processed, but data from initial processing indicates a baroclinic velocity structure in the northern part of the trough and strong time variability. Once the moorings are recovered, we will be able to quantify this variability further.

We observed the surface outcrop of the East Greenland Front at the Fram Strait 78º 50' N section around 2º W (Fig. 5.5 and 5.6), although water at near-freezing temperatures was found further east due to ice cover. Sloping isohalines around the shelf break (Fig. 5.6. and 5.7) suggest horizontally recirculating or eddying currents, which is supported by the VMADCP data (not shown), showing north- and southward motion just west and east of this location, respectively.

Data management

CTD data as well as LADCP and VMADCP data collected during PS85 will be delivered after post-cruise calibration to the PANGEA database and to the appropriate national data centres. The data recorded by the recovered moored instrumentation will be processed after the cruise at AWI and submitted to the PANGEA database. The gliders are piloted from AWI in real time. The uncalibrated data will be provided in near-real time to the Coriolis data centre for use in operational applications. The calibration and final processing will take place after completion of the mission, and the data will be delivered to the PANGAEA database. The ARGO float data will be provided in near-real time to the Coriolis data centre and replaced by delayed mode quality controlled data afterwards.

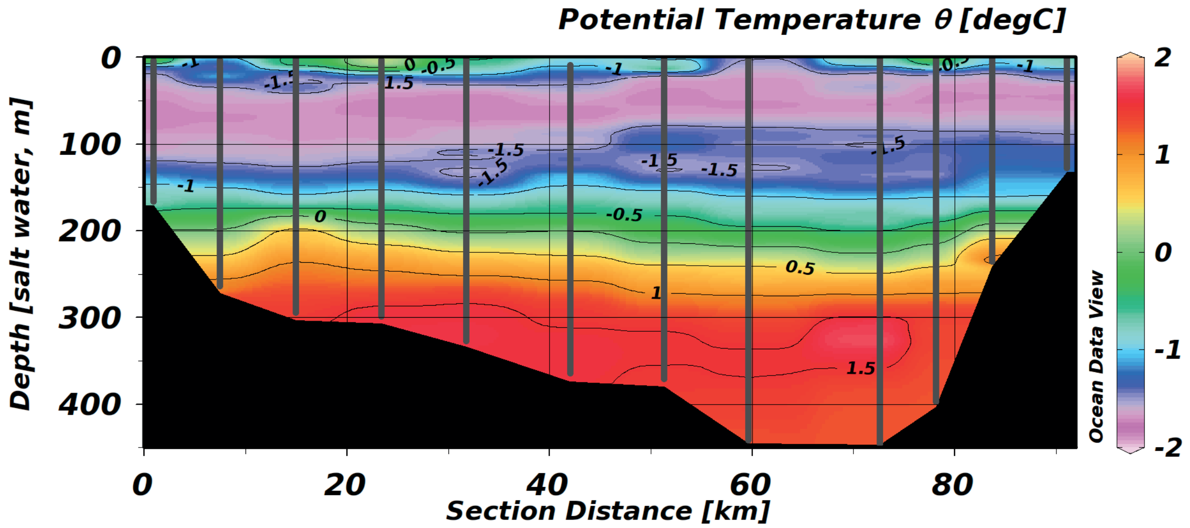

Fig. 5.3: Potential temperature, referenced to 0 dbar, from CTD casts along the Norske Trough section. Locations of CTD casts are denoted by thick grey lines.

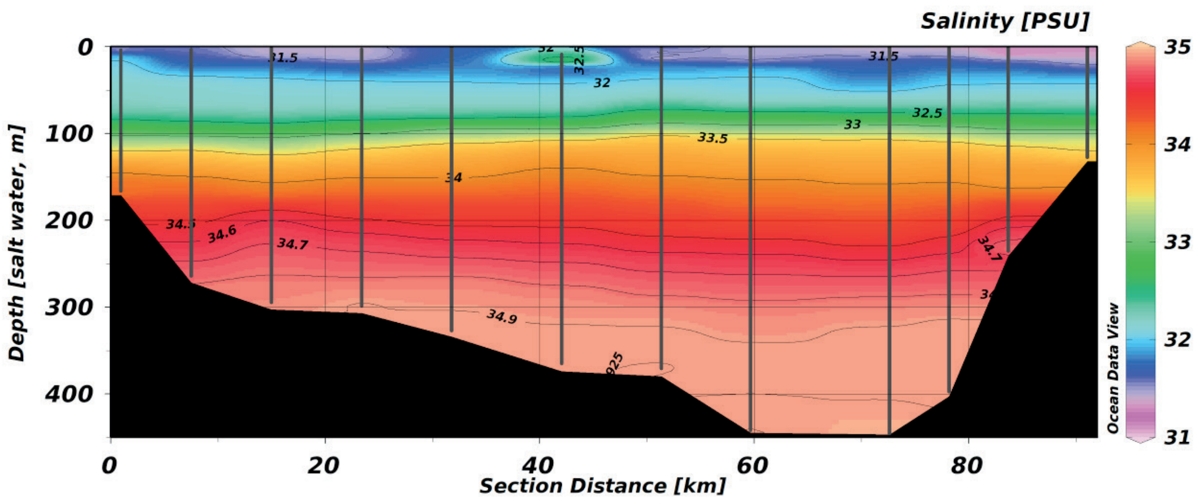

Fig. 5.4: Salinity from CTD casts along the Norske Trough section. Locations of CTD casts are denoted by thick grey lines.

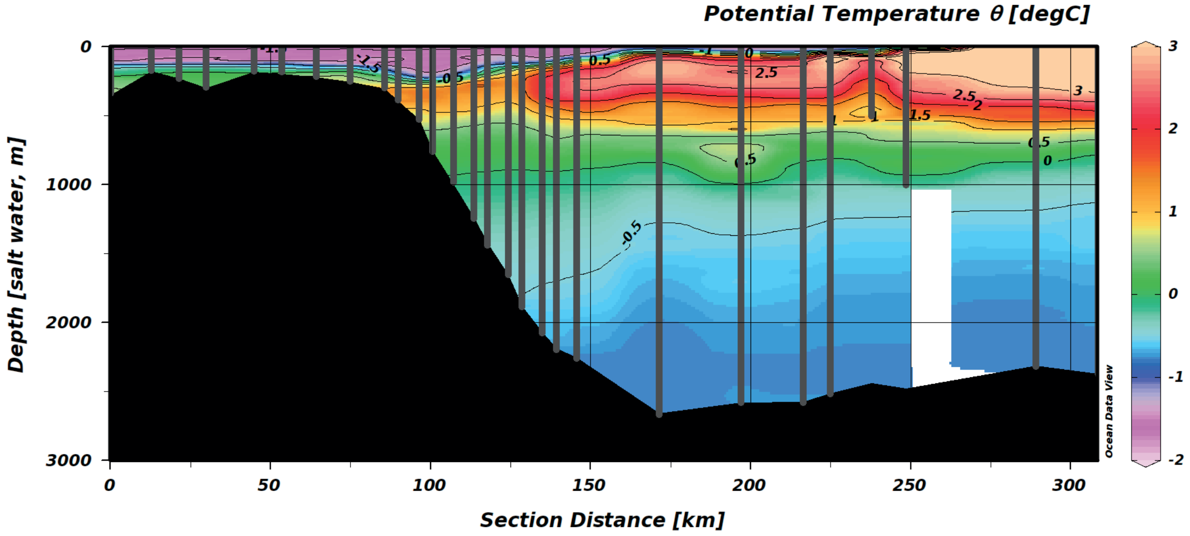

Fig. 5.5: Potential temperature from CTD casts along the section at 78° 50' N: full-depth. Locations of CTD casts are denoted by thick grey lines.

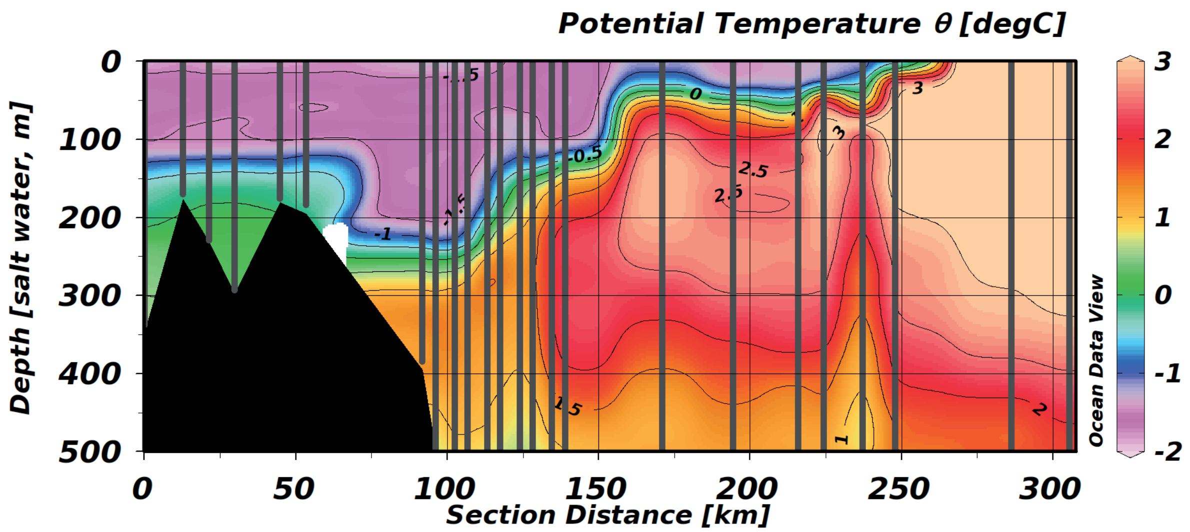

Fig. 5.6: Potential temperature from CTD casts along the section at 78° 50' N: only upper 400 m. Locations of CTD casts are denoted by thick grey lines.

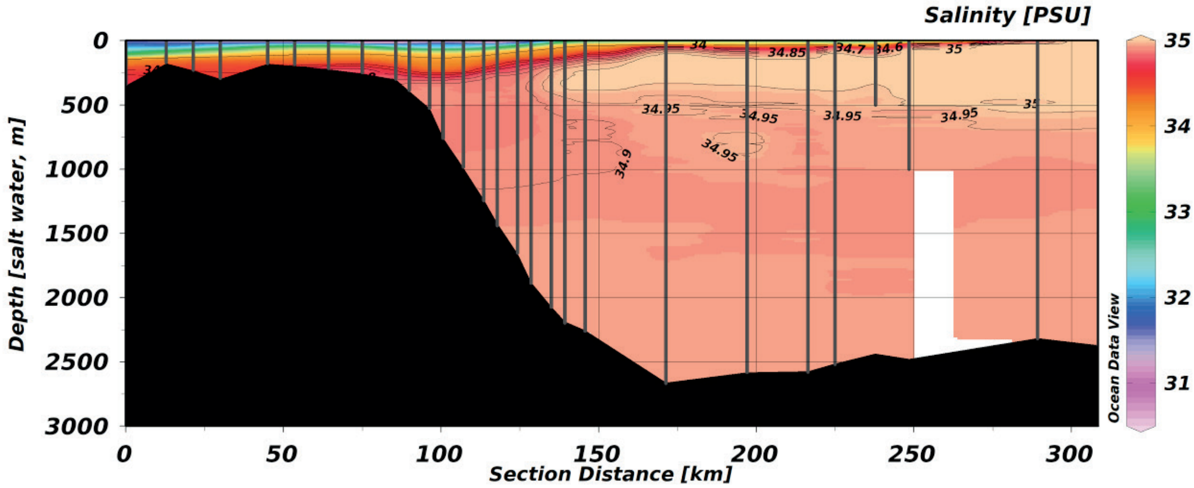

Fig. 5.7: Salinity from CTD casts along the section at 78º 50′ N: full-depth. Locations of CTD casts are denoted by thick grey lines

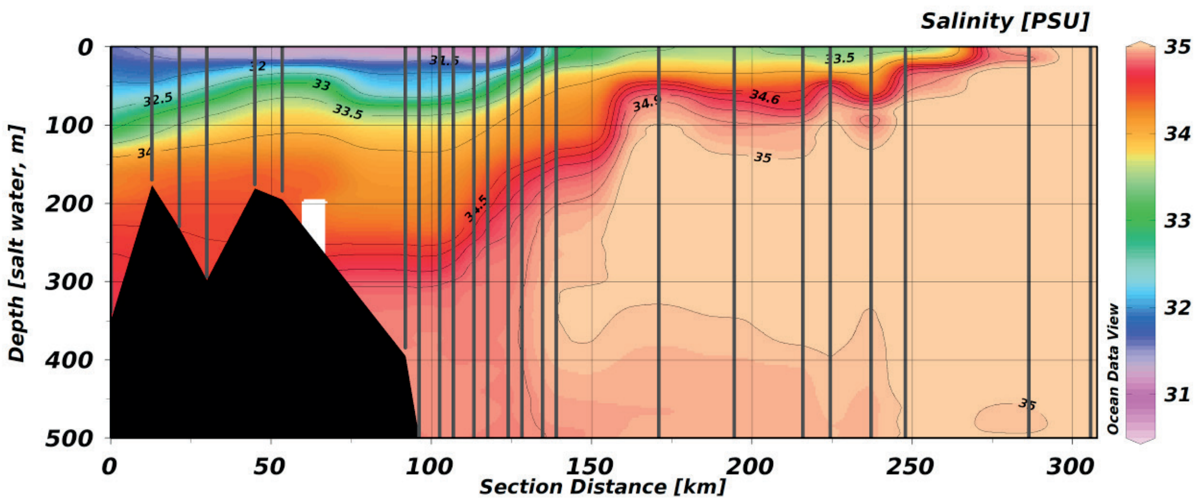

Fig. 5.8: Salinity from CTD casts along the section at 78º 50′ N: only upper 400 m. Locations of CTD casts are denoted by thick grey lines

6. BIOLOGY OF SEA ICE

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Grant No: AWI_PS85_04

Objectives

Global warming has caused a dramatic decrease in summer sea-ice extent in the Arctic during the past decade reaching the record minimum in 2012. Additionally, about 75 % of multi-year ice (MYI) has been lost. While previously the snow load on Arctic sea ice was moderate it is expected that the increasing open water will increase the moisture in the atmosphere and in return result in an increase of the snow thickness. All changes have major implications for the sea ice biota by affecting their biomass, primary production, biodiversity and the general carbon cycle. Within the ice exopolymeric substances (EPS) are an important component of the carbon pool and little is known about these compounds in the changing Arctic as well as their associated bacteria. The loss of sea ice might be favourable for the phytoplankton primary production by increasing the growth season. However, nutrient availability is considered to be the limiting factor controlling the primary production of the entire Arctic ecosystem. Nutrient depletion and warming have further shown to favour especially small phytoplankton species with poor food quality for higher trophic levels. Additionally, the replacement of MYI by first-year ice (FYI) will further increase the occurrence of melt ponds, an ecosystem which might have been overlooked in previous investigations.

Previous studies have been shown that Neodymium is a valuable tracer giving information about the source regions of water masses. Little is known if this tracer can also be used to identify the origin of sea ice and snow which is transported via the Transpolar Drift through the Fram Strait. But during the freeze up process not only these tracers might get entrapped; also high concentrations of microplastics have been reported from Arctic sea ice and might accumulate in the pelagic food web after the sea ice melting with so far unknown consequences for the Arctic ecosystem.

During the cruise we were particular interested to describe the variability in sea and under ice algal biomass, their photosynthetic performance in relation to the prevailing light temperature, and nutrient conditions in the in the Fram Strait, the outflow region of the Transpolar drift. These measurements will be combined with large snow depth grid measurements to upscale the current findings. To elucidate ecological consequences of climate change in the key region Transpolar drift this data will be compared with historic data in the framework of the BMBF project TRANSDRIFT. Special emphasis will be given to study the role of pico- and nanoplankton in the ice and associated systems and their impact for the Arctic ecosystem. The study of EPS in sea ice will investigate the quantitative difference between TEP (acidic sugars) and CSP (proteins) and their associated bacterial communities and relative abundance. Neodymium isotopes studies may help to identify the source regions of the ice and snow obtained during this cruise. To get a better understanding of the contamination with mircoplastics in the Artic, sea ice cores will be investigated for these compounds.

Work at Sea

In total 10 ice stations were performed five with a helicopter and 5 with a zodiac (see Stationbook). A regular ice stations involved the determination of snow depth on large transects 100x100 m, snow sampling for Neodymium, ice coring for different parameters (Tab.1), optical measurements, under ice videos and under ice water sampling. A hand held CTD with a fluorescence sensor was used to determine the under ice environmental conditions and the development of the plankton community at most stations. UIW was taken with a Kemmerer bottle directly under the ice and melt pond sampling was only performed if they were present Light attenuation was measured with calibrated Li-Cor air and underwater sensors, as PAR above and below the ice to calculate transmission of light. The spectral distribution of light between 320 and 920 nm was measured with a TRIos spectroradiometer below the ice and in air, which provides information on which wavelengths of light undergo greater or lesser attenuation through the ice and snow. This data will be compared with the underway PAR which was logged on the bridge of *Polarstern* and collected data every 5 minutes. This data allow calculating the total amount of light per day at the underside of the ice.

The temperature of the ice was directly measured on the floe by drilling into the ice and determining the temperature every 5 cm. Thereafter the core was sectioned in 10 cm pieces and weighted to calculate the brine volume. After melting the salinity was determined and samples for nutrients, CDOM and algae species were taken. The Biology cores were sectioned in 10 cm intervals and melted in filtered sea water and water sampling was done after complete melting of the cores (see Table 6.1). Including BIO-cores up to seven cores were used for two variable chlorophyll fluorescence methods (Variability cores). It involved the two-dimensional fluorescence imaging of intact ice sections using a Walz M-series Imaging-PAM chlorophyll fluorometer. Two-dimensional fluorescence imaging is a major recent advance in the understanding of ice algal distribution and physiology in intact ice. With the second liquid-phase fluorescence analysis of algae in thawed ice samples (Walz Phyto-PAM phytoplankton analyser) additional supporting information on algal physiological condition and acclimation to the prevailing light availability has been performed. The Phyto-PAM also provides information on which taxonomic groups of algae are present in significant quantities in samples, and performs Rapid Light Curves (RLCs), which describe aspects of algal activity and their response to increasing light intensity. Phyto-PAM analysis was also performed on the freshly collected seawater and melt pond water samples at each station. To study the composition of the various exopolymer substances TEP (acidic sugars) and CSP (proteins) are determined from various ice cores. Additional experiments were carried out on three ice stations to determine the EPS associated bacterial communities and their relative abundances in sea ice cores.

Preliminary (expected) results

The current data set involves samples from the land fast ice in the west, samples in polar and Atlantic influenced water mass and the west east transect is completed with strong melting ice floes of the eastern most stations influenced by the warm Atlantic water. Preliminary results indicate a low standing stock of pico-and nanoplankton in the west of Greenland and reaching highest abundances at the eastern most stations. This is valid for all biomes, except the sea ice in the east, were the deteriorated ice is totally depleted in any ice algae. This observation are corroborated by variable chlorophyll fluorescence measurement's which showed that the structure of algal biomass differed along the transect of ice stations, with extensive ice-algal colonisation in the western and central stations. From ice stations 1-6, there was an increasing well-developed crystalline structure of the ice, which apparently favoured the build-up of extensive algal populations. In contrast, all stations in the east had almost no ice algal colonisation, and the ice in these stations had a more irregular structure caused by ablating due to warmer Atlantic water. One aspect of post-voyage work will be detailed analysis of the ice structure and algal distribution of the images, to develop a better understanding of how physical structure of ice controls biomass. In all stations, *F*v/*F*m in the images was low; suggesting restricted photosynthetic activity at the time of collection.

Average sea ice thickness was about 1,50 m and thus was much thinner compared to previous collected ice cores in 1997 during the same season and region. In general sea ice temperature never exceeded -1,7°C and was much warmer than the ice that has been sampled 17 years ago which reached values of almost -5°C.

Once all data of this data set are analysed they will give new insights how climate change has affected the sea ice biota in the Fram Strait and it will be a valuable data set in a region, which was not sampled for several years and should be more included in future programs of this regions.

The TEP (acidic sugars) and CSP (proteins) measurements will give first quantitative assessment of the relative abundance various EPS compounds and the detailed study of their associated bacteria might help to trace ice associated EPS in the water column after melting of the ice. The Neodymium studies may allow to trace the origin of the sea ice floes sampled and the microplastics studies will give insights if the high occurrence of this compounds are a pan arctic phenomena.

Data management

Post-cruise data archival will be hosted by the information system PANGAEA (http://www.pangaea.de) at the World Data Center for Marine Environmental Sciences (WDC-MARE) operated by the Alfred Wegener Institute for Polar and Marine Research, Bremerhaven (AWI) and the MARUM, Bremen. Molecular data will be deposited in globally accessible databases such as GenBank. After the data are quality accessed by the individual P.I.s they will be made available for all project partners and will be accessible to other cruise participants on request. Depending on the finalization of master and PhD theses and publications, data will be submitted to PANGAEA and will be open for external use.

Tab. 6.1: Parameters obtained at each ice station.

Abbreviation as follows:

Bacteria RNA:	Ribonucleic Acid of bacteria
BIO:	Biology core label
BPSi:	Biogenic particulate Silica
CDOM:	Colored Dissolved Organic Matter
CORE:	Ice Corer
DNA:	Desoxyribonucleic Acid
FISH:	Fluorescent *in-situ* hybridization
Frac_chla:	Fractionated chlorophyll a (<10 µm &> 10 µm)
I-PAM:	Imaging PAM
KB:	Kemmerer Bottle
Micro_Bio:	Microbiology core label
MP:	Melt Pond
Neo:	Neodymium core label
Neo_SN:	Neodymium snow sample
Nuts:	Nutrients
PABS:	Particulate Absorption
PAM:	Phytopam
Pig:	Pigments
PNP:	Pico-Nanoplankton
POC:	Particulate Organic Carbon
PS:	Plastic shuffle
TEP/CSP:	Transparent Exopolymers/ Comassie Stainable Particles
T/S:	temperature & salinity
UIW:	Under ice water
UT:	Utermöhl samples
VAR:	Variability core label
WB:	Water bottle.

* Irregularly sampled

			Parameters obtained at most ice station								
Gear	**Label**	**Sample**	**T/S**	**Nuts**	**PIG**	**Frac_chla**	**POC**	**PNP**	**TEP/CSP**	**PAB**	**CDOM**
CORE	PHYs	Ice core	x	x							x
CORE	BIO	Ice core			x	x	x	x	x	x	
CORE	VAR	Ice core			x*	x	x	x*			
CORE	Micro_Bio	Ice core							x		
KB	UIW	Under ice water	x	x	x	x	x	x		x	x
WB	MP	Melt Pond Water	x	x	x	x	x	x			

			Parameters obtained at most ice station								
Gear	**Label**	**Sample**	**PAM**	**I-PAM**	**BPSi**	**UT**	**DNA**	**Bacteria RNA**	**FISH**	**Micro-plastic**	**Neo-dymium**
CORE	PHYs	Ice core				x					
CORE	BIO	Ice core	x	x	x	x	x				
CORE	VAR	Ice core	x	x	x		x*				
CORE	Micro_Bio	Ice core						x	x		
Core	Neo	Ice core									x
Core	MP	Ice core								x	
KB	UIW	Under ice water	x			x	x				
WB	MP	Melt Pond Water	x				x				
PS	Neo_SN	Snow									x

7. PLANKTON ECOLOGY AND BIOGEOCHEMISTRY IN A CHANGING ARCTIC OCEAN (PEBCAO)

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Astrid Bracher, Anja Engel, Steffi Gäbler-Schwarz, Martin Graeve, Kai-Uwe Ludwichowski, Barbara Niehoff, Eva-Maria Nöthig (not on board[1])

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Grant No: AWI_PS85_05

Objectives

Acknowledging the sensitivity of the Arctic to environmental change, the project PEBCAO (Plankton Ecology and Biogeochemistry in a Changing Arctic Ocean) is dedicated to study plankton communities and microbial processes relevant for biogeochemical cycles of in the Arctic Ocean. It is expected that the Arctic is facing rising temperatures, a decline of sea ice and/or a decrease in seawater pH in the future. In order to understand and track potential consequences for the pelagic ecosystem in the Arctic Ocean both long-term field observations and experimental work with Arctic plankton species and communities are needed to gain knowledge about the biological feedback potential of pelagic communities in the future Arctic Ocean. During this cruise leg, samples have been collected via net hauls and CTD casts over the Greenland shelf, on a transect along ~ 78.5° N (distance 1.5° longitude) and in the area of the deep-sea long-term observatory 'HAUSGARTEN' located between 2-6° E and 78-80° N. The study area includes warm and cold water masses originating from the West Spitsbergen current and the East Greenland current, separated by the Arctic front.

Biogeochemistry & Phytoplankton

Recent investigations have shown that rising temperatures as well as freshening of surface waters promote a shift in phytoplankton communities towards a dominance of smaller cells. A change in size of the primary producers could have significant consequences for the entire food web in polar waters as well as for the cycling and sequestering of organic matter. An increase in ice-free water surface as well as CO_2- and temperature-related changes in the carbonate chemistry of the ocean will also affect the cycling of biogenic elements. Because of the vast spatial dimensions of the oceanic system, even small changes in the biological pump could significantly affect atmospheric CO_2 concentration.

Bacterioplankton

Based on the awareness that global change has increasingly changed marine ecosystems, we also intend to examine the 'present day' situation of pelagic micro-biogeochemistry in the Arctic Ocean, with emphasis on the turnover of organic matter during production and decomposition processes. The bio-reactivity of particulate and dissolved organic matter is determined by its biochemical composition and digenetic state. The loss of organic matter within and below the euphotic zone is mainly mediated by the degradation activity of heterotrophic bacteria, colonizing sinking particles and their surroundings. Hence, bacterial activity co-determines the efficiency of carbon export to the deep ocean. Furthermore, bacterioplankton plays an important role in the fate of organic matter in the ocean and is substantially contributing to oxygen consumption and CO_2 release in the ocean. Dissolved organic matter is almost exclusively accessible for bacterial cells that make it available for higher trophic levels by the production of bacterial biomass. Effects of increasing temperature and decreasing pH on bacterial communities and their activity are thereby of outstanding importance, but yet hardly considered. Studies conducted in the past decades revealed strong physiological responses of marine bacteria to changing temperature and pH, but their relevance for biogeochemical cycles in the future ocean is only poorly investigated.

Particulate matter absorption (PAB) and dissolved organic matter (DOM)

The distribution and composition of both particulate and dissolved matter in the Fram Strait is influenced by different factors such as the water masses exchanges between the Arctic and Atlantic basins, the intensity of phytoplankton blooms, the riverine outflow, among others. The main issues to be addressed are related to the amount and composition of the particulate matter (organic and inorganic) and dissolved organic matter and the dynamics of those optically important components in relation to the water masses (and water column) structure and phytoplankton dynamics.

Zooplankton

Zooplankton species are key components in pelagic food webs as they link primary production to higher trophic levels. As different zooplankton species are associated with distinct water masses, rising water temperatures due to climate change might result in a shift in the zooplankton species composition in Fram Strait. This could have severe consequences for the ecosystem functioning. To detect possible impacts of environmental changes, we studied the zooplankton community composition and depth distribution in the HAUSGARTEN area during PS85 (ARK-XXVII/2) and compare these with previous studies from the same area. In addition, we investigated how dominant calanoid copepod species will cope with changing food regimes due to climate change by means of incubation experiments.

Nutrients

The determinations of nutrients are closely connected with the physical and planktological investigations. The development of phytoplankton blooms is especially dependent on the available nutrients. On the other hand nutrients are well suited as tracers for the identification of water masses. The change in nutrient and oxygen concentrations will be followed in the Fram Strait region and during the Greenland Sea transect, especially across the Greenland shelf and slope. In comparison with similar transects in former years, the seasonal and interannual variability will be determined. In the 1980s and 1990s water masses of Pacific origin occurred usually in the shelf and slope regions of the Fram Strait and further south of the Greenland Sea. The data from 2004, 2008 however, show almost no signal of water of Pacific origin. Especially the nitrate to phosphate ratio and silicate are good tracers to follow the outflow of upper halocline Arctic surface water along the Greenland continental shelf and slope. Water masses may be especially rich in silicate compared to Atlantic waters. The data from this expedition will show whether there are further modifications of the water masses exiting the Arctic Ocean.

Work at sea

During this cruise leg, samples have been collected via net hauls and CTD casts over the Greenland shelf, on a transect along ~ 78.5° N (distance 1.5° longitude) and in the area of the 'deep-sea long-term observatory HAUSGARTEN' located between 2-6°E and 78-80°N. The study area includes warm Atlantic and cold polar water masses originating from the West

Spitsbergen Current and the East Greenland Current, respectively, separated by the Arctic front.

Biogeochemistry & Phytoplankton

We sampled seawater of 5 - 8 depths by a CTD/rosette sampler at 16 stations across the Fram Strait. Samples have been taken for biogeochemical parameters such as chlorophyll *a* and pigments (HPLC), seston, dissolved and particulate organic carbon (DOC and POC), dissolved and particulate organic nitrogen (DON and PON) and particulate biogenic silica (PbSi) and to determine the impact of microbial processes on the aggregation of sedimentation of organic matter. Additionally samples were taken by CTD casts for microscopy and flow cytometry, and at selected stations with a hand net to examine the phytoplankton and protozooplankton species composition.

All samples are preserved or frozen at -20°C or -80°C. Samples for carbohydrates and amino acids were collected and stored at -20°C. Concentrations will be determined by the use of IC and HPLC, respectively. Samples for transparent exopolymer particles (TEP) and Coomassie stainable particles (CSP) were taken and stored at -20°C until analysis by photometry and microscopy back at the institute. Samples for total alkalinity (TA) were collected at all stations and stored refrigerated. Furthermore, water samples were collected for molecular genetic analyses of the phytoplankton community (eukaryotes) composition by automated ribosomal intragenic spacer analysis (ARISA), 454-next generation sequencing, and quantitative PCR. This included 17 samples collected with the ships pump on a transect between 70.5°N, 0.5°W and 77.5°N, 15.0°W and samples collected via CTD casts from the top 100m depth in order to assess differences. The samples were fractionated by three filtrations on 10.0 µm, 3.0 µm and 0.2 µm filters. DNA was isolated from the surface samples. The presence of *Phaeocystis pouchetii*, *Phaeocystis globosa*, dinoflagellates, and *Micromonas pusilla* was assessed via quantitative PCR on board ship. All other samples were stored at -80°C until further analysis in the laboratory.

Bacterioplankton

Rates of bacterial biomass production were determined in samples from all CTD casts. Furthermore, samples were taken to determine bacterial abundance by flow cytometry.

Particulate matter absorption (PAB) and dissolved organic matter (DOM)

Water samples for PAB and the chromophoric and fluorescent fractions of DOM (CDOM and FDOM, respectively) were taken to assess the dynamics of particles and organic matter through the Fram Strait, regarding the different water masses and the remarkable oceanographic conditions presented within the area. Samples for PAB were filtered on board immediately after sampling and the filters were thermally chocked on liquid nitrogen and stored in the -80°C freezer afterwards. Water samples for CDOM/FDOM analysis were filtered and analyzed on board with the spectrofluorometer HORIBA® Aqualog, right after filtration. To determine the pico- and nanoplankton (PNP), flow cytometer measurements were carried out on fresh samples using an Accuri C6 flow cytometer. Three size groups were quantified: pico-plankton (0-3 µm), small nanoplankton (3-10 µm) and large nanoplankton (10-25 µm). Samples for δ^{13}C-DOC were stored in the -20°C freezer right after sampling.

Zooplankton

To investigate the large-scale community composition and depth distribution of the mesozooplankton in the study area, we used a multi net equipped with 5 nets (mesh size: 150 µm). Vertical net hauls sampling 5 different depth stata (1,500-1,000-500-200-50-0 m) were conducted on three stations along the transect at 78.5° N and at two HAUSGARTEN stations.

The samples were immediately preserved in formalin buffered with hexamethylentetramin and will be analyzed at the AWI laboratories in Bremerhaven. In addition, the small-scale distribution of the mesozooplankton was investigated with the LOKI (Lightframe On-sight Key species Investigation, Schulz et al. 2009). This video plankton recorder, which simultaneously measures depth, salinity, temperature and oxygen concentration, was successfully deployed at two stations along the oceanographic transect and at three HAUSGARTEN stations.

To study the effects of changing food regimes on dominant calanoid copepods, live individuals of *Calanus finmarchicus*, *C. glacialis and C. hyperboreus* were sorted from Bongo net hauls from the Norwegian Sea, the East-Greenland shelf and the HAUSGARTEN area and incubated in filtered seawater. Copepods were fed *ad libitum* with cultures of the diatom *Thalassiosira weissflogii* and/or the heterotrophic dinoflagellate *Oxyrrhis marina.* Regularly, samples were taken for measuring carbon, nitrogen and phosphorus content, digestive enzyme activity, lipid composition, extracellular ion concentration, extracellular pH, fecal pellet production and respiration rates.

Nutrients

Water samples were taken with the rosette sampler at different depth for analysis of the nutrients - nitrate, nitrite, phosphate, silicate and ammonia in the AWI lab according to standard methods. Using an autanalyser-system quantification will be done using certified laboratory standards. In total, 473 nutrient samples were taken at PEBCAO related and other stations. The samples were kept deep frozen until further analysis, except 22 samples, which will be used for method development. They were collected in parallel from the same Niskin bottle and stored at room temperature.

Samplings accomplished by the PEBCAO team from CTD casts and by net hauls are summarized in Tables 7.1 to 7.3.

Tab. 7.1: Biogeochemical parameters sampled from CTD casts: Chla: chlorophyll a; HPLC; pigment analysis, POC/PON: particulate organic carbon & nitrogen; bPSi: biogenic particulate silica; DOC: dissolved organic carbon; DON: dissolved organic nitrogen; TEP: transparent exopolymer particles; CSP: Coomassie stainable particles; TA: total alkalinity; CHO: carbohydrates; AA: amino acids.

	Chl*a* & HPLC	**POC PON**	**bPSi**	**DOC / DON**	**TEP CSP**	**CHO AA**	**TA**	**PAB – CDOM / FDOM**	**Nutrients**
PS85/411	x	x	x	x	x	x	x	x	x
PS85/418	x	x	x	x	x	x	x	x	x
PS85/424	x	x	x	x	x	x	x	x	x
PS85/426	x	x	x	x	x	x	x	x	x
PS85/429	x	x	x	x	x	x	x	x	x
PS85/432	x	x	x	x	x	x	x	x	x
PS85/437	x	x	x	x	x	x	x	x	x
PS85/444	x	x	x	x	x	x	x	x	x
PS85/455	x	x	x	x	x	x	x	x	x
PS85/460	x	x	x	x	x	x	x	x	x
PS85/465	x	x	x	x	x	x	x	x	x

	Chl*a* & HPLC	POC PON	bPSi	DOC / DON	TEP CSP	CHO AA	TA	PAB – CDOM / FDOM	Nutrients
PS85/470	x	x	x	x	x	x	x	x	x
PS85/473	x	x	x	x	x	x	x	x	x
PS85/482	x	x	x	x	x	x	x	x	x
PS85/486	x	x	x	x	x	x	x	x	x

Tab. 7.2: Biological parameters: PhytoCells: phytoplankton cell numbers

	Microscopy	PhytoCells (Flow cytometry)	DNA Euk	Bacterial Production/ Cell numbers	Multi net	LOKI	Bongo net
PS85/401							x
PS85/411		x	x	x			
PS85/418		x	x	x			
PS85/424	x	x	x	x			
PS85/426		x	x	x			
PS85/428							x
PS85/429		x	x	x			
PS85/432		x	x	x			
PS85/437		x	x	x	x		
PS85/444	x	x	x	x	x	x	
PS85/449						x	
PS85/451					x		
PS85/455		x	x	x			
PS85/456						x	
PS85/460	x	x	x	x			x
PS85/461					x		
PS85/465		x	x	x		x	
PS85/470		x	x	x			
PS85/473		x	x	x	x	x	
PS85/482		x	x	x			
PS85/486		x	x	x			

Tab. 7.3: Additional nutrient sampling

	Nutrients
PS85/412	x
PS85/413	x
PS85/414	x
PS85/415	x
PS85/416	x
PS85/417	x
PS85/422	x
PS85/423	x
PS85/425	x
PS85/427	x
PS85/430	x
PS85/431	x
PS85/433	x
PS85/434	x
PS85/435	x
PS85/438	x
PS85/439	x
PS85/440	x
PS85/442	x
PS85/443	x
PS85/446	x
PS85/447	x
PS85/448	x
PS85/456	x
PS85/469	x
PS85/481	x
PS85/482	x
PS85/483	x

Preliminary/expected results

Biogeochemistry & Phytoplankton, Species composition of unicellular microplankton

Most samples will be analysed in the home laboratory at AWI. Quantitative PCR was used on-board ship to assess the presence of *Phaeocystis pouchetii* and *Phaeocystis globosa*. Preliminary results suggest a bloom of *Phaeocystis pouchetii* in the ice-covered area north of 70° latitude, which was more pronounced in ice-covered areas with salt concentrations ~ 34

PSU, then in areas with low salt concentrations of ~31 PSU. The current data set suggests that *Phaeocystis globosa* is present with abundances just above the detection limit of the quantitative PCR in the study area.

Bacterioplankton

Samples for bacterial abundances will be analysed by flow cytometry in the home laboratory at the GEOMAR.

PAB

All samples will be analyzed at the AWI laboratories in Bremerhaven.

CDOM/FDOM

All samples were already analyzed and the data will be processed at the AWI in Bremerhaven.

Zooplankton

Pictures obtained from the LOKI hauls show that calanoid copepods dominate the mesozooplankton community in the upper 1000 m on the transect and in the HAUSGARTEN area. Other taxa that occurred frequently were chaetognaths, ostracods, amphipods and radiolarians. Species determination from LOKI pictures and multi net hauls and correlation of zooplankton abundance and environmental parameters will be done at the AWI.

Feeding experiments with *Calanus finmarchicus* showed that respiration rates differed among copepods incubated at different food conditions, being highest in copepods fed with *T. weissflogii* and lowest in starved ones. Fecal pellet production was higher in copepods feeding on *T. weissflogii* than in copepods feeding on *O. marina*. All other samples taken during the experiments will be analysed at the AWI laboratories in Bremerhaven.

Data management

After compiling and evaluation of the primary data, a dataset based on the nutrient data will be available after 1 year after the cruise. The data set will be made available for the public in the PANGAEA Data Publisher for Earth & Environmental Science at least 2-3 years after the cruise.

Almost all sample processing will be carried out in the home laboratory at AWI. It usually takes one to three years depending on the parameter as well as analyzing methods such as chemical measurements or tedious swimmer picking in trap material and species enumerations and identifications, respectively. As soon as the data sets are available they can be used by other cruise participants after request. When the data will be published, they will be submitted to PANGAEA and are open for external use.

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8. IMPACT OF CLIMATE CHANGE ON ARCTIC MARINE ECOSYSTEMS

Eduard Bauerfeind AWI

Grant No: AWI_PS85_06

The Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI) established the deep-sea long-term observatory HAUSGARTEN to detect and track the impact of large-scale environmental changes in the transition zone between the northern North Atlantic and the central Arctic Ocean, and to determine experimentally the factors controlling deep-sea biodiversity. The work at the multidisciplinary long-term observatory (Fig. 8.1) started in 1999 and is the first, and until now is the only open-ocean long-term station in a polar region. This long-term multidisciplinary research activity offers the opportunity to discover and to track changes and impacts of climate change on an Arctic marine ecosystem.

Within the framework of the BMBF financed project “TRANSDRIFT (System Laptewsee)”, the work currently performed in the HAUSGARTEN area is extended by additional stations in the western part of the Fram Strait from the 1,000 m isobath at the Greenland slope to ~2,500 m depth. In this region, at the southern limit of the transpolar drift, just like at the HAUSGARTEN, sediment samples are taken by a multiple corer to record benthic organisms of different size classes and to analyse the activity and biomass of the small sediment-inhabiting biota. The inter-annual variability of large organisms (megafauna) should be studied by using our towed photo/video system OFOS (Ocean Floor Observation System)

To investigate the impact of a changed primary production on meiobenthic organisms, which is likely to happen in the future, a long-term enrichment experiment of sediments should be installed at 1,200 m water depth. Long-term moorings equipped with sediment traps, RCMs and self-recording CTDs collect sedimenting particles and record the hydrographic conditions throughout the mooring period.

These moorings are complemented by 2 McLane Moored profilers (MMP) in the eastern and western Fram Strait which are installed in cooperation with ArcticNet, Canada. These instruments equipped with a CTD and oxygen and fluorescence sensors will conduct profiles in the upper water column, and thus will add valuable information in additions to the instruments moored at a fixed depth.

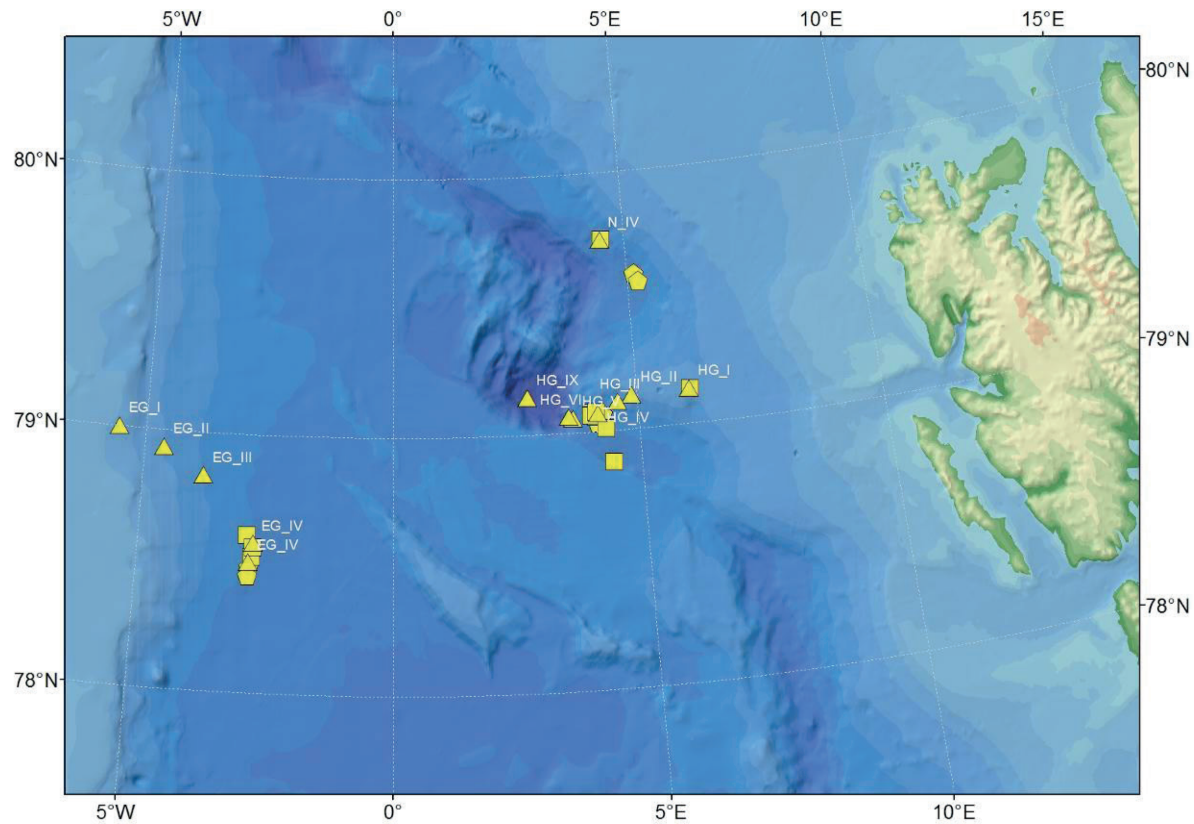

Fig. 8.1: Stations of the HAUSGARTEN long-term-observatory and its extension at the East-Greenland slope, sampled during PS85

8.1. Prokaryotic plankton dynamics in the Fram Strait

Ian Salter[1] [1]AWI

Grant No: AWI_PS85_06

Outline

Prokaryotic plankton (Bacteria and Archeae) communities play a pivotal role in the transformation and turnover of dissolved and particulate organic matter. There are many different sources of organic matter in the Arctic originating from e.g. primary production, ice-melt, and terrigenous input. There are strong hydrographic and geochemical gradients across the Fram Strait that results from the complex interaction of different water masses and ice conditions. The aim of the present work on board *Polarstern* was to conduct a preliminary assessment of bacterial community dynamics across the Fram Strait in relation to phytoplankton composition. Notably this work targeted different water masses. A second component of the work aims to try and link particle-attached bacterial communities to particulate organic matter source diagnosed from lipid biomarkers. The East Greenland Current is the main conduit for waters exiting the Arctic Ocean through the Fram Strait. In addition to addition to low-salinity Polar water and sea ice, Atlantic inflow water in the east and recirculation patterns in the Fram Strait create a complex hydrographic regime. The study aims to detect particulate organic carbon signatures originating from the Arctic shelves and sea-ice and transported out of the Arctic through the Fram Strait.

Objectives

Examine the horizontal and vertical scales in phylogenetic composition of particles attached and free-living communities across the Fram Strait. Characterize the source and composition of POM in surface waters across the Fram Strait in relation to particle-attached bacterial communities.

Work at sea

Particle attached and free-living bacterial communities were sampled from CTD casts. CTD cast stations were targeted to establish adequate vertical and horizontal resolution of across the Fram Strait. Samples were collected from the surface, chlorophyll maximum and some depth below the chlorophyll maximum (Table 8.1). Typically 1-3 litres were filtered and size fractionated onto 3 µm polycarbonate filters (particle-attached) and 0.2 µm Sterivex cartridges (free-living). The samples were stored at -80°C. Exact sampling depths and volumes are summarised in Table HGX1. Larger volume samples were also taken from the CTD cast for organic biomarkers and POC. These water samples were filtered onto 25 mm and 47 mm pre-combusted GF/F filters. The samples were stored at -80°C. Due to the large volumes required (>10L), only one depth was sampled from each CTD. The depth was selected based on the real-time temperature and salinity profiles obtained during the cast. Stations were chosen to obtain representative samples from the main hydrographic features in the Fram Strait (Table 8.1).

Tab. 8.1: Summary of CTD sampling: [1]Depth from which organic biomarker samples were taken,[2]The volume of water filtered for organic biomarker samples, [3]Depths from which 3 um and 0.2 um DNA size fraction samples were taken, [4]Volumes filtered for genomic DNA samples

Station	Depth	Lip Depth1	Vol. (L)2	DNA (m)3	Vol. (L)4
PS85/0413-1	374.8	no sample	no sample	5, 30, 320	2, 2, 2
PS85/0418-1	173.2	no sample	no sample	5, 30, 50	2, 2, 2
PS85/0424-1	243.6	no sample	no sample	5, 20, 45	2, 2, 2
PS85/0426-1	350.3	40	15	5, 25, 40	2, 2, 2
PS85-0429-1	299.7	5	10	5, 15, 30	2, 2, 2
PS85-0432-1	219.4	210	18	5, 15, 30	3, 3, 3
PS85-0437-1	535.5	340	17	5, 25, 30	3, 3, 3
PS85-0442-1	1453.2	225	37	225	6
PS85-0444-1	1894.2	5	24	5, 25, 30	3, 3, 3
PS85-0455-1	2609.1	50	15	5, 20, 50	3, 3, 3
PS85-0460-1	2402.4	200	16	5, 50, 100, 200	1.9, 1.6, 3, 3
PS85-0465-1	5534.7	250	15	5, 20, 50, 250	2.5, 3, 3, 3
PS85-0470-1	1242.7	110	17	5, 23, 30, 110	3, 2.5, 3, 3
PS85-0473-01	2516	150	17	5, 40, 55, 150	2.3, 2.3, 2.9, 4
PS85-0482-1	-	300	15	5, 30 50, 300	1.9, 3, 3, 3
PS85-0485-01	-	80	9	5, 15, 60, 80	3, 2, 3, 3

Preliminary (expected) results

There are no preliminary results from the cruise. The 3 μm and 0.2 μm polycarbonate filters will be used to extract genomic DNA and RNA. The RNA will be reverse transcribed to obtain cDNA (Salter et al. 2014). The DNA and cDNA fractions will be sequenced using specific primers for Archeae (Hugoni et al. 2013) and bacteria (Salter et al. 2014). Subsequently the sequences from the standing stock of prokaryotes (DNA) and metabolically active fraction (cDNA) will be combined with corresponding biogeochemical and physical data to create a statistical model (Salter et al. 2014) that attempts to elucidate the primary controls on bacterioplankton community dynamics. The GF/F filters will be extracted to separate the neutral and polar lipid fractions. Specific compounds will be identified and quantified using GC-MS (Wolff et al. 2011). The lipid biomarkers will be used to establish evidence of particle source originating from different water masses in the Fram Strait. Subsequently this data will be combined with the sequence data from particle-attached bacteria to elucidate if specific bacterial sub-groups are associated with particles of a specific origin.

Data management

All DNA sequences will be submitted to the sequence read archive. Particulate organic carbon and lipid concentrations will be deposited in the AWI Pangaea database.

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Salter I, Galand P, Fagervold S, Lebaron P, Obernosterer I, Oliver M, Suzuki M, Tricoire C (2014) Seasonal dynamics of active SAR11 ecotypes in the oligotrophic NW Mediterranean Sea. ISME Jounral, *in press*.

8.2. Moorings, sedimentary Processes and Interactions

Eduard Bauerfeind[1], Tim Küber[1], Catherine Lalande[1], Normen Lochthofen[1], Burkhard Sablotny[1], Ian Salter[1]

[1] AWI

Grant No: AWI_PS85_06

Objectives

Organisms living in the deep sea mainly depend on the organic matter that sinks out of the productive layer and finally reaches the sediments of the deep sea. Therefore the transfer of organic matter from the upper productive layer in the water column to the bottom of the Ocean is one of the key processes that facilitate life at the seafloor. Measurements of settling particles are performed by means of moored sediment traps. The moorings are also equipped with current meters (RCMs) and self-recording CTDs to gain information’s on the hydrographic conditions. Results obtained by these instruments are of major importance for the interpretation of the results derived by the sediment traps, as the settling particles can be transported over long distances before arriving at the seafloor.

Work at sea

During the *Polarstern* cruise PS85 (ARK-XXVIII/2), two deep-sea moorings should be recovered and redeployed. Due to the severe ice condition, we only were able to recover the moorings at the central HAUSGARTEN (HGIV). The mooring at the northern HAUSGARTEN station (N4) had to be left in the water until next year. However, we were able two deploy two fully equipped moorings at the central and northern HAUSGARTEN station (Fig. 8.1, Table 8.2). Within the project "TRANSDRIFT", 2 moorings also equipped with sediment traps were moored in western Fram Strait (Table 8.1). One of these, (TD ST) shall be recovered in autumn 2014, whereas the other mooring (TD LT) will stay until summer 2015.

Another mooring consisting of a prototype of an underwater winch and a profiling sensor package (Fig. 8.2,) was deployed in the vicinity of the central HAUSGARTEN (HGIV) station. The sensor package of this mooring consists of a CO^2, O^2 and fluorescence sensor and a CTD. This Subsurface Winch Profiling System (SWIPS) has been developed within the BMBF funded project ICOS_D (Integrated Carbon Observation System) (N. Lochthofen) and it is programmed to perform vertical profiles in the upper water column from 100 m depth to 10m below the surface in 24 h intervals until autumn 2014. For the same purpose 2 MMP moorings, one at the HAUSGARTEN and another one at western Fram Strait were deployed in cooperation with ArcticNet Canada (Fig. 8.3, Table 8.2). These instruments were programmed to perform profiles from 1,000 m depth to 100 m below the surface every 13 h for the period of one year. And they are equipped with sensors for measurements of conductivity, temperature, depth, oxygen, fluorescence.

Tab. 8.2: Moorings deployed at Hausgarten- and in the East Greenland-Sea during the cruise ARKXXVIII-2

Cruise	Name	Date	Lat	Long
PS85/0450-1	TD-2014-LT	20.06.2014	78° 31,69' N	2° 45,87' W
PS85/0453-1	TD-2014-ST	20.06.2014	78° 32,29' N	2° 44,51' W
PS85/0452-1	D AN-MMP-TD	20.06.2014	78°33,84' N	2°45,10' W
PS85/0462-1	Fevi 30	23.06.2014	79° 0,62' N	4° 19,68' E
PS85/0472-1	Fevi 29	25.06.2014	79° 44,87' N	4° 16,78' E
PS85/0477-1	SWIPSMooring	26.06.2014	79° 4,16' N	4° 4,57' E
PS85/0489-1	D AN-MMP-HG	29.06.2014	79° 4,16' N	4° 4,57' E
PS85/0478-1	Long_term Lander	26.06.2014	79° 4,16' N	4° 4,57' E

Fig. 8.2: Subsurface winch and profiler during deployment

Fig. 8.3: Deployment MMP- profiler

Preliminary results

There are only a few preliminary results from the cruise resulting from the mooring that was recovered at HAUSGARTEN. First and rough impressions of sedimentation at this location and its seasonality during 2013/14 can be obtained by visible inspection of the amount of material collected in the sampling bottles. (Fig. 8.4 a,b). This figure shows the sampling jars of the sediment trap obtained in ~ 230 m and at ~1,100 m depth. A seasonal pattern in sedimentation can be clearly deduced in the upper trap, with large amounts of material in the sampling jars during the beginning of the sampling period July to September 2013. After this period sedimentation seemingly diminished and stayed at a low level till June 2014 when sedimentation increased again. In 1,100m less material is intercepted by the traps and no obvious seasonal pattern can be deduced by this first visible inspection of the samples. More profound results on sedimentation, the quantity and composition of the sedimented matter will be obtained only after detailed, chemical, biochemical and microscopic analyses of the samples in the land based laboratory.

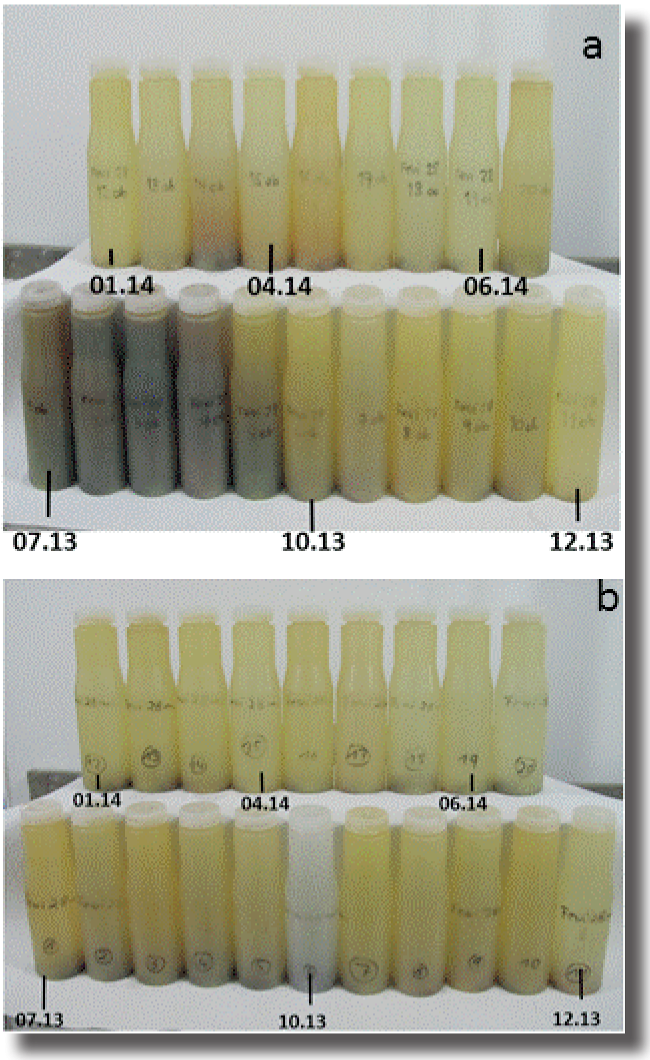

Fig. 8.4: Sampling jars of an annually moored sediment trap at Station HGIV from 07/2013 till 06/2014; samples from the trap moored at ~200 m below the surface (a) and from ~1,100 m (b).

Data management

The finally processed data will be submitted to the PANGAEA data library. The unrestricted availability from PANGAEA will depend on the required time and effort for acquisition of individual datasets and its status of scientific publication

8.3. Benthic studies at HAUSGARTEN observatory and at the East Greenland continental shelf

Christiane Hasemann[1], Heiko Lilienthal[2], Normen Lochthofen[1], Burkhard Sablotny[1], Svenja Schütte[1], Miriam Seifert[1]

[1] AWI,
[2] ISITEC

Grant No: AWI_PS85_06

Objectives

Benthic investigations at HAUSGARTEN observatory and within the framework of the TRANSDRIFT project at the East Greenland continental shelf comprise biochemical analyses to estimate the input of organic matter from phytodetritus sedimentation and to analyze the activity and biomass of the small sediment-inhabiting biota. Results from these studies will help to describe the eco-status of the benthic system.

Work at sea

Virtually undisturbed sediment samples were taken using a video-guided multiple corer (MUC) at 8 HAUSGARTEN stations along a depth gradient between 1,200 and 5,500 m water depth (HGI-HGVI & HGIX) and at one of the northern stations (N4) at the HAUSGARTEN latitudinal transect in 2,500 m water depth as well as at four stations at 1,000, 1,500, 2,000 and 2,500 m water depth (EGI-EGIV) at the East Greenland continental shelf (Table 8.3, Fig. 8.1). The top five centimeters of the sediment were sub-sampled to analyze a variety of parameters, indicating the input of organic matter to the seafloor as well as sediment-bound biomass and benthic activity. The sediments were also sub-sampled to analyze abundance and biomass of meiofauna organisms as well as diversity patterns of nematodes.

Chloroplastic pigments (chlorophyll a and its degradation products) represent a suitable indicator for the input of phytoplanktonic detritus to the seafloor. They can be analyzed with high sensitivity by fluorometric measurements. To acquire fast and reliable estimations about the total biomass of the microbial community in the sediment, we will analyze various biochemical bulk parameters.

The determination of phospholipids, being typical cell wall compartments, provides good estimates about the biomass of living organism in the sediments (i.e. bacteria, yeasts, fungi, flagellates, ciliates, foraminiferans and metazoan meiofauna). To determine the total biomass in the sediments (organisms and detrital matter) we will analyze sediment-bound particulate proteins.

Tab. 8.3: HAUSGARTEN and East Greenland-Stations ARKXXVIII-2

Station No.	Station	Date	Coordinates	
			Latitude	Longitude
PS85/436-1	EGI	17.06.2014	78° 58. 40' N	5° 17. 43' E
PS85/441-1	EGII	18.06.2014	78° 56. 019' N	4° 39. 020' E
PS85/445-1	EGIII	19.06.2014	78° 48. 146' N	3° 52. 503' E
PS85/454-2	EGIV	20.06.2014	78° 30. 350' N	2° 48. 995' E
PS85/470-3	HGI	25.06.2014	79° 8. 011' N	6° 6. 391' E
PS85/469-2	HGII	24.06.2014	79° 7. 927' N	4° 54. 377' E
PS85/468-1	HGIII	24.06.2014	79° 6. 387' N	4° 35. 087' E
PS85/460-4	HGIV	22.06.2014	79° 3. 909' N	4° 10. 980' E
PS85/463-1	HGV	23.06.2014	79° 3. 142' N	3° 40. 376' E
PS85/464-1	HGVI	23.06.2014	79° 3. 553' N	3° 34. 370' E
PS85/465-4	HGIX	24.06.2014	79° 9. 36' N	2° 52. 996' E
PS85/473-7	NIV	25.06.2014	79° 45. 474' N	4° 22. 617' E
PS85/0476-2	Bottom Lander	26.06.2014	79° 8,69' N	6° 8,23' E

To estimate the potential heterotrophic activity of bacteria, we measured cleaving rates of extracellular enzymes using the model-substrate FDA (fluorescein-diacetate) in incubation experiments. FDA was added in saturated concentration to obtain the maximum cleaving-rate of hydrolytic enzymes like esterase, lipase, protease etc. To avoid losses in activity these analyzes were done immediately after the recovery of the sediment samples on board *Polarstern*.

A bottom-lander based biological long-term experiment was deployed at 1200 m water depth at HAUSGARTEN-station HGI (Table 8.2). The free-falling device carrying colonization-cores with azoic, organically-enriched artificial sediments will be recovered after three month deployment, to study the attraction of “plain” sediments to meiofauna organisms, focusing on nematode communities.

Preliminary results

Along four stations at 1000, 1500, 2000 and 2500 m water depth at the bathymetric HAUSGARTEN (HGI-HGIV) and East Greenland transect (EGI-IV; Fig. 8.1), concentrations of sediment-bound chloroplastic pigments and the potential hydrolytic activity of sediment-inhabiting bacteria showed decreasing values with increasing water depth except for the deepest East Greenland station (EGIV; Fig. 8.5 & 8.6) and the shallowest HAUSGARTEN station (HGI) for bacterial activity (Fig. HGX5b). EGIV is located closest to the Polar Front and the highest values for both parameters at the deepest East Greenland stations may be due to the influence of this highly productive boundary layer.

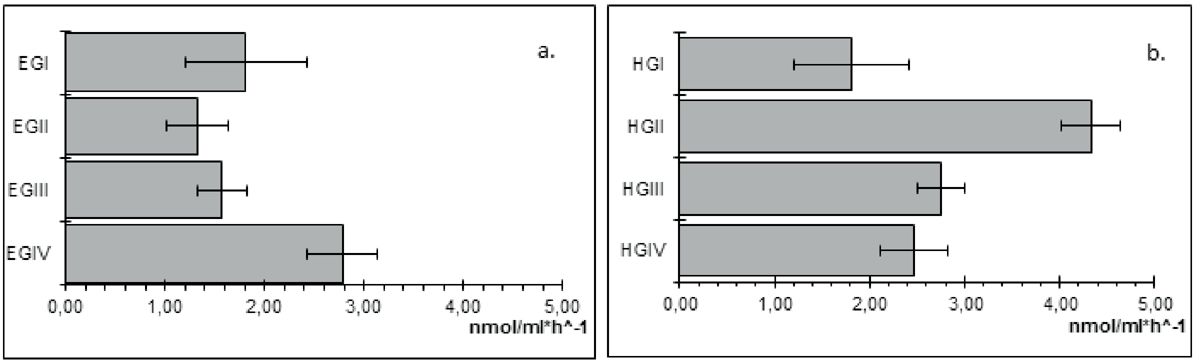

Fig. 8.5: Hydrolytic activity of bacteria within the first sediment centimeter between 1,000 and 2,500 m water depth (a: East Greenland; b: HAUSGARTEN)

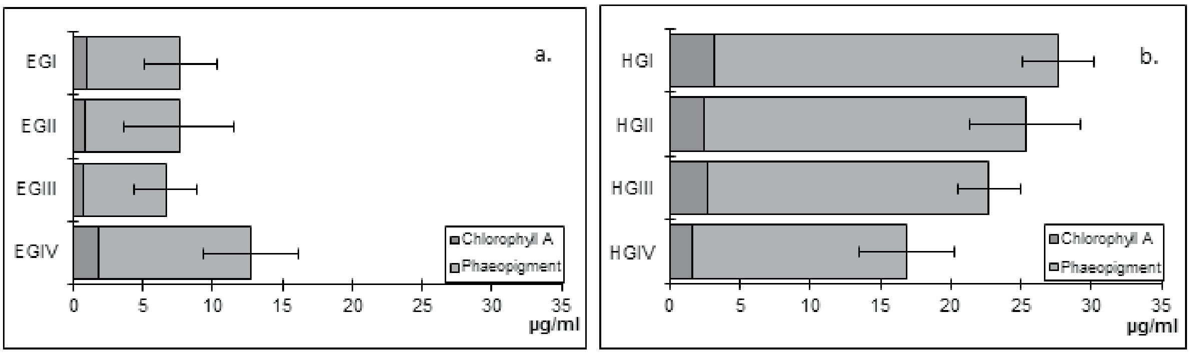

Fig. 8.6: Chloroplastic pigments bound in the first sediment centimeter between 1,000 and 2,500 m water depth (a: East Greenland; b: HAUSGARTEN)

In general, the East Greenland stations showed lower values for both parameters than the HAUSGARTEN stations. The lower values could be partially attributed to the influence of the ice-infested East Greenland Current (EGC) which transports cold, fresh water and sea ice south out of the Arctic basin and is less productive compared to the West Spitsbergen Current (WSC) which influences the HAUSGARTEN stations.

Upcoming analyses of additional parameters, especially of the fauna data, at the home laboratory are necessary to evaluate whether the assumed processes might be responsible for the observed results and which other factors might be a key to understanding.

Data management

The finally processed data will be submitted to the PANGAEA data library. The unrestricted availability from PANGAEA will depend on the required time and effort for acquisition of individual datasets and its status of scientific publication.

8.4. Megafaunal Dynamics and Ecology

James Taylor[1], Heiko Lilienthal[2], Burkhard Sablotny[1]
[1]AWI,
[2] ISITEC

Grant No: AWI_PS85_06

Objectives

The original plan was to continue the study of inter-annual dynamics of megafaunal organisms using our towed photo/video system OFOS (Ocean Floor Observation System) at four established transects at HAUSGARTEN (N3, HG-IV, S3 and HG-I) to extend the time series footage that started in 2002 and to create a new transect at East Greenland IV (EG-IV) as part of the TRANSDRIFT project. However due to heavy ice coverage and the resulting delays only three of the overall five proposed transects were able to be completed. Transects at the HAUSGARTEN S3 and HG-1 sites were those that were postponed to a later date.

Work at sea

The first OFOS deployment occurred at the new TRANSDRIFT transect located at EG IV, under ideal conditions. The sea floor at this site was characterized by soft sediment with the presence of very large drop stones occurring at frequent intervals (Fig. 8.7).

Fig. 8.7: Drop stone and associated organisms observed at the OFOS transect in western Fram Strait

Conditions for OFOS deployment at the established transects of HAUSGARTEN N3 and HG-IV were more challenging than those at East Greenland IV, however each deployment was a success with only the HD video at HG-IV failing to function properly.

Preliminary (expected) results

Tab. 8.4: Stations and retrieved image and video data

Location	Station No.	Date	Total Images Taken	HD Video Taken
EG-IV	PS85/455-1	21/06/14	501	Yes
HG-IV	PS85/461-1	23/06/14	560	No
HG-N3	PS85/474-1	26/06/14	453	Yes

Further preliminary results are unavailable at this time. The images will have to be first manually analyzed and annotated in order to extract the data.

Data management

Images obtained during PS85 (ARK-XXVIII/2) will be uploaded and stored in an online image database accessible using the web 2.0 software BIIGLE. BIIGLE is also used for the time-consuming manual annotations of the images. An output of label counts for each image can be exported to allow for the calculation of mega faunal densities, as well as temporal and spatial dynamics of the mega faunal communities.

9. BENTHIC MICROBIOLOGY

Christina Bienhold[1,2], Katy Hoffmann[1,2], Josephine Rapp[1,2], Stefan Becker[2]

[1]AWI
[2]MPI

Grant No: AWI_PS85_07

Objectives

Benthic bacteria dominate deep-sea sediments in terms of biomass, accounting for up to 90 % of the total benthic biomass (Rowe et al., 1991), and therefore play a central role in carbon and nutrient cycles at the seafloor (Jørgensen & Boetius, 2007). Yet, the functions of specific bacterial groups, e.g. in organic matter remineralization are still little understood. Also, factors affecting bacterial diversity and activity are not resolved, including the effect of pressure/depressurization on environmental microbial communities from the deep sea. To address these questions we sampled deep-sea surface sediment samples for bacterial DNA and RNA analyses, as well as for dissolved organic matter analyses. We also set up experimental enrichments, including incubations of deep-sea sediments at *in-situ* pressure on board of *Polarstern* cruise PS85. Furthermore, sediment samples from HAUSGARTEN stations will contribute to the continuation of time-series analyses of bacterial diversity at this site (Jacob et al. 2013, Jacob et al. unpublished) and results will be interpreted in conjunction with environmental parameters from the same sites (see chapter 8). In addition to benthic work, we included sampling of the water column (CTD rosette) at selected stations, and will subsample sediment trap material at the home laboratory (see chapter 8), in order to investigate links between the pelagic and benthic environments in terms of bacterial diversity (e.g., Kellogg & Deming, 2009, Zinger et al., 2011).

The work contributes to the European Research Council Advanced Investigator grant ABYSS (no. 294757; Antje Boetius).

Work at sea

Sediment samples

Undisturbed sediment cores were retrieved from the seafloor from a total of 15 stations by the deployment of a video-guided multiple corer (TV-MUC). Cores were either subsampled in 20 ml cut-off syringes for later processing of individual depth layers or directly subsampled in five to ten depth layers (1 cm resolution). Subsequently, samples were shock-frozen in liquid nitrogen for microbial DNA/RNA extraction (Tab. 9.1) and also fixed for the determination of microbial cell numbers (Tab. 9.2). The respective analyses will be performed in the home laboratory. In addition, samples for several environmental parameters were taken from these cores (see chapter 8).

Live sediments for laboratory experiments

Live sediments obtained from TV-MUC cores were used to initiate feeding and pressure experiments with chitin and algal material at *in-situ* temperature and at both atmospheric and *in-situ* pressure directly on board. Subsamples were taken for the determination of prokaryotic cell numbers, microbial diversity, and potential extracellular enzyme activity. This will help to identify key players in the degradation of organic material and their adaptation to deep-sea pressure. Additional sediment samples were used for cultivation and isolation attempts of bacteria using both liquid and solid media. Live sediments were also stored at 0°C for further analyses and experiments in the home laboratory (Tab. 9.3).

Furthermore, the upper sediment layers of benthic chambers from lander deployments (see Chapter 10) were sampled for microbiological analyses, including microbial cell numbers (Tab. 9.4) and diversity (Tab. 9.5), and for a characterization of the geochemical environment, e.g. chlorophyll pigment concentrations (Chl a) and total organic carbon content (TOC) (Tab. 9.6). In addition, samples were fixed for biomarker and faunal analyses (see chapter 10).

Dissolved organic matter

Porewater samples for dissolved organic matter (DOM) analyses were taken along the HAUSGARTEN depth transect to explore changes in the DOM pool with increasing water depth (Tab. 9.7). Porewater was directly extracted from modified MUC cores (with pre-drilled holes) using rhizones (http://www.rhizosphere.com/rhizons). Ultra high-resolution mass spectrometry (i.e. Fourier Transform Ion Cyclotron Resonance Mass Spectrometry) will be performed in the home laboratory (with P. Rossel, AWI/MPI and T. Dittmar, ICBM Oldenburg/MPI). Samples from two multiple corers at East Greenland station IV at around 2,500 m water depth were used for experimental set-ups started on board of *Polarstern*, in order to develop a better understanding of the dynamics of organic matter degradation by environmental bacterial communities.

Water samples

For insights into the bacterial community composition at different depths (surface water, 500 m, bottom water), water samples were retrieved from the CTD rosette and the overlying water from MUC cores at two HAUSGARTEN stations (HGIV and N4, PS85456-1 and 460-1, PS85/473-1 and 473-6). Water samples were filtered and fixed for the determination of prokaryotic cell counts (AODC and FISH) (Tab. 9.8 and Tab. 9.9), as well as for DNA extractions (Tab. 9.10). DNA samples were obtained with Sterivex filters (0.22 µm), as well as with sequential filtrations over three different pore sizes (10 µm, 3 µm, 0.22 µm), in order to separate bacterial communities attached to smaller particles and free-living ones (Tab. 9.10). Molecular analyses will be performed in the home laboratory and water sample communities will be compared with those of sinking particles and surface sediments.

On 21 June 2014, surface water samples were obtained with the CTD rosette (PS85/455-2) and filtered over 0.22 µm Sterivex filters, in order to contribute to the Ocean Sampling Day 2014. This is a worldwide effort performed for the first time and coordinated jointly by Jacobs University in Bremen, Germany and the University of Oxford, UK. It is launched under the umbrella of the European-funded project Micro B3. Samples will be submitted to the OSD core team for further analyses.

Preliminary (expected) results

Sediment samples will be analyzed at the home laboratory for microbial diversity (DNA) and activity (RNA), particularly along the HAUSGARTEN water depth transect, using next generation sequencing. This will add to a further understanding of bacterial community dynamics in this region. Results will be interpreted in conjunction with environmental parameters (e.g. chlorophyll pigments, total organic carbon). The high-resolution analysis of porewater samples will contribute to a better understanding of dissolved organic matter dynamics along gradients of organic matter availability, including water depth and sediment depth.

With different cultivation approaches we attempt to enrich the most common and active types of deep-sea bacteria in Arctic sediments to enable their genetic and physiological characterization. It is still debated whether pressure has an effect on the culturability of deep-sea microorganisms. In a substrate enrichment experiment we will study the effect of pressure (225 bar *in-situ* pressure and 550 bar) on microbial activity, diversity and culturability. Preliminary results of pressure incubation studies on HAUSGARTEN deep-sea sediments suggest that both pressure and food have significant effects on bacterial activity and community structure. We set up a pressure incubation experiment with deep-sea sediments (retrieved from HGIV, PS85/460-5+6) directly on board of *Polarstern*, in order to minimize the time of exposure to atmospheric pressure after retrieval with the TV-MUC. Sediments were fed with a range of different substrates and incubated at *in-situ*, elevated, and at atmospheric pressure. First measurements of potential extracellular enzymatic activity of chitobiase and beta-glucosidase show that *Thalassiosira weissflogii*-fed sediment bacteria show a 2 times higher chitobiase activity compared to other food sources like chitin or other algae. Those measurements will serve as a baseline to compare to upcoming data in a time series that will run for at least 3 months.

Besides pressure incubations of deep-sea surface sediments, also liquid media and agarose cultivation approaches have been set up to enrich and isolate the most abundant Arctic deep sea sediment bacteria (sediment taken from HGIV, PS85/460-5+6 and N4, PS85/473-6). With a range of treatments we plan to enrich bacterial key species from HAUSGARTEN deep-sea sediments, for further description of their genomes and possible function in the ecosystem.

Data management

Post-cruise data archival will be mainly 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 the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven and the MARUM, Bremen. Scientific data retrieved from observations, measurements and home-based data analyses will be submitted to PANGAEA either upon publication, or with password protection as soon as the data are available and quality-assessed. This includes also biological data, for most of which parameters are already defined in PANGAEA. Molecular data will be deposited in globally accessible databases such as GenBank. Microbiological samples will be stored deep frozen or fixed at the Max Planck Institute in Bremen.

References

Jørgensen BB, Boetius A (2007) Feast and famine - microbial life in the deep-sea bed. Nat Rev Microbiol 5: 770-781.

Jacob M, Soltwedel T, Boetius A, Ramette A (2013) Biogeography of Deep-Sea Benthic Bacteria at Regional Scale (LTER HAUSGARTEN, Fram Strait, Arctic). PLoS ONE 8: e72779.

Kellogg CTE, Deming JW (2009) Comparison of free-living, suspended particle, and aggregate-associated bacterial and archaeal communities in the Laptev Sea. Aquat Microb Ecol 57: 1-18.

Zinger L, Amaral-Zetter LA, Fuhrman JA, Horner-Devine MC, Huse SM, et al. (2011) Global patterns of bacterial beta-diversity in seafloor and seawater ecosystems PLoS ONE 6: e24570.

Appendix to Chapter 9

Tab. 9.1: Sediment samples for DNA and RNA extraction from MUC deployments. Samples are stored at -20°C or -80°C, respectively.

Station	Date	Gear	Core	Depth bsf [cm]	DNA sample #	RNA sample #
PS85/436-1	17.06.14	MUC	1	0-5	1	1
PS85/436-1	17.06.14	MUC	2	0-5	2	2
PS85/436-1	17.06.14	MUC	3	0-5	3	3
PS85/441-1	18.06.14	MUC	1	0-5	4	4
PS85/441-1	18.06.14	MUC	2	0-5	5	5
PS85/441-1	18.06.14	MUC	3	0-5	/	6
PS85/441-1	18.06.14	MUC	4	0-5	/	7
PS85/441-1	18.06.14	MUC	1+2	0-7	6	/
PS85/441-1	18.06.14	MUC	1+2	0-7	7	/
PS85/441-1	18.06.14	MUC	1+2	0-7	8	/
PS85/441-1	18.06.14	MUC	1+2	0-7	9	/
PS85/441-1	18.06.14	MUC	1+2	0-7	10	/
PS85/441-1	18.06.14	MUC	1+2	0-7	11	/
PS85/441-1	18.06.14	MUC	1+2	0-7	12	/
PS85/441-1	18.06.14	MUC	1+2	0-7	13	/
PS85/441-1	18.06.14	MUC	1+2	0-7	14	/
PS85/441-1	18.06.14	MUC	1+2	0-7	15	/
PS85/441-1	18.06.14	MUC	1+2	0-7	16	/
PS85/441-1	18.06.14	MUC	1+2	0-7	17	/
PS85/441-1	18.06.14	MUC	1+2	0-7	18	/
PS85/441-1	18.06.14	MUC	1+2	0-7	19	/
PS85/441-1	18.06.14	MUC	1+2	0-7	20	/
PS85/441-1	18.06.14	MUC	1+2	0-7	21	/
PS85/441-1	18.06.14	MUC	1+2	0-7	22	/
PS85/441-1	18.06.14	MUC	1+2	0-7	23	/
PS85/441-1	18.06.14	MUC	1+2	0-7	24	/
PS85/441-1	18.06.14	MUC	1+2	0-7	25	/
PS85/445-1	19.06.14	MUC	1	0-5	26	8
PS85/445-1	19.06.14	MUC	2	0-5	27	9
PS85/445-1	19.06.14	MUC	3	0-5	28	10
PS85/445-1	19.06.14	MUC		0-5	/	11
PS85/454-3	20.06.14	MUC	1	0-5	29	12
PS85/454-3	20.06.14	MUC	2	0-5	30	13
PS85/454-3	20.06.14	MUC	3	0-5	31	14
PS85/454-3	20.06.14	MUC	3	0-5	/	15
PS85/460-6	22.06.14	MUC	1	2-3	32	/
PS85/460-6	22.06.14	MUC	1	3-4	33	/
PS85/460-6	22.06.14	MUC	1	4-5	34	/
PS85/460-6	22.06.14	MUC	1	5-6	35	/
PS85/460-6	22.06.14	MUC	1	6-7	36	/
PS85/460-6	22.06.14	MUC	1	7-8	37	/
PS85/460-6	22.06.14	MUC	1	8-9	38	/
PS85/460-6	22.06.14	MUC	1	9-10	39	/
PS85/460-6	22.06.14	MUC	3	2-3	40	/
PS85/460-6	22.06.14	MUC	3	3-4	41	/
PS85/460-6	22.06.14	MUC	3	4-5	42	/

Station	Date	Gear	Core	Depth bsf [cm]	DNA sample #	RNA sample #
PS85/460-6	22.06.14	MUC	3	5-6	43	/
PS85/460-6	22.06.14	MUC	3	6-7	44	/
PS85/460-6	22.06.14	MUC	3	7-8	45	/
PS85/460-6	22.06.14	MUC	3	8-9	46	/
PS85/460-6	22.06.14	MUC	3	9-10	47	/
PS85/460-6	22.06.14	MUC	4	2-3	48	/
PS85/460-6	22.06.14	MUC	4	3-4	49	/
PS85/460-6	22.06.14	MUC	4	4-5	50	/
PS85/460-6	22.06.14	MUC	4	5-6	51	/
PS85/460-6	22.06.14	MUC	4	6-7	52	/
PS85/460-6	22.06.14	MUC	4	7-8	53	/
PS85/460-6	22.06.14	MUC	4	8-9	54	/
PS85/460-6	22.06.14	MUC	4	9-10	55	/
PS85/460-6	22.06.14	MUC	2	0-1	56	/
PS85/460-6	22.06.14	MUC	2	1-2	57	/
PS85/460-6	22.06.14	MUC	2	2-3	58	/
PS85/460-6	22.06.14	MUC	2	3-4	59	/
PS85/460-6	22.06.14	MUC	2	4-5	60	/
PS85/460-6	22.06.14	MUC	2	5-6	61	/
PS85/460-6	22.06.14	MUC	2	6-7	62	/
PS85/460-6	22.06.14	MUC	2	7-8	63	/
PS85/460-6	22.06.14	MUC	2	8-9	64	/
PS85/460-6	22.06.14	MUC	2	9-10	65	/
PS85/460-6	22.06.14	MUC	/	fluffy	66	/
PS85/460-6	22.06.14	MUC	/	fluffy	67	/
PS85/460-6	22.06.14	MUC	/	fluffy	68	/
PS85/460-6	22.06.14	MUC	/	fluffy	69	/
PS85/460-6	22.06.14	MUC	/	fluffy	70	/
PS85/460-5+6	23.06.14	MUC	/	0-2	71	15
PS85/460-5+6	23.06.14	MUC	/	0-2	72	16
PS85/460-5+6	23.06.14	MUC	/	0-2	73	17
PS85/460-5+6	23.06.14	MUC	/	0-2	74	18
PS85/460-5+6	23.06.14	MUC	/	0-2	75	19
PS85/460-5+6	23.06.14	MUC	/	0-2	76	20
PS85/460-5+6	23.06.14	MUC	/	0-2	77	21
PS85/460-5+6	23.06.14	MUC	/	0-2	78	22
PS85/460-5+6	23.06.14	MUC	/	0-2	79	23
PS85/460-5+6	23.06.14	MUC	/	0-2	80	24
PS85/460-5+6	23.06.14	MUC	/	0-2	81	25
PS85/460-5+6	23.06.14	MUC	/	0-2	82	26
PS85/460-5+6	23.06.14	MUC	/	0-2	83	/
PS85/460-5+6	23.06.14	MUC	/	0-2	84	/
PS85/460-5+6	23.06.14	MUC	/	0-2	85	/
PS85/460-5+6	23.06.14	MUC	/	0-2	86	/
PS85/460-5+6	23.06.14	MUC	/	0-2	87	/
PS85/460-5+6	23.06.14	MUC	/	0-2	88	/
PS85/460-5+6	23.06.14	MUC	/	0-2	89	/
PS85/460-5+6	23.06.14	MUC	/	0-2	90	/
PS85/460-4	22.06.14	MUC	1	0-5	91	27
PS85/460-4	22.06.14	MUC	2	0-5	92	28
PS85/460-4	22.06.14	MUC	3	0-5	93	29

Station	Date	Gear	Core	Depth bsf [cm]	DNA sample #	RNA sample #
PS85/460-4	22.06.14	MUC	3	0-5	/	30
PS85/463-1	23.06.14	MUC	1	0-1		WP1
PS85/463-1	23.06.14	MUC	1	1-2		WP2
PS85/463-1	23.06.14	MUC	1	2-3		WP3
PS85/463-1	23.06.14	MUC	1	3-4		WP4
PS85/463-1	23.06.14	MUC	1	4-5		WP5
PS85/463-1	23.06.14	MUC	2	0-1		WP6
PS85/463-1	23.06.14	MUC	2	1-2		WP7
PS85/463-1	23.06.14	MUC	2	2-3		WP8
PS85/463-1	23.06.14	MUC	2	3-4		WP9
PS85/463-1	23.06.14	MUC	2	4-5		WP10
PS85/463-1	23.06.14	MUC	3	0-1		WP11
PS85/463-1	23.06.14	MUC	3	1-2		WP12
PS85/463-1	23.06.14	MUC	3	2-3		WP13
PS85/463-1	23.06.14	MUC	3	3-4		WP14
PS85/463-1	23.06.14	MUC	3	4-5		WP15
PS85/464-1	23.06.14	MUC	1	0-1		WP16
PS85/464-1	23.06.14	MUC	1	1-2		WP17
PS85/464-1	23.06.14	MUC	1	2-3		WP18
PS85/464-1	23.06.14	MUC	1	3-4		WP19
PS85/464-1	23.06.14	MUC	1	4-5		WP20
PS85/464-1	23.06.14	MUC	2	0-1		WP21
PS85/464-1	23.06.14	MUC	2	1-2		WP22
PS85/464-1	23.06.14	MUC	2	2-3		WP23
PS85/464-1	23.06.14	MUC	2	3-4		WP24
PS85/464-1	23.06.14	MUC	2	4-5		WP25
PS85/465-4	24.06.14	MUC	1	0-1	94	31
PS85/465-4	24.06.14	MUC	1	1-2	95	32
PS85/465-4	24.06.14	MUC	1	2-3	96	33
PS85/465-4	24.06.14	MUC	1	3-4	97	34
PS85/465-4	24.06.14	MUC	1	4-5	98	35
PS85/465-4	24.06.14	MUC	2	0-1	99	36
PS85/465-4	24.06.14	MUC	2	1-2	100	37
PS85/465-4	24.06.14	MUC	2	2-3	101	38
PS85/465-4	24.06.14	MUC	2	3-4	102	39
PS85/465-4	24.06.14	MUC	2	4-5	103	40
PS85/465-4	24.06.14	MUC	3	0-1	104	41
PS85/465-4	24.06.14	MUC	3	1-2	105	42
PS85/465-4	24.06.14	MUC	3	2-3	106	43
PS85/465-4	24.06.14	MUC	3	3-4	107	44
PS85/465-4	24.06.14	MUC	3	4-5	108	45
PS85/468-1	24.06.14	MUC	1	0-5	115	46
PS85/468-1	24.06.14	MUC	2	0-5	116	47
PS85/468-1	24.06.14	MUC	3	0-5	117	48
PS85/469-2	24.06.14	MUC	1	0-5	118	49
PS85/469-2	24.06.14	MUC	2	0-5	119	50
PS85/469-2	24.06.14	MUC	3	0-5	120	51
PS85/470-2	25.06.14	MUC	1	0-5	121	52
PS85/470-2	25.06.14	MUC	2	0-5	122	53

Station	Date	Gear	Core	Depth bsf [cm]	DNA sample #	RNA sample #
PS85/470-2	25.06.14	MUC	3	0-5	123	54
PS85/473-7	25.06.14	MUC	1	0-1	124	55
PS85/473-7	25.06.14	MUC	1	1-2	125	56
PS85/473-7	25.06.14	MUC	1	2-3	126	57
PS85/473-7	25.06.14	MUC	1	3-4	127	58
PS85/473-7	25.06.14	MUC	1	4-5	128	59
PS85/473-7	25.06.14	MUC	2	0-1	129	60
PS85/473-7	25.06.14	MUC	2	1-2	130	61
PS85/473-7	25.06.14	MUC	2	2-3	131	62
PS85/473-7	25.06.14	MUC	2	3-4	132	63
PS85/473-7	25.06.14	MUC	2	4-5	133	64
PS85/473-8	25.06.14	MUC	1	0-1		65
PS85/473-8	25.06.14	MUC	1	0-1		66
PS85/473-8	25.06.14	MUC	1	1-2		67
PS85/473-8	25.06.14	MUC	1	1-2		68
PS85/473-8	25.06.14	MUC	1	2-3		69
PS85/473-8	25.06.14	MUC	1	2-3		70
PS85/473-8	25.06.14	MUC	1	3-4		71
PS85/473-8	25.06.14	MUC	1	3-4		72
PS85/473-8	25.06.14	MUC	1	4-5		73
PS85/473-8	25.06.14	MUC	1	4-5		74
PS85/473-8	25.06.14	MUC	1	5-6		75
PS85/473-8	25.06.14	MUC	1	5-6		76
PS85/473-8	25.06.14	MUC	1	6-7		77
PS85/473-8	25.06.14	MUC	1	6-7		78
PS85/473-8	25.06.14	MUC	1	7-8		79
PS85/473-8	25.06.14	MUC	1	7-8		80
PS85/473-8	25.06.14	MUC	1	8-9		81
PS85/473-8	25.06.14	MUC	1	8-9		82
PS85/473-8	25.06.14	MUC	1	9-10		83
PS85/473-8	25.06.14	MUC	1	9-10		84
PS85/473-8	25.06.14	MUC	2	0-1	134	
PS85/473-8	25.06.14	MUC	2	1-2	135	
PS85/473-8	25.06.14	MUC	2	2-3	136	
PS85/473-8	25.06.14	MUC	2	3-4	137	
PS85/473-8	25.06.14	MUC	2	4-5	138	
PS85/473-8	25.06.14	MUC	2	5-6	139	
PS85/473-8	25.06.14	MUC	2	6-7	140	
PS85/473-8	25.06.14	MUC	2	7-8	141	
PS85/473-8	25.06.14	MUC	2	8-9	142	
PS85/473-8	25.06.14	MUC	2	9-10	143	
PS85/473-8	25.06.14	MUC	2	0-1	144	
PS85/473-8	25.06.14	MUC	2	1-2	145	
PS85/473-8	25.06.14	MUC	2	2-3	146	
PS85/473-8	25.06.14	MUC	2	3-4	147	
PS85/473-8	25.06.14	MUC	2	4-5	148	
PS85/460-5+6	23.06.14	MUC		0-2	149	85
PS85/460-5+6	23.06.14	MUC		0-2	150	/

Station	Date	Gear	Core	Depth bsf [cm]	DNA sample #	RNA sample #
PS85/460-5+6	23.06.14	MUC		0-2	151	/
PS85/460-5+6	23.06.14	MUC		0-2	152	86
PS85/460-5+6	23.06.14	MUC		0-2	153	/
PS85/460-5+6	23.06.14	MUC		0-2	154	/
PS85/460-5+6	23.06.14	MUC		0-2	155	87
PS85/460-5+6	23.06.14	MUC		0-2	156	/
PS85/460-5+6	23.06.14	MUC		0-2	157	88
PS85/460-5+6	23.06.14	MUC		0-2	158	/
PS85/460-5+6	23.06.14	MUC		0-2	159	/
PS85/460-5+6	23.06.14	MUC		0-2	160	89
PS85/460-5+6	23.06.14	MUC		0-2	161	/
PS85/460-5+6	23.06.14	MUC		0-2	162	
PS85/460-5+6	23.06.14	MUC		0-2	163	
PS85/460-5+6	23.06.14	MUC		0-2	164	
PS85/460-5+6	23.06.14	MUC		0-2	165	
PS85/460-5+6	23.06.14	MUC		0-2	166	
PS85/460-5+6	23.06.14	MUC		0-2	167	
PS85/460-5+6	23.06.14	MUC		0-2	168	
PS85/460-5+6	23.06.14	MUC		0-2	169	
PS85/460-5+6	23.06.14	MUC		0-2	170	
PS85/460-5+6	23.06.14	MUC		0-2	171	
PS85/460-5+6	23.06.14	MUC		0-2	172	
PS85/460-5+6	23.06.14	MUC		0-2	173	
PS85/460-5+6	23.06.14	MUC		0-2	174	
PS85/460-5+6	23.06.14	MUC		0-2	175	
PS85/460-5+6	23.06.14	MUC		0-2	176	
PS85/460-5+6	23.06.14	MUC		0-2	177	
PS85/460-5+6	23.06.14	MUC		0-2	178	
PS85/460-5+6	23.06.14	MUC		0-2	179	
PS85/460-5+6	23.06.14	MUC		0-2	180	
PS85/460-5+6	23.06.14	MUC		0-2	181	
PS85/460-5+6	23.06.14	MUC		0-2	182	
PS85/460-5+6	23.06.14	MUC		0-2	183	
PS85/460-5+6	23.06.14	MUC		0-2	184	
PS85/460-5+6	23.06.14	MUC		0-2	185	
PS85/460-5+6	23.06.14	MUC		0-2	186	
PS85/460-5+6	23.06.14	MUC		0-2	187	

Tab. 9.2: Sediment samples from MUC deployments, stored for total prokaryotic cell counts (Acridine Orange Direct Counts – AODC and Fluorescence *in-situ* hybridization – FISH). Storage at 4°C or -20°C, respectively.

Station	Date	Gear	Core	Depth bsf [cm]	AODC sample #	FISH sample #
PS85/436-1	17.06.14	MUC	1	0-1	1	1
PS85/436-1	17.06.14	MUC	1	1-2	2	2
PS85/436-1	17.06.14	MUC	1	2-3	3	3

Station	Date	Gear	Core	Depth bsf [cm]	AODC sample #	FISH sample #
PS85/436-1	17.06.14	MUC	1	3-4	4	4
PS85/436-1	17.06.14	MUC	1	4-5	5	5
PS85/441-1	18.06.14	MUC	1+2	0-1	6	6
PS85/441-1	18.06.14	MUC	1+2	1-2	7	7
PS85/441-1	18.06.14	MUC	1+2	2-3	8	8
PS85/441-1	18.06.14	MUC	1+2	3-4	9	9
PS85/441-1	18.06.14	MUC	1+2	4-5	10	10
PS85/441-1	18.06.14	MUC	1+2	0-7	11	-
PS85/441-1	18.06.14	MUC	1+2	0-7	12	-
PS85/441-1	18.06.14	MUC	1+2	0-7	13	-
PS85/441-1	18.06.14	MUC	1+2	0-7	14	-
PS85/441-1	18.06.14	MUC	1+2	0-7	15	-
PS85/441-1	18.06.14	MUC	1+2	0-7	16	-
PS85/441-1	18.06.14	MUC	1+2	0-7	17	-
PS85/441-1	18.06.14	MUC	1+2	0-7	18	-
PS85/441-1	18.06.14	MUC	1+2	0-7	19	-
PS85/441-1	18.06.14	MUC	1+2	0-7	20	-
PS85/441-1	18.06.14	MUC	1+2	0-7	21	-
PS85/441-1	18.06.14	MUC	1+2	0-7	22	-
PS85/441-1	18.06.14	MUC	1+2	0-7	23	-
PS85/441-1	18.06.14	MUC	1+2	0-7	24	-
PS85/441-1	18.06.14	MUC	1+2	0-7	25	-
PS85/441-1	18.06.14	MUC	1+2	0-7	26	-
PS85/441-1	18.06.14	MUC	1+2	0-7	27	-
PS85/441-1	18.06.14	MUC	1+2	0-7	28	-
PS85/441-1	18.06.14	MUC	1+2	0-7	29	-
PS85/441-1	18.06.14	MUC	1+2	0-7	30	-
PS85/445-1	19.06.14	MUC	1+2	0-1	31	11
PS85/445-1	19.06.14	MUC	1+2	1-2	32	12
PS85/445-1	19.06.14	MUC	1+2	2-3	33	13
PS85/445-1	19.06.14	MUC	1+2	3-4	34	14
PS85/445-1	19.06.14	MUC	1+2	4-5	35	15
PS85/436-1	19.06.14	MUC	SC2	0-1	36	-
PS85/436-1	19.06.14	MUC	SC2	1-2	37	-
PS85/436-1	19.06.14	MUC	SC2	2-3	38	-
PS85/436-1	19.06.14	MUC	SC2	3-4	39	-
PS85/436-1	19.06.14	MUC	SC2	4-5	40	-
PS85/441-1	20.06.14	MUC	SC1	0-1	41	-
PS85/441-1	20.06.14	MUC	SC1	1-2	42	-
PS85/441-1	20.06.14	MUC	SC1	2-3	43	-
PS85/441-1	20.06.14	MUC	SC1	3-4	44	-

Station	Date	Gear	Core	Depth bsf [cm]	AODC sample #	FISH sample #
PS85/441-1	20.06.14	MUC	SC1	4-5	45	-
PS85/454-3	20.06.14	MUC	1+2	0-1	46	16
PS85/454-3	20.06.14	MUC	1+2	1-2	47	17
PS85/454-3	20.06.14	MUC	1+2	2-3	48	18
PS85/454-3	20.06.14	MUC	1+2	3-4	49	19
PS85/454-3	20.06.14	MUC	1+2	4-5	50	20
PS85/445-1	21.06.14	MUC	SC2	0-1	51	-
PS85/445-1	21.06.14	MUC	SC2	1-2	52	-
PS85/445-1	21.06.14	MUC	SC2	2-3	53	-
PS85/445-1	21.06.14	MUC	SC2	3-4	54	-
PS85/445-1	21.06.14	MUC	SC2	4-5	55	-
PS85/454-3	22.06.14	MUC	SC2	0-1	56	-
PS85/454-3	22.06.14	MUC	SC2	1-2	57	-
PS85/454-3	22.06.14	MUC	SC2	2-3	58	-
PS85/454-3	22.06.14	MUC	SC2	3-4	59	-
PS85/454-3	22.06.14	MUC	SC2	4-5	60	-
PS85/460-4	22.06.14	MUC	1+2	0-1	61	21
PS85/460-4	22.06.14	MUC	1+2	1-2	62	22
PS85/460-4	22.06.14	MUC	1+2	2-3	63	23
PS85/460-4	22.06.14	MUC	1+2	3-4	64	24
PS85/460-4	22.06.14	MUC	1+2	4-5	65	25
PS85/460-5+6	23.06.14	MUC	/	0-2	66	26
PS85/460-5+6	23.06.14	MUC	/	0-2	67	-
PS85/460-5+6	23.06.14	MUC	/	0-2	68	-
PS85/460-5+6	23.06.14	MUC	/	0-2	69	27
PS85/460-5+6	23.06.14	MUC	/	0-2	70	-
PS85/460-5+6	23.06.14	MUC	/	0-2	71	-
PS85/460-5+6	23.06.14	MUC	/	0-2	72	28
PS85/460-5+6	23.06.14	MUC	/	0-2	73	-
PS85/460-5+6	23.06.14	MUC	/	0-2	74	-
PS85/460-5+6	23.06.14	MUC	/	0-2	75	29
PS85/460-5+6	23.06.14	MUC	/	0-2	76	-
PS85/460-5+6	23.06.14	MUC	/	0-2	77	-
PS85/460-5+6	23.06.14	MUC	/	0-2	78	
PS85/460-5+6	23.06.14	MUC	/	0-2	79	
PS85/460-5+6	23.06.14	MUC	/	0-2	80	
PS85/460-5+6	23.06.14	MUC	/	0-2	81	
PS85/460-5+6	23.06.14	MUC	/	0-2	82	
PS85/460-5+6	23.06.14	MUC	/	0-2	83	
PS85/460-5+6	23.06.14	MUC	/	0-2	84	
PS85/460-5+6	23.06.14	MUC	/	0-2	85	

Station	Date	Gear	Core	Depth bsf [cm]	AODC sample #	FISH sample #
PS85/463-1	23.06.14	MUC	/	0-1	86	30
PS85/463-1	23.06.14	MUC	/	1-2	87	31
PS85/463-1	23.06.14	MUC	/	2-3	88	32
PS85/463-1	23.06.14	MUC	/	3-4	89	33
PS85/463-1	23.06.14	MUC	/	4-5	90	34
PS85/464-1	23.06.14	MUC	/	0-1	91	35
PS85/464-1	23.06.14	MUC	/	1-2	92	36
PS85/464-1	23.06.14	MUC	/	2-3	93	37
PS85/464-1	23.06.14	MUC	/	3-4	94	38
PS85/464-1	23.06.14	MUC	/	4-5	95	39
PS85/465-4	24.06.14	MUC	/	0-1	96	40
PS85/465-4	24.06.14	MUC	/	1-2	97	41
PS85/465-4	24.06.14	MUC	/	2-3	98	42
PS85/465-4	24.06.14	MUC	/	3-4	99	43
PS85/465-4	24.06.14	MUC	/	4-5	100	44
PS85/468-1	24.06.14	MUC	1+2	0-1	116	45
PS85/468-1	24.06.14	MUC	1+2	1-2	117	46
PS85/468-1	24.06.14	MUC	1+2	2-3	118	47
PS85/468-1	24.06.14	MUC	1+2	3-4	119	48
PS85/468-1	24.06.14	MUC	1+2	4-5	120	49
PS85/460-4	24.06.14	MUC	SC2	0-1	121	-
PS85/460-4	24.06.14	MUC	SC2	1-2	122	-
PS85/460-4	24.06.14	MUC	SC2	2-3	123	-
PS85/460-4	24.06.14	MUC	SC2	3-4	124	-
PS85/460-4	24.06.14	MUC	SC2	4-5	125	-
PS85/469-2	24.06.14	MUC	1+2	0-1	126	50
PS85/469-2	24.06.14	MUC	1+2	1-2	127	51
PS85/469-2	24.06.14	MUC	1+2	2-3	128	52
PS85/469-2	24.06.14	MUC	1+2	3-4	129	53
PS85/469-2	24.06.14	MUC	1+2	4-5	130	54
PS85/470-3	25.06.14	MUC	1+2	0-1	131	55
PS85/470-3	25.06.14	MUC	1+2	1-2	132	56
PS85/470-3	25.06.14	MUC	1+2	2-3	133	57
PS85/470-3	25.06.14	MUC	1+2	3-4	134	58
PS85/470-3	25.06.14	MUC	1+2	4-5	135	59
PS85/473-7	25.06.14	MUC		0-1	136	60
PS85/473-7	25.06.14	MUC		1-2	137	61
PS85/473-7	25.06.14	MUC		2-3	138	62
PS85/473-7	25.06.14	MUC		3-4	139	63
PS85/473-7	25.06.14	MUC		4-5	140	64
PS85/473-8	25.06.14	MUC		fluffy layer	141	

Station	Date	Gear	Core	Depth bsf [cm]	AODC sample #	FISH sample #
PS85/473-8	25.06.14	MUC		fluffy layer	142	
PS85/460-5+6	23.06.14	MUC		0-2	143	65
PS85/460-5+6	23.06.14	MUC		0-2	144	/
PS85/460-5+6	23.06.14	MUC		0-2	145	/
PS85/460-5+6	23.06.14	MUC		0-2	146	66
PS85/460-5+6	23.06.14	MUC		0-2	147	/
PS85/460-5+6	23.06.14	MUC		0-2	148	/
PS85/460-5+6	23.06.14	MUC		0-2	149	/
PS85/460-5+6	23.06.14	MUC		0-2	150	/
PS85/460-5+6	23.06.14	MUC		0-2	151	67
PS85/460-5+6	23.06.14	MUC		0-2	152	/
PS85/460-5+6	23.06.14	MUC		0-2	153	/
PS85/460-5+6	23.06.14	MUC		0-2	154	/
PS85/460-5+6	23.06.14	MUC		0-2	155	/
PS85/460-5+6	23.06.14	MUC		0-2	156	
PS85/460-5+6	23.06.14	MUC		0-2	157	/
PS85/460-5+6	23.06.14	MUC		0-2	158	/
PS85/460-5+6	23.06.14	MUC		0-2	159	/
PS85/460-5+6	23.06.14	MUC		0-2	160	/
PS85/460-5+6	23.06.14	MUC		0-2	161	/
PS85/460-5+6	23.06.14	MUC		0-2	162	/
PS85/460-5+6	23.06.14	MUC		0-2	163	/
PS85/460-5+6	23.06.14	MUC		0-2	164	/
PS85/460-5+6	23.06.14	MUC		0-2	165	/
PS85/460-5+6	23.06.14	MUC		0-2	166	/
PS85/460-5+6	23.06.14	MUC		0-2	167	/
PS85/460-5+6	23.06.14	MUC		0-2	168	/
PS85/460-5+6	23.06.14	MUC		0-2	169	/
PS85/460-5+6	23.06.14	MUC		0-2	170	/
PS85/460-5+6	23.06.14	MUC		0-2	171	/
PS85/460-5+6	23.06.14	MUC		0-2	172	/
PS85/460-5+6	23.06.14	MUC		0-2	173	/
PS85/460-5+6	23.06.14	MUC		0-2	174	/
PS85/460-5+6	23.06.14	MUC		0-2	175	/
PS85/460-5+6	23.06.14	MUC		0-2	176	/
PS85/460-5+6	23.06.14	MUC		0-2	177	/
PS85/460-5+6	23.06.14	MUC		0-2	178	/
PS85/460-5+6	23.06.14	MUC		0-2	179	/
PS85/460-5+6	23.06.14	MUC		0-2	180	/
PS85/460-5+6	23.06.14	MUC		0-2	181	/

Station	Date	Gear	Core	Depth bsf [cm]	AODC sample #	FISH sample #
PS85/468-1	27.06.14	MUC	SC2	0-1 cm	192	0-1 cm
PS85/468-1	27.06.14	MUC	SC2	1-2 cm	193	1-2 cm
PS85/468-1	27.06.14	MUC	SC2	2-3 cm	194	2-3 cm
PS85/468-1	27.06.14	MUC	SC2	3-4 cm	195	3-4 cm
PS85/468-1	27.06.14	MUC	SC2	4-5 cm	196	4-5 cm
PS85/469-2	27.06.14	MUC	SC2	0-1 cm	197	0-1 cm
PS85/469-2	27.06.14	MUC	SC2	1-2 cm	198	1-2 cm
PS85/469-2	27.06.14	MUC	SC2	2-3 cm	199	2-3 cm
PS85/469-2	27.06.14	MUC	SC2	3-4 cm	200	3-4 cm
PS85/469-2	27.06.14	MUC	SC2	4-5 cm	201	4-5 cm
PS85/470-2	27.06.14	MUC	SC2	0-1 cm	202	0-1 cm
PS85/470-2	27.06.14	MUC	SC2	1-2 cm	203	1-2 cm
PS85/470-2	27.06.14	MUC	SC2	2-3 cm	204	2-3 cm
PS85/470-2	27.06.14	MUC	SC2	3-4 cm	205	3-4 cm
PS85/470-2	27.06.14	MUC	SC2	4-5 cm	206	4-5 cm

Tab. 9.3: Live sediments retrieved from the upper 2 cm of MUC cores. Sediments were mixed with sterile filtered deep water (1:1) and stored at 0°C.

Station	Date	Gear	Water depth [m]	Sediment depth [cm]	HAUSGARTEN station
PS85/454-4	21.06.14	MUC	2550	0-2	EG IV
PS85/454-4	21.06.14	MUC	2550	0-2	EG IV
PS85/454-4	21.06.14	MUC	2550	0-2	EG IV
PS85/454-4	21.06.14	MUC	2550	0-2	EG IV
PS85/454-4	21.06.14	MUC	2550	0-2	EG IV
PS85/454-4	21.06.14	MUC	2550	0-2	EG IV
PS85/454-5	21.06.14	MUC	2561	0-2	EG IV
PS85/454-5	21.06.14	MUC	2561	0-2	EG IV
PS85/454-5	21.06.14	MUC	2561	0-2	EG IV
PS85/454-5	21.06.14	MUC	2561	0-2	EG IV
PS85/454-5	21.06.14	MUC	2561	0-2	EG IV
PS85/460-5+6	25.06.14	MUC	2405	0-2	HG IV
PS85/460-5+6	25.06.14	MUC	2405	0-2	HG IV
PS85/460-5+6	25.06.14	MUC	2405	0-2	HG IV
PS85/460-5+6	25.06.14	MUC	2405	0-2	HG IV
PS85/473-8	25.06.14	MUC	2412	0-2	N4
PS85/473-8	25.06.14	MUC	2412	0-2	N4
PS85/473-8	25.06.14	MUC	2412	0-2	N4

Tab. 9.4: Sediment samples from lander deployments, stored for total prokaryotic cell counts (Acridine Orange Direct Counts – AODC). Storage at 4°C. BL_C – Benthic chamber lander. K1 – Chamber 1, K2 – Chamber 2, K3 – Chamber 3. Station numbers indicate the recovery of the lander.

Station	Date	Gear	Chamber	Depth bsf (cm)	AODC sample #
PS85/466-1	24.06.14	BL_C	K1	0-1	101
PS85/466-1	24.06.14	BL_C	K1	1-2	102
PS85/466-1	24.06.14	BL_C	K1	2-3	103
PS85/466-1	24.06.14	BL_C	K1	3-4	104
PS85/466-1	24.06.14	BL_C	K1	4-5	105
PS85/466-1	24.06.14	BL_C	K2	0-1	106
PS85/466-1	24.06.14	BL_C	K2	1-2	107
PS85/466-1	24.06.14	BL_C	K2	2-3	108
PS85/466-1	24.06.14	BL_C	K2	3-4	109
PS85/466-1	24.06.14	BL_C	K2	4-5	110
PS85/466-1	24.06.14	BL_C	K3	0-1	111
PS85/466-1	24.06.14	BL_C	K3	1-2	112
PS85/466-1	24.06.14	BL_C	K3	2-3	113
PS85/466-1	24.06.14	BL_C	K3	3-4	114
PS85/466-1	24.06.14	BL_C	K3	4-5	115
PS85/476-1	26.06.14	BL_C	K1	0-1	182
PS85/476-1	26.06.14	BL_C	K1	1-2	183
PS85/476-1	26.06.14	BL_C	K1	2-3	184
PS85/476-1	26.06.14	BL_C	K1	3-4	185
PS85/476-1	26.06.14	BL_C	K1	4-5	186
PS85/476-1	26.06.14	BL_C	K2	0-1	187
PS85/476-1	26.06.14	BL_C	K2	1-2	188
PS85/476-1	26.06.14	BL_C	K2	2-3	189
PS85/476-1	26.06.14	BL_C	K2	3-4	190
PS85/476-1	26.06.14	BL_C	K2	4-5	191

Tab. 9.5: Sediment samples for DNA extraction from lander deployments. Samples are stored at -20°C. BL_C– Benthic chamber lander. K1 – Chamber 1, K2 – Chamber 2, K3 – Chamber 3. Station numbers indicate the recovery of the lander.

Station	Date	Gear	Chamber	Depth bsf [cm]	DNA sample #
PS85/466-1	24.06.14	Lander	KL1	0-5	109
PS85/466-1	24.06.14	Lander	KL1	0-5	110
PS85/466-1	24.06.14	Lander	KL2	0-5	111
PS85/466-1	24.06.14	Lander	KL2	0-5	112

Station	Date	Gear	Chamber	Depth bsf [cm]	DNA sample #
PS85/466-1	24.06.14	Lander	KL3	0-5	113
PS85/466-1	24.06.14	Lander	KL3	0-5	114

Tab. 9.6: Sediment samples from lander deployments, stored at -20°C for the determination of chlorophyll pigments and total organic carbon. BL_C – Benthic chamber lander. K1 – Chamber 1, K2 – Chamber 2, K3 – Chamber 3. Station numbers indicate the recovery of the lander.

Station	Date	Gear	Chamber	Depth bsf (cm)	Chl-a sample #	TOC sample #
PS85/466-1	24.06.14	BL_C	K1	0-5	1	1
PS85/466-1	24.06.14	BL_C	K2	0-5	2	2
PS85/466-1	24.06.14	BL_C	K3	0-5	3	3
PS85/476-1	26.06.14	BL_C	K1	0-5	4	4
PS85/476-1	26.06.14	BL_C	K2	0-5	5	5

Tab. 9.7: Porewater samples for DOC analyses were extracted from TV-MUC cores with rhizones and were stored in 50 ml tubes (pre-rinsed with MilliQ) at -20°C. At all stations samples were taken with the following resolution: bottom water, 0-1 cm, 1-5 cm, 5-10 cm.

Station	Date	Gear	Core	Depth bsf [cm]	DOC sample #	Comment
PS85/436-1	17.06.14	MUC	1	-1 (bw)	5	EGI
PS85/436-1	17.06.14	MUC	1	-1 (bw)	6	
PS85/436-1	17.06.14	MUC	1	0-1	7	
PS85/436-1	17.06.14	MUC	1	1-5	8	
PS85/436-1	17.06.14	MUC	1	1-5	9	
PS85/436-1	17.06.14	MUC	1	5-10	10	
PS85/441-1	18.06.14	MUC	1	-1 (bw)	11	EG II
PS85/441-1	18.06.14	MUC	1	-1 (bw)	12	
PS85/441-1	18.06.14	MUC	1	0-1	13	
PS85/441-1	18.06.14	MUC	1	1-5	14	
PS85/441-1	18.06.14	MUC	1	1-5	15	
PS85/441-1	18.06.14	MUC	1	5-10	16	
PS85/441-1	18.06.14	MUC	1	5-10	17	
PS85/445-1	19.06.14	MUC	1	-1 (bw)	18	EGIII
PS85/445-1	19.06.14	MUC	1	-1 (bw)	19	
PS85/445-1	19.06.14	MUC	1	0-1	20	
PS85/445-1	19.06.14	MUC	1	1-5	21	

Station	Date	Gear	Core	Depth bsf [cm]	DOC sample #	Comment
PS85/445-1	19.06.14	MUC	1	5-10	22	
PS85/445-1	19.06.14	MUC	2	-1 (bw)	23	EGIII
PS85/445-1	19.06.14	MUC	2	-1 (bw)	24	
PS85/445-1	19.06.14	MUC	2	0-1	25	
PS85/445-1	19.06.14	MUC	2	1-5	26	
PS85/445-1	19.06.14	MUC	2	1-5	27	
PS85/445-1	19.06.14	MUC	2	5-10	28	
PS85/445-1	19.06.14	MUC	2	5-10	29	
PS85/454-3	19.06.14	MUC	1	-1 (bw)	30	EGIV
PS85/454-3	19.06.14	MUC	1	-1 (bw)	31	
PS85/454-3	19.06.14	MUC	1	0-1	32	
PS85/454-3	19.06.14	MUC	1	1-5	33	
PS85/454-3	19.06.14	MUC	1	1-5	34	
PS85/454-3	19.06.14	MUC	1	5-10	35	
PS85/454-3	19.06.14	MUC	1	5-10	36	
PS85/454-4	20.06.14	MUC	1	-1 (bw)	37	
PS85/454-4	20.06.14	MUC	1	-1 (bw)	38	
PS85/454-4	20.06.14	MUC	2	-1 (bw)	39	
PS85/454-4	20.06.14	MUC	2	-1 (bw)	40	
PS85/454-5	20.06.14	MUC	1	-1 (bw)	41	
PS85/454-5	20.06.14	MUC	1	-1 (bw)	42	
PS85/454-5	20.06.14	MUC	2	-1 (bw)	43	
PS85/454-5	20.06.14	MUC	2	-1 (bw)	44	
PS85/454-4 + 454-5	21.06.14	MUC	7+7	0-2	45	DOC experiment: sediment 0-2 cm
PS85/454-4 + 454-5	21.06.14	MUC	7+7	0-2	46	DOC experiment: sediment 0-2 cm i
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	47	DOC experiment: sediment 5-10 cm
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	48	DOC experiment: sediment 5-10 cm
PS85/460-4	22.06.14	MUC	1	-1 (bw)	49	HGIV
PS85/460-4	22.06.14	MUC	1	-1 (bw)	50	
PS85/460-4	22.06.14	MUC	1	0-1	51	
PS85/460-4	22.06.14	MUC	1	1-5	52	
PS85/460-4	22.06.14	MUC	1	1-5	53	
PS85/460-4	22.06.14	MUC	1	5-10	54	
PS85/460-4	22.06.14	MUC	1	5-10	55	
PS85/460-4	22.06.14	MUC	2	-1 (bw)	56	HGIV (sample from 2 MUC cores)
PS85/460-4	22.06.14	MUC	2	-1 (bw)	57	

Station	Date	Gear	Core	Depth bsf [cm]	DOC sample #	Comment
PS85/460-4	22.06.14	MUC	2	0-1	58	
PS85/460-4	22.06.14	MUC	2	1-5	59	
PS85/460-4	22.06.14	MUC	2	1-5	60	
PS85/460-4	22.06.14	MUC	2	5-10	61	
PS85/460-4	22.06.14	MUC	2	5-10	62	
PS85/454-4 + 454-5	21.06.14	MUC	7+7	0-2	63	DOC experiment, t0: control
PS85/454-4 + 454-5	21.06.14	MUC	7+7	0-2	64	DOC experiment, t0: treatment
PS85/454-4 + 454-5	21.06.14	MUC	7+7	0-2	65	DOC experiment, t0: control
PS85/454-4 + 454-5	21.06.14	MUC	7+7	0-2	66	DOC experiment, t0: treatment
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	67	DOC experiment, t0: control
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	68	DOC experiment, t0: control
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	69	DOC experiment, t0: treatment
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	70	DOC experiment, t0: treatment
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	71	DOC experiment, t0: control
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	72	DOC experiment, t0: treatment
PS85/454-4 + 454-5	21.06.14	MUC	7+7	0-2	73	DOC experiment: sediment after washing
PS85/454-4 + 454-5	21.06.14	MUC	7+7	0-2	74	DOC experiment: sediment after washing
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	75	DOC experiment: sediment after washing
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	76	DOC experiment: sediment after washing
PS85/454-4 + 454-5	21.06.14	MUC	7+7	0-2	77	DOC experiment: killed and washed sediment
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	78	DOC experiment: killed and washed sediment
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	79	DOC experiment: porewater, no treatment

Station	Date	Gear	Core	Depth bsf [cm]	DOC sample #	Comment
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	80	DOC experiment: porewater, no treatment
PS85/454-4 + 454-5	21.06.14	MUC	7+7	5-10	81	DOC experiment: porewater, no treatment
PS85/463-1	23.06.14	MUC	1	-1 (bw)	82	HG V
PS85/463-1	23.06.14	MUC	2	-1 (bw)	83	
PS85/463-1	23.06.14	MUC	1	0-1	84	
PS85/463-1	23.06.14	MUC	2	0-1	85	
PS85/463-1	23.06.14	MUC	1	1-5	86	
PS85/463-1	23.06.14	MUC	2	1-5	87	
PS85/463-1	23.06.14	MUC	1	5-10	88	
PS85/463-1	23.06.14	MUC	2	5-10	89	
PS85/464-1	23.06.14	MUC	1	-1 (bw)	90	HG VI
PS85/464-1	23.06.14	MUC	2	-1 (bw)	91	
PS85/464-1	23.06.14	MUC	3	-1 (bw)	92	
PS85/464-1	23.06.14	MUC	1	0-1	93	
PS85/464-1	23.06.14	MUC	2	0-1	94	
PS85/464-1	23.06.14	MUC	3	0-1	95	
PS85/464-1	23.06.14	MUC	1	1-5	96	
PS85/464-1	23.06.14	MUC	2	1-5	97	
PS85/464-1	23.06.14	MUC	3	1-5	98	
PS85/464-1	23.06.14	MUC	1	1-5	99	
PS85/464-1	23.06.14	MUC	2	1-5	100	
PS85/464-1	23.06.14	MUC	3	1-5	101	
PS85/464-1	23.06.14	MUC	1	5-10	102	
PS85/464-1	23.06.14	MUC	2	5-10	103	
PS85/464-1	23.06.14	MUC	3	5-10	104	
PS85/464-1	23.06.14	MUC	2	5-10	105	
PS85/464-1	23.06.14	MUC	3	5-10	106	
PS85/463-1	23.06.14	MUC	1	-1 (bw)	107	HG V
PS85/463-1	23.06.14	MUC	2	-1 (bw)	108	
PS85/465-4	24.06.14	MUC	1	-1 (bw)	109	HG IX
PS85/465-4	24.06.14	MUC	1	-1 (bw)	110	
PS85/465-4	24.06.14	MUC	2	-1 (bw)	111	
PS85/465-4	24.06.14	MUC	2	-1 (bw)	112	
PS85/465-4	24.06.14	MUC	1	0-1	113	
PS85/465-4	24.06.14	MUC	2	0-1	114	
PS85/465-4	24.06.14	MUC	1	1-5	115	
PS85/465-4	24.06.14	MUC	1	1-5	116	

Station	Date	Gear	Core	Depth bsf [cm]	DOC sample #	Comment
PS85/465-4	24.06.14	MUC	2	1-5	117	
PS85/465-4	24.06.14	MUC	2	1-5	118	
PS85/465-4	24.06.14	MUC	1	5-10	119	
PS85/465-4	24.06.14	MUC	2	5-10	120	
PS85/468-1	24.06.14	MUC	1	-1 (bw)	121	HG III
PS85/468-1	24.06.14	MUC	1	-1 (bw)	122	
PS85/468-1	24.06.14	MUC	2	-1 (bw)	123	
PS85/468-1	24.06.14	MUC	2	-1 (bw)	124	
PS85/468-1	24.06.14	MUC	1	0-1	125	
PS85/468-1	24.06.14	MUC	2	0-1	126	
PS85/468-1	24.06.14	MUC	1	1-5	127	
PS85/468-1	24.06.14	MUC	1	1-5	128	
PS85/468-1	24.06.14	MUC	2	1-5	129	
PS85/468-1	24.06.14	MUC	2	1-5	130	
PS85/468-1	24.06.14	MUC	1	5-10	131	
PS85/468-1	24.06.14	MUC	1	5-10	132	
PS85/468-1	24.06.14	MUC	2	5-10	133	
PS85/468-1	24.06.14	MUC	2	5-10	134	
PS85/469-2	24.06.14	MUC	1	-1 (bw)	135	HGII (sample from 2 MUC cores)
PS85/469-2	24.06.14	MUC	1	-1 (bw)	136	
PS85/469-2	24.06.14	MUC	1	0-1	137	
PS85/469-2	24.06.14	MUC	1	1-5	138	
PS85/469-2	24.06.14	MUC	1	1-5	139	
PS85/469-2	24.06.14	MUC	1	5-10	140	
PS85/469-2	24.06.14	MUC	1	5-10	141	
PS85/469-2	24.06.14	MUC	2	-1 (bw)	142	HGII (sample from 2 MUC cores)
PS85/469-2	24.06.14	MUC	2	-1 (bw)	143	
PS85/469-2	24.06.14	MUC	2	0-1	144	
PS85/469-2	24.06.14	MUC	2	1-5	145	
PS85/469-2	24.06.14	MUC	2	1-5	146	
PS85/469-2	24.06.14	MUC	2	5-10	147	
PS85/470-3	24.06.14	MUC	1	-1 (bw)	148	HGI (sample from 2 MUC cores); upper layer of this core got highly disturbed during sampling
PS85/470-3	24.06.14	MUC	1	-1 (bw)	149	
PS85/470-3	24.06.14	MUC	1	0-1	150	
PS85/470-3	24.06.14	MUC	1	1-5	151	

Station	Date	Gear	Core	Depth bsf [cm]	DOC sample #	Comment
PS85/470-3	24.06.14	MUC	1	5-10	152	
PS85/470-3	24.06.14	MUC	1	5-10	153	
PS85/470-3	24.06.14	MUC	2	-1 (bw)	154	
PS85/470-3	24.06.14	MUC	2	0-1	155	
PS85/470-3	24.06.14	MUC	2	1-5	156	
PS85/470-3	24.06.14	MUC	2	1-5	157	
PS85/470-3	24.06.14	MUC	2	5-10	158	
PS85/470-3	24.06.14	MUC	2	5-10	159	
PS85/473-3	25.06.14	MUC	1	-1 (bw)	160	N-IV (sample from 3 MUC cores)
PS85/473-3	25.06.14	MUC	1	-1 (bw)	161	
PS85/473-3	25.06.14	MUC	1	0-1	162	
PS85/473-3	25.06.14	MUC	1	1-5	163	
PS85/473-3	25.06.14	MUC	1	1-5	164	
PS85/473-3	25.06.14	MUC	1	5-10	165	
PS85/473-3	25.06.14	MUC	2	-1 (bw)	167	N-IV (sample from 3 MUC cores)
PS85/473-3	25.06.14	MUC	2	-1 (bw)	168	
PS85/473-3	25.06.14	MUC	2	0-1	169	
PS85/473-3	25.06.14	MUC	2	1-5	170	
PS85/473-3	25.06.14	MUC	2	1-5	171	
PS85/473-3	25.06.14	MUC	2	5-10	172	
PS85/473-3	25.06.14	MUC	3	-1 (bw)	173	N-IV (sample from 3 MUC cores)
PS85/473-3	25.06.14	MUC	3	-1 (bw)	174	
PS85/473-3	25.06.14	MUC	3	0-1	175	
PS85/473-3	25.06.14	MUC	3	1-5	176	
PS85/473-3	25.06.14	MUC	3	1-5	177	
PS85/473-3	25.06.14	MUC	3	5-10	178	
PS85/473-3	25.06.14	MUC	1	0-1	181	N-IV; sediment
PS85/473-3	25.06.14	MUC	1	1-5	182	N-IV; sediment
PS85/473-3	25.06.14	MUC	1	5-10	183	N-IV; sediment

Tab. 9.8: Water samples (~ 50 ml) from the CTD rosette or MUC bottom water were fixed in a final concentration of 2% formalin for total prokaryotic cell counts. Samples are stored at 0°C.

Station	Date	Gear	Water depth [m]	AODC sample #
PS85/456-1	22.06.2014	CTD	500	1
PS85/456-1	22.06.2014	CTD	500	2

Station	Date	Gear	Water depth [m]	AODC sample #
PS85/456-1	22.06.2014	CTD	500	3
PS85/456-1	22.06.2014	CTD	500	4
PS85/456-1	22.06.2014	CTD	2000	5
PS85/456-1	22.06.2014	CTD	2000	6
PS85/456-1	22.06.2014	CTD	2000	7
PS85/456-1	22.06.2014	CTD	2000	8
PS85/456-1	22.06.2014	CTD	2500 (bottom)	9
PS85/456-1	22.06.2014	CTD	2500 (bottom)	10
PS85/456-1	22.06.2014	CTD	2500 (bottom)	11
PS85/456-1	22.06.2014	CTD	2500 (bottom)	12
PS85/460-1	22.06.2014	CTD	surface	13
PS85/460-1	22.06.2014	CTD	surface	14
PS85/460-5+6	22./23.06.14	MUC	bottom water	15
PS85/460-5+6	22./23.06.14	MUC	bottom water	16
PS85/460-5+6	22./23.06.14	MUC	bottom water	17
PS85/460-5+6	22./23.06.14	MUC	bottom water	18
PS85/473-1	25.06.2014	CTD	2559 (bottom)	19
PS85/473-1	25.06.2014	CTD	2559 (bottom)	20
PS85/473-1	25.06.2014	CTD	2559 (bottom)	21
PS85/473-1	25.06.2014	CTD	2559 (bottom)	22
PS85/473-1	25.06.2014	CTD	500	23
PS85/473-1	25.06.2014	CTD	500	24
PS85/473-1	25.06.2014	CTD	500	25
PS85/473-1	25.06.2014	CTD	500	26
PS85/473-6	25.06.2014	CTD	surface	27
PS85/473-6	25.06.2014	CTD	surface	28
PS85/473-8	25.06.2014	MUC	bottom	29
PS85/473-8	25.06.2014	MUC	bottom	30
PS85/473-8	25.06.2014	MUC	bottom	31
PS85/473-8	25.06.2014	MUC	bottom	32

Tab. 9.9: Water samples from the CTD rosette or MUC bottom water fixed for fluorescence *in-situ* hybridization (FISH). 30 and 100 ml of water were fixed in a final concentration of 2% formalin. Filters are stored at -20°C.

Station	Date	Gear	Volume filtered [ml]	Pore size [µl]	Water depth [m]	FISH sample #
PS85/456-1	22.06.2014	CTD	100	0.22	500	1
PS85/456-1	22.06.2014	CTD	100	0.22	500	2
PS85/456-1	22.06.2014	CTD	100	0.22	500	3

Station	Date	Gear	Volume filtered [ml]	Pore size [µl]	Water depth [m]	FISH sample #
PS85/456-1	22.06.2014	CTD	100	0.22	2000	4
PS85/456-1	22.06.2014	CTD	100	0.22	2000	5
PS85/456-1	22.06.2014	CTD	100	0.22	2000	6
PS85/456-1	22.06.2014	CTD	100	0.22	2500 bottom	7
PS85/456-1	22.06.2014	CTD	100	0.22	2500 bottom	8
PS85/456-1	22.06.2014	CTD	100	0.22	2500 bottom	9
PS85/460-1	22.06.2014	CTD	30	0.22	surface	10
PS85/460-1	22.06.2014	CTD	30	0.22	surface	11
PS85/460-1	22.06.2014	CTD	30	0.22	surface	12
PS85/460-5 + 460-6	22./23.06.14	MUC	100	0.22	bottom water	13
PS85/460-5 + 460-6	22./23.06.14	MUC	100	0.22	bottom water	14
PS85/460-5 + 460-6	22./23.06.14	MUC	30	0.22	bottom water	15
PS85/460-5 + 460-6	22./23.06.14	MUC	30	0.22	bottom water	16
PS85/460-5 + 460-6	22./23.06.14	MUC	30	0.22	bottom water	17
PS85/473-1	25.06.2014	CTD	100	0.22	2559 (bottom)	18
PS85/473-1	25.06.2014	CTD	100	0.22	2559 (bottom)	19
PS85/473-1	25.06.2014	CTD	100	0.22	2559 (bottom)	20
PS85/473-1	25.06.2014	CTD	100	0.22	500	21
PS85/473-1	25.06.2014	CTD	100	0.22	500	22
PS85/473-1	25.06.2014	CTD	100	0.22	500	23
PS85/473-6	25.06.2014	CTD	30	0.22	surface	24
PS85/473-6	25.06.2014	CTD	30	0.22	surface	25
PS85/473-6	25.06.2014	CTD	30	0.22	surface	26
PS85/473-8	25.06.2014	MUC	30	0.22	bottom	27
PS85/473-8	25.06.2014	MUC	30	0.22	bottom	28
PS85/473-8	25.06.2014	MUC	30	0.22	bottom	29

Tab. 9.10: Water samples for DNA extraction from different water depth, either collected with the CTD rosette or taken from the top of MUC cores, and sequentially filtered over three different pore sizes (10 µm, 3 µm, 0.22 µm). Filters are stored at -20°C.

Station	Date	Gear	Filter size [µm]	Water depth [m]	DNA sample #	Filtered volume
PS85/456-1	22.06.14	CTD	0.22	500	1	5 L
PS85/456-1	22.06.14	CTD	0.22	500	2	5 L
PS85/456-1	22.06.14	CTD	0.22	500	3	5 L
PS85/456-1	22.06.14	CTD	0.22	500	4	5 L
PS85/456-1	22.06.14	CTD	0.22	500	5	5 L
PS85/456-1	22.06.14	CTD	0.22	2000	6	5 L
PS85/456-1	22.06.14	CTD	0.22	2000	7	5 L

Station	Date	Gear	Filter size [µm]	Water depth [m]	DNA sample #	Filtered volume
PS85/456-1	22.06.14	CTD	0.22	2000	8	5 L
PS85/456-1	22.06.14	CTD	0.22	2000	9	5 L
PS85/456-1	22.06.14	CTD	0.22	2000	10	5.4 L
PS85/456-1	22.06.14	CTD	0.22	2000	11	5 L
PS85/456-1	22.06.14	CTD	0.22	2550	12	5 L
PS85/456-1	22.06.14	CTD	0.22	2550	13	5 L
PS85/456-1	22.06.14	CTD	0.22	2550	14	3.6 L
PS85/460-1	22.06.14	CTD	0.22	2400	15	5 L
PS85/460-1	22.06.14	CTD	0.22	surface	16	2 L
PS85/460-5+6	22.06.14	MUC	0.22	2400	17	2 L
PS85/460-5+6	22.06.14	MUC	0.22	2400	18	2 L
PS85/460-5+6	22.06.14	MUC	0.22	2400	19	2 L
PS85/460-5+6	22.06.14	MUC	0.22	2400	20	2 L
PS85/460-1	22.06.14	CTD	0.22	surface	21	2 L
PS85/460-1	22.06.14	CTD	0.22	surface	22	1.9 L
PS85/460-5+6	22.06.14	MUC	0.22	2400	23	2 L
PS85/473-1	25.06.14	CTD	0.22	2560	24	10 L
PS85/473-1	25.06.14	CTD	0.22	2560	25	10 L
PS85/473-1	25.06.14	CTD	0.22	2560	26	6 L
PS85/473-1	25.06.14	CTD	0.22	500	27	10 L
PS85/473-1	25.06.14	CTD	0.22	500	28	10 L
PS85/473-1	25.06.14	CTD	0.22	500	29	6 L
PS85/473-6	25.06.14	CTD	10	surface	30	N IV, sequential filtration
PS85/473-6	25.06.14	CTD	10	surface	31	N IV, sequential filtration
PS85/473-6	25.06.14	CTD	10	surface	32	N IV, sequential filtration
PS85/473-6	25.06.14	CTD	3	surface	33	N IV, sequential filtration
PS85/473-6	25.06.14	CTD	3	surface	34	N IV, sequential filtration
PS85/473-6	25.06.14	CTD	3	surface	35	N IV, sequential filtration
PS85/473-6	25.06.14	CTD	0.22	surface	36	N IV, sequential filtration; 1 filter with 1.6 Liter, 1 filter with 0.4 L
PS85/473-6	25.06.14	CTD	0.22	surface	37	N IV, sequential filtration, 1 filter with 1.6 Liter, 1 filter with 0.4 L

Station	Date	Gear	Filter size [µm]	Water depth [m]	DNA sample #	Filtered volume
PS85/473-6	25.06.14	CTD	0.22	surface	38	N IV, sequential filtration, 1 filter with 1.1 L, 1 filter with 0.9 L
PS85/473-6	25.06.14	CTD	0.22	surface	39	2 L
PS85/473-6	25.06.14	CTD	0.22	surface	40	2 L
PS85/473-6	25.06.14	CTD	0.22	surface	41	2 L
PS85/473-6	25.06.14	CTD	0.22	surface	42	0.8 L
PS85/473-8	25.06.14	MUC	0.22	2413	43	2 L
PS85/473-8	25.06.14	MUC	0.22	2413	44	2 L
PS85/473-8	25.06.14	MUC	0.22	2413	45	2 L
PS85/473-8	25.06.14	MUC	0.22	2413	46	2 L

10. BENTHIC RESPIRATION RATES AND BIOGEOCHEMICAL FLUXES

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Grant No: AWI_PS85_08

Objectives

Deep-sea benthic communities are strictly dependent on carbon supply through the water column which is determined by temporal and spatial variations in the vertical export flux from the euphotic zone but also lateral supply from shelf areas. Most organic carbon is recycled in the pelagic, but a significant fraction of the organic material ultimately reaches the seafloor, where it is either re-mineralized or retained in the sediment record. Benthic oxygen fluxes provide the best and integrated measurement of the metabolic activity of surface sediments. They quantify benthic carbon mineralization rates and thus can be used to evaluate the efficiency of the biological pump (export of organic carbon from the photic zone).

Work at sea

Benthic carbon mineralization was studied *in-situ* at two sites (HAUSGARTEN HG-IV at 2,500 m water depth, and HG-I at 1,280 m water depth), as well as *ex-situ* along two depth gradients (East Greenland transect from 2,500 m to 1,000 m and Hausgarten transect from 2,500 m to 1,280 m). The benthic O_2 uptake is a commonly used measure for the total benthic mineralization rate. We measured benthic oxygen consumption rates at different spatial and temporal scales. A benthic lander was equipped with different instruments to investigate the oxygen penetration and distribution as well as the oxygen uptake of the arctic sediments: (1) Microprofiler, for high-resolution pore water profiles (O_2, T, conductivity) to quantify diffusive oxygen uptake (DOU), which is generally assigned to microbial respiration. The microprofiler was equipped with eight oxygen-, one temperature- and one conductivity-microsensor. The measurements across the water-sediment interphase were performed with a vertical resolution of 100 µm and a total length of 15 -20 cm. During the deployments the microprofiler performed two-five vertical profiles separated by 10 cm. (2) Three benthic chambers measured total oxygen uptake (TOU) and nutrient exchange of the sediment integrating all relevant solute transport processes (diffusion, advection and fauna-mediated transport) and an area of 400 cm². During the deployment an oxygen optode measured changes in oxygen concentration and 7 syringes took water samples in pre-programmed time intervals for analyses of nutrients. The overall benthic reaction was followed by measurement of sediment community oxygen consumption to calculate carbon turnover rates.

Using a multicorer (MUC), sediment samples were gained and used to measure onboard gradients and fluxes, and to retrieve sediment samples for fauna and microbial community analysis. In addition, we took sediment samples for ^{210}Pb depth profiles (measure for bioturbation and sediment accumulation). Furthermore we added a bromide tracer to the ex situ experiments to quantify bio-irrigation. From the sediments recovered from the benthic chambers and MUC cores, subsamples were taken to quantify microbial and meiofauna biomass and the larger macrofauna was sieve out. We will identify these organisms in the laboratory and try to relate their functional biodiversity (how they bioturbate) to the fluxes observed.

Preliminary (expected) results:

A comparison of the mean diffusive oxygen uptake calculated from the ex situ profiles shows a positive correlation with depth for the East Greenland stations and a negative correlation for the Hausgarten stations with higher values in 1,000 m depth at the Hausgarten side and nearly similar values at both study sites in 2,000 m and 2,500 m (Fig. 10.1).

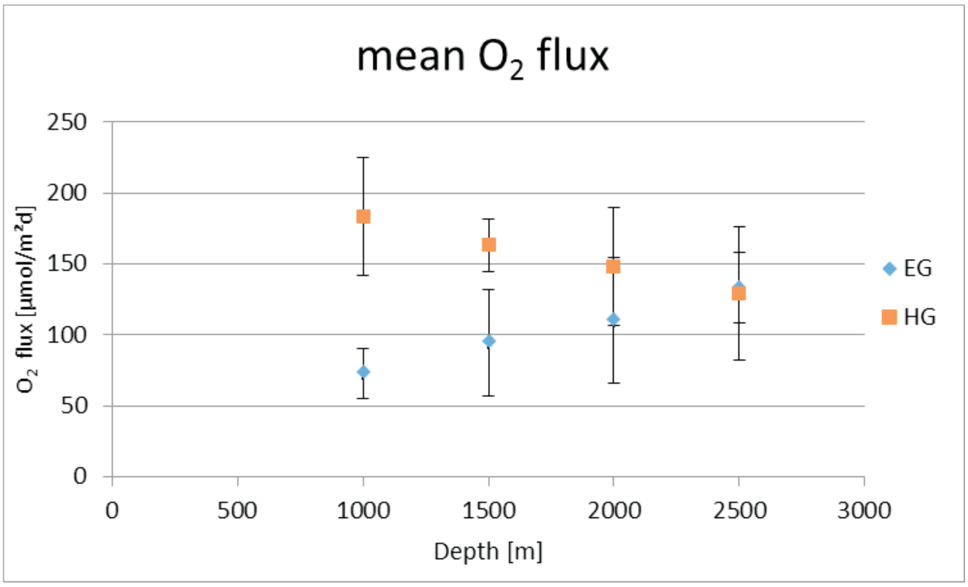

Fig. 10.1: Mean Diffusive Oxygen Uptake (DOU) ± sd, calculated from ex-situ profiles. Positive and negative correlation between mean DOU and depth for East Greenland stations (EG) and Hausgarten stations (HG), respectively. Total incubation data still need some post processing and are therefore not shown.

Data management

Post-cruise data archival will be mainly 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 the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven and the MARUM, Bremen. Scientific data retrieved from observations, measurements and home-based data analyses will be submitted to PANGAEA either upon publication, or with password protection as soon as the data are available and quality-assessed. This includes also biological data, for most of which parameters are already defined in PANGAEA. Molecular data will be deposited in globally accessible databases such as GenBank. All macro-, meiofaunal and microbiological samples are stored fixed or deep-frozen at the MPI in Bremen.

Appendix to Chapter 10

Tab. 10.1: Location of sampled stations with TV guided Multicorer (TVMUC) and Benthic chamber lander (BL_C).

Station	Date	Time	Gear	Position Lat	Position Lon	Depth [m]	Comment
PS85/0436-1	17/06/2014	14:30	TVMUC	78° 58,40' N	5° 17,43' W	1056,3	EG I
PS85/0441-1	18/06/2014	3:18	TVMUC	78° 56,01' N	4° 39,02' W	1499,7	EG II
PS85/0445-1	19/06/2014	2:02	TVMUC	78° 48,19' N	3° 52,52' W	1943,8	EG III
PS85/0454-3	20/06/2014	17:59	TVMUC	78° 30,34' N	2° 49,06' W	2557,7	EG IV
PS85/0457-2	22/06/2014	9:07	BL_C	79° 3,17' N	4° 8,35' E	2498,7	deployment lander at HG IV
PS85/0459-1	22/06/2014	14:16	BL_C	79° 4,19' N	4° 2,70' E	2521,0	recovery lander at HG IV
PS85/0460-4	22/06/2014	18:47	TVMUC	79° 3,91' N	4° 10,98' E	2402,6	HG IV
PS85/0468-1	24/06/2014	15:43	TVMUC	79° 6,39' N	4° 35,10' E	1904,8	HG III
PS85/0469-2	24/06/2014	19:18	TVMUC	79° 7,93' N	4° 54,37' E	1492,3	HG II
PS85/0470-3	24/06/2014	23:34	TVMUC	79° 8,01' N	6° 6,39' E	1244,2	HG I
PS85/0471-1	25/06/2014	1:36	BL_C	79° 8,47' N	6° 6,85' E	1253,8	deployment lander at HG I
PS85/0476-1	26/06/2014	15:03	BL_C	79° 8,69' N	6° 8,65' E	1264,6	recovery lander at HG I

Tab. 10.2: Oxygen samples of overlying bottom water from MUC cores, taken directly after sampling ("for AWI") or during ex situ incubations (WC: water core; SC1 and SC2: sediment cores) at three different sampling times.

Date	Station	Chamber	Time	O_2 Sample #	Comments
17.06.2014	PS85/436-1	BottomWater	NA	1	for AWI
	PS85/436-1	BottomWater	NA	2	for AWI
	PS85/436-1	BottomWater	NA	3	for AWI
	PS85/436-1	WC1	0	4	
	PS85/436-1	SC1	0	5	
	PS85/436-1	SC2	0	6	
19.06.2014	PS85/436-1	WC1	2	7	
	PS85/436-1	SC1	2	8	
	PS85/436-1	SC2	2	9	
18.06.2014	PS85/436-1	BottomWater	1	10	for dilution calculation
	PS85/436-1	BottomWater	1	11	for dilution calculation
	PS85/436-1	BottomWater	1	12	for dilution calculation
	PS85/441-1	BottomWater	NA	13	for AWI
	PS85/441-1	BottomWater	NA	14	for AWI
	PS85/441-1	BottomWater	NA	15	for AWI
	PS85/441-1	WC1	0	16	
	PS85/441-1	SC1	0	17	

Date	Station	Chamber	Time	O_2 Sample #	Comments
20.06.2014	PS85/441-1	WC1	2	18	
	PS85/441-1	SC1	2	19	
19.06.2014	PS85/441-1	BottomWater	1	20	for dilution calculation
	PS85/441-1	BottomWater	1	21	for dilution calculation
	PS85/441-1	BottomWater	1	22	for dilution calculation
	PS85/445-1	BottomWater	NA	23	for AWI
	PS85/445-1	BottomWater	NA	24	for AWI
	PS85/445-1	BottomWater	NA	25	for AWI
	PS85/445-1	WC1	0	26	
	PS85/445-1	SC1	0	27	
	PS85/445-1	SC2	0	28	
21.06.2014	PS85/445-1	WC1	2	29	
	PS85/445-1	SC1	2	30	
	PS85/445-1	SC2	2	31	
20.06.2014	PS85/445-1	BottomWater	1	32	for dilution calculation
	PS85/445-1	BottomWater	1	33	for dilution calculation
	PS85/445-1	BottomWater	1	34	for dilution calculation
	PS85/454-3	BottomWater	NA	35	for AWI
	PS85/454-3	BottomWater	NA	36	for AWI
	PS85/454-3	BottomWater	NA	37	for AWI
	PS85/454-3	WC1	0	38	
	PS85/454-3	SC1	0	39	
	PS85/454-3	SC2	0	40	
22.06.2014	PS85/454-3	WC1	2	41	
	PS85/454-3	SC1	2	42	
	PS85/454-3	SC2	2	43	
21.06.2014	PS85/454-3	BottomWater	1	44	for dilution calculation
	PS85/454-3	BottomWater	1	45	for dilution calculation
	PS85/454-3	BottomWater	1	46	for dilution calculation
22.06.2014	PS85/460-4	BottomWater	NA	47	for AWI
	PS85/460-4	BottomWater	NA	48	for AWI
	PS85/460-4	BottomWater	NA	49	for AWI
	PS85/460-4	WC1	0	50	
	PS85/460-4	SC1	0	51	
	PS85/460-4	SC2	0	52	
24.06.2014	PS85/460-4	WC1	2	53	
	PS85/460-4	SC1	2	54	
	PS85/460-4	SC2	2	55	
23.06.2014	PS85/460-4	BottomWater	1	56	for dilution calculation
	PS85/460-4	BottomWater	1	57	for dilution calculation
	PS85/460-4	BottomWater	1	58	for dilution calculation
24.06.2014	PS85/468-1	BottomWater	NA	59	for AWI

Date	Station	Chamber	Time	O_2 Sample #	Comments
	PS85/468-1	BottomWater	NA	60	for AWI
	PS85/468-1	BottomWater	NA	61	for AWI
24.06.2014	PS85/468-1	WC1	0	62	
	PS85/468-1	SC1	0	63	
	PS85/468-1	SC2	0	64	
27.06.2014	PS85/468-1	WC1	2	65	
	PS85/468-1	SC1	2	66	
	PS85/468-1	SC2	2	67	
26.06.2014	PS85/468-1	BottomWater	1	68	for dilution calculation
	PS85/468-1	BottomWater	1	69	for dilution calculation
	PS85/468-1	BottomWater	1	70	for dilution calculation
24.06.2014	PS85/469-2	BottomWater	NA	71	for AWI
	PS85/469-2	BottomWater	NA	72	for AWI
	PS85/469-2	BottomWater	NA	73	for AWI
24.06.2014	PS85/469-2	WC1	0	74	
	PS85/469-2	SC1	0	75	
	PS85/469-2	SC2	0	76	
27.06.2014	PS85/469-2	WC1	2	77	
	PS85/469-2	SC1	2	78	
	PS85/469-2	SC2	2	79	
26.06.2014	PS85/469-2	BottomWater	1	80	for dilution calculation
	PS85/469-2	BottomWater	1	81	for dilution calculation
	PS85/469-2	BottomWater	1	82	for dilution calculation
24.06.2014	PS85/470-2	BottomWater	NA	83	for AWI
	PS85/470-2	BottomWater	NA	84	for AWI
	PS85/470-2	BottomWater	NA	85	for AWI
24.06.2014	PS85/470-2	WC1	0	86	no sample
	PS85/470-2	SC1	0	87	
	PS85/470-2	SC2	0	88	
27.06.2014	PS85/470-2	WC1	2	89	no sample
	PS85/470-2	SC1	2	90	
	PS85/470-2	SC2	2	91	
26.06.2014	PS85/470-2	BottomWater	1	92	for dilution calculation
	PS85/470-2	BottomWater	1	93	for dilution calculation
	PS85/470-2	BottomWater	1	94	for dilution calculation
	PS85/470-2	SC1	1	95	extra sample

Tab. 10.3: Sediment samples from lander deployments, stored at -20°C for the determination of chlorophyll pigments and total organic carbon. BL_C – Benthic chamber lander 1. K1 – Chamber 1, K2 – Chamber 2, K3 – Chamber 3. Station numbers indicate the deployment of the lander.

Station	Date	Gear	Chamber	Depth bsf (cm)	Chl-a sample #	TOC sample #
PS85/466-1	24.06.14	BL_C	K1	0-5	1	1
PS85/466-1	24.06.14	BL_C	K2	0-5	2	2
PS85/466-1	24.06.14	BL_C	K3	0-5	3	3
PS85/476-1	26.06.14	BL_C	K1	0-5	4	4
PS85/476-1	26.06.14	BL_C	K2	0-5	5	5

Tab. 10.4: Sediment samples from lander deployments, stored for total prokaryotic cell counts (Acridine Orange Direct Counts – AODC). Storage 10.t 4°C. BL_C – Chamber lander 1. K1 – Chamber 1, K2 – Chamber 2, K3 – Chamber 3. Station numbers indicate the deployment of the landers.

Station	Date	Gear	Chamber	Depth bsf (cm)	AODC sample #
PS85/466-1	24.06.14	BL_C	K1	0-1	101
PS85/466-1	24.06.14	BL_C	K1	1-2	102
PS85/466-1	24.06.14	BL_C	K1	2-3	103
PS85/466-1	24.06.14	BL_C	K1	3-4	104
PS85/466-1	24.06.14	BL_C	K1	4-5	105
PS85/466-1	24.06.14	BL_C	K2	0-1	106
PS85/466-1	24.06.14	BL_C	K2	1-2	107
PS85/466-1	24.06.14	BL_C	K2	2-3	108
PS85/466-1	24.06.14	BL_C	K2	3-4	109
PS85/466-1	24.06.14	BL_C	K2	4-5	110
PS85/466-1	24.06.14	BL_C	K3	0-1	111
PS85/466-1	24.06.14	BL_C	K3	1-2	112
PS85/466-1	24.06.14	BL_C	K3	2-3	113
PS85/466-1	24.06.14	BL_C	K3	3-4	114
PS85/466-1	24.06.14	BL_C	K3	4-5	115
PS85/476-1	26.06.14	BL_C	K1	0-1	182
PS85/476-1	26.06.14	BL_C	K1	1-2	183
PS85/476-1	26.06.14	BL_C	K1	2-3	184
PS85/476-1	26.06.14	BL_C	K1	3-4	185
PS85/476-1	26.06.14	BL_C	K1	4-5	186
PS85/476-1	26.06.14	BL_C	K2	0-1	187
PS85/476-1	26.06.14	BL_C	K2	1-2	188
PS85/476-1	26.06.14	BL_C	K2	2-3	189
PS85/476-1	26.06.14	BL_C	K2	3-4	190
PS85/476-1	26.06.14	BL_C	K2	4-5	191

Tab. 10.5: Water samples from MUC core incubation, stored at -20°C for the determination of nutrients. Numbers 37-39, 46-48 and 55-58 missing due to no SC II sample.

Date	Station	chamber	Time	Replica	Nutrient sample #
17.06.2014	PS85/436-1	WC1	0	A	1
	PS85/436-1	WC1	0	B	2
	PS85/436-1	WC1	0	C	3
	PS85/436-1	SC1	0	A	4
	PS85/436-1	SC1	0	B	5
	PS85/436-1	SC1	0	C	6
	PS85/436-1	SC2	0	A	7
	PS85/436-1	SC2	0	B	8
	PS85/436-1	SC2	0	C	9
18.06.2014	PS85/436-1	WC1	1	A	10
	PS85/436-1	WC1	1	B	11
	PS85/436-1	WC1	1	C	12
	PS85/436-1	SC1	1	A	13
	PS85/436-1	SC1	1	B	14
	PS85/436-1	SC1	1	C	15
	PS85/436-1	SC2	1	A	16
	PS85/436-1	SC2	1	B	17
	PS85/436-1	SC2	1	C	18
19.06.2014	PS85/436-1	WC1	2	A	19
	PS85/436-1	WC1	2	B	20
	PS85/436-1	WC1	2	C	21
	PS85/436-1	SC1	2	A	22
	PS85/436-1	SC1	2	B	23
	PS85/436-1	SC1	2	C	24
	PS85/436-1	SC2	2	A	25
	PS85/436-1	SC2	2	B	26
	PS85/436-1	SC2	2	C	27
18.06.2014	PS85/436-1	BW	1	A	28
	PS85/436-1	BW	1	B	29
	PS85/436-1	BW	1	C	30
18.06.2014	PS85/441-1	WC1	0	A	31
	PS85/441-1	WC1	0	B	32
	PS85/441-1	WC1	0	C	33
	PS85/441-1	SC1	0	A	34
	PS85/441-1	SC1	0	B	35
	PS85/441-1	SC1	0	C	36
19.06.2014	PS85/441-1	WC1	1	A	40
	PS85/441-1	WC1	1	B	41

Date	Station	chamber	Time	Replica	Nutrient sample #
	PS85/441-1	WC1	1	C	42
	PS85/441-1	SC1	1	A	43
	PS85/441-1	SC1	1	B	44
	PS85/441-1	SC1	1	C	45
	PS85/441-1	WC1	2	A	49
	PS85/441-1	WC1	2	B	50
	PS85/441-1	WC1	2	C	51
	PS85/441-1	SC1	2	A	52
	PS85/441-1	SC1	2	B	53
	PS85/441-1	SC1	2	C	54
19.06.2014	PS85/441-1	BW	1	A	59
	PS85/441-1	BW	1	B	60
	PS85/441-1	BW	1	C	61
19.06.2014	PS85/445-1	WC1	0	A	62
	PS85/445-1	WC1	0	B	63
	PS85/445-1	WC1	0	C	64
	PS85/445-1	SC1	0	A	65
	PS85/445-1	SC1	0	B	66
	PS85/445-1	SC1	0	C	67
	PS85/445-1	SC2	0	A	68
	PS85/445-1	SC2	0	B	69
	PS85/445-1	SC2	0	C	70
20.06.2014	PS85/445-1	WC1	1	A	71
	PS85/445-1	WC1	1	B	72
	PS85/445-1	WC1	1	C	73
	PS85/445-1	SC1	1	A	74
	PS85/445-1	SC1	1	B	75
	PS85/445-1	SC1	1	C	76
	PS85/445-1	SC2	1	A	77
	PS85/445-1	SC2	1	B	78
	PS85/445-1	SC2	1	C	79
21.06.2014	PS85/445-1	WC1	2	A	80
	PS85/445-1	WC1	2	B	81
	PS85/445-1	WC1	2	C	82
	PS85/445-1	SC1	2	A	83
	PS85/445-1	SC1	2	B	84
	PS85/445-1	SC1	2	C	85
	PS85/445-1	SC2	2	A	86
	PS85/445-1	SC2	2	B	87
	PS85/445-1	SC2	2	C	88

Date	Station	chamber	Time	Replica	Nutrient sample #
20.06.2014	PS85/445-1	BW	1	A	89
	PS85/445-1	BW	1	B	90
	PS85/445-1	BW	1	C	91
20.06.2014	PS85/454-3	WC1	0	A	92
	PS85/454-3	WC1	0	B	93
	PS85/454-3	WC1	0	C	94
	PS85/454-3	SC1	0	A	95
	PS85/454-3	SC1	0	B	96
	PS85/454-3	SC1	0	C	97
	PS85/454-3	SC2	0	A	98
	PS85/454-3	SC2	0	B	99
	PS85/454-3	SC2	0	C	100
21.06.2014	PS85/454-3	WC1	1	A	101
	PS85/454-3	WC1	1	B	102
	PS85/454-3	WC1	1	C	103
	PS85/454-3	SC1	1	A	104
	PS85/454-3	SC1	1	B	105
	PS85/454-3	SC1	1	C	106
	PS85/454-3	SC2	1	A	107
	PS85/454-3	SC2	1	B	108
22.06.2014	PS85/454-3	SC2	1	C	109
	PS85/454-3	WC1	2	A	110
	PS85/454-3	WC1	2	B	111
	PS85/454-3	WC1	2	C	112
	PS85/454-3	SC1	2	A	113
	PS85/454-3	SC1	2	B	114
	PS85/454-3	SC1	2	C	115
	PS85/454-3	SC2	2	A	116
	PS85/454-3	SC2	2	B	117
	PS85/454-3	SC2	2	C	118
21.06.2014	PS85/454-3	BW	1	A	119
	PS85/454-3	BW	1	B	120
	PS85/454-3	BW	1	C	121
22.06.2014	PS85/460-4	WC1	0	A	122
	PS85/460-4	WC1	0	B	123
	PS85/460-4	WC1	0	C	124
	PS85/460-4	SC1	0	A	125
	PS85/460-4	SC1	0	B	126
	PS85/460-4	SC1	0	C	127
	PS85/460-4	SC2	0	A	128

Date	Station	chamber	Time	Replica	Nutrient sample #
	PS85/460-4	SC2	0	B	129
	PS85/460-4	SC2	0	C	130
23.06.2014	PS85/460-4	WC1	1	A	131
	PS85/460-4	WC1	1	B	132
	PS85/460-4	WC1	1	C	133
	PS85/460-4	SC1	1	A	134
	PS85/460-4	SC1	1	B	135
	PS85/460-4	SC1	1	C	136
	PS85/460-4	SC2	1	A	137
	PS85/460-4	SC2	1	B	138
	PS85/460-4	SC2	1	C	139
24.06.2014	PS85/460-4	WC1	2	A	140
	PS85/460-4	WC1	2	B	141
	PS85/460-4	WC1	2	C	142
	PS85/460-4	SC1	2	A	143
	PS85/460-4	SC1	2	B	144
	PS85/460-4	SC1	2	C	145
	PS85/460-4	SC2	2	A	146
	PS85/460-4	SC2	2	B	147
	PS85/460-4	SC2	2	C	148
23.06.2014	PS85/460-4	BW	1	A	149
	PS85/460-4	BW	1	B	150
	PS85/460-4	BW	1	C	151
24.06.2014	PS85/468-1	WC1	0	A	152
	PS85/468-1	WC1	0	B	153
	PS85/468-1	WC1	0	C	154
	PS85/468-1	SC1	0	A	155
	PS85/468-1	SC1	0	B	156
	PS85/468-1	SC1	0	C	157
	PS85/468-1	SC2	0	A	158
	PS85/468-1	SC2	0	B	159
	PS85/468-1	SC2	0	C	160
26.06.2014	PS85/468-1	WC1	1	A	161
	PS85/468-1	WC1	1	B	162
	PS85/468-1	WC1	1	C	163
	PS85/468-1	SC1	1	A	164
	PS85/468-1	SC1	1	B	165
	PS85/468-1	SC1	1	C	166
	PS85/468-1	SC2	1	A	167
	PS85/468-1	SC2	1	B	168

Date	Station	chamber	Time	Replica	Nutrient sample #
	PS85/468-1	SC2	1	C	169
27.06.2014	PS85/468-1	WC1	2	A	170
	PS85/468-1	WC1	2	B	171
	PS85/468-1	WC1	2	C	172
	PS85/468-1	SC1	2	A	173
	PS85/468-1	SC1	2	B	174
	PS85/468-1	SC1	2	C	175
	PS85/468-1	SC2	2	A	176
	PS85/468-1	SC2	2	B	177
	PS85/468-1	SC2	2	C	178
26.06.2014	PS85/468-1	BW	1	A	179
	PS85/468-1	BW	1	B	180
	PS85/468-1	BW	1	C	181
24.06.2014	PS85/469-2	WC1	0	A	182
	PS85/469-2	WC1	0	B	183
	PS85/469-2	WC1	0	C	184
	PS85/469-2	SC1	0	A	185
	PS85/469-2	SC1	0	B	186
	PS85/469-2	SC1	0	C	187
27.06.2014	PS85/469-2	SC2	0	A	188
	PS85/469-2	SC2	0	B	189
	PS85/469-2	SC2	0	C	190
26.06.2014	PS85/469-2	WC1	1	A	191
	PS85/469-2	WC1	1	B	192
	PS85/469-2	WC1	1	C	193
	PS85/469-2	SC1	1	A	194
	PS85/469-2	SC1	1	B	195
	PS85/469-2	SC1	1	C	196
	PS85/469-2	SC2	1	A	197
	PS85/469-2	SC2	1	B	198
	PS85/469-2	SC2	1	C	199
27.06.2014	PS85/469-2	WC1	2	A	200
	PS85/469-2	WC1	2	B	201
	PS85/469-2	WC1	2	C	202
	PS85/469-2	SC1	2	A	203
	PS85/469-2	SC1	2	B	204
	PS85/469-2	SC1	2	C	205
	PS85/469-2	SC2	2	A	206
	PS85/469-2	SC2	2	B	207
	PS85/469-2	SC2	2	C	208

Date	Station	chamber	Time	Replica	Nutrient sample #
26.06.2014	PS85/469-2	BW	1	A	209
	PS85/469-2	BW	1	B	210
	PS85/469-2	BW	1	C	211
25.06.2014	PS85/470-2	WC1	0	A	212
	PS85/470-2	WC1	0	B	213
	PS85/470-2	WC1	0	C	214
	PS85/470-2	SC1	0	A	215
	PS85/470-2	SC1	0	B	216
	PS85/470-2	SC1	0	C	217
	PS85/470-2	SC2	0	A	218
	PS85/470-2	SC2	0	B	219
	PS85/470-2	SC2	0	C	220
26.06.2014	PS85/470-2	SC1	1	A	221
	PS85/470-2	SC1	1	B	222
	PS85/470-2	SC1	1	C	223
	PS85/470-2	SC2	1	A	224
	PS85/470-2	SC2	1	B	225
	PS85/470-2	SC2	1	C	226
27.06.2014	PS85/470-2	SC1	2	A	227
	PS85/470-2	SC1	2	B	228
	PS85/470-2	SC1	2	C	229
	PS85/470-2	SC2	2	A	230
	PS85/470-2	SC2	2	B	231
	PS85/470-2	SC2	2	C	232
26.06.2014	PS85/470-2	BW	1	A	232
	PS85/470-2	BW	1	B	233
	PS85/470-2	BW	1	C	234

Tab. 10.6: Water samples from MUC core incubation, 2 ml stored at 4°C for the determination of bromide. Numbers 25-27, 31-33 and 37-39 are missing due to no SC II sample.

Date	Station	Chamber	Time	Replica	Bromide sample #
17.06.2014	PS85/436-1	SC1	0	A	1
	PS85/436-1	SC1	0	B	2
	PS85/436-1	SC1	0	C	3
	PS85/436-1	SC2	0	A	4
	PS85/436-1	SC2	0	B	5
	PS85/436-1	SC2	0	C	6
18.06.2014	PS85/436-1	SC1	1	A	7

Date	Station	Chamber	Time	Replica	Bromide sample #
	PS85/436-1	SC1	1	B	8
	PS85/436-1	SC1	1	C	9
	PS85/436-1	SC2	1	A	10
	PS85/436-1	SC2	1	B	11
	PS85/436-1	SC2	1	C	12
19.06.2014	PS85/436-1	SC1	2	A	13
	PS85/436-1	SC1	2	B	14
	PS85/436-1	SC1	2	C	15
	PS85/436-1	SC2	2	A	16
	PS85/436-1	SC2	2	B	17
	PS85/436-1	SC2	2	C	18
18.06.2014	PS85/436-1	BW	1	A	19
	PS85/436-1	BW	1	B	20
	PS85/436-1	BW	1	C	21
18.06.2014	PS85/441-1	SC1	0	A	22
	PS85/441-1	SC1	0	B	23
	PS85/441-1	SC1	0	C	24
19.06.2014	PS85/441-1	SC1	1	A	28
	PS85/441-1	SC1	1	B	29
	PS85/441-1	SC1	1	C	30
20.06.2014	PS85/441-1	SC1	2	A	34
	PS85/441-1	SC1	2	B	35
	PS85/441-1	SC1	2	C	36
19.06.2014	PS85/444-1	BW	1	A	40
	PS85/444-1	BW	1	B	41
	PS85/444-1	BW	1	C	42
19.06.2014	PS85/445-1	SC1	0	A	43
	PS85/445-1	SC1	0	B	44
	PS85/445-1	SC1	0	C	45
	PS85/445-1	SC2	0	A	46
	PS85/445-1	SC2	0	B	47
	PS85/445-1	SC2	0	C	48
20.06.2014	PS85/445-1	SC1	1	A	49
	PS85/445-1	SC1	1	B	50
	PS85/445-1	SC1	1	C	51
	PS85/445-1	SC2	1	A	52
	PS85/445-1	SC2	1	B	53
	PS85/445-1	SC2	1	C	54
21.06.2014	PS85/445-1	SC1	2	A	55
	PS85/445-1	SC1	2	B	56

Date	Station	Chamber	Time	Replica	Bromide sample #
	PS85/445-1	SC1	2	C	57
	PS85/445-1	SC2	2	A	58
	PS85/445-1	SC2	2	B	59
	PS85/445-1	SC2	2	C	60
20.06.2014	PS85/445-1	BW	1	A	61
	PS85/445-1	BW	1	B	62
	PS85/445-1	BW	1	C	63
20.06.2014	PS85/454-3	SC1	0	A	64
	PS85/454-3	SC1	0	B	65
	PS85/454-3	SC1	0	C	66
	PS85/454-3	SC2	0	A	67
	PS85/454-3	SC2	0	B	68
	PS85/454-3	SC2	0	C	69
21.06.2014	PS85/454-3	SC1	1	A	70
	PS85/454-3	SC1	1	B	71
	PS85/454-3	SC1	1	C	72
	PS85/454-3	SC2	1	A	73
	PS85/454-3	SC2	1	B	74
	PS85/454-3	SC2	1	C	75
22.06.2014	PS85/454-3	SC1	2	A	76
	PS85/454-3	SC1	2	B	77
	PS85/454-3	SC1	2	C	78
	PS85/454-3	SC2	2	A	79
	PS85/454-3	SC2	2	B	80
	PS85/454-3	SC2	2	C	81
21.06.2014	PS85/454-3	BW	1	A	82
	PS85/454-3	BW	1	B	83
	PS85/454-3	BW	1	C	84
22.06.2014	PS85/460-4	SC1	0	A	85
	PS85/460-4	SC1	0	B	86
	PS85/460-4	SC1	0	C	87
	PS85/460-4	SC2	0	A	88
	PS85/460-4	SC2	0	B	89
	PS85/460-4	SC2	0	C	90
23.06.2014	PS85/460-4	SC1	1	A	91
	PS85/460-4	SC1	1	B	92
	PS85/460-4	SC1	1	C	93
	PS85/460-4	SC2	1	A	94
	PS85/460-4	SC2	1	B	95
	PS85/460-4	SC2	1	C	96

Date	Station	Chamber	Time	Replica	Bromide sample #
24.06.2014	PS85/460-4	SC1	2	A	97
	PS85/460-4	SC1	2	B	98
	PS85/460-4	SC1	2	C	99
	PS85/460-4	SC2	2	A	100
	PS85/460-4	SC2	2	B	101
	PS85/460-4	SC2	2	C	102
23.06.2014	PS85/460-4	BW	1	A	103
	PS85/460-4	BW	1	B	104
	PS85/460-4	BW	1	C	105
24.06.2014	PS85/468-1	SC1	0	A	106
	PS85/468-1	SC1	0	B	107
	PS85/468-1	SC1	0	C	108
	PS85/468-1	SC2	0	A	109
	PS85/468-1	SC2	0	B	110
	PS85/468-1	SC2	0	C	111
26.06.2014	PS85/468-1	SC1	1	A	112
	PS85/468-1	SC1	1	B	113
	PS85/468-1	SC1	1	C	114
	PS85/468-1	SC2	1	A	115
	PS85/468-1	SC2	1	B	116
	PS85/468-1	SC2	1	C	117
27.06.2014	PS85/468-1	SC1	2	A	118
	PS85/468-1	SC1	2	B	119
	PS85/468-1	SC1	2	C	120
	PS85/468-1	SC2	2	A	121
	PS85/468-1	SC2	2	B	122
	PS85/468-1	SC2	2	C	123
26.06.2014	PS85/468-1	BW	1	A	124
	PS85/468-1	BW	1	B	125
	PS85/468-1	BW	1	C	126
24.06.2014	PS85/469-2	SC1	0	A	127
	PS85/469-2	SC1	0	B	128
	PS85/469-2	SC1	0	C	129
	PS85/469-2	SC2	0	A	130
	PS85/469-2	SC2	0	B	131
	PS85/469-2	SC2	0	C	132
26.06.2014	PS85/469-2	SC1	1	A	133
	PS85/469-2	SC1	1	B	134
	PS85/469-2	SC1	1	C	135
	PS85/469-2	SC2	1	A	136

Date	Station	Chamber	Time	Replica	Bromide sample #
	PS85/469-2	SC2	1	B	137
	PS85/469-2	SC2	1	C	138
27.06.2014	PS85/469-2	SC1	2	A	139
	PS85/469-2	SC1	2	B	140
	PS85/469-2	SC1	2	C	141
	PS85/469-2	SC2	2	A	142
	PS85/469-2	SC2	2	B	143
	PS85/469-2	SC2	2	C	144
26.06.2014	PS85/469-2	BW	1	A	145
	PS85/469-2	BW	1	B	146
	PS85/469-2	BW	1	C	147
25.06.2014	PS85/470-2	SC1	0	A	148
	PS85/470-2	SC1	0	B	149
	PS85/470-2	SC1	0	C	150
	PS85/470-2	SC2	0	A	151
	PS85/470-2	SC2	0	B	152
	PS85/470-2	SC2	0	C	153
26.06.2014	PS85/470-2	SC1	1	A	154
	PS85/470-2	SC1	1	B	155
	PS85/470-2	SC1	1	C	156
	PS85/470-2	SC2	1	A	157
	PS85/470-2	SC2	1	B	158
	PS85/470-2	SC2	1	C	159
27.06.2014	PS85/470-2	SC1	2	A	160
	PS85/470-2	SC1	2	B	161
	PS85/470-2	SC1	2	C	162
	PS85/470-2	SC2	2	A	163
	PS85/470-2	SC2	2	B	164
	PS85/470-2	SC2	2	C	165
26.06.2014	PS85/470-2	BW	1	A	166
	PS85/470-2	BW	1	B	167
	PS85/470-2	BW	1	C	168

Tab. 10.7: Sediment samples from MUC core incubation, sliced in large petri dishes, stored at -20°C for the determination 210Pb

Date	Station	Core	Depth bsf [cm]	^{210}Pb sample #
19.06.2014	PS85/436-1	SC1	0-0,5	1
	PS85/436-1	SC1	0,5-1	2
	PS85/436-1	SC1	1-1,5	3

Date	Station	Core	Depth bsf [cm]	^{210}Pb sample #
	PS85/436-1	SC1	1,5-2	4
	PS85/436-1	SC1	2-2,5	5
	PS85/436-1	SC1	2,5-3	6
	PS85/436-1	SC1	3-3,5	7
	PS85/436-1	SC1	3,5-4	8
	PS85/436-1	SC1	4-4,5	9
	PS85/436-1	SC1	4,5-5	10
	PS85/436-1	SC1	5-6	11
	PS85/436-1	SC1	6-7	12
	PS85/436-1	SC1	7-8	13
	PS85/436-1	SC1	8-9	14
	PS85/436-1	SC1	9-10	15
	PS85/436-1	SC1	10-11	16
	PS85/436-1	SC1	11-12	17
	PS85/436-1	SC1	12-13	18
	PS85/436-1	SC1	13-14	19
	PS85/436-1	SC1	14-15	20
	PS85/436-1	SC1	15-16	21
	PS85/436-1	SC1	16-17	22
	PS85/436-1	SC1	17-18	23
	PS85/436-1	SC1	18-19	24
	PS85/436-1	SC1	19-20	25
21.06.2014	PS85/445-1	SC1	0-0,5	26
	PS85/445-1	SC1	0,5-1	27
	PS85/445-1	SC1	1-1,5	28
	PS85/445-1	SC1	1,5-2	29
	PS85/445-1	SC1	2-2,5	30
	PS85/445-1	SC1	2,5-3	31
	PS85/445-1	SC1	3-3,5	32
	PS85/445-1	SC1	3,5-4	33
	PS85/445-1	SC1	4-4,5	34
	PS85/445-1	SC1	4,5-5	35
	PS85/445-1	SC1	5-6	36
	PS85/445-1	SC1	6-7	37
	PS85/445-1	SC1	7-8	38
	PS85/445-1	SC1	8-9	39
	PS85/445-1	SC1	9-10	40
	PS85/445-1	SC1	10-11	41
	PS85/445-1	SC1	11-12	42
	PS85/445-1	SC1	12-13	43

Date	Station	Core	Depth bsf [cm]	^{210}Pb sample #
	PS85/445-1	SC1	13-14	44
	PS85/445-1	SC1	14-15	45
	PS85/445-1	SC1	15-16	46
	PS85/445-1	SC1	16-17	47
	PS85/445-1	SC1	17-18	48
	PS85/445-1	SC1	18-19	49
	PS85/445-1	SC1	19-20	50
22.06.2014	PS85/454-3	SC1	0-0,5	51
	PS85/454-3	SC1	0,5-1	52
	PS85/454-3	SC1	1-1,5	53
	PS85/454-3	SC1	1,5-2	54
	PS85/454-3	SC1	2-2,5	55
	PS85/454-3	SC1	2,5-3	56
	PS85/454-3	SC1	3-3,5	57
	PS85/454-3	SC1	3,5-4	58
	PS85/454-3	SC1	4-4,5	59
	PS85/454-3	SC1	4,5-5	60
	PS85/454-3	SC1	5-6	61
	PS85/454-3	SC1	6-7	62
	PS85/454-3	SC1	7-8	63
	PS85/454-3	SC1	8-9	64
	PS85/454-3	SC1	9-10	65
	PS85/454-3	SC1	10-11	66
	PS85/454-3	SC1	11-12	67
	PS85/454-3	SC1	12-13	68
	PS85/454-3	SC1	13-14	69
	PS85/454-3	SC1	14-15	70
	PS85/454-3	SC1	15-16	71
	PS85/454-3	SC1	16-17	72
	PS85/454-3	SC1	17-18	73
	PS85/454-3	SC1	18-19	74
	PS85/454-3	SC1	19-20	75
24.06.2014	PS85/460-4	SC1	0-0,5	76
	PS85/460-4	SC1	0,5-1	77
	PS85/460-4	SC1	1-1,5	78
	PS85/460-4	SC1	1,5-2	79
	PS85/460-4	SC1	2-2,5	80
	PS85/460-4	SC1	2,5-3	81
	PS85/460-4	SC1	3-3,5	82
	PS85/460-4	SC1	3,5-4	83

Date	Station	Core	Depth bsf [cm]	^{210}Pb sample #
	PS85/460-4	SC1	4-4,5	84
	PS85/460-4	SC1	4,5-5	85
	PS85/460-4	SC1	5-6	86
	PS85/460-4	SC1	6-7	87
	PS85/460-4	SC1	7-8	88
	PS85/460-4	SC1	8-9	89
	PS85/460-4	SC1	9-10	90
	PS85/460-4	SC1	10-11	91
	PS85/460-4	SC1	11-12	92
	PS85/460-4	SC1	12-13	93
	PS85/460-4	SC1	13-14	94
	PS85/460-4	SC1	14-15	95
	PS85/460-4	SC1	15-16	96
	PS85/460-4	SC1	16-17	97
	PS85/460-4	SC1	17-18	98
	PS85/460-4	SC1	18-19	99
	PS85/460-4	SC1	19-20	100
27.06.2014	PS85/468-1	SC1	0-0,5	101
	PS85/468-1	SC1	0,5-1	102
	PS85/468-1	SC1	1-1,5	103
	PS85/468-1	SC1	1,5-2	104
	PS85/468-1	SC1	2-2,5	105
	PS85/468-1	SC1	2,5-3	106
	PS85/468-1	SC1	3-3,5	107
	PS85/468-1	SC1	3,5-4	108
	PS85/468-1	SC1	4-4,5	109
	PS85/468-1	SC1	4,5-5	110
	PS85/468-1	SC1	5-6	111
	PS85/468-1	SC1	6-7	112
	PS85/468-1	SC1	7-8	113
	PS85/468-1	SC1	8-9	114
	PS85/468-1	SC1	9-10	115
	PS85/468-1	SC1	10-11	116
	PS85/468-1	SC1	11-12	117
	PS85/468-1	SC1	12-13	118
	PS85/468-1	SC1	13-14	119
	PS85/468-1	SC1	14-15	120
	PS85/468-1	SC1	15-16	121
	PS85/468-1	SC1	16-17	122
	PS85/468-1	SC1	17-18	123

Date	Station	Core	Depth bsf [cm]	^{210}Pb sample #
	PS85/468-1	SC1	18-19	124
	PS85/468-1	SC1	19-20	125
27.06.2014	PS85/469-2	SC1	0-0,5	126
	PS85/469-2	SC1	0,5-1	127
	PS85/469-2	SC1	1-1,5	128
	PS85/469-2	SC1	1,5-2	129
	PS85/469-2	SC1	2-2,5	130
	PS85/469-2	SC1	2,5-3	131
	PS85/469-2	SC1	3-3,5	132
	PS85/469-2	SC1	3,5-4	133
	PS85/469-2	SC1	4-4,5	134
	PS85/469-2	SC1	4,5-5	135
	PS85/469-2	SC1	5-6	136
	PS85/469-2	SC1	6-7	137
	PS85/469-2	SC1	7-8	138
	PS85/469-2	SC1	8-9	139
	PS85/469-2	SC1	9-10	140
	PS85/469-2	SC1	10-11	141
	PS85/469-2	SC1	11-12	142
	PS85/469-2	SC1	12-13	143
	PS85/469-2	SC1	13-14	144
	PS85/469-2	SC1	14-15	145
	PS85/469-2	SC1	15-16	146
	PS85/469-2	SC1	16-17	147
	PS85/469-2	SC1	17-18	148
	PS85/469-2	SC1	18-19	149
	PS85/469-2	SC1	19-20	150
27.06.2014	PS85/470-2	SC1	0-0,5	151
	PS85/470-2	SC1	0,5-1	152
	PS85/470-2	SC1	1-1,5	153
	PS85/470-2	SC1	1,5-2	154
	PS85/470-2	SC1	2-2,5	155
	PS85/470-2	SC1	2,5-3	156
	PS85/470-2	SC1	3-3,5	157
	PS85/470-2	SC1	3,5-4	158
	PS85/470-2	SC1	4-4,5	159
	PS85/470-2	SC1	4,5-5	160
	PS85/470-2	SC1	5-6	161
	PS85/470-2	SC1	6-7	162
	PS85/470-2	SC1	7-8	163

Date	Station	Core	Depth bsf [cm]	^{210}Pb sample #
	PS85/470-2	SC1	8-9	164
	PS85/470-2	SC1	9-10	165
	PS85/470-2	SC1	10-11	166
	PS85/470-2	SC1	11-12	167
	PS85/470-2	SC1	12-13	168
	PS85/470-2	SC1	13-14	169
	PS85/470-2	SC1	14-15	170
	PS85/470-2	SC1	15-16	171
	PS85/470-2	SC1	16-17	172
	PS85/470-2	SC1	17-18	173
	PS85/470-2	SC1	18-19	174
	PS85/470-2	SC1	19-20	175

Tab. 10.8: Sediment samples from MUC, sliced, sieved on 500 µm, stored in borax buffered formaldehyde 4 %

Date	Station	Core	Macrofauna sample #	Depth
19.06.2014	PS85/436-1	SC2	1	0-5 cm
	PS85/436-1	SC2	2	5-10 cm
	PS85/436-1	SC2	3	> 10 cm
20.06.2014	PS85/441-1	SC1	4	0-5 cm
	PS85/441-1	SC1	5	5-10 cm
	PS85/441-1	SC1	6	> 10 cm
21.06.2014	PS85/445-1	SC2	7	0-5 cm
	PS85/445-1	SC2	8	5-10 cm
	PS85/445-1	SC2	9	> 10 cm
22.06.2014	PS85/454-3	SC2	10	0-5 cm
	PS85/454-3	SC2	11	5-10 cm
	PS85/454-3	SC2	12	> 10 cm
24.06.2014	PS85/460-4	SC2	13	0-5 cm
	PS85/460-4	SC2	14	5-10 cm
	PS85/460-4	SC2	15	> 10 cm
27.06.2014	PS85/468-1	SC2	16	0-5 cm
	PS85/468-1	SC2	17	5-10 cm
	PS85/468-1	SC2	18	> 10 cm
27.06.2014	PS85/469-2	SC2	19	0-5 cm
	PS85/469-2	SC2	20	5-10 cm
	PS85/469-2	SC2	21	> 10 cm
27.06.2014	PS85/470-2	SC2	22	0-5 cm

Date	Station	Core	Macrofauna sample #	Depth
	PS85/470-2	SC2	23	5-10 cm
	PS85/470-2	SC2	24	> 10 cm

Tab. 10.9: Sediment samples from MUC, for determination of meiofauna (20 mL syringes, sliced, stored in borax buffered formaldehyde 4 % in Kautex bottles) and AODC (5 mL syringes, sliced, stored in 4 % formaldehyde in scintillationvials, see Christina Bienhold article in this report)

Date	Station	Core	Depth Bsf [Cm]	Meiofauna Sample #
19.06.2014	PS85/436-1	SC2	top (0-1 cm)	1
	PS85/436-1	SC2	up (1-2 cm)	2
	PS85/436-1	SC2	low (2-3 cm)	3
	PS85/436-1	SC2	deep (3-4 cm)	4
	PS85/436-1	SC2	bott (4-5 cm)	5
20.06.2014	PS85/441-1	SC1	top (0-1 cm)	6
	PS85/441-1	SC1	up (1-2 cm)	7
	PS85/441-1	SC1	low (2-3 cm)	8
	PS85/441-1	SC1	deep (3-4 cm)	9
	PS85/441-1	SC1	bott (4-5 cm)	10
21.06.2014	PS85/445-1	SC2	top (0-1 cm)	11
	PS85/445-1	SC2	up (1-2 cm)	12
	PS85/445-1	SC2	low (2-3 cm)	13
	PS85/445-1	SC2	deep (3-4 cm)	14
	PS85/445-1	SC2	bott (4-5 cm)	15
22.06.2014	PS85/454-3	SC2	top (0-1 cm)	16
	PS85/454-3	SC2	up (1-2 cm)	17
	PS85/454-3	SC2	low (2-3 cm)	18
	PS85/454-3	SC2	deep (3-4 cm)	19
	PS85/454-3	SC2	bott (4-5 cm)	20
24.06.2014	PS85/460-4	SC2	top (0-1 cm)	21
	PS85/460-4	SC2	up (1-2 cm)	22
	PS85/460-4	SC2	low (2-3 cm)	23
	PS85/460-4	SC2	deep (3-4 cm)	24
	PS85/460-4	SC2	bott (4-5 cm)	25
27.06.2014	PS85/468-1	SC2	top (0-1cm)	26
	PS85/468-1	SC2	up (1-2 cm)	27
	PS85/468-1	SC2	low (2-3 cm)	28
	PS85/468-1	SC2	deep (3-4 cm)	29

Date	Station	Core	Depth Bsf [Cm]	Meiofauna Sample #
	PS85/468-1	SC2	bott (4-5 cm)	30
27.06.2014	PS85/469-2	SC2	top (0-1 cm)	31
	PS85/469-2	SC2	up (1-2 cm)	32
	PS85/469-2	SC2	low (2-3 cm)	33
	PS85/469-2	SC2	deep (3-4 cm)	34
	PS85/469-2	SC2	bott (4-5 cm)	35
27.06.2014	PS85/470-2	SC2	top (0-1 cm)	36
	PS85/470-2	SC2	up (1-2 cm)	37
	PS85/470-2	SC2	low (2-3 cm)	38
	PS85/470-2	SC2	deep (3-4 cm)	39
	PS85/470-2	SC2	bott (4-5 cm)	40

Tab. 10.10: Water samples from lander syringes for determination of oxygen and nutrient concentration. Oxygen concentration was determined on bord, nutrient samples are stored in scintillation vial at -20°C

Date	Station	Chamber	Syringe	O_2 Sample #	Nutrient Sample #
24.06.2014	PS457-2	K1	1	1	1
	PS457-2	K1	2	2	2
	PS457-2	K1	3	3	3
	PS457-2	K1	4	4	4
	PS457-2	K1	5	5	5
	PS457-2	K1	6	6	6
	PS457-2	K1	7	7	7
	PS457-2	K2	1	8	8
	PS457-2	K2	2	9	9
	PS457-2	K2	3	10	10
	PS457-2	K2	4	11	11
	PS457-2	K2	5	12	12
	PS457-2	K2	6	13	13
	PS457-2	K2	7	14	14
	PS457-2	K3	1	15	15
	PS457-2	K3	2	16	16
	PS457-2	K3	3	17	17
	PS457-2	K3	4	18	18
	PS457-2	K3	5	19	19
	PS457-2	K3	6	20	20
	PS457-2	K3	7	21	21
24.06.2014	PS457-2	Niskin	NA	22	22

Date	Station	Chamber	Syringe	O_2 Sample #	Nutrient Sample #
	PS457-2	Niskin	NA	23	23
	PS457-2	Niskin	NA	24	24
26.06.2014	PS471-1	K1	1	25	25
	PS471-1	K1	2	26	26
	PS471-1	K1	3	27	27
	PS471-1	K1	4	28	28
	PS471-1	K1	5	29	29
	PS471-1	K1	6	30	30
	PS471-1	K1	7	31	31
	PS471-1	K2	1	32	32
	PS471-1	K2	2	33	33
	PS471-1	K2	3	34	34
	PS471-1	K2	4	35	35
	PS471-1	K2	5	36	36
	PS471-1	K2	6	37	37
	PS471-1	K2	7	38	38
	PS471-1	K3	1	39	39
	PS471-1	K3	2	40	40
	PS471-1	K3	3	41	41
	PS471-1	K3	4	42	42
	PS471-1	K3	5	43	43
	PS471-1	K3	6	44	44
	PS471-1	K3	7	45	45
26.06.2014	PS471-1	Niskin	NA	46	46
	PS471-1	Niskin	NA	47	47
	PS471-1	Niskin	NA	48	48

Tab. 10.11: Sediment samples from the lander for determination of meiofauna. For morphology determination the samples were takes by 20 mL syringes, sliced and stored in borax buffered formaldehyde 4% in Kautex bottles. For molecular determination the samples were taken by 20 mL syringes, sliced and stored in DESS in Kautex bottles

Date	Station	Core	Depth Bsf [Cm]	Meiofauna Sample Morf #	Meiofauna Sample Mol #
24.06.2014	PS457-2	K1	top (0-1 cm)	1	1
	PS457-2	K1	up (1-2 cm)	2	2
	PS457-2	K1	low (2-3 cm)	3	3
	PS457-2	K1	deep (3-4 cm)	4	4
	PS457-2	K1	bott (4-5 cm)	5	5

Date	Station	Core	Depth Bsf [Cm]	Meiofauna Sample Morf #	Meiofauna Sample Mol #
	PS457-2	K2	top (0-1 cm)	6	6
	PS457-2	K2	up (1-2 cm)	7	7
	PS457-2	K2	low (2-3 cm)	8	8
	PS457-2	K2	deep (3-4 cm)	9	9
	PS457-2	K2	bott (4-5 cm)	10	10
	PS457-2	K3	top (0-1 cm)	11	11
	PS457-2	K3	up (1-2 cm)	12	12
	PS457-2	K3	low (2-3 cm)	13	13
	PS457-2	K3	deep (3-4 cm)	14	14
	PS457-2	K3	bott (4-5 cm)	15	15
	PS471-1	K1	top (0-1 cm)	13	13
	PS471-1	K1	up (1-2 cm)	14	14
	PS471-1	K1	low (2-3 cm)	15	15
	PS471-1	K1	deep (3-4 cm)	16	16
	PS471-1	K1	bott (4-5 cm)	17	17
	PS471-1	K2	top (0-1 cm)	18	18
	PS471-1	K2	up (1-2 cm)	19	19
	PS471-1	K2	low (2-3 cm)	20	20
	PS471-1	K2	deep (3-4 cm)	21	21
	PS471-1	K2	bott (4-5 cm)	22	22

Tab. 10.12: Sediment samples from lander deployments, sieved on 500 µm and stored in borax buffered formaldehyde 4 %

Date	Station	Core	Macrofauna Sample #
24.06.2014	PS457-2	K1	1
	PS457-2	K2	2
	PS457-2	K3	3
26.06.2014	PS471-1	K1	4
	PS471-1	K2	5

11. HISTORY OF THE TRANSPOLAR DRIFT: GEOCHEMICAL PROXIES

Antje Wildau[1], Dieter Garbe-Schönberg[1] (not on board), Georgi Laukert[2] (not on board), Martin Frank[2] (not on board)

[1]Univ. Kiel
[2]GEOMAR

Grant No: AWI_PS85_09

Objectives

Geochemical Proxies

Global warming and climate change are topics of great importance and the driving forces as well as their effects need to be understood for predicting future conditions. The BMBF-funded German-Russian multidisciplinary research project “Transdrift: The Transpolar System of the Arctic Ocean” aims gaining a better understanding of processes actuating the transpolar drift from sea ice formation in the Laptev Sea to sea ice melting in the Fram Strait.

“History of the Transpolar Drift” is one of the project’s work packages, investigating past periods with similar climatic conditions (Early Holocene, ~10 ka b. p.) as well as periods with higher temperatures and sea level than today (Eemian, ~130 ka – 118 ka b. p.). Of major interest are the investigation of varying sea ice production, coverage and fluctuation of sea ice in the Arctic Ocean and the effects on the sea level, but also to investigate possible regional changes in important sea ice source areas. The way that primary productivity and distribution of Atlantic surface water changed with variable ice coverage will be investigated, as well as a possibly varying ice drift pattern and the question of a continued transpolar drift are of major importance. The variability of the transpolar ice drift over the last 150 ka will be reconstructed in the subproject “Geochemical Proxies” using established, and developing new inorganic proxies at the Christian-Albrechts-University (CAU) in Kiel. Sediment cores represent chemical archives, of which elemental ratios and trace element abundance in bulk sediment layers with chemical fingerprints of selected mineral grains will be used for the ice drift reconstruction. *In-situ* elemental analyses (e.g. ED-XRF core scanning, LA-ICP-MS) and bulk chemical analyses (e.g. ICP-OES, ICP-MS, WD-XRF) as well as calibration of the generated ED-XRF data will be conducted.

Transpolar Mass Transport

One of the other work packages, “Arctic Halocline, Water Mass Production and Mass Transport in the Transpolar Driftsystem”, encloses the subproject “Transpolar Mass Transport” which is carried out at the GEOMAR in Kiel. The coupled dissolved signatures of radiogenic neodymium (Nd) isotopes (expressed as εNd) and rare earth element (REE) patterns are powerful geochemical tracers of water masses introduced into seawater through weathering of the rocks in the source areas of the water masses (*cf*. Frank, 2002). Source rock composition and age of the continental crust are geographically variable and characteristic for particular groups and ages of rocks providing a geochemical “fingerprint”. The global average residence time of Nd in seawater is about 400-1,000 years (Arsouze et al., 2009), thus typical isotopic signatures of water masses can be preserved and transported over large distances. While changes in weathering inputs from land (rivers, exchange with shelf sediments) influence the surface water signatures, changes of the Nd isotope signatures in the open ocean are only controlled by mixing of water masses with different signatures, which can also be extracted from sediments and have been used for reconstruction of past water mass mixing and ocean circulation in the Arctic ocean (e.g. Haley et al., 2008). The purpose of the project is to provide an assessment of water mass signatures based on radiogenic Nd isotopes and REE patterns and compare the results with data obtained in 2012 (ARK-XXVII/1). Sampling in Fram Strait allows to capture water masses entering and exiting the Arctic Ocean through Fram Strait. Database from 2012 and years before available for comparison indicates that there are strong interannual as well as interdecadal variations in the distribution of Siberian and Alaskan freshwater, as well as of the contribution of Pacific waters to the Arctic Ocean halocline. At greater depth the variability of Atlantic inflow and Arctic outflow will be investigated with the same proxy tracers. An evaluation of the freshwater exchange through Fram Strait will help to further understand the impact of the variations in Arctic Ocean hydrographic conditions and Arctic and global climate change.

Work at sea

Sediment samples

Deploying a video-guided multiple corer (TV-MUC), eleven undisturbed sediment cores were taken starting on the continental slope in the west to the eastern Fram Strait (Fig. 11.1: stations *436-1, 441-1, 445-1, 454-3, 460-4, 463-1, 464-1, 465-4, 469-2, 470-3 and 473-8*). These short sediment cores, varying in sediment depth from 22 cm to 32 cm, were subsampled in 1 cm intervals. After preparation, these subsamples will be analyzed for trace elements of the contained heavy minerals in the labs of the CAU in Kiel.

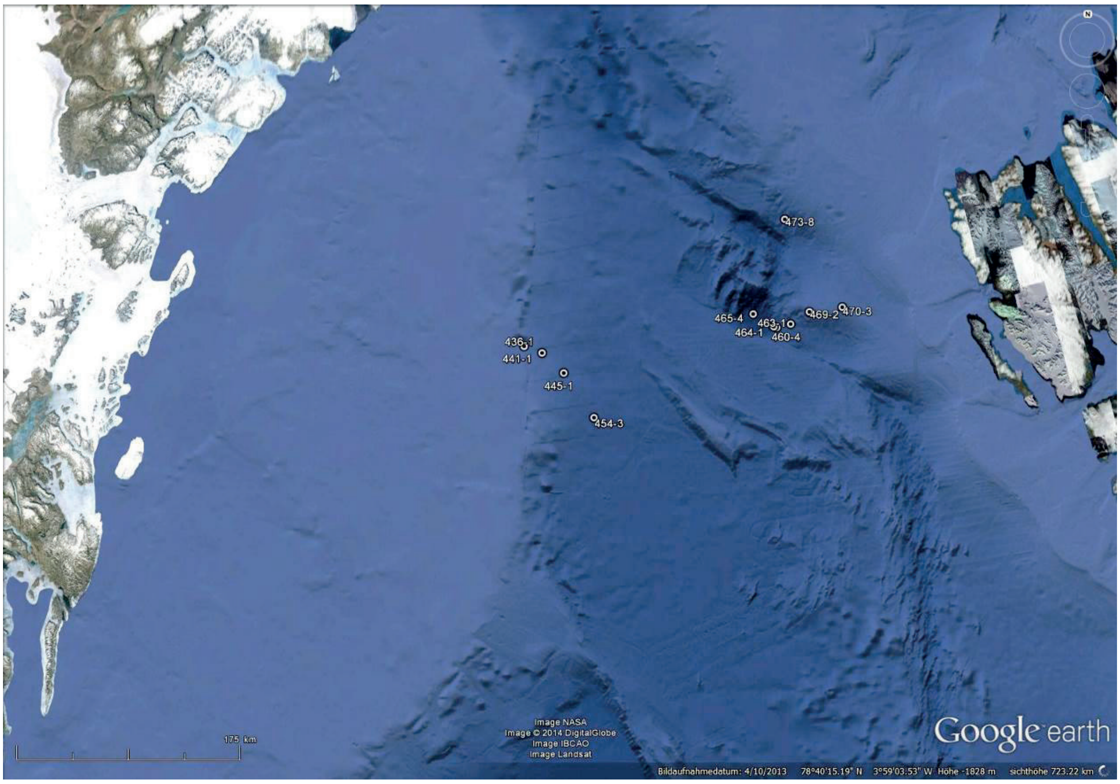

Fig. 11.1: Locations of the sampled MUC stations in the working area of the cruise PS85 (ARK-XXVIII/2

Sea ice

Sea ice was sampled during five trips with a zodiac on the Greenland Shelf and in the Fram Strait (Fig. 11.2: stations *443-1, 452-1, 457-1, 473-2 and 481-2*). Three times it was possible to sample dirty sea ice which contains most likely trapped sediments during ice formation in the Laptev Sea. Two times solely clean sea ice could be sampled. After melting the ice and waiting for the sediments to settle down, the clean water was taken-off with single-use syringes (50 ml and 20 ml) to reduce the amount of the water to a minimum. In the labs of the CAU in Kiel, mineral, major element and trace element chemistry analyzes will be conducted for characterization and comparison to the minerals in the sediment samples deduced from the MUC.

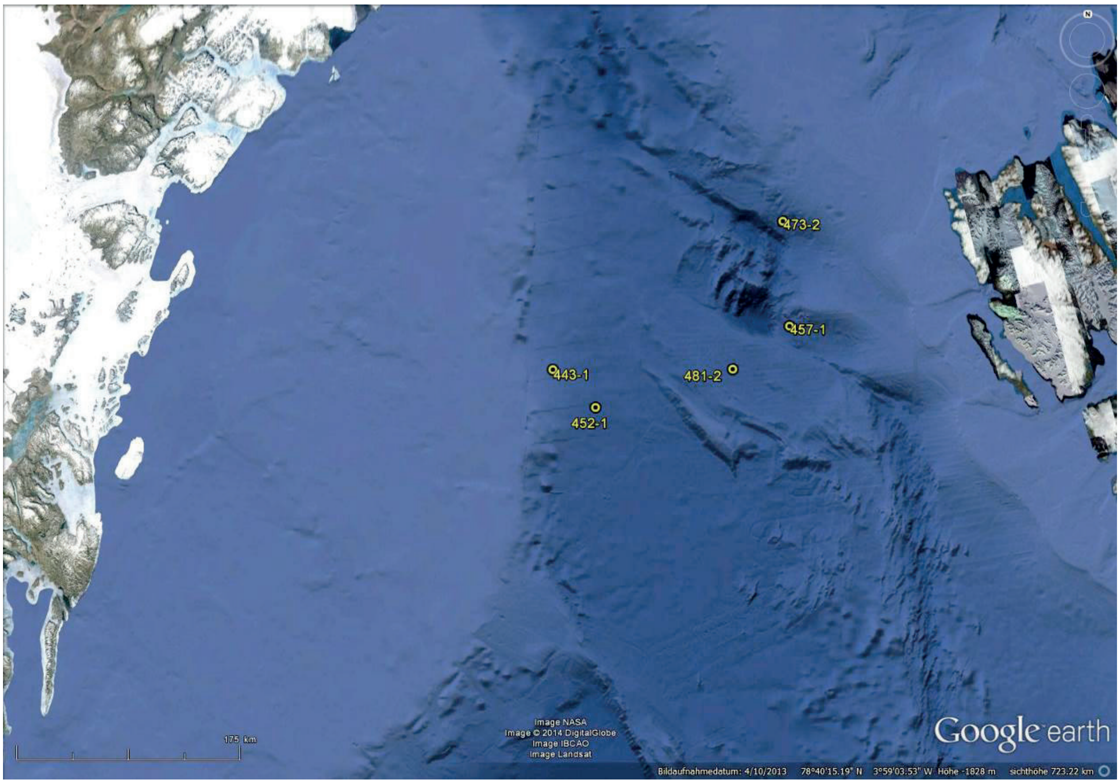

Fig. 11.2: Locations of the sampled dirty ice stations in the working area of the cruise PS85 (ARK-XXVIII/2)

Water samples

For investigating the Nd-isotopes and REE signature, filtered water samples were retrieved from the CTD-rosette at seven stations (Fig. 11.3: stations *413-2, 417-1, 435-1, 448-1, 465-1, 469-1 and 481-1*) and different depth levels (10 – 20 l per depth). Sampling was conducted within the halocline and intermediate waters down to deep and bottom waters with a maximum depth of 5,535 m. Samples have been recovered from the East Greenland Shelf as well as in the Central Fram Strait.

Preliminary (expected) results

Geochemical Proxies

First results of the sediment samples can be evaluated after the samples will have been transported to the home laboratory at the CAU in Kiel and after EPMA and LA-ICP-MS analyzes. It is expected to identify the heavy minerals amphibole, pyroxene, epidote, garnet, apatite, titanite, zircon, tourmaline, rutile, kyanite, staurolite, andalusite, sillimanite (and monazite), which occur in great variance in the Laptev Sea. As each mineral species can incorporate a number of trace elements (e.g. Y, Hf, Th etc.), it is envisaged to identify chemical fingerprints for the different minerals to trace them back to the respective river valleys in the Laptev Sea (or even Kara Sea etc.), which represent the source areas of rock massifs which become drained by the rivers.

Transpolar Mass Transport

First results of the water samples can be evaluated after the samples have been transported to the home laboratory at GEOMAR in Kiel, and analyzed by multicollector ICP-MS. Strong Nd signals from different water masses, especially in the upper water column are expected. A strong unradiogenic signature will most likely dominate the surface waters on the Greenland shelf; more radiogenic signatures can be expected from waters with a Pacific component.

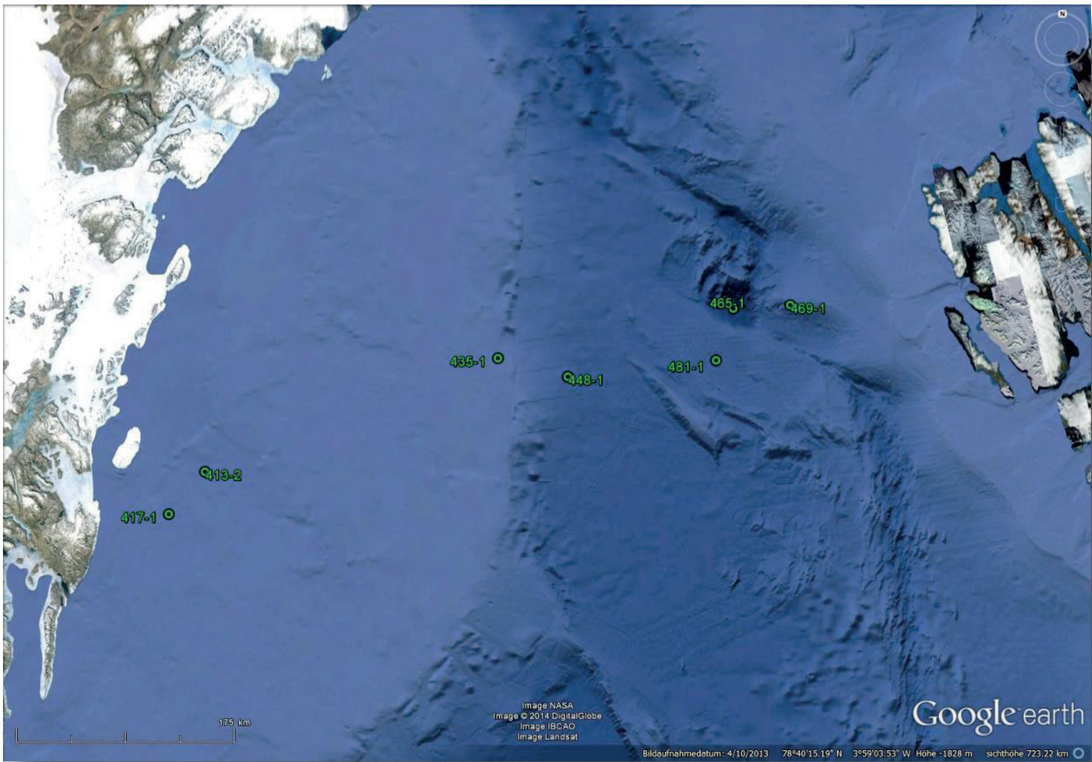

Fig. 11.3: Locations of the sampled CTD stations in the working area of the cruise PS85 (ARK-XXVIII/2)

Data management

Final post-cruise data will be made public available in due time in the open access library PANGAEA data publisher for Earth and Environmental Science which is hosted by the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research in Bremerhaven, Germany.

References

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Frank M (2002) Radiogenic isotopes: Tracers of past ocean circulation and erosional input. Rev. Geophys. 40(1), 1001, 10.1029/2000rg000094.

Haley BA, Frank M, Spielhagen RF and Eisenhauer A (2008) Influence of brine formation on Arctic Ocean circulation over the past 15 million years. Nature Geoscience 1, 68-72.

12. HYDROACOUSTICS

Jan Erik Arndt[1], Lars Radig[1]   [1]AWI

Grant No: AWI_PS85_10

Objectives

The glacial history of the Greenland Ice Sheet for the area of the North-East Greenland Continental Shelf (NEGCS) is still widely unknown. Geophysical data such as swath bathymetric and sub-bottom profiler data is only sparsely available here, due to remoteness and year-round heavy ice conditions. Latest publications based on such data are showing that the Ice Sheet advanced at least until the mid-shelf in the northern Westwind Trough (Evans et al., 2008, Winkelmann et al., 2010). This is in contrast to previously hypothesized ice termination close to modern day coastline. During this cruise it was planned to acquire hydroacoustic data of the Norske Trough which is even less observed than the northern part of the NEGCS. This new data is supposed to also improve general bathymetric models of this area which are still showing major data gaps and thus are not accurate.

In addition, the observed data directly supports other scientists on board in their work during the cruise by delivering accurate up to date depth information for the vessels position and its proximity.

Work at sea

Bathymetric surveying took place during the entire cruise with the hull mounted *ATLAS Hydrosweep DS3* multibeam echosounding system. The system was controlled using *ATLAS Hydromap Control*. The *Hypack* programme suite was used for on the fly visualization of the acquired data. Data storage was performed with *ATLAS Parastore* and additionally with *Hypack*. Data processing and cleaning then was performed in in *CARIS Hips and Sips*. The cleaned data was gridded and visualized in *QPS Fledermaus* software and afterwards converted to *ArcGIS* compatible files.

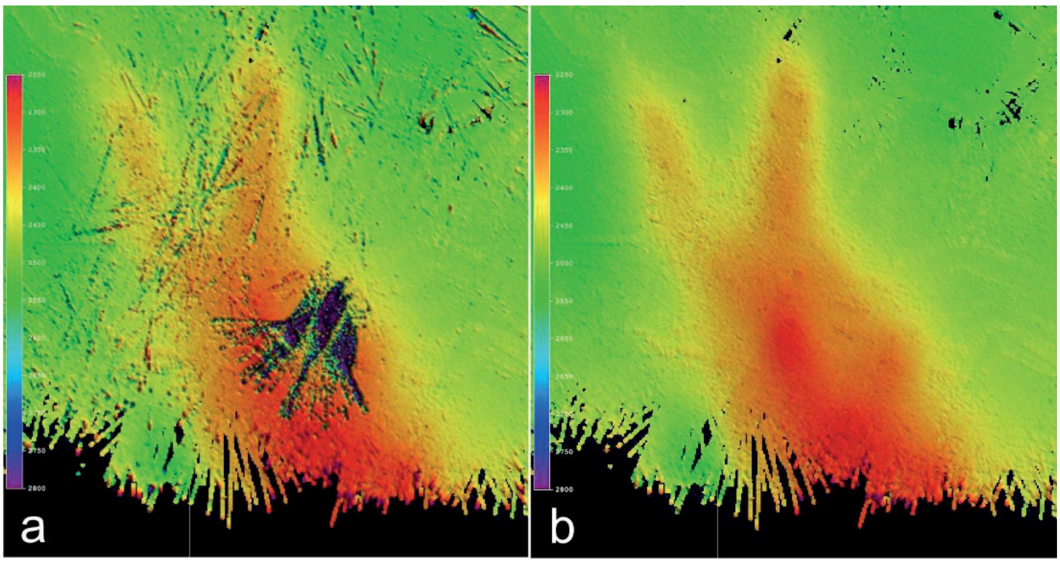

Fig. 12.1: Bathymetric data during heavy icebreaking activities (a) before and (b) after data cleaning

Soundvelocity corrections from CTD stations have been applied to the bathymetric data. Icebreaking activities disturbed the sounding signal and necessitated increased effort in cleaning the data (see Fig. 12.1). Due to heavy sound disturbances in the water column while icebreaking, occasionally the system lost the correct depth horizon. In such cases the system was manually steered back to the seafloor by adjusting its depth window.

Sub-bottom profiler data was acquired with the hull mounted *ATLAS Parasound P-70* system during the entire cruise. *Parasound* can resolve the sediment layering of up to 200m depth below seafloor by using a combination of high frequency (~20kHz) and low frequency (~4kHz) signals. The system was controlled using *ATLAS Hydromap Control*. Both frequencies have been acquired and displayed during the entire cruise with *ATLAS Parastore*.

Preliminary (expected) results

The bathymetric data acquired in this cruise on the NEGCS show that nearly the entire shelf is covered by seafloor morphology related to recent and older glacial activity. Shoals are widely eroded by icebergs (see Fig. 12.2 a), most probably exported from the Arctic Ocean with the East-Greenland Current. Such iceberg scours were detected in the new bathymetry data down to approximately 700 m depth. Other parts of the shelf are showing mega-scale glacial lineations (see Fig. 12.2 b). These are indicative of a former fast flowing ice stream from the Greenland Icesheet.

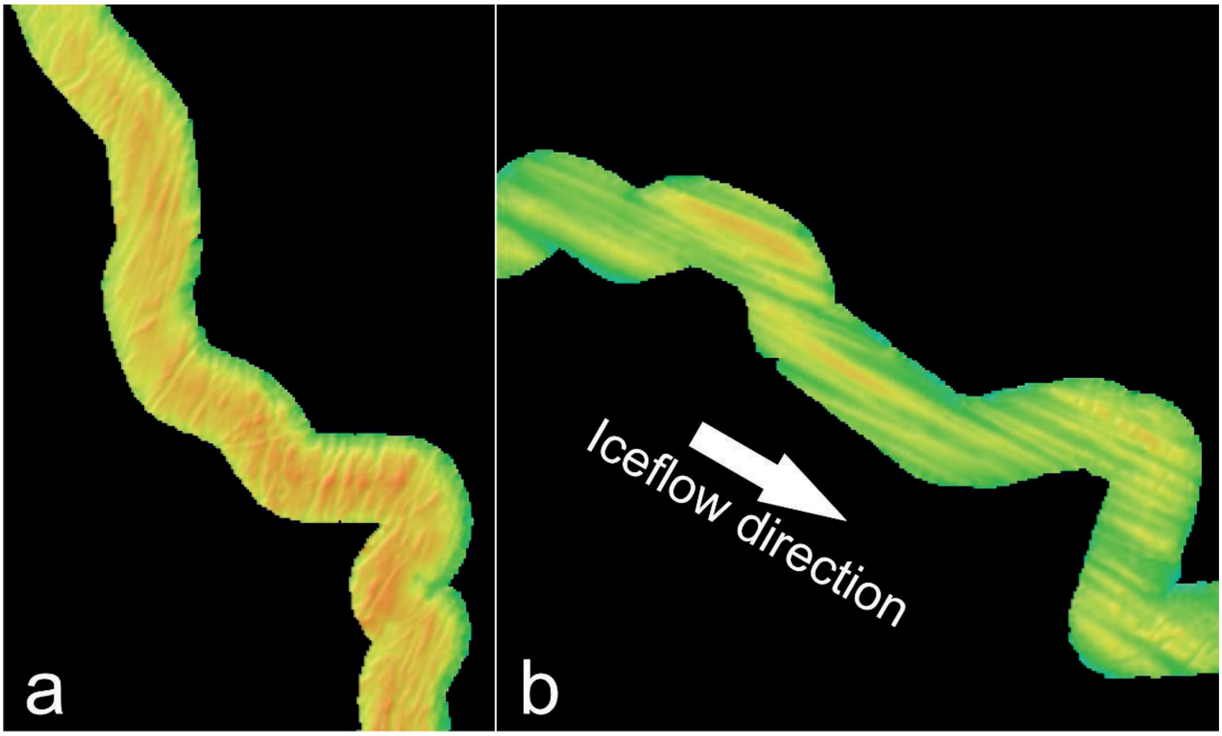

Fig. 12.2: New bathymetry showing a) iceberg plowmarks and b) mega-scale glacial lineations

The sub-bottom profiler data are giving information about the structure of the upper sediment layers. Correct and thorough interpretation of glacigenic seafloor features strongly relies on this data. The features discovered in the swath bathymetric data are also detected in the sub-bottom profiler data. Figure 12.3 is showing an area with numerous iceberg scours. The sediments are clearly disturbed by several events reworking the upper sedimentary layers creating furrows and berms.

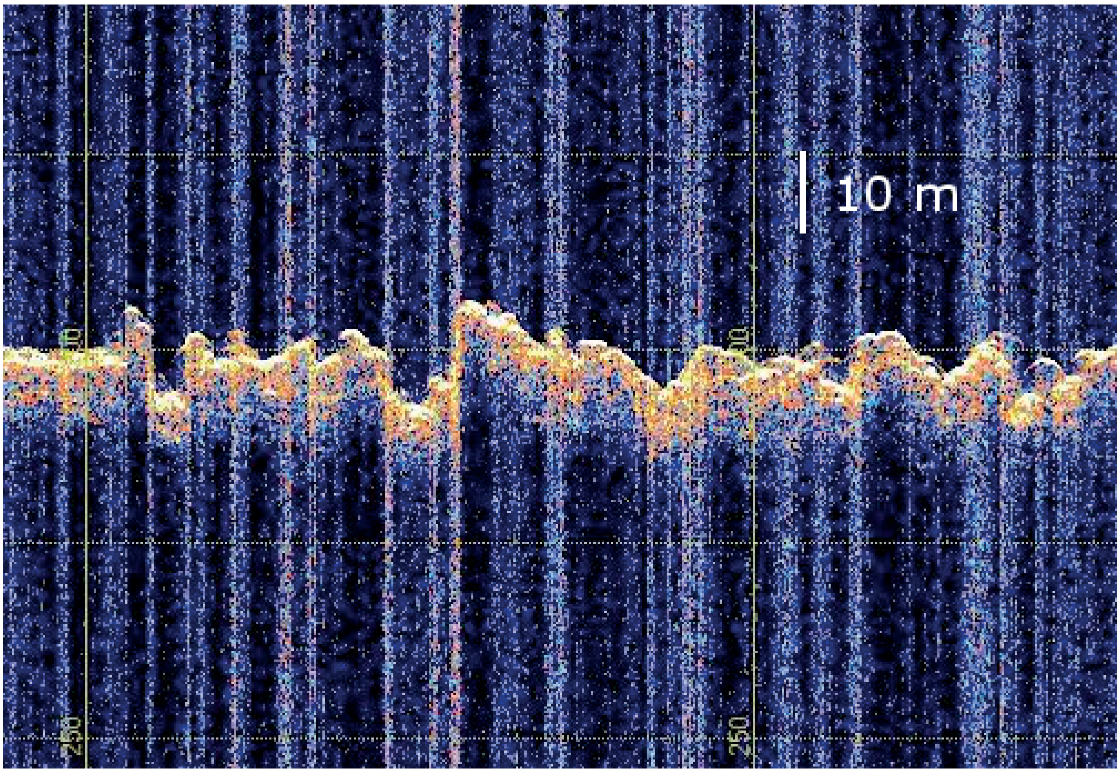

Fig. 12.3: Sub-bottom profiler data of a massively iceberg scoured area in about 200 m water depth

The bathymetric and sub-bottom profiler data acquired during this cruise will systematically be investigated for such glacigenic seafloor features and will improve our knowledge of the glacial history of the NEGCS.

In addition, the newly acquired bathymetric data will also be incorporated in a new improved detailed bathymetric compilation of the NEGCS. This will give insights in the general morphology of the shelf including its trough systems and is of central importance to investigate the flow of warm and saline water onto the shelf and to the floating ice tongue of Nioghalvfjerdsfjorden Gletscher (79° Glacier).

Data management

All acquired hydroacoustic data will be stored at the scientific data warehouse *PANGAEA*.

References

Evans J, CO Cofaigh, JA Dowdeswell and P Wadhams (2008), Marine geophysical evidence for former expansion and flow of the Greenland Ice Sheet across the north-east Greenland continental shelf, *Journal of Quaternary Science*, doi: 10.1002/jqs.1231

Winkelmann D, W Jokat, L Jensen, and H-W Schenke (2010), Submarine end moraines on the continental shelf off NE Greenland e Implications for Lateglacial dynamics, *Quaternary Science Reviews*, *29*, 1069-1077, doi: 10.1016/j.quascirev.2010.02.002

APPENDIX

A.1 PARTICIPATING INSTITUTIONS

A.2 CRUISE PARTICIPANTS

A.3 SHIP'S CREW

A.4 STATION LIST

A.1 TEILNEHMENDEINSTITUTE/PARTICIPATINGINSTITUTIONS

	Address
AWI	Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung Postfach 120161 27515 Bremerhaven, Germany
DWD	Deutscher Wetterdienst Geschäftsbereich Wettervorhersage Seeschifffahrtsberatung Bernhard Nocht Str. 76, 20359 Hamburg, Germany
GEOMAR	GEOMAR Helmholtz-Zentrum für Ozeanforschung, Kiel Düsternbrooker Weg 20, D-24109 Kiel/Germany
HeliService	HeliService international GmbH Am Luneort 15, D-27572 Bremerhaven/Germany
HZG	Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research GmbH Max-Planck-Street 01, D-21502 Geesthacht/Germany
IOPAN	Institute of Oceanology PAS, Powst. Warszawy 55 81-712 Sopot/Poland
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MPI-Bremen	Max Planck Institute for Marine Microbiology, Deutschland Celsiusstr. 1, 28359 Bremen/Germany
Univ. Aarhus	Aquatic Biology Bioscience, Aarhus University Ole Worms Allé 1 Build. 1134 8000 Aarhus C/Denmark
Univ. Delaware	University of Delaware 111 Robinson Hall Newark, DE 19716/USA
Univ. Ghent	Ghent University, Department of Biology K.L. Ledeganckstraat 35 9000 Gent

	Address
Univ. Kiel	Cristian Albrechts Universität Kiel Institut für Geowissenschaften, 24098 Kiel/Germany
Univ. Laval	Université Laval, Québec-Océan, Québec City/Canada ArcticNet, Network of Centres of Excellence of Canada
Univ. Trier	University of Trier Faculty of Regional and Environmental Sciences Department of Environmental Meteorology 54286 Trier/Germany

A.2 FAHRTTEILNEHMER / CRUISE PARTICIPANTS

Name/Last name	Vorname/ First name	Institut/ Institute	Beruf/Profession
Arndt	Jan Erik	AWI	scientist, geo sciences
Asendorf	Volker	MPI	technician, biology
Bauerfeind	Eduard	AWI	scientist, biology
Becker	Stefan	MPI	student, biology
Beszczynska-Möller	Agnieszka	IOPAN	scientist, oceanography
Bienhold	Christina	MPI	scientist, biology
Bold	Sina	GEOMAR	student, biology
Braeckman	Ulrike	Univ. Gent	scientist, biology
Dietrich	Ulrike	AWI	student, biology
Dippe	Tina	Univ. Bremen	student, oceanography
Gall	Fabian	HeliService	technician, helicopter
Goncalves Araujo	Rafael	AWI	scientist, biology
Hasemann	Christiane	AWI	scientist, biology
Hempelt	Juliane	DWD	technician, metereology
Hildebrandt	Nicole	AWI	scientist, biology
Hoffman	Katy	MPI	scientist, biology
Hoffmann	Ralf	AWI	scientist, biology
Kiel	Mandy	AWI	technician, chemistry
Kohnemann	Svenja	Univ. Trier	scientist, physics
Küber	Tim	AWI	technician, biology
Lalande	Catherine	Univ. Laval	scientist, biology
Latarius	Katrin	AWI	scientist, oceanography
Lilienthal	Heiko	iSiTEC	engineer, biology
Lochthofen	Normen	AWI	engineer, biology
Lund-Hansen	Lars Chresten	Univ. Aarhus	scientist, biology
Metfies	Katja	AWI	scientist, biology
Muenchow	Andreas	Univ. Delaware	scientist, oceanography
Paulman	Christian	DWD	metereologist
Peeken	Ilka	AWI	scientist, biology

Name/Last name	Vorname/ First name	Institut/ Institute	Beruf/Profession
Piontek	Judith	GEOMAR	scientist, biology
Poole	Jonathan	Univ. Delaware	technician, oceanography
Rabe	Benjamin	AWI	scientist, oceanography
Radig	Lars	TU Dresden	student, geo sciences
Rapp	Josephine	MPI	scientist, biology
Richter	Roland	HeliService	technician, helicopter
Sablotny	Burkhard	AWI	engineer, biology
Salter	Ian	AWI	scientist, biology
Schaffer	Janin	AWI	student, oceanography
Schewe	Ingo	AWI	scientist, biology
Schütte	Svenja	AWI	student, biology
Seifert	Miriam	Univ. Bremen	student, biology
Sorrell	Brian Keith	Univ. Aarhus	scientist, biology
Steffens	Martin	HeliService	pilot, helicopter
Strothmann	Olaf	AWI	technician, oceanography
Taylor	James	Univ. Oldenburg	scientist, biology
Tonkes	Henrieke	AWI	student, biology
Vaupel	Lars	HeliService	pilot, helicopter
Von Appen	Wilken-Jon	AWI	scientist, oceanography
Wildau	Antje	Univ. Kiel	scientist, geo sciences
Winkler	Maria	Univ. Dresden	student, biology
Xie	Zhiyong	HZG	scientist, chemistry
Ziersen	Bibi	Univ. Aarhus	scientist, biology

A.3 SCHIFFSBESATZUNG / SHIP'S CREW

No.	Name	Rank
1	Wunderlich, Thomas	Master
2	Spielke, Steffen	1.Offc.
3	Ziemann, Olaf	Ch.Eng.
4	Hering, Igor	2.Offc.
5	Kentges, Felix	2.Offc.
6	Lauber, Felix	2.Offc.
7	Spilok, Norbert	Doctor
8	Koch, Georg	R.Offc.
9	Heuck, Hinnerk	2.Eng.
10	Schnürch, Helmut	2.Eng.
11	Westphal, Henning	2.Eng.
12	Brehme, Andreas	Elec.Tech.
13	Christian, Boris	Electron.
14	Dimmler, Werner	Electron.
15	Feiertag, Thomas	Electron.
16	Ganter, Armin	Electron.
17	Winter, Andreas	Electron.
18	Schröter, Rene	Boatsw.
19	Neisner, Winfried	Carpenter
20	Brickmann, Peter	A.B.
21	Burzan, Gerd-Ekkehard	A.B.
22	Clasen, Nils	A.B.
23	Gladow, Lothar	A.B.
24	Kreis, Reinhard	A.B.
25	Kretzschmar, Uwe	A.B.
26	Moser, Siegfried	A.B.
27	Schröder, Norbert	A.B.
28	Sedlak, Andreas	A.B.
29	Beth, Detlef	Storekeep.
30	Dinse, Horst	Mot-man
31	Fritz, Günter	Mot-man
32	Krösche, Eckard	Mot-man
33	Plehn, Markus	Mot-man
34	Watzel, Bernhard	Mot-man
35	Fischer, Matthias	Cook
36	Tupy, Mario	Cooksmate
37	Völske, Thomas	Cooksmate

No.	Name	Rank
38	Luoto, Eija	1.Stwd.
39	Westphal, Kerstin	Stwdss/KS
40	Chen, Quan Lun	2.Steward
41	Hischke, Peggy	2.Stwdess
42	Hu, Guo Yong	2.Steward
43	Streit, Christina	2.Stwdess
44	Wartenberg, Irina	2.Stwdess
45	Ruan, HuiGuang	Laundrym.

A.4 STATIONSLISTE / STATION LIST PS 85

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0401-1	10.6.14	0:08	CTD/RO	in the water	66° 0,09' N	0° 0,04' W	3071,7
PS85/0401-1	10.6.14	0:24	CTD/RO	on ground/ max depth	66° 0,02' N	0° 0,30' W	3063,0
PS85/0401-1	10.6.14	0:46	CTD/RO	on deck	65° 59,97' N	0° 0,47' W	3071,7
PS85/0401-2	10.6.14	1:00	BONGO	in the water	65° 59,94' N	0° 0,48' W	3070,5
PS85/0401-2	10.6.14	1:08	BONGO	on ground/ max depth	65° 59,92' N	0° 0,49' W	3078,2
PS85/0401-2	10.6.14	1:13	BONGO	on deck	65° 59,92' N	0° 0,51' W	3068,5
PS85/0401-2	10.6.14	1:18	BONGO	in the water	65° 59,91' N	0° 0,56' W	3102,7
PS85/0401-2	10.6.14	1:26	BONGO	on ground/ max depth	65° 59,92' N	0° 0,66' W	3098,7
PS85/0401-2	10.6.14	1:30	BONGO	on deck	65° 59,92' N	0° 0,68' W	3090,5
PS85/0401-2	10.6.14	1:39	BONGO	in the water	65° 59,90' N	0° 0,69' W	3065,7
PS85/0401-2	10.6.14	1:48	BONGO	on ground/ max depth	65° 59,88' N	0° 0,73' W	3092,7
PS85/0401-2	10.6.14	1:54	BONGO	on deck	65° 59,87' N	0° 0,78' W	3088,5
PS85/0401-3	10.6.14	2:02	LOKI	in the water	65° 59,87' N	0° 0,87' W	3078,0
PS85/0401-3	10.6.14	2:12	LOKI	profile start	65° 59,86' N	0° 0,93' W	3063,2
PS85/0401-3	10.6.14	2:12	LOKI	on ground/ max depth	65° 59,86' N	0° 0,93' W	3063,2
PS85/0401-3	10.6.14	2:33	LOKI	profile end	65° 59,84' N	0° 1,08' W	3065,0
PS85/0401-3	10.6.14	2:34	LOKI	on deck	65° 59,84' N	0° 1,09' W	3057,7
PS85/0401-4	10.6.14	2:47	FLOAT	on ground/ max depth	65° 59,83' N	0° 1,02' W	3061,0
PS85/0402-1	10.6.14	3:50	FLOAT	in the water	66° 9,65' N	0° 0,00' W	3143,0
PS85/0402-1	10.6.14	3:50	FLOAT	on ground/ max depth	66° 9,65' N	0° 0,00' W	3143,0
PS85/0403-1	11.6.14	2:16	FLOAT	in the water	69° 59,97' N	1° 38,74' E	3267,0
PS85/0403-1	11.6.14	2:16	FLOAT	on ground/ max depth	69° 59,97' N	1° 38,74' E	3267,0
PS85/0404-1	11.6.14	3:16	FLOAT	in the water	70° 8,95' N	1° 51,04' E	3261,7
PS85/0404-1	11.6.14	3:16	FLOAT	on ground/ max depth	70° 8,95' N	1° 51,04' E	3261,7
PS85/0405-1	12.6.14	6:50	FLOAT	in the water	74° 54,95' N	0° 0,04' E	3757,7
PS85/0405-1	12.6.14	6:50	FLOAT	on ground/ max depth	74° 54,95' N	0° 0,04' E	3757,7
PS85/0406-1	12.6.14	7:49	FLOAT	in the water	75° 4,89' N	0° 0,03' E	3754,2
PS85/0406-1	12.6.14	7:49	FLOAT	on ground/ max depth	75° 4,89' N	0° 0,03' E	3754,2
PS85/0407-1	13.6.14	7:10	CTD/RO	in the water	77° 9,97' N	7° 41,83' W	279,5
PS85/0407-2	13.6.14	7:11	HN	in the water	77° 9,98' N	7° 41,80' W	279,7
PS85/0407-2	13.6.14	7:17	HN	on ground/ max depth	77° 10,00' N	7° 41,64' W	279,7
PS85/0407-2	13.6.14	7:19	HN	on deck	77° 10,01' N	7° 41,57' W	279,8

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0407-1	13.6.14	7:26	CTD/RO	on ground/ max depth	77° 10,03' N	7° 41,40' W	279,9
PS85/0407-1	13.6.14	7:26	CTD/RO	hoisting	77° 10,03' N	7° 41,40' W	279,9
PS85/0407-1	13.6.14	7:40	CTD/RO	at surface	77° 10,12' N	7° 41,11' W	278,0
PS85/0407-1	13.6.14	7:42	CTD/RO	on deck	77° 10,13' N	7° 41,07' W	278,2
PS85/0407-3	13.6.14	13:11	ICE	in the water	77° 30,00' N	9° 19,20' W	0,0
PS85/0407-3	13.6.14	15:51	ICE	on ground/ max depth	77° 30,00' N	9° 19,20' W	0,0
PS85/0408-1	14.6.14	6:15	MOR	in the water	77° 60,00' N	14° 19,72' W	248,5
PS85/0408-1	14.6.14	6:15	MOR	in the water	77° 60,00' N	14° 19,72' W	248,5
PS85/0408-1	14.6.14	6:27	MOR	in the water	78° 0,04' N	14° 19,46' W	239,1
PS85/0408-1	14.6.14	6:57	MOR	in the water	78° 0,07' N	14° 18,77' W	229,5
PS85/0408-2	14.6.14	7:05	ICE	in the water	78° 20,00' N	14° 14,43' W	0,0
PS85/0408-1	14.6.14	7:20	MOR	on ground/ max depth	77° 59,85' N	14° 18,61' W	249,3
PS85/0408-1	14.6.14	7:22	MOR	on deck	77° 59,82' N	14° 18,64' W	251,9
PS85/0409-1	14.6.14	8:22	MOR	in the water	77° 57,82' N	14° 30,24' W	402,1
PS85/0409-1	14.6.14	8:35	MOR	in the water	77° 57,79' N	14° 30,12' W	401,8
PS85/0409-1	14.6.14	8:36	MOR	on ground/ max depth	77° 57,79' N	14° 30,12' W	401,9
PS85/0409-1	14.6.14	8:37	MOR	on deck	77° 57,79' N	14° 30,13' W	401,8
PS85/0409-1	14.6.14	8:37	MOR	in the water	77° 57,79' N	14° 30,13' W	401,8
PS85/0409-1	14.6.14	8:45	MOR	on deck	77° 57,77' N	14° 30,13' W	401,8
PS85/0410-1	14.6.14	9:30	MOR	in the water	77° 55,64' N	14° 39,35' W	454,4
PS85/0410-1	14.6.14	9:45	MOR	in the water	77° 55,55' N	14° 39,35' W	455,8
PS85/0410-1	14.6.14	10:02	MOR	in the water	77° 55,51' N	14° 39,00' W	455,7
PS85/0410-1	14.6.14	10:09	MOR	on ground/ max depth	77° 55,51' N	14° 38,87' W	455,8
PS85/0410-1	14.6.14	10:10	MOR	on deck	77° 55,50' N	14° 38,85' W	455,1
PS85/0410-1	14.6.14	10:13	MOR	on deck	77° 55,50' N	14° 38,79' W	455,5
PS85/0411-1	14.6.14	13:05	MOR	in the water	77° 42,56' N	15° 26,50' W	367,9
PS85/0411-1	14.6.14	13:16	MOR	on ground/ max depth	77° 42,55' N	15° 26,52' W	369,1
PS85/0411-1	14.6.14	13:16	MOR	in the water	77° 42,55' N	15° 26,52' W	369,1
PS85/0411-1	14.6.14	13:16	MOR	action	77° 42,55' N	15° 26,52' W	369,1
PS85/0411-1	14.6.14	13:17	MOR	on deck	77° 42,55' N	15° 26,53' W	368,9
PS85/0411-1	14.6.14	13:23	MOR	on deck	77° 42,54' N	15° 26,59' W	369,0
PS85/0411-1	14.6.14	13:27	MOR	on deck	77° 42,53' N	15° 26,60' W	369,3
PS85/0411-2	14.6.14	13:44	CTD/RO	in the water	77° 43,06' N	15° 28,70' W	375,0
PS85/0411-2	14.6.14	14:00	CTD/RO	on ground/ max depth	77° 43,06' N	15° 28,69' W	374,5
PS85/0411-2	14.6.14	14:06	CTD/RO	hoisting	77° 43,06' N	15° 28,67' W	377,9
PS85/0408-2	14.6.14	14:28	ICE	on ground/ max depth	78° 20,00' N	14° 14,43' W	0,0
PS85/0411-2	14.6.14	14:30	CTD/RO	on deck	77° 43,05' N	15° 28,54' W	374,1
PS85/0412-1	14.6.14	16:26	CTD/RO	in the water	77° 50,00' N	14° 58,04' W	448,0

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0412-2	14.6.14	16:39	HN	in the water	77° 49,98' N	14° 58,16' W	447,3
PS85/0412-1	14.6.14	16:43	CTD/RO	on ground/ max depth	77° 49,98' N	14° 58,07' W	445,5
PS85/0412-1	14.6.14	16:44	CTD/RO	on ground/ max depth	77° 49,98' N	14° 58,08' W	447,1
PS85/0412-2	14.6.14	16:47	HN	on ground/ max depth	77° 49,97' N	14° 58,16' W	446,7
PS85/0412-1	14.6.14	16:54	CTD/RO	on deck	77° 49,98' N	14° 58,27' W	443,2
PS85/0412-2	14.6.14	16:56	HN	on deck	77° 49,98' N	14° 58,22' W	446,6
PS85/0413-1	14.6.14	18:06	CTD/RO	in the water	77° 46,32' N	15° 11,06' W	374,8
PS85/0413-1	14.6.14	18:19	CTD/RO	on ground/ max depth	77° 46,32' N	15° 11,11' W	380,1
PS85/0413-1	14.6.14	18:20	CTD/RO	action	77° 46,31' N	15° 11,11' W	374,6
PS85/0413-2	14.6.14	18:20	CTD	in the water	77° 46,31' N	15° 11,11' W	374,6
PS85/0413-2	14.6.14	18:30	CTD	on ground/ max depth	77° 46,33' N	15° 11,08' W	374,9
PS85/0413-2	14.6.14	18:30	CTD	on deck	77° 46,33' N	15° 11,08' W	374,9
PS85/0413-1	14.6.14	18:37	CTD/RO	at surface	77° 46,34' N	15° 11,08' W	374,9
PS85/0413-1	14.6.14	18:38	CTD/RO	on deck	77° 46,34' N	15° 11,08' W	374,8
PS85/0414-1	14.6.14	20:45	CTD/RO	in the water	77° 37,12' N	15° 33,37' W	333,1
PS85/0414-1	14.6.14	20:59	CTD/RO	on ground/ max depth	77° 37,14' N	15° 33,36' W	334,0
PS85/0414-1	14.6.14	21:00	CTD/RO	hoisting	77° 37,14' N	15° 33,36' W	334,0
PS85/0414-1	14.6.14	21:13	CTD/RO	at surface	77° 37,17' N	15° 33,33' W	333,8
PS85/0414-1	14.6.14	21:15	CTD/RO	on deck	77° 37,17' N	15° 33,31' W	334,2
PS85/0415-1	14.6.14	22:10	CTD/RO	in the water	77° 32,32' N	15° 40,33' W	308,8
PS85/0415-1	14.6.14	22:23	CTD/RO	on ground/ max depth	77° 32,33' N	15° 40,19' W	307,0
PS85/0415-1	14.6.14	22:36	CTD/RO	on deck	77° 32,34' N	15° 40,24' W	308,5
PS85/0416-1	14.6.14	23:28	CTD/RO	in the water	77° 27,88' N	15° 46,69' W	306,8
PS85/0416-1	14.6.14	23:40	CTD/RO	on ground/ max depth	77° 27,92' N	15° 46,55' W	303,8
PS85/0416-1	14.6.14	23:52	CTD/RO	on deck	77° 27,95' N	15° 46,50' W	303,3
PS85/0417-1	15.6.14	0:46	CTD/RO	in the water	77° 25,54' N	16° 2,79' W	274,2
PS85/0417-1	15.6.14	0:56	CTD/RO	on ground/ max depth	77° 25,57' N	16° 2,79' W	272,4
PS85/0417-1	15.6.14	1:14	CTD/RO	on deck	77° 25,63' N	16° 2,93' W	276,7
PS85/0418-1	15.6.14	2:40	CTD/RO	in the water	77° 23,27' N	16° 18,34' W	173,2
PS85/0418-1	15.6.14	2:47	CTD/RO	on ground/ max depth	77° 23,30' N	16° 18,28' W	171,5
PS85/0418-1	15.6.14	2:48	CTD/RO	hoisting	77° 23,31' N	16° 18,27' W	171,1
PS85/0418-1	15.6.14	3:04	CTD/RO	on deck	77° 23,40' N	16° 17,95' W	175,0
PS85/0419-1	15.6.14	6:12	MOR	in the water	77° 23,42' N	16° 17,75' W	171,9
PS85/0419-1	15.6.14	6:13	MOR	in the water	77° 23,42' N	16° 17,75' W	171,9
PS85/0419-1	15.6.14	6:21	MOR	on ground/ max depth	77° 23,39' N	16° 17,83' W	172,6

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0419-1	15.6.14	6:24	MOR	at surface	77° 23,38' N	16° 17,86' W	175,4
PS85/0419-1	15.6.14	6:33	MOR	on deck	77° 23,40' N	16° 17,85' W	174,1
PS85/0419-1	15.6.14	6:40	MOR	in the water	77° 23,36' N	16° 18,18' W	171,5
PS85/0419-1	15.6.14	6:57	MOR	on deck	77° 23,37' N	16° 18,31' W	168,8
PS85/0419-2	15.6.14	7:07	ICE	in the water	77° 48,00' N	16° 3,60' W	0,0
PS85/0420-1	15.6.14	8:00	MOR	in the water	77° 25,55' N	16° 2,76' W	271,8
PS85/0420-1	15.6.14	8:07	MOR	on ground/ max depth	77° 25,54' N	16° 2,75' W	272,6
PS85/0420-1	15.6.14	8:08	MOR	in the water	77° 25,53' N	16° 2,75' W	272,9
PS85/0420-1	15.6.14	8:08	MOR	action	77° 25,53' N	16° 2,75' W	272,9
PS85/0420-1	15.6.14	8:12	MOR	on deck	77° 25,53' N	16° 2,71' W	274,5
PS85/0420-1	15.6.14	8:31	MOR	on deck	77° 25,55' N	16° 2,51' W	277,1
PS85/0421-1	15.6.14	9:39	MOR	in the water	77° 27,93' N	15° 46,46' W	302,4
PS85/0421-1	15.6.14	9:39	MOR	in the water	77° 27,93' N	15° 46,46' W	302,4
PS85/0421-1	15.6.14	9:47	MOR	on ground/ max depth	77° 27,92' N	15° 46,52' W	303,1
PS85/0421-1	15.6.14	9:47	MOR	in the water	77° 27,92' N	15° 46,52' W	303,1
PS85/0421-1	15.6.14	9:47	MOR	action	77° 27,92' N	15° 46,52' W	303,1
PS85/0421-1	15.6.14	9:56	MOR	on deck	77° 27,91' N	15° 46,49' W	304,3
PS85/0419-2	15.6.14	15:39	ICE	on ground/ max depth	77° 48,00' N	16° 3,60' W	0,0
PS85/0422-1	15.6.14	16:18	CTD/RO	in the water	77° 55,49' N	14° 36,19' W	448,3
PS85/0422-1	15.6.14	16:34	CTD/RO	on ground/ max depth	77° 55,48' N	14° 36,02' W	447,4
PS85/0422-1	15.6.14	16:35	CTD/RO	hoisting	77° 55,48' N	14° 36,01' W	447,4
PS85/0422-1	15.6.14	16:53	CTD/RO	on deck	77° 55,49' N	14° 35,72' W	447,4
PS85/0423-1	15.6.14	17:31	CTD/RO	in the water	77° 57,83' N	14° 27,68' W	400,9
PS85/0423-1	15.6.14	17:46	CTD/RO	on ground/ max depth	77° 57,82' N	14° 27,43' W	403,8
PS85/0423-1	15.6.14	17:49	CTD/RO	hoisting	77° 57,82' N	14° 27,39' W	402,9
PS85/0423-1	15.6.14	18:04	CTD/RO	at surface	77° 57,80' N	14° 27,21' W	403,9
PS85/0423-1	15.6.14	18:05	CTD/RO	on deck	77° 57,80' N	14° 27,19' W	403,8
PS85/0424-1	15.6.14	18:43	CTD/RO	in the water	77° 59,66' N	14° 16,89' W	243,6
PS85/0424-2	15.6.14	18:48	HN	in the water	77° 59,66' N	14° 16,78' W	240,6
PS85/0424-2	15.6.14	18:50	HN	on ground/ max depth	77° 59,66' N	14° 16,72' W	240,8
PS85/0424-1	15.6.14	18:55	CTD/RO	on ground/ max depth	77° 59,64' N	14° 16,60' W	241,1
PS85/0424-2	15.6.14	18:58	HN	on deck	77° 59,63' N	14° 16,54' W	241,3
PS85/0424-1	15.6.14	19:18	CTD/RO	on deck	77° 59,64' N	14° 16,37' W	237,6
PS85/0424-3	15.6.14	19:30	RAMSES	in the water	77° 59,84' N	14° 16,40' W	217,4
PS85/0424-3	15.6.14	19:40	RAMSES	on ground/ max depth	77° 59,88' N	14° 16,38' W	210,8
PS85/0424-3	15.6.14	19:50	RAMSES	on deck	77° 59,99' N	14° 16,49' W	197,2
PS85/0425-1	15.6.14	20:42	CTD/RO	in the water	78° 2,48' N	14° 2,90' W	127,8

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0425-1	15.6.14	20:50	CTD/RO	on ground/ max depth	78° 2,49' N	14° 2,71' W	132,9
PS85/0425-1	15.6.14	20:51	CTD/RO	hoisting	78° 2,49' N	14° 2,71' W	133,0
PS85/0425-1	15.6.14	21:00	CTD/RO	at surface	78° 2,47' N	14° 2,64' W	130,5
PS85/0425-1	15.6.14	21:01	CTD/RO	on deck	78° 2,47' N	14° 2,63' W	129,2
PS85/0426-1	16.6.14	11:54	CTD/RO	in the water	78° 48,34' N	9° 55,75' W	349,5
PS85/0426-2	16.6.14	12:00	HN	in the water	78° 48,33' N	9° 55,69' W	349,0
PS85/0426-2	16.6.14	12:05	HN	on ground/ max depth	78° 48,32' N	9° 55,76' W	349,8
PS85/0426-1	16.6.14	12:08	CTD/RO	on ground/ max depth	78° 48,31' N	9° 55,84' W	350,3
PS85/0426-2	16.6.14	12:10	HN	on deck	78° 48,31' N	9° 55,91' W	350,9
PS85/0426-3	16.6.14	12:22	ICE	in the water	78° 46,00' N	8° 46,20' W	0,0
PS85/0426-1	16.6.14	12:25	CTD/RO	on deck	78° 48,26' N	9° 55,94' W	350,8
PS85/0427-1	16.6.14	14:49	CTD/RO	in the water	78° 50,07' N	9° 22,93' W	175,1
PS85/0427-1	16.6.14	14:59	CTD/RO	on ground/ max depth	78° 50,06' N	9° 22,81' W	177,9
PS85/0427-1	16.6.14	15:00	CTD/RO	hoisting	78° 50,06' N	9° 22,80' W	178,0
PS85/0427-1	16.6.14	15:11	CTD/RO	on deck	78° 50,03' N	9° 22,57' W	182,8
PS85/0426-3	16.6.14	15:55	ICE	on ground/ max depth	78° 46,00' N	8° 46,20' W	0,0
PS85/0428-1	16.6.14	16:00	CTD/RO	in the water	78° 50,07' N	8° 59,94' W	220,0
PS85/0428-1	16.6.14	16:14	CTD/RO	on ground/ max depth	78° 50,03' N	8° 59,66' W	232,9
PS85/0428-1	16.6.14	16:30	CTD/RO	on deck	78° 49,95' N	8° 58,95' W	244,1
PS85/0428-2	16.6.14	16:36	BONGO	in the water	78° 49,94' N	8° 58,70' W	250,1
PS85/0428-2	16.6.14	16:44	BONGO	on ground/ max depth	78° 49,90' N	8° 58,52' W	246,0
PS85/0428-2	16.6.14	16:49	BONGO	on deck	78° 49,89' N	8° 58,45' W	244,2
PS85/0428-3	16.6.14	16:51	BONGO	in the water	78° 49,88' N	8° 58,44' W	244,1
PS85/0428-3	16.6.14	16:59	BONGO	on ground/ max depth	78° 49,82' N	8° 58,15' W	240,1
PS85/0428-3	16.6.14	17:03	BONGO	on deck	78° 49,80' N	8° 58,05' W	240,8
PS85/0428-4	16.6.14	17:06	BONGO	in the water	78° 49,79' N	8° 57,95' W	241,1
PS85/0428-4	16.6.14	17:12	BONGO	on ground/ max depth	78° 49,75' N	8° 57,72' W	237,8
PS85/0428-4	16.6.14	17:17	BONGO	on deck	78° 49,70' N	8° 57,50' W	236,3
PS85/0429-1	16.6.14	18:11	CTD/RO	in the water	78° 49,90' N	8° 33,70' W	299,7
PS85/0429-1	16.6.14	18:24	CTD/RO	on ground/ max depth	78° 49,88' N	8° 33,89' W	298,6
PS85/0429-1	16.6.14	18:24	CTD/RO	hoisting	78° 49,88' N	8° 33,89' W	298,6
PS85/0429-2	16.6.14	18:29	HN	in the water	78° 49,79' N	8° 34,02' W	303,3
PS85/0429-2	16.6.14	18:32	HN	on ground/ max depth	78° 49,77' N	8° 33,99' W	304,2
PS85/0429-2	16.6.14	18:33	HN	on deck	78° 49,77' N	8° 33,99' W	304,8
PS85/0429-1	16.6.14	18:45	CTD/RO	at surface	78° 49,64' N	8° 33,82' W	304,5

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0429-1	16.6.14	18:46	CTD/RO	on deck	78° 49,63' N	8° 33,78' W	303,2
PS85/0430-1	16.6.14	21:18	CTD/RO	in the water	78° 45,92' N	7° 54,88' W	182,8
PS85/0430-1	16.6.14	21:28	CTD/RO	on ground/ max depth	78° 45,87' N	7° 55,11' W	181,1
PS85/0430-1	16.6.14	21:29	CTD/RO	hoisting	78° 45,86' N	7° 55,13' W	181,4
PS85/0430-1	16.6.14	21:39	CTD/RO	at surface	78° 45,74' N	7° 55,23' W	181,1
PS85/0430-1	16.6.14	21:40	CTD/RO	on deck	78° 45,71' N	7° 55,23' W	181,8
PS85/0431-1	16.6.14	23:08	CTD/RO	in the water	78° 43,91' N	7° 29,12' W	201,0
PS85/0431-1	16.6.14	23:19	CTD/RO	on ground/ max depth	78° 43,82' N	7° 29,25' W	195,7
PS85/0431-1	16.6.14	23:32	CTD/RO	on deck	78° 43,73' N	7° 29,45' W	188,8
PS85/0432-1	17.6.14	1:09	CTD/RO	in the water	78° 39,47' N	7° 0,33' W	219,4
PS85/0432-1	17.6.14	1:21	CTD/RO	on ground/ max depth	78° 39,43' N	7° 0,64' W	223,6
PS85/0432-2	17.6.14	1:21	HN	in the water	78° 39,43' N	7° 0,64' W	223,6
PS85/0432-2	17.6.14	1:26	HN	on ground/ max depth	78° 39,41' N	7° 0,82' W	220,4
PS85/0432-2	17.6.14	1:31	HN	on deck	78° 39,41' N	7° 0,97' W	218,1
PS85/0432-1	17.6.14	1:40	CTD/RO	on deck	78° 39,41' N	7° 1,14' W	216,7
PS85/0433-1	17.6.14	3:42	CTD/RO	in the water	78° 39,33' N	6° 32,26' W	253,6
PS85/0433-1	17.6.14	3:55	CTD/RO	on ground/ max depth	78° 39,52' N	6° 32,54' W	256,3
PS85/0433-1	17.6.14	3:57	CTD/RO	hoisting	78° 39,55' N	6° 32,59' W	258,4
PS85/0433-1	17.6.14	4:10	CTD/RO	on deck	78° 39,76' N	6° 32,95' W	254,2
PS85/0434-1	17.6.14	8:04	CTD/RO	in the water	78° 39,50' N	5° 58,16' W	302,8
PS85/0434-1	17.6.14	8:18	CTD/RO	on ground/ max depth	78° 39,54' N	5° 58,06' W	302,8
PS85/0434-1	17.6.14	8:36	CTD/RO	on deck	78° 39,56' N	5° 57,76' W	302,3
PS85/0434-2	17.6.14	9:18	ICE	in the water	78° 54,00' N	5° 52,80' W	0,0
PS85/0435-1	17.6.14	11:07	CTD/RO	in the water	78° 49,93' N	5° 44,86' W	394,7
PS85/0435-1	17.6.14	11:21	CTD/RO	on ground/ max depth	78° 49,95' N	5° 44,91' W	395,5
PS85/0434-2	17.6.14	11:31	ICE	on ground/ max depth	78° 54,00' N	5° 52,80' W	0,0
PS85/0435-1	17.6.14	11:44	CTD/RO	on deck	78° 49,95' N	5° 45,08' W	395,8
PS85/0436-1	17.6.14	14:04	TVMUC	in the water	78° 58,44' N	5° 17,28' W	1062,4
PS85/0436-1	17.6.14	14:30	TVMUC	on ground/ max depth	78° 58,40' N	5° 17,43' W	1056,3
PS85/0436-1	17.6.14	14:31	TVMUC	hoisting	78° 58,40' N	5° 17,45' W	1056,2
PS85/0436-1	17.6.14	14:58	TVMUC	on deck	78° 58,33' N	5° 17,11' W	1059,1
PS85/0437-1	17.6.14	16:35	CTD/RO	in the water	78° 49,96' N	5° 29,56' W	535,5
PS85/0437-1	17.6.14	16:52	CTD/RO	on ground/ max depth	78° 49,97' N	5° 29,85' W	529,7
PS85/0437-1	17.6.14	16:53	CTD/RO	hoisting	78° 49,97' N	5° 29,85' W	531,3
PS85/0437-1	17.6.14	17:20	CTD/RO	on deck	78° 49,95' N	5° 30,09' W	524,6
PS85/0437-2	17.6.14	17:26	LOKI	in the water	78° 49,95' N	5° 30,12' W	522,1

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0437-2	17.6.14	17:35	LOKI	on ground/ max depth	78° 49,94' N	5° 30,19' W	521,9
PS85/0437-2	17.6.14	17:35	LOKI	profile start	78° 49,94' N	5° 30,19' W	521,9
PS85/0437-2	17.6.14	17:35	LOKI	profile end	78° 49,94' N	5° 30,19' W	521,9
PS85/0437-2	17.6.14	17:36	LOKI	hoisting	78° 49,94' N	5° 30,20' W	521,9
PS85/0437-3	17.6.14	17:51	MN	in the water	78° 49,95' N	5° 30,27' W	521,3
PS85/0437-3	17.6.14	18:05	MN	on ground/ max depth	78° 50,02' N	5° 30,44' W	520,9
PS85/0437-3	17.6.14	18:06	MN	hoisting	78° 50,02' N	5° 30,44' W	521,3
PS85/0437-3	17.6.14	18:25	MN	at surface	78° 50,11' N	5° 30,60' W	522,9
PS85/0437-3	17.6.14	18:28	MN	on deck	78° 50,12' N	5° 30,62' W	523,2
PS85/0438-1	17.6.14	19:18	CTD/RO	in the water	78° 49,85' N	5° 15,34' W	760,3
PS85/0438-1	17.6.14	19:43	CTD/RO	on ground/ max depth	78° 49,85' N	5° 15,29' W	759,9
PS85/0438-1	17.6.14	19:44	CTD/RO	hoisting	78° 49,85' N	5° 15,29' W	760,7
PS85/0438-1	17.6.14	20:07	CTD/RO	at surface	78° 49,82' N	5° 15,16' W	762,3
PS85/0438-1	17.6.14	20:08	CTD/RO	on deck	78° 49,82' N	5° 15,16' W	762,7
PS85/0439-1	17.6.14	20:56	CTD/RO	in the water	78° 50,10' N	5° 1,35' W	986,8
PS85/0439-1	17.6.14	21:26	CTD/RO	on ground/ max depth	78° 49,79' N	5° 1,22' W	993,8
PS85/0439-1	17.6.14	21:27	CTD/RO	hoisting	78° 49,79' N	5° 1,23' W	984,2
PS85/0439-1	17.6.14	21:56	CTD/RO	at surface	78° 49,43' N	5° 0,84' W	978,6
PS85/0439-1	17.6.14	21:57	CTD/RO	on deck	78° 49,41' N	5° 0,81' W	991,8
PS85/0440-1	17.6.14	23:02	CTD/RO	in the water	78° 50,15' N	4° 44,07' W	1265,0
PS85/0440-1	17.6.14	23:34	CTD/RO	on ground/ max depth	78° 49,65' N	4° 44,68' W	1238,4
PS85/0440-1	18.6.14	0:08	CTD/RO	on deck	78° 49,39' N	4° 46,43' W	1202,1
PS85/0441-1	18.6.14	2:36	TVMUC	in the water	78° 56,52' N	4° 39,15' W	1506,3
PS85/0441-1	18.6.14	2:41	TVMUC	on deck	78° 56,48' N	4° 39,22' W	1515,2
PS85/0441-1	18.6.14	2:46	TVMUC	in the water	78° 56,41' N	4° 39,20' W	1498,9
PS85/0441-1	18.6.14	3:18	TVMUC	on ground/ max depth	78° 56,01' N	4° 39,02' W	1499,7
PS85/0441-1	18.6.14	3:47	TVMUC	at surface	78° 55,74' N	4° 39,35' W	1487,4
PS85/0441-1	18.6.14	3:52	TVMUC	on deck	78° 55,69' N	4° 39,48' W	1483,6
PS85/0442-1	18.6.14	5:06	CTD/RO	in the water	78° 50,00' N	4° 30,28' W	1453,2
PS85/0442-1	18.6.14	5:41	CTD/RO	on ground/ max depth	78° 49,53' N	4° 31,10' W	1424,9
PS85/0442-1	18.6.14	5:41	CTD/RO	hoisting	78° 49,53' N	4° 31,10' W	1424,9
PS85/0442-1	18.6.14	6:23	CTD/RO	at surface	78° 48,95' N	4° 31,74' W	1404,1
PS85/0442-1	18.6.14	6:24	CTD/RO	on deck	78° 48,93' N	4° 31,75' W	1402,1
PS85/0443-1	18.6.14	8:03	CTD/RO	in the water	78° 50,87' N	4° 14,43' W	1701,2
PS85/0443-1	18.6.14	8:48	CTD/RO	on ground/ max depth	78° 49,90' N	4° 15,62' W	1660,4
PS85/0443-1	18.6.14	8:49	CTD/RO	hoisting	78° 49,88' N	4° 15,65' W	1661,3
PS85/0443-1	18.6.14	9:48	CTD/RO	at surface	78° 48,74' N	4° 19,76' W	1576,1
PS85/0443-1	18.6.14	9:49	CTD/RO	on deck	78° 48,72' N	4° 19,78' W	1575,0

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0443-2	18.6.14	9:56	ICE	in the water	78° 54,00' N	4° 29,40' W	0,0
PS85/0443-2	18.6.14	13:53	ICE	on ground/ max depth	78° 54,00' N	4° 29,40' W	0,0
PS85/0444-1	18.6.14	15:05	CTD/RO	in the water	78° 50,29' N	3° 58,56' W	1894,2
PS85/0444-1	18.6.14	15:49	CTD/RO	on ground/ max depth	78° 49,87' N	3° 58,82' W	1882,4
PS85/0444-1	18.6.14	15:50	CTD/RO	hoisting	78° 49,87' N	3° 58,85' W	1880,4
PS85/0444-1	18.6.14	16:45	CTD/RO	on deck	78° 49,23' N	4° 0,67' W	1849,6
PS85/0444-2	18.6.14	16:59	LOKI	in the water	78° 48,66' N	4° 1,13' W	1831,5
PS85/0444-2	18.6.14	17:48	LOKI	on ground/ max depth	78° 48,09' N	4° 1,81' W	1816,0
PS85/0444-2	18.6.14	17:48	LOKI	profile start	78° 48,09' N	4° 1,81' W	1816,0
PS85/0444-2	18.6.14	17:48	LOKI	hoisting	78° 48,09' N	4° 1,81' W	1816,0
PS85/0444-2	18.6.14	17:48	LOKI	profile end	78° 48,09' N	4° 1,81' W	1816,0
PS85/0444-2	18.6.14	18:26	LOKI	at surface	78° 47,43' N	4° 2,25' W	1799,8
PS85/0444-2	18.6.14	18:30	LOKI	on deck	78° 47,35' N	4° 2,23' W	1797,8
PS85/0444-3	18.6.14	18:39	MN	in the water	78° 47,26' N	4° 2,55' W	1791,8
PS85/0444-3	18.6.14	19:31	MN	on ground/ max depth	78° 46,48' N	4° 3,96' W	1761,5
PS85/0444-3	18.6.14	19:31	MN	hoisting	78° 46,48' N	4° 3,96' W	1761,5
PS85/0444-3	18.6.14	20:32	MN	at surface	78° 45,59' N	4° 5,37' W	1734,6
PS85/0444-3	18.6.14	20:36	MN	on deck	78° 45,54' N	4° 5,29' W	1735,4
PS85/0445-1	19.6.14	1:23	MUC	in the water	78° 48,56' N	3° 52,50' W	1946,2
PS85/0445-1	19.6.14	2:02	MUC	on ground/ max depth	78° 48,19' N	3° 52,52' W	1943,8
PS85/0445-1	19.6.14	2:03	MUC	hoisting	78° 48,17' N	3° 52,51' W	1942,9
PS85/0445-1	19.6.14	2:43	MUC	on deck	78° 47,69' N	3° 53,24' W	1934,8
PS85/0446-1	19.6.14	10:22	CTD/RO	in the water	78° 52,03' N	3° 45,46' W	2074,4
PS85/0446-1	19.6.14	11:12	CTD/RO	on ground/ max depth	78° 51,46' N	3° 45,38' W	2071,0
PS85/0446-1	19.6.14	12:02	CTD/RO	on deck	78° 50,76' N	3° 45,85' W	2054,3
PS85/0447-1	19.6.14	14:25	CTD/RO	in the water	78° 48,03' N	3° 29,95' W	2205,8
PS85/0447-1	19.6.14	15:22	CTD/RO	on ground/ max depth	78° 47,34' N	3° 30,28' W	2187,7
PS85/0447-1	19.6.14	15:23	CTD/RO	hoisting	78° 47,33' N	3° 30,29' W	2187,6
PS85/0447-1	19.6.14	16:16	CTD/RO	on deck	78° 46,81' N	3° 31,16' W	2167,4
PS85/0448-1	19.6.14	18:44	CTD/RO	in the water	78° 43,42' N	3° 15,40' W	2247,1
PS85/0448-1	19.6.14	19:40	CTD/RO	on ground/ max depth	78° 43,31' N	3° 15,51' W	2255,5
PS85/0448-1	19.6.14	19:41	CTD/RO	hoisting	78° 43,31' N	3° 15,51' W	2254,6
PS85/0448-1	19.6.14	20:48	CTD/RO	on deck	78° 43,23' N	3° 15,36' W	2253,8
PS85/0449-1	20.6.14	1:52	CTD/RO	in the water	78° 35,68' N	2° 40,50' W	2530,7
PS85/0449-1	20.6.14	2:50	CTD/RO	on ground/ max depth	78° 35,41' N	2° 41,53' W	2523,1
PS85/0449-1	20.6.14	2:51	CTD/RO	hoisting	78° 35,40' N	2° 41,57' W	2522,8
PS85/0449-1	20.6.14	3:57	CTD/RO	on deck	78° 35,03' N	2° 42,63' W	2518,3

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0449-2	20.6.14	4:04	LOKI	in the water	78° 35,00' N	2° 42,68' W	2522,1
PS85/0449-2	20.6.14	4:58	LOKI	on ground/ max depth	78° 34,80' N	2° 44,00' W	2520,1
PS85/0449-2	20.6.14	4:59	LOKI	hoisting	78° 34,79' N	2° 44,03' W	2517,8
PS85/0449-2	20.6.14	4:59	LOKI	profile start	78° 34,79' N	2° 44,03' W	2517,8
PS85/0449-2	20.6.14	5:40	LOKI	profile end	78° 34,76' N	2° 44,68' W	2514,3
PS85/0449-2	20.6.14	5:41	LOKI	on deck	78° 34,76' N	2° 44,71' W	2516,7
PS85/0450-1	20.6.14	6:42	MOR	in the water	78° 36,70' N	2° 52,34' W	2468,4
PS85/0450-1	20.6.14	6:42	MOR	in the water	78° 36,70' N	2° 52,34' W	2468,4
PS85/0450-1	20.6.14	6:49	MOR	in the water	78° 36,70' N	2° 52,45' W	2448,3
PS85/0450-1	20.6.14	6:57	MOR	in the water	78° 36,71' N	2° 52,44' W	2447,7
PS85/0450-1	20.6.14	7:04	MOR	in the water	78° 36,72' N	2° 52,39' W	2449,1
PS85/0450-1	20.6.14	7:10	MOR	in the water	78° 36,72' N	2° 52,37' W	2447,9
PS85/0450-1	20.6.14	7:24	MOR	in the water	78° 36,67' N	2° 52,75' W	2445,2
PS85/0450-1	20.6.14	7:37	MOR	in the water	78° 36,67' N	2° 52,75' W	2446,5
PS85/0450-1	20.6.14	7:48	MOR	in the water	78° 36,66' N	2° 52,72' W	2445,0
PS85/0450-1	20.6.14	7:59	MOR	in the water	78° 36,67' N	2° 52,72' W	2444,9
PS85/0450-1	20.6.14	8:05	MOR	in the water	78° 36,66' N	2° 52,80' W	2444,8
PS85/0450-1	20.6.14	8:12	MOR	in the water	78° 36,66' N	2° 52,86' W	2444,5
PS85/0450-1	20.6.14	8:16	MOR	in the water	78° 36,66' N	2° 52,85' W	2443,7
PS85/0450-1	20.6.14	8:23	MOR	on ground/ max depth	78° 36,68' N	2° 52,84' W	2443,1
PS85/0450-1	20.6.14	8:23	MOR	in the water	78° 36,68' N	2° 52,84' W	2443,1
PS85/0450-1	20.6.14	8:24	MOR	action	78° 36,68' N	2° 52,84' W	2445,4
PS85/0450-1	20.6.14	8:25	MOR	on deck	78° 36,68' N	2° 52,84' W	2443,7
PS85/0451-1	20.6.14	8:53	MN	in the water	78° 35,99' N	2° 50,79' W	2458,7
PS85/0451-1	20.6.14	9:39	MN	on ground/ max depth	78° 35,97' N	2° 50,70' W	2459,2
PS85/0451-1	20.6.14	9:40	MN	hoisting	78° 35,97' N	2° 50,69' W	2464,0
PS85/0451-1	20.6.14	10:33	MN	on deck	78° 35,89' N	2° 50,31' W	2465,6
PS85/0452-1	20.6.14	10:59	MOR	in the water	78° 34,53' N	2° 45,76' W	2506,8
PS85/0452-1	20.6.14	11:02	MOR	in the water	78° 34,51' N	2° 45,67' W	2508,1
PS85/0452-1	20.6.14	11:30	MOR	in the water	78° 34,41' N	2° 45,45' W	2511,9
PS85/0452-1	20.6.14	11:48	MOR	in the water	78° 34,33' N	2° 45,34' W	2511,9
PS85/0452-1	20.6.14	13:05	MOR	in the water	78° 33,93' N	2° 45,06' W	2517,2
PS85/0452-1	20.6.14	13:16	MOR	on ground/ max depth	78° 33,84' N	2° 45,12' W	2519,8
PS85/0452-1	20.6.14	13:17	MOR	action	78° 33,84' N	2° 45,10' W	2518,0
PS85/0452-1	20.6.14	13:18	MOR	on deck	78° 33,84' N	2° 45,09' W	2516,7
PS85/0452-1	20.6.14	13:22	MOR	on deck	78° 33,82' N	2° 45,03' W	2517,7
PS85/0453-1	20.6.14	14:13	MOR	in the water	78° 32,29' N	2° 44,51' W	2532,2
PS85/0453-1	20.6.14	14:19	MOR	in the water	78° 32,25' N	2° 44,57' W	2533,3
PS85/0453-1	20.6.14	14:27	MOR	in the water	78° 32,19' N	2° 44,61' W	2543,1
PS85/0453-1	20.6.14	14:31	MOR	in the water	78° 32,16' N	2° 44,60' W	2533,8

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0453-1	20.6.14	14:43	MOR	in the water	78° 32,09' N	2° 44,65' W	2536,2
PS85/0453-1	20.6.14	14:57	MOR	in the water	78° 32,00' N	2° 44,77' W	2536,4
PS85/0453-1	20.6.14	15:26	MOR	in the water	78° 31,83' N	2° 45,52' W	2535,0
PS85/0453-1	20.6.14	15:29	MOR	in the water	78° 31,81' N	2° 45,50' W	2535,8
PS85/0453-1	20.6.14	15:39	MOR	in the water	78° 31,75' N	2° 45,75' W	2533,8
PS85/0453-1	20.6.14	15:48	MOR	on ground/ max depth	78° 31,69' N	2° 45,87' W	2534,8
PS85/0453-1	20.6.14	15:48	MOR	in the water	78° 31,69' N	2° 45,87' W	2534,8
PS85/0453-1	20.6.14	15:48	MOR	action	78° 31,69' N	2° 45,87' W	2534,8
PS85/0453-1	20.6.14	15:49	MOR	on deck	78° 31,69' N	2° 45,87' W	2534,5
PS85/0453-1	20.6.14	15:52	MOR	on deck	78° 31,66' N	2° 45,88' W	2535,8
PS85/0454-1	20.6.14	16:14	MN	in the water	78° 30,71' N	2° 47,71' W	2554,4
PS85/0454-1	20.6.14	16:22	MN	on ground/ max depth	78° 30,65' N	2° 47,94' W	2553,4
PS85/0454-1	20.6.14	16:22	MN	hoisting	78° 30,65' N	2° 47,94' W	2553,4
PS85/0454-1	20.6.14	16:33	MN	on deck	78° 30,61' N	2° 48,09' W	2557,8
PS85/0454-2	20.6.14	16:45	ICE	in the water	78° 30,58' N	2° 48,06' W	2555,0
PS85/0454-2	20.6.14	16:50	ICE	action	78° 30,56' N	2° 48,11' W	2556,9
PS85/0454-2	20.6.14	16:54	ICE	on deck	78° 30,52' N	2° 48,03' W	2556,8
PS85/0454-2	20.6.14	16:58	ICE	in the water	78° 30,50' N	2° 48,12' W	2559,0
PS85/0454-2	20.6.14	17:00	ICE	action	78° 30,50' N	2° 48,10' W	2558,0
PS85/0454-3	20.6.14	17:09	TVMUC	in the water	78° 30,47' N	2° 48,11' W	2559,5
PS85/0454-3	20.6.14	17:59	TVMUC	on ground/ max depth	78° 30,34' N	2° 49,06' W	2557,7
PS85/0454-3	20.6.14	18:00	TVMUC	hoisting	78° 30,34' N	2° 49,07' W	2557,6
PS85/0454-2	20.6.14	18:48	ICE	action	78° 30,31' N	2° 49,83' W	2556,0
PS85/0454-3	20.6.14	18:49	TVMUC	at surface	78° 30,31' N	2° 49,84' W	2554,6
PS85/0454-3	20.6.14	18:54	TVMUC	on deck	78° 30,31' N	2° 49,91' W	2554,5
PS85/0454-2	20.6.14	19:07	ICE	on ground/ max depth	78° 30,31' N	2° 50,06' W	2554,2
PS85/0454-2	20.6.14	19:08	ICE	action	78° 30,31' N	2° 50,07' W	2553,4
PS85/0454-2	20.6.14	19:15	ICE	on deck	78° 30,31' N	2° 50,20' W	2551,2
PS85/0454-4	20.6.14	19:21	TVMUC	in the water	78° 30,30' N	2° 50,26' W	2552,8
PS85/0454-4	20.6.14	20:06	TVMUC	information	78° 30,29' N	2° 50,61' W	2549,2
PS85/0454-4	20.6.14	20:16	TVMUC	on ground/ max depth	78° 30,30' N	2° 50,53' W	2550,0
PS85/0454-4	20.6.14	20:16	TVMUC	hoisting	78° 30,30' N	2° 50,53' W	2550,0
PS85/0454-4	20.6.14	21:06	TVMUC	at surface	78° 30,33' N	2° 50,35' W	2550,8
PS85/0454-4	20.6.14	21:10	TVMUC	on deck	78° 30,33' N	2° 50,29' W	2550,6
PS85/0454-5	20.6.14	21:34	TVMUC	in the water	78° 30,31' N	2° 49,94' W	2553,6
PS85/0454-5	20.6.14	22:23	TVMUC	action	78° 30,24' N	2° 49,55' W	2560,1
PS85/0454-5	20.6.14	22:28	TVMUC	on ground/ max depth	78° 30,23' N	2° 49,49' W	2561,0
PS85/0454-5	20.6.14	22:29	TVMUC	hoisting	78° 30,23' N	2° 49,49' W	2561,3
PS85/0454-5	20.6.14	23:29	TVMUC	on deck	78° 29,96' N	2° 48,73' W	2575,5

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0455-1	21.6.14	0:05	OFOS	in the water	78° 29,63' N	2° 48,63' W	2583,1
PS85/0455-1	21.6.14	0:45	OFOS	action	78° 29,33' N	2° 48,13' W	2588,1
PS85/0455-1	21.6.14	0:46	OFOS	on ground/ max depth	78° 29,32' N	2° 48,12' W	2584,7
PS85/0455-1	21.6.14	0:46	OFOS	profile start	78° 29,32' N	2° 48,12' W	2584,7
PS85/0455-1	21.6.14	4:53	OFOS	profile end	78° 27,29' N	2° 49,56' W	2609,4
PS85/0455-1	21.6.14	4:53	OFOS	hoisting	78° 27,29' N	2° 49,56' W	2609,4
PS85/0455-1	21.6.14	5:35	OFOS	on deck	78° 27,21' N	2° 49,71' W	2610,2
PS85/0455-2	21.6.14	5:42	CTD/RO	in the water	78° 27,20' N	2° 49,78' W	2609,1
PS85/0455-2	21.6.14	6:01	CTD/RO	on ground/ max depth	78° 27,20' N	2° 49,97' W	2609,6
PS85/0455-2	21.6.14	6:01	CTD/RO	hoisting	78° 27,20' N	2° 49,97' W	2609,6
PS85/0455-2	21.6.14	6:29	CTD/RO	on deck	78° 27,22' N	2° 49,78' W	2610,6
PS85/0456-1	22.6.14	1:46	CTD/RO	in the water	79° 0,40' N	4° 19,83' E	2548,5
PS85/0456-1	22.6.14	2:44	CTD/RO	on ground/ max depth	79° 0,29' N	4° 19,48' E	2558,8
PS85/0456-1	22.6.14	2:45	CTD/RO	hoisting	79° 0,29' N	4° 19,49' E	2553,1
PS85/0456-1	22.6.14	3:46	CTD/RO	on deck	79° 0,35' N	4° 19,32' E	2553,0
PS85/0456-2	22.6.14	3:57	LOKI	in the water	79° 0,34' N	4° 19,43' E	2556,1
PS85/0456-2	22.6.14	4:33	LOKI	on ground/ max depth	79° 0,28' N	4° 19,52' E	2556,4
PS85/0456-2	22.6.14	4:34	LOKI	hoisting	79° 0,28' N	4° 19,53' E	2555,7
PS85/0456-2	22.6.14	4:34	LOKI	profile start	79° 0,28' N	4° 19,53' E	2555,7
PS85/0456-2	22.6.14	5:10	LOKI	profile end	79° 0,21' N	4° 19,73' E	2555,2
PS85/0456-2	22.6.14	5:13	LOKI	on deck	79° 0,20' N	4° 19,74' E	2554,5
PS85/0456-3	22.6.14	5:29	MN	in the water	79° 0,16' N	4° 19,82' E	2556,2
PS85/0456-3	22.6.14	6:13	MN	on ground/ max depth	79° 0,01' N	4° 20,42' E	2557,7
PS85/0456-3	22.6.14	6:13	MN	hoisting	79° 0,01' N	4° 20,42' E	2557,7
PS85/0456-3	22.6.14	7:03	MN	at surface	78° 59,87' N	4° 20,56' E	2556,9
PS85/0456-3	22.6.14	7:07	MN	on deck	78° 59,86' N	4° 20,63' E	2560,3
PS85/0457-1	22.6.14	8:00	ZODIAK	in the water	79° 3,18' N	4° 8,47' E	2495,2
PS85/0457-2	22.6.14	8:18	BL_C	in the water	79° 3,18' N	4° 8,35' E	2498,6
PS85/0457-2	22.6.14	8:18	BL_C	in the water	79° 3,18' N	4° 8,35' E	2498,6
PS85/0457-1	22.6.14	8:25	ZODIAK	action	79° 3,17' N	4° 8,38' E	2472,5
PS85/0457-2	22.6.14	9:03	BL_C	in the water	79° 3,17' N	4° 8,39' E	2498,1
PS85/0457-2	22.6.14	9:07	BL_C	in the water	79° 3,17' N	4° 8,35' E	2498,7
PS85/0457-2	22.6.14	9:11	BL_C	in the water	79° 3,18' N	4° 8,32' E	2475,7
PS85/0457-1	22.6.14	9:13	ZODIAK	action	79° 3,18' N	4° 8,32' E	2500,4
PS85/0457-2	22.6.14	9:16	BL_C	in the water	79° 3,18' N	4° 8,33' E	2486,4
PS85/0457-2	22.6.14	9:20	BL_C	on ground/ max depth	79° 3,16' N	4° 8,33' E	2499,9
PS85/0457-2	22.6.14	9:21	BL_C	in the water	79° 3,16' N	4° 8,33' E	2492,6
PS85/0457-2	22.6.14	9:21	BL_C	action	79° 3,16' N	4° 8,33' E	2492,6
PS85/0457-2	22.6.14	9:23	BL_C	on deck	79° 3,16' N	4° 8,33' E	2500,6

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0457-1	22.6.14	9:27	ZODIAK	on ground/ max depth	79° 3,16' N	4° 8,36' E	2502,2
PS85/0457-1	22.6.14	9:28	ZODIAK	on deck	79° 3,16' N	4° 8,37' E	2499,7
PS85/0457-2	22.6.14	9:28	BL_C	on deck	79° 3,16' N	4° 8,37' E	2499,7
PS85/0458-1	22.6.14	10:58	MOR	on ground/ max depth	79° 3,77' N	4° 2,56' E	2545,9
PS85/0458-1	22.6.14	11:01	MOR	action	79° 3,75' N	4° 2,64' E	2548,4
PS85/0458-1	22.6.14	11:05	MOR	action	79° 3,74' N	4° 2,79' E	2546,0
PS85/0458-1	22.6.14	11:18	MOR	action	79° 3,67' N	4° 1,39' E	2574,6
PS85/0458-1	22.6.14	11:20	MOR	on deck	79° 3,65' N	4° 1,37' E	2578,0
PS85/0458-1	22.6.14	11:28	MOR	on deck	79° 3,64' N	4° 1,65' E	2578,2
PS85/0458-1	22.6.14	11:41	MOR	on deck	79° 3,59' N	4° 1,92' E	2575,6
PS85/0458-1	22.6.14	11:59	MOR	on deck	79° 3,54' N	4° 2,06' E	2578,6
PS85/0458-1	22.6.14	12:07	MOR	on deck	79° 3,53' N	4° 2,05' E	2579,4
PS85/0458-1	22.6.14	12:19	MOR	on deck	79° 3,51' N	4° 2,16' E	2579,7
PS85/0458-1	22.6.14	12:34	MOR	on deck	79° 3,49' N	4° 2,45' E	2576,6
PS85/0458-1	22.6.14	12:41	MOR	on deck	79° 3,48' N	4° 2,64' E	2576,4
PS85/0458-1	22.6.14	12:49	MOR	on deck	79° 3,47' N	4° 2,87' E	2572,9
PS85/0458-1	22.6.14	12:58	MOR	on deck	79° 3,49' N	4° 3,07' E	2568,2
PS85/0459-1	22.6.14	13:19	BL_C	on ground/ max depth	79° 4,48' N	4° 4,51' E	2475,2
PS85/0459-1	22.6.14	14:05	BL_C	at surface	79° 4,33' N	4° 3,41' E	2500,2
PS85/0459-1	22.6.14	14:11	BL_C	hoisting	79° 4,21' N	4° 2,97' E	2515,3
PS85/0459-1	22.6.14	14:16	BL_C	on deck	79° 4,19' N	4° 2,70' E	2521,0
PS85/0460-1	22.6.14	14:44	CTD/RO	in the water	79° 3,92' N	4° 11,08' E	2402,4
PS85/0460-2	22.6.14	15:08	ICE	in the water	79° 3,93' N	4° 10,79' E	2403,1
PS85/0460-2	22.6.14	15:25	ICE	action	79° 3,91' N	4° 10,71' E	2406,2
PS85/0460-1	22.6.14	15:37	CTD/RO	on ground/ max depth	79° 3,90' N	4° 10,73' E	2404,4
PS85/0460-1	22.6.14	15:39	CTD/RO	hoisting	79° 3,90' N	4° 10,70' E	2405,4
PS85/0460-2	22.6.14	16:27	ICE	action	79° 3,91' N	4° 11,11' E	2401,1
PS85/0460-2	22.6.14	16:40	ICE	on ground/ max depth	79° 3,92' N	4° 11,11' E	2399,5
PS85/0460-2	22.6.14	16:40	ICE	on deck	79° 3,92' N	4° 11,11' E	2399,5
PS85/0460-1	22.6.14	16:43	CTD/RO	on deck	79° 3,92' N	4° 11,10' E	2401,1
PS85/0460-3	22.6.14	16:53	BONGO	in the water	79° 3,92' N	4° 11,02' E	2401,1
PS85/0460-3	22.6.14	17:00	BONGO	on ground/ max depth	79° 3,91' N	4° 11,00' E	2402,1
PS85/0460-3	22.6.14	17:01	BONGO	hoisting	79° 3,91' N	4° 10,98' E	2401,8
PS85/0460-3	22.6.14	17:05	BONGO	on deck	79° 3,90' N	4° 10,88' E	2403,5
PS85/0460-3	22.6.14	17:07	BONGO	in the water	79° 3,90' N	4° 10,82' E	2405,2
PS85/0460-3	22.6.14	17:14	BONGO	on ground/ max depth	79° 3,90' N	4° 10,74' E	2405,3
PS85/0460-3	22.6.14	17:14	BONGO	hoisting	79° 3,90' N	4° 10,74' E	2405,3
PS85/0460-3	22.6.14	17:19	BONGO	on deck	79° 3,90' N	4° 10,65' E	2408,3

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0460-3	22.6.14	17:27	BONGO	on ground/ max depth	79° 3,91' N	4° 10,58' E	2411,5
PS85/0460-3	22.6.14	17:27	BONGO	hoisting	79° 3,91' N	4° 10,58' E	2411,5
PS85/0460-3	22.6.14	17:32	BONGO	on deck	79° 3,90' N	4° 10,57' E	2406,0
PS85/0460-3	22.6.14	17:34	BONGO	in the water	79° 3,90' N	4° 10,57' E	2406,8
PS85/0460-3	22.6.14	17:40	BONGO	on ground/ max depth	79° 3,89' N	4° 10,60' E	2410,0
PS85/0460-3	22.6.14	17:40	BONGO	hoisting	79° 3,89' N	4° 10,60' E	2410,0
PS85/0460-3	22.6.14	17:47	BONGO	on deck	79° 3,89' N	4° 10,53' E	2408,6
PS85/0460-4	22.6.14	18:02	TVMUC	in the water	79° 3,91' N	4° 10,93' E	2405,0
PS85/0460-4	22.6.14	18:47	TVMUC	information	79° 3,91' N	4° 10,98' E	2402,6
PS85/0460-4	22.6.14	18:47	TVMUC	on ground/ max depth	79° 3,91' N	4° 10,98' E	2402,6
PS85/0460-4	22.6.14	18:48	TVMUC	hoisting	79° 3,91' N	4° 10,98' E	2402,2
PS85/0460-4	22.6.14	19:35	TVMUC	at surface	79° 3,95' N	4° 10,97' E	2403,8
PS85/0460-4	22.6.14	19:39	TVMUC	on deck	79° 3,94' N	4° 11,01' E	2401,6
PS85/0460-5	22.6.14	20:00	TVMUC	in the water	79° 3,89' N	4° 10,85' E	2404,4
PS85/0460-5	22.6.14	20:47	TVMUC	information	79° 3,91' N	4° 10,86' E	2404,6
PS85/0460-5	22.6.14	20:50	TVMUC	on ground/ max depth	79° 3,91' N	4° 10,90' E	2405,9
PS85/0460-5	22.6.14	20:51	TVMUC	hoisting	79° 3,91' N	4° 10,90' E	2402,8
PS85/0460-5	22.6.14	21:39	TVMUC	at surface	79° 3,91' N	4° 10,94' E	2403,4
PS85/0460-5	22.6.14	21:43	TVMUC	on deck	79° 3,90' N	4° 10,94' E	2405,2
PS85/0460-6	22.6.14	22:04	TVMUC	in the water	79° 3,89' N	4° 10,74' E	2409,6
PS85/0460-6	22.6.14	22:50	TVMUC	action	79° 3,90' N	4° 10,96' E	2403,3
PS85/0460-6	22.6.14	22:53	TVMUC	on ground/ max depth	79° 3,91' N	4° 11,02' E	2403,4
PS85/0460-6	22.6.14	23:46	TVMUC	on deck	79° 3,84' N	4° 10,79' E	2411,6
PS85/0461-1	23.6.14	0:25	OFOS	in the water	79° 2,01' N	4° 9,94' E	2565,7
PS85/0461-1	23.6.14	1:01	OFOS	action	79° 2,01' N	4° 9,98' E	2566,8
PS85/0461-1	23.6.14	1:02	OFOS	on ground/ max depth	79° 2,01' N	4° 9,98' E	2565,6
PS85/0461-1	23.6.14	1:02	OFOS	profile start	79° 2,01' N	4° 9,98' E	2565,6
PS85/0461-1	23.6.14	2:51	OFOS	action	79° 2,71' N	4° 12,72' E	2497,1
PS85/0461-1	23.6.14	4:38	OFOS	action	79° 3,68' N	4° 16,52' E	2373,9
PS85/0461-1	23.6.14	5:06	OFOS	profile end	79° 3,89' N	4° 17,26' E	2353,1
PS85/0461-1	23.6.14	5:11	OFOS	hoisting	79° 3,93' N	4° 17,38' E	2349,8
PS85/0461-1	23.6.14	5:47	OFOS	on deck	79° 3,86' N	4° 17,08' E	2355,2
PS85/0461-2	23.6.14	6:38	MN	in the water	79° 3,84' N	4° 16,89' E	2359,4
PS85/0461-3	23.6.14	7:19	ZODIAK	in the water	79° 3,81' N	4° 16,74' E	2361,3
PS85/0461-2	23.6.14	7:23	MN	on ground/ max depth	79° 3,80' N	4° 16,77' E	2360,6
PS85/0461-2	23.6.14	7:23	MN	hoisting	79° 3,80' N	4° 16,77' E	2360,6
PS85/0461-3	23.6.14	7:41	ZODIAK	action	79° 3,78' N	4° 16,66' E	2363,2
PS85/0461-3	23.6.14	7:42	ZODIAK	on ground/ max depth	79° 3,77' N	4° 16,64' E	2364,5

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0461-2	23.6.14	8:10	MN	at surface	79° 3,72' N	4° 16,48' E	2368,7
PS85/0461-2	23.6.14	8:13	MN	on deck	79° 3,71' N	4° 16,45' E	2370,4
PS85/0461-3	23.6.14	8:45	ZODIAK	action	79° 0,85' N	4° 18,85' E	2537,0
PS85/0462-1	23.6.14	9:02	MOR	in the water	79° 0,62' N	4° 19,68' E	2535,0
PS85/0462-1	23.6.14	9:02	MOR	in the water	79° 0,62' N	4° 19,68' E	2535,0
PS85/0462-1	23.6.14	9:10	MOR	in the water	79° 0,57' N	4° 20,02' E	2535,9
PS85/0462-1	23.6.14	9:16	MOR	in the water	79° 0,57' N	4° 20,56' E	2536,1
PS85/0461-3	23.6.14	9:21	ZODIAK	on deck	79° 0,57' N	4° 21,05' E	2533,2
PS85/0462-1	23.6.14	9:27	MOR	in the water	79° 0,56' N	4° 21,56' E	2533,1
PS85/0462-1	23.6.14	9:34	MOR	in the water	79° 0,57' N	4° 22,32' E	2523,4
PS85/0462-1	23.6.14	9:49	MOR	in the water	79° 0,42' N	4° 23,14' E	2522,1
PS85/0462-1	23.6.14	10:03	MOR	in the water	79° 0,22' N	4° 23,64' E	2524,4
PS85/0462-1	23.6.14	10:10	MOR	in the water	79° 0,21' N	4° 24,00' E	2521,9
PS85/0462-1	23.6.14	10:26	MOR	in the water	79° 0,20' N	4° 24,49' E	2519,7
PS85/0462-1	23.6.14	10:40	MOR	in the water	79° 0,21' N	4° 24,47' E	2518,4
PS85/0462-1	23.6.14	10:53	MOR	in the water	79° 0,25' N	4° 24,59' E	2514,5
PS85/0462-1	23.6.14	10:59	MOR	action	79° 0,24' N	4° 24,71' E	2516,3
PS85/0462-1	23.6.14	11:00	MOR	on ground/ max depth	79° 0,24' N	4° 24,76' E	2517,2
PS85/0462-1	23.6.14	11:01	MOR	on deck	79° 0,25' N	4° 24,82' E	2515,2
PS85/0462-1	23.6.14	11:05	MOR	on deck	79° 0,26' N	4° 25,09' E	2511,9
PS85/0463-1	23.6.14	13:00	TVMUC	in the water	79° 3,16' N	3° 40,31' E	3038,8
PS85/0463-1	23.6.14	13:58	TVMUC	on ground/ max depth	79° 3,14' N	3° 40,37' E	3033,6
PS85/0463-1	23.6.14	15:13	TVMUC	on deck	79° 2,93' N	3° 41,01' E	2962,1
PS85/0464-1	23.6.14	15:45	TVMUC	in the water	79° 3,53' N	3° 33,49' E	3610,0
PS85/0464-1	23.6.14	16:31	TVMUC	on ground/ max depth	79° 3,55' N	3° 34,37' E	3531,0
PS85/0464-1	23.6.14	16:31	TVMUC	hoisting	79° 3,55' N	3° 34,37' E	3531,0
PS85/0464-1	23.6.14	17:29	TVMUC	on deck	79° 3,42' N	3° 35,55' E	3423,1
PS85/0465-1	23.6.14	19:35	CTD/RO	in the water	79° 8,73' N	2° 45,24' E	5534,7
PS85/0465-1	23.6.14	21:29	CTD/RO	on ground/ max depth	79° 8,92' N	2° 47,45' E	5537,0
PS85/0465-1	23.6.14	21:31	CTD/RO	hoisting	79° 8,92' N	2° 47,49' E	5541,3
PS85/0465-2	23.6.14	23:27	HN	in the water	79° 9,10' N	2° 50,44' E	5534,2
PS85/0465-2	23.6.14	23:32	HN	on ground/ max depth	79° 9,13' N	2° 50,50' E	5533,6
PS85/0465-2	23.6.14	23:37	HN	on deck	79° 9,17' N	2° 50,54' E	5537,6
PS85/0465-1	23.6.14	23:44	CTD/RO	on deck	79° 9,20' N	2° 50,60' E	5528,5
PS85/0465-3	23.6.14	23:50	LOKI	in the water	79° 9,22' N	2° 50,67' E	5531,9
PS85/0465-3	24.6.14	0:30	LOKI	on ground/ max depth	79° 9,32' N	2° 51,06' E	5532,3
PS85/0465-3	24.6.14	0:31	LOKI	profile start	79° 9,32' N	2° 51,07' E	5537,6
PS85/0465-3	24.6.14	1:07	LOKI	profile end	79° 9,30' N	2° 52,17' E	5529,1
PS85/0465-3	24.6.14	1:08	LOKI	on deck	79° 9,30' N	2° 52,19' E	5530,4

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0465-4	24.6.14	1:24	TVMUC	in the water	79° 9,36' N	2° 52,23' E	5529,1
PS85/0465-4	24.6.14	2:48	TVMUC	on ground/ max depth	79° 9,50' N	2° 52,97' E	5524,6
PS85/0465-4	24.6.14	2:49	TVMUC	hoisting	79° 9,50' N	2° 52,99' E	5525,9
PS85/0465-4	24.6.14	4:55	TVMUC	at surface	79° 9,87' N	2° 52,88' E	5525,1
PS85/0465-4	24.6.14	4:58	TVMUC	on deck	79° 9,90' N	2° 52,83' E	5525,1
PS85/0466-1	24.6.14	7:39	BL_C	action	79° 3,32' N	4° 8,61' E	2477,5
PS85/0466-1	24.6.14	8:29	BL_C	on ground/ max depth	79° 3,35' N	4° 8,57' E	2472,5
PS85/0466-1	24.6.14	8:31	BL_C	at surface	79° 3,35' N	4° 8,56' E	2474,7
PS85/0466-1	24.6.14	8:58	BL_C	on deck	79° 3,24' N	4° 8,51' E	2490,0
PS85/0466-1	24.6.14	9:09	BL_C	on deck	79° 3,29' N	4° 9,07' E	2489,2
PS85/0466-1	24.6.14	9:55	BL_C	on deck	79° 3,51' N	4° 10,57' E	2452,8
PS85/0466-1	24.6.14	10:15	BL_C	on deck	79° 3,64' N	4° 11,27' E	2431,1
PS85/0467-1	24.6.14	11:10	MOORY	in the water	79° 1,00' N	4° 2,93' E	2665,0
PS85/0467-1	24.6.14	11:12	MOORY	in the water	79° 1,00' N	4° 3,08' E	2662,5
PS85/0467-1	24.6.14	11:56	MOORY	in the water	79° 1,00' N	4° 6,70' E	2635,4
PS85/0467-1	24.6.14	12:15	MOORY	on ground/ max depth	79° 0,94' N	4° 8,46' E	2622,0
PS85/0467-1	24.6.14	12:36	MOORY	hoisting	79° 0,92' N	4° 10,45' E	2605,9
PS85/0467-1	24.6.14	12:54	MOORY	on deck	79° 0,92' N	4° 12,34' E	2582,0
PS85/0467-1	24.6.14	13:13	MOORY	on deck	79° 0,90' N	4° 13,99' E	2566,3
PS85/0467-1	24.6.14	13:54	MOORY	on deck	79° 0,94' N	4° 17,58' E	2541,6
PS85/0467-1	24.6.14	14:00	MOORY	on deck	79° 0,93' N	4° 18,04' E	2544,0
PS85/0468-1	24.6.14	15:15	TVMUC	in the water	79° 6,41' N	4° 35,54' E	1896,4
PS85/0468-1	24.6.14	15:43	TVMUC	on ground/ max depth	79° 6,39' N	4° 35,10' E	1904,8
PS85/0468-1	24.6.14	15:44	TVMUC	hoisting	79° 6,39' N	4° 35,09' E	1875,3
PS85/0468-1	24.6.14	16:28	TVMUC	on deck	79° 6,59' N	4° 33,62' E	1835,6
PS85/0469-1	24.6.14	17:13	CTD/RO	in the water	79° 7,83' N	4° 53,73' E	1512,6
PS85/0469-1	24.6.14	17:51	CTD/RO	on ground/ max depth	79° 7,83' N	4° 53,71' E	1515,4
PS85/0469-1	24.6.14	17:53	CTD/RO	hoisting	79° 7,84' N	4° 53,74' E	1511,7
PS85/0469-1	24.6.14	18:42	CTD/RO	at surface	79° 7,96' N	4° 54,03' E	1496,9
PS85/0469-1	24.6.14	18:44	CTD/RO	on deck	79° 7,97' N	4° 54,03' E	1494,3
PS85/0469-2	24.6.14	18:57	TVMUC	in the water	79° 7,85' N	4° 54,35' E	1502,6
PS85/0469-2	24.6.14	19:18	TVMUC	on ground/ max depth	79° 7,93' N	4° 54,37' E	1492,3
PS85/0469-2	24.6.14	19:20	TVMUC	hoisting	79° 7,94' N	4° 54,38' E	1492,1
PS85/0469-2	24.6.14	19:45	TVMUC	at surface	79° 8,01' N	4° 54,29' E	1491,6
PS85/0469-2	24.6.14	19:48	TVMUC	on deck	79° 8,01' N	4° 54,25' E	1491,7
PS85/0470-1	24.6.14	21:50	CTD/RO	in the water	79° 8,07' N	6° 4,61' E	1242,7
PS85/0470-1	24.6.14	22:19	CTD/RO	on ground/ max depth	79° 8,10' N	6° 5,37' E	1240,8
PS85/0470-2	24.6.14	22:23	HN	in the water	79° 8,11' N	6° 5,29' E	1243,2

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0470-2	24.6.14	22:28	HN	on ground/ max depth	79° 8,10' N	6° 5,39' E	1244,3
PS85/0470-2	24.6.14	22:30	HN	on deck	79° 8,10' N	6° 5,46' E	1246,8
PS85/0470-1	24.6.14	23:02	CTD/RO	on deck	79° 8,02' N	6° 5,85' E	1244,7
PS85/0470-3	24.6.14	23:13	TVMUC	in the water	79° 8,05' N	6° 5,98' E	1248,0
PS85/0470-3	24.6.14	23:33	TVMUC	action	79° 8,01' N	6° 6,39' E	1244,1
PS85/0470-3	24.6.14	23:34	TVMUC	on ground/ max depth	79° 8,01' N	6° 6,39' E	1244,2
PS85/0470-3	25.6.14	0:00	TVMUC	on deck	79° 8,10' N	6° 6,56' E	1245,3
PS85/0471-1	25.6.14	0:36	BL_C	in the water	79° 8,18' N	6° 2,22' E	1249,8
PS85/0471-1	25.6.14	1:03	BL_C	in the water	79° 8,33' N	6° 4,32' E	1251,9
PS85/0471-1	25.6.14	1:16	BL_C	in the water	79° 8,38' N	6° 5,35' E	1254,9
PS85/0471-1	25.6.14	1:29	BL_C	in the water	79° 8,44' N	6° 6,33' E	1252,5
PS85/0471-1	25.6.14	1:36	BL_C	action	79° 8,47' N	6° 6,85' E	1253,8
PS85/0471-1	25.6.14	1:36	BL_C	on ground/ max depth	79° 8,47' N	6° 6,85' E	1253,8
PS85/0471-1	25.6.14	1:39	BL_C	on deck	79° 8,48' N	6° 6,99' E	1253,1
PS85/0472-2	25.6.14	7:50	ICE	action	79° 44,18' N	4° 17,19' E	2681,0
PS85/0472-2	25.6.14	8:07	ICE	on ground/ max depth	79° 44,17' N	4° 17,13' E	2745,1
PS85/0472-2	25.6.14	8:17	ICE	action	79° 44,21' N	4° 17,02' E	2739,7
PS85/0472-1	25.6.14	8:18	MOR	in the water	79° 44,23' N	4° 16,99' E	2745,2
PS85/0472-1	25.6.14	8:19	MOR	in the water	79° 44,25' N	4° 16,96' E	2744,8
PS85/0472-1	25.6.14	8:23	MOR	in the water	79° 44,32' N	4° 16,81' E	2742,6
PS85/0472-1	25.6.14	8:27	MOR	in the water	79° 44,38' N	4° 16,70' E	2723,5
PS85/0472-1	25.6.14	8:33	MOR	in the water	79° 44,43' N	4° 16,63' E	2706,6
PS85/0472-1	25.6.14	8:38	MOR	in the water	79° 44,44' N	4° 16,65' E	2698,8
PS85/0472-1	25.6.14	8:49	MOR	in the water	79° 44,46' N	4° 16,70' E	2694,2
PS85/0472-1	25.6.14	8:59	MOR	in the water	79° 44,55' N	4° 16,66' E	2671,1
PS85/0472-1	25.6.14	9:17	MOR	in the water	79° 44,67' N	4° 16,69' E	2653,1
PS85/0472-1	25.6.14	9:30	MOR	in the water	79° 44,79' N	4° 16,76' E	2633,6
PS85/0472-1	25.6.14	9:33	MOR	in the water	79° 44,82' N	4° 16,77' E	2628,0
PS85/0472-1	25.6.14	9:43	MOR	on ground/ max depth	79° 44,87' N	4° 16,78' E	2618,3
PS85/0472-1	25.6.14	9:43	MOR	in the water	79° 44,87' N	4° 16,78' E	2618,3
PS85/0472-1	25.6.14	9:43	MOR	action	79° 44,87' N	4° 16,78' E	2618,3
PS85/0472-1	25.6.14	9:43	MOR	on deck	79° 44,87' N	4° 16,78' E	2618,3
PS85/0472-1	25.6.14	9:46	MOR	on deck	79° 44,89' N	4° 16,79' E	2606,2
PS85/0473-1	25.6.14	10:04	CTD/RO	in the water	79° 45,30' N	4° 15,59' E	2575,0
PS85/0473-2	25.6.14	10:22	ICE	in the water	79° 45,33' N	4° 15,60' E	2569,1
PS85/0473-2	25.6.14	10:45	ICE	on ground/ max depth	79° 45,44' N	4° 15,93' E	2562,0
PS85/0473-1	25.6.14	11:01	CTD/RO	on ground/ max depth	79° 45,53' N	4° 16,57' E	2559,3
PS85/0473-1	25.6.14	12:08	CTD/RO	on deck	79° 45,84' N	4° 17,96' E	2562,6

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0473-3	25.6.14	12:13	LOKI	in the water	79° 45,83' N	4° 18,23' E	2550,3
PS85/0473-3	25.6.14	12:51	LOKI	on ground/ max depth	79° 45,78' N	4° 20,08' E	2539,9
PS85/0473-3	25.6.14	12:52	LOKI	profile start	79° 45,78' N	4° 20,12' E	2542,0
PS85/0473-2	25.6.14	13:12	ICE	action	79° 45,80' N	4° 21,06' E	2527,2
PS85/0473-2	25.6.14	13:25	ICE	on deck	79° 45,79' N	4° 21,44' E	2514,9
PS85/0473-3	25.6.14	13:32	LOKI	profile end	79° 45,82' N	4° 21,56' E	2513,6
PS85/0473-3	25.6.14	13:33	LOKI	on deck	79° 45,82' N	4° 21,58' E	2505,8
PS85/0473-4	25.6.14	13:44	MN	in the water	79° 45,86' N	4° 21,69' E	2503,2
PS85/0473-5	25.6.14	14:11	HN	in the water	79° 45,94' N	4° 21,78' E	2497,0
PS85/0473-5	25.6.14	14:13	HN	on ground/ max depth	79° 45,95' N	4° 21,77' E	2499,3
PS85/0473-5	25.6.14	14:14	HN	on deck	79° 45,95' N	4° 21,77' E	2494,4
PS85/0473-4	25.6.14	14:29	MN	on ground/ max depth	79° 45,93' N	4° 21,96' E	2490,7
PS85/0473-4	25.6.14	14:29	MN	hoisting	79° 45,93' N	4° 21,96' E	2490,7
PS85/0473-4	25.6.14	15:18	MN	on deck	79° 45,78' N	4° 22,74' E	2502,7
PS85/0473-6	25.6.14	15:28	CTD/RO	in the water	79° 45,71' N	4° 23,07' E	2516,0
PS85/0473-6	25.6.14	15:46	CTD/RO	on ground/ max depth	79° 45,62' N	4° 23,16' E	2530,3
PS85/0473-6	25.6.14	15:46	CTD/RO	hoisting	79° 45,62' N	4° 23,16' E	2530,3
PS85/0473-6	25.6.14	16:12	CTD/RO	on deck	79° 45,59' N	4° 23,05' E	2533,3
PS85/0473-7	25.6.14	16:19	TVMUC	in the water	79° 45,56' N	4° 23,03' E	2542,0
PS85/0473-7	25.6.14	16:59	TVMUC	on ground/ max depth	79° 45,47' N	4° 22,60' E	2566,3
PS85/0473-7	25.6.14	17:00	TVMUC	hoisting	79° 45,48' N	4° 22,58' E	2558,3
PS85/0473-7	25.6.14	17:57	TVMUC	at surface	79° 45,52' N	4° 21,70' E	2564,2
PS85/0473-7	25.6.14	17:59	TVMUC	on deck	79° 45,51' N	4° 21,67' E	2573,8
PS85/0473-8	25.6.14	18:24	TVMUC	in the water	79° 46,33' N	4° 26,39' E	2424,1
PS85/0473-8	25.6.14	19:07	TVMUC	on ground/ max depth	79° 46,43' N	4° 25,65' E	2412,8
PS85/0473-8	25.6.14	19:07	TVMUC	hoisting	79° 46,43' N	4° 25,65' E	2412,8
PS85/0473-8	25.6.14	20:00	TVMUC	at surface	79° 46,63' N	4° 24,72' E	2414,3
PS85/0473-8	25.6.14	20:03	TVMUC	on deck	79° 46,65' N	4° 24,67' E	2412,3
PS85/0474-1	26.6.14	0:12	OFOS	in the water	79° 35,99' N	5° 9,87' E	2723,4
PS85/0474-1	26.6.14	0:49	OFOS	action	79° 35,93' N	5° 10,14' E	2722,6
PS85/0474-1	26.6.14	0:50	OFOS	on ground/ max depth	79° 35,92' N	5° 10,15' E	2720,9
PS85/0474-1	26.6.14	0:50	OFOS	profile start	79° 35,92' N	5° 10,15' E	2720,9
PS85/0474-1	26.6.14	3:52	OFOS	profile end	79° 34,13' N	5° 15,29' E	2600,0
PS85/0474-1	26.6.14	3:53	OFOS	hoisting	79° 34,12' N	5° 15,31' E	2598,8
PS85/0474-1	26.6.14	4:39	OFOS	on deck	79° 34,20' N	5° 17,76' E	2558,4
PS85/0475-1	26.6.14	7:00	MOORY	information	79° 44,37' N	4° 30,03' E	2637,1
PS85/0475-1	26.6.14	7:00	MOORY	in the water	79° 44,37' N	4° 30,03' E	2637,1
PS85/0475-1	26.6.14	7:43	MOORY	on ground/ max depth	79° 44,42' N	4° 29,92' E	2617,8

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0475-1	26.6.14	7:46	MOORY	on deck	79° 44,42' N	4° 29,88' E	2616,1
PS85/0476-1	26.6.14	14:03	BL_C	on ground/ max depth	79° 8,54' N	6° 7,45' E	1257,6
PS85/0476-1	26.6.14	14:05	BL_C	at surface	79° 8,55' N	6° 7,53' E	1255,3
PS85/0476-1	26.6.14	14:17	BL_C	hoisting	79° 8,48' N	6° 7,00' E	1258,7
PS85/0476-1	26.6.14	14:18	BL_C	action	79° 8,48' N	6° 7,01' E	1252,2
PS85/0476-1	26.6.14	14:22	BL_C	on deck	79° 8,50' N	6° 7,07' E	1251,6
PS85/0476-1	26.6.14	14:32	BL_C	on deck	79° 8,57' N	6° 7,44' E	1256,4
PS85/0476-1	26.6.14	14:55	BL_C	on deck	79° 8,65' N	6° 8,33' E	1263,1
PS85/0476-1	26.6.14	15:03	BL_C	on deck	79° 8,69' N	6° 8,65' E	1264,6
PS85/0476-2	26.6.14	15:14	LANDER	in the water	79° 8,69' N	6° 8,23' E	1265,6
PS85/0476-2	26.6.14	15:14	LANDER	on ground/ max depth	79° 8,69' N	6° 8,23' E	1265,6
PS85/0477-1	26.6.14	18:32	MOR	in the water	79° 3,80' N	3° 60,00' E	2585,8
PS85/0477-1	26.6.14	18:32	MOR	in the water	79° 3,80' N	3° 60,00' E	2585,8
PS85/0477-1	26.6.14	18:35	MOR	in the water	79° 3,80' N	4° 0,04' E	2587,3
PS85/0477-1	26.6.14	19:18	MOR	in the water	79° 3,74' N	4° 0,89' E	2576,9
PS85/0477-1	26.6.14	19:25	MOR	in the water	79° 3,73' N	4° 0,90' E	2578,2
PS85/0477-1	26.6.14	19:33	MOR	in the water	79° 3,73' N	4° 0,93' E	2578,3
PS85/0477-1	26.6.14	19:46	MOR	in the water	79° 3,71' N	4° 1,19' E	2576,5
PS85/0477-1	26.6.14	19:51	MOR	on ground/ max depth	79° 3,67' N	4° 1,22' E	2581,4
PS85/0477-1	26.6.14	19:52	MOR	in the water	79° 3,66' N	4° 1,21' E	2581,8
PS85/0477-1	26.6.14	19:52	MOR	action	79° 3,66' N	4° 1,21' E	2581,8
PS85/0477-1	26.6.14	19:53	MOR	on deck	79° 3,65' N	4° 1,21' E	2581,2
PS85/0477-1	26.6.14	19:56	MOR	on deck	79° 3,62' N	4° 1,24' E	2582,5
PS85/0478-1	26.6.14	20:18	LANDER	in the water	79° 4,16' N	4° 4,59' E	2493,5
PS85/0478-1	26.6.14	20:19	LANDER	on ground/ max depth	79° 4,16' N	4° 4,57' E	2495,4
PS85/0479-1	27.6.14	8:06	MOR	in the water	78° 50,93' N	0° 47,75' W	2608,6
PS85/0479-1	27.6.14	8:06	MOR	in the water	78° 50,93' N	0° 47,75' W	2608,6
PS85/0479-1	27.6.14	8:50	MOR	in the water	78° 51,04' N	0° 48,53' W	2608,5
PS85/0479-1	27.6.14	9:02	MOR	in the water	78° 51,10' N	0° 48,76' W	2609,1
PS85/0479-1	27.6.14	9:12	MOR	in the water	78° 51,15' N	0° 48,99' W	2610,4
PS85/0479-1	27.6.14	9:16	MOR	in the water	78° 51,16' N	0° 49,07' W	2611,1
PS85/0479-1	27.6.14	9:25	MOR	on ground/ max depth	78° 51,20' N	0° 49,26' W	2612,9
PS85/0479-1	27.6.14	9:25	MOR	in the water	78° 51,20' N	0° 49,26' W	2612,9
PS85/0479-1	27.6.14	9:25	MOR	action	78° 51,20' N	0° 49,26' W	2612,9
PS85/0479-1	27.6.14	9:25	MOR	hoisting	78° 51,20' N	0° 49,26' W	2612,9
PS85/0479-1	27.6.14	9:29	MOR	on deck	78° 51,21' N	0° 49,32' W	2612,4
PS85/0480-1	27.6.14	13:52	MOR	in the water	78° 49,87' N	1° 57,40' W	2652,5
PS85/0480-1	27.6.14	13:57	MOR	in the water	78° 49,85' N	1° 57,44' W	2654,2
PS85/0480-1	27.6.14	14:25	MOR	in the water	78° 49,83' N	1° 58,10' W	2652,3
PS85/0480-1	27.6.14	14:47	MOR	in the water	78° 49,80' N	1° 58,61' W	2652,6

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0480-1	27.6.14	14:57	MOR	in the water	78° 49,80' N	1° 58,91' W	2651,8
PS85/0480-1	27.6.14	15:05	MOR	in the water	78° 49,77' N	1° 59,04' W	0,0
PS85/0480-1	27.6.14	15:14	MOR	in the water	78° 49,73' N	1° 59,06' W	2650,3
PS85/0480-1	27.6.14	15:19	MOR	on ground/ max depth	78° 49,72' N	1° 59,06' W	2653,1
PS85/0480-1	27.6.14	15:19	MOR	in the water	78° 49,72' N	1° 59,06' W	2653,1
PS85/0480-1	27.6.14	15:20	MOR	action	78° 49,71' N	1° 59,06' W	2653,6
PS85/0480-1	27.6.14	15:21	MOR	on deck	78° 49,71' N	1° 59,05' W	2653,4
PS85/0481-1	27.6.14	16:29	CTD/RO	in the water	78° 48,24' N	1° 59,80' W	2669,6
PS85/0481-2	27.6.14	16:40	ICE	in the water	78° 48,22' N	1° 60,00' W	2661,8
PS85/0481-1	27.6.14	17:24	CTD/RO	on ground/ max depth	78° 48,14' N	2° 0,87' W	2660,4
PS85/0481-1	27.6.14	17:25	CTD/RO	hoisting	78° 48,14' N	2° 0,88' W	2660,1
PS85/0481-1	27.6.14	18:31	CTD/RO	at surface	78° 48,00' N	2° 2,44' W	2659,7
PS85/0481-1	27.6.14	18:32	CTD/RO	on deck	78° 48,00' N	2° 2,47' W	2659,2
PS85/0481-2	27.6.14	18:37	ICE	on ground/ max depth	78° 47,98' N	2° 2,57' W	2658,9
PS85/0481-2	27.6.14	18:44	ICE	on deck	78° 47,96' N	2° 2,77' W	2658,5
PS85/0482-1	28.6.14	0:50	CTD/RO	in the water	78° 49,85' N	0° 53,78' W	2576,1
PS85/0482-1	28.6.14	1:49	CTD/RO	on ground/ max depth	78° 50,08' N	0° 54,90' W	2582,2
PS85/0482-2	28.6.14	2:03	HN	in the water	78° 50,13' N	0° 55,21' W	2580,9
PS85/0482-2	28.6.14	2:06	HN	on ground/ max depth	78° 50,14' N	0° 55,25' W	2582,5
PS85/0482-2	28.6.14	2:11	HN	on deck	78° 50,16' N	0° 55,37' W	2583,2
PS85/0482-1	28.6.14	3:14	CTD/RO	on deck	78° 50,41' N	0° 56,78' W	2585,9
PS85/0482-3	28.6.14	3:47	HYDRO	in the water	78° 49,90' N	0° 48,88' W	2595,6
PS85/0482-3	28.6.14	3:47	HYDRO	on ground/ max depth	78° 49,90' N	0° 48,88' W	2595,6
PS85/0482-3	28.6.14	3:48	HYDRO	profile start	78° 49,90' N	0° 48,89' W	2561,3
PS85/0482-3	28.6.14	4:05	HYDRO	profile end	78° 49,99' N	0° 49,39' W	2595,5
PS85/0482-3	28.6.14	4:07	HYDRO	on deck	78° 50,00' N	0° 49,46' W	2594,4
PS85/0483-1	28.6.14	15:53	CTD/RO	in the water	78° 49,88' N	0° 0,91' E	2574,2
PS85/0483-1	28.6.14	16:48	CTD/RO	on ground/ max depth	78° 49,65' N	0° 0,26' E	2574,6
PS85/0483-1	28.6.14	16:49	CTD/RO	hoisting	78° 49,65' N	0° 0,23' E	2570,9
PS85/0483-1	28.6.14	17:57	CTD/RO	at surface	78° 49,30' N	0° 1,61' W	2564,4
PS85/0483-1	28.6.14	17:57	CTD/RO	on deck	78° 49,30' N	0° 1,61' W	2564,4
PS85/0484-1	28.6.14	19:37	CTD/RO	in the water	78° 50,33' N	0° 27,07' E	2517,2
PS85/0484-1	28.6.14	20:33	CTD/RO	on ground/ max depth	78° 50,52' N	0° 24,51' E	2513,8
PS85/0484-1	28.6.14	20:34	CTD/RO	hoisting	78° 50,52' N	0° 24,44' E	2514,8
PS85/0484-1	28.6.14	21:31	CTD/RO	at surface	78° 50,39' N	0° 21,63' E	2520,9
PS85/0484-1	28.6.14	21:31	CTD/RO	on deck	78° 50,39' N	0° 21,63' E	2520,9
PS85/0485-1	28.6.14	23:25	CTD/RO	in the water	78° 50,13' N	1° 0,31' E	2434,7

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0485-1	28.6.14	23:39	CTD/RO	on ground/ max depth	78° 50,15' N	1° 0,52' E	2437,1
PS85/0485-1	28.6.14	23:59	CTD/RO	on deck	78° 50,18' N	1° 0,40' E	2440,7
PS85/0486-1	29.6.14	1:27	CTD/RO	in the water	78° 50,05' N	1° 29,83' E	2473,1
PS85/0486-1	29.6.14	1:53	CTD/RO	on ground/ max depth	78° 50,20' N	1° 30,01' E	2476,7
PS85/0486-1	29.6.14	2:15	CTD/RO	on deck	78° 50,34' N	1° 29,82' E	2478,4
PS85/0487-1	29.6.14	3:36	MOR	action	78° 49,93' N	1° 34,52' E	2480,4
PS85/0487-1	29.6.14	3:37	MOR	on ground/ max depth	78° 49,94' N	1° 34,53' E	2480,4
PS85/0487-1	29.6.14	3:44	MOR	in the water	78° 49,98' N	1° 34,56' E	2480,1
PS85/0487-1	29.6.14	3:54	MOR	on deck	78° 50,04' N	1° 34,48' E	2479,1
PS85/0487-1	29.6.14	4:26	MOR	in the water	78° 50,19' N	1° 34,41' E	2477,9
PS85/0487-1	29.6.14	4:39	MOR	action	78° 50,23' N	1° 34,41' E	2481,2
PS85/0487-1	29.6.14	4:45	MOR	action	78° 50,26' N	1° 34,28' E	2462,4
PS85/0487-1	29.6.14	4:50	MOR	at surface	78° 50,29' N	1° 34,19' E	2478,6
PS85/0487-1	29.6.14	4:52	MOR	on deck	78° 50,31' N	1° 34,16' E	2480,0
PS85/0487-1	29.6.14	5:21	MOR	action	78° 50,44' N	1° 35,21' E	2482,9
PS85/0487-1	29.6.14	5:24	MOR	on deck	78° 50,47' N	1° 35,19' E	2484,6
PS85/0487-1	29.6.14	5:33	MOR	on deck	78° 50,57' N	1° 34,99' E	2457,2
PS85/0487-1	29.6.14	5:47	MOR	on deck	78° 50,67' N	1° 34,91' E	2484,5
PS85/0487-1	29.6.14	6:08	MOR	on deck	78° 50,87' N	1° 34,69' E	2483,4
PS85/0487-1	29.6.14	6:42	MOR	on deck	78° 51,16' N	1° 34,36' E	2488,8
PS85/0487-1	29.6.14	6:55	MOR	on deck	78° 51,32' N	1° 36,37' E	2490,0
PS85/0488-1	29.6.14	10:24	MOR	in the water	78° 49,27' N	2° 44,59' E	2441,0
PS85/0488-1	29.6.14	10:32	MOR	on ground/ max depth	78° 49,26' N	2° 44,65' E	2443,6
PS85/0488-1	29.6.14	10:34	MOR	action	78° 49,25' N	2° 44,70' E	2442,8
PS85/0488-1	29.6.14	10:35	MOR	on deck	78° 49,25' N	2° 44,78' E	2442,5
PS85/0488-1	29.6.14	11:06	MOR	action	78° 49,19' N	2° 45,37' E	2441,3
PS85/0488-1	29.6.14	11:09	MOR	on deck	78° 49,17' N	2° 45,43' E	2442,5
PS85/0488-1	29.6.14	11:22	MOR	on deck	78° 49,05' N	2° 45,51' E	2444,5
PS85/0488-1	29.6.14	11:35	MOR	on deck	78° 48,97' N	2° 45,58' E	2441,6
PS85/0488-1	29.6.14	11:55	MOR	on deck	78° 48,84' N	2° 45,73' E	2442,0
PS85/0488-1	29.6.14	12:24	MOR	on deck	78° 48,68' N	2° 45,86' E	2437,5
PS85/0488-1	29.6.14	12:30	MOR	on deck	78° 48,64' N	2° 45,83' E	2441,3
PS85/0489-1	29.6.14	15:25	MOR	in the water	78° 51,55' N	4° 33,92' E	2790,1
PS85/0489-1	29.6.14	15:28	MOR	in the water	78° 51,55' N	4° 33,75' E	2795,7
PS85/0489-1	29.6.14	16:00	MOR	in the water	78° 51,49' N	4° 31,44' E	2820,0
PS85/0489-1	29.6.14	16:16	MOR	in the water	78° 51,49' N	4° 30,73' E	2803,5
PS85/0489-1	29.6.14	17:45	MOR	in the water	78° 51,30' N	4° 22,49' E	2455,4
PS85/0489-1	29.6.14	18:20	MOR	on ground/ max depth	78° 51,32' N	4° 21,98' E	2442,5
PS85/0489-1	29.6.14	18:20	MOR	in the water	78° 51,32' N	4° 21,98' E	2442,5
PS85/0489-1	29.6.14	18:22	MOR	on deck	78° 51,31' N	4° 21,92' E	2436,8

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS85/0490-1	29.6.14	18:49	CTD/RO	in the water	78° 51,48' N	4° 15,40' E	2364,1
PS85/0490-1	29.6.14	19:46	CTD/RO	on ground/ max depth	78° 51,60' N	4° 15,03' E	2371,2
PS85/0490-1	29.6.14	19:47	CTD/RO	hoisting	78° 51,60' N	4° 15,02' E	2369,8
PS85/0490-1	29.6.14	20:43	CTD/RO	at surface	78° 51,68' N	4° 15,14' E	2375,1
PS85/0490-1	29.6.14	20:44	CTD/RO	on deck	78° 51,68' N	4° 15,13' E	2376,4
PS85/0491-1	29.6.14	22:00	CTD/RO	in the water	78° 49,98' N	3° 22,40' E	2313,6
PS85/0491-1	29.6.14	22:52	CTD/RO	on ground/ max depth	78° 49,98' N	3° 22,42' E	2314,4
PS85/0491-1	29.6.14	23:41	CTD/RO	on deck	78° 49,96' N	3° 22,69' E	2312,2
PS85/0492-1	30.6.14	7:04	CTD/RO	in the water	77° 17,98' N	2° 21,30' E	3193,6
PS85/0492-1	30.6.14	7:12	CTD/RO	information	77° 17,97' N	2° 21,29' E	3190,0
PS85/0492-1	30.6.14	7:31	CTD/RO	lowering	77° 17,99' N	2° 21,42' E	3190,0
PS85/0492-1	30.6.14	7:59	CTD/RO	on ground/ max depth	77° 17,99' N	2° 21,55' E	3190,0
PS85/0492-1	30.6.14	9:03	CTD/RO	hoisting	77° 17,99' N	2° 22,01' E	3190,0
PS85/0492-1	30.6.14	9:36	CTD/RO	at surface	77° 18,01' N	2° 22,08' E	3190,0
PS85/0492-1	30.6.14	9:38	CTD/RO	on deck	77° 18,01' N	2° 22,09' E	3196,0
PS85/0493-1	30.6.14	22:25	CTD/RO	in the water	74° 60,00' N	0° 0,15' W	3701,6
PS85/0493-2	30.6.14	22:41	GLD	in the water	74° 59,99' N	0° 0,17' W	3702,9
PS85/0493-2	30.6.14	23:01	GLD	on ground/ max depth	74° 59,98' N	0° 0,14' W	3701,5
PS85/0493-2	30.6.14	23:28	GLD	at surface	74° 59,99' N	0° 0,22' W	3702,1
PS85/0493-1	30.6.14	23:48	CTD/RO	on ground/ max depth	75° 0,02' N	0° 0,10' W	3701,1
PS85/0493-2	1.7.14	0:51	GLD	on deck	74° 59,97' N	0° 0,05' W	3704,0
PS85/0493-1	1.7.14	1:01	CTD/RO	on deck	74° 59,98' N	0° 0,06' E	3698,9
PS85/0493-2	1.7.14	1:30	GLD	in the water	75° 0,05' N	0° 0,01' E	3702,0
PS85/0493-2	1.7.14	2:10	GLD	action	75° 0,08' N	0° 0,33' W	3699,8
PS85/0493-2	1.7.14	2:21	GLD	on ground/ max depth	75° 0,10' N	0° 0,57' W	3700,9
PS85/0493-2	1.7.14	2:27	GLD	on deck	75° 0,11' N	0° 0,55' W	3699,6
PS85/0493-2	1.7.14	3:19	GLD	on ground/ max depth	75° 0,18' N	0° 0,77' W	3718,8
PS79/056-1	10.01.12	08:24	CTD/RO	am Grund/auf Tiefe	40° 47,17' S	12° 45,75' E	4654,7
PS79/056-1	10.01.12	08:26	CTD/RO	Hieven	40° 47,14' S	12° 45,76' E	4654,7
PS79/056-1	10.01.12	08:34	CTD/RO	an Deck	40° 47,06' S	12° 45,84' E	4655
PS79/056-2	10.01.12	08:43	GO-FLO	zu Wasser	40° 46,96' S	12° 45,93' E	4655,2
PS79/056-2	10.01.12	09:07	GO-FLO	am Grund/auf Tiefe	40° 46,78' S	12° 46,05' E	4656,7
PS79/056-2	10.01.12	09:12	GO-FLO	Hieven	40° 46,75' S	12° 46,10' E	4656,5
PS79/056-2	10.01.12	09:37	GO-FLO	an Deck	40° 46,61' S	12° 46,07' E	4654,2
PS79/057-1	11.01.12	10:40	CTD/RO	zu Wasser	44° 0,07' S	10° 0,21' E	4683,5
PS79/057-1	11.01.12	12:25	CTD/RO	am Grund/auf Tiefe	44° 0,07' S	10° 0,28' E	4583,5

Station	Date	Time	Gear	Action	Position Lat	Position Lon	Water depth [m]
PS79/057-1	11.01.12	12:27	CTD/RO	Hieven	44° 0,06' S	10° 0,29' E	4670,2
PS79/057-1	11.01.12	13:58	CTD/RO	an Deck	44° 0,24' S	10° 0,72' E	4669
PS79/057-2	11.01.12	14:10	GO-FLO	zu Wasser	43° 59,93' S	10° 0,12' E	4497,5
PS79/057-2	11.01.12	14:54	GO-FLO	am Grund/auf Tiefe	44° 0,10' S	10° 0,22' E	4675,7
PS79/057-2	11.01.12	14:54	GO-FLO	Aktion	44° 0,10' S	10° 0,22' E	4675,7
PS79/057-2	11.01.12	15:00	GO-FLO	Hieven	44° 0,12' S	10° 0,21' E	4677,5
PS79/057-2	11.01.12	15:15	GO-FLO	an Deck	44° 0,15' S	10° 0,30' E	4626,7
PS79/057-3	11.01.12	15:44	RAMSES	zu Wasser	43° 59,89' S	9° 59,72' E	4470
PS79/057-3	11.01.12	16:02	RAMSES	am Grund/auf Tiefe	43° 59,87' S	9° 59,74' E	4472
PS79/057-3	11.01.12	16:03	RAMSES	Hieven	43° 59,87' S	9° 59,75' E	4468,5
PS79/057-3	11.01.12	16:15	RAMSES	Wasseroberfl„che	43° 59,86' S	9° 59,77' E	4459
PS79/057-3	11.01.12	16:16	RAMSES	an Deck	43° 59,86' S	9° 59,77' E	4466,5
PS79/057-4	11.01.12	16:31	CTD	zu Wasser	43° 59,80' S	9° 59,74' E	4453,7
PS79/057-4	11.01.12	16:47	CTD	am Grund/auf Tiefe	43° 59,76' S	9° 59,92' E	4443,5
PS79/057-4	11.01.12	16:49	CTD	Hieven	43° 59,76' S	9° 59,94' E	4443,5
PS79/057-4	11.01.12	17:05	CTD	Wasseroberfläche	43° 59,71' S	10° 0,00' E	4437,2
PS79/057-4	11.01.12	17:06	CTD	an Deck	43° 59,71' S	10° 0,00' E	4435,5
PS79/057-5	11.01.12	17:27	ISP	zu Wasser	43° 59,71' S	10° 0,09' E	4438,5
PS79/057-5	11.01.12	17:35	ISP	Aktion	43° 59,73' S	10° 0,07' E	4442,2
PS79/057-5	11.01.12	17:44	ISP	Aktion	43° 59,76' S	10° 0,00' E	4465,2
PS79/057-5	11.01.12	17:47	ISP	am Grund/auf Tiefe	43° 59,77' S	9° 59,98' E	4260
PS79/057-6	11.01.12	18:36	HN	zu Wasser	43° 59,99' S	9° 59,79' E	4589,5
PS79/057-6	11.01.12	18:37	HN	am Grund/auf Tiefe	44° 0,00' S	9° 59,79' E	4541,7
PS79/057-6	11.01.12	18:37	HN	an Deck	44° 0,00' S	9° 59,79' E	4541,7
PS79/057-5	11.01.12	20:28	ISP	Hieven	44° 0,98' S	9° 58,29' E	4510,5
PS79/057-5	11.01.12	20:37	ISP	an Deck	44° 1,14' S	9° 57,99' E	4463,5
PS79/057-5	11.01.12	20:40	ISP	an Deck	44° 1,19' S	9° 57,91' E	4775
PS79/057-5	11.01.12	20:48	ISP	an Deck	44° 1,35' S	9° 57,77' E	4774
PS79/057-5	11.01.12	20:51	ISP	an Deck	44° 1,42' S	9° 57,75' E	4771,7

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