Helmholtz-Zentrum für Ozeanforschung Kiel

RV SONNE Fahrtbericht / Cruise Report S0268

**Assessing the Impacts of Nodule Mining
on the Deep-sea Environment**

NoduleMonitoring

Manzanillo (Mexico) – Vancouver (Canada)
17.02. – 27.05.2019

Berichte aus dem GEOMAR
Helmholtz-Zentrum für Ozeanforschung Kiel

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1 Cruise Summary

1.1 German

Die SO268-Ausfahrt ist Teil der zweiten Phase des Europäischen JPI-Oceans Verbundprojektes MiningImpact, welches die Umweltauswirkungen eines Abbaus von polymetallischen Knollen am Tiefseeboden der Clarion-Clipperton Bruchzone (CCZ) bewertet. Ziel der Ausfahrt war eine unabhängige wissenschaftliche Begleituntersuchung des ersten industriellen Komponenten-Tests eines Knollenkollektor-Fahrzeugs der belgischen Firma DEME-GSR durchzuführen. Hierzu sollten die erforderlichen Basisdaten in den festgelegten Test- und Referenzgebieten in den belgischen und deutschen Explorationslizenzen erhoben werden, eine Quantifizierung der räumlichen und zeitlichen Ausbreitung der durch die Tests aufgewirbelten Sedimentwolke und eine erste Beprobung der erzeugten Umweltschäden erfolgen. Während des ersten Fahrtabschnitts informierte DEME-GSR uns jedoch, dass der Kollektortest aufgrund unerwartet aufgetretener technischer Probleme, die nicht zeitnah behoben werden können, ausfällt. Daher mussten wir auf unseren Alternativplan ausweichen, der u.a. darin bestand, ein kleinskaliges Sedimentaufwirbelungsexperiment mit einer kleinen Kettendredge durchzuführen, um die räumliche und zeitliche Ausbreitung der Sedimentwolke, die Partikelkonzentration und die Größe und Dicke des daraus abgelagerten Sediments auf dem Meeresboden zu bestimmen.

Auf den beiden Fahrtabschnitten wurde detailliert der Ist-Zustand sowohl der festgelegten Kollektor-Testgebiete und der Referenzgebiete als auch im Gebiet des kleinskaligen Sedimentaufwirbelungsexperiments erhoben. Dieses Experiment wurde mittels eines ausgebrachten Netzes verschiedener akustischer und optischer Sensoren überwacht und im Anschluß die Umweltschädigung untersucht, mit dem Ziel, Standards und Protokolle für eine Umweltüberwachung und -bewertung und Vorschläge für internationale Regularien, wie den ‚Mining Code‘ der ISA, zu entwickeln. Dies beinhaltet auch das eher technische Ziel, Technologien und Konzepte für die Umweltüberwachung eines zukünftigen Tiefseebergbaus zu testen. Die Arbeiten umfassten daher ozeanographische, biologische, mikrobiologische, biogeochemische und geologische Untersuchungen mittels einer Vielzahl an Geräten. Ein wichtiges Arbeitsgerät war hierbei das ROV Kiel 6000, um die gezielte Beprobung der Sedimente, Manganknollen, benthischer Fauna, die Durchführung von in situ Messungen und Experimenten und das Ausbringen des Sensornetzes zu ermöglichen. Eine hochauflösende Kartierung des Meeresbodens und seines Manganknollenhabitats erfolgte durch Einsätze von Multibeam-Echolotsystemen und Video/Kamera-Systemen auf AUV Abyss und ROV Kiel 6000. Die Photobeobachtungen wurden durch das bordeigene OFOS-System ergänzt. Ozeanographische Variablen wurden durch mehrere benthische Landersysteme und Verankerungen mit akustischen und optischen Sensoren gemessen. Sedimentproben für biologische, geochemische und mikrobiologische Analysen wurden mittels Kastengreifer, Schwerelot, TV-Multicorer und ROV-Pushcores gewonnen, während ein CTD-Kranzwasserschöpfer, in situ Pumpen und ein Bodenwasserschöpfer zur Beprobung der Wassersäule zum Einsatz kamen. Schließlich wurden mit dem ROV Kiel 6000 künstliche Hartsubstrate am Meeresboden der Arbeitsgebiete ausgebracht, um die Besiedlung durch Knollen-assoziierte Fauna zu untersuchen – der Start eines auf mehrere Jahrzehnte angelegten Experiments.

1.2 English

Cruise SO268 is fully integrated into the second phase of the European collaborative JPI-Oceans project MiningImpact and is designed to assess the environmental impacts of deep-sea mining of polymetallic nodules in the Clarion-Clipperton Fracture Zone (CCZ). In particular, the cruise aimed at conducting an independent scientific monitoring of the first industrial test of a pre-prototype nodule collector by the Belgian company DEME-GSR. The work includes collecting the required baseline data in the designated trial and reference sites in the Belgian and German contract areas, a quantification of the spatial and temporal spread of the produced sediment plume during the trials as well as a first assessment of the generated environmental impacts. However, during SO268 Leg 1 DEME-GSR informed us that the collector trials would not take place as scheduled due to unresolvable technical problems. Thus, we adjusted our work plan accordingly by implementing our backup plan. This involved conducting a small-scale sediment plume experiment with a small chain dredge to quantify the spatial and temporal dispersal of the suspended sediment particles, their concentration in the plume as well as the spatial footprint and thickness of the deposited sediment blanket on the seabed.

Leg 1 and 2 acquired detailed environmental baseline data in the designated collector trial and reference sites as well as the site of the small-scale sediment plume experiment. The plume experiment was monitored by an array of acoustic and optical sensors and the impacted area was investigated in order to develop standards and protocols for impact assessments and recommendations for marine policy and international legislation. A more technical aim of the cruise was to test tools, technologies, and a concept for the environmental monitoring of future deep-sea mining operations. This comprised oceanographic, biological, microbiological, biogeochemical, and geologic investigations which required the deployment of a multitude of seagoing equipment, such as ROV Kiel 6000 for sampling of sediments, nodules, and benthic fauna as well as carrying out in situ measurements and experiments, and the deployment of the plume sensor array. AUV ABYSS and ROV Kiel 6000 were used for high-resolution acoustic mapping of the seafloor using mounted multibeam systems and video/photo surveys of the manganese nodule habitat. This work was accompanied by video observations with the OFOS system. Several benthic landers and moorings with acoustic and optical sensors were deployed and recovered for the measurements of physical and chemical oceanographic variables. Coring devices (i.e., box corer, gravity corer, TV-guided multiple corer, ROV-operated push cores) were used to collect sediment samples for biological, geochemical, and microbiological analyses, and a CTD rosette water sampler, in situ pumps, and a bottom water sampler sampled the water column. In addition, recolonization experiments for nodule-associated fauna were started by deploying artificial hard substrates on the seabed of the working areas.

2 Participants

2.1 Principal Investigators

Peter Linke	Chief Scientist	Leg 1	GEOMAR
Matthias Haeckel	Chief Scientist	Leg 2	GEOMAR

2.2 Scientific Party

Name	Task	Institute
Friedrich Abegg	Head ROV team	GEOMAR
Teresa Paula Fernandes Amaro	Food web	CIIMAR
Volker Asendorf	In situ ROV module technician	MPI
Eve-Julie Arsenault-Pernet	Lab technician Infauna	IFREMER
Jakob Barz	Lab technician Microbiology	MPI
Florian Bischof	ROV team	GEOMAR
Matthias Bodendorfer	ROV team	GEOMAR
Yasemin Bodur	Megafauna, OFOS	MPI/AWI
Emanuela Buschi	Microbiology, Organic matter	UNIVPM
Magdalini Christodoulou	Taxonomy, Genetics, Maldi TOF	SGN
Patrick Cuno	ROV team	GEOMAR
Patricia Esquete	Macrofauna	UAveiro
Iason-Zois Gazis	Multibeam, Parasound, Sensors	GEOMAR
Ana Hilário	Macrofauna and megafauna	UAveiro
Hannes Huusmann	ROV team	GEOMAR
Felix Janssen	PI microbiology, in situ flux	MPI / AWI
Marcus Köckritz	AUV team	GEOMAR
Dennis Köhler	Geochemistry technician	AWI
Kevin Koeser	PI mapping	GEOMAR
Pedro Martinez Arbizu	PI fauna	SGN
Torge Matthiessen	ROV team	GEOMAR

Nancy Fabiola Mercado Salas	Metabarcoding	SGN
Annika Moje	Metal geochemistry technician	JUB
Massimiliano Molari	Microbiology, CTD	MPI
Ellen Pape	Meiofauna	UGhent
Sophie Anna Luise Paul	Metal geochemistry	JUB
Asmus Petersen	Lander technician	GEOMAR
Martin Pieper	ROV team	GEOMAR
Eva-Louise Regina Posch	Coring technician	SGN
Timm Schoening	PI mapping, sensors	GEOMAR
Thorsten Schott	Lander technician	GEOMAR
Jens Schroeder	AUV team	GEOMAR
Anja Steinführer	Head AUV team	GEOMAR
Tanja Stratmann	Food web	Utrecht
Inken Suck	ROV team	GEOMAR
Jessica Bianca Volz	PI geochemistry	AWI
Tim Weiss	AUV team	GEOMAR
Helena Wicklund	Sponges, ddPCR	UResearch
Daniela Zeppilli	Infauna, Meiofauna	IFREMER

Leg 2

Name	Task	Institute
Friedrich Abegg	Head ROV team	GEOMAR
Jakob Barz	Lab technician Microbiology	MPI
Matthias Bodendorfer	ROV team	GEOMAR
Yasemin Bodur	Megafauna, OFOS	MPI/AWI
Patrick Cuno	ROV team	GEOMAR
Hendrik Corstiaan de Stigter	PI lander, sensors	NIOZ

Coral Diaz-Recio Lorenzo	Meiofauna, recolonization exp.	NIOZ
Ingrid Dohrmann	Geochemistry technician	AWI
Patricia Esquete	Macrofauna	UAveiro
Eduard Fabrizio	Lander technician	GEOMAR
Dennis Hagedorn	Sediment trap technician	BGR
Sabine Haalboom	Lander, sensors	NIOZ
Kristin Hamann	Geochemistry	GEOMAR
Freija Hauquier	PI Meiofauna	UGhent
Ana Hilário	Macrofauna, Megafauna	UAveiro
Torge Matthiessen	ROV team	GEOMAR
Lenaick Menot	PI Infauna, Meiofauna	Ifremer
Steffen Niemann	Videos, Photos	GEOMAR
Julia Marén Otte	Microbiology	MPI/AWI
Tasnim Patel	Scavengers	RBINS
Sophie Anna Luise Paul	Metal geochemistry	JUB
Martin Pieper	ROV team	GEOMAR
Sofia Alexandra Pinto Ramalho	Macrofauna and megafauna	UAveiro
Jan Rindfleisch	ROV team	GEOMAR
Sven Rossel	Taxonomy, Genetics, Maldi TOF	SGN
Elena Schiller	ROV in situ tools technician	MPI
Katja Schmidt	Metal geochemistry	BGR
Timm Schoening	PI mapping, sensors	GEOMAR
Thorsten Schott	Lander technician	GEOMAR
Peter Striewski	ROV team	GEOMAR
Inken Suck	ROV team	GEOMAR
Katja Uhlenkott	Taxonomy, Genetics, Maldi TOF	SGN
Peter Urban	Mapping, sensors	GEOMAR
Jessica Bianca Volz	PI geochemistry	AWI
Frank Wenzhöfer	PI ROV in situ tools	MPI
Ann-Kathrin Wessels	Student Assistant Taxonomy	SGN
Batuhan Cagri Yapan	Microbiology	MPI/AWI

2.3 Participating Institutions

AWI	Alfred Wegener Institute Helmholtz Centre for Polar & Marine Research, Germany
BGR	Federal Institute for Geosciences and Natural Resources, Germany
CIIMAR	Interdisciplinary Centre of Marine and Environmental Research, Portugal
CIMA	Universidade do Algarve, Portugal
GEOMAR	GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer, France
IMAR	Institute of Marine Research, Portugal
JUB	Jacobs University Bremen gGmbH, Germany
MPI	Max Planck Institute for Marine Microbiology, Germany
NIOZ	Royal Netherlands Institute for Sea Research, The Netherlands
NIVA	Norwegian Institute for Water Research, Norway
RBINS	Royal Belgian Institute of Natural Sciences, Belgium
SGN	Senckenberg Gesellschaft für Naturforschung, Germany
UA	Universidade de Aveiro, Portugal
UGent	Gent University, Belgium
UNIVPM	Polytechnic University of Marche, Italy
URes	Uni Research, Norway
UU	Utrecht University, Belgium

3 Research Programme

3.1 Description of the Working Areas

SO268 has conducted its research work in the ISA contract areas for the exploration of polymetallic nodules of Germany and Belgium in the Clarion-Clipperton Zone (CCZ) (Fig. 3.1). The CCZ is located in the North-east Pacific Ocean and is bound in the south at roughly 5°N by the Clipperton Fracture Zone and in the north at roughly 20°N by the Clarion Fracture Zone. Longitudinally, it extends from 157°W to 115°W, i.e. from the exclusive economic zones (EEZ) of Hawaii (USA) and Kiribati in the west to Mexican waters in the east. About 3.8 Mio km² of this 12.6 Mio km² large area are of commercial interest, harbouring an estimated dry mass of 21,100 Mio t of nodules (ISA, 2010). The license areas are surrounded by 9 designated “Areas of Particular Environmental Interest” (APEIs), which are supposed to be protected from future mining operations, each of them consisting of a 200x200 km² large core area and a 100-km buffer zone around (ISA LTC, 2011).

Fig. 3.1: Map of the Northeast Pacific Ocean showing the cruise track of SO268 (black lines) with the harbours Manzanillo and Vancouver (red squares), the exploration license areas for polymetallic nodules in the CCZ (red areas) issued by the ISA and the APEIs (purple squares), as well as countries' EEZs (green areas).

The working areas of SO268 are located in the “Prospective Area #1” (PA1) of the German contract area (Fig. 3.2) and in the B4S03 area of the Belgian contract area (Fig. 3.8). In both areas the selected collector trial and reference sites have been sampled by previous exploration work of the contractors BGR and GSR (BGR, 2018; GSR, 2018). In addition, the German reference site

was also studied during SO239 in the first phase of the MiningImpact project (Martinez-Arbizu and Haeckel, 2015) and the German trial site was sampled by BGR during SO262.

The collector trial sites were selected based on available information on bathymetry, nodule size and abundance on the seabed as well as the possibility to have a suitable reference site nearby. While the German trial site (Fig. 6.3) exhibits a rather smooth terrain with slopes of 0-3° in water depths of 4080-4130 m and small nodules of less than 4 cm in size with an abundance of 20-26 kg/m² of wet weight (BGR, 2018), the Belgian trial site (Fig. 6.9) exhibits a rougher terrain with slopes of up to 3-7° in water depths of 4450-4530 m and larger nodules of more than 4 cm in size with an abundance of 20-24 kg/m² of wet weight (GSR, 2018). Therefore, some differences in the impact are expected, particularly in association with the dispersal and deposition behaviour of the produced sediment plume.

The reference sites (Figs. 3.4 and 3.10) were selected based on the following criteria: (i) data from previous years are available, (ii) these data indicate that they are representative for the ecosystem and environment of the trial sites, and (iii) they are located at sufficient distance and direction from the trial sites that they will likely not be impacted by the collector trial, i.e. the suspended sediment plume.

The site of the small-scale sediment plume experiment (Dredge Site, Fig. 3.5) in the German working area was placed in an area that had been sampled on previous cruises and in sufficient distance from the trial and reference sites to avoid any impact on them. The Dredge Site exhibits a smooth topography with a few highs and lows (4115-4125 m water depth). It is located slightly north of the SO239-24-EBS track.

A site free of polymetallic nodules on the seabed was visited to provide a reference area for the hard substrate recolonization experiment. It is located about 20 nm west of the German reference site (Fig. 6.2). In addition to this No-Nodule Site, the frames with artificial hard substrates were also placed at the seafloor in one of the tracks in the Dredge Site and in the German Reference Site.

The following maps provide an overview of the gear deployments in the working areas. Color codes of the deployed gear types are kept identical in each map: BC (red), GC (yellow), MUC (green), CTD (blue), Lander (violet), Mooring (black). Tracks of OFOS surveys and ROV dives are omitted for graphical clarity.

Fig. 3.2: Overview map of the German working area (located in PA1 of the license area) showing the locations of the No-Nodule Site (triangle), Reference Site (ellipse), Trial Site (square), and Dredge Site (NE of the Reference Site and S of the Trial Site). Bathymetry is a georeferenced image taken from BGR (2018).

Fig. 3.3: Map of the German Trial Site showing the gear locations: BC (red), GC (yellow), MUC (green), CTD (blue), Lander (violet), Mooring (black). AUV-based high-resolution multibeam bathymetry is superimposed on ship-based multibeam bathymetry using different color coding. The designated Collector Impact Site is indicated by a gray rectangle.

Fig. 3.4: Map of the German Reference Site showing the gear locations: BC (red), GC (yellow), MUC (green), CTD (blue), Lander (violet). AUV-based high-resolution multibeam bathymetry from SO239 is superimposed on ship-based multibeam bathymetry using different color coding.

Fig. 3.5: Map of the Dredge Site showing the gear locations: BC (red), GC (yellow), MUC (green), CTD (blue), Lander (violet), Mooring (black). AUV-based high-resolution multibeam bathymetry from SO239 is superimposed on ship-based multibeam bathymetry using different color coding. Dredge tracks (black lines) are based on preliminary analysis of OFOS surveys. 24-EBS track from SO239 (gray line) is shown for reference.

Fig. 3.6: Perspective view on the layout of the sensor array for the plume experiment consisting of 14 platforms with 29 optical and acoustic sensors (colored cones) and SLIC boards (black dots). Dredge tracks (black lines) and areas of thick (purple) and faint (greenish) sediment deposition on the seafloor are based on preliminary analysis of OFOS surveys.

Fig. 3.7: Map showing the locations of CTD (blue) and Mooring (black) deployments for the study of the eddy. White lines indicate the ship-based 38-kHz ADCP measurements of the surface ocean current velocity and direction while sailing through the eddy. Bathymetry of the German contract area is a georeferenced image taken from BGR (2018).

Fig. 3.8: Overview map of the Belgian working area (located in B4S03 of the license area) showing the locations of the Reference Site (ellipse) and Trial Site (square), plotted on ship-based multibeam bathymetry.

Fig. 3.9: Map of the Belgian Trial Site showing the gear locations: BC (red), GC (yellow), MUC (green), CTD (blue), Lander (violet). ROV-based high-resolution multibeam bathymetry is superimposed on ship-based multibeam bathymetry using different color coding. The designated Collector Impact Site is indicated by a gray rectangle.

Fig. 3.10: Map of the Belgian Reference Site showing the gear locations: BC (red), MUC (green), Lander (violet), plotted on ship-based multibeam bathymetry.

3.2. Aims of the Cruise

Cruise SO268 is fully integrated into the second phase of the European collaborative JPIOceans project MiningImpact and is designed to assess the environmental risks and impacts of deep-sea mining of polymetallic nodules. The field work in particular aimed at acquiring the environmental baseline data for the first industrial trials of a nodule collector pre-prototype by DEME-GSR in the Belgian and German contract areas of the Clarion-Clipperton Fracture Zone. A more technical aim of the cruise was to test tools, technologies, and a concept for the environmental monitoring of future deep-sea mining operations. In this context the overarching goal is to develop standards and protocols for impact assessments and to derive recommendations for marine policy and international legislation.

Specific scientific aims to be addressed were:

Fate and impact of the sediment plume inside and outside of the mined area

How large is the spatial footprint of the created sediment plume (including crushed nodule material) and how does it evolve with time? How fast do particles aggregate and drop out of the plume; which fraction of fine particles stays in the plume and how quickly is it diluted by currents? How large is the area of blanketing by the resettling particles and how thick is this cover (inside and outside the mined area)? How tolerant is the benthic (and pelagic) fauna, particularly filter feeders, to the sediment particle concentration of the plume (exposure time will likely be important), and how can the benthic fauna cope with the sediment blanket? Are toxic substances (e.g., heavy metals) released within the plume and is oxygen consumed by released reduced

substances? Are microorganisms redistributed by the plume and do they change functions where they resettle?

Direct impacts in the mined area and test of restoration measures

How much of the larger fauna, including mobile organisms not directly attached to nodules, is lost in the mined area? How severe is the mortality for smaller organisms (meio- and macrofauna) living on or in the sediments? How much is the underlying sediment compacted (and porewater squeezed out) due to the deployment of the heavy collector system; does this impact persist for longer times – how elastic does the sediment respond? Does this affect the solute fluxes across the sediment surface? Does this compaction and also the general exposure of the stiffer sediment (below the bioturbated zone) control (and potentially delay) the recolonization of burrowing organisms? How does low-to-no bioturbation after the impact affect biogeochemical functions, bacterial community structure and activity, and the benthic foodweb? Can placing of artificial hard substrates assist in the recolonization of the mined areas? Which materials are suitable in substituting the manganese nodules?

Environmental Risk Assessment (ERA) of polymetallic nodule exploitation

What standards and protocols should be developed for environmental impact assessments (EIA)? What is the propensity to harm the deep-sea ecosystem? Which is the ecosystem that needs to be looked at in an ERA? What is the wider environmental impact of mining beyond the mined areas? Which discrete risk scenarios can be identified? What are the costs of a mining hazard (e.g., impacted ecosystem services, value of ecosystem/fauna, remediation costs)? How can the impact of mining be minimized (e.g., strategies for spatial planning of mining operations, establishment of marine protected areas, protection of seamounts, recommendation of criteria)? What is the spatial variability of e.g., environmental parameters and faunal communities on regional scale (i.e. mined area and vicinity), in the license areas, and across the CCZ? How closely are abyssal populations genetically connected over these different distances (tens, hundreds and thousands of kilometers)?

3.3. Agenda of the Cruise

SO268 acquired detailed environmental baseline data and samples in the designated collector trial sites and its associated reference sites in the German and Belgium contract areas for polymetallic nodule exploration in the Clarion-Clipperton Zone. In addition baseline data were collected at the site of a small-scale sediment plume experiment. The plume experiment was monitored by an array of acoustic and optical sensors and subsequently the impacted area was investigated. The overall work comprised oceanographic, biological, microbiological, biogeochemical, and geologic investigations which required the deployment of a multitude of seagoing equipment, such as ROV Kiel 6000 for sampling of sediments, nodules, and benthic fauna as well as carrying out in situ measurements and experiments, and the deployment of the plume sensor array. AUV ABYSS and ROV Kiel 6000 were used for high-resolution acoustic mapping of the seafloor using mounted multibeam systems and video/photo surveys of the manganese nodule habitat. This work was accompanied by video observations with the OFOS system. Several benthic landers and moorings with acoustic and optical sensors were deployed and

recovered for the measurements of physical and chemical oceanographic variables. Coring devices (i.e., box corer, gravity corer, TV-guided multiple corer, ROV-operated push cores) were used to collect sediment samples for biological, geochemical, and microbiological analyses, and a CTD rosette water sampler, in situ pumps, and a bottom water sampler sampled the water column. In addition, recolonization experiments for nodule-associated fauna were started in the working areas by deploying artificial hard substrates on the seabed.

4 Narrative of the Cruise

4.1 Leg 1 (17 February – 27 March 2019, Manzanillo – Manzanillo)

The first group of scientists arrived already on 13.02.19 in Manzanillo to install the ROV-system; whereas the AUV-system had stayed on board from the previous cruise SO267. On the next day, 14.02.19, another group followed to receive the 14 container in total and install the other equipment and laboratories. RV SONNE was waiting for us at a large pier (fiscal pier) of the passenger terminal next to the city center, where the cruise liners usually stop. Unfortunately, during the first meeting on board it became clear already that customs declarations and the logistic handling of a research vessel in the required dimensions and time frame could not be performed. The crew of the RV FALKOR (Schmidt Ocean Institute) had to make the same experience and had been waiting at this pier for one week already for the delivery of one container. After the arrival of the rest of the scientific crew a tedious and time-wise not foreseeable fight for the delivery of airfreight and container started. After a personal meeting with customs and with a letter of support from the German embassy some movements evolved and RV SONNE was scheduled for a 24 hour window to move into the container harbor on the 22nd of February. In the meanwhile container and freight had been unstuffed and inspected in detail and were all delivered in mixed arrangements after another inspection via truck to the vessel. By the joined efforts of the crew and the science party we were able to put the containers in position and to distribute the delivered gear on board. At noon of the following day RV SONNE returned to the passenger terminal, where we finally started to rig up the large instrumentation and to prepare the laboratories. Parts of the airfreight were not delivered in time as some of it contained dangerous goods. All together, these circumstances caused a significant delay of 1 week and loss of valuable ship time which will imply a reduced working program. RV SONNE set sail at 16:25 LT on the 24th of February leaving Manzanillo and RV FAKOR behind for the transit towards the German contract area.

Fig. 4.1.1: (Left) RV SONNE waiting at the empty passenger terminal in Manzanillo (in the background RV FALKOR). (Center) Loading of container on the back deck. (Right) View at the busy working deck from the side.

Fig. 4.1.2: (Top) View at the back of RV SONNE with ROV Kiel 6000. (Left) View at the full working deck, while leaving Manzanillo harbor with the container terminal in the back.

The 3-day transit to the German contract area with calm and sunny weather was used to prepare the equipment and the laboratories on board. On 26th of February the multibeam was switched on, a swim test of the AUV in multibeam configuration was performed and the obligatory harbor test of the ROV was conducted as a free water test beyond the 200 nm zone. During this test, first erratic problems with the HD camera as well as hydraulic oil leakage at the right manipulator occurred. Part of the problems seemed to disappear during descent to 600 m water depth. At this point, it may be added that the ROV system experienced a complete inspection and overhaul with a successful concluding test in the marine docks at Kiel.

Fig. 4.1.3: (Top) Launch and Recovery System (LARS) of AUV ABYSS on starboard side of RV SONNE. (Right) The LARS of ROV Kiel 6000 mounted to the A-frame on the back deck.

After continuation of the transit RV SONNE reached the German contract area on February 27. The working program was started with the deployment of the long baseline transponder network for the underwater navigation of the AUV. A CTD station followed to obtain a sound velocity profile for the calibration of the multibeam, a calibration of turbidity sensors and for sampling bottom water with the water sampler carousel. After this, the calibration of the transponder was performed to obtain an accurate positioning of the AUV. During the night the working area was mapped with the multibeam of SONNE to have a basis for the upcoming investigations. In the morning of February 28 the AUV was deployed with its launch and recovery system (LARS) to perform a high resolution mapping within a 12 km² section of the working area.

After this, the first deployment of the brand new multicorer of the Senckenberg Institute was conducted using the video telemetry system of RV SONNE for video-guided sediment sampling. With 3 successful, consecutive deployments, each providing 20 cores, the whole group of biologists, microbiologists and geochemists received their first samples from 4080 m water depth.

Fig. 4.1.4: Preparation of the equipment: (top left) Elevator lander with launcher, box corer and multicorer on deck; (others) the first video-guided deployment of the new multicorer with 20 liners.

Before the AUV resurfaced after a 12-hr deployment, the remaining time was used to recover a short mooring belonging to BGR, which will be redeployed during this cruise. After this, the AUV arrived at the surface on schedule and was recovered with its LARS. This was the first successful deployment by a new team under remote supervision from colleagues in Kiel.

Fig. 4.1.5: Elevator Lander with Launcher mounted on top.

Now, both elevator landers equipped with modules for in situ measurements and experiments were deployed video-guided by a launcher in the immediate surrounding of the 1st ROV dive. On 1st of March the ROV was sent to depth, unfortunately additional problems as encountered during the test dive occurred. The HD was functional again, but the two landers were found only by using the acoustic beacons as the sonar of the ROV failed completely. This instrument has a fundamental function for the ROV. Comparable with a radar helping a surface vessel to find objects in fog, the sonar is used to relocate small objects in the sediment cloud the ROV's propeller are creating during deployment of the modules in the surrounding of the elevator landers. Due to this, the landers were not unloaded and a mapping transect for macrofauna occurrence was started. Unfortunately, this had to be terminated soon due to the ongoing leakage of hydraulic oil.

After this, the work program had to be changed to simple mechanical sampling of macrofauna by the box corer. Unfortunately, even this proved to be not successful as the trigger mechanism of the boxcorer was not working well and with two trials only one bad sample was recovered. After re-installation of the video equipment on the OFOS the sled was deployed for an optical survey of the seafloor. Here, during descent close to the seafloor problems occurred with the fiber optic cable and the instrument had to be recovered. Again a change of plan and the CTD with water sampler carousel and 5 in situ pumps installed in different depth on the cable was deployed to sample water for suspended particles and microorganism on filters for a 4 hour in situ incubation.

After recovery of the pumps the sampling with the box corer on the wire and the search for failures on the ROV and the fiber optic cable were continued. In the case of the boxcorer with success as the box penetrated into the sediment but without sample recovery due to the trigger mechanic which refused to work properly even after mechanical treatment. However, the subsequent deployments of gravity corer and multi corer on the wire recovered the desired sediment samples. On the morning of the 3rd of March the ROV was deployed again and we hope that we will be able to perform the central objectives without the sonar.

The second week at sea started again with some technical problems und draw backs in the work plan. The second deployment of the AUV was dedicated to perform photo mosaicking of the trial site equipped with a camera and LED flash light system build at GEOMAR. Before, this had been

used successfully during cruise SO239. For this purpose, the AUV has to fly in close profiles in about 7 m distance to the seafloor. Unfortunately, we had to notice after recovery that although the AUV had followed the pre-programmed profiles but it did not take any pictures. Furthermore, the trim of the vehicle was not ideal, forcing the AUV to use all of its propulsion power and to drop the emergency weight to get back to the sea surface. As the photo mosaicking is an important mission of this cruise, the team started to analyze the failures immediately. The following time after this station sediment sampling with the multi corer was continued and the second ROV dive performed. During this dive, it was possible to take the benthic chambers and profilers which had been deployed by both elevator landers at the seafloor before and to initiate the pre-programmed measuring cycles. Unfortunately, the dive had to be aborted too early again due to continuous leakage of oil.

Fig. 4.1.6: (Top) Elevator 1 at the seafloor. The ROV pilots fly to the lander and remove the scientific instruments to deploy them at selected spots on the seafloor. At the end of the measurements the instruments are placed again on the elevator and secured by rubber bands for their lift back to the sea surface. (Bottom left) Benthic chamber for the determination of the oxygen consumption of the sediment. (Bottom right) Microprofiler for the measurement of oxygen concentration profiles with fine glass electrodes in the sediment.

Nevertheless, the sixth box corer finally provided the long desired sediment sample for the quantitative determination of the macro fauna. After this, a long OFOS profile was conducted over the trial area and the surrounding to determine the distribution of polymetallic nodules and the associated mega and macro fauna. In the afternoon of March 4, a 500m-long mooring of the BGR with a sediment trap and current meters was recovered successfully followed by the 2nd CTD station with in situ pumps and 2 box corer stations. In parallel, the ROV team used the day without

a dive to inspect the problems in the hydraulic system of the ROV and exchanged the old, apparently defect hydraulic pump by a new one with the support of the ship's engineers.

During the following ROV dive on March 5, some of the scientific instrumentation was placed back on elevator 2, 3 frames with artificial nodules were placed for a recolonization experiment and one benthic chamber was retrieved by the ROV before the dive had to be terminated. However, our attempts to recover the elevator by acoustic release of the bottom weight showed no success. By using the acoustic ranging of a transponder it became obvious, that despite a positive reply of the releaser, the lander was still in 4080m water depth at the sea floor. During the night sediment sampling with multi corer and box corer continued.

The 4th ROV dive started with the mechanic release of elevator 2 and subsequent recovery by using the zodiac. Due to increasing wind and wave conditions this became a substantial challenge for the deck's crew. Meanwhile, the ROV continued a targeted sampling of the macro fauna. After the last samples and scientific modules were placed on elevator 1, it was released by the ROV as well and recovered by the vessel after the ROV was back on deck. During the night, another long OFOS transect was conducted until noon followed by a short ROV dive to complete the sediment sampling by push corers. In parallel to this, elevator 2 was inspected and tested with great care on deck and a problem in the release mechanism was found and solved.

Fig. 4.1.7: (Left) Elevator 2 with launcher mounted on top on the deck and (Top) carrying the scientific instrumentation at the seafloor.

In the early morning of March 8 elevator 2 equipped with 3 micro profilers, 2 racks with 26 nodule frames, 2 stand-alone cameras and 3 amphipod traps was deployed video-guided at the seafloor of the reference site in the German contract area.

On the following 5th ROV dive with 2 benthic chambers on the „porch“ (stage underneath of the cameras and manipulators) of the ROV all modules were deployed and measurements initiated

as well as 26 nodule frames were placed on the sediment for a recolonization experiment. This was the first dive without a substantial loss of oil.

Fig. 4.1.8: (Top left) Sediment sampling with ROV-operated pushcorers. (Top right) Recolonization experiment with artificial nodules placed at the seafloor. (Bottom left) Careful sampling of manganese nodules with associated fragile macrofauna. (Bottom right) Rocket-like lift-off of the Elevator Lander from the seafloor after triggering the mechanical release mechanism by ROV Kiel 6000 to drop off the lander's bottom weight for the ascent back to the sea surface.

After recovery of the ROV, a successful AUV test dive was conducted to test the camera system and the trim of the vehicle in 200m water depth. Unfortunately, the dive for photo mosaicking, being shifted already for several times, had to be abandoned due to the increased wind and wave conditions. As an alternative the multi corer was deployed for sediment sampling.

On March 9, the 6th ROV dive was performed in the reference site again for sampling the fauna and sediment sampling by push corer, recovery of the used modules with the elevator and with 2 modules on the porch. A subsequent AUV dive followed, which had to be abandoned again. After this, a last sediment sampling with multi corer and box corer followed today before we recover the transponder net and another BGR mooring (157OBM) and start transit to the Belgian contract area.

During our 2-day transit to the Belgian contract area the wind and waves became stronger (6-7 Bft. with a high swell). When we arrived on March 13 we deployed and calibrated the transponder network for the AUV. This was followed by a CTD water sampler carousel station to get water samples and a sound velocity profile to calibrate the ship's multibeam for the next survey in the new working area. The next stations were performed with the CTD and the in situ pumps, the multiple and box corer providing samples for the benthic fauna team.

In the morning of the 15th of March both elevator landers were deployed loaded with benthic chambers and profilers, 2 stand-alone cameras and amphipod traps in the Belgian contract area. Here, the first video-guided deployment of elevator 2 on March 15 had shown already that the sediment surface is more densely covered by larger nodules compared to the German area.

Whereas the first deployment went smoothly, the subsequent deployment of elevator 1 became a free fall deployment by an unexpected activation of the electromagnetic release disconnecting the lander from the launcher when the telemetry was switched on at 71 m water depth. Fortunately, the elevator was found in 4507 m water depth by the ROV pilots on a subsequent dive (9) on March 17 very close to its deployment position and the dive plan using the freight of both elevators could be continued almost as scheduled.

This dive was followed by 3 multicorer deployments and a Parasound survey for the next gravity corer deployment. However, the presence of the ROV during dive 10 on March 18 proved to be very helpful again since the acoustic releasers on both elevators failed. After both elevators were recovered and since weather was favorable, we decided to deploy the large Molab Master lander. This lander was equipped with a sediment trap, a downward-looking still camera and Aquadopp profiler, 2 ADCPs, a CTD with various turbidity sensors and an acoustic modem. Together with the launcher it weighs about 2.6 tons in air and with its 2.4m long legs used as bottom weights it is designed to monitor the water column above and the bottom water underneath the floatation unit. So far, it has been deployed only 2-times before in shallow water in Norwegian fjords.

Fig. 4.1.9: (Left) Molab Master Lander ready for deployment. (Right) Successful recovery of Molab by ROV Kiel 6000 in a 2-wire operation.

The first deployment in the deep sea proved to be a real challenge: first to bring it intact into the water and to the seafloor – during the first trial the legs were lost already on the surface when the lander hit the vessel in the swell and during the second trial at 1800 m water depth when the legs detached spontaneously. To make a long and tedious story short: When the wire was heaved back in, we noticed that the attachment part of the launcher had been ripped off and the lander with launcher on top was slowly descending back to the seafloor. Luckily, the signal of the transponder provided the position, but it took us 2 subsequent ROV dives (11 & 12) to recover on March 20 the upside down lander with launcher by a 2-wire operation back on deck.

After this and after a last unsuccessful AUV-test, we decided that both instruments need substantial improvements/ maintenance.

During these operations the sediment sampling program was continued during the nights with deployments of the gravity-, multi- and box corer in the Belgian trial and reference sites. With the last dive (13) on March 21 the MPI team concluded its activities to measure oxygen fluxes directly at the seafloor. The second half of the dive was dedicated to an experiment feeding holothurians with labelled algae. After return of the ROV the transponder net was recovered with another set of gravity-, multi- and box corer deployments.

After a final test of our acoustic releasers on the CTD/water sampler carousel we terminated our demanding work program on March 22 and started transit back to Manzanillo. The transit was used to pack, clear up, maintain instrumentation and write the cruise report. On Wednesday 27th March, the vessel arrived in Manzanillo at the fiscal pier to await the handover of scientists and gear between both legs. Hopefully the logistics for the discharge of our 3 AUV-containers and unloading of 6 other containers with important supply for the vessel will be handled more efficiently than at the start of this leg.

4.2 Leg 2 (30 March – 27 May 2019, Manzanillo – Vancouver)

In port we exchanged 24 scientific participants, while 14 remained on board for the second leg. AUV Abyss was shipped back home, since its electronic problems could not be repaired, while a container with additional mooring equipment and several airfreight packages were loaded onto the vessel – this time without delay. Another container with lander weights got stuck in Cartagena and did not arrive in Manzanillo. Leg 2 set sail on 30th of March leaving Manzanillo harbour towards the German working area.

The first destination of leg 2 was an ocean gyre (eddy) that had formed off the coast of Central America six months earlier and was moving towards the German working area. Since eddies in the NE Pacific are known to increase current velocities throughout the entire water column, i.e. also at the seafloor in more than 4000 m depth, by a factor of two to three, they may resuspend the fine-grained seafloor sediments. While crossing the eddy, its surface currents were characterized by the ship's ADCP as well as four CTD stations with in situ pumps conducting vertical ADCP profiles. On April 4, we arrived in the German working area, where we collected baseline data of the site chosen for a small-scale sediment plume experiment. This included gravity, multiple, and box coring of the surface sediment, surveying the benthic habitat with the OFOS sled and ROV dives for in situ measurements of microbial oxygen consumption and macrofauna sampling. Subsequently, various hydroacoustic and optical sensors on a variety of platforms were distributed in the plume experiment area by the ROV and the moorings were deployed on a north-south transect across the German contract area. During the night of 10th to 11th of April eleven dredge tracks were towed suspending the seafloor sediments. Afterwards, the immediate impact was sampled by multiple coring and ROV-pushcoring for geochemical analyses.

On April 14 we returned to the Belgian working area to sample the food experiment started on leg 1 and finish our baseline investigations of the designated trial and reference sites. This involved more box coring for macrofauna, OFOS surveys for megafauna identification, gravity coring for

geochemistry as well as ROV dives for push coring, in situ measurements and megafauna sampling. In addition, a multibeam system was mounted to the ROV to collect high-resolution bathymetry data of the designated collector trial site. This operation was necessary because of the damage to AUV Abyss on leg 1 that prevented collecting such data. While retrieving one of the elevator landers in rough weather on April 18, it was sucked under the ship's bow and resurfaced at the stern about half an hour later having lost three microprofilers and benthic chambers. The lost equipment was recovered successfully during an additional ROV dive, but one chamber was only found shredded in pieces at the seafloor, likely from contact with the ship's propeller.

After investigations in the Belgian area were finalized on 24th of April, we returned to the German working area. Here, we deployed another set of artificial nodule frames at a site with no manganese nodules on the seabed as a control part of the recolonization experiment. On April 27 we arrived at the dredge experiment site to proceed with the impact assessment and also to continue the baseline investigations in the designated German trial and reference sites. However, after two OFOS surveys, box coring and two ROV dives, we had to interrupt our studies in order to return to Manzanillo due to a medical emergency. One of the elevator landers had to be left down at the seafloor during this time as well, because its weights could not be released. Six days later, on May 7, we were back in the German trial site to rescue the elevator by another two-wire operation. During this dive we discovered an amphipod trap that we had lost four years ago during cruise SO239. At the end of the dive we also recovered this amphipod trap.

During the next three days we finalized the baseline investigations in the German reference site by conducting the remaining multiple and box coring, an OFOS survey, and an ROV dive with in situ measurements. On 11th of May we moved to the plume experiment site. An intense sampling program of the impacts, particularly along the gradient of sediment redeposition, was conducted, including multiple and box coring as well as in situ measurements, amphipod deployments and megafauna sampling during ROV dives. The third part of the recolonization experiment, i.e. artificial nodule frames, was deployed in one of the dredge tracks. In addition, the moorings were recovered and redeployed with different configurations a few days later in the plume experiment site (two short 6-m moorings) and in the designated collector trial site (a short 6-m and a long 200-m mooring). They will stay at the seafloor until the BGR cruise scheduled for 2020 in order to record bottom current velocities and directions, collect the amount of sinking particles in sediment traps, and monitor a possible resuspension of the freshly deposited plume sediment. Our work program was finalized by ROV dives and elevator lander deployments retrieving the array of optical and acoustic sensors from the plume experiment area, a CTD deployment with in situ pumps as well as missing box coring in the German reference site.

On 17th of May we started the 2400 nautical miles long voyage towards Vancouver, Canada. Due to the customs problems in Manzanillo at the beginning of SO268, Vancouver had been chosen as new destination for this cruise in March. After 11 days of transit, we safely arrived in Vancouver on May 27. Here, we unloaded the five ROV containers from the ship and then packed eight containers with our large gear and equipment on the pier. These operations were rather slow and took until 29th of May, when the containers were finally sealed. Due to a union strike in the harbour of Vancouver the last container did not arrive before RV SONNE had to leave port again and hence, we decided to ship those pallets with equipment onboard SONNE to Singapore, the final destination of leg 3.

During the three and a half month long research expedition SO268 we accomplished a total of 210 stations (Chapter 7)

5 Preliminary Results

5.1 CTD and BWS Deployments

5.1.1 CTD with in situ pumps, ADCPs, SVP

(M. Molari, S. Halboom, K. Schmidt)

During the SO268 cruise, 17 CTD (conductivity-temperature-density) casts were carried out in the German and Belgian working areas using a SBE 911 plus CTD profiler attached to a Sea Bird SBE 32 carousel water sampler (Tabs. 7.1.2 and 7.1.3). CTD water column profiles were obtained to get information about general physico-chemical composition of the water column (i.e. the vertical variability of temperature, salinity and oxygen) and to select the appropriate water depths for water sampling. The registration of the hydrographic parameters was performed from the sea surface down to the sea bottom and vice versa.

The system consists of:

- a) **SBE 9 plus CTD** which is supplied with: titanium main housing and T and C sensors, to 10,500 meters; digiquartz pressure sensor; secondary T and C sensors; auxiliary sensors (an SBE 43 oxygen self-regenerative Clark-sensor with Teflon membrane, WetLabs sensors (ECO-NTU turbidity meter and ECO-AFL/FL fluorometer, and altimeter); TC duct (it ensures that temperature and conductivity measurements are made on the same parcel of water); submersible pump; 300 baud modem for water sampler control; eight 12-bit A/D differential input, low pass-filtered channels for auxiliary sensors.
- b) **SBE 11 plus V2 Deck Unit** - The deck unit supplies DC power to the SBE9plus, decodes the SBE 9plus data stream, and passes the data to a computer. Other features: NMEA interface (it permits the deck unit to integrate latitude, longitude, and time data into the CTD data stream); 300 baud modem interface - provides power and real-time control for water sampler (bottles are fired sequentially); remote output; RS-232 serial data uplink interface.
- c) **SBE 32 carousel water sampler** equipped with twenty-four 12-L Niskin bottles.

The system provides real-time data acquisition (both upcast and downcast) for the following parameters:

- Pressure; temperature; conductivity; oxygen; fluorescence; turbidity

From these data, the following parameters are derived (formulas for their computation are given in Foffonoff and Millard (1983):

- Depth; potential temperature; salinity; density; oxygen (requires pressure, temperature, and conductivity, as well as oxygen signal); sound velocity; acceleration

Fig. 5.1.1: The Sea Bird SBE 32 carousel water sampler with the SBE 911 plus CTD profiler.

During Leg 1 water samples were collected at three water depths: bottom water (ca. 5 meter above seafloor (mab)), 50 mab and 200 mab. Niskin bottles were used to collect water for microbiology (Ch. 5.13), extracellular DNA analysis (Ch. 5.13), and sensor calibration exercises (Ch. 5.4). GoFlo bottles (2 and 5 L) were used to collect water for biogeochemistry (Ch. 5.14). Two McLane and five Challenger pre-programmed *in-situ* pumps were additionally attached during some of the deployments, one to the CTD frame itself and the others along the cable at distances of 15 m, 25 m, 30 m, 60 m, 100-m, and 200 m above the frame. They were used to collect large amounts of microbial cells (Ch. 8.5), particulate materials filtered onto 0.45 μm or 0.2 μm Supor-filters and natural radionuclides adsorbed by manganese coated acrylic fibre cartridges (Ch. 5.15), respectively. This general program was kept during the second leg (Tabs. 5.1.2 and 5.1.3), but additional water samples were taken for general geochemical purposes throughout the entire water column (Ch. 5.15), and to collect suspended particulate matter (SPM) in the bottom water 5 mab (Ch. 5.15). No samples were taken for the sensor calibration exercises during the second leg.

During Leg 2 the CTD was additionally equipped with a JFE Advantech Infinity Series optical backscatter sensor (OBS), used for measuring the turbidity. Only at 088-1-CTD-08 the CTD was equipped with 14 of these JFE OBSs for intercalibration purposes. Occasionally the CTD was equipped with 1 or 2 2 MHz Nortek Aquadopp current profilers for current measurements during 10-minute stops at specified depth (bottom, 4000 m, 3500 m, 3000 m, 2500 m, 2000 m, 1500 m, 1000 m, 500 m, 250 m, 150 m, and 50 m) during the upcasts. At 88-CTD08, 90-CTD09, 92-CTD10 and 94-CTD11 the CTD was equipped with both an upward-looking and a downward-looking Nortek AquaDopp, whereas it was only equipped with a downward-looking Nortek AquaDopp at 159-CTD15, 183-CTD16 and 208-CTD17. At 120-CTD12, 131-CTD13 and 151-CTD14 no Nortek AquaDopp was added to the CTD frame (Tab. 5.1.1). Both sensors operated at a measuring interval of 1 s.

Tab. 5.1.1: Overview of sensor deployments during SO268/2.

Station SO268/2	Working Area	Additional sensors	Remarks
088-1_CTD-08	Eddy	14x JFE OBS 2x Nortek AquaDopp	All JFE OBSs for intercalibration purposes One upward-looking and one downward-looking AquaDopp
090-1_CTD-09	Eddy	1x JFE OBS 2x Nortek AquaDopp	One upward-looking and one downward-looking AquaDopp
092-1_CTD-10	Eddy	1x JFE OBS 2x Nortek AquaDopp	One upward-looking and one downward-looking AquaDopp
094-1_CTD-11	GER dredge	1x JFE OBS 2x Nortek AquaDopp	One upward-looking and one downward-looking AquaDopp
120-1_CTD-12	GER dredge	1x JFE OBS	
131-1_CTD-13	BEL trial	1x JFE OBS	
151-1_CTD-14	BEL ref	1x JFE OBS	
159-1_CTD-15	GER dredge	1x JFE OBS 1x Nortek Aquadopp	Downward-looking Aquadopp
183-1_CTD16	GER dredge	1x JFE OBS 1x Nortek Aquadopp	Downward-looking Aquadopp
208-1_CTD-17	GER dredge	1x JFE OBS 1x Nortek Aquadopp	Downward-looking Aquadopp

5.1.2 Bottom water sampler (BWS)

The Bottom water sampler (BWS) is a multihorizon sampling device for the investigation of the sediment-water benthic layer. The frame is made of titanium, and five 12 Liter Teflon-coated GoFlo bottles are mounted on a central middle axis in distances between 0.5 m to 2 m above the bottom plate. This enables for a high resolution, trace-metal clean sampling of the bottom water close to the sediment surface. The BWS is lowered through the water column until it reaches the seafloor. Closing of the bottles is initialized by burned wire electronics. It has been pre-programmed on board and set to one hour after arriving at the seafloor. This time delay allows to sweep away sediment particles suspended during tough-down.

During the only successful deployment of the BWS during Leg 2 (112 BWS) we sampled the bottom water in the Dredge Area before the impact and applied 0.8/0.2 µm capsule filtration for all samples. For two of these samples, we additionally applied 0.2 µm membrane filtration of the original seawater with subsequent 0.015 µm membrane filtration and 0.02 µm syringe filter filtration. Ultrafiltration with a 10 KDa membrane was conducted for one of the 0.8/0.2 µm prefiltered samples.

Tab. 5.1.2: Overview of CTD casts and in situ pumps carried out during SO268/1. Sampling depths of in-situ pumps were calculated based on the distance of the pump to the CTD and the CTD water depth during pumping (usually about 5 mab, except for 049 CTD05 with 15 mab).

Station SO268/1	Working area	Bottle number	Water depth [m]	Sampling Depth [m]	Sampling (group)	In-situ pump	Sampling depth [m]	Sampling (group)
002-1_CTD-01	GER Trial	1–4, 21	4105	4101	microbiology (MPI)	-	-	-
		5–11	4105	4101	sensor calibration (GEOMAR)	-	-	-
		20	4105	4101	extracellular DNA (NORCE + NHM)	Jimmy 7	4073	microbiology (MPI)
014-1_CTD-02	GER Trial	1–11, 18, 19	4078	4073	microbiology (MPI)	Hulda_8	4048	microbiology (MPI)
		17	4078	4073	extracellular DNA (NORCE + NHM)	ISP 1	4058	geochemistry (AWI)
		20, 21	4078	4028	microbiology (MPI)	ISP 2	4043	geochemistry (AWI)
		22, 23	4078	3878	microbiology (MPI)	ISP 7	4013	geochemistry (AWI)
		24	4078	3878	microbiology (MPI), chemistry (AWI)	ISP 4	3973	geochemistry (AWI)
						ISP 5	3873	geochemistry (AWI)
023-1_CTD-03	GER Trial	1–16	4108	4104	microbiology (MPI)	ISP 4	4089	geochemistry (AWI)
		17	4108	4104	extracellular DNA (NORCE + NHM)	IPS 7	4074	geochemistry (AWI)
		18, 19	4108	4058	microbiology (MPI)	ISP 5	4044	geochemistry (AWI)
		20, 21	4108	3908	microbiology (MPI)	ISP 1	4004	geochemistry (AWI)
		22	4108	4104	biogeochemistry (JUB)	Jimmy_7	3924	microbiology (MPI)
		23	4108	4058	biogeochemistry (JUB)	ISP 2	3904	geochemistry (AWI)
		24	4108	3908	biogeochemistry (JUB)	-	-	-
047-1_CTD-04	BEL Trial	1–16	4485	4435	microbiology (MPI)	-	-	-
049-1_CTD-05	BEL Trial	1, 5	4456	4449	isotope experiment (T. Amaro)	Hulda_8	4441	microbiology (MPI)
		2, 3	4456	4449	microbiology (MPI)	ISP 1	4426	geochemistry (AWI)
		4	4456	4449	extracellular DNA (NORCE + NHM)	Jimmy_7	4416	microbiology (MPI)

Station SO268/1	Working area	Bottle number	Water depth [m]	Sampling Depth [m]	Sampling (group)	In-situ pump	Sampling depth [m]	Sampling (group)
		8, 9	4456	4406	microbiology (MPI)	ISP 2	4411	geochemistry (AWI)
		10, 11	4456	4256	microbiology (MPI)	ISP 4	4381	geochemistry (AWI)
		18, 19	4456	4449	sensor calibration (GEOMAR)	ISP 5	4341	geochemistry (AWI)
		22	4456	4449	biogeochemistry (JUB)	ISP 7	4241	geochemistry (AWI)
		23	4456	4406	biogeochemistry (JUB)	-	-	-
		24	4456	4256	biogeochemistry (JUB)	-	-	-
059-1_CTD-06	BEL Trial	2, 3	4481	4477	microbiology (MPI)	-	-	-
		4	4481	4477	extracellular DNA (NORCE + NHM)	-	-	-
		9	4481	4477	sensor calibration (GEOMAR)	-	-	-
		10	4481	4477	chemistry (AWI)	-	-	-
		17, 18	4481	4431	microbiology (MPI)	-	-	-
		21, 22	4481	4281	microbiology (MPI)	-	-	-

Tab. 5.1.3: Overview of CTD casts and in situ pumps carried out during SO268/2. Sampling depths of in-situ pumps were calculated based on the distance of the pump to the CTD and the CTD water depth during pumping (usually about 5 mab).

Station SO268/2	Working area	Bottle number	Water depth [m]	Sampling Depth [m]	Sampling (group)	In-situ pump	Sampling depth [m]	Sampling (group)
086-1_CTD-07		-	-	-	-	-	-	-
088-1_CTD-08	Eddy	2	4122	4117	SPM (NIOZ)	Hulda_8	4117	microbiology (MPI)
		3	4122	4117	(RBINS)	ISP 1	4102	geochemistry (AWI)
		4,5	4122	4117	microbiology (MPI)	Jimmy_7	4092	microbiology (MPI)
088-1_CTD-08		22	4122	4117	biogeochemistry (JUB, BGR)	ISP 2	4087	geochemistry (AWI)
		1	4122	4072	biogeochemistry (JUB, BGR)	ISP 4	4057	geochemistry (AWI)
		20,21	4122	4072	microbiology (MPI)	ISP 5	4017	geochemistry (AWI)
		11	4122	3922	chemistry (AWI)	ISP 7	3917	geochemistry (AWI)
		24	4122	3922	biogeochemistry (JUB, BGR)			

Station SO268/2	Working area	Bottle number	Water depth [m]	Sampling Depth [m]	Sampling (group)	In-situ pump	Sampling depth [m]	Sampling (group)
		6	4122	3700	biogeochemistry (JUB, BGR)			
		7	2900	2900	biogeochemistry (JUB, BGR)			
		8	2400	2400	biogeochemistry (JUB, BGR)			
		9	1900	1900	biogeochemistry (JUB, BGR)			
		10	1400	1400	biogeochemistry (JUB, BGR)			
		17	1000	1000	biogeochemistry (JUB, BGR)			
		23	500	500	biogeochemistry (JUB, BGR)			
		18	250	250	SPM (NIOZ)			
		19	80	80	biogeochemistry (JUB, BGR)			
090-1_CTD-09	Eddy	2	4150	4145	SPM (NIOZ)			
		3	4150	4145	(RBINS)			
		22	4150	4145	biogeochemistry (JUB, BGR)			
		1	4150	4100	biogeochemistry (JUB, BGR)			
		24	4150	3951	biogeochemistry (JUB, BGR)			
		23	4150	500	biogeochemistry (JUB, BGR)			
		17	4150	250	SPM (NIOZ)			
092-1_CTD-10	Eddy	2	4111	4106	SPM (NIOZ)	Hulda_8	4106	microbiology (MPI)
		3	4111	4106	extracellular DNA (NORCE + NHM)	Jimmy_7	4081	microbiology (MPI)
		4,5	4111	4106	microbiology (MPI)			
		6,7	4111	4106	Backup			
092-1_CTD-10		20,21	4111	4106	SW for sediment trap (JUB, BGR)			
		22	4111	4106	biogeochemistry (JUB, BGR)			
		8,9	4111	4060	microbiology (MPI)			
		10,11	4111	4060	Backup			
		24	4111	4060	biogeochemistry (JUB, BGR)			
		19	4111	3910	biogeochemistry (JUB, BGR)			
		23	4111	500	biogeochemistry (JUB, BGR)			
		17	4111	250	SPM (NIOZ)			

Station SO268/2	Working area	Bottle number	Water depth [m]	Sampling Depth [m]	Sampling (group)	In-situ pump	Sampling depth [m]	Sampling (group)
094-1_CTD-11	GER Dredge	2	4124	4119	SPM (NIOZ)			
		3	4124	4119	extracellular DNA (NORCE+NHM)			
		4,5	4124	4119	Backup			
		22	4124	4119	biogeochemistry (JUB, BGR)			
		1	4124	4074	biogeochemistry (JUB, BGR)			
		21	4124	4074	Backup			
		20	4124	3924	Backup			
		24	4124	3924	biogeochemistry (JUB, BGR)			
		6	4124	3700	biogeochemistry (JUB, BGR)			
		7	4124	2900	biogeochemistry (JUB, BGR)			
		8	4124	2400	biogeochemistry (JUB, BGR)			
		9	4124	1900	biogeochemistry (JUB, BGR)			
		10	4124	1400	biogeochemistry (JUB, BGR)			
		17	4124	1000	biogeochemistry (JUB, BGR)			
		23	4124	250	biogeochemistry (JUB, BGR)			
		18	4124	250	SPM (NIOZ)			
		11	4124	250	Backup			
		19	4124	80	biogeochemistry (JUB, BGR)			
120-1_CTD-12	GER Dredge	2	4120	4115	SPM (NIOZ)	Hulda_8	4115	microbiology (MPI)
		3	4120	4115	extracellular DNA (NORCE + NHM)	ISP 1	4100	geochemistry (AWI)
		4,5	4120	4115	microbiology (MPI)	Jimmy_7	4090	microbiology (MPI)
		22	4120	4115	biogeochemistry (JUB, BGR)	ISP 7	4085	geochemistry (AWI)
		23	4120	4115	biogeochemistry (JUB, BGR)	ISP 2	4055	geochemistry (AWI)
		1	4120	4070	biogeochemistry (JUB, BGR)	ISP 5	4015	geochemistry (AWI)
		6,7	4120	4070	microbiology (MPI)	ISP 4	3915	geochemistry (AWI)
		8	4120	3920	chemistry (AWI)			
		24	4120	3920	biogeochemistry (JUB, BGR)			
		9	4120	3700	biogeochemistry (JUB, BGR)			

Station SO268/2	Working area	Bottle number	Water depth [m]	Sampling Depth [m]	Sampling (group)	In-situ pump	Sampling depth [m]	Sampling (group)
		10	4120	2900	biogeochemistry (JUB, BGR)			
		11	4120	2400	biogeochemistry (JUB, BGR)			
		17	4120	1900	biogeochemistry (JUB, BGR)			
		18	4120	1400	biogeochemistry (JUB, BGR)			
		19	4120	1000	biogeochemistry (JUB, BGR)			
		20	4120	500	biogeochemistry (JUB, BGR)			
		21	4120	250	SPM (NIOZ)			
131-1_CTD-13	BEL Trial	2,3	4503	4497	SPM (NIOZ)	Hulda_8	4498	microbiology (MPI)
		4	4503	4497	extracellular DNA (NORCE + NHM)	ISP 7	4483	geochemistry (AWI)
		5,6	4503	4497	microbiology (MPI)	Jimmy_7	4453	microbiology (MPI)
		22,23	4503	4497	biogeochemistry (JUB, BGR)	ISP 5	4468	geochemistry (AWI)
		1	4503	4453	biogeochemistry (JUB, BGR)	ISP 2	4438	geochemistry (AWI)
		7,8	4503	4453	microbiology (MPI)	ISP 1	4398	geochemistry (AWI)
		9,10	4503	4303	microbiology (MPI)	ISP 4	4313	geochemistry (AWI)
131-1_CTD-13		11	4503	4303	chemistry (AWI)			
		24	4503	4303	biogeochemistry (JUB, BGR)			
		17	4503	3700	biogeochemistry (JUB, BGR)			
		18	4503	2900	biogeochemistry (JUB, BGR)			
		19	4503	1900	biogeochemistry (JUB, BGR)			
		20	4503	1000	biogeochemistry (JUB, BGR)			
		21	4503	500	biogeochemistry (JUB, BGR)			
151-1_CTD-14	BEL Ref	1	4523	4529	biogeochemistry (JUB, BGR)	Hulda_8	4528	microbiology (MPI)
		2,3	4523	4529	SPM (NIOZ)	ISP 7	4513	geochemistry (AWI)
		4	4523	4529	extracellular DNA (NORCE + NHM)	ISP 5	4498	geochemistry (AWI)
		5,6	4523	4529	microbiology (MPI)	ISP 2	4468	geochemistry (AWI)
		22,23	4523	4529	biogeochemistry (JUB, BGR)	ISP 1	4428	geochemistry (AWI)
		24	4523	4529	biogeochemistry (JUB, BGR)	ISP 4	432	geochemistry (AWI)

Station SO268/2	Working area	Bottle number	Water depth [m]	Sampling Depth [m]	Sampling (group)	In-situ pump	Sampling depth [m]	Sampling (group)
		7,8	4523	4483	microbiology (MPI)			
		9,10	4523	4333	microbiology (MPI)			
		11	4523	4333	chemistry (AWI)			
		17	4523	3700	biogeochemistry (JUB, BGR)			
		18	4523	2905	biogeochemistry (JUB, BGR)			
		19	4523	1900	biogeochemistry (JUB, BGR)			
		20	4523	1000	biogeochemistry (JUB, BGR)			
		21	4523	500	biogeochemistry (JUB, BGR)			
159-1_CTD-15	GER Dredge	2,3	4125	4120	SPM (NIOZ)	Hulda_8	4120	microbiology (MPI)
		4	4125	4120	extracellular DNA (NORCE + NHM)	ISP 1	4105	geochemistry (AWI)
		5,6	4125	4120	microbiology (MPI)	Jimmy_7	4095	microbiology (MPI)
159-1_CTD-15		22,23	4125	4120	biogeochemistry (JUB, BGR)	ISP 7	4090	geochemistry (AWI)
		1	4125	4075	biogeochemistry (JUB, BGR)	ISP 4	4060	geochemistry (AWI)
		7,8	4125	4075	microbiology (MPI)	ISP 2	4020	geochemistry (AWI)
		9	4125	3925	chemistry (AWI)	ISP 5	3920	geochemistry (AWI)
		24	4125	3925	biogeochemistry (JUB, BGR)			
		10	4125	3700	biogeochemistry (JUB, BGR)			
		11	4125	2900	biogeochemistry (JUB, BGR)			
		17	4125	2400	biogeochemistry (JUB, BGR)			
		18	4125	1900	biogeochemistry (JUB, BGR)			
		19	4125	1400	biogeochemistry (JUB, BGR)			
		20	4125	1000	biogeochemistry (JUB, BGR)			
		21	4125	500	biogeochemistry (JUB, BGR)			
183-1_CTD-16	GER Dredge	1	4125	4120	biogeochemistry (JUB, BGR)			
		2,3	4125	4120	SPM (NIOZ)			
		4	4125	4120	extracellular DNA (NORCE + NHM)			
		5,6	4125	4120	microbiology (MPI)			

Station SO268/2	Working area	Bottle number	Water depth [m]	Sampling Depth [m]	Sampling (group)	In-situ pump	Sampling depth [m]	Sampling (group)
		7	4125	4120	biogeochemistry (JUB, BGR)			
		22	4125	4120	biogeochemistry (JUB, BGR)			
		23	4125	4120	biogeochemistry (JUB, BGR)			
		24	4125	4120	biogeochemistry (JUB, BGR)			
		8	4125	4074	biogeochemistry (JUB, BGR)			
		9,10	4125	4074	microbiology (MPI)			
		11	4125	3700	biogeochemistry (JUB, BGR)			
		17	4125	2900	biogeochemistry (JUB, BGR)			
		18	4125	1900	biogeochemistry (JUB, BGR)			
183-1_CTD-16		19	4125	1400	biogeochemistry (JUB, BGR)			
		20	4125	1000	biogeochemistry (JUB, BGR)			
		21	4125	500	biogeochemistry (JUB, BGR)			
208-1_CTD-17	GER Dredge	1	4123	4118	biogeochemistry (JUB, BGR)			
		2,3	4123	4118	SPM (NIOZ)			
		4	4123	4118	extracellular DNA (NORCE + NHM)			
		5,6	4123	4118	microbiology (MPI)			
		22-24	4123	4118	biogeochemistry (JUB, BGR)			
		7,8	4123	4073	microbiology (MPI)			
		9,10	4123	3919	microbiology (MPI)			
		11	4123	3919	chemistry (AWI)			
		17	4123	3700	biogeochemistry (JUB, BGR)			
		18	4123	2900	biogeochemistry (JUB, BGR)			
		19	4123	1900	biogeochemistry (JUB, BGR)			
		20	4123	1000	biogeochemistry (JUB, BGR)			
		21	4123	500	biogeochemistry (JUB, BGR)			

5.2 AUV Missions

(M. Köckritz, J. Schröder, A. Steinführer, T. Weiß)

The Autonomous Underwater Vehicle (AUV) „ABYSS“ is a modular AUV designed to survey the ocean combining geophysical studies of the seafloor with oceanographic investigations of the overlying water column. The basic mission of ABYSS is deep-sea exploration, specifically in volcanically and tectonically active parts, such as mid-ocean ridges. With a maximum mission depth of 6000 meters, the AUV uses several technologies to map the seafloor accurately and determine its geological structure with applications from geology to biology to mineral exploration.

The system built by HYDROID Inc. comprises the AUV itself, a control and workshop container, and a mobile Launch and Recovery System (LARS) with a deployment frame that was installed at the afterdeck of R/V Sonne. The self-contained LARS was developed by WHOI to support ship-based operations so that no Zodiac or crane is required for launch and recovery. The LARS is mounted on steel plates, which are screwed to the deck of the ship. The LARS is configured in a way that the AUV can be deployed over the stern or port/starboard side of the German medium and ocean-going research vessels. The AUV Abyss can be launched and recovered at weather conditions with a swell up to 2.5 m and wind speeds of up to 6 Beaufort. For the recovery the nose float pops off when triggered through an acoustic command. The float and the ca. 17 m recovery line drift away from the vehicle so that a grapnel hook can snag the line. The line is then connected to the LARS winch, and the vehicle is pulled up. Finally, the AUV is brought up on deck and secured in the LARS.

Depending on scientific needs different sensors can be used, following are part of the standard configuration: Reson SeaBat 7125 multibeam echosounder, Edgetech 2200-MP sidescan sonar, Seabird SBE 49 FastCat and Wet Labs ECO FLNTU fluorometer and turbidity sensor. Optional instead of the MBES (Multibeam Echosounder) the Edgetech 2200-MP sub-bottom profiler or the electronic still camera (Canon 6D) can be installed, the REDOX potential sensor by Ko-ichi Nakamura on request. A general description of the used sensors during this cruise SO268-1 is located below in the section AUV Abyss sensor description.

The navigation of Abyss is mainly based on the Kearfott Inertial Navigation System (INS). The INS is capable to determine acceleration and angular velocity in 3-dimensional space and it usually requires an initial position by GPS to dead reckon its own position. Since the dead reckoning based navigation is associated with an increasing error, the Long Base Line Positioning (LBL) has been used successfully to aid. The LBL concept makes use of acoustic transponders moored to the seabed. The transponder positions are known from a preceding calibration from the surface vessel. The AUV position is computed from range measurements to the transponders. The downward looking Doppler velocity log (DVL) stabilizes continuously the INS navigation by exact ground velocity values. The AUV depth is determined by a separate pressure sensor (Paroscientific 8B7000). The above mentioned DVL (Teledyne RDI Workhorse Navigator) provide the altitude (height above seabed), too. Once the AUV is surfaced and is within the WIFI range, it can be controlled from the ship. The vehicle can detect obstacles in its pre-field and escape upwards.

Fig. 5.2.1: AUV Abyss (top left) ready for launch; (top right + bottom left) launching AUV Abyss; (bottom right) in the water. (Photos: Peter Linke)

During cruise SO286-1, two dives by the AUV were completed using the multibeam echosounder (MBES) and one in camera configuration of the vehicle (Tab. 7.2.1). Three additional missions were aborted. Abyss 318 was a test dive with a maximum depth of 200m. The missions were planned based on ship bathymetry. The sidescan sonar and subbottom-profiler were not used.

Tab. 5.2.1: AUV Mission Statistics for cruise SO268-1, Mission time includes descent, survey and ascent phase; Travel distance is total distance during mission; MB200 = Multibeam Echo Sounder 200 kHz; ESC = Electronic Still Camera

Station	Area	Mission	Date	Time	Travel Distance	Sensors (Comments)
SO268/1 4-1	GER trial	316	28.02.2019	15:47	87.25 km	MB200
SO268/1 17-1	GER trial	317	03.03.2019	20:54	91.58 km	ESC; no images
SO268/1 36-1	GER ref	318	09.03.2019	00:36	03.09 km	ESC-Test dive
SO268/1 41-1	GER trial	319	10.03.2019	02:03	6.58 km	ESC; aborted
SO268/1 51-1	BEL	320	14.03.2019	04:43	16.71 km	MB200; aborted
SO268/1 58-1	BEL	321	16.03.2019	03:42	6.02 km	MB200; aborted
			Total:	46.25h	211.23 km

Fig. 5.2.2: AUV missions in the German Trial Site.

5.2.1 AUV missions in the German Trial Site

Long Base Line Positioning (LBL)

As mentioned above the AUV Abyss uses Long Base Line Positioning to adjust the navigation at the seafloor. Upon arrival in the area three LBL-transponders were deployed and an acoustic survey was performed to determine position and depth of their landing spot on the bottom of the ocean. During the missions Abyss 316 and Abyss 317 the AUV repositioned itself successfully after the descent phase. The acoustic navigation is only used as an initial start position for the dead reckoning navigation during the survey. Table 5.2.1.1 shows surveyed positions and dates of deployment and recovery.

Tab. 5.2.1.1: LBL Positioning in the German Trial Site

Transponder	Type	Position	Transducer depth (m)	Deployment	Released	Recovered
4A	DT4A-LF	11° 54.369' N 117° 02.299' W	4101.7	27.02.2019 18:08 UTC	10.03.2019 15:05 UTC	10.03.2019 16:34 UTC
4C	DT4C-LF	11° 54.810' N 117° 02.755' W	4111.6	27.02.2019 17:42 UTC	10.03.2019 15:23 UTC	10.03.2019 17:17 UTC
4D	DT4D-LF	11° 54.821' N 117° 02.279' W	4095.8	27.02.2019 17:14 UTC	10.03.2019 17:10 UTC	10.03.2019 18:30 UTC

Abyss Mission 0316

Mission 0316 was supposed to map the Trial Site with high-resolution bathymetry data on which the planning of the photo surveys is based. The vehicle dived with an altitude of 80 meters in depths between 3979 and 4055 meters.

Fig. 5.2.1.1: Abyss Mission 0316 mean value

Fig. 5.2.1.2: Abyss Mission 0316 standard deviation (95%)

Figure 5.2.1.2 shows the standard deviation (95%) of the dataset. In the overlapping swaths are navigational errors. This clearly shows the need for a considerable adjustment so that we don't have it yet processed.

Abyss Mission 0317

Mission 0317 was done in camera configuration with different altitudes, 7, 8 and 9 meters to find variations in depth and to avoid bottom contact. Unfortunately the camera wasn't working properly due to a faulty connection (defective cable). The camera could not receive start commands and no picture was taken. Independently of that conspicuous differences in the behavior of the vehicle were observed. The pitch fins control the vehicle pitch and during that mission they provide an upward pitch angle, which is not generally achieved in normal operation. The buoyancy and trim change with each of the sensor configurations. The sensor was changed from Mission 0316 to Mission 0317 and accordingly lead ballast, trim weights, and auxiliary foam were installed resp. removed to maintain the slightly positive buoyancy and proper pitch and roll trim. It was verified before releasing the AUV from the LARS nevertheless the pitch fins were up and at the end of the survey the ascent weight was released automatically to bring the vehicle to the surface (emergency operation). Several fault messages and values especially overcurrent and over temperature were logged which indicate motor problems that may be attributed to the incorrectly ballast, trim or to the special shape of the camera configuration. Already in previous missions the LED flash segment used in camera configuration affected the hydrodynamic of the vehicle significantly. The altitude varied around the target value by +/- 2 meters, reduced velocity and the pitch fins were constantly up. Required pitch angles during descent could not be reached and extended the descent time. The causal relationship between camera configuration especially the LED foam segment and motor power seems obvious.

Abyss Mission 0318

Mission 0318 was a camera test survey conditioned by the faults of Abyss 0317. In a water depth of 200m the vehicle covered a distance of 300m several times with different propeller speeds (200, 215 and 235 rpm). The cable connection of the camera was repaired and photos were made.

Abyss Mission 0319

Mission 0319 was planned as a repetition of Abyss 0317 but aborted manually during the descent phase. At short intervals the thruster shut down and caused a momentary pause in the mission. The vehicle is positively ballasted, means that when the vehicle's propeller stops turning, it will float to the surface. After a few minutes the thruster started again and the vehicle continued on with the descent. This yo-yo effect was intentionally stopped through the Acoustic Command Interface.

Station	SO268/1-004_AUV-02		Day (UTC)	28.02.-01.03.2019
Mission	Abyss 0316
Mission goal:	Multibeam (200kHz) mapping
			Times (UTC)	
			Launch	10:54 (28.02.19)
			Mission start	11:17
			Survey start	13:10
			Survey finished	01:42 (01.03.19)
			Mission finished	03:04
			Recovery	08:56
			Distance travelled	87.25 km
			Mission comments	Line spacing: 160 m Range 200m Power 210dB Gain 25 dB Pulse length 65
Depth / Altitude Sensor	- survey depths between 4061.20 – 4125.05 m - altitude: 80 m RESON Seabat 7125 200 kHz Multibeam Echosounder			
Total raw files	57 files (*.s7k) / 155GB	First file	20190228_130929.s7k	
		Last file:	20190301_013233.s7k	
Survey area covered:	12,2 km ²	Average coverage:		
Sensor	Eh / REDOX Sensor (Koichi Nakamura)			
Total raw files	1 file (.txt) / 3.9 MB	File name	Abyss316_REDOX.txt	
Comments	- Sensor data positions are not shifted to the corrected vehicle track			
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4948793-0168)			
Total raw files	1 file (.txt) / 23.6 MB	File name	Abyss316_CTD.txt	
Comments	- Sensor data positions are not shifted to the corrected vehicle track			
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)			
Total raw files	1 file (.txt) / 4.9 MB	File name	Abyss316_ECO.txt	
Comments	- Sensor data positions are not shifted to the corrected vehicle track			
Comments				

Station	SO268/1-017_AUV-03		Day (UTC)	03.03.-04.03.2019	
Mission	Abyss 0317
Mission goal:	Photo survey	
			Times (UTC)		
			Launch	06:45 (03.03.19)	
			Mission start	06:50	
			Survey start	10:02	
			Survey finished	01:24 (04.03.19)	
			Mission finished	03:44	
			Recovery	04:02	
			Distance travelled	91.58 km	
			Mission comments	different altitudes 7,8,9 m	
Depth / Altitude	- survey depths between 4054 – 4114 m - altitude: 7/8/9 m				
Sensor	Electronic still camera (Canon 6D)				
Total raw files	No files		First file	-	
			Last file:	-	
Sensor	Eh / REDOX Sensor (Koichi Nakamura)				
Total raw files	1 file (.txt) / 4.7 MB		File name	Abyss317_REDOX.txt	
Comments	- Sensor data positions are not shifted to the corrected vehicle track				
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4948793-0168)				
Total raw files	1 file (.txt) / 28.7 MB		File name	Abyss317_CTD.txt	
Comments	- Sensor data positions are not shifted to the corrected vehicle track				
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)				
Total raw files	1 file (.txt) / 7.5 MB		File name	Abyss317_ECO.txt	
Comments	- Sensor data positions are not shifted to the corrected vehicle track				

Station	SO268/1-036_AUV-05		Day (UTC)	09.03.2019
Mission	Abyss 0318
Mission goal:	Test dive in 200m depth with camera configuration and different propeller speed (200,215 and 235 rpm), check trim
		Times (UTC)		
		Launch	03:25	
		Mission start	03:29	
		Mission finished	04:07	
		Recovery	04:18	
		Distance travelled	3.09 km	
		Mission comments		
Depth	- 200m depth			
Sensor	Electronic still camera (Canon 6D)			
Comments				

Station	SO268/1-41_AUV-06		Day (UTC)	10.03.2019
Mission	Abyss 0319
Mission goal:	Photo survey, Repetition Abyss 0317
			Times (UTC)	
			Launch	02:35
			Mission start	02:40
			Mission finished	04:44
			Recovery	04:58
			Distance travelled	6.58 km
			Mission comments	intentional mission stop
Depth	1966 m			
Sensor	Electronic still camera (Canon 6D)			
Comments	motor failure ; no bottom lock			

5.2.2 AUV missions in the Belgian Trial Site

Long Base Line Positioning (LBL)

As in the German Trial Site three LBL-transponders were set and surveyed to determine position and depth. During all missions the AUV repositioned itself successfully after the descent phase.

Tab. 5.2.2.1: LBL Positioning Belgian Trial Site

Transponder	Type	Position	Transducer depth (m)	Deployment	Released	Recovered
1D	DT4D-LF	14° 05.377' N 125° 52.694' W	4454.7	13.03.2019 00:07 UTC	22.03.2019 01:55 UTC	22.03.2019 03:15 UTC
2A	DT4A-LF	14° 05.379' N 125° 53.163' W	4463.7	13.03.2019 00:26 UTC	22.03.2019 02:12 UTC	22.03.2019 03:35 UTC
3C	DT4C-LF	14° 04.944' N 125° 52.674' W	4468.7	13.03.2019 00:44 UTC	22.03.2019 02:31 UTC	22.03.2019 03:50 UTC

Abyss Mission 0320

Mission 0320 was planned as a multibeam mission but aborted by the AUV itself due to an unknown reason which released the Pickup float at the second leg of the survey. There were no problems during descent and ascent. The analysis of the collected data has shown that the sonar also didn't work properly. The 200kHz projector wasn't pinging by a disconnected cable and so the receiver detected the signal from the Doppler velocity log (DVL).

Fig. 5.2.2.1: Abyss Mission 0320 Detected DVL signal

Abyss Mission 0321

Mission 0321 should be the same planned multibeam mission as Abyss 0320. During the descent phase in 3313m depth the motor stopped and the vehicle floated to the surface due to the positive buoyancy.

Abyss Mission 0322

Repairs on the tail/motor were done and should be tested in Mission 0322, the same mission file as Abyss 0320. Just before the deployment, fault messages from the emergency board occurred. The emergency board controls vehicle “life support” programming for basic system function, even if the main vehicle batteries are completely off line. It would allow the vehicle to make Iridium messages, reply to pings from acoustic communication and flash the emergency flashers. An Iridium test was performed but iridium phone call or SMS message failed. Since the iridium communication is a security system to avoid the loss of the vehicle, the deployment was cancelled. Probably the motor failures esp. the overheating have more effects than previously expected. All work was done at this point; repairs to this extent aren’t possible on board.

Station	SO268/1-051_AUV-08		Day (UTC)	14.03.2019
Mission	Abyss0320
Mission goal:	
			Multibeam survey (200kHz)	
			Times (UTC)	
			Launch	18:30
			Mission start	18:33
			Mission finished	21:40
			Recovery	23:17
			Distance travelled	16.71 km
			Mission comments	
			Line spacing: 160 m Range 200m Power 210dB Gain 25 dB Pulse length 65	
Depth / Altitude	4475m / 80m			
Sensor	RESON Seabat 7125 200 kHz Multibeam Echosounder			
Comments	Total raw files: 3 files (*.s7k) / 636 MB, 20190314_203411.s7k, 20190314_210043.s7k, 20190314_212719.s7k			

Station	SO268/1-58_AUV-09		Day (UTC)	16.03.2019
Mission	Abyss 0321
Mission goal:	
			Multibeam survey (200kHz), Repetition Abyss 0320	
			Times (UTC)	
			Launch	03:31
			Mission start	03:35
			Mission finished	07:19
			Recovery	08:20
			Distance travelled	6.02 km
			Mission comments	Line spacing: 160 m Range 200m Power 210dB Gain 25 dB Pulse length 65
			Depth	3313m
Sensor	RESON Seabat 7125 200 kHz Multibeam Echosounder			
Comments	motor failure no bottom lock			

5.2.3 AUV-Abyss sensor description

Tab. 5.2.3.1: Multibeam

Vendor	Reson	
Typ	SeaBat 7125 Receiver EM7216 PN:85002184 SN:1713118 200kHz Projektor TC2163 PN: 85000327 SN: 3710027	
Last calibration	September 2017	
Exported data	*.s7k	
Unit	-	
Notes	The following specifications are taken from the general datasheet	
Frequency	200kHz (400kHz available on request)	
Along-track beamwidth	transmit	2.2° (± 0.5°) at 200 kHz / 1° (± 0.2°) at 400 kHz
Across-track beamwidth	receive	1.1° (± 0.05°) at 200 kHz / 0.54° (± 0.03°) at 400 kHz
Max ping rate	50 Hz (± 1 Hz)	
50 Hz (± 1 Hz)	33 µsec to 300 µsec	
Number of beams	256EA*/256ED* at 200kHz 256EA*, 512EA*, 512ED* at 400kHz	* EA= Equi-angle / ED= Equi-distant
Max Swath angle	128°	
Depth resolution	6mm	
	Bathymetry, sidescan & snippets; 7K data format Gbit Ethernet	

Tab. 5.2.3.2: Camera

Vendor	Canon
Typ	6D
Lens	CANON EF 8-15mm f/4L Fisheye USM
Exported data	*.jpeg
Frequency	Max 1Hz

Tab. 5.2.3.3: ADCP

Vendor	RDI Teledyne
Typ	Model WHN300 S/N
Serial number	11436
Last calibration	
Exported data contains	<ul style="list-style-type: none"> - Latitude (degrees), Longitude (degrees) - Altitude (meters), Depth (meters) - Forward velocity over the bottom (meters/sec) - Starboard velocity over the bottom (meters/sec) - Error velocity - Temperature (degrees C) - Ensemble number - Heading (in degrees) - Stbd water velocity in mm/sec - Forward water velocity in mm/sec - Water velocity away from the transducer face (mm/sec) - Coordinate transform mode. The MSB (0x80) of this value indicates whether the water velocities are from the upward (set) or downward (cleared) looking beams.
Sample rate	

Tab. 5.2.3.3: CTD

Vendor	Seabird
Typ	SBE 49 FastCAT
Serial number- [CTD1] or [CTD2]	4955482-[0198] or [0168]
Last calibration	03.07.2017
Exported data contains	latitude, longitude, mission_time, depth, conductivity, temperature, salinity, sound speed
Unit	[deg],[deg],[HH.MM.SS.F],[m],[S/m],[°C],[psu],[m/s]
Sample rate	4Hz

Tab. 5.2.3.4: ECO (Combination Fluorometer and Turbidity Sensor)

Vendor	Wetlabs
Typ	FLNTU / 0712017
Serial number	FLNTURTD-939
Last calibration	-
Exported data contains	latitude, longitude, mission_time, depth, version, chl_ref(lambda), chl_sig, chlorophyll_a, turbidity_ref, turbidity_raw, turbidity
Unit	[deg],[deg],[HH.MM.SS.F],[m],[],[nm],[count],[µg/l],[nm],[count],[NTU]
Sample rate	1Hz

Tab. 5.2.3.5: Pressure/Depth

Vendor	Paroscientific	Serial number	109773
Typ	Digiquartz Intelligent Depth Sensor	Last calibration	-
Model	8BT7000-I	Exported data contains	
Range	7000m	Unit	
PN	1537-001-0	Sample rate	1Hz

5.3 OFOS Transects and Deep-Sea Camera Deployments

(Y. Bodur, A. Purser, T. Schoening, K. Köser, T. Stratmann)

Description of OFOS and the applied setup

The steel OFOS frame (approximately 160 cm x 115 cm, height: 117 cm) was equipped with a Canon EOS 5D Mark IV still camera with 24mm lens and an HD-SDI video camera with 65° x 40° field of view. The cameras were 50 cm spaced apart, both directed in vertical position to the seafloor, together with 2 strobe lights (Sea&Sea YS-250), 4 LED lights (SeaLite Sphere), 3 lasers, an altimeter (Tritech) and a USBL positioning system (Posidonia) to track the position of the OFOS during deployments. All lights, lasers, cameras and the altimeter were mounted approximately at the same height at the frame bottom, the USBL device was mounted at the top of the frame. The three laser pointers (FlexPoint Dot Lazer Modules, 50 mW) were mounted around the photo camera during the cruise shortly before the OFOS dives. They were positioned in 40 cm distance to one another and should look down vertically. As they are mounted around the still camera, they were well visible around the center of the view of the still camera and in the upper field of view of the video, and were used to assess the size of seafloor structures and fauna. Energy and data were transmitted through ship telemetry (isitec).

Fig. 5.3.1: The OFOS (Ocean Floor Observation System)

The video camera was recording continuously while the still camera was triggered automatically every 10 s. Additional images were taken manually when features of particular interest occurred in the view. Both cameras were equipped with a dome port that does not change the field of view of the lens, in case the lens is properly centered with the dome. During SO268-1, before the actual OFOS mission the cameras were calibrated on deck by taking pictures of a camera calibration target.

Acquired imagery data by OFOS

In total 12 successful OFOS dives (Tab. 7.3.1) with a total bottom time of 114.6 h were accomplished. 92.5°km of total track length was covered. During SO268-1, 3 dives were accomplished and in total 30,4 km of sea floor was imaged; 19,9 km in the German and 10,5 km in the Belgian Trial area. During SO268-2, in total 9 dives were completed and 62.1°km of the sea floor were covered, of which 17.3 km were covered in the Belgian license area, and 44,8 km in the German license area. Of these OFOS dives, one station was carried out directly before and three directly after the dredge experiment in the German license area.

Fig. 5.3.3: Overview of the OFOS deployments in the a) Belgian license area, b) German license area and c), d) German Dredge area of the Clarion Clipperton Fracture Zone. c) (St. SO268-2_100 (green; before the dredge), SO268-2_164 (red; after the dredge) and d) (St. SO268-2_126 (orange) and SO268-2_160 (red); after the dredge, respectively) show a close-up of the red rectangle in b).

Deep-sea camera deployments

Underwater time-lapse cameras were deployed on the seafloor to monitor the behavior of stalked and stalk-associated fauna, and to assess their response to short-term mining disturbance. Two types of deep-sea cameras, both positioned in front of the target organisms by the ROV, were used for this purpose: (1) “GlasPi” cameras with pressure-resistant glass housing and batteries that supplied power for approx. 1-2 days, and (2) “AquaPi” cameras with a titanium housing that were intended to take pictures for approx. 4-7 days. An overview of the camera deployments and target communities is presented in Table 5.3.2.

Tab. 5.3.1: Overview of the OFOS deployments.

Station	Area		Date/Time (UTC)	Latitude [°N]	Longitude [°W]	Depth [m]	approx. track length [km]	approx. bottom time [h]	Number of pictures taken at the sea floor
SO268-1_13-1_OFOS01	GER Trial	Failed							
SO268-1_21-1_OFOS02	GER Trial	Start	04.03.2019 06:53	11°55.783	117°02.438	4992	9,2	11	3923
		End	04.03.2019 21:02	11°55.801	117°01.279	4084			
SO268-1_30-1_OFOS03	GER Trial	Start	07.03.2019 02:15	11°54.470	117°00.570	4070	10,7	12	4986
		End	07.03.2019 17:20	11°57.656	117°00.720	4069			
SO268-1_63-1_OFOS04	BEL Trial	Start	16.03.2019 22:38	14°06.134	125°52.927	4455	10,5	12,5	4627
		End	17.03.2019 14:28	14°07.813	125°52.081	4501			
SO268-2_100-1_OFOS05	GER Dredge (before)	Start	06.04.2019 03:41	11°51.492	117°01.357	4374	5	8,6	2770
		End	06.04.2019 14:23	11°51.890	117°00.729	4119			
SO268-2_117-1_OFOS06	GER Dredge	Start	10.04.2019 3:31	11°51.457	117°03.029	4123	7,7	8,5	3145
		End	10.04.2019 14:48	11°52.481	116°58.932	4095			
SO268-2_126-1_OFOS07	GER Dredge (after)	Start	13.04.2019 14:42	11°51.796	117°01.046	4119	8,8	10	2694
		End	14.04.2019 03:31	11°51.875	117°00.905	4116			
SO268-2_128-1_OFOS08	BEL Trial	Start	16.04.2019 05:04	14°06.789	125°50.962	4480	5,5	8	2752
		End	16.04.2019 16:12	14°08.238	125°53.102	4492			

SO268-2_147-1_OFOS09	BEL Reference	Start	21.04.2019 5:39	14°00.968	125°55.586	4540	5,8	8	2974
		End	21.04.2019 16:55	14°03.438	125°53.647	4498			
SO268-2_153-1_OFOS10	BEL Reference	Start	23.04.2019 04:15	14°00.056	125°53.234	4508	6,0	8	2303
		End	23.04.2019 15:11	14°02.025	125°55.477	4536			
SO268-2_160-1_OFOS11	GER Dredge (after)	Start	27.04.2019 15:10	11°51.833	117°00.643	4115	11	10	3571
		End	28.04.2019 03:50	11°51.963	117°00.796	4115			
SO268-2_164-1_OFOS12	GER Dredge (after)	Start	29.04.2019 02:14	11°51.567	117°01.039	4123	5,0	9	3068
		End	29.04.2019 14:20	11°52.216	117°01.109	4113			
SO268-2_177-1_OFOS13	GER Reference	Start	09.05.2019 22:57	11°51.355	117°01.650	4121	7,3	9,5	3398
		End	10.05.2019 11:07	11°50.538	117°03.408	4132			

Tab. 5.3.2: Overview of deep-sea camera deployments.

Deployment station (Recovery station)	Event label	Descent platform Ascent platform	Deployment time (UTC)	Position	Target community
SO268-1_11_ROV01 (SO268-1_20_ROV02)	11_glaspi13	Elevator 2 ROV	Not deployed	-	-
	11_glaspi14	Elevator 2 ROV	Not deployed	-	-
	11_glaspi15	Elevator 2 Elevator 2	Not deployed	-	-
SO268-1_25_ROV03 (SO268-1_29-ROV04)	25_glaspi13	ROV ROV	05.03.2019 19:22	11°55.5980'N 117°1.3559'W	Porifera with Ophiuroidea
	25_glaspi14	ROV ROV	05.03.2019 19:10	11°55.5987'N 117°1.3573'W	Porifera with Ophiuroidea
SO268-1_35-ROV06	35_glaspi13	Elevator 2	08.03.2019 19:52	11°50.6571 'N	Porifera with Ophiuroidea

(SO268-1_40_ROV07)		ROV		117°3.4960'W	
	35_glaspi14	Elevator 2 ROV	Not deployed	-	-
SO268-2_99-ROV14 (SO268-2_101_ROV15)	99_glaspi16	Elevator 2 Elevator 2	06.04.2019 20:33	11°51.7936'N 117°0.7031'W	Ophiuroidea with Xenophyophore
	99_glaspi18	Elevator 2 Elevator 2	06.04.2019 21:10	11°51.7934'N 117°0.7036'W	Porifera with sessile Ctenophyophora
	99_glaspi19	Elevator 2 Elevator 2	Not deployed	-	
	99_glaspi20	Elevator 2 Elevator 2	06.04.2019 20:50	11°51.7940'N 117°0.7036'W	Porifera with Asteroidea
	99_aquapi1	Elevator 2 Elevator 2	06.04.2019 20:11	11°51.7942'N 117°0.7040'W	Porifera with Hydrozoa
SO268-2_111-ROV16 (SO268-2_193_ROV30)	111_aquapi2	Elevator 2	08.04.2019 20:54	11°51.7271'N 117°0.7919'W	Porifera with Ophiuroidea
	111_aquapi3	Elevator 2 ROV	08.04.2019 21:14	11°51.7280'N 117°0.7750'W	
SO268-2_174_ROV28	174_glaspi11	Elevator 2 Elevator 2	Not deployed		
(SO268-2_174_ROV28)	174_glaspi19	Elevator 2 Elevator 2	Not deployed		
	174_glaspi20	Elevator 1 (mounted on MICP- DEEP-1) Elevator 2	08.05.2019 16:52	11°50.4787'N 117°3.5266'W	Xenophyophore with Asteroidea
SO268-2_188-ROV29	188_aquapi1	Elevator 1 Elevator 1	Not deployed		
SO268-2_193-ROV30 (SO268-2_209-ROV32)	193_glaspi20	Elevator 1 ROV	13.05.2019 19:00	11°51.7272'N 117° 0.7942'W	Porifera with Ophiuroidea

5.4 Mooring Deployments and Plume Monitoring Array

(K. Schmidt, D. Hagedorn, H. de Stigter, S. Haalboom, T. Schoening)

5.4.1 Introduction and research objectives

The use of seabed (test-)mining equipment will create operational and discharge plumes of particulate material, potentially at different levels in the water column depending on the depth of discharge. Physical oceanographic and sedimentological data are required to (i) analyse the natural spatial and temporal variability of the current and particle flux regime at potential mining sites, and (ii) predict and model the behaviour and environmental impact of potential sediment plumes.

Long-term data on current speed and direction as well as background turbidity needs be collected at the depths that will be influenced by the operational and discharge plumes arising from the testing of collector systems and equipment, i.e. in particular near the seafloor. Previous deployments of long-term, short, moored systems (Ocean Bottom Moorings; OBMs) equipped with current and turbidity profilers (600 kHz Acoustic Doppler Current Profilers (ADCPs), 150 kHz ADCP, Seaguard Recording Current Meters (RCMs)) to obtain high resolution data from close to the seafloor in the German Contract Area East delivered a wealth of information on the variability of the bottom current regime in the CCZ. Average current speeds close to the seafloor are relatively low at 3.8 cm/s, varying between 0.1 and approximately 7 cm/s in dependence of the tides. However, a three-fold increase to average values around 13 cm/s can occur for weeks on end when mesoscale eddies pass over, which develop off the coast of Mexico 3 to 8 times a year and travel westwards, often influencing bottom currents in the study area (Aleynik et al., 2017). Current directions change continuously in an anticyclonic (clockwise) direction on time scales of hours during some phases but have a clear unidirectional component during other phases (e.g. during periods of eddy passage).

During SO268, the BGR moorings were used for different purposes:

- For monitoring the possible near-bottom expression of the mesoscale eddy that was passing in westward direction across the German contract area coincident with our cruise
- As part of the sensor array for the dredge resuspension experiment, to record far-field characteristics
- Long-term monitoring of bottom current characteristics and vertical particles fluxes

Ultimately, the measured high-resolution current and turbidity data will contribute to (i) the assessment of hydrographic conditions that are characteristic of the area (e.g. background mean flow velocities, tidal wave activities, inter-seasonal and near-inertial fluctuations, degree of local stratification/mixing, etc.), and (ii) the configuration, implementation and calibration of existing and specifically adapted deep-sea 3D ocean circulation-sediment transport models that will provide information on the probable fate of mining-induced discharged sediments under varying discharge scenarios in and beyond the (test-)mining area.

5.4.2 Mooring Deployments

5.4.2.1 Short-term deployment of ADCP moorings and sediment trap moorings

To capture bottom current velocities and directions and the vertical particle flux during for the duration of our work in the German Contract Area East, and to monitor the possible near-bottom

expression of the mesoscale eddy, two short ADCP moorings (6 m long) and two longer sediment trap moorings (70 m long) were deployed for a period of 29-32 days. Together with the short ADCP mooring 006 OBM which had already been deployed during cruise SO262 in 2018 (recovered as 176-1_MOOR-08), the moorings were arranged along an 96 km long, NNW-SSE trending transect (Fig. 5.4.2.5). With this set-up we will be able (1) to obtain far-field background data outside the area which is influenced by the dredge sediment suspension experiment, and (2) to monitor the passage of the eddy approaching from East at the seafloor. A first assessment of the obtained sensor data is provided in Chapter 8.11.

Short mooring instrumentation and configuration

Two OBMs, each equipped with an upward-oriented 600 kHz Teledyne RDI ADCP Workhorse Sentinel recording current velocity profiles between 7 and 31 mab and a sideward-oriented 2 MHz Aanderaa Seaguard RCM (Fig. 7.4.2.1) recording current velocity at 3.5 mab, were used during the short-term deployment. A third one similarly equipped with instruments was left where it had been deployed in April 2018 and was only recovered near the end of the cruise (176-1_MOOR-08). Details on specifications and configurations of the sensors are given in Table 5.4.2.1.

Fig. 5.4.2.1: Left: Teledyne RDI Workhorse Sentinel (600 kHz) clamped into a buoy of syntactic foam and equipped with beacons for exact location purposes. Right: Aanderaa Seaguard RCM (2 MHz) in its inline mooring frame.

Each 600 kHz ADCP was clamped into the top of a syntactic foam buoy for the upward vertical measurement of currents. A Novatech IR-7300 iridium beacon and Novatech MMF-7500 miniflasher were also installed in the buoy for asset recovery purposes. Furthermore, each OBM was equipped with an IXBLUE OCEANO dual acoustic releaser of the type RT861B2S (steel housings), holding a train wheel that served for anchor.

Fig. 5.4.2.2: OBM configuration for the 600 kHz ADCPs and RCMs.

Tab. 5.4.2.1: Specifications and configurations of current profilers deployed during SO268.

	Teledyne RDI ADCP WHS600-I-UG501	Aanderaa DW RCM	Seaguard	Nortek Aquadopp DW
Sampling interval [min]	5	5		6
Max. range [m]	50	4		5
Number of Bins	16	1		1
Bin size [m]	1.5	1.5		0.75
Frequency [kHz]	600	2.000		2.000
Blanking length [m]	2.59	0.5		0.5
Number of Pings	170	200 (burst mode)		180
Current range [cm/s]	0-500	0-300		0-300
Resolution [cm/s]	0.1	0.01		0.5
Mean accuracy [cm/s]	0.36	0.15		0.5 vertical / 0.3 horizontal

Two 70 m long sediment trap mooring systems were deployed, equipped with one KUM K/MT 234 sediment trap 8 mab and two Nortek AS Aquadopp Deep Water (DW) current meters (Figs. 5.4.2.3 and 5.4.2.4).

Fig. 5.4.2.3: Sediment trap mooring configuration.

The 0.5 m² aperture trap was covered with hexagonal lattice grid baffle which serves as current stabilizer and reduces washout. It also prevents large swimmers from entering the funnel and clogging the funnel exit. The rotation platform was loaded with 20 HDPE bottles (400 ml). The HDPE bottles were chemically cleaned and filled with 400 ml seawater that was collected during previous CTD deployments during SO268/2 from 3700–4000 m water depth. The water was filtered through a 0.2 µm Acropac filter and evaporated at 80°C in order to increase its salinity to 49.5 psu, which helps to reduce diffusion out of the cups during deployment. 1.32 g of dried HgCl₂ (analytical grade) was added to each bottle in order to suppress organic matter degradation by microbial activity. All bottles that are not placed directly under the funnel's orifice are sealed from the outer seawater medium. The control unit of the two traps was programmed with an interval of 30 h and 34 h, respectively, so that a shift to the open hole occurs shortly before recovery (Tab. 5.4.2.2).

Two Nortek Aquadopp current meters with Seapoint optical backscatter sensors were installed in the mooring lines at 18 and 45 mab, respectively. They were installed using an Aquafin, which shackles into the mooring line and allows the Aquadopp to swivel freely so that its beams always look into undisturbed flow. The Aquadopp functions at 2 MHz and is equipped with temperature,

compass, tilt and pressure sensors. Additional Seapoint turbidity meters were installed on the Aquadopps. Each of the sediment trap moorings was supplemented with a passive trace metal sampler fixed to the sediment trap frame (see Ch. 5.6.3.4), and JFE Advantech optical backscatter sensors of NIOZ fixed to the acoustic releases with sensor head at 2 mab. The latter sensors served as far-field reference for the dredge plume monitoring array (Ch. 5.4.4).

Fig. 5.4.2.4: Left: KUM K/MT 234 sediment trap with 21 cups; Middle: two Vitronex float modules and the KUM top float in water during deployment; Right: Deployment of the sediment trap.

Three floatation modules were used in the mooring, two consisting of four Vitrovex 17'' single floats and one consisting of two floats, with a net buoyancy of 26 kg per float (Fig. 5.4.1.3 and 5.4.1.4), and all linked to 14 mm nylon rope ("Meteor Leine"). A KUM top float was equipped with a Novatech MMF-7500 miniflasher. A double IXBLUE OCEANO dual acoustic releaser of the type RT861B2S (steel housings) was used. Two railway wheels with an approximate weight of 450 kg in water were used to anchor the mooring on the seafloor. At each sediment trap a plate with passive sampler probes was attached (see also Ch. 5.6.3.4). These probes accumulate labile-bound dissolved elements from seawater during the deployment period. Locations and characteristics of the deployed moorings (OBMs and the sediment trap mooring) are provided in Fig. 5.4.2.5 and Table 5.4.2.3.

Tab. 5.4.2.2: Configuration of sediment traps during the short-term deployment on SO268.

Sediment trap SN	Start date UTC	Time between bottle switch	End date UTC
2018446	13/04/2019 03:00	1d, 06h 20min	08/05/2019 09:40
2018464	10/04/2019 03:00	1d, 10h	08/05/2019 11:00

Tab. 5.4.2.3: Mooring station characteristics for short-term deployments (serial numbers of deployed instruments; OBM and sediment trap mooring positions. Positions for 113_MOOR, 123_MOOR and 176_MOOR are URBL positions, otherwise ships position during anchor deployment. Note: SO262/2 006 OBM mooring deployed in 2018 has been recovered as 176-1_MOOR-08 during SO268/2).

	113-1_MOOR-04	114-1_MOOR-05	115-1_MOOR-06	123-1_MOOR-07	176-1_MOOR-08
Deployment Date	09/04/2019 14:32	09/04/2019 16:00	09/04/2019 21:18	12/04/2019 15:41	14/04/2018 20:47
Latitude	11°06.726'N	11°18.922'N	11°56.509'N	11°47.442'N	11°57.212'N
Longitude	116°46.625'W	116°50.347'W	116°55.208'W	116°57.846'W	117°00.658'W
Depth	4232	4170	4155	4035	4101
Recovery Date	09/05/2019	11/05/2019	09/05/2019	11/05/2019	09/05/2019
Teledyne WHS600-I-UG501	17177		17271		17270
AANDERAA Seaguard DW RCM	331		336		333
sediment trap K/MT234		2018446		2018464	
Aquadopp DW (upper)		14209		14994	
Aquadopp DW (lower)		14300		14995	
MetOcean IR-7300	E11-042		E11-044		E11-044
MetOcean ST400A			Y01-087		
MetOcean 523-12000		F09-108		G09-073	A11-021
MetOcean 533-12000				G09-075

Fig. 5.4.2.5: Mooring locations short-term deployment.

5.4.2.2 Long-term deployment of ADCP moorings and sediment trap moorings

At the end of station work in the German Contract Area East we deployed three short ADCP moorings of 25 m long equipped with 600 kHz ADCPs and RCMs and one 585 m long double sediment trap mooring equipped with two Aquadopp current meters set to obtain current data on an hourly basis and particle fluxes on a two-weekly basis until spring 2020. With these deployments we will continue collecting good high-resolution temporal data of the natural current and particle flux regime close to the seafloor, including changes induced by potential eddy passages. The sediment trap mooring, in which the traps themselves are positioned about 7 m and 550 m above the seafloor, respectively, will deliver useful information on the seasonality of the natural particle flux regime at the test site.

Tab. 5.4.2.4: Specifications and configurations of current profilers deployed during SO268.

	Teledyne RDI ADCP WHS600-I-UG501	Aanderaa DW RCM	Seaguard Nortek Aquadopp DW
Sampling interval [min]	45	30	60
Max. range [m]	50	4	5
Number of Bins	16	1	1
Bin size [m]	1.5	1.5	0.75
Frequency [kHz]	600	2.000	2.000
Blanking length [m]	2.59	0.5	0.5
Number of Pings	170	200 (burst mode)	180
Current range [cm/s]	0-500	0-300	0-300
Resolution [cm/s]	0.1	0.01	0.5
Mean accuracy [cm/s]	±0.36	±0.15	±0.5 vertical / ±0.3 horizontal

OBM instrumentation and configuration

Three OBMs, each equipped with an downward-oriented 600 kHz Teledyne RDI ADCP Workhorse Sentinel and a sideward-oriented 2 MHz Aanderaa Seaguard RCM, were used during the long-term deployment. Details on specifications and configurations of the sensors are given in Fig. 5.4.2.6 and Table 5.4.2.4.

Fig. 5.4.2.6: Configuration of ADCP moorings for long-term deployment.

Sediment trap mooring instrumentation and configuration

One 585 m long mooring with two sediment traps and two Nortek AS Aquadopp Deep Water (DW) current meters were deployed at the end of the cruise (Fig. 5.4.2.7). The traps are placed 7 m and 555 mab, and the cups are programmed to shift every 14 days. The current meters are placed 18 mab and 550 mab.

Fig. 5.4.2.7: Configuration of double sediment trap mooring for long-term deployment.

Tab. 5.4.2.5: Configuration of sediment traps during long-term deployment cruise SO268

Sediment trap SN	Start date UTC	Time between bottle switch	End date UTC
2018446 / 2018464	17/05/2019 12:00	14d	21/02/2020 12:00

Five floatation modules were used in the mooring, two consisting of four Vitroex 17” single floats above the lower sediment trap and two consisting of three floats above the upper sediment trap, with a net buoyancy of 26 kg per float, and all linked to 14 mm nylon rope (“Meteor

Leine”). A KUM top float was equipped with a Novatech MMF-7500 miniflasher. A double IXBLUE OCEANO dual acoustic releaser of the type RT861B2S (steel housings) was used. Two railway wheels with an approximate weight of 450 kg in water were used to anchor the mooring on the seafloor. The control unit of the two traps was programmed with an interval of 14 days (Table 5.4.2.5).

Mooring locations

Locations and characteristics of the deployed moorings (OBMs and the sediment trap mooring) are provided Fig. 5.4.2.8 and Table 5.4.2.6.

Tab. 5.4.2.6: Mooring station characteristics for long-term deployments (serial numbers of deployed instruments; OBM and sediment trap mooring deployment positions).

	201-1_ MOOR-09	202-1_ MOOR-10	203-1_ MOOR-11	204-1_ MOOR-12
Deployment Date	15/05/2019 14:50	15/05/2019 15:08	15/05/2019 16:09	15/05/2019 18:24
Latitude	11°51.798’N	11°51.787’N	11°56.813’N	11°55.311’N
Longitude	117°00.753’W	117°00.810’W	117°02.251’W	117°00.465’W
Latitude at seafloor	11°51.801’N	-	-	-
Longitude at seafloor	117°00.712’W	-	-	-
Depth	4117	4119	4094	4097
Teledyne WHS600-I-UG501	17177	17271	17270	
AANDERAA Seaguard DW RCM	331	336	333	
sediment trap K/MT234 (upper)				2018446
sediment trap K/MT234 (lower)				2018464
Aquadopp DW (upper)				14995
Aquadopp DW (middle)				14300
Aquadopp DW (lower)				14994
MetOcean IR-7300	E11-043		E11-043	
MetOcean ST400A			Y01-087	
MetOcean 523-12000	F09-108	A11-021		G09-073

Fig. 5.4.2.8: Mooring locations for long-term deployment.

5.4.3 Plume monitoring array

The large collection of sensors and sensor platforms which GEOMAR, NIOZ and RBINS had brought together for the purpose of monitoring the sediment plume generated by the DEME nodule collector vehicle Patania II, were deployed alternatively in a small-scale plume experiment carried out in the German contract area during Leg 2. In this experiment, a sediment plume was produced by dragging a heavy rock dredge repeatedly along a 500 m stretch of seabed perpendicular to the expected prevailing current direction. Sensors and other monitoring devices were placed in and along the path of the dredge to record the dispersion of the plume by bottom currents. To capture any possible effect on near-bed current dynamics of the mesoscale eddy passing across the German area during Leg 2, the plume monitoring array was maintained in place for several weeks after the dredging.

Starting on 5 April, the following devices were deployed as part of the plume monitoring array:

- 7 small triangular frames, each equipped with a Nortek Aquadopp 2 MHz current profiler, recording current velocity between about 1 and 11 mab, and a JFE Advantech optical backscatter sensor measuring turbidity at 1 mab (Fig. 7.4.3.1a).
- 2 small tripod frames, each with an upward-looking RDI 300 kHz ADCP cardanically suspended in the frame, recording current velocity between about 3.5 and 45 mab (Fig. 7.4.3.1b).
- 3 Seabird SBE19+ CTDs, placed upright on a rectangular foot, and each with two Seapoint optical backscatter sensors measuring turbidity at about 1 mab (Fig. 7.4.3.1c).
- 2 small tripod frames, each with a Nortek ADV current meter recording current velocity at high sampling rate at 0.25 mab, and a JFE Advantech optical backscatter sensor measuring turbidity at 1 mab (Fig. 7.4.3.1d).
- 20 SLIC (Sedimentation Level Indicator) boxes made by GEOMAR, consisting of two 20 x 40 cm sections of corrugated iron painted white and black, set in a square 40 x 40 x 10 cm³

iron frame (Fig. 7.4.3.1e). An oblique measuring stick was mounted on one side of each box. The SLIC boxes were intended to collect sediment falling out from the mining plume. The width of sediment accumulating in the troughs of the corrugated iron, quantifiable from photo imagery collected with AUV, ROV and OFOS, would provide a means to estimate the average thickness of the redeposited sediment drape.

- 1 BOBO (BOttom BOundary) lander (Fig. 7.4.3.1f) (Van Weering et al., 2000) equipped with an upward-looking RDI 300 kHz ADCP recording current velocity between 7 and 45 mab, a downward-looking RDI 1200 kHz ADCP recording current velocity between 0 and 2 mab, a Seabird SB16+ CTD recording conductivity, temperature and pressure at 2 mab, a WetLabs FLNTU optical backscatter and fluorescence sensor connected to the CTD, a JFE Advantech optical backscatter sensor measuring turbidity at 2 mab, a Technicap PPS4/3 sediment trap with 0.1 m² opening at 4 mab, and a xx hydrophone for recording underwater sound. In addition, a Develogic acoustic modem was also mounted in the BOBO lander frame, intended for acoustic transmission of ADCP data to the ship.

Deployment details of all sensor platforms and respective sensor settings are presented in Table 5.4.3.1. All devices except the large BOBO lander were delivered to the seafloor by means of the two GEOMAR elevators or occasionally by ROV Kiel 6000, and then placed at their designated locations on the seabed by ROV Kiel 6000. The 12 platforms equipped with turbidity sensors were distributed along two parallel lines perpendicular to the planned dredge path, at 100, 200 and 300 m distance north and south of the dredge path (Fig. 7.4.3.2). The distance between the two lines was 150 m. The sensors were placed in two lines in order to provide replicate recordings of the plume signal on either side of the dredge path. Platforms at increasing distance from the dredge path were meant to give insight in the decrease in suspended sediment concentration and deposition away from the source. Sensors in the western line were set to record at relatively high sampling rate for an intended battery lifetime of 1 week, so as to record the dispersal of the dredging plume with relatively high temporal resolution. Sensors in the eastern line were set to record at a lower sampling rate for an intended battery lifetime of 6 weeks or more, so as to record the dredging plume but also the possible resuspension of plume sediments in the wake of the eddy. The 2 ADCP platforms were placed in between the two lines, at 100 and 150 m distance north and south of the dredge path.

Fig. 5.4.3.1: Plume monitoring devices. a: Triangular frame with Nortek Aquadopp 2 MHz current profiler and JFE Advantech optical backscatter sensor; b: Tripod frame with upward-looking RDI 300 kHz ADCP; c: Seabird SBE19+ CTD on rectangular foot, with two Seapoint optical backscatter sensors; d: Tripod frame with Nortek ADV current meter and JFE Advantech optical backscatter sensor; e: SLIC (Sedimentation Level Indicator) box, handled by ROV Kiel 6000; f: BOBO (BOttom BOundary) lander equipped with current profilers, turbidity sensors, CTD, sediment trap and acoustic recorder. Photos a-e: GEOMAR ROV Team; f: Ana Hilario.

The 20 SLIC boxes were distributed within the central part of the 600 x 200 m area of the array, mostly at less than 100 m distance north and south of the dredge path and some even within the dredge path (Fig. 5.4.3.3). Seven SLIC boxes were washed off the elevator while passing through the splash zone, landing uncontrolled on the seabed below. Of those 7, 4 were eventually localized by ROV Kiel 6000. Prior to dredging, the SLIC boxes were photographed two times by ROV Kiel 6000: immediately after placement and one day before the dredging. While taking photographs, the ROV was held at sufficient height above the seabed so as not to stir up any sediment.

Fig. 5.4.3.2: Map of the plume array layout. Dashed black lines represent the estimated dredge tracks. Light blue lines show the eastern and western plume array lines, spaced 150 m apart. The western line was the “high-resolution” part for which the sensor settings focused on the direct dredge impact. Sensors in the eastern line were configured to record at lower temporal resolution but for a longer time interval to also capture the potential effect of the passing eddy. Light blue and green points show positions of Aquadopp/JFE platforms, dark blue shows RDI ADCP positions, purple shows ADV/JFE positions, orange shows Seabird CTD/Seapoint positions. The BOBO lander was placed almost 1 km north of the dredge path.

Fig. 5.4.3.3: Distribution of the SLIC boxes. Dashed black lines represent the estimated dredge tracks.

The BOBO lander was launched free fall at about 1 km distance north of the dredge path, to serve as reference for background conditions during the dredge experiment, and potentially to record the far-field plume in case the current would disperse the plume northwards. The position of BOBO on the seabed was determined on the basis of acoustic ranging of the Benthos acoustic releases of the lander, carried out on several occasions in between or during other activities. For additional monitoring of background near-bed turbidity, a JFE Advantech turbidity sensor was attached to the set of IXSEA acoustic releases of two of the short BGR moorings (Ch. 5.4.2.1).

With all plume monitoring devices in place, the rock dredge was lowered to the seabed in the evening of 11 April, and during the night dragged 11 times along the WSW-ENE oriented path through the sensor array (Fig. 5.4.3.2). The dredge path was laid out a few hundred metres to the north and parallel to an old epibenthic sled trace made in 2015 during RV Sonne expedition SO239 (Peukert et al., 2018). A *Posidonia* transponder attached at 500 m above the dredge provided an indication of the approximate course of the dredge over the seabed. A bag filled with a mixture of pink fluorescent dye and local sediment, originally meant to be dispersed by the DEME-GSR nodule collector as a tracer for plume dispersion, had been placed inside the dredge with the intention of dispersing the tracer together with the sediment plume stirred up by the dredge. However, when the dredge was recovered on board, the bag was found to have remained intact with most of the pink mixture still inside.

Fig. 5.4.3.4: Rock dredge used to produce a sediment plume. (Photo: Henko de Stigter)

The day after the dredging, the SLIC boxes were photographed by ROV Kiel 6000 for assessment of the amount of sediment collected in the boxes. One week after the dredging, one sensor platform was retrieved by ROV Kiel 6000 to read out the recorded data. Two others were moved to the middle of the dredge path where most of the sediment mobilised during dredging

had settled. If any resuspension of freshly deposited sediment would occur in the weeks after the dredging, this would be the best place to record it.

All other sensor platforms, including the BOBO lander, were retrieved one month after the dredging, in the course of 12-16 May. The smaller platforms were collected from the seabed by ROV Kiel 6000 and placed on the elevators, which then brought the platforms back to the sea surface. The BOBO lander returned to the surface by its own buoyancy after the anchor weights had been acoustically released. In the same time that the platforms were retrieved, the SLIC boxes were photographed for a last time.

Tab. 5.4.3.1: Deployment details and sensor settings of plume monitoring platforms involved in dredge plume experiment.

Platform	GMR_PFM-07_Tripod_ADV
Launched from board	109-1_LANDER-11 Elevator 2
Positioned by ROV	111_ROV-16 08/04/2019 19:14:27 11°51.936'N 117°00.861'W
Picked up by ROV	197_ROV-31 14/05/2019 20:29:42 11°51.933'N 117°00.863'W
Recovered on board	196-1_LANDER-23 Elevator 2
Sensor Payload	Sensor setting
GMR_HYA-08_ADV_Nortek	Xx
NIOZ_ENV-03 OBS_JFEAdvantech	Every 10 min burst of 15 samples 1Hz

Platform	GMR_PFM-08_Tripod_ADV
Launched from board	110-1_LANDER-12 Elevator 1
Positioned by ROV	118_ROV-17 10/04/2019 21:29:19 11°51.625'N 117°00.769'W
Picked up by ROV	188_ROV-29 12/05/2019 16:42:22 11°51.620'N 117°00.768'W
Recovered on board	187-1_LANDER-21 Elevator 1
Sensor Payload	Sensor setting
GMR_HYA-09_ADV_Nortek	Xx
NIOZ_ENV-04 OBS_JFEAdvantech	Every 10 min burst of 15 samples 1Hz

Platform	GMR_PFM-09_Tripod_ADCP
Launched from board	111_ROV-16
Positioned by ROV	111_ROV-16 08/04/2019 17:13:26 11°51.847'N 117°00.786'W
Picked up by ROV	197_ROV-31 14/05/2019 00:18:12 11°51.847'N 117°00.780'W
Recovered on board	197_ROV-31
Sensor Payload	Sensor setting
GMR_HYA-04_ADCP_Teledyne- RDI-Workhorse-300kHz	Every 5 min burst of 80 pings, 35 depth cells of 2 m

Platform	GMR_PFM-10_Tripod_ADCP
Launched from board	098-1_LANDER-09 Elevator 2
Positioned by ROV	111_ROV-16 08/04/2019 21:50:10 11°51.689'N 117°00.750'W
Picked up by ROV	188_ROV-29 12/05/2019 22:09:11 11°51.668'N 117°00.748'W
Recovered on board	188_ROV-29
Sensor Payload	Sensor setting
GMR_HYA-03_ADCP_Teledyne- RDI-Workhorse-300kHz	Every 5 min burst of 80 pings, 35 depth cells of 2 m

Platform	NIOZ_PFM-01_LDR_BoBo
Launched from board	07/04/2019 xx
Triangulated bottom position	Xx
Recovered on board	16/05/2019 xx
Sensor Payload	Sensor setting
GMR_ENV-01_CTD_SBE- 16+V2	Every 5 min 40 cycles

GMR_ENV-04_FLNTU	Every 5 min 40 cycles
NIOZ_ENV-15_OBS_JFEAdvantech	Every 10 min burst of 15 samples 1Hz
NIOZ_HYA-01_ADCP_Teledyne-RDI-Workhorse-1200kHz	Every 5 min burst of 50 pings, 15 depth cells of 0.2 m
NIOZ_HYA-02_ADCP_Teledyne-RDI-Workhorse-300kHz	Every 5 min burst of 80 pings, 35 depth cells of 2 m
NIOZ_SAM-01 SedimentTrap Technicap	12 jars of 3 days each (start 09/04/2019 00:00:00)

Platform	NIOZ_PFM-02_Tripod_AQD
Launched from board	109-1 LANDER-11 Elevator 2
Positioned by ROV	111 ROV-16 08/04/2019 18:21:32 11°51.901'N 117°00.759'W
Picked up by ROV	197 ROV-31 14/05/2019 19:36:24 11°51.903'N 117°00.758'W
Recovered on board	196-1 LANDER-23 Elevator 2
Sensor Payload	Sensor setting
NIOZ_HYA-03_Nortek-Aquadopp-2000kHz	Every 5 min burst of 60 pings, 20 depth cells of 0.5 m
NIOZ_ENV-07 OBS_JFEAdvantech	Every 10 min burst of 15 samples 1Hz

Platform	NIOZ_PFM-03_Tripod_AQD
Launched from board	109-1 LANDER-11 Elevator 2
Positioned by ROV	111 ROV-16 08/04/2019 17:55:30 11°51.852'N 117°00.745'W
Picked up by ROV	124 ROV-18 12/04/2019 23:52:44 11°51.851'N 117°00.739'W
Positioned by ROV	124 ROV-18 13/04/2019 00:06:11 11°51.796'N 117°00.742'W
Picked up by ROV	197 ROV-31 14/05/2019 19:15:12 11°51.798'N 117°00.738'W
Recovered on board	196-1 LANDER-23 Elevator 2
Sensor Payload	Sensor setting
NIOZ_HYA-04_Nortek-Aquadopp-2000kHz	Every 5 min burst of 60 pings, 20 depth cells of 0.5 m
NIOZ_ENV-08 OBS_JFEAdvantech	Every 10 min burst of 15 samples 1Hz
BGR trace metal sampler	

Platform	NIOZ_PFM-04_Tripod_AQD
Launched from board	110-1 LANDER-12 Elevator 1
Positioned by ROV	118 ROV-17 10/04/2019 19:21:33 11°51.700'N 117°00.699'W
Picked up by ROV	188 ROV-29 12/05/2019 21:10:11 11°51.698'N 117°00.696'W
Recovered on board	187-1 LANDER-21 Elevator 1
Sensor Payload	Sensor setting
NIOZ_HYA-05_Nortek-Aquadopp-2000kHz	Every 5 min burst of 60 pings, 20 depth cells of 0.5 m
NIOZ_ENV-09 OBS_JFEAdvantech	Every 10 min burst of 15 samples 1Hz

Platform	NIOZ_PFM-05_Tripod_AQD
Launched from board	109-1 LANDER-11 Elevator 2
Positioned by ROV	111 ROV-16 08/04/2019 18:41:02 11°51.883'N 117°00.843'W
Picked up by ROV	197 ROV-31 14/05/2019 20:00:45 11°51.882'N 117°00.841'W
Recovered on board	196-1 LANDER-23 Elevator 2
Sensor Payload	Sensor setting
NIOZ_HYA-06_Nortek-Aquadopp-2000kHz	Every 1 min burst of 60 pings, 20 depth cells of 0.5 m
NIOZ_ENV-10 OBS_JFEAdvantech	Every 2 min burst of 15 samples 1Hz

Platform	NIOZ_PFM-06_Tripod_AQD
Launched from board	109-1 LANDER-11 Elevator 2

Positioned by ROV	111 ROV-16 08/04/2019 17:38:58 11°51.828'N 117°00.822'W
Picked up by ROV	124 ROV-18 13/04/2019 00:27:41 11°51.831'N 117°00.822'W
Recovered on board	110-1 LANDER-12 Elevator 1
Sensor Payload	Sensor setting
NIOZ_HYA-07 Nortek-Aquadopp-2000kHz	Every 1 min burst of 60 pings, 20 depth cells of 0.5 m
NIOZ_ENV-13 OBS_JFEAdvantech	Every 1 min burst of 15 samples 1Hz

Platform	NIOZ_PFM-07 Tripod AQD
Launched from board	110-1 LANDER-12 Elevator 1
Positioned by ROV	118 ROV-17 10/04/2019 19:50:47 11°51.728'N 117°00.791'W
Picked up by ROV	124 ROV-18 12/04/2019 21:13:33 11°51.727'N 117°00.789'W
Positioned by ROV	124 ROV-18 12/04/2019 21:30:08 11°51.768'N 117°00.808'W
Picked up by ROV	193 ROV-30 14/05/2019 00:48:51 11°51.765'N 117°00.803'W
Recovered on board	192-1 LANDER-22 Elevator 1
Sensor Payload	Sensor setting
GMR_HYA-06 Nortek-Aquadopp	Every 1 min burst of 15 pings, 18 depth cells of 0.1 m
NIOZ_ENV-12 OBS_JFEAdvantech	Every 2 min burst of 15 samples 1Hz

Platform	NIOZ_PFM-08 Tripod AQD
Launched from board	110-1 LANDER-12 Elevator 1
Positioned by ROV	118 ROV-17 10/04/2019 19:00:24 11°51.676'N 117°00.785'W
Picked up by ROV	188 ROV-29 12/05/2019 21:42:13 11°51.677'N 117°00.783'W
Recovered on board	187-1 LANDER-21 Elevator 1
Sensor Payload	Sensor setting
GMR_HYA-07 Nortek-Aquadopp	Every 1 min burst of 60 pings, 20 depth cells of 0.5 m
NIOZ_ENV-14 OBS_JFEAdvantech	Every 2 min burst of 15 samples 1Hz

Platform	RBINS_PFM-01 CTD-Snowboot
Launched from board	109-1 LANDER-11 Elevator 2
Positioned by ROV	111 ROV-16 08/04/2019 19:43:01 11°51.951'N 117°00.774'W
Picked up by ROV	197 ROV-31 14/05/2019 21:17:57 11°51.950'N 117°00.772'W
Recovered on board	196-1 LANDER-23 Elevator 2
Sensor Payload	Sensor setting
RBINS_ENV-01 CTD Seabird	Every 5 min 40 cycles
RBINS_ENV-04 OBS Seapoint	Every 5 min 40 cycles
RBINS_ENV-05 OBS Seapoint	Every 5 min 40 cycles

Platform	RBINS_PFM-02 CTD-Snowboot
Launched from board	098-1 LANDER-09 Elevator 2
Positioned by ROV	111 ROV-16 08/04/2019 22:24:55 11°51.747'N 117°00.722'W
Picked up by ROV	188 ROV-29 12/05/2019 20:12:52 11°51.748'N 117°00.716'W
Recovered on board	187-1 LANDER-21 Elevator 1
Sensor Payload	Sensor setting
RBINS_ENV-02 CTD Seabird	Every 5 min 40 cycles
RBINS_ENV-06 OBS Seapoint	Every 5 min 40 cycles
RBINS_ENV-07 OBS Seapoint	Every 5 min 40 cycles
BGR trace metal sampler	

Platform	RBINS_PFM-03 CTD-Snowboot
Launched from board	098-1 LANDER-09 Elevator 2
Positioned by ROV	111 ROV-16 08/04/2019 22:54:51 11°51.647'N 117°00.682'W
Picked up by ROV	188 ROV-29 12/05/2019 20:42:04 11°51.644'N 117°00.678'W
Recovered on board	187-1 LANDER-21 Elevator 1
Sensor Payload	Sensor setting

RBINS ENV-03 CTD Seabird	Every 5 min 40 cycles
RBINS ENV-08 OBS Seapoint	Every 5 min 40 cycles
RBINS ENV-09 OBS Seapoint	Every 5 min 40 cycles

Tab. 5.4.3.2: Deployment details of GEOMAR SLIC boxes. Positions are of ROV Kiel 6000 while handling or photographing SLIC boxes. Photo positions may be a few metres off the SLIC box position. Where multiple photos were taken during a photo stop, time and position of just one representative photo is listed below.

SLIC box	01
Launched from board	098-1 LANDER-09 Elevator 2, washed off
Positioned and photo	99 ROV-14 05/04/2019 19:56:28 11°51.742'N 117°00.757'W
Photo one day before dredge	118 ROV-17 10/04/2019 18:21:52 11°51.744'N 117°00.758'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:52:29 11°51.741'N 117°00.756'W
Photo one month after dredge	188 ROV-29 12/05/2019 19:58:36 11°51.741'N 117°00.757'W

SLIC box	02
Launched from board	098-1 LANDER-09 Elevator 2, washed off
Positioned and photo	99 ROV-14 05/04/2019 18:17:14 11°51.784'N 117°00.774'W
Photo one day before dredge	118 ROV-17 10/04/2019 18:14:08 11°51.781'N 117°00.773'W
Photo one day after dredge	124 ROV-18 12/04/2019 19:34:36 11°51.779'N 117°00.766'W
	124 ROV-18 12/04/2019 21:39:33 11°51.777'N 117°00.771'W
Photo one month after dredge	188 ROV-29 12/05/2019 19:37:53 11°51.779'N 117°00.774'W

SLIC box	03
Launched from board	098-1 LANDER-09 Elevator 2
Positioned and photo	111 ROV-16 09/04/2019 00:31:37 11°51.748'N 117°00.719'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:52:27 11°51.749'N 117°00.715'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:44:30 11°51.743'N 117°00.717'W
Photo one month after dredge	188 ROV-29 12/05/2019 20:06:23 11°51.744'N 117°00.722'W

SLIC box	04
Launched from board	098-1 LANDER-09 Elevator 2
Positioned and photo	111 ROV-16 09/04/2019 00:24:36 11°51.729'N 117°00.746'W
Photo one day before dredge	118 ROV-17 10/04/2019 18:25:53 11°51.729'N 117°00.744'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:49:32 11°51.726'N 117°00.745'W
Photo one month after dredge	188 ROV-29 12/05/2019 20:01:06 11°51.730'N 117°00.749'W

SLIC box	05
Launched from board	098-1 LANDER-09 Elevator 2
Positioned and photo	111 ROV-16 09/04/2019 00:38:58 11°51.779'N 117°00.727'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:46:53 11°51.778'N 117°00.725'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:36:31 11°51.778'N 117°00.724'W
Photo one month after dredge	188 ROV-29 12/05/2019 19:26:31 11°51.773'N 117°00.722'W

SLIC box	06
Launched from board	110-1 LANDER-12 Elevator 1, washed off and lost

SLIC box	07
Launched from board	110-1 LANDER-12 Elevator 1
Positioned and photo	111 ROV-16 09/04/2019 01:00:05 11°51.856'N 117°00.729'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:32:02 11°51.847'N 117°00.743'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:19:56 11°51.848'N 117°00.744'W
Photo one month after dredge	197 ROV-31 14/05/2019 18:45:43 11°51.854'N 117°00.742'W

SLIC box	08
Launched from board	110-1 LANDER-12 Elevator 1
Positioned and photo	111 ROV-16 09/04/2019 00:54:59 11°51.833'N 117°00.738'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:35:54 11°51.834'N 117°00.737'W

Photo one day after dredge	124 ROV-18 12/04/2019 20:24:28 11°51.831'N 117°00.737'W
Photo one month after dredge	197 ROV-31 14/05/2019 18:42:28 11°51.832'N 117°00.736'W

SLIC box	09
Launched from board	110-1 LANDER-12 Elevator 1
Positioned and photo	111 ROV-16 09/04/2019 00:50:27 11°51.812'N 117°00.740'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:39:05 11°51.811'N 117°00.731'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:28:58 11°51.810'N 117°00.735'W
Photo one month after dredge	197 ROV-31 14/05/2019 18:22:16 11°51.811'N 117°00.734'W

SLIC box	10
Launched from board	110-1 LANDER-12 Elevator 1
Positioned and photo	111 ROV-16 09/04/2019 00:44:30 11°51.787'N 117°00.727'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:44:03 11°51.788'N 117°00.725'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:33:33 11°51.785'N 117°00.724'W
Photo one month after dredge	188 ROV-29 12/05/2019 19:29:03 11°51.785'N 117°00.728'W

SLIC box	11
Launched from board	110-1 LANDER-12 Elevator 1, washed off and lost

SLIC box	12
Launched from board	110-1 LANDER-12 Elevator 1, washed off
Positioned and photo	
Photo one day before dredge	118 ROV-17 10/04/2019 21:20:53 11°51.657'N 117°00.753'W
Photo one day after dredge	124 ROV-18 13/04/2019 01:09:22 11°51.657'N 117°00.749'W
Photo one month after dredge	188 ROV-29 12/05/2019 16:46:43 11°51.655'N 117°00.754'W

SLIC box	13
Launched from board	110-1 LANDER-12 Elevator 1, washed off
Positioned and photo	
Photo one day before dredge	118 ROV-17 10/04/2019 19:25:33 11°51.703'N 117°00.707'W
Photo one day after dredge	124 ROV-18 13/04/2019 01:16:50 11°51.700'N 117°00.707'W
Photo one month after dredge	188 ROV-29 12/05/2019 21:03:41 11°51.701'N 117°00.709'W

SLIC box	14
Launched from board	110-1 LANDER-12 Elevator 1, washed off and lost

SLIC box	15
Launched from board	110-1 LANDER-12 Elevator 1
Positioned and photo	111 ROV-16 09/04/2019 01:09:33 11°51.847'N 117°00.783'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:24:56 11°51.845'N 117°00.786'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:14:50 11°51.848'N 117°00.783'W
Photo one month after dredge	197 ROV-31 14/05/2019 18:50:14 11°51.844'N 117°00.778'W

SLIC box	16
Launched from board	118 ROV-17
Positioned and photo	118 ROV-17 10/04/2019 17:24:11 11°51.831'N 117°00.824'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:16:38 11°51.830'N 117°00.819'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:09:56 11°51.830'N 117°00.820'W
Photo one month after dredge	197 ROV-31 14/05/2019 18:55:25 11°51.830'N 117°00.821'W

SLIC box	17
Launched from board	118 ROV-17
Positioned and photo	118 ROV-17 10/04/2019 17:35:01 11°51.811'N 117°00.821'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:09:27 11°51.805'N 117°00.823'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:06:16 11°51.804'N 117°00.819'W
Photo one month after dredge	197 ROV-31 14/05/2019 18:58:32 11°51.803'N 117°00.821'W

SLIC box	18
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Launched from board	118 ROV-17
Positioned and photo	118 ROV-17 10/04/2019 17:41:15 11°51.786'N 117°00.820'W
Photo one day before dredge	118 ROV-17 10/04/2019 20:04:12 11°51.780'N 117°00.819'W
Photo one day after dredge	124 ROV-18 12/04/2019 20:02:49 11°51.785'N 117°00.813'W
Photo one month after dredge	197 ROV-31 14/05/2019 19:01:32 11°51.785'N 117°00.819'W

SLIC box	19
Launched from board	118 ROV-17
Positioned and photo	118 ROV-17 10/04/2019 17:51:51 11°51.748'N 117°00.812'W
Photo one day before dredge	118 ROV-17 10/04/2019 19:57:33 11°51.745'N 117°00.806'W
Photo one day after dredge	124 ROV-18 12/04/2019 21:01:11 11°51.749'N 117°00.808'W
Photo one month after dredge	188 ROV-29 12/05/2019 19:48:36 11°51.749'N 117°00.811'W

SLIC box	20
Launched from board	118 ROV-17
Positioned and photo	118 ROV-17 10/04/2019 18:02:39 11°51.728'N 117°00.796'W
Photo one day before dredge	118 ROV-17 10/04/2019 19:53:38 11°51.732'N 117°00.791'W
Photo one day after dredge	124 ROV-18 12/04/2019 21:05:57 11°51.731'N 117°00.793'W
Photo one month after dredge	188 ROV-29 12/05/2019 19:51:48 11°51.733'N 117°00.797'W

5.4.4 Optical sensor calibration

In order to allow relative turbidity units rendered by the different types of optical backscatter sensors to be converted to a common unit of mass concentration of suspended sediment, all optical turbidity sensors used for plume monitoring (JFE Advantech, Wetlabs FLNTU, Seapoint, Aanderaa) were calibrated on board prior to and after the dredge plume experiment. To that end, sensors were immersed one-by-one in a large tub filled with 50 L unfiltered bottom water to which in seven consecutive steps increasing doses of sediment suspension were added (Fig. 5.4.4.1). The suspension used for calibrating the sensors was prepared by JUB from surface sediment and bottom water from the Belgian contract area collected by GSR. To keep the sediment suspension homogeneous and prevent sediment to settle out, an immersion pump maintaining a vigorous turbulent flow was placed at the bottom of the calibration tub. In between calibration measurements, sensors were kept immersed in a second tub filled with bottom water. To avoid possible temperature effects on the measurements and interference with ambient light, the calibrations were carried out in a climatized lab with dimmed light and with the calibration tub largely shielded off with light-blocking cloth. Sensors were set to record at highest sampling rate (1, 2 or 10 second(s) sampling interval), for 1 or 2 minutes. After each calibration step 20 ml sample(s) were taken from the suspension for an additional control by JUB on the respective sediment concentrations used for calibration.

Fig. 5.4.4.1: Left: Onboard calibration of the optical backscatter sensors in darkened thermo lab; right: with lights on. Tub with calibration suspension in foreground center, tub with clean seawater used for parking sensors to the right. Photo: Henko de Stigter.

In order to relate optical backscatter sensor output to the (very low) background concentration of suspended particulate matter in the water column, all 14 available JFE Advantech optical backscatter sensors were attached to the CTD frame and lowered to the bottom and back up again once during each leg of the cruise, along with the Wetlabs FLNTU sensor which was standard on the CTD. During Leg 2 one of the JFE Advantech sensors was kept on the CTD frame during all subsequent casts (Fig. 5.4.4.2). For quantifying background mass concentration of suspended particulate matter in the near-bottom water, 4.5 or 9 L of water from Niskin samples taken at 5 mab during each of the CTD casts of Leg 2 was filtered over pre-weighed polycarbonate filters with 0.4 μm pore size. Filters were stored frozen at -20°C for later determination of the weight of collected particulate matter (see Ch. 5.7.3).

Fig. 5.4.4.2: The 12 JFE Advantech OBS sensors used for plume monitoring were taped to the CTD frame and lowered through the water column for intercalibration between sensors and ‘master’ FLNTR sensor of the CTD. Photo: Julia Otte.

5.5 ROV and Elevator Operations

5.5.1 Deployment of ROV KIEL 6000 during expedition SO268

(ROV-Team Kiel 6000: F. Abegg, F. Bischof, M. Bodendorfer, P. Cuno, H. Huusmann, T. Matthiessen, M. Pieper, J. Rindfleisch, P. Striewski, I. Suck)

ROV KIEL 6000 is a 6000 m rated deep diving platform manufactured by Schilling Robotics LLC, Davis, USA. It is based on commercially available ROVs, but customized to research demands, e.g. being truly mobile. As a truly versatile system it has been operated from a variety of different national and international research vessels (RV Sonne, N/O l'Atalante, RV Maria S. Merian, RV Meteor, RV Celtic Explorer, RRS James Cook and RV Polarstern) until today. It is an electrically driven work class ROV of the type QUEST, build No. 7. ROV KIEL 6000 is based at the Helmholtz Centre for Marine Sciences GEOMAR in Kiel, Germany.

Including this cruise, ROV KIEL 6000 has accomplished 296 dives during 23 missions. During SO268-1, 13 dives (Table 5.5.1) could be accomplished; during SO268-2 we completed 18 dives, i.e. 32 dives in total. During 30 dives, scientific sampling was done, while 2 dives (073ROV11 and 146ROV21) were exclusively dedicated to recovering the GEOMAR MOLAB lander and sensor modules owned by AWI/MPI. Maximum diving depth was more than 4500 m and maximum bottom time was almost 11 hours. In total, bottom time accumulated to approximately almost 214 hours (total dive time approx. 330 hours).

Fig. 5.5.1.1: (clockwise from top left to bottom left): Different Tooling on ROV KIEL 6000 during SO268: Frontal view of ROV KIEL 6000 with faunal sampling set-up. 9-compartment biobox on portside drawer, Senckenberg biobox on starboard drawer, Slurpgun nozzle on starboard side, handnets on the porch; LIBS (Robust) bottle and 48 V adapter bottle on the aft starboard toolskid; Multibeam attached to the aft of the ROV; Plankton camera on the portside aft pole of the ROV frame.

ROV Tasks during SO268

During SO268, tasks of ROV KIEL 6000 included placing and operating different scientific tools on the seafloor. These included MPI profilers, MPI Benthic chambers, AWI PiCams and AquaPix (Fig. 7.5.1.3), NIOZ Nodule Frames and Corrals (Fig. 7.5.1.2) (for trophic studies). In addition, fauna sampling (Figs. 7.5.1.2 and 7.5.1.4) was conducted, with the main focus on corals, anemones, holothurians, ophiuroids and sponges. These were collected using nets, the ORION claw or the slurp gun and transported in a dedicated sealed 9-compartment biobox(es) (Fig 7.5.1.1), the Senckenberg biobox (Fig. 7.5.4.1) or the slurp gun containers. Sediment was sampled by means of pushcores. During the second leg, as the collector test could not be performed, a dredge experiment was conducted to create a massive plume and try to follow its fate. A sensor array was placed in the vicinity using two Elevators and the ROV. These sensors were ADCPs, turbidity sensors and CTD on tripod mounts (Fig. 7.5.1.3). In addition so called SLIC boards were placed on the sediment (Fig. 7.5.1.3) and inspected several times during the cruise. During dive 152ROV22, a Kongsberg Multibeam was mounted on the aft of the ROV (Fig. 7.5.1.1) and integrated into the ROV system with online transmission of data. During Dives 169ROV27 and 209ROV32, the LIBS System (Laser-Induced Breakdown Spectroscopy, Fig. 7.5.1.1), which is also integrated into the ROV system, was tested. After several drawbacks during the first dives (loss of our high-resolution SONAR, oil leaks, one camera malfunctioning), ROV KIEL 6000 worked satisfactorily and the tasks, i.e. module handling, nodule sampling (with primnoid corals, anemones, sponges), megafauna sampling, pushcoring, regular release of elevators, and “rescue” of the MOLAB lander, an amphipod trap that had been deployed (and lost) in 2015 (Fig. 3g), a drone that had drowned during the present cruise, and locating and rescuing one benthic chamber and three profilers that were lost off an elevator during recovery, were accomplished. In total, a second wire with rescue hook was deployed off the ship during 5 dives in order to recover gear that could not be released acoustically (2x MOLAB, 2x elevator, 1x amphipod trap).

On the second leg, the sonar of our small ROV PHOCA was integrated into our system and facilitated work.

ROV tools used during SO268:

- Slurp gun w/ 8 sampling containers (ROV KIEL 6000)
- Push cores (ROV KIEL 6000)
- Handnets (ROV KIEL 6000)
- Lasers (integrated) (Alpha Cam, ROV KIEL 6000)
- “Senckenberg” Biobox (large) (ROV KIEL 6000)
- Scoop (MPI / ROV KIEL 6000)
- Benthic chambers (incl. magnet T-Handle and/or optical communication) (MPI)
- Profilers (incl. magnet T-Handle and/or optical communication) (MPI)
- Sealing Bioboxes (9pc) (A. Hilário)
- Corrals (T. Amaro)
- Sediment bottles (T. Amaro)
- Passive markers (NIOZ)
- Rescue Hooks (RV SONNE / ROV KIEL 6000)
- Elevators (ROV KIEL 6000)

- Nodule frames (& Biobox) (S.Gollner, NIOZ)
- PiCams (AWI)
- Aquapix Camera (AWI)
- Aquadopp Tripod (NIOZ, GEOMAR)
- LIBS (ROBUST) (Laserzentrum Hannover)
- Multibeam (GEOMAR)
- ADCP In mount (GEOMAR, ROV KIEL 6000)
- HOMER Tripods (as camera mounts) (GEOMAR, ROV KIEL 6000)
- CTD tripod (RBINS)
- SLIC boards (GEOMAR)
- ADV tripod (GMR)
- Amphitraps (RBINS)
- Rake/Fork (UGhent)

Tab. 5.5.1.1: ROV station list

Station Number SO268	Date Year 2019 (UTC)	Time Start (UTC)	At Bottom (UTC)	Off Bottom (UTC)	Time End (UTC)	Study Site	Depth (m)	ROV Bottom Time
		TestDive on transit to working German working area						
011ROV01	01.03.	15:03	17:03	18:18	20:15	GER Trial	4085	01:15
020ROV02	03.03.	15:10	17:11	20:53	22:48	GER Trial	4085	03:42
025ROV03	05.03.	16:58	18:45	20:38	22:22	GER Trial	4103	01:53
029ROV04	06.03.	15:10	16:50	23:11	00:47	GER Trial	4100	06:21
031ROV05	07.03.	18:14	19:58	00:14	01:50	GER Trial	4100	04:16
035ROV06	08.03.	16:04	17:41	00:54	02:40	GER Reference	4100	07:13
040ROV07	09.03.	15:55	17:37	23:25	01:15	GER Reference	4100	05:48
057ROV08	15.03.	15:05	16:55	00:55	02:42	BEL Trial	4500	08:00
064ROV09	17.03.	15:09	17:04	01:20	03:16	BEL Trial	4500	08:16
069ROV10	18.03.	15:35	17:35	22:06	23:57	BEL Trial, recovery Elevator	4500	04:31
073ROV11	19.03.	16:35	18:26	20:24	22:14	BEL Trial, recovery MOLAB	4500	01:58
077ROV12	20.03.	16:07	17:55	01:02	02:59	BEL Trial, recovery MOLAB	4500	07:07
081ROV13	21.03.	16:40	18:27	00:04	02:05	BEL Trial	4500	05:37
099ROV14	05.04.	16:02	17:43	02:13	03:00	GER Dredge	4100	08:30
101ROV15	06.04.	15:15	17:03	02:26	04:10	GER Dredge	4100	09:23
111ROV16	08.04.	15:22	17:02	01:18	02:58	GER Dredg	4100	08:16
118ROV17	10.04.	15:37	17:14	00:50	02:33	GER Dredge	4100	07:36
124ROV18	12.04.	17:15	18:50	03:26	05:06	GER Dredge	4100	08:36
134ROV19	17.04.	19:16	21:01	03:45	05:43	BEL Trial	4500	06:44
137ROV20	18.04.	15:11	17:00	01:05	03:12	BEL Trial	4500	08:05
146ROV21	20.04.	14:05	15:56	01:32	03:37	BEL Trial, rescue	4500	09:36
152ROV22	22.04.	15:24	17:21	01:02	03:12	BEL Trial, Multibeam	4500	07:41
154ROV23	23.04.	15:40	17:31	00:52	02:47	BEL Reference	4500	07:21
158ROV24	26.04.	14:55	16:38	00:28	02:15	GER No-Nodule	4300	07:50
163ROV25	28.04.	14:44	16:21	23:47	01:34	GER Trial	4100	07:26
165ROV26	29.04.	17:13	18:50	02:50	04:36	GER Trial	4100	08:00
169ROV27	07.05.	14:09	17:05	17:55	19:51	GER Trial, LIBS, rescue	4100	00:50
174ROV28	08.05.	14:07	15:46	02:28	04:17	GER Reference	4100	10:42
188ROV29	12.05.	13:37	15:14	22:46	00:35	GER Dredge	4100	07:32
193ROV30	13.05.	15:32	17:08	01:44	03:37	GER Dredge	4100	08:36
197ROV31	14.05.	14:56	16:43	00:45	02:30	GER Dredge	4100	08:02
209ROV32	16.05.	18:31	20:12	03:21	05:16	GER Dredge, LIBS	4100	07:09

Fig. 5.5.1.2: a) coral (Primnoidea, Alcyonacea) on nodule; b) holothurian *Psychropotes longicauda* ; c) sponge; d) anemone cf. Hormatiidae; e) ophiuroid *Ophiuroglypha* sp.; f) elevator with profilers; g) pouring algal solution into corral; h) pushcoring; i) nodule frames for recolonization experiments; j) PiCam in front of stalked sponge *Hyalonema* sp. with brisingiid starfish (Asteroidea).

Fig. 5.5.1.3: Instruments handled by ROV KIEL 6000: **a)** CTD tripod, **b)** ADV tripod, **c)** Aquadopp tripod, **d)** ADCP tripod, **e)** rake/fork, **f)** profiler and AquaPix camera, **g)** amphipod trap (deployed in 2015, recovered with rescue hook in 2019), **h)** amphitrap, **i)** SLIC board, **j)** benthic chamber.

Fig. 5.5.1.4: More fauna of the CCZ a) galatheid crustacean, b) holothurian *Psychropotes longicauda*, c) asteroid, d) ORION sampling a nodule with a coral, e) echinoid *Plesiodiadema* sp., f) echinoid *Urechinidae*, g) cephalopod *Grimpoteuthis* sp., h) anemone, i) deepsea fish cf slickhead, j) anemone cf *Bolocera* sp..

5.5.2 Elevator Operations

(P. Linke, A. Petersen, T. Schott, E. Fabrizius)

To transport ROV-modules, sampling and experimental gear to the seafloor and back to the surface and to increase the efficiency of the ROV's bottom time, two elevator landers were used during cruise SO268. Whereas the first elevator has been used already on several cruises together with ROV KIEL 6000, the second one was newly designed in view of the large number and variety of different modules used during a previous cruise (SO242-2). Whereas the old elevator (1) has a frame of stainless steel and two platforms and drawers for samples, the new elevator (2) has a lighter frame of glass fiber reinforced plastic (GFRP) and an open platform around the floatation. Due to reduction in weight of elevator 1 the payload increased to 230 kg (max.) with more space on the platform (3.6 m²) compared to the old elevator (2.6 m²). To keep the elevator lander at the bottom during deployment and removal of the scientific payload, either a train reel (~300 kg, elevator 1) or a block of steel (442 kg, elevator 2) was used. Both elevators were equipped with blocks of syntactic foam for floatation, direction finding beacons for location at the seafloor, dual KUM releasers and manual emergency release with ROV, flasher and radio beacon for relocation on the sea surface during recovery by using a floatation line. They were deployed video-guided by a launcher to ensure a targeted and soft deployment (Fig. 7.5.2.1).

Fig. 5.5.2.1: Elevator 1 (left) and Elevator 2 (right) loaded with scientific equipment and ready for deployment by the launcher on top of the landers.

An electromagnetic release was used on the launcher to separate the lander from the launcher. The release signal was transmitted from the surface unit of the telemetry unit when the elevator reached the position approx. 1 m above the seafloor and was clearly visible for the winch operator in the vessel's data room.

During the cruise various equipment in different combinations had to be transported by both elevators, either to be deployed and put back on the elevator by the ROV and/or used mounted permanently on the elevator and filled with samples by the ROV or attracted by bait. Careful planning was needed to use the available space and payload of both elevators, secure the equipment during descent and recovery as well during ROV operations by the pilots.

In total 20 deployments were conducted during SO268, 10 each for Elevator 1 and 2.

Fig. 5.5.2.2: Elevator 1 equipped with 3 profilers on the porch and 2 sixpacks of push corers in the drawer on the right. In the middle of the elevator a grey box with a flotation line is visible, which is released when dropping the bottom weight to facilitate the recovery of the elevator at the sea surface.

Fig. 5.5.2.3: Elevator 2 with 2 racks of nodule frames and 2 microprofilers on the porch.

5.6 Multiple Corer Deployments

(N. F. Mercado-Salas, F. Hauquier, D. Zeppilli, E. Pape, S. Rossel, K. Uhlenkott, A-K. Wessels, M. Molari, E. Buschi, J. Otte, B. Yapan, J. Volz, S. Paul, K. Schmidt, R. Posh, M. Christodoulou, D. Köhler, A. Moje, J. Barz, T. Amaro, M. Haeckel, P. Martínez Arbizu)

Deep-sea polymetallic nodules represent one of the marine mineral resources that will be target of mining in the future. Mining techniques used for the extraction of nodules from the seafloor will lead to the complete destruction of the upper 0–10 cm layer of soft sediments and the removal of nodules dispersed in the upper sediment layer, killing most meiobenthic organisms inhabiting these upper sediment layers, as well as those colonising the nodules. In order to investigate the possible deep-sea mining impacts, a baseline in the still pristine environments should be established including different approaches. These studies will be later used to assess the mining impacts on benthic communities and the deep-sea ecosystem. During SO268/1 and SO268/2 cruises we sampled sediments using the Multicorer in the German (GER) and Belgian (BEL) contract areas for baseline studies of benthic communities (microbiology and meiofauna), geochemistry and other relevant environmental parameters.

Description of Gear

A new model of a Multicorer (MUC) from Oktopus GmbH including 20 liners was used on board (Fig. 7.6.1). This instrument from Senckenberg Institute is equipped with twenty 60 cm long tubes, each 100 mm outside diameter. Its inner diameter is 96 mm, covering an area of 55 cm². The gear is designed in order to sample an intact column (core) of sediment together with its overlying water and the transitional thick fluffy layer (formed between the transition water/sediment). During all deployments the MUC was equipped with the underwater acoustic positioning system Posidonia, mounted 50m above the gear. The MUC was lowered with 1.0 m/sec (leg 1) or 0.8 m/sec (leg 2) until it reached ca. 50 m above the sea floor, then stopped for few seconds, and afterwards descending speed was changed to 0.5 m/s until contact with seafloor (monitored through changes in wire tension). The gear stayed on the seafloor for ca. 2 minutes and then was heaved with 0.5 m/s for the first meters of ascendance. After the MUC was pulled out of the sediment and the liner closed, the gear was heaved with 1.0 m/s until the recovery of the Posidonia transponder (attached on the wire 50m above the MUC) and brought on board to recover the samples. During the first three deployments in the German Trial Site the MUC was equipped with a camera and telemetry system provided by RV Sonne (Fig. 5.6.1 B-D). During SO268/2 the camera-guided MUC was used on more stations (10) to allow targeted sampling of post-dredge disturbance and related gradients in sediment blanketing. The camera and the telemetry systems were tested and settings were adjusted with the help of WTD crew members.

Fig. 5.6.1: Work at sea during MUC Deployment. A) Preparation of the gear; B) TV-MUC Image during lowering; C) TV-MUC Image touching the sea floor; D) TV-MUC Image during heaving, cores filled with sediments; E) Recovery of the filled multicorer after deployment; F) Work on deck, G) Work on deck. Photos: A, E: P. Martínez; C-G: M. Christodoulou.

Sampled stations and intended analyses

Twenty-one stations were sampled during SO268/1, ten in the German contract and eleven in the Belgian contract (Tab. 5.6.1). During SO268/2, an additional twenty stations were sampled, two times four in both the German and Belgian reference areas, and twelve in the dredge experiment area (2 pre-impact, 10 post-impact) (Tab. 5.6.2). In most of the deployments 18-20 tubes were filled with about 40 cm of sediment. Sediment cores were distributed among different research groups according to a certain pattern in the baseline stations (Tab. 5.6.2) and upon request for the dredge-impact (see Chapter 12.2 for a core distribution list per deployment).

Tab. 5.6.1: List of MUC stations during SO268 Leg 1 and 2

	Station	Date	Lat (N)	Long (W)	Depth (m)	Area
SO268/1_	5-1_MUC-01 ¹	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial
	6-1_MUC-02 ¹	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial
	7-1_MUC-03 ¹	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial
	18-1_MUC-04	3/03	11° 55.470'	117° 01.039'	4095.2	GER Trial
	19-1_MUC-05	3/03	11° 55.298'	117° 00.815'	4101.4	GER Trial
	26-1_MUC-06	6/03	11° 56.047'	117° 01.772'	4084.9	GER Trial
	38-1_MUC-07	9/03	11° 50.695'	117° 03.608'	4130.2	GER Reference
	39-1_MUC-08	9/03	11° 51.274'	117° 02.366'	4130.1	GER Reference
	42-1_MUC-09	10/03	11° 51.733'	117° 00.391'	4118.1	GER Reference
	43-1_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial
	50-1_MUC-11*	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial
	50-2_MUC-12	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial
	56-1_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial
	65-1_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial
	66-1_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial
	67-1_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial
	74-1_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial
	75-1_MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial
	79-1_MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Reference
	80-1_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Reference
	85-1_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Reference
SO268/2_	106-1_MUC-22	7/04	11° 51.773'	117° 00.740'	4119	GER dredge
	107-1_MUC-23	7/04	11° 51.729'	117° 00.844'	4120.8	GER dredge
	122-1_MUC-24 ¹	12/04	11° 51.637'	117° 00.893'	4123.7	GER dredge
	125-1_MUC-25 ¹ *	13/04	11° 51.857'	117° 00.771'	4119.4	GER dredge
	125-2_MUC-26 ¹	13/04	11° 51.844'	117° 00.782'	4120.3	GER dredge
	135-1_MUC-27	17/04	14° 01.109'	125° 55.357'	4541	BEL Reference
	136-1_MUC-28	17/04	14° 01.505'	125° 55.234'	4542	BEL Reference
	138-1_MUC-29	19/04	14° 01.126'	125° 54.953'	4527	BEL Reference
	139-1_MUC-30	19/04	14° 01.897'	125° 55.003'	4523	BEL Reference
	171-1_MUC-31	8/05	11° 51.003'	117° 03.323'	4122	GER Reference
	172-1_MUC-32	8/05	11° 50.447'	117° 03.314'	4136	GER Reference
	178-1_MUC-23	10/05	11° 50.456'	117° 03.323'	4132	GER Reference
	179-1_MUC-34	10/05	11° 50.367'	117° 03.578'	4142	GER Reference
	184-1_MUC-35 ¹	11/05	11° 51.785'	117° 00.701'	4116	GER dredge
	185-1_MUC-36 ¹	11/05	11° 51.774'	117° 00.760'	4120	GER dredge
	186-1_MUC-37 ¹	12/05	11° 51.793'	117° 00.747'	4116	GER dredge
	198-1_MUC-38 ¹	15/05	11° 51.763'	117° 00.715'	4115	GER dredge
	199-1_MUC-39 ¹	15/05	11° 51.751'	117° 00.761'	4119	GER dredge
	200-1_MUC-40 ¹	15/05	11° 51.761'	117° 00.777'	4121	GER dredge
	207-1_MUC-41 ¹	16/05	11° 51.790'	117° 00.789'	4124	GER dredge

¹ TV-guided MUC

* deployment failed

Tab. 5.6.2: General core distribution of MUC liners for baseline samples.

Core	GER Area	BEL Area
1	Camera/ CIIMAR Isotopes-FA	Camera/ CIIMAR Isotopes-FA
2	SGN Metabarcoding (DESS)	UGent Metabarcoding -80°C
3	SGN Metabarcoding (DESS)	UGent Metabarcoding -80°C
4	SGN Metabarcoding (DESS)	UGent Metabarcoding -80°C
5	SGN MALDI-TOF (Ethanol)	SGN MALDI-TOF (Ethanol)
6	SGN MALDI-TOF (Ethanol)	SGN MALDI-TOF (Ethanol)
7	SGN MALDI-TOF (Ethanol)	SGN MALDI-TOF (Ethanol)
8	SGN community (Formaldehyde)	UGent community (Formaldehyde)
9	SGN community (Formaldehyde)	UGent community (Formaldehyde)
10	SGN reference Lib Ethanol	UGent reference Lib Ethanol
11	SGN reference Lib DESS	UGent reference Lib DESS
12	UGent -80C environmental data	UGent -80C environmental data
13	UNVIPM OM, eDNA, microeukaryotes, viruses	UGent -80C environmental data
14	MPI microbial communities and functions/MARUM sed. structure CT	UNVIPM OM, eDNA, microeukaryotes, viruses
15	JUB Trace metals 1	MPI microbial communities and functions/MARUM sed. structure CT
16	JUB Trace metals 2	JUB Trace metals 1
17	AWI ex-situ oxygen sediment	JUB Trace metals 2
18	AWI/NIOZ pore water sediment	AWI ex-situ oxygen sediment
19	JUB aminoacids	AWI/NIOZ pore water sediment
20	GEOMAR ex situ shear strength profiles	JUB aminoacids

5.7 Boxcorer Deployments

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5.7.1 Purpose: Infauna, epifauna and nodule sampling

The main goal of boxcorer sampling is to retrieve quantitative samples of sediment for the study of the associated macrofaunal (epifauna and infauna) assemblages, as well as the microbiota and geological properties of the sediment and other structures (in this case, manganese nodules). In SO268, the different fractions were treated with the following specific objectives:

1. The sediment was sampled and treated for assessing distribution patterns of the infaunal assemblages at a regional scale, and comparative analyses of the infauna in the different areas before and after the impact.

2. Nodules were sampled from the boxcores taken as a control for the nodule frame experiment (see Ch. 8.9.3) and for the diversity of the nodule-associated fauna before and after impact. Additionally, selected nodules were preserved and treated for studying the associated microbiome (see Ch. 5.13).

3. Imaging of the surface of the sample and further treatment of the nodules were used for a later quantitative analysis of the visual, nodule size in underwater photos and the real size of the sampled nodules (see Ch. 7). These data are intended for the improvement of models which aim at Mn-nodule resource assessment.

4. Bearing in mind that in some current designs for industrial nodule collectors powerful water jets shearing over the seabed will be used to lift nodules from the seabed, and that surface sediments will inevitably be eroded more deeply by these jets when more hydraulic power is needed to lift the nodules, it seemed relevant to collect some data on the force required to lift nodules from the sediment.

5.7.2 The equipment

A USNEL Spade Corer (Fig. 5.7.1) was used for sampling the sediment and nodules. It consists on a box of a 50 cm x 50 cm x 60 cm that sinks into the seafloor. The penetration of the box into the sediment is limited by stoppers located on the sides of the frame. A friction release frees the spade arm when the weight of the corer is relieved from the wire. When wire is reeled in to return the device to the ship, the initial action is to lever the spade down into the substrate until it closes off the bottom of the core. Subsequent take-up on the wire pulls the apparatus out of the bottom. At the top of the core box a valve allows free passage to water entering at the mouth. The valve is opened during the descent and closed by a friction release mechanism triggered by the spade closure.

Fig. 5.7.1: The Boxcorer ready for deployment.
Photo by A. Hilário.

Operation of the gear

The stoppers were positioned to allow a penetration of 40 cm into the seafloor. The box-corer was deployed from starboard side and lowered at a speed of 1 m/s until it reached an altitude of 50 m above the seafloor. After a stop of about one minute, the box-corer was lowered, and landed at a speed of 0.5 m/s. Landing and pull out were monitored on a plot of rope tension (Fig. 7.7.2). Landing is visually assessed by a significant drop in rope tension. The winch was stopped for 20 seconds or 5-7 m of cable after landing and the box-corer was pulled out after another 20 seconds at 0.2 to 0.3 m/s. Pull out tension for a successful box-core ranged from 35 to 45 kN, and was visualized as a peak in rope tension.

Fig. 5.7.2: Variations in rope tension during landing and pull of a box corer.

5.7.3 Onboard sample treatment

Once the boxcorer was on deck and the box out of the frame, the sample was treated as follows:

1. The overlying water was removed and sieved through a 300 μ m mesh. The residue was kept for live-sorting.
2. Photos of the untouched sediment surface with the nodules were taken under controlled illumination (two 50W daylight lamps with 5400K shining from above, see Fig. 5.7.3) for later quantitative analysis of the visual, apparent, nodule size distribution from a photo as compared to the actual nodule content of the sample, and for obtaining the sediment color.

Fig. 5.7.3: Left: Photo station with curtains to shut off sunlight. Right: Sample is being photographed inside the photo station.

3. A small pushcore was placed in the center of the sample for later granulometric analyses. The core was sliced into three layers (0-3, 3-5, 5-10 cm) which were kept in separate bags at -20°C.
4. Selected nodules were first hand-picked and treated for microbiological analyses (see Ch. 5.8.5),
5. Nodule lift force, weight and size was measured.
6. Nodules were processed for the study of associated meiofauna (Tab 5.7.3).
7. The boxcore sediment sample was sliced into three layers (0-3, 3-5, 5-10 cm) and sieved separately through a 300 μ m mesh. The first layer was sieved in cold water at 4°C and live sorted. The faunal specimens were photographed and preserved in either ethanol or DESS and stored at 4°C. The remaining sediment, as well as the residue of the second and third layers were fixed in ethanol and stored at 4°C. After 24 hours, the ethanol was changed in order to assure a high percentage of ethanol and the sample stored at -20°C for later sorting and identification of the fauna (see Ch. 8.2 and 8.3).

In total, the box-corer was deployed 50 times, of which 36 were successful. (See appendix)

5.7.4 Nodule lift-force, weight and size measurement

An estimation of the force required to lift nodules from the sediment was carried out as follows: on average three nodules per boxcore were lifted with an improvised gripper suspended below a digital hanging scale (Fig. 5.7.4). From this scale the maximum force required for pulling the nodule from the sediment was read. Subsequently the wet weight of the nodule in air and immersed in seawater was also taken, and the difference between these two was subtracted from the recorded pull force to estimate the pull force under water. The rest of the nodules were hand-picked.

Fig. 5.7.4: Measuring the force required for lifting a nodule from cohesive sediment, using gripper and digital hanging scale.

The nodules were brought to the cold room (4°C) as soon as possible. Here, they were rinsed using cold filtered (20 µm mesh) seawater and inspected for conspicuous, metazoan epifauna. Nodules with conspicuous epifauna were studied under stereo microscope, all metazoan fauna was picked off, photographed and fixed in ethanol. Afterwards, all the nodules from the first 10 cm of each box-corer were measured for their length, width, height and wet mass (Fig. 5.7.5). Some of the preliminary results are given in Table 5.7.1 and Figure 5.7.6.

Fig. 5.7.5: Processing of the nodules in the laboratory.

Tab. 5.7.1: Nodule size and weight statistics for each box corer which did not fail. Median size is computed from the lengths of the two main axes and assuming an ellipsoidal nodule shape.

Box corer	Study Site	Median (mm ²)	Size	Std.Dev. of Size	Abundance (kg/m ²)	Seafloor Coverage (%)
012-2 BC-02	GER Trial	9.2		5.9	13.5	49
015-3 BC-03	GER Trial	15.0		8.3	15.0	51
024-3 BC-09	GER Trial	14.5		10.0	19.5	61
027-1 BC-10	GER Trial	16.6		11.2	25.3	77
028-1 BC-11	GER Trial	11.1		10.5	21.1	65
033-2 BC-12	GER Trial	12.8		8.3	20.6	66
044-2 BC-14	GER Trial	12.4		6.9	14.7	53
052-1 BC-15	BEL Trial	51.0		25.1	22.5	38
053-1 BC-16	BEL Trial	40.0		25.3	24.3	46
060-1 BC-17	BEL Trial	44.5		20.9	25.0	51
061-1 BC-18	BEL Trial	45.4		15.0	21.1	36
072-1 BC-19	BEL Trial	31.8		17.4	19.7	46
076-1 BC-20	BEL Reference	53.4		31.5	16.9	28
082-1 BC-21	BEL Reference	80.4		48.1	19.7	30
083-1 BC-22	BEL Reference	7.2		22.1	15.5	29
095-2 BC-24	GER Dredge	21.6		27.8	24.5	48
096-1 BC-25	GER Dredge	29.2		13.3	15.8	40
102-1 BC-26	GER Dredge	24.7		16.1	23.6	60
103-1 BC-27	GER Dredge	18.8		18.9	18.9	48
116-1 BC-29	GER Dredge	16.6		19.7	19.4	46
129-1 BC-30	BEL Trial	53.0		26.6	22.5	44
140-1 BC-31	BEL Reference	14.1		32.9	12.9	22
141-1 BC-32	BEL Reference	8.2		40.0	14.1	20
142-1 BC-33	BEL Reference	74.2		22.5	15.5	20
148-1 BC-34	BEL Reference	46.9		22.5	11.5	20
149-1 BC-35	BEL Trial	59.7		19.9	16.4	26
161-1 BC-36	GER Trial	20.0		18.7	25.1	61
166-1 BC-37	GER Reference	0.0		23.2	14.9	38
175-1 BC-39	GER Reference	18.7		15.9	21.1	55
180-1 BC-40	GER Reference	24.2		21.9	20.6	46
181-1 BC-41	GER Reference	17.9		17.2	26.6	65
182-1 BC-42	GER Reference	14.6		12.4	18.3	53
189-1 BC-43	GER Dredge	9.8		8.8	21.0	26
190-1 BC-44	GER Dredge	15.1		9.2	21.7	25
191-1 BC-45	GER Dredge	9.8		4.9	18.6	23
205-2 BC-49	GER Reference	7.9		6.7	18.8	24

With the caveat that the rate at which nodules were pulled was far from constant and that creep processes may thus to a variable degree have reduced the peak pull force, and that nodules were often somewhat dislodged from the sediment while applying the gripper, a roughly linear relationship was observed between weight and hence size of the nodules and pull force (Fig. 5.7.6), with required force to pull a nodule from the sediment almost five times the nodule weight in water.

Fig. 5.7.6: Relationship between pull force and weight of nodules immersed in sea water. Data only from boxcores of the German working area.

5.7.5 Nodule epifauna

Nodules were finally processed for the study of associated meiofauna (Table 5.7.2). During the first leg, in the GER area, 25 nodules were selected at random from each boxcore and stored individually in 4% borax-buffered formaldehyde. The remainder of the nodules was roughly divided in 2; one half was bulk fixed in non-denatured ethanol and stored at -20°C, whilst the other half was stored in 4% formaldehyde and kept at ambient temperature. In the Belgian contract area (BEL) between 2 and 4 nodules were selected at random from six of the boxcores, fixed individually in non-denatured ethanol and stored at -20°C. During the second leg, all nodules except those from below 10 cm sediment depth, were taken. All visible epifauna was removed and stored in 96% non-denatured ethanol. The first 25 nodules of each boxcore were stored in 8% borax-buffered formaldehyde at ambient temperature and the remainder were roughly divided into equal amounts for storage in 8% formaldehyde and 96% non-denatured ethanol. Most nodules were preserved individually.

Tab. 5.7.2: Overview of boxcore nodule samples collected for NIOZ.

Station	Area	BC	Nodule sampling
12_2	GER trial	BC02	Disturbed boxcore sample; Part of the nodules stored bulk in 4% formaldehyde
15_3	GER trial	BC06	All surficial nodules (150) stored individually in non-denatured ethanol
24_3	GER trial	BC09	25 individual nodules in 4% formaldehyde, remaining nodules bulk fixation: half non-denatured ethanol, half 4% formaldehyde
27_1	GER trial	BC10	25 individual nodules in 4% formaldehyde, remaining nodules bulk fixation: half non-denatured ethanol, half 4% formaldehyde
60_1	BEL trial	BC17	4 individual nodules fixed in non-denatured ethanol
61_1	BEL trial	BC18	2 individual nodules fixed in non-denatured ethanol
72_1	BEL trial	BC19	4 individual nodules fixed in non-denatured ethanol
76_1	BEL ref	BC20	3 individual nodules fixed in non-denatured ethanol
82_1	BEL ref	BC21	2 individual nodules, 2 bulk-fixed nodules, fixed in non-denatured ethanol
83_1	BEL ref	BC22	3 individual nodules fixed in non-denatured ethanol
95_2	GER Dredge pre-impact	BC24	44 individual nodules, 34 fixed in 8% formaldehyde, 10 fixed in non-denatured ethanol
96_1	GER Dredge pre-impact	BC25	71 individual nodules, 48 fixed in 8% formaldehyde, 23 fixed in non-denatured ethanol
102_1	GER Dredge pre-impact	BC26	Overlying water partly lost, 62 individual nodules, 43 fixed in 8% formaldehyde, 18 fixed in non-denatured ethanol
103_1	GER Dredge pre-impact	BC27	52 individual nodules, 38 fixed in 8% formaldehyde, 14 fixed in non-denatured ethanol
116_1	GER Dredge pre-impact	BC29	46 individual nodules, 35 fixed in 8% formaldehyde, 11 fixed in non denatured ethanol
129_1	BEL Trial	BC30	22 individual nodules in non denatured ethanol
140_1	BEL Ref	BC31	17 individual nodules in 8% formaldehyde
141_1	BEL Ref	BC32	15 individual nodules 8% formaldehyde
142_1	BEL Ref	BC33	16 individual nodules in non denatured ethanol
148_1	BEL Ref	BC34	50 individual nodules in non denatured ethanol
149_1	BEL Trial	BC35	Disturbed boxcore, no nodules taken
161_1	GER Trial	BC36	70 individual nodules fixed in non denatured ethanol
166_1	GER Ref	BC37	67 individual nodules fixed in 8% formaldehyde
175_1	GER Ref	BC39	76 individual nodules fixed in non denatured ethanol
180_1	GER Ref	BC40	47 nodules bulk fixed in 8% formaldehyde
181_1	GER Ref	BC41	50 nodules bulk fixed in 8% formaldehyde
182_1	GER Ref	BC42	65 nodules bulk fixed in 8% formaldehyde
189_1	GER Dredge post impact	BC43	No nodules taken
190_1	GER Dredge post impact	BC44	No nodules taken
191_1	GER Dredge post impact	BC45	No nodules taken

Tab. 5.7.3: Phylum abundances of the nodule epifauna

	Anne- lida	Arthro- poda	Brachio- poda	Bryozoa	Cnidaria	Echino- dermata	Fora- minifera	Hydro- zoa	Incertae	Mollusca	Nemertea	Porifera	Tuni- cata	Total
BC02	1			1			1					1		4
BC06	1			3	5	1						11		21
BC09	4		1	2	1							1		9
BC10	2			4	2							4		12
BC11	1				1							2		4
BC12	1			1	2		1					4		9
BC14	2			4	1		2					8		17
BC15	3			3	3							1		10
BC16	1			3	4						1	5		14
BC17				8	9							3		20
BC18	4		1	4	4	1	7					4		25
BC19	2		1	2	4	1						1		11
BC20	1		2	3	4							2		12
BC21	2			3	5						1	1		12
BC22	2		3	2	17					2		1	1	28
BC26	2													2
BC27								1				1		2
BC32					5									5
BC33				2	1									3
BC34					1									1
BC36				2	2							1		5
BC37				1								1		2
BC39	1				1					1				3
BC40				2										2
BC41									1					1
BC42	1		1				1					1		4
BC44				2	1							1		4
BC45				2		1						1		4
BC46					1									1
BC49	1			2			1							4
BC50	1			2			1							4

5.8 Gravity Corer Deployments

(J. Volz, I. Dohrmann, D. Köhler, S. Paul, A. Moje, K. Schmidt, K. Hamann, M. Haeckel)

Long sediment cores (gravity cores; GCs) of up to 5 m were retrieved from the deep sea during Leg 1 (4 GCs) and Leg 2 (5 GCs) (Tab. 5.8.1). The sediment as well as the interstitial pore water was sampled and analyzed onboard. Once the 5-m long GC was back on deck, the 12-cm wide plastic liner was cut into 1-m long segments and stored in the cold room at 4°C (Fig. 5.8.1). After O₂ measurements were performed, the liners were split into two halves – one half (archive half) was used for the core description, while the second half (working half) was used for geochemical and microbiological sampling. Afterwards, both halves were wrapped and packed for long-term archival in the cooled core repository at GEOMAR. The geochemical program onboard includes the analyses of nutrients in the pore water as well as subsampling of pore water and sediment for shore-based analyses. For microbiology, sediment samples for cell counting (FISH/AODC), for viral production and extracellular enzyme activity tests were taken. In addition, the cores were sampled for DNA and RNA for further analysis of the microbial community in the sediments (DNA & RNA extractions will be performed at MPI).

Fig. 5.8.1: Gravity coring during SO268-2. Description: 5-m long gravity core, slicing the plastic core into 1-m intervals, oxygen measurements, sampling for geochemical analysis (Photos: J. Volz), sampling for microbial analysis (Photos: J. Otte), differently colored samples from different sediment depths, AODC and viral production samples, closer look at the sediment core.

Tab. 5.8.1: Overview of subsampling the 5 m long gravity cores during SO268-2 with contract (German or Belgium), site (Reference or Trial area), gear, sample ID, and depth below sea floor (bsf). Number of DNA, RNA, AODC/FISH samples. Comments on buried manganese nodules in the 5 m long gravity core. Particularly subsampled for viral production and/or extracellular enzyme activity tests. Locations of stations are provided in Chapter 3.3.

Station	Area	Site	Gear	Sample ID	Depth bsf [cm]	DNA #	RNA #	AODC /FISH #	Nodules in the core?	Viral production?	EEA?
Gravity core #1											
SO268/2_104-1	GER	Ref	GC_06	GC_0	0	0	0				
SO268/2_104-1	GER	Ref	GC_06	GC_1	9	1	1				
SO268/2_104-1	GER	Ref	GC_06	GC_2	19	2	2				
SO268/2_104-1	GER	Ref	GC_06	GC_3	31	3	3				
SO268/2_104-1	GER	Ref	GC_06	GC_4	54	4	4				
SO268/2_104-1	GER	Ref	GC_06	GC_5	77	5	5				
SO268/2_104-1	GER	Ref	GC_06	GC_6	100	6	6				
SO268/2_104-1	GER	Ref	GC_06	GC_7	151	7	7				
SO268/2_104-1	GER	Ref	GC_06	GC_8	199	8	8				
SO268/2_104-1	GER	Ref	GC_06	GC_9	257	9	9				
SO268/2_104-1	GER	Ref	GC_06	GC_10	299	10	10				
SO268/2_104-1	GER	Ref	GC_06	GC_11	301	11	11				
SO268/2_104-1	GER	Ref	GC_06	GC_12	310	12	12				
SO268/2_104-1	GER	Ref	GC_06	GC_13	314	13	13				
SO268/2_104-1	GER	Ref	GC_06	GC_14	320	14	14				
SO268/2_104-1	GER	Ref	GC_06	GC_15	331	15	15				
SO268/2_104-1	GER	Ref	GC_06	GC_16	340	16	16				
SO268/2_104-1	GER	Ref	GC_06	GC_17	350	17	17				
SO268/2_104-1	GER	Ref	GC_06	GC_18	359	18	18				
SO268/2_104-1	GER	Ref	GC_06	GC_19	374	19	19				
SO268/2_104-1	GER	Ref	GC_06	GC_20	391	20	20				
SO268/2_104-1	GER	Ref	GC_06	GC_21	398	21	21				
SO268/2_104-1	GER	Ref	GC_06	GC_22	415	22	22				
SO268/2_104-1	GER	Ref	GC_06	GC_23	436	23	23				
SO268/2_104-1	GER	Ref	GC_06	GC_24	457	24	24				
SO268/2_104-1	GER	Ref	GC_06	GC_25	490	25	25				
SO268/2_104-1	GER	Ref	GC_06	GC_26	514	26	26				
SO268/2_104-1	GER	Ref	GC_06	GC_27	551	27	27				
Gravity core #2 - karst structure eastern ridge											
SO268/2_130-1	BEL	trial	GC_07	GC_28	2	28	28		24 cm		

Station	Area	Site	Gear	Sample ID	Depth [cm]	bsf	DNA #	RNA #	AODC /FISH #	Nodules in the core?	Viral production?	EEA?
SO268/2_130-1	BEL	trial	GC_07	GC_29	82	29	29			88 cm		
SO268/2_130-1	BEL	trial	GC_07	GC_30	138	30	30			133 cm		
SO268/2_130-1	BEL	trial	GC_07	GC_31	183	31	31					
SO268/2_130-1	BEL	trial	GC_07	GC_32	211	32	32					
SO268/2_130-1	BEL	trial	GC_07	GC_33	285	33	33					
SO268/2_130-1	BEL	trial	GC_07	GC_34	322	34	34			360 cm		
SO268/2_130-1	BEL	trial	GC_07	GC_35	364	35	35					
Gravity core #3 - karst structure eastern hill												
SO268/2_143-1	BEL	Ref	GC_08	GC_36	14	36	36					x
SO268/2_143-1	BEL	Ref	GC_08	GC_37	49	37	37					x
SO268/2_143-1	BEL	Ref	GC_08	GC_38	112	38	38					x
SO268/2_143-1	BEL	Ref	GC_08	GC_39	173	39	39					x
SO268/2_143-1	BEL	Ref	GC_08	GC_40	233	40	40					x
SO268/2_143-1	BEL	Ref	GC_08	GC_41	297	41	41					x
SO268/2_143-1	BEL	Ref	GC_08	GC_42	334	42	42			334 cm		x
SO268/2_143-1	BEL	Ref	GC_08	GC_43	371	43	43					x
Gravity core #4 - trial depression deep												
SO268/2_144-1	BEL	Ref	GC_09	GC_44	11	44	44	1		15cm		
SO268/2_144-1	BEL	Ref	GC_09	GC_45	52	45	45	2				
SO268/2_144-1	BEL	Ref	GC_09	GC_46	117	46	46	3				
SO268/2_144-1	BEL	Ref	GC_09	GC_47	175	47	47	4				
SO268/2_144-1	BEL	Ref	GC_09	GC_48	212	48	48	5				
SO268/2_144-1	BEL	Ref	GC_09	GC_49	236	49	49	6				
SO268/2_144-1	BEL	Ref	GC_09	GC_50	276	50	50	7				
SO268/2_144-1	BEL	Ref	GC_09	GC_51	309	51	51	8				
SO268/2_144-1	BEL	Ref	GC_09	GC_52	334	52	52	9				
SO268/2_144-1	BEL	Ref	GC_09	GC_53	372	53	53	10				
SO268/2_144-1	BEL	Ref	GC_09	GC_54	434	54	54	11				
SO268/2_144-1	BEL	Ref	GC_09	GC_55	475	55	55	12				
Gravity core #4 - no nodule												
SO268/2_157-1	GER	No Nodule	GC_10	GC_56	11	56	56	13			x	
SO268/2_157-1	GER	No Nodule	GC_10	GC_57	34	57	57	14				
SO268/2_157-1	GER	No Nodule	GC_10	GC_58	52	58	58	15				
SO268/2_157-1	GER	No Nodule	GC_10	GC_59	77	59	59	16				
SO268/2_157-1	GER	No Nodule	GC_10	GC_60	93	60	60	17				

Station	Area	Site	Gear	Sample ID	Depth [cm]	bsf	DNA #	RNA #	AODC /FISH #	Nodules in the core?	Viral production?	EEA?
SO268/2 157-1	GER	No Nodule	GC 10	GC 61	102		61	61	18		x	
SO268/2 157-1	GER	No Nodule	GC 10	GC 62	117		62	62	19			
SO268/2 157-1	GER	No Nodule	GC 10	GC 63	124		63	63	20			
SO268/2 157-1	GER	No Nodule	GC 10	GC 64	132		64	64	21			
SO268/2 157-1	GER	No Nodule	GC 10	GC 65	141		65	65	22			
SO268/2 157-1	GER	No Nodule	GC 10	GC 66	151		66	66	23			
SO268/2 157-1	GER	No Nodule	GC 10	GC 67	159		67	67	24			
SO268/2 157-1	GER	No Nodule	GC 10	GC 68	171		68	68	25		x	
SO268/2 157-1	GER	No Nodule	GC 10	GC 69	182		69	69	26			
SO268/2 157-1	GER	No Nodule	GC 10	GC 70	193		70	70	27			
SO268/2 157-1	GER	No Nodule	GC 10	GC 71	217		71	71	28		x	
SO268/2 157-1	GER	No Nodule	GC 10	GC 72	237		72	72	29			
SO268/2 157-1	GER	No Nodule	GC 10	GC 73	259		73	73	30			
SO268/2 157-1	GER	No Nodule	GC 10	GC 74	293		74	74	31			
SO268/2 157-1	GER	No Nodule	GC 10	GC 75	311		75	75	32			
SO268/2 157-1	GER	No Nodule	GC 10	GC 76	358		76	76	33		x	
SO268/2 157-1	GER	No Nodule	GC 10	GC 77	393		77	77	34			
SO268/2 157-1	GER	No Nodule	GC 10	GC 78	433		78	78	35			
SO268/2 157-1	GER	No Nodule	GC 10	GC 79	458		79	79	36			
SO268/2 157-1	GER	No Nodule	GC 10	GC 80	469		80	80	37			
SO268/2 157-1	GER	No Nodule	GC 10	GC 81	481		81	81	38		x	
Gravity core #5												
SO268/1 84-1	BEL	Ref	GC 5	GC 82	6.5		82	82	39		x	
SO268/1 84-1	BEL	Ref	GC 5	GC 83	56		83	83	40		x	
SO268/1 84-1	BEL	Ref	GC 5	GC 84	101,5		84	84	41			
SO268/1 84-1	BEL	Ref	GC 5	GC 85	158,5		85	85	42			
SO268/1 84-1	BEL	Ref	GC 5	GC 86	187		86	86	43			
SO268/1 84-1	BEL	Ref	GC 5	GC 87	214		87	87	44		x	
SO268/1 84-1	BEL	Ref	GC 5	GC 88	235		88	88	45			
SO268/1 84-1	BEL	Ref	GC 5	GC 89	247		89	89	46		x	
SO268/1 84-1	BEL	Ref	GC 5	GC 90	262		90	90	47			
SO268/1 84-1	BEL	Ref	GC 5	GC 91	274		91	91	48		x	
SO268/1 84-1	BEL	Ref	GC 5	GC 92	292		92	92	49			
SO268/1 84-1	BEL	Ref	GC 5	GC 93	317		93	93	50		x	
SO268/1 84-1	BEL	Ref	GC 5	GC 94	360		94	94	51			

Station	Area	Site	Gear	Sample ID	Depth [cm]	bsf	DNA #	RNA #	AODC /FISH #	Nodules in the core?	Viral production?	EEA?
SO268/1 84-1	BEL	Ref	GC 5	GC 95	382		95	95	52			
SO268/1 84-1	BEL	Ref	GC 5	GC 96	426		96	96	53		x	
SO268/1 84-1	BEL	Ref	GC 5	GC 97	500		97	97	54		x	
SO268/1 84-1	BEL	Ref	GC 5	GC 98	542		98	98	55		x	
Gravity core #6												
SO268/1 16-1	GER	Trial	GC 1	GC 99	9		99	99	56		x	
SO268/1 16-1	GER	Trial	GC 1	GC 100	53		100	100	57			
SO268/1 16-1	GER	Trial	GC 1	GC 101	92		101	101	58			
SO268/1 16-1	GER	Trial	GC 1	GC 102	122		102	102	59			
SO268/1 16-1	GER	Trial	GC 1	GC 103	161		103	103	60		x	
SO268/1 16-1	GER	Trial	GC 1	GC 104	188		104	104	61			
SO268/1 16-1	GER	Trial	GC 1	GC 105	230		105	105	62			
SO268/1 16-1	GER	Trial	GC 1	GC 106	251		106	106	63			
SO268/1 16-1	GER	Trial	GC 1	GC 107	290		107	107	64			
SO268/1 16-1	GER	Trial	GC 1	GC 108	330		108	108	65			
SO268/1 16-1	GER	Trial	GC 1	GC 109	372		109	109	66			
SO268/1 16-1	GER	Trial	GC 1	GC 110	409		110	110	67			
SO268/1 16-1	GER	Trial	GC 1	GC 111	462		111	111	68		x	
Gravity core #7 - OPD above 3.5m												
SO268/1 71-1	BEL	Trial	GC 3	GC 115	7		112	112	69			
SO268/1 71-1	BEL	Trial	GC 3	GC 116	29		113	113	70			
SO268/1 71-1	BEL	Trial	GC 3	GC 117	42		114	114	71			
SO268/1 71-1	BEL	Trial	GC 3	GC 118	81		115	115	72			
SO268/1 71-1	BEL	Trial	GC 3	GC 119	111		116	116	73			
SO268/1 71-1	BEL	Trial	GC 3	GC 120	140		117	117	74			
SO268/1 71-1	BEL	Trial	GC 3	GC 121	171		118	118	75			
SO268/1 71-1	BEL	Trial	GC 3	GC 122	211		119	119	76			
SO268/1 71-1	BEL	Trial	GC 3	GC 123	184		120	120	77			
SO268/1 71-1	BEL	Trial	GC 3	GC 124	221		121	121	78			
SO268/1 71-1	BEL	Trial	GC 3	GC 125	301		122	122	79			
SO268/1 71-1	BEL	Trial	GC 3	GC 126	324		123	123	80			
SO268/1 71-1	BEL	Trial	GC 3	GC 127	332		124	124	81			
SO268/1 71-1	BEL	Trial	GC 3	GC 128	342		125	125	82			
SO268/1 71-1	BEL	Trial	GC 3	GC 129	361		126	126	83			
SO268/1 71-1	BEL	Trial	GC 3	GC 130	388		127	127	84			
SO268/1 71-1	BEL	Trial	GC 3	GC 131	406		128	128	85			

Station	Area	Site	Gear	Sample ID	Depth [cm]	bsf #	DNA #	RNA #	AODC /FISH #	Nodules in the core?	Viral production?	EEA?
SO268/1 71-1	BEL	Trial	GC 3	GC 132	431		129	129	86			
SO268/1 71-1	BEL	Trial	GC 3	GC 133	447		130	130	87			
SO268/1 71-1	BEL	Trial	GC 3	GC 134	471		131	131	88			
Gravity core #8 - OPD above 3.5m												
SO268/1 78-1	BEL	Trial	GC 4	GC 135	9		132	132	89			
SO268/1 78-1	BEL	Trial	GC 4	GC 136	41		133	133	90			
SO268/1 78-1	BEL	Trial	GC 4	GC 137	69		134	134	91			
SO268/1 78-1	BEL	Trial	GC 4	GC 138	92		135	135	92			
SO268/1 78-1	BEL	Trial	GC 4	GC 139	109		136	136	93			
SO268/1 78-1	BEL	Trial	GC 4	GC 140	149		137	137	94			
SO268/1 78-1	BEL	Trial	GC 4	GC 141	192		138	138	95			
SO268/1 78-1	BEL	Trial	GC 4	GC 142	218		139	139	96			
SO268/1 78-1	BEL	Trial	GC 4	GC 143	243		140	140	97			
SO268/1 78-1	BEL	Trial	GC 4	GC 144	279		141	141	98			
SO268/1 78-1	BEL	Trial	GC 4	GC 145	309		142	142	99			
SO268/1 78-1	BEL	Trial	GC 4	GC 146	329		143	143	100			
SO268/1 78-1	BEL	Trial	GC 4	GC 147	341		144	144	101			
SO268/1 78-1	BEL	Trial	GC 4	GC 148	352		145	145	102			
SO268/1 78-1	BEL	Trial	GC 4	GC 149	372		146	146	103			
SO268/1 78-1	BEL	Trial	GC 4	GC 150	397		147	147	104			
SO268/1 78-1	BEL	Trial	GC 4	GC 151	418		148	148	105			
SO268/1 78-1	BEL	Trial	GC 4	GC 152	441		149	149	106			
SO268/1 78-1	BEL	Trial	GC 4	GC 153	469		150	150	107			
SO268/1 78-1	BEL	Trial	GC 4	GC 154	495		151	151	108			

5.9 Hydroacoustic surveys (EM122, Parasound, EK60, Ship ADCPs)

(I.-Z. Gazis, P. Urban)

5.9.1 Kongsberg EM[®] 122

The EM122 onboard the R/V Sonne is a 12 kHz hull-mounted multibeam system with large transducer elements that allow forming beams with opening angles of 1° in along and 0.5° in across-track direction. It can form up to 432 simultaneous beams per swath. The system corrects the bathymetric data using the static transducer and position system offsets and motion data that is directly fed to it by a Seapath MRU-GPS system. In deep waters the transmit fan is split into up to eight different sectors per swath. These sectors can be steered in different directions to compensate for yaw and pitch and can feature a different ping setup (e.g. FM pulse length for the outer sectors). In dual swath mode, two swaths are generated per ping cycle. These two swaths use a different along-track tilt which takes into account depth, coverage and vessel speed to give a constant sounding separation along track direction. This increases the along-track sounding resolution which can be important for higher survey speeds.

Tab. 5.9.1: EM122 runtime parameters used during SO268-1

Sector Coverage	Transects	Survey Areas
Max. angle (°)	130° (65°-65°)/ 120° (60°-60°)	100° (50°-50°)/ 120° (60°-60°)
Max. coverage (m)	15000-15000	10000-10000/15000-15000
Angular coverage mode	Auto	Auto
Beam Spacing	HD Equidistance	HD Equidistance
Depth Parameters		
Dual Swath	Dynamic/Fixed	Dynamic/Fixed
Ping Mode	Auto (Deep)	Auto (Deep)
FM Disable	Off	Off
Transmit Parameters		
Pitch Stabilization	On	On
Along direction / Auto tilt	1° / Off	2° / Off
Yaw stabilization mode	Real Mean HDG	Real Mean HDG
Heading (HDG) filter	Medium	Medium
Filters and Gains		
Spike filter strength	Medium	Medium
Range Gate / Phase ramp	Normal/Normal	Normal/Normal
Slope filter	On	On
Penetration Filter	Off	Off
Sector Tracking	On	On
Aeration ¹⁰ /Interference	Off/Off	Off/Off
The angle from nadir (°)	5°	10°
Water Column		
log R/ dB Offset	30/20	30/20

During the SO268 expedition, the survey speed during transit was up to 14 knots. For dedicated bathymetric mapping surveys in the working areas, the speed was reduced to 8kn to increase the data density along track. Bathymetric and water column data are stored in separated files following the Kongsberg em3000 file format specifications. The .all files include all packages regarding the bathymetry, navigation and auxiliary information, while the water column packets are stored in

separated .wcd files. The EM122 is operated via the Kongsberg SIS[®] acquisition software, which allows the use of different runtime parameters (Tab. 5.9.1).

Fig. 5.9.1: The SVP profiles in A: the German (GER) and B: the Belgian (BEL) area.

Fig. 5.9.2: Beam statistics plot of the EM122 in 4100m water depth. The graphs show the expected U-shaped pattern of uncertainty which increases with beam angle. The purple area is the 95% interval (2σ) based on a normal distribution, and the blue line is the mean value. **A:** y axis=meters and x axis=beam angle. All data fall within the IHO specification indicated by the dot yellow lines. **B:** y axis=depth bias (% of W.D) and x axis=beam angle. Depth bias values inside $\pm 0.2\%$ over the majority of the swath are typically expected and considered as good performance.

Sound velocity profiles estimated from CTD casts have been uploaded into the system upon arrival at the different survey areas (Fig. 5.9.1). For the estimation of the sound velocity (m/s), the Chen-Millero (1977) formula was used. Data processing of the .all data was performed using QPS Qimera[®] software for bathymetry and QPS FMGT[®] for backscatter mosaics. The edited data in

.asc format were plotted using the ESRI ArcMAP®. The system worked well and gave good results, which was also confirmed from the beam statistics (Fig. 5.9.2).

Fig. 5.9.3:: Bathymetric map of the German working area.

Fig. 5.9.4: Bathymetric map of the Belgian working area.

During the first leg of SO268 two dedicated ship-based multibeam bathymetry surveys have been conducted. The resulting data has been processed to high-quality bathymetric maps from the

German (Fig. 5.9.3) and the Belgian (Fig. 5.9.4) working area. Both maps were used in the planning of the deployment positions in both legs.

During the second leg of SO268 no dedicated bathymetric surveys have been conducted but a total of 169.000 km of bathymetric data was acquired during the transects to, from and between the GER and BEL working areas. The runtime setup was the same as during SO268-1. For the first transects the swath width was set to 80°. Upon reaching the BEL area, the swath width was set to 130° for all following transects to increase the coverage. The transects between the Mexican EEZ and the German working area crossed over a large seafloor feature visible in the ETOPO1 dataset. If possible transects were planned as parallel overlapping lines to previous ones to increase the bathymetric coverage (Fig. 5.9.5).

Fig. 5.9.5: Overview of bathymetric data that has been acquired during SO268/1 and SO268/2. The colored outlines are the exploration contracts in the CCZ, where the filled outlines mark the German licence area and the Belgium licence area. Marked in white are the exclusive economic zones (EEZ) of Mexico and France (Clipperton Island). The grey background image depicts the ETOPO-1 topography (dark values: low altitude, bright values: high altitudes).

5.9.2 Teledyne Atlas PARASOUND P70®

The Atlas Parasound P70 is a hull-mounted parametric sub-bottom profiler system, which uses the parametric effect based on the non-linear propagation effect of sound in seawater for high energy signals. Here, two high energy harmonic signals of high frequency (PHF-Primary High Frequency) of 18-33 kHz & 18.5 – 39 kHz are produced from the same transmission array, interfere and result in a Secondary Low Frequency (SLF) of 0.5-6 kHz with 4.5° x 5.0° beam width along track, which is used for sub-bottom profiling. The maximum ping rate is > 20 kHz (depth depended). The transmission and reception beams are fully motion-compensated with respect to the vessel's movements. The Atlas Parasound P70 is operated via the HYDROMAP CONTROL®

software, which allows the use of different basic parameters of the transmitted pulses (Tab. 5.9.2). The same parameters were used in transects and survey areas, with survey speeds of 14 kn and 8kn respectively. The program ATLAS PARASTORE was used for storing data and displaying echograms. PHF and PHF/SLF data were stored in .ps3 and .sgy formats, containing the entire water column as well as the seafloor, along with the auxiliary data. Data were preliminarily processed to confirm sediment coverage in the planned sampling sites (box-corers and gravity corers).

Tab. 5.9.2: P70 runtime parameters used during SO268-1

Transmission Sequence	Quasi-Equidistant-Transmission ¹
Pulse Type / Shape	Continuous wave / Rectangular
Pulse Length / No. of Periods per Pulse	0.500 ms / 2
Desired PHF Frequency	18.800 kHz
Current PHF Frequency	18.750 kHz
Desired SLF Frequency	4.000 kHz
Current SLF Frequency	4.166 kHz
Manually PHF/SHF Bandwidth ²	
Output Sample Rate	12.2 / 6.1 kHz
Band Width	33% / 66% out of sample rate
Manually SLF/PLF Bandwidth ²	
Output Sample Rate	12.2 kHz / 6.1 kHz
Band Width	33% /66% out of sample rate

¹: The system transmits at equal intervals, a signal into the water column, irrespective of whether the previously transmitted signal was already received back at the receiver. Therefore, there can be more than one signal in the water column in deep-sea areas. Here, the desired time interval was set to 500ms with maximum transmission voltage level equal to 160V.

²: Bandwidth $\geq$ SLF/PLF-Frequency / Number of Periods per Pulse

During the second leg SO268-2, the same parameters for the P70 were used as during the first leg. While acquiring parascound data, the 18 kHz and 38 kHz frequency transducers of the EK60 single beam system had to be turned off to avoid interference. Parascound data were acquired during the transect from the BEL to the GER area, during the transects to and from Manzanillo (short term visit), during the transect to Vancouver and during some of the smaller transects within the GER and BEL working areas.

Fig. 5.9.6: Example Parascound record during data acquisition in SO268-1.

5.9.3 Simrad EK60®

The Simrad EK60 is a hull-mounted split-beam echo sounder, which features multiple transducers to transmit and receive on a wide frequency range (18 – 200 kHz). Split beam transducers transmit and receive acoustic pulses within a single beam similar to classic single beam systems. However, the transducer is divided in three or up to four individual channels which relate to a certain physical section of the transducer. For individual targets, the different arrival time of the returning echo signal at each of these sectors can be investigated to calculate the exact position of the target within the beam lobe (so-called single target detection). During SO268-1, data were collected using the following settings:

Tab. 5.9.3: EK60 runtime parameters used during SO268-1

Operating Frequency	18kHz
Pulse Duration	8192µS
Sampling Interval	2048 µS
Bandwidth	382kHz
Ping rate	max.30p/s

During SO268-2, all operating frequencies (18 kHz, 38 kHz, 120 kHz, and 200 kHz) were used to record EK60 data. Only the 18 kHz system recorded high-quality data for the full water depth of more than 4000 meters. However, the data of the higher frequencies is valuable to investigate biomass and plankton migration in the upper layers of the water column. The system recorded data nearly continuously for 37 days of leg 2. The recording was only interrupted due to technical problems while in transit from the BEL to the GER area and during actions that involved ranging, communicating or releasing deployed elevators, moorings, and the NIOZ BOBO lander. Additionally, the 18 kHz and 38 kHz frequencies were set to passive mode during the parasound transects and operational tests of the 38 kHz ADCP. The EK60 data have been transferred to the Deep-Sea Fish Ecology Lab; University of Hawaii at Manoa for further analysis on midwater organisms.

5.9.4 Teledyne Ocean Surveyor/Observer® ADCP

The Ocean Surveyor/Observer is an ADCP (Acoustic Doppler Current Profiler) for real-time acquisition and mapping of the velocity and direction water currents. ADCPs make use of the Doppler Frequency Shift that is caused by moving suspended materials in the water mass. Usually, three to four beams, which are tilted into different directions, are used to measure the movement of the targets in different directions. ADCPs do not rely on individual measurements but integrate multiple consecutive pings to individual current measurements (ensembles). Each ensemble consists of a depth profile of water currents below the ship. The so-called bin size represents the depth resolution of the profiles (a smaller bin size increases the resolution but decreases the accuracy of the measurements). To calculate the correct ocean currents from a moving vessel, the exact speed vector of the vessel, which is known from the navigation and motion sensors, must be subtracted. Next to measuring ocean currents, ADCPs are also suitable for water column backscatter measurements similar to single beam echosounder systems. The R/V Sonne features two hull-mounted ADCPs (A 38 kHz and a 75 kHz system). Unfortunately, due to technical problems, these systems were not available the entire time.

During Leg 1, the 38 kHz ADCP was used to collect data using the following settings:

Tab. 5.9.4: ADCP parameters used during SO268-1

Operating Frequency	38.4kHz
First Bin	-31,89m
Bin Size	16.00m
No. Bins	120
Ping/Ensemble	33
Time/Ping	0s

The 38 kHz ADCP stopped recording meaningful data approx. at the 20.03.2019 due to technical failure. The technical staff was informed and investigated the problem during SO268-2. However, because the system is hull-mounted, the malfunction could not be fixed during the cruise.

Fig. 5.9.7: 38 kHz ADCP echo amplitude data from SO268-1. The image shows the average echo amplitude of all beams. In the middle of the image, it can be observed that the echo amplitude decreases significantly due to technical failure. The echo amplitude also shows plankton migration from the deeper regions to the surface layer at night. The same can be observed on the 75 kHz data from SO268-2. The times from chart are given in UTC (local time was UTC -7 hours).

During the second leg SO268-2 the recording of ADCP data had a higher priority than during the first leg because it provided information about the approaching Eddy in the upper layers of the water column. The hull-mounted 75 kHz ADCP continuously recorded data during transects and while being on station. It was only turned off during actions that involved ranging, communicating with or releasing deployed elevators, moorings, and the NIOZ BOBO lander.

The 75 kHz recorded good quality data for a depth range of up to 500m. During the nights the effective range of the system decreased to approximately 300m because most of the plankton migrated to the surface layer and there was not enough suspended matter in the deeper layers to cause a useable return signal in the ADCP (Fig. 5.9.8).

Fig. 5.9.8: Vertical velocities (A) and echo amplitude (B) measured by the 75 kHz ADCP during the first days of SO268-2. Migrating plankton can be seen in both datagrams. The vertical velocities indicate a vertical migration speed of approximately 10 cm/s. The grey background of the velocity datagram shows where the correlation values have been too low to measure meaningful velocities. The migration happened in the morning and in the evening. The timescale of the plots is in UTC. Local time was UTC -7 hours.

The setup and bin size of the ADCP were varied slightly during the cruise. For the first transect from Manzanillo to the German area, the system was recording in the high-resolution broadband mode. The data from the transect showed surface currents that met our expectations and fitted to an anti-cyclonic eddy (Fig. 5.9.9).

During the recording in the German exploration area, the 75 kHz ADCP started to have technical problems similar to the 38 kHz system and stopped recording meaningful data in broadband mode (at the 12.04.2019). It was then set to Narrowband (low resolution) mode where it continued to provide seemingly valid data. The first transect to the Belgium reference area showed mostly northward current components.

The recordings in the Belgium area showed exclusively southward current components. Unfortunately, the system failed entirely during the transect back to the German license area. Therefore no meaningful current measurements are available from the time that the vessel re-entered the influence zone of the Eddy which had reached the German license area by that time. The technical staff of RV Sonne was informed about the technical failure of the 75 kHz system. Similar to the 38 kHz system, the problems with the 75 kHz system could not be fixed during the expedition.

Fig. 5.9.9: Current vectors from the ADCP 75 kHz transect through the Eddy to the German exploration license area. The background image is the Eddy surface anomaly on the 3rd of April. It is roughly 20 cm at the (dark red) center of the Eddy. The arrows show the measured current velocities at the measured 136 and 216-meter depth layers. The arrow length shows the velocity magnitude, where the numbers which are printed to some individual arrows show the respective velocity in mm/s.

5.9.5 Kongsberg EM2040 mobile Multibeam attached to the ROV Kiel 6000

(P. Urban, S. Haalboom)

For SO268-2, a Kongsberg EM2040 multibeam with a depth rating of 6000m has been rented to be attached to the ROV Kiel 6000. The EM2040 has nearly the same features as the hull-mounted EM122 which was described above, but operates at a frequency of 200-400 kHz. The integration of the system to the Kiel 6000 ROV has been prepared by the GEOMAR ROV team and was tested at GEOMAR in Kiel prior to the expedition. The transducers were attached in downward looking configuration at the rear of the ROV (Fig. 5.9.10) and connected to the fiber optical cable, such that they could be controlled by the Kongsberg SIS software from a hydrographic work station that was installed at R/V Sonne. The offsets of the system compared to the ROV devices were measured and are described in the log file that can be found with the EM2040 data.

Fig. 5.9.10: Kongsberg EM2040 attached to the rear ROV Kiel 6000 during ROV dive 22. For this dive, additionally a JFE optical backscatter sensor was attached to the ROV to record possible sediment in the water column.

The EM2040 has the ability to record water column data and the original intention of bringing an EM2040 to SO268-2 was to use this ability to carry out point wise 3D mapping the of sediment plume caused by the prototype mining vehicle Patania. For this, multiple dedicated EM2040 dives were planned during the planned impact experiment. This impact experiment did not happen due to the absence of Patania. Instead, since the AUV Abyss was not available during SO268-2, the ROV dive 22 was used as dedicated EM2040 MBES dive to produce the missing high resolution bathymetry map of the Belgium trial area.

During the dive, the SIS operation with the transducers in 4000 m water depth worked without notable problems. The system was fed with navigation information from the hull-mounted USBL (Posidonia) and with the motion sensor data from the ROV. The USBL data provides a good absolute position of the ROV when integrated over time. However, at a distance of over 4000 meters, individual position values have an uncertainty of up to 20 meters. To solve this, the ROV DVL (Doppler velocity log) system constantly logged the ROV motion over ground. The integrated speed vectors from this system can be fused with the USBL data in post-processing to provide an improved navigation path. To ensure a good quality of the DVL data, the ROV kept a constant distance of 25 meters to the seafloor during the entire bathymetric operation. Overall the integration of the EM2040 to the ROV was very successful and it was possible to establish a stable live link from the ship to the device in 4000 m water depth. Only the live feed of the depth values provided by the ROV CTD into the EM2040 SIS system could not be established, such that this information had to be added in post-processing. The area for the high-resolution bathymetry mapping was moved 75 meters to the North West compared to the original plan. This was done to increase distance of the planned collector impact area towards elevator deployments (Fig. 5.9.11). Such deployments leave large weights at the seafloor that could be harmful to the collector prototype.

Fig. 5.9.11: Left side: Planned ROV track and the originally planned collector impact area and the positions of elevator deployments in the area. Elevator deployments leave large weights behind that could be harmful to a prototype mining vehicle.

The motion sensors from the ROV Kiel 6000 have not been built for precise bathymetric operations and only provide updates once per second. While this would have been more than sufficient for the originally planned water column plume monitoring, the roll and pitch movements of the vehicle cannot be compensated completely which decreases the quality bathymetric map. However, several measures were taken to ensure that a reasonable bathymetric map can be produced in post-processing. A total of twelve lines with a line spacing of 44 to 58 meters were planned. This resulted in a high line overlap of nearly 50% and will allow reasonable statistics to correct some errors. At the start and end of each track line, the ROV held its position for one minute to get a better absolute position for these fixed points. During the tracks the ROV pilots kept the heading as stable as possible and corrected the position only by lateral movements to avoid heading artifacts.

For the post-processing MBSsystem (mbrolltimelag) has been used to compare the system roll to the multibeam roll artifacts and determine the timelag of the respective sensor. The found timelag of 50.1 to 53 seconds has been applied to all ROV-provided data (Motion, DVL, CTD depth) which greatly improved the quality of the resulting map. Using the mbsystem patch test tool, the static mounting roll offset of the MBES could be determined to be 0.6° . Unfortunately no consistent offset values could be determined for the heading and the pitch values. To decrease the remaining roll, and pitch artifacts the data has been gridded to 4 meter grid cells and a Gaussian filter was applied. The resulting map shows a mostly flat area which only changes by 22 meters in height (Fig. 5.9.12 A). However, a small part of the area shows a high slope of more than 5° (Fig. 5.9.12 B) which should be considered when planning a possible collector impact experiment.

Fig. 5.9.12: A: Processed 4m grid bathymetry of the area is mostly flat and varies by only 22 meters. B. The maximum slope is more than 6° in a small part of the area.

Fig. 5.9.13: A: Backscatter mosaic from the EM2040 MBES. The red stars indicate the recorded positions for elevator weights. Several features can be detected within the mosaic: 1: This area appears different than the rest because the backscatter setup was changed at the beginning of the survey. 2: In these two areas a small variation in the backscatter can be detected which correspond to slope features in the bathymetry (Fig. 5.9.11). 3: A high backscatter feature of unknown cause. 4: A high backscatter point feature which could indicate a not-recorded lander weight. 5: Area where the small scale sediment plume experiment was conducted. B: Zoom-in that shows an elevator weight that can be seen as bright point in the backscatter mosaic.

A backscatter mosaic has been produced from the MBES data (Fig. 5.9.13 A) which confirms the position of one of the elevator weights (Fig. 5.9.13 B) but also shows variations in backscatter (Fig. 5.9.13) which could indicate features that might be interesting to be investigated in future dives.

At the end of the dive, a short additional experiment was conducted to acquire some EM2040 water column recordings of the very fine sediment in the area. For this, the ROV went very close to the seafloor and created an artificial plume using the thrusters that could be monitored using the MBES. The first investigation of the water column images confirmed the ability of the MBES to detect suspended particles (Fig. 5.9.14).

Fig. 5.9.14: EM2040 water column image of a ROV created plume. The MBES location is at the top of the image. The red line shows the acoustic return from the seafloor. The circular shaped artifacts in the lower part of the image are side-lobe artifacts induced by the strong return from the seafloor.

A JFE Advantech optical backscatter sensor from the NIOZ was attached to the ROV to measure the turbidity during the Experiment. Due to the physical separation of the JFE and the multibeam water column measurements (Fig. 5.9.10) a direct calibration of the multibeam water column measurements towards the turbidity gained from the JFE will be difficult. Still, these measurements will be compared to get a better idea of the threshold of suspended particulate matter concentration that the multibeam can detect in the area.

5.10 Megafauna

(T. Amaro, Y. Bodur, M. Christodoulou, A. Hilário, S. Ramalho, S. Rossel, K. Uhlenkott, A.-K. Wessels, T. Stratmann)

Objectives

Data on megafauna of both the German and Belgian license areas were acquired using two different approaches: 1) collection of specimens using the Remotely Operated Vehicle (ROV) Kiel 6000, 2) video imagery using the ROV Kiel 6000 and the Ocean Floor Observation System (OFOS). The collected specimens will be used to study taxonomical and functional biodiversity, biogeography and connectivity using integrated molecular and morphological approaches. Further, collected specimens will be used to study several aspects of species autoecology (e.g. reproductive and feeding ecology), and as control in the assessment of the impact of the ecological effects of the sediment plume on dominant megafauna taxa. Video and photo imagery was acquired to assess the composition and diversity of megafauna in both areas and to determine their response and resilience to short-term mining impacts. Baseline information on megafauna distribution and seafloor habitat characteristics were collected prior to disturbance during SO268-1 and -2. During SO268-2, an additional focus was set on the direct impact of disturbance and sediment cover after the dredge experiment in the German licence area.

Sample collection and processing

A total of 283 individuals were collected on both legs of the cruise, during the 32 ROV dives (Tabs. 5.10.1 and 5.10.2), all of which were photographed *in situ* prior to collection (Fig. 5.10.1). Although the collection was focused on dominant megafauna taxa (Porifera, Holothuroidea, Ophiuroidea, Echinoidea, and Anthozoa), representatives of other taxa were also collected (Fig. 5.10.1). Most specimens were collected individually using the manipulator arm "Orion" and placed in a thermally stable biobox for transport to the surface. When possible the hard substrate to which the animals were attached was collect to avoid damaging the specimens. Occasionally specimens were also collected using the suction sampler.

Tab. 5.10.1: Number of specimens collected during Leg 1 in the different working areas.

	GER Trial	GER reference	BEL Trial
Porifera	5	2	5
Actiniaria	1	-	7
Alcyonacea	10	1	-
Gastropoda	-	-	1
Asteroidea	1	-	2
Ophiuroidea	13	7	12
Holothuroidea	6	5	9
Echinoidea	-	-	3
Galatheiodea	-	-	3

Tab. 5.10.2: Number of specimens collected during Leg 2 in the different working areas.

	GER Trial	GER reference	GER (before impact)	dredge (after impact)	GER (after impact)	dredge	BEL Trial	BEL reference
Porifera	7	2	6		7		2	1
Briozoa	-	-	-		-		3	-
Cnidaria	-	-	-		1		-	-
Anthozoa	-	-	1		-		-	-
Actiniaria		1	1		1		3	10
Alcyonacea	8	1	11		9		1	-
Antipatharia	-	-	1		-		-	-
Gastropoda	-	-	-		-		-	-
Polyplacophora	-	-	-		-		1	-
Polychaeta	-	-	1		-		-	-
Asteroidea	1	1	4		1		-	-
Ophiuroidea	17	9	5		19		4	6
Holothuroidea	-	-	-		7		-	-
Echinoidea	1		3		8		8	9
Crinoidea	-	-	-		1		-	-
Decapoda	-	-	-		1		-	-
Paguroidea	1	-	-		-		-	-
Galatheiodea	-	1	-		-		4	-
Cirripedia	-	-	-		-		-	2

Anthozoan corals, collected to study their associated microbial communities' studies, were placed in separated containers and sealed at depth to prevent microbial contamination from other specimens or different water masses during ascent. Each container was washed, ethanol sterilized, filled with freshwater, and sealed while the ROV was on deck. The freshwater evacuated at depth when the container was opened to receive the coral sample, so that only seawater local to the coral samples was entrained during collection. Once on deck, all individuals (except anthozoan corals) were immediately transferred to clean, cold seawater and placed in a cold room (4 - 7°C) for processing. The collector containers with anthozoans were transferred to the cold room and kept sealed until processing (less than 1 hour). The specimens were photographed (Fig. 5.10.1) and then subsampled as follows. Samples were distributed among different research groups as summarized in Chapter 12.1.

Fig. 5.10.1: Examples of specimens collected during SO268. a) Porifera (Bio_42); b) Holothuroidea (Bio_243); c) Ophiuroidea and Asteroidea (Bio_84); d) Echinoidea; e) Asteroidea (Bio_106); f) Alcyonacea (Bio_185); g) Actiniaria (Bio_70); h) Galatheid (Bio_55).

Fig. 5.10.2: The same Alcyonacea specimen (Bio_1) at the seafloor and in the laboratory.

Porifera: After photographing the specimens, a small piece of each individual was taken for barcoding (COI gene sequencing), metabarcoding (Restriction-site-Associated DNA Sequencing, RADS) and spicule analysis and fixed in 96% ethanol. Barcoding will allow the taxonomic allocation of the specimens to species. A second small piece of each specimen was preserved at -80°C for whole genome sequencing (WGS). Depending on whether the sponges were covered with sediment during the sampling, they were either preserved frozen (sponges covered with sediment) or fixed in formaldehyde, which was subsequently replaced by an ethanol dilution series. For the frozen sponges, all remaining tissue was wrapped in aluminum foil, before it was packed in plastic bags and stored frozen at -21°C. Sponges that were free of sediment were divided in two equal large pieces. One piece was transferred to ~4% formaldehyde for 10-12 h, before this was replaced by 30% ethanol. After 5 min, this 30% ethanol was replaced by 50% ethanol and kept at 4°C. The other piece was wrapped in aluminum foil, packed in plastic bags at kept at -21°C.

Holothuroidea: Muscle tissue was taken for trophic ecology. All the samples were preserved at -80°C. Additionally, the gut content was also removed from each specimen to look at the impact of the plume on the feeding strategy of these specimens. Gut contents were also preserved at -80°C. Finally, tissue sample from specimens collected in the German License area were preserved in 96% ethanol for the taxonomic identification of the species through barcoding.

Ophiuroidea: At least two subsamples were taken from each individual: one was fixed in 96% ethanol and placed at -20°C for taxonomy and connectivity studies, and the other was preserved at -80°C for trophic ecology and physiology condition studies. Additionally, for reproductive studies, the disk of *Ophiosphalma glabrum* was fixed in 4% formaldehyde for 48 hours and then transferred to 70% ethanol. The ethanol samples will be used for the taxonomic identification of the specimens through barcoding (COI gene sequencing) in order for the specimens to be allocated to species. Furthermore, the connectivity between the two German and the Belgian License areas will be studied and compared with results from past JPIO cruises (SO239, SO242). For this reason the most abundant ophiuroid, *Ophiosphalma glabrum* (Fig. 5.10.1c) was selected as a model organism. Finally, using RAD-seq the population structure, reproductive mode and dispersal capacity of *O. glabrum* will be investigated.

Echinoidea: Sampling was focused on specimens of the family Aspidodiadematidae (Fig. 5.10.1d). Several spines with internal tissue were fixed in 96% ethanol and placed at -20°C for taxonomy and connectivity studies, and the rest of the specimen was fixed in 4% formaldehyde for 48 hours and then transferred to 70% ethanol for reproductive ecology studies.

Anthozoa: Alcyonacea (Fig. 5.10.1f) Each specimen was removed from the container with sterilized forceps and cut into at least 5 pieces (at least 3 polyps) that were preserved 1) at -80°C, 2) in RNAlater solution, 3) in 96% ethanol, 4) in 4% formaldehyde, 5) in 2% glutaraldehyde buffered with sodium cocodylate solution. The samples in RNAlater and 96% ethanol were placed at 4°C overnight to allow the fixative to infiltrate the samples, and then transferred to -20°C. Samples in formaldehyde were transferred for 70% ethanol after 48 hours, and samples in glutaraldehyde were washed with 0.1M sodium cocodylate buffer after 8-12 hours, post-fixed for 1 hour in 1% osmium tetroxide in buffer and transferred and stored in buffer. **Actiniaria** (Fig. 5.10.1 g) Specimens were processed as alcyonacea corals but only 3 subsamples were taken and preserved at -80°C, in RNAlater solution and in 96% ethanol.

Other taxa: In most cases two subsamples were taken from each individual: one was fixed in 96% ethanol and placed at -20°C for taxonomy and connectivity studies, and the other was preserved at -80°C for trophic ecology and physiology condition studies. The individuals belonged to a variety of groups such as Asteroidea (sea stars, Fig. 5.10.1c+e), Galatheidæ (squat lobsters, Fig. 5.10.1h), Gastropoda (snails). When the specimen appeared to belong to an undescribed species it was preserved as whole in 96% ethanol in order to facilitate its taxonomic description but also to be kept as museum voucher specimen.

5.10.3 Image acquisition

The remotely operated vehicle Kiel6000, operated by GEOMAR, performed a total of 17 standardized video transects (8850 m), over 8 dives in the German and Belgian license areas. The transects were conducted on sites with varying nodule densities, as well as a non-nodule area (German Area) and one transect to revisit one site where experimental removal of nodules was conducted with an epibenthic sledge sampler (EBS) during the SO239 cruise (Table 5.10.2). The transects recording video with the high-definition colour video camera (Kongsberg HDTV-Camera OE14-500) were conducted at 1 m above the seafloor and an approximate speed of 0.2 m.s⁻¹ while. The ROV camera was positioned at consistent camera angle in order to maintain the same field of view. Two laser pointers on the seabed 6.5 cm apart from each other, permit the calculation of the total sampled area. The optical resolution of the cameras enabled the reliable identification of all organisms larger than 3 cm. The transects were preliminarily annotated in real time in the science meeting room for the presence of mega-epifaunal taxa using the software Ocean Floor Observation Protocol (OFOP; Huetten and Greinert, 2010).

The 12 OFOS are transects are described in detail in Chapter 5.3.

Tab. 5.10.3 Video transect details. Latitude and longitude are in degrees. Track transects are marked with an asterisk.

Station	Area	Start		End		Distance (m)
		Lat	Lon	Lat	Lon	
111ROV16	GER ref	-117.01131	11.86072	-117.01227	11.86116	400
118ROV17	GER ref SO239 EBS track	-117.01288	11.86028	-117.01584	11.85953	450
118ROV17	GER ref	-117.01595	11.86230	-117.01288	11.86298	350
134ROV19	BEL Trial	-125.86838	14.11320	-125.87152	14.11162	400
137ROV20	BEL Trial	-125.86981	14.10913	-125.87150	14.11123	300
154ROV23	BEL ref	-125.92251	14.03325	-125.92442	14.03516	300
154ROV23	BEL ref	-125.92447	14.03512	-125.92605	14.03320	300
158ROV24	GER No-nodule	-117.38312	11.84970	-117.38224	11.84960	100
158ROV24	GER No-nodule	-117.38220	11.84948	-117.38308	11.84957	100
158ROV24	GER No-nodule	-117.38338	11.84988	-117.38337	11.84951	850
165ROV26	GER Trial	-117.01480	11.91059	-117.02449	11.92819	4300
174ROV28	GER ref	-117.05792	11.84110	-117.05506	11.84086	300
174ROV28	GER ref	-117.05534	11.84077	-117.05822	11.84146	400
174ROV28	GER ref	-117.05838	11.84150	-117.05752	11.84370	300

5.10.4 Preliminary megafauna findings/observations from OFOS and ROV

German license area

Although the bathymetric structure of the region is, compared to the Belgian area, quite homogenous, areas of different nodule coverage in terms of density, size and shape could be distinguished (Fig. 5.10.3) which also appeared to influence the distribution of megafauna. From the preliminary analysis of the real-time annotations performed during OFOS and ROV deployments, the German trial area and most of its surroundings appeared to be characterized by intermediate nodule coverage and size and high abundances of nodule-associated fauna, particularly Foraminifera (xenophyophores and komokiaceans; Fig. 5.10.4 g). In terms of sessile fauna, the highest proportion of the observations were of different morphospecies of Alcyonacea corals (Fig. 5.10.4 a; Fig 5.10.5) followed by Porifera (stalked and non-stalked; Fig. 5.10.4 f). Ophiuroidea, Fig. 5.10.4 d) occurred in high densities, often associated with the mentioned sessile fauna (Fig. 5.10.4 g). In areas where no- to very few nodules were observed (Fig. 5.10.4 b), sessile fauna appeared to be absent and Holothuroidea (Fig. 5.10.4 e) were present in low densities. Other fauna observed included sea urchins (Echinoidea, Fig. 5.10.4 c), different morphospecies of shrimps (Decapoda) and fishes. The whole area seems to be characterized by a high amount of fauna-mediated seafloor marks such as mounds, burrows, tracks and holothurian feces.

Fig. 5.10.3: Different nodule densities observed at the seafloor during OFOS transects in the a-c) German and d-h) Belgian license area of the Clarion Clipperton Fracture Zone.

Fig. 5.10.4: Selection of fauna from the Clarion Clipperton Zone observed in the German and Belgian license area during OFOS transects. a) Alcyonacea (Cnidaria), b) Actiniaria (Cnidaria), c) Echinoidea (Echinodermata), d) Ophiuroidea (Echinodermata), e) different Holothuroidea (Echinodermata), f) Porifera, g) different Foraminefera.

Belgian license area

The Belgian Trial area was generally characterized by high nodule abundances of relatively large size when compared to the German area (Fig. 5.10.3e). However, nodule coverage is very heterogeneous, with frequent switches from areas of high nodule abundance and size to areas of low abundance or absence of nodules (Fig. 5.10.3 d-h).

In contrast to the German license area, fewer fauna was generally observed in the Belgian license area. Xenophyophores and other nodule-associated sessile fauna appeared to have a lower abundance. Especially Alcyonacea and Ophiuroidea appeared to be less abundant. Anthozoans in this area where by contrast to the German area primarily represented by different morphospecies of Actiniaria (Fig. 5.10.5 a,b,c,d), while Alcyonancea corals were predominately represented by one small morphospecies (Fig. 5.10.5 e). Most Ophiuroidea were free-living. Echinoidea appeared to have a higher density in the Belgian license area compared to the German license area. Galatheoidea (Fig. 5.10.5 h) appeared to be common, in contrast to the German license area where these crustaceans were rarely spotted.

Fig. 5.10.5: Selection of different morphospecies of Anthozoans observed in the German and Belgian license area during the SO268-2 ROV dives. a,b,c,d,i,j) Actiniaria; e,f, g,h) Alcyonacea, k) Corallimorpharia.

5.11 Macrofauna

(L. Menot, P. Esquete, A. Hilário, D. Zeppilli, H. Wiklund, E.-J. Arsenault-Pernet, S. Ramalho)

5.11.1 Research objectives

In terms of macrofauna sampling, the objectives of the SO268 cruises were twofold:

- Establish a baseline of macrofaunal community structure and composition, prior to the test of Patania II nodule collector in the GER and BEL areas.
- In place of Patania II test, assess the impact of the sediment plume created by a dredge experiment.

5.11.2 Sampling strategy

The macrofauna was quantitatively sampled by means of a spade box-corer (Ch. 5.7). A balanced Before/After Control/Impact sampling design was planned for the baseline study. In each of the GER and BEL areas, 7 box-core samples were planned in the Reference (i.e. control) and Trial (i.e. impact) sites. The objectives of the sampling plan could not be fully achieved as 6 box-cores, instead of 7, were successfully sampled in GER Reference site. The sampling scheme of the GER area is thus unbalanced. A balanced Before/After sampling design was planned to assess the impact of the dredge, with 5 box-cores before and 5 box-cores after dredging. The objectives of the sampling plan could not be fully achieved as 3 box-cores, instead of 5, were successfully sampled after the dredge experiment.

5.11.2 Preliminary results

Metazoans of the upper 0-3 cm sediment layer of each box-core have been sorted, identified down to the lowest practical taxonomic level and counted on board. Preliminary results are limited to the infaunal taxa and exclude in particular epifaunal taxa, such as Bryozoa, Cnidaria and Brachiopoda. A total of 2251 specimens from 27 box-cores have been sorted for the purpose of the baseline study (Tab. 5.11.1) and 850 specimens from 8 box-cores in the dredge experiment. At phylum level, the Arthropoda and Annelida are the two dominant taxa. It should be noted however that among arthropods, the order Copepoda and Ostracoda include pelagic forms.

Tab. 5.11.1: Abundance of infaunal phyla from the top layer of quantitative box-cores of the baseline study. Samples are ordered by areas (BEL, GER) and by sites (Reference, Trial).

Study Site	Box-core	Annelida	Arthropoda	Echino-dermata	Mollusca	Nematoda	Total
BEL REF	BC20	27	43	1	7	4	82
BEL REF	BC21	11	30		3	4	48
BEL REF	BC22	9	16	1	3	5	34
BEL REF	BC31	17	37	1	7		62
BEL REF	BC32	10	41		2	9	62
BEL REF	BC33	18	22		4	28	72
BEL REF	BC34	20	54	2	11	13	100
BEL TRIAL	BC15	17	16		4	4	41
BEL TRIAL	BC16	24	39		4	7	74
BEL TRIAL	BC17	13	11	1	4	1	30
BEL TRIAL	BC18	20	35		9	7	71
BEL TRIAL	BC19	25	26		12	9	72
BEL TRIAL	BC30	18	47		3	18	86
BEL TRIAL	BC35	20	23			15	58
GER REF	BC37	34	53	4	2	24	117
GER REF	BC39	39	72	2	6	32	151
GER REF	BC40	35	47	2	4	12	100
GER REF	BC41	43	41	3	2	16	105
GER REF	BC42	32	40		4	31	107
GER REF	BC49	42	46	2	7		97
GER TRIAL	BC06	35	32	3	7	17	94
GER TRIAL	BC09	32	25	2	3	4	66
GER TRIAL	BC10	42	66	4	6	22	140
GER TRIAL	BC11	30	36	5	2	7	80
GER TRIAL	BC12	37	38		14	7	96
GER TRIAL	BC14	50	32	4	4	9	99
GER TRIAL	BC36	38	48	1	3	17	107
Total		738	1016	38	137	322	2251

The patterns in density and taxonomic composition of the macrofauna *stricto sensu* (i.e. excluding meiofaunal taxa – Nematoda, Copepoda, Ostracoda – and juveniles of megafaunal taxa – Echinodermata) are figured on Figure 5.11.1 and 5.11.2 respectively. Macrofaunal densities are lower in BEL than the GER area, which is consistent with a westward decrease in surface primary productivity in the CCFZ. Within each of the BEL and GER areas, there are no significant differences between sites. In the dredge experiment, macrofaunal densities are similar pre- and post-disturbance.

Tab. 5.11.2: Abundance of infaunal phyla from the top layer of quantitative box-cores of the dredge experiment in the GER area. Samples are ordered according to timing (pre and post-dredging).

Timing	Boxcore #	Annelida	Arthropoda	Echinodermata	Mollusca	Nematoda	Total
Before	BC24	17	24		1	7	49
Before	BC25	42	65		3	13	123
Before	BC26	32	31		2	26	91
Before	BC27	37	34		4	24	99
Before	BC29	33	75		3	47	158
After	BC43	30	48	1	1	26	106
After	BC44	19	55	5	4	21	104
After	BC45	37	66		1	16	120
Total		247	398	6	19	180	850

Fig. 5.11.1: Box plot of macrofaunal densities per sites and areas (BEL: Turquoise, GER: Salmon).

Patterns in taxonomic composition have been analysed at the lowest practical taxonomic level (i.e. family for Polychaeta, order for Arthropoda, class for Mollusca). The two first axes of a Principal Component Analysis (PCA) explains 18% and 9% of the variance in taxonomic composition respectively (Figure 5.11.2). Samples from the GER and BEL areas are discriminated along the first axis of the PCA, while the second axis merely reflects variations within each area. Within areas however, there is no clear discriminations between sites.

Fig. 5.11.2: Principal component analysis of the taxonomic composition of box-core samples. Box-core samples are named according to sites and color-coded according to areas (BEL: Turquoise, GER: Salmon). Raw data were hellinger-transformed.

5.11.3 Future work

At the University of Aveiro, the metazoans of the three box-core sediments layers, including the 0-3 cm layer, will be sorted or re-sorted and macrofaunal taxa identified down to the lowest possible taxonomic level based on morphological characters. At Ifremer, the macrofaunal specimens will be barcoded using a combination of at least two mitochondrial genes (COI and 16S).

5.12 Metazoan Meiofauna

(N. F. Mercado-Salas, D. Zeppilli, E. Pape, S. Rossel, K. Uhlenkott, A-K. Wessels, R. Posh, F. Hauquier & P. Martínez Arbizu.)

5.12.1 Research Objectives

To assess the impact of deep-sea mining on the meiofauna (32-1000 µm size fraction) living mainly in the upper 5-10 cm of the sediment, undisturbed samples from the sediment-water interface were taken using the MUC (see Ch. 5.6) and pushcores (PUC) obtained with the ROV (see Ch. 5.5). Meiofauna mainly consists of free-living nematodes (70-90% of total abundances) and harpacticoid copepods, which form the study objects of UGent/Ifremer and Senckenberg, respectively. They play a significant role in the benthic food web and the remineralization of nutrients, especially at abyssal depths. From each deployment at least one core will be used for environmental analyses (Ch. 5.12.2) to allow the correlation of meiofauna community structure and diversity (Ch. 5.12.3) to environmental conditions. Additionally to morphological community analyses, the rapid assessment methods Metabarcoding (Ch. 5.12.4) and MALDI-TOF MS (Ch. 8.4.5) will be tested to allow acceleration of community data assessment and species level analyses of community structures. These will allow a more detailed analysis of mining impact but also improve comparison of the different potential mining impact areas. Impact of mining will be simulated by the previously described dredge test in the GER reference area. Additionally to this, samples will be collected to enlarge the reference libraries (Ch. 5.12.6) for future tests of the Patania II nodule collector.

5.12.2 Environmental analyses

All cores intended for environmental assessment were sliced down to 10cm in 0-1, 1-5 and 5-10cm. All analyses will be performed at the UGent laboratory. Amongst the intended analyses are: pigment concentrations (as a measure of fresh food input to the meiofauna), total organic matter, total organic carbon and nitrogen, and grain size distribution.

5.12.3 Community analyses

Sediment samples fixed in a solution of formaldehyde (4%) and filtered seawater will be used for community analyses based on morphological specimen identifications. Because morphological specimen identification is very difficult and because for most of the species obtained in this area scientific species descriptions are lacking, animals will often be identified only to higher taxonomic level or assigned to operational taxonomic units (OTUs). Based on the assessed data, statistical analyses such as calculation of biodiversity indices, ANOSIM or NMDS plotting can be carried out to compare species distribution and biodiversity at the different sampling sites. These analyses allow making a statement about the influence of nodule density, nodule size or other abiotic factors on meiofauna communities but also assessing the potential impact of mining and related sediment blanketing events. Pre-impacted areas will be compared to areas either directly impacted by the dredge or impacted by re-sedimentation of the sediment plume generated during

the dredge test experiment. Different intensities of re-sedimentation will be compared: areas without sediment coverage, faintly covered areas and strongly covered areas. All meiofauna will be extracted, counted and identified to major taxon level in the home institutes. Harpacticoid copepods will be identified to genus/species level at DZMB and nematodes to genus level at UGent/Ifremer.

5.12.4 Rapid assessment – Metabarcoding

Metabarcoding allows community analyses using batch samples. Thereby, time-consuming sorting of single specimens from centrifuged sediment samples is skipped and DNA extraction is carried out directly on centrifuged samples. Following to this, up to 96 samples can be processed simultaneously for sequencing. For species identification, from every sample, several hundred thousand DNA sequence reads will be obtained, curated and compared to the previously assessed reference libraries (see 8.4.6). Unclassified sequences will be clustered into molecular operational taxonomic units (MOTUs) using a certain sequence similarity threshold. This will allow a more detailed analysis of community structures compared to previous analyses carried out on family or genus level only. For the metabarcoding approach, in the German License Area cores were fixed in DESS (20%), while in the Belgian Area metabarcoding samples were fixed at -80°C.

5.12.5 Rapid assessment – MALDI-TOF MS

Matrix-Assisted Laser Desorption/Ionization Time-of-Flight mass spectrometry (MALDI-TOF MS) uses peptide and protein compositions of single specimens (proteomic fingerprint) to differentiate between species. This technique will be applied for the first time to samples from the CCZ and be compared to morphological assessments as well as metabarcoding. The advantage of this method is a rapid and cost-effective workflow which has the power to accelerate quantitative community data assessment compared to morphological identifications or specimen by specimen barcoding. Also, it allows a faster between-sampling sites comparison on species level compared to difficult morphological identifications which often fail to differentiate between cryptic or closely-related species. Single specimens will be sorted from centrifuged sediment samples and processed individually for measurement of a proteomic fingerprint. Data will be analyzed either using previously assessed reference libraries or unsupervised biodiversity assessment tools. Similar to metabarcoding, mass spectra can be clustered into OTUs, which allows comparison of species distribution between sampling sites or of pre- and post-impacted dredge test areas. Samples for MALDI-TOF analysis were fixed in 98% ethanol (denatured).

5.12.6 Reference library

Metabarcoding strongly relies on reference libraries to assess species diversity. Hence from each deployment specimens from one sample will be used to generate COI (~650 bp) and 18S rRNA (V1 & V2 hypervariable regions, ~380 bp) reference libraries. For this, single specimens will be sorted from the samples and identified morphologically to family, genus or species level and subsequently be processed for amplification of the gene fragments used in Metabarcoding.

Usually, the empty cuticles of harpacticoid copepods are retained after DNA extraction, thus a reference specimen for each obtained DNA sequence will be stored for further morphological analyses of these animals. For the reference libraries two cores were fixed, the first in DESS and the second in 96% ethanol (undenatured) in the German Area, while in the Belgian contract both cores were fixed in DESS.

5.12.7 Preliminary results

Since extraction of organisms and the analyses of environmental variables have to be done in a standardised way in the lab, no preliminary results are available for the meiofauna. For the sampling scheme and a complete list of samples obtained with the MUC see Chapter 5.6.

For the PUCs obtained with the ROV, a different sampling strategy was followed in the two license areas. In the GER area, pushcores were taken nearby different MUC locations to be able to compare data between the two sampling techniques. UGENT processes one or two pushcores per location for environmental variable analysis (frozen, 0-5 cm), all other PUCs will be processed by SGN for meiofauna community analysis (0-5 cm). Additionally, PUCs were used for the investigation of the soft-bottom restoration experiment (see Ch. 5.9).

In the BEL area, pushcores were collected at five different sites (two PUCs per site) ca. 200 m apart, one for environmental variable analysis (0-5 cm), and one for meiofauna community analysis (0-5 cm, 4% formaldehyde). A list of ROV pushcore samples processed for meiofauna and environmental variables is presented in Tables 5.12.1 and 5.12.2.

Tab. 5.12.1: List of PUC stations and purpose of core samples of leg 1.

Station SO268/1	Date	Gear	Lat (N)	Lon (W)	Study Site	Core	Fixative	Institute	Research Purpose	Comment
31	07/03/2019	ROV_05	11° 55' 48	117° 01' 28	GER_Trial	PUC 07	4% Formaldehyd	SGN	Meiofauna	near MUC2_Sta.06
31	07/03/2019	ROV_05	11° 55' 48	117° 01' 28	GER_Trial	PUC 12	4% Formaldehyd	SGN	Meiofauna	near MUC2_Sta.06
31	07/03/2019	ROV_05	11° 55' 379	117° 01' 154	GER_Trial	PUC 24	4% Formaldehyd	SGN	Meiofauna	near MUC3_Sta.07
31	07/03/2019	ROV_05	11° 55' 379	117° 01' 154	GER_Trial	PUC 29	4% Formaldehyd	SGN	Meiofauna	near MUC3_Sta.07
31	07/03/2019	ROV_05	11° 55' 481	117° 01' 280	GER_Trial	PUC 38	96% EtOH undenatured	SGN	Meiofauna	ca. 3cm sedim., no nodules, near MUC2_Sta.06
31	07/03/2019	ROV_05	11° 55' 379	117° 01' 154	GER_Trial	PUC 48	4% Formaldehyd	SGN	Meiofauna	near MUC3_Sta.07
31	07/03/2019	ROV_05	11° 55' 379	117° 01' 154	GER_Trial	PUC 65	4% Formaldehyd	SGN	Meiofauna	near MUC3_Sta.07
31	07/03/2019	ROV_05	11° 55' 481	117° 01' 280	GER_Trial	PUC 71	4% Formaldehyd	SGN	Meiofauna	near MUC2_Sta.06
31	07/03/2019	ROV_05	11° 55' 481	117° 01' 280	GER_Trial	PUC 08	Frozen	Ugent	Environmental variables	near MUC2_Sta.06
31	07/03/2019	ROV_05	11° 55' 379	117° 01' 154	GER_Trial	PUC 43	Frozen	Ugent	Environmental variables	near MUC3_Sta.07
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 03	99,8 % EtOH denatured	SGN	Metabarcoding	near MUC7_Sta.38 + GC_Sta.37
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 08	4% Formaldehyde	SGN	Meiofauna	near MUC7_Sta.38 + GC_Sta.37
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 17	99,8 % EtOH denatured	SGN	Metabarcoding	near MUC7_Sta.38 + GC_Sta.37
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 20	4% Formaldehyd	SGN	Meiofauna	near MUC7_Sta.38 + GC_Sta.37
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 25	4% Formaldehyd	SGN	Meiofauna	near MUC7_Sta.38 + GC_Sta.37
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 43	99,8 % EtOH denatured	SGN	Metabarcoding	near MUC7_Sta.38 + GC_Sta.37
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 54	4% Formaldehyd	SGN	Meiofauna	near MUC7_Sta.38 + GC_Sta.37

Station SO268/1	Date	Gear	Lat (N)	Lon (W)	Study Site	Core	Fixative	Institute	Research Purpose	Comment
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 65	4% Formaldehyd	SGN	Meiofauna	near MUC7_Sta.38 + GC Sta.37
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 12	Frozen	UGent	Environmental variables	near MUC7_Sta.38 + GC Sta.37
40	09/03/2019	ROV_07	11° 50' 418	117° 03' 367	GER_Ref	PUC 24	Frozen	UGent	Environmental variables	near MUC7_Sta.38 + GC Sta.37
57	15/03/2019	ROV_08	14° 06' 465	125° 52' 149	BEL_Trial	PUC 41	frozen	UGent	Environmental variables	collector site
57	15/03/2019	ROV_08	14° 06' 465	125° 52' 149	BEL_Trial	PUC 57	4% Formaldehyd	UGent	Meiofauna	collector site
57	15/03/2019	ROV_08	14° 06' 395	125° 52' 640	BEL_Trial	PUC 43	frozen	UGent	Environmental variables	plume site
57	15/03/2019	ROV_08	14° 06' 395	125° 52' 640	BEL_Trial	PUC 81	4% Formaldehyd	UGent	Meiofauna	plume site
57	15/03/2019	ROV_08	14° 06' 349	125° 52' 152	BEL_Trial	PUC 17	frozen	UGent	Environmental variables	"M10"
57	15/03/2019	ROV_08	14° 06' 349	125° 52' 152	BEL_Trial	PUC 42	4% Formaldehyd	UGent	Meiofauna	"M10"
57	15/03/2019	ROV_08	14° 06' 303	125° 51' 566	BEL_Trial	PUC 8	frozen	UGent	Environmental variables	"M11"
57	15/03/2019	ROV_08	14° 06' 303	125° 51' 566	BEL_Trial	PUC 38	4% Formaldehyd	UGent	Meiofauna	"M11"
57	15/03/2019	ROV_08	14° 06' 271	125° 51' 533	BEL_Trial	PUC 54	frozen	UGent	Environmental variables	80m from MUC S-E
57	15/03/2019	ROV_08	14° 06' 271	125° 51' 533	BEL_Trial	PUC 71	4% Formaldehyd	UGent	Meiofauna	80m from MUC S-E

Tab. 5.12.2: List of PUC stations and purpose of core samples of leg 2.

Station SO268/2	Date	Gear	Lat (N)	Lon (W)	Study Site	Core	Fixative	Institute	Research Purpose	Comment
101	06.04.2019	ROV_15	11° 51' 471	117° 00' 462	GER dredge	PUC 38	Frozen	UGent	environmental variables	
101	06.04.2019	ROV_15	11° 51' 467	117° 00' 463	GER dredge	PUC 81	99,8 % EtOH denatured	SGN	MALDI-TOF	
101	06.04.2019	ROV_15	11° 51' 46.9	11° 51' 46.9	GER dredge	PUC 8	DESS	SGN	Metabarcoding	
101	06.04.2019	ROV_15	11° 51' 471	117° 00' 461	GER dredge	PUC 17	4% Formaldehyde	UGent	Meiofauna community analysis	
101	06.04.2019	ROV_15	11° 51' 466	117° 00' 465	GER dredge	PUC 42		UGent	environmental variables	
101	06.04.2019	ROV_15	11° 51' 465	117° 00' 465	GER dredge	PUC 7	4% Formaldehyde	UGent	Meiofauna community analysis	
101	06.04.2019	ROV_15	11° 51' 468	117° 00' 465	GER dredge	PUC 43	Frozen	UGent	environmental variables	
101	06.04.2019	ROV_15	11° 51' 468	117° 00' 462	GER dredge	PUC 45	99,8 % EtOH denatured	SGN	MALDI-TOF	
101	06.04.2019	ROV_15	11° 51' 465	117° 00' 464	GER dredge	PUC 13	DESS	SGN	Metabarcoding	
101	06.04.2019	ROV_15	11° 51' 464	117° 00' 473	GER dredge	PUC 65	DESS	SGN	Metabarcoding	disturbed
101	06.04.2019	ROV_15	11° 51' 464	117° 00' 474	GER dredge	PUC 41	4% Formaldehyde	UGent	Meiofauna community analysis	
101	06.04.2019	ROV_15	11° 51' 464	117° 00' 475	GER dredge	PUC 54	99,8 % EtOH denatured	SGN	MALDI-TOF	
101	06.04.2019	ROV_15	11° 51' 467	117° 00' 478	GER dredge	PUC 23		RBINS		
124	12.04.2019	ROV_18	11° 51' 473	117° 00' 436	GER dredge	PUC 43	96% EtOH undenatured	SGN	Reference library (EtOH un.)	next to dredge track, sediment covered
124	12.04.2019	ROV_18	11° 51' 472	117° 00' 430	GER dredge	PUC 8	DESS	SGN	Metabarcoding	next to dredge track, sediment covered
124	12.04.2019	ROV_18	11° 51' 472	-117° 00' 430	GER dredge	PUC 65	99,8% EtOH denatured	SGN	MALDI-TOF	next to dredge track, sediment covered
174	08.05.2019	ROV_28	1° 50' 266	117° 03' 189	GER ref	PUC 7	4% Formaldehyde	SGN	Meiofauna community analysis	next to MUC track

Station SO268/2	Date	Gear	Lat (N)	Lon (W)	Study Site	Core	Fixative	Institute	Research Purpose	Comment
174	08.05.2019	ROV_28	1° 50' 266	117° 03' 189	GER ref	PUC 17	4% Formaldehyde	SGN	Meiofauna community analysis	disturbed, next to MUC track
174	08.05.2019	ROV_28	1° 50' 266	117° 03' 189	GER ref	PUC 51	4% Formaldehyde	SGN	Meiofauna community analysis	disturbed, next to MUC track
174	08.05.2019	ROV_28	11° 50' 267	117° 03' 189	GER ref	PUC 24				empty
174	08.05.2019	ROV_28	11° 50' 267	117° 03' 189	GER ref	PUC 27	Frozen	UGent	environmental variables	next to MUC track
174	08.05.2019	ROV_28	11° 50' 267	117° 03' 189	GER ref	PUC 54	DESS	SGN		next to MUC track
174	08.05.2019	ROV_28	11° 50' 267	117° 03' 189	GER ref	PUC 71	99,8 % EtOH denatured	SGN	MALDI-TOF	next to MUC track
174	08.05.2019	ROV_28	11° 50' 38.3	117° 03' 266	GER ref	PUC 25	99,8% EtOH denatured	SGN	MALDI-TOF	next to rediscovered amphipod trap
174	08.05.2019	ROV_28	11° 50' 383	117° 03' 266	GER ref	PUC 11	99,8% EtOH denatured	SGN	MALDI-TOF	next to rediscovered amphipod trap
174	08.05.2019	ROV_28	11° 50' 383	117° 03' 266	GER ref	PUC 20	Frozen	UGent	environmental variables	next to rediscovered amphipod trap
174	08.05.2019	ROV_28	11° 50' 383	117° 03' 266	GER ref	PUC 65	DESS	SGN	Metabarcoding	next to rediscovered amphipod trap
174	08.05.2019	ROV_28	11° 50' 383	117° 03' 266	GER ref	PUC 16				empty
174	08.05.2019	ROV_28	11° 50' 383	117° 03' 266	GER ref	PUC 46	DESS	SGN	Metabarcoding	next to rediscovered amphipod trap
174	08.05.2019	ROV_28	11° 50' 384	117° 03' 265	GER ref	PUC 36	4% Formaldehyde	SGN	Meiofauna community analysis	next to rediscovered amphipod trap
188	12.05.2019	ROV-29	11° 51' 370	117° 00' 453	GER Ref old EBS track	PUC 20		UGent	envrionmental variables	decompaction stretch 1
188	12.05.2019	ROV-29	11° 51' 369	117° 00' 453	GER Ref old EBS track	PUC 7		UGent	community composition	decompaction stretch 1
188	12.05.2019	ROV-29	11° 51' 369	117° 00' 453	GER Ref old EBS track	PUC 27		UGent	community composition	control 1
188	12.05.2019	ROV-29	11° 51' 371	117° 00' 452	GER Ref old EBS track	PUC 71		UGent	envrionmental variables	control 1
188	12.05.2019	ROV-29	11° 51' 369	117° 00' 454	GER Ref old EBS track	PUC 24		UGent	community composition	decompaction stretch 2

Station SO268/2	Date	Gear	Lat (N)	Lon (W)	Study Site	Core	Fixative	Institute	Research Purpose	Comment
188	12.05.2019	ROV-29	11° 51' 368	117° 00' 452	GER Ref old EBS track	PUC 36		UGent	envrionmental variables	decompaction stretch 2
188	12.05.2019	ROV-29	11° 51' 369	117° 00' 454	GER Ref old EBS track	PUC 11		UGent	community composition	control 2
188	12.05.2019	ROV-29	11° 51' 367	117° 00' 455	GER Ref old EBS track	PUC 57		UGent	envrionmental variables	control 2
188	12.05.2019	ROV-29	11° 51' 368	117° 00' 457	GER Ref old EBS track	PUC 46		UGent	envrionmental variables	decompaction stretch 3, PUC #46 was to far down into the sediment
188	12.05.2019	ROV-29	11° 51' 368	117° 00' 455	GER Ref old EBS track	PUC 12		UGent	community composition	decompaction stretch 3
188	12.05.2019	ROV-29	11° 51' 370	117° 00' 458	GER Ref old EBS track	PUC 17		UGent	community composition	control 3
188	12.05.2019	ROV-29	11° 51' 368	117° 00' 457	GER Ref old EBS track	PUC 25		UGent	envrionmental variables	control 3

5.13 Microbiology

(M. Molari, J. Barz, M. Buschi, T. Stratmann, F. Janssen, J. Otte, B. Yapan, J. Barz, Y. Bodur, F. Wenzhoefer)

5.13.1 Objectives

Microorganisms play a crucial role in deep sea ecosystem function (Jørgensen and Boetius, 2007), yet, little is known about the microbial diversity and mediated processes in nodules fields. In particular spatial variability, connectivity, and the role in carbon cycling of microbial communities inhabiting bottom seawater, sediments and Mn nodules of CCZ is largely unknown. Main objective of the microbiology group was to investigate microbial community composition and carbon cycling (e.g. organic matter degradation and remineralization) in water, sediments and Mn nodules samples collected at German (GER) and Belgian (BEL) contract areas. In each contract area two areas were also sampled to elucidate variability at local scale (0-10 km). Second objective was to investigate the impact of sediment plume, potentially generated by nodules mining activities (Miller et al., 2018), on pelagic microbial communities. In order to achieve the impacts of a sediment plume an *ex situ* sediment plume experiment was carried out.

5.13.2 Work at sea and preliminary results

5.13.2.1 Seawater

Seawater samples were collected with 12 L Niskin bottles from 5 CTD casts on leg 1 (SO268/1_002, SO268/1_014, SO268/1_023, SO268/1_049, SO268/1_059) and 8 CTD casts on leg 2 (SO268/2_088, SO268/2_092, SO268/2_120, SO268/2_131, SO268/2_151, SO268/2_159, SO268/2_183, SO268/2_208) (Tab. 12.4.1) and processed for cell counting (DAPI and fluorescent *in situ* hybridisations [FISH]), DNA extraction (for molecular analysis), characterization of dissolved organic carbon (DOC), quantification of particulate organic carbon (POC), extracellular enzymatic activities (EEA) and oxygen measurements. To fix cells for counting (microscopic analyses) 1 L of samples seawater were treated with formaldehyde (2% final concentration). After incubation period of 6-5 hours at 4°C, the samples were filtered onto 0.2-µm polycarbonate filters (47 mm diameter) using a vacuum pump system. Formaldehyde was washed out with 0.2-µm filtered bottom seawater and 70% Ethanol to dry the filters. The filters were stored in petri dishes at -20°C for further analysis. To retrieve material for DNA extraction and gene amplification-based tag sequencing analysis 8-10 L of seawater were filtered onto 0.2-µm Sterivex filter (Merck) using a peristaltic pump system installed in a temperature-controlled laboratory (4°C). Filters were immediately stored at -20°C for further analysis. 500 mL of seawater outflow from Sterivex filter were collected in polycarbonate bottle, acidified with HCl (pH <3) and stored at 4°C for further DOC analysis at ICBM laboratory (Oldenburg; Dr. Pamela Rossel). To retrieve POC 6-7 L of seawater was filtered onto 0.6-08-µm pre-combusted (540°C) and pre-weighted GF/F filters (47 mm diameter) using a vacuum pump system. Filters were immediately stored at -20°C for further analysis at AWI laboratory (Prof. Dr. Sabine Kasten).

The hydrolysis of the fluorogenic substrate analogous β -glucoside (MUF- β), N-acetylglucosamine (MUF-N-Ac), leucine (MCA), and fluorescein diacetate (FDA) was measured to estimate potential activity rates of β -glucosidase, chitinase, aminopeptidase, and esterase, respectively. Seawater samples (3 mL) were incubated in the dark at *in situ* temperature for 48 h. The linearity of the increase in fluorescence over time was checked up to 48 h, showing a deviation to linearity after 24 h. For routine analysis the fluorescence was measured at four different interval times (0, 12, 24, 48 h). To determine enzyme kinetics 6 different concentrations were used for differed substrate, ranging from 0.05 to 50 μ M for MUF- β , MUF-N-Ac, and FDA and from 0.24 to 250 μ M for MCA (Fig. 8.5.1). A final concentration of 10 μ M was applied for MUF-B and FDA, 100 μ M for MUF-N-Ac, and 500 μ M MCA. These concentrations have been previously reported as the saturating concentration in Atlantic deep sea water (Baltar *et al.*, 2010).

Fig. 5.13.1: Example of substrate saturation curves for esterase activity in (a) seawater and (b) nodules.

Bottle incubations were conducted on board to investigate respiration rates (Tab. 5.13.1) in bottom-near waters as a bulk measure of microbial organic matter remineralization and the possible influence of suspended particles introduced by resuspension of sediments (Y. Bodur). A bottle incubation setup was installed in the cold room for measurements of oxygen consumption in bottom waters. Up to twelve 300 mL glass bottles, stirred with magnetic stirrers and glass-coated stirrer bars, were incubated in a water bath kept at a constant temperature of 2° (+/- 0.01-0.02 °C) by a cooling coil connected to an external cooler. The bottles contained oxygen-sensitive sensor spots (OXSP5, Pyroscience, DE) which were connected to 3 4-channel optical oxygen meters (FireStingO2/4 channels; Pyroscience DE) by bare optical fibers (SPFIB-BARE, Pyroscience, DE) attached to the outside of the bottles. Following instructions by the manufacturer, 2-point calibrations were performed with air saturated water within the glass bottles installed in the water bath before and after addition of Sodium Dithionite to remove all oxygen.

Samples from (1) bottom-near waters collected in Niskin bottles with the CTD Rosette water sampler and (2) plume experiment containers were filled bubble-free into the glass bottles where oxygen concentrations were monitored for periods of several days at 30s intervals. For most measurement series, samples from the same Niskin Bottles / experimental containers were collected in 50 mL glass bottles for manual Winkler titration. Where available, Winkler results were used to verify/correct sensor readings to further improve calibration. As a control, one of the bottles per sample series (from one depth sampled with CTD or one of the experimental containers) was toxified with HgCl₂ to knock out biological activity and stop respiration. This was done by either adding 12 mL of 37% Formaldehyde solution to a final concentration of 4% or 1% (300 μ L)

of saturated mercuric chloride solution. At the final time point of the plume experiment (T₃ at day 9) a positive control was incubated additionally by the addition of Leucine (final concentration of 130 µM) to 3 additional glass bottles.

To retrieve large amount of microbial cells for transcriptomic and genomic analysis, 3 CTD rosette casts on leg 1 and 6 CTD casts on leg 2 (Tab. 12.4.1) were equipped with pre-programmed *in situ* pumps (MacLane), which were equipped with polycarbonate filters (142 mm diameter; 0.2 µm pore size). The pumps were operated at three water depths: bottom water (ca. 5 m above seafloor [asf], attached to CTD frame, 20 m above CTD (attached to CTD cable), and 200 m above CTD (attached to CTD cable). The pump operated about 180 minutes and on average 6400 L of water was filtered (Table 8.5.2). Directly after retrieval on deck, pumps were opened, filter were sectioned in 6 equal pieces and shock-frozen in liquid nitrogen (each piece into 50 ml Sarstedt centrifuge tubes) and 3 tubes were stored at -80°C (for RNA) and 3 tubes were stored at -20°C (for DNA) until further analysis at the MPI laboratory.

Tab. 5.13.1: Overview of the bottle incubations to quantify oxygen respiration rates carried out during SO268.

Sample origin	Position	Incubation start (UTC)	Niskin bottle / Experimental container ID	Glass bottle ID	Winkler bottle ID
SO268-1_14-1 CTD	11° 56.305' N, 117° 01.957' W	02. Mar. 2019	1 (5 mab)	A2, B2	-
			20 (50 mab)	A3, B3	-
			22 (200 mab / F*)	A4, B4	-
			24 (200 mab)	A1, B1	-
SO268-1_23-1 CTD	11° 54.682' N, 117° 02.125' W	05. Mar. 2019	3 (5 mab / Hg*)	A1, B1	-
			18 (50 mab)	A3, B3	-
			2 (5 mab)	A2, B2	-
			20 (200 mab)	A4, B4	-
SO268-1_49-1 CTD	14° 05.787' N, 125° 52.959' W	14. Mar. 2019	2 (7 mab)	C1	23
			7 (50 mab)	C3	7
			10 (200 mab)	C2	22
				C4	
SO268-1_59-1 CTD	14° 05.307' N, 125° 52.301' W	16. Mar. 2019	2 (5 mab)	C2	6
			17 (50 mab)	C3	7
			21 (200 mab)	C4	24
			21 (200 mab / Hg*)	C1	
Plume t0 / 0.5 d	experiment NA	13. Mar. 2019	1 (contr.)	B4	14
			2 (contr.)	B2	30
			3 (contr.)	B3	18
			3 (contr. / Hg*)	B1	
			4 (plume)	A2	12
			5 (plume)	A3	21
			6 (plume)	A4	8
			6 (plume / Hg*)	A1	
Plume t1 / 2 d	experiment NA	15. Mar. 2019	7 (contr.)	B2	27
			8 (contr.)	B3	15
			9 (contr.)	B4	25
			9 (contr. / Hg*)	B1	
			10 (plume)	A2	19
			11 (plume)	A3	10
			12 (plume)	A4	16
			12 (plume / Hg*)	A1	
Plume t2 / 4 d	experiment NA	17. Mar. 2019	13 (contr.)	B2	30
			14 (contr.)	B3	12
			15 (contr.)	B4	22

Sample origin	Position	Incubation start (UTC)	Niskin bottle / Experimental container ID	Glass bottle ID	incubation	Winkler bottle ID
Plume t2 / 9 d	experiment	NA	22. Mar. 2019	15 (contr. / Hg*)	B1	
				16 (plume)	A2	5
				17 (plume)	A3	28
				18 (plume)	A4	
				18 (plume / Hg*)	A1	20
				20 (contr. / pos.*)	B3 & C4 / L*	21
				22 (contr. / pos.*)	B2 & C2 / L	1
				21 (contr. / pos.*)	B4 & C3 / L*	8
				21 (contr. / Hg*)	B1	
				19 (plume)	A3	14
				23 (plume)	A2	23
				24 (plume)	A4	
				24 (plume / Hg*)	A1	18
SO268-2_88-1_CTD	11° 44.992' N, 113° 07.011' W	02. Apr.2019		5 (5 mab)	A2 & A3	5
				5 (5 mab / Hg*)	A1	5
				21 (50 mab)	A4, B1	22
SO268-2_92-1_CTD	11° 48.003' N, 114° 56.400' W	03. Apr.2019		5 (5 mab)	B3, B4	10
				5 (5 mab / Hg*)	B1	10
				9 (50 mab)	C2, C3	25
SO268-2_120_CTD	11° 51.785' N, 117° 00.736' W	11. Apr.2019		5 (5 mab)	B3, B4	6
				5 (5 mab / Hg*)	B1	6
				7 (50 mab)	C2, C3	7
SO268-2_131_CTD	14° 07.090' N, 125° 52.003' W	17. Apr.2019		6 (5 mab / Hg*)	B1	16
				6 (5 mab)	B3	16
				8 (50 mab)	B2	18
				10 (200 mab)	B4	20

F=37% formaldehyde solution was added to a final concentration of 4 %; Hg= 1% of saturated mercuric chloride solution was added; pos: positive control with the addition of leucine solution to a final concentration of 130 µM; NA = not available.

Tab. 5.13.2: Overview of the in situ pump deployments carried out during SO268. Polycarbonate filters (142 mm diameter; 0.2 µm pore size). Pump sample volume: 4000 L, initial flow rate: 6500 ml/min, minimum flow rate: 4000 ml/min, time: 180 min. 20 m above CTD means about 25 m above the seafloor; on CTD frame means about 5 m above the seafloor. Exact water depth of the in situ pumps in Table 12.4.1.

Sample ID	In situ pump Name	Location on CTD	Start volume [Gallon]*	End volume [Gallon]*	Volume [Gallon]*	Volume [L]	Duration [min]	Comment
SO268-1 14-1 CTD	Hulda	20 m above CTD	23.969	24.2232	0.2542	11,556.16	180	
SO268-1 14-1 CTD	Jimmy	on CTD frame	18.254	18.2860	0.032	1,454.75	180	
SO268-1 23-1 CTD	Jimmy	20 m above CTD	18.2840	18.3201	0.0361	1,641.14	180	
SO268-1_49-1 CTD	Hulda	20 m above CTD	24.2223	24.4767	0.2544	11,565.25	180	Glass fritt broken
SO268-1 49-1 CTD	Jimmy	20 m above CTD	18.3183	18.3510	0.0327	1,486.57	180	
SO268-2 88-1 CTD	Hulda	on CTD frame	24.4748	24.4755	0.0007	31.82	180	
SO268-2 88-1 CTD	Jimmy	20 m above CTD	18.3496	18.4304	0.0808	3,673.24	180	
SO268-2 92-1 CTD	Hulda	on CTD frame	24.475	24.5705	0.0955	4,341.52	180	
SO268-2 92-1 CTD	Jimmy	20 m above CTD	18.429	18.6798	0.2508	11,401.59	180	
SO268-2 120 CTD	Hulda	20 m above CTD	24.5696	24.8376	0.268	12,183.52	180	
SO268-2 120 CTD	Jimmy	on CTD frame	18.6784	18.8994	0.221	10,046.86	180	
SO268-2 131 CTD	Hulda	20 m above CTD	24.5696	24.8376	0.268	12,183.52	180	
SO268-2 131 CTD	Jimmy	on CTD frame	18.8995	18.9893	0.0898	4,082.39	180	
SO268-2 159 CTD	Hulda	on CTD frame	24.8364	24.8941	0.0577	2,623.09	180	
SO268-2 159 CTD	Jimmy	20 m above CTD	18.9773	19.0068	0.0295	1,341.10	180	

*1 Gallon = 4,54609 Liter

5.13.2.2 Ex situ plume experiment

Ex situ mesocosms on leg 1 (24 plastic tubes: 120 cm high and 15 cm diameter) were set up to simulate sediment plume (M. Molari) (Fig. 5.13.2). For each sampling time (T0: after 12 hours; T1: after 2 days; T2: after 4 days; T3: after 9 days) three tubes were filled with 20 L of bottom seawater (as control) and three with bottom seawater mixed with 30 mL of wet sediments from 0-10 cm sediment layer (final concentration 200 mg/L; dry sediment density of 1.5). Before sampling, seawater into the tubes was mixed for 5 minutes using a peristaltic pump (at rates of ca. 1.5 L per minute), and then turbidity was measured with JFE sensor (Advantech Co., Ltd; ATUD-USB-CE; S/No. 0018; provided by Dr. Henko de Stigter, NIOZ). To prevent resuspension of settled particles during the seawater mixing and sampling a plastic bee-nest (10 cm high) was placed at the bottom of the tubes. Water samples were collected at 15 cm above the tube bottom and processed as describe above for natural bottom seawater.

Fig. 5.13.2: 24 ex situ mesocosms to stimulate a sediment plume on board of SO268-1. One mesocosm: 120 cm high and 15 cm diameter filled with 20 L of bottom seawater mixed with 30 mL of wet sediments from 0-10 cm sediment layer (final concentration 200 mg/L; dry sediment density of 1.5).

5.13.2.3 Sediments

Sediment samples for MPI microbiological and biogeochemical analyses were sampled with an ROV and a TV guided multicorer (TV-MUC). Sediment samples were collected from 18 MUC deployments on leg 1 and 15 MUC deployments on leg 2 (Ch. 12.2) and 8 PUCs on leg 1 (SO268/1_031, SO268/1_035, SO268/1_040, SO268/1_057) and 14 PUCs (SO268/2_101, SO268/2_124, SO268/2_137, SO268/2_154, SO268/2_158, SO268/2_193, SO268/2_197) from leg 2 from ROV dives.

In a temperature controlled laboratory (4°C) cores were subsampled in layers of 0-1 cm, 1-2 cm, 2-3 cm, 3-5 cm, 5-10 cm, 10-15 cm, and 15-20 cm. The sediment subsamples were preserved at -20°C for later measurements (at MPI laboratories) of phytopigments, porosity, and phospholipid composition. Additional samples were preserved for DNA and RNA extractions, to investigate microbial community composition and metabolism applying different molecular approaches. Further samples were fixed with formaldehyde (2% final concentration) for total cell counts via the acridine orange direct cell count method (AODC) and FISH. After 5-6 hour of

fixation at 4°C, FISH samples washed (by centrifugation) three times with PBS, resuspended in PBS-Ethanol (1:1) and stored at -20°C.

The samples for addressing the UNIVPM tasks were collected by a multicorer. During the first leg a total of 9 cores (one for each deployment) were collected in the German area and 10 cores in Belgian area by M. Buschi (UNIVPM) and during leg 2 a total of 20 cores were collected in the German area by J. Barz (MPI) (Tab. 12.4.3). In each deployment an undisturbed core was immediately sliced in a climate room (4°C). Seawater from the top of the core was kept for laboratory analyses and sediment samples were collected from 0-1 cm, 1-3 cm, 3-5 cm, 5-10 cm, and 10-15 cm layers. Samples collected for the biochemical composition of organic matter, viral abundance and the molecular analyses (eDNA) were immediately frozen at -20°C. Sediment aliquots from 0-1 cm layer were also used for assessing viral production and analyses of extracellular enzymatic activities. For viral production analysis, a slurry was prepared from each core mixing ca. 5 cm³ sediment samples and 5 mL filtered 0.02-µm cold bottom seawater (1:1 ratio). From each slurry 4 aliquot of 0.5 mL were mixed with 2 mL of filtered 0.02-µm cold bottom seawater (final volume of 2.5 mL). One aliquot was immediately frozen at -20°C (corresponding to T₀) and the others three aliquots were frozen after 3, 6, 12 hours, respectively. For the investigation of enzymatic activities, slurry of the top 1 cm of the sediment was prepared, mixing ca. 5 cm³ sediment samples and 20 mL filtered 0.2-µm cold bottom seawater (1:4 ratio). Four slurry aliquots of 4.9 mL were transfer in sterile plastic tubes with 100 µL of the specific substrate (each one for a different substrate: aminopeptidase, β-glucosidase, chitinase and esterase; stock solution of 10 mM) to reach a final concentration of 200 µM. After centrifugation (5 min at 3500 rpm and 4°C) the fluorescence of the supernatant was immediately measured at the appropriate wavelengths (T₀ point). Supernatants were mixed again with corresponding sediment and incubated at in situ temperature and in the dark. Other two measurements were done after one hour and after 3 hours from the T₀. After the final measurement the supernatants were discarded and the sediments were stored at -20°C. At UNIVPM laboratory the sediments will be dried and weighted.

Preliminary results, considering the volume of sediment in each sample, show that the enzymatic activity varies between 23.24 µM h⁻¹ and 97.12 µM h⁻¹ for the aminopeptidase, between 0.012 µM h⁻¹ and 0.134 µM h⁻¹ for the β-glucosidase, between 0.055 µM h⁻¹ and 0.411 µM h⁻¹ for the chitinase and between 1.596 µM h⁻¹ and 10.02 µM h⁻¹ for the esterase. Pore water was extracted with Rhizons (SMS type MOM 19.21.21F, mean pore size 0.15 µm; Rhizosphere Research Products) at the interval of 1 cm from sediment-water interface to the bottom of the core. For each layer 14 mL of pore water was transferred to 15 mL tube, acidified with HCl (pH <3) and stored at 4°C for further DOC analysis at ICBM laboratory (Oldenburg; Dr. Pamela Rossel).

5.13.2.4 Manganese nodules

A total of 27 manganese nodules on leg 1 and 72 nodules on leg 2 were collected to investigate the microbial diversity and potential organic matter degradation. 22 on leg 1 and 58 nodules on leg 2 were collected with BCs and 1 with MUC (Tab. 5.13.3) and 5 nodules on leg 1 (SO268/1_029 BIO_07, BIO_09, BIO_11 SO268/1_064 BIO_67 and BIO_69; Tab. 12.4.2) and 13 nodules on leg 2 (SO268/2_099 BIO_3 and BIO_8; SO268/2_137 BIO_3 and BIO_4; SO268/2_154 BIO_4

and BIO_8; SO268/2_163 BIO_9, BIO_2 and BIO_4; SO268/2_210 BIO_1, BIO_2, BIO_3, and BIO_4 (Tab. 12.4.2) with associated fauna (corals or anemones) were retrieved with ROV. The nodules were washed gently with in situ temperature and 0.2- μ m filtered bottom seawater, and then they were stored in sterile plastic bag at -20°C (13 nodules on leg 1 and 13 nodules on leg 2) or subsampled (14 nodules on leg 1 and 59 nodules on leg 2). The nodules subsampling was carried out in a temperature-controlled laboratory (4°C) within 8 hours or maximal 48 hours after the nodules collection. Before processing the nodules they were stored in sterile filtered bottom sea water at 4°C in the dark, weighted and photos were taken from the top, bottom and side.

Fig. 5.13.3: Manganese nodule collected in Belgian contract area (SO268/1_072). (a) nodule profile, (b) upper side exposed to bottom water, (c) bottom side buried in sediment, and (d) cross section showing nodule core (delimited by red line).

Nodules were divided in three layers: upper layer exposed to seawater, core layer and bottom layer buried in the sediments (Figure 5.13.4). For each layer fragments of nodules were processed as described above for sediments (DNA, RNA, AODC and FISH analyses). Extracellular enzymatic activities (EEA) for beta-glucosidase, chitinase, aminopeptidase, and esterase were measured on board via assays with fluorescent substrates (Figure 5.13.5). A volume of 0.5 mL of nodule's fragments were mixed with 4.5 mL of cold 0.2- μ m filtered bottom seawater and incubated in the dark at in situ temperature for 6 h. Deviation from the linearity of the increase in fluorescence over time was observed after 3h. For routine analysis the fluorescence was measured at three different interval times (0, 1, and 3 hours). To determine enzyme kinetics 4 different concentrations were used for differed substrate, ranging from 10 to 250 μM for MUF- β , MUF-N-Ac, and FDA and from 50 to 1250 μM for MCA (Fig. 8.5.1). A final concentration of 250 μM was applied for MUF-B, 100 μM for MUF-N-Ac and DFA, and 500 μM MCA. Extracellular enzymatic activities were higher in the upper layer (Fig. 5.13.4) and similar to that measured in the sediments.

Fig. 5.13.4: Extracellular enzymatic activities in manganese nodules collected at the German and Belgian contract area.

5.13.3 Data management

All data will be quality-checked, stored and be available after publication in peer-reviewed journals through PANGAEA Data Publisher for Earth & Environmental Science. Gene sequences of processes sediment microbiota will be publicly available via European Nucleotide Archive (ENA) after publication aimed within the next two years.

Tab. 5.13.3: Overview of subsampling Manganese nodules during SO268 with time (before or after the dredge experiment), contract area (German or Belgium), site (Reference or Trial area), gear, layer of nodules (whole nodule or 3 layers with surface, core, and bottom). Number of DNA, RNA, AODC or FISH sample. Comments on associated fauna on the nodule surface. Dimensions and weight of the nodule after washing and subsampling for cell counting and 16S rRNA sequencing (analysed in MPI Bremen). Locations of stations are shown in Table 12.4.2.

Station	Time	Area	Site	Gear	Nodule no./ Layer		DNA sample #	RNA sample #	AODC Sample #	FISH sample #	Comments; fauna associated?	Height [mm]	Width [mm]	Depth [mm]	Weight [g]
SO268/1_28-1	Pre	GER	Trial	BC11	1	whole					stored at -20C	69	51	33	120
SO268/1_28-1	Pre	GER	Trial	BC11	2	whole					stored at -20C	80	60	26	125
SO268/1_28-1	Pre	GER	Trial	BC11	3	whole					stored at -20C	78	52	39	135
SO268/1_28-1	Pre	GER	Trial	BC11	4	surface	1	1	1	1		114	75	55	385
SO268/1_28-1	Pre	GER	Trial	BC11	4	core	2	2	2	2		114	75	55	385
SO268/1_28-1	Pre	GER	Trial	BC11	4	bottom	3	3	3	3		114	75	55	385
SO268/1_28-1	Pre	GER	Trial	BC11	5	surface	4	4	4	4		70	68	53	200
SO268/1_28-1	Pre	GER	Trial	BC11	5	core	5	5	5	5		70	68	53	200
SO268/1_28-1	Pre	GER	Trial	BC11	5	bottom	6	6	6	6		70	68	53	200
SO268/1_28-1	Pre	GER	Trial	BC11	6	surface	7	7	7	7		80	59	32	160
SO268/1_28-1	Pre	GER	Trial	BC11	6	core	8	8	8	8		80	59	32	160
SO268/1_28-1	Pre	GER	Trial	BC11	6	bottom	9	9	9	9		80	59	32	160
SO268/1_29-1	Pre	GER	Trial	ROV4	1	whole					corals				
SO268/1_29-1	Pre	GER	Trial	ROV4	2	surface	10	10	10	10	corals	-	-	-	-
SO268/1_29-1	Pre	GER	Trial	ROV4	2	core	11	11	11	11		-	-	-	-
SO268/1_29-1	Pre	GER	Trial	ROV4	2	bottom	12	12	12	12		-	-	-	-
SO268/1_29-1	Pre	GER	Trial	ROV4	3	surface	13	13	13	13	corals	-	-	-	-
SO268/1_29-1	Pre	GER	Trial	ROV4	3	core	14	14	14	14		-	-	-	-
SO268/1_29-1	Pre	GER	Trial	ROV4	3	bottom	15	15	15	15		-	-	-	-
SO268/1_44-2	Pre	GER	Trial	BC	1	whole					at -20C				
SO268/1_44-2	Pre	GER	Trial	BC	2	whole					at -20C				
SO268/1_44-2	Pre	GER	Trial	BC	3	whole					fixed in 2% FA/SW; at -20C in PBS/EtOH				
SO268/1_44-2	Pre	GER	Trial	BC	4	surface	16	16	16	16		-	-	-	-
SO268/1_44-2	Pre	GER	Trial	BC	4	core	17	17	17	17		-	-	-	-
SO268/1_44-2	Pre	GER	Trial	BC	4	bottom	18	18	18	18		-	-	-	-
SO268/1_52-1	Pre	BEL	Trial	BC	1	surface	19	19	19	19	labelled as SO268/1_53-1	110	97	65	625
SO268/1_52-1	Pre	BEL	Trial	BC	1	core	20	20	20	20	53-1	110	97	65	625
SO268/1_52-1	Pre	BEL	Trial	BC	1	bottom	21	21	21	21	53-1	110	97	65	625

Station	Time	Area	Site	Gear	Nodule no./ Layer		DNA sample #	RNA sample #	AODC Sample #	FISH sample #	Comments; fauna associated?	Height [mm]	Width [mm]	Depth [mm]	Weight [g]
SO268/1 52-1	Pre	BEL	Trial	BC	2	surface	22	22	22	22	53-1	132	69	58	565
SO268/1 52-1	Pre	BEL	Trial	BC	2	core	23	23	23	23	53-1	132	69	58	565
SO268/1 52-1	Pre	BEL	Trial	BC	2	bottom	24	24	24	24	53-1	132	69	58	565
SO268/1 52-1	Pre	BEL	Trial	BC	3	surface	25	25	25	25	53-1	132	69	58	565
SO268/1 52-1	Pre	BEL	Trial	BC	3	core	26	26	26	26	53-1	104	73	58	370
SO268/1 52-1	Pre	BEL	Trial	BC	3	bottom	27	27	27	27	53-1	104	73	58	370
SO268/1 53-1	Pre	BEL	Trial	BC	1	whole						99	72	53	415
SO268/1 53-1	Pre	BEL	Trial	BC	2	whole						97	72	50	345
SO268/1 53-1	Pre	BEL	Trial	BC	3	whole						91	79	48	260
SO268/1 60-1	Pre	BEL	Trial	BC	1	surface	28	28	28	28		110	113	67	625
SO268/1 60-1	Pre	BEL	Trial	BC	1	core	29	29	29	29		110	113	67	625
SO268/1 60-1	Pre	BEL	Trial	BC	1	bottom	30	30	30	30		110	113	67	625
SO268/1 60-1	Pre	BEL	Trial	BC	2	surface	31	31	31	31		89	88	55	565
SO268/1 60-1	Pre	BEL	Trial	BC	2	core	32	32	32	32		89	88	55	565
SO268/1 60-1	Pre	BEL	Trial	BC	2	bottom	33	33	33	33		89	88	55	565
SO268/1 60-1	Pre	BEL	Trial	BC	3	surface	34	34	34	34		90	73	37	370
SO268/1 60-1	Pre	BEL	Trial	BC	3	core	35	35	35	35		90	73	37	370
SO268/1 60-1	Pre	BEL	Trial	BC	3	bottom	36	36	36	36		90	73	37	370
SO268/1 64-1	Pre	BEL	Trial	ROV	1	surface	37	37	37	37	anemone	-	-	-	-
SO268/1 64-1	Pre	BEL	Trial	ROV	1	core	38	38	38	38		-	-	-	-
SO268/1 64-1	Pre	BEL	Trial	ROV	1	bottom	39	39	39	39		-	-	-	-
SO268/1 64-1	Pre	BEL	Trial	ROV	2	surface	40	40	40	40	anemone	-	-	-	-
SO268/1 64-1	Pre	BEL	Trial	ROV	2	core	41	41				-	-	-	-
SO268/1 64-1	Pre	BEL	Trial	ROV	2	bottom	42	42				-	-	-	-
SO268/1 72-1	Pre	BEL	Trial	BC	1	whole	cut in two stored at -4C					94	79	48	280
SO268/1 76-1	Pre	BEL	Ref	BC	1	whole						118	107	91	770
SO268/1 76-1	Pre	BEL	Ref	BC	2	whole						98	85	46	315
SO268/1 82-1	Pre	BEL	Ref	BC	1	whole						144	112	76	960
SO268/1 82-1	Pre	BEL	Ref	BC	2	whole	cut in two, stored at -4C					102	102	65	640
SO268/1 82-1	Pre	BEL	Ref	BC	3	whole						112	90	57	515
SO268/2 95-2	Pre	GER	Ref	BC23	1	surface	43	43				87	55	36	150
SO268/2 95-2	Pre	GER	Ref	BC23	1	bottom	44	44				87	55	36	150
SO268/2 95-2	Pre	GER	Ref	BC23	2	whole						99	80	45	290
SO268/2 95-2	Pre	GER	Ref	BC23	3	surface	45	45				117	86	67	555
SO268/2 95-2	Pre	GER	Ref	BC23	3	bottom	46	46				117	86	67	555

Station	Time	Area	Site	Gear	Nodule no./ Layer		DNA sample #	RNA sample #	AODC Sample #	FISH sample #	Comments; fauna associated?	Height [mm]	Width [mm]	Depth [mm]	Weight [g]
SO268/2_95-2	Pre	GER	Ref	BC23	3	core	47	47				117	86	67	555
SO268/2_96-1	Pre	GER	Ref	BC24	1	whole						70	47	30	120
SO268/2_96-1	Pre	GER	Ref	BC24	2	surface	48	48				65	59	42	175
SO268/2_96-1	Pre	GER	Ref	BC24	2	core	49	49				65	59	42	175
SO268/2_96-1	Pre	GER	Ref	BC24	2	bottom	50	50				65	59	42	175
SO268/2_96-1	Pre	GER	Ref	BC24	3	surface	51	51		43		92	68	38	245
SO268/2_96-1	Pre	GER	Ref	BC24	3	bottom	52	52		44		92	68	38	245
SO268/2_96-1	Pre	GER	Ref	BC24	3	core	53	53		45		92	68	38	245
SO268/2_99-1	Pre	GER	Ref	ROV	3	surface	54	54		46		110	95	68	420
SO268/2_99-1	Pre	GER	Ref	ROV	3	core	55	55		47		110	95	68	420
SO268/2_99-1	Pre	GER	Ref	ROV	3	bottom	56	56		48		110	95	68	420
SO268/2_99-1	Pre	GER	Ref	ROV	8	whole					at -20C	105	82	60	370
SO268/2_102-1	Pre	GER	Ref	BC26	1	whole	fixed in 2% FA/SW; at -20C inPBS/EtOH					78	77	42	180
SO268/2_102-1	Pre	GER	Ref	BC26	2	surface	57	57				105	65	35	230
SO268/2_102-1	Pre	GER	Ref	BC26	2	core	58	58				105	65	35	230
SO268/2_102-1	Pre	GER	Ref	BC26	2	bottom	59	59				105	65	35	230
SO268/2_103-1	Pre	GER	Ref	BC27	1	whole	fixed in 2% FA/SW; at -20C inPBS/EtOH; polychaeta					104	81	38	230
SO268/2_103-1	Pre	GER	Ref	BC27	2	surface						120	100	60	520
SO268/2_103-1	Pre	GER	Ref	BC27	2	core						120	100	60	520
SO268/2_103-1	Pre	GER	Ref	BC27	2	bottom						120	100	60	520
SO268/2_116-1	Pre	GER	Ref	BC29	1	whole					at -20°C	74	67	31	170
SO268/2_116-1	Pre	GER	Ref	BC29	2	surface	63	63		52		105	85	40	280
SO268/2_116-1	Pre	GER	Ref	BC29	2	core	64	64		53		105	85	40	280
SO268/2_116-1	Pre	GER	Ref	BC29	2	bottom	65	65		54		105	85	40	280
SO268/2_129-1	Pre	BEL	Trial	BC30	1	surface	66	66		55	hard surface	113	100	68	595
SO268/2_129-1	Pre	BEL	Trial	BC30	1	core	67	67		56	no enzyme activity test	113	100	68	595
SO268/2_129-1	Pre	BEL	Trial	BC30	1	bottom	68	68		57		113	100	68	595
SO268/2_137-1	Pre	BEL	Ref	ROV20	3	surface	69	69		58		100	73	55	385
SO268/2_137-1	Pre	BEL	Ref	ROV20	3	core	70	70		59		100	73	55	385
SO268/2_137-1	Pre	BEL	Ref	ROV20	3	bottom	71	71		60		100	73	55	385
SO268/2_137-1	Pre	BEL	Ref	ROV20	4	whole	72	72		61	fixed in 2% FA/SW; at -20C in PBS/EtOH	65	42	57	145
SO268/2_137-1	Pre	BEL	Ref	ROV20	4	?	73	73		62		65	42	57	145
SO268/2_137-1	Pre	BEL	Ref	ROV20	4	?	74	74		63		65	42	57	145

Station	Time	Area	Site	Gear	Nodule no./ Layer		DNA sample #	RNA sample #	AODC Sample #	FISH sample #	Comments; fauna associated?	Height [mm]	Width [mm]	Depth [mm]	Weight [g]
SO268/2_140-1	Pre	BEL	Ref	BC31	1	surface	75	75		64		135	75	68	455
SO268/2_140-1	Pre	BEL	Ref	BC31	1	core	76	76		65		135	75	68	455
SO268/2_140-1	Pre	BEL	Ref	BC31	1	bottom	77	77		66		135	75	68	455
SO268/2_141-1	Pre	BEL	Ref	BC32	1	surface	78	78		67		90	98	50	320
SO268/2_141-1	Pre	BEL	Ref	BC32	1	core	79	79		68		90	98	50	320
SO268/2_141-1	Pre	BEL	Ref	BC32	1	bottom	80	80		69		90	98	50	320
SO268/2_141-1	Pre	BEL	Ref	BC32	2	surface	81	81		70		108	87	65	530
SO268/2_141-1	Pre	BEL	Ref	BC32	2	core	82	82		71		108	87	65	530
SO268/2_141-1	Pre	BEL	Ref	BC32	2	bottom	83	83		72		108	87	65	530
SO268/2_142-1	Pre	BEL	Ref	BC33	1	whole	84	84		73		105	88	51	435
SO268/2_142-1	Pre	BEL	Ref	BC33	1	?	85	85		74	fixed in 2% FA/SW; at -20C in PBS/EtOH	105	88	51	435
SO268/2_142-1	Pre	BEL	Ref	BC33	1	?	86	86		75		105	88	51	435
SO268/2_149-1	Pre	BEL	Trial	BC35	1	surface	87	87		76	2 cm deep; EEA	115	100	64	615
SO268/2_149-1	Pre	BEL	Trial	BC35	1	core	88	88		77	EEA	115	100	64	615
SO268/2_149-1	Pre	BEL	Trial	BC35	1	bottom	89	89		78	EEA	115	100	64	615
SO268/2_149-1	Pre	BEL	Trial	BC35	2	surface	90	90		79	5 cm deep; EEA	135	95	82	820
SO268/2_149-1	Pre	BEL	Trial	BC35	2	core	91	91		80	EEA	135	95	82	820
SO268/2_149-1	Pre	BEL	Trial	BC35	2	bottom	92	92		81	EEA	135	95	82	820
SO268/2_154-1	Pre	BEL	Ref	ROV	4	surface	93	93		82	big anemone	90	95	60	370
SO268/2_154-1	Pre	BEL	Ref	ROV	4	core	94	94		83		90	95	60	370
SO268/2_154-1	Pre	BEL	Ref	ROV	4	bottom	95	95		84		90	95	60	370
SO268/2_154-1	Pre	BEL	Ref	ROV	8	surface	96	96		85		110	90	70	630
SO268/2_154-1	Pre	BEL	Ref	ROV	8	core	97	97		86		110	90	70	630
SO268/2_154-1	Pre	BEL	Ref	ROV	8	bottom	98	98		87		110	90	70	630
SO268/2_161-1	Pre	GER	Ref	BC36	1	whole	10 cm deep; fixed in 2% FA/SW; at -20C in PBS/EtOH					88	55	55	250
SO268/2_161-1	Pre	GER	Ref	BC36	2	surface	99	99		88	10 cm deep	90	70	45	250
SO268/2_161-1	Pre	GER	Ref	BC36	2	core	100	100		89		90	70	45	250
SO268/2_161-1	Pre	GER	Ref	BC36	2	bottom	101	101		90		90	70	45	250
SO268/2_163-1	Pre	GER	Trial	ROV25	9	whole	black stuff; fixed in 2% FA/SW + stored at -20C in PBS/EtOH					35	44	22	30
SO268/2_163-1	Pre	GER	Trial	ROV25	2	surface	102	102		91	black stuff; fauna	85	90	63	330
SO268/2_163-1	Pre	GER	Trial	ROV25	2	core	103	103		92		85	90	63	330
SO268/2_163-1	Pre	GER	Trial	ROV25	2	bottom	104	104		93		85	90	63	330
SO268/2_163-1	Pre	GER	Trial	ROV25	4	surface	105	105		94	Fauna	105	80	50	350

Station	Time	Area	Site	Gear	Nodule no./ Layer		DNA sample #	RNA sample #	AODC Sample #	FISH sample #	Comments; fauna associated?	Height [mm]	Width [mm]	Depth [mm]	Weight [g]
SO268/2 163-1	Pre	GER	Trial	ROV25	4	core	106	106		95		105	80	50	350
SO268/2 163-1	Pre	GER	Trial	ROV25	4	bottom	107	107		96		105	80	50	350
SO268/2 166-1	Pre	GER	Ref	BC37	1	surface	108	108		97		100	70	55	345
SO268/2 166-1	Pre	GER	Ref	BC37	1	core	109	109		98		100	70	55	345
SO268/2 166-1	Pre	GER	Ref	BC37	1	bottom	110	110		99		100	70	55	345
SO268/2 166-1	Pre	GER	Ref	BC37	2	surface	111	111		100		110	60	55	330
SO268/2 166-1	Pre	GER	Ref	BC37	2	core	112	112		101		110	60	55	330
SO268/2 166-1	Pre	GER	Ref	BC37	2	bottom	113	113		102		110	60	55	330
SO268/2 166-1	Pre	GER	Ref	BC37	3	whole	fixed in 2% FA/SW and stored at -20C in PBS/EtOH					60	65	25	100
SO268/2 166-1	Pre	GER	Ref	BC37	4	surface	114	114		103		70	55	45	255
SO268/2 166-1	Pre	GER	Ref	BC37	4	core	115	115		104		70	55	45	255
SO268/2 166-1	Pre	GER	Ref	BC37	4	bottom	116	116		105		70	55	45	255
SO268/2 167-1	Pre	GER	Ref	BC38	1	surface	117	117		106		80	70	35	245
SO268/2 167-1	Pre	GER	Ref	BC38	1	core	118	118		107		80	70	35	245
SO268/2 167-1	Pre	GER	Ref	BC38	1	bottom	119	119		108		80	70	35	245
SO268/2 167-1	Pre	GER	Ref	BC38	2	whole	fixed in 2% FA/SW and stored at -20C in PBS/EtOH					80	85	35	350
SO268/2 167-1	Pre	GER	Ref	BC38	3	surface	120	120		109		100	75	55	400
SO268/2 167-1	Pre	GER	Ref	BC38	3	core	121	121		110		100	75	55	400
SO268/2 167-1	Pre	GER	Ref	BC38	3	bottom	122	122		111		100	75	55	400
SO268/2 167-1	Pre	GER	Ref	BC38	4	whole					at -20C	85	70	35	330
SO268/2 167-1	Pre	GER	Ref	BC38	5	whole					at -20C	50	60	22	130
SO268/2 167-1	Pre	GER	Ref	BC38	6	whole					at -20C	85	63	40	195
SO268-2 167-1	Pre	GER	Ref	BC38	7	whole					at -20C	73	73	30	200
SO268-2 167-1	Pre	GER	Ref	BC38	8	whole					at -20C	115	70	35	285
SO268/2 162-1	Pre	GER	Ref	F 1	6	surface	123	123		112	Pool	pieces			
SO268/2 162-1	Pre	GER	Ref	F 1	6	core	124	124		123	Pool	pieces			
SO268/2 162-1	Pre	GER	Ref	F 1	6	bottom	125	125		124	Pool	pieces			
SO268/2 162-1	Pre	GER	Ref	F 2	6	surface	126	126		125	Pool	pieces			
SO268/2 162-1	Pre	GER	Ref	F 2	6	core	127	127		126	Pool	pieces			
SO268/2 162-1	Pre	GER	Ref	F 2	6	bottom	128	128		127	Pool	pieces			
SO268/2 162-1	Pre	GER	Ref	F 3	6	surface	129	129		128	Pool	pieces			
SO268/2 162-1	Pre	GER	Ref	F 3	6	core	130	130		129	Pool	pieces			
SO268/2 162-1	Pre	GER	Ref	F 3	6	bottom	131	131		130	Pool	pieces			
SO268/2 175-1	Pre	GER	Ref	BC39	1	surface	132	132		131		105	65	35	265
SO268/2 175-1	Pre	GER	Ref	BC39	1	core	133	133		132		105	65	35	265
SO268/2 175-1	Pre	GER	Ref	BC39	1	bottom	134	134		133		105	65	35	265

Station	Time	Area	Site	Gear	Nodule no./ Layer		DNA sample #	RNA sample #	AODC Sample #	FISH sample #	Comments; fauna associated?	Height [mm]	Width [mm]	Depth [mm]	Weight [g]
SO268/2	180-1	Pre	GER	Ref	BC40	1	surface	135	135	134		95	75	40	245
SO268/2	180-1	Pre	GER	Ref	BC40	1	core	136	136	135		95	75	40	245
SO268/2	180-1	Pre	GER	Ref	BC40	1	bottom	137	137	136		95	75	40	245
SO268/2	180-1	Pre	GER	Ref	BC40	2	surface	138	138	137		107	90	40	320
SO268/2	180-1	Pre	GER	Ref	BC40	2	core	139	139	138		107	90	40	320
SO268/2	180-1	Pre	GER	Ref	BC40	2	bottom	140	140	139		107	90	40	320
SO268/2	181-1	Pre	GER	Ref	BC41	1	surface	141	141	140		80	85	60	290
SO268/2	181-1	Pre	GER	Ref	BC41	1	core	142	142	141		80	85	60	290
SO268/2	181-1	Pre	GER	Ref	BC41	1	bottom	143	143	142		80	85	60	290
SO268/2	182-1	Pre	GER	Ref	BC42	1	surface	144	144	143		88	55	30	155
SO268/2	182-1	Pre	GER	Ref	BC42	1	core	145	145	144		88	55	30	155
SO268/2	182-1	Pre	GER	Ref	BC42	1	bottom	146	146	145		88	55	30	155
SO268/2	182-1	Pre	GER	Ref	BC42	2	surface	147	147	146	Fauna	100	75	65	330
SO268/2	182-1	Pre	GER	Ref	BC42	2	core	148	148	147		100	75	65	330
SO268/2	182-1	Pre	GER	Ref	BC42	2	bottom	149	149	148		100	75	65	330
SO268/2	186-1	Dred	GER		MUC	19	surface	150	150	149		100	95	60	340
SO268/2	186-1	Dred	GER		MUC	19	core	151	151	150		100	95	60	340
SO268/2	186-1	Dred	GER		MUC	19	bottom	152	152	151		100	95	60	340
SO268/2	189-1	Dred	GER	D#1	BC43	1	surface	153	153	152		115	80	53	420
SO268/2	189-1	Dred	GER	D#1	BC43	1	core	154	154	153		115	80	53	420
SO268/2	189-1	Dred	GER	D#1	BC43	1	bottom	155	155	154		115	80	53	420
SO268/2	189-1	Dred	GER	D#1	BC43	2	surface	156	156	155		125	115	62	680
SO268/2	189-1	Dred	GER	D#1	BC43	2	core	157	157	156		125	115	62	680
SO268/2	189-1	Dred	GER	D#1	BC43	2	bottom	158	158	157		125	115	62	680
SO268/2	189-1	Dred	GER	D#1	BC43	3	surface	159	159	158	10 cm deep	95	65	33	260
SO268/2	189-1	Dred	GER	D#1	BC43	3	core	160	160	159	10 cm deep	95	65	33	260
SO268/2	189-1	Dred	GER	D#1	BC43	3	bottom	161	161	160	10 cm deep	95	65	33	260
SO268/2	190-1	Dred	GER	D#2	BC44	1	surface	162	162	161		73	65	35	330
SO268/2	190-1	Dred	GER	D#2	BC44	1	core	163	163	162		73	65	35	330
SO268/2	190-1	Dred	GER	D#2	BC44	1	bottom	164	164	163		73	65	35	330
SO268/2	191-1	Dred	GER	D#3	BC45	1	surface	165	165	164		82	70	40	230
SO268/2	191-1	Dred	GER	D#3	BC45	1	core	166	166	165		82	70	40	230
SO268/2	191-1	Dred	GER	D#3	BC45	1	bottom	167	167	166		82	70	40	230
SO268/2	191-1	Dred	GER	D#3	BC45	2	surface	168	168	167		83	72	35	245
SO268/2	191-1	Dred	GER	D#3	BC45	2	core	169	169	168		83	72	35	245

Station	Time	Area	Site	Gear	Nodule no./ Layer		DNA sample #	RNA sample #	AODC Sample #	FISH sample #	Comments; fauna associated?	Height [mm]	Width [mm]	Depth [mm]	Weight [g]
SO268/2 191-1	Dred	GER	D#3	BC45	2	bottom	170	170		169		83	72	35	245
SO268/2 206-1	Ref	GER	ref #7	BC49	1	surface	171	171		170		80	80	30	215
SO268/2 206-1	Ref	GER	ref #7	BC49	1	core	172	172		171		80	80	30	215
SO268/2 206-1	Ref	GER	ref #7	BC49	1	bottom	173	173		172		80	80	30	215
SO268/2 206-1	Ref	GER	ref #7	BC49	2	surface	174	174		173		95	75	35	265
SO268/2 206-1	Ref	GER	ref #7	BC49	2	core	175	175		174		95	75	35	265
SO268/2 206-1	Ref	GER	ref #7	BC49	2	bottom	176	176		175		95	75	35	265
SO268/2 210-1	Ref	GER	ref #8	ROV33	1						at 4°C				
SO268/2 210-1	Ref	GER	ref #8	ROV33	2						at 4°C				
SO268/2 210-1	Ref	GER	ref #8	ROV33	3						at 4°C				
SO268/2 210-1	Ref	GER	ref #8	ROV33	4						at 4°C				

5.14 Sediment and Porewater Geochemistry

(J. Volz, I. Dohrmann, D. Köhler, S. Paul, A. Moje, K. Schmidt, K. Hamann, M. Haeckel)

5.14.1 Objectives

Geochemical studies in different European areas for the exploration of manganese nodules in the CCZ have shown that the natural/undisturbed redox zonation in the sediments varies between different exploration areas (inter-areal) but also differs significantly on a small scale within one exploration area (intra-areal) (Mewes et al., 2014; 2016; Mogollón et al., 2016; Volz et al., 2018). These spatial differences in the geochemical environment were suggested to mainly result from variations in sedimentation rates and different burial rates of organic matter in the sediments, which are highly influenced locally by bottom-water currents and seafloor topography (Mewes et al., 2014; Juan et al., 2018; Volz et al., 2018). For the evaluation of the impact of an industrial mining equipment test on geochemical conditions in prospective polymetallic nodule areas in the German and Belgian contract areas, a thorough investigation of the natural/undisturbed geochemical environment in the sediments prior to the mining trial is crucial. Due to the lack of mining trials with industrial mining equipment in the deep sea, so far only small-scale disturbance experiments for the simulation of deep-sea mining activities have provided a first-order approximation to evaluate the expected impacts on the geochemical system of abyssal environments (König et al., 2001; Haffert et al., in press; Volz et al., 2020). These studies have shown that with the mining-related removal of the surface sediments (5–15 cm), the oxic zone extends up to 10 m deeper into the sediments as a result of lower oxygen consumption rates due to the loss of reactive labile organic carbon, while transport-reaction modelling has revealed that natural/undisturbed geochemical conditions may be re-established on a millennia scale after the disturbance (König et al., 2001; Volz et al., 2020).

In order to (1) determine the undisturbed/natural geochemical conditions in the sediments of the designated GER and BEL Trial sites, including sedimentation rates, bioturbation depths and element fluxes across the sediment-water interface, (2) investigate the natural spatial variation of geochemical parameters in the sediments across the GER and BEL Trial and Reference sites and (3) evaluate the short-term impact (hours/weeks) of a small-scale dredge experiment (see Ch. 3 and 8.11) on the geochemical processes in surface sediments, a comprehensive set of sediment and pore water samples were taken by AWI, JUB, BGR and GEOMAR. Gravity cores (GC) were deployed at undisturbed stations for the retrieval of up to 5 m long sediment cores. Surface sediments (upper 20–30 cm) were sampled using a multi-corer (MUC) and ROV-operated push cores (PUC) in parallel to the GC stations before and after the dredge experiment in the German area within clearly visible tracks, plume-covered tracks as well as in areas of apparent visual thin and thick sediment drape. In undisturbed surface sediments, oxygen concentrations, DOC, N-isotopes, amino acids, total alkalinity, nutrients, and dissolved element concentrations are used to characterize the undisturbed/natural geochemical conditions and the spatial variability. These pore-water constituents' elemental fluxes as well as sediment porosity and sediment composition are suggested to be impacted by mining-related activities due to sediment removal and compaction, mixing, re-suspension and -deposition. In order to be able to evaluate mining-related consequences of sediment re-suspension and -deposition as well as to quantify the associated expulsion of pore water into the water column, further investigations of the pre- and post-impact geochemical

sediment conditions are crucial. These include the distribution of potentially toxic metals in the pore water (e.g., As, Cd), the assessment of phase association of metals with nanoparticles and colloids (NPCs) in pore water, and the distribution of ^{230}Th in the sediments. To investigate the extent and composition of the sediment re-suspension and the associated release of pore water into the water column in comparison to natural conditions, sediment geochemical work was complemented by baseline water column sampling using rosette water sampler/CTD, the Bottom Water Sampler and large-volume in-situ pumps, which is explained in detail in Chapter 8.7, to assess anthropogenic impacts in the future.

5.14.2 Sampling areas and strategy

As shown in Figs 5.14.2.1, 5.14.2.2, and 5.14.2.3, GC cores were taken at several undisturbed sediment stations throughout the GER and BEL Trial and Reference Sites, which are each complemented by MUC cores for the recovery of surface sediments. Based on this sample collection, the undisturbed/natural spatial variation in geochemical conditions and processes in the sediments as well as element fluxes across the sediment-water and sedimentation rates will be investigated in cooperation by AWI, JUB, BGR, GEOMAR and NIOZ as fundamental baseline studies for the evaluation of the potential mining-related impact. In order to properly study the lesser known Belgian working area with regard to undisturbed/natural geochemical conditions in the sediments, 5 GC cores were taken inside and in close proximity to the BEL Trial Site. In order to cover the variability of geochemical conditions in sediments potentially impacted by a large-scale mining trial, up to 5 MUC cores were taken inside and in close proximity to the GER and BEL Collector Sites (Fig. 5.14.2.1) as well as in the areas of suggested plume settling (Plume Impact Sites). One GC and one MUC station were taken before the dredge experiment in the GER Dredge Site, and in total 8 MUC stations and 3 ROV-PUC deployments after the dredge experiment (after one day, two days, and 30-35 days), within clearly visible tracks, plume-covered tracks as well as in areas of apparent visual thin and thick sediment drape (Fig. 5.14.2.3).

Furthermore, two GC cores were retrieved from karst structures within the Belgian area in order to test for active fluid flow. In addition, one GC core (complemented by a ROV-PUC) was retrieved from a nodule-free seafloor area to the west of the GER Trial and Reference Sites (117°22,946'W 11°50,981'N), which is hereafter referred to as the “No-nodule Site”. These nodule-barren area will not necessarily be avoided during industrial mining activities, and thus, geochemical baseline studies in order to be able to assess the consequences of potential mining-related activities are needed.

Fig. 5.14.2.1: Locations of MUC and GC cores sampled for geochemistry in the GER TRIAL site (left; collector impact area marked in grey) and the GER REFERENCE site (right).

Fig. 5.14.2.2: Locations of MUC and GC cores sampled for geochemistry in the BEL TRIAL (collector impact area marked in grey) and the BEL REFERENCE site.

Fig. 5.14.2.3: Locations of MUC and GC cores sampled for geochemistry in the GER DREDGE site before and after the sediment resuspension experiment. Dark green indicates thick sediment cover and grey represents thin sediment cover after the dredge experiment.

8.6.3 Methods

The GC sediment cores were cut into 1 m segments on deck and immediately transferred into the cold room at temperatures of approximately 4°C (Fig. 5.14.3.1). After 12 h of equilibration in the cold room, oxygen measurements were performed. Hereafter, the GC cores were cut open and the working half was transferred back into the cold room for the sampling of pore water and sediment by AWI, JUB, BGR and GEOMAR, while the archive half was stored at 4°C (see Ch. 7.8 for sampling details).

Fig. 5.14.3.1: Left: Freshly retrieved GC core on deck. Middle left: Cutting of the GC core into 1-m sections on deck. Middle right: Transport of 1-m sections into the cold room at 4°C. Right: Freshly opened GC core.

5.14.3.1 Porewater and sediment geochemistry

Immediately after core recovery, the multi-corer (MUC) and push-corer (PUC) sediment cores sampled by AWI, GEOMAR and NIOZ were transferred into the cold room at a temperature of approximately 4°C. One MUC/PUC core was used for the retrieval of the supernatant bottom water as well as the pore water and the later determination of solid-phase iron/manganese species. One parallel MUC/PUC core was separately used for (1) oxygen measurements, (2) sediment sampling for the later determination of sediment porosity and total organic/inorganic carbon, nitrogen and sulfur (CNS) contents as well as the performance of total acid digestions for (3) the later measurement of radionuclides (Th, Pb, Ra) and major element contents. The pore water of all MUC/PUC and GC cores was extracted by means of rhizons with an average pore size of 0.1 μM (Seeberg-Elverfeldt et al., 2005). In order to allow for high resolution sampling of the MUC/PUC cores without mixing of the pore water of different depths, all MUC/PUC cores were sliced, the sediment slices were transferred into a 50 mL Falcon tube and then sampled by means of rhizons. Sampling intervals of pore water and sediment for the MUC/PUC cores are presented in Figure 5.14.3.2. Porewater and sediment sampling for the GC cores was performed every 20 cm. In order to avoid any dilution or oxidation during the pore-water sampling by rhizons, the first mL of the freshly extracted pore water was discarded.

Shipboard analyses include the determination of oxygen and nutrients such as nitrate, nitrite, ammonium, phosphate and silica in the pore water by AWI. Porewater samples were stored at 4°C

for the later determination of the isotopic composition of dissolved Sr at GEOMAR as well as the concentration of dissolved cations and dissolved inorganic carbon (DIC) at AWI. Sediment samples were stored at 4°C for the determination of total organic/inorganic carbon, nitrogen and sulfur (CNS) and sediment porosity at GEOMAR as well as radionuclides (^{230}Th , ^{210}Pb , ^{226}Ra) at NIOZ and AWI. Porewater-extracted sediment samples were stored at -20°C for the later determination of the iron/manganese speciation and isotopic composition.

Fig. 5.14.3.2: Slicing scheme for MUC and PUC cores (left) and rhizon sampling on MUC/PUC samples (middle) and GC (right). (Photos: Jessica Volz)

Ex-situ oxygen (O_2) concentrations in the supernatant bottom seawater of some MUC cores were determined using Winkler titration by AWI in order to test whether the bottom water was contaminated with water from the upper water column during retrieval of the MUC, which would bias the dissolved oxygen concentrations at the sediment-water interface as well as in the sediment significantly. The iodometric titration after Winkler (1888) is performed using a multi-step oxidation of dissolved oxygen to iodine using the iodide ion in presence of an alkaline manganese(II) ion solution, while the amount of generated iodine is then determined by titration with a standard thiosulfate solution (Grasshoff, 1999). The supernatant bottom water was retrieved about 2 h after MUC retrieval onboard, once in-situ temperatures of about 4°C were reached. For the titration at room temperature, a Titrisol® sodium thiosulfate solution ($\text{Na}_2\text{S}_2\text{O}_3$, 0.1N, Merck) was used with a 775 Dosimat (Metrohm). Sodium thiosulfate was added until the titrated solution reaches a light straw color. Subsequently, 100 μL of a zinc iodide starch solution (ZnI_2 , p.a., Merck) was added, which gives the titrated solution a deep blue color. Sodium thiosulfate was added until the end-point, a clear solution, was reached. Several blanks were measured using local bottom water, which was flushed with Argon for about 30 min and then treated after the same procedure as described above. If the results of this measurements indicated that the bottom water was not contaminated with water from the upper water column during MUC retrieval, ex-situ oxygen measurements using amperometric Clark-type oxygen sensors in the sediments were performed.

Ex-situ oxygen measurements (O_2) were performed on MUC and GC cores using amperometric Clark-type oxygen sensors with an internal reference and equipped with a guard cathode (Revsbech and Jørgensen, 1986) according to the procedure described by Ziebis et al.

(2012) and Mewes et al. (2014). The electrodes (Unisense, Denmark) are made of glass with a 6 cm long tip that was inserted into a hyperdermic needle (diameter 1.1 mm, length 50 mm) and had a response time shorter than 10s. Signals were amplified and transformed to mV by a picoamperemeter, digitalized by an analogue/digital converter (ADC 216, Unisense, Denmark) and recorded using the software PROFIX (Unisense, Denmark). For the two-point calibration of the oxygen sensors, Ar-flushed (0% oxygen saturation) and air-purged (100% oxygen saturation) local bottom water was used. Measurements were recorded at each sampling point for 2–3 min and mean oxygen saturation values were taken when signals were stable to calculate the depth profiles. High-resolution (1 mm) vertical profiles of oxygen concentrations across the sediment/water interface were accomplished for MUC cores by use of a micromanipulator down to a maximum sediment depth of 5–6 cm. For oxygen measurements in deeper parts of the MUC core as well as for all GCs, holes were drilled through the walls of the core liners in intervals of 1 cm for MUCs and of 5 cm for GCs for the insertion of the microelectrode. During the measurement, usually two sensors of different sensitivities were used in parallel.

A QuAatro continuous segmented flow analyzer (Seal Analytical) was used by AWI for the simultaneous determination of dissolved **nitrate, nitrite, phosphate and silica** concentrations and the separate determination of dissolved **ammonia** concentrations in the pore water. For the determination of nitrate, nitrite, phosphate and silica, 1.3 mL of freshly extracted untreated pore water was analyzed upon 3-fold dilution, while the system was constantly flushed with nitrogen. For the measurement of total NO_x (nitrate + nitrite) concentrations a copperized cadmium reduction coil was used where nitrate is reduced to nitrite at pH8 and measured photometrically at 520 nm. Furthermore, nitrite was analyzed separately where it reacts under acidic conditions with sulphanilamide and measured photometrically at 520 nm. Nitrate concentrations were determined by subtracting measured nitrite from total NO_x (nitrate + nitrite) concentrations. Phosphate (PO₄³⁻) was determined using the molybdenum blue method (Grasshoff et al., 1999). For this, an ammonium molybdate solution was added to the pore water aliquot and spiked with an ascorbic acid solution. The phosphomolybdate complex was reduced to molybdenum blue and measured photometrically at 880 nm. Silica (SiO₂) was measured photometrically at 820 nm as a silica molybdate complex.

Ammonium (NH₄⁺) was separately analyzed in untreated pore-water splits upon 3-fold dilution during SO268/1 and in untreated undiluted pore-water splits of 3 mL during SO268/2 fluorimetrically using the ortho-phthalaldehyde (OPA) method, while the system was constantly flushed with nitrogen. In order to evaluate the accuracy of the measurement, four different certified reference materials for nutrients in seawater (RMNS) were analyzed, including KANSO CRM Lot BZ, CJ, CD (KANSO CO., LTD).

Pore-water cations (Al, Ba, Ca, Mg, Mn, Fe, Si, P and more) will be analyzed in the home-laboratory at AWI using inductively coupled plasma optical emission spectrometry (ICP-OES). Subsamples of approximately 1 mL of pore water were acidified with 25 µL double sub-boiling distilled hydrochloric acid (HCl).

Pore water for the analysis of **sulfate (SO₄²⁻), chloride (Cl⁻)** and the **isotopic composition of dissolved Sr** were collected for shore-based analyses at AWI and GEOMAR, respectively, and stored untreated at 4°C.

Aliquots for **total alkalinity (TA)** were taken from 0.02 μm PES syringe filtered samples from JUB (see Ch. 8.6.3.2 for a description), except for cores 185 MUC and 200 MUC, where porewater sampled with rhizons was used. The TA of the porewater was determined by titration with 0.02 N HCl using a mixture of methyl red and methylene blue as indicator. The titration vessel was bubbled with nitrogen to strip any CO_2 produced during the titration. The IAPSO seawater standard was used for calibration. For an overview of cores analyzed for TA see Table 5.14.3.2.

Sediment samples for the analysis of radionuclides were collected from MUC/PUC cores and were stored at 4°C until analysis at AWI (^{230}Th) and NIOZ (^{210}Pb , ^{226}Ra). Parallel sediment samples were taken for the determination of **porosity and total organic/inorganic carbon, sulfur and nitrogen contents** from MUC/PUC and GC cores and stored at 4°C until analysis at GEOMAR.

Sediment samples for the determination of **solid-phase iron/manganese species** were collected from MUC/PUC and GC and stored in 50 mL centrifuge tubes and cut-off 10 mL syringes, respectively, and stored at -20°C until analysis at AWI.

Tab. 5.14.3.1: Sites investigated geochemically by AWI, GEOMAR (Sr-isotopes, PP/CNS) and NIOZ (^{210}Pb , ^{226}Ra) during cruise SO268 Leg 1 and 2 showing parameters analyzed on board (O_2 , NH_4 , NO_3 , Si, PO_4) by AWI and aliquots of samples stored and conserved.

[illegible]

075-1_MUC-18	18											x		x
078-1_GC-04	/	x	x	x		x	x	x	x	x	x		x	x
079-1_MUC-19	18	x										x		x
079-1_MUC-19	20		x	x		x	x	x	x	x	x		x	
084-1_GC-05	/	x	x	x		x	x	x	x	x	x		x	x

Station # SO268-2_	Core #	O ₂	NH ₄	NO ₃	Si	PO ₄	ICP-OES	DIC	IC	Sr-Isotopes	²³⁰ Th, ²¹⁰ Pb, ²²⁶ Ra	PW-extr. Sed.	PP/CNS
104-1_GC-06	/	x	x	x	x	x	x	x	x	x		x	x
106-1_MUC-22	9		x	x	x	x	x	x	x	x		x	
106-1_MUC-22	19	x									x		x
122-1 TVMUC-24	2		x	x	x	x	x	x	x	x		x	
122-1 TVMUC-24	3	x									x		x
124-1_ROV-18 PUC	13										x		x
124-1_ROV-18 PUC	16										x		x
125-2 TVMUC-26	4	x									x		x
125-2 TVMUC-26	5		x	x	x	x	x	x	x	x		x	
130-1_GC-07	/		x	x	x	x	x	x	x	x		x	x
143-1_GC-08	/	x	x	x	x	x	x	x	x	x		x	x
144-1_GC-09	/	x	x	x	x	x	x	x	x	x		x	x
157-1_GC-10	/	x	x	x	x	x	x	x	x	x		x	x
158-1_ROV-24 PUC	23										x		x
158-1_ROV-24 PUC	65		x	x	x	x	x	x	x	x		x	
158-1_ROV-24 PUC	51		x	x	x	x	x	x	x	x		x	
158-1_ROV-24 PUC	81	x									x		x
179-1_MUC-34*	17												x
184-1 TVMUC-35	4	x									x		x
184-1 TVMUC-35	17		x	x	x	x	x	x	x	x		x	
184-1 TVMUC-35	19	x									x		
185-1 TVMUC-36	14		x	x	x	x	x	x	x			x	
186-1 TVMUC-37	8	x									x		x
186-1 TVMUC-37	10		x	x	x	x	x	x	x			x	
193-1_ROV-30 PUC	8		x	x	x	x	x	x	x		x	x	
193-1_ROV-30 PUC	18		x	x	x	x	x	x	x		x	x	
193-1_ROV-30 PUC	38		x	x	x	x	x	x	x		x	x	
197-1_ROV-31 PUC	7		x	x	x	x	x	x	x		x	x	
197-1_ROV-31 PUC	17		x	x	x	x	x	x	x		x	x	
197-1_ROV-31 PUC	25		x	x	x	x	x	x	x		x	x	
197-1_ROV-31 PUC	36		x	x	x	x	x	x	x		x	x	
198-1 TVMUC-38	16		x	x	x	x	x	x	x			x	
198-1 TVMUC-38	19										x		x
200-1 TVMUC-40	8	x									x		x
200-1 TVMUC-40	9		x	x	x	x	x	x	x			x	
207-1 TVMUC-41	9	x									x		x
207-1 TVMUC-41	7		x	x	x	x	x	x	x			x	

*Core SO268-2_179 MUC only sampled for porosity for Dr. Torben Stichel (AWI)

5.14.3.2 Trace metal geochemistry

Onboard, JUB and BGR collected pore water samples for trace metals (TM) including rare earth elements and yttrium (REY), dissolved organic carbon (DOC), dissolved and particulate amino acids, nitrogen isotopes, and copper-binding ligands. At few selected stations, large volume pore-water samples for rare earth element and yttrium (REY) analyses were collected.

MUCs, ROV-PUCs and GCs for TM and DOC were sampled with HNO₃ and deionized water (DI) pre-cleaned plastic spoons into HNO₃ and DI pre-cleaned 50 mL centrifuge vials in the cold room of RV SONNE at approx. 4-7 °C. MUCs and ROV-PUCs were sliced in 2 cm layers except for samples in the plume impact area after the sediment suspension experiment, where the upper layer was resolved in 0.5 to 1 cm layers in order to sample the resettled plume material. GCs were sampled after eye inspection at interesting layers, usually ca. 15 samples per core. Samples were then centrifuged at 4°C, 3500 rpm for 40 minutes to separate the pore water from the sediment. The supernatant was subsequently filtered through 0.2 µm polyethersulfone (PES) syringe filters (Fig. 8.6.3.3) that were pre-cleaned with DI during Leg 1 and with 0.1 M suprapure HCl and DI during Leg 2. The syringes were pre-cleaned with 0.1 M suprapure HCl and DI. Selected samples were also filtered through 0.02 µm Anotop syringe filters, to separate the dissolved metal pool < 0.2 µm into further size pools, giving more information about colloiddally bound metals such as Fe, Mn, Cu, and Co. Anotop filters were cleaned with DI during Leg 1 and 0.015 M suprapure HCl and DI during Leg 2, except for some 143 GC and 144 GC, where they were only cleaned with DI. Filtration was performed under a clean bench, except for GC samples from suboxic core parts – then the filtration was performed in a glove tent filled with nitrogen (Fig. 8.6.3.4). Syringes were rinsed with sample first, which was discarded, and the first drops of sample filtered through the syringe filter were also discarded.

Fig. 5.14.3.3: From sediment to clear pore water: sampling in the cold room, centrifugation, syringe filtration. (Photos: Timm Schoening)

Fig. 5.14.3.4:

Left: Filtration in the glove tent filled with nitrogen. (Photo: Sophie Paul)

Right: Pore water sampling using rhizons.

Samples for TM were acidified with 1.5 µL ultrapure HCl per 1 mL sample. **DOC** samples were acidified with 1 µL ultrapure HCl per 1 mL sample. TM and DOC samples were stored at ca. 4°C. The centrifuged sediment samples were kept cool for TM analyses in the JUB lab, where they will be pressure-acid digested and analyzed for major and trace elements with inductively coupled plasma optical emission spectrometry and mass spectrometry (ICP-OES and ICP-MS).

For **grain size distribution** and **mineralogical analyses**, original, not centrifuged sediment was kept from MUC and ROV-PUC samples of the sediment suspension experiment.

For **REY** analyses, pore water from two to eight MUC liners from the same deployment were pooled after 0.2 µm PES filtration as described above to have large volume samples available for salt matrix removal and preconcentration prior to REY measurements with inductively coupled plasma mass spectrometry (ICP-MS) at JUB. Bottom water, 0-2 cm, and 2-10 cm layers were pooled for REY at station 018 MUC and bottom water and 0-10 cm at station 067 MUC during Leg 1. During Leg 2, samples were taken for bottom water, and then pooled in 2 cm steps for the upper 4 cm and in 4 cm steps below (139 MUC, 172 MUC and 179 MUC) and from 0-4 cm and 4-16 cm for 178 MUC, for 178 MUC filtering the sample through 0.2 µm PC filters cleaned with 0.1 M suprapure HCl and DI using a filter tower. REY pore water samples were acidified with ultrapure HCl using 1.2-1.5 µL per 1 mL sample.

Samples for **dissolved amino acids (DAA)** and **N-isotopes** were taken with rhizons (pore size 0.12-0.18 µm, from Rhizosphere) from the MUCs and ROV-PUCs in the cold room of RV SONNE (Fig. 8.6.3.4). New rhizons were cleaned with DI and used rhizons were cleaned with 0.1 M suprapure HCl and DI before reusing them. Bottom water as well as four to six depths per core were sampled. The first mL of samples was used to rinse the syringe and was subsequently discarded. Following the rhizon pore water extraction, corresponding sediment depths were sampled with plastic spoons for solid-phase amino acids. All amino acid and N-isotope samples were frozen at -20°C and will be analyzed at the University of Hamburg and the Helmholtz Centre Geesthacht, Institute for Coastal Research, respectively.

Bottom water and pore-water samples for **copper-binding ligands** were also taken with rhizons (pore size 0.12-0.18 µm, from Rhizosphere) in the cold-room of RV SONNE (Fig. 8.6.3.4). New rhizons were cleaned with DI and used rhizons were cleaned with 0.1M suprapure HCl and DI before reusing them. The first mL of samples was used to rinse the syringe and was subsequently discarded. The pore water was pooled from three depths in the upper ca. 10 cm of the MUC and between ca. 15-25 cm. Samples were frozen at -20°C and will be analyzed by adsorptive cathodic stripping voltammetry (AdCSV) at JUB.

Tab. 5.14.3.2: Overview of MUC, ROV-PUC, and GC stations sampled by JUB and BGR for sediment and pore water. TM = trace metals (pore water and solid phase), DOC = dissolved organic carbon, AA = amino acids (dissolved and particulate), N-iso. = N-isotopes, Cu-L = copper binding ligands, REY = rare earth elements and yttrium, orig. sedi. = original sediment, not centrifuged, TA = total alkalinity

Station SO268	MUC Liner	Latitude (N)	Longitude (W)	Depth [m]	TM 0.2 µm	TM 0.02 µm	DOC 0.2 µm	DOC 0.02 µm	AA	N- iso.	Cu-L	REY 0.2 µm	REY 0.02 µm	orig. sedi.	TA	work area
005-1_TVMUC-01	15	11° 55.872'	117° 01.588'	4081	x		x									GERMAN TRIAL SITE
	19										x					
	20								x	x						
016-1_GC-01		11° 55.863'	117° 01.537'	4083	x		x									
018-1_MUC-04	15	11° 55.454'	117° 01.039'	4092	x	x	x	x								
	16															
	17						x					x				
	18															
	19															
037-1_GC-02		11° 50.708'	117° 03.593'	4132	x	x	x									GERMAN REFERENCE SITE
038-1_MUC-07	11	11° 50.686'	117° 03.612'	4130	x	x	x									
	20								x	x						GERMAN TRIAL SITE
043-1_MUC-10	17	11° 55.834'	117° 01.346'	4082	x		x									
056-1_MUC-13	17	14° 06.599'	125° 52.099'	4501	x		x									BELGIAN TRIAL SITE
	19										x					
	20								x	x						
065-1_MUC-14	15	14° 06.772'	125° 52.297'	4495	x		x									
	17								x	x						
	19										x					

Station SO268	MUC Liner	Latitude (N)	Longitude (W)	Depth [m]	TM 0.2 µm	TM 0.02 µm	DOC 0.2 µm	DOC 0.02 µm	AA	N- iso.	Cu-L	REY 0.2 µm	REY 0.02 µm	orig. sedi.	TA	work area
067-1_MUC-16	19	14° 06.292'	125° 51.678'	4514	x		x									BELGIAN TRIAL SITE
	18								x							
	15						x					x	x			
	16															
	20															
071_GC-03		14° 06.696'	125° 52.368'	4486	x		x					x				
074-1_MUC-17	16	14° 08.105'	125° 51.819'	4509	x	x	x									
	19										x					
	20								x							
075-1_MUC-18	19	14° 06.992'	125° 52.544'	4495	x		x									
078-1_GC-04		14° 08.125'	125° 51.817'	4502	x		x					x				
079-1_MUC-19	16	14° 02.187'	125° 55.471'	4535	x	x	x									BELGIAN REFERENCE SITE
	17								x		x					
084-1_GC-05		14° 02.163'	125° 55.471'	4545												GERMAN DREDGE SITE (before)
104-1_GC-06		11° 51.780'	117° 00.742'	4120	x		x					x			x	
106-1_MUC-22	7	11° 51.773'	117° 00.740'	4122	x	x	x								x	
	17								x	x						GERMAN DREDGE SITE (after)
122-1_TVMUC-24	4	11° 51.773'	117° 00.790'	4124	x	x	x								x	
	7								x	x						
124-1_ROV-18-PUC	17	11° 51.789'	117° 00.767'	4127	x	x	x								x	
	23	11° 51.789'	117° 00.767'	4127					x	x						
	45	11° 51.788'	117° 00.728'	4126	x	x	x									
	81	11° 51.788'	117° 00.728'	4126					x	x						
125-2_TVMUC-26	3	11° 51.793'	117° 00.797'	4120	x	x	x								x	
	12													x		BELGIAN TRIAL SITE
130-1_GC-07		14° 05.217'	125° 50.053'	4487	x		x								x	
136-1_MUC-28	4	14° 01.505'	125° 55.234'	4542	x	x	x	x							x	

Station SO268	MUC Liner	Latitude (N)	Longitude (W)	Depth [m]	TM 0.2 µm	TM 0.02 µm	DOC 0.2 µm	DOC 0.02 µm	AA	N- iso.	Cu-L	REY 0.2 µm	REY 0.02 µm	orig. sedi.	TA	work area
	15															BELGIAN REFERENCE SITE
139-1_MUC-30	11	14° 01.897'	125° 55.003'	4524			x	x				x	x			
	12															
	13															
143-1_GC-08		14° 06.560'	125° 53.398'	4502	x	x	x								x	BELGIAN TRIAL SITE
144-1_GC-09		14° 06.126'	125° 51.550'	4522	x	x	x								x	
157-1_GC-10		11° 50.976'	117° 22.956'	4275	x	x	x								x	NO NODULE AREA
158-1_ROV-24-PUC	8	11° 50.971'	117° 22.930'	4278	x	x	x								x	
171-1_MUC-31	4	11° 51.003'	117° 03.323'	4122	x	x	x	x								GERMAN REFERENCE SITE
	5															
172-1_MUC-32	9	11° 50.447'	117° 03.314'	4134			x	x				x	x		x	
	19															
178-1_MUC-33	7	11° 50.456'	117° 03.323'	4131			x					x				
	8															
	9															
	14															
	15															
	16															
	19															
	20															

Station SO268	MUC Liner	Latitude (N)	Longitude (W)	Depth [m]	TM 0.2 µm	TM 0.02 µm	DOC 0.2 µm	DOC 0.02 µm	AA	N- iso.	Cu-L	REY 0.2 µm	REY 0.02 µm	orig. sedi.	TA	work area
179-1_MUC-34	14	11° 50.367'	117° 03.578'	4142								x				GERMAN REFERENCE SITE
	15															
184-1_TVMUC-35	7	11° 51.785'	117° 00.701'	4116							x					
	11				x		x								x	

	13														x		GERMAN DREDGE SITE (after)	
185-1_TVMUC-36	14	11° 51.774'	117° 00.760'	4121												x		
	15																	
186-1_TVMUC-37	9	11° 51.793'	117° 00.747'	4117	x	x	x									x		
	11																	
	13				x rhi- zons					x	x	x						
193-1_ROV-30 PUC	16	11°51.789'	117° 00.774'	4127	x		x									x		
197-1_ROV-31 PUC	20	11°51.814'	117°00.787'	4128	x		x									x		x
	27	11°51.786'	117°00.766'	4128												x		
	51	11°51.789'	117°00.782'	4128	x		x									x		x
	65	11°51.778'	117°00.764'	4128	x		x									x		x
198-1_MUC-38	14	11° 51.763'	117° 00.715'	4146	x	x	x									x		x
200-1_TVMUC-40	9	11° 51.761'	117° 00.777'	4129													x	
207-1_TVMUC-41	6	11° 51.790'	117° 00.789'	4118	x	x	x											
	8				x rhi- zons					x	x	x						
	10											x	x					

5.14.3.3 Passive samplers for trace metal geochemistry

In addition to directly sample pore water and seawater BGR and JUB deployed passive sampler probes (diffusive gradients in thin film – DGT, Fig. 5.14.3.5), which accumulate labile bound dissolved compounds from solution over time. This mainly includes the bioavailable fractions of metals of interest, which might affect the biological systems. With this sampling technique, we aim to obtain both background concentrations in seawater and pore water as well as element concentrations/fluxes in response to sediment suspension and re-settling in the Dredge area. We will further use the results for a method comparison with data obtained from 0.2 μm and 0.02 μm pore water and seawater filtration. The probes are provided by DGT® Research, Lancaster, UK, and consist of a layer of binding agent impregnated in a hydrogel to accumulate the solutes. A diffusion layer comprising a diffusive hydrogel and a filter membrane overlies the binding layer. Ions diffuse through the filter and diffusive gel and bind to the binding layer. DGT can be used for any dissolved species for which there is a selective binding agent. During this cruise, we used probes with a chelating resin for elements such as Fe, Mn, Cu, Co, Cr, Ni, Pb, Zn, Cd, and REY. Probes with a titanium oxide resin are used to accumulate oxyanions such as Mo, V, and As (V). For Hg and As (III), we used probes with a 3-mercaptopropyl functionalized silica gel binding layer. For pore water sampling we applied sediment probes in MUC cores, and for seawater sampling we used holders mounted on moored platforms. The passive sampling technique measures the mean flux of labile species to the device, which can be converted into the mean concentration at the interface between the device surface and the sediment or seawater during the deployment. DGT is based on the application of Fick's law of diffusion. Once the mass of the analyte has been determined, the time-integrated concentration of the analyte can be determined knowing the diffusion coefficient, the deployment time, and the area of the DGT membrane.

The passive sampling thin film technique provides averaged in situ concentrations of elements during the time of deployment. As the accumulated element concentrations increase with exposure time to solution, long-term deployment times overcome low trace metal concentrations in seawater, which are in pico-to nanomolar range. The technique further minimizes metal contamination we typically face during point sampling.

Fig. 5.14.3.5: DGT passive sampling unit and principle of sampling.

We typically deployed two different types of DGTs (for transition metals and oxyanions, respectively), and used three DGT units of the same type at each position, mounted in polyacryl plates (Fig. 5.14.3.6). The plates were prepared under the clean bench in the lab. The DGT probes

were rinsed with DI before and after sampling. During handling of the holder plates while deployment/recovery on deck there is a risk of contamination from air and gears. Hence, the plates were covered with clean plastic bags after fixing them on the respective platform until deployment. We deployed the DGT devices in the German license area for different purposes (see Tabs. 5.14.3.3., 5.14.3.4, and 5.14.3.5):

Long-term deployment in seawater (about 1 year): As basis we used the BGR moorings that are deployed for approximately one year in the German contract area (see also Ch. 5.4). Here, we will be able to obtain baseline time-averaged elemental concentrations in the water column. The DGT sampler sets are fixed on both sediment traps of the long double-mooring deployed east of the Trial area (204 MOOR), at 7 mab and 555 mab, respectively, and at the rope of two of the short ADCP moorings (one in the Dredge area, one NW of Trail area), at about 22 mab. One DGT set consists of three probes with chelating resin plus three probes with titanium oxide resin.

Short-term deployment in seawater (about 4 weeks): DGT sampler sets were mounted at three of the sensor platforms (about 0.5 mab) that were arranged at the seafloor in the dredge sediment suspension area for a period of several weeks (Ch. 5.19). To minimize metal contamination from the sensor platform, we wrapped the frames in parafilm. We additionally fixed two DGT sampler sets at the sediment traps of the short-term moorings deployed in the German license area (about 6 mab) further away from the dredge area in about the same time window (see Ch. 5.4). These sites are likely to be unaffected by sediment resuspension due to the dredge activities. By comparing the time-averaged concentrations of both settings, we may be able to evaluate the impact of sediment suspension on the bioavailable fraction of metals in bottom seawater after sediment suspension.

At 7, DGT stripes were placed in MUC **surface sediment cores**. The overlying water was removed except for a few cm, and the 15 cm long stripes were pushed into the cores from the top and left there for approx. 12-15 hours (Fig. 5.14.3.6). The upper rim stayed approx. 1 cm outside the sediment. The stripes will provide high-resolution profiles of pore water concentrations and fluxes. After sampling, the stripes were carefully removed from the core and the position of the sediment surface was marked. Remaining sediment was rinsed off and the stripes were placed in sealed plastic bags. At each of the MUC stations, pore water was also sampled by sediment centrifugation and subsequent filtration (see Ch. 5.14.3.2), which allows for a comparison of elemental concentrations in the $<0.2\ \mu\text{m}$ / $<0.02\ \mu\text{m}$ filtered size fractions of pore water and those obtained from passive samplers. We applied DGT stripes at two stations in the Belgian reference area, and at one station in the German reference area. In the Dredge area, stripes were deployed at one station before the experiment (for baseline fluxes and concentrations), and at 3 stations after the experiment, for impact-induced changes of fluxes and concentrations (Tab. 5.14.3.5). At some of the stations, we placed two stripes with the same resin in parallel MUC liners. After recovery, all DGT units were rinsed with DI, placed in plastic bags and kept at 4°C.

For water column sampling, one set of field blanks (2x3 holders, see above) has been prepared, which were handled the same way as the sample devices: Taken out of their plastic bags, mounted to holder plate, covered with plastic bags, taken on deck and fixed to a deployment platform (192 LANDER, which was deployed for 24 hours), taken back to lab after end of station, demounted, rinsed and placed back into original bags. Field blanks for sediment sticks were prepared in the cold room, with the same treatment as the sample sediment sticks (DI rinse, storage in plastic

bags). In the home laboratory, the DGT membranes will be removed from the holders and subsequently leached with either 1 ml of 1M HNO₃ (for transition metals), or 1 ml of 1M NaOH (for oxyanions). The sediment stick membranes will be cut at similar intervals as the associated pore water sampling (see Ch. 5.14.3.2).

Fig. 5.14.3.6: Passive samplers mounted on sensor platforms (top), on a sediment trap (lower left), on a ADCP mooring for long-term deployment (lower middle), and a passive sampler stripe placed into surface sediment in a MUC liner (lower right).

Fig. 5.14.3.7 Distribution of DGT samplers mounted on three of the sensor platforms (about 0.5 mab) that were arranged at the seafloor in the dredge sediment suspension area for a period of several weeks.

Tab. 5.14.3.3: Passive sampler deployments dredge area.

Sample ID SO268	Platform	Lat [N]	Lon [W]	depth [mab]	start time 2019	end time 2019	deployment platform	recovery platform	DGT type	Remarks
PS-1	RBINS-PFM-02	11°51.752'	117°0.666'	0.5	05.04. 15:30:00	12.05.	098- 1_LANDER-09	187- 1_LANDER-21	3 x Transition metals [LSNM-NP], 3 x oxyanions [LSNT-NP]	Dredge impact area, deployed during 111 ROV
PS-2	NIOZ-PFM-03	11°51.796'	117°0.738'	0.5	08.04. 11:00:00	14.05.	109- 1_LANDER-11	192- 1_LANDER-30	3 x Transition metals [LSNM-NP], 3 x oxyanions [LSNT-NP]	Dredge impact area, deployed during 111 ROV, re-positioned 1 day after dredging during 124 ROV
PS-3	RBINS-PFM-01	11°51.951'	117°0.774'	0.5	08.04. 11:00:00	14.05.	109- 1_LANDER-11	192- 1_LANDER-30	3 x Transition metals [LSNM-NP], 3 x oxyanions [LSNT-NP]	Dredge impact area, deployed during 111 ROV
PS-4	Sediment trap	11° 19.922'	116° 50.347'	6	09.04. 13:30:00	11.05.	114- 1_MOOR_05	114- 1_MOOR_05	3 x Transition metals [LSNM-NP], 3 x oxyanions [LSNT-NP]	approx. 60 km SSE of Dredge area
PS-5	Sediment trap	11° 47.442'	116° 57.846'	6	12.04. 14:30:00	11.05.	123- 1 MOOR 07	123- 1 MOOR 07	3 x Hg, As [LSNP-AB]	approx. 10 km SE of Dredge area

Tab. 5.14.3.4: Passive sampler deployments long-term mooring.

Sample ID	Platform	Lat [N]	Lon [W]	Depth [mab]	Start time 2019	DG type
MOOR_PS-3	201-1_MOOR-09	11° 51.798'	117° 00.753'	22	15.05. 15:00:00	3 x Transition metals [LSNM-NP], 3 x oxyanions [LSNT-NP]
MOOR_PS-1	203-1_MOOR-11	11° 56.813'	117° 02.251'	22	15.05. 17:30:00	3 x Transition metals [LSNM-NP], 3 x oxyanions [LSNT-NP]
MOOR_PS-2	204-1_MOOR-12	11° 55.311'	117° 03.465'	555	15.05. 23:00:00	3 x Transition metals [LSNM-NP], 3 x oxyanions [LSNT-NP]
MOOR_PS-5	204-1_MOOR-12	11° 55.311'	117° 03.465'	7	15.05. 23:00:00	3 x Transition metals [LSNM-NP], 3 x oxyanions [LSNT-NP]
MOOR_PS-6	204-1_MOOR-12	11° 55.311'	117° 03.465'	555	15.05. 23:00:00	3 x Transition metals [LSNM-NP], 3 x oxyanions [LSNT-NP]

Tab. 5.14.3.5: Passive sampler deployments MUC stations.

Sample ID	Station ID	Latitude [N]	Longitude [W]	Liner	Duration deployment	of DGT type	Remarks
MUC_PS-1	106-1_MUC-22	11° 51.773'	117° 00.740'	Liner 16	15 min	1 x Transition metals [LSPM_NP]	GER Dredge (before)
MUC_PS-2	125-1_TVMUC-25	11° 51.793'	117° 00.797'	Liner 18	18 min	1 x Transition metals [LSPM_NP]	German Dredge area (imm. after)
MUC_PS-3	125-1_TVMUC-25	11° 51.793'	117° 00.797'	Liner 19	18 min	1 x oxyanions [LSPT_NP]	German Dredge area (imm. after)
MUC_PS-4	136-1_MUC-28	14° 01.505'	125° 55.234'	Liner 2	12 hours 5 min	1 x Transition metals [LSPM_NP]	BEL ref
MUC_PS-5	136-1_MUC-28	14° 01.505'	125° 55.234'	Liner 3	11 hours 54 min	1 x Transition metals [LSPM_NP]	BEL ref
MUC_PS-6	136-1_MUC-28	14° 01.505'	125° 55.234'	Liner 12	11 hours 55 min	1 x oxyanions [LSPT_NP]	BEL ref
MUC_PS-7	136-1_MUC-28	14° 01.505'	125° 55.234'	Liner 18	11 hours 56 min	1 x oxyanions [LSPT_NP]	BEL ref
MUC_PS-8	139-1_MUC-30	14° 01.897'	125° 55.003'	Liner 7	12 hours	1 x Transition metals [LSPM_NP]	BEL ref
MUC_PS-9	171-1_MUC-31	11° 51.003'	117° 03.323'	Liner 1	13 hours 49 min	1 x Transition metals [LSPM_NP]	GER ref
MUC_PS-10	171-1_MUC-31	11° 51.003'	117° 03.323'	Liner 2	12 hours 45 min	1 x oxyanions [LSPT_NP]	GER ref
MUC_PS-11	171-1_MUC-31	11° 51.003'	117° 03.323'	Liner 3	12 hours 44 min	1 x oxyanions [LSPT_NP]	GER ref
MUC_PS-12	171-1_MUC-31	11° 51.003'	117° 03.323'	Liner 10	13 hours 56 min	1 x Transition metals [LSPM_NP]	GER ref
MUC_PS-13	186-1_TVMUC-37	11° 51.793'	117° 00.747'	Liner 12	12 hours	1 x Transition metals [LSPM_NP]	German Dredge area (weeks after)
MUC_PS-14	207-1_TVMUC-41	11° 51.790'	117° 00.789'	Liner 14	11 hours 55 min	1 x Transition metals [LSPM_NP]	German Dredge area (weeks after)

5.14.4 Preliminary results

GERMAN/BGR TRIAL AREA **GERMAN/BGR DREDGE AREA** **GERMAN/BGR REFERENCE AREA**

Fig. 5.14.4.1: Preliminary results for undisturbed/natural sediments from the German/GER Trial, Dredge and Reference sites.

Fig. 5.14.4.2: Preliminary results for undisturbed/natural sediments from the Belgian/BEL Trial and Reference sites.

Examples of undisturbed/natural shipboard pore-water results are provided below for one site each in the GER Trial, Dredge and Reference sites and in the BEL Trial and Reference sites (Figs. 5.14.4.1 and 5.14.4.2). Ex-situ oxygen concentrations for the study sites in the GER area show that the oxygen penetration depth (OPD) varies between the sites with throughout oxic conditions in the upper 5 m of sediment at the GER Trial site and an OPD of about 2 m at the GER Dredge site before the dredge experiment. In comparison, the OPD at the study sites in the BEL area is located at greater depth of about 3–4 m (note the different scale for oxygen in Fig. 5.14.4.1 for the GER sites and BEL sites). Under suboxic conditions in the sediments, nitrate concentrations slightly decrease with depth, such as at the GER Dredge site, which is in accordance with earlier studies (Mewes et al., 2014; 2016; Volz et al., 2018) and might be associated with the coupling of the Mn-N geochemical cycles (Mogollón et al., 2016).

In the upper 20 cm of the sediments, nitrite is released as a result of dissimilatory nitrate reduction. In the GCs, nitrite concentrations are mostly below detection limit, and therefore, the

data is not shown in Figs. 5.14.4.1 and 5.14.4.2. The nitrite concentrations at the BEL Trial site are significantly lower compared to the BEL Reference site indicating that the delivery and degradation rate of organic material may be lower at the BEL Trial site. Dissolved silica concentrations are considerably higher at the GER Dredge and reference sites as well as at the BEL reference site in comparison with the GER and BEL Trial sites, respectively, indicating a slight difference in sediment composition. First shipboard results for the evaluation of the impact of the dredge experiment in the German area on the sedimentary geochemical system are shown in Figure 5.14.4.2. One day after the dredge experiment, oxygen concentrations are lower in the disturbed surface sediments within the track as a result of sediment removal. One month after the dredge experiment, low oxygen concentrations in the disturbed sediments are being balanced out by diffusion from oxygen-rich bottom water into the sediment. Dissolved silica concentrations are higher at the freshly disturbed sediment surface 1 day after the disturbance due to the removal of the sediment, which is mostly balanced out already 1 month after the disturbance. Total alkalinity data do not indicate significant differences in the uppermost sediments before and after the dredge experiment.

Fig. 5.14.4.3: Preliminary results for disturbed sediments from the German/GER Dredge site.

5.15 Water Column Geochemistry

(J. Volz, I. Dohrmann, D. Köhler, S. Paul, A. Moje, K. Schmidt)

5.15.1 Objectives

Mining-related activities in the deep-sea are expected to create a sediment plume in the bottom waters, with sediment re-deposition and bottom blanketing in the vicinity of the mining site (e.g., Gillard et al., 2019) as well as the release of pore water into the water column. In order to (1) investigate the potential mining-induced transfer of particles and pore water into the overlying water column, and to (2) address the impact of sediment re-suspension and plume dispersal on geochemical processes in the water column and in the benthic layer, profound pre- and post-impact data on geochemical characteristics of the bottom water and the water column are required. As the collector trials by DEME-GSR could not take place as scheduled, we focused on collecting baseline data and sampling the bottom water shortly after the small-scale sediment plume experiment in the German Dredge area in order to quantify the particle transfer and pore water release into the water column.

Background water column sampling for dissolved radium isotopes (^{226}Ra , ^{228}Ra) and particles was performed using large-volume in-situ pumps by AWI. To complement pore water and sediment data (see Ch. 8.6) with respect to dissolved metal and organic carbon fluxes, bottom seawater were sampled with trace metal clean GoFlo bottles mounted on a CTD rosette water sampler in distances of 5 m to 200 m above seafloor (mab) (JUB and BGR). We here aim at investigating the background particulate and dissolved concentrations of organic carbon (DOC) and trace metals such as Fe, Mn, Co, Cu, Zn, Ni, Cd, V, Mo, Pb and REY in near-bottom seawater, and to address the distribution of these constituents between different physical and chemical species. Immediately after recovery, we applied different (ultra)filtration methods such as pressure filtration and cross-flow filtration with pore sizes between 800 nm and 2 nm, to obtain information on the elemental distribution of trace metals between suspended particles, organic and inorganic colloids, and the truly dissolved pool. In the CCZ, the bottom water and the sediment pore water in the upper decimetres are oxygenated and metal release from re-suspended surface sediment and pore water during mining is hence likely limited. An increase in colloidal-bound metal concentrations, however, can be expected, related to sorption of dissolved elements to suspended Mn oxide or Fe oxyhydroxide nanoparticles. During Leg 2, additional samples were taken at 5-8 different water depths through the whole water column with NISKIN bottles of the CTD, for general geochemical characteristics (major and minor elements, DOC, nutrients). The possible impact of the dredge experiment on the release of metals (Fe, Mn, Co, Cu, Zn, Ni, Cd, V, Mo, Pb and REY) and of dissolved/particulate organic carbon at the sediment-water interface in the bottom water was investigated during one CTD station.

During our transit to the first working area at the beginning of Leg 2, we crossed the surface expression of an ocean gyre (eddy) which had been formed off the coast of Central America six months earlier and was constantly moving westwards towards the German working area (see also Ch. 5.9). Such eddies are an important oceanographic phenomenon and are known to form local biogeochemical environments. In seafloor areas with future mining activities such eddies could potentially remobilize freshly settled plume sediment, related to their enhanced current velocities (Gillard et al., 2019). This makes them quite interesting for this project and we used the chance to

obtain more information in this regard. Four CTD stations with in situ pumps recording vertical ADCP profiles were deployed as E-W transect from the centre to the rim of the eddy, to record current directions and velocities, and to characterize its physico-chemical properties throughout the water column (see Ch. 5.16). Repeated CTD stations with water sampling at one of these locations provided the opportunity to investigate its temporal evolution and its potential footprint at the seafloor over a period of about 5 weeks. Water samples were here taken throughout the water column.

5.15.2 Water sampling methods and sample treatment

5.15.2.1 Radium sampling in the water column using in-situ pumps

Large volumes of water of up to 3233 liters were sampled by AWI using five in-situ pumps (Challenger Oceanic) for the analysis of dissolved radium isotopes (^{226}Ra , ^{228}Ra) in the water column (Fig. 5.15.2.1). The in-situ pumps were attached 15 m, 30 m, 60 m, 100 m and 200 m at the wire above the rosette water sampler/CTD. Once the rosette water sampler/CTD was at depth, the time-programmed in-situ pumps were pumping seawater for 3 h through 0.45 μM Pall Supor® membrane filters (AWI) or 0.2 μm PES filters (JUB/BGR) and through one or two consecutive MnO_2 -coated acrylic grooved fiber cartridges (for more details see Table 5.15.2.1). The acrylic fiber cartridges were coated with MnO_2 prior to cruise SO268 in the Marine Geochemistry lab at AWI after the procedure by Henderson et al. (2013). For the separate determination of dissolved ^{226}Ra concentrations in the water column, parallel water column samples of 1 L (filtered and unfiltered) were taken 200 m above the seafloor with the rosette water sampler and acidified with 1 mL of double sub-boiling distilled HCl. Before deployment, the cartridges were pre-soaked with tap water in order to ensure that the pumps were not running dry. After the retrieval of the in-situ pumps, all filters were stored in plastic bags at -20°C . The MnO_2 -coated acrylic grooved fiber cartridges were rinsed with MilliQ® and stored in plastic bags at 4°C until further analysis in the Marine Geochemistry lab at AWI.

Fig. 5.15.2.1: Left: Example of an in-situ pump equipped with two consecutive MnO_2 -coated fiber cartridges and the filter tower on top. Middle left: Deployment of the in-situ pump at the wire above the rosette water sampler/CTD. Middle right: MnO_2 -coated acrylic grooved fiber cartridges (black) and polypropylene fibers used as pre-filters only at station SO268-1_014 CTD. Right: Example of a 0.45 μM Pall Supor® membrane filter after in-situ pumping.

Tab. 5.15.2.1: Overview of CTD stations with in-situ pumps equipped with acrylic fiber cartridges for the sampling of dissolved Ra-isotopes and 0.45 µM Pall Supor® membrane filters or 0.2 µm PES membrane filters sampled by AWI and BGR/JUB.

Station SO268	Pump Nr.	meters above CTD frame	Ra	Filter	Water meter before pumping	Water meter after pumping	Volume [L]
014-1_CTD-02	ISP 1	15	1x	none	1620135	1620425	290
	ISP 2	30	1x	none	1435212	1435470	258
	ISP 7	60	1x	none	105216	105211	0
	ISP 4	100	1x	none	119870	121062	1192
	ISP 5	200	1x	none	1620135	1620425	290
023-1_CTD-03	ISP 4	15	2x	0.45 µm AWI1	143552	143545	0
	ISP 7	30	2x	0.45 µm AWI1	105223	105534	311
	ISP 5	60	1x	0.45 µm AWI1	1340596	1340462	134
	ISP 1	100	1x	0.45 µm AWI1	1620495	1620233	262
	ISP 2	200	1x	0.45 µm AWI1	1210704	1213937	3233
049-1_CTD-05	ISP 1	15	2x	0.2 µm JUB2	162033	161980	0
	ISP 2	30	1x	0.2 µm JUB2	121401	121610	209
	ISP 4	60	1x	0.2 µm JUB2	143550	143531	0
	ISP 5	100	2x	0.2 µm JUB2	134050	134040	0
	ISP 7	200	1x	0.2 µm JUB2	105558	105769	211
088-1_CTD-08	ISP 1	15	1x	0.2 µm JUB3	161991	162025	34
	ISP 2	30	1x	0.2 µm JUB3	121618	121721	103
	ISP 4	60	1x	0.2 µm JUB3	143543	143562	19
	ISP 5	100	1x	0.2 µm JUB3	134052	134052	0
	ISP 7	200	1x	0.2 µm JUB3	105779	105977	198
120-1_CTD-12	ISP 1	15	1x	0.2 µm JUB3	162029,9	162081	51,1
	ISP 7	30	2x	0.2 µm JUB3	105983,2	106253,5	270,3
	ISP 2	60	2x	0.2 µm JUB3	121726,4	121836,8	110,4
	ISP 5	100	1x	0.2 µm JUB3	134047	134039,6	0
	ISP 4	200	1x	0.2 µm JUB3	143567,2	143588	20,8
131-1_CTD-13	ISP 7	15	2x	0.2 µm JUB3	106260,5	106523	262,5
	ISP 5	30	1x	0.2 µm JUB3	134043,9	134036,6	0
	ISP 2	60	2x	0.2 µm JUB3	121842,2	121834,4	0
	ISP 1	100	1x	0.2 µm JUB3	162085,3	162147	61,7
	ISP 4	200	1x	0.2 µm JUB3	143593,4	143599,2	5,8
151-1_CTD-14	ISP 7	15	1x	none	106531,5	106958,5	427
	ISP 5	30	1x	none	134042	134064,8	22,8
	ISP 2	60	1x	none	121839,8	121882,6	42,8
	ISP 1	100	1x	none	162154	163804,6	1650,6
	ISP 4	200	1x	none	143603,7	143700,4	96,7
159-1_CTD-15	ISP 1	15	1x	none	163808,4	164444,6	636,2
	ISP 7	30	1x	none	106964,6	107576	611,4
	ISP 4	60	1x	none	143704,6	144461,4	756,8
	ISP 2	100	1x	none	121886,6	121906,2	19,6
	ISP 5	200	1x	none	134067,6	134084,2	16,6

¹pre-cleaned

with

2M

HCl

²not

pre-cleaned

³pre-cleaned with MilliQ®

5.15.2.2 CTD rosette water sampler / GoFlo bottles

Seawater from 5, 50, and 200 m above ground were sampled by JUB and BGR at two CTD stations during Leg 1 (one in the German Trial Area and one in the Belgian Trial Area) using trace metal clean 2L and 5L Teflon-coated GoFlo bottles and filtered consecutively through 0.8 µm PC,

0.2 μm PC, and 0.015 μm Nuclepore Track Etch Membrane Filters (Whatman). Filters were soaked in DI before placing them in the filter tower (except 0.015 μm filter for 023 CTD) and rinsed with sample. The sample used for rinsing the filter and filter tower was discarded. The filtered water was sampled for TM (0.8 μm , 0.2 μm , 0.015 μm), DOC (0.2 μm and 0.015 μm), and DAA (only 0.2 μm). Additionally, samples for copper-binding ligands and Nd-isotopes were taken using only 0.2 μm one-step filtration (Table 5.15.2.1). Samples were treated as described above in the pore water trace metal section.

During Leg 2, water column sampling by trace metal clean GoFlo bottles was complemented by Niskin bottle samples, with an adapted filtration scheme as described below. For a detailed sample overview see Table 5.15.2.1. In total, we sampled seawater at 10 CTD stations. Four stations were conducted at the beginning of Leg 2 during the westward transit into the German working area. The most western of these CTD stations is located within the working area close to the German Dredge site (about 300 m SSE, 94 CTD), and has been repeated three more times (Fig. 5.15.2.1; Ch. 5.16) over the following weeks. We here aimed at monitoring the water column close to the Dredge site and to record the possible transit of the eddy. In the Belgian licence area, we deployed one baseline CTD in the Trial area and one baseline CTD in the Reference area. One CTD station (120 CTD) has been deployed immediately (within a few hours) after sediment resuspension directly in the dredge area (Fig. 5.15.2.1).

Niskin bottle water was filtered with 0.8 μm /0.2 μm Acropac capsule filters and sampled for major and minor elements, DOC, and nutrients. Seawater sampled with trace metal clean GoFlo bottles was filtered through 0.2 μm polycarbonate (PC) membrane filters or 0.8 μm /0.2 μm capsule filters (Fig. 8.7.2.2). Non-filtered aliquots were taken to determine total element concentrations and to calculate particulate ($> 0.2 \mu\text{m}$) concentrations in the seawater. Selected samples were consecutively filtered through 0.015 μm Nuclepore Track Etch PC membrane filters, and 0.02 μm Anotop syringe filters. At three stations the 5 mab samples were ultrafiltered through a 10 KDa membrane (Fig. 8.7.2.2), to separate and preconcentrate colloids larger than 10 KDa and smaller than 0.2 μm . Filtered seawater from GoFlo bottles was sampled for trace metals, DOC, and nutrients. At station 183 CTD we sampled 10 l of bottom water for Nd isotopes.

Membrane filtration with the filter tower and sample acidification was done under clean air in the clean bench. During Leg 1, membrane filters were soaked in DI for several days. During Leg 2, PC membrane filters were soaked in 0.5 M HCl for one hour, and subsequently soaked in DI for several days. Acropac capsule filters were rinsed with 0.01M HCl, DI, and 3L of bottom seawater before first use. Nutrients were measured on board, for a description of the method see Chapter 5.14.3.1.

Fig. 5.15.2.1: Map showing the location of the CTD repeat stations SSE of the Dredge area and the one post-impact CTD station (120 CTD).

Fig. 5.15.2.2: From left to right: Filtration with Acropac capsule filtration, large volume ultrafiltration in the laboratory, 5L GoFlo bottle mounted to the CTD rosette frame before deployment.

Tab. 5.15.2.1: Sample overview CTD and BWS stations, including filtration treatment. A: acidified, NA: not acidified, NF: not filtered, N: Niskin bottle. Acropak PES-TM: trace metal clean filter used only for GoFlo bottles, 5 m above bottom is CTD depth, otherwise rope length

Station SO268	Bottle No	Bottle type	Lat [N]	Lon [W]	Depth [m]	0.8 µm PC mem-brane/A	0.8/0.2 µm Acro-pak PES	0.8/0.2 µm Acro-pak PES-TM	0.2 µm PC mem-brane/A	Ano-top 0.02 µm/A	PC track -etch 0.015 µm/A	Milli-pore 10 KDa/A	NF/A	NF/NA	Milli-pore Reten-tate/A	Milli-pore Reten-tate/NA	Aliquots	Remarks
023-1_CTD-03	22	GoFlo 5L	11° 54.671'	117° 02.131'	4104	x			x		x						TM, DOC, AA, copper binding ligands, Nd-isotopes	GER TRIAL 5 mab
	23	GoFlo 5L	11° 54.671'	117° 02.131'	4058	x			x		x						TM, DOC, AA	50 mab
	24	GoFlo 2L	11° 54.671'	117° 02.131'	3908	x			x		x						TM, DOC, AA	200 mab
049-1_CTD-05	22	GoFlo 5L	14° 05.785'	125° 52.954'	4449	x			x		x						TM, DOC, AA, Nd-isotopes	BEL TRIAL 5 mab
	23	GoFlo 5L	14° 05.785'	125° 52.954'	4406	x			x		x						TM, DOC, AA	50 mab
	24	GoFlo 2L	14° 05.785'	125° 52.954'	4256	x			x		x						TM, DOC, AA	200 mab
088-1_CTD-08	6	N	11° 44.980'	113° 07.013'	3700		x										ICP, DOC, AA, Nutrients	Eddy water depth: 4122 m
	7	N	11° 44.980'	113° 07.013'	2900		x										ICP, DOC, AA, Nutrients	
	8	N	11° 44.980'	113° 07.013'	2400		x										ICP, DOC, AA, Nutrients	
	9	N	11° 44.980'	113° 07.013'	1900		x										ICP, DOC, AA, Nutrients	
	10	N	11° 44.980'	113° 07.013'	1400		x										ICP, DOC, AA, Nutrients	
	17	N	11° 44.980'	113° 07.013'	1000		x										ICP, DOC, AA, Nutrients	

Station SO268	Bottle No	Bottle type	Lat [N]	Lon [W]	Depth [m]	0.8 µm PC membrane/A	0.8/0.2 µm Acropak PES	0.8/0.2 µm Acropak PES-TM	0.2 µm PC membrane/A	Ano-top 0.02 µm/A	PC track-etch 0.015 µm/A	Millipore 10 KDa/A	NF/A	NF/NA	Millipore Reten-tate/A	Millipore Reten-tate/NA	Aliquots	Remarks
	19	N	11° 44.980'	113° 07.013'	250		x										ICP, DOC, AA, Nutrients	
	1	GoFlo 2L	11° 44.980'	113° 07.013'	4072				x		x		x				TM, DOC, AA, Nutrients	50 mab
	22	GoFlo 5L	11° 44.980'	113° 07.013'	4118				x		x		x	x			TM, DOC, AA, Nutrients	5 mab
	23	GoFlo 5L	11° 44.980'	113° 07.013'	500				x		x		x				TM, DOC, AA, Nutrients	
	24	GoFlo 2L	11° 44.980'	113° 07.013'	3922				x				x				TM, DOC, AA, Nutrients	200 mab
090-1_CTD-09	1	GoFlo 2L	11° 46.000'	114° 02.164'	4100				x				x				TM, DOC, Nutrients	50 mab, Eddy CTD, water depth: 4150 m, nutrients: no deep water samples!
	22	GoFlo 5L	11° 46.000'	114° 02.164'	4145				x				x				TM, DOC, Nutrients	5 mab
	23	GoFlo 5L	11° 46.000'	114° 02.164'	500				x				x				TM, DOC, Nutrients	
	24	GoFlo 2L	11° 46.000'	114° 02.164'	3951				x				x				TM, DOC, Nutrients	200 mab
092-1_CTD-10	1	GoFlo 2L	11° 47.976'	114° 56.401'	4114		NISKIN?	x									TM, DOC, Nutrients	Eddy CTD, water depth: 4111 m, Nutrients look bad
	22	GoFlo 5L	11° 47.976'	114° 56.401'	4106			x					x				TM, DOC, Nutrients	5 mab
	23	GoFlo 5L	11° 47.976'	114° 56.401'	500			x					x				TM, DOC, Nutrients	

Station SO268	Bottle No	Bottle type	Lat [N]	Lon [W]	Depth [m]	0.8 µm PC mem-brane/A	0.8/0.2 µm Acro-pak PES	0.8/0.2 µm Acro-pak PES-TM	0.2 µm PC mem-brane/A	Ano-top 0.02 µm/A	PC track-etch 0.015 µm/A	Milli-pore 10 KDa/A	NF/A	NF/NA	Milli-pore Reten-tate/A	Milli-pore Reten-tate/NA	Aliquots	Remarks
094-1_CTD-11	6	N	11° 51.598'	117° 00.839'	3700		x										TM, Nutrients	Repeat station Eddy/German Dredge, water depth: 4111 m
	7	N	11° 51.598'	117° 00.839'	2900		x										TM, Nutrients	DOC,
	8	N	11° 51.598'	117° 00.839'	2400		x										TM, Nutrients	DOC,
	9	N	11° 51.598'	117° 00.839'	1900		x										TM, Nutrients	DOC,
	10	N	11° 51.598'	117° 00.839'	1400		x										TM, Nutrients	DOC,
	17	N	11° 51.598'	117° 00.839'	1000		x										TM, Nutrients	DOC,
	19	N	11° 51.598'	117° 00.839'	80		x										TM, Nutrients	DOC,
	1	GoFlo 2L	11° 51.598'	117° 00.839'	4072			x					x				TM, Nutrients	DOC, 50 mab
	22	GoFlo 5L	11° 51.598'	117° 00.839'	4119			x	x		x	x	x	x			TM, Nutrients	DOC, 2 mab
	23	GoFlo 5L	11° 51.598'	117° 00.839'	250			x			x	x	x				TM, Nutrients	DOC,
	24	GoFlo 2L	11° 51.598'	117° 00.839'	3924			x					x				TM, Nutrients	DOC, 200 mab
120-1_CTD-12	9	N	11° 51.769'	117° 00.739'	3700		x										TM, Nutrients	GER Dredge after sed. suspension, water depth: 4120 m
	10	N	11° 51.769'	117° 00.739'	2900		x										ICP, Nutrients	DOC,

Station	SO268	Bottle No	Bottle type	Lat [N]	Lon [W]	Depth [m]	0.8 μm PC membrane/A	0.8/0.2 μm Acropak PES	0.8/0.2 μm Acropak PES-TM	0.2 μm PC membrane/A	Ano-top 0.02 μm/A	PC track-etch 0.015 μm/A	Millipore 10 KDa/A	NF/A	NF/NA	Millipore Reten-tate/A	Millipore Reten-tate/NA	Aliquots	Remarks	
		11	N	11° 51.769'	117° 00.739'	2400		x										ICP, Nutrients	DOC,	
		17	N	11° 51.769'	117° 00.739'	1900		x										ICP, Nutrients	DOC,	
		18	N	11° 51.769'	117° 00.739'	1400		x										ICP, Nutrients	DOC,	
		19	N	11° 51.769'	117° 00.739'	1000		x										ICP, Nutrients	DOC,	
		20	N	11° 51.769'	117° 00.739'	500		x										ICP, Nutrients	DOC,	
		1	GoFlo 2L	11° 51.769'	117° 00.739'	4067				x		x		x				ICP, Nutrients	DOC, 50 nutrients good	mab,
		22	GoFlo 5L	11° 51.769'	117° 00.739'	4115			x		x	x		x	x			ICP, Nutrients	DOC, 5 nutrients bad	mab,
		23	GoFlo 5L	11° 51.769'	117° 00.739'	4115				x				x				ICP, Nutrients	DOC, 5 nutrients not measured	mab, not
131-1_CTD-13		17	N	14° 07.090'	125° 52.003'	3700		x										ICP, Nutrients	DOC, BEL water 4503	trial, depth:
		18	N	14° 07.090'	125° 52.003'	2900		x										ICP, Nutrients	DOC,	
		9	N	14° 07.090'	125° 52.003'	1900		x										ICP, Nutrients	DOC,	
		20	N	14° 07.090'	125° 52.003'	1000		x										ICP, Nutrients	DOC,	
		21	N	14° 07.090'	125° 52.003'	500		x										ICP, Nutrients	DOC,	
		22	GoFlo 5L	14° 07.090'	125° 52.003'	4497			x		x	x	x	x	x	x	x	ICP, Nutrients	DOC, 5 mab	

Station SO268	Bottle No	Bottle type	Lat [N]	Lon [W]	Depth [m]	0.8 µm PC membrane/A	0.8/0.2 µm Acropak PES	0.8/0.2 µm Acropak PES-TM	0.2 µm PC membrane/A	Ano-top 0.02 µm/A	PC track-etch 0.015 µm/A	Millipore 10 KDa/A	NF/A	NF/NA	Millipore Reten-tate/A	Millipore Reten-tate/NA	Aliquots	Remarks
	23	GoFlo 5L	14° 07.090'	125° 52.003'	4497								x				ICP, Nutrients	DOC, 5 mab
151-1_CTD-14	17	N	14° 01.141'	125° 54.949'	3700		x										ICP, Nutrients	DOC, BEL water 4521 Ref, depth:
	18	N	14° 01.141'	125° 54.949'	2900		x										ICP, Nutrients	DOC, nutrients bad
	19	N	14° 01.141'	125° 54.949'	1900		x										ICP, Nutrients	DOC,
	20	N	14° 01.141'	125° 54.949'	1000		x										ICP, Nutrients	DOC,
	21	N	14° 01.141'	125° 54.949'	500		x										ICP, Nutrients	DOC,
	22	GoFlo 5L	14° 01.141'	125° 54.949'	4529			x		x	x	x	x	x			ICP, Nutrients	DOC, 5 nutrients good mab, look
	23	GoFlo 5L	14° 01.141'	125° 54.949'	4529					x			x		x		ICP, Nutrients	DOC, 5 nutrients good mab, look
159-1_CTD-15	10	N	11° 51.587'	117° 00.842'	3700		x										ICP, Nutrients	DOC, GER water 4126 Dredge, depth:
	11	N	11° 51.587'	117° 00.842'	2900		x										ICP, Nutrients	DOC,
	17	N	11° 51.587'	117° 00.842'	2400		x										ICP, Nutrients	DOC,
	18	N	11° 51.587'	117° 00.842'	1900		x										ICP, Nutrients	DOC,
	19	N	11° 51.587'	117° 00.842'	1400		x										ICP, Nutrients	DOC,

Station SO268	Bottle No	Bottle type	Lat [N]	Lon [W]	Depth [m]	0.8 µm PC membrane/A	0.8/0.2 µm Acropak PES	0.8/0.2 µm Acropak PES-TM	0.2 µm PC membrane/A	Ano-top 0.02 µm/A	PC track-etch 0.015 µm/A	Millipore 10 KDa/A	NF/A	NF/NA	Millipore Reten-tate/A	Millipore Reten-tate/NA	Aliquots	Remarks
	20	N	11° 51.587'	117° 00.842'	1000		x										ICP, Nutrients	DOC,
	21	N	11° 51.587'	117° 00.842'	500		x										ICP, Nutrients	DOC,
	1	GoFlo 2L	11° 51.587'	117° 00.842'	4075			x			x		x				ICP, Nutrients	DOC, 50 mab
	22	GoFlo 5L	11° 51.587'	117° 00.842'	4120			x			x		x	x			ICP, Nutrients	DOC, 5 mab, leaking on deck
183-1_CTD-16	7	N	11° 51.600'	117° 00.839'	4120		x										ICP, Nutrients, isotopes	DOC, Nd Repeat station GER Dredge, depth: 4122
	11	N	11° 51.600'	117° 00.839'	3700		x										ICP, Nutrients	DOC,
	17	N	11° 51.600'	117° 00.839'	2900		x										ICP, Nutrients	DOC,
	18	N	11° 51.600'	117° 00.839'	1900		x										ICP, Nutrients	DOC,
	19	N	11° 51.600'	117° 00.839'	1400		x										ICP, Nutrients	DOC,
	20	N	11° 51.600'	117° 00.839'	1000		x										ICP, Nutrients	DOC,
	21	N	11° 51.600'	117° 00.839'	500		x										ICP, Nutrients	DOC,
	1	GoFlo 2L	11° 51.600'	117° 00.839'	4120								x				ICP, Nutrients	DOC, 5 mab
	22	GoFlo 5L	11° 51.600'	117° 00.839'	4120			x			x	x	x	x	x	x	ICP, Nutrients	DOC, 5 mab
	23	GoFlo 5L	11° 51.600'	117° 00.839'	4120								x				ICP, Nutrients	DOC, 5 mab

Station SO268	Bottle No	Bottle type	Lat [N]	Lon [W]	Depth [m]	0.8 µm PC membrane/A	0.8/0.2 µm Acropak PES	0.8/0.2 µm Acropak PES-TM	0.2 µm PC membrane/A	Ano-top 0.02 µm/A	PC track-etch 0.015 µm/A	Milli-pore 10 KDa/A	NF/A	NF/NA	Milli-pore Reten-tate/A	Milli-pore Reten-tate/NA	Aliquots	Remarks
208-1_CTD-17	17	N	11° 51.601'	117° 00.834'	3700		x										ICP, Nutrients	Repeat station Dredge, depth: 4123
	18	N	11° 51.601'	117° 00.834'	2900		x										ICP, Nutrients	DOC,
208 CTD	19	N	11° 51.601'	117° 00.834'	1900		x										ICP, Nutrients	DOC,
	20	N	11° 51.601'	117° 00.834'	1000		x										ICP, Nutrients	DOC,
	21	N	11° 51.601'	117° 00.834'	500		x										ICP, Nutrients	DOC,
	11	N	11° 51.601'	117° 00.834'	3919		x										ICP, Nutrients	DOC,
	23	GoFlo 5L	11° 51.601'	117° 00.834'	4118			x									ICP, Nutrients, AA	DOC, 5 mab
	24	GoFlo 2L	11° 51.601'	117° 00.834'	4118			x						x			ICP, Nutrients	DOC, 5 mab
112-1_BWS-01	8	GoFlo 12 L	11° 51.773'	117° 00.731'	4119			x					x				ICP, Nutrients	DOC, GER after sediment suspension
	9	GoFlo 12 L	11° 51.773'	117° 00.731'	4119			x	x	x	x		x	x	x	x	ICP, Nutrients	DOC,
	7	GoFlo 12 L	11° 51.773'	117° 00.731'	4119			x					x				ICP, Nutrients	DOC,
	11	GoFlo 12 L	11° 51.773'	117° 00.731'	4119			x					x				ICP, Nutrients	DOC,
	10	GoFlo 12 L	11° 51.773'	117° 00.731'	4119			x	x	x	x		x	x			ICP, Nutrients	DOC,

5.15.3 Suspended particulate matter (SPM) sampling

(S. Haalboom)

In order to analyse suspended particulate matter (SPM) concentrations, 2 bottles of 4.5 L each were drawn from one Niskin bottle, which was taken during the upcast, and were filters over pre-weighed 47 mm polycarbonate filters with a pore size of 0.4 μm (Fig. 5.15.3.1). At the beginning of leg 2 these bottles were filtered separately, but later it was decided to pour both bottles over 1 filter. In total, 31 filters have been collected for SPM from the CTD casts (Tab. 5.15.3.1). 2 additional samples have been collected from 114 BWS-01. The filters were subsequently stored at -20 °C for further analysis at NIOZ.

Tab. 5.15.3.1: Samples collected with the CTD meant for SPM analysis.

Station/Cast	Bottle	Depth	Portion	Filter	Remarks
88 – CTD 08	2	4117	A	18.061	5 L
88 – CTD 08	2	4117	B	18.062	4.425 L
88 – CTD 08	18	250	A	18.063	5 L
88 – CTD 08	18	250	B	18.064	4.492 L
90 – CTD 09	2	4144	A	18.065	4.5 L
90 – CTD 09	2	4144	B	18.066	4.5 L
90 – CTD 09	17	250	A	18.067	4.5 L
90 – CTD 09	17	250	B	18.068	4.5 L
92 – CTD 10	2	4106	A	18.069	4.5 L
92 – CTD 10	2	4106	B	18.070	4.5 L
92 – CTD 10	17	250	A	18.071	4.5 L
92 – CTD 10	17	250	B	18.072	4.5 L
94 – CTD 11	2	4119	A	18.073	4.5 L
94 – CTD 11	2	4119	B	18.074	4.5 L
94 – CTD 11	18	250	A	18.075	4.5 L
94 – CTD 11	18	250	B	18.076	4.5 L
114 – BWS 01	8	4118	A	18.077	3.5 L
114 – BWS 01	8	4118	B	18.078	2.866 L
120 – CTD 12	2	4115	A	18.081	4.5 L
120 – CTD 12	2	4115	B	18.082	4.5 L
120 – CTD 12	21	250	A	18.083	4.5 L
120 – CTD 12	21	250	B	18.084	4.5 L
131 – CTD 13	2	4497	A	18.085	9 L
131 – CTD 13	3	4497	A	18.086	9 L
151 – CTD 14	2	4529	A	18.087	4.5 L
151 – CTD 14	3	4529	B	18.088	9 L
151 – CTD 14	2	4529	A	18.091	4.5 L
159 – CTD 15	2	4120	A	18.092	9 L
159 – CTD 15	3	4120	A	18.093	9 L
183 – CTD 16	2	4120	A	18.094	9 L
183 – CTD 16	3	4120	A	18.095	9 L
208 – CTD 17	2	4118	A	18.096	9 L
208 – CTD 17	3	4118	A	18.097	9 L

Fig. 5.15.3.1: SPM filtration set up (Photo: S. Haalboom)

5.16 Physical Properties of Seawater

(K. Schmidt, S. Haalboom)

5.16.1 General characterization of water masses

Figure 5.16.1 presents the water mass characteristics in both areas. Sea surface temperatures (SST) in the GER Trial Site in February-May 2019 ranged between 26.5 °C and 28.5 °C. A pronounced pycnocline separates the mixed layer of warm, low-salinity Tropical Surface Water (TSW) from the subpycnocline waters. The temperature and salinity profiles show that this surface mixed layer in the GER area is about 50 m thick, with a very sharp change below 60 to 65 m depth (top of the thermocline and halocline, respectively). The fluorescence as a measure of phytoplankton concentration starts to increase at the depth of the pycnocline (thermocline). Main maxima between occur between 60 and 70 m in GER (similar to 2018), with a second maxima between 110-120 m. The oxygen concentration in the GER trial area sharply drops from about 170 $\mu\text{mol/kg}$ to less than 10 $\mu\text{mol/kg}$ below 60-65 m and marks the beginning of the oxygen minimum zone, which extends to about 800 m water depth. The strong increase in fluorescence to maximum values coincides with this depth, indicating that primary production and subsequent remineralization of particulate organic matter occur under oxygen consumption.

The intermediate (subpycnocline) waters are very low in oxygen and range down to 1000 m. These water masses are sourced both from the south (Antarctic Intermediate Water AAIW) and from the north (North Pacific Intermediate Water NPIW). The properties of deep and bottom waters in the Pacific are set by their distant sources in the Antarctic and the Atlantic. The Deep Water (DW) between 100 m and 2500 m is characterized by a steady decrease of temperature and increase in salinity. North Pacific Deep Water (NPDW) is the 1.2-2°C cold water mass occurring at a depth less than 2500 m. The bottom water below 4000 m is the Lower Circumpolar Water (LCPW), a mixture of Antarctic Bottom Water and North Atlantic Deep Water.

Figure 5.16.2 compares the downcast properties of temperature, oxygen, and fluorescence for the GER and BEL trial areas through the water column. In the BEL trial area, the surface water shows lower temperature (25-26°C) and lower salinity compared to the GER trial area, with more irregular profiles of temperature, salinity, oxygen, fluorescence in the mixed layer and the pycnocline. Generally, the thermocline is less pronounced, with a more moderate temperature decrease. The main and the second fluorescence maximas are significantly lower. Within the OMZ, oxygen concentration is higher compared to the GER trial area. In both areas we observe an enforced oxygen increase between 500 m to 300 m above the seafloor. Within the benthic boundary layer (0-300 m above seafloor), oxygen concentrations are stable.

Fig. 5.16.1: Water mass characteristics in the German (CTD02) and Belgian (CTD13) licence areas (Trial Sites) displayed as downcast profiles of temperature, salinity, density, and oxygen.

Fig. 5.16.2: Water mass characteristics of the upper 250 m in the German (GER, blue) and Belgian (BEL, red) licence areas (Trial Sites) displayed as downcast profiles of temperature (left), oxygen (center), and fluorescence (right).

5.16.2 Characterization of a mesoscale Eddy

Eddies are temporary loops of swirling water of several hundred kilometres in diameter that can travel long distances through the open ocean before dissipating. Eddies have been recognized to play an important role in the vertical and horizontal transport of momentum, heat, mass, and chemical constituents of seawater through the open ocean. Being highly dynamic and difficult to

capture, they can reach down through the entire water column inducing impacts at the seafloor over hundreds of square kilometers in this usually quiet, low-energy environment.

In situ measurements of current speeds in the German licence area (Aleynik et al., 2017) have shown that one to two full water depth eddies pass this area every year. These eddies originate from the western coast of central America and draw their energy mainly from the Central American mountain Gaps Winds, driven by pressure gradient variations between the Pacific and the Gulf of Mexico (Aleynik et al., 2017). During SO268 leg 2, just in time, we were able to catch one such Eddy traveling west towards the German licence Area. The westward propagation of a large surface eddy towards the German licence area was revealed from maps of sea level anomalies (sla) created from satellite data (NOAA, see Fig. 8.8.3, prepared by K. Purkiani, MARUM). The eddy is a warm core, anticyclonic eddy with positive sla and clockwise rotation, rotating with a speed of about 25 km/day. Its centre moved directly westward with a speed of about 15 km/day. Surface eddies are characterized by the presence of enhanced horizontal speeds accompanied by isopycnal displacements and T-S anomalies.

To characterize the water mass properties inside and outside the eddy, we conducted between April 2 to April 4 four CTD full water column stations along an E-W transect from Eddy surface centre (as sla maximum) to the edge of the eddy (spatial record, Fig. 5.16.3). The westernmost station was then repeated three more times in the following 5 weeks (last deployment: May 16), to monitor the passing eddy (temporal record). Additional current meters often recorded enhanced current speeds in the upper 1500 m. The measured current speed and direction were in agreement with the ship-based ADCP data and with the expected current direction based on the location of the station with regard to the eddy. For example, at 092-CTD10, northern directed surface currents were expected as the stations was west of the eddy's center, which were recorded by both the ship's ADCP (Figure 5.16.3) and the current meter mounted to the CTD (Fig. 5.16.4).

Fig. 5.16.3: Map of sea level anomalies (sla), created from satellite data (NOAA) for April 1st. Open circles show the centre point of the eddy that is heading towards the eastern German licence area (L-shaped box). Blue diamonds: CTD stations SO268/2. White lines: current vectors of ship-based ADCP along cruise track. Map provided by K. Purkiani (MARUM).

Fig. 5.16.4: Ten minute time series recorded of current speed and direction at 092-1_CTD-10 at 150 m water depth, showing the first two bins (bin 1 = black; bin 2 = red).

Eddy E-W transect (April 2-April 4)

We conducted a CTD station transect from the sea surface expression of the Eddy centre towards west (i.e., from eddy centre to eddy rim), recording a clear eddy signal in the upper water layer (Figure 5.16.5). At the eddy rim station 094-1_CTD-11 the pycnocline starts at 70 m with a sharp drop of temperature and oxygen, and a sharp increase of salinity and fluorescence. In the centrally located eddy stations 088-1_CTD-08 and 090-1_CTD-09, the surface mixed layer is characterized by slightly higher temperature, lower salinity and lower fluorescence, and the thermo-, halo-, and oxyclines are deepened to about 75 m. This brings warmer, less saline, and oxygen-rich waters to deeper levels and can be explained by the clockwise rotation of water masses pushing the mixed layer deeper. The Eddy core stations 088-1_CTD-08 and 090-1_CTD-09 also display a more moderate temperature drop in the thermocline below the mixed layer (within the first 25 m, T dropped by about 8.5°C, while same T decrease occurs within 10 m at eddy rim station 094-1_CTD-11). Similar profiles occur for salinity (more moderate increase within eddy core) and for oxygen (more moderate oxygen increase within eddy core). This indicates more intense mixing of warm, nutrient-poor surface water and cold, nutrient-rich deeper water. In one of the eddy core stations (088-1_CTD-08) the fluorescence maxima, and hence the phytoplankton maxima, is significantly reduced, which coincides with lower nutrient concentrations (phosphate and nitrate concentrations, measured at 80 m). Phytoplankton growth in the deep chlorophyll maximum (DCM) is limited by both nutrient and light, exists at the same depth as the nutricline. Lower nutrient concentrations imply less primary productivity, and could be explained by more intense mixing at thermocline top. Deviations from the “background” CTD station 094-1_CTD-11 can be also be observed at deeper levels, between 200 m and 400 m depth (relative oxygen depletion), as well as between 850 m and 1000 m and between 3200 m and 3700 m, where oxygen is enriched in the eddy stations. Compared to the GER trial site CTD profiles (see above), 094-1_CTD-11 is characterized by a deeper onset of the pycnocline (70 m compared to 60-65 m). The second phytoplankton maxima as observed in the GER trial area, is only weakly expressed at the eddy rim station and absent in the eddy core stations.

Fig. 5.16.5: Downcast profiles of temperature, oxygen, and fluorescence for Eddy transect CTD stations 08-11, April 2-4, showing a clear eddy signal. Stripped line: eddy rim station 094CTD-1_CTD-11, red: 088-1_CTD-08, cyan: 090-1_CTD-09, green: 092CTD-1_CTD-10.

Eddy repeat station (April 4 – May 16)

Starting with station 094-1_CTD-11, we determined the water mass properties at this location over a period of five weeks. During this time, sea level anomalies recorded the westward passage of the eddy centre at the seawater surface (Fig. 5.16.6). Similar to the water column transect from the eddy centre to the eddy rim between April 2nd and April 4th, we observe a well-expressed deepening of the thermo-, halo-, and oxyclines to 80-90 m for the CTD stations deployed between April 26 to May 16, which nicely coincides with deeper fluorescence (phytoplankton) maxima (Fig. 5.16.8). Again, the onset of the thermo- halo-, and oxyclines are more moderate, indicating more mixing between surface waters and sub-pycnocline waters. The less intense fluorescence maximas at these stations may either be related to lower nutrient concentrations or less light penetration. From the succession of the thermocline (and oxycline, halocline) deepening and satellite sla maps we can suggest that 159-1_CTD-15 was deployed while the eddy was approaching from the east, 183-1_CTD-16 was deployed within the Eddy centre at the surface, and 208-1_CTD-17 at the eastern rim of the westward moving eddy. Further deviations from the “background” CTD station 094-1_CTD-11 can be observed at 200-400 m depth and between 850 m and 1000 m, where oxygen is depleted and enriched, respectively.

Fig. 5.16.6: Map of sea level anomalies (sla), created from satellite data (NOAA) for May 15, Eddy transect CTD stations 08-11, CTD repeat stations 11-17. Map provided by Kaveh Purkiani (MARUM).

Fig. 5.16.7: Map showing the location of the CTD repeat stations (CTD11-17) SSE of the Dredge area and the one post-impact CTD station (120 CTD12).

Fig. 5.16.8: Downcast profiles of temperature, oxygen, and fluorescence for repeat CTD stations 11-17 in GER dredge area, deployed between April 4 and May 16, showing a clear eddy signal. Stippled line: eddy rim station 094CTD-11 on April 4, green: 159-1_CTD-15, purple: 183-1_CTD-16, cyan: 208-1_CTD-17.

Post-impact CTD station

Station 120-1_CTD-12 was conducted immediately after sediment suspension with the chainbag dredge, above the dredged area (Fig. 5.16.7). The water column profiles of temperature, salinity, oxygen, and fluorescence closely resemble that of station 094-1_CTD-11, even as the turbidity profile indicating that there was not an enhanced amount of suspended particulate matter.

5.17 In-situ Experiments and Ecotoxicology

5.17.1 Benthic Chambers and Microprofiler

(F. Janssen, V. Asendorf, F. Wenzhöfer, E. Schiller)

Respiration rates were measured directly at the seafloor (*in situ*) to obtain baseline information on the organic matter remineralization rates of sediment and nodule communities without artifacts connected to recovering sediments from depth for measurements in the ship's lab. Three types of *in situ* modules, all manipulated by ROV have been used for *in situ* respiration measurements of sediments and nodules: (1) Benthic chamber modules ('BFC-ROV') were used to quantify total oxygen uptake ('TOU') in a small sediment patch enclosed by a circular acrylic chamber with optical oxygen sensors (type '4430', Aanderaa Instruments, NO & type 'Hydroflash', Kongsberg/Contros NO/DE) to record time series of oxygen concentration in the enclosed overlying water. In combination with the chamber volume / overlying water height the rate of decrease is used to calculate TOU. Chamber volume / overlying water height was determined visually (ROV footage) and calculated based on the salinity decrease observed with sensors and in samples taken from the overlying water after adding 50mL of deionized water to the chamber. (2) Electrochemical microprofilers (MICP) and (3) Fiberoptical microprofilers (MICP-DEEP) were used for high resolution measurements of vertical profiles of pore water oxygen concentration in the top 150 to 250 mm of the sediment. Diffusive oxygen uptake (DOU) is calculated from (I) the slope of the oxygen gradient right above or below the sediment surface, (II) from changes in slope of the entire depth gradient (i.e., first derivative of the profile), or (III), by fitting a biogeochemical model with adjustment of volumetric respiration / organic matter supply rates. The glass microsensors, that were used in case of the electrochemical profiler have tip diameters of only some tens of micrometers and are thus able to resolve changes in oxygen concentration at particularly high resolution, especially near the sediment surface where vertical gradients are steepest. In addition to Clark-type amperometric oxygen sensors, also LIX pH sensors and conductivity sensors (to detect the sediment surface and calculate sediment porosity) have been employed during the MICP-deployments. During the first leg, however, only a small data set could be obtained due to technical difficulties and the high density of nodules, easily breaking the delicate sensors that are always lowered at once (typically 7-8 oxygen, 2 pH, 1 conductivity). To account for the hostile sedimentary environment, the recently developed fiberoptical microprofiler was deployed in parallel. It uses two sets of 4 fiberoptical sensors (230 micrometer tip diameter, Pyroscience, DE) that are embedded in hypodermic needles mounted to solid shafts made from carbon-reinforced plastic. This allows to record longer profiles, that are better suited for low-respiration environments and deep oxygen penetration sites as the CCZ and are robust enough to at least cope with smaller pieces of nodule debris found in the sediments. As the two sets of 4 sensors are attached to independent profiling stages, a second set of measurements can be obtained without recovery of the instrument, even if the first set of sensors broke during the first profile. Together with online communication via an optical modem attached to the ROV and the *in situ* modules (Hydromea, CH), that was used successfully for the first time during the cruise, this offers a high amount of flexibility and make the new profilers highly versatile tools to work in these demanding environments.

Tab. 5.17.1.1: Overview of in situ module deployments during SO268.

Deployment station	Event label (deployment)	Deployment start (UTC) /	Area	Position	Water depth
SO 268-1					
SO268-1_020_ROV02	SO268-1_020_MICP-DEEP_1-1	03.03.19 17:48:08	Impact area DE	11°55.71'N 117°1.43'W	4102 m
SO268-1_020_ROV02	fiberoptical microprofiler 1	03.03.19 20:50:21			
SO268-1_020_ROV02	SO268-1_020_MICP_2-1	03.03.19 18:25:32	Impact area DE	11°55.799'N 117°1.475'W	4098 m
SO268-1_025_ROV03	electrochemical microprofiler 2	05.03.19 20:01:25			
SO268-1_020_ROV02	SO268-1_020_MICP_1-1	03.03.19 18:31:32	Impact area DE	11°55.762'N 117°1.452'W	4102 m
SO268-1_029_ROV04	electrochemical microprofiler 1	06.03.19 17:21:11			
SO268-1_020_ROV02	SO268-1_020_BFC-ROV_1-1	03.03.19 18:50:59	Impact area DE	11°55.712'N 117°1.448'W	4102 m
SO268-1_025_ROV03	benthic chamber 1	05.03.19 20:17:44			
SO268-1_020_ROV02	SO268-1_020_BFC-ROV_2-1	03.03.19 19:21:31	Impact area DE	11°55.797'N 117°1.476'W	4101 m
SO268-1_025_ROV03	benthic chamber 2	05.03.19 19:59:39			
SO268-1_020_ROV02	SO268-1_020_MICP-DEEP_1-2	03.03.19 20:50:21	Impact area DE	11°55.711'N 117°1.433'W	4102 m
SO268-1_029_ROV04	fiberoptical microprofiler 1	06.03.19 17:46:14			
SO268-1_035_ROV06	SO268-1_035_BFC-ROV_1-1	08.03.19 18:08:50	Reference area DE	11°50.674'N 117°3.508'W	4168 m
SO268-1_040_ROV07	benthic chamber 1	09.03.19 21:43:27			
SO268-1_035_ROV06	SO268-1_035_BFC-ROV_2-1	08.03.19 18:35:16	Reference area DE	11°50.634'N 117°3.555'W	4172 m
SO268-1_040_ROV07	benthic chamber 2	09.03.19 22:52:05			
SO268-1_035_ROV06	SO268-1_035_MICP-DEEP_1-1	08.03.19 19:10:28	Reference area DE	11°50.636'N 117°3.551'W	4172 m
SO268-1_035_ROV06	fiberoptical microprofiler 1	09.03.19 00:18:21			
SO268-1_035_ROV06	SO268-1_035_MICP_1-1	08.03.19 19:39:44	Reference area DE	11°50.675'N 117°3.503'W	4168 m
SO268-1_035_ROV06	electrochemical microprofiler 1	08.03.19 22:59:06			
SO268-1_035_ROV06	SO268-1_035_MICP_2-1	08.03.19 20:39:18	Reference area DE	11°50.641'N 117°3.545'W	4171 m
SO268-1_035_ROV06	electrochemical microprofiler 2	09.03.19 00:47:10			
SO268-1_035_ROV06	SO268-1_035_MICP_1-2	08.03.19 23:11:00	Reference area DE	11°50.675'N 117°3.501'W	4168 m
SO268-1_040_ROV07	electrochemical microprofiler 1	09.03.19 17:59:38			
SO268-1_035_ROV06	SO268-1_035_MICP-DEEP_1-2	09.03.19 00:27:24	Reference area DE	11°50.633'N 117°3.547'W	4172 m
SO268-1_040_ROV07	fiberoptical microprofiler 1	09.03.19 17:47:44			
SO268-1_040_ROV07	SO268-1_040_MICP-DEEP_1-3	09.03.19 17:47:44	Reference area DE	11°50.633'N 117°3.545'W	4172 m
SO268-1_040_ROV07	fiberoptical microprofiler 1	09.03.19 22:14:31			
SO268-1_040_ROV07	SO268-1_040_MICP_1-3	09.03.19 18:10:58	Reference area DE	11°50.683'N 117°3.508'W	4168 m
SO268-1_040_ROV07	electrochemical microprofiler 1	09.03.19 21:49:04			
SO268-1_057_ROV08	SO268-1_057_BFC-ROV_2-1	15.03.19 17:27:27	Impact area BE	14°6.785'N 125°52.253'W	4549 m
SO268-1_077_ROV12	benthic chamber 2	21.03.19 00:58:32			
SO268-1_057_ROV08	SO268-1_057_BFC-ROV_1-1	15.03.19 18:18:52	Impact area BE	14°6.725'N 125°52.212'W	4547 m
SO268-1_064_ROV09	benthic chamber 1	18.03.19 00:08:41			
SO268-1_057_ROV08	SO268-1_057_MICP-DEEP_1-1	15.03.19 18:49:22	Impact area BE	14°6.724'N 125°52.212'W	4547 m
SO268-1_064_ROV09	fiberoptical microprofiler 1	17.03.19 19:49:40			
SO268-1_064_ROV09	SO268-1_064_MICP_1-1	17.03.19 19:07:22	Impact area BE	14°6.767'N 125°52.258'W	4548 m
SO268-1_064_ROV09	electrochemical microprofiler 1	18.03.19 01:17:29			
SO268-1_064_ROV09	SO268-1_064_MICP-DEEP_1-2	17.03.19 20:01:23	Impact area BE	14°6.727'N 125°52.208'W	4547 m
SO268-1_064_ROV09	fiberoptical microprofiler 1	18.03.19 00:08:41			
SO268-1_081_ROV13	SO268-1_081_MICP-DEEP_1-1	21.03.19 18:56:40	Impact area BE	14°6.8'N 125°52.281'W	4547 m
SO268-1_081_ROV13	fiberoptical microprofiler 1	21.03.19 23:54:03			
SO 268-2					
SO268-2_099_ROV14	SO268-2_099_MICP-DEEP_3-1	21.03.19 18:56:40	Reference area DE / pre dredge impact	11°51.813'N 117°0.791'W	4126 m
SO268-2_099_ROV14	fiberoptical microprofiler 3	06.04.19 00:48:05			
SO268-2_099_ROV14	SO268-2_099_MICP-DEEP_2-1	05.04.19 18:26:19	Reference area DE / pre dredge impact	11°51.783'N 117°0.772'W	4125 m
SO268-2_099_ROV14	fiberoptical microprofiler 2	06.04.19 00:18:52			
SO268-2_099_ROV14	SO268-2_099_BFC-ROV_2-1	05.04.19 18:43:43	Reference area DE / pre dredge impact	11°51.817'N 117°0.789'W	4125 m
SO268-2_101_ROV15	benthic chamber 2	06.04.19 22:39:33			
SO268-2_099_ROV14	SO268-2_099_BFC-ROV_1-1	05.04.19 19:11:20	Reference area DE / pre dredge impact	11°51.782'N 117°0.784'W	4126 m
SO268-2_101_ROV15	benthic chamber 1	06.04.19 22:07:44			
SO268-2_099_ROV14	SO268-2_099_BFC-ROV_3-1	05.04.19 19:26:09	Reference area DE / pre dredge impact	11°51.817'N 117°0.781'W	4124 m
SO268-2_099_ROV14	benthic chamber 3	06.04.19 01:07:09			
SO268-2_099_ROV14	SO268-2_099_MICP-DEEP_2-2	06.04.19 00:29:34	Reference area DE / pre dredge impact	11°51.784'N 117°0.782'W	4126 m
SO268-2_101_ROV15	fiberoptical microprofiler 2	06.04.19 17:32:21			
SO268-2_099_ROV14	SO268-2_099_MICP-DEEP_3-2	06.04.19 00:50:26	Reference area DE / pre dredge impact	11°51.812'N 117°0.79'W	4126 m
SO268-2_101_ROV15	fiberoptical microprofiler 3	06.04.19 17:18:48			
SO268-2_101_ROV15	SO268-2_101_MICP-DEEP_3-3	06.04.19 17:25:19	Reference area DE / pre dredge impact	11°51.815'N 117°0.793'W	4126 m
SO268-2_101_ROV15	fiberoptical microprofiler 3	07.04.19 02:13:24			
SO268-2_101_ROV15	SO268-2_101_MICP-DEEP_2-3	06.04.19 17:35:16	Reference area DE / pre dredge impact	11°51.783'N 117°0.782'W	4126 m
SO268-2_101_ROV15	fiberoptical microprofiler 2	07.04.19 01:53:44			

Deployment station	Event label (deployment)	Deployment start (UTC) /	Area	Position	Water depth
SO268-2_124_ROV18	SO268-2_124_MICP_1-1	12.04.19 19:30:23	Reference area DE /	11°51.791'N 117°0.771'W	4126 m
SO268-2_124_ROV18	electrochemical microprofiler 1	12.04.19 22:21:18	post dredge impact: in track		
SO268-2_124_ROV18	SO268-2_124_MICP_2-1	12.04.19 19:47:02	Reference area DE / post dredge impact:	11°51.773'N 117°0.771'W	4127 m
SO268-2_124_ROV18	electrochemical microprofiler 2	12.04.19 22:32:19	outside track / strong cover		
SO268-2_124_ROV18	SO268-2_124_MICP_1-2	12.04.19 22:23:45	Reference area DE /	11°51.789'N 117°0.778'W	4126 m
SO268-2_124_ROV18	electrochemical microprofiler 1	13.04.19 01:49:25	post dredge impact: in track		
SO268-2_124_ROV18	SO268-2_124_MICP_2-2	12.04.19 22:38:28	Reference area DE / post dredge impact:	11°51.786'N 117°0.738'W	4125 m
SO268-2_124_ROV18	electrochemical microprofiler 2	13.04.19 01:33:04	outside track / strong cover		
SO268-2_134_ROV19	SO268-2_134_MICP_1-1	17.04.19 21:25:36			
SO268-2_137_ROV20	electrochemical microprofiler 1	18.04.19 17:25:34	Impact area BE	14°6.694'N 125°52.299'W	4495 m
SO268-2_134_ROV19	SO268-2_134_MICP-DEEP_2-1	17.04.19 21:47:50			
SO268-2_134_ROV19	fiberoptical microprofiler 2	18.04.19 03:28:45	Impact area BE	14°6.695'N 125°52.308'W	4495 m
SO268-2_134_ROV19	SO268-2_134_MICP-DEEP_3-1	17.04.19 22:03:35			
SO268-2_134_ROV19	fiberoptical microprofiler 3	18.04.19 03:16:45	Impact area BE	14°6.68'N 125°52.301'W	4495 m
SO268-2_134_ROV19	SO268-2_134_BFC-ROV_2-1	17.04.19 22:23:47			
SO268-2_137_ROV20	benthic chamber 2	18.04.19 22:58:09	Impact area BE	14°6.692'N 125°52.312'W	4496 m
SO268-2_134_ROV19	SO268-2_134_BFC-ROV_3-1	17.04.19 22:38:21			
SO268-2_134_ROV19	benthic chamber 3	18.04.19 03:42:59	Impact area BE	14°6.681'N 125°52.298'W	4496 m
SO268-2_134_ROV19	SO268-2_134_MICP-DEEP_3-2	18.04.19 03:16:48			
SO268-2_137_ROV20	fiberoptical microprofiler 3	18.04.19 17:44:02	Impact area BE	14°6.692'N 125°52.296'W	4497 m
SO268-2_134_ROV19	SO268-2_134_MICP-DEEP_2-2	18.04.19 03:36:02			
SO268-2_137_ROV20	fiberoptical microprofiler 2	18.04.19 17:09:25	Impact area BE	14°6.691'N 125°52.314'W	4495 m
SO268-2_137_ROV20	SO268-2_137_MICP-DEEP_2-3	18.04.19 17:14:28			
SO268-2_137_ROV20	fiberoptical microprofiler 2	18.04.19 23:19:10	Impact area BE	14°6.71'N 125°52.318'W	4496 m
SO268-2_137_ROV20	SO268-2_137_MICP-DEEP_3-3	18.04.19 17:44:19			
SO268-2_137_ROV20	fiberoptical microprofiler 3	18.04.19 23:44:44	Impact area BE	14°6.679'N 125°52.299'W	4495 m
SO268-2_154_ROV23	SO268-2_154_MICP-DEEP_3-1	23.04.19 17:50:02			
SO268-2_154_ROV23	fiberoptical microprofiler 3	24.04.19 00:16:32	Impact area BE	14°1.987'N 125°55.495'W	4542 m
SO268-2_154_ROV23	SO268-2_154_MICP_2-1	23.04.19 18:17:36			
SO268-2_154_ROV23	electrochemical microprofiler 2	24.04.19 00:02:14	Impact area BE	14°2.000'N 125°55.508'W	4542 m
SO268-2_158_ROV24	SO268-2_158_MICP_2-1	26.04.19 17:14:59			
SO268-2_158_ROV24	electrochemical microprofiler 2	26.04.19 19:34:27	Nodule free DE	11°50.972'N 117°22.991'W	4277 m
SO268-2_158_ROV24	SO268-2_158_MICP-DEEP_3-1	26.04.19 17:52:05			
SO268-2_158_ROV24	fiberoptical microprofiler 3	27.04.19 00:09:30	Nodule free DE	11°50.981'N 117°22.985'W	4277 m
SO268-2_158_ROV24	SO268-2_158_MICP_2-2	26.04.19 19:40:31			
SO268-2_158_ROV24	electrochemical microprofiler 2	26.04.19 23:36:30	Nodule free DE	11°50.981'N 117°22.985'W	4277 m
SO268-2_163_ROV25	SO268-2_163_BFC-ROV_2-1	28.04.19 16:35:37			
SO268-2_165_ROV26	benthic chamber 2	30.04.19 02:25:06	Impact area DE	11°55.703'N 117°1.445'W	4089 m
SO268-2_163_ROV25	SO268-2_163_MICP-DEEP_3-1	28.04.19 17:03:04			
SO268-2_163_ROV25	fiberoptical microprofiler 3	28.04.19 23:09:00	Impact area DE	11°55.705'N 117°1.448'W	4089 m
SO268-2_163_ROV25	SO268-2_163_MICP_2-1	28.04.19 17:22:08			
SO268-2_163_ROV25	electrochemical microprofiler 2	28.04.19 20:26:44	Impact area DE	11°55.710'N 117°1.449'W	4089 m
SO268-2_163_ROV25	SO268-2_163_MICP_2-2	28.04.19 20:30:48			
SO268-2_163_ROV25	electrochemical microprofiler 2	28.04.19 23:23:30	Impact area DE	11°55.710'N 117°1.442'W	4089 m
SO268-2_174_ROV28	SO268-2_174_MICP-DEEP_3-1	08.05.19 16:03:01			
SO268-2_174_ROV28	fiberoptical microprofiler 3	08.05.19 22:20:13	Reference area DE	11°50.490'N 117°3.506'W	4143 m
SO268-2_174_ROV28	SO268-2_174_MICP_2-1	08.05.19 16:18:55			
SO268-2_174_ROV28	electrochemical microprofiler 2	08.05.19 19:31:21	Reference area DE	11°50.479'N 117°3.501'W	4142 m
SO268-2_174_ROV28	SO268-2_174_MICP-DEEP_1-1	08.05.19 16:52:13			
SO268-2_174_ROV28	fiberoptical microprofiler 1	08.05.19 22:44:04	Reference area DE	11°50.479'N 117°3.525'W	4145 m
SO268-2_174_ROV28	SO268-2_174_MICP_2-2	08.05.19 19:39:15			
SO268-2_174_ROV28	electrochemical microprofiler 2	08.05.19 21:49:19	Reference area DE	11°50.488'N 117°3.517'W	4144 m
SO268-2_193_ROV30	SO268-2_193_BFC-ROV_2-1	13.05.19 17:24:53	Reference area DE / post dredge impact:	11°51.784'N 117°0.772'W	4126 m
SO268-2_209_ROV32	benthic chamber 2	17.05.19 03:03:37	outside track / strong cover		
SO268-2_193_ROV30	SO268-2_193_MICP-DEEP_3-1	13.05.19 18:06:17	Reference area DE / post dredge impact:	11°51.778'N 117°0.771'W	4126 m
SO268-2_193_ROV30	fiberoptical microprofiler 3	14.05.19 00:26:23	outside track / strong cover		
SO268-2_193_ROV30	SO268-2_193_MICP-DEEP_1-1	13.05.19 18:59:37	Reference area DE /	11°51.727'N 117°0.792'W	4129 m
SO268-2_193_ROV30	fiberoptical microprofiler 1	14.05.19 01:07:17	post dredge impact: not impacted		
SO268-2_193_ROV30	SO268-2_193_MICP_2-1	13.05.19 19:36:16	Reference area DE /	11°51.791'N 117°0.774'W	4126 m
SO268-2_193_ROV30	electrochemical microprofiler 2	13.05.19 21:39:51	post dredge impact: in track		
SO268-2_193_ROV30	SO268-2_193_MICP_2-2	13.05.19 21:50:45	Reference area DE /	11°51.788'N 117°0.778'W	4127 m
SO268-2_193_ROV30	electrochemical microprofiler 2	13.05.19 23:56:56	post dredge impact: in track		
SO268-2_193_ROV30	SO268-2_193_MICP_2-3	14.05.19 00:07:35	Reference area DE /	11°51.778'N 117°0.769'W	4127 m
SO268-2_209_ROV32	electrochemical microprofiler 2	17.05.19 01:54:56	post dredge impact: in track		
SO268-2_193_ROV30	SO268-2_193_MICP-DEEP_3-2	14.05.19 00:32:46	Reference area DE / post dredge	11°51.787'N 117°0.772'W	4127 m
SO268-2_209_ROV32	fiberoptical microprofiler 3	16.05.19 20:44:31	impact: outside track / strong cover		
SO268-2_193_ROV30	SO268-2_193_MICP-DEEP_1-2	14.05.19 01:17:14	Reference area DE /	11°51.726'N 117°0.795'W	4130 m
SO268-2_209_ROV32	fiberoptical microprofiler 1	16.05.19 21:05:19	post dredge impact: not impacted		
SO268-2_209_ROV32	SO268-2_209_MICP-DEEP_3-3	16.05.19 20:46:58	Reference area DE /	11°51.790'N 117°0.772'W	4126 m
SO268-2_209_ROV32	fiberoptical microprofiler 3	17.05.19 02:26:51	post dredge impact: in track		
SO268-2_209_ROV32	SO268-2_209_MICP-DEEP_1-3	16.05.19 21:18:40	Reference area DE /	11°51.724'N 117°0.774'W	4129 m
SO268-2_209_ROV32	fiberoptical microprofiler 1	17.05.19 01:57:37	post dredge impact: not impacted		

With a focus on baseline variability, measurements were carried out at all three sites where ROV dives have been conducted: (1) the reference area and (2) the potential impact area in the German contract area, as well as (3) the reference area and (4) the potential impact area in the Belgian contract area. Although some deployments were not successful due to instrument malfunction or breaking sensors, the necessary profiles and data to assess TOU and DOU in the selected areas of the two contract areas could be conducted at appropriate replication. In addition, *in situ* benthic flux studies were carried out in an area experimentally impacted by means of dredge

tows during leg 2. In the experimental site located in the German reference area chamber and profiler measurements were performed in the dredge track, a nearby area with a thick cover of resettling sediments suspended during the disturbance, and an unaffected area somewhat further away. Table 5.17.1.1 provides an overview of the deployments during leg 1 and 2. Figure 5.17.1.1 provides examples of data obtained with the fiberoptical profiler (MICP-DEEP, left panel) and the benthic chamber (BFC-ROV, right panel). A first analysis of the oxygen profiles shows pronounced differences between the two investigated areas (left panel of Fig. 8.9.1.1). Higher oxygen concentrations deep in the sediments in the potential impact area in the Belgian contract area as compared to the German license area are indicative of deeper oxygen penetration and lower rates of oxygen uptake and microbial activity. Due to the capacity of the new fiberoptical profiler to record long profiles the data from both areas include the strongly curved upper part of the profiles, where most of the oxygen consumption is taking place. Profile-based flux data will be combined with oxygen uptake measurements derived from oxygen time series in the benthic chambers (right panel of Fig. 5.17.1.1). To account for the signal drift, typically found in optical sensors in the deep sea, the benthic chambers always host an additional sensor that records bottom water concentrations during the deployment. The apparent decrease in oxygen in these bottom-water recordings is then used to correct the sensor readings obtained in the chamber. Figure 5.17.1.2 shows the altered oxygen penetration after removing the upper sediment layer with the benthic dredge. A shift to lower oxygen concentrations in the upper horizon can be seen. Modelling both profiles will allow to quantify the short-term disturbance effect on benthic oxygen fluxes.

Fig. 5.17.1.1: Examples of in situ oxygen consumption measurements. Left panel: oxygen profiles obtained with the new fiberoptical microprofiler in the German (black line) and the Belgian license area (red line). The grey dotted line indicates the position of the sediment surface. Right panel: Oxygen concentration time series recorded in benthic chamber's overlying water (orange line) and the bottom water (blue line). The difference in slope between the recordings inside and outside the chamber is used to calculate oxygen consumption rates. Please note the ordinate scale: due to the relatively small activity typically found in deep-sea sediments, the concentration in the chamber only decreases by $\sim 15 \mu\text{mol/L}$ (or 3%) over the 5 day incubation period.

In order to get the full picture, in situ data will be combined with oxygen measurements down to several meters sediment depth that are carried out in the ship's lab by project partners from the Alfred Wegener Institute (AWI) using cores collected with the Multicorer and Gravity corer. Oxygen uptake data will further be used for biogeochemical and foodweb modeling by GEOMAR and Utrecht University / NIOZ for integrated assessments of ecosystem function and energy and element flows in the benthic communities.

Fig. 5.17.1.2: Example of oxygen profiles measure before and after the dredge experiment.

Fig. 5.17.1.3: Photographs of deployments of in situ modules: microprofilers ('MICP'), fiberoptical microprofilers ('MICP-DEEP'), and benthic chambers ('BFC-ROV').

Fig. 5.17.1.3 continued.

Fig. 5.17.1.3 continued.

Fig. 5.17.1.3 continued.

5.17.2 In-Situ Experiment: Benthic Ecosystem Functioning

(T. Amaro)

To study the mining impact on benthic ecosystem functioning at the abyssal seafloor an *in situ* experiment was performed in the potential impact area in the Belgian contract area (waypoint ‘track site’; 14°6.7997’N 125°52.2821’W). The experimental work was carried out directly at the seafloor using open chambers used here as ‘Corrals’ that were deployed by the ROV. All experiments followed the pulse-chase approach where labelled particulate organic material (¹³C ‘POM’) was added to the enclosures. The food was injected to stimulate a spring bloom and follow the fate of this within the abyssal food web components (microbes, meio-macro and megafauna) with special emphasis on surface deposit-feeders megafauna that are expected to be particularly affected by sediment blanketing and suspended matter loads. During leg 1, we were able to perform a short-term experiment in 4 Corrals, which lasted 5 days and deployed a long-term experiment in other 4 Corrals that will be collected after 3 weeks on leg 2. All Corrals contained an holothurian as a representative of megafauna (Tab. 5.17.2.1).

Tab. 5.17.2.1: Holothurians in each Corral for the a) short and the b) long-term experiment.

a)	Holothurian species	Corral	b)	Holothurian species	Corral
	Probable <i>Synallactes</i> sp.	6		Probable <i>Benthodytes</i> sp.	6
	No holothurian	7		Probable <i>Synallactes</i> sp.	7
	Probable <i>Psychropotes</i> sp.	10		Probable <i>Psychropotes</i> sp.	10
	Probable <i>Benthodytes</i> sp.	11		Probable <i>Psychropotes</i> sp.	11

At the end of the short-term incubation time, undisturbed sediment samples were collected inside of each corral with the push cores (n = 4). Upon recovery, faunal samples were taken from 0 to 10 cm. Part of the slice was kept for meiofaunal (defined here as animals passing through 250 µm and retained on a 32 µm mesh sieve) stable isotope analysis and the rest was sieved through a 250 µm mesh sieve to retain macrofauna specimens. Meio- and macrofauna samples were stored in 4% formalin until picking and identification under a binocular microscope. One push core in each Corral was used for both bacterial analysis and organic matter quality and quantity taken from 0 to 1, 1 to 5 and 5 to 10 cm horizons. The samples were placed in glass vials and stored at –80°C until analysis. Muscle tissue of each holothurian was also taken for isotopic analysis and preserved at –80°C. Note that during retrieval of the experiment, the holothurian placed in Corral nr 7 was not found. In addition to the experimental samples, background samples were already taken in the past to quantify the natural abundances and stable isotope signatures of all the benthic assemblages described above. Table 5.17.2.2 gives an overview of the deployments.

Tab. 5.17.2.2: Overview of a) the short-term and b) long-term experiment deployment at 4345 m water depth.

a)	Deployments	Lon E-W	Lat N-S	b)	Deployments	Lon E-W	Lat N-S
	Corral 6	125°52,13'W	14°6,70'N		Corral 6	125°52,14'W	14°6,71'N
	Corral 7	125°52,213'W	14°6,733'N		Corral 7	125°52,17'W	14°6,71'N
	Corral 10	125°52,25' W	14°6,78'N		Corral 10	125°52,25'W	14°6,78'N
	Corral 11	125°2,213'W	14°6,73'N		Corral 11	125°52,215'W	14°6,74'N

Fig. 5.17.2.1: Example of one of the corrals at the seafloor.

Fig. 5.17.2.2: Example of one of the corrals short-term incubation with the inclusion of an holothurian (*Psychropotes* sp.).

Fig. 5.17.2.3: Example of the sampling procedure of one of the corrals, which contained 4 push cores and one holothurian.

5.17.3 Restoration experiment: Hard-substrate

(F. Hauquier, C. Díaz, E. Pape)

5.17.3.1 Research Objectives

Polymetallic nodule exploitation will cause multiple stressors for fauna living in the deep sea within and around the license areas of the CCZ. One of these is the physical removal of the nodules themselves, which provide habitat to sessile macrofauna as well as smaller organisms living inside the nodules (burrowing meiofauna). The removal of these habitats will lead to a loss in biodiversity in the license areas within the CCZ and recovery rates may take many decades as shown by recently published results from the Peru Basin, where after almost 3 decades, biodiversity remains significantly lower than pre-mining levels. The exact time required for these organisms to reach initial levels of biodiversity if it is indeed possible for this to occur, is unknown. The removal of these nodules may lead to loss in biodiversity and abundance of species as well as irreversible effects on ecosystem functioning, most noted in areas of direct disturbance. This research marks

the beginning of a hard-substrate restoration experiment whereby we attempt to speed up the process of recovery by replacing the removed nodules with fake ceramic nodules made from commercially available clays as well as deep sea clay. These nodules, as well as real nodules collected from previous cruises (for control) are deployed with the aid of ROV KIEL 6000 in the German contract area zone of the CCZ. Due to expected low settlement and growth rates of organisms expected to settle in these areas, this is a long-term experiment of approximately 30 years.

5.17.3.2 Sampling strategy

Three sets of 27 frames containing 25 nodules each (mixture of real polymetallic and artificial ceramic nodules) were deployed at three different sites: On the 08th March, one set was deployed during 35-ROV06 in the German Reference Site (11°50.647'N, 117°3.555'W), on the 24th April the second set was deployed in the No-Nodule Site (11°51.011'N, 117°23.032'W) during 158-ROV25 and on the 14th May, the final set was deployed in a track of the Dredge Site (11°51.810'N, 117°0.720'W) during 188-ROV29 and 197-ROV31. 3 of each set of frames contained a scrubbing sponge attached to a stalk to simulate the natural stalked sponges found in these areas. In addition, a set of 3 sterile frames was deployed during 188-ROV29 in the SO239_24-EBS track (11°51.615'N, 117°0.745'W), next to the decompaction experiment (Ch. 5.17.4). These frames will be revisited, if possible, in the following years to decades over a period of approximately 30 years. Another set of 3 sterile frames was deployed in the German Trial Site (11°55.716'N, 117°1.455'W) on Leg 1 during the 25-ROV03 Dive and recovered on Leg 2 during 163-ROV25 to investigate if a short deployment might yield initial results i.e. whether any organisms had settled on deployed nodules between the time of deployment and retrieval, i.e. within 54 days.

Fig. 5.17.3.1: Deployment of nodule frames in the German reference area, conducted by the ROV KIEL 6000. Photo: GEOMAR ROV Kiel6000.

Fig. 5.17.3.2: Deployment of nodule frames in a track of the dredge experiment, conducted by the ROV KIEL 6000. Photo: GEOMAR ROV Kiel6000.

5.17.4. Restoration experiment: Soft-bottom

(F. Hauquier, C. Díaz, E. Pape)

5.17.4.1 Research Objectives

The removal of the upper 10-15cm of the deep seafloor during future mining activities will entail a significant risk of biodiversity loss in the CCZ license areas. Also for smaller organisms living inside the surface sediment layers (i.e. the meiofauna – see Ch. 5.12), mining will have a clear effect on their environment and distribution. This has already been shown by assessment of the meiofauna community composition in previously disturbed tracks mimicking actual mining operations. Even after several decades, meiofaunal densities had not fully recovered compared to undisturbed patches due to their limited dispersal capacity. One of the envisioned effects to the deep-seafloor communities when mining operations start will be the compaction of the sediment by the vehicle. From previous study we know that this compaction also entails that the sediment geochemistry changes and that these changes are detrimental for the meiofauna. Combined with their inability to disperse over larger distances, this makes them especially vulnerable. Most communities require several years to decades to recover from an impact that could be comparable to that from a mining vehicle. One of our aims is therefore to look for ways in which we could speed up this recovery process, by loosening the sediment again after the passing of the vehicle by de-compacting the topmost sediment layer with a rake. To this end, we put out some experimental test patches with the help of the ROV KIEL 6000 in the German contract area zone of the CCZ.

5.17.4.2 Sampling strategy

On the 6th of April we deployed a rake by means of the ROV KIEL 6000 arm (Fig. 5.17.4.1) in triplicate patches inside an epibenthic sledge track from 2015 since this contains compacted sediment. Each patch was 3m long and distance between two consecutive patches was roughly 2m (Fig. 5.17.4.2). The area was marked for future assessment of the same three patches.

The next step was to collect sediment samples from within and just outside the de-compacted seafloor strips by means of pushcore sampling. This was done on the 12th of May, a little bit more

than 1 month after the initial experiment. Each strip was sampled by 2 PUCs, one for environmental variables and one for meiofauna community analyses (see Tab. 5.17.4.1). As a control to the de-compacted sediments, we also sampled the compact sediment patches between each two stretches in the same way. All PUCs were sliced per centimetre down to 5cm depth and stored either frozen (-80°C ; environmental variables) or in a 4% formaldehyde/seawater solution (community analyses). Analyses to be performed are similar to those for the multicorer stations (see Ch. 5.12 for details) and will be carried out at the UGent Marine Biology lab.

Fig. 5.17.4.1: ROV KIEL 6000 arm operating the rake to de-compact the sediment within the SO239 24-EBS track from 2015. Photo: GEOMAR ROV Kiel6000.

Fig. 5.17.4.2: Image of one of the de-compacted sediment stretches at 4100m depth, freshly made by ROV KIEL 6000. Photo: GEOMAR ROV Kiel6000.

Fig. 5.17.4.3: Pushcore sampling in one of the de-compacted sediment stretches by ROV KIEL 6000. Photo: GEOMAR ROV Kiel6000.

Tab. 5.17.4.1: List of PUC stations and purpose of core samples.

Station SO268/2_	Date	Gear	Lat (N)	Long (W)	Area	Core	Fixative	Research Purpose	Comment
188-1	12/05/2019	ROV 29	11.8602781	117.0126038	GER Reference - old EBS track	PUC 20	Frozen	env vars	decompaction stretch 1
188-1	12/05/2019	ROV 29	11.8602562	117.0125961	GER Reference - old EBS track	PUC 7	4% formaldehyde	community	decompaction stretch 1
188-1	12/05/2019	ROV 29	11.8602562	117.0125961	GER Reference - old EBS track	PUC 27	4% formaldehyde	community	control 1
188-1	12/05/2019	ROV 29	11.8603067	117.0125656	GER Reference - old EBS track	PUC 71	Frozen	env vars	control 1
188-1	12/05/2019	ROV 29	11.8602629	117.0126266	GER Reference - old EBS track	PUC 24	4% formaldehyde	community	decompaction stretch 2
188-1	12/05/2019	ROV 29	11.86024	117.0125656	GER Reference - old EBS track	PUC 36	Frozen	env vars	decompaction stretch 2
188-1	12/05/2019	ROV 29	11.8602762	117.0126343	GER Reference - old EBS track	PUC 11	4% formaldehyde	community	control 2
188-1	12/05/2019	ROV 29	11.860219	117.0126419	GER Reference - old EBS track	PUC 57	Frozen	env vars	control 2
188-1	12/05/2019	ROV 29	11.8602324	117.0126953	GER Reference - old EBS track	PUC 46	Frozen	env vars	decompaction stretch 3
188-1	12/05/2019	ROV 29	11.8602486	117.0126572	GER Reference - old EBS track	PUC 12	4% formaldehyde	community	decompaction stretch 3
188-1	12/05/2019	ROV 29	11.8602886	117.0127411	GER Reference - old EBS track	PUC 17	4% formaldehyde	community	control 3
188-1	12/05/2019	ROV 29	11.8602333	117.0126953	GER Reference - old EBS track	PUC 25	Frozen	env vars	control 3

5.18 Scavenging Amphipoda (pelagic fauna sampling)

(T. Patel)

5.18.1 Research Objectives

Amphipod crustaceans belonging to the Lysianassoidea family, make up more than 90% of the amphipod community in the Clarion-Clipperton fracture Zone (CCZ). The Royal Belgian Institute for Natural Sciences (RBINS) are investigating whether there are differences and similarities in the species compositions of these deep-sea scavenging crustaceans (i.e. richness, abundances, community structure) in the GER and BEL contract areas, and whether deep-sea mining of manganese nodules and subsequent sediment plumes, would affect the biodiversity and recolonisation abilities of these crustaceans.

5.18.2 Community and DNA analyses

Our approach is two-fold, using complimentary morphological and genetic techniques. Firstly, detailed sorting and identification was performed onboard using the morphological species concept and taxonomic keys to separate the samples into “morphotypes”. Two species are selected as model specimens for further genetic analysis; *Paralicella caperesca* and *Abyssorhomene gerulicorbis*. These will be analysed for Cytochrome Oxidase I (COI) gene, barcoded and then further analysed using Next-Generation Sequencing (NGS) methods.

5.18.3 Environmental Analyses

Specimens were dissected and either pleopods or urosome fixed in 96% molecular grade ethanol. Tissue was similarly dissected for heavy metal analysis (pre- and post-dredge experiment) and frozen at -20 °C. During SO268-2, it was also possible to sample the sediment close to the trap deployments using the Push Cores with ROV. This sediment will be analysed for the presence of heavy metals and used to compare to the levels present within the amphipod tissue. This is a first test before the *Patania* nodule collector trial, to see if plume-driven heavy metal uptake has a bio-accumulative effect within these deep-sea scavengers, possibly affecting the functionality of their feeding and respiration abilities.

5.18.4 Preliminary results (Onboard)

During SO268-2, there were eight deployments of the baited trap boxes either using Elevators I or II, or deployed with the ROV, six of which were successful with Lysianassoidea amphipods present within.

Station	Area	Adult Individuals
101-1	GER (pre-dredge)	10
109-1	GER	21
124-1	GER (1 day post-dredge)	20
132-1	BEL	3
156-1	BEL	26
163-1	GER	4
173-1	GER (post-dredge)	4
188-1	GER (post-dredge)	45

5.18.5 Aims: NGS Sequencing

For the specimens from SO242-1 and SO239, it has not yet been possible to successfully apply DDRad-Sequencing techniques. Therefore, for these specimens, 2b-RAD-Sequencing (which

utilises only one enzyme creating a more streamlined genotyping process) will be performed in late summer 2019.

Fig. 5.18.1: The Traps

Fig. 5.18.2: Work on the microscope

Fig. 5.18.3: Amphipods (pre-dissection)

Fig. 5.18.4: Slicing n' dicing

5.19 Dredge Plume Experiment and Sensor Array

(H. de Stigter, S. Haalboom, T. Schöning)

Most of the sensors deployed for the dredge plume experiment were found to have functioned well and to have recorded good data. Whilst much data processing is still to be done, a first assessment of the collected data showed that over the 6 weeks of deployment of the sensors, near-bottom current speeds were mostly below 10 cm s^{-1} , with apparent tidal variation in current direction (Fig. 5.19.1). Patterns of variation in current speed and direction over longer term might be attributed to the fortnightly spring-neap tidal cycle. However, a number of current sensors recorded a shift from a distinctly cyclic current pattern in the first half of the recording period, to a pattern with prevalent eastward flow component in the latter half. By its timing and nature this shift in current pattern might be associated with the passage of the mesoscale eddy over the area, but more extensive analysis of the data and comparison with long-term records collected by BGR moorings would be required to confirm this.

Fig. 5.19.1: Time series records of current velocity at 1 mab recorded in the first 5 days after dredging by profilers on NIOZ_PFM-07 and -08, resp. 100 and 200 m south of the dredge path. Sampling interval resp. 1 and 2 minutes.

Near-bottom turbidity as recorded by optical and acoustic sensors was overall very low, showing no obvious correlation with near-bed current dynamics. It thus seems that near-bed currents were too weak to cause resuspension of either pristine or redeposited sediment. Short-lived peaks in turbidity observed at individual or multiple platforms can be attributed to various SO268 activities affecting the seabed in the vicinity of the platforms.

In the dredging experiment, a distinct increase in turbidity was observed in all sensor platforms located south of the dredge path, whilst north of the dredge path no response in turbidity was recorded (Fig. 8.11.2). After dredging had started on 11 April, the southern sensors started to record enhanced turbidity 1:27 h, 2:13–3:25 h and 3:55 h later at, respectively, 100 m (NIOZ_PFM-07), 200 m (NIOZ_PFM-08 and NIOZ_PFM-04) and 300 m (GMR_PFM-08) distance from the dredge path. The time lag is consistent with recorded currents of $< 5 \text{ cm s}^{-1}$, shifting from eastward

to southward direction during the dredging. Also, over the longer term, bottom water flow was prevailing in southerly direction, which explains why the dredging plume was not recorded by any of the platforms north of the dredge line. Platforms located 100 and 200 m south of the dredge line recorded distinctly higher peaks in turbidity than platforms at 300 m, which may reflect both a dilution of the plume as it was spreading away from the source and mixed with clear water, but also the rapid loss of suspended sediment particles from the plume by settling. From acoustic backscatter profiles recorded by the Nortek Aquadopp 2 MHz current profilers it appears that the dredging plume extended to about 5 metres above the seabed.

Fig. 5.19.2: Time series records of turbidity at 1 mab recorded in the first 5 days after dredging by JFE Advantech OBS sensors on NIOZ_PFM-07, -08 and GMR_PFM-8, resp. 100, 200 and 300 m south of the dredge path.

The prevalent southward dispersion of the dredge plume was also clearly reflected in the amount of sediment collected in the SLIC boxes. Whilst north of the dredging path the SLIC boxes contained as little sediment after the dredging as they had contained before, the SLIC boxes south of the dredging path contained appreciably more sediment after the dredging (Fig. 5.19.3).

Fig. 5.19.3: SLIC (Sedimentation Level Indicator) boxes positioned to the north, in the middle and south of the dredge path, photographed one day before and one day after the dredging. Photos: GEOMAR ROV Team.

On the longer term, until one month after the dredging, no further natural resuspension events were observed in the plume monitoring array. Localized increases in turbidity could be explained by nearby sampling operations. A more thorough analysis of current records will be needed to determine whether the passing mesoscale eddy had any effect in bottom water current dynamics.

5.20 Sediment Geomechanics

(M. Haeckel)

Introduction

Bioturbation is a key process affecting benthic ecosystem structure and functions by controlling sediment biogeochemistry, such as organic matter remineralization, nutrient fluxes, and oxygen consumption, as well as physical sediment properties, such as porosity and mechanical stiffness (Meysman et al., 2006).

After its deposition at the seafloor the particulate organic carbon (POC) is degraded by microorganisms, thereby consuming oxygen and releasing nutrients that, in turn, stimulate the growth of microbial biomass. As an important component in the food web this sustains higher trophic communities, i.e. meiofauna and macrofauna. Reworking of the sediment by macrofauna (i.e. bioturbation) mixes fresh (labile) organic material into deeper sediment layers, thereby increasing the reaction zone and time for organic carbon remineralization. This determines the effectiveness of the consumption of oxygen and the overall redox zonation in the surface sediments (Haeckel et al., 2001), thus in turn controlling microbial communities and their functions.

In addition, burrowing fauna fracture the sediment through their activity (Dorgan et al., 2005), thereby reducing the mechanical stability of the sediments. This allows them to shape their environment as ecosystem engineers.

Mining the seafloor will have an immediate and direct impact on this complex interaction between macrofaunal and microbial metabolic activities and thus on benthic ecosystem functioning as documented by the investigations of the decade-old disturbance tracks in the CCZ and the DISCOL area during the first project phase. The analysis of this data suggests that sediment stiffness is an additional factor controlling faunal recolonization.

Objective

The geomechanical stiffness of the surface sediments will be determined before and after the collector trial (i) to improve our understanding of the role of bioturbation in the recolonization of impacted sites, i.e. where more compacted subsurface sediments with increased shear strength are exposed at the surface, and (ii) to constrain the resulting sediment compaction (respectively the induced porewater expulsion) that is induced by the weight of the nodule collector system. Hence, during SO268 the vane shear strength of the surface sediments in the German and Belgian working areas (Tab. 5.20.1) was measured prior to the collector trial. In addition, a core from the area with thicker sediment deposition in the Dredge Site (Fig. 3.1) was also measured.

Method

A motorized miniature vane shear apparatus (FL 2503, APS GmbH, Rosdorf, Germany) was used to analyze sediment stiffness, peak undrained shear strength and residual undrained shear strength (Fig. 5.20.1). Two four-bladed vanes, model C with a diameter of 12.7 mm and a height

of 25.4 mm and model G with a diameter of 25.4 mm and a height of 50.8 mm, were used. The torque was measured with an electrical torque transducer unit. The torque measurement result was converted to a unit shearing resistance of the cylindrical surface area defined by the vane dimensions. The vane shear apparatus was calibrated prior to shipboard use. The measurement's relative accuracy was $\pm 0.3\%$. During the automatized strength tests, data were recorded in 1-s intervals using the manufacturer's software GEOSYS (APS GmbH, Rosdorf, Germany). The measurements were carried out in accordance to recommendations in ASTM D4648/D4648M – 16 (*Standard Test Methods for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil*).

The MUC liner was placed below the vane and fixed to the apparatus. Then the vane was inserted to its full height into the sediment: 25.4 mm for vane C and 50.8 mm for vane G. Regions with visually flat and undisturbed surfaces without nodule were chosen for the measurements (if possible). The sample was sheared with constant vane rotation of $6^\circ/\text{min}$ up to a vane rotation of 30° to measure peak vane strength. For all measurements, prior to reaching 30° a peak strength maximum was passed and strength was declining. Immediately afterwards the vane was rotated for 720° at $60^\circ/\text{min}$. After that the measurement for residual strength was carried out using the same test parameters as during measurement of peak strength. Calculations to convert torque into shearing resistance were done according to ASTM D4648.

This procedure was performed sequentially for both vanes. Afterwards the sheared disturbed sediment layer was removed and measurements for the next sediment layer proceeded. The result is a depth profile of the shear strength (Fig. 5.20.2).

Fig. 5.20.1: Setup for Vane shear strength during SO266, here a MeBo200 half round core. Photo: C. Deusner

Preliminary Results

Shear strength generally increases slightly with depth (Fig. 5.20.2). While the profiles are quite similar for the MUCs of GER trial and reference as well as the BEL reference and the GER dredge site, at the BEL trial site the shear strength is higher and the profile more curved reaching a plateau value below 8 cm.

For the last depth interval (18-21 cm) measured in the core from the GER trial site the shear strength is significantly elevated. This sample may indicate that the transition from the bioturbated zone to the more compacted (stiffer) subsurface sediments below.

Fig. 5.20.2: Depth profiles of vane (model C) shear strength in surface sediments at the five study sites.

Tab. 5.20.1: List of cores measured for vane shear strength.

Station	Lat N	Lon W	Water Depth	Study Site
005-MUC-01 ^a	11° 55.872'	117° 01.588'	4081.5 m	GER Trial
065-MUC-14 ^a	14° 06.772'	125° 52.297'	4495.3 m	BEL Trial
135-MUC-27	14° 01.109'	125° 55.357'	4548.9 m	BEL Ref
178-MUC-33	11° 50.456'	117° 03.323'	4130.6 m	GER Ref
185-MUC-36 ^a	11° 51.774'	117° 00.760'	4121.6 m	Dredge (thick cover)

^a Cores contained a manganese nodule at the surface.

6 Ship's Meteorological Station

No data available.

7 Station List

Leg 1

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
27/02/19 17:00	001-1_AUV-01	11° 54.767' N	117° 02.378' W	Ship	4111.0	GER Trial	Transponder calibration
27/02/19 20:30	002-1_CTD-01	11° 54.674' N	117° 02.099' W	USBL	4094.8	GER Trial	sound velocity profile
28/02/19 01:08	003-1_EM122-01	11° 54.959' N	117° 12.179' W	Ship	4111.8	GER Trial	Start Transect
28/02/19 10:52	004-1_AUV-02	11° 54.636' N	117° 01.323' W	Ship	4123.7	GER Trial	Start Transect
28/02/19 15:52	005-1_MUC-01	11° 55.872' N	117° 01.588' W	Ship	4081.5	GER Trial	TV-MUC
28/02/19 19:31	006-1-MUC-02	11° 55.799' N	117° 01.475' W	Ship	4087.3	GER Trial	
28/02/19 23:06	007-1_MUC-03	11° 55.633' N	117° 01.258' W	Ship	4089.2	GER Trial	
01/03/19 00:26	008-1_MOOR-01	11° 55.338' N	117° 01.753' W	SO262	4088.7	GER Trial	Recovery SO262-005OBM
01/03/19 06:45	009-1_LANDER-01	11° 55.711' N	117° 01.450' W	USBL	4083.0	GER Trial	Elevator 1
01/03/19 10:49	010-1_LANDER-02	11° 55.732' N	117° 01.435' W	USBL	4087.1	GER Trial	Elevator 2
01/03/19 17:02	011-1_ROV-01	11° 55.726' N	117° 01.438' W	USBL	4084.0	GER Trial	Start Transect
01/03/19 22:03	012-1_BC-01	11° 55.873' N	117° 01.633' W	Ship	4081.0	GER Trial	failed
02/03/19 00:56	012-2_BC-02	11° 55.880' N	117° 01.631' W	Ship	4051.3	GER Trial	failed
02/03/19 03:12	013-1_OFOS-01	11° 56.306' N	117° 01.966' W	Ship	4083.3	GER Trial	aborted: technical problems
02/03/19 11:38	014-1_CTD-02	11° 56.299' N	117° 01.963' W	USBL	4085.3	GER Trial	
02/03/19 18:11	012-3_BC-03	11° 55.873' N	117° 01.633' W	Ship	4080.4	GER Trial	
02/03/19 21:22	015-1_BC-04	11° 55.798' N	117° 01.532' W	Ship	4082.9	GER Trial	failed
03/03/19 00:15	015-2_BC-05	11° 55.786' N	117° 01.540' W	Ship	4086.1	GER Trial	failed
03/03/19 03:01	016-1_GC-01	11° 55.863' N	117° 01.537' W	USBL	4083.5	GER Trial	
03/03/19 06:48	017-1_AUV-03	11° 54.653' N	117° 02.114' W	Ship	4109.8	GER Trial	Start Transect
03/03/19 09:33	018-1_MUC-04	11° 55.454' N	117° 01.039' W	USBL	4099.3	GER Trial	
03/03/19 12:45	019-1_MUC-05	11° 55.289' N	117° 00.819' W	USBL	4106.9	GER Trial	
03/03/19 17:11	020-1_ROV-02	11° 55.717' N	117° 01.440' W	USBL	4084.1	GER Trial	Start Transect
04/03/19 00:24	015-3_BC-06	11° 55.790' N	117° 01.530' W	USBL	4089.8	GER Trial	

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
04/03/19 08:30	021-1 OFOS-02	11° 55.770' N	117° 02.449' W	USBL	4093.9	GER Trial	Start Transect
04/03/19 21:44	022-1 MOOR-02	11° 55.268' N	117° 00.624' W	SO262	4092.7	GER Trial	Recovery SO262-028ST
05/03/19 03:50	023-1 CTD-03	11° 54.671' N	117° 02.131' W	Ship	4102.9	GER Trial	
05/03/19 11:02	024-1 BC-07	11° 55.874' N	117° 01.628' W	Ship	4087.0	GER Trial	failed
05/03/19 13:47	024-2 BC-08	11° 55.873' N	117° 01.633' W	Ship	4087.6	GER Trial	failed
05/03/19 18:45	025-1 ROV-03	11° 55.570' N	117° 01.432' W	USBL	4087.0	GER Trial	Start Transect
06/03/19 00:59	024-3 BC-09	11° 55.864' N	117° 01.641' W	USBL	4087.6	GER Trial	
06/03/19 04:03	026-1 MUC-06	11° 56.035' N	117° 01.775' W	USBL	4087.3	GER Trial	
06/03/19 07:03	027-1 BC-10	11° 56.032' N	117° 01.823' W	USBL	4085.3	GER Trial	
06/03/19 10:08	028-1 BC-11	11° 55.626' N	117° 01.313' W	USBL	4093.2	GER Trial	
06/03/19 16:51	029-1 ROV-04	11° 55.722' N	117° 01.452' W	USBL	4083.4	GER Trial	Start Transect
07/03/19 03:55	030-1 OFOS-03	11° 54.487' N	117° 00.534' W	USBL	4070.4	GER Trial	Start Transect
07/03/19 20:00	031-1 ROV-05	11° 55.781' N	117° 01.468' W	USBL	4088.5	GER Trial	
08/03/19 01:55	032-1 AUV-04	11° 55.655' N	117° 01.185' W	Ship	4088.3	GER Trial	Test dive
08/03/19 05:59	033-1 BC-12	11° 55.466' N	117° 01.085' W	Ship	4096.1	GER Trial	
08/03/19 12:27	034-1 LANDER-03	11° 50.633' N	117° 03.552' W	USBL	4128.8	GER Reference	Elevator 2
08/03/19 17:40	035-1 ROV-06	11° 50.676' N	117° 03.500' W	Ship	4131.8	GER Reference	
09/03/19 02:45	036-1 AUV-05	11° 55.664' N	117° 03.502' W	Ship	4128.8	GER Reference	Test dive
09/03/19 06:04	037-1 GC-02	11° 50.708' N	117° 03.593' W	USBL	4131.9	GER Reference	
09/03/19 09:03	038-1 MUC-06	11° 50.686' N	117° 03.612' W	USBL	4130.2	GER Reference	
09/03/19 13:16	039-1 MUC-08	11° 51.262' N	117° 02.368' W	USBL	4130.1	GER Reference	
09/03/19 17:36	040-1 ROV-07	11° 50.647' N	117° 03.541' W	USBL	4131.8	GER Reference	Start Transect
10/03/19 02:21	041-1 AUV-06	11° 54.649' N	117° 02.121' W	Ship	4110.0	GER Trial	Start Transect; failed
10/03/19 07:22	042-1 MUC-09	11° 51.716' N	117° 00.393' W	USBL	4118.1	GER Reference	
10/03/19 10:48	043-1 MUC-10	11° 55.834' N	117° 01.346' W	USBL	4087.8	GER Trial	
10/03/19 14:08	044-1 BC-13	11° 55.830' N	117° 01.349' W	Ship	4088.5	GER Trial	failed
10/03/19 20:29	044-2 BC-14	11° 55.835' N	117° 01.342' W	USBL	4089.1	GER Trial	

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
11/03/19 01:02	045-1 MOOR-03	11° 48.326' N	117° 31.895' W	SO262	4351.0	GER	Recovery SO262-157OBM
13/03/19 00:02	046-1 AUV-07	14° 05.402' N	125° 52.644' W	Ship	4467.8	BEL Trial	Transponder calibration
13/03/19 02:52	047-1 CTD-04	14° 04.982' N	125° 52.590' W	Ship	4485.7	BEL Trial	
13/03/19 06:20	048-1 EM122-02	14° 12.885' N	125° 41.836' W	Ship	4579.2	BEL Trial	Start Transect
14/03/19 09:07	049-1 CTD-05	14° 05.785' N	125° 52.954' W	Ship	4459.7	BEL Trial	
14/03/19 12:46	050-1 MUC-11	14° 06.831' N	125° 52.350' W	USBL	4496.7	BEL Trial	failed
14/03/19 15:44	050-2 MUC-12	14° 06.831' N	125° 52.350' W	USBL	4508.2	BEL Trial	
14/03/19 18:19	051-1 AUV-08	14° 05.302' N	125° 52.298' W	Ship	4484.6	BEL Trial	Start Transect
14/03/19 21:33	052-1 BC-15	14° 06.804' N	125° 52.273' W	USBL	4506.6	BEL Trial	
15/03/19 01:39	053-1 BC-16	14° 06.713' N	125° 52.458' W	USBL	4484.9	BEL Trial	
15/03/19 07:36	054-1 LANDER-04	14° 06.730' N	125° 52.212' W	USBL	4507.2	BEL Trial	Elevator 2
15/03/19 10:08	055-1 LANDER-05	14° 06.761' N	125° 52.258' W	USBL	4498.5	BEL Trial	Elevator 1
15/03/19 12:21	056-1 MUC-13	14° 06.599' N	125° 52.099' W	USBL	4501.9	BEL Trial	
15/03/19 16:53	057-1 ROV-08	14° 06.758' N	125° 52.230' W	USBL	4480.7	BEL Trial	Start Transect
16/03/19 03:25	058-1 AUV-09	14° 05.304' N	125° 52.303' W	Ship	4482.7	BEL Trial	Start Transect
16/03/19 06:18	059-1 CTD-06	14° 05.307' N	125° 52.301' W	Ship	4468.7	BEL Trial	
16/03/19 10:37	060-1 BC-17	14° 06.491' N	125° 51.849' W	Ship	4512.3	BEL Trial	
16/03/19 14:00	061-1 BC-18	14° 06.869' N	125° 52.324' W	Ship	4499.8	BEL Trial	
16/03/19 18:50	062-1 LANDER-06	14° 07.090' N	125° 52.116' W	Ship	4493.7	BEL Trial	MoLab: loss of weights
17/03/19 00:30	063-1 OFOS-04	14° 06.134' N	125° 52.931' W	USBL	4454.7	BEL Trial	Start Transect
17/03/19 17:01	064-1 ROV-09	14° 06.830' N	125° 52.651' W	USBL	4471.7	BEL Trial	Start Transect
18/03/19 05:05	065-1 MUC-14	14° 06.772' N	125° 52.297' W	USBL	4495.3	BEL Trial	
18/03/19 08:27	066-1 MUC-15	14° 06.438' N	125° 51.894' W	USBL	4508.7	BEL Trial	
18/03/19 11:51	067-1 MUC-16	14° 06.292' N	125° 51.678' W	Ship	4514.1	BEL Trial	
18/03/19 13:46	068-1 PS-01	14° 06.009' N	125° 54.692' W	Ship	4489.8	BEL Trial	Start Transect
18/03/19 17:34	069-1 ROV-10	14° 06.731' N	125° 52.229' W	USBL	4497.9	BEL Trial	Start Transect
19/03/19 01:00	070-1 LANDER-07	14° 07.110' N	125° 51.991' W	USBL	4511.1	BEL Trial	MoLab: loss of lander

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
19/03/19 08:38	071-1 GC-03	14° 06.696' N	125° 52.368' W	USBL	4487.3	BEL Trial	
19/03/19 11:54	072-1 BC-19	14° 06.638' N	125° 52.053' W	USBL	4508.8	BEL Trial	
19/03/19 18:26	073-1 ROV-11	14° 07.096' N	125° 52.074' W	USBL	4505.3	BEL Trial	MoLab recovery dive failed
20/03/19 02:30	074-1 MUC-17	14° 08.105' N	125° 51.819' W	USBL	4518.1	BEL Trial	
20/03/19 06:01	075-1 MUC-18	14° 06.992' N	125° 52.544' W	USBL	4500.2	BEL Trial	
20/03/19 12:28	076-1 BC-20	14° 02.167' N	125° 55.472' W	USBL	4540.5	BEL Reference	
20/03/19 17:56	077-1 ROV-12	14° 07.079' N	125° 52.003' W	USBL	4504.8	BEL Trial	MoLab recovery dive
21/03/19 05:03	078-1 GC-04	14° 08.125' N	125° 51.817' W	Ship	4502.1	BEL Trial	
21/03/19 09:38	079-1 MUC-19	14° 02.187' N	125° 55.471' W	Ship	4535.2	BEL Reference	
21/03/19 13:01	080-1 MUC-20	14° 02.013' N	125° 55.736' W	Ship	4527.7	BEL Reference	
21/03/19 18:26	081-1 ROV-13	14° 06.798' N	125° 52.266' W	USBL	4501.3	BEL Trial	Start Transect
22/03/19 06:40	082-1 BC-21	14° 01.999' N	125° 55.741' W	USBL	4538.9	BEL Reference	
22/03/19 10:09	083-1 BC-22	14° 01.734' N	125° 55.505' W	USBL	4543.6	BEL Reference	
22/03/19 13:18	084-1 GC-05	14° 02.163' N	125° 55.471' W	USBL	4539.6	BEL Reference	
22/03/19 16:47	085-1 MUC-21	14° 01.750' N	125° 55.509' W	USBL	4549.1	BEL Reference	

Leg 2

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
31/03/19 17:45	086-1 CTD-07	16° 12.368' N	107° 04.083' W	Ship	3396.3	Eddy	
31/03/19 21:00	087-1 EM122-03	15° 52.516' N	107° 22.876' W	Ship	3842.2	Eddy	Start Transect
02/04/19 16:30	088-1 CTD-08	11° 44.980' N	113° 07.013' W	USBL	4122.2	Eddy	
03/04/19 00:15	089-1 EM122-04	11° 45.205' N	113° 07.064' W	Ship	4119.2	Eddy	Start Transect
03/04/19 07:14	090-1 CTD-09	11° 46.000' N	114° 02.164' W	USBL	4150.3	Eddy	
03/04/19 10:57	091-1 EM122-05	11° 46.025' N	114° 02.163' W	Ship	4152.1	Eddy	Start Transect
03/04/19 18:30	092-1 CTD-10	11° 47.976' N	114° 56.401' W	USBL	4114.1	Eddy	
04/04/19 01:55	093-1 EM122-06	11° 47.882' N	114° 56.624' W	Ship	4110.9	Eddy	Start Transect

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
04/04/19 14:21	094-1 CTD-11	11° 51.598' N	117° 00.839' W	USBL	4126.7	GER Dredge	
04/04/19 19:52	095-1 BC-23	11° 51.740' N	117° 00.765' W	Ship	4119.1	GER Dredge	failed
04/04/19 22:39	095-2 BC-24	11° 51.740' N	117° 00.765' W	USBL	4120.2	GER Dredge	
05/04/19 01:41	096-1 BC-25	11° 51.736' N	117° 00.837' W	USBL	4122.4	GER Dredge	
05/04/19 07:59	097-1 LANDER-08	11° 51.818' N	117° 00.786' W	USBL	4123.3	GER Dredge	Elevator 1
05/04/19 14:10	098-1 LANDER-09	11° 51.728' N	117° 00.755' W	USBL	4122.5	GER Dredge	Elevator 2
05/04/19 17:43	099-1 ROV-14	11° 51.811' N	117° 00.746' W	USBL	4118.0	GER Dredge	Start Transect
06/04/19 05:16	100-1 OFOS-05	11° 51.488' N	117° 01.289' W	USBL	4124.9	GER Dredge	Start Transect
06/04/19 17:02	101-1 ROV-15	11° 51.807' N	117° 00.788' W	USBL	4126.0	GER Dredge	Start Transect
07/04/19 08:21	102-1 BC-26	11° 51.824' N	117° 00.880' W	Ship	4123.2	GER Dredge	
07/04/19 11:30	103-1 BC-27	11° 51.907' N	117° 00.720' W	Ship	4116.2	GER Dredge	
07/04/19 14:33	104-1 GC-06	11° 51.780' N	117° 00.742' W	USBL	4119.7	GER Dredge	
07/04/19 17:52	105-1 LANDER-10	11° 52.194' N	117° 00.834' W	Ship	4114.6	GER Dredge	BoBo free fall deployment
07/04/19 19:48	106-1 MUC-22	11° 51.773' N	117° 00.740' W	USBL	4122.3	GER Dredge	
07/04/19 23:09	107-1 MUC-23	11° 51.729' N	117° 00.844' W	USBL	4120.8	GER Dredge	
08/04/19 02:37	108-1 BC-28	11° 51.715' N	117° 00.669' W	Ship	4117.5	GER Dredge	failed
08/04/19 08:33	109-1 LANDER-11	11° 51.866' N	117° 00.798' W	USBL	4117.2	GER Dredge	Elevator 1
08/04/19 13:34	110-1 LANDER-12	11° 51.681' N	117° 00.753' W	USBL	4118.6	GER Dredge	Elevator 2
08/04/19 17:01	111-1 ROV-16	11° 51.845' N	117° 00.767' W	USBL	4118.0	GER Dredge	Start Transect
09/04/19 06:24	112-1 BWS-01	11° 51.773' N	117° 00.731' W	USBL	4118.6	GER Dredge	
09/04/19 14:32	113-1 MOOR-04	11° 06.777' N	116° 46.622' W	Ship	4220.4	Eddy	Deployment mooring 3
09/04/19 16:31	114-1 MOOR-05	11° 18.922' N	116° 50.347' W	Ship	4170.0	Eddy	Deployment mooring ST2
09/04/19 20:20	115-1 MOOR-06	11° 36.417' N	116° 55.205' W	Ship	4155.8	Eddy	Deployment mooring 2
10/04/19 01:15	116-1 BC-29	11° 51.711' N	117° 00.671' W	Ship	4117.2	GER Dredge	
10/04/19 04:58	117-1 OFOS-06	11° 51.441' N	117° 03.043' W	USBL	4122.2	GER Dredge	Start Transect
10/04/19 17:13	118-1 ROV-17	11° 51.835' N	117° 00.819' W	USBL	4120.7	GER Dredge	Start Transect
11/04/19 07:44	119-1 DRG-01	11° 51.752' N	117° 00.902' W	USBL	4122.2	GER Dredge	Start Dredge tracks

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
11/04/19 21:20	120-1 CTD-12	11° 51.769' N	117° 00.739' W	USBL	4118.3	GER Dredge	
12/04/19 06:02	121-1 BWS-02	11° 51.773' N	117° 00.739' W	USBL	4118.6	GER Dredge	
12/04/19 10:51	122-1 MUC-24	11° 51.773' N	117° 00.790' W	USBL	4123.7	GER Dredge	TV-MUC
12/04/19 14:51	123-1 MOOR-07	11° 47.484' N	116° 57.860' W	Ship	4072.5	Eddy	Deployment mooring ST1
12/04/19 18:50	124-1 ROV-18	11° 51.788' N	117° 00.749' W	USBL	4118.3	GER Dredge	Start Transect
13/04/19 08:02	125-1 MUC-25	11° 51.862' N	117° 00.768' W	Ship	4119.4	GER Dredge	TV-MUC; failed
13/04/19 11:57	125-2 MUC-26	11° 51.793' N	117° 00.797' W	USBL	4120.3	GER Dredge	TV-MUC
13/04/19 16:16	126-1 OFOS-07	11° 51.771' N	117° 01.052' W	USBL	4118.6	GER Dredge	Start Transect
14/04/19 03:44	127-1 EM122-07	11° 51.922' N	117° 00.877' W	Ship	4117.0	Transit	Start Transect
16/04/19 06:46	128-1 OFOS-08	14° 06.802' N	125° 50.903' W	USBL	4474.2	BEL Trial	Start Transect
16/04/19 18:10	129-1 BC-30	14° 07.004' N	125° 52.504' W	USBL	4503.0	BEL Trial	
16/04/19 21:42	130-1 GC-07	14° 05.217' N	125° 50.053' W	USBL	4487.3	BEL Trial	
17/04/19 02:00	131-1 CTD-13	14° 07.090' N	125° 52.003' W	USBL	4506.2	BEL Trial	
17/04/19 11:43	132-1 LANDER-13	14° 06.685' N	125° 52.305' W	USBL	4504.8	BEL Trial	Elevator 1
17/04/19 17:25	133-1 LANDER-14	14° 06.793' N	125° 52.102' W	USBL	4506.6	BEL Trial	Elevator 2
17/04/19 21:00	134-1 ROV-19	14° 06.698' N	125° 52.294' W	USBL	4508.7	BEL Trial	Start Transect
18/04/19 08:12	135-1 MUC-27	14° 01.109' N	125° 55.357' W	USBL	4548.9	BEL Reference	
18/04/19 12:02	136-1 MUC-28	14° 01.505' N	125° 55.234' W	USBL	4541.7	BEL Reference	
18/04/19 17:00	137-1 ROV-20	14° 06.697' N	125° 52.319' W	USBL	4503.1	BEL Trial	Start Transect
19/04/19 07:51	138-1 MUC-29	14° 01.126' N	125° 54.953' W	USBL	4526.7	BEL Reference	
19/04/19 11:48	139-1 MUC-30	14° 01.897' N	125° 55.003' W	USBL	4523.5	BEL Reference	
19/04/19 15:28	140-1 BC-31	14° 01.902' N	125° 55.005' W	USBL	4521.9	BEL Reference	
19/04/19 18:57	141-1 BC-32	14° 01.130' N	125° 55.346' W	Ship	4541.0	BEL Reference	
19/04/19 22:20	142-1 BC-33	14° 01.504' N	125° 55.249' W	Ship	4541.3	BEL Reference	
20/04/19 02:10	143-1 GC-08	14° 06.560' N	125° 53.398' W	USBL	4501.7	BEL Trial	
20/04/19 05:40	144-1 GC-09	14° 06.126' N	125° 51.550' W	USBL	4521.5	BEL Trial	
20/04/19 11:48	145-1 LANDER-15	14° 05.297' N	125° 53.831' W	USBL	4469.6	BEL Trial	Elevator 2

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
20/04/19 15:56	146-1 ROV-21	14° 05.016' N	125° 54.342' W	USBL	4468.5	BEL Trial	Elevator 2 recovery dive
21/04/19 07:13	147-1 OFOS-09	14° 00.983' N	125° 55.582' W	USBL	4542.1	BEL Reference	Start Transect
21/04/19 18:58	148-1 BC-34	14° 01.140' N	125° 54.949' W	USBL	4529.0	BEL Reference	
21/04/19 22:47	149-1 BC-35	14° 06.313' N	125° 51.648' W	USBL	4516.5	BEL Trial	
22/04/19 04:42	150-1 LANDER-16	14° 01.995' N	125° 55.506' W	USBL	4539.3	BEL Reference	Elevator 2
22/04/19 08:45	151-1 CTD-14	14° 01.141' N	125° 54.949' W	USBL	4520.6	BEL Reference	
22/04/19 17:22	152-1 ROV-22	14° 06.771' N	125° 52.583' W	USBL	4487.5	BEL Trial	Start Transect
23/04/19 05:58	153-1 OFOS-10	14° 00.109' N	125° 53.226' W	USBL	4509.7	BEL Reference	Start Transect
23/04/19 17:30	154-1 ROV-23	14° 02.003' N	125° 55.501' W	USBL	4540.4	BEL Reference	Start Transect
24/04/19 03:14	155-1 EM122-08	14° 01.663' N	125° 55.614' W	Ship	4540.5	Transit	Start Transect
26/04/19 09:10	156-1 LANDER-17	11° 50.988' N	117° 23.005' W	USBL	4272.2	GER NoNodule	Elevator 1
26/04/19 12:24	157-1 GC-10	11° 50.976' N	117° 22.956' W	USBL	4275.0	GER NoNodule	
26/04/19 16:37	158-1 ROV-24	11° 50.995' N	117° 23.000' W	USBL	4273.0	GER NoNodule	Start Transect
27/04/19 07:25	159-1 CTD-15	11° 51.587' N	117° 00.842' W	USBL	4123.3	GER Dredge	
27/04/19 16:41	160-1 OFOS-11	11° 51.820' N	117° 00.655' W	USBL	4116.4	GER Dredge	Start Transect
28/04/19 07:16	161-1 BC-36	11° 55.263' N	117° 00.825' W	USBL	4125.3	GER Trial	
28/04/19 12:56	162-1 LANDER-18	11° 55.695' N	117° 01.458' W	USBL	4080.2	GER Trial	Elevator 1
28/04/19 16:21	163-1 ROV-25	11° 55.701' N	117° 01.439' W	USBL	4082.3	GER Trial	Start Transect
29/04/19 04:10	164-1 OFOS-12	11° 51.548' N	117° 01.052' W	USBL	4123.4	GER Dredge	Start Transect
29/04/19 18:50	165-1 ROV-26	11° 54.632' N	117° 00.886' W	USBL	4112.0	GER Trial	Start Transect
30/04/19 07:19	166-1 BC-37	11° 50.715' N	117° 03.610' W	USBL	4123.8	GER Reference	
30/04/19 10:12	167-1 BC-38	11° 50.980' N	117° 03.320' W	USBL	4121.5	GER Reference	failed
30/04/19 11:40	168-1 EM122-09	11° 50.994' N	117° 03.326' W	Ship	4120.1	Transit	Start Transect
07/05/19 17:02	169-1 ROV-27	11° 55.696' N	117° 01.470' W	USBL	4081.1	GER Trial	Elevator 1 recovery dive
08/05/19 00:14	170-1 LANDER-19	11° 50.492' N	117° 03.506' W	USBL	4133.3	GER Reference	Elevator 2
08/05/19 03:41	171-1 MUC-31	11° 51.003' N	117° 03.323' W	Ship	4122.3	GER Reference	
08/05/19 06:52	172-1 MUC-32	11° 50.447' N	117° 03.314' W	USBL	4134.4	GER Reference	

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
08/05/19 12:09	173-1 LANDER-20	11° 50.478' N	117° 03.504' W	USBL	4132.0	GER Reference	Elevator 1
08/05/19 15:45	174-1 ROV-28	11° 50.481' N	117° 03.496' W	USBL	4131.7	GER Reference	Start Transect
09/05/19 07:50	175-1 BC-39	11° 50.547' N	117° 03.067' W	Ship	4129.1	GER Reference	
09/05/19 21:08	176-1 MOOR-08	11° 57.212' N	117° 00.658' W	SO262	4319.2	GER Reference	Recovery SO262-6OBM
10/05/19 00:33	177-1 OFOS-13	11° 51.359' N	117° 01.640' W	USBL	4128.6	GER Reference	Start Transect
10/05/19 13:07	178-1 MUC-33	11° 50.456' N	117° 03.323' W	USBL	4130.6	GER Reference	
10/05/19 16:15	179-1 MUC-34	11° 50.367' N	117° 03.578' W	USBL	4141.6	GER Reference	
10/05/19 19:21	180-1 BC-40	11° 50.370' N	117° 03.574' W	USBL	4143.2	GER Reference	
10/05/19 22:15	181-1 BC-41	11° 50.455' N	117° 03.321' W	USBL	4133.3	GER Reference	
11/05/19 01:10	182-1 BC-42	11° 50.983' N	117° 03.326' W	USBL	4119.3	GER Reference	
11/05/19 04:54	183-1 CTD-16	11° 51.600' N	117° 00.839' W	Ship	4122.9	GER Dredge	
11/05/19 11:18	184-1 MUC-35	11° 51.785' N	117° 00.701' W	USBL	4116.1	GER Dredge	TV-MUC
12/05/19 01:22	185-1 MUC-36	11° 51.774' N	117° 00.760' W	USBL	4121.4	GER Dredge	TV-MUC
12/05/19 04:47	186-1 MUC-37	11° 51.793' N	117° 00.747' W	USBL	4116.5	GER Dredge	TV-MUC
12/05/19 10:15	187-1 LANDER-21	11° 51.672' N	117° 00.740' W	USBL	4119.7	GER Dredge	Elevator 1
12/05/19 15:13	188-1 ROV-29	11° 51.605' N	117° 00.757' W	USBL	4117.1	GER Dredge	Start Transect
13/05/19 02:43	189-1 BC-43	11° 51.773' N	117° 00.845' W	USBL	4122.1	GER Dredge	
13/05/19 05:37	190-1 BC-44	11° 51.789' N	117° 00.779' W	USBL	4124.0	GER Dredge	
13/05/19 08:36	191-1 BC-45	11° 51.784' N	117° 00.748' W	USBL	4117.3	GER Dredge	
13/05/19 13:57	192-1 LANDER-22	11° 51.689' N	117° 00.744' W	Ship	4123.7	GER Dredge	Elevator 1
13/05/19 17:05	193-1 ROV-30	11° 51.726' N	117° 00.765' W	USBL	4120.2	GER Dredge	Start Transect
14/05/19 05:08	194-1 BC-46	11° 51.764' N	117° 00.813' W	USBL	4120.5	GER Dredge	failed
14/05/19 08:02	195-1 BC-47	11° 51.805' N	117° 00.694' W	USBL	4116.7	GER Dredge	failed
14/05/19 13:23	196-1 LANDER-23	11° 51.858' N	117° 00.778' W	USBL	4117.4	GER Dredge	Elevator 2
14/05/19 16:41	197-1 ROV-31	11° 51.874' N	117° 00.770' W	USBL	4118.0	GER Dredge	Start Transect
15/05/19 05:28	198-1 MUC-38	11° 51.763' N	117° 00.715' W	USBL	4145.5	GER Dredge	TV-MUC
15/05/19 08:45	199-1 MUC-39	11° 51.751' N	117° 00.761' W	USBL	4120.0	GER Dredge	TV-MUC

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Study Site	Comment
15/05/19 12:05	200-1 MUC-40	11° 51.761' N	117° 00.777' W	USBL	4128.5	GER Dredge	TV-MUC
15/05/19 14:50	201-1 MOOR-09	11° 51.798' N	117° 00.753' W	Ship	4119.6	GER Dredge	Deployment Mooring 1 (ADCP)
15/05/19 15:08	202-1 MOOR-10	11° 51.782' N	117° 00.810' W	Ship	4119.4	GER Dredge	Deployment Mooring 2 (ADCP)
15/05/19 16:09	203-1 MOOR-11	11° 56.813' N	117° 02.251' W	Ship	4098.7	GER Trial	Deployment Mooring 3 (ADCP)
15/05/19 18:25	204-1 MOOR-12	11° 55.311' N	117° 00.465' W	Ship	4097.0	GER Trial	Deployment Mooring 4 (ST)
16/05/19 00:17	205-1 BC-48	11° 50.228' N	117° 03.414' W	USBL	4131.7	GER Reference	failed
16/05/19 03:39	205-2 BC-49	11° 50.214' N	117° 03.418' W	USBL	4133.9	GER Reference	
16/05/19 06:41	206-1 BC-50	11° 50.319' N	117° 03.089' W	USBL	4129.1	GER Reference	failed
16/05/19 10:39	207-1 MUC-41	11° 51.790' N	117° 00.789' W	USBL	4117.8	GER Dredge	TV-MUC
16/05/19 14:19	208-1 CTD-17	11° 51.601' N	117° 00.834' W	USBL	4123.4	GER Dredge	
16/05/19 20:11	209-1 ROV-32	11° 51.772' N	117° 00.784' W	USBL	4117.1	GER Dredge	Start Transect
17/05/19 06:39	210-1 EM122-10	11° 51.102' N	117° 00.890' W	Ship	4123.5	Transit	Start Transect

Study sites in the Belgian (BEL) and German (GER) working areas:

Trial Site: consists of the Collector Impact Site and the Plume Impact Site.

Collector Impact Site: Area, where the collector removes the nodules and surface sediment. Here, also the main fraction of the suspended sediment plume is expected to resettle.

Plume Impact Site: Area outside the Collector Impact Site, where the suspended sediment plume will be deposited.

Reference Site: is anticipated to be representative for the ecosystem and environment of the Trial Site and is located at sufficient distance from the Trial Site that it will not be impacted by the collector trial, i.e. the suspended sediment plume.

No-Nodule Site: Area with no polymetallic nodules on the seabed, located approx. 20 nm west of the German Reference Site.

Dredge Site: Area of the small-scale sediment plume experiment conducted with a chain dredge, located approx. 2.7 nm northeast of the German Reference Site and about 4 nm south of the German Trial Site.

Eddy: Several stations on the transit from Manzanillo to the German working area were dedicated to study a mesoscale eddy, a large body of swirling water mass of a few 100-km in diameter, moving towards and across the German working area during the cruise.

8 Data and Sample Storage and Availability

All data generated from SO268 will be archived in the information system PANGAEA (<http://www.pangaea.de/search?q=campaign:cruisename>) at the World Data Center for Marine Environmental Sciences (WDC-MARE) to ensure long-term storage and access to the data for the world-wide scientific community. MiningImpact2 possesses a project data policy specifying time schedules from data creation during SO268 to internal project availability and final publication in PANGAEA, facilitated by the Ocean Science Information System OSIS-Kiel. Data will be made publically available latest 2 years after the project has ended (i.e. February 2024) or at the time of publication of the respective scientific paper. Ship-based hydroacoustic raw data has been submitted to the bathymetric data centre of the Bundesamt für Seeschifffahrt und Hydrografie (BSH) directly after the cruise. Metadata of the onboard DSHIP system has been made available after the cruise in the OSIS-Kiel (<https://portal.geomar.de/osis>). Molecular data generated in the project will be deposited in GenBank (overseen by partner Senckenberg). Contact information for data sets are provided in Table 8.1.

The distribution of fauna samples will be coordinated by Senckenberg. After the life time of MiningImpact, participants will be asked to return any non-needed samples and biological material to Senckenberg for long-term storage. Holotypes of new species will be deposited in appropriate collections of a European natural history museum (e.g. in London, Paris, or Frankfurt) and information on the fate of samples and specimens will be made available via Senckenberg. Microbial samples are stored at the Max-Planck-Institute for Microbiology in Bremen. Sediment cores and samples are stored at the GEOMAR core repository.

Tab. 8.1: Overview of data availability. All data will be made publically available in February 2024 or at the time of earlier scientific publication.

Type of data	Chapter	Contact Person, Institute, Email address
Hydroacoustic survey data	5.9	Jens Greinert, GEOMAR, jgreinert@geomar.de
Sediment plume sensor data	5.19	Henko de Stigter, NIOZ, henko.de.stigter@nioz.nl
AUV photos	5.2	Timm Schoening, GEOMAR, tschoening@geomar.de
OFOS photos	5.3	Autun Purser, AWI, autun.purser@awi.de
CTD data	5.16	Matthias Haeckel, GEOMAR, mhaeckel@geomar.de
Water column chemical data	5.15	Katja Schmidt, BGR, katja.schmidt@bgr.de
Mooring and sediment trap data	5.4	Katja Schmidt, BGR, katja.schmidt@bgr.de
Sediment biogeochemical data	5.14	Sabine Kasten, AWI, sabine.kasten@awi.de
Metal geochemical data	5.14	Andrea Koschinsky, JUB, a.koschinsky@jacobs-university.de
Oxygen respiration and profile data	5.17	Felix Janssen, MPI/AWI, felix.janssen@awi.de
Microbiological data	5.13	Massimiliano Molari, MPI, mamolari@mpi-bremen.de
Sediment geomechanical data	5.20	Matthias Haeckel, GEOMAR, mhaeckel@geomar.de
Megafauna	5.10	Pedro Martinez, SGN, pedro.martinez@senckenberg.de
Macrofauna	5.11	Ana Hilario, UA, ahilario@ua.pt Lenaick Menot, IFREMER, lenaick.menot@ifremer.fr
Meiofauna	5.12	Ann Vanreusel, UGent, ann.vanreusel@ugent.be Pedro Martinez, SGN, pedro.martinez@senckenberg.de
Scavengers	5.18	Tasnim Patel, RBINS, tpatel@naturalsciences.be
In situ food web data	5.17	Teresa Amaro, CIIMAR, tamaro@ciimar.up.pt
Recolonization experiment	5.17	Sabine Gollner, NIOZ, sabine.gollner@nioz.nl

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Disclaimer

MiningImpact is conducted independently of DEME-GSR activities. DEME-GSR is responsible for obtaining all necessary permissions for its operations and does not receive any funding from the MiningImpact project. Neither does the MiningImpact project receive any financial contributions from DEME-GSR.

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11 Abbreviations

AODC	Acridine Orange Direct Count
AUV	Autonomous Underwater Vehicle
BC	Box Corer
BEL	Belgian Contract Area for polymetallic nodule exploration in the CCZ
BIC	Benthic Incubation Chamber
BWS	Bottom Water Sampler
CA	Cellulose Acetate
CTD	Conductivity, Temperature, Density probe
CCZ	Clarion-Clipperton Zone
DIC	Dissolved Inorganic Carbon
DISCOL	DISturbance and reCOLonization experiment
DEA	DISCOL Experimental Area
DOC	Dissolved Organic Carbon
DOU	Diffusive Oxygen Uptake
EBS	Epi-Benthic Sled
EEA	Extracellular Enzymatic Activity
EEZ	Exclusive Economic Zone
FACS	Fluorescence Assisted Cell-Sorting
FLNTU	Fluorescence / Turbidity
FISH	Fluorescence In Situ Hybridisation
GC	Gravity Corer
GER	German Contract Area for polymetallic nodule exploration in the CCZ
GF/F	Glass Microfiber Filter
GFRP	Glass Fiber Reinforced Plastic
IAPSO	International Association for the Physical Sciences of the Oceans
ICP-AES	Inductively-Coupled Plasma Atomic Emission Spectroscopy
ICP-OES	Inductively-Coupled Plasma Optical Emission Spectrometry
ISCHAM	Nodule Respiration CHAMBER
JPIO	Joint Programming Initiative Healthy and Productive Seas and Oceans
MAPR	Miniature Autonomous Plume Recorder
MUC	Multiple Corer
OFOP	Ocean Floor Observation Protocol
OFOS	Ocean Floor Observing System
OPD	Oxygen penetration depth
OMZ	Oxygen Minimum Zone
ORP	Oxygen Reduction Potential
OSCA	Ocean Support Carriage Application
PHF	Primary High Frequency
POC	Particulate Organic Carbon
PUC	Push Core
ROBEX	Robotic Exploration of Extreme Environments
ROV	Remote Operated Vehicle
SLF	Secondary Low Frequency
SPM	Suspended Particulate Matter
TOC	Total Organic Carbon
TOU	Total Oxygen Uptake
TV-MUC	Video-guided Multiple Corer
USBL	Ultra Short Base Line

12 Appendices

12.1 Megafauna Specimens

Tab. 12.1.1: Megafauna specimens collected during SO268 and how they were distributed among different research groups.

(*) *specimens not collected with the ROV.*

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_01	SO268/1_020_ROV02	COLBOX-BIO#9	Alcyonacea	UAVR, IMAR	UAVR	UAVR; IMAR	UAVR	UAVR	
BIO_02	SO268/1_024_BC09	BC09	Ophiuroidea			SGN			
BIO_03	SO268/1_024_BC09	BC09	Ophiuroidea (cf. Ophiosphalma glabrum)	UAVR, IMAR		SGN		UAVR	
BIO_04	SO268/1_028_BC11	BC11	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_05	SO268/1_029_ROV04	COLBOX-BIO#1	Alcyonacea	UAVR	UAVR	UAVR, IMAR	UAVR	UAVR, IMAR	
BIO_06	SO268/1_029_ROV04	COLBOX-BIO#2	Alcyonacea	UAVR	UAVR	UAVR, IMAR	UAVR	UAVR, IMAR	
BIO_07	SO268/1_029_ROV04	COLBOX-BIO#3	Alcyonacea	UAVR	UAVR	UAVR, IMAR	UAVR	UAVR, IMAR	
BIO_08	SO268/1_029_ROV04	COLBOX-BIO#4	Alcyonacea	UAVR	UAVR	UAVR, IMAR	UAVR	UAVR, IMAR	
BIO_09	SO268/1_029_ROV04	COLBOX-BIO#5	Alcyonacea	UAVR	UAVR	UAVR, IMAR	UAVR	UAVR, IMAR	
BIO_10	SO268/1_029_ROV04	COLBOX-BIO#6	Alcyonacea	UAVR	UAVR	UAVR, IMAR	UAVR	UAVR, IMAR	
BIO_11	SO268/1_029_ROV04	COLBOX-BIO#7	Alcyonacea	UAVR	UAVR	UAVR, IMAR	UAVR	UAVR, IMAR	
BIO_12	SO268/1_029_ROV04	COLBOX-BIO#8	Alcyonacea	UAVR, IMAR	UAVR	UAVR, IMAR	UAVR	UAVR, IMAR	
BIO_13	SO268/1_029_ROV04	Slurp gun/ COLBOX	Holothuroidea	CIIMAR					
BIO_14	SO268/1_029_ROV04	Manipulator/ COLBOX	Holothuroidea	CIIMAR					
BIO_15	SO268/1_029_ROV04	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_16	SO268/1_029_ROV04	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_17	SO268/1_029_ROV04	COLBOX	Sponge/Foraminifera						

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_18	SO268/1_029_ROV04	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_19	SO268/1_029_ROV04	COLBOX	Ophiuroidea	IMAR		SGN			
BIO_20	SO268/1_029_ROV04	COLBOX	Asteroidea			SGN			Utrecht
BIO_21	SO268/1_029_ROV04	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_22	SO268/1_031_ROV05	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_23	SO268/1_031_ROV05	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_24	SO268/1_031_ROV05	COLBOX	Alcyonacea	IMAR		SGN		IMAR	
BIO_25	SO268/1_031_ROV05	COLBOX	Ophiuroidea	IMAR		SGN			
BIO_26	SO268/1_031_ROV05	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR; CIIMAR		SGN		UAVR	
BIO_27	SO268/1_031_ROV05	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR; CIIMAR		SGN		UAVR	
BIO_28	SO268/1_031_ROV05	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_29	SO268/1_031_ROV05	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR; CIIMAR		SGN		UAVR	
BIO_30	SO268/1_031_ROV05	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)			SGN		UAVR	
BIO_31	SO268/1_031_ROV05	Manipulator/ COLBOX	Holothuroidea	CIIMAR					
BIO_32	SO268/1_031_ROV05	Manipulator/ COLBOX	Holothuroidea	CIIMAR					
BIO_33	SO268/1_031_ROV05	Slurp gun/COLBOX	Holothuroidea	CIIMAR					
BIO_34	SO268/1_031_ROV05	Manipulator/ COLBOX	Holothuroidea	CIIMAR					
BIO_35	SO268/1_029_ROV04	COLBOX	Ophiuroidea			SGN			
BIO_36	SO268/1_031_ROV05	COLBOX	Actiniaria			SGN			
BIO_37	SO268/1_040_ROV07	COLBOX	Holothuroidea	CIIMAR					
BIO_38	SO268/1_040_ROV07	COLBOX	Holothuroidea	CIIMAR					
BIO_39	SO268/1_040_ROV07	COLBOX	Holothuroidea	CIIMAR					
BIO_40	SO268/1_040_ROV07	COLBOX	Holothuroidea	CIIMAR					
BIO_41	SO268/1_040_ROV07	COLBOX	Holothuroidea	CIIMAR					
BIO_42	SO268/1_040_ROV07	COLBOX	Porifera						
BIO_43	SO268/1_040_ROV07	COLBOX	Porifera						
BIO_44	SO268/1_040_ROV07	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_45	SO268/1_040_ROV07	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_46	SO268/1_040_ROV07	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht
BIO_47	SO268/1_040_ROV07	COLBOX	Ophiuroidea	IMAR		SGN			Utrecht
BIO_48	SO268/1_040_ROV07	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht
BIO_49	SO268/1_040_ROV07	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht
BIO_50	SO268/1_040_ROV07	COLBOX	Alcyonacea	IMAR		SGN		IMAR	
BIO_51	SO268/1_034	Elevator	Ophiuroidea	IMAR		SGN			Utrecht
BIO_52	SO268/1_064_ROV09	COLBOX	Holothuroidea	CIIMAR					
BIO_53	SO268/1_064_ROV09	COLBOX	Asteroidea			SGN			Utrecht
BIO_54	SO268/1_064_ROV09	COLBOX	Galatheoidea	SGN		SGN			
BIO_55	SO268/1_064_ROV09	COLBOX	Galatheoidea	SGN		SGN			
BIO_56	SO268/1_064_ROV09	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN			
BIO_57	SO268/1_064_ROV09	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_58	SO268/1_064_ROV09	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_59	SO268/1_064_ROV09	COLBOX-BIO#3	Porifera	SGN		SGN		Utrecht	Utrecht
BIO_60	SO268/1_064_ROV09	COLBOX-BIO#5	Porifera	SGN		SGN			Utrecht
BIO_61	SO268/1_064_ROV09	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_62	SO268/1_064_ROV09	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_63	SO268/1_064_ROV09	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_64	SO268/1_064_ROV09	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_65	SO268/1_064_ROV09	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_66	SO268/1_064_ROV09	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_67	SO268/1_064_ROV09	COLBOX-BIO#4	Actinaria	IMAR; UAVR	UAVR	SGN; UAVR			

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_68	SO268/1_064_ROV09	COLBOX-BIO#1	Actiniaria	IMAR; UAVR	UAVR	SGN; UAVR			
BIO_69	SO268/1_064_ROV09	COLBOX-BIO#6	Actiniaria	UAVR	UAVR	SGN; UAVR			
BIO_70	SO268/1_064_ROV09	COLBOX-BIO#9	Actiniaria	UAVR	UAVR	SGN; UAVR			
BIO_71	SO268/1_064_ROV09	COLBOX-BIO#2	Actiniaria	IMAR; UAVR	UAVR	SGN; UAVR			
BIO_72	SO268/1_064_ROV09	COLBOX-BIO#8	Actiniaria	IMAR; UAVR	UAVR	SGN; UAVR			
BIO_73	SO268/1_064_ROV09	COLBOX	Porifera						Utrecht
BIO_74	SO268/1_069_ROV10	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht
BIO_75	SO268/1_069_ROV10	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht
BIO_76	SO268/1_069_ROV10	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht
BIO_77	SO268/1_069_ROV10	Slup gun	Gastropoda						
BIO_78	SO268/1_077_ROV12	COLBOX-BIO#3	Actiniaria	UAVR	UAVR	SGN; UAVR			
BIO_79	SO268/1_077_ROV12	COLBOX-BIO#1	Porifera						
BIO_80	SO268/1_077_ROV12	COLBOX-BIO#5	Porifera						
BIO_81	SO268/1_077_ROV12	COLBOX-BIO#7	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht
BIO_82	SO268/1_077_ROV12	COLBOX-BIO#7	Ophiuroidea (cf. Ophiosphalma glabrum)			SGN			
BIO_83	SO268/1_077_ROV12	COLBOX-BIO#7	Ophiuroidea	IMAR					Utrecht
BIO_84	SO268/1_077_ROV12	COLBOX-BIO#7	Asteroidea			SGN			
BIO_85	SO268/1_077_ROV12	Slup gun	Galatheiodea			SGN			
BIO_86	SO268/1_077_ROV12	Slup gun	Holothuroidea	CIIMAR					
BIO_87	SO268/1_077_ROV12	COLBOX-BIO#6	Holothuroidea	CIIMAR					
BIO_88	SO268/1_077_ROV12	COLBOX-BIO#6	Holothuroidea	CIIMAR					
BIO_89	SO268/1_077_ROV12	COLBOX-BIO#2	Holothuroidea	CIIMAR					
BIO_90	SO268/1_077_ROV12	COLBOX-BIO#4	Holothuroidea	CIIMAR					
BIO_91	SO268/1_077_ROV12	COLBOX-BIO#8	Holothuroidea	CIIMAR					
BIO_92	SO268/1_081_ROV13	Slup gun	Holothuroidea	CIIMAR					
BIO_93	SO268/1_081_ROV13	COLBOX	Holothuroidea	CIIMAR					
BIO_94	SO268/2_099_ROV14	COLBOX-BIO#6	Alcyonacea	UAVR	UAVR	UAVR			

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_95	SO268/2_099_ROV14	COLBOX-BIO#8	Alcyonacea	UAVR	UAVR	UAVR			
BIO_96	SO268/2_099_ROV14	COLBOX-BIO#1	Alcyonacea	UAVR	UAVR	UAVR			
BIO_97	SO268/2_099_ROV14	COLBOX-BIO#4	Alcyonacea	UAVR	UAVR	UAVR			
BIO_98	SO268/2_099_ROV14	COLBOX-BIO#2	Alcyonacea	UAVR	UAVR	UAVR			
BIO_99	SO268/2_099_ROV14	COLBOX-BIO#9	Alcyonacea	UAVR	UAVR	UAVR			
BIO_100	SO268/2_099_ROV14	COLBOX-BIO#3	Alcyonacea	UAVR	UAVR	UAVR	UAVR	UAVR	
BIO_101	SO268/2_099_ROV14	COLBOX-BIO#5	Alcyonacea	UAVR	UAVR	UAVR			
BIO_102	SO268/2_099_ROV14	COLBOX-BIO#7	Alcyonacea	UAVR	UAVR	UAVR			
BIO_103	SO268/2_099_ROV14	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht
BIO_104	SO268/2_099_ROV14	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	Utrecht
BIO_105	SO268/2_099_ROV14	COLBOX	Asteroidea (cf. Brisingida)	IMAR		SGN		IMAR	
BIO_106	SO268/2_099_ROV14	COLBOX	Asteroidea			SGN			
BIO_107	SO268/2_099_ROV14	COLBOX	Actiniaria	IMAR		SGN			
BIO_108	SO268/2_099_ROV14	COLBOX	Alcyonacea	IMAR		SGN		IMAR	
BIO_109	SO268/2_099_ROV14	on BIO_98	Anthozoa			SGN			
BIO_110	SO268/2_099_ROV14	With BIO_98	Ophiuroidea			SGN			
BIO_111	SO268/2_099_ROV14	with BIO_99	Serpulidae			UAVR			
BIO_112	SO268/2_101_ROV15	COLBOX	Asteroidea			SGN			
BIO_113	SO268/2_101_ROV15	COLBOX	Asteroidea	IMAR		SGN			
BIO_114	SO268/2_101_ROV15	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_115	SO268/2_101_ROV15	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_116	SO268/2_101_ROV15	COLBOX	Alcyonacea	IMAR		SGN			
BIO_117	SO268/2_101_ROV15	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_118	SO268/2_101_ROV15	COLBOX	Echinoidea			SGN	UAVR		
BIO_119	SO268/2_101_ROV15	COLBOX	Porifera	IMAR					
BIO_120	SO268/2_101_ROV15	COLBOX	Porifera			SGN			
BIO_121	SO268/2_101_ROV15	COLBOX	Ophiuroidea	IMAR		SGN			
BIO_122	SO268/2_118_ROV17	COLBOX-BIO#1	Antipatharia	IMAR		SGN			
BIO_123	SO268/2_118_ROV17	COLBOX	Porifera	IMAR; SGN		SGN			
BIO_124	SO268/2_118_ROV17	COLBOX	Porifera	IMAR; SGN		SGN			
BIO_125	SO268/2_118_ROV17	COLBOX-BIO#5	Echinoidea			SGN	UAVR		
BIO_126	SO268/2_118_ROV17	COLBOX-BIO#5	Echinoidea			SGN	UAVR		

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_127	SO268/2_124_ROV18	COLBOX	Porifera	IMAR; SGN		SGN			Utrecht
BIO_128	SO268/2_124_ROV18	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_129	SO268/2_137_ROV20	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_130	SO268/2_137_ROV20	COLBOX-BIO#7	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_131	SO268/2_137_ROV20	COLBOX-BIO#9	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_132	SO268/2_137_ROV20	COLBOX	Galatheioidea	IMAR		SGN			
BIO_133	SO268/2_137_ROV20	COLBOX	Galatheioidea	IMAR		SGN			
BIO_134	SO268/2_137_ROV20	COLBOX	Galatheioidea	IMAR		SGN			
BIO_135	SO268/2_137_ROV20	COLBOX	Galatheioidea	IMAR		SGN			
BIO_136	SO268/2_137_ROV20	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_137	SO268/2_137_ROV20	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_138	SO268/2_137_ROV20	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_139	SO268/2_137_ROV20	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_140	SO268/2_137_ROV20	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_141	SO268/2_137_ROV20	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_142	SO268/2_137_ROV20	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_143	SO268/2_137_ROV20	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN		UAVR	
BIO_144	SO268/2_137_ROV20	COLBOX-BIO#7	Bryozoa			SGN			
BIO_145	SO268/2_137_ROV20	COLBOX-BIO#9	Porifera	SGN		SGN			Utrecht
BIO_146	SO268/2_137_ROV20	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_147	SO268/2_137_ROV20	COLBOX-BIO#3	Actiniaria	UAVR	UAVR	UAVR			
BIO_148	SO268/2_137_ROV20	COLBOX-BIO#4	Actiniaria	UAVR	UAVR	UAVR			
BIO_149	SO268/2_137_ROV20	COLBOX-BIO#5	Actiniaria	UAVR	UAVR	UAVR			
BIO_150	SO268/2_137_ROV20	COLBOX-BIO#4	Bryozoa			SGN			
BIO_151	SO268/2_137_ROV20	COLBOX-BIO#1	Bryozoa			SGN			
BIO_152	SO268/2_137_ROV20	COLBOX-BIO#1	Alcyonacea	UAVR	UAVR	UAVR			

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_153	SO268/2_137_ROV20	COLBOX-BIO#8	Polyplacophora			SGN			
BIO_154	SO268/2_137_ROV20	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_155	SO268/2_154_ROV23	COLBOX-BIO#3	Actiniaria	UAVR		UAVR			
BIO_156	SO268/2_154_ROV23	COLBOX-BIO#4	Actiniaria	UAVR		UAVR			
BIO_157	SO268/2_154_ROV23	COLBOX-BIO#2	Actiniaria	UAVR		UAVR			
BIO_158	SO268/2_154_ROV23	COLBOX-BIO#1	Actiniaria	UAVR		UAVR			
BIO_159	SO268/2_154_ROV23	COLBOX-BIO#5	Actiniaria	UAVR		UAVR			
BIO_160	SO268/2_154_ROV23	COLBOX-BIO#9	Actiniaria	UAVR		UAVR			
BIO_161	SO268/2_154_ROV23	COLBOX-BIO#8	Actiniaria	UAVR		UAVR			
BIO_162	SO268/2_154_ROV23	COLBOX-BIO#6	Actiniaria	UAVR		UAVR			
BIO_163	SO268/2_154_ROV23	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_164	SO268/2_154_ROV23	COLBOX	Actiniaria	IMAR		SGN			
BIO_165	SO268/2_154_ROV23	COLBOX	Actiniaria			SGN			
BIO_166	SO268/2_154_ROV23	COLBOX	2x Cirripedia			SGN	UAVR		
BIO_167	SO268/2_154_ROV23	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN	UAVR		
BIO_168	SO268/2_154_ROV23	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN	UAVR		
BIO_169	SO268/2_154_ROV23	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN	UAVR		
BIO_170	SO268/2_154_ROV23	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN	UAVR		
BIO_171	SO268/2_154_ROV23	COLBOX	Ophiuroidea			SGN			
BIO_172	SO268/2_154_ROV23	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN	UAVR		
BIO_173	SO268/2_154_ROV23	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		
BIO_174	SO268/2_154_ROV23	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		
BIO_175	SO268/2_154_ROV23	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		
BIO_176	SO268/2_154_ROV23	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		
BIO_177	SO268/2_154_ROV23	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		
BIO_178	SO268/2_154_ROV23	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_179	SO268/2_154_ROV23	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		
BIO_180	SO268/2_154_ROV23	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		
BIO_181	SO268/2_154_ROV23	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		
BIO_182	SO268/2_163_ROV25	COLBOX-BIO#3	Alcyonacea	UAVR		UAVR		UAVR	
BIO_183	SO268/2_163_ROV25	COLBOX-BIO#2	Alcyonacea	UAVR		UAVR	UAVR	UAVR	
BIO_184	SO268/2_163_ROV25	COLBOX-BIO#1	Alcyonacea	UAVR		UAVR			
BIO_185	SO268/2_163_ROV25	COLBOX-BIO#6	Alcyonacea	UAVR		UAVR	UAVR	UAVR	
BIO_186	SO268/2_163_ROV25	COLBOX-BIO#4	Alcyonacea	UAVR		UAVR	UAVR	UAVR	
BIO_187	SO268/2_163_ROV25	COLBOX-BIO#7	Alcyonacea	UAVR		UAVR		UAVR	
BIO_188	SO268/2_163_ROV25	COLBOX	Alcyonacea				UAVR	UAVR	
BIO_189	SO268/2_163_ROV25	COLBOX-BIO#5	Porifera	SGN		SGN			Utrecht
BIO_190	SO268/2_163_ROV25	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_191	SO268/2_163_ROV25	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_192	SO268/2_163_ROV25	COLBOX	Asteroidea	IMAR		SGN			
BIO_193	SO268/2_163_ROV25	COLBOX	Echinoidea (cf. Aspidodiadematidae)			SGN	UAVR		
BIO_194	SO268/2_163_ROV25	COLBOX	Paguroidea			SGN			
BIO_195	SO268/2_163_ROV25	Slurp gun	Porifera			SGN			
BIO_196	SO268/2_163_ROV25	Slurp gun	Porifera			SGN			
BIO_197	SO268/2_163_ROV25	Slurp gun	Porifera	SGN					
BIO_198	SO268/2_163_ROV25	COLBOX-BIO#3	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR					
BIO_199	SO268/2_163_ROV25	COLBOX-BIO#5	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR					
BIO_200	SO268/2_163_ROV25	COLBOX	Ophiuroidea	IMAR		SGN			
BIO_201	SO268/2_163_ROV25	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_202	SO268/2_163_ROV25	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_203	SO268/2_163_ROV25	COLBOX	Ophiuroidea	IMAR		SGN			
BIO_204	SO268/2_163_ROV25	COLBOX	Ophiuroidea	IMAR		SGN			
BIO_205	SO268/2_163_ROV25	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_206	SO268/2_163_ROV25	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_207	SO268/2_163_ROV25	COLBOX	Porifera	SGN				Utrecht	Utrecht
BIO_208	SO268/2_163_ROV25	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_209	SO268/2_163_ROV25	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_210	SO268/2_163_ROV25	COLBOX	Ophiuroidea					UAVR	
BIO_211	SO268/2_163_ROV25	COLBOX	Ophiuroidea					UAVR	
BIO_212	SO268/2_163_ROV25	COLBOX	Ophiuroidea					UAVR	
BIO_213	SO268/2_163_ROV25	COLBOX	Ophiuroidea			SGN		UAVR	
BIO_214	SO268/2_163_ROV25	COLBOX	Ophiuroidea					UAVR	
BIO_215	SO268/2_163_ROV25	COLBOX	Ophiuroidea					UAVR	
BIO_216	SO268/2_163_ROV25	COLBOX-BIO#4	Alcyonacea			SGN			
BIO_217	SO268/2_174_ROV28	COLBOX	Ophiuroidea	IMAR		SGN			
BIO_218	SO268/2_174_ROV28	COLBOX	Asteroidea (cf. Brisingida)	IMAR		SGN			
BIO_219	SO268/2_174_ROV28	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_220	SO268/2_174_ROV28	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_221	SO268/2_174_ROV28	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_222	SO268/2_174_ROV28	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_223	SO268/2_174_ROV28	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_224	SO268/2_174_ROV28	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_225	SO268/2_174_ROV28	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_226	SO268/2_174_ROV28	COLBOX	Ophiuroidea	IMAR		SGN		UAVR	
BIO_227	SO268/2_174_ROV28	COLBOX	Actiniaria	IMAR		SGN		IMAR	
BIO_228	SO268/2_174_ROV28	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_229	SO268/2_174_ROV28	COLBOX	Porifera	SGN		SGN			Utrecht
BIO_230	SO268/2_174_ROV28	COLBOX	Alcyonacea	IMAR		UAVR		IMAR	
BIO_231	SO268/2_174_ROV28	COLBOX	Galatheiodea	IMAR		SGN			
BIO_232	SO268/2_193_ROV30	COLBOX	Decapoda			SGN			
BIO_233	SO268/2_193_ROV30	COLBOX	Ophiuroidea			SGN			
BIO_234	SO268/2_193_ROV30	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_235	SO268/2_193_ROV30	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_236	SO268/2_193_ROV30	COLBOX	Actiniaria	IMAR		SGN, IMAR		IMAR	
BIO_237	SO268/2_193_ROV30	COLBOX	Alcyonacea	IMAR		SGN		IMAR	
BIO_238	SO268/2_193_ROV30	COLBOX	Crinoidea			SGN			
BIO_239	SO268/2_193_ROV30	COLBOX	Porifera	SGN		SGN			Utrecht

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_240	SO268/2_193_ROV30	COLBOX	Echinoidea (cf. Aspidodiadematidae)	SGN				UAVR	
BIO_241	SO268/2_193_ROV30	COLBOX	Echinoidea (cf. Aspidodiadematidae)	SGN				UAVR	
BIO_242	SO268/2_193_ROV30	COLBOX	Echinoidea (cf. Aspidodiadematidae)	SGN				UAVR	
BIO_243	SO268/2_193_ROV30	COLBOX	Holothuroidea	IMAR	SGN	SGN			
BIO_244	SO268/2_193_ROV30	COLBOX	Holothuroidea	IMAR	SGN	SGN			
BIO_245	SO268/2_193_ROV30	COLBOX	Holothuroidea	IMAR	SGN	SGN			
BIO_246	SO268/2_193_ROV30	COLBOX	Holothuroidea	IMAR	SGN	SGN			
BIO_247	SO268/2_193_ROV30	Slurp gun	Porifera	SGN					
BIO_247 b	SO268/2_209_ROV32	COLBOX-BIO#4	Alcyonacea	UAVR	UAVR	UAVR			
BIO_248	SO268/2_209_ROV32	COLBOX-BIO#1	Alcyonacea	UAVR	UAVR	UAVR			
BIO_249	SO268/2_209_ROV32	COLBOX-BIO#8	Alcyonacea	UAVR	UAVR	UAVR			
BIO_250	SO268/2_209_ROV32	COLBOX-BIO#3	Alcyonacea	UAVR	UAVR	UAVR			
BIO_251	SO268/2_209_ROV32	COLBOX-BIO#5	Alcyonacea	UAVR	UAVR	UAVR			
BIO_252	SO268/2_209_ROV32	COLBOX-BIO#2	Alcyonacea	UAVR	UAVR	UAVR			
BIO_253	SO268/2_209_ROV32	COLBOX-BIO#6	Alcyonacea	UAVR	UAVR	UAVR			
BIO_254	SO268/2_209_ROV32	COLBOX-BIO#9	Alcyonacea	UAVR		UAVR			
BIO_255	SO268/2_209_ROV32	COLBOX	Porifera	SGN		SGN			UUtrecht
BIO_256	SO268/2_209_ROV32	COLBOX	Ophiuroidea	IMAR		SGN			
BIO_257	SO268/2_209_ROV32	COLBOX	Porifera	SGN		SGN			UUtrecht
BIO_258	SO268/2_209_ROV32	COLBOX	Porifera	SGN		SGN			UUtrecht
BIO_259	SO268/2_209_ROV32	COLBOX	Porifera	SGN		SGN			UUtrecht
BIO_260	SO268/2_209_ROV32	COLBOX	Echinoidea (cf. Aspidodiadematidae)	SGN				UAVR	
BIO_261	SO268/2_209_ROV32	COLBOX	Echinoidea (cf. Aspidodiadematidae)	SGN				UAVR	
BIO_262	SO268/2_209_ROV32	COLBOX	Echinoidea (cf. Aspidodiadematidae)	SGN				UAVR	
BIO_263	SO268/2_209_ROV32	COLBOX	Echinoidea (cf. Aspidodiadematidae)	SGN				UAVR	
BIO_264	SO268/2_209_ROV32	COLBOX	Echinoidea	SGN					
BIO_265	SO268/2_209_ROV32	COLBOX	Holothuroidea	IMAR		SGN			
BIO_266	SO268/2_209_ROV32	COLBOX	Holothuroidea	IMAR		SGN			
BIO_267	SO268/2_209_ROV32	COLBOX	Holothuroidea	IMAR		SGN			

ID	Station	Collector	Taxa	-80°C	RNA later	Ethanol	Glutaraldehyde	Formaldehyde	-20°C
BIO_268	SO268/2_209_ROV32	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_269	SO268/2_209_ROV32	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_270	SO268/2_209_ROV32	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_271	SO268/2_209_ROV32	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_272	SO268/2_209_ROV32	COLBOX	Ophiuroidea (cf. Ophiosphalma glabrum)	IMAR		SGN		UAVR	
BIO_273	SO268/2_209_ROV32	COLBOX	Ophiuroidea			SGN		UAVR	
BIO_274	SO268/2_209_ROV32	COLBOX	Ophiuroidea			SGN		UAVR	
BIO_275	SO268/2_209_ROV32	COLBOX	Ophiuroidea					UAVR	
BIO_276	SO268/2_209_ROV32	COLBOX	Asteroidea (cf. Brisingida)	IMAR		SGN			
BIO_277	SO268/2_209_ROV32	COLBOX-BIO#2	Cnidaria			IMAR			
BIO_278	SO268/2_209_ROV32	COLBOX	Ophiuroidea					UAVR	
BIO_279	SO268/2_209_ROV32	COLBOX	Ophiuroidea			SGN			
BIO_280	SO268/2_209_ROV32	COLBOX	Ophiuroidea					UAVR	
BIO_281	SO268/2_209_ROV32	COLBOX	Ophiuroidea					UAVR	
BIO_282	SO268/2_209_ROV32	COLBOX	Ophiuroidea					UAVR	
BIO_283	SO268/2_209_ROV32	COLBOX-BIO	Ophiuroidea			SGN			

12.2 Multiple Corer Samples

Tab. 12.2.1: Detailed core distribution of all MUC stations of Leg 1 and 2.

Station SO268/1	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	02	SGN	Metabarcoding
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	03	SGN	Metabarcoding
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	04	SGN	Metabarcoding
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	05	SGN	Reference library
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	06	SGN	Reference library
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	07	SGN	MALDI-TOF
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	08	SGN	MALDI-TOF
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	09	SGN	MALDI-TOF
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	10	SGN	Morphology/Community
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	11	SGN	Morphology/Community
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	12	UGENT	Environmental variables
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	13	UIVPM	OM. eDNA, microeukaryotes, Viruses
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	15	JUB	Trace Metals/aminoacids
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	16	AWI	ex-situ oxygen sediment/Pore water sediment
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	17	AWI	ex-situ oxygen sediment/Pore water sediment
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	18	GEOMAR	ex situ shear strength profiles
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	19	JUB	Trace Metals/aminoacids
5 MUC-01	28/02	11° 55.876'	117° 01.588'	4081.5	GER Trial	20	JUB	Trace Metals/aminoacids
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	02	SGN	Metabarcoding
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	04	SGN	Metabarcoding
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	05	SGN	MALDI-TOF
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	06	SGN	Reference library
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	08	SGN	MALDI-TOF
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	09	SGN	MALDI-TOF
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	10	SGN	MALDI-TOF
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	11	SGN	MALDI-TOF
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	12	UGENT	Environmental variables
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	13	UIVPM	OM. eDNA, microeukaryotes, Viruses
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	15	SGN	Morphology/Community

Station SO268/1	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	16	MARUM	Sed. structure CT
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	17	CIIMAR	Isotopes-FA
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	18	SGN	Morphology/Community
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	19	SGN	Metabarcoding
6 MUC-02	28/02	11° 55.798'	117° 01.474'	4087.3	GER Trial	20	SGN	Metabarcoding
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	02	SGN	Metabarcoding
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	03	SGN	MALDI-TOF
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	04	SGN	MALDI-TOF
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	06	SGN	Reference library
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	07	SGN	MALDI-TOF
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	09	SGN	MALDI-TOF
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	10	SGN	Metabarcoding
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	11	SGN	Metabarcoding
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	12	UGENT	Environmental variables
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	15	SGN	Metabarcoding
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	16	SGN	Reference library
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	17	CIIMAR	Isotopes-FA
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	18	SGN	Morphology/Community
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	19	MARUM	Sed. structure CT
7 MUC-03	28/02	11° 55.632'	117° 01.258'	4089.2	GER Trial	20	SGN	Morphology/Community
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	01	CIIMAR	Isotopes-FA
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	02	SGN	Reference library
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	02	SGN	Metabarcoding
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	03	SGN	Metabarcoding
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	04	SGN	Metabarcoding
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	05	SGN	MALDI-TOF
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	06	SGN	Reference library
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	08	SGN	MALDI-TOF
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	09	SGN	Morphology/Community
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	11	SGN	Morphology/Community
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	12	UGENT	Environmental variables
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	15	JUB	Trace Metals/aminoacids

Station SO268/1	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	16	JUB	Trace Metals/aminoacids
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	17	JUB	Trace Metals/aminoacids
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	18	JUB	Trace Metals/aminoacids
18 MUC-04	03/03	11° 55.470'	117° 01.039'	4095.2	GER Trial	19	JUB	Trace Metals/aminoacids
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	01	MARUM	Sed. structure CT
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	02	SGN	Reference library
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	03	SGN	Metabarcoding
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	04	SGN	Metabarcoding
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	05	SGN	Metabarcoding
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	06	SGN	Reference library
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	08	SGN	Metabarcoding
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	09	SGN	Morphology/Community
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	11	SGN	MALDI-TOF
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	12	UGENT	Environmental variables
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
19_MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	15	SGN	MALDI-TOF
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	17	SGN	MALDI-TOF
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	18	SGN	MALDI-TOF
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	19	SGN	Morphology/Community
19 MUC-05	03/03	11° 55.298'	117° 00.815'	4101.4	GER Trial	20	AWI	ex-situ oxygen sediment/Pore water sediment
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	01	CIIMAR	Isotopes-FA
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	02	AWI	ex-situ oxygen sediment/Pore water sediment
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	03	SGN	Reference library
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	04	SGN	Metabarcoding
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	05	SGN	Metabarcoding
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	06	SGN	Metabarcoding
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	07	SGN	Reference library
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	08	SGN	MALDI-TOF
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	09	SGN	MALDI-TOF
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	10	SGN	MALDI-TOF
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	11	SGN	Morphology/Community
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	12	UGENT	Environmental variables
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
26_MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT

Station SO268/1	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	15	MARUM	Sed. structure CT
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	16	SGN	Morphology/Community
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	18	AWI	ex-situ oxygen sediment/Pore water sediment
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	19	SGN	Reference library
26 MUC-06	06/03	11° 56.047'	117° 01.772'	4084.9	GER Trial	20	AWI	ex-situ oxygen sediment/Pore water sediment
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	01	SGN	Metabarcoding
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	02	SGN	Metabarcoding
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	03	SGN	Metabarcoding
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	04	SGN	Reference library
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	05	SGN	MALDI-TOF
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	06	SGN	Morphology/Community
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	07	SGN	Metabarcoding
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	08	AWI	ex-situ oxygen sediment/Pore water sediment
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	09	SGN	Metabarcoding
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	10	SGN	MALDI-TOF
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	11	JUB	Trace Metals/aminoacids
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	12	UGENT	Environmental variables
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	13	UIVPM	OM. eDNA. microeukaryotes. viruses
38_MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	15	SGN	Morphology/Community
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	16	AWI	ex-situ oxygen sediment/Pore water sediment
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	17	SGN	MALDI-TOF
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	18	SGN	Reference library
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	19	SGN	MALDI-TOF
38 MUC-06	09/03	11° 50.695'	117° 03.608'	4130.2	GER Ref	20	JUB	Trace Metals/aminoacids
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	01	SGN	Reference library
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	02	SGN	Metabarcoding
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	03	SGN	MALDI-TOF
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	04	SGN	MALDI-TOF
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	05	SGN	MALDI-TOF
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	06	SGN	Morphology/Community
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	08	SGN	Metabarcoding
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	09	SGN	MALDI-TOF
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	10	SGN	Morphology/Community
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	11	UGENT	Environmental variables
39 MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	12	UGENT	Environmental variables

Station SO268/1	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
39_MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	13	UIVPM	OM. eDNA, microeukaryotes, viruses
39_MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	14	MARUM	Sed. structure CT
39_MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	15	SGN	MALDI-TOF
39_MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	16	MARUM	Sed. structure CT
39_MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	18	SGN	Metabarcoding
39_MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	19	SGN	Metabarcoding
39_MUC-08	09/03	11° 51.274'	117° 02.366'	4130.1	GER Ref	20	SGN	Ref library
42_MUC-09	10/03	11° 51.733'	117° 00.391'	4118.1	GER Ref	13	SGN	MALDI-TOF
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	01	CIIMAR	Isotopes-FA
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	02	SGN	Ref library
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	04	SGN	MALDI-TOF
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	05	SGN	Morphology/Community
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	06	SGN	Morphology/Community
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	08	SGN	Metabarcoding
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	09	SGN	Metabarcoding
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	10	SGN	MALDI-TOF
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	11	SGN	Ref library
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	12	UGENT	Environmental variables
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	15	MPI MM	microbial communities and functions/MARUM sed. structure CT
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	16	MARUM	Sed. structure CT
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	17	JUB	Trace Metals/aminoacids
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	18	UIVPM	OM. eDNA, microeukaryotes, viruses
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	19	AWI	ex-situ oxygen sediment/Pore water sediment
43_MUC-10	10/03	11° 55.844'	117° 01.339'	4082	GER Trial	20	AWI	ex-situ oxygen sediment/Pore water sediment
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	01	SGN	MALDI-TOF
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	02	SGN	MALDI-TOF
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	04	UGENT	Environmental variables
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	05	UGENT	Meio barcoding
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	06	UGENT	Metabarcoding
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	07	UGENT	Meio barcoding
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	08	UGENT	Metabarcoding
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	09	UGENT	Metabarcoding
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	10	UGENT	Meio community
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	11	UGENT	Meio community

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50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	12	UGENT	Environmental variables
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	15	CIIMAR	Isotopes-FA
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	16	MARUM	Sed. structure CT
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	17	SGN	MALDI-TOF
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	18	UGENT	Environmental variables
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	19	UGENT	Meio community
50_MUC-11	14/03	14° 06.840'	125° 52.341'	4506.6	BEL Trial	20	SGN	MALDI-TOF
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	01	SGN	MALDI-TOF
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	02	SGN	MALDI-TOF
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	03	SGN	MALDI-TOF
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	04	UGENT	Metabarcoding
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	05	UGENT	
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	06	UGENT	Metabarcoding
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	07	UGENT	Environmental variables
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	08	UGENT	Meio community
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	09	UGENT	Meio barcoding
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	10	UGENT	Meio community
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	11	UGENT	Metabarcoding
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	12	UGENT	Meio community
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	14	UGENT	Meio barcoding
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	15	JUB	Trace Metals/aminoacids
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	16	JUB	Trace Metals/aminoacids
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	17	GEOMAR	ex situ shear strength profiles
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	18	SGN	MALDI-TOF
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	19	AWI	ex-situ oxygen sediment/Pore water sediment
56_MUC-13	15/03	14° 06.601'	125° 52.091'	4501.4	BEL Trial	20	GEOMAR	ex situ shear strength profiles
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	01	SGN	MALDI-TOF
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	02	SGN	MALDI-TOF
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	03	SGN	MALDI-TOF
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	04	UGENT	Meio community
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	05	UGENT	Metabarcoding
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	06	UGENT	Environmental variables
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	07	UGENT	

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65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	08	UGENT	Metabarcoding/meio community
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	09	UGENT	Metabarcoding
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	10	UGENT	Meio barcoding
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	11	MPI MM	microbial communities and functions/MARUM sed. structure CT
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	12	UGENT	Environmental variables
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	14	UGENT	Meio community
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	15	AWI	ex-situ oxygen sediment/Pore water sediment
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	16	AWI	ex-situ oxygen sediment/Pore water sediment
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	17	AWI	ex-situ oxygen sediment/Pore water sediment
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	18	AWI	ex-situ oxygen sediment/Pore water sediment
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	19	AWI	ex-situ oxygen sediment/Pore water sediment
65_MUC-14	18/03	14° 06.788'	125° 52.295'	4495.3	BEL Trial	20	AWI	ex-situ oxygen sediment/Pore water sediment
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	01	SGN	MALDI-TOF
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	02	SGN	MALDI-TOF
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	03	SGN	MALDI-TOF
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	04	UGENT	Metabarcoding
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	05	UGENT	Environmental variables
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	06	UGENT	Meio barcoding
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	07	UGENT	Meio community
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	08	UGENT	Environmental variables
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	09	UGENT	Metabarcoding
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	10	UGENT	Meio community
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	11	UGENT	Meio community
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	12	UGENT	Metabarcoding
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	15	SGN	MALDI-TOF
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	16	SGN	Metabarcoding
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	17	SGN	Metabarcoding
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	18	SGN	Ref library
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	19	MARUM	Sed. structure CT
66_MUC-15	18/03	14° 06.448'	125° 51.886'	4508.7	BEL Trial	20	CIIMAR	Isotopes-FA
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	01	SGN	MALDI-TOF
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	02	SGN	MALDI-TOF

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67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	03	SGN	MALDI-TOF
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	04	UGENT	Metabarcoding
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	05	UGENT	Environmental variables
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	06	UGENT	Metabarcoding
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	07	UGENT	Meio community
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	08	UGENT	Meio community
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	09	UGENT	Meio barcoding
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	10	UGENT	Environmental variables
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	11	UGENT	Metabarcoding
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	12	UGENT	Meio community
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	15	JUB	Trace Metals/aminoacids
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	16	JUB	Trace Metals/aminoacids
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	17	JUB	Trace Metals/aminoacids
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	18	JUB	Trace Metals/aminoacids
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	19	JUB	Trace Metals/aminoacids
67_MUC-16	18/03	14° 06.292'	125° 51.678'	4514.1	BEL Trial	20	AWI	ex-situ oxygen sediment/Pore water sediment
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	01	SGN	MALDI-TOF
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	02	SGN	MALDI-TOF
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	03	SGN	MALDI-TOF
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	04	UGENT	Metabarcoding
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	05	UGENT	Environmental variables
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	06	UGENT	Meio barcoding
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	07	UGENT	Meio community
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	08	UGENT	Metabarcoding
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	09	UGENT	Metabarcoding
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	10	UGENT	Meio community
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	11	UGENT	Meio community
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	12	UGENT	Environmental variables
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	13	UIVPM	OM. eDNA. microeukaryotes. viruses
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	14	MPI MM	microbial communities and functions/MARUM sed. structure CT
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	15	MPI MM	microbial communities and functions/MARUM sed. structure CT
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	16	AWI	ex-situ oxygen sediment/Pore water sediment
74_MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	17	AWI	ex-situ oxygen sediment/Pore water sediment

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74 MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	18	AWI	ex-situ oxygen sediment/Pore water sediment
74 MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	19	AWI	ex-situ oxygen sediment/Pore water sediment
74 MUC-17	20/03	14° 08.121'	125° 51.815'	4509.8	BEL Trial	20	AWI	ex-situ oxygen sediment/Pore water sediment
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	01	SGN	Metabarcoding
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	02	SGN	Metabarcoding
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	03	SGN	MALDI-TOF
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	04	UGENT	Meio community
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	05	UGENT	Meio community
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	06	UGENT	Meio community
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	07	UGENT	Meio barcoding
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	08	UGENT	Metabarcoding
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	09	UGENT	Environmental variables
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	10	UGENT	Metabarcoding
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	11	UGENT	Metabarcoding
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	12	MPI MM	microbial communities and functions/MARUM sed. structure CT
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	13	UIVPM	OM. eDNA, microeukaryotes, viruses
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	14	UGENT	Environmental variables
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	15	SGN	MALDI-TOF
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	16	SGN	MALDI-TOF
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	17	MARUM	Sed. structure CT
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	18	JUB	Trace Metals/aminoacids
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	19	AWI	ex-situ oxygen sediment/Pore water sediment
75 MUC-18	20/03	14° 06.999'	125° 52.537'	4494.5	BEL Trial	20	AWI	ex-situ oxygen sediment/Pore water sediment
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	01	SGN	MALDI-TOF
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	02	SGN	MALDI-TOF
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	03	UIVPM	OM. eDNA, microeukaryotes, viruses
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	04	UGENT	Environmental variables
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	05	UGENT	Environmental variables
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	06	UGENT	Metabarcoding
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	07	UGENT	Meio barcoding
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	08	UGENT	Metabarcoding
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	09	UGENT	Meio community
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	10	UGENT	Meio community
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	11	UGENT	Meio community
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	12	UGENT	Meio barcoding
79 MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	13	SGN	MALDI-TOF

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79_MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	14	SGN	Metabarcoding
79_MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	15	MPI MM	microbial communities and functions/MARUM sed. structure CT
79_MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	16	JUB	Trace Metals/aminoacids
79_MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	17	JUB	Trace Metals/aminoacids
79_MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	18	JUB	Trace Metals/aminoacids
79_MUC-19	21/03	14° 02.187'	125° 55.471'	4535.2	BEL Ref	20	AWI	ex-situ oxygen sediment/Pore water sediment
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	02	SGN	MALDI-TOF
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	03	SGN	MALDI-TOF
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	04	UGENT	Environmental variables
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	05	UGENT	Environmental variables
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	06	UGENT	Metabarcoding
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	07	UGENT	Meio barcoding
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	08	UGENT	Meio community
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	09	UGENT	Meio community
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	10	UGENT	Meio community
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	12	MPI MM	microbial communities and functions/MARUM sed. structure CT
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	13	UIVPM	OM. eDNA. microeukaryotes. viruses
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	14	UGENT	Metabarcoding
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	15	MPI MM	microbial communities and functions/MARUM sed. structure CT
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	16	CIIMAR	Isotopes-FA
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	17	SGN	MALDI-TOF
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	18	SGN	Metabarcoding
80_MUC-20	21/03	14° 02.013'	125° 55.736'	4527.7	BEL Ref	19	SGN	Metabarcoding
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	01	SGN	MALDI-TOF
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	02	SGN	MALDI-TOF
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	03	SGN	MALDI-TOF
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	04	UGENT	Environmental variables
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	05	UGENT	Environmental variables
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	06	UGENT	Metabarcoding
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	07	UGENT	Metabarcoding
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	08	UGENT	Metabarcoding
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	09	UGENT	Meio community
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	11	UGENT	Meio community
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	12	UGENT	Meio community
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	13	UIVPM	OM. eDNA. microeukaryotes. viruses

Station SO268/1	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	14	SGN	MALDI-TOF
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	15	MPI MM	microbial communities and functions/MARUM sed. structure CT
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	16	SGN	MALDI-TOF
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	17	SGN	Metabarcoding
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	18	MARUM	Sed. structure CT
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	19	SGN	Metabarcoding
85_MUC-21	22/03	14° 01.753'	125° 55.506'	4549.1	BEL Ref	20	SGN	Metabarcoding

Station SO268/2	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	1	SGN	MALDI-TOF
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	2	SGN	MALDI-TOF
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	3	SGN	Metabarcoding
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	4	UGENT	environmental variables
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	5	SGN	Ref library (EtOH un.)
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	6	UGENT	Meiofauna community analysis
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	7	JUB/BGR	sediment and pore water
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	8	UGENT	Metabarcoding
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	9	AWI/GEO MAR	Geochemistry
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	10	-	empty
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	11	SGN	MALDI-TOF
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	12	UGENT	Metabarcoding
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	13	MPI	Microbial communities and functions
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	14	UIVPN	OM. eDNA. microeukaryotes. viruses
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	16	BGR	passive sampler
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	17	JUB/BGR	sediment and pore water
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	18	SGN	Metabarcoding
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	19	AWI/GEO MAR	Geochemistry
106_MUC-22	07.04	11° 51.773'	117° 00.740'	4119	GER dredge	20		
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	1	SGN	Ref library (EtOH un.)
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	2	SGN	MALDI-TOF
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	3	SGN	MALDI-TOF
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	4	SGN	Metabarcoding
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	5	SGN	Metabarcoding

Station SO268/2	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	6	SGN	Meiofauna community analysis
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	7	UGENT	environmental variables
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	8	SGN	Metabarcoding
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	9	MPI	x-ray
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	10	-	empty
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	11	MPI	x-ray
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	12	UIVPN	OM. eDNA. microeukaryotes. viruses
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	13	UIVPN	OM. eDNA. microeukaryotes. viruses
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	14	MPI	Microbial communities and functions
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	15	MPI	x-ray
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	16	UGENT	Metabarcoding
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	17	UGENT	Metabarcoding
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	18	UGENT	Meiofauna community analysis
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	19	UGENT	Meiofauna community analysis
107_MUC-23	07.04	11° 51.729'	117° 00.844'	4120.8	GER dredge	20	UGENT	Ref library (DESS)
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	1	-	camera
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	2	AWI/GEO MAR	Geochemistry
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	3	AWI/GEO MAR	Geochemistry
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	4	JUB/BGR	sediment and pore water
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	5	UIVPN	OM. eDNA. microeukaryotes. viruses
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	6	UIVPN	OM. eDNA. microeukaryotes. viruses
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	7	JUB/BGR	sediment and pore water
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	8	RBINS	sediment properties
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	9	SGN	MALDI-TOF
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	10	SGN	MALDI-TOF
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	11	SGN	Ref library (EtOH un.)
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	12	SGN	Metabarcoding
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	13	UGENT	Meiofauna community analysis
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	14	MPI	x-ray
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	15	UGENT	Metabarcoding
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	16	MPI	x-ray
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	17	UGENT	environmental variables
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	18	UGENT	Metabarcoding
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	19	UIVPN	OM. eDNA. microeukaryotes. viruses
122_MUC-24	12.04	11° 51.637'	117° 00.893'	4123.7	GER dredge	20	UIVPN	OM. eDNA. microeukaryotes. viruses
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	1	-	camera

Station SO268/2	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	2	SGN	Metabarcoding
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	3	JUB/BGR	sediment and pore water
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	4	AWI/GEO MAR	Geochemistry
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	5	AWI/GEO MAR	Geochemistry
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	6	-	empty
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	7	SGN	Metabarcoding
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	8	-	empty
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	9	SGN	MALDI-TOF
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	10	-	empty
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	11	SGN	MALDI-TOF
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	12	JUB/BGR	sediment and pore water
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	13	UGENT	Meiofauna community analysis
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	14	UGENT	Metabarcoding
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	15	UGENT	environmental variables
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	16	SGN	Ref library (EtOH un.)
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	17	UGENT	Metabarcoding
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	18	BGR	passive sampler
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	19	BGR	passive sampler
125_MUC-25	13.04	11° 51.844'	117° 00.782'	4120.3	GER dredge	20	UGENT	Meiofauna community analysis
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	1	MPI	x-ray
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	2	MPI	x-ray
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	3	SGN	MALDI-TOF
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	4	SGN	MALDI-TOF
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	5	SGN	MALDI-TOF
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	6	SGN	Ref library (EtOH un.)
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	7	MPI	Microbial communities and functions
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	8	GEOMAR	sediment
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	9	UIVPN	OM. eDNA. microeukaryotes. viruses
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	10	-	empty
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	11	UGENT	Metabarcoding
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	12	UIVPN	OM. eDNA. microeukaryotes. viruses
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	13	UGENT	Ref library (DESS)
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	14	UGENT	environmental variables
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	15	UGENT	Metabarcoding
135_MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	16	UGENT	Metabarcoding

Station SO268/2	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
135 MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	17	UGENT	environmental variables
135 MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	18	UGENT	Meiofauna community analysis
135 MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	19	UGENT	Meiofauna community analysis
135 MUC-27	17.04	14° 01.109'	125° 55.357'	4541	BEL Ref	20	MPI	x-ray
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	1	UIVPN	OM. eDNA. microeukaryotes. viruses
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	2	BGR	passive sampler
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	3	BGR	passive sampler
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	4	JUB/BGR	sediment and pore water
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	5	UGENT	Ref library (DESS)
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	6	MPI	Microbial communities and functions
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	7	SGN	MALDI-TOF
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	8	SGN	MALDI-TOF
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	9	UIVPN	OM. eDNA. microeukaryotes. viruses
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	10	SGN	Ref library (EtOH un.)
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	11	UGENT	Metabarcoding
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	12	BGR	passive sampler
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	13	UGENT	Metabarcoding
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	14	UGENT	environmental variables
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	15	JUB/BGR	sediment and pore water
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	16	UGENT	Metabarcoding
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	17	UGENT	Meiofauna community analysis
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	18	BGR	passive sampler
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	19	UGENT	environmental variables
136 MUC-28	17.04	14° 01.505'	125° 55.234'	4542	BEL Ref	20	UGENT	Meiofauna community analysis
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	1	SGN	MALDI-TOF
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	2	SGN	MALDI-TOF
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	3	SGN	Ref library (EtOH un.)
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	4	-	empty
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	5	UIVPN	OM. eDNA. microeukaryotes. viruses
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	6	-	empty
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	7	UGENT	Ref library (DESS)
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	8	UGENT	Meiofauna community analysis
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	9	MPI	Microbial communities and functions
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	10	SGN	Metabarcoding
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	11	SGN	Metabarcoding
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	12	UGENT	Meiofauna community analysis
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	13	UGENT	lost in cold room

Station SO268/2	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	14	UGENT	Metabarcoding
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	15	-	empty
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	16	UGENT	environmental variables
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	17	UIVPN	OM. eDNA. microeukaryotes. viruses
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	18	UGENT	environmental variables
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	19	NIOZ	sediment
138 MUC-29	19.04	14° 01.126'	125° 54.953'	4527	BEL Ref	20	UGENT	Metabarcoding
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	1	UGENT	Metabarcoding
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	2	UGENT	environmental variables
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	3	UGENT	Meiofauna community analysis
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	4	SGN	Ref library (EtOH un.)
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	5	MPI	Microbial communities and functions
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	6	UIVPN	OM. eDNA. microeukaryotes. viruses
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	7	BGR	passive sampler
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	8	-	empty
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	9	SGN	MALDI-TOF
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	10	UGENT	Metabarcoding
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	11	JUB/BGR	sediment and pore water
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	12	JUB/BGR	sediment and pore water
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	13	JUB/BGR	sediment and pore water
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	14		
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	15	SGN	MALDI-TOF
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	16	-	empty
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	17	-	empty
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	18	UIVPN	OM. eDNA. microeukaryotes. viruses
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	19	UGENT	environmental variables
139 MUC-30	19.04	14° 01.897'	125° 55.003'	4523	BEL Ref	20	UGENT	Meiofauna community analysis
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	1	BGR	passive sampler
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	2	BGR	passive sampler
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	3	BGR	passive sampler
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	4	JUB/BGR	sediment and pore water
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	5	JUB/BGR	sediment and pore water
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	6	SGN	Meiofauna community analysis
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	7	SGN	MALDI-TOF
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	8	SGN	Meiofauna community analysis
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	9	MPI	Microbial communities and functions
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	10	BGR	passive sampler

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171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	11	UGENT	environmental variables
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	12	UIVPN	OM. eDNA. microeukaryotes. viruses
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	13	SGN	Metabarcoding
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	14	UIVPN	OM. eDNA. microeukaryotes. viruses
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	15	UIVPN	OM. eDNA. microeukaryotes. viruses
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	16	SGN	Ref library (EtOH un.)
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	17	SGN	Metabarcoding
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	18	UIVPN	OM. eDNA. microeukaryotes. viruses
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	19	SGN	MALDI-TOF
171 MUC-31	08.05	11° 51.003'	117° 03.323'	4122	GER Ref	20	SGN	MALDI-TOF
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	1	SGN	Meiofauna community analysis
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	2	MPI	Microbial communities and functions
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	3	SGN	MALDI-TOF
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	4	UIVPN	OM. eDNA. microeukaryotes. viruses
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	5	SGN	Metabarcoding
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	6	UGENT	environmental variables
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	7	-	empty
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	8	SGN	MALDI-TOF
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	9	JUB/BGR	sediment and pore water
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	10	SGN	Ref library (EtOH un.)
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	11	-	empty
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	12	-	empty
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	13	-	empty
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	14	-	empty
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	15	SGN	Metabarcoding
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	16	SGN	Metabarcoding
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	17	UIVPN	OM. eDNA. microeukaryotes. viruses
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	18	-	empty
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	19	JUB/BGR	sediment and pore water
172 MUC-32	08.05	11° 50.447'	117° 03.314'	4136	GER Ref	20	SGN	MALDI-TOF
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	1	SGN	Metabarcoding
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	2	SGN	Metabarcoding
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	3	SGN	MALDI-TOF
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	4	UGENT	environmental variables
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	5	GEOMAR	sediment
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	6	SGN	Ref library (EtOH un.)
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	7	JUB/BGR	sediment and pore water

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178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	8	JUB/BGR	sediment and pore water
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	9	JUB/BGR	sediment and pore water
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	10	MPI	Microbial communities and functions
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	11	UIVPN	OM. eDNA. microeukaryotes. viruses
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	12	SGN	Metabarcoding
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	13	-	empty
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	14	JUB/BGR	sediment and pore water
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	15	JUB/BGR	sediment and pore water
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	16	JUB/BGR	sediment and pore water
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	17	SGN	MALDI-TOF
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	18	-	empty
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	19	JUB/BGR	sediment and pore water
178 MUC-33	10.05	11° 50.456'	117° 03.323'	4132	GER Ref	20	JUB/BGR	sediment and pore water
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	1	-	empty
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	2	UIVPN	OM. eDNA. microeukaryotes. viruses
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	3	-	empty
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	4	SGN	MALDI-TOF
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	5	UGENT	environmental variables
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	6	-	empty
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	7	UIVPN	OM. eDNA. microeukaryotes. viruses
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	8	UIVPN	OM. eDNA. microeukaryotes. viruses
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	9	SGN	Ref library (EtOH un.)
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	10	-	empty
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	11	SGN	MALDI-TOF
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	12	SGN	Meiofauna community analysis
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	13	SGN	MALDI-TOF
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	14	JUB/BGR	sediment and pore water
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	15	JUB/BGR	sediment and pore water
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	16	UIVPN	OM. eDNA. microeukaryotes. viruses
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	17		
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	18	MPI	Microbial communities and functions
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	19	SGN	Metabarcoding
179 MUC-34	10.05	11° 50.367'	117° 03.578'	4142	GER Ref	20	SGN	Metabarcoding
184 MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	1	-	camera
184 MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	2	-	empty
184 MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	3	MPI	Microbial communities and functions

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184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	4	AWI/GEO MAR	Geochemistry
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	5	UGENT	Metabarcoding
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	6	UGENT	environmental variables
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	7	JUB/BGR	sediment and pore water
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	8	MPI	Microbial communities and functions
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	9	UGENT	Meiofauna community analysis
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	10	SGN	Metabarcoding
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	11	JUB/BGR	sediment and pore water
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	12	SGN	Ref library (EtOH un.)
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	13	JUB/BGR	sediment and pore water
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	14	MPI	Microbial communities and functions
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	15	UGENT	Metabarcoding
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	16	SGN	MALDI-TOF
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	17	AWI/GEO MAR	Geochemistry
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	18	SGN	Metabarcoding
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	19	AWI/GEO MAR	Geochemistry
184_MUC-35	11.05	11° 51.785'	117° 00.701'	4116	GER dredge	20	SGN	MALDI-TOF
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	1	GEOMAR	sediment
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	2	SGN	MALDI-TOF
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	3	-	camera
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	4	SGN	MALDI-TOF
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	5	SGN	Ref library (EtOH un.)
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	6	-	empty
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	7	UIVPN	OM. eDNA. microeukaryotes. viruses
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	8	SGN	Metabarcoding
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	9	UGENT	Metabarcoding
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	10	SGN	Metabarcoding
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	11	UGENT	Meiofauna community analysis
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	12	UIVPN	OM. eDNA. microeukaryotes. viruses
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	13	UGENT	Metabarcoding
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	14	AWI/GEO MAR	Geochemistry
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	15	JUB/BGR	sediment and pore water
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	16	SGN	Meiofauna community analysis
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	17	MPI	Microbial communities and functions

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185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	18	MPI	Microbial communities and functions
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	19	UGENT	environmental variables
185_MUC-36	11.05	11° 51.774'	117° 00.760'	4120	GER dredge	20	UIVPN	OM. eDNA. microeukaryotes. viruses
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	1	-	empty
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	2	UGENT	environmental variables
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	3	-	camera
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	4	-	empty
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	5	MPI	Microbial communities and functions
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	6	-	empty
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	7	SGN	Metabarcoding
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	8	AWI/GEO MAR	Geochemistry
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	9	JUB/BGR	sediment and pore water
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	10	AWI/GEO MAR	Geochemistry
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	11	JUB/BGR	sediment and pore water
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	12	BGR	passive sampler
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	13	JUB/BGR	sediment and pore water
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	14	UGENT	Meiofauna community analysis
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	15	-	empty
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	16	UIVPN	OM. eDNA. microeukaryotes. viruses
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	17	UIVPN	OM. eDNA. microeukaryotes. viruses
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	18	SGN	MALDI-TOF
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	19	UIVPN	OM. eDNA. microeukaryotes. viruses
186_MUC-36	12.05	11° 51.793'	117° 00.747'	4116	GER dredge	20	SGN	MALDI-TOF
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	1	MPI	Microbial communities and functions
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	2	MPI	Microbial communities and functions
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	3	-	camera
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	4	SGN	Metabarcoding
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	5	UIVPN	OM. eDNA. microeukaryotes. viruses
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	6	UIVPN	OM. eDNA. microeukaryotes. viruses
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	7	SGN	Ref library (EtOH un.)
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	8	-	empty
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	9	-	empty
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	10	UGENT	Meiofauna community analysis
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	11	UIVPN	OM. eDNA. microeukaryotes. viruses
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	12	-	empty

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198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	13	-	empty
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	14	JUB/BGR	sediment and pore water
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	15	SGN	Metabarcoding
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	16	AWI/GEO MAR	Geochemistry
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	17	UGENT	Metabarcoding
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	18	UGENT	environmental variables
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	19	AWI/GEO MAR	Geochemistry
198_MUC-38	15.05	11° 51.763'	117° 00.715'	4115	GER dredge	20	SGN	MALDI-TOF
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	1	SGN	MALDI-TOF
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	2	SGN	MALDI-TOF
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	3	-	camera
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	4	MPI	Microbial communities and functions
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	5	SGN	Ref library (EtOH un.)
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	6	UIVPN	OM. eDNA. microeukaryotes. viruses
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	7	SGN	Metabarcoding
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	8	SGN	Metabarcoding
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	9	-	empty
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	10		
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	11	-	empty
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	12	UGENT	Meiofauna community analysis
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	13	UIVPN	OM. eDNA. microeukaryotes. viruses
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	14	-	empty
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	15	UIVPN	OM. eDNA. microeukaryotes. viruses
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	16	-	empty
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	17	UGENT	Meiofauna community analysis
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	18	UGENT	Metabarcoding
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	19	UGENT	Metabarcoding
199_MUC-39	15.05	11° 51.751'	117° 00.761'	4119	GER dredge	20	UGENT	environmental variables
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	1	-	empty
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	2	SGN	MALDI-TOF
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	3	-	camera
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	4	SGN	MALDI-TOF
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	5	SGN	Ref library (EtOH un.)
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	6	SGN	Metabarcoding
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	7	SGN	Metabarcoding

Station SO268/2_	Date 2019	Lat (N)	Lon (W)	Depth	Area	Core No.	Institute	Research Purpose
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	8	AWI/GEO MAR	Geochemistry
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	9	AWI/GEO MAR	Geochemistry
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	10	UGENT	environmental variables
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	11	SGN	Metabarcoding
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	12	MPI	x-ray
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	13	-	empty
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	14	UGENT	Metabarcoding
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	15	UGENT	Metabarcoding
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	16	-	empty
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	17	UGENT	Meiofauna community analysis
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	18	MPI	x-ray
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	19	MPI	x-ray
200_MUC-40	15.05	11° 51.761'	117° 00.777'	4121	GER dredge	20	UGENT	Meiofauna community analysis
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	1	-	empty
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	2	SGN	MALDI-TOF
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	3	-	camera
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	4	SGN	MALDI-TOF
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	5	MPI	x-ray
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	6	JUB/BGR	sediment and pore water
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	7	AWI/GEO MAR	Geochemistry
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	8	JUB/BGR	sediment and pore water
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	9	AWI/GEO MAR	Geochemistry
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	10	JUB/BGR	sediment and pore water
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	11	SGN	Ref library (EtOH un.)
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	12	MPI	x-ray
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	13	SGN	Metabarcoding
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	14	BGR	passive sampler
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	15	UGENT	environmental variables
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	16	UGENT	Metabarcoding
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	17	UGENT	Meiofauna community analysis
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	18	UGENT	Metabarcoding
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	19	-	empty
207_MUC-41	16.05	11° 51.790'	117° 00.789'	4124	GER dredge	20	MPI	x-ray

12.3 Box Corer Samples

Tab. 12.3.1: Boxcore deployments and samples. Coordinates are USBL coordinates at box-core landing unless stated (* No USBL, ship coordinates)

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
12-1/BC1	11° 55.873'N	117° 01.633'W	4031	GER/trial collector area	failed		
12-2/BC2	11° 55.873'N	117° 01.633'W	4001.3	GER/trial collector area	Not enough penetration; the water was lost on deck. The sample was disturbed; it was sieved and fixed altogether (not sorted) All nodules for NIOZ
12-3/BC3	11° 55.873'N	117° 01.633'W	4080.6	GER/trial	failed		
15-1/BC4	11° 55.798'N	117° 01.532'W	4082.9	GER/trial	failed		
15-2/BC5	11° 55.633'N	117° 01.310'W	4086.1	GER/trial	failed		
15-2/BC6	11° 55.790'N	117° 01.530'W	4090	GER/trial	All nodules for NIOZ
24-1/BC7	11° 54.650'N	117° 01.308'W	4087	GER/trial	failed		
24-2/BC8	11° 55.873'N	117° 01.633'W	4031	GER/trial	failed		

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
24-3/BC9	11° 55.864'N	117° 01.641'W	4088	GER/trial	All nodules to NIOZ
27-1/BC10	11° 56.032'N	117° 01.823'W	4085	GER/trial	All nodules for NIOZ
28-1/BC11	11° 55.626'N	117° 01.313'W	4093	GER/trial	6 nodules for microbiology (MPI)

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
33-1/BC12	11° 55.466'N	117° 01.085'W	4096*	GER/trial
44-1/BC13	11.9304940	-117.0224880	4088		failed		
44-2/BC14	11° 55.835'N	117° 01.342'W	4089	GER/trial	4 nodules for microbiology (MPI)
52-1/BC15	14° 06.804'N	125° 52.273'W	4507	BEL/trial collector area	The number of station is wrong in the tag of the picture; 3 nodules for microbiology (MPI)

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
53-1/BC16	14° 06.713'N	125° 52.458'W	4485*	BEL/trial collector area	3 nodules for microbiology (MPI)
60-1/BC17	14° 06.491'N	125° 51.849'W	4512*	BEL/trial collector area	3 nodules for microbiology (MPI), 4 for NIOZ
61-1/BC18	14° 06.869'N	125° 52.324'W	4500*	BEL/trial	Due to a problem with the winch, the boxcorer was swinging over the deck after recovery. Sample slightly disturbed. 2 nodules for NIOZ

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
72-1/BC19	14° 06.638'N	125° 52.053'W	4509	BEL/trial	1 nodule for microbiology (MPI). 4 nodules for NIOZ
76-1/BC20	14° 02.167'N	125° 55.472'W	4540	BEL/Ref	2 nodules for microbiology (MPI) 3 Nodules for NIOZ
82-1/BC21	14° 01.999'N	125° 55.741'W	4539	BEL/Ref	3 nodules for microbiology (MPI), 2 for NIOZ

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
83-1/BC22	14° 01.734'N	125° 55.505'W	4544	BEL/Ref	3 nodules for NIOZ
95-1/BC23	11° 51.740'N	117° 00.765'W	4119	GER/ Dredge trial, pre- impact	failed		
95-2/BC24	11° 51.740'N	117° 00.765'W	4120	GER Dredge trial, pre- impact	3 nodules for microbiology - MPI 44 nodules epifauna - NIOZ 1 nodule geochemistry - GEOMAR

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
96-1/BC25	11° 51.736'N	117° 00.837'W	4122	GER Dredge trial, pre- impact	3 nodules for microbiology - MPI 71 nodules epifauna - NIOZ
102-1/BC26	11° 51.824'N	117° 00.880'W	4123	GER Dredge trial, pre- impact	Overlying water partly lost 2 nodules for microbiology - MPI 62 nodules epifauna - NIOZ
103-1/BC27	11° 51.907'N	117° 00.720'W	4116	GER Dredge trial, pre- impact	2 nodules for microbiology - MPI 52 nodules epifauna - NIOZ
108-1/BC28	11° 51.715'N	117° 00.669'W	4117	GER	failed		

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
				Dredge trial, pre-impact			
116-1/BC29	11° 51.711'N	117° 00.671'W	4117	GER Dredge trial, pre-impact	2 nodules for microbiology - MPI 46 nodules epifauna - NIOZ
129-1/BC30	14° 07.004'N	125° 52.504'W	4503	BEL/ Trial	1 nodule for microbiology -MPI 22 nodules epifauna - NIOZ
140-1/BC31	14° 01.902'N	125° 55.005'W	4521	BEL/Ref	1 nodule for microbiology - MPI 17 nodules epifauna - NIOZ

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
141-1/BC32	14° 01.130'N	125° 55.346'W	4541	BEL/Ref	2 nodules for microbiology - MPI 15 nodules epifauna - NIOZ
142-1/BC33	14° 01.504'N	125° 55.249'W	4541	BEL/Ref	1 nodule for microbiology - MPI 16 nodules epifauna - NIOZ
148-1/BC34	14° 01.140'N	125° 54.949'W	4529	BEL/Ref	50 nodules epifauna - NIOZ

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
149-1/BC35	14° 06.313'N	125° 51.648'W	4516	BEL/ Trial	Disturbed boxcore 2 nodules for microbiology - MPI no nodule for epifauna - NIOZ
161-1/BC36	11° 55.263'N	117° 00.825'W	4125	GER/ Trial	2 nodules for microbiology - MPI 70 nodules epifauna - NIOZ
166-1/BC37	11° 50.715'N	117° 03.610'W	4124	GER/Ref	4 nodules for microbiology - MPI 67 nodules epifauna - NIOZ
167-1/BC38	11° 50.980'N	117° 03.320'W	4121	GER/Ref	Failed, mixed layers		

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
					8 nodules for microbiology - MPI		
175-1/BC39	11° 50.547'N	117° 03.067'W	4129	GER/Ref	1 nodule for microbiology - MPI 76 nodules epifauna - NIOZ
180-1/BC40	11° 50.370'N	117° 03.574'W	4143	GER/Ref	2 nodules for microbiology - MPI 47 nodules epifauna - NIOZ

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
181-1/BC41	11° 50.455'N	117° 03.321'W	4133	GER/Ref	2 nodules for microbiology - MPI 50 nodules epifauna - NIOZ
182-1/BC42	11° 50.983'N	117° 03.326'W	4119	GER/Ref	65 nodules epifauna - NIOZ
189-1/BC43	11° 51.773'N	117° 00.845'W	4122	GER Dredge trial, post impact	3 nodules for microbiology - MPI NIOZ -No nodules taken

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
190-1/BC44	11° 51.789'N	117° 00.779'W	4124	GER Dredge trial, post impact	1 nodule for microbiology - MPI NIOZ -No nodules taken
191-1/BC45	11° 51.784'N	117° 00.748'W	4117	GER Dredge trial, post impact	2 nodules for microbiology - MPI NIOZ -No nodules taken
194-1/BC46	11° 51.764'N	117° 00.813'W	4120	GER Dredge trial, post impact	failed

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
195-1/BC47	11° 51.805'N	117° 00.694'W	4117	GER Dredge trial, post impact	failed
205-1/BC48	11° 50.228'N	117° 03.414'W	4132	GER/Ref	failed
205-2/BC49	11° 50.214'N	117° 03.418'W	4134	GER/Ref	Partly washed out

Station	Latitude	Longitude	Depth	Area	Remarks	Box-core surface	Tube core profile
206-1/BC50	11° 50.319'N	117° 03.089'W	4129	GER/Ref	Failed, washed and mixed 2 nodules for microbiology - MPI		

12.4 Microbiology Samples

Tab. 12.4.1: Overview of SO268 samples for microbial analysis: Station no., gear, location, and purpose of sampling. Core/bottle column indicates ID of multicore (MUC) liner, push cores (PUC), box core (BC) or Niskin bottles from which samples are taken. Jimmy (25 m above CTD) and Hulda (in CTD frame) are names of in situ pumps in CTD casts.

Site	Station	Gear	Latitude	Longitude	Depth	Core/Bottle	Purpose
GER Trial	SO268/1_5-1	MUC	11° 55.874' N	117° 01.587' W	4080	14	Pore water DOC
GER Trial	SO268/1_6-1	MUC	11° 55.798' N	117° 01.474' W	4087	14	Pore water DOC
						16	X-ray
GER Trial	SO268/1_7-1	MUC	11° 55.632' N	117° 01.258' W	4089	14	Pore water DOC
						19	X-ray
GER Trial	SO268/1_16-1	GC	11° 55.863' N	117° 01.537' W	4083	NA	Microbiology sampling
GER Trial	SO268/1_18-1	MUC	11° 55.470' N	117° 01.039' W	4095	14	Microbiology Sampling
GER Trial	SO268/1_19-1	MUC	11° 55.298' N	117° 00.815' W	4101	1	X-ray
						14	Microbiology sampling
GER Trial	SO268/1_26-1	MUC	11° 56.047' N	117° 01.772' W	4085	14	Microbiology sampling
						15	X-ray
GER Trial	SO268/1_28-1	BC	11° 55.626' N	117° 01.313' W	4093	NA	Manganese nodule
GER Trial	SO268/1_29-1	ROV	11.928262	-117.023973	4089	NA	Manganese nodule
GER Trial	SO268/1_31-1	PUC	11.929928	-117.024558	4087	51+27	Microbiology sampling
			11.927263	-117.02098	4093	11+16	Microbiology sampling
			11.927041	-117.022118	4093	42+57	Microbiology sampling
GER Ref	SO268/1_35-1	PUC	11.843928	-117.05937	4138	45+23	Microbiology sampling
			11.84434	-117.059726	4138	25+48	Microbiology sampling
GER Ref	SO268/1_38-1	MUC	11° 50.695' N	117° 03.608' W	4130	14	Pore water DOC
GER Ref	SO268/1_39-1	MUC	11° 51.274' N	117° 02.366' W	4130.1	14	X-ray
						16	X-ray
GER Ref	SO268/1_40-1	PUC	11.844777	-117.060242	4140	7+13	Microbiology sampling
			11.844823	-117.060257	4140	23+45	Microbiology sampling
GER Trial	SO268/1_43-1	MUC	11° 55.844' N	117° 01.339' W	4082	14	Pore water DOC
						15	Microbiology sampling
						16	X-ray
GER Trial	SO268/1_44-2	BC	11° 55.835' N	117° 01.342' W	4089	NA	Manganese nodule
BEL Trial	SO268/1_50-2	MUC	14° 06.840' N	125° 52.341' W	4507	14	Pore water DOC
						16	X-ray
BEL Trial	SO268/1_52-1	BC	14° 06.804' N	125° 52.273' W	4507	NA	Manganese nodule
BEL Trial	SO268/1_53-1	BC	14° 06.713' N	125° 52.458' W	4485	NA	Manganese nodule
BEL Trial	SO268/1_57-1	PUC	14.113037	-125.870842	4507	31+3	Microbiology sampling

Site	Station	Gear	Latitude	Longitude	Depth	Core/Bottle	Purpose
			14.111013	-125.868502	4507	27+16	Microbiology sampling
			14.107633	-125.864542	4513	25+11	Microbiology sampling
BEL Trial	SO268/1_60-1	BC	14° 06.491' N	125° 51.849' W	4512	NA	Manganese nodule
BEL Trial	SO268/1_64-1	ROV	14.112437	-125.870599	4506	NA	Manganese nodule
BEL Trial	SO268/1_65-1	MUC	14° 06.789' N	125° 52.295' W	4495	11	Pore water DOC
BEL Trial	SO268/1_66-1	MUC	14° 06.448' N	125° 51.886' W	4509	14	Pore water DOC
						19	X-ray
BEL Trial	SO268/1_67-1	MUC	14° 06.292' N	125° 51.678' W	4514	14	Microbiology sampling
BEL Trial	SO268/1_71-1	GC	14° 06.696' N	125° 52.368' W	4486	NA	Microbiology sampling
BEL Trial	SO268/1_72-1	BC	14° 06.638' N	125° 52.053' W	4509	NA	Manganese nodule
BEL Trial	SO268/1_74-1	MUC	14° 08.121' N	125° 51.815' W	4510	14	Pore water DOC
						15	Microbiology sampling
BEL Trial	SO268/1_75-1	MUC	14° 06.999' N	125° 52.537' W	4495	12	Microbiology sampling
						17	X-ray
BEL Ref	SO268/1_76-1	BC	14° 02.167' N	125° 55.472' W	4540	NA	Manganese nodule
BEL Trial	SO268/1_78-1	GC	14° 08.125' N	125° 51.817' W	4502	NA	Microbiology sampling
BEL Ref	SO268/1_79-1	MUC	14° 02.187' N	125° 55.471' W	4535	15	Microbiology sampling
BEL Ref	SO268/1_80-1	MUC	14° 02.013' N	125° 55.736' W	4528	15	Microbiology sampling
						12	X-ray
BEL Ref	SO268/1_82-1	BC	14° 01.999' N	125° 55.741' W	4539	NA	Manganese nodule
BEL Ref	SO268/1_84-1	GC	14° 02.163' N	125° 55.471' W	4545	NA	Microbiology sampling
BEL Ref	SO268/1_85-1	MUC	14° 01.753' N	125° 55.506' W	4549	15	Microbiology sampling
						18	X-ray
GER Ref	SO268/2_95-2	BC	11° 51.751' N	117° 00.761' W	4120	NA	Manganese nodule
GER Ref	SO268/2_96-1	BC	11° 51.748' N	117° 00.837' W	4122	NA	Manganese nodule
GER Ref	SO268/2_99-1	BC	11° 51.801' N	117° 00.703' W	4365	NA	Manganese nodule
GER Dred	SO268/2_101-1	PUC	11.86306	-117.012839	4126	3+11	Microbiology sampling
GER Dred	SO268/2_102-1	BC	11° 51.833' N	117° 00.800' W	4123	NA	Manganese nodule
GER Dred	SO268/2_103-1	BC	11° 51.907' N	117° 00.720' W	4116	NA	Manganese nodule
GER Dred	SO268/2_104-1	GC	11° 51.780' N	117° 00.742' W	4120	NA	Microbiology sampling
GER Dred	SO268/2_106-1	MUC	11° 51.792' N	117° 00.740' W	4122	13	Microbiology sampling
GER Dred	SO268/2_107-1	MUC	11° 51.744' N	117° 00.841' W	4120	14	Microbiology sampling
GER Dred	SO268/2_116-1	BC	11° 51.711' N	117° 00.671' W	4117	NA	Manganese nodule
GER Dred	SO268/2_124-1	PUC	11.863196	-117.012835	4127	7+31	Microbiology sampling
			11.863103	-117.012117	4126	41+42	Microbiology sampling
BEL Ref	SO268/2_129-1	BC	14° 07.033' N	125° 52.501' W	4503	NA	Manganese nodule
BEL Karst	SO268/2_130-1	GC	14° 05.217' N	125° 50.053' W	4487	NA	Microbiology sampling

Site	Station	Gear	Latitude	Longitude	Depth	Core/Bottle	Purpose
BEL Ref	SO268/2_135-1	MUC	14° 01.125' N	125° 55.350' W	4549	7 X	Microbiology sampling Pore water DOC
BEL Ref	SO268/2_136-1	MUC	14° 01.500' N	125° 55.250' W	4542	6 X	Microbiology sampling Pore water DOC
BEL Trial	SO268/2_137-1	PUC	14.11142 14.111436	-125.871765 -125.871772	4495 4495	19+22 33+46	Microbiology sampling Microbiology sampling
BEL Ref	SO268/2_138-1	MUC	14° 01.152' N	125° 54.948' W	4527	9 X	Microbiology sampling Pore water DOC
BEL Ref	SO268/2_139-1	MUC	14° 01.916' N	125° 55.006' W	4524	5 X	Microbiology sampling Pore water DOC
BEL Ref	SO268/2_140-1	BC	14° 01.914' N	125° 00.000' W	4521	NA	Manganese nodule
BEL Ref	SO268/2_141-1	BC	14° 01.125' N	125° 55.350' W	4541	NA	Manganese nodule
BEL Ref	SO268/2_142-1	BC	14° 01.500' N	125° 55.250' W	4541	NA	Manganese nodule
BEL Karst	SO268/2_143-1	GC	14° 06.560' N	125° 53.398' W	4502	NA	Microbiology sampling
BEL Trial	SO268/2_144-1	GC	14° 06.126' N	125° 51.550' W	4522	NA	Microbiology sampling
BEL Trial	SO268/2_149-1	BC	14° 06.321' N	125° 51.643' W	4517	NA	Manganese nodule
BEL Ref	SO268/2_154-1	PUC	14.032957 14.03327 14.033157	-125.924959 -125.925055 -125.925025	4542 4543 4542	30+19 5+33 43+45	Microbiology sampling Microbiology sampling Microbiology sampling
No Nod	SO268/2_158-1	PUC	11.849792 11.850195 11.849548	-117.383375 -117.383874 -117.3822	4278 4278 4278	3+24 71+57 17+7	Microbiology sampling Microbiology sampling Microbiology sampling
No Nod	SO268/2_157-1	GC	11° 50.976' N	117° 22.956' W	4275	NA	Microbiology sampling
GER Ref	SO268/2_161-1	BC	11° 55.263' N	117° 00.825' W	4125	NA	Manganese nodule
GER Ref	SO268/2_166-1	BC	11° 50.715' N	117° 03.610' W	4124	NA	Manganese nodule
GER Ref	SO268/2_171-1	MUC	11° 51.003' N	117° 03.323' W	4122	9 12 15	Microbiology sampling Pore water DOC EEA
GER Ref	SO268/2_172-1	MUC	11° 50.465' N	117° 03.320' W	4134	2 4 7	Microbiology sampling Pore water DOC EEA
GER Ref	SO268/2_175-1	BC	11° 50.547' N	117° 03.067' W	4129	NA	Manganese nodule
GER Ref	SO268/2_178-1	MUC	11° 50.776' N	117° 03.321' W	4131	10	Microbiology sampling
GER Ref	SO268/2_179-1	MUC	11° 50.385' N	117° 03.573' W	4142	18 2 7	Microbiology sampling Pore water Doc EEA
GER Ref	SO268/2_180-1	BC	11° 50.370' N	117° 03.574' W	4143	NA	Manganese nodule

Site	Station	Gear	Latitude	Longitude	Depth	Core/Bottle	Purpose
GER Ref	SO268/2_181-1	BC	11° 50.455' N	117° 03.321' W	4133	NA	Manganese nodule
GER Ref	SO268/2_182-1	BC	11° 50.983' N	117° 03.326' W	4119	NA	Manganese nodule
GER Dred	SO268/2_184-1	MUC	11° 51.600' N	117° 00.839' W	4123	8	Microbiology sampling
						3	Microbiology sampling
						14	Microbiology sampling
GER Dred	SO268/2_185-1	MUC	11° 51.801' N	117° 00.782' W	4121	17	Microbiology sampling
						18	Microbiology sampling
						7	EEA
						12	EEA
						20	EEA
GER Dred	SO268/2_186-1	MUC	11° 51.852' N	117° 00.751' W	4117	5	Microbiology sampling
GER Dred	SO268/2_189-1	BC	11° 51.773' N	117° 00.845' W	4122	NA	Manganese nodule
GER Dred	SO268/2_190-1	BC	11° 51.789' N	117° 00.779' W	4124	NA	Manganese nodule
GER Dred	SO268/2_191-1	BC	11° 51.784' N	117° 00.748' W	4117	NA	Manganese nodule
GER Dred	SO268/2_193-1	PUC	11.863178	-117.012927	4127	13+14	Microbiology sampling
			11.863178	-117.012927	4127	3+21	Microbiology sampling
			11.862981	-117.012898	4127	4+42	Microbiology sampling
			11.863178	-117.012927	4127	22+72	Microbiology sampling
			11.862981	-117.012898	4127	6+59	Microbiology sampling
GER Dred	SO268/2_197-1	PUC	11.86416	-117.013154	4128	11+12	Microbiology sampling
			11.864187	-117.013146	4128	24+41	Microbiology sampling
			11.8642	-117.013137	4128	54+71	Microbiology sampling
GER Dred	SO268/2_198-1	MUC	11° 51.782' N	117° 00.712' W	4145	1	Microbiology sampling
						2	Microbiology sampling
						11	EEA
						6	EEA
						5	EEA
GER Dred	SO268/2_199-1	MUC	11° 51.765' N	117° 00.756' W	4120	1	Microbiology sampling
GER Ref	SO268/2_206-1	BC	11° 50.319' N	117° 03.089' W	4129	NA	Manganese nodule
GER Trial	SO268/1_2-1	CTD	11° 54.683' N	117° 02.284' W	4100	2	DNA and DOC
					4100	1	Microbiology sampling
GER Trial	SO268/1_14-1	CTD	11° 56.305' N	117° 01.958' W	4073	2	DNA and DOC
					4073	1	Microbiology sampling
					4028	21	DNA and DOC
					4028	20	Microbiology sampling
					3878	23	DNA and DOC
					3878	22	Microbiology sampling

Site	Station	Gear	Latitude	Longitude	Depth	Core/Bottle	Purpose
GER Trial	SO268/1_14-1	Pump	11° 56.305' N	117° 01.958' W	4073	Jimmy	DNA and RNA
					4048	Hulda	DNA and RNA
GER Trial	SO268/1_23-1	CTD	11° 54.682' N	117° 02.125' W	4104	1	DNA and DOC
					4104	2	Microbiology sampling
					4104	22	DOC
					4058	19	DNA and DOC
					4058	18	Microbiology sampling
					3908	21	DNA and DOC
					3908	20	Microbiology sampling
GER Trial	SO268/1_23-1	Pump	11° 54.682' N	117° 02.125' W	3924	Jimmy	DNA and RNA
BEL Trial	SO268/1_49-1	CTD	14° 05.785' N	125° 52.954' W	4449	3	DNA and DOC
					4449	2	Microbiology sampling
					4449	X	DOC
					4406	8	DNA and DOC
					4406	7	Microbiology sampling
					4406	X	
					4256	6	DNA and DOC
					4256	10	Microbiology sampling
					4256	X	DOC
BEL Trial	SO268/1_49-1	Pump	14° 05.785' N	125° 52.954' W	4422	Jimmy	DNA and RNA
					4457	Hulda	DNA and RNA
BEL Trial	SO268/1_59-1	CTD	14° 05.307' N	125° 52.301' W	4481	3	DNA and DOC
					4481	2	Microbiology sampling
					4431	18	DNA and DOC
					4431	17	Microbiology sampling
					4281	22	DNA and DOC
					4281	21	Microbiology sampling
GER Eddy	SO268/2_88-1	CTD	11° 44.992' N	113° 07.011' W	4117	4	DNA and DOC
					4117	5	Microbiology sampling
					4072	20	DNA and DOC
					4072	21	Microbiology sampling
GER Eddy	SO268/2_88-1	Pump	11° 44.992' N	113° 07.011' W	4082	Jimmy	DNA and RNA
					4107	Hulda	DNA and RNA
GER Eddy	SO268/2_92-1	CTD	11° 48.003' N	114° 56.400' W	4106	4	DNA
					4106	5	Microbiology sampling
					4061	8	DNA
					4061	9	Microbiology sampling

Site	Station	Gear	Latitude	Longitude	Depth	Core/Bottle	Purpose
GER Eddy	SO268/2_92-1	Pump	11° 48.003' N	114° 56.400' W	4071	Jimmy	DNA and RNA
					4096	Hulda	DNA and RNA
GER Dred	SO268/2_120-1	CTD	11° 51.785' N	117° 00.736' W	4115	4	DNA and DOC
					4115	5	Microbiology sampling
					4070	6	DNA and DOC
					4070	7	Microbiology sampling
					4115	Jimmy	DNA and RNA
GER Dred	SO268/2_120-1	Pump	11° 51.785' N	117° 00.736' W	4115	Jimmy	DNA and RNA
BEL Trial	SO268/2_131-1	CTD	14° 07.114' N	125° 52.008' W	4501	5	DNA and DOC
					4501	6	Microbiology sampling
					4456	7	DNA and DOC
					4456	8	Microbiology sampling
					4306	9	DNA and DOC
					4306	10	Microbiology sampling
					4501	Jimmy	DNA and RNA
BEL Trial	SO268/2_131-1	Pump	14° 07.114' N	125° 52.008' W	4481	Hulda	DNA and RNA
					4517	5	DNA
BEL Ref	SO268-2_151-1	CTD	14° 01.153' N	125° 54.949' W	4517	6	Microbiology sampling
					4472	7	DNA
					4472	8	Microbiology sampling
					4322	9	DNA
					4322	10	Microbiology sampling
					4517	Hulda	DNA and RNA
GER Dred	SO268-2_159-1	CTD	11° 51.652' N	117° 00.840' W	4118	5	DNA
					4118	6	Microbiology sampling
					4073	7	DNA
					4073	8	Microbiology sampling
GER Dred	SO268-2_159-1	Pump	11° 51.652' N	117° 00.840' W	4073	Jimmy	DNA and RNA
					4118	Hulda	DNA and RNA
GER Dred	SO268-2_183-1	CTD	11° 51.600' N	117° 00.839' W	4117	5	DNA
					4117	6	Microbiology sampling
					4072	9	DNA
					4072	10	Microbiology sampling
GER Dred	SO268-2_208-1	CTD	11° 51.620' N	117° 00.840' W	4110	5	DNA
					4110	6	Microbiology sampling
					4073	7	DNA
					4073	8	Microbiology sampling

Tab. 12.4.2: Microbial sampling details of SO268 Leg 1 and Leg 2 with station number, name of gear, number of samples taken for microbial analyses. Sediment samples were taken from 7 depth layers up to 20 cm below sea floor. DOC from pore water was taken from 21 layers up to 20 cm below sea floor. Whole nodules will be further analysed in MPI Bremen. Whole sediment cores were preserved for X-ray scanning. Jimmy (25 m above CTD) and Hulda (in CTD frame) are the names of in situ pumps during CTD casts. Locations of stations are shown in Table 12.4.1.

Poro. = porosity, *Phospho.* = phospholipids, *Nod.* = Manganese nodules, *Dred.* = dredge experiment. *NA* = not available. *X* = unknown. Gray coloured rows represent nodule sampling to distinguish whole nodule and sediment core preservation.

Site	Station	Gear	Core/Bottle	DNA	RNA	AODC	FISH	Chl-a	Poro.	Phospho.	POC	DOC	Nod./X-ray	Total
GER Trial	SO268/1_5-1	MUC	14									19		19
GER Trial	SO268/1_6-1	MUC	14									21		21
GER Trial	SO268/1_6-1	MUC	16										1	1
GER Trial	SO268/1_7-1	MUC	14									21		21
GER Trial	SO268/1_7-1	MUC	19										1	1
GER Trial	SO268/1_18-1	MUC	14										2	2
GER Trial	SO268/1_18-1	MUC	14	7	7	7	7	7	7	7				49
GER Trial	SO268/1_19-1	MUC	1										1	1
GER Trial	SO268/1_19-1	MUC	14	7	7	7	7	7	7	7				49
GER Trial	SO268/1_26-1	MUC	14	7	7	7	7	7	7	7				49
GER Trial	SO268/1_26-1	MUC	15										1	1
GER Trial	SO268/1_28-1	BC	NA	9	9	9	9						3	39
GER Trial	SO268/1_29-1	ROV	NA	6	6	6	6						1	25
GER Trial	SO268/1_31-1	PUC	11										1	1
GER Trial	SO268/1_31-1	PUC	16										3	3
GER Trial	SO268/1_31-1	PUC	42										3	3
GER Trial	SO268/1_31-1	PUC	56										2	2
GER Trial	SO268/1_31-1	PUC	51+27	7	7	7	7	7	7	7				49
GER Trial	SO268/1_31-1	PUC	11+16	7	7	7	7	7	7	7				49
GER Trial	SO268/1_31-1	PUC	42+57	7	7	7	7	7	7	7				49

[illegible]

Site	Station	Gear	Core/Bottle	DNA	RNA	AODC	FISH	Chl-a	Poro.	Phospho.	POC	DOC	Nod./X-ray	Total
BEL Trial	SO268/1_66-1	MUC	14									21		21
BEL Trial	SO268/1_66-1	MUC	19										1	1
BEL Trial	SO268/1_67-1	MUC	14	7	7	7	7	7	7	7				49
BEL Trial	SO268/1_72-1	BC	NA										1	1
BEL Trial	SO268/1_74-1	MUC	14									21		21
BEL Trial	SO268/1_74-1	MUC	15	7	7	7	7	7	7	7				49
GER Trial	SO268/1_74-1	MUC	15										1	1
BEL Trial	SO268/1_75-1	MUC	12	7	7	7	7	7	7	7				49
BEL Trial	SO268/1_75-1	MUC	17										1	1
BEL Ref	SO268/1_76-1	BC	NA										2	2
BEL Ref	SO268/1_79-1	MUC	15	7	7	7	6	7	7	7				48
BEL Ref	SO268/1_80-1	MUC	15	7	7	7	7	7	7	7				49
BEL Ref	SO268/1_80-1	MUC	12										1	1
BEL Ref	SO268/1_82-1	BC	NA										3	3
BEL Ref	SO268/1_85-1	MUC	15	7	7	7	7	7	7	7				49
BEL Ref	SO268/1_85-1	MUC	18										1	1
GER Ref	SO268/2_95-2	BC	NA	5	5								1	11
GER Ref	SO268/2_96-1	BC	NA	6	6		3						1	16
GER Ref	SO268/2_99-1	BC	NA	3	3		3						1	10
GER Dred	SO268/2_101-1	PUC	3+11	7	7	7	7	7	7	7				49
GER Dred	SO268/2_102-1	BC	NA	3	3								1	7
GER Dred	SO268/2_103-1	BC	NA										2	2
GER Dred	SO268/2_106-1	MUC	13	7	6	5	4	5	5	5				37
GER Dred	SO268/2_107-1	MUC	14	7	7	7	7	6	6	6				46
GER Dred	SO268/2_116-1	BC	NA	3	3		3						1	10
GER Dred	SO268/2_124-1	PUC	7+31	7	7	7	7	7	7	7				49

Site	Station	Gear	Core/Bottle	DNA	RNA	AODC	FISH	Chl-a	Poro.	Phospho.	POC	DOC	Nod./X-ray	Total
GER Dred	SO268/2_124-1	PUC	41+42	7	7	7	7	7	7	7				49
BEL Ref	SO268/2_129-1	BC	NA	3	3		3							9
BEL Ref	SO268/2_135-1	MUC	7	7	7	7	7	7	7	7				49
BEL Ref	SO268/2_135-1	MUC										21		21
BEL Ref	SO268/2_136-1	MUC	6	7	7	7	7	7	7	7				49
BEL Ref	SO268/2_136-1	MUC										21		21
BEL Trial	SO268/2_137-1	ROV	NA	3	3		3						1	10
BEL Trial	SO268/2_137-1	PUC	19+22	7	7	7	7	7	7	7				49
BEL Trial	SO268/2_137-1	PUC	33+46	7	7	7	7	7	7	7				49
BEL Ref	SO268/2_138-1	MUC	9	7	7	7	7	7	7	7				49
BEL Ref	SO268/2_138-1	MUC										21		21
BEL Ref	SO268/2_139-1	MUC	5	6	7	7	7	5	5	4				41
BEL Ref	SO268/2_139-1	MUC										21		21
BEL Ref	SO268/2_140-1	BC	NA	3	3		3							9
BEL Ref	SO268/2_141-1	BC	NA	6	6		6							18
BEL Ref	SO268/2_142-1	BC	NA										1	1
BEL Trial	SO268/2_149-1	BC	NA	6	6		6							18
BEL Ref	SO268/2_154-1	ROV	NA	6	6		6							18
BEL Ref	SO268/2_154-1	PUC	30+19	7	7	7	7	7	7	7				49
BEL Ref	SO268/2_154-1	PUC	5+33	7	7	7	7	7	7	6				48
BEL Ref	SO268/2_154-1	PUC	43+45	7	7	7	7	7	7	7				49
No Nod	SO268/2_156-1	PUC	3+24	7	7	7	7	7	7	7				49
No Nod	SO268/2_156-1	PUC	71+57	7	7	7	7	7	7	7				49
No Nod	SO268/2_156-1	PUC	17+7	7	7	7	7	7	7	7				49
GER Ref	SO268/2_161-1	BC	NA	3	3		3						1	10
GER Trial	SO268/2_163-1	ROV	NA	6	6		6						1	19

Site	Station	Gear	Core/Bottle	DNA	RNA	AODC	FISH	Chl-a	Poro.	Phospho.	POC	DOC	Nod./X-ray	Total
GER Ref	SO268/2_166-1	BC	NA	9	9		9						1	28
GER Ref	SO268/2_167-1	BC	NA	6	6		6						6	24
GER Ref	SO268/2_171-1	MUC	9	7	6	6	6	6	6	6				43
GER Ref	SO268/2_171-1	MUC	12									19		19
GER Ref	SO268/2_172-1	MUC	2	7	7	6	6	6	6	6				44
GER Ref	SO268/2_172-1	MUC	4									21		21
GER Ref	SO268/2_175-1	BC	NA	3	3		3							9
GER Ref	SO268/2_178-1	MUC	10	7	7	7	7	7	7	7				49
GER Ref	SO268/2_179-1	MUC	18	7	7	7	7	7	7	7				49
GER Ref	SO268/2_179-1	MUC	2									21		21
GER Ref	SO268/2_180-1	BC	NA	6	6		6							18
GER Ref	SO268/2_181-1	BC	NA	3	3		3							9
GER Ref	SO268/2_182-1	BC	NA	6	6		6							18
GER Dred	SO268/2_184-1	MUC	8	7	7	7	7	7	7	7				49
GER Dred	SO268/2_184-1	MUC	3	7	7	7	7	7	7	7				49
GER Dred	SO268/2_184-1	MUC	14	7	7	7	7	7	7	7				49
GER Dred	SO268/2_185-1	MUC	17	7	7	7	7	7	7	7				49
GER Dred	SO268/2_185-1	MUC	18	7	7	7	7	6	6	6				46
GER Dred	SO268/2_186-1	MUC	5	7	7	7	7	7	7	7				49
GER Dred	SO268/2_186-1	MUC	5	3	3		3							9
GER Dred	SO268/2_189-1	BC	NA	9	9		9							27
GER Dred	SO268/2_190-1	BC	NA	3	3		3							9
GER Dred	SO268/2_191-1	BC	NA	6	6		6							18
GER Dred	SO268/2_193-1	PUC	13+14	6	6	6	6	6	6	6				42
GER Dred	SO268/2_193-1	PUC	3+21	7	7	7	7	7	7	7				49
GER Dred	SO268/2_193-1	PUC	4+42	7	7	7	7	7	7	7				49

[illegible]

[illegible]

[illegible]

Site	Station	Gear	Core/Bottle	DNA	RNA	AODC	FISH	Chl-a	Poro.	Phospho.	POC	DOC	Nod./X-ray	Total
GER Dred	SO268/2_159-1	CTD	6				1				1			2
GER Dred	SO268/2_159-1	CTD	7	1										1
GER Dred	SO268/2_159-1	CTD	8				1				1			2
GER Dred	SO268/2_159-1	Pump	Jimmy	3	3									6
GER Dred	SO268/2_159-1	Pump	Hulda	3	3									6
GER Dred	SO268/2_183-1	CTD	5	1										1
GER Dred	SO268/2_183-1	CTD	6				1				1			2
GER Dred	SO268/2_183-1	CTD	9	1										1
GER Dred	SO268/2_183-1	CTD	10				1				1			2
GER Dred	SO268/2_208-1	CTD	5	1										1
GER Dred	SO268/2_208-1	CTD	6				1				1			2
GER Dred	SO268/2_208-1	CTD	7	1										1
GER Dred	SO268/2_208-1	CTD	8				1				1			2

Tab. 12.4.3: Overview of SO268 Leg 1 and Leg 2 samples for microbial analysis of UNIVPM (M. Buschi, leg 1) & J. Barz (MPI, leg 2) with sampling date, claim (Belgium or German), site (Trial/Reference/Dredge/Impact with thin or thick coverage), station number, multicorer number, number of samples taken for microbial analyses. Sediment samples were taken from following layers: 0-1 cm, 1-3 cm, 3-5 cm, 5-10 cm, 10-15 cm below sea floor. Locations of stations are shown in Table 12.4.1.

Sampling date	Area	Site	Station#	Gear#	Core#	Rep#	Layer	Time	OM, prok. + viral abund.	Viral prod.?	EEA?	Mol. anal.?	Sediment Viral prod.?
28.02.2019	GER	Trial	SO268/1_5	TV- MUC01	1	1	0-1	t0	x	x	x	x	x
28.02.2019	GER	Trial	SO268/1_5	TV- MUC01	1	1	1-3	t1	x				
28.02.2019	GER	Trial	SO268/1_5	TV- MUC01	1	1	3-5	t2	x				
28.02.2019	GER	Trial	SO268/1_5	TV- MUC01	1	1	5-10	t3	x				
28.02.2019	GER	Trial	SO268/1_5	TV- MUC01	1	1	10-15		x		x		
28.02.2019	GER	Trial	SO268/1_6	TV- MUC02	2	2	0-1	t0	x	x	x	x	x
28.02.2019	GER	Trial	SO268/1_6	TV- MUC02	2	2	1-3	t1	x				
28.02.2019	GER	Trial	SO268/1_6	TV- MUC02	2	2	3-5	t2	x				
28.02.2019	GER	Trial	SO268/1_6	TV- MUC02	2	2	5-10	t3	x				
28.02.2019	GER	Trial	SO268/1_6	TV- MUC02	2	2	10-15		x		x		
28.02.2019	GER	Trial	SO268/1_7	TV- MUC03	3	3	0-1	t0	x	x	x	x	x
28.02.2019	GER	Trial	SO268/1_7	TV- MUC03	3	3	1-3	t1	x				
28.02.2019	GER	Trial	SO268/1_7	TV- MUC03	3	3	3-5	t2	x				
28.02.2019	GER	Trial	SO268/1_7	TV- MUC03	3	3	5-10	t3	x				
28.02.2019	GER	Trial	SO268/1_7	TV- MUC03	3	3	10-15		x		x		
03.03.2019	GER	Trial	SO268/1_18	MUC01	4	4	0-1	t0	x	x	x	x	x
03.03.2019	GER	Trial	SO268/1_18	MUC01	4	4	1-3	t1	x				
03.03.2019	GER	Trial	SO268/1_18	MUC01	4	4	3-5	t2	x				

Sampling date	Area	Site	Station#	Gear#	Core#	Rep#	Layer	Time	OM, prok. + viral abund.	Viral prod.?	EEA?	Mol. anal.?	Sediment Viral prod.?
03.03.2019	GER	Trial	SO268/1 18	MUC01	4	4	5-10	t3	x				
03.03.2019	GER	Trial	SO268/1 18	MUC01	4	4	10-15		x		x		
03.03.2019	GER	Trial	SO268/1 19	MUC02	5	5	0-1	t0	x	x	x	x	
03.03.2019	GER	Trial	SO268/1 19	MUC02	5	5	1-3	t1	x				
03.03.2019	GER	Trial	SO268/1 19	MUC02	5	5	3-5	t2	x				
03.03.2019	GER	Trial	SO268/1 19	MUC02	5	5	5-10	t3	x				
03.03.2019	GER	Trial	SO268/1 19	MUC02	5	5	10-15		x		x		
05.03.2019	GER	Trial	SO268/1 26	MUC06	6	6	0-1	t0	x	x	x	x	
05.03.2019	GER	Trial	SO268/1 26	MUC06	6	6	1-3	t1	x				
05.03.2019	GER	Trial	SO268/1 26	MUC06	6	6	3-5	t2	x				
05.03.2019	GER	Trial	SO268/1 26	MUC06	6	6	5-10	t3	x				
05.03.2019	GER	Trial	SO268/1 26	MUC06	6	6	10-15		x		x		
09.03.2019	GER	Ref	SO268/1 38	MUC07	7	7	0-1	t0	x	x	x	x	
09.03.2019	GER	Ref	SO268/1 38	MUC07	7	7	1-3	t1	x				
09.03.2019	GER	Ref	SO268/1 38	MUC07	7	7	3-5	t2	x				
09.03.2019	GER	Ref	SO268/1 38	MUC07	7	7	5-10	t3	x				
09.03.2019	GER	Ref	SO268/1 38	MUC07	7	7	10-15		x		x		
09.03.2019	GER	Ref	SO268/1 39	MUC08	8	8	0-1	t0	x	x	x	x	
09.03.2019	GER	Ref	SO268/1 39	MUC08	8	8	1-3	t1	x				
09.03.2019	GER	Ref	SO268/1 39	MUC08	8	8	3-5	t2	x				
09.03.2019	GER	Ref	SO268/1 39	MUC08	8	8	5-10	t3	x				
09.03.2019	GER	Ref	SO268/1 39	MUC08	8	8	10-15		x		x		
10.03.2019	GER	Ref	SO268/1 42	MUC07	9	9	0-1	t0	x	x	x	x	
10.03.2019	GER	Ref	SO268/1 42	MUC07	9	9	1-3	t1	x				
10.03.2019	GER	Ref	SO268/1 42	MUC07	9	9	3-5	t2	x				
10.03.2019	GER	Ref	SO268/1 42	MUC07	9	9	5-10	t3	x				
10.03.2019	GER	Ref	SO268/1 42	MUC07	9	9	10-15		x		x		
10.03.2019	GER	Trial	SO268/1 43	MUC08	10	10	0-1	t0	x	x	x	x	
10.03.2019	GER	Trial	SO268/1 43	MUC08	10	10	1-3	t1	x				
10.03.2019	GER	Trial	SO268/1 43	MUC08	10	10	3-5	t2	x				
10.03.2019	GER	Trial	SO268/1 43	MUC08	10	10	5-10	t3	x				
10.03.2019	GER	Trial	SO268/1 43	MUC08	10	10	10-15		x		x		
14.03.2019	BEL	Trial	SO268/1 50 2	MUC09	12	12	0-1	t0	x	x	x	x	
14.03.2019	BEL	Trial	SO268/1 50 2	MUC09	12	12	1-3	t1	x				
14.03.2019	BEL	Trial	SO268/1 50 2	MUC09	12	12	3-5	t2	x				
14.03.2019	BEL	Trial	SO268/1 50 2	MUC09	12	12	5-10	t3	x				

Sampling date	Area	Site	Station#	Gear#	Core#	Rep#	Layer	Time	OM, prok. + viral abund.	Viral prod.?	EEA?	Mol. anal.?	Sediment Viral prod.?
14.03.2019	BEL	Trial	SO268/1 50	2	MUC09	12	12	10-15	x		x		
15.03.2019	BEL	Trial	SO268/1 56		MUC09	13	13	0-1	t0	x	x	x	x
15.03.2019	BEL	Trial	SO268/1 56		MUC09	13	13	1-3	t1	x			
15.03.2019	BEL	Trial	SO268/1 56		MUC09	13	13	3-5	t2	x			
15.03.2019	BEL	Trial	SO268/1 56		MUC09	13	13	5-10	t3	x			
15.03.2019	BEL	Trial	SO268/1 56		MUC09	13	13	10-15	x		x		
17.03.2019	BEL	Trial	SO268/1 65		MUC14	14	14	0-1	t0	x	x	x	x
17.03.2019	BEL	Trial	SO268/1 65		MUC14	14	14	1-3	t1	x			
17.03.2019	BEL	Trial	SO268/1 65		MUC14	14	14	3-5	t2	x			
17.03.2019	BEL	Trial	SO268/1 65		MUC14	14	14	5-10	t3	x			
17.03.2019	BEL	Trial	SO268/1 65		MUC14	14	14	10-15	x		x		
18.03.2019	BEL	Trial	SO268/1 66		MUC09	15	15	0-1	t0	x	x	x	x
18.03.2019	BEL	Trial	SO268/1 66		MUC09	15	15	1-3	t1	x			
18.03.2019	BEL	Trial	SO268/1 66		MUC09	15	15	3-5	t2	x			
18.03.2019	BEL	Trial	SO268/1 66		MUC09	15	15	5-10	t3	x			
18.03.2019	BEL	Trial	SO268/1 66		MUC09	15	15	10-15	x		x		
18.03.2019	BEL	Trial	SO268/1 67		MUC09	16	16	0-1	t0	x	x	x	x
18.03.2019	BEL	Trial	SO268/1 67		MUC09	16	16	1-3	t1	x			
18.03.2019	BEL	Trial	SO268/1 67		MUC09	16	16	3-5	t2	x			
18.03.2019	BEL	Trial	SO268/1 67		MUC09	16	16	5-10	t3	x			
18.03.2019	BEL	Trial	SO268/1 67		MUC09	16	16	10-15	x		x		
20.03.2019	BEL	Trial	SO268/1 74		MUC09	17	17	0-1	t0	x	x	x	x
20.03.2019	BEL	Trial	SO268/1 74		MUC09	17	17	1-3	t1	x			
20.03.2019	BEL	Trial	SO268/1 74		MUC09	17	17	3-5	t2	x			
20.03.2019	BEL	Trial	SO268/1 74		MUC09	17	17	5-10	t3	x			
20.03.2019	BEL	Trial	SO268/1 74		MUC09	17	17	10-15	x		x		
20.03.2019	BEL	Trial	SO268/1 75		MUC09	18	18	0-1	t0	x	x	x	x
20.03.2019	BEL	Trial	SO268/1 75		MUC09	18	18	1-3	t1	x			
20.03.2019	BEL	Trial	SO268/1 75		MUC09	18	18	3-5	t2	x			
20.03.2019	BEL	Trial	SO268/1 75		MUC09	18	18	5-10	t3	x			
20.03.2019	BEL	Trial	SO268/1 75		MUC09	18	18	10-15	x		x		
21.03.2019	BEL	Ref	SO268/1 79		MUC09	19	19	0-1	t0	x	x	x	x
21.03.2019	BEL	Ref	SO268/1 79		MUC09	19	19	1-3	t1	x			
21.03.2019	BEL	Ref	SO268/1 79		MUC09	19	19	3-5	t2	x			
21.03.2019	BEL	Ref	SO268/1 79		MUC09	19	19	5-10	t3	x			
21.03.2019	BEL	Ref	SO268/1 79		MUC09	19	19	10-15	x		x		

Sampling date	Area	Site	Station#	Gear#	Core#	Rep#	Layer	Time	OM, prok. + viral abund.	Viral prod.?	EEA?	Mol. anal.?	Sediment Viral prod.?
21.03.2019	BEL	Ref	SO268/1 80	MUC09	20	20	0-1	t0	x	x	x	x	
21.03.2019	BEL	Ref	SO268/1 80	MUC09	20	20	1-3	t1	x				
21.03.2019	BEL	Ref	SO268/1 80	MUC09	20	20	3-5	t2	x				
21.03.2019	BEL	Ref	SO268/1 80	MUC09	20	20	5-10	t3	x				
21.03.2019	BEL	Ref	SO268/1 80	MUC09	20	20	10-15		x		x		
22.03.2019	BEL	Ref	SO268/1 85	MUC09	21	21	0-1	t0	x	x	x	x	
22.03.2019	BEL	Ref	SO268/1 85	MUC09	21	21	1-3	t1	x				
22.03.2019	BEL	Ref	SO268/1 85	MUC09	21	21	3-5	t2	x				
22.03.2019	BEL	Ref	SO268/1 85	MUC09	21	21	5-10	t3	x				
22.03.2019	BEL	Ref	SO268/1 85	MUC09	21	21	10-15		x		x		
07.04.2019	GER	Ref/Dred	SO268/2 106		22	22	0-1	t0	x	x	x	x	
07.04.2019	GER	Ref/Dred	SO268/2 106		22	22	1-3	t1	x				
07.04.2019	GER	Ref/Dred	SO268/2 106		22	22	3-5	t2	x				
07.04.2019	GER	Ref/Dred	SO268/2 106		22	22	5-10	t3	x				
07.04.2019	GER	Ref/Dred	SO268/2 106		22	22	10-15		x				
07.04.2019	GER	Ref/Dred	SO268/2 107		23	23	0-1	t0	x	x	x	x	
07.04.2019	GER	Ref/Dred	SO268/2 107		23	23	1-3	t1	x				
07.04.2019	GER	Ref/Dred	SO268/2 107		23	23	3-5	t2	x				
07.04.2019	GER	Ref/Dred	SO268/2 107		23	23	5-10	t3	x				
07.04.2019	GER	Ref/Dred	SO268/2 107		23	23	10-15		x				
07.04.2019	GER	Ref/Dred	SO268/2 107		24	24	0-1	t0	x	x	x	x	
07.04.2019	GER	Ref/Dred	SO268/2 107		24	24	1-3	t1	x				
07.04.2019	GER	Ref/Dred	SO268/2 107		24	24	3-5	t2	x				
07.04.2019	GER	Ref/Dred	SO268/2 107		24	24	5-10	t3	x				
07.04.2019	GER	Ref/Dred	SO268/2 107		24	24	10-15		x				
12.04.2019	GER	Impact	SO268/2 122		25	25	0-1	t0	x	x	x	x	
12.04.2019	GER	Impact	SO268/2 122		25	25	1-3	t1	x				
12.04.2019	GER	Impact	SO268/2 122		25	25	3-5	t2	x				
12.04.2019	GER	Impact	SO268/2 122		25	25	5-10	t3	x				
12.04.2019	GER	Impact	SO268/2 122		25	25	10-15		x				
12.04.2019	GER	Impact	SO268/2 122		26	26	0-1	t0	x	x	x	x	
12.04.2019	GER	Impact	SO268/2 122		26	26	1-3	t1	x				
12.04.2019	GER	Impact	SO268/2 122		26	26	3-5	t2	x				
12.04.2019	GER	Impact	SO268/2 122		26	26	5-10	t3	x				
12.04.2019	GER	Impact	SO268/2 122		26	26	10-15		x				
12.04.2019	GER	Impact	SO268/2 122		27	27	0-1	t0	x	x	x	x	

Sampling date	Area	Site	Station#	Gear#	Core#	Rep#	Layer	Time	OM, prok. + viral abund.	Viral prod.?	EEA?	Mol. anal.?	Sediment Viral prod.?
12.04.2019	GER	Impact	SO268/2 122		27	27	1-3	t1	x				
12.04.2019	GER	Impact	SO268/2 122		27	27	3-5	t2	x				
12.04.2019	GER	Impact	SO268/2 122		27	27	5-10	t3	x				
12.04.2019	GER	Impact	SO268/2 122		27	27	10-15		x				
18.04.2019	GER	Ref	SO268/2 135		28	28	0-1	t0	x	x	x	x	
18.04.2019	GER	Ref	SO268/2 135		28	28	1-3	t1	x				
18.04.2019	GER	Ref	SO268/2 135		28	28	3-5	t2	x				
18.04.2019	GER	Ref	SO268/2 135		28	28	5-10	t3	x				
18.04.2019	GER	Ref	SO268/2 135		28	28	10-15		x				
18.04.2019	GER	Ref	SO268/2 136		29	29	0-1	t0	x	x	x	x	
18.04.2019	GER	Ref	SO268/2 136		29	29	1-3	t1	x				
18.04.2019	GER	Ref	SO268/2 136		29	29	3-5	t2	x				
18.04.2019	GER	Ref	SO268/2 136		29	29	5-10	t3	x				
18.04.2019	GER	Ref	SO268/2 136		29	29	10-15		x				
19.04.2019	GER	Ref	SO268/2 138		30	30	0-1	t0	x	x	x	x	
19.04.2019	GER	Ref	SO268/2 138		30	30	1-3	t1	x				
19.04.2019	GER	Ref	SO268/2 138		30	30	3-5	t2	x				
19.04.2019	GER	Ref	SO268/2 138		30	30	5-10	t3	x				
19.04.2019	GER	Ref	SO268/2 138		30	30	10-15		x				
19.04.2019	GER	Ref	SO268/2 139		31	31	0-1	t0	x	x	x	x	
19.04.2019	GER	Ref	SO268/2 139		31	31	1-3	t1	x				
19.04.2019	GER	Ref	SO268/2 139		31	31	3-5	t2	x				
19.04.2019	GER	Ref	SO268/2 139		31	31	5-10	t3	x				
19.04.2019	GER	Ref	SO268/2 139		31	31	10-15		x				
08.05.2019	GER	Ref	SO268/2 171	18	32	32	0-1	t0	x	x	x	x	
08.05.2019	GER	Ref	SO268/2 171	18	32	32	1-3	t1	x				
08.05.2019	GER	Ref	SO268/2 171	18	32	32	3-5	t2	x				
08.05.2019	GER	Ref	SO268/2 171	18	32	32	5-10	t3	x				
08.05.2019	GER	Ref	SO268/2 171	18	32	32	10-15		x				
08.05.2019	GER	Ref	SO268/2 171	14	33	33	0-1	t0	x	x	x	x	
08.05.2019	GER	Ref	SO268/2 171	14	33	33	1-3	t1	x				
08.05.2019	GER	Ref	SO268/2 171	14	33	33	3-5	t2	x				
08.05.2019	GER	Ref	SO268/2 171	14	33	33	5-10	t3	x				
08.05.2019	GER	Ref	SO268/2 171	14	33	33	10-15		x				
10.05.2019	GER	Ref	SO268/2 178	11	34	34	0-1	t0	x	x	x	x	
10.05.2019	GER	Ref	SO268/2 178	11	34	34	1-3	t1	x				

Sampling date	Area	Site	Station#	Gear#	Core#	Rep#	Layer	Time	OM, prok. + viral abund.	Viral prod.?	EEA?	Mol. anal.?	Sediment Viral prod.?
10.05.2019	GER	Ref	SO268/2 178	11	34	34	3-5	t2	x				
10.05.2019	GER	Ref	SO268/2 178	11	34	34	5-10	t3	x				
10.05.2019	GER	Ref	SO268/2 178	11	34	34	10-15		x				
10.05.2019	GER	Ref	SO268/2 179	8	35	35	0-1	t0	x	x	x	x	
10.05.2019	GER	Ref	SO268/2 179	8	35	35	1-3	t1	x				
10.05.2019	GER	Ref	SO268/2 179	8	35	35	3-5	t2	x				
10.05.2019	GER	Ref	SO268/2 179	8	35	35	5-10	t3	x				
10.05.2019	GER	Ref	SO268/2 179	8	35	35	10-15		x				
10.05.2019	GER	Ref	SO268/2 179	16	36	36	0-1	t0	x	x	x	x	
10.05.2019	GER	Ref	SO268/2 179	16	36	36	1-3	t1	x				
10.05.2019	GER	Ref	SO268/2 179	16	36	36	3-5	t2	x				
10.05.2019	GER	Ref	SO268/2 179	16	36	36	5-10	t3	x				
10.05.2019	GER	Ref	SO268/2 179	16	36	36	10-15		x				
12.05.2019	GER	Thick cover	SO268/2 186		37	37	0-1	t0	x	x	x	x	
12.05.2019	GER	Thick cover	SO268/2 186		37	37	1-3	t1	x				
12.05.2019	GER	Thick cover	SO268/2 186		37	37	3-5	t2	x				
12.05.2019	GER	Thick cover	SO268/2 186		37	37	5-10	t3	x				
12.05.2019	GER	Thick cover	SO268/2 186		37	37	10-15		x				
12.05.2019	GER	Thick cover	SO268/2 186		38	38	0-1	t0	x	x	x	x	
12.05.2019	GER	Thick cover	SO268/2 186		38	38	1-3	t1	x				
12.05.2019	GER	Thick cover	SO268/2 186		38	38	3-5	t2	x				
12.05.2019	GER	Thick cover	SO268/2 186		38	38	5-10	t3	x				
12.05.2019	GER	Thick cover	SO268/2 186		38	38	10-15		x				
12.05.2019	GER	Thick cover	SO268/2 186		39	39	0-1	t0	x	x	x	x	
12.05.2019	GER	Thick cover	SO268/2 186		39	39	1-3	t1	x				
12.05.2019	GER	Thick cover	SO268/2 186		39	39	3-5	t2	x				
12.05.2019	GER	Thick cover	SO268/2 186		39	39	5-10	t3	x				
12.05.2019	GER	Thick cover	SO268/2 186		39	39	10-15		x				
15.05.2019	GER	Thin cover	SO268/2 199		40	40	0-1	t0	x	x	x	x	
15.05.2019	GER	Thin cover	SO268/2 199		40	40	1-3	t1	x				
15.05.2019	GER	Thin cover	SO268/2 199		40	40	3-5	t2	x				
15.05.2019	GER	Thin cover	SO268/2 199		40	40	5-10	t3	x				
15.05.2019	GER	Thin cover	SO268/2 199		40	40	10-15		x				
15.05.2019	GER	Thin cover	SO268/2 199		41	41	0-1	t0	x	x	x	x	
15.05.2019	GER	Thin cover	SO268/2 199		41	41	1-3	t1	x				
15.05.2019	GER	Thin cover	SO268/2 199		41	41	3-5	t2	x				

Sampling date	Area	Site	Station#	Gear#	Core#	Rep#	Layer	Time	OM, prok. + viral abund.	Viral prod.?	EEA?	Mol. anal.?	Sediment Viral prod.?
15.05.2019	GER	Thin cover	SO268/2 199		41	41	5-10	t3	x				
15.05.2019	GER	Thin cover	SO268/2 199		41	41	10-15		x				
15.05.2019	GER	Thin cover	SO268/2 199		42	42	0-1	t0	x	x	x	x	
15.05.2019	GER	Thin cover	SO268/2 199		42	42	1-3	t1	x				
15.05.2019	GER	Thin cover	SO268/2 199		42	42	3-5	t2	x				
15.05.2019	GER	Thin cover	SO268/2 199		42	42	5-10	t3	x				
15.05.2019	GER	Thin cover	SO268/2 199		42	42	10-15		x				

12.5 Gravity Core Descriptions

SO268/2 gravity core description

Core: SO268/1-016 Gc01

Section: 05 0-100 cm

Date: 05-05-2019

Described by: HJS

General remarks: Top of sediment core probably lost during coring and handling of gravity corer on deck, preserved sections 1-5 are in good shape

Depth (cm)	Lithology	Colour	Description
0 -			
10 -		10YR5/4 yell-brown 10YR6/4 light yell brown	0-10 cm: Yellowish brown silty clay with diffuse lighter coloured streaks, and light yellowish brown band ~ 1 cm thick marking boundary to =
20 -		10YR4/2 dark grayish brown	10-29 cm: Dark grayish brown silty clay with contrasting light yellowish brown patches and rings 1-2 cm
29 -		10YR6/4 light yell brown	Irregular gradual transition to =
40 -		10YR5/3 brown	29-72 cm: Mottled brown silty clay, in upper part with oval and irregular light yellowish brown patches with dark grayish brown core, further down only light yell brown oval patches and rings. then homogeneous part 45-60 cm, and lower part with diffuse slightly lighter coloured bands and contrasting light oval with darker core.
50 -		10YR6/3 pale brown	Irregular boundary to =
60 -		10YR5/3 brown	
70 -			
72 -		10YR4/2 dark grayish brown	72-93 cm: Mottled dark grayish brown silty clay with some lighter patches and contrasting light yellowish cloudy patches and darker mottles.
80 -		10YR6/4 light yell brown	
90 -		10YR5/3 brown	93-100 cm: Mottled brown silty clay with irregular lighter and darker
93 -		10YR6/4 light yell brown	
100 -			

SO268/2 gravity core description

Core: SO268/1 - 016 GC01

Section: 04 (00-200 cm)

Date: 05-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0 - 44 cm = Mottled brown silty clay with irregular patches of contrasting light yellowish brown and band of dark grayish brown ~ 1 cm thick at 5 cm, likely a burrow trace.
5 -			
10 -		10YR 4/2 dark grayish brown	Gradual transition to =
20 -		10YR 6/4 light yell brown	
30 -		10YR 5/3 brown	44 - 65 cm: Mottled dark grayish brown silty clay with irregular oval patches of pale brown, irregular ring shape ~ 2 cm Ø at 43-45 cm. Irregular gradual transition to =
40 -			
44 -		10YR 4/2 dark grayish brown	65 - 82 cm: Irregular patchwork of brown and light yellowish brown silty/clay, roundish and elongate patches reminiscent of burrow traces.
50 -		10YR 6/3 pale brown	
60 -		10YR 5/3 brown	Irregular boundary to =
65 -		10YR 6/4 light yell. brown	
70 -			82 - 100 cm: light yellowish brown silty clay with a few small patches of grayish brown.
80 -			
82 -		10YR 6/4 light yell brown	
90 -			
100 -			

SO268/2 gravity core description

Core: SO268/1-016 GC01

Section: 03 200-300 cm

Date: 05-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR5/3 brown	0-20 cm: light yellowish brown silty clay with contrasting brown irregular patches, conspicuous discontinuous brown band ~ 0.5 cm thick crossing obliquely at 13-17 cm, likely burrow trace.
10 -		10YR6/4 light yell. brown	
13 -			
17 -			
20 -		10YR6/4 light yellowish brown	Irregular boundary to =
30 -			
37 -		10YR5/3 brown	20-37 cm: light yellowish brown silty clay with a few irregular and oval small patches
40 -			Irregular boundary to =
50 -		10YR6/4 light yell. brown	37-98 cm: Mottled brown silty clay, locally darker grayish brown, with oval, irregular, and elongate patches of light yellowish brown. Conspicuous light coloured contrasting band 1 cm thick crossing obliquely at 55-58 cm likely burrow trace, more at 70 and 90 cm.
54 -			
55 -		10YR4/2 dark gray brown	Irregular cloudy transition to =
56 -			
58 -		10YR5/3 brown	95-100 cm: light yellowish brown silty clay.
60 -		10YR6/4 light yell. brown	Burrows ~ 1 cm filled with watery sediment at 51, 55, 56 and 78 cm
70 -			
78 -			
80 -			
90 -			
95 -			
100 -			

SO268/2 gravity core description

Core: SO268/1-016 Geol

Section: 02 300-400 cm

Date: 05-05-2019

Described by: HDS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			
10 -		10YR 6/4 light yellowish brown	0 - 79 cm: Mostly homogeneous light yellowish brown silty clay, swarm of oval and elongate patches ~ 0.5 cm thick. At 17-27 cm, reminiscent of burrow traces. Small brown spots at 44-49 cm, elongate patch at 60 cm.
20 -		10YR 5/3 brown	At 40 cm fragments of light-coloured vesicular rock, probably pumice.
30 -			Irregular but distinct boundary to;
40 -		10YR 6/4 light yellowish brown	79 - 100 cm: Dark grayish brown silty clay with relatively large irregular patches of contrasting light yellowish gray, some elongate bands ~ 1 cm thick obliquely crossing in lower 5 cm reminiscent of burrow traces. Small nodule at 81-84 cm sampled from archive half
50 -			
60 -			
70 -			
80 -		10YR 4/2 dark grayish brown	
90 -		10YR 6/4 light yell. brown	
100 -			

SO268/2 gravity core description

Core: SO268/1-016 GC01

Section: 01 400-485 cm

Date: 06-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 - 9		10YR 6/4 light yellowish brown	0 - 17 cm = Mottled brown to dark grayish brown silty clay with bands and patches of light yellowish brown, large patch at 0-4 cm. Sharp boundary to =
10 - 17		2.5Y 4/2 dark grayish brown	
17 - 22		10YR 6/4 light yellowish brown	
22 - 25
25 - 30		10YR 5/2 grayish brown	
30 - 36			17 - 60 cm = Light yellowish brown silty clay with irregular diffuse patches of grayish brown; some distinctly outlined bands ~1 cm thick crossing horizontally or obliquely at 22, 25-27, 36, 59 cm likely are burrow traces. Gradual transition to =
36 - 40
40 - 50
50 - 59
59 - 60
60 - 70		10YR 6/4 light yellowish brown	60 - 85 cm; Homogeneous light yellowish brown silty clay with only in upper part some slightly darker patches.
70 - 80
80 - 85
85 - 90
90 - 100

SO268/2 gravity core description

Core: SO268/1-037 Gc02

Section: 05 0-100 cm

Date: 06-05-2019

Described by: HJS

General remarks: Top of core probably lost during coring and handling of gravity core on deck, but preserved sections 1-5 appear in good shape

Depth (cm)	Lithology	Colour	Description
0 -			0-16 cm: Brown silty clay with diffuse lighter coloured mottles and patches
9		10YR 4/3 brown	
10 -		10YR 5/4 yell. brown	Large round patch of light yellowish brown at 9-12 cm, around burrow trace filled with watery mud.
12			From 10 cm down scattered black speckles.
16 -		10YR 5/3 brown	
20 -			
22			
30 -			16-45 cm: Brown silty clay, slightly lighter than above, with diffuse irregular patches and mottles in slightly lighter and darker hues, some ring-shaped with darker core ~ 1 cm, likely representing burrow traces with re-ox. halos.
40 -		10YR 6/4 light yell. brown	
45 -		10YR 5/4 yell. brown	Irregular boundary to =
50 -			45-53 cm: Yellowish brown silty clay with patches of light yellowish brown, some with darker core.
53 -			Irregular boundary to =
60 -		10YR 4/3 brown	53-85 cm: Brown silty clay with slightly lighter mottles and patches, and some irregular patches of contrasting light yellowish brown. Some ring-shaped. Irreg boundary to =
70 -		10YR 6/4 light yell. brown	
80 -			85-96 cm: Yellowish brown silty clay with light and dark patches
85 -		10YR 5/4 yell. brown	
90 -		10YR 6/4 light yell. br.	
96 -			96-100 cm: Light yellowish brown with large elongate patch in contrasting dark brown
100 -			

SO268/2 gravity core description

Core: SO268/1-037 GC02

Section: 04 100-200 cm

Date: 06-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			
10 -		10YR 4/3 brown	0-22 cm: Brown silty clay with diffuse lighter coloured patches. Some irregular ring shaped. Gradual transition to:
20 -			22-35 cm: Mottled brown to dark grayish brown silty clay with irregular patches and mottles of light yellowish brown. Irregular ring shaped at 25 cm, and oblique track crossing at 29 cm. Gradual transition to:
22 -		10YR 6/4 light yell. brown	
25 -			
29 -		10YR 4/2 dark grayish brown	
35 -			35-66 cm: Mostly light yellowish brown silty clay, in upper half with cloudy mottles and patches of brown, lower half more uniform light colour. Irregular boundary to:
40 -		10YR 5/3 brown	
50 -		10YR 6/4 light yellowish brown	
60 -			66-100 cm: Brown silty clay with contrasting oval and elongate patches of light yellowish brown. The lighter patches ~ 1 cm thick likely representing burrow traces
66 -			
70 -			
80 -		10YR 5/3 brown	
90 -		10YR 6/4 light yell. brown	
100 -			

SO268/2 gravity core description

Core: 50268/1-037 9202

Section: 03

200-300cm

Date: 06-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 5/3 brown	0-12 cm: Brown silty clay with large round and elongate patches of light yellowish brown.
10 -		10YR 6/4 light yell. brown	Irregular transition to =
12 -			
20 -		10YR 4/2 dark grayish brown	12-42 cm: Brown to dark grayish brown silty clay with irregular elongate and ring shaped patches of light yellowish gray, at 26 cm burrow trace filled with watery mud, in lower part some dark grayish brown mottling. Gradual transition to =
26 -			
30 -			
40 -		10YR 6/4 light yell. brown	42-55 cm: Light yellowish brown silty clay with irregular cloudy patches and mottles of brown. Gradual transition to =
42 -		10YR 5/3 brown	
50 -		10YR 6/4 light yellowish brown	
55 -			
59 -			
60 -			
66 -		10YR 6/3 pale brown	55-100 cm: Mostly light yellowish brown silty clay, with diffuse bands of pale brown at 59-66 cm and 81-87 cm. Elongate band ~ 1 cm thick at 59-60 cm wholly burrow trace,
70 -		10YR 6/4 light yellow brown	
80 -			
81 -			
84 -			
87 -		10YR 6/3 pale brown	
90 -		10YR 6/4 light yell. brown	
100 -			

SO268/2 gravity core description

Core: SO268/1-037 GC02

Section: 02 300-400 cm

Date: 06-05-2019

Described by: Hds

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0-67 cm: Mostly light yellowish brown silty clay, irregular patches and mottles at 17-27 cm, dark grayish brown spots and patches at 35-41 cm, cloudy patch and bands at 55-67 cm. Irregular boundary to:
10 -		10YR 6/4 light yellowish brown	
17 -			67-100 cm: Grayish brown silty clay with irregular patches and elongate bands of contrasting light yellowish brown, elongate patches likely representing burrow traces.
20 -		10YR 5/3 brown	
27 -			
30 -			
35 -		10YR 6/4 light yellowish brown	
40 -			
41 -		10YR 4/2 dark grayish brown	
50 -			
55 -		10YR 5/2 grayish brown	
60 -			
67 -		10YR 5/2 grayish brown	
70 -			
80 -		10YR 6/4 light yellowish brown	
90 -			
100 -			

SO268/2 gravity core description

Core: SO268/1-037 GC02

Section: 01 400-485 cm

Date: 06-05-2019

Described by: HDS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 4/2 dark grayish brown	0-13 cm = Brown to dark grayish brown silty clay with patches and streaks of contrasting light yellowish brown. Irregular ring-shaped patch 1 cm Ø at 10 cm. Gradual transition to =
10 -		10YR 6/4 light yell. brown	
13 -			
20 -			
30 -		10YR 5/3 brown	13-85 cm: Mottled patchwork of brown and light yellowish brown silty clay. Subhorizontal bands ~1 cm thick at 24, 26, 39, 70 cm. Wholly represent burrow traces, same for ring shaped patches at 13, 58 cm. Black nodule at 78-85 cm sampled from archive half.
39 -		10YR 6/4 light yellowish brown	
40 -			
50 -			
58 -
60 -			
70 -			
78 -			
80 -		10YR 2/1 black	
90 -	core catcher		
100 -			

SO268/2 gravity core description

Core: SO268/1-071 GC03 Section: 05 0-92 cm
Date: 06-05-2019 Described by: HJS

General remarks: Top sediment probably lost during coring and handling of gravity/coret on deck, preserved sections 1-5 are good shape, but section 5 somewhat stretched out.

Depth (cm)	Lithology	Colour	Description
0 -			
6		10YR 6/4 light yellowish brown	0-36 cm = Brown silty clay with light yellowish brown mottles, larger band of light coloured sediment at 6-10 cm, ring shape ~ 1 cm at 18 cm.
10 -			Gradual transition to =
18		10YR 4/3 brown	
20 -			
30 -			36-60 cm = Brown silty clay with cloudy patches of light yellowish brown in lower part more contrasting light yellowish brown rings 2-3 cm and irregular bands 1-2 cm thick
36			Gradual transition to =
40 -		10YR 5/3 brown	
50 -			
60		10YR 6/4 light yell. brown	60-92 cm: Brown silty clay with diffuse yellowish brown mottles, large ringlike patches at 60-63 and 80-84 cm.
70 -			Post-coring crack at 74 cm.
74		10YR 5/3 4/3 brown	
80 -			
90 -		10YR 5/4 yellowish brown	
100 -	void		

SO268/2 gravity core description

Core: SO268/1-071 Gc 03

Section: 04 92-192 cm

Date: 06-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0-39 cm = Brown silty clay with diffuse patches of light yellowish brown, notably 10-20 cm and 81-39 cm. Gradual transition to =
10 -		10YR 5/3 brown	
20 -		10YR 6/4 light yellowish brown	39-71 cm: Brown silty clay with only occasional patches of light yellowish brown, at 60-64 cm with darker core and 69-71 cm, possibly burrow traces with redox halo. Gradual transition to:
30 -			
39 -			
40 -			
50 -		10YR 5/3 brown	71-83 cm: Brown silty clay, slightly darker than above, with elongate and round patch of light yellowish brown, round patch at 78-80 cm has darker core suggestive of burrow with redox halo. Gradual transition to:
60 -			
64 -		10YR 6/4 light yellowish brown	
70 -			
71 -			
78 -		10YR 4/3 brown	83-100 cm: Light yellowish brown silty clay, in upper part with diffuse patches and bands of brown, in lower part more homogeneous
80 -			
83 -			
90 -		10YR 6/4 light yell. brown	
		10YR 5/3 brown	
100 -			

SO268/2 gravity core description

Core: SO268/1-071 GLO3

Section: 03 192-292 cm

Date: 06-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR5/3 brown	0-7 cm: Brown silty clay with yellowish brown patches. Sharp boundary to =
7 -		10YR6/4 light yellowish brown	7-12 cm: Band of light yellowish silty clay; sharp boundary to =
10 -			
12 -		10YR5/3 brown	12-41 cm: Brown silty clay with diffuse lighter and darker mottles, elongate patch of contrasting light yellowish brown ~ 1 cm thick and with darker core crossing obliquely at 37-41 cm (likely represents burrow trace with halo some black spots from 33 cm down)
20 -			Gradual transition to =
30 -		10YR6/4 light yellowish brown	
37 -			
40 -		10YR6/4 light yellowish brown	
41 -		10YR6/3 pale brown	41-81 cm: Mostly light yellowish brown silty clay, in upper part with diffuse pale brown mottles and streaks, from 59 cm down ward more contrasting patches and streaks of brown. Some small black spots throughout. Gradual transition to =
50 -			
53 -			
59 -			
60 -			
70 -		10YR5/3 brown	
80 -			
81 -		10YR5/3 brown	81-100 cm: Brown silty clay with diffuse streaks and bands of light yellowish brown
90 -		10YR6/4 light yellowish brown	
100 -			

SO268/2 gravity core description

Core: SO268/1-071 GC03

Section: 02 292-392cm

Date: 06-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 - 6		10YR 5/3 brown	0-36 cm: Brown silty clay with diffuse light yellowish brown mottles and elongate patches (anthracite) at 6, 10, 13-15, 30-33 cm suggestive of burrow traces. Gradual transition to =
10 - 13			
15 - 20		10YR 6/4 light yellowish brown	
20 - 30			
30 - 33			36-59 cm: Mottled brown silty clay with contrasting light yellowish brown mottles and larger patches, some small black speckles throughout. Gradual transition to =
33 - 36			
36 - 40		10YR 5/3 brown	
40 - 50		10YR 6/4 light yellow brown	
50 - 59			59-100 cm: Mostly light yellowish brown silty clay with cloudy bands of pale brown and brown mottling at 65-74 cm and 81-88 cm. Some small black speckles throughout interval.
59 - 60			
60 - 65		10YR 6/4 light yellow brown	
65 - 74		10YR 6/3 pale brown	
74 - 80			
80 - 81			
81 - 88		10YR 5/3 brown	
88 - 90			
90 - 100		10YR 6/4 light yell. brown	

SO268/2 gravity core description

Core: SO268/1-071 GC03

Section: 01 392-977 cm

Date: 06-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 5/3 brown	0-4 cm: Brown silty clay
4 -		10YR 6/4 light yellow brown	4-18 cm: Light yellowish brown silty clay with a few brown streaks in lower part.
10 -			Irregular boundary to =
18 -		10YR 5/3 brown	18-58 cm: Mottled brown silty clay, in upper part with irregular and elongate patches of contrasting light yellowish brown, diffuse ring-like patch with darker cores at 35-41 cm, and more irregular streaks of light yellowish brown at 48-53 cm.
20 -			Sharp irregular boundary to =
30 -		10YR 6/4 light yellow brown	58-67 cm: Light yellowish brown silty clay. Sharp irregular boundary to =
35 -			67-85 cm: Mottled grayish brown and light yellowish brown silty clay
40 -		10YR 5/2 grayish brown	
41 -		10YR 6/4 light yellow brown	
48 -			
50 -			
53 -			
58 -			
60 -			
67 -			
70 -			
80 -			
85 -			
90 -			
100 -			

SO268/2 gravity core description

Core: SO268/1-078 GC04

Section: 05 0-100 cm

Date: 07-05-2019

Described by: HJS

General remarks: Sediment top probably lost during coring and recovery of gravity corer on deck. Preserved sections 1-5 appear in good shape

Depth (cm)	Lithology	Colour	Description
0 -			
10 -		WYR 4/3 brown	
20 -			
22 -			
25 -		WYR 6/4 light yellowish brown	
30 -			
32 -			
40 -			
42 -			
48 -			
50 -		WYR 4/3 brown	
60 -			
70 -		WYR 6/4 light yellowish brown	
76 -			
80 -			
90 -		WYR 5/4 yellowish brown	
92 -		WYR 4/3 brown	
100 -			

0-76 cm: Brown silty/clay with irregular patches, bands and ring shaped patches of light yellowish brown. Contours of patches appear diffuse but may be result of scraping of core surface. Comprosonous light-coloured band 1 cm thick crossing obliquely at 22-25 cm, likely a burrow trace. Ring like features at 27-30, 42-48 cm, likely also burrow traces with redox halo.

Irregular gradual transition to:

76-92 cm: Yellowish brown silty clay with diffuse light yellowish brown mottling.

Gradual transition to:

92-100 cm: Brown silty clay with light yellowish brown patch.

SO268/2 gravity core description

Core: SO268/1-078 GC04

Section: 04 100-200 cm

Date: 07-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 5/4 yell. brown	0-14 cm: Mottled yellowish brown and light yellowish brown silty clay. Irregular boundary to:
10 -		10YR 6/4 light yell. brown	14-57 cm: Mostly homogeneous brown silty clay with occasional yellowish brown ring-shaped features ~1 cm Ø at 20, 26, 30, 39, 43 and 46 cm, likely burrow traces with redox halo. Gradual transition to:
14 -			
20 -			
26 -		10YR 4/3 brown	
30 -			
39 -			
40 -			
43 -		10YR 5/4 yell. brown	
46 -			
50 -			
57 -			
60 -		10YR 6/4 light yell. brown	57-100 cm: Brown to yellowish brown silty clay with irregular cloudy and roundish patches of light yellowish brown. Hole at 73-76 cm. Burrow?
70 -			
73 -			
76 -			
80 -		10YR 5/4 yellowish brown	
90 -		10YR 6/4 light yellow brown	
100 -			

SO268/2 gravity core description

Core: SO268/1-078 GC04

Section: 03 200-300 cm

Date: 07-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 4/3 5/3 brown	0-23 cm: Mostly brown silty clay with irregular bands and streaks and mottles of light yellowish brown. From 20 cm down have some scattered fine black speckles.
10 -		10YR 6/4 light yell. brown	Irregular boundary to:
20 -		10YR 5/3 brown	23-53 cm: Mostly homogeneous light yellowish brown silty clay, cloudy patches of pale brown with some fine black speckles at 31-39 cm. Irregular boundary to:
23 -		10YR 6/4 light yell. brown	53-100 cm: Brown mottled silty clay with large and small irregular patches of light yellowish brown. Diffuse black speckles in brown patches. Two horizontal bands of light yellowish brown crossing at 91 cm suggestive of burrow trace with redox halo.
30 -		10YR 6/4 light yell. brown	
31 -		10YR 6/3 pale brown	
39 -		10YR 6/4 light yell. brown	
40 -		10YR 6/4 light yell. brown	
50 -		10YR 5/3 brown	
53 -		10YR 6/4 light yellow brown	
60 -
70 -
80 -
90 -
100 -			

SO268/2 gravity core description

Core: S0268/1 - 078 GC04

Section: 02 300-400 cm

Date: 07-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 - 3			0-19 cm = Brown silty clay with irregular patches of light yellowish brown silty clay. Irregular boundary to:
3 - 10		WYR 5/3 brown	
10 - 16		WYR 6/4 light yell. brown	19-45 cm = Mottled yellowish brown silty clay with irregular patches and bands of light yellowish brown. Some elongate patches ~ 1 cm Ø cross-crossing at 32-39 cm reminiscent of burrow traces. Irregular boundary to:
16 - 19		WYR 6/4 light yell. brown	
19 - 20		WYR 6/4 light yell. brown	
20 - 30		WYR 5/4 yellowish brown	
30 - 40		WYR 6/4 light yell. brown	
40 - 45		WYR 6/4 light yell. brown	45-100 cm = Mostly homogeneous light yellowish brown silty clay, with some brown mottles in upper part, and bands of cloudy pale brown mottling at 53-58 cm, 71-75 cm, 90-95 cm.
45 - 50		WYR 6/4 light yell. brown	
50 - 53		WYR 6/3 pale brown	
53 - 58		WYR 6/4 light yell. brown	
58 - 60		WYR 6/3 pale brown	
60 - 70		WYR 6/4 light yell. brown	
70 - 71		WYR 6/4 light yell. brown	
71 - 75		WYR 6/3 pale brown	
75 - 80		WYR 6/3 pale brown	
80 - 90		WYR 6/3 pale brown	
90 - 95		WYR 6/3 pale brown	
95 - 100		WYR 6/3 pale brown	

SO268/2 gravity core description

Core: 80268/1-078 9004

Section: 01 400-500 cm

Date: 07-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 - 5		10YR 6/4 light yell br	0 - 30 cm = Homogeneous light yellowish brown silty clay with cloudy band of pale brown at 5-12 cm
5 - 12		10YR 6/3 pale brown	
12 - 20		10YR 6/4 light yellowish brown	Irregular boundary to = 30 - 50 cm = Patchwork of cloudy and mottled dark grayish brown and light yellowish brown silty clay.
20 - 30		10YR 4/2 dark grayish brown	Light coloured horizontal band ~1 cm thick crossing at 33 cm and thin band at 49 cm reminiscent of burrow traces.
30 - 33		10YR 6/4 light yell brown	
33 - 40		10YR 6/4 light yell brown	Irregular gradual transition to = 50 - 69 cm = Mottled grayish brown silty clay with cloudy mottles and small patches of light yellowish brown. Irregular boundary to =
40 - 49		10YR 6/4 light yell brown	
49 - 50		10YR 5/2 grayish brown	69 - 91 cm: Brown to grayish brown mottled silty clay with large irregular patches of light yellowish brown, some reminiscent of ring shaped patches 84-88 cm.
50 - 60		10YR 5/2 grayish brown	
60 - 69		10YR 6/4 light yellow brown	Irregular boundary to = 91 - 100 cm = Light yellowish brown silty clay
69 - 70		10YR 6/4 light yellow brown	
70 - 80		10YR 5/3 brown	
80 - 90		10YR 6/4 light yell brown	
90 - 91		10YR 6/4 light yell brown	
91 - 100		10YR 6/4 light yell brown	

SO268/2 gravity core description

Core: SO268/1-084 GC05

Section: 06 0-66 cm

Date: 07-05-2019

Described by: Mds

General remarks: Top sediment probably lost during coring and handling of gravity core on deck. Section 06 stretched and thinned but structure reasonably intact, sections 5-1 in good shape

Depth (cm)	Lithology	Colour	Description
0 -			0-35 cm: Void
10 -	void		35-53 cm: Mottled brown silty clay relatively sharp boundary to =
20 -			53-66 cm: Brown and light yellowish brown silty clay with some elongate and round patches ~ 1 cm possibly representing burrow traces
35 -			
40 -		104R4/3 brown	
50 -			
53 -		104R6/4 light yell. brown	
60 -		104R5/3 brown	
66 -			
70 -			
80 -			
90 -			
100 -			

SO268/2 gravity core description

Core: SO268/1 - 084 GC05 Section: 05 66-165 cm

Date: Described by:

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 6/4 light yellowish brown	0-24 cm: Alternating irregular bands of light yellowish brown silty clay with brown patches ~ 1 cm and brown silty clay with light yellowish brown patches.
10 -		10YR 5/3 brown	Irregular boundary to:
20 -		10YR 6/4 light yell. br.	24-84 cm: Brown silty clay, in upper half with irregular horizontal band of light yellowish brown crossing at 27-29 cm, and numerous clearly outlined or more diffuse elongate oval patches of light brown with darker core ~ 1 cm probably representing burrow traces with redox halo, at 35, 38-41, 45-53 cm.
24 -			In lower half only few lighter coloured rings at 64, 68, 78, 82 cm, and large open burrow 1 cm filled with watery mud at 62 and 67 cm.
27 -			Sharp boundary to =
29 -			84-99 cm: Alternating bands of light yellowish brown and brown silty clay.
30 -		10YR 5/3 brown	
35 -		10YR 6/4 light yell. brown	
38 -			
40 -			
41 -			
45 -			
50 -			
53 -			
60 -			
62 -			
64 -			
67 -			
70 -			
78 -			
80 -			
84 -			
90 -			
99 -			
100 -			

SO268/2 gravity core description

Core: 80268/1-084 GLOS

Section: 04 165-265 cm

Date: 07-05-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0		10YR 5/4 yellowish brown	0-32 cm: Yellowish brown and light yellowish brown diffusely mottled silty clay.
10		10YR 6/4 light yellowish brown	
20		10YR 5/4 yellowish brown	Irregular transition to: 32-100 cm: Homogeneous light yellowish brown silty clay with a few faintly outlined subhorizontal elongate bands of ^{pale brown} 10YR 5/3 brown which represent burrow traces, at 45-50 cm and 82-90 cm.
32		10YR 6/4 light yellowish brown	
45		10YR 5/3 brown	
50		10YR 6/4 light yellowish brown	
60		10YR 5/3 brown	
70		10YR 6/4 light yellowish brown	
80			
82		10YR 5/3 brown	
88			
90			
100			

SO268/2 gravity core description

Core: 80268/1-084 GC05

Section: 03 265-365 cm

Date: 07-05-2019

Described by: Hds

General remarks:

Depth (cm)	Lithology	Colour	Description
0 - 2		LOYR 5/3 brown	0-15 cm: light yellowish brown silty clay with diffuse patch of brown 2-10 cm.
10 - 15		LOYR 6/4 light yellowish brown	Irregular boundary to =
15 - 20		LOYR 5/3 brown	15-41 cm = Brown silty clay with diffuse lighter mottling and irregular elongate patches
27 - 30		LOYR 6/4 light yellowish brown	bands ~ 1 cm thick crossing at 26 cm and 32-38 cm
30 - 31			suggestive of burrow traces, Ring like patches at 27-31 cm.
40 - 41			Irregular boundary to =
50 - 57		LOYR 6/4 light yellow brown	41-100 cm: Homogeneous light yellowish brown silty clay with only few small (pale brown) mottles, between 57 and 67 cm
67 - 70			Swarm of small black spicules
80 -			
90 -			
100 -			

SO268/2 gravity core description

Core: 80268/1-084 GC05 Section: 02 365-465 cm

Date: 07-05-2019 Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			
10 -		104R6/4 light yellowish brown	0 - 27/30 cm: light yellowish brown silty clay, with irregular cloudy patch of contrasting dark grayish brown at 13-24 cm, accompanied by swarm of small black speckles!
13 -		2544/2 dark grayish brown	Irregular boundary to:
20 -			27/30 cm - 70 cm = Grayish brown cloudy silty clay with light yellowish brown mottles, oval patches and elongate bands 0.5-1 cm thick crossing at 29, 30, 32, 39 cm, wholly burrow traces, irregular lighter coloured ring shapes at 65-70 cm. Gradual transition to:
24 -		104R5/2 grayish brown	70 - 89 cm: light yellowish brown silty clay with pale brown mottles and streaks, in lower part mostly pale and grayish brown with elongate patches and bands of light yellowish brown. Wholly burrow traces. Gradual transition to:
27 -		104R6/4 light yellowish brown	89 - 100 cm: light yellowish brown silty clay with horizontal burrow trace slightly more yellowish hue at 94 cm
30 -		104R5/2 grayish brown	
40 -		104R6/4 light yellowish brown	
50 -		104R5/2 grayish brown	
60 -			
65 -		104R6/4 light yell. brown	
70 -		104R6/3 pale brown	
80 -		104R6/4 light yellowish brown	
89 -			
90 -			
94 -			
100 -			

SO268/2 gravity core description

Core: SO268/1-084 Geos

Section: 01 465-550 cm

Date: 07-05-2019

Described by: Hds

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0-85 cm: Homogeneous light yellowish brown silty clay, with only small grayish brown diffuse cloudy patches at 25 and 30 cm, with some tiny black speckles. Also black speckle at 57 cm. Some indurated sediment at 65 cm, under the surface appears a black nodule
10 -		104R6/4 light yellowish brown	
20 -			
25 -			
30 -		104R5/2 grayish brown	
40 -			
50 -			
57 -			
60 -			
65 -		black	
70 -			
80 -			
90 -	Core catcher		
100 -			

SO268/2 gravity core description

0 - 100 cm

Core: SO268-2-104 GC06

Section: 6

Date: 08-04-2019

Described by: HJS

General remarks:

Top 99 cm lost during coring

Depth (cm)	Lithology	Colour	Description
0 -			
10 -		10YR 5/4 yell brown	0 - 27 cm = mottled yellowish brown to dark yellowish brown silty clay. Burrow traces ~ 1 cm
20 -		10YR 4/4 dark yellowish brown	Irregular bioturbated transition to =
27 -			27 - 60 cm: mottled yellowish brown and locally light yellowish brown silty clay. Round burrow trace ~ 1 cm with redox halo at 30-31 cm. Patch with soft watery mud at 45-48 cm
30 -		10YR 6/4 light yell br.	Irregular bioturbated transition to =
40 -		10YR 5/4 yell-brown	60 - 73 cm: light yellowish brown silty clay with darker yellowish brown bioturbation traces
45 -			Irregular transition to =
48 -			73 - 100 cm = mottled dark yellowish brown to dark brown silty clay. Burrow traces ~ 1 cm
50 -			stand out as slightly lighter colour. Open burrow at 75 cm.
60 -		10YR 6/4 light yellowish brown	
70 -			
73 -			
75 -			
80 -			
90 -		10YR 4/4 4/3 dark yellowish brown dark brown	
100 -			

SO268/2 gravity core description

Core: SO268-2-104 GC 06

Section: 5 100-200 cm

Date: 08-04-2019

Described by: KDS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 6/3 pale brown	0-10 cm: mottled pale brown to brown silty clay. Irregular transition to =
10 -		10YR 5/3 brown	
20 -		10YR 5/4 yellowish brown	10-23 cm: mottled yellowish brown silty clay, getting darker to brown in lower part. Open burrow lane filled with watery mud and fecal pellets at 23 cm. Irregular but distinct transition to =
23 -		10YR 4/3 brown	
30 -		10YR 6/4 light yell. brown	
35 -			
40 -		10YR 5/3 brown	23-35 cm: mottled light yellowish brown silty clay, slightly lighter than sediment above and below. Gradual transition to =
50 -			
60 -		10YR 4/3 brown	35-77 cm: mottled brown silty clay; downwards the mottling becomes more distinct with more contrast between brown and light yellowish brown. Burrow traces along with lighter coloured halo. Irregular distinct transition to =
70 -		10YR 6/4 light yell. brown	
77 -		10YR 6/4 light yell. brown	77-86 cm: light yellowish brown silty clay with brown mottles. Irregular distinct transition to =
80 -			
86 -		10YR 5/3 brown	86-100 cm: mottled brown silty clay
90 -			
100 -			

SO268/2 gravity core description

Core: SO 268-2-104 GC06

Section: 4 200-300 cm

Date: 08-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 5/3 brown	0-26 cm = mottled brown silty clay with pale brown burrow traces
10 -		10YR 6/3 pale brown	Horizontal burrow ~1 cm at 10-11 cm
20 -			Gradual transition to:
26 -			26-44 cm: Mottled pale brown to light yellowish brown silty clay
30 -		10YR 6/3 pale brown to light yell-brown	locally brown. Irregular distinct transition to:
40 -			44-60 cm: light yellowish brown silty clay with only few small darker mottles. Irregular distinct transition to:
44 -
50 -		10YR 6/4 light yellowish brown	
60 -			60-100 cm: Mottled brown and pale brown silty clay - lighter coloured patches 1-2 cm
70 -		10YR 6/3 pale brown 10YR 5/3 brown	suggestive of burrow traces
80 -
90 -			
100 -			

SO268/2 gravity core description

Core: SO268-2-104 GC06

Section: 3 300-400 cm

Date: 08-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0-50 cm: Mottled brown-yellowish brown silty clay with burrow traces standing out in light yellowish brown, often with light coloured halo around darker core. Horizontal light coloured burrow 12-14 cm
10 -		10YR 4/3 brown	
12 -			
14 -		10YR 6/4 light yellowish brown	
20 -			Gradual but distinct transition to:
30 -			
40 -		10YR 4/3 brown	50-78 cm: light yellowish brown silty clay with occasional cloudy darker patches.
50 -		10YR 5/3 yell. brown	Irregular transition to:
60 -		10YR 6/4 light yell. brown	78-100 cm: light yellowish brown silty clay with distinctly darker brown mottles, some with lighter core and dark halo.
70 -			
78 -			
80 -		10YR 6/4 light yell. brown	
90 -		10YR 5/4 yell. brown	
100 -			

SO268/2 gravity core description

Core: SO268-2-104 GC06

Section: 2 400-500cm

Date: 08-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 6/4 light yell. brown	0 - 15 cm: light yellowish brown silty clay with a few brown mottles.
10 -		10YR 6/4 light yell. brown	15 - 29 cm: light yellowish brown silty clay with irregular large patches of brown.
15 -		10YR 5/3 brown	29 - 53 cm: light yellowish brown silty clay with only few dark grayish brown burrow traces ~ 1 cm
20 -		10YR 6/4 light yell. brown	53 - 100 cm: Irregular patches of light yellowish brown alternating with dark grayish brown patches silty clay. Different from overlying intervals, individual burrow traces can not be distinguished.
29 -		10YR 4/2 dark grayish brown	
30 -		10YR 6/4 light yell. brown	
40 -			
50 -			
53 -			
60 -			
70 -			
80 -			
90 -			
100 -			

SO268/2 gravity core description

Core: SO268-2-104 GC 06

Section: 1

500-560 cm

Date: 08-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			
10 -		10YR 4/2 dark gray-brown	0-26 cm: Dark grayish brown silty clay with cloudy irregular patches of light yellowish gray. Irregular but distinct transition to:
20 -		10YR 6/4 light yell. brown	
26 -			26-40 cm: Light yellowish brown silty clay with a few irregular patches of brown.
30 -		10YR 6/4 light yell. brown	
40 -			40-60 cm: Brown silty clay with irregular cloudy patches of light yellowish brown.
50 -		10YR 5/3 brown	
60 -		10YR 6/4 light yell. brown	
60 -	Core catcher		
70 -			
80 -			
90 -			
100 -			

SO268/2 gravity core description

Core: SO268-2-130 GE 07

Section: 04 0-100 cm

Date: 17-04-2019

Described by: KJS

General remarks: Top of sediment core washed out and lost. the more consolidated sediment slumped in upper 3 core sections, reasonably intact in deepest section

Depth (cm)	Lithology	Colour	Description
0 -			0-100 cm: Dark yellowish brown to brown silty clay, occasional patches of light yellowish brown at ~ 5, 35, 67 cm. Most structure lost due to slumping in core liner.
5 -		40YR 6/4 light yell-brown	
10 -		10YR 4/4 dark yell-brown	
20 -		10YR 2.5/3 brown	
30 -			
35 -			
40 -			
50 -			
60 -			
67 -		10YR 6/4 light yell-brown	
70 -			
80 -			
90 -			
100 -			

SO268/2 gravity core description

Core: SO268-2-130 GC 07

Section: 03 100-200 cm

Date: 17-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			<p>0-100 cm: Brown silty clay with occasional patches of light yellowish brown at 68, 80, 93-100 cm</p> <p>Small nodule on side of core lower at 56-58 cm, taken from archive half of core for analysis. Intervals 51-53 cm and 61-63 cm above and below nodule also sampled from archive half.</p>
10 -		10YR 4/3 brown	
20 -			
30 -			
40 -			
50 -			
56 -			
58 -		black	
60 -			
68 -			
70 -			
80 -			
90 -		10YR 6/4 light yell. brown	
93 -			
100 -			

SO268/2 gravity core description

Core: SO268-2-130 GC07

Section: 02 200-300 cm

Date: 17-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -	void		0-100 cm: Brown silty clay with occasional spots and mottles of yellowish brown. 0-2 cm void. Black small nodules at ~29-31 cm and 69-70 cm, the first taken from archive half core for analysis. Interval 25-28 cm also sampled from archive half.
9 -			
10 -			
20 -			
23 -			
30 -			
43 -			
50 -			
60 -			
69 -			
70 -			
73 -			
80 -			
88 -			
90 -			
100 -			

10YR5/4
yellowish
brown

10YR4/3
brown

black

10YR5/4
light yell
brown

SO268/2 gravity core description

Core: SO268-2-130 GC 07

Section: 01 300-385 cm

Date: 17-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0 - 85 cm = Brown silty clay, slightly more consolidated than overlying sections, with some dispersed, yellowish brown cloudy spots and mottles. Irregular cloudy band of dark grayish brown between 25 and 32 cm. Small black nodules at 57-58 cm and at side of liner at 85 cm.
10 -		10YR 4/3 brown	
20 -		10YR 5/4 yell. brown	
25 -		10YR 4/2 dark grayish brown	
30 -			
32 -			
40 -			
50 -		10YR 5/4 yell. brown	
57 -		black	
58 -			
60 -		10YR 4/3 brown	
70 -			
80 -			
85 -			
90 -	Core Catcher		
100 -			

SO268/2 gravity core description

Core: SO268/2 - 143 GLOB

Section: 5 0-55 cm

Date: 21.04.2019

Described by: HJS

General remarks:

Top sediment sloshed out during recovery of corer on deck.

Depth (cm)	Lithology	Colour	Description
0 -	void		0-55 cm: Brown silty clay with occasional slightly lighter coloured yellowish brown cloudy mottles and patches.
10 -	10YR 5/4 yell-brown		
20 -	10YR 4/3 brown		
30 -			
40 -			
50 -			
55			
60 -	void		
70 -			
80 -			
90 -			
100 -			

SO268/2 gravity core description

Core: SO268/2 - 143 GC08

Section: 4 55-97 cm

Date: 21-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			<p>0-42 cm: Brown silty clay with occasional cloudy mottles of yellowish brown.</p> <p>0-15 cm surface disturbed during core splitting.</p>
10 -		10YR4/3 brown	
15 -			
20 -			
30 -		10YR5/4 yell. brown	
40 -			
42 -			
50 -			
60 -			
70 -			
80 -			
90 -			
100 -			

SO268/2 gravity core description

Core: 80268/2-143 Geod

Section: 3 97-197 cm

Date: 21-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR5/4 yell.-brown	0-100 cm = Yellowish brown, in some part brown, silty clay with cloudy mottles standing out in lighter yellowish brown shades, notably 0-9 cm, 22-44 cm, 62-65 cm, 90-100 cm. At 62-65 cm, lighter coloured rings with darker core, ~2 cm ϕ , likely representory burrow traces with rebox halo.
9 -
10 -
20 -
22 -		10YR4/3 brown	
30 -
35 -
38 -		10YR6/4 light yell brown	
40 -
44 -
50 -
60 -
62 -
65 -			
70 -			
80 -		10YR5/4 yellowish brown	
90 -			
100 -		10YR6/4 light yell. brown	

SO268/2 gravity core description

Core: SO268/2-147 GC08

Section: 2 197-297 cm

Date: 21-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0-3		10YR 5/4 yell brown	0-3 cm: Yellowish brown silty clay, Grading to
3-65		10YR 4/3 brown	3-65 cm: Brown silty clay with only few mottles of yellowish brown, at 47-50 cm irregular open oval ring with darker colour, likely a burrow trace with redox halo.
65-100			Distinct but gradual transition to: 65-100 cm: Yellowish brown silty clay with irregular cloudy patches of light yellowish brown and darker brown. Some patches appear more ring- shaped with lighter halo around darker core, at 73 cm, 82-84 cm, at 92-96 cm also lighter patches with darker halo.
73		10YR 5/4 yell brown	
82-84
92-96		10YR 6/4 light yell. brown	

SO268/2 gravity core description

Core: 80268/2-147 GC08

Section: 1 297-382 cm

Date: 21-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 4/3 brown	0-25 cm: Brown silty clay with only few lighter brown mottles, at 3 and 8 cm lighter coloured rings ~ 1 cm Ø with darker core, likely burrow traces. Gradual transition to =
10 -			
20 -			
25 -
30 -		10YR 6/4 light yellowish brown	25-61/64 cm: Alternating bands of light yellowish brown and yellowish brown silty clay. Black small nodule at 29-32 cm, sampled from working half. Distinct boundary to =
32 -			
40 -			
50 -		10YR 5/4 yell brown	
60 -		10YR 6/4 light yell brown	
61/64 -			61/64-85 cm: Predominantly brown silty clay, with some irregular streaks and bands of light yellowish brown at 78-83 cm
70 -		10YR 4/3 brown	
78 -
80 -		10YR 6/4 light yell brown	
83 -			
85 -			
90 -	Core catcher		
100 -			

SO268/2 gravity core description

Core: SO268/2 - 144 GC09

Section: 05 0-100cm

Date: Described by:

General remarks:

Top sediment layer lost during coring

Depth (cm)	Lithology	Colour	Description
0 -			
10 -		10YR 6/4 light yellowish brown	0-32 cm: Homogeneous light yellowish brown silty clay, with black Mn-ox speckles at 21 cm.
20 -			Distinct irregular colour boundary to =
21		black	32-65 cm: Mottled brown silty clay with lighter yellowish brown patches standing out against darker background. (Lighter coloured rings with dark core, ~ 1 cm Ø, likely burrow traces with redox halo, at 43, 47, 63 cm.
30 -			Irregular boundary to =
32 -			65-95 cm: Mottled brown to dark grayish brown silty clay with irregular patches and cloudy mottles of light yellowish brown. Irregular light spot with dark core at 78 cm.
40 -		10YR 5/3 brown	Irregular boundary to =
43			95-100 cm: Mottled brown with light yellowish brown silty clay
47		10YR 6/4 light yell. brown	
50 -			
60 -			
63		10YR 5/3 brown	
65 -		10YR 4/3 brown	
70 -			
78		10YR 4/2 dark grayish brown	
80 -			
90 -		10YR 5/3 brown	
95			
100 -		10YR 6/4 light yell brown	

SO268/2 gravity core description

Core: SO268/2-144 GLOG

Section: 04 100-200 cm

Date: 21-04-2019

Described by: HDS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -		10YR 6/4 light yell. br	0-30 cm: Grayish brown silty clay with relatively large irregular patches of light yellowish brown distinctly standing out against darker background. Irregular boundary to =
10 -		10YR 5/2 5/3 grayish brown	30-45 cm: Mottled brown to dark grayish brown silty clay with some lighter yellowish brown spots reminiscent of burrow traces. Diffuse transition to =
20 -			
30 -			
40 -		10YR 5/3 brown	45-65 cm: Grayish brown silty clay with relatively large irregular patches of light yellowish brown, in lower part small diffuse lighter patches. Diffuse transition to =
50 -		10YR 4/2 dark grayish brown	
60 -		10YR 6/4 light yell. brown	65-90 cm: Mottled and cloudy grayish and dark grayish brown silty clay with irregular cloudy patches of light yellowish gray. Some ring shaped patches with darker core, possibly burrow traces. Irregular boundary to =
70 -		10YR 5/2 grayish brown	
80 -		10YR 4/2 grayish to dark grayish brown	
90 -		10YR 6/4 light yell. br.	90-100 cm: Dark grayish brown silty clay
100 -		10YR 4/2 dark grayish brown	

SO268/2 gravity core description

Core: SO268/2-144 GC09

Section: 03 200-300 cm

Date: 21-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0 - 78 cm: Largely homogeneous brown silty clay, with very slightly lighter coloured subhorizontal to oblique bands approx 1 cm thick, with darker coloured core showing at 14-36 cm and 50-69 cm, presumably representing burrow traces with redox halo. Semiconcave ring-shaped light yellowish brown patch at 45-47 cm. Diffuse transition to;
10 -		10YR 4/3 brown	
14			
20 -			
30 -			
36			
40 -			
45			
47			
50 -			
60 -		10YR 4/2 dark grayish brown	78-100 cm: Dark grayish brown silty clay with small brown mottles and irregular ring shaped light yellowish brown patches at 83 and 93 cm and oblique blotched lighter coloured band crossing from 85 to 98 cm, likely representing burrow traces with redox halo.
61			
69			
70 -			
78			
80 -			
83			
85			
90 -			
96			
98		10YR 5/4 light yellowish brown	
100 -			

SO268/2 gravity core description

Core: SO268/2-144 GLOG

Section: 02 300-400 cm

Date: 21-04-2019

Described by: KJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0-100 cm: Almost homogeneous dark brown silty clay with only few lighter yellowish brown irregular ring shaped or thin elongated patches, likely representing burrow traces with redox halo.
10 -			
20 -		10YR 3/3 dark brown	Overall, sediment appears more stiff than in previous cores in SO268/2.
30 -			
40 -			
50 -			
60 -			
70 -			
80 -			
90 -			
100 -		10YR 5/4 yellowish brown	

SO268/2 gravity core description

Core: SO268/2-144 gc 09

Section: 01 400-485 cm

Date: 21-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0-85 cm = Nearly homogeneous stiff dark brown silty clay with very few lighter yellowish brown spots and streaks, ring shaped ~1 cm Ø at 8, 12, 25-27 cm, reminiscent of haloed burrow traces. Possibly thin horizontal laminations at 52-54 cm.
8	---	WYR 3/3	
10 -	---	3/4	
13	---	dark brown	
15	---		
20 -	---		
25	---	WYR 5/4	
27	---	yellowish brown	
30 -	---		
40 -	---		
50 -	---		
52	---		
54	---		
60 -	---		
70 -	---		
80 -	---		
85	---		
90 -	Core Catcher		
100 -			

SO268/2 gravity core description

Core: SO268/2-157 GC10

Section: 05 0-100 cm

Date: 27-04-2019

Described by: HJS

General remarks: All 5 core sections in undisturbed state; only the upper ~20cm (?) slumped out and lost during handling of core on deck.

Depth (cm)	Lithology	Colour	Description
0 -			
10 -		10YR 5/4 yellowish brown	0-10cm: Yellowish brown silty clay. Irregular boundary to =
20 -			10-53cm: Light yellowish brown silty clay with only subtle variation in lighter and slightly darker patches. Open burrows ~1cm filled with watery mud at 10, 20, 27cm. Possibly also some horizontal filled burrows at 26 and 30cm.
26 -		10YR 6/4 light yell. brown	Gradual transition, with lighter coloured band marking boundary to =
30 -			53-75cm: Yellowish brown to brown silty clay, yellowish brown in upper half, in lower half brown mottles stand out against light yellowish brown.
40 -			Open burrow ~1cm filled with water/mud at 66cm.
50 -			Irregular boundary to =
53 -		10YR 5/4 yellowish brown	75-100cm: Light yellowish brown grading downward to yellowish brown.
60 -			Open burrow ~1cm at 88cm.
66 -		10YR 5/3 brown	
70 -		10YR 6/4	
75 -			
80 -			
88 -		10YR 6/4 light yell. brown	
90 -			
100 -		10YR 5/4 yell. brown	

SO268/2 gravity core description

Core: SO268/2 - 157 Gc10

Section: 04 100-200 cm

Date: 27-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 - 8		10YR 6/4 light yell. brown	0-10 cm: Light yellowish brown silty clay with elongate and round patches ~ 1 cm Ø standing out in slightly darker colour. likely burrow traces. Open burrow at 8 cm.
10 - 20		10YR 5/3 brown	Gradual transition to:
20 - 30		10YR 5/4 yellowish brown	10-88 cm: Mottled silty clay in different shades of light yellowish brown to brown to dark grayish brown.
30 - 36		10YR 4/2 dark gr. brown	10-30 cm: Diffuse cloudy patches of yellowish brown and brown
36 - 39		10YR 4/2 dark gr. brown	30-45 cm: More contrasting colours, oval and more irregular patches of dark grayish brown standing out against more lighter yellowish brown, but also light coloured ovals ~ 1 cm Ø with darker core, reminiscent of burrow traces with halo, at 36 and 39 cm.
39 - 45		10YR 5/4 yell. brown	45-60 cm: Lighter colours with cloudy streaks of brown
45 - 60		10YR 5/3 brown	60-69 cm: Brown with lighter mottles
60 - 69		10YR 5/3 brown	69-96 cm: Mostly light-coloured with cloudy streaks and patches of brown
69 - 70		10YR 6/4 light yell. brown	
70 - 80		10YR 6/4 light yell. brown	
80 - 88		10YR 5/3 brown	
88 - 90		10YR 5/3 brown	
90 - 100		10YR 6/3 pale brown	90-100 cm: Pale brown silty clay

SO268/2 gravity core description

Core: SO268/2 - 157 Gc10

Section: 03 200-300 cm

Date: 27-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -	---		0-100 cm: Homogeneous pale brown to light yellowish brown silty clay. Slightly lighter-coloured spots at 12, and 44 cm, and grayish spot at 84 cm.
10 -	---	W4R6/3	
12	53	LO4R6/4	
20 -	---	pale brown to light yellowish brown	
30 -	---		
40 -	---		
44	0		
50 -	---		
60 -	---		
70 -	---		
80 -	---		
84	---		
90 -	---		
100 -	---		

SO268/2 gravity core description

Core: SO268/2 - 157 GC10

Section: 02 300-400 cm

Date: 27-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0 - 100 cm: Homogeneous light yellowish brown silt/clay. Elongate burrow trace filled with more watery mud at 25 cm.
10 -		10YR 6/4 light yellowish brown	
20 -			
25			
30 -			
40 -			
50 -			
60 -			
70 -			
80 -			
90 -			
100 -			

SO268/2 gravity core description

Core: SO268/2 - 157 GE10

Section: 01 400-487 cm

Date: 27-04-2019

Described by: HJS

General remarks:

Depth (cm)	Lithology	Colour	Description
0 -			0-55 cm: Homogeneous light yellowish brown silty/clay.
10 -		10YR 6/4 light yell. brown	With only in lower part some grayish brown streaks ~50 cm.
20 -			Irregular distinct transition to
30 -			55-87 cm: Mottled pale brown and grayish brown silty/clay.
40 -			From 55 to 72 cm, pale brown oval patches of 1-2 cm Ø stand out against slightly darker grayish brown sediment with peculiar granulated texture, grains up to 1 mm size and with soft consistence.
50 -			72-87 cm brown and grayish brown with less distinct cloudy streaks and patches
55 -		10YR 6/3 pale brown	
60 -			
62 -		10YR 5/2 grayish br.	
67 -		10YR 6/3 pale brown	
70 -		10YR 5/3 brown	
72 -		10YR 5/2 grayish brown	
78 -			
80 -			
87 -	Core Catcher		
90 -			
100 -			

12.6 ROV Dive Protocols

Kiel 6000 Dive 01 (SO268-1_011_ROV01)

Date: 01/03/2019

Observers: AMARO, Teresa; BODUR, Yasemin; CHRISTODOULOU, Magdalini; HILARIO, Ana; JANSEN, Felix; Pape, ELEN; STRATMANN, Tanya

ROV positions (at the bottom)

Start of dive: 11°55.727'N 117°1.439'W

End of dive: 11°55.806'N 117°1.463'W

Dive duration¹:

ROV in the water: 01.03.19 15:03:42

ROV at the bottom: 01.03.2019 17:03:32

ROV off the bottom: 01.03.19 18:19:08

ROV on deck: 01.03.19 20:14:50

Explored sites: DE impact area

Aims of the Dive:

- Deployment of 3 profilers for in situ respiration measurements
- Reposition 3 profilers in adjacent sites for replicating measurements
- Deployment of 3 cameras for observing megafaunal organisms
- Deployment of 3 nodule frames (recolonization experiment)
- Megafauna sampling (mainly ophiuroids, sponges, holothurians)

Handled ROV Tools (including scientific payload):

- Senckenberg biobox (COLBOX-SGN)
- 9 compartment biobox (COLBOX-BIO)
- slurp gun (SLURP, with filtered seawater from Wet Lab)
- T-handle with magnet
- scoop (SCOOP)
- 3 hand nets (NET)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- 2 x 6 pushcores (PUC), *present but not handled during the dive*
- trap set (2 amphipod traps, 1 ostracod trap), *present but not handled during the dive*
- 2 electrochemical profilers (MICP1-2), *present but not handled during the dive*
- 1 fiberoptical profiler (MICP-DEEP), *present but not handled during the dive*

Elevator 2

- 3 Time lapse cameras (PV-PICAMs), *present but not handled during the dive*
- 2 Benthic chamber modules (BFC-ROV1-2), *present but not handled during the dive*

¹ All dates and times in the protocols refer to UTC

- 3 nodule frames in one tray (ARTSUBS), *present but not handled during the dive*
- trap set (2 amphipod traps, 1 ostracod trap), *present but not handled during the dive*

Dive summary (protocol by Magdalini Christodoulou)

The dive took place in the DE impact area and its aims were: to deploy the microsensor profilers and later reposition them in adjacent sites in order to have replicated measurements; to deploy the time lapse cameras in front of nodule associated fauna and make consecutive observations; to deploy 3 nodule frames and finally collect faunal specimens. After the ROV reached the bottom of the sea (17:04:39) it then located both elevators with some minutes difference (17:08:33 and 17:15:31) but it was not able to complete any of the dive tasks as the ROV presented hydraulic problems (i.e. the arm was not operational). For this reason it was decided to stop the dive and the ROV to return to the surface for repairs. Just before the ROV left the bottom it made a short scouting survey (17:33:19–18:16:25) in order to make observations on the fauna found in the area. A number of Porifera (sponges) were observed together with Ophiuroidea (brittles stars), Holothuroidea (sea cucumbers), Actinaria (anemones), Foraminifera and Alcyonacea (corals), while photos were taken.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-03-01	15:03:41	-117.025219	11.927325	19	IN THE WATER
2019-03-01	17:03:31	-117.023981	11.928795	4074	AT THE BOTTOM
2019-03-01	17:24:02	-117.024176	11.928525	4088	ROV to Lift
2019-03-01	17:24:24	-117.024183	11.928524	4088	arrive at benthic chamber 2
2019-03-01	17:24:55	-117.02419	11.928515	4088	chamber LED flashing as planned
2019-03-01	17:28:18	-117.02419	11.928519	4088	hydraulic pump does not work - cannot operate manipulator
2019-03-01	17:31:58	-117.024181	11.928501	4088	elevators are 30 m further south according to ROV position as compared to waypoint
2019-03-01	17:35:29	-117.024185	11.928523	4088	picam on beer crade has light permanently on. The other 2 are dark
2019-03-01	17:36:37	-117.024181	11.928515	4088	chamber deployment cancelled (original action 2)
2019-03-01	17:37:01	-117.024171	11.928508	4088	heading towards action 1 waypoint (profilers) to image seafloor
2019-03-01	17:38:40	-117.024166	11.928522	4088	looking at other site of the lift
2019-03-01	17:42:17	-117.024196	11.928455	4087	NOW heading towards action point 1 (profilers)
2019-03-01	17:44:10	-117.024275	11.928499	4088	Non-stalked on Nodule
2019-03-01	17:45:02	-117.024244	11.928508	4088
2019-03-01	17:46:16	-117.024278	11.92854	4088	heading further towards waypoint 1

2019-03-01	17:47:38	-117.024322	11.928554	4088
2019-03-01	17:47:47	-117.02432	11.928556	4088	heading further towards waypoint 1
2019-03-01	17:50:37	-117.024351	11.928833	4087
2019-03-01	17:50:55	-117.024356	11.928848	4087
2019-03-01	17:54:22	-117.0244	11.929187	4087	putting on laser pointers
2019-03-01	17:55:27	-117.024398	11.929297	4087	laser pointers on
2019-03-01	18:00:26	-117.024399	11.929554	4087
2019-03-01	18:00:29	-117.0244	11.929553	4087

2019-03-01	18:00:31	-117.024401	11.929552	4087
2019-03-01	18:03:47	-117.024439	11.929618	4087
2019-03-01	18:03:56	-117.024432	11.929617	4087
2019-03-01	18:04:05	-117.024426	11.929615	4087	photos taken of Holothuroid
2019-03-01	18:05:59	-117.024425	11.929681	4087
2019-03-01	18:06:18	-117.02442	11.929687	4087

several black nodule-associated structures

Bryozoan

2019-03-01	18:06:20	-117.02442	11.929688	4087
2019-03-01	18:07:57	-117.024426	11.929819	4087	black-nodule associated structures (distributed over wide range)
2019-03-01	18:09:01	-117.024429	11.929908	4086	at position of action points 1 and 2
2019-03-01	18:11:02	-117.02442	11.930053	4086	black nodule-associated structures
2019-03-01	18:12:00	-117.024425	11.930069	4086
2019-03-01	18:12:13	-117.024419	11.930071	4086	Bryozoan with Ophiuroid
2019-03-01	18:12:15	-117.024418	11.930071	4086	Photo Taken
2019-03-01	18:14:50	-117.02439	11.930098	4086
2019-03-01	18:16:19	-117.024354	11.93008	4086	end transect
2019-03-01	18:17:24	-117.024392	11.9301	4086	location at northern rim of lower Patania track
2019-03-01	18:18:40	-117.024401	11.930072	4086	leaving ground
2019-03-01	18:19:07	-117.024408	11.930055	4071	OFF THE BOTTOM
2019-03-01	20:14:48	-117.024302	11.929382	-9	ON DECK

Kiel 6000 Dive 02 (SO268-1_020_ROV02)

Date: 03/03/2019

Observers: JANSSEN, Felix; BODUR, Yasemin; HILARIO, Ana; CHRISTODOULOU, Magdalini

ROV positions (at the bottom)

Start of dive: 11°55.713'N 117°1.436'W

End of dive: 11°55.708'N 117°1.448'W

Dive duration²:

ROV in the water: 03.03.2019 15:32:21

ROV at the bottom: 03.03.2019 17:26:34

ROV off the bottom: 03.03.2019 20:52:47

ROV on deck: 03.03.2019 22:48:55

Explored sites: DE impact area

Aims of the Dive:

- Deployment of microprofiler- and benthic chamber modules for in situ measurements of seafloor oxygen uptake
- Collect nodules with attached primnoid corals
- Megafauna sampling
- Recover 2 cameras from elevator

Handled ROV Tools (including scientific payload):

- Senckenberg biobox (COLBOX)
- 9 compartment biobox (COLBOX-BIO)
- Slurp gun (SLURP)
- Scoop (SCOOP)
- 3 hand nets (NET)
- T-handle with magnet

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- 2 electrochemical profilers (MICP)
- 1 fiberoptical profiler (MICP-DEEP)
- *Trap set (2 amphipod traps and 1 ostracod trap)*
- *2 x 6 ROV push cores (PUC)*

Elevator 2

- 2 Benthic chamber modules (BFC-ROV)
- 3 Time-lapse cameras (PV-PICAM)

² All dates and times in the protocols refer to UTC

- 3 Nodule frames with recolonization substrates (ARTSUBS)
- Trap set (2 amphipod traps and 1 ostracod trap)

Dive summary (protocol by Felix Janssen)

A significant part of the dive was dedicated to in situ respiration studies. One fiberoptical microprofiler (MICP-DEEP 1) was deployed (deployment MICP-DEEP 1-1), as well as 2 electrochemical microprofiler (MICP 1 & 2; deployments MICP 1-1 & MICP 2-1). MICP 2 could not be started. Further two benthic chamber modules (BFC-ROV 1 & 2) were deployed next to microprofilers MICP-DEEP 1 and MICP 2 (deployments BFC-ROV 1-1 and 2-1). Later some fauna sampling took place with a focus on nodule-attached corals (Alcyonacea). As the ROV suffered from decreasing oil pressure, fauna sampling had to be abandoned earlier than planned. Towards the end of the dive, 2 cameras (PV-PICAM) were collected from Elevator 2 and MICP-DEEP was restarted (deployment MICP-DEEP 1-2) without repositioning (profiling with the second stage in a fresh patch of sediment). After 3.5 h bottom time the ROV left the seafloor with the 2 cameras on the porch.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-03-03	15:32:20	-117.024894	11.928141	129	IN THE WATER
2019-03-03	17:26:33	-117.023915	11.92853	4088	AT THE BOTTOM
2019-03-03	17:29:32	-117.023858	11.928498	4088
2019-03-03	17:29:38	-117.023856	11.928489	4088
2019-03-03	17:29:50	-117.023855	11.928473	4088

2019-03-03	17:30:09	-117.023864	11.928455	4088
2019-03-03	17:36:47	-117.023889	11.928472	4089	ROV to Lift
2019-03-03	17:37:42	-117.023865	11.928451	4087	Elevator 1
2019-03-03	17:40:46	-117.023896	11.928461	4089	straps of Profiler deep (MICP-DEEP) released
2019-03-03	17:41:51	-117.023881	11.928458	4088	MICP-DEEP taken out of elevator
2019-03-03	17:45:07	-117.023877	11.928487	4088	MICP-DEEP turned around
2019-03-03	17:45:23	-117.023871	11.928489	4088	MICP-DEEP left on seafloor (close to elevator)
2019-03-03	17:47:53	-117.023868	11.928497	4088	MICP-DEEP 1-1 started
2019-03-03	17:48:08	-117.023869	11.928504	4088	blinking stopped, motor is running
2019-03-03	17:48:56	-117.023876	11.9285	4088
2019-03-03	17:49:05	-117.023875	11.928495	4088
2019-03-03	17:50:03	-117.023869	11.928453	4088	back to elevator
2019-03-03	17:52:16	-117.02391	11.928455	4088	MICP1 and 2 are blinking
2019-03-03	17:53:15	-117.023915	11.928448	4089	MICP1 and 2 located on the left side of the payload section (MICP-DEEP on the right part)
2019-03-03	17:53:35	-117.02391	11.928444	4089	straps of MICP1 and 2 released
2019-03-03	17:55:53	-117.023889	11.928458	4088	MICP2 taken and positioned on the porch
2019-03-03	17:55:56	-117.02389	11.928459	4088	Gear Received
2019-03-03	17:57:13	-117.023904	11.928449	4088	position of MICP2 on porch adjusted
2019-03-03	17:58:43	-117.023897	11.928443	4088	MICP1 received from elevator
2019-03-03	17:58:47	-117.0239	11.92844	4088	Gear Received
2019-03-03	17:59:44	-117.023917	11.928378	4086	fish spotted
2019-03-03	18:00:46	-117.024051	11.928527	4086	MICP-DEEP located Southeast of the originally planned position of Profiler 1
2019-03-03	18:04:35	-117.024203	11.929297	4085	heading towards position of Profiler 2
2019-03-03	18:05:08	-117.024197	11.92933	4086	heading towards planned position of Profiler 2
2019-03-03	18:05:42	-117.024201	11.929338	4086	looking for nodule-free spot at planned position of Profiler 2
2019-03-03	18:07:51	-117.02417	11.929345	4087	MICP1 turned around 180 degrees to see the releaser
2019-03-03	18:08:05	-117.024174	11.929338	4087

2019-03-03	18:09:16	-117.024168	11.929301	4087	Gear Deployed
2019-03-03	18:09:20	-117.024167	11.9293	4087	MICP1
2019-03-03	18:10:54	-117.024216	11.92937	4085	MICP1 not started yet; going to start on the way back
2019-03-03	18:12:33	-117.024387	11.929608	4085	heading towards planned location Chamber 2
2019-03-03	18:15:48	-117.024541	11.929881	4085	Fauna
2019-03-03	18:17:17	-117.024552	11.929913	4086	ROV stopped
2019-03-03	18:17:25	-117.024553	11.929913	4086
2019-03-03	18:17:55	-117.024558	11.92991	4086	
2019-03-03	18:18:05	-117.024559	11.929908	4086	
2019-03-03	18:19:19	-117.02457	11.929911	4086
2019-03-03	18:19:25	-117.024569	11.92991	4086	
2019-03-03	18:19:36	-117.024569	11.929906	4086	
2019-03-03	18:21:26	-117.024566	11.92991	4086	Gear Deployed
2019-03-03	18:21:30	-117.024564	11.929909	4086	MICP2
2019-03-03	18:22:41	-117.024568	11.929899	4086	MICP2 turned on
2019-03-03	18:24:13	-117.024585	11.929905	4086	waiting
2019-03-03	18:24:20	-117.024586	11.929908	4086	MICP2 no movement
2019-03-03	18:25:31	-117.024551	11.929897	4084	MICP2 blinking stopped
2019-03-03	18:25:40	-117.024544	11.929884	4085	MICp2 still no movement
2019-03-03	18:28:18	-117.024182	11.929371	4085	MICP2 1-1 not started
2019-03-03	18:28:40	-117.024164	11.929368	4085	ROV to Lift
2019-03-03	18:29:30	-117.02415	11.92937	4087	ROV to MICP1
2019-03-03	18:30:17	-117.024169	11.929339	4087	ROV arrived at MICP-1
2019-03-03	18:31:17	-117.024171	11.929358	4087	MICP1 blinking
2019-03-03	18:31:23	-117.024171	11.929361	4087	small plume created
2019-03-03	18:31:31	-117.024171	11.929365	4087	MICP1 turned on
2019-03-03	18:31:37	-117.02417	11.929368	4087	MICP1 stopped blinking
2019-03-03	18:32:38	-117.024138	11.9294	4086	MICP1 is running
2019-03-03	18:32:51	-117.024112	11.92937	4086	MICP1 1-1 started
2019-03-03	18:32:58	-117.024096	11.929347	4085	Fauna
2019-03-03	18:33:03	-117.024085	11.929328	4085	fish
2019-03-03	18:33:40	-117.024056	11.929169	4086	ROV to Lift
2019-03-03	18:33:46	-117.024058	11.92914	4086	Elevator 2
2019-03-03	18:33:55	-117.024062	11.9291	4086	Fauna
2019-03-03	18:34:00	-117.024065	11.92908	4086	Fauna
2019-03-03	18:34:59	-117.024083	11.928882	4086	Fauna
2019-03-03	18:35:12	-117.024082	11.928848	4086	pelagic polychaete
2019-03-03	18:36:51	-117.02411	11.928608	4086	sediment plume
2019-03-03	18:37:47	-117.024152	11.928513	4086	Fauna
2019-03-03	18:38:28	-117.024159	11.928509	4086	spotted Elevator 2
2019-03-03	18:41:53	-117.024184	11.928519	4088	Chamber 1 and 2 on elevator are blinking
2019-03-03	18:44:54	-117.024166	11.928501	4088	arrived at Elevator 2
2019-03-03	18:45:29	-117.024174	11.928505	4087	straps of Chamber 1 released
2019-03-03	18:45:40	-117.024176	11.928505	4087	Chamber 1 lifted
2019-03-03	18:45:48	-117.024177	11.928505	4087	sediment plume
2019-03-03	18:46:54	-117.024112	11.928502	4087	Gear Received
2019-03-03	18:47:43	-117.024087	11.928499	4087	Chamber 1
2019-03-03	18:48:35	-117.024102	11.928507	4088	heading towards southeast of elevator 2
2019-03-03	18:48:42	-117.024103	11.928506	4088	ROV stopped
					Gear Deployed
					Chamber 1

2019-03-03	18:49:05	-117.024096	11.928503	4088
2019-03-03	18:50:24	-117.024074	11.928507	4088	sight is turbid
2019-03-03	18:50:58	-117.024084	11.92851	4088	Chamber 1 turned on
2019-03-03	18:51:07	-117.024087	11.92851	4088	Chamber 1 stopped blinking
2019-03-03	18:51:36	-117.024092	11.928508	4088	Chamber 1 1-1 started
2019-03-03	18:53:24	-117.024079	11.928507	4088	Chamber 1 1-1 = BFC-ROV 1-1
2019-03-03	18:53:52	-117.024082	11.928509	4088	ROV to Lift
2019-03-03	18:54:02	-117.024083	11.928508	4088	Elevator 2
2019-03-03	18:55:29	-117.024114	11.928496	4088	arrived at Elevator 2
2019-03-03	18:56:35	-117.024174	11.928537	4088	approaching Chamber 2
2019-03-03	18:57:33	-117.024175	11.928541	4087	Fauna
2019-03-03	18:57:46	-117.024175	11.928547	4088	Zoarcid fish
2019-03-03	19:01:12	-117.024188	11.928517	4088	straps of Chamber 2 released
2019-03-03	19:02:51	-117.024209	11.928555	4088	Gear Received
2019-03-03	19:02:57	-117.024209	11.928558	4087	Chamber 2
2019-03-03	19:05:19	-117.024245	11.928792	4087	heading towards planned position of Chamber 2
2019-03-03	19:09:38	-117.024569	11.929672	4086	Fauna
2019-03-03	19:11:33	-117.024584	11.929843	4086	MICP2 spotted
2019-03-03	19:15:20	-117.024576	11.929888	4086
2019-03-03	19:15:25	-117.024574	11.929886	4086	Gear Deployed
2019-03-03	19:16:15	-117.024566	11.92988	4086	Chamber 2 = BFC-ROV 2-1
2019-03-03	19:19:37	-117.02456	11.929883	4087
2019-03-03	19:21:30	-117.024559	11.929906	4087	Chamber 2 turned on
2019-03-03	19:21:34	-117.024557	11.929905	4087	Chamber 2 stopped blinking
2019-03-03	19:21:42	-117.024552	11.929902	4087	BFC-ROV 2-1 started
2019-03-03	19:23:53	-117.024569	11.929919	4087	apptrying to start Profiler 2 once again
2019-03-03	19:24:56	-117.024551	11.929885	4087	MICP2 did not start in second approach
2019-03-03	19:31:14	-117.024573	11.929842	4087	Moving away from profiler and chamber 2
2019-03-03	19:34:00	-117.024526	11.929764	4087	Start fauna sampling
2019-03-03	19:36:05	-117.024546	11.929686	4086	Ophiuroidea
2019-03-03	19:36:47	-117.024498	11.929647	4087	Ophiuroidea
2019-03-03	19:38:41	-117.024515	11.929581	4087	Alcyonacea
2019-03-03	19:38:47	-117.024514	11.929576	4086	Ophiuroidea

2019-03-03	19:41:56	-117.024508	11.929578	4087
2019-03-03	19:42:42	-117.024492	11.929565	4087
2019-03-03	19:42:45	-117.02449	11.929564	4087
2019-03-03	19:42:55	-117.024485	11.929564	4087
2019-03-03	19:44:01	-117.024482	11.929573	4087	COLBOX-BIO
2019-03-03	19:44:53	-117.024484	11.929591	4087	COLBOX-BIO_9 opened
2019-03-03	19:50:10	-117.024502	11.929571	4087	First Alcyonacea lost in the plume (smaller one)
2019-03-03	19:52:36	-117.024488	11.92956	4087	Second Alcyonacea lost (bigger with ophiuroid)
2019-03-03	19:53:10	-117.024506	11.929546	4087	Third Alcyonacea sighted
2019-03-03	19:53:26	-117.02451	11.92954	4087	ROV moving closer to third Alcyonacea
2019-03-03	19:55:15	-117.02451	11.929577	4087

2019-03-03	19:55:33	-117.024513	11.929574	4087
2019-03-03	19:55:40	-117.024512	11.92957	4087
2019-03-03	19:56:55	-117.024487	11.929536	4087	Third Alcyonacea sampled
2019-03-03	19:57:09	-117.024491	11.929538	4087	Third Alcyonacea slipped from ROV arm
2019-03-03	19:58:35	-117.024525	11.929553	4087	Third Alcyonacea recovered
2019-03-03	19:59:38	-117.024506	11.929556	4087	Third Alcyonacea placed in COLBOX-BIO_9
2019-03-03	20:00:52	-117.024502	11.929533	4087	Lid placed on COLBOX-BIO_9
2019-03-03	20:01:16	-117.024496	11.929528	4087	COLBOX-BIO_9 closed
2019-03-03	20:06:19	-117.024515	11.929386	4087	Fourth Alcyonacea sighted
2019-03-03	20:06:39	-117.024519	11.929393	4088
2019-03-03	20:06:51	-117.024523	11.9294	4088
2019-03-03	20:07:08	-117.02453	11.929408	4088
2019-03-03	20:10:07	-117.024519	11.92939	4088	Finish fauna sampling
2019-03-03	20:10:59	-117.02452	11.929378	4088	ROV hydrolic pressure malfunctioning
2019-03-03	20:11:24	-117.024511	11.92936	4086	Heading towards elevators

2019-03-03	20:19:24	-117.024172	11.928505	4088
2019-03-03	20:21:26	-117.024174	11.928499	4088
2019-03-03	20:24:26	-117.024125	11.928514	4088	taking two PV-PICAMs from elevator and place them in the ROV to bring up to surface
2019-03-03	20:29:34	-117.024182	11.928484	4088	both cameras on ROV
2019-03-03	20:33:03	-117.02418	11.928511	4086	move to elevator 1 to re-start MICP-DEEP
2019-03-03	20:42:19	-117.023897	11.928504	4087	rat tail fish
2019-03-03	20:45:57	-117.023861	11.928495	4087	MICP-DEEP
2019-03-03	20:48:42	-117.023891	11.928516	4088
2019-03-03	20:48:56	-117.023901	11.928524	4087
2019-03-03	20:50:20	-117.023861	11.928496	4088

2019-03-03	20:51:13	-117.023877	11.92853	4088
2019-03-03	20:52:46	-117.023892	11.928502	4088
2019-03-03	21:04:22	-117.024178	11.928691	3713
2019-03-03	22:48:54	-117.024125	11.928479	-4	

Kiel 6000 Dive 03 (SO268-1_025_ROV03)

Date: 05/03/2019

Observers: JANSSEN, Felix; BODUR, Yasemin

ROV positions (at the bottom)

Start of dive: 11°55.571'N 117°1.432'W

End of dive: 11°55.715'N 117°1.454'W

Dive duration³:

ROV in the water: 05.03.2019 16:58:12

ROV at the bottom: 05.03.2019 18:45:28

ROV off the bottom: 05.03.2019 20:38:25

ROV on deck: 05.03.2019 22:21:58

Explored sites: DE impact area

Aims of the Dive:

- Recovery of 1 electrochemical microprofiler and 2 benthic chambers, deployed during dive 2
- Deployment of 2 time-lapse cameras in front of nodule-attached communities
- Deployment of nodule frames / recolonization substrates
- *Push coring (had to be skipped due to technical issues reducing bottom time)*

Handled ROV Tools (including scientific payload):

- 2 time-lapse cameras (PV-PICAM 13) brought to depth on porch

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- 1 electrochemical profiler (MICP 1), collected from seafloor
- *Trap set (2 amphipod traps and 1 ostracod trap)*
- *2 x 6 ROV push cores (PUC)*

Elevator 2

- 2 Benthic chamber modules (BFC-ROV 1 & 2) collected from seafloor
- 3 Nodule frames with recolonization substrates (ARTSUBS)
- *1 Time-lapse camera (PV-PICAM XX), not deployed, stayed on elevator*
- *Trap set (2 amphipod traps and 1 ostracod trap)*

Dive summary (protocol by Felix Janssen)

Some of the modules deployed during dive 2 for in situ respiration studies (1 microprofiler and 2 chambers) were collected and put on the elevators for transport back to the surface. The time lapse cameras collected from the elevator at the end of dive 2 for servicing and

³ All dates and times in the protocols refer to UTC

battery replacement were brought down again and deployed in front of nodule fauna. Three sterilized nodule frames with different colonization substrates were deployed close to elevator 2. After that the dive had to end ahead of schedule as ROV oil pressure was dropping.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-03-05	16:09:08	-117.025231	11.928651	51	test
2019-03-05	16:58:11	-117.025231	11.928651	51	IN THE WATER
2019-03-05	18:45:27	-117.023866	11.926159	4057	AT THE BOTTOM
2019-03-05	18:52:06	-117.023785	11.926117	4088	start of dive
2019-03-05	18:55:01	-117.023732	11.926222	4089	flying towards waypoint camera limit in zickzacking course
2019-03-05	18:59:50	-117.023529	11.926397	4090
2019-03-05	19:00:21	-117.023514	11.926413	4090
2019-03-05	19:02:59	-117.023637	11.926464	4091	first object found
2019-03-05	19:03:08	-117.023637	11.92646	4091	sponge behind nodule with ophiuroid
2019-03-05	19:03:13	-117.023635	11.926457	4091	ROV has landed
2019-03-05	19:04:13	-117.023606	11.926448	4091	waiting for sediment plume to disappear
2019-03-05	19:05:46	-117.023642	11.926461	4091
2019-03-05	19:06:05	-117.02362	11.926457	4091

2019-03-05	19:06:50	-117.023618	11.926451	4091
2019-03-05	19:06:57	-117.02362	11.926452	4091	attached sponge was released by sediment plume and drifted a little bit away
2019-03-05	19:07:46	-117.023619	11.92646	4091	Gear Operated
2019-03-05	19:07:54	-117.023622	11.926463	4091	first camera taken up with ROV arm
2019-03-05	19:09:07	-117.023618	11.926466	4091	camera placed on seafloor
2019-03-05	19:09:26	-117.023623	11.926458	4091	Gear Deployed
2019-03-05	19:09:57	-117.023624	11.926456	4091
2019-03-05	19:10:10	-117.023624	11.926455	4091	camera placed on seafloor
2019-03-05	19:10:11	-117.023624	11.926455	4091
2019-03-05	19:10:40	-117.023623	11.926459	4090
2019-03-05	19:12:25	-117.023604	11.926472	4091

2019-03-05	19:12:47	-117.023605	11.926468	4091
2019-03-05	19:15:17	-117.02377	11.926538	4089	stalked sponge with ophiuroid on stalk
2019-03-05	19:15:31	-117.023775	11.926542	4089
2019-03-05	19:15:51	-117.023763	11.926547	4090
2019-03-05	19:16:30	-117.023761	11.926553	4090
2019-03-05	19:22:00	-117.023767	11.926545	4090
2019-03-05	19:22:16	-117.023769	11.926544	4090

2019-03-05	19:22:25	-117.023772	11.926542	4090
2019-03-05	19:24:56	-117.023755	11.926539	4088
2019-03-05	19:32:02	-117.023976	11.927683	4089	ophiuroid on stalk
2019-03-05	19:33:29	-117.023982	11.927855	4089
2019-03-05	19:34:20	-117.023971	11.927917	4089	stalked sponge with ophiuroid
2019-03-05	19:36:38	-117.02394	11.928127	4089	heading towards ROV MICP-1
2019-03-05	19:39:38	-117.024015	11.928299	4089
2019-03-05	19:40:30	-117.02402	11.928347	4089	crustacea
2019-03-05	19:41:55	-117.02406	11.928423	4088
2019-03-05	19:42:04	-117.024064	11.928433	4089	fish
2019-03-05	19:42:57	-117.024078	11.928489	4086	Chamber 1 (near elevator 2) spotted

2019-03-05	19:43:27	-117.024086	11.928534	4084
2019-03-05	19:43:44	-117.024093	11.928552	4084
2019-03-05	19:43:52	-117.024097	11.928561	4084
2019-03-05	19:44:02	-117.024103	11.928574	4084	of chamber 1 and elevator 2
2019-03-05	19:50:29	-117.024322	11.929233	4085	heading towards BFC-ROV2-1/ROV MICP2-1
2019-03-05	19:52:24	-117.024445	11.929508	4085	LED of chamber 2 were still blinking
2019-03-05	19:55:20	-117.024565	11.929839	4085	BFC-ROV2-1/ROV MICP2-1 spotted
2019-03-05	19:57:11	-117.024648	11.929955	4084
2019-03-05	19:59:39	-117.024641	11.929976	4086	Gear Received
2019-03-05	19:59:52	-117.024642	11.929977	4087	BFC-ROV2-1
2019-03-05	20:00:24	-117.024645	11.929973	4087	BFC-ROV2-1 positioned on porch
2019-03-05	20:01:24	-117.024635	11.929966	4087	ROV MICP2-1 lifted
2019-03-05	20:01:25	-117.024635	11.929966	4087	Gear Received
2019-03-05	20:02:40	-117.024566	11.929864	4086	ROV to Lift
2019-03-05	20:02:53	-117.024541	11.929833	4086	elevator 1
2019-03-05	20:06:54	-117.024027	11.928703	4088	elevator 1 spotted
2019-03-05	20:07:20	-117.024016	11.928619	4087	elevator 2 spotted
2019-03-05	20:08:47	-117.023939	11.928504	4086	elevator 1 spotted
2019-03-05	20:13:06	-117.023934	11.928518	4089	Gear on Lift
2019-03-05	20:14:45	-117.024038	11.92855	4085	ROV to Lift
2019-03-05	20:14:49	-117.024048	11.928549	4085	elevator 2
2019-03-05	20:15:55	-117.024145	11.928581	4088	BFC-ROV1-1 spotted
2019-03-05	20:16:09	-117.024154	11.928594	4088	yellow ring on sediment surface
2019-03-05	20:17:14	-117.024158	11.928599	4088	BDC-ROV1-1 blinking
2019-03-05	20:17:44	-117.024189	11.928585	4088	Gear Received
2019-03-05	20:19:48	-117.024224	11.928604	4088	Gear on Lift

2019-03-05	20:22:06	-117.024233	11.928672	4088	BFC-ROV1-1 safely positioned on elevator 2
2019-03-05	20:23:12	-117.024261	11.928643	4088	ROV to the other site of the elevator
2019-03-05	20:25:43	-117.024254	11.928624	4088	Gear on Lift
2019-03-05	20:26:53	-117.024259	11.928607	4087	BFC ROV2-1 safely positioned on elevator
2019-03-05	20:28:10	-117.024263	11.928608	4088	box with nodule frames: ape fist entangled
2019-03-05	20:29:20	-117.024274	11.928618	4088	ape fist lost
2019-03-05	20:29:29	-117.024273	11.928618	4088	box with nodule frames opened
2019-03-05	20:31:53	-117.02425	11.928642	4088	two nodule frames picked
2019-03-05	20:32:04	-117.024248	11.928638	4088	correction: all three frames
2019-03-05	20:32:16	-117.024249	11.928631	4088	one nodule frame picked
2019-03-05	20:33:13	-117.024255	11.92862	4088	nodule frame 1: handle broke
2019-03-05	20:33:25	-117.02425	11.92862	4088	frame 1 fell on the sea floor upside down
2019-03-05	20:36:44	-117.024253	11.928628	4088
2019-03-05	20:36:49	-117.024254	11.928626	4088	nodule frame 3 picked and positioned next to 1
2019-03-05	20:36:55	-117.024255	11.928624	4088
2019-03-05	20:37:04	-117.024258	11.92862	4088
2019-03-05	20:37:22	-117.024262	11.928615	4088	Gear Received
2019-03-05	20:37:27	-117.024263	11.928614	4088	marker
2019-03-05	20:37:38	-117.024262	11.928611	4088

2019-03-05	20:37:40	-117.024261	11.92861	4088
2019-03-05	20:38:25	-117.024176	11.928602	4085	
2019-03-05	22:21:56	-117.024307	11.928272	-7	

Kiel 6000 Dive 04 (SO268-1_029_ROV04)

Date: 06/03/2019

Observers: AMARO, Teresa; BODUR, Yasemin; CHRISTODOULOU, Magdalini; HILARIO, Ana; JANSSEN, Felix; LINKE, Peter; MARTINEZ-ARBIZU, Pedro; MOLARI, Massimiliano

ROV positions (at the bottom)

Start of dive: 11°55.452'N 117°01.227'W

End of dive: 11°55.440'N 117°01.227'W

Dive duration:

ROV in the water: 06/03/2019 15:16:51

ROV at the bottom: 06/03/2019 16:50:59

ROV off the bottom: 06/03/2019 23:11:39

ROV on deck: 07/03/2019 00:47:03

Explored sites: DE impact area

Aims of the Dive:

- Manual release of Elevator 2
- Collect MICP1 and 2 and position on porch for ascent
- Fauna collection (Alcyonacea and Actinaria)
- PUC sampling near the position of MUC3
- PUC sampling near Elevator 1

Handled ROV Tools (including scientific payload):

- PV-PICAM13 and 14
- Microprofiler (MICP1, MICP2)
- Push cores (PUC)
- 9-compartment Biobox (COLBOX-BIO)
- Senckenberg-Biobox (COLBOX-SGN)
- Slurp gun (SLURP)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- MICP-2, *present but not handled during the dive*

Elevator 2

- 2x BFC-ROV, *present but not handled during the dive*
- PV-PICAM15, *present but not handled during the dive*
- Empty box of ARTSUBS (artificial substrate), *present but not handled during the dive*

Dive summary (protocol by Yasemin Bodur)

Photos of the nodule frames close to Elevator 2 were taken. Since the Elevator could not be released, the ROV managed to release it manually by pulling the emergency trigger. Afterwards, MICP-1 and MICP-DEEP were positioned on the elevator for recovery. 7 Alcyonacea and one Holothuroidea were collected and placed in COLBOX-BIO. One 2 Ophiuroidea, 1 Porifera and 1 Holothuroidea was collected and placed in COLBOX-SGN. Afterwards, the fauna (sponge and Ophiuroidea) that was monitored by PV-PICAM13 was collected. PV-PICAM13 and 14 were positioned on the porch and the ROV ascended. Among the fauna that was observed were Holothuroidea, Ohpiuroidea, Alcyonacea, Xenophyophora, Antipatharia and fish.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-03-06	15:16:51	-117.025359	11.928282	171	IN THE WATER
2019-03-06	16:50:59	-117.024184	11.928679	4071	AT THE BOTTOM
2019-03-06	16:54:13	-117.024186	11.928637	4087	next to Elevator 2
2019-03-06	16:57:32	-117.024242	11.928613	4087
2019-03-06	16:57:40	-117.024243	11.928616	4087	of elevator and nodule frames
2019-03-06	16:58:18	-117.024247	11.92864	4087	checking for reasons why elevator did not release
2019-03-06	16:58:34	-117.024252	11.928642	4087
2019-03-06	17:00:04	-117.024238	11.928616	4086	heading towards the other site of the elevator
2019-03-06	17:04:52	-117.02424	11.928577	4087	elevator 2 released
2019-03-06	17:05:49	-117.024232	11.928585	4087	buoy of elevator 2 released
2019-03-06	17:09:17	-117.024195	11.928529	4087
2019-03-06	17:09:23	-117.024194	11.92853	4087	spotted a crack on elevator 2
2019-03-06	17:10:31	-117.024204	11.92853	4088	Crack is located on the synthetic foam block
2019-03-06	17:13:57	-117.024209	11.928586	4087	emergency release pulled
2019-03-06	17:14:13	-117.024197	11.928587	4088	elevator is pulled along the ground
2019-03-06	17:14:19	-117.024192	11.928587	4088	elevator released

2019-03-06	17:14:53	-117.02419	11.928594	4088	elevator released successfully
2019-03-06	17:16:57	-117.02421	11.92892	4087	heading north towards ROV MICP-1
2019-03-06	17:18:32	-117.024181	11.929283	4087	ROV MICP-1 not blinking
2019-03-06	17:19:20	-117.02418	11.92933	4087
2019-03-06	17:19:40	-117.024178	11.929331	4087
2019-03-06	17:21:10	-117.024189	11.929359	4088	Gear TakenUp
2019-03-06	17:21:21	-117.02419	11.929359	4088	ROV to Lift
2019-03-06	17:21:25	-117.024191	11.929359	4088	elevator 1
2019-03-06	17:22:59	-117.024198	11.929296	4087
2019-03-06	17:23:05	-117.024197	11.929284	4088	profiler needles broken
2019-03-06	17:25:53	-117.02396	11.928614	4088	elevator 1 spotted
2019-03-06	17:26:50	-117.023908	11.928534	4087	batteries of MICP1 empty, but sensors went back to start position
2019-03-06	17:27:49	-117.023921	11.928489	4088	MICP-DEEP located next to elevator
2019-03-06	17:28:02	-117.023923	11.928488	4089	MICP-DEEP no blinking
2019-03-06	17:28:15	-117.023925	11.928487	4089	Gear on Lift
2019-03-06	17:28:22	-117.023928	11.928486	4089	MICP1
2019-03-06	17:30:48	-117.023952	11.928488	4089	MICP1 positioned on elevator 1 next to MICP-2
2019-03-06	17:31:38	-117.023945	11.928487	4089	MICP2 secured on elevator
2019-03-06	17:34:31	-117.023923	11.928474	4089	MICP2 secures with second rope
2019-03-06	17:39:25	-117.023926	11.928469	4089	MICP1 secured on elevator
2019-03-06	17:43:05	-117.023991	11.928547	4089	MICP-DEEP not blinking
2019-03-06	17:43:15	-117.023989	11.928552	4089

2019-03-06	17:44:26	-117.023961	11.928551	4089
2019-03-06	17:44:35	-117.02396	11.928549	4089
2019-03-06	17:44:44	-117.023957	11.928545	4089
2019-03-06	17:45:23	-117.023927	11.92852	4089	MICP-DEEP both profiler stages were up
2019-03-06	17:46:14	-117.023936	11.928518	4089	Gear taken up
2019-03-06	17:46:18	-117.023938	11.928517	4089	MICP-DEEP
2019-03-06	17:48:34	-117.023938	11.928473	4089	Gear on Lift
2019-03-06	17:48:39	-117.023937	11.928471	4089	MICP-DEEP
2019-03-06	17:52:07	-117.023937	11.928486	4089	MICP-DEEP secured on elevator
2019-03-06	17:54:43	-117.023909	11.928451	4089	MICP-DEEP secured with second rope
2019-03-06	17:57:11	-117.023931	11.928476	4089	now secured with second rope
2019-03-06	17:57:42	-117.023961	11.928458	4089	Action 1 completed
2019-03-06	17:59:52	-117.023953	11.928455	4089	Starting Action 2_Coral Sampling
2019-03-06	18:00:46	-117.023974	11.928367	4089	Shrimp
2019-03-06	18:03:20	-117.024053	11.928267	4089
2019-03-06	18:05:46	-117.024002	11.928332	4089

2019-03-06	18:08:08	-117.024027	11.928268	4089	First try for collecting Alcyonacea
2019-03-06	18:09:31	-117.023991	11.928266	4089
2019-03-06	18:10:03	-117.023981	11.928252	4089
2019-03-06	18:10:30	-117.023991	11.92826	4089
2019-03-06	18:11:17	-117.024015	11.928254	4089	COLBOX-BIO
2019-03-06	18:12:08	-117.024037	11.928261	4089	Opening compartment COLBOX-BIO_1
2019-03-06	18:14:07	-117.023973	11.928262	4089	First Alcyonacea picked up
2019-03-06	18:14:38	-117.024015	11.928258	4089
2019-03-06	18:15:41	-117.024036	11.928241	4089	First Alcyonacea placed in compartment COLBOX-BIO_1
2019-03-06	18:16:11	-117.02404	11.92824	4089	Closing lid of COLBOX-BIO_1
2019-03-06	18:17:03	-117.024024	11.928239	4089	Second Alcyonacea spotted
2019-03-06	18:18:12	-117.024042	11.92823	4089

2019-03-06	18:18:24	-117.024048	11.92823	4089
2019-03-06	18:18:35	-117.024054	11.92823	4089
2019-03-06	18:18:53	-117.024063	11.928225	4089
2019-03-06	18:19:07	-117.024064	11.92822	4089	Second try for collecting Alcyonacea
2019-03-06	18:19:48	-117.024046	11.928223	4089	Opening compartment COLBOX-BIO_2
2019-03-06	18:21:04	-117.024065	11.928233	4089	Second Alcyonacea picked up (collected)
2019-03-06	18:21:29	-117.024059	11.928223	4089
2019-03-06	18:22:50	-117.024055	11.928221	4089	Second Alcyonacea placed in compartment COLBOX-BIO_2
2019-03-06	18:23:29	-117.024031	11.928222	4089	Closing lid of compartment COLBOX-BIO_2
2019-03-06	18:24:14	-117.024028	11.92822	4089	Third Alcyonacea spotted
2019-03-06	18:26:16	-117.024069	11.928223	4089	Third try for collecting Alcyonacea
2019-03-06	18:27:04	-117.024045	11.928226	4089

2019-03-06	18:27:40	-117.024044	11.928218	4089
2019-03-06	18:27:55	-117.024048	11.928222	4089
2019-03-06	18:29:07	-117.024025	11.928215	4089	Opening compartment COLBOX-BIO_3
2019-03-06	18:31:29	-117.024067	11.928208	4089
2019-03-06	18:33:15	-117.024042	11.928234	4089	Third Alcyonacea placed in compartment COLBOX-BIO_3
2019-03-06	18:33:40	-117.024049	11.928225	4089	Closing lid of compartment COLBOX-BIO_3
2019-03-06	18:35:09	-117.024058	11.928187	4089	First try for collecting Holothuroidea
2019-03-06	18:36:21	-117.024028	11.928188	4089
2019-03-06	18:36:51	-117.024046	11.928204	4089
2019-03-06	18:38:35	-117.024033	11.928185	4089	SLURP
2019-03-06	18:39:57	-117.024042	11.928178	4089	Slurp gun approaching first Holothuroidea
2019-03-06	18:40:43	-117.024051	11.928205	4089	Holothuroidea collected
2019-03-06	18:40:45	-117.02405	11.928206	4089	COLBOX-SGN
2019-03-06	18:41:25	-117.024063	11.928212	4089	Holothuroidea placed in COLBOX-SGN

2019-03-06	18:42:18	-117.024049	11.928213	4089
2019-03-06	18:42:37	-117.02405	11.928203	4089
2019-03-06	18:43:50	-117.023927	11.928327	4088	A group of Alcyonacea spotted
2019-03-06	18:46:05	-117.024042	11.928161	4089	Fourth try for collecting Alcyonacea
2019-03-06	18:46:36	-117.024029	11.928146	4089	Opening compartment COLBOX-BIO_4
2019-03-06	18:47:34	-117.024032	11.928173	4089
2019-03-06	18:47:53	-117.024023	11.928194	4089
2019-03-06	18:49:44	-117.024074	11.92814	4089	Fourth Alcyonacea picked up (collected)
2019-03-06	18:50:15	-117.024057	11.928131	4089	Fourth Alcyonacea placed in compartment COLBOX-BIO_4
2019-03-06	18:51:08	-117.02407	11.928181	4089	Lid placed on compartment COLBOX-BIO_4
2019-03-06	18:53:35	-117.024118	11.92815	4089	Fifth try for collecting Alcyonacea
2019-03-06	18:54:05	-117.024106	11.928165	4089

2019-03-06	18:54:19	-117.024075	11.928171	4089
2019-03-06	18:55:53	-117.02404	11.928213	4089	Opening compartment COLBOX-BIO_5
2019-03-06	18:57:07	-117.024011	11.928255	4089	Fifth Alcyonacea picked up (collected)
2019-03-06	18:57:39	-117.024022	11.928226	4089	Fifth Alcyonacea placed in compartment COLBOX-BIO_5
2019-03-06	18:58:20	-117.023959	11.928169	4089	Lid placed on COLBOX-BIO_5
2019-03-06	18:59:14	-117.023912	11.928207	4089	Sixth try for collecting Alcyonacea
2019-03-06	18:59:43	-117.023972	11.928259	4089
2019-03-06	19:00:08	-117.024026	11.928236	4089
2019-03-06	19:00:59	-117.023996	11.928228	4089	Opening compartment COLBOX-BIO_6
2019-03-06	19:02:41	-117.024039	11.928253	4089	Fifth Alcyonacea picked up (collected)
2019-03-06	19:03:09	-117.024056	11.928246	4089
2019-03-06	19:03:32	-117.024051	11.92825	4089	Fifth Alcyonacea placed in COLBOX-BIO_6
2019-03-06	19:04:06	-117.02406	11.928255	4089	Lid placed on COLBOX-BIO_6
2019-03-06	19:08:37	-117.024056	11.928222	4089	Seventh Alcyonacea spotted
2019-03-06	19:08:52	-117.024036	11.928217	4089

2019-03-06	19:09:13	-117.024045	11.92821	4089
2019-03-06	19:10:18	-117.024069	11.928232	4089	Opening compartment COLBOX-BIO_7
2019-03-06	19:14:31	-117.024041	11.928093	4089	Seventh Alcyonacea picked up (collected)
2019-03-06	19:15:02	-117.024034	11.928152	4089	Seventh Alcyonacea placed in COLBOX_BIO_7
2019-03-06	19:15:41	-117.024079	11.928231	4089	Lid placed on COLBOX-BIO_7
2019-03-06	19:21:16	-117.024036	11.928174	4089	First try for collecting Ophiuroidea
2019-03-06	19:22:15	-117.023995	11.928172	4089
2019-03-06	19:22:31	-117.024056	11.928181	4089
2019-03-06	19:23:40	-117.024061	11.928172	4089	COLBOX-SGN
2019-03-06	19:25:22	-117.024045	11.928226	4089	Looks like Ophiosphalma glabrum
2019-03-06	19:25:45	-117.024037	11.928241	4089	Ophiuroidea in COLBOX-SGN
2019-03-06	19:26:36	-117.024078	11.928196	4089
2019-03-06	19:27:30	-117.024057	11.92821	4089

2019-03-06	19:27:59	-117.024082	11.92825	4089
2019-03-06	19:28:07	-117.024092	11.928246	4089
2019-03-06	19:32:57	-117.024458	11.928205	4084	Fish
2019-03-06	19:34:41	-117.024495	11.928118	4084	Fauna collection is stopped
2019-03-06	20:20:07	-117.028397	11.926209	4082
2019-03-06	20:20:25	-117.028376	11.926194	4082
2019-03-06	20:26:30	-117.028397	11.926311	4082

2019-03-06	20:27:04	-117.028401	11.926256	4082
2019-03-06	20:27:59	-117.028344	11.926258	4082
2019-03-06	20:39:05	-117.028313	11.926222	4083
2019-03-06	20:43:23	-117.028278	11.926179	4081
2019-03-06	20:47:27	-117.028159	11.926132	4083
2019-03-06	20:48:41	-117.028187	11.926147	4083

2019-03-06	20:49:26	-117.028151	11.926134	4083
2019-03-06	20:49:28	-117.028151	11.926134	4083
2019-03-06	20:54:09	-117.028157	11.92615	4083	Collecting sponge
2019-03-06	20:56:30	-117.028181	11.926158	4083	collecting ophiuroid
2019-03-06	21:05:13	-117.027525	11.926161	4084	shrimp
2019-03-06	21:08:58	-117.027273	11.926189	4084
2019-03-06	21:09:09	-117.027272	11.926195	4084
2019-03-06	21:12:22	-117.027303	11.926214	4084	collecting holothurian into biobox with slurpgun
2019-03-06	21:13:39	-117.027316	11.926231	4084	did not work with slurpgun, we try with the claw
2019-03-06	21:17:08	-117.027265	11.926341	4083	going to the cameras
2019-03-06	21:32:04	-117.025748	11.926263	4086	we are heading to the cameras without collecting fauna
2019-03-06	21:54:03	-117.02387	11.926489	4089	cameras on sight
2019-03-06	21:54:46	-117.023825	11.926533	4089	PV-PICAM13
2019-03-06	21:55:37	-117.023793	11.926481	4089

2019-03-06	21:56:05	-117.023791	11.926462	4089
2019-03-06	22:01:02	-117.023791	11.926507	4090
2019-03-06	22:01:10	-117.023799	11.926524	4090
2019-03-06	22:01:20	-117.023808	11.926555	4090
2019-03-06	22:03:40	-117.023775	11.926459	4090	collecting sponge and ophiuroid that were in front of the camera
2019-03-06	22:06:17	-117.023784	11.926503	4090	finish action
2019-03-06	22:10:57	-117.02375	11.926507	4090	collecting camera PV PICAM 13
2019-03-06	22:11:03	-117.02375	11.926499	4090	Gear TakenUp
2019-03-06	22:11:52	-117.023736	11.926453	4090	camera on ROV
2019-03-06	22:12:12	-117.023748	11.926471	4089	rov to PIV PICAM1
2019-03-06	22:22:33	-117.023598	11.926456	4090
2019-03-06	22:29:53	-117.023626	11.926393	4091	Gear TakenUp
2019-03-06	22:32:48	-117.023624	11.926394	4090	camera on ROV
2019-03-06	22:34:18	-117.023582	11.926434	4090	heading to elevator

2019-03-06	22:50:42	-117.023834	11.928391	4087
2019-03-06	23:11:39	-117.02359	11.928722	4060	OFF THE BOTTOM
2019-03-07	00:47:03	-117.023349	11.928655	-3	ON DECK

Kiel 6000 Dive 05 (SO268-1_031_ROV05)

Date: 07/03/2019 - 08/03/2019

Observers: AMARO Teresa, CHRISTODOULOU Magdalini, MARTINEZ Pedro, PAPE Ellen

ROV positions (at the bottom)

Start of dive: 11°55.79229 'N 117°01.47903'W

End of dive: 11°55.62092'N 117°01.32797'W

Dive duration: 7:36

ROV in the water: 07/03/2019 18:14:47

ROV at the bottom: 07/03/2019 19:58:39

ROV off the bottom: 08/03/2019 00:14:10

ROV on deck: 08/03/2019 01:50:47

Explored sites: DE impact area

Aims of the Dive:

- PUC sampling
- Fauna sampling with a focus on ophiuroids, sponges, holothurians

Handled ROV Tools (including scientific payload):

- Collector box (COLBOX)
- Push corers (PUC)
- slurp gun (SLURP)
- 3 nets
- scoop

Relevant Elevator payload (*italic: payload not used during the dive*) no elevators were used

Dive summary (protocol by Ellen Pape)

The aim of ROV dive 5 was twofold: (1) collect pushcores at 3 different locations for UGent, SGN and MPI and (2) collect fauna while moving between these 3 locations. The ROV touched bottom near the location of MUC2 inside the collector area in the BGR trial area. Firstly, we looked for an imprint of the MUC-20 but without success. Near the MUC2 location a first set of 7 PUCs were taken in seemingly nodule-free sediments. Then, we moved to the location of MUC3 and underway we sampled 4 holothurians (1 specimen was damaged during manipulation with the slurp gun) and 2 ophiuroids. We also observed an octopus and a fish. At the MUC3 location, another set of 7 pushcores was collected (instead of the 2 PUCs which were initially planned, this to make sure all 10 PUCs would be taken by the end of the dive for UGent and SGN), again in seemingly nodule-free sediments. Next, the ROV moved towards MUC4 while sampling 1 coral, 2 sponges and 4 ophiuroids. Moreover, a potential imprint of a boxcorer was observed and photographed. At the end of the dive the last 2 pushcores were collected for MPI.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-03-07	17:12:00	-117.025473	11.92964	5	test
2019-03-07	18:15:02	-117.025473	11.92964	5	IN THE WATER
2019-03-07	19:58:39	-117.024668	11.929853	4071	AT THE BOTTOM
2019-03-07	20:07:41	-117.024676	11.929945	4085	MUC imprints
2019-03-07	20:08:40	-117.024644	11.929946	4085	fish
2019-03-07	20:14:56	-117.024521	11.930103	4085	fish
2019-03-07	20:15:23	-117.024491	11.930017	4085	2019-03-07_20-15-19_Sonne_SO268-1_031ROV05_Logo.jpg
2019-03-07	20:22:21	-117.024517	11.929929	4087	MUC2 push core1 nr 51
2019-03-07	20:22:30	-117.024521	11.929929	4087	PUC
2019-03-07	20:23:12	-117.024526	11.929926	4087
2019-03-07	20:25:27	-117.024558	11.929928	4087	PUC2 nr 27, push core3 nr8, PUC nr4 12, PUC5 nr7, PUC6 nr71, PUC7 nr38
2019-03-07	20:37:00	-117.024545	11.929959	4087
2019-03-07	20:38:37	-117.024498	11.929944	4087	Put all the PUCs into ROV
2019-03-07	20:38:45	-117.024497	11.929944	4087	fish
2019-03-07	20:43:41	-117.024533	11.929913	4087	end of action
2019-03-07	20:46:41	-117.024587	11.92998	4087	moving to MUC3 and fauna collection
2019-03-07	20:51:53	-117.024582	11.929822	4086

2019-03-07	20:52:11	-117.024582	11.929822	4086
2019-03-07	20:55:48	-117.024625	11.929839	4087
2019-03-07	20:57:49	-117.024712	11.930018	4087	SLURP
2019-03-07	21:00:57	-117.024583	11.929873	4087	slurp gun put back, holo too big
2019-03-07	21:02:46	-117.024599	11.92991	4087	SCOOP
2019-03-07	21:04:12	-117.024657	11.92979	4087	holo scooped up
2019-03-07	21:05:33	-117.024651	11.929789	4087	holo fell on top of the box
2019-03-07	21:05:48	-117.024685	11.9298	4087	COLBOX-SGN
2019-03-07	21:07:10	-117.024602	11.929798	4087	holo in sgn box
2019-03-07	21:11:52	-117.02459	11.929841	4087	looking for black sponge with isopod
2019-03-07	21:13:36	-117.024631	11.929843	4087
2019-03-07	21:13:50	-117.024602	11.929838	4087
2019-03-07	21:16:00	-117.024601	11.929886	4087	ophiuroid taken up with ROV claw
2019-03-07	21:16:11	-117.024599	11.929875	4087	COLBOX-SGN
2019-03-07	21:18:03	-117.024577	11.92981	4087	ophiuroid stuck in oragne rope on handle
2019-03-07	21:18:32	-117.02459	11.929805	4087	ophiuroid inside box SGN

2019-03-07	21:23:07	-117.024439	11.929703	4088
2019-03-07	21:23:19	-117.024434	11.929705	4087
2019-03-07	21:24:55	-117.024443	11.929704	4088	ophiuroid taken up with ROV claw
2019-03-07	21:25:20	-117.024435	11.929698	4087	COLBOX-SGN
2019-03-07	21:25:41	-117.024419	11.929693	4087	ophiuroid lost
2019-03-07	21:26:46	-117.024436	11.929701	4088	ophiuroid avoiding ROV claw, too hard to take
2019-03-07	21:31:33	-117.024312	11.929662	4087	Fish
2019-03-07	21:34:09	-117.024273	11.929634	4088
2019-03-07	21:34:25	-117.024276	11.929636	4088
2019-03-07	21:36:34	-117.024243	11.929614	4088	Gear TakenUp
2019-03-07	21:36:44	-117.024245	11.92961	4088	SLURP
2019-03-07	21:38:16	-117.024243	11.929631	4088	holo sucked up
2019-03-07	21:38:58	-117.024231	11.929623	4088	holo destroyed while sucking up
2019-03-07	21:40:41	-117.024245	11.929617	4088	slurp gun put back
2019-03-07	21:41:22	-117.02425	11.929605	4088

2019-03-07	21:41:28	-117.024249	11.929603	4088
2019-03-07	21:46:06	-117.024141	11.929581	4088
2019-03-07	21:47:26	-117.024159	11.929577	4088
2019-03-07	21:47:37	-117.024163	11.929582	4088	sgn box opened
2019-03-07	21:48:41	-117.024169	11.929579	4088	taken up holo with ROV claw
2019-03-07	21:49:26	-117.02418	11.929581	4088	holo inside sgn box
2019-03-07	21:52:49	-117.024134	11.929557	4088
2019-03-07	21:53:01	-117.024135	11.929555	4088
2019-03-07	21:53:26	-117.024134	11.929561	4088	COLBOX-SGN
2019-03-07	21:53:59	-117.024132	11.929575	4088	sgn box opened
2019-03-07	21:56:15	-117.024143	11.929554	4088	taken up ophiuroid with ROV claw
2019-03-07	21:56:28	-117.024143	11.929553	4088	ophiuroid inside SGN box
2019-03-07	21:59:28	-117.024118	11.929581	4088	trying to take sponge on noudle with ROV claw
2019-03-07	21:59:48	-117.024106	11.92958	4088	failed to take sponge, closing SGN box
2019-03-07	22:16:24	-117.022598	11.928282	4088	holo from slurp gun went down into box
2019-03-07	22:19:34	-117.022399	11.928224	4089	fish

2019-03-07	22:24:49	-117.022248	11.927896	4089	planning to collect pink holothurian
2019-03-07	22:27:21	-117.02217	11.927966	4090
2019-03-07	22:27:37	-117.022178	11.927959	4090
2019-03-07	22:27:41	-117.022179	11.927958	4090
2019-03-07	22:27:59	-117.02218	11.927956	4090	Isopoda associated with sponge, pic taken
2019-03-07	22:28:07	-117.022179	11.927957	4090
2019-03-07	22:28:09	-117.022179	11.927957	4090

2019-03-07	22:28:17	-117.022179	11.927958	4090
2019-03-07	22:30:16	-117.022206	11.927956	4090	grabbing net with ROV claw
2019-03-07	22:30:46	-117.022195	11.927984	4090	COLBOX-SGN
2019-03-07	22:32:27	-117.022217	11.927964	4090	picking up net again
2019-03-07	22:32:35	-117.022218	11.927967	4090	NET
2019-03-07	22:36:51	-117.022228	11.927964	4090	net put over holo and scooped
2019-03-07	22:37:20	-117.022251	11.92799	4090	holding net in water column to get rid of sed
2019-03-07	22:38:18	-117.022208	11.927953	4090	net filled with sed
2019-03-07	22:39:43	-117.022183	11.927959	4090	content of net inside SGN box
2019-03-07	22:39:53	-117.02218	11.92796	4090	SGN box closed
2019-03-07	22:43:19	-117.022079	11.927809	4090	Moving towards MUC 3 position
2019-03-07	22:52:21	-117.021124	11.927198	4092	Fish
2019-03-07	22:53:25	-117.021123	11.927268	4092	Medusa
2019-03-07	22:56:59	-117.021069	11.927283	4092	ROV near MUC 3 position
2019-03-07	22:57:28	-117.021083	11.927301	4092	Action 3 starting
2019-03-07	22:57:53	-117.021067	11.927265	4093	Taking PUCs in MUC 3 position
2019-03-07	23:00:18	-117.021033	11.927257	4093	PUC is out of the drawer
2019-03-07	23:00:47	-117.02102	11.927239	4093	PUC is in the sediment
2019-03-07	23:03:31	-117.021019	11.927295	4093	PUC 48 is out of the drawer
2019-03-07	23:04:17	-117.021123	11.927326	4093	PUC 48 is in the sediment
2019-03-07	23:05:33	-117.021058	11.927315	4093	PUC 43 is out of the drawer
2019-03-07	23:05:50	-117.021032	11.927303	4093	PUC 43 is in the sediment
2019-03-07	23:06:48	-117.021025	11.927254	4093	PUC 11 is out of the drawer
2019-03-07	23:07:29	-117.02098	11.927263	4093	PUC 11 is in the sediment
2019-03-07	23:08:28	-117.021011	11.927252	4093	PUC 16 is out of the drawer
2019-03-07	23:09:10	-117.020995	11.927258	4093	PUC 16 is in the sediment
2019-03-07	23:10:16	-117.021012	11.927253	4093	PUC 24 is out of the drawer
2019-03-07	23:10:35	-117.021019	11.927252	4093	PUC 24 is in the sediment
2019-03-07	23:11:20	-117.021033	11.927245	4093	PUC 65 is out of the drawer
2019-03-07	23:12:11	-117.021021	11.927266	4093	PUC 65 is in the sediment
2019-03-07	23:12:50	-117.021037	11.927308	4093
2019-03-07	23:13:11	-117.021041	11.927303	4093	First PUC was no. 29
2019-03-07	23:13:17	-117.021042	11.927302	4093
2019-03-07	23:13:58	-117.02102	11.927234	4093	PUC 43 is out of the sediment and back in the drawer

2019-03-07	23:14:47	-117.021033	11.927242	4093	PUC 24 is out of the sediment and back to the drawer
2019-03-07	23:16:43	-117.021019	11.927248	4093	PUC 29 is out of the sediment and back to the drawer
2019-03-07	23:17:18	-117.021024	11.927243	4093	PUC 48 is out of the sediment and back to the drawer
2019-03-07	23:18:05	-117.021045	11.927229	4093	PUC 65 is out of the sediment and back to the drawer
2019-03-07	23:18:55	-117.021055	11.927251	4093	PUC 11 is out of the sediment and back to the drawer
2019-03-07	23:19:51	-117.02102	11.927286	4093	PUC 16 is out of the sediment and back to the drawer
2019-03-07	23:21:48	-117.021033	11.927248	4093	Action 3 completed: 7 PUCs collection in MUC3 position
2019-03-07	23:25:38	-117.021026	11.927213	4093	Starting Action 4: Fauna sampling
2019-03-07	23:26:25	-117.021035	11.927205	4093	Argonaut shell (Mollusca)
2019-03-07	23:26:29	-117.021036	11.927205	4093
2019-03-07	23:26:41	-117.021035	11.927207	4093
2019-03-07	23:27:07	-117.021039	11.927212	4093
2019-03-07	23:27:29	-117.02106	11.927244	4093
2019-03-07	23:28:17	-117.02111	11.927399	4093	Alcyonacea collection
2019-03-07	23:30:43	-117.021046	11.927206	4093
2019-03-07	23:31:11	-117.021045	11.927216	4093	Alcyonacea in the COLBOX-SGN

2019-03-07	23:33:53	-117.021016	11.927233	4093	Porifera collection
2019-03-07	23:34:32	-117.020993	11.927234	4093
2019-03-07	23:35:23	-117.02101	11.927273	4093
2019-03-07	23:37:19	-117.021025	11.927209	4093	Porifera collected with the arm
2019-03-07	23:37:39	-117.021013	11.927213	4093	Porifera in the COLBOX-SGN
2019-03-07	23:38:32	-117.021015	11.927251	4093
2019-03-07	23:41:53	-117.020991	11.927219	4093
2019-03-07	23:42:14	-117.020987	11.927212	4093
2019-03-07	23:44:13	-117.020994	11.927241	4093	Ophiuroidea in the COLBOX-SGN
2019-03-07	23:45:10	-117.02099	11.927257	4093	Shrimp
2019-03-07	23:45:22	-117.020994	11.927259	4093	Collection of second Ophiuroidea in the same spot
2019-03-07	23:45:38	-117.021005	11.927256	4093	Second Ophiuroidea in the COLBOX-SGN
2019-03-07	23:47:19	-117.020996	11.927288	4091	Porifera

2019-03-07	23:48:18	-117.020999	11.927271	4092
2019-03-07	23:49:27	-117.020998	11.927239	4093
2019-03-07	23:49:44	-117.021005	11.927245	4093
2019-03-07	23:50:01	-117.021007	11.927264	4093
2019-03-07	23:50:11	-117.021006	11.927274	4093
2019-03-07	23:50:26	-117.020998	11.927283	4093
2019-03-07	23:51:44	-117.020968	11.92731	4093	Collection of Ophiuroidea

2019-03-07	23:52:30	-117.020965	11.927319	4093	Ophiuroidea in the COLBOX-SGN
2019-03-07	23:52:55	-117.020955	11.927308	4093	Collection of Porifera
2019-03-07	23:54:01	-117.020985	11.927287	4093	Porifera in the COLBOX-SGN (upside cone shaped)
2019-03-07	23:55:23	-117.021027	11.927266	4093	Ophiuroidea collection
2019-03-07	23:56:06	-117.021027	11.927266	4093
2019-03-07	23:57:22	-117.021193	11.927768	4093	Ophiuroidea in the COLBOX-SGN
2019-03-08	00:00:22	-117.021246	11.927143	4092	Action 4 completed
2019-03-08	00:00:37	-117.021309	11.927135	4092	Action 5 starting
2019-03-08	00:00:58	-117.021382	11.927131	4092	Taking the last two PUCs
2019-03-08	00:04:02	-117.021952	11.927086	4092	Box Corer inprint
2019-03-08	00:04:04	-117.021954	11.927086	4092
2019-03-08	00:04:05	-117.021954	11.927086	4092
2019-03-08	00:04:25	-117.021978	11.927082	4092
2019-03-08	00:04:34	-117.021997	11.927075	4092
2019-03-08	00:08:36	-117.022113	11.927029	4093	PUC 57 is in the sediment
2019-03-08	00:08:52	-117.02212	11.927022	4093	PUC 42 is out of the drawer

2019-03-08	00:10:15	-117.022118	11.927041	4093	PUC 42 is in the sediment
2019-03-08	00:10:34	-117.022116	11.927038	4093
2019-03-08	00:10:57	-117.02212	11.927056	4093	PUC 42 is out of the sediment
2019-03-08	00:11:32	-117.022117	11.927045	4093	PUC 42 is back in the drawer
2019-03-08	00:11:46	-117.022115	11.927032	4093	PUC 57 is out of the sediment
2019-03-08	00:12:09	-117.02211	11.92702	4093	PUC 57 is back in the drawer
2019-03-08	00:12:32	-117.022112	11.927024	4093	Action 5 completed
2019-03-08	00:14:10	-117.022112	11.927029	4091	OFF THE BOTTOM
2019-03-08	01:50:47	-117.021055	11.92734	4	ON DECK

Kiel 6000 Dive 06 (SO268-1_035_ROV06)

Date: 08/03/2019

Observers: JANSSEN, Felix; BODUR, Yasemin; STRATMANN, Tanja; AMARO, Teresa; PAPE, Ellen

ROV positions (at the bottom)

Start of dive: 11° 50.669' N 117° 3.502' W

End of dive: 11° 50.632' N 117° 3.56' W

Dive duration:

ROV in the water: 08/03/2019 16:05:56

ROV at the bottom: 08/03/2019 17:40:3

ROV off the bottom: 09/03/2019 00:53:56

ROV on deck: 09/03/2019 02:40:03

Explored sites: DE impact area

Aims of the Dive:

- Deployment of three profilers
- Deployment of two chambers
- Deployment of two cameras
- Deployment of 26 nodule frames

Handled ROV Tools (including scientific payload):

- 2 benthic flux chambers (BFC-ROV 1 and 2) on the porch during descent
- Collector box (COLBOX)
- Slurp gun/ suction pump (SLURP)
- 3 hand nets (NET)
- Magnetic T-handle

Relevant Elevator payload

Elevator 1

- No elevator 1

Elevator 2

- 3 microsensor profiler (MICP 1 and 2, MICP-DEEP)
- 2 time-lapse cameras (PV-PICAM 1 and 2)
- 26 nodule frames/ artificial substrate (ARTSUBS) in two stacks
- 1 marker
- *Amphipod traps*

Dive summary (protocol by Tanja Stratmann)

After deploying benthic flux chamber 1 (BFC-ROV 1) at the north-eastern site in the German impact area, benthic flux chamber 2 (BFC-ROV 2) and microsensor profiler MICP DEEP

were positioned approximately 20 m away from elevator 2. Microsensor profiler MICP 1 was positioned close to BFC-ROV 1 and microsensor profiler MICP 2 was deployed at the south-western site in the German impact area. The ROV returned to the elevator and picked up one stack of 13 nodule frames/ artificial substrate (ARTSUBS). These frames were distributed in 0.2 m distance from each other and placed in rows with 4 frames per column on the seafloor. After picking up the second stack of 13 nodule frames (ARTSUBS), they were placed next to the previously deployed 13 frames. Afterwards, the ROV completed the deployment of artificial substrate by positioning a marker and taking pictures of the network of nodule frames on the seafloor. As the start of microsensor profiler MICP 2 was unsuccessful the first time, it was tried again to switch it on, but when this did not work, it was taken on the ROV porch. MICP 1 was re-positioned approximately 10 m from its original position and started again. Before the dive was finished, three push cores (PUC) were taken west of elevator 2.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-03-08	15:08:51	-117.059302	11.84402	52	test
2019-03-08	16:05:56	-117.059302	11.84402	52	IN THE WATER
2019-03-08	17:40:37	-117.058354	11.844513	4125	AT THE BOTTOM
2019-03-08	17:53:23	-117.058319	11.844542	4134	Gear Received
2019-03-08	17:53:40	-117.058323	11.844554	4134	chamber 1 from porch
2019-03-08	17:54:32	-117.058314	11.844531	4134	chamber 1 blinking
2019-03-08	17:58:11	-117.05835	11.844607	4134	looking for nodule-free spot for deploying chamber 1
2019-03-08	17:59:48	-117.058352	11.84463	4134
2019-03-08	17:59:59	-117.058352	11.844631	4134	of the spot to deploy
2019-03-08	18:02:41	-117.058366	11.844629	4134	Gear Deployed
2019-03-08	18:02:50	-117.058365	11.844626	4134	chamber 1
2019-03-08	18:06:55	-117.058338	11.844606	4134	t-handle put on magnetic switch
2019-03-08	18:08:49	-117.058347	11.844635	4134	chamber stopped blinking
2019-03-08	18:08:54	-117.058346	11.844633	4134	chamber 1 switched on
2019-03-08	18:12:14	-117.058345	11.844661	4134
2019-03-08	18:16:32	-117.058334	11.84463	4134	BFC-ROV NE (chamber 1) waypoint set
2019-03-08	18:20:14	-117.058682	11.844269	4134	position of ELV2 is further south-east than indicated on its waypoint
2019-03-08	18:21:54	-117.058952	11.844076	4135	position of waypoint of ELV2 reached - heading further southeast
2019-03-08	18:22:05	-117.058988	11.844048	4135	ROV to Lift
2019-03-08	18:24:20	-117.059191	11.843915	4136	ELV2 spotted

2019-03-08	18:26:11	-117.059198	11.843923	4136	Nachtrag: chamber of chamber 1 was pushed into the sediment until the lower rim of the white stripe
2019-03-08	18:26:24	-117.0592	11.843917	4136	HD camera recording was not switched on
2019-03-08	18:26:33	-117.059203	11.843913	4136	HD camera recording switched on now
2019-03-08	18:29:22	-117.059197	11.843917	4136	Gear Received
2019-03-08	18:29:25	-117.059196	11.843917	4136
2019-03-08	18:29:28	-117.059197	11.843917	4136	Photo Taken
2019-03-08	18:31:15	-117.059203	11.843936	4137	Gear Deployed
2019-03-08	18:31:19	-117.059202	11.843936	4137	chamber 2
2019-03-08	18:32:49	-117.059196	11.8439	4137
2019-03-08	18:35:15	-117.059217	11.843927	4137	chamber 2 switched on
2019-03-08	18:35:20	-117.059216	11.843925	4137	not blinking anymore
2019-03-08	18:35:47	-117.059214	11.843913	4137	BFC-ROV-2-1 (chamber 2) started
2019-03-08	18:39:55	-117.05919	11.84393	4138	chamber of chamber 2: sediment reaches underneath white stripe (less high than in chamber 1)
2019-03-08	18:40:55	-117.0592	11.843922	4138
2019-03-08	18:41:07	-117.059194	11.843915	4138	chamber of chamber 2: sediment positioned on green stripe
2019-03-08	18:41:11	-117.059192	11.843914	4138
2019-03-08	18:44:15	-117.059315	11.843874	4137	ROV to Lift
2019-03-08	18:44:26	-117.059319	11.843865	4137	all three profilers located on the northeast side of the elevator
2019-03-08	18:49:59	-117.05932	11.84384	4138	light of one picam was on continuously
2019-03-08	18:51:20	-117.059326	11.843835	4138	straps of profiler 3 released
2019-03-08	18:51:33	-117.059309	11.843831	4138	Gear Received
2019-03-08	18:51:41	-117.0593	11.84383	4138	profiler 3

2019-03-08	19:02:48	-117.059173	11.843943	4135	profiler MICP-DEEP (profiler 3) and chamber 2 positioned 55 degrees from elevator 2
2019-03-08	19:04:18	-117.059184	11.843931	4136
2019-03-08	19:04:38	-117.059187	11.843933	4136
2019-03-08	19:06:25	-117.059186	11.843925	4137	Gear Deployed
2019-03-08	19:06:39	-117.059191	11.843916	4137
2019-03-08	19:06:44	-117.059192	11.843912	4137	MICP-DEEP deployed
2019-03-08	19:07:09	-117.059185	11.843899	4137
2019-03-08	19:08:11	-117.059187	11.843926	4137
2019-03-08	19:10:27	-117.059214	11.84392	4137	MICP-DEEP turned on
2019-03-08	19:10:58	-117.059218	11.843934	4137	stage 1 of MICP-DEEP 1-1 started
2019-03-08	19:12:29	-117.059162	11.843889	4137	ROV to Lift

2019-03-08	19:15:41	-117.059303	11.843814	4138
2019-03-08	19:15:51	-117.059308	11.843822	4138
2019-03-08	19:15:58	-117.059311	11.843829	4137	of the cameras on the lift
2019-03-08	19:18:00	-117.059345	11.843816	4138	Gear Received
2019-03-08	19:18:16	-117.059341	11.84382	4138	PV-GlasPi13
2019-03-08	19:18:33	-117.059336	11.843824	4138	PV-GlasPi 13 positioned on porch
2019-03-08	19:20:29	-117.059317	11.843841	4137	ROV to Lift
2019-03-08	19:27:21	-117.059073	11.844014	4134	Gear Received
2019-03-08	19:27:28	-117.059057	11.844024	4134	profiler 1
2019-03-08	19:27:46	-117.05901	11.844052	4134	heading towards position of chamber 1
2019-03-08	19:31:26	-117.058368	11.844501	4133	chamber 1 spotted
2019-03-08	19:33:39	-117.058367	11.844548	4133
2019-03-08	19:35:51	-117.058377	11.844546	4134	Gear Deployed
2019-03-08	19:35:58	-117.058378	11.844545	4134	MICP-2
2019-03-08	19:36:06	-117.058379	11.844543	4134
2019-03-08	19:36:27	-117.058377	11.844535	4134

2019-03-08	19:39:43	-117.05836	11.84455	4134	MICP-2-1 stopped blinking and started#
2019-03-08	19:43:25	-117.058379	11.844562	4134	ROV to Lift
2019-03-08	19:45:34	-117.058389	11.844533	4133	PVPICAM taken from porch in manipulator
2019-03-08	19:45:48	-117.058389	11.844523	4133	zig-zag course towards ELV 2
2019-03-08	19:46:18	-117.058404	11.844491	4133	searching for spot to deploy PV-PICAM
2019-03-08	19:49:06	-117.058352	11.844382	4134
2019-03-08	19:49:27	-117.058353	11.844376	4134
2019-03-08	19:49:39	-117.05835	11.844376	4134	PV-PICAM
2019-03-08	19:53:02	-117.058391	11.844362	4134	sediment plume obscures view. moving on to look for another spot
2019-03-08	19:53:12	-117.058378	11.844358	4134	Gear TakenUp
2019-03-08	19:53:20	-117.058366	11.84435	4134	PV-PICAM
2019-03-08	19:54:01	-117.058325	11.844301	4134	continue traveling towards Elevator
2019-03-08	19:54:20	-117.058309	11.844295	4134
2019-03-08	19:55:19	-117.058303	11.844278	4134
2019-03-08	19:55:32	-117.058307	11.844279	4134	icnops
2019-03-08	19:55:34	-117.058308	11.844279	4134

2019-03-08	19:55:38	-117.058308	11.84428	4134
2019-03-08	19:55:50	-117.05831	11.844284	4134	target picam communities
2019-03-08	19:57:52	-117.058296	11.844293	4134	Gear Deployed
2019-03-08	19:58:00	-117.0583	11.844293	4134	PV-PICAM
2019-03-08	19:58:37	-117.058311	11.844309	4134	tilt down with manipulator
2019-03-08	19:59:21	-117.058296	11.844318	4134
2019-03-08	19:59:24	-117.058295	11.844317	4134	Picam together with community
2019-03-08	20:00:43	-117.058305	11.844288	4134
2019-03-08	20:00:45	-117.058304	11.844288	4134
2019-03-08	20:00:48	-117.058302	11.844289	4134	community members and camera
2019-03-08	20:01:21	-117.058294	11.844296	4134	ROV waypoint
2019-03-08	20:03:08	-117.058315	11.844279	4134	waypoint name: PICAM 13
2019-03-08	20:11:19	-117.059148	11.84381	4136	ROV to Lift
2019-03-08	20:13:45	-117.059287	11.84385	4137	MICP-2 will not be deployed on planned waypoint (MICP SW). instead on half of the way to it
2019-03-08	20:16:35	-117.059313	11.843848	4138	straps of MICP-2 released
2019-03-08	20:20:14	-117.059336	11.843831	4138	Gear Received
2019-03-08	20:20:47	-117.059332	11.843826	4137	MICP-2 blinking
2019-03-08	20:25:03	-117.0589	11.844079	4134	a nodule-free place spotted

2019-03-08	20:25:43	-117.058889	11.844095	4134
2019-03-08	20:27:23	-117.058896	11.844082	4135
2019-03-08	20:27:43	-117.058886	11.844082	4135	of spot of target
2019-03-08	20:29:22	-117.058878	11.844104	4135	Gear Deployed
2019-03-08	20:29:41	-117.058874	11.844107	4135
2019-03-08	20:29:53	-117.058872	11.844107	4135
2019-03-08	20:31:22	-117.058857	11.844099	4134	MICP2 2-1 will be lifted and deployed once again since sediment was too much disturbed while deployment
2019-03-08	20:32:26	-117.058843	11.844108	4135
2019-03-08	20:34:13	-117.058861	11.844112	4135	Gear Deployed
2019-03-08	20:35:38	-117.058847	11.844119	4135	MICP2 2-1 will be lifted once again, since now there is a nodule in the way of the sensors

2019-03-08	20:37:22	-117.058802	11.84415	4134
2019-03-08	20:37:32	-117.058802	11.844158	4135	
2019-03-08	20:38:08	-117.058801	11.844148	4135
2019-03-08	20:38:16	-117.058798	11.844138	4135	of the spot
2019-03-08	20:39:16	-117.058786	11.844132	4135
2019-03-08	20:39:40	-117.058788	11.844148	4135
2019-03-08	20:39:47	-117.058789	11.844152	4135	MICP2 2-1
2019-03-08	20:43:41	-117.058784	11.844134	4135	MICP 21-1 started
2019-03-08	20:45:04	-117.058778	11.844142	4135	delete
2019-03-08	20:45:19	-117.058778	11.84414	4135	MICP 2-1 not able to start
2019-03-08	20:46:20	-117.058775	11.844133	4135	MICP2 resets all the time
2019-03-08	20:47:42	-117.058766	11.844137	4135	MICP2 stops and starts blinking continuously
2019-03-08	20:52:48	-117.059167	11.843831	4134	going to elevator
2019-03-08	20:53:16	-117.05924	11.843793	4135

2019-03-08	20:58:45	-117.05935	11.843835	4138
2019-03-08	21:00:39	-117.059356	11.843811	4137	Nodules frames to be deployed
2019-03-08	21:04:16	-117.059354	11.843809	4138	Gear Received
2019-03-08	21:07:45	-117.059329	11.84381	4138	fish
2019-03-08	21:18:02	-117.059247	11.843837	4137	moving to place where we will deploy the frames
2019-03-08	21:20:45	-117.059252	11.84412	4136	first 10 frames
2019-03-08	21:21:22	-117.059252	11.844119	4136	frame 82 deployed on sediment
2019-03-08	21:22:11	-117.059244	11.844129	4136	frame 72 deployed on sediment
2019-03-08	21:22:56	-117.059243	11.844135	4136	frame 18 deployed on sediment
2019-03-08	21:23:42	-117.059237	11.844125	4136	frame 10 deployed on sediment
2019-03-08	21:24:37	-117.059252	11.844112	4136	frame 46 deployed on sediment
2019-03-08	21:25:17	-117.059251	11.844128	4136	frame 86 deployed on sediment
2019-03-08	21:25:56	-117.059238	11.844134	4136	frame 37 deployed on sediment
2019-03-08	21:26:37	-117.059234	11.844122	4136	frame 77 deployed on sediment
2019-03-08	21:27:20	-117.059236	11.844141	4136	frame 15 deployed on sediment
2019-03-08	21:28:00	-117.059245	11.844138	4136	frame 76 deployed on sediment
2019-03-08	21:28:52	-117.05926	11.844113	4136	frame 7 deployed on sediment
2019-03-08	21:29:49	-117.059231	11.844112	4136	frame 66 deployed on sediment
2019-03-08	21:30:49	-117.059243	11.844119	4136	frame 16 deployed on sediment
2019-03-08	21:31:51	-117.059247	11.844115	4136
2019-03-08	21:32:03	-117.05925	11.844111	4136
2019-03-08	21:32:17	-117.05925	11.844109	4136

2019-03-08	21:33:07	-117.059237	11.84411	4136
2019-03-08	21:33:40	-117.059237	11.844104	4135	ROV to Lift
2019-03-08	21:35:07	-117.059238	11.844096	4136	named the place as artificial nodules
2019-03-08	21:35:15	-117.059239	11.844092	4136	fish
2019-03-08	21:35:26	-117.059241	11.84409	4136
2019-03-08	21:35:38	-117.059245	11.844093	4136
2019-03-08	21:35:50	-117.059248	11.844098	4136
2019-03-08	21:44:40	-117.059348	11.843817	4138	putting the next 10 frames into the ROV to be deployed in the same place as the others
2019-03-08	21:51:50	-117.059336	11.84384	4137	moving to the place where the frames are
2019-03-08	21:53:50	-117.059336	11.843844	4137	went back to elevator to bring a marker with us
2019-03-08	21:56:11	-117.059246	11.844079	4136

2019-03-08	21:57:32	-117.059221	11.844104	4136
2019-03-08	21:58:24	-117.059231	11.844123	4136	frame 53 deployed
2019-03-08	21:59:04	-117.05923	11.844114	4136	frame 9 deployed
2019-03-08	22:00:02	-117.059262	11.844085	4136	frame 64 deployed
2019-03-08	22:01:18	-117.059268	11.844059	4136	frame 63 deployed
2019-03-08	22:02:01	-117.059243	11.844079	4136	frame 90 deployed
2019-03-08	22:03:01	-117.059241	11.844102	4136	frame 45 deployed
2019-03-08	22:03:53	-117.059264	11.844084	4136	frame 23 deployed
2019-03-08	22:04:41	-117.059271	11.84409	4136	frame 24 deployed
2019-03-08	22:05:18	-117.059245	11.844105	4136	frame 38 deployed
2019-03-08	22:05:54	-117.059254	11.844095	4136	frame 82 deployed
2019-03-08	22:06:34	-117.059263	11.844086	4136	frame 78 deployed
2019-03-08	22:07:05	-117.059261	11.84409	4136	frame 8 deployed
2019-03-08	22:07:46	-117.059273	11.844094	4136	frame 59 deployed
2019-03-08	22:08:37	-117.059285	11.844089	4136
2019-03-08	22:08:46	-117.059283	11.844092	4136
2019-03-08	22:08:58	-117.05928	11.844094	4136

2019-03-08	22:09:06	-117.059279	11.844095	4136
2019-03-08	22:09:29	-117.059278	11.844092	4136
2019-03-08	22:10:26	-117.059274	11.844074	4135
2019-03-08	22:10:45	-117.05928	11.844067	4135
2019-03-08	22:16:08	-117.0593	11.843921	4136	ROV to Lift
2019-03-08	22:22:29	-117.059348	11.843786	4138	holding nodules big frames into elevator
2019-03-08	22:26:17	-117.059341	11.843826	4138	securing empty cage of frames with rope
2019-03-08	22:31:48	-117.059344	11.843791	4138	cage secured
2019-03-08	22:33:50	-117.059318	11.843826	4137	plan to move to MICP-deep to check whether it is finished
2019-03-08	22:34:10	-117.05928	11.843812	4137	shrimp
2019-03-08	22:34:44	-117.05924	11.843814	4136	move to micp-deep
2019-03-08	22:35:59	-117.059218	11.843849	4136	MICP-DEEP
2019-03-08	22:36:07	-117.059217	11.843849	4136	MIC2-deep not finished
2019-03-08	22:37:21	-117.059104	11.843923	4136	now moving to MICP2 to try and start it
2019-03-08	22:37:37	-117.05907	11.84396	4135	MICP-DEEP
2019-03-08	22:38:12	-117.059012	11.844025	4135	mic2-deep all 8 sensors were inside the sediment
2019-03-08	22:42:48	-117.058762	11.844087	4135	taking metal handle
2019-03-08	22:42:49	-117.058762	11.844087	4135	MICP
2019-03-08	22:43:48	-117.058795	11.844134	4135	MICP2 was released but motor did not start
2019-03-08	22:44:36	-117.058833	11.844144	4135	MICP2 did not start
2019-03-08	22:45:25	-117.058794	11.844149	4135	MICP2 left
2019-03-08	22:46:26	-117.0588	11.844124	4135	now planning to move to MICP1
2019-03-08	22:52:51	-117.058461	11.844437	4133	MICP
2019-03-08	22:53:11	-117.058451	11.844451	4133	MICP1 in sight: Flashing, so should be finished

2019-03-08	22:54:18	-117.058403	11.844476	4133
2019-03-08	22:55:36	-117.058381	11.844524	4133
2019-03-08	22:56:17	-117.058387	11.844518	4133
2019-03-08	22:56:54	-117.058375	11.844534	4133	MICP1 finished, part of the sensors ok, move it a few meters
2019-03-08	22:59:05	-117.058392	11.844539	4133	Gear TakenUp
2019-03-08	22:59:21	-117.058377	11.844543	4133	MICP1 taken up
2019-03-08	22:59:53	-117.058364	11.844545	4133	planning to look for a spot with few nodules
2019-03-08	23:00:45	-117.058339	11.844553	4133	looking for a spot with few nodules
2019-03-08	23:03:25	-117.058327	11.844556	4133
2019-03-08	23:04:18	-117.058338	11.844556	4133	Gear Deployed
2019-03-08	23:05:54	-117.058355	11.844553	4133
2019-03-08	23:09:04	-117.058358	11.844544	4133	taking metal handle
2019-03-08	23:09:54	-117.058346	11.844534	4133	MICP

2019-03-08	23:10:57	-117.058338	11.844557	4133	MICP1 operqted
2019-03-08	23:10:59	-117.058338	11.844559	4133	Gear Operated
2019-03-08	23:13:31	-117.058401	11.844576	4132	planning to move back to the elevator to check whether MICP-DEEP finished. Oil levels may be low
2019-03-08	23:16:15	-117.058619	11.844384	4133	also planning to pick up non-functioning MICP2 and place it back on the elevator
2019-03-08	23:17:12	-117.058759	11.844249	4133	fish
2019-03-08	23:19:11	-117.05874	11.84416	4134	MICP
2019-03-08	23:19:21	-117.058744	11.844161	4134	MICP2 in sight
2019-03-08	23:21:22	-117.058775	11.844158	4135	Gear TakenUp
2019-03-08	23:21:33	-117.058771	11.84416	4135	MICP2 taken up
2019-03-08	23:26:20	-117.059126	11.843988	4135	sponge on stalk
2019-03-08	23:26:51	-117.05921	11.843969	4136	moving ROV while holding MICP2
2019-03-08	23:27:09	-117.059252	11.843945	4136	ROV to Lift
2019-03-08	23:27:13	-117.059258	11.84394	4136	elevator in sight
2019-03-08	23:30:27	-117.059354	11.843878	4137	MICP2 placed near the elvator, so can be found back easily
2019-03-08	23:32:07	-117.059407	11.843915	4137	moving to take pushcores
2019-03-08	23:34:04	-117.059373	11.843909	4138	planning to take 3 pucs for Massi (MPI)
2019-03-08	23:34:47	-117.059378	11.843919	4138	PUC
2019-03-08	23:35:40	-117.059379	11.843924	4138	PUC23 put in
2019-03-08	23:35:56	-117.059374	11.843924	4138	PUC
2019-03-08	23:36:33	-117.05937	11.843928	4138	PUC45 put in
2019-03-08	23:37:02	-117.05938	11.843918	4138	PUC
2019-03-08	23:38:20	-117.059377	11.843926	4138	PUC3 put in, verz disturbed
2019-03-08	23:38:40	-117.059376	11.843922	4138	fish
2019-03-08	23:38:53	-117.059372	11.84392	4138	PUC
2019-03-08	23:39:35	-117.05938	11.843918	4138	PUC25 put in
2019-03-08	23:40:35	-117.059394	11.843891	4138
2019-03-08	23:41:31	-117.059378	11.843904	4138	PUC3 taken out, in drawer
2019-03-08	23:42:08	-117.05939	11.843919	4138	PUC45 taken out
2019-03-08	23:42:36	-117.059409	11.843936	4138	PUC45 in drawer
2019-03-08	23:45:40	-117.059401	11.843896	4138	PUC
2019-03-08	23:45:50	-117.059403	11.843897	4138	PUC25 in drawer
2019-03-08	23:46:39	-117.059447	11.843977	4138	missed taking out PUC23 because discussing about next actions
2019-03-08	23:48:53	-117.059402	11.843936	4138	now planning to move to location 75 m away to collect 3 PUCs for Massi (in the direction of the MUC location, 150 m NW off elevator)
2019-03-08	23:51:12	-117.059456	11.844048	4137	
2019-03-08	23:55:14	-117.0597	11.844334	4138	PUC location reached
2019-03-08	23:55:54	-117.059706	11.844358	4139	PUC
2019-03-08	23:56:42	-117.059717	11.844355	4139	PUC9 in sediment
2019-03-08	23:57:19	-117.059735	11.84437	4139	PUC
2019-03-08	23:57:48	-117.05974	11.844381	4139	PUC13 in sediment
2019-03-08	23:58:11	-117.059727	11.844351	4138	PUC
2019-03-08	23:58:57	-117.059726	11.84434	4138	PUC48 in sediment

2019-03-08	23:59:28	-117.059741	11.844345	4138
2019-03-09	00:00:02	-117.059727	11.84434	4138	PUC48 taken out
2019-03-09	00:02:00	-117.059707	11.844349	4139	PUC13 taken out
2019-03-09	00:04:13	-117.059729	11.84436	4138	PUC6 taken out (not PUC 9!!!!)
2019-03-09	00:05:49	-117.059731	11.844333	4139	oil level too low. NO more pushcoring
2019-03-09	00:06:15	-117.059755	11.844328	4138	ROV to Lift
2019-03-09	00:12:30	-117.059286	11.843987	4135	elevator in sight
2019-03-09	00:14:17	-117.059286	11.843987	4135	MICP-DEEP
2019-03-09	00:14:35	-117.059281	11.843971	4135	MICP-deep blinking, so finished its programme
2019-03-09	00:15:30	-117.059267	11.843815	4136
2019-03-09	00:16:53	-117.059224	11.843912	4137	curious fish
2019-03-09	00:18:09	-117.059193	11.843912	4137	Gear TakenUp
2019-03-09	00:18:21	-117.059192	11.843919	4137	MICP-DEEP taken up
2019-03-09	00:20:20	-117.059152	11.843928	4136	looking for relatively noudle-free spot to redeploy MICP-DEEP
2019-03-09	00:21:28	-117.059152	11.843914	4136
2019-03-09	00:25:26	-117.059198	11.843929	4137	Gear Deployed
2019-03-09	00:25:34	-117.059199	11.843931	4137	taking metal handle
2019-03-09	00:27:24	-117.05912	11.843893	4137	GEAR DEPLOYED
2019-03-09	00:29:34	-117.059153	11.843881	4137	photos from the wrong spot, other group of sensors went down into the sediment
2019-03-09	00:29:48	-117.05915	11.843878	4137
2019-03-09	00:30:30	-117.059127	11.84387	4137	Photo Taken
2019-03-09	00:30:54	-117.059143	11.843874	4137	photo taken of the real patch where the sensors are going down
2019-03-09	00:38:49	-117.05924	11.843857	4136	fish
2019-03-09	00:40:13	-117.05927	11.84384	4136	very turbid

2019-03-09	00:40:27	-117.059267	11.843844	4136	MICP
2019-03-09	00:40:37	-117.059266	11.843847	4136	MICP2 in sight
2019-03-09	00:41:24	-117.059266	11.843846	4136
2019-03-09	00:43:10	-117.059359	11.84389	4136	shrimp
2019-03-09	00:46:09	-117.059389	11.84387	4138	Gear TakenUp
2019-03-09	00:46:21	-117.05939	11.843873	4138	MICP2 taken up
2019-03-09	00:47:09	-117.05938	11.843898	4138	Gear Received
2019-03-09	00:47:20	-117.059385	11.843889	4138	MICP 2 on porch of ROV
2019-03-09	00:52:12	-117.059364	11.843874	4138	end of dive
2019-03-09	00:53:56	-117.059383	11.843879	4134	OFF THE BOTTOM
2019-03-09	02:40:03	-117.05938	11.843398	-4	ON DECK

Kiel 6000 Dive 07 (SO268-1_040_ROV_07)

Date: 09/03/2019

Observers: AMARO Teresa, BODUR Yasemin, CHRISTODOULOU Magdalini, HILARIO Ana, JANSEN Felix, MARTINEZ ARBIZU Pedro, STRATMANN Tanya

ROV positions (at the bottom)

Start of dive: 11°50.649'N 117°03.5230'W

End of dive: 11°50.680'N 117°03.459'W

Dive duration:

ROV in the water: 09/03/2019 15:53:26

ROV at the bottom: 09/03/2019 17:36:58

ROV off the bottom: 09/03/2019 23:25:40

ROV on deck: 10/03/2019 01:08:27

Explored sites: BE impact area

Aims of the Dive:

- Reposition and restarting 1 electrochemical profiler (MICP) at the plume impact area
- Fauna sampling (mainly ophiuroids, sponges, holothurians)
- Recollection of gear already deployed in previous dives (2 benthic chamber modules, 2 profilers, 1 time lapse camera)
- Safeguard Elevator 2 release

Handled ROV Tools (including scientific payload):

- Senckenberg biobox (COLBOX-SGN)
- 9 compartment biobox (COLBOX-BIO)
- 16 pushcores (PUC)
- slurp gun (SLURP)
- 3 hand nets (NET)
- scoop (SCOOP)
- magnet T-Handle

Relevant Elevator payload

Elevator 1

- No Payload (Elevator 1 was not deployed during this dive)

Elevator 2

- 1 time lapse camera (PV-PICAM)
- 1 electrochemical profiler (MICP 1)
- 1 fiberoptical profiler (MICP-DEEP 1)

- 2 empty trays for nodule frames (ARTSUBS)
- trap set (2 amphipod traps, 1 ostracod trap)

Dive summary (protocol by Magdalini Christodoulou)

The seventh dive took place in the BE impact area and its aims were: to reposition and restart 2 Profilers; to collect faunal specimens; to collect pushcores at different locations; recollect the deployed devices (2 benthic chamber modules, 2 profilers, 1 time lapse camera), and finally to safeguard the Elevator 2 release. Shortly after the ROV reached the bottom of the sea (17:36:58), it located the fiberoptical profiler (MICP-DEEP) and restarted it. The ROV then headed NE (for about 140m) towards the location of the electrochemical profiler (MICP 1) in order to reposition it to another poor nodule site and restart it. After the reposition was completed the ROV headed towards the sampling position MUC7 (11°50.695N, 117°03.612W) in order for the pushcore (PUC) sampling to take place. In the meantime between the position of the electrochemical profiler (MICP 1) and the MUC7 position the faunal observations and sampling took place. In total 4 Holothuroidea, 2 Porifera, 7 Ophiuroidea and 1 Alcyonacea were collected, either by using the ROV arm or the hand net, and placed within the Senckenberg biobox (COLBOX-SGN), while their photos were taken before being collected. Furthermore, Foraminifera, Dendrobranchiata (shrimps), Pisces (fish), Actiniaria (anemones), Crinoidea (sea lilies) as well as more Holothuroidea, Porifera, Alcyonacea and Ophiuroidea were observed. Once the ROV reached the MUC7 position 13 pushcores (No.3, No.7-8, No.12-13, No. 17, No. 20, No. 24-25, No. 43, No.48, No. 54) were sampled. Another two pushcores (No. 23, N. 45) were taken in a nearby site where a different coloration on the sediment was observed ("white"). After the pushcoring sampling in MUC7 position was completed the faunal sampling restarted, collecting one more Holothuroidea and taking one last pushcore (No. 6) in the site the Holothuroidea was found. The ROV then headed towards the position of the first benthic chamber module in order to be collected and placed on the elevator. On the way old EBS tracks from a previous research cruise were observed. After the first benthic chamber module was placed on the ROV porch, the ROV headed towards the direction of the Elevator 2. The benthic chamber module was then placed on the elevator together with the second benthic chamber module that was originally deployed in the elevator's proximity. Finally, the two profilers and the time lapse camera were placed also on the elevator in order to be brought in the surface. The acoustic release of the elevator was then triggered which was not working thus the ROV facilitated the release of the elevator. After the Elevator was released and in a safe distance from the ROV the ROV started its ascent.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-03-09	15:55:35	-117.060416	11.843427	18	IN THE WATER
2019-03-09	17:37:45	-117.058997	11.844129	4129	AT THE BOTTOM
2019-03-09	17:43:53	-117.059178	11.843957	4136	MICP-DEEP spotted
2019-03-09	17:44:36	-117.059175	11.843946	4136	BFC-ROV
2019-03-09	17:44:42	-117.059175	11.843946	4136	2 blinking
2019-03-09	17:44:45	-117.059175	11.843946	4136	MICP-DEEP
2019-03-09	17:44:48	-117.059175	11.843946	4136	blinking

2019-03-09	17:45:13	-117.059194	11.843981	4136	MICP-DEEP will be restarted
2019-03-09	17:47:38	-117.059068	11.843941	4137	MICP
2019-03-09	17:47:42	-117.059067	11.843947	4137	delete
2019-03-09	17:47:43	-117.059066	11.843948	4137	MICP-DEEP
2019-03-09	17:47:48	-117.059066	11.843954	4137	stage 2 started profile
2019-03-09	17:49:40	-117.059166	11.843956	4137	heading towards
2019-03-09	17:49:42	-117.059167	11.843957	4137	MICP
2019-03-09	17:49:46	-117.05917	11.843959	4137	1 and
2019-03-09	17:49:48	-117.059171	11.843959	4137	BFC-ROV
2019-03-09	17:49:51	-117.059173	11.843961	4137	1
2019-03-09	17:54:51	-117.058379	11.844579	4133	MICP
2019-03-09	17:54:55	-117.058379	11.844579	4133	1 blinking
2019-03-09	17:56:28	-117.058362	11.844579	4133	some sensors of
2019-03-09	17:56:30	-117.058361	11.844578	4133	MICP
2019-03-09	17:56:36	-117.058361	11.844576	4133	1 killed
2019-03-09	17:57:03	-117.05837	11.844578	4133
2019-03-09	17:57:54	-117.05837	11.844624	4134	Decapoda
2019-03-09	17:58:08	-117.058387	11.844607	4134
2019-03-09	17:59:37	-117.05837	11.844616	4134	MICP
2019-03-09	17:59:41	-117.05837	11.844623	4133	1 lifted
2019-03-09	18:02:04	-117.058256	11.844678	4133	looking for a nodule free spot to deploy
2019-03-09	18:02:05	-117.058256	11.844676	4133	MICP
2019-03-09	18:04:27	-117.058251	11.844646	4134
2019-03-09	18:04:40	-117.05825	11.844639	4134
2019-03-09	18:05:02	-117.058247	11.844632	4134	second photo with lazer point on the planned deployment position

2019-03-09	18:07:06	-117.058235	11.844636	4134	Gear Deployed
2019-03-09	18:07:15	-117.058234	11.844647	4134	MICP
2019-03-09	18:08:18	-117.058247	11.84467	4134
2019-03-09	18:08:43	-117.058242	11.844682	4134
2019-03-09	18:10:48	-117.058297	11.844667	4134	MICP
2019-03-09	18:10:57	-117.058302	11.844668	4134	switched on
2019-03-09	18:11:03	-117.058304	11.84467	4134	MICP1-2 started
2019-03-09	18:12:42	-117.058272	11.844641	4134	MICP1-3 started
2019-03-09	18:14:21	-117.058253	11.84465	4128	heading towards Northeast
2019-03-09	18:16:24	-117.058568	11.844617	4133	heading towards west (towards MUC position)
2019-03-09	18:21:14	-117.058563	11.844626	4134	sample 3 ophiuroids
2019-03-09	18:21:23	-117.058556	11.844622	4134
2019-03-09	18:23:57	-117.058551	11.844695	4134	ophiuroid1
2019-03-09	18:25:38	-117.058549	11.84464	4134
2019-03-09	18:26:19	-117.05854	11.844613	4134
2019-03-09	18:28:08	-117.058606	11.844741	4134	ophiuroid2

2019-03-09	18:31:20	-117.058653	11.844678	4135	ophiuroid3
2019-03-09	18:32:20	-117.058653	11.844678	4135	going to MUC7
2019-03-09	18:32:26	-117.058653	11.844678	4135	fish
2019-03-09	18:33:55	-117.058653	11.844678	4135	collecting sponge
2019-03-09	18:35:05	-117.058605	11.84467	4134
2019-03-09	18:40:29	-117.058726	11.84467	4134	collecting sponge2
2019-03-09	18:41:56	-117.058713	11.844671	4134
2019-03-09	18:42:08	-117.058713	11.844671	4134
2019-03-09	18:43:45	-117.05874	11.844734	4134	and ophiuroid
2019-03-09	18:47:54	-117.058829	11.844722	4134
2019-03-09	18:48:15	-117.058829	11.844722	4134

2019-03-09	18:48:32	-117.058829	11.844722	4134
2019-03-09	18:49:12	-117.058829	11.844722	4134	sample 2 holothurians
2019-03-09	19:03:00	-117.058835	11.844701	4134	sample ophiuroid
2019-03-09	19:08:30	-117.058928	11.844686	4134
2019-03-09	19:08:44	-117.058916	11.84472	4134
2019-03-09	19:14:24	-117.058965	11.844707	4135	sample holothurian
2019-03-09	19:14:29	-117.058964	11.844705	4135	and ophiuroid
2019-03-09	19:15:32	-117.059039	11.84469	4135
2019-03-09	19:20:13	-117.058998	11.844636	4134	going to MUC7
2019-03-09	19:26:59	-117.059604	11.844639	4137
2019-03-09	19:28:44	-117.05959	11.844579	4137	sample holothuria

2019-03-09	19:38:56	-117.06027	11.844772	4139
2019-03-09	19:43:15	-117.060299	11.844758	4139
2019-03-09	19:44:32	-117.060245	11.844713	4139	PUCs	
2019-03-09	19:46:46	-117.060286	11.844706	4140
2019-03-09	19:46:59	-117.060286	11.844702	4140
2019-03-09	19:48:53	-117.060255	11.844688	4140	PUC1 nr8	
2019-03-09	19:50:21	-117.060235	11.844759	4140	PUC2 nr48	
2019-03-09	19:51:02	-117.060242	11.844777	4140	PUC3 nr13	
2019-03-09	19:53:44	-117.060179	11.844725	4140	PUC4 nr7	
2019-03-09	19:54:08	-117.060169	11.844689	4140
2019-03-09	19:55:43	-117.060252	11.84475	4140	PUC5 nr3	
2019-03-09	19:56:51	-117.060279	11.844732	4140	PUC5 nr20	
2019-03-09	19:58:28	-117.060243	11.84469	4140	PUC6 nr17	
2019-03-09	20:00:19	-117.060213	11.844792	4140	PUC7 nr24	
2019-03-09	20:01:57	-117.060202	11.844898	4140	PUC8 nr12	
2019-03-09	20:03:14	-117.060219	11.844765	4140	PUC9 nr3	

2019-03-09	20:05:18	-117.060264	11.844718	4140	PUC10 nr43
2019-03-09	20:06:53	-117.060286	11.844714	4140	PUC11 nr54
2019-03-09	20:08:55	-117.060297	11.844632	4140	PUC12 nr?
2019-03-09	20:09:17	-117.060297	11.844632	4140
2019-03-09	20:10:08	-117.060297	11.844632	4140	Last PUC was nr 13
2019-03-09	20:10:27	-117.060368	11.844748	4140
2019-03-09	20:11:43	-117.060361	11.844748	4140	PUC13 nr65
2019-03-09	20:11:56	-117.060319	11.844746	4140	Put all the 13 PUC into ROV rag
2019-03-09	20:32:34	-117.06027	11.844705	4140	Finish action
2019-03-09	20:38:32	-117.060272	11.84471	4140	white spots sampled with PUC
2019-03-09	20:39:39	-117.060233	11.844681	4139
2019-03-09	20:41:32	-117.06029	11.844812	4140
2019-03-09	20:45:38	-117.060257	11.844823	4140	PUC white spot nr23
2019-03-09	20:48:37	-117.060237	11.84468	4140	PUC white spot nr45
2019-03-09	20:48:57	-117.060204	11.844681	4140
2019-03-09	20:49:24	-117.060162	11.844682	4140	Putting both PUCs into the ROVs rag

2019-03-09	20:54:08	-117.060241	11.844711	4140	going to where 2 holothurians were and take 1 PUC and the holos
2019-03-09	20:54:56	-117.060217	11.844736	4140
2019-03-09	20:55:19	-117.06021	11.844717	4140
2019-03-09	21:09:36	-117.060229	11.844763	4140
2019-03-09	21:11:48	-117.06025	11.84472	4140	holothurian taken up with arm
2019-03-09	21:12:52	-117.060274	11.844716	4140	holothurian in biobox
2019-03-09	21:14:36	-117.060233	11.844716	4140	PUC 6 taken
2019-03-09	21:14:58	-117.060236	11.844719	4140	PUC 6 placed at seafloor
2019-03-09	21:15:21	-117.060239	11.844728	4140
2019-03-09	21:16:03	-117.060232	11.844749	4140	PUC 6 retrieved from sediment
2019-03-09	21:16:24	-117.060229	11.844746	4140	PUC 6 back in elevator rack
2019-03-09	21:32:30	-117.059882	11.844714	4137	ipnops
2019-03-09	21:33:23	-117.059667	11.844689	4135	shrimp
2019-03-09	21:43:05	-117.058507	11.84463	4133	BFC-ROV
2019-03-09	21:43:20	-117.058507	11.84463	4133	#1
2019-03-09	21:43:21	-117.058507	11.84463	4133	Gear Received
2019-03-09	21:43:27	-117.058507	11.84463	4133	Gear TakenUp
2019-03-09	21:43:45	-117.058518	11.844625	4133	taken on porch
2019-03-09	21:44:16	-117.058518	11.844625	4133	next step: moving to
2019-03-09	21:44:17	-117.058518	11.844625	4133	MICP
2019-03-09	21:44:24	-117.058518	11.844625	4133	#1
2019-03-09	21:44:37	-117.058434	11.844663	4133	BFC-ROV
2019-03-09	21:44:46	-117.058354	11.844699	4133	#1 on porch
2019-03-09	21:46:27	-117.058286	11.844712	4133	MICP
2019-03-09	21:46:50	-117.05826	11.84476	4133	#1 is blinking, profile finished

2019-03-09	21:47:18	-117.058243	11.844749	4133	most sensors broken
2019-03-09	21:48:52	-117.058365	11.844804	4133	MICP
2019-03-09	21:48:57	-117.058354	11.844786	4133	#2
2019-03-09	21:49:02	-117.058345	11.84477	4133	Gear TakenUp
2019-03-09	21:49:51	-117.058253	11.844613	4133	MICP
2019-03-09	21:50:53	-117.058222	11.844616	4133	#2 kept in locked manipulator while flying back to elevator 2
2019-03-09	21:56:28	-117.059383	11.843943	4136	arrivin at elevator 2
2019-03-09	22:01:25	-117.059436	11.843847	4137	MICP 1 and BFC-ROV 1 are placed on the seafloor near the elevator for the moment as visibility is very low
2019-03-09	22:04:20	-117.059435	11.84393	4137	plans changed: MICP 1 poitioned directly on the side of the elevator payload section
2019-03-09	22:06:54	-117.059392	11.843976	4137	BFC-ROV
2019-03-09	22:07:16	-117.059357	11.843998	4137	#1 positioned on the left side of the elevators payload section
2019-03-09	22:09:07	-117.059343	11.843896	4137	leaving elevator direction NE to pick up
2019-03-09	22:09:09	-117.059344	11.843898	4137	MICP-DEEP
2019-03-09	22:09:16	-117.059346	11.843909	4137	#1
2019-03-09	22:14:21	-117.059245	11.84393	4136	MICP-DEEP
2019-03-09	22:14:29	-117.05924	11.843933	4136	#2
2019-03-09	22:14:30	-117.05924	11.843934	4136	Gear TakenUp
2019-03-09	22:14:40	-117.059235	11.843935	4136	returning to elevator 2 to put
2019-03-09	22:14:42	-117.059235	11.843936	4136	MICP-DEEP
2019-03-09	22:15:01	-117.059252	11.843938	4135	#2 in the middle of the payload section
2019-03-09	22:16:09	-117.059328	11.843898	4136	arriving at elevator
2019-03-09	22:18:13	-117.059489	11.844554	4137	MICP-DEEP
2019-03-09	22:18:32	-117.059503	11.844558	4137	#2 positioned on payload section
2019-03-09	22:19:06	-117.059416	11.844128	4137	fasten
2019-03-09	22:19:07	-117.059413	11.844115	4137	MICP-DEEP
2019-03-09	22:19:09	-117.059407	11.844087	4137	MICP-DEEP
2019-03-09	22:19:25	-117.05936	11.843923	4137	#2 with rubber straps
2019-03-09	22:22:57	-117.059541	11.843997	4138	MICP-DEEP
2019-03-09	22:23:05	-117.059573	11.844018	4138	#1 fastened
2019-03-09	22:36:47	-117.058602	11.844107	4134	searching for
2019-03-09	22:36:52	-117.058598	11.844114	4134	PV-PICAM
2019-03-09	22:36:58	-117.058593	11.844123	4134	#13
2019-03-09	22:38:12	-117.058636	11.844398	4133	posidonia positioning very unstable
2019-03-09	22:41:47	-117.058348	11.844324	4134	PV-PICAM
2019-03-09	22:41:57	-117.058348	11.844324	4134	#13 in view
2019-03-09	22:42:23	-117.058348	11.844324	4134	sampling target community
2019-03-09	22:42:25	-117.058348	11.844324	4134	PV-PICAM
2019-03-09	22:42:33	-117.058348	11.844324	4134	looks at
2019-03-09	22:43:34	-117.058269	11.844288	4135	RON at bottom
2019-03-09	22:44:24	-117.058339	11.844274	4135	that was observed yesterday is no longer there
2019-03-09	22:46:32	-117.058279	11.844349	4135	failed to sample sponge.
2019-03-09	22:47:08	-117.058389	11.844351	4134	ophiroid observed near to the camera - possibly the one that was originally part of the community
2019-03-09	22:51:37	-117.059156	11.843823	4136	arrived at
2019-03-09	22:51:50	-117.059199	11.843828	4137	BFC-ROV
2019-03-09	22:51:56	-117.059211	11.843834	4137	#2
2019-03-09	22:52:04	-117.059223	11.843841	4137	Gear TakenUp
2019-03-09	22:52:56	-117.05923	11.843862	4136	BFC-ROV
2019-03-09	22:53:07	-117.059237	11.843864	4136	#2 still blinking
2019-03-09	22:53:58	-117.059391	11.843899	4136	positioned on porch
2019-03-09	22:54:46	-117.059408	11.843923	4136	arrived at elevator#2
2019-03-09	22:55:22	-117.059343	11.843858	4137	nest task is to release the leading buoy of the elevator by ROV
2019-03-09	23:02:14	-117.059374	11.843664	4135	waiting for the elevator to be released from deck while monitoring it from safe distance
2019-03-09	23:02:29	-117.059374	11.843664	4135	release trials fail
2019-03-09	23:02:41	-117.059374	11.843664	4135	so far
2019-03-09	23:02:48	-117.059374	11.843664	4135	no movement of elevator
2019-03-09	23:03:54	-117.059374	11.843664	4135	very turbid waters. hard to see the elevator any more
2019-03-09	23:06:14	-117.059072	11.844033	4135	leading buoy line visible sometimes. No changes in homer beacon distance

2019-03-09	23:07:13	-117.059072	11.844033	4135	task is not to release elevator by ROV
2019-03-09	23:07:27	-117.059072	11.844033	4135	ROV approaching elevator
2019-03-09	23:08:23	-117.059072	11.844033	4135	very turbid
2019-03-09	23:09:23	-117.059072	11.844033	4135	in view of elevator
2019-03-09	23:10:06	-117.059072	11.844033	4135	grabbed manual releasers ape fist
2019-03-09	23:10:25	-117.059072	11.844033	4135	moving up and backwards
2019-03-09	23:10:45	-117.059072	11.844033	4135	pulling rope
2019-03-09	23:11:17	-117.059072	11.844033	4135	no release
2019-03-09	23:13:18	-117.059254	11.844008	4136	trying from a lower position with a flatter angle
2019-03-09	23:22:20	-117.059404	11.843901	4138	MICP-DEEP
2019-03-09	23:22:26	-117.059404	11.843901	4138	removed from elevator payload section
2019-03-09	23:22:49	-117.059404	11.843901	4138	added on top of camera to the left side of the porch
2019-03-09	23:23:07	-117.059404	11.843901	4138	pulling release string horizontally
2019-03-09	23:24:11	-117.059404	11.843901	4138	elevator released and on its way to the surface
2019-03-09	23:25:18	-117.059404	11.843901	4138	OFF THE BOTTOM
2019-03-10	01:11:59	-117.058885	11.843766	10	ON DECK

Kiel 6000 Dive 08 (SO268-1_057_ROV08)

Date: [15/03/2019]

Observers: JANSEEN, Felix; BODUR, Yasemin; AMARO, Teresa; CHRISTODOULOU, Magdalini

ROV positions (at the bottom)

Start of dive: [14°06.77622'N 125°52.24884'W]

End of dive: [14°06.4562'N 125°51.8742'W]

Dive duration:

ROV in the water: [15/03/2019 15:05:32]

ROV at the bottom: [15/03/2019 16:56:14]

ROV off the bottom: [16/03/2019 00:53:42]

ROV on deck: [16/03/2019 02:44:46]

Explored sites: [BE impact area]

Aims of the Dive:

- Positioning of the 3 profilers and 2 chambers
- Positioning of 2 time-lapse cameras
- Push core sampling
- Start a short-term experiment
- Reposition of 3 profilers

Handled ROV Tools (including scientific payload):

- Senckenberg biobox, slurp gun, hand nets, magnet T-handle, optical modem, 1 chamber on porch ('BFC-ROV 2')

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- 2 PUC sixpacks,
- 2 microprofiler ('MICP 1 & 2'),
- 2 time-lapse cameras ('PV-PICAM 13 & 14')

Elevator 2

- 6 corrals,
- 1 microprofiler ('MICP-DEEP 1'),
- 1 chamber ('BFC-ROV 1')

Dive summary (Teresa Amaro)

The first part of the dive was dedicated to look for elevator 1, which fell down in free fall. As we were not able to communicate with it, we did not find its location and decided to go on with the plan of the dive.

We went to elevator 2 and deployed 1 profiler (MIC-DEEP 1) and 1 chamber (BFC-ROV1) at 20-30 m distance from the elevator. Upon positioning and start BFC-ROV1 in the collector site, we also took 4 push cores in the neighboring area.

The following hours were dedicated to start a short-term experiment with the objective to assess the transfer of matter and energy in the benthic food web by taxa of all size classes but with special emphasis on surface deposit-feeders that are expected to be particularly affected by sediment blanketing and suspended matter loads. We successfully deployed 4 corrals on top of an holothurian each where labeled particulate organic material (^{13}C 'POM') was added to the enclosures.

At the end of the dive we headed SE following the planned MUC line where we took 2 sets of pushcores (4 PUCs and then 2 PUCs).

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations /Comments /Image
2019-03-15	14:20:30	-125.871873	14.112778	51	test
2019-03-15	15:05:29	-125.871873	14.112778	51
2019-03-15	16:56:12	-125.870462	14.112523	4503	AT THE BOTTOM
2019-03-15	17:11:46	-125.87067	14.11288	4504	trying to get homer navigation to work
2019-03-15	17:14:29	-125.870764	14.112935	4504	flying to exact waypoint position to deploy BFC-ROV 2
2019-03-15	17:15:00	-125.87081	14.112944	4504
2019-03-15	17:15:10	-125.870819	14.112943	4504	holothurian
2019-03-15	17:18:16	-125.870859	14.113023	4506	selecting nodule-poor spot
2019-03-15	17:18:45	-125.870863	14.113053	4506
2019-03-15	17:18:56	-125.870866	14.11306	4506	selected spot
2019-03-15	17:20:37	-125.870856	14.113033	4506	Gear Received
2019-03-15	17:20:51	-125.870857	14.113037	4506	BFC-ROV 1
2019-03-15	17:22:50	-125.870828	14.113028	4507	BFC-ROV

2019-03-15	17:26:06	-125.870861	14.113054	4506	BFC-2
2019-03-15	17:26:08	-125.870861	14.113054	4506	Gear Deployed
2019-03-15	17:27:25	-125.870868	14.11303	4507	area is covered very densely by large nodules; BFC-ROV2 was not set on a nodule-free spot
2019-03-15	17:29:01	-125.870858	14.113043	4507	BFC-ROV 2-1 started
2019-03-15	17:31:54	-125.870853	14.113041	4507
2019-03-15	17:33:36	-125.870805	14.113009	4507	Garbage
2019-03-15	17:33:36	-125.870805	14.113009	4507	Garbage
2019-03-15	17:33:47	-125.870806	14.113008	4507
2019-03-15	17:34:31	-125.870829	14.113008	4507	sediment right on the white ring of the chamber
2019-03-15	17:38:26	-125.870859	14.113036	4507	PUC 41
2019-03-15	17:39:27	-125.87084	14.113039	4507	PUC 31
2019-03-15	17:40:26	-125.870844	14.113025	4507	PUC 3
2019-03-15	17:41:49	-125.870846	14.113044	4507	PUC 57
2019-03-15	17:43:18	-125.87084	14.113033	4507
2019-03-15	17:43:56	-125.870842	14.113033	4507	PUC57 Gear Received
2019-03-15	17:44:08	-125.870845	14.113033	4507	PUC 31 Gear Received
2019-03-15	17:45:20	-125.870849	14.113038	4507	PUC 3 Gear Received
2019-03-15	17:46:07	-125.870867	14.113026	4507	PUC 41 Gear Received
2019-03-15	17:48:15	-125.870855	14.113039	4507
2019-03-15	17:49:09	-125.870846	14.113043	4507	Garbage
2019-03-15	17:49:09	-125.870846	14.113043	4507	Garbage
2019-03-15	17:57:43	-125.870261	14.112942	4506	ROV to Lift
2019-03-15	17:57:48	-125.870261	14.112942	4506	Elevator 2
2019-03-15	18:00:12	-125.87018	14.112742	4506	ELV2 is south to USBL position

2019-03-15	18:00:38	-125.87019	14.112732	4506	VERY HUGE
2019-03-15	18:01:00	-125.87019	14.112732	4506	loads of huge mounts
2019-03-15	18:02:04	-125.870247	14.112341	4504	apart from that not much going on here
2019-03-15	18:02:11	-125.870247	14.112341	4504	ELV2 in sight
2019-03-15	18:04:00	-125.870228	14.112218	4504
2019-03-15	18:05:28	-125.870265	14.112123	4504	all boxes there on ELV2
2019-03-15	18:08:27	-125.870321	14.112107	4505	BFC-ROV
2019-03-15	18:08:31	-125.870321	14.112107	4505	1
2019-03-15	18:08:33	-125.870322	14.112106	4505	syringe is at 50ml
2019-03-15	18:09:20	-125.870287	14.112116	4505	BFC-ROV
2019-03-15	18:09:23	-125.870284	14.112118	4505	1
2019-03-15	18:09:29	-125.870279	14.11212	4505	straps released
2019-03-15	18:10:44	-125.87026	14.112127	4505	Gear Received
2019-03-15	18:11:24	-125.870274	14.112121	4504	BFC-ROV
2019-03-15	18:11:33	-125.870273	14.112121	4504	1
2019-03-15	18:11:34	-125.870272	14.112121	4504	not blinking
2019-03-15	18:14:56	-125.870238	14.112055	4504
2019-03-15	18:15:10	-125.870235	14.112053	4504
2019-03-15	18:17:30	-125.870202	14.112077	4505	Gear Deployed
2019-03-15	18:18:51	-125.870205	14.112084	4505
2019-03-15	18:21:31	-125.870204	14.112061	4505	BFC-ROV
2019-03-15	18:21:35	-125.870206	14.112061	4505	1
2019-03-15	18:22:00	-125.870208	14.112066	4505	turned on; but since nothing is blinking it's not sure if it has started
2019-03-15	18:27:52	-125.870202	14.112118	4505	BFC-ROV
2019-03-15	18:27:56	-125.870196	14.112113	4505	1

2019-03-15	18:28:03	-125.870186	14.112105	4505	south of
2019-03-15	18:28:09	-125.870178	14.112096	4505	elevator 2
2019-03-15	18:31:01	-125.870274	14.112081	4505	fish
2019-03-15	18:31:02	-125.870274	14.112083	4505	ROV to Lift
2019-03-15	18:32:25	-125.87029	14.11213	4505	straps of
2019-03-15	18:32:34	-125.870293	14.112133	4505	MICP-DEEP
2019-03-15	18:32:38	-125.870294	14.112134	4505	released
2019-03-15	18:33:11	-125.870305	14.112146	4505	Gear Received
2019-03-15	18:33:18	-125.870306	14.112147	4505	MICP-DEEP
2019-03-15	18:37:42	-125.870184	14.112073	4505
2019-03-15	18:40:50	-125.870186	14.112047	4505
2019-03-15	18:41:40	-125.870175	14.112068	4505
2019-03-15	18:41:41	-125.870174	14.112069	4505	Gear Deployed
2019-03-15	18:41:44	-125.870174	14.112069	4505	MICP-DEEP
2019-03-15	18:41:53	-125.870174	14.11207	4505	MICP-DEEP
2019-03-15	18:42:02	-125.870177	14.112069	4505	blinking
2019-03-15	18:43:49	-125.870153	14.112047	4505
2019-03-15	18:44:02	-125.870148	14.112045	4505	stage 2 of
2019-03-15	18:44:02	-125.870148	14.112045	4505	MICP-DEEP
2019-03-15	18:47:30	-125.870178	14.112083	4505	communication with
2019-03-15	18:47:32	-125.870178	14.112083	4505	MICP-DEEP
2019-03-15	18:47:48	-125.870176	14.112079	4505	was successfull (remote communication)
2019-03-15	18:49:18	-125.870156	14.112071	4505	MICP-DEEP
2019-03-15	18:49:20	-125.870156	14.112072	4505	Gear Deployed
2019-03-15	18:49:26	-125.870157	14.112073	4505	motor turning

2019-03-15	18:49:40	-125.87016	14.112075	4505	light flackering
2019-03-15	18:52:37	-125.870142	14.112056	4505	many fish around
2019-03-15	18:53:21	-125.870158	14.112061	4505	MICP-DEEP
2019-03-15	18:53:27	-125.870159	14.112061	4505	1-1 started
2019-03-15	18:54:58	-125.870155	14.112048	4504	ROV to Lift
2019-03-15	18:55:05	-125.870157	14.112049	4504	looking for lost ELV1
2019-03-15	19:16:25	-125.870213	14.112146	4505	Starting Holothuroidea experiment
2019-03-15	19:22:39	-125.870236	14.11216	4505	First corall (no.7) taken from ELV2
2019-03-15	19:24:07	-125.870225	14.112152	4505	No.7 corall on ROV
2019-03-15	19:26:20	-125.870242	14.112155	4505	Second corall taken from ELV2
2019-03-15	19:27:47	-125.870228	14.112138	4505	Secon corall on ROV
2019-03-15	19:30:10	-125.87022	14.112208	4505	First Holothuroidea sighted
2019-03-15	19:34:25	-125.8702	14.112207	4506
2019-03-15	19:34:35	-125.870199	14.112212	4506
2019-03-15	19:37:52	-125.870196	14.112217	4506	First corall placed on the sediment
2019-03-15	19:39:36	-125.870197	14.11222	4506	Second corall placed on a Holothuroidea
2019-03-15	19:39:57	-125.870209	14.112212	4506
2019-03-15	19:43:30	-125.870203	14.112234	4506	First algae bottle out of drawer
2019-03-15	19:47:55	-125.870195	14.112209	4506	Algae bottle content in the corall (part of it is spill out)
2019-03-15	19:48:05	-125.870203	14.112208	4506

2019-03-15	19:53:05	-125.870214	14.1122	4506
2019-03-15	19:59:01	-125.870223	14.112171	4506
2019-03-15	20:07:07	-125.870217	14.112252	4506	Second Holothuroidea sighted
2019-03-15	20:07:41	-125.870229	14.112266	4506
2019-03-15	20:11:41	-125.870221	14.112244	4506	Second corral placed over the Holothuroidea
2019-03-15	20:19:07	-125.870238	14.112265	4506	Second algae bottle out of the drawer
2019-03-15	20:20:13	-125.870277	14.112279	4506	Algae bottle content poured inside the coral (part of it is spilled out)
2019-03-15	20:26:09	-125.870228	14.112278	4506	Second corall no. 11
2019-03-15	20:28:35	-125.87023	14.112281	4505
2019-03-15	20:32:03	-125.870173	14.112185	4505
2019-03-15	20:34:16	-125.870199	14.112194	4506	Return to Corall no. 7 to pour another algae bottle in
2019-03-15	20:40:23	-125.870222	14.112212	4506	Third algae bottle out of the drawer
2019-03-15	20:41:03	-125.870224	14.112203	4506	Third algae bottle content poured into the corall no.7 (some was spilled out)

2019-03-15	20:41:58	-125.870219	14.112179	4506
2019-03-15	20:49:22	-125.870215	14.11217	4505	Return to ELV2 to get two more coralls
2019-03-15	20:54:01	-125.870177	14.112154	4506	Third corall (no. 6) taken from ELV2
2019-03-15	20:54:45	-125.87018	14.112174	4506	Corall no.6 placed on ROV
2019-03-15	21:03:48	-125.870187	14.112179	4506	Fourth corall (no. 10) taken from ELV2
2019-03-15	21:03:59	-125.870203	14.112174	4505	Corall no.10 on the ROV
2019-03-15	21:12:11	-125.870276	14.112258	4505	Third Holothuroidea sighted
2019-03-15	21:28:17	-125.870642	14.112769	4507
2019-03-15	21:31:56	-125.870742	14.112976	4507	Third Holothuroidea sighted
2019-03-15	21:32:58	-125.870801	14.113014	4507
2019-03-15	21:34:18	-125.870801	14.113014	4508
2019-03-15	21:37:05	-125.870815	14.113033	4508	Third corall placed above the Holothuroidea
2019-03-15	21:40:15	-125.87081	14.113004	4508	Fourth algae bottle out of the drawer
2019-03-15	21:40:30	-125.870828	14.112999	4508	Fourth algae bottle poured into the corall
2019-03-15	21:49:07	-125.870813	14.112962	4508	Corall sits on a nodule so its slightly tilted
2019-03-15	21:50:59	-125.870923	14.113051	4508

2019-03-15	21:51:13	-125.870896	14.113041	4508	Third corall= no. 10
2019-03-15	22:04:07	-125.87028	14.11266	4506	shrimp
2019-03-15	22:11:07	-125.869385	14.11229	4506	shrimp
2019-03-15	22:15:35	-125.869376	14.112175	4506	shrimp
2019-03-15	22:22:57	-125.869019	14.111834	4505	fish
2019-03-15	22:26:18	-125.868933	14.111787	4506
2019-03-15	22:27:10	-125.868902	14.111784	4506
2019-03-15	22:27:33	-125.868893	14.111774	4506
2019-03-15	22:27:42	-125.868896	14.111758	4506
2019-03-15	22:29:36	-125.868936	14.111933	4506	EXP-CORRAL
2019-03-15	22:29:48	-125.868943	14.111906	4506	Gear TakenUp
2019-03-15	22:29:59	-125.868944	14.111879	4506	corral nr 4 taken from the porch
2019-03-15	22:31:21	-125.868903	14.111733	4506	Gear Deployed
2019-03-15	22:31:58	-125.868882	14.111706	4506
2019-03-15	22:35:08	-125.8689	14.111759	4506	take algae bottle from drawer
2019-03-15	22:35:28	-125.868914	14.111757	4506	bottle taken

2019-03-15	22:36:02	-125.868922	14.111756	4506	algae bottle turned
2019-03-15	22:37:17	-125.868935	14.111752	4506	lid removed
2019-03-15	22:37:30	-125.868936	14.111754	4506	algae added to corral
2019-03-15	22:37:45	-125.868928	14.111756	4506
2019-03-15	22:40:56	-125.868913	14.111766	4506	empty bottle placed back in the drawer
2019-03-15	22:41:35	-125.868881	14.111742	4506
2019-03-15	22:43:06	-125.868876	14.111724	4506	trying to close the hole in the net, but unsuccessful
2019-03-15	22:53:55	-125.868575	14.11119	4505	had to step out. Trying to communicate with elevator. did not work
2019-03-15	23:00:56	-125.868502	14.110918	4507
2019-03-15	23:02:38	-125.868432	14.110929	4507	PUC
2019-03-15	23:03:03	-125.868432	14.110929	4507
2019-03-15	23:04:37	-125.868466	14.111006	4506	PUC81 in seabed
2019-03-15	23:06:11	-125.868498	14.111035	4507	PUC43 in seabed
2019-03-15	23:07:52	-125.868502	14.111013	4507	PUC 27 in seabed
2019-03-15	23:09:53	-125.86846	14.111016	4507	PUC16 in seabed
2019-03-15	23:10:06	-125.868463	14.110982	4507

2019-03-15	23:10:43	-125.868462	14.110949	4507	PUC16 taken out
2019-03-15	23:11:38	-125.86846	14.110987	4506	PUC27 taken out
2019-03-15	23:12:32	-125.868441	14.111001	4506	PUC81 taken out
2019-03-15	23:13:05	-125.86844	14.111014	4507	PUC43 taken out
2019-03-15	23:27:28	-125.867818	14.110567	4507
2019-03-15	23:30:22	-125.867557	14.110428	4507
2019-03-15	23:31:39	-125.867502	14.110413	4507
2019-03-15	23:37:19	-125.867347	14.110223	4507	shrimp
2019-03-15	23:43:53	-125.866964	14.10965	4509	PUC
2019-03-15	23:45:23	-125.866948	14.109672	4509
2019-03-15	23:46:03	-125.866969	14.109647	4509	PUC42 in seabed
2019-03-15	23:49:24	-125.866962	14.109653	4509
2019-03-15	23:49:25	-125.866962	14.109654	4509	Photo Taken
2019-03-15	23:50:06	-125.866974	14.109661	4509	PUC42 taken out
2019-03-15	23:52:35	-125.866935	14.109696	4509	PUC17 taken out
2019-03-16	00:08:35	-125.865773	14.108532	4509	at M_11

2019-03-16	00:10:22	-125.865724	14.108392	4510
2019-03-16	00:11:37	-125.865724	14.108392	4510	PUC38 in the seabed
2019-03-16	00:13:23	-125.865715	14.108421	4510
2019-03-16	00:14:33	-125.865697	14.108454	4510	PUC8 taken out
2019-03-16	00:15:59	-125.865707	14.108418	4510	PUC38 take out
2019-03-16	00:17:45	-125.865706	14.108414	4510	Moving towards MUC southeast
2019-03-16	00:28:53	-125.864745	14.107659	4511
2019-03-16	00:29:01	-125.864745	14.107659	4511
2019-03-16	00:34:28	-125.864524	14.107593	4513

2019-03-16	00:34:43	-125.864525	14.107601	4513
2019-03-16	00:35:48	-125.864542	14.107633	4513	PUC11 in seabed, PUC54 in seabed, PUC71 in seabed, PUC25 in seabed
2019-03-16	00:43:52	-125.864565	14.107601	4513
2019-03-16	00:44:01	-125.864565	14.107603	4513
2019-03-16	00:45:30	-125.864531	14.107623	4513	PUC25 taken out, PUC71 taken out, PUC11 taken out, PUC54 taken out
2019-03-16	00:53:38	-125.864557	14.107611	4509	OFF THE BOTTOM
2019-03-16	02:44:43	-125.8645	14.107268	14	ON DECK

Kiel 6000 Dive 09 (SO268-1_064_ROV09)

Date: [17/03/2019]

Observers: HILÁRIO, Ana, JANSEN Felix, CHRISTODOULOU, Magdalini, ESQUETE, Patricia, AMARO, Teresa, STRATMANN, Tanya, BODUR, Yasemin

ROV positions (at the bottom)

Start of dive: [14°06.683'N 125°52.647'W]

End of dive: [14°06.767'N 125°52.253'W]

Dive duration:

ROV in the water: [17/03/2019 15:27:10]

ROV at the bottom: [17/03/2019 17:04:11]

ROV off the bottom: [18/03/2019 01:20:22]

ROV on deck: [18/03/2019 03:14:52]

Explored sites: BE impact area

Aims of the Dive:

- Find elevator 1
- Collect fauna
- Deploy and recover one microsensor profiler (MICP 1) from elevator 1
- Reposition and recover microsensor profiler (MICP-DEEP)
- Release (if necessary) elevator 2

Handled ROV Tools (including scientific payload):

- Collector box (COLBOX)
- Collector box (COLBOX-BIO)
- Scoop
- 3 hand nets (NET)
- Slurp gun (SLURP)
- Magnetic T-Handle
- Microsensor profiler (MICP 1 on the ascent)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- Microsensor profiler (MICP 1)
- *Microsensor profiler (MICP 2)*
- *2 time-lapse cameras ('PV-PICAM 13 & 14')*
- *2 PUC sixpacks*

Elevator 2

- 1 Microsensor profiler (MICP-DEEP) (at the end of the dive)

- 1 Benthic flux chamber (BFC- ROV 1) (at the end of the dive)
- 1 *Benthic mesocosm experiment (CORRAL)*

Dive summary (protocol by Ana Hilario)

The first 1.5 hours of the dive were dedicated to collect fauna while searching for elevator 1. During this time one holothurian, one asteroid and one sponge (that broke during collection) were collected with the arm of the ROV into the collector box "COLBOX".

Upon finding elevator 1 (at 18:43), in a position near to the planned working area, it was decided to deploy MICP 1 (19:05). While moving toward MICP-DEEP two galatheid crabs were collected with the slurp gun and one actinarian with the arm into the collector box "COLBOX-BIO". At 19:50 the microsensor profiler MICP-DEEP was successfully repositioned and operated.

The following 4 hours were dedicated to fauna sampling near elevator 2, in an area with a radius of approximately 150 m: five anemones and two sponges were collected with the arm into "COLBOX-BIO"; three echinoids and six ophiuroids were collected with the arm into the box "COLBOX". At the end of the dive the benthic flux chamber "BFC- ROV 1" (00:17) and the microsensor profiler MICP-DEEP (00:30) were placed in elevator 2 and a marker was placed on the seafloor to identify the location of the benthic mesocosm experiments (CORRALS).

The acoustic release of elevator 2 was unsuccessful, which led to the decision to release it mechanically with the ROV, which also failed. Before leaving the bottom the microsensor profiler MICP 1 (01:18) was placed on the porch of the ROV.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations / Comments / Image
2019-03-17	14:23:40	-125.880305	14.113605	611	test
2019-03-17	15:27:10	-125.880305	14.113605	611	IN THE WATER
2019-03-17	17:04:11	-125.877474	14.113821	4486	AT THE BOTTOM
2019-03-17	17:17:51	-125.87652	14.113835	4489
2019-03-17	17:27:07	-125.875917	14.113822	4491
2019-03-17	17:28:18	-125.875908	14.113851	4491	stop to collect holothuria and asteroidea
2019-03-17	17:34:56	-125.875872	14.113841	4492	collect holothurian with arm

2019-03-17	17:36:28	-125.875861	14.113834	4492	COLBOX-SGN
2019-03-17	17:38:06	-125.875868	14.113844	4492	collect asteroidea on nodule with arm
2019-03-17	17:39:34	-125.875877	14.113837	4492	COLBOX-SGN
2019-03-17	17:41:53	-125.875828	14.113846	4490	continue moving Eastwards
2019-03-17	17:45:46	-125.875439	14.113866	4491	stop to collect sponge
2019-03-17	17:48:57	-125.87542	14.113846	4492
2019-03-17	17:49:53	-125.875421	14.113873	4492
2019-03-17	17:52:53	-125.875384	14.113856	4492	collect sponge with arm
2019-03-17	17:53:35	-125.875408	14.113864	4492	sponge broke
2019-03-17	18:00:41	-125.875089	14.113867	4490	elevator 2 is at 580 m - got response with homer beacon. Still no sign of elevator 1
2019-03-17	18:10:44	-125.874178	14.113806	4489	flying at 2m - difficult to see animals
2019-03-17	18:13:08	-125.874	14.113828	4490	possible response from elevator 1
2019-03-17	18:16:32	-125.873693	14.113744	4490	elevator 1 may be near track site
2019-03-17	18:43:07	-125.871251	14.112884	4503	elevator 1 on sight
2019-03-17	18:50:27	-125.870985	14.112714	4505	at elevator 1
2019-03-17	18:52:47	-125.870972	14.112737	4505	Gear Received
2019-03-17	18:52:52	-125.870971	14.112737	4505	delete
2019-03-17	18:53:08	-125.87097	14.112738	4505	decided to deploy MICP from elevator 1 before proceeding with fauna sample
2019-03-17	18:54:21	-125.870969	14.112745	4505
2019-03-17	18:58:24	-125.870993	14.11276	4506	Gear Received
2019-03-17	18:59:01	-125.870989	14.112757	4506	MICP
2019-03-17	19:02:20	-125.870937	14.112773	4505
2019-03-17	19:04:01	-125.870943	14.112776	4506	Gear Deployed

2019-03-17	19:04:55	-125.870939	14.11278	4506
2019-03-17	19:05:02	-125.870938	14.112781	4506	MICP1-1
2019-03-17	19:05:07	-125.870938	14.112781	4506
2019-03-17	19:07:21	-125.870953	14.112777	4506	Gear Operated
2019-03-17	19:11:07	-125.870953	14.11278	4506
2019-03-17	19:11:47	-125.870958	14.112787	4506
2019-03-17	19:13:50	-125.870975	14.112802	4506
2019-03-17	19:14:41	-125.870984	14.112799	4506	Galatheidæ crab is registered as cirripedia

2019-03-17	19:16:06	-125.870983	14.112798	4507
2019-03-17	19:16:15	-125.870984	14.112798	4507
2019-03-17	19:18:25	-125.870989	14.112791	4507	collect galatheid with slurp gun
2019-03-17	19:23:18	-125.870999	14.112777	4507	COLBOX-SGN
2019-03-17	19:23:35	-125.870996	14.112773	4507	collected second galatheid
2019-03-17	19:25:29	-125.871003	14.112795	4507
2019-03-17	19:25:46	-125.871004	14.112793	4507
2019-03-17	19:27:00	-125.871002	14.112788	4506	galatheid into carrousel
2019-03-17	19:31:13	-125.871005	14.112783	4507	both galatheid inside bucket1
2019-03-17	19:36:29	-125.870681	14.112513	4506	moving towards elevator 2
2019-03-17	19:37:44	-125.870599	14.112437	4506	stop to collect actiniaria on nodule
2019-03-17	19:38:37	-125.870577	14.112418	4507

2019-03-17	19:38:42	-125.870576	14.112415	4507
2019-03-17	19:41:17	-125.87059	14.112432	4507	collect anemone into compartment 4
2019-03-17	19:43:38	-125.870426	14.112374	4506
2019-03-17	19:47:48	-125.870213	14.112065	4505
2019-03-17	19:49:25	-125.87019	14.11208	4505	at MICP-DEEP
2019-03-17	19:49:37	-125.870184	14.112083	4505	MICP-DEEP
2019-03-17	19:49:39	-125.870183	14.112083	4505	Gear TakenUp
2019-03-17	19:57:57	-125.870133	14.112142	4505	Gear Deployed
2019-03-17	19:58:28	-125.870129	14.112142	4505	delete
2019-03-17	20:00:59	-125.870098	14.112145	4505	Gear Deployed
2019-03-17	20:01:02	-125.870098	14.112146	4505	MICP-DEEP 1 - 2
2019-03-17	20:01:22	-125.870097	14.112145	4505
2019-03-17	20:01:39	-125.870094	14.112143	4505
2019-03-17	20:03:29	-125.870099	14.11215	4505	Gear Operated
2019-03-17	20:08:10	-125.870074	14.112201	4506	stop to collect echinoid

2019-03-17	20:08:16	-125.870073	14.112202	4506
2019-03-17	20:08:37	-125.870072	14.112205	4506
2019-03-17	20:09:10	-125.870073	14.112205	4506
2019-03-17	20:10:40	-125.870067	14.112199	4506	collect echinoid with arm
2019-03-17	20:11:25	-125.870069	14.112198	4506	COLBOX-SGN
2019-03-17	20:12:32	-125.870054	14.112205	4505	COLBOX-SGN
2019-03-17	20:12:46	-125.870047	14.112214	4504	rattail
2019-03-17	20:13:48	-125.870001	14.112225	4505	anemone on nodule
2019-03-17	20:20:31	-125.869986	14.112252	4506	COLBOX-BIO
2019-03-17	20:21:04	-125.870008	14.112227	4506	COLBOX-BIO_Compartment 2 opened
2019-03-17	20:21:08	-125.870009	14.112225	4506
2019-03-17	20:21:12	-125.870011	14.112224	4506
2019-03-17	20:22:40	-125.870006	14.112231	4506	Anemone placed in the compartment 2

2019-03-17	20:26:10	-125.86992	14.1121	4506
2019-03-17	20:26:51	-125.869921	14.112094	4506
2019-03-17	20:27:28	-125.869916	14.112087	4506	Collection of two Echinoidea
2019-03-17	20:27:36	-125.869915	14.112089	4506	COLBOX-SGN
2019-03-17	20:28:46	-125.869917	14.112103	4506	First Echinoidea in the COLBOX-SGN
2019-03-17	20:32:19	-125.869929	14.112122	4506	Second Echinoidea collection failed
2019-03-17	20:33:53	-125.869884	14.112068	4506	Foraminifera
2019-03-17	20:33:54	-125.869884	14.112068	4506
2019-03-17	20:34:30	-125.869885	14.112057	4506	Collection of Ophiuroidea with Foraminifera
2019-03-17	20:36:45	-125.869895	14.112067	4506	Failed collection
2019-03-17	20:38:10	-125.869889	14.112051	4506	Collection of second Ophiuroidea
2019-03-17	20:38:12	-125.869889	14.112051	4506
2019-03-17	20:38:53	-125.869892	14.112058	4506
2019-03-17	20:39:29	-125.869895	14.112068	4506	COLBOX-SGN
2019-03-17	20:40:16	-125.869891	14.112077	4506	Ophiuroidea in the COLBOX-SGN
2019-03-17	20:43:30	-125.869878	14.112055	4506	COLBOX-BIO

2019-03-17	20:44:25	-125.869872	14.112056	4506	COLBOX-BIO Compartment 6 is opened
2019-03-17	20:45:08	-125.869872	14.112074	4506
2019-03-17	20:45:23	-125.869874	14.112076	4506
2019-03-17	20:47:55	-125.869845	14.112048	4506	Actiniaria in the Compartment No. 6
2019-03-17	20:49:28	-125.869856	14.112024	4506	Lid placed in compartment no. 6
2019-03-17	20:57:21	-125.869784	14.112003	4506	Collection of Porifera
2019-03-17	20:58:41	-125.869786	14.112006	4506	COLBOX-BIO
2019-03-17	21:00:20	-125.8698	14.111979	4506	COLBOX-BIO Compartment No. 5
2019-03-17	21:01:31	-125.869793	14.111986	4506
2019-03-17	21:01:44	-125.869791	14.111988	4506
2019-03-17	21:01:57	-125.86979	14.11199	4506
2019-03-17	21:05:20	-125.869805	14.111988	4506	Porifera in COLBOX-BIO compartment no. 5
2019-03-17	21:07:27	-125.869775	14.112015	4506	Lid placed on compartment No. 5

2019-03-17	21:17:04	-125.86976	14.111978	4506
2019-03-17	21:17:24	-125.869761	14.111982	4506
2019-03-17	21:17:56	-125.869766	14.112	4506
2019-03-17	21:18:10	-125.869768	14.112006	4506
2019-03-17	21:20:37	-125.869755	14.111969	4506	Collection of Echinoidea
2019-03-17	21:20:41	-125.869756	14.11197	4506	COLBOX-SGN
2019-03-17	21:21:43	-125.869753	14.111998	4506	Collection of Echinoidea failed
2019-03-17	21:24:05	-125.869783	14.11197	4506	Collection of Ophiuroidea failed
2019-03-17	21:27:36	-125.869783	14.11197	4506	Collection of Echinoidea
2019-03-17	21:28:38	-125.869768	14.111976	4506
2019-03-17	21:29:49	-125.869775	14.111952	4506	COLBOX-SGN
2019-03-17	21:34:27	-125.8698	14.111999	4506	Collection failed
2019-03-17	21:37:21	-125.8698	14.111914	4505	Collection of Actiniaria
2019-03-17	21:38:14	-125.86981	14.11191	4506	COLBOX-BIO

2019-03-17	21:38:34	-125.869806	14.111916	4506
2019-03-17	21:40:26	-125.869758	14.111921	4506	COLBOX-BIO compartment No. 9 opened
2019-03-17	21:42:29	-125.869793	14.111915	4506	Actiniaria in the compartment No. 9
2019-03-17	21:43:56	-125.869793	14.11192	4506	Lid on compartment No. 9
2019-03-17	21:51:45	-125.869784	14.111911	4506
2019-03-17	21:57:03	-125.869788	14.111902	4506	ophiroid in COLBOX-SGN
2019-03-17	22:01:29	-125.869774	14.11189	4506
2019-03-17	22:04:09	-125.869782	14.111922	4506	collection of actiniaria
2019-03-17	22:04:37	-125.86978	14.11192	4506	COLBOX-BIO
2019-03-17	22:04:54	-125.869775	14.111917	4506	actiniaria in COLBOX-Bio n 2
2019-03-17	22:07:27	-125.869775	14.111904	4506
2019-03-17	22:18:00	-125.869934	14.111879	4506

2019-03-17	22:18:44	-125.869957	14.111863	4506
2019-03-17	22:20:34	-125.869935	14.111853	4506	COLBOX-BIO
2019-03-17	22:23:40	-125.869954	14.111864	4506	actinia in compartment n 8
2019-03-17	22:26:03	-125.869938	14.111871	4506
2019-03-17	22:27:18	-125.869931	14.111862	4506	possible echinoid
2019-03-17	22:33:13	-125.869971	14.111854	4506
2019-03-17	22:35:30	-125.869988	14.111876	4506	echinoid collection
2019-03-17	22:37:46	-125.869995	14.111869	4506	echinoid collection failed
2019-03-17	22:44:15	-125.870038	14.111833	4506
2019-03-17	22:45:25	-125.870055	14.111815	4506	COLBOX-SGN
2019-03-17	22:47:36	-125.870056	14.111823	4506	ophiroid collection
2019-03-17	22:48:52	-125.870064	14.11183	4506	ophiroid in COLBOX-SGN
2019-03-17	22:52:21	-125.870086	14.111843	4506

2019-03-17	22:58:03	-125.870051	14.111866	4506
2019-03-17	22:58:48	-125.870041	14.11187	4506	COLBOX-BIO
2019-03-17	22:59:20	-125.870044	14.111881	4506	compartment n 3
2019-03-17	23:00:54	-125.870057	14.111882	4506	ophiroid collection
2019-03-17	23:03:14	-125.870016	14.111884	4506	ophiroid in compartment n 3
2019-03-17	23:03:31	-125.870029	14.111872	4506	sponge collection
2019-03-17	23:12:54	-125.870113	14.111867	4506	sponge in compartment n 3 (w. ophiroid)
2019-03-17	23:18:39	-125.870046	14.111835	4506
2019-03-17	23:20:27	-125.87009	14.111871	4505	shrimp
2019-03-17	23:21:33	-125.870114	14.111853	4505
2019-03-17	23:28:48	-125.870272	14.111731	4506
2019-03-17	23:28:57	-125.870272	14.111731	4506
2019-03-17	23:32:28	-125.870447	14.11187	4506	ophiroid collection
2019-03-17	23:33:38	-125.870292	14.111808	4506	COLBOX-SGN
2019-03-17	23:34:13	-125.870296	14.111816	4506	ophiroid in COLBOX

2019-03-17	23:35:37	-125.87021	14.111785	4506
2019-03-17	23:35:59	-125.870206	14.111814	4506
2019-03-17	23:37:05	-125.870203	14.11184	4506	echinoid collection
2019-03-17	23:39:10	-125.870195	14.111772	4506	echinoid in COLBOX-SGN
2019-03-17	23:44:05	-125.870271	14.111865	4505	moving to the elevator
2019-03-17	23:46:37	-125.870266	14.111916	4506
2019-03-17	23:47:28	-125.870235	14.111911	4506	COLBOX-SGN
2019-03-17	23:49:45	-125.870204	14.111902	4506	ophiroid collection
2019-03-17	23:50:23	-125.870201	14.111899	4506	ophiroid in COLBOX-SGN
2019-03-17	23:55:12	-125.870195	14.111993	4506
2019-03-17	23:58:57	-125.870168	14.11198	4506	COLBOX-SGN
2019-03-18	00:01:21	-125.870186	14.111997	4506	ophiroid collection
2019-03-18	00:01:49	-125.870181	14.11199	4506	ophiroid in COLBOX-SGN
2019-03-18	00:05:01	-125.870149	14.112089	4505	BFC-ROV
2019-03-18	00:05:34	-125.870156	14.112102	4506	BFC n.1
2019-03-18	00:05:53	-125.870162	14.112098	4506

2019-03-18	00:06:07	-125.870166	14.112096	4506
2019-03-18	00:08:40	-125.87017	14.112089	4506	Gear TakenUp
2019-03-18	00:11:10	-125.870152	14.112092	4505	ROV to Lift
2019-03-18	00:17:41	-125.870267	14.11214	4506	Gear on Lift
2019-03-18	00:26:25	-125.870168	14.112106	4505	MICP-DEEP
2019-03-18	00:26:45	-125.870144	14.11213	4505	LEDs are blinking blue
2019-03-18	00:27:19	-125.870122	14.11215	4506	Gear TakenUp
2019-03-18	00:28:12	-125.870156	14.112162	4505	ROV to Lift
2019-03-18	00:30:45	-125.870245	14.112166	4506	Gear on Lift
2019-03-18	00:34:20	-125.870268	14.112178	4506	fish
2019-03-18	00:35:06	-125.870272	14.112187	4506	two fish and several galatheididae near the amphi traps
2019-03-18	00:38:39	-125.870254	14.112173	4506
2019-03-18	00:38:41	-125.870253	14.112172	4506	shrimp
2019-03-18	00:38:50	-125.870248	14.112171	4506
2019-03-18	00:39:03	-125.870242	14.112171	4506
2019-03-18	00:39:08	-125.870241	14.112172	4506

2019-03-18	00:43:12	-125.870225	14.112162	4505	signal released
2019-03-18	00:44:30	-125.870216	14.112172	4505	marker
2019-03-18	00:44:34	-125.870216	14.112172	4505	Gear TakenUp
2019-03-18	00:44:44	-125.870414	14.112184	4505	Gear Deployed
2019-03-18	00:51:52	-125.870307	14.112185	4506	acoustic releaser failed
2019-03-18	01:13:35	-125.87087	14.112717	4507	ROV to Lift
2019-03-18	01:13:46	-125.870881	14.112734	4507	elevator 1
2019-03-18	01:14:27	-125.870884	14.112785	4507
2019-03-18	01:14:47	-125.870893	14.11279	4507	MICP
2019-03-18	01:15:07	-125.870913	14.112781	4507	MICP n 1
2019-03-18	01:16:01	-125.87097	14.112768	4507
2019-03-18	01:16:19	-125.870971	14.112775	4507
2019-03-18	01:17:28	-125.870969	14.112786	4507	Gear TakenUp
2019-03-18	01:18:29	-125.870964	14.112779	4507	Gear Received
2019-03-18	01:20:22	-125.870917	14.112782	4507
2019-03-18	03:14:52	-125.871319	14.112611	3	ON DECK

Kiel 6000 Dive 10 (SO268-1_069_ROV10)

Date: 18/03/2019

Observers: AMARO, Teresa

ROV positions (at the bottom)

Start of dive: 14° 6.745' N 125° 52.257' W

End of dive: 14° 6.769' N 125° 52.276' W

Dive duration:

ROV in the water: 03/18/2019 15:38:28

ROV at the bottom: 03/18/2019 17:34:00

ROV off the bottom: 03/18/2019 22:06:26

ROV on deck: 03/18/2019 23:56:59

Explored sites: BE impact area

Aims of the Dive:

- Rescue elevator 2/ release it mechanically with the ROV
- Opportunistic fauna collection

Handled ROV Tools (including scientific payload):

- Collector box (COLBOX)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- No elevator 1

Elevator 2

- 1 microsensor profiler (MICP-DEEP)
- 1 benthic flux chamber (BFC- ROV 1)
- 1 benthic mesocosm experiment (CORRAL)

Dive summary (protocol by Tanja Stratmann)

Since the mission of this dive was to “rescue” elevator 2, i.e., to release its weights mechanically, a rescue hook attached to a second wire was lowered from the vessel. This hook was grabbed by the manipulator arm of the ROV and taken to elevator 2. The hook was inserted into the rescue sling of elevator 2. The wire was heaved, and the elevator started to ascend. Afterwards, the ROV headed west and fauna was collected in the collector box (COLBOX).

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations / Comments / Image
2019-03-18	15:38:28	-125.871497	14.111887	189	IN THE WATER
2019-03-18	17:28:31	-125.87095	14.112025	4279	HD recordings on
2019-03-18	17:34:00	-125.870762	14.111964	4500	AT THE BOTTOM
2019-03-18	17:38:36	-125.870545	14.112082	4503	Elevator2 in sight
2019-03-18	17:39:17	-125.870494	14.112126	4503
2019-03-18	17:41:23	-125.870436	14.112183	4502	inspecting elevator for emergency lift point
2019-03-18	17:41:41	-125.870425	14.112173	4502
2019-03-18	17:44:29	-125.870545	14.112298	4503	approaching rescue hook
2019-03-18	17:52:36	-125.870502	14.11243	4491	weight visible
2019-03-18	17:54:35	-125.870512	14.112443	4493	approaching weight
2019-03-18	17:58:22	-125.870475	14.112431	4497	weight is moving some metres due to waves
2019-03-18	18:00:51	-125.870499	14.112404	4497	hook grabbed
2019-03-18	18:06:25	-125.870572	14.112206	4501	backing off to go back to elevator 2
2019-03-18	18:06:34	-125.87056	14.112203	4501	approaching elevator 2
2019-03-18	18:12:27	-125.870399	14.112207	4504	employing the hook in the rescue sling
2019-03-18	18:13:00	-125.870393	14.112203	4504	disentangling the rope
2019-03-18	18:15:32	-125.870422	14.11219	4504	starting to heave the second wire
2019-03-18	18:18:10	-125.87047	14.112186	4504	rope is slowly pulling
2019-03-18	18:20:38	-125.870476	14.112157	4504	elevator ascending
2019-03-18	18:23:27	-125.870514	14.112188	4504	heading west
2019-03-18	19:57:24	-125.871288	14.112361	4504	Collection of Ophiuroidea initiated
2019-03-18	19:59:58	-125.871269	14.112339	4504	COLBOX-SGN
2019-03-18	20:00:13	-125.871272	14.112343	4504	Ophiuroidea in the COLBOX-SGN
2019-03-18	20:03:55	-125.871293	14.112362	4503	Gastropoda
2019-03-18	20:10:24	-125.871249	14.112343	4504

2019-03-18	20:10:49	-125.871259	14.112334	4504
2019-03-18	20:16:16	-125.871268	14.112339	4504	COLBOX-SGN
2019-03-18	20:16:32	-125.871278	14.112341	4504	Ophiuroidea in the COLBOX-SGN
2019-03-18	20:26:46	-125.871265	14.112325	4504	Success of Collection of Echinoidea uncertain
2019-03-18	20:26:59	-125.871265	14.112325	4504	Collection of Gastropoda
2019-03-18	20:27:03	-125.871265	14.112325	4504	SLURP
2019-03-18	20:36:24	-125.871259	14.112362	4504	Gastropoda collected
2019-03-18	22:06:26	-125.871289	14.112838	4504	OFF THE BOTTOM
2019-03-18	23:56:59	-125.871669	14.112796	9	ON DECK

Kiel 6000 Dive 11 (SO268-1_073_ROV11)

Date: 03/19/2019

Observers: LINKE, Peter

ROV positions (at the bottom)

Start of dive: [14°07.080'N 125°52.023'W]

End of dive: [14°07.090'N 125°52.031'W]

Dive duration: 2h

ROV in the water: 03/19/2019 16:35:37

ROV at the bottom: 03/19/2019 18:26:08

ROV off the bottom: 03/19/2019 20:23:49

ROV on deck: 03/19/2019 22:12:22

Explored sites: BE impact area

Aims of the Dive:

- Recovery of the MoLab Lander (first attempt)

Handled ROV Tools (including scientific payload):

- none

Dive summary (protocol by Yasemin Bodur)

Since the MoLab Lander was lost during its deployment, this dive was dedicated to its manual recovery by lifting it and attaching it to the hooks from the ship wire.

#Date	Time	SUB1_L on	SUB1_L at	SUB1_D epth	Observations/Comments	Image
2019-03-19	16:35:37	125.86875	14.117719	58	IN THE WATER	
2019-03-19	18:26:08	125.867859	14.118306	4502	AT THE BOTTOM	A wide-angle underwater photograph showing a lander resting on a dark, sandy seafloor. The lander is a rectangular structure with various instruments and lights. The water is clear and blue. A GEOMAR logo is visible in the bottom right corner.
2019-03-19	18:45:32	125.867515	14.118524	4512	Moving lander	A close-up view of the lander's legs and wheels. The lander is positioned on a patterned surface, possibly a tarp or a specific type of seabed. The legs are metallic and the wheels are black. A GEOMAR logo is visible in the bottom right corner.
2019-03-19	18:46:30	125.867505	14.118519	4512	taking steel wire from porch	A close-up view of the lander's porch area. Two large orange cylindrical containers are visible, along with a black mechanical component. A steel wire is being handled. A GEOMAR logo is visible in the bottom right corner.
2019-03-19	18:51:54	125.867515	14.118512	4512	pushing steel wire into the launcher	A close-up view of the lander's launcher area. Three orange cylindrical containers are visible, arranged in a row. A steel wire is being pushed into the launcher. A GEOMAR logo is visible in the bottom right corner.
2019-03-19	18:57:43	125.867525	14.118502	4512	grabbing hook	A close-up view of the lander's hook area. The hook is visible, and the lander is positioned on a patterned surface. A GEOMAR logo is visible in the bottom right corner.

2019-03-19	19:00:37	-125.867526	14.118529	4512	caught loop of wire
2019-03-19	19:05:19	-125.867504	14.118536	4512	putting hook back
2019-03-19	19:12:22	-125.86754	14.118484	4512	looking for ship's wire on OFOP
2019-03-19	19:14:50	-125.867526	14.118462	4506	Photo Taken
2019-03-19	19:14:50	-125.867526	14.118462	4506	Photo Taken

2019-03-19	19:15:25	-125.867541	14.118497	4505	moving towards ship's wire
2019-03-19	19:26:37	-125.867657	14.118626	4494	seeing weight	
2019-03-19	19:38:12	-125.86746	14.118538	4501	grabbed line	
2019-03-19	19:39:59	-125.867513	14.118453	4504	approaching lander	
2019-03-19	19:42:08	-125.867505	14.11848	4507	putting hook on porch	
2019-03-19	19:48:51	-125.867542	14.118481	4503	rope twisted around manipulator	
2019-03-19	19:55:11	-125.867514	14.118466	4503	hook in hand	
2019-03-19	19:56:38	-125.867521	14.118495	4509	getting to lander	
2019-03-19	20:02:09	-125.867531	14.118514	4512	both loops in snap hook	
2019-03-19	20:02:10	-125.867531	14.118514	4512	Photo Taken
2019-03-19	20:02:21	-125.867527	14.118512	4512	Photo Taken

2019-03-19	20:02:37	-125.867518	14.11851	4512	Photo Taken
2019-03-19	20:05:02	-125.867537	14.1185	4512	Photo Taken
2019-03-19	20:07:04	-125.867503	14.118512	4511	trying to get ape fist from lander recovery rope	
2019-03-19	20:07:45	-125.867502	14.118507	4511	pulling rope	
2019-03-19	20:09:53	-125.867516	14.118496	4509	Photo Taken
2019-03-19	20:11:36	-125.867522	14.118502	4509	Photo Taken
2019-03-19	20:23:49	-125.868477	14.118464	4495	OFF THE BOTTOM	
2019-03-19	22:12:22	-125.868875	14.118553	40	ON DECK	

Kiel 6000 Dive 12 (SO268-1_077_ROV12)

Date: 20/03/2019

Observers: LINKE; Peter; AMARO Teresa, CHRISTODOULOU, Magdalini; HILARIO, Ana; JANSEN, Felix; STRATMANN, Tanya; BODUR, Yasemin

ROV positions (at the bottom)

Start of dive: 14°07.080'N 125°52.003'W

End of dive: 14°06.785'N 125°52.250'W

Dive duration:

ROV in the water: 20/03/2019 17:08:09

ROV at the bottom: 20/03/2019 18:26:55

ROV off the bottom: 21/03/2019 01:02:34

ROV on deck: 21/03/2019 02:59:14

Explored sites: BE impact area

Aims of the Dive:

- Rescue MoLAB lander
- Collect fauna
- Recover benthic flux chamber (BFC-ROV 2)

Handled ROV Tools (including scientific payload):

- Collector box (COLBOX-BIO)
- Slurp gun (SLURP)
- Scoop (SCOOP)
- 1 Benthic flux chamber (BFC-ROV, on the ascent)

Dive summary (protocol by Ana Hilario)

The first two hours of the dive were used to rescue the MoLAB lander. The lander was found upside down but with the wire loop and hook used in the previous dive still attached.

After the lander was attached to the lifting rope the ROV moved behind the ship and started collected fauna in a limited area as the ship could only move after the lander arrived on deck. As only the collector box "COOLBOX-BIO" and the slurp gun carousel were available the collection was limited to few specimens. During this time two sponge (COOLBOX-BIO #1 and 5), three holothurians (COOLBOX-BIO #4, 2 and 8), three ophiuroids (COOLBOX-BIO #7), one asteroid (COOLBOX-BIO #7) and one actinarian (COOLBOX-BIO #3) were collected with the arm and one galatheid crab was collected with the slurp gun.

At 23:02, after the lander was secured on deck, the ROV started heading towards the location of the benthic flux chamber "BFC-ROV 2". During this time three holothurians were collected, two with the arm into COOLBOX-BIO #6 and one with the slurp gun. The ROV flew more or less at a constant altitude until 00:45 (approximately 700 m), making this transect useful for future video analyses. At 00:50 the benthic flux chamber "BFC-ROV 2"

was placed on the porch of the ROV and the dive ended. During the ascent COOLBOX-BIO #1 opened and the sponge specimen was lost.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations / Comments / Images
2019-03-20	16:12:07	-125.86846	14.117658	254	IN THE WATER
2019-03-20	17:51:21	-125.866474	14.118893	4289	ROV at 4300m, first HOMER replies
2019-03-20	17:55:18	-125.866709	14.117982	4482	AT THE BOTTOM
2019-03-20	17:58:37	-125.866549	14.11826	4504	approaching MoLab position
2019-03-20	18:00:55	-125.866519	14.11828	4504	at lander, upside down
2019-03-20	18:02:46	-125.866524	14.118314	4504	wire and hook still attached
2019-03-20	18:03:50	-125.866525	14.118353	4506
2019-03-20	18:04:16	-125.866527	14.118377	4506
2019-03-20	18:04:39	-125.866517	14.118387	4506
2019-03-20	18:05:12	-125.866507	14.11838	4506

2019-03-20	18:06:34	-125.866582	14.118402	4505	approaching weight/hook
2019-03-20	18:07:04	-125.866581	14.118402	4500
2019-03-20	18:07:11	-125.866578	14.118399	4499
2019-03-20	18:17:35	-125.866815	14.118281	4496	HOMER at 55m distance
2019-03-20	18:21:51	-125.866786	14.118303	4496	weight in sight
2019-03-20	18:23:36	-125.866626	14.118433	4495
2019-03-20	18:26:28	-125.866531	14.118466	4497	trying to grab hook
2019-03-20	18:30:21	-125.866521	14.118488	4498	grabbing hook
2019-03-20	18:31:11	-125.866703	14.118492	4502	pulling hook/rope to lander
2019-03-20	18:33:03	-125.866694	14.118463	4503	heaving weight by some metres
2019-03-20	18:34:24	-125.866642	14.118375	4502
2019-03-20	18:45:16	-125.866488	14.118436	4508	repositioning hook in claw
2019-03-20	18:45:39	-125.866484	14.118445	4508	grabbed hook at t-handle
2019-03-20	18:50:23	-125.866485	14.118377	4508	trying to hook both loops of wire
2019-03-20	18:53:53	-125.866459	14.118395	4508	shackle in the way

2019-03-20	19:00:13	-125.866453	14.11843	4508	grabbed hook fixating the rope, thus moving the shackle out of the way
2019-03-20	19:11:40	-125.866489	14.11843	4508	hook is nearly hooked into both loops, heaving weight to pull
2019-03-20	19:11:59	-125.86649	14.118435	4508	hook falls out
2019-03-20	19:18:05	-125.866453	14.118433	4508	hook new positioned, heaving weight again
2019-03-20	19:19:13	-125.866474	14.118412	4508	rope underneath lander
2019-03-20	19:19:17	-125.866475	14.118411	4508	still heaving
2019-03-20	19:20:36	-125.866461	14.118403	4508	weight seems to be east of lander
2019-03-20	19:25:22	-125.866468	14.118418	4508	regrabbed - tried again and both loops hooked.
2019-03-20	19:25:31	-125.866468	14.118418	4508
2019-03-20	19:29:47	-125.86648	14.118444	4508	hook put down
2019-03-20	19:30:05	-125.866478	14.118425	4508	grabbing roundhook from drawer
2019-03-20	19:34:10	-125.866516	14.118462	4505	ROV is moving to clarify the liftline
2019-03-20	19:39:23	-125.866474	14.118481	4504	ship is moving to 320 to help clearing the liftline
2019-03-20	19:41:04	-125.866488	14.118468	4504	liftline possibly still entangled in lander
2019-03-20	19:47:16	-125.866533	14.118451	4502	ship moving ahead - not improving.
2019-03-20	19:47:45	-125.866536	14.118448	4502	liftline put down, ROV retreating
2019-03-20	19:48:14	-125.866535	14.118432	4503	heaving weight
2019-03-20	19:53:33	-125.86654	14.118306	4503
2019-03-20	19:54:10	-125.866548	14.11831	4503	Ship's winch starting to lift lander.
2019-03-20	19:54:34	-125.866547	14.118311	4503	gone
2019-03-20	19:54:55	-125.866548	14.118316	4503	ROV moving behind vessel
2019-03-20	19:55:08	-125.86655	14.118323	4503	Lander lifted with 0.3m/s
2019-03-20	20:17:04	-125.867346	14.118483	4510
2019-03-20	20:19:52	-125.867374	14.11845	4511	Collection of Porifera initiated

2019-03-20	20:20:17	-125.867381	14.118459	4511
2019-03-20	20:22:14	-125.86739	14.118478	4511	COLBOX-BIO
2019-03-20	20:23:44	-125.867382	14.118483	4511	COLBOX-BIO Compartment 1 lid opened
2019-03-20	20:25:35	-125.867365	14.118475	4511	Porifera placed in the compartment 1
2019-03-20	20:26:11	-125.867362	14.118469	4511	Lid closed
2019-03-20	20:29:03	-125.867374	14.11848	4511
2019-03-20	20:29:05	-125.867374	14.11848	4511	Ophiuroidea
2019-03-20	20:36:11	-125.867236	14.118386	4511	Galatheidæ
2019-03-20	20:38:47	-125.867248	14.118383	4511	Collection of Holothuroidea
2019-03-20	20:40:43	-125.86723	14.118387	4511	COLBOX-BIO
2019-03-20	20:41:04	-125.867234	14.118376	4511	COLBOX-BIO compartment No.2 opened
2019-03-20	20:41:13	-125.867237	14.118372	4511	2019-03-20_20-41-12_Sonne_SO268-1_077ROV12_Logo.jpg
2019-03-20	20:41:22	-125.86724	14.11837	4511
2019-03-20	20:44:29	-125.867252	14.118382	4511	SCOOP

2019-03-20	21:01:19	-125.867257	14.118356	4511	Collection failed
2019-03-20	21:01:45	-125.867266	14.118365	4511	Compartment 2 lid closed
2019-03-20	21:07:35	-125.86727	14.118388	4511	Collection of Galatheidae
2019-03-20	21:08:14	-125.867262	14.11838	4511	SLURP
2019-03-20	21:10:51	-125.86726	14.11838	4511
2019-03-20	21:31:45	-125.867277	14.118294	4511
2019-03-20	21:34:35	-125.867354	14.118312	4511	Holothuroidea in the compartment No. 4
2019-03-20	21:44:27	-125.86743	14.118404	4512
2019-03-20	21:46:50	-125.867411	14.118387	4512	COLBOX-BIO
2019-03-20	21:47:16	-125.867412	14.118382	4512	COLBOX-BIO compartment No. 7 opened
2019-03-20	21:47:50	-125.867395	14.118382	4512	Ophiuroidea in compartment No. 7
2019-03-20	21:50:45	-125.867414	14.118399	4512	Lid of compartment No. opened again
2019-03-20	21:50:52	-125.867411	14.118398	4512	No 7
2019-03-20	21:50:56	-125.86741	14.118397	4512
2019-03-20	21:52:38	-125.867421	14.1184	4512	Second Ophiuroidea lost an arm
2019-03-20	21:53:51	-125.86743	14.118419	4512	Lid placed on compartment No. 7
2019-03-20	21:55:16	-125.867427	14.118408	4512	Little Asteroid or Ophiuroid next to the second collected ophiuroid
2019-03-20	21:55:20	-125.867427	14.118409	4511	Fish
2019-03-20	21:57:22	-125.867501	14.118435	4512	Collection of Holothuroidea

2019-03-20	21:57:31	-125.867495	14.118439	4512
2019-03-20	21:59:00	-125.867497	14.118436	4512	COLBOX-BIO
2019-03-20	21:59:06	-125.867501	14.118436	4512	Compartment No. 2 opened
2019-03-20	22:01:23	-125.867455	14.118443	4512	Holothuroidea in compartment no. 2
2019-03-20	22:02:15	-125.867455	14.118443	4512	Lid placed on compartment no. 2
2019-03-20	22:04:11	-125.867506	14.118478	4512	Collection of Porifera
2019-03-20	22:04:19	-125.867495	14.118471	4512
2019-03-20	22:08:12	-125.867525	14.118487	4512	COLBOX-BIO
2019-03-20	22:08:44	-125.867533	14.11848	4512	COLBOX-BIO compartment no. 5 opened
2019-03-20	22:10:16	-125.867533	14.11848	4512	Porifera placed in compartment no. 5
2019-03-20	22:13:34	-125.867495	14.118506	4511	Lid placed on compartment no. 5
2019-03-20	22:16:26	-125.867495	14.118506	4511
2019-03-20	22:30:08	-125.867536	14.118463	4511	shrimp
2019-03-20	22:30:34	-125.867543	14.118458	4511
2019-03-20	22:30:50	-125.86755	14.11846	4511
2019-03-20	22:31:14	-125.867564	14.11847	4511	collection of holothuria

2019-03-20	22:32:38	-125.86759	14.118454	4513
2019-03-20	22:33:51	-125.867585	14.118467	4513	COLBOX-BIO
2019-03-20	22:34:18	-125.867587	14.118458	4513	COLBOX-bio compartment n.8 open
2019-03-20	22:35:49	-125.867618	14.118449	4513	Holothuria placed in compartment #8
2019-03-20	22:35:53	-125.867618	14.118449	4513	too big
2019-03-20	22:35:59	-125.867618	14.118449	4513
2019-03-20	22:42:43	-125.867571	14.118434	4513	Lid placed on compartment #8
2019-03-20	22:45:51	-125.867618	14.118446	4513	collection of actiniaria
2019-03-20	22:46:10	-125.867629	14.118443	4513
2019-03-20	22:47:09	-125.867643	14.118437	4513	COLBOX-BIO
2019-03-20	22:47:36	-125.86765	14.118434	4513	COLBOX-BIO compartment #3 opened
2019-03-20	22:50:31	-125.86761	14.118468	4513	Actiniaria placed in compartment #3
2019-03-20	22:51:43	-125.867601	14.118477	4513	Lid placed on compartment #3
2019-03-20	22:54:42	-125.867609	14.118455	4513
2019-03-20	22:54:48	-125.867612	14.118456	4513	Collection of ophiuroid
2019-03-20	22:55:48	-125.867631	14.118427	4513	will also try to collect asteroidea
2019-03-20	22:56:42	-125.867611	14.118421	4513	COLBOX-BIO
2019-03-20	22:57:01	-125.867604	14.118414	4513	COLBOX-BIO compartment #7 opened
2019-03-20	22:58:14	-125.867614	14.118395	4513	Asteroidea placed in compartment #7
2019-03-20	22:59:33	-125.867617	14.118423	4513	Ophiuroidea placed in compartment #7
2019-03-20	23:00:12	-125.867623	14.118428	4513	Lid placed on compartment #7
2019-03-20	23:02:04	-125.867637	14.118408	4512	head toward BFC-ROV 1
2019-03-20	23:06:10	-125.867742	14.118188	4513	Collection of holothuria
2019-03-20	23:08:49	-125.86779	14.118175	4513	COLBOX-BIO compartment #6 opened

2019-03-20	23:09:03	-125.86779	14.118175	4513
2019-03-20	23:11:24	-125.867749	14.118126	4513	Holothuria placed in compartment #6
2019-03-20	23:12:10	-125.867763	14.118144	4513	Lid placed on compartment #6
2019-03-20	23:16:45	-125.867753	14.118109	4513
2019-03-20	23:18:28	-125.867753	14.118109	4513	SLURP
2019-03-20	23:20:04	-125.867769	14.118114	4513	Collection of holothuria
2019-03-20	23:24:31	-125.867732	14.11808	4513	Collection of Porifera
2019-03-20	23:24:33	-125.867733	14.118079	4513
2019-03-20	23:25:00	-125.867746	14.118081	4513	COLBOX-BIO
2019-03-20	23:25:35	-125.86774	14.118089	4513	COLBOX-BIO compartment #9 opened
2019-03-20	23:28:09	-125.86774	14.11809	4513	Porifera NOT collected
2019-03-20	23:28:40	-125.867727	14.11808	4513	Lid placed on compartment #9
2019-03-20	23:29:50	-125.867722	14.11806	4513	Continue heading towards BFC-ROV 1
2019-03-20	23:37:38	-125.867866	14.117788	4514	shrimp
2019-03-20	23:39:25	-125.868057	14.11728	4515
2019-03-20	23:39:33	-125.868057	14.11728	4515

2019-03-20	23:40:27	-125.868057	14.11728	4515	flying too high to annotate fauna
2019-03-20	23:49:47	-125.868155	14.116931	4515
2019-03-20	23:50:10	-125.868153	14.116927	4515	Collection of holothuria
2019-03-20	23:50:21	-125.868153	14.116926	4514
2019-03-20	23:50:56	-125.868145	14.116924	4515	COLBOX-BIO
2019-03-20	23:51:25	-125.868134	14.116926	4515	COLBOX_BIO compartment #6 opened
2019-03-20	23:53:04	-125.868137	14.116923	4515	Holothuria placed in compartment #6
2019-03-20	23:54:05	-125.868113	14.116908	4514	Lid placed on compartment #6
2019-03-21	00:11:01	-125.868914	14.115716	4512	waypoint
2019-03-21	00:12:15	-125.869009	14.115665	4512	waypoint
2019-03-21	00:16:31	-125.86925	14.115417	4512	waypoint
2019-03-21	00:35:45	-125.870177	14.11436	4513	waypoint
2019-03-21	00:42:33	-125.870461	14.113869	4511	waypoint
2019-03-21	00:49:25	-125.870756	14.113432	4509	waypoint
2019-03-21	00:53:29	-125.870886	14.113142	4509	arrived to PBC-ROV
2019-03-21	00:54:01	-125.870882	14.113144	4509	BFC-ROV
2019-03-21	00:54:21	-125.870887	14.113135	4509
2019-03-21	00:55:21	-125.870894	14.113106	4509
2019-03-21	00:56:40	-125.870882	14.1131	4509	BFC-ROV not blinking
2019-03-21	00:58:33	-125.870866	14.113079	4508	Gear TakenUp
2019-03-21	00:58:34	-125.870867	14.113079	4508	Gear Received
2019-03-21	00:59:52	-125.870868	14.113033	4507	BFC-ROV on the ROV porch
2019-03-21	01:02:19	-125.870865	14.113036	4507	ROV going up
2019-03-21	01:02:30	-125.870863	14.113034	4506	OFF THE BOTTOM
2019-03-21	02:59:08	-125.870881	14.112448	5	ON DECK

Kiel 6000 Dive 13 (SO268-1_081_ROV13)

Date: [21/03/2019]

Observers: JANSEEN, Felix; BODUR, Yasemin; AMARO, Teresa

ROV positions (at the bottom)

Start of dive: 14°6.7997'N 125°52.2821'W

End of dive: 14°6.7997'N 125°52.2821'W

Dive duration:

ROV in the water: 21/03/2019 16:40:34

ROV at the bottom: 21/03/2019 18:27:47

ROV off the bottom: 22/03/2019 00:04:47

ROV on deck: 22/03/2019 02:05:03

Explored sites: BE impact area

Aims of the Dive:

- Deploy and collect profiler deep
- Finish the short-term experiment (5 days) by sample each corral (4 pushcores, 4 holothurians)
- Start the long-term experiment (+/-20 days) by repositioning the previous 4 corrals on one holothurian each

Handled ROV Tools (including scientific payload):

- profiler deep on the porch
- port drawer extension with algae bottles,
- Senckenberg biobox,
- 16 PUC,
- slurp gun (filtered seawater from Pedro),
- 3 hand nets,
- Scoop,
- magnetic T-Handle

Dive summary

The main objective of this dive was to finish the short-term experiment deployed on the 15th of March. In total 16 push cores were taken and three holothurians were sampled. Each corral was then deployed on top of a new holothurian at a neighboring area to start a long-term experiment (3 weeks) that needs to be retrieved at the beginning of the next leg. Two holothurians outside of the experiment were taken to complete the background holothurian samples. In addition to the experiment, a profiler deep which was taken on the porch of the ROV was also deployed in the vicinity of the corral experiments.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations / Comments / Image
2019-03-21	15:47:17	-125.872449	14.112575	50	test
2019-03-21	16:40:35	-125.872449	14.112575	50	IN THE WATER
2019-03-21	18:27:45	-125.871126	14.11328	4504	AT THE BOTTOM
2019-03-21	18:32:25	-125.871284	14.11334	4504	MICP-DEEP
2019-03-21	18:35:01	-125.871294	14.113354	4504	on porch
2019-03-21	18:36:04	-125.871291	14.113366	4504	Gear Received
2019-03-21	18:41:16	-125.871283	14.113369	4506	checking for nodule-free spot to deploy
2019-03-21	18:47:53	-125.871329	14.113331	4506
2019-03-21	18:48:22	-125.871332	14.113338	4506
2019-03-21	18:48:30	-125.871334	14.113341	4506
2019-03-21	18:50:51	-125.871332	14.113351	4506	Aufwirbelungen
2019-03-21	18:51:07	-125.87134	14.113353	4506
2019-03-21	18:53:48	-125.871346	14.11333	4506	stage 1 seems to point towards a nodule-free spot while there seems to one nodule underneath some optodes of stage 2

2019-03-21	18:56:27	-125.871356	14.113335	4506	MICP-DEEP
2019-03-21	18:56:31	-125.871357	14.113333	4506	blinking
2019-03-21	18:56:37	-125.871357	14.11333	4506	MICP-DEEP
2019-03-21	18:56:45	-125.871354	14.113326	4506	remotely started
2019-03-21	18:57:05	-125.871341	14.113324	4506	Gear Operated
2019-03-21	18:57:13	-125.871335	14.113326	4506	motors running
2019-03-21	18:57:14	-125.871334	14.113326	4506	Gear Operated
2019-03-21	18:57:49	-125.871322	14.113334	4506	Felix waiting for data to "stream in" on his monitor remotely
2019-03-21	19:04:17	-125.871335	14.113292	4505	leaving for corral 10
2019-03-21	19:08:01	-125.870948	14.113055	4506	corral in view
2019-03-21	19:08:20	-125.870926	14.113046	4506	large holothurian next to it (large, violet, with sail)
2019-03-21	19:08:44	-125.870879	14.113041	4506	continue to corral 10
2019-03-21	19:09:32	-125.870833	14.113036	4507	ROV landing next to corral 10
2019-03-21	19:09:43	-125.870834	14.113036	4508	holothurian still in corral 10
2019-03-21	19:10:08	-125.87084	14.11304	4508
2019-03-21	19:10:34	-125.870841	14.113043	4508	
2019-03-21	19:12:01	-125.870841	14.11305	4508	lifting corral 10 and put to the side of the experiment footprint
2019-03-21	19:12:09	-125.870841	14.113052	4508	lifting was quite gently
2019-03-21	19:12:30	-125.870844	14.113056	4508
2019-03-21	19:13:06	-125.870847	14.113058	4508	
2019-03-21	19:13:07	-125.870847	14.113058	4508	Photo Taken
2019-03-21	19:14:02	-125.870845	14.113058	4508	starting with pushcoring
2019-03-21	19:14:53	-125.870835	14.113039	4508	PUC 16 inserted into sediment
2019-03-21	19:14:56	-125.870835	14.113039	4508	PUC
2019-03-21	19:16:37	-125.87084	14.113045	4508	PUC 81

2019-03-21	19:20:19	-125.870847	14.113053	4508	...inserted into sediment
2019-03-21	19:20:59	-125.87084	14.113062	4508	PUC 3
2019-03-21	19:22:35	-125.870842	14.113051	4508	...inserted into sediment
2019-03-21	19:24:07	-125.870825	14.113054	4508	PUC 38
2019-03-21	19:24:33	-125.870845	14.113062	4508
2019-03-21	19:25:36	-125.870826	14.113063	4508	COLBOX-SGN
2019-03-21	19:25:39	-125.870825	14.113063	4508	opened
2019-03-21	19:27:27	-125.870839	14.11306	4508	taken up
2019-03-21	19:27:36	-125.870843	14.113061	4508	inserted into
2019-03-21	19:27:40	-125.870844	14.113061	4508	COLBOX-SGN
2019-03-21	19:28:06	-125.870845	14.113057	4508	COLBOX-SGN
2019-03-21	19:28:09	-125.870845	14.113056	4508	closed
2019-03-21	19:28:43	-125.870842	14.113048	4508	PUC 3 Gear Received
2019-03-21	19:29:52	-125.870837	14.113059	4508	PUC 16 Gear Received
2019-03-21	19:30:50	-125.870831	14.113065	4508	PUC 81 Gear Received
2019-03-21	19:31:39	-125.870832	14.113045	4508	PUC 38 Gear Received
2019-03-21	19:32:15	-125.870849	14.113051	4508	all cores inserted in PUC box on porch
2019-03-21	19:37:39	-125.870896	14.113081	4508
2019-03-21	19:37:58	-125.870905	14.113085	4508
2019-03-21	19:39:36	-125.870898	14.113071	4508	EXP-CORRAL
2019-03-21	19:39:50	-125.870902	14.113068	4508	put on top of holothurian
2019-03-21	19:39:53	-125.870904	14.113067	4508	Gear Deployed
2019-03-21	19:41:04	-125.870934	14.113053	4508
2019-03-21	19:41:10	-125.870937	14.113051	4508	#10
2019-03-21	19:42:36	-125.870894	14.113081	4508	tiny one

2019-03-21	19:43:35	-125.870886	14.11307	4508	algae bottles
2019-03-21	19:44:02	-125.870893	14.113061	4508	taken out and getting shaken
2019-03-21	19:45:26	-125.870919	14.113065	4508	algae bottle opened
2019-03-21	19:45:32	-125.870918	14.113066	4508	and emptied into
2019-03-21	19:45:34	-125.870917	14.113067	4508	EXP-CORRAL
2019-03-21	19:45:38	-125.870916	14.113068	4508	#10
2019-03-21	19:48:07	-125.870911	14.113078	4508	fish
2019-03-21	19:50:46	-125.870912	14.113098	4508	SLURP
2019-03-21	19:52:44	-125.870902	14.113109	4508	slurped in
2019-03-21	19:55:17	-125.870945	14.113069	4508	waypoint set for
2019-03-21	19:55:20	-125.870945	14.113069	4508	EXP-CORRAL
2019-03-21	19:55:24	-125.870944	14.113069	4508	#10
2019-03-21	20:00:40	-125.870754	14.112925	4507	Fauna
2019-03-21	20:01:47	-125.870664	14.112792	4507	many small mounds
2019-03-21	20:04:59	-125.870407	14.112482	4506	EXP-CORRAL
2019-03-21	20:05:03	-125.870406	14.112474	4506	spotted
2019-03-21	20:08:59	-125.870341	14.112359	4506	still inside of
2019-03-21	20:09:01	-125.870339	14.112355	4506	EXP-CORRAL
2019-03-21	20:09:59	-125.870362	14.112273	4506	EXP-CORRAL
2019-03-21	20:10:01	-125.870363	14.112272	4506	Gear Received
2019-03-21	20:10:10	-125.870365	14.11227	4506
2019-03-21	20:10:46	-125.870325	14.112294	4506
2019-03-21	20:13:48	-125.870323	14.112299	4506	PUC 54 inserted into sediment
2019-03-21	20:16:19	-125.870279	14.11232	4506	PUC 42 inserted into sediment
2019-03-21	20:19:15	-125.870291	14.112277	4506	PUC 65 inserted into sediment
2019-03-21	20:21:30	-125.870275	14.112285	4506	PUC 41 inserted into sediment
2019-03-21	20:23:57	-125.870274	14.112287	4506
2019-03-21	20:25:13	-125.870278	14.112288	4506	SLURP
2019-03-21	20:27:52	-125.870277	14.112293	4506	inserted into
2019-03-21	20:27:54	-125.870278	14.112292	4506	COLBOX-SGN
2019-03-21	20:29:33	-125.870265	14.112303	4506	PUC Gear Received 65
2019-03-21	20:30:07	-125.870265	14.112301	4506	PUC 54 Gear Received
2019-03-21	20:31:12	-125.870268	14.112295	4506	PUC 41 Gear Received
2019-03-21	20:31:49	-125.870272	14.112296	4506	PUC #16

2019-03-21	20:32:59	-125.870286	14.112284	4506	EXP-CORRAL
2019-03-21	20:33:11	-125.870284	14.112281	4506	Gear Received
2019-03-21	20:35:27	-125.870239	14.112327	4506
2019-03-21	20:35:48	-125.870243	14.112328	4506
2019-03-21	20:36:38	-125.870219	14.112353	4506	EXP-CORRAL
2019-03-21	20:36:44	-125.870217	14.112353	4506	#11
2019-03-21	20:36:51	-125.870216	14.112353	4506	putted on top of
2019-03-21	20:37:18	-125.87022	14.112348	4506	Holothurian in corral #11 is smaller than the one #10; both same species
2019-03-21	20:39:24	-125.870246	14.11234	4506	bottle with algae taken and shaken
2019-03-21	20:40:20	-125.870247	14.112334	4506	bottle with algae emptied into
2019-03-21	20:40:22	-125.870247	14.112334	4506	EXP-CORRAL
2019-03-21	20:40:25	-125.870245	14.112333	4506	#11
2019-03-21	20:41:07	-125.870225	14.112326	4506
2019-03-21	20:43:25	-125.870245	14.112326	4506
2019-03-21	20:43:57	-125.870259	14.11231	4506	waypoint for corral nr #11 set
2019-03-21	20:47:59	-125.870217	14.112294	4505	EXP-CORRAL
2019-03-21	20:48:04	-125.870218	14.112293	4505	spotted
2019-03-21	20:49:33	-125.870218	14.112266	4505	#7

2019-03-21	20:52:58	-125.870247	14.112228	4506
2019-03-21	20:53:42	-125.870253	14.112227	4506	EXP-CORRAL
2019-03-21	20:53:46	-125.870254	14.112226	4506	#7
2019-03-21	20:53:52	-125.870254	14.112226	4506	Gear Received
2019-03-21	20:55:25	-125.870272	14.112221	4506	Holothurian seems to be missing
2019-03-21	20:56:52	-125.870262	14.112233	4506	PUC 8 inserted into sediment
2019-03-21	20:58:15	-125.870253	14.112227	4506	PUC 13 inserted into sediment
2019-03-21	20:59:57	-125.870271	14.112246	4506	PUC 23 inserted into sediment
2019-03-21	21:02:22	-125.870241	14.112247	4506	PUC 11 inserted into sediment
2019-03-21	21:02:41	-125.870237	14.112244	4506
2019-03-21	21:02:50	-125.870236	14.112243	4506
2019-03-21	21:04:11	-125.870241	14.112227	4506	PUC 23 Gear Received
2019-03-21	21:04:17	-125.870243	14.112226	4506	PUC 8 Gear Received
2019-03-21	21:04:46	-125.870253	14.112222	4506	PUC 11 Gear Received
2019-03-21	21:05:52	-125.870257	14.112234	4506	PUC 13 Gear Received
2019-03-21	21:06:56	-125.870296	14.112235	4506	all PUCs in drawer
2019-03-21	21:22:59	-125.869541	14.111894	4505	continue search for holothurians while flying towards..
2019-03-21	21:23:04	-125.869535	14.111891	4505	EXP-CORRAL
2019-03-21	21:23:14	-125.869523	14.111885	4505	...#6
2019-03-21	21:27:21	-125.869448	14.111828	4506
2019-03-21	21:27:36	-125.86945	14.111827	4506	...of spiny holothurian
2019-03-21	21:27:52	-125.869451	14.111826	4506	Gear Deployed
2019-03-21	21:27:57	-125.869452	14.111825	4506	EXP-CORRAL
2019-03-21	21:28:41	-125.869461	14.111823	4505	...# 7 placed on top of holothurian
2019-03-21	21:28:55	-125.869459	14.111822	4505	corral pressed a little in the sediment

2019-03-21	21:29:49	-125.869429	14.111822	4505	checking if holothurian is inside
2019-03-21	21:30:09	-125.869429	14.111828	4505
2019-03-21	21:30:29	-125.869436	14.111837	4506	...of deployed corral #7
2019-03-21	21:30:52	-125.869441	14.111847	4506	no holothurian visible outside - must be captured inside
2019-03-21	21:32:03	-125.869437	14.111834	4506	algae bottle taken from drawer...
2019-03-21	21:33:35	-125.86943	14.11182	4506	shrimp
2019-03-21	21:33:40	-125.869428	14.111819	4506	...lid removed...
2019-03-21	21:34:37	-125.869433	14.111812	4506	...content inserted into corral
2019-03-21	21:34:58	-125.869435	14.111814	4505	...some fraction lost after removing the cap but most should be inside
2019-03-21	21:35:11	-125.869434	14.111815	4505	EXP-CORRAL
2019-03-21	21:35:23	-125.869434	14.111815	4506	Gear Deployed
2019-03-21	21:35:36	-125.869434	14.111814	4506	7 experiment started
2019-03-21	21:36:52	-125.869432	14.111836	4506	corral 7 moved a little bit while emptying the last bit of the bottle content..
2019-03-21	21:38:01	-125.869422	14.11185	4506	...maybe some algae got lost from the corral below the lower rim
2019-03-21	21:38:33	-125.869421	14.111849	4506	water looked a bit greenish in the vicinity of the corral for some time maybe.
2019-03-21	21:39:30	-125.869418	14.111847	4506	algae bottle back into drawer
2019-03-21	21:39:47	-125.869412	14.111851	4506	continuing flight towards corral 6
2019-03-21	21:42:25	-125.869109	14.111754	4505	EXP-CORRAL
2019-03-21	21:42:42	-125.869074	14.11176	4505	...#6 in sight
2019-03-21	21:43:04	-125.869042	14.111776	4505	...holothurian nearby
2019-03-21	21:45:37	-125.868952	14.111791	4505	arriving at...
2019-03-21	21:45:40	-125.86895	14.111789	4505	EXP-CORRAL
2019-03-21	21:45:46	-125.868946	14.111785	4505	...#6
2019-03-21	21:46:20	-125.868923	14.111766	4505
2019-03-21	21:46:54	-125.868915	14.111772	4506	ROV landed in front of...
2019-03-21	21:46:56	-125.868915	14.111773	4506	EXP-CORRAL
2019-03-21	21:47:01	-125.868914	14.111776	4506	...#6
2019-03-21	21:48:21	-125.868912	14.111787	4506
2019-03-21	21:50:09	-125.868933	14.111792	4506	lift...
2019-03-21	21:50:11	-125.868933	14.111792	4506	EXP-CORRAL
2019-03-21	21:51:53	-125.868945	14.111777	4506	...#6 and put aside on sediment

2019-03-21	21:52:26	-125.86894	14.111762	4506	sediment surface in the area of the footprint somewhat disturbed
2019-03-21	21:53:05	-125.868944	14.111765	4506	holothurian almost lost upon corral retrieval
2019-03-21	21:53:27	-125.86894	14.111763	4506	...trying to capture it with the...
2019-03-21	21:53:29	-125.868939	14.111762	4506	SLURP
2019-03-21	21:54:10	-125.868933	14.111755	4506	trying to slurp it from the purch
2019-03-21	21:54:34	-125.868932	14.111758	4506	not visiblle at the momemt - too turbid
2019-03-21	21:55:06	-125.868932	14.111764	4506	waiting for water to clear
2019-03-21	21:58:25	-125.86894	14.111821	4506	still on the porch...
2019-03-21	21:58:26	-125.868939	14.111822	4506	SLURP
2019-03-21	21:58:44	-125.86893	14.111833	4506	successfully
2019-03-21	22:00:07	-125.868902	14.111761	4506	transferring into slurp sample carousel
2019-03-21	22:00:42	-125.86891	14.111749	4506	for the time being left in the vortex container on top of sample container #2
2019-03-21	22:01:17	-125.868917	14.11175	4506	Push-coring in corral fottprint
2019-03-21	22:01:37	-125.86892	14.111754	4506	PUC #17 Gear Received
2019-03-21	22:02:22	-125.868925	14.111768	4506	from drawer,
2019-03-21	22:02:25	-125.868926	14.111769	4506	PUC ...17 Gear Deployed
2019-03-21	22:02:49	-125.868935	14.111771	4506	PUC 7 Gear Received
2019-03-21	22:03:27	-125.868949	14.111768	4506	PUC 7 inserted into sediment
2019-03-21	22:03:39	-125.868949	14.111771	4506	PUC 43 Gear Received
2019-03-21	22:04:12	-125.868933	14.111782	4506	PUC 43 Gear Deployed, inserted into sediment
2019-03-21	22:05:17	-125.868936	14.11176	4506	PUC 45 Gear Received from drawer
2019-03-21	22:05:44	-125.868952	14.111755	4506	PUC 45 Gear Deployed ...inserted into sediment
2019-03-21	22:06:38	-125.868963	14.111749	4506
2019-03-21	22:07:01	-125.868954	14.11175	4506	...of the four PUCs in the sediment taken
2019-03-21	22:07:03	-125.868953	14.111749	4506	PUC ...#17 back into drawer Gear Received
2019-03-21	22:07:44	-125.868927	14.111745	4506	PUC ...#45 recollected and put into drawer
2019-03-21	22:09:08	-125.868918	14.111757	4506	PUC ...#45 collected some sediment may have been lost from it
2019-03-21	22:09:45	-125.868933	14.111769	4506	#45 transferred into drawer
2019-03-21	22:09:53	-125.868938	14.11177	4506	...#7 collected from sediment and put into drawer
2019-03-21	22:10:49	-125.868925	14.111814	4506	all 4 PUCs pressed down in the drawer
2019-03-21	22:11:32	-125.86891	14.111811	4506	EXP-CORRAL
2019-03-21	22:11:39	-125.86892	14.111791	4506	...#6...
2019-03-21	22:13:50	-125.868915	14.111746	4506	heading in search for the nearby holothurian spotted earlier
2019-03-21	22:14:34	-125.868931	14.111751	4506	holothurian spotted
2019-03-21	22:14:55	-125.868953	14.111757	4506
2019-03-21	22:15:14	-125.868964	14.111764	4506	... of holothurian for the next corral deployment
2019-03-21	22:15:17	-125.868965	14.111765	4506	EXP-CORRAL
2019-03-21	22:15:31	-125.868966	14.111771	4506	...#6 placed on top of holothurian
2019-03-21	22:15:43	-125.868963	14.111777	4506	delete
2019-03-21	22:15:54	-125.86896	14.11178	4506	ROV landed
2019-03-21	22:16:08	-125.868956	14.111781	4506	...near holothurian
2019-03-21	22:16:56	-125.868965	14.111775	4506	holothurian not visible in front of porch

2019-03-21	22:17:08	-125.868972	14.111772	4506	maybe sucked in by the thrusters
2019-03-21	22:18:07	-125.868981	14.111752	4505	going a bit up with the ROV to look for holothurian from above
2019-03-21	22:18:17	-125.868983	14.111747	4505	quite turbid
2019-03-21	22:19:12	-125.868981	14.111744	4505	holothurian spotted again
2019-03-21	22:20:20	-125.868984	14.111728	4505	try to put corral on holothurian right away
2019-03-21	22:21:18	-125.868987	14.111739	4506	holothurian hardly fits into corral
2019-03-21	22:21:48	-125.868999	14.111738	4506	hard to spot whether its inside
2019-03-21	22:22:33	-125.868998	14.111746	4506	landing in front of corral
2019-03-21	22:22:39	-125.868998	14.11175	4506	very turbid again
2019-03-21	22:23:56	-125.869	14.111779	4506	pressing chamber gently into sediment#
2019-03-21	22:24:28	-125.869008	14.111755	4506	holothurian spotted inside corral
2019-03-21	22:24:32	-125.86901	14.111752	4506	EXP-CORRAL
2019-03-21	22:24:40	-125.869014	14.111746	4506	#6...
2019-03-21	22:24:43	-125.869015	14.111745	4506	Gear Deployed
2019-03-21	22:25:14	-125.869027	14.111739	4506	taking algae bottle from drawer
2019-03-21	22:26:29	-125.868998	14.11171	4506	opening lid with the help of the second arm (Riggmaster)
2019-03-21	22:27:35	-125.868977	14.111715	4506	only little amount of algae lost before inserting the bottle into...
2019-03-21	22:27:38	-125.868977	14.111716	4506	EXP-CORRAL
2019-03-21	22:27:46	-125.868977	14.111716	4506	...#6
2019-03-21	22:29:03	-125.868987	14.111721	4506	EXP-CORRAL
2019-03-21	22:29:10	-125.868988	14.111722	4506	Gear Deployed
2019-03-21	22:29:25	-125.868986	14.111724	4506	experiment started
2019-03-21	22:29:33	-125.868985	14.111723	4506	#6
2019-03-21	22:31:17	-125.869023	14.111719	4504	MICP-DEEP
2019-03-21	22:31:22	-125.869024	14.111718	4505	ROV lifted to fly towards...
2019-03-21	22:35:12	-125.869266	14.111802	4505	distance to ...
2019-03-21	22:35:18	-125.869273	14.111808	4505	MICP-DEEP
2019-03-21	22:35:27	-125.869283	14.111817	4505	...approx 300m
2019-03-21	22:37:39	-125.869359	14.111814	4505	holothurian spotted
2019-03-21	22:39:35	-125.869423	14.111804	4506	ROV landing near holothurian
2019-03-21	22:39:54	-125.869421	14.111807	4506
2019-03-21	22:41:28	-125.869404	14.111794	4506	Teresa thinks that this may be the one which escaped corral #7
2019-03-21	22:42:57	-125.869419	14.111834	4506
2019-03-21	22:44:39	-125.86938	14.111846	4506	holothurian collected with manipulator in Senkenberg biobox
2019-03-21	22:45:17	-125.869394	14.111851	4506	slurp gun sampler rotated to capture holothurian slurped in earlier (compartment 2)
2019-03-21	22:46:44	-125.869389	14.111838	4503	holothurian slurped from experiment is expected in slurp sampler compartment 1
2019-03-21	22:47:14	-125.869426	14.111863	4503	moving on towards...
2019-03-21	22:47:17	-125.86943	14.111867	4503	MICP-DEEP
2019-03-21	22:47:35	-125.869459	14.111895	4503	#1-1 deployment
2019-03-21	23:20:44	-125.871172	14.113299	4504	arrived to MICP-DEEP
2019-03-21	23:23:15	-125.871315	14.113307	4505	MICP-DEEP

2019-03-21	23:23:19	-125.871313	14.113308	4505	blinking
2019-03-21	23:25:06	-125.871324	14.113329	4506	communication with ROV successful
2019-03-21	23:27:04	-125.871302	14.113311	4505	yt
2019-03-21	23:27:04	-125.871302	14.113311	4505	
2019-03-21	23:27:07	-125.871301	14.113311	4505	delete
2019-03-21	23:27:25	-125.871297	14.113311	4505	stage 1 motor turning, stage 2 motor still
2019-03-21	23:28:16	-125.871322	14.113315	4505	stage 2 motor running
2019-03-21	23:33:26	-125.871304	14.113353	4506
2019-03-21	23:33:28	-125.871303	14.113352	4506
2019-03-21	23:36:11	-125.87131	14.113348	4506	oxygen optodes not enough out of sediment (motor did not retrieve as much as actually needed)
2019-03-21	23:42:36	-125.871324	14.113347	4507	trying to turn on motor 1 remotely
2019-03-21	23:42:52	-125.871323	14.113344	4506	communication seems to be lost
2019-03-21	23:43:28	-125.871314	14.113338	4506	ROV communication port turned off and on again
2019-03-21	23:43:46	-125.871308	14.113332	4506	communication with
2019-03-21	23:43:51	-125.871306	14.11333	4507	MICP-DEEP
2019-03-21	23:43:58	-125.871306	14.113328	4507	failed
2019-03-21	23:47:15	-125.871299	14.113336	4507	communication port turned off
2019-03-21	23:47:31	-125.871305	14.113335	4506	*port
2019-03-21	23:47:39	-125.871309	14.113337	4507	communication port turned on again
2019-03-21	23:48:55	-125.871318	14.113338	4506	stage 1 motor runs again
2019-03-21	23:50:56	-125.871319	14.113327	4507	stage 1 motor Zahnrad broken
2019-03-21	23:51:13	-125.871322	14.113324	4507	motor runs but optodes are not lifted out of the sediment
2019-03-21	23:52:16	-125.871316	14.11335	4507	stage 1 motor turned off
2019-03-21	23:54:07	-125.871299	14.113338	4507	MICP-DEEP
2019-03-21	23:54:08	-125.871299	14.113338	4507	Gear Received
2019-03-21	23:57:00	-125.871314	14.113351	4507	MICP-DEEP
2019-03-21	23:59:01	-125.871294	14.11334	4507	positioned on porch
2019-03-22	00:04:40	-125.871341	14.113378	4507	OFF THE BOTTOM
2019-03-22	02:05:01	-125.871076	14.112715	31	ON DECK

Kiel 6000 Dive 14 (SO268-2_099_ROV14)

Date: 05/04/2019

Observers: WENZHOEFER Frank, BODUR Yasemin, HILÁRIO Ana, RAMALHO Sofia

ROV positions (at the bottom)

Start of dive: 11°51.810'N 117°0.754'W

End of dive: 11°51.759'N 117°0.7770'W

Dive duration⁴:

ROV in the water: 05.04.19 16:02:37

ROV at the bottom: 05.04.2019 17:44:10

ROV off the bottom: 06.04.19 01:14:20

ROV on deck: 06.04.19 03:00:55

Explored sites: DE reference area/Dredge impact area

Aims of the Dive:

- Deployment of microprofiler- and benthic chamber modules for in situ respiration measurements
- Deployment of time lapse cameras for observations of megafauna
- Megafauna sampling

Handled ROV Tools (including scientific payload):

- Collector box (COLBOX)
- Collector box (COLBOX-BIO)
- Scoop
- 3 hand nets
- Slurp gun
- Magnet T-Handle
- 1 fiberoptical profiler (MICP-DEEP)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- xxx

Elevator 2

- xxx

Dive summary (protocol by Ana Hilário)

The first hour of the dive was dedicated to the deployment of the two microprofilers (MICP-DEEP) and three benthic chambers (ISCHAM), one of which could not be activated (ISCHAM-2). During this time, two sediment level indicator boxes (SLICBOX)

⁴ All dates and times in the protocols refer to UTC

that dropped from **elevator x** were found. During the following 1.5 hours four cameras were deployed (one PV-APIX and three PV-PICAM) in front of fauna "communities". The following three hours were dedicated to collect megafauna for biodiversity and reproductive biology studies, as well as for the study of the impact of sediment plumes on filter feeders. During this time the location of a previous EBS deployment was confirmed. At the end of the dive the two microprofilers are re-positioned and the benthic chamber that was not working was placed on the porch of the ROV.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments
2019-04-05	16:02:37	-117.013656	11.863149	291	IN THE WATER
2019-04-05	17:44:10	-117.012563	11.863492	4123	AT THE BOTTOM
2019-04-05	17:48:07
2019-04-05	18:01:55	-117.013198	11.86354	4125	MICP-DEEP-3-1
2019-04-05	18:03:21	-117.013145	11.863527	4125
2019-04-05	18:03:56	-117.013137	11.863549	4125

2019-04-05	18:05:35	-117.01319	11.863533	4125
2019-04-05	18:08:54	-117.01312	11.863511	4125	ROV to Lift
2019-04-05	18:09:12
2019-04-05	18:09:32	-117.013089	11.86351	4125
2019-04-05	18:12:29	-117.013055	11.863581	4125	MICP-DEEP #2 Received
2019-04-05	18:16:44	-117.012919	11.863098	4125	Checkerboard #2 found
2019-04-05	18:16:44	-117.012919	11.863098	4125
2019-04-05	18:17:07	-117.012885	11.863069	4125

2019-04-05	18:26:17	-117.012872	11.863045	4125	MICP-DEEP-2-1
2019-04-05	18:26:53	-117.012871	11.863044	4125
2019-04-05	18:27:44	-117.012893	11.863039	4125
2019-04-05	18:27:56	-117.012889	11.863042	4125
2019-04-05	18:28:17
2019-04-05	18:28:29	-117.012877	11.863044	4125
2019-04-05	18:41:35	-117.013133	11.863604	4125	ISCHAM-2-1

2019-04-05	18:44:23	-117.013132	11.863613	4125
2019-04-05	18:44:50	-117.013116	11.863596	4126
2019-04-05	18:45:43	-117.013098	11.863592	4126
2019-04-05	19:09:58	-117.013075	11.86305	4126	ISCHAM-1-1
2019-04-05	19:11:41	-117.01307	11.863037	4126
2019-04-05	19:35:37	-117.012819	11.862601	4127
2019-04-05	19:36:57	-117.012817	11.862602	4127	ISCHAM-3-1
2019-04-05	19:51:23	-117.012789	11.86259	4127	no connection established to ISCHAM-3

2019-04-05	19:55:24	-117.012698	11.862385	4126	SLICBOX-1 spotted
2019-04-05	19:56:23	-117.012613	11.862365	4126
2019-04-05	19:59:04	-117.012537	11.862232	4126	At elevator #2
2019-04-05	20:03:52	-117.01251	11.862129	4127	PV-APIX #1 Received
2019-04-05	20:07:05	-117.01251	11.862129	4127
2019-04-05	20:07:12	-117.012493	11.862101	4127
2019-04-05	20:10:21	-117.012471	11.862121	4127	PV-APIX-1-1. Deployment in front of sponge with hydroid and crustacean
2019-04-05	20:10:32	-117.012472	11.862123	4127

2019-04-05	20:10:51	-117.012478	11.862131	4127
2019-04-05	20:11:13	-117.012484	11.862138	4127
2019-04-05	20:13:34	-117.012499	11.862109	4126
2019-04-05	20:20:35	-117.012518	11.862185	4127	PV-APIX #16 received
2019-04-05	20:26:55	-117.01263	11.862066	4128
2019-04-05	20:33:02	-117.012639	11.86205	4128	PV-PICAM-16-1.Deployment in front of ophiuroid near a xenophyophore
2019-04-05	20:33:39	-117.01261	11.86204	4128

2019-04-05	20:37:27	-117.012511	11.86217	4126	ROV to Lift
2019-04-05	20:41:29	-117.012528	11.862199	4126	PV-PICAM #20 received
2019-04-05	20:46:04	-117.012648	11.862124	4127
2019-04-05	20:46:40	-117.012671	11.862124	4128
2019-04-05	20:48:55	-117.012656	11.862115	4128
2019-04-05	20:50:27	-117.012677	11.862148	4126	PV-PICAM-20-1 Deployment in front of sponge with ophiuroid on its stalk
2019-04-05	20:54:24	-117.012488	11.862174	4127	ROV to Lift
2019-04-05	20:54:32	-117.012492	11.862175	4127	PV-PICAM #18 received
2019-04-05	20:58:31	-117.012558	11.862301	4126

2019-04-05	20:58:32	-117.012558	11.862301	4126
2019-04-05	21:03:05	-117.012823	11.862517	4127
2019-04-05	21:04:58.1	-117.012824	11.862541	4127
2019-04-05	21:10:08	-117.012826	11.862527	4127
2019-04-05	21:10:14	-117.012827	11.862527	4127	PV-PICAM-18-1 Deployment in front of sponge with small ctenophores
2019-04-05	21:13:55	-117.012819	11.862573	4126	trying to communicate with ISCHAM #3
2019-04-05	21:15:32	-117.012807	11.86259	4127	communication with could not be established
2019-04-05	21:24:47	-117.012806	11.86254	4126	Move towards the old EBS track and sample megafauna on the way

2019-04-05	21:35:04	-117.012864	11.862341	4128
2019-04-05	21:35:13	-117.012864	11.862341	4128
2019-04-05	21:38:21	-117.012815	11.862358	4128	Alcyonacea (BIO_94) collected into COLBOX-BIO #6
2019-04-05	21:44:48
2019-04-05	21:49:56	-117.012853	11.862208	4129
2019-04-05	21:51:16	-117.012879	11.862225	4129
2019-04-05	21:51:37	-117.012883	11.862227	4129	Alcyonacea (BIO_95) collected into COLBOX-BIO #8

2019-04-05	21:54:10	-117.012873	11.862227	4129
2019-04-05	21:58:29	-117.01288	11.862178	4129
2019-04-05	22:00:34	-117.012865	11.862183	4129	Alcyonacea (BIO_96) collected into COLBOX-BIO #1
2019-04-05	22:16:03	-117.012939	11.861761	4130
2019-04-05	22:18:01	-117.012922	11.861812	4130	Alcyonacea (BIO_97) collected into COLBOX-BIO #4
2019-04-05	22:28:10	-117.012941	11.861759	4130
2019-04-05	22:29:23	-117.012918	11.861759	4130	Alcyonacea (BIO_98) collected into COLBOX-BIO #2
2019-04-05	22:36:08	-117.012969	11.861704	4130

2019-04-05	22:37:14	-117.01298	11.861707	4130	Alcyonacea (BIO_99) collected into COLBOX-BIO #9
2019-04-05	22:44:21	-117.012968	11.861698	4129
2019-04-05	22:44:28	-117.012968	11.861698	4129
2019-04-05	22:44:38	-117.012969	11.861698	4130
2019-04-05	22:47:14	-117.01295	11.861452	4129
2019-04-05	22:47:37	-117.01296	11.861434	4129

2019-04-05	22:47:43	-117.01296	11.861434	4129
2019-04-05	22:48:29	-117.012985	11.861432	4130
2019-04-05	22:48:33	-117.012986	11.861431	4130
2019-04-05	22:49:24	-117.012988	11.861411	4130	Brisingid (BIO_105) and actiniaria (BIO_107) collected into COLBOX-SGN
2019-04-05	22:55:29	-117.012966	11.861421	4130
2019-04-05	22:57:12	-117.012953	11.861383	4130

2019-04-05	22:57:14	-117.012952	11.861383	4130
2019-04-05	22:57:16	-117.012952	11.861384	4130
2019-04-05	22:59:41	-117.012968	11.861443	4130
2019-04-05	23:01:57	-117.012954	11.861419	4130	Alcyonacea (BIO_100) collected into COLBOX-BIO #3
2019-04-05	23:15:28	-117.012848	11.860219	4128
2019-04-05	23:15:40	-117.012851	11.860221	4128

2019-04-05	23:15:45	-117.012858	11.860226	4128
2019-04-05	23:15:52	-117.012858	11.860226	4128
2019-04-05	23:15:59
2019-04-05	23:16:11
2019-04-05	23:16:26

2019-04-05	23:16:28	-117.012689	11.860361	4128
2019-04-05	23:17:52	-117.0127	11.860356	4128
2019-04-05	23:18:02	-117.01272	11.860341	4128
2019-04-05	23:18:19	-117.012761	11.860292	4128
2019-04-05	23:31:26	-117.012703	11.860816	4129

2019-04-05	23:31:40	-117.0127	11.860827	4129	GEOMAR
2019-04-05	23:32:38	-117.012714	11.860841	4129	GEOMAR
2019-04-05	23:33:31	-117.012724	11.860827	4129	Alcyonacea (BIO_101) collected into COLBOX-BIO #5
2019-04-05	23:36:18	-117.012725	11.860832	4129	GEOMAR
2019-04-05	23:37:40	-117.012676	11.860836	4129	GEOMAR
2019-04-05	23:38:16	-117.012702	11.860844	4129	GEOMAR
2019-04-05	23:41:51	-117.012695	11.860857	4129	Asteroid (BIO_106) collected into COLBOX-SGN

2019-04-05	23:49:08	-117.012811	11.861543	4130
2019-04-05	23:49:16	-117.012811	11.861544	4130
2019-04-05	23:52:01	-117.012821	11.861526	4130	Alcyonacea (BIO_102) collected into COLBOX-BIO #7
2019-04-06	00:05:54	-117.012885	11.863005	4127
2019-04-06	00:08:27	-117.012909	11.863012	4127	Ophiuroid collected into COLBOX-SGN
2019-04-06	00:11:42	-117.012901	11.863041	4127
2019-04-06	00:11:46	-117.012899	11.863041	4127

2019-04-06	00:15:08	-117.012905	11.863036	4127
2019-04-06	00:16:23	-117.012888	11.863042	4127	Alcyonacea collected into COLBOX-SGN
2019-04-06	00:17:02	-117.012892	11.86304	4127	Ophiuroid collected into COLBOX-SGN
2019-04-06	00:18:52	-117.012917	11.863052	4127	At MICP-DEEP #2
2019-04-06	00:21:15	-117.012922	11.863023	4127
2019-04-06	00:29:34	-117.013034	11.863064	4126	MICP-DEEP-2-2
2019-04-06	00:31:30	-117.013026	11.86308	4126
2019-04-06	00:38:30	-117.013053	11.863074	4127	Gear operated using the T-handle
2019-04-06	00:48:05	-117.013182	11.863585	4126	At MICP-DEEP #3
2019-04-06	00:50:24	-117.013172	11.863539	4126	MICP-DEEP-3-2
2019-04-06	00:55:24	-117.013174	11.863549	4127	Gear Operated with T-handle
2019-04-06	01:02:50	-117.01286	11.862703	4126	PV-PICAM #18 with the lasers ON

2019-04-06	01:03:48	-117.012834	11.862655	4126
2019-04-06	01:05:28	-117.012826	11.86265	4128	At ISCHAM #3
2019-04-06	01:09:06	-117.012833	11.862638	4127	ISCHAM #3 placed on porch
2019-04-06	01:11:09	-117.012845	11.862653	4127	end of dive
2019-04-06	01:14:20	-117.012827	11.862653	4110	OFF THE BOTTOM
2019-04-06	03:00:55	-117.012869	11.862684	1	ON DECK

Kiel 6000 Dive 15 (SO268-2_101_ROV15)

Date: 06/04/2019

Observers: WENZHÖFER, Frank; BODUR, Yasemin; HAUQUIER, Freija; ÜHLENKOTT, Katja; ROSSEL, Sven; OTTE, Julia; SCHOENING, Timm; DE STIGTER, Henko

ROV positions (at the bottom)

Start of dive: 11°51.806'N 117°00.794'W

End of dive: 11°51.813'N 117°00.780'W

Dive duration⁵:

ROV in the water: 06.04.2019 15:21:11

ROV at the bottom: 06.04.2019 17:02:53

ROV off the bottom: 07.04.2019 02:26:22

ROV on deck: 07.04.2019 04:10:30

Explored sites: German reference pre-impact; old EBS track

Aims of the Dive:

- Replacement of two microprofilers for in situ respiration measurements at dredge track site
- Megafauna sampling
- Deployment of recolonization device (fork/rake) at the seafloor in EBS track
- Take 16 PUCs in dredge track site
- Bring 2 chambers, 4 cameras, and 2 profilers deep to elevator 1 and 2
- Take sensors from elevator 2 and wait for elevator release

Handled ROV Tools (including scientific payload):

- Decompaction tool/rake UGent

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- 2 electrochemical profilers (*MICP*)
- 1 fiberoptical profiler (*MICP-DEEP*)
- Trap set (2 amphipod traps and 1 ostracod trap)
- 2 x 6 ROV push cores (*PUC*)

Elevator 2

- 2 Benthic chamber modules (*BFC-ROV*)
- 3 Time-lapse cameras (*PV-PICAM*)
- 3 Nodule frames with recolonization substrates (*ARTSUBS*)
- Trap set (2 amphipod traps and 1 ostracod trap)

⁵ All dates and times in the protocols refer to UTC

Dive summary (protocol by Freija Hauquier)

replace profiler deep, take PUCs, fork decompaction and fauna sampling, retrieve cameras, profiler and chamber

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments	Image
2019-04-06	14:43:09	117.013766	11.862603	24	test	
2019-04-06	15:21:08	117.013766	11.862603	24	IN THE WATER	
2019-04-06	17:02:49	117.013203	11.86344	4107	AT THE BOTTOM	
2019-04-06	17:26:02	117.01323	11.863609	4126	Deployment 3 (MICP-DEEP 3)	
2019-04-06	17:37:33	117.013059	11.863039	4126	Gear Deployed
2019-04-06	17:37:35	117.013058	11.86304	4126	Deployment 3 (MICP-DEEP 2)
2019-04-06	17:42:29	117.012893	11.862652	4127	ROV to Elevator II	
2019-04-06	17:51:59	117.012486	11.86216	4128	Gear Received: decompaction tool from Elevator II	
2019-04-06	17:52:37	117.012466	11.862146	4128	going to old EBS track	

2019-04-06	18:18:27	-117.012624	11.860302	4128	reached EBS track	
2019-04-06	18:24:39	-117.012667	11.860274	4128	Photo Taken
2019-04-06	18:27:01	-117.012654	11.860245	4128	Gear Deployed: deployment 1 fork (UGhent)	
2019-04-06	18:27:21	-117.012655	11.860259	4128	fork in the sediment : Photo Taken
2019-04-06	18:30:03	-117.01261	11.860265	4127	end of deployment 1	
2019-04-06	18:30:17	-117.01261	11.860269	4128	deployment 2 (fork) : pulling fork through sediment (3 m)	
2019-04-06	18:32:01	-117.01258	11.860267	4127	end deployment 2	
2019-04-06	18:32:42	-117.012556	11.860274	4128	start deployment 3 (fork UGhent)	
2019-04-06	18:33:26	-117.012538	11.860322	4128	Photo Taken

2019-04-06	18:33:36	-117.01254	11.860325	4128	Photo Taken
2019-04-06	18:34:25	-117.012571	11.860317	4127	end of deployment 3 (fork UGhent)	
2019-04-06	18:36:39	-117.012526	11.860294	4128	applying the position marker	
2019-04-06	18:36:51	-117.012524	11.860297	4127	Photo Taken
2019-04-06	18:39:48	-117.012519	11.860313	4127	Photo Taken
2019-04-06	18:40:25	-117.012544	11.860313	4127	video transect across the experiment	
2019-04-06	18:40:31	-117.012548	11.860314	4127	Photo Taken

2019-04-06	18:41:27	-117.012569	11.860319	4127	Photo Taken
2019-04-06	18:42:31	-117.012625	11.860315	4127	Photo Taken
2019-04-06	18:42:48	-117.012625	11.860311	4127	pile of nodules ent the end of deployment 2
2019-04-06	18:46:13	-117.012656	11.860286	4127	Photo Taken
2019-04-06	18:46:22	-117.012661	11.86029	4127	Photo Taken

2019-04-06	18:46:27	-117.012664	11.860292	4127	Photo Taken
2019-04-06	18:46:38	-117.012673	11.860297	4127	end of video transect across experiment	
2019-04-06	18:48:43	-117.012599	11.860345	4127	way back as videotransect for biology	
2019-04-06	18:48:47	-117.012595	11.86035	4127	ROV to Lift: Elevator II	
2019-04-06	19:24:52	-117.012499	11.862186	4128	Gear on Lift: Fork (Ugent) on Elevator II	
2019-04-06	19:28:21	-117.012488	11.862167	4128	ROV to future dredge track to sample PUCs	
2019-04-06	19:33:25	-117.012578	11.862432	4127	Photo Taken of Asteroid
2019-04-06	19:33:26	-117.012578	11.862432	4127	Photo Taken
2019-04-06	19:36:52	-117.012621	11.862468	4128	COLBOX-SGN: sample Asteroidea	

2019-04-06	19:41:30	-117.012633	11.862541	4128	Photo Taken: Porifera + Ophiuroidea
2019-04-06	19:41:32	-117.012633	11.862541	4128	Photo Taken
2019-04-06	19:41:41	-117.012634	11.862541	4128	Photo Taken
2019-04-06	19:44:58	-117.01262	11.86256	4128	COLBOX-SGN: sampled Porifera	
2019-04-06	19:46:26	-117.012641	11.862588	4128	COLBOX-SGN: sampled Ophiuroidea underneath Porifera	
2019-04-06	19:49:58	-117.012668	11.862619	4127	Photo Taken: Porifera (stalked)

2019-04-06	19:49:59	-117.012668	11.862619	4127	Photo Taken
2019-04-06	19:50:18	-117.012662	11.862616	4127	Photo Taken
2019-04-06	19:50:50	-117.012644	11.862616	4127
2019-04-06	19:51:19	-117.012642	11.862611	4127	Photo Taken: Crinoidea
2019-04-06	19:51:31	-117.012648	11.862608	4127	Photo Taken: Alcyonacea

2019-04-06	19:51:42	-117.012654	11.862606	4127	Photo Taken: Asteroidea
2019-04-06	19:54:54	-117.012649	11.862612	4127	COLBOX-SGN: Sample stalked sponge with nodule attached	
2019-04-06	19:58:25	-117.012609	11.862617	4127	COLBOX-SGN: Sample Alcyonacea attached to nodule	
2019-04-06	20:00:52	-117.012688	11.862697	4127	Photo Taken: Asteroidea attached to stalk
2019-04-06	20:01:16	-117.01269	11.862681	4127	Photo Taken: Shrimp
2019-04-06	20:01:41	-117.012703	11.862674	4127	Photo Taken: Asteroidea

2019-04-06	20:02:10	-117.012714	11.862687	4127	Photo Taken: Fish	A photograph of a fish, possibly a snapper, swimming in deep blue water. The fish is white with a hint of yellow on its side. The GEOMAR logo is in the bottom right corner.
2019-04-06	20:04:03	-117.0127	11.862694	4127	Photo Taken: several mounds of sediment	A photograph of the seabed showing several dark, irregular mounds of sediment. A small white starfish is visible on the sand. The GEOMAR logo is in the bottom right corner.
2019-04-06	20:04:38	-117.012681	11.862677	4127	Photo Taken: animal within sediment mound (close up)	A close-up photograph of a small, spiky animal, likely a brittle star, resting on a mound of sediment. The GEOMAR logo is in the bottom right corner.
2019-04-06	20:11:12	-117.0127	11.862663	4127	COLBOX-SGN: Sample Asteroidea	
2019-04-06	20:15:09	-117.012837	11.863006	4126	Arrived at future dredge track	
2019-04-06	20:16:12	-117.012821	11.863021	4126	Photo Taken: Echinoidea	A photograph of a sea urchin on the seabed. The urchin has a dark central disk and long, thin spines. The GEOMAR logo is in the bottom right corner.

2019-04-06	20:16:16	117.012818	11.863023	4126	Photo taken of Echinoid
2019-04-06	20:16:22	117.012814	11.863026	4126	Photo Taken
2019-04-06	20:19:56	117.012844	11.863062	4126	Gear Deployed: 6 Pushcores taken inside future dredge track: PUC 38, 11, 3, 8, 17, 81	
2019-04-06	20:25:25	117.012822	11.863075	4126	Photo taken of deployed PUCs
2019-04-06	20:26:11	117.012841	11.863073	4126	Gear Received: 6 PUCs back onto ROV: PUC 38, 11, 3, 8, 17, 81	
2019-04-06	20:38:10	117.012937	11.86299	4127	Photo Taken of second PUC area

2019-04-06	20:38:12	-117.012936	11.862989	4127	Photo taken
2019-04-06	20:38:37	-117.012926	11.862981	4127	Gear Deployed: 6 PUCs in second area within future dredge track: PUC 16, 42, 7, 43, 45, 13	
2019-04-06	20:45:52	-117.012952	11.862969	4127	Photo Taken of PUCs 16, 42, 7, 43, 45, 13
2019-04-06	20:46:11	-117.012952	11.86296	4127	Photo taken
2019-04-06	20:47:17	-117.012904	11.862918	4127	Gear Received: 6 PUCs back onto ROV: PUC 38, 11, 3, 8, 17, 81	
2019-04-06	20:49:00	-117.012923	11.862948	4127	Lost sediment from PUC13. Trying to rinse it for resampling	
2019-04-06	20:52:09	-117.013042	11.862974	4127	Gear Deployed: PUC 13 retry	
2019-04-06	20:52:26	-117.012996	11.862969	4127	Photo Taken of repositioned PUC 13

2019-04-06	20:52:29	-117.012989	11.862969	4127	Photo taken
2019-04-06	20:52:31	-117.012984	11.862968	4127	Photo Taken
2019-04-06	20:52:59	-117.012956	11.86297	4126	Gear Received: remaining PUCs onto ROV	
2019-04-06	21:05:04	-117.013201	11.862891	4127	Gear Deployed: 4 PUCs at third site: 65, 41, 54, 23	
2019-04-06	21:10:08	-117.013298	11.862921	4127	Photo Taken
2019-04-06	21:10:56	-117.013245	11.862901	4127	Gear Received: PUCs 54, 65, 41, 23 back onto ROV	
2019-04-06	21:18:20	-117.013247	11.862923	4126	Starting westward video transect on future dredge track	
2019-04-06	21:30:56	-117.0139	11.86298	4127	Heading 20 meter northwards to make a track back parallel to the future dredge track	

2019-04-06	21:39:45	- 117.013292	11.862881	4127	Photo Taken : Echinoidea
2019-04-06	21:39:57	- 117.013297	11.862882	4127	Photo Taken
2019-04-06	21:39:59	- 117.013297	11.862882	4127	Photo Taken
2019-04-06	21:43:15	- 117.013238	11.86287	4127	COLBOX-SGN: sample Echinoidea	
2019-04-06	21:45:04	- 117.013235	11.862872	4127	Photo Taken: Bryozoa
2019-04-06	21:45:20	- 117.013152	11.862843	4127	Photo Taken

2019-04-06	21:47:39	-117.013137	11.862786	4127	Photo Taken: Antipatharia
2019-04-06	21:47:42	-117.013139	11.862788	4127	Photo of stalked sponge
2019-04-06	21:54:00	-117.013173	11.86285	4127	COLBOX-SGN: sample stalked sponge	
2019-04-06	22:00:40	-117.013004	11.863007	4126	ROV towards BFC-ROV	
2019-04-06	22:03:16	-117.013042	11.863012	4126	Photo Taken: BFC-ROV chamber
2019-04-06	22:07:44	-117.013091	11.863075	4126	Gear TakenUp: BFC-ROV	
2019-04-06	22:21:01	-117.013075	11.863616	4125	Gear on Lift: BFC-ROV on Elevator I	
2019-04-06	22:33:33	-117.013179	11.8636	4126	Gear TakenUp: BFC-ROV#2	
2019-04-06	22:39:29	-117.013159	11.863693	4126	Gear on Lift: BFC-ROV#2 on Elevator I	
2019-04-06	23:06:16	-117.012845	11.862602	4127	PV-PICAM #18 in sight	

2019-04-06	23:10:34	-117.012849	11.862531	4128	Gear Received: PV-PICAM#18 on ROV porch	
2019-04-06	23:17:06	-117.012503	11.862167	4127	ROV to Lift: to Elevator II	
2019-04-06	23:21:37	-117.012546	11.862192	4128	PV-PICAM #18 on Elevator II	
2019-04-06	23:24:44	-117.012475	11.862128	4128	PV-APIX #1 spotted	
2019-04-06	23:29:54	-117.012488	11.862138	4128	Photo Taken
2019-04-06	23:30:30	-117.01249	11.862134	4128	Photo Taken
2019-04-06	23:30:42	-117.012481	11.862129	4128	Photo Taken of Porifera with hydroid
2019-04-06	23:39:57	-117.012492	11.862143	4128	Gear Received: PV-APIX #1 on ROV porch	
2019-04-06	23:42:01	-117.012508	11.862135	4128	ROV to Lift: to Elevator II	
2019-04-06	23:44:46	-117.012502	11.862185	4128	Gear on Lift: PV-APIX #1 on Elevator II	

2019-04-07	00:04:22	-117.012617	11.862184	4128	PV-PICAM #16 spotted	
2019-04-07	00:12:49	-117.012557	11.862334	4128	Gear Received: PV-PICAM #16 onto ROV porch	
2019-04-07	00:14:10	-117.01256	11.862106	4128	ROV to Lift: To Elevator II	
2019-04-07	00:23:15	-117.012537	11.86219	4128	Gear on Lift: PV-PICAM#16 secured on Elevator II	
2019-04-07	00:29:48	-117.012613	11.862177	4128	PV-PICAM #20 spotted	
2019-04-07	00:40:04	-117.012684	11.862058	4129	sponge with brisingid-like ophiuroid collected into COLBOX-SGN	
2019-04-07	00:46:18	-117.01267	11.862123	4129	Gear Received: PV-PICAM #20 onto ROV porch	
2019-04-07	00:46:59	-117.01259	11.862154	4129	ROV to Lift: to Elevator II	
2019-04-07	00:50:57	-117.012529	11.862175	4128	Gear on Lift: PV-PICAM#20 onto Elevator II	
2019-04-07	01:00:02	-117.012512	11.862173	4128	Gear Received: ROV-CTD RBINS-02 with passive sampler for metals off Elevator II	
2019-04-07	01:01:20	-117.012419	11.862213	4128	Gear Deployed: ROV-CTD RBINS-02	
2019-04-07	01:06:46	-117.012541	11.862182	4128	ROV to Lift: to Elevator II	
2019-04-07	01:07:18	-117.012541	11.862182	4128	Gear Received: ROV-ADCP (GMR-PFM-10) off Elevator II	
2019-04-07	01:10:49	-117.012426	11.862149	4128	Gear Deployed: ROV-ADCP (GMR-PFM-10)	
2019-04-07	01:17:51	-117.01245	11.862153	4129	Gear Received: SLICBOX 3-5 off Elevator II	

2019-04-07	01:21:35	-117.012474	11.862147	4128	Gear Deployed: SLICBOX 3-5	
2019-04-07	01:45:34	-117.012427	11.862239	4127	Elevator II released by ROV	
2019-04-07	01:53:11	-117.013	11.862999	4127	Gear TakenUp: MICP-DEEP#2	
2019-04-07	02:06:35	-117.01304	11.86358	4127	Gear on Lift: MICP-DEEP#2 on Elevator I	
2019-04-07	02:13:22	-117.013086	11.863578	4126	Gear TakenUp: MICP-DEEP#3	
2019-04-07	02:16:08	-117.013072	11.863609	4127	Gear on Lift: MICP-DEEP#3 on Elevator I	
2019-04-07	02:24:28	-117.013027	11.863564	4126	Elevator I released by ROV	
2019-04-07	02:26:20	-117.012973	11.863548	4124	OFF THE BOTTOM	
2019-04-07	04:10:26	-117.012425	11.863343	-1	ON DECK	

Kiel 6000 Dive 16 (SO268-2_111_ROV16)

Date: 01/03/2019

Observers: JANSSEN, Felix, BODUR, Yasemin

ROV positions (at the bottom)

Start of dive: 11°55.727'N 117°1.439'W

End of dive: 11°55.806'N 117°1.463'W

Dive duration⁶:

ROV in the water: 01.03.19 15:03:42

ROV at the bottom: 01.03.2019 17:03:32

ROV off the bottom: 01.03.19 18:19:08

ROV on deck: 01.03.19 20:14:50

Explored sites: DE impact area

Aims of the Dive (not achieved, see below):

- Deployment of microprofiler- and benthic chamber modules for in situ respiration measurements
- Deployment of time lapse cameras for observations of megafauna communities
- Megafauna sampling
- Deployment of recolonization devices at the seafloor

Handled ROV Tools (including scientific payload):

- None (see below)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- 2 electrochemical profilers (MICP)
- 1 fiberoptical profiler (MICP-DEEP)
- Trap set (2 amphipod traps and 1 ostacod trap)
- 2 x 6 ROV push cores (PUC)

Elevator 2

- 2 Benthic chamber modules (BFC-ROV)
- 3 Time-lapse cameras (PV-PICAM)
- 3 Nodule frames with recolonization substrates (ARTSUBS)
- Trap set (2 amphipod traps and 1 ostacod trap)

Dive summary (protocol by Felix Janssen)

Problems with the hydraulic system of the ROV made handling of instruments and tools at the seafloor impossible and restricted the bottom time to a small fraction of which was

⁶ All dates and times in the protocols refer to UTC

originally planned. The available time was used for fauna observations at the seafloor. All planned work had to be postponed.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments	Image
2019-04-08	14:45:33	-117.013573	11.862184	16	test	
2019-04-08	15:22:13	-117.013573	11.862184	16	IN THE WATER	
2019-04-08	17:02:37	-117.012849	11.864001	4120	AT THE BOTTOM	
2019-04-08	17:10:58	-117.013113	11.864152	4124	Gear Deployed	
2019-04-08	17:13:26	-117.013045	11.864114	4127	Gear Deployed	
2019-04-08	17:13:28	-117.013044	11.864112	4127	GMR_HYA-04_RDI300	<p>2019-04-08_17-13-57_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	17:14:52	-117.013053	11.864118	4126	ROV to Lift	
2019-04-08	17:14:54	-117.013054	11.86412	4126	Transect towards lift	
2019-04-08	17:19:43	-117.013218	11.864416	4127	Photo Taken	<p>2019-04-08_17-19-32_Sonne_SO268-2_111ROV16_Logo.jpg</p>

2019-04-08	17:19:43	-117.013218	11.864416	4127	Photo Taken	<p>2019-04-08_17-19-32_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	17:19:46	-117.013219	11.864414	4127	Photo Taken	<p>2019-04-08_17-19-42_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	17:19:59	-117.013224	11.864411	4127	delete	
2019-04-08	17:24:36	-117.013292	11.864416	4127	Gear Received	
2019-04-08	17:25:13	-117.013302	11.864409	4127	ROV-AQD	
2019-04-08	17:25:16	-117.013306	11.864409	4127	ROV-AQD	
2019-04-08	17:25:22	-117.013315	11.864409	4127	NIOZ_PFM-06	
2019-04-08	17:36:47	-117.013683	11.863933	4127	Video Start	
2019-04-08	17:38:58	-117.013723	11.863807	4127	Gear Deployed	
2019-04-08	17:39:02	-117.01372	11.863808	4127	ROV-AQD	
2019-04-08	17:39:07	-117.013718	11.86381	4127	NIOZ_PFM-06	

2019-04-08	17:39:23	-117.013709	11.863822	4127	Photo Taken	<p>2019-04-08_17-39-22_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	17:39:51	-117.013696	11.863846	4127	ROV to Lift	
2019-04-08	17:40:03	-117.013689	11.863853	4127	Transect to lift	
2019-04-08	17:48:57	-117.013324	11.864459	4127	Gear Received	
2019-04-08	17:49:00	-117.013325	11.864459	4127	ROV-AQD	
2019-04-08	17:49:04	-117.013326	11.864458	4126	NIOZ_PFM-03	
2019-04-08	17:55:30	-117.012418	11.864189	4125	Gear Deployed	
2019-04-08	17:55:33	-117.012417	11.864189	4125	ROV-AQD	
2019-04-08	17:55:35	-117.012416	11.864189	4125	NIOZ_PFM-03	<p>2019-04-08_17-56-25_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	17:57:10	-117.012458	11.864273	4125	Photo Taken	<p>2019-04-08_17-56-35_Sonne_SO268-2_111ROV16_Logo.jpg</p>

2019-04-08	17:57:11	-117.012459	11.864276	4125	Photo Taken	<p>2019-04-08_17-57-08_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	17:57:15	-117.01246	11.864288	4125	Photo Taken	<p>2019-04-08_17-56-44_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	17:57:24	-117.012458	11.864316	4125	Photo Taken	<p>2019-04-08_17-57-21_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	17:58:10	-117.012438	11.864359	4125	ROV to Lift	
2019-04-08	17:58:22	-117.012441	11.864339	4125	Transect to lift	
2019-04-08	18:14:04	-117.013296	11.864418	4127	Gear Received	
2019-04-08	18:14:08	-117.013297	11.86442	4127	ROV-AQD	
2019-04-08	18:14:11	-117.013299	11.864421	4127	NIOZ_PFM-02	
2019-04-08	18:21:32	-117.012614	11.865018	4124	Gear Deployed	
2019-04-08	18:21:34	-117.012613	11.865018	4124	ROV-AQD	

2019-04-08	18:21:36	-117.012613	11.865019	4124	NIOZ_PFM-02	
2019-04-08	18:21:52	-117.01261	11.865021	4124	Photo Taken	<p>2019-04-08_18-21-51_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	18:22:04	-117.01261	11.865019	4124	Photo Taken	<p>2019-04-08_18-22-06_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	18:22:11	-117.012611	11.865017	4124	Photo Taken	<p>2019-04-08_18-22-00_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	18:22:44	-117.012636	11.864986	4124	ROV to Lift	
2019-04-08	18:22:46	-117.012638	11.864984	4124	Transect to lift	
2019-04-08	18:32:25	-117.013286	11.864404	4127	Gear Received	
2019-04-08	18:32:27	-117.013286	11.864405	4127	ROV-AQD	
2019-04-08	18:32:36	-117.013291	11.86441	4127	NIOZ_PFM-05	
2019-04-08	18:41:02	-117.014023	11.86472	4126	Gear Deployed	

2019-04-08	18:41:04	-117.014023	11.864719	4126	ROV-AQD	
2019-04-08	18:41:07	-117.014024	11.864719	4126	NIOZ_PFM-05	
2019-04-08	18:41:30	-117.014025	11.86471	4126	Photo Taken	<p>2019-04-08_18-41-26_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	18:41:41	-117.014023	11.864706	4126	Photo Taken	<p>2019-04-08_18-41-39_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	18:41:52	-117.014017	11.864704	4126	Photo Taken	<p>2019-04-08_18-41-52_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	18:42:26	-117.013984	11.86473	4126	ROV to Lift	
2019-04-08	18:42:30	-117.013979	11.864737	4125	Transect to lift	
2019-04-08	18:54:02	-117.013299	11.864364	4127	Gear Received	
2019-04-08	18:54:06	-117.013297	11.86436	4127	ROV-ADV	
2019-04-08	18:54:09	-117.013295	11.864358	4127	GMR_PFM-07	

2019-04-08	19:14:27	-117.014368	11.865572	4125	Gear Deployed	
2019-04-08	19:14:31	-117.014368	11.865572	4125	ROV-ADV	
2019-04-08	19:14:33	-117.014368	11.865572	4125	GMR_PFM_07	
2019-04-08	19:18:26	-117.01414	11.865391	4125	ROV to Lift	
2019-04-08	19:31:36	-117.013278	11.864386	4126	Gear Received	
2019-04-08	19:31:58	-117.013283	11.864396	4126	RBINS_PFM-01	
2019-04-08	19:32:20	-117.013283	11.864403	4126	ROV-CTD	
2019-04-08	19:43:01	-117.012885	11.865858	4121	Gear Deployed	
2019-04-08	19:43:04	-117.012885	11.865858	4120	ROV-CTD	
2019-04-08	19:43:31	-117.012887	11.865862	4121	RBINS_PFM-01	
2019-04-08	19:44:23	-117.012905	11.865875	4120	Photo Taken	<p>2019-04-08_19-44-15_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	19:45:40	-117.012931	11.86589	4120	ROV to Lift	<p>2019-04-08_19-44-40_Sonne_SO268-2_111ROV16_Logo.jpg</p>

2019-04-08	20:01:58	-117.013309	11.864405	4126	PV-APIX	
2019-04-08	20:02:27	-117.013303	11.864414	4126	Gear Received	
2019-04-08	20:02:30	-117.013301	11.864414	4126	Nr. 3	
2019-04-08	20:13:25	-117.01332	11.864403	4126	Gear TakenUp	
2019-04-08	20:13:37	-117.013321	11.864401	4125	Gear Received	
2019-04-08	20:13:39	-117.013322	11.8644	4125	PV-APIX	
2019-04-08	20:13:40	-117.013322	11.864399	4125	Nr. 2	
2019-04-08	20:14:28	-117.013318	11.864349	4125	Transect to a location 100 m south of the planed dredge track	
2019-04-08	20:42:35	-117.013648	11.862008	4128	looking for good camera deployment locations on a transect parallel to the dredge line	
2019-04-08	20:50:33	-117.013253	11.862107	4129	Found deployment position for PV-APIX	
2019-04-08	20:50:36	-117.013252	11.862107	4129	PV-APIX	
2019-04-08	20:50:43	-117.013249	11.862107	4129	Nr. 2	
2019-04-08	20:51:22	-117.013233	11.862103	4129	Photo Taken	<p>2019-04-08_20-51-08_Sonne_SO268-2_111ROV16_Logo.jpg</p>

2019-04-08	20:51:23	-117.013233	11.862102	4129	Photo Taken	<p>2019-04-08_20-51-10_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	20:53:47	-117.013227	11.862098	4129	Photo Taken	<p>2019-04-08_20-53-44_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	20:57:43	-117.013217	11.862097	4130	Gear Deployed	
2019-04-08	20:57:45	-117.013217	11.862098	4130	PV-APIX	
2019-04-08	20:57:46	-117.013217	11.862098	4130	Nr. 2	
2019-04-08	20:58:38	-117.013219	11.862113	4130	Photo Taken	<p>2019-04-08_20-58-35_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	21:04:12	-117.01311	11.862109	4129	Continue parallel transect to find a good location for the second camera	
2019-04-08	21:05:57	-117.012993	11.862142	4129	Photo Taken	<p>2019-04-08_21-05-57_Sonne_SO268-2_111ROV16_Logo.jpg</p>

2019-04-08	21:07:47	-117.012969	11.862083	4128	Found good location for camera	
2019-04-08	21:07:49	-117.012971	11.862084	4128	PV-APIX	
2019-04-08	21:07:55	-117.012975	11.862087	4129	Nr. 2	
2019-04-08	21:09:49	-117.012878	11.862159	4129	Photo Taken	<p>2019-04-08_21-09-47_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	21:09:54	-117.012883	11.862155	4129	Photo Taken	<p>2019-04-08_21-09-52_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	21:10:28	-117.012908	11.862135	4129	Photo Taken	<p>2019-04-08_21-10-28_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	21:14:20	-117.012942	11.86213	4129	Photo Taken	<p>2019-04-08_21-14-13_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	21:14:33	-117.012941	11.86213	4129	Gear Deployed	

2019-04-08	21:14:36	-117.012941	11.86213	4129	PV-APIX	
2019-04-08	21:14:42	-117.012942	11.862128	4129	Nr. 2	
2019-04-08	21:17:09	-117.012941	11.862132	4129	PV-APIX	
2019-04-08	21:17:10	-117.012941	11.862132	4129	Camera numbers are swaped PV-APIX Nr.2 <> PV-APIX Nr.3	
2019-04-08	21:23:25	-117.01255	11.862189	4127	At sensor dropoff point	
2019-04-08	21:24:53	-117.012548	11.86212	4127	ROV-ADCP	
2019-04-08	21:24:56	-117.012548	11.86212	4127	Cleaning ADCP	
2019-04-08	21:25:52	-117.012556	11.862281	4128	GMR_PFM-10	
2019-04-08	21:29:16	-117.012463	11.862181	4128	Photo Taken	<p>2019-04-08_21-29-13_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	21:31:38	-117.012448	11.862147	4128	done cleaning the ADCP	
2019-04-08	21:37:59	-117.012448	11.862133	4128	Gear TakenUp	
2019-04-08	21:38:08	-117.012453	11.862132	4128	Gear TakenUp	
2019-04-08	21:38:23	-117.012462	11.862135	4128	ROV-ADCP	
2019-04-08	21:39:23	-117.012468	11.862168	4128	GMR_PFM-10	

2019-04-08	21:50:10	-117.01249	11.861471	4128	Gear Deployed	
2019-04-08	21:57:28	-117.012341	11.861418	4128	Gear Deployed	
2019-04-08	21:58:03	-117.012329	11.861407	4128	Amphitrap 03	
2019-04-08	21:58:17	-117.012327	11.861406	4128	Photo Taken	<p>2019-04-08_21-58-15_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	22:01:25	-117.012351	11.861417	4128	ROV to sensor dropoff	
2019-04-08	22:14:28	-117.012437	11.862138	4127	Photo Taken	<p>2019-04-08_22-12-53_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	22:14:52	-117.012435	11.862142	4127	RBINS_PFM-02	
2019-04-08	22:15:25	-117.01243	11.862151	4127	Gear TakenUp	
2019-04-08	22:24:55	-117.011987	11.862461	4126	Gear Deployed	
2019-04-08	22:25:15	-117.011979	11.86245	4126	ROV-CTD	<p>2019-04-08_22-25-19_Sonne_SO268-2_111ROV16_Logo.jpg</p>

2019-04-08	22:25:32	-117.011974	11.862448	4126	RBINS_PFM-02	
2019-04-08	22:25:37	-117.011974	11.862449	4126	Photo Taken	
2019-04-08	22:26:12	-117.011984	11.862461	4126	Photo Taken	<p>2019-04-08_22-27-06_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	22:27:09	-117.011976	11.862484	4125	Photo Taken	<p>2019-04-08_22-26-41_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	22:27:55	-117.011988	11.862483	4125	Photo Taken	<p>2019-04-08_22-27-49_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	22:29:59	-117.012036	11.862435	4126	ROV to sensor dropoff	
2019-04-08	22:33:53	-117.012366	11.862289	4127	Photo Taken	<p>2019-04-08_22-33-51_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	22:34:42	-117.012379	11.862258	4127	fish	

2019-04-08	22:38:00	-117.012462	11.862212	4127	Gear TakenUp	
2019-04-08	22:38:16	-117.012468	11.862213	4127	ROV-CTD	
2019-04-08	22:38:45	-117.012493	11.862206	4127	RBINS_PFM-03	
2019-04-08	22:54:51	-117.011369	11.860737	4126	Gear Deployed	
2019-04-08	22:55:03	-117.011369	11.860735	4126	ROV-CTD	<p>2019-04-08_22-55-09_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	22:55:21	-117.01137	11.860747	4126	RBINS_PFM-03	<p>2019-04-08_22-55-21_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	22:55:23	-117.01137	11.860748	4126	Photo Taken	
2019-04-08	22:55:25	-117.01137	11.86075	4126	Photo Taken	
2019-04-08	22:56:27	-117.011359	11.860741	4126	Exploring further south across EBS track	
2019-04-08	22:57:39	-117.011339	11.860749	4126	Photo Taken	<p>2019-04-08_22-57-21_Sonne_SO268-2_111ROV16_Logo.jpg</p>

2019-04-08	22:58:13	-117.011329	11.860748	4126	Alcyonacea	<p>2019-04-08_22-57-37_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	22:59:11	-117.011306	11.860721	4126	Video Start	
2019-04-08	23:01:21	-117.011273	11.860572	4126	Photo Taken	<p>2019-04-08_23-01-20_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	23:01:48	-117.011279	11.860533	4126	Track	
2019-04-08	23:15:24	-117.011208	11.859959	4127	Back along exploration track	
2019-04-08	23:32:34	-117.012271	11.861162	4128	Video End	
2019-04-08	23:35:58	-117.012441	11.861308	4128	Photo Taken	<p>2019-04-08_23-35-56_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-08	23:36:22	-117.012459	11.861332	4128	Elevator 1	
2019-04-08	23:45:17	-117.012532	11.861328	4129	ROV to Lift	
2019-04-08	23:45:48	-117.012528	11.861321	4129	ROV at lift	

2019-04-08	23:47:24	-117.012523	11.861334	4128	Gear TakenUp	
2019-04-08	23:47:26	-117.012524	11.861334	4128	SLICBOX frame moved aside	
2019-04-09	00:00:38	-117.01252	11.861341	4129	Gear TakenUp	
2019-04-09	00:10:38	-117.012537	11.861353	4129	SLICBOX-15 placed on ROV	
2019-04-09	00:10:59	-117.012539	11.861352	4129	Gear TakenUp	
2019-04-09	00:12:45	-117.012521	11.861345	4129	SLICBOX-07 placed on ROV	
2019-04-09	00:12:49	-117.012519	11.861343	4129	Gear TakenUp	
2019-04-09	00:13:07	-117.012514	11.861335	4129	SLICBOX-08 placed on ROV	
2019-04-09	00:13:10	-117.012514	11.861334	4129	Gear TakenUp	
2019-04-09	00:13:46	-117.012528	11.861342	4129	SLICBOX-09 placed on ROV	
2019-04-09	00:14:11	-117.012546	11.861362	4129	Gear TakenUp	
2019-04-09	00:15:01	-117.012565	11.861373	4129	SLICBOX-10 placed on ROV	
2019-04-09	00:19:07	-117.012562	11.86157	4128	ROV moving to distribute SLICBOXes	
2019-04-09	00:24:36	-117.012454	11.862144	4128	Gear Deployed	
2019-04-09	00:24:45	-117.012453	11.862143	4128	SLICBOX	

2019-04-09	00:25:12	-117.012443	11.862143	4128	SLICBOX-04	
2019-04-09	00:25:25	-117.012437	11.862145	4128	Gear TakenUp	
2019-04-09	00:25:54	-117.012427	11.862151	4128	SLICBOX-05 from seabed on ROV	
2019-04-09	00:26:38	-117.01244	11.862157	4128	Gear TakenUp	
2019-04-09	00:27:26	-117.012457	11.862193	4128	SLICBOX-03 from seabed on ROV	
2019-04-09	00:31:37	-117.011989	11.862468	4126	Gear Deployed	
2019-04-09	00:32:08	-117.011986	11.862454	4126	SLICBOX-03 next to RBINS_PFM-02	<p>2019-04-09_00-31-59_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	00:38:58	-117.012118	11.862973	4126	Gear Deployed	
2019-04-09	00:39:02	-117.012119	11.862974	4126	Photo Taken	<p>2019-04-09_00-39-15_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	00:39:31	-117.012126	11.862977	4126	SLICBOX-05 between positions 7 and 8	

2019-04-09	00:44:30	-117.012121	11.863119	4126	Gear Deployed	<p>2019-04-09_00-44-44_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	00:45:07	-117.012118	11.863116	4126	SLICBOX-10 on position 8	
2019-04-09	00:45:10	-117.01212	11.863116	4126	Photo Taken	
2019-04-09	00:50:27	-117.012289	11.86352	4125	Gear Deployed	
2019-04-09	00:50:30	-117.012287	11.86352	4125	SLICBOX-09 on position 9	
2019-04-09	00:50:41	-117.012282	11.863521	4125	Photo Taken	<p>2019-04-09_00-50-37_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	00:54:59	-117.012317	11.863899	4125	Gear Deployed	<p>2019-04-09_00-54-49_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	00:55:03	-117.012319	11.863901	4125	SLICBOX-08 on position 10	

2019-04-09	00:55:14	-117.012322	11.863907	4125	Photo Taken	<p>2019-04-09_00-55-10_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	00:55:24	-117.012324	11.863912	4125	Photo Taken	<p>2019-04-09_00-55-19_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	01:00:05	-117.012318	11.864175	4125	Gear Deployed	
2019-04-09	01:00:08	-117.012322	11.864172	4125	SLICBOX-07 next to NIOZ_PFM-03	<p>2019-04-09_01-00-18_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	01:00:21	-117.012342	11.864162	4125	Photo Taken	<p>2019-04-09_01-00-30_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	01:00:26	-117.012352	11.864162	4125	Photo Taken	<p>2019-04-09_01-00-24_Sonne_SO268-2_111ROV16_Logo.jpg</p>

2019-04-09	01:00:49	-117.012384	11.86417	4125	Photo Taken	<p>2019-04-09_01-00-37_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	01:09:33	-117.013054	11.864136	4127	Gear Deployed	
2019-04-09	01:09:37	-117.013052	11.864136	4127	SLICBOX-15 next to GMR_PFM-09	
2019-04-09	01:09:48	-117.013046	11.864137	4127	Photo Taken	<p>2019-04-09_01-10-06_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	01:10:06	-117.013041	11.86414	4127	Photo Taken	<p>2019-04-09_01-10-15_Sonne_SO268-2_111ROV16_Logo.jpg</p>
2019-04-09	01:18:45	-117.013012	11.863729	4125	OFF THE BOTTOM	
2019-04-09	02:58:01	-117.012785	11.863528	17	ON DECK	

Kiel 6000 Dive 17 (SO268-2_118_ROV17)

Date: 10/04/2019

Observers: DE STIGTER, Henko, SCHOENING, Timm, HAALBOOM, Sabine, URBAN, Peter, RAMALHO, Sofia, HILARIO, Ana

ROV positions (at the bottom)

Start of dive: 11.863934°N 117.013678°W

End of dive: 11.864313°N 117.013287°W

Dive duration⁷:

ROV in the water: 10.04.19 15:38:03

ROV at the bottom: 10.04.2019 17:13:58

ROV off the bottom: 11.04.19 00:51:04

ROV on deck: 11.04.19 02:34:34

Explored sites: German reference area pre-impact

Aims of the Dive (not achieved, see below):

- Deploy remaining SLIC boxes
- Place remaining plume sensor array
- Fly over SLIC boxes
- Video transect
- Collect fauna

Handled ROV Tools (including scientific payload):

- SLIC box frame
- BioBoxes: COLBOX-BIO and COLBOX-SGN

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- SLICBOX frame
- 3 ROV-AQD tripods
 - NIOZ_PFM-04
 - NIOZ_PFM-08
 - NIOZ_PFM-07
- 1 ROV-ADV tripod
 - GMR_PFM-08

Elevator 2

- -

Dive summary (protocol by Sabine Haalboom)

⁷ All dates and times in the protocols refer to UTC

The remaining SLIC boxes were deployed, as well as the remaining sensor frames. All SLIC boxes were photographed for a pre-impact assessment. Two video transects have been made and 7 specimens have been samples (5 in COLBOX-BIO and 2 in COLBOX-SGN).

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments	Image
2019-04-10	15:38:03	-117.013785	11.862397	16	IN THE WATER	
2019-04-10	17:13:58	-117.013678	11.863934	4095	AT THE BOTTOM	
2019-04-10	17:24:11	-117.01372	11.863861	4128	Gear Deployed SLICBOX 16	
2019-04-10	17:24:54	-117.013741	11.863862	4128	Photo Taken of SLICBOX 16
2019-04-10	17:25:20	-117.013746	11.863853	4127	Photo Taken of SLICBOX in front of AQD Tripod
2019-04-10	17:27:36	-117.013665	11.863738	4127	Photo Taken of Holo
2019-04-10	17:28:01	-117.013659	11.863727	4127	Photo Taken of Holo
2019-04-10	17:35:01	-117.013667	11.86348	4128	Gear Deployed SLICBOX17	

2019-04-10	17:35:51	-117.013684	11.863453	4128	Photo Taken of SLICBOX17
2019-04-10	17:41:15	-117.013674	11.863069	4128	Gear Deployed SLICBOX18	
2019-04-10	17:42:30	-117.013699	11.863117	4128	Photo Taken of SLICBOX18
2019-04-10	17:48:23	-117.013499	11.862454	4129	Photo Taken
2019-04-10	17:48:32	-117.013496	11.86245	4129	Photo Taken
2019-04-10	17:51:51	-117.013523	11.862459	4129	Gear Deployed SLICBOX19	
2019-04-10	17:52:53	-117.013537	11.862486	4129	Photo Taken of SLICBOX19

2019-04-10	17:53:12	-117.013534	11.862509	4129	Photo Taken of SLICBOX19	An underwater photograph showing a white, rectangular SLICBOX19 resting on a dark, sandy seabed. The box is illuminated from above, and a small orange marker is visible to its left. The GEOMAR logo is in the bottom right corner.
2019-04-10	17:59:57	-117.013213	11.862174	4128	Photo Taken of camera	An underwater photograph showing a camera mounted on a blue and white frame resting on a dark, sandy seabed. The camera is illuminated from above, and the GEOMAR logo is in the bottom right corner.
2019-04-10	18:02:39	-117.013224	11.862145	4130	Gear Deployed SLICBOX 20	
2019-04-10	18:03:35	-117.013213	11.862179	4130	Photo Taken of SLICBOX 20	An underwater photograph showing a white, rectangular SLICBOX 20 resting on a dark, sandy seabed. The box is illuminated from above, and the GEOMAR logo is in the bottom right corner.
2019-04-10	18:04:22	-117.013187	11.862166	4130	Photo Taken of SLICBOX 20 and camera	An underwater photograph showing a white, rectangular SLICBOX 20 resting on a dark, sandy seabed. A camera is visible in the background, and the GEOMAR logo is in the bottom right corner.
2019-04-10	18:14:08	-117.012867	11.862992	4126	Photo Taken of SLICBOX 02	An underwater photograph showing a white, rectangular SLICBOX 02 resting on a dark, sandy seabed. The box is illuminated from above, and the GEOMAR logo is in the bottom right corner.

2019-04-10	18:21:52	-117.012613	11.86238	4127	Photo Taken of SLICBOX01
2019-04-10	18:25:53	-117.012402	11.862201	4127	Photo Taken of SLICBOX04 (without white waves)
2019-04-10	18:27:03	-117.012432	11.862201	4127	ROV to Lift; Transit to Elevator 1	
2019-04-10	18:43:54	-117.012517	11.861297	4129	Gear on Lift; SLICBOX frame from ROV porch	
2019-04-10	18:51:42	-117.012491	11.861313	4129	Gear Received; ROV-AQD NIOZ_PFM-08	
2019-04-10	19:00:14	-117.01309	11.861283	4130	Photo Taken of ROV-AQD NIOZ_PFM-08
2019-04-10	19:00:24	-117.013082	11.861285	4130	Gear Deployed; ROV-AQD NIOZ_PFM-08	
2019-04-10	19:00:30	-117.013076	11.861287	4129	ROV to Lift	
2019-04-10	19:12:45	-117.01247	11.861299	4129	Gear Received ROV-AQD NIOZ_PFM-04	
2019-04-10	19:15:54	-117.012222	11.861463	4127	Photo Taken of Holo

2019-04-10	19:15:59	-117.012207	11.861466	4127	Photo Taken of Holo
2019-04-10	19:21:33	-117.011634	11.861604	4126	Gear Deployed ROV-AQD NIOZ_PFM-04	
2019-04-10	19:22:16	-117.011618	11.861593	4127	Photo Taken of ROV-AQD NIOZ_PFM-04
2019-04-10	19:22:28	-117.011621	11.861594	4127	Photo Taken of ROV-AQD NIOZ_PFM-04
2019-04-10	19:22:46	-117.011639	11.861599	4127	Photo Taken of ROV-AQD NIOZ_PFM-04
2019-04-10	19:25:33	-117.011797	11.861703	4125	Photo taken of SLICBOX13
2019-04-10	19:26:10	-117.011806	11.861718	4125	Found SLICBOX13; created marker	

2019-04-10	19:27:23	-117.011813	11.861714	4125	Photo Taken
2019-04-10	19:28:04	-117.01182	11.861693	4125	ROV to Lift	
2019-04-10	19:29:55	-117.011973	11.861637	4126	Photo Taken
2019-04-10	19:30:03	-117.011988	11.861631	4126	Photo Taken
2019-04-10	19:40:57	-117.012471	11.861279	4129	Gear Received ROV-AQD NIOZ_PFM-07	
2019-04-10	19:50:47	-117.013171	11.862134	4130	Gear Deployed ROV-AQD NIOZ_PFM-07	
2019-04-10	19:51:43	-117.013154	11.862115	4129	Photo Taken of ROV-AQD NIOZ_PFM-07, camera and SLICBOX
2019-04-10	19:51:48	-117.013153	11.862112	4129	Photo Taken of ROV-AQD NIOZ_PFM-07

2019-04-10	19:52:03	-117.013153	11.862104	4130	Photo Taken of ROV-AQD NIOZ_PFM-07, camera and SLICBOX
2019-04-10	19:53:36	-117.013184	11.862165	4128	Photo taken of SLICBOX 20
2019-04-10	19:53:49	-117.013184	11.86217	4128	Photo Taken; post ROV deployment impact picture of SLICBOX 20
2019-04-10	19:55:13	-117.013249	11.862294	4127	transect to SLICBOX 19	
2019-04-10	19:57:31	-117.013435	11.862428	4127	Photo taken of SLICBOX 19
2019-04-10	19:57:34	-117.013439	11.862429	4127	Photo taken; Post ROV deployment impact picture of SLICBOX 19
2019-04-10	19:57:49	-117.013452	11.86244	4127	Photo Taken of SLICBOX19

2019-04-10	19:58:50	-117.01342	11.862556	4127	transect to SLICBOX 18	
2019-04-10	20:00:45	-117.013449	11.862773	4126	Photo Taken
2019-04-10	20:00:51				Photo Taken
2019-04-10	20:04:11	-117.013624	11.863022	4126	Photo Taken of SLICBOX18
2019-04-10	20:04:12	-117.013624	11.863023	4126	Photo Taken; Post ROV impact picture of SLICBOX 18
2019-04-10	20:04:20	-117.013628	11.863028	4126	Photo taken SLICBOX18
2019-04-10	20:05:24	-117.013594	11.863097	4126	transect to SLICBOX 17	

2019-04-10	20:09:14	-117.013688	11.863394	4126	Photo Taken of SLICBOX17; post ROV deployment impact	An underwater photograph showing a white SLICBOX17 resting on a dark, sandy seafloor. The box is open, revealing a black interior with white markings. A small white tag is attached to the box. The number '17' is visible on the side of the box. The GEOMAR logo is in the bottom right corner.
2019-04-10	20:09:27	-117.013678	11.863399	4126	Photo Taken of SLICBOX17	An underwater photograph showing a white SLICBOX17 resting on a dark, sandy seafloor. The box is open, revealing a black interior with white markings. A small white tag is attached to the box. The number '17' is visible on the side of the box. The GEOMAR logo is in the bottom right corner.
2019-04-10	20:09:33	-117.013673	11.8634	4126	Photo Taken of SLICBOX 17	An underwater photograph showing a white SLICBOX 17 resting on a dark, sandy seafloor. The box is open, revealing a black interior with white markings. A small white tag is attached to the box. The number '17' is visible on the side of the box. The GEOMAR logo is in the bottom right corner.
2019-04-10	20:09:49	-117.013657	11.863405	4126	Photo Taken	An underwater photograph showing a small, orange crustacean swimming in the water. The background is a deep blue. The GEOMAR logo is in the bottom right corner.
2019-04-10	20:10:18	-117.013638	11.863424	4126	transect to SLICBOX 16	
2019-04-10	20:10:38	-117.01364	11.863449	4126	Photo Taken of Crustacea	An underwater photograph showing a small, orange crustacean swimming in the water. The background is a deep blue. The GEOMAR logo is in the bottom right corner.
2019-04-10	20:16:38	-117.013683	11.863826	4125	Photo Taken Post ROV deployment impact picture of SLICBOX 16 and ROV-AQD tripod	An underwater photograph showing a white SLICBOX 16 and a ROV-AQD tripod on the seafloor. The box is open, revealing a black interior with white markings. A small white tag is attached to the box. The number '16' is visible on the side of the box. The GEOMAR logo is in the bottom right corner.

2019-04-10	20:17:22	-117.013695	11.863844	4125	Photo Taken of SLICBOX16
2019-04-10	20:17:26	-117.013693	11.863848	4125	Photo Taken of SLICBOX 16
2019-04-10	20:17:32	-117.013689	11.863853	4126	Photo Taken of SLICBOX16
2019-04-10	20:19:04	-117.013515	11.8639	4125	transect ot SLICBOX 15	
2019-04-10	20:24:56	-117.013071	11.864084	4125	Photo Taken; Post ROV deployment impact picture of SLICBOX 15
2019-04-10	20:25:00	-117.013072	11.864083	4125	Photo Taken of SLICBOX15
2019-04-10	20:25:08	-117.013073	11.864081	4125	Photo Taken of SLICBOX15

2019-04-10	20:25:28	-117.013066	11.86407	4125	transect to SLICBOX 07	
2019-04-10	20:30:28	-117.012439	11.864085	4123	Photo Taken
2019-04-10	20:31:30	-117.012397	11.864067	4123	Photo Taken
2019-04-10	20:32:02	-117.012407	11.864102	4123	Photo Taken; Post ROV deployment impact picture of SLICBOX07
2019-04-10	20:32:06	-117.012407	11.864105	4123	Photo Taken of SLICBOX07
2019-04-10	20:32:11	-117.012408	11.864107	4123	Photo Taken of SLICBOX 07
2019-04-10	20:32:23	-117.01241	11.864109	4123	transect to SLICBOX 08	

2019-04-10	20:35:54	-117.012285	11.863883	4123	Photo Taken; Post ROV deployment impact picture of SLICBOX 08
2019-04-10	20:36:04	-117.012286	11.863878	4123	Photo Taken of SLICBOX08
2019-04-10	20:36:07	-117.012286	11.863877	4123	Photo Taken of SLICBOX08
2019-04-10	20:36:23	-117.01229	11.863867	4123	transect to SLICBOX 09	
2019-04-10	20:39:05	-117.012211	11.863536	4123	Photo Taken; Post ROV deployment impact picture of SLICBOX 09
2019-04-10	20:39:18	-117.012221	11.86353	4123	Photo Taken of SLICBOX09
2019-04-10	20:39:32	-117.01224	11.863526	4123	transect to SLICBOX 10	

2019-04-10	20:44:00	-117.012088	11.863131	4124	Photo taken of SLICBOX 10; post ROV deployment impact
2019-04-10	20:44:07	-117.012091	11.863125	4124	Photo Taken
2019-04-10	20:44:10	-117.012093	11.863122	4124	Photo Taken
2019-04-10	20:44:20	-117.0121	11.863113	4124	transect to SLICBOX 05	
2019-04-10	20:46:53	-117.01208	11.86297	4124	Photo Taken; Post ROV deployment impact picture of SLICBOX 05
2019-04-10	20:47:02	-117.012086	11.862966	4124	Photo Taken of SLICBOX 05
2019-04-10	20:47:05	-117.012089	11.862965	4124	Photo Taken of SLICBOX 05

2019-04-10	20:47:32	-117.012133	11.862957	4124	transect to SLICBOX 03	
2019-04-10	20:47:38	-117.012146	11.86295	4124	Photo Taken
2019-04-10	20:51:31	-117.012025	11.862476	4125	Photo Taken of SLICBOX 03; Post ROV deployment
2019-04-10	20:52:27	-117.01199	11.862432	4125	Photo Taken of SLICBOX03
2019-04-10	20:52:31	-117.011987	11.862431	4125	Photo Taken of SLICBOX03
2019-04-10	20:52:37	-117.011984	11.86243	4125	Photo Taken of SLICBOX 03
2019-04-10	20:53:20	-117.011983	11.862403	4125	ROV to Lift	

2019-04-10	20:54:05	-117.01198	11.86235	4125	Photo Taken
2019-04-10	20:54:26	-117.011971	11.862342	4125	Photo Taken
2019-04-10	20:54:54	-117.011967	11.862334	4125	Photo Taken
2019-04-10	20:56:55	-117.012095	11.862215	4125	Photo Taken of shrimp
2019-04-10	20:58:33	-117.012173	11.862083	4125	Photo Taken
2019-04-10	20:58:38	-117.012177	11.862075	4125	Photo Taken

2019-04-10	21:02:20	-117.012347	11.86178	4128	Photo Taken	GEOMAR
2019-04-10	21:03:10	-117.012358	11.861726	4128	Photo Taken	GEOMAR
2019-04-10	21:06:16	-117.01239	11.861518	4128	Photo Taken	GEOMAR
2019-04-10	21:16:00	-117.012491	11.861299	4128	Gear Received ROV-ADV GMR_PFM-08	
2019-04-10	21:19:04	-117.012523	11.861101	4127	found SLICBOX 12	
2019-04-10	21:20:53	-117.012541	11.860958	4127	Photo Taken of Free fall impact picture of SLICBOX12	GEOMAR
2019-04-10	21:21:06	-117.012544	11.86095	4127	Photo Taken of SLICBOX 12	GEOMAR

2019-04-10	21:21:09	-117.012544	11.860948	4127	Photo Taken
2019-04-10	21:29:19	-117.012824	11.860393	4129	Gear Deployed ROV-ADV GMR_PFM-08; ca. 17 North of the old EBS track	
2019-04-10	21:29:46	-117.012833	11.860402	4129	Photo Taken of ROV-ADV GMR_PFM-08
2019-04-10	21:34:38	-117.012878	11.860284	4128	Start video transect	
2019-04-10	21:35:03	-117.012884	11.860255	4128	at EBS track	
2019-04-10	22:06:17	-117.015549	11.859451	4127	Found another old track with the sonar. Will move there to have a look	
2019-04-10	22:09:13	-117.015521	11.859557	4129	At the track. It is much shallower than the previous one	
2019-04-10	22:13:21	-117.015835	11.859525	4128	end of video transect	
2019-04-10	22:16:00	-117.016019	11.859524	4128	Start fauna sampling	
2019-04-10	22:18:11	-117.016007	11.859669	4128	Stop to collect "black nodule"	
2019-04-10	22:19:22	-117.016002	11.859649	4130	Photo Taken

2019-04-10	22:19:28	-117.016001	11.859645	4130	Photo Taken
2019-04-10	22:21:22	-117.016	11.859708	4130	COLBOX-BIO "black nodule" into COLBOX-BIO #3	
2019-04-10	22:27:34	-117.015983	11.859651	4130	Photo Taken
2019-04-10	22:28:33	-117.015979	11.859652	4130	COLBOX-BIO antipatharian into COLBOX-BIO #1	
2019-04-10	22:37:14	-117.01596	11.859738	4130	Photo Taken
2019-04-10	22:37:23	-117.015968	11.859738	4130	Photo Taken
2019-04-10	22:40:47	-117.016089	11.85983	4130	"black nodule" collected into COLBOX-BIO #9	
2019-04-10	22:41:08	-117.016067	11.859817	4130	Photo Taken

2019-04-10	22:41:37	-117.016	11.859783	4130	"Black nodule" collected into COLBOX-BIO #9	
2019-04-10	22:52:04	-117.016005	11.859948	4131	Photo Taken
2019-04-10	22:53:51	-117.01598	11.859937	4131	Photo Taken
2019-04-10	22:56:06	-117.015992	11.859917	4131	stalked sponge collected into COLBOX-SGN	
2019-04-10	22:58:46	-117.016002	11.860221	4130	Photo Taken
2019-04-10	22:59:22	-117.016005	11.860295	4130	Photo Taken
2019-04-10	23:01:32	-117.016013	11.860465	4130	Photo Taken

2019-04-10	23:01:36	-117.016014	11.86047	4130	Photo Taken	2019-04-10 23:01:36 GEOMAR
2019-04-10	23:05:23	-117.015948	11.860574	4131	Photo Taken	2019-04-10 23:05:23 GEOMAR
2019-04-10	23:05:35	-117.015947	11.860578	4130	Photo Taken	2019-04-10 23:05:35 GEOMAR
2019-04-10	23:06:06	-117.015966	11.860603	4130	Photo Taken	2019-04-10 23:06:06 GEOMAR
2019-04-10	23:10:58	-117.015991	11.860621	4130	Non-stalked, tall sponge collected into COLBOX_SGN	
2019-04-10	23:24:46	-117.01602	11.861442	4131	Photo Taken	2019-04-10 23:24:46 GEOMAR

2019-04-10	23:24:54	-117.016021	11.861443	4131	Photo Taken
2019-04-10	23:26:52	-117.01598	11.861501	4131	echinoid into COLBOX-BIO#3	
2019-04-10	23:31:24	-117.015979	11.861454	4131	Photo Taken
2019-04-10	23:31:25				Photo taken
2019-04-10	23:31:29				Photo taken
2019-04-10	23:31:43	-117.015985	11.861462	4131	Photo Taken
2019-04-10	23:33:30	-117.015989	11.86144	4131	echinoid collected into COLBOX-BIO#5	
2019-04-10	23:35:40	-117.015976	11.86151	4130	Stop fauna collection	
2019-04-10	23:35:59	-117.015977	11.861552	4130	Move towards dredge track to perform video transect	

2019-04-10	23:45:47	-117.01595	11.862299	4128	Start video transect	
2019-04-11	00:07:34	-117.013921	11.862816	4128	ctenophore	
2019-04-11	00:19:41	-117.012889	11.862981	4126	At SLICBOX #2	
2019-04-11	00:19:59	-117.012883	11.862981	4126	Stop video transect	
2019-04-11	00:21:23	-117.01292	11.86311	4125	Move towards elevator #2	
2019-04-11	00:29:44	-117.013318	11.864279	4126	At elevator #2	
2019-04-11	00:30:16	-117.013326	11.86432	4126	fish on the elevaor	
2019-04-11	00:30:52	-117.013325	11.864355	4126	Photo Taken
2019-04-11	00:33:31	-117.013321	11.864421	4126	waiting for the elevator to release	
2019-04-11	00:46:50	-117.013302	11.864411	4127	Elevator up	
2019-04-11	00:46:52	-117.013301	11.86441	4127	Releasing elevator manually	
2019-04-11	00:51:04	-117.013287	11.864313	4123	OFF THE BOTTOM	
2019-04-11	02:34:34	-117.013112	11.864283	2	ON DECK	

Kiel 6000 Dive 18 (SO268-2_124_ROV18)

Date: 01/03/2019

Observers: WENZHÖFER, Frank; BODUR, Yasemin; SCHOENING, Timm; URBAN, Peter; DE STIGTER, Henko; HALBOOM, Sabine; VOLZ, Jessica; HAUQUIER, Freija; HAECKEL, Matthias

ROV positions (at the bottom)

Start of dive: 11.863128N -117.012511W

End of dive: 11.861487N -117.012769W

Dive duration⁸:

ROV in the water: see protocol below

ROV at the bottom: see protocol below

ROV off the bottom: see protocol below

ROV on deck: see protocol below

Explored sites: GER Dredge area

Aims of the Dive:

- Deployment of microprofiler-modules for in situ respiration measurements
- Push core sampling
- Repositioning of one plume array sensor and recovery of another
- Photographic inspection of SLICBOXes

Handled ROV Tools (including scientific payload):

- Magnet T-Handle, Optical Communication, PUC Rack

ROV payload

- 2 electrochemical profilers (MICP)

Dive summary (protocol by Timm Schoening)

The task for this dive was the immediate post-dredge impact assessment for various disciplines (see aims above).

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments
2019-04-12	17:21:27	-117.0137	11.86251	71	IN THE WATER
2019-04-12	18:50:49	-117.012511	11.863128	4116	AT THE BOTTOM

⁸ All dates and times in the protocols refer to UTC

2019-04-12	19:15:09	-117.012588	11.862922	4126	MICP #2 Deployed temporarily
2019-04-12	19:26:40	-117.01284	11.863176	4126	MICP #1 Deployed within track
2019-04-12	19:30:23	-117.012851	11.863188	4126	MICP #1 Program started
2019-04-12	19:33:19	-117.012827	11.863033	4125	SLICBOX #2
2019-04-12	19:34:36	-117.012793	11.862987	4125	
2019-04-12	19:34:44	-117.012788	11.862987	4125
2019-04-12	19:40:52	-117.012615	11.862939	4125	MICP #2 Gear Received
2019-04-12	19:46:30	-117.012844	11.862857	4127	MICP #2 Gear Deployed outside of the track
2019-04-12	19:47:02	-117.012843	11.862888	4127	MICP #2 started
2019-04-12	19:47:42	-117.012842	11.862925	4127
2019-04-12	19:47:52	-117.01284	11.862916	4127
2019-04-12	19:57:50	-117.013032	11.862864	4126

2019-04-12	19:57:54	-117.013033	11.862863	4126
2019-04-12	19:58:05	-117.013035	11.862859	4126
2019-04-12	19:58:24	-117.013044	11.862858	4126
2019-04-12	20:02:29	-117.0136	11.863045	4126	SLICBOX 18 Post Dredge Photos
2019-04-12	20:02:49	-117.013598	11.863048	4126
2019-04-12	20:02:56	-117.013599	11.86305	4126
2019-04-12	20:05:58	-117.013678	11.863372	4126	SLICBOX 17 Post Dredge Photos

2019-04-12	20:06:16	-117.013678	11.863376	4126	A photograph of a SLICBOX 17, a white rectangular box with a black interior and a wavy white top edge. The box is placed on a dark, sandy seabed. A white tag is attached to the side. The number '17' is printed in black on the bottom right corner. A GEOMAR logo is visible in the bottom right corner of the image.
2019-04-12	20:06:20	-117.013676	11.863375	4126	A photograph of a SLICBOX 17, a white rectangular box with a black interior and a wavy white top edge. The box is placed on a dark, sandy seabed. A white tag is attached to the side. The number '17' is printed in black on the bottom right corner. A GEOMAR logo is visible in the bottom right corner of the image.
2019-04-12	20:08:47	-117.013666	11.863748	4126	SLICBOX 16 Post Dredge Photos
2019-04-12	20:09:56	-117.013665	11.863826	4126	A photograph of a SLICBOX 16, a white rectangular box with a black interior and a wavy white top edge. The box is placed on a dark, sandy seabed. A white tag is attached to the side. The number '16' is printed in black on the bottom right corner. A GEOMAR logo is visible in the bottom right corner of the image.
2019-04-12	20:09:58	-117.013664	11.863826	4126	A photograph of a SLICBOX 16, a white rectangular box with a black interior and a wavy white top edge. The box is placed on a dark, sandy seabed. A white tag is attached to the side. The number '16' is printed in black on the bottom right corner. A GEOMAR logo is visible in the bottom right corner of the image.
2019-04-12	20:14:31	-117.013027	11.864075	4126	SLICBOX 15 Post Dredge Photos
2019-04-12	20:14:50	-117.013023	11.864071	4126	A photograph of a SLICBOX 15, a white rectangular box with a black interior and a wavy white top edge. The box is placed on a dark, sandy seabed. A white tag is attached to the side. The number '15' is printed in black on the bottom right corner. A GEOMAR logo is visible in the bottom right corner of the image.

2019-04-12	20:14:54	-117.013022	11.864068	4126	A photograph of a white SLICBOX 07 on a dark, sandy seabed. The box is open, showing a white interior with a wavy pattern. A small white tag is attached to the box. The GEOMAR logo is visible in the bottom right corner.
2019-04-12	20:18:56	-117.012454	11.864155	4124	SLICBOX 07 Post Dredge Photos
2019-04-12	20:19:50	-117.012415	11.864139	4124	A photograph of a white SLICBOX 07 on a dark, sandy seabed. The box is open, showing a white interior with a wavy pattern. A small white tag is attached to the box. The GEOMAR logo is visible in the bottom right corner.
2019-04-12	20:19:56	-117.012415	11.864136	4124	A photograph of a white SLICBOX 07 on a dark, sandy seabed. The box is open, showing a white interior with a wavy pattern. A small white tag is attached to the box. The GEOMAR logo is visible in the bottom right corner.
2019-04-12	20:24:02	-117.012293	11.86385	4124	SLICBOX 08 Post Dredge Photos
2019-04-12	20:24:28	-117.012274	11.863845	4124	A photograph of a white SLICBOX 08 on a dark, sandy seabed. The box is open, showing a white interior with a wavy pattern. A small white tag is attached to the box. The GEOMAR logo is visible in the bottom right corner.
2019-04-12	20:24:32	-117.012272	11.863844	4124	A photograph of a white SLICBOX 08 on a dark, sandy seabed. The box is open, showing a white interior with a wavy pattern. A small white tag is attached to the box. The GEOMAR logo is visible in the bottom right corner.
2019-04-12	20:28:16	-117.012252	11.863493	4124	SLICBOX 09 Post Dredge Photos

2019-04-12	20:28:16	-117.012252	11.863493	4124	A photograph of a white SLICBOX 09, a sediment sampling device, resting on a dark, sandy seabed. The box is open, showing internal compartments. A small white label with the number '9' is visible on the side. A GEOMAR logo and a timestamp '2019-04-12 20:28:16' are in the bottom right corner.
2019-04-12	20:28:58	-117.012265	11.863495	4124	A photograph of a white SLICBOX 09, a sediment sampling device, resting on a dark, sandy seabed. The box is open, showing internal compartments. A small white label with the number '9' is visible on the side. A GEOMAR logo and a timestamp '2019-04-12 20:28:58' are in the bottom right corner.
2019-04-12	20:32:27	-117.012093	11.863105	4125	SLICBOX 10 Post Dredge Photos
2019-04-12	20:33:33	-117.012069	11.863101	4125	A photograph of a white SLICBOX 10, a sediment sampling device, resting on a dark, sandy seabed. The box is open, showing internal compartments filled with sediment. A small white label with the number '10' is visible on the side. A GEOMAR logo and a timestamp '2019-04-12 20:33:33' are in the bottom right corner.
2019-04-12	20:33:38	-117.012065	11.863099	4125	A photograph of a white SLICBOX 10, a sediment sampling device, resting on a dark, sandy seabed. The box is open, showing internal compartments filled with sediment. A small white label with the number '10' is visible on the side. A GEOMAR logo and a timestamp '2019-04-12 20:33:38' are in the bottom right corner.
2019-04-12	20:35:52	-117.012057	11.862939	4125	SLICBOX 05 Post Dredge Photos
2019-04-12	20:36:14	-117.012054	11.862945	4125	A photograph of a white SLICBOX 05, a sediment sampling device, resting on a dark, sandy seabed. The box is open, showing internal compartments filled with sediment. A small white label with the number '5' is visible on the side. A GEOMAR logo and a timestamp '2019-04-12 20:36:14' are in the bottom right corner.

2019-04-12	20:36:31	-117.012051	11.862955	4125
2019-04-12	20:40:47	-117.011957	11.862483	4126
2019-04-12	20:41:00	-117.011955	11.862473	4126
2019-04-12	20:42:55	-117.011974	11.862441	4126
2019-04-12	20:43:02	-117.011974	11.862438	4126
2019-04-12	20:44:29	-117.011947	11.862405	4126	SLICBOX 3 Post Dredge Photos

2019-04-12	20:44:30	-117.011947	11.862405	4126
2019-04-12	20:44:32	-117.011947	11.862406	4126
2019-04-12	20:49:08	-117.012416	11.862154	4127	SLICBOX 04 Post Dredge Photos
2019-04-12	20:49:32	-117.012393	11.862148	4127
2019-04-12	20:49:36	-117.01239	11.862149	4127
2019-04-12	20:51:14	-117.012524	11.862283	4127	SLICBOX 1 Post Dredge Photos
2019-04-12	20:52:29	-117.012557	11.862365	4127

2019-04-12	20:52:34	-117.012554	11.862366	4127
2019-04-12	20:58:02	-117.013458	11.862476	4128
2019-04-12	20:58:15	-117.013465	11.862485	4128
2019-04-12	20:58:38	-117.013477	11.862492	4128
2019-04-12	21:00:00	-117.013452	11.862426	4128
2019-04-12	21:01:11	-117.013464	11.862457	4128	SLICBOX 19 Post Dredge Photos

2019-04-12	21:01:13	-117.013465	11.862456	4128
2019-04-12	21:01:19	-117.013463	11.862459	4128
2019-04-12	21:05:26	-117.013208	11.862165	4129	SLICBOX 20 Post Dredge Photos
2019-04-12	21:05:44	-117.013204	11.862164	4129
2019-04-12	21:05:57	-117.013205	11.86217	4129
2019-04-12	21:13:33	-117.013127	11.862103	4130	Gear TakenUp NIOZ_PFM-07 to reposition it closer to the impact area
2019-04-12	21:18:18	-117.013204	11.86259	4127

2019-04-12	21:18:21	-117.013209	11.862597	4127
2019-04-12	21:30:08	-117.013401	11.862789	4128	Gear Deployed NIOZ_PFM-07
2019-04-12	21:30:46	-117.013381	11.862786	4128
2019-04-12	21:31:40	-117.013379	11.862807	4128
2019-04-12	21:39:23	-117.012854	11.862936	4125	SLICBOX 02 Post Dredge Photos
2019-04-12	21:39:33	-117.012835	11.862942	4125
2019-04-12	21:57:28	-117.012797	11.863177	4127
2019-04-12	21:57:54	-117.012803	11.863175	4127	

2019-04-12	21:57:56	-117.012804	11.863175	4127
2019-04-12	22:06:38	-117.012773	11.863143	4127
2019-04-12	22:06:59	-117.012786	11.863151	4127
2019-04-12	22:08:07	-117.012792	11.863172	4127	PUC 16, 17, 23 taken
2019-04-12	22:19:40	-117.012809	11.863189	4126
2019-04-12	22:20:04	-117.012813	11.863188	4126

2019-04-12	22:20:14	-117.012818	11.863189	4126
2019-04-12	22:21:12	-117.012856	11.863191	4126	Gear TakenUp MICP #1
2019-04-12	22:23:45	-117.012971	11.863151	4126	Gear Deployed MICP #1
2019-04-12	22:31:13	-117.012823	11.862907	4126
2019-04-12	22:31:15	-117.012824	11.862906	4126
2019-04-12	22:32:16	-117.012867	11.862894	4126	Gear TakenUp MICP #2
2019-04-12	22:38:28	-117.012292	11.8631	4125	Gear Deployed MICP #2
2019-04-12	23:03:26	-117.012136	11.863122	4126
2019-04-12	23:03:59	-117.012138	11.86313	4126	Gear Received PUCs #45, 42, 43, 31, 13, 81, 38, 54

2019-04-12	23:27:43	-117.011964	11.863088	4126
2019-04-12	23:27:45	-117.011963	11.863088	4126	Gear Received PUC #8, 25, 7, 65, 41
2019-04-12	23:52:44	-117.012395	11.864212	4124	Gear TakenUp ROV-AQD NIOZ_PFM-03
2019-04-13	00:01:49	-117.012238	11.863285	4124
2019-04-13	00:01:51	-117.012239	11.863285	4124
2019-04-13	00:02:41	-117.012242	11.863276	4124
2019-04-13	00:06:13	-117.012328	11.863279	4125

2019-04-13	00:06:42	-117.01233	11.863284	4125	Deployed ROV-AQD NIOZ_PFM-03 into dredge track
2019-04-13	00:06:51	-117.012329	11.863285	4125
2019-04-13	00:08:31	-117.012303	11.86328	4125
2019-04-13	00:08:39	-117.012297	11.863271	4125
2019-04-13	00:15:50	-117.013007	11.863596	4125	Elevator Weight
2019-04-13	00:15:50	-117.013007	11.863596	4125
2019-04-13	00:27:41	-117.013705	11.863833	4127	Gear TakenUp ROV-AQD NIOZ_PFM-06

2019-04-13	00:41:48	-117.01284	11.86215	4127
2019-04-13	01:01:52	-117.012487	11.861306	4128	Gear on Lift ROV-AQD NIOZ_PFM-06
2019-04-13	01:08:36	-117.012453	11.861022	4128	SLICBOX 12 Post Dredge Photos
2019-04-13	01:08:53	-117.012464	11.860982	4128
2019-04-13	01:09:22	-117.012462	11.860954	4128
2019-04-13	01:15:35	-117.011878	11.861644	4125	SLICBOX 13 Post Dredge Photos
2019-04-13	01:15:54	-117.011842	11.86166	4125

2019-04-13	01:16:50	-117.011829	11.861706	4125
2019-04-13	01:16:50	-117.011829	11.861706	4125
2019-04-13	01:20:31	-117.012265	11.86209	4126	SLICBOX 04 Post Dredge Inspection
2019-04-13	01:26:48	-117.01271	11.86287	4125	SLICBOX 02 Post Dredge Inspection
2019-04-13	01:33:04	-117.012195	11.86308	4126	Gear TakenUp MICP #2
2019-04-13	01:49:25	-117.012946	11.863151	4126	Gear TakenUp MICP #1
2019-04-13	02:18:30	-117.012454	11.861284	4129	Gear on Lift MICP #1 and MICP #2 but not fixed yet
2019-04-13	02:27:35	-117.012867	11.862146	4129
2019-04-13	02:27:48	-117.012874	11.862142	4129

2019-04-13	02:28:00	-117.012879	11.862142	4129
2019-04-13	02:34:51	-117.012879	11.862144	4130	Gear TakenUp PVAPIX #3
2019-04-13	02:46:01	-117.012457	11.861292	4128	Fixing Profilers on Elevator 1
2019-04-13	03:06:08	-117.012343	11.861358	4128
2019-04-13	03:06:11	-117.012341	11.861359	4128
2019-04-13	03:06:13	-117.01234	11.86136	4128
2019-04-13	03:06:31	-117.012334	11.861357	4128

2019-04-13	03:06:36	-117.012333	11.861354	4128
2019-04-13	03:08:05	-117.012275	11.861365	4129	Gear TakenUp Amphitrap
2019-04-13	03:23:36	-117.012497	11.8613	4129	Released Elevator 1
2019-04-13	03:25:39	-117.012769	11.861487	4129	OFF THE BOTTOM
2019-04-13	03:25:50	-117.012793	11.861493	4129	HD off
2019-04-13	05:06:13	-117.012619	11.861094	1	ON DECK

Kiel 6000 Dive 19 (SO268-2_134_ROV19)

Date: 17/04/2019 – 18/04/2019

Observers: WENZHÖFER, Frank; BODUR, Yasemin; SCHILLER, Elena; RAMALHO, Sofia; HILARIO, Ana; ESQUETE, Patricia; HAUQUIER, Freija

ROV positions (at the bottom)

Start of dive: 14°06.697'N 125°52.293'W

End of dive: 14°06.682'N 125°52.303'W

Dive duration⁹:

ROV in the water: 17.04.2019 19:16:12

ROV at the bottom: 17.04.2019 21:01:18

ROV off the bottom: 18.04.2019 03:45:36

ROV on deck: 18.04.2019 05:43:55

Explored sites: BE trial area

Aims of the Dive:

- Deployment of 3x microprofiler- and 2x benthic chamber modules for in situ respiration measurements; repositioning of the 3 microprofilers at the end of the dive
- Recovery of 4 experimental corrals from SO268/1: sampling holothurian + taking 4 PUCs inside each corral
- Megafauna sampling
- Videotransect

Handled ROV Tools (including scientific payload):

- Senckenberg biobox
- 16 PUC

Relevant Elevator payload (*italic: payload not used during the dive*)

On Porch:

- 1 electrochemical profiler (MICP)

Elevator 1

- 2 fiberoptical profilers (MICP-DEEP)
- 2 Benthic chamber modules (BFC-ROV)
- 2 x 6 ROV push cores (PUC)

Elevator 2

- Trap (2 amphipod traps)
- 1 InSitu Pump

⁹ All dates and times in the protocols refer to UTC

- 4 Corrals (on way up)

Dive summary (protocol by Freija Hauquier)

During the dive 3 profilers (1x MICP, 2x MICP-DEEP) and two benthic chambers (BFC-ROV) were placed on the seabed and started. One of the main tasks was to recollect four experimental corrals in the Belgian trial area which had been placed onto the seabed during SO268/1 (on 21st of March – 082ROV13). Each of these corrals contained (or should contain) an individual holothurian. These were sampled into the Senckenberg Biobox, and an additional 4 PUCs were taken in each corral. After that, some fauna sampling was carried out. The dive ended with the repositioning and restarting of the three profilers.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments	Image
2019-04-17	19:16:09	-125.872947	14.112832	92	IN THE WATER	
2019-04-17	21:01:15	-125.871586	14.111615	4486	AT THE BOTTOM	
2019-04-17	21:11:42	-125.871647	14.111544	4495	Gear received: MICP #1 taken off ROV porch	
2019-04-17	21:14:57	-125.871654	14.111563	4496	Gear Deployed: MICP#1 on a spot with less nodules	
2019-04-17	21:16:32	-125.871662	14.111578	4496	Photo Taken
2019-04-17	21:16:56	-125.871667	14.111572	4496	Photo Taken

2019-04-17	21:17:17	-125.871666	14.111568	4496	Photo Taken
2019-04-17	21:23:11	-125.871603	14.111531	4495	Gear operated: MICP #1 running	
2019-04-17	21:29:28	-125.871629	14.111522	4495	Photo Taken: wood of Schneeschuhe taken off porch and placed right next to the profiler
2019-04-17	21:29:31	-125.871628	14.111521	4495	Photo Taken (woodfall)
2019-04-17	21:31:11	-125.871666	14.111505	4494	ROV to Lift: to Elevator I	
2019-04-17	21:32:16	-125.871706	14.111466	4493	Photo Taken: Elevator I
2019-04-17	21:38:49	-125.871813	14.111458	4494	Gear Received: MICP-DEEP #2	

2019-04-17	21:47:42	-125.871799	14.111575	4495	Photo Taken
2019-04-17	21:47:48	-125.871799	14.111575	4495	Gear Deployed: MICP-DEEP #2	
2019-04-17	21:48:36	-125.871817	14.111566	4495	Photo Taken
2019-04-17	21:54:21	-125.8718	14.111445	4493	ROV to Lift: Elevator I	
2019-04-17	21:56:30	-125.871792	14.111411	4494	Gear Received: MICP-DEEP #3	
2019-04-17	22:02:28	-125.87167	14.111322	4495	Gear Deployed: MICP-DEEP #3	
2019-04-17	22:04:01	-125.87168	14.111324	4495	Photo Taken
2019-04-17	22:04:11	-125.871679	14.111322	4495	Photo Taken

2019-04-17	22:05:43	-125.87168	14.111306	4495	Gear Operated: MICP-DEEP #3 running	
2019-04-17	22:11:37	-125.871768	14.11142	4495	ROV to Lift: Elevator I	
2019-04-17	22:16:42	-125.871747	14.111433	4495	Gear Received : BFC-ROV #2	
2019-04-17	22:23:43	-125.87186	14.111543	4496	Gear Deployed: BFC-ROV #2	
2019-04-17	22:26:56	-125.871858	14.111677	4496	Gear Operated: BFC-ROV #2	
2019-04-17	22:27:46	-125.871789	14.111647	4494	ROV to Lift: Elevator I	
2019-04-17	22:32:29	-125.871761	14.111505	4495	Gear Received: BFC-ROV #3	
2019-04-17	22:36:22	-125.871611	14.111351	4496	Photo Taken
2019-04-17	22:38:18	-125.871628	14.111347	4496	Gear Deployed: BFC-ROV #3	
2019-04-17	22:49:00	-125.871574	14.111364	4496	activation of BFC-ROV #3 failed	
2019-04-17	22:55:00	-125.871246	14.111525	4497	moving towards corral #11 to start sampling	
2019-04-17	23:02:22	-125.870258	14.112299	4505	At EXP-CORRAL#11	

2019-04-17	23:02:24	-125.870257	14.112298	4505	Photo Taken
2019-04-17	23:05:38	-125.87025	14.11233	4506	Photo Taken
2019-04-17	23:13:41	-125.870195	14.112331	4507	COLBOX-SGN: holothurian collected into COLBOX-SGN	
2019-04-17	23:14:18	-125.870225	14.112322	4507	Gear Deployed: take 4 PUCs inside corral#11: PUC45, 27, 24, 20	
2019-04-17	23:14:40	-125.870261	14.112324	4507	Photo Taken
2019-04-17	23:23:52	-125.870271	14.112349	4507	Photo Taken
2019-04-17	23:23:58	-125.870282	14.112342	4507	Photo Taken

2019-04-17	23:27:12	-125.870313	14.112374	4507	Gear Received: PUC20, 24, 27, 45 into drawer ROV	
2019-04-17	23:34:03	-125.870189	14.11232	4507	Gear Taken up: Corral placed on ROV porch	
2019-04-17	23:35:47	-125.870247	14.112382	4505	Moving toward corral#10	
2019-04-17	23:43:09	-125.870931	14.113036	4506	At EXP-CORRAL#10	
2019-04-17	23:48:07	-125.870944	14.113049	4508	Photo Taken
2019-04-17	23:52:16	-125.870931	14.113054	4508	Photo Taken: after removal of Corral 10
2019-04-17	23:52:26	-125.870943	14.113062	4508	Photo Taken: No holothurian inside the corral, but a Galatheidæ
2019-04-17	23:53:27	-125.870942	14.113079	4508	Photo Taken

2019-04-17	23:54:40	-125.871019	14.113127	4508	Gear deployed: sample 4 pucs in corral #10: PUC 54, 17, 6, 25	
2019-04-18	00:00:29	-125.870972	14.113119	4508	Photo Taken
2019-04-18	00:01:58	-125.870794	14.113159	4508	Gear Received: PUC25, 6, 17 and 54 back into ROV drawer	
2019-04-18	00:08:10	-125.870917	14.113086	4508	COLBOX-SGN: Galatheidæ sampled into COLBOX-SGN	
2019-04-18	00:09:05	-125.87098	14.113036	4508	Placing both corrals on the porch	
2019-04-18	00:14:23	-125.870888	14.113227	4508	ROV to lift: to Elevator II to leave corrals	
2019-04-18	00:31:44	-125.868814	14.113224	4510	Arrive at an old track	
2019-04-18	00:32:27	-125.86881	14.113206	4510	set waypoint	
2019-04-18	00:32:30	-125.86881	14.113204	4510	Photo Taken
2019-04-18	00:32:30	-125.86881	14.113204	4510	Photo Taken

2019-04-18	00:34:44	-125.868597	14.113186	4511	At Elevator #2	
2019-04-18	00:37:06	-125.868444	14.113265	4511	Photo Taken
2019-04-18	00:37:09	-125.868444	14.113265	4511	Photo Taken
2019-04-18	00:37:18	-125.868444	14.113265	4511	Photo Taken
2019-04-18	00:37:27	-125.868444	14.113265	4511	Photo Taken
2019-04-18	00:43:33	-125.868405	14.113308	4512	Corrals fell while placing on the elevator: one broke and placed in back of portside drawer; other corral fixed onto Elevator II	
2019-04-18	01:02:42	-125.868396	14.113238	4512	Moving towards EXP-CORRAL #7	

2019-04-18	01:09:08	-125.868924	14.112739	4510	Photo Taken: Holothuroidea
2019-04-18	01:10:37	-125.869069	14.112643	4509	Photo Taken: Holothuroidea
2019-04-18	01:19:24	-125.869406	14.111885	4505	Arrive at EXP-CORRAL #7	
2019-04-18	01:20:57	-125.869407	14.111845	4505	Photo Taken
2019-04-18	01:21:05	-125.869406	14.111844	4505	Photo Taken
2019-04-18	01:21:09	-125.869406	14.111844	4505	EXP-CORRAL #7 lifted and put aside → no Holothuroidea inside	
2019-04-18	01:26:28	-125.86943	14.111841	4507	Photo Taken

2019-04-18	01:26:45	-125.869437	14.111842	4507	Photo Taken
2019-04-18	01:27:39	-125.86951	14.111885	4507	Gear Deployed: take 4 PUC inside Corral#7: PUC11, 13, 51, 71	
2019-04-18	01:33:35	-125.869444	14.111827	4507	Photo Taken
2019-04-18	01:34:14	-125.86943	14.111833	4507	Gear Received: PUC#71, 51, 11, 13 back into ROV drawer	
2019-04-18	01:38:56	-125.869524	14.111878	4506	Gear Taken Up: Placing EXP-CORRAL #6 on the porch	
2019-04-18	01:39:46	-125.869424	14.111825	4506	Moving toward EXP-CORRAL #6	
2019-04-18	01:42:23	-125.869048	14.111751	4505	At EXP-CORRAL#6	
2019-04-18	01:42:56	-125.86902	14.111742	4505	Photo Taken

2019-04-18	01:47:30	-125.868998	14.111676	4507	Photo Taken
2019-04-18	01:47:38	-125.868996	14.111667	4507	Photo Taken
2019-04-18	01:48:27	-125.869007	14.111657	4507	COLBOX-SGN: Collect holothurian into COLBOX-SGN (damaged by corral)	
2019-04-18	01:50:32	-125.869042	14.111742	4507	Gear Deployed: take 4 PUC inside EXP-CORRAL#6: PUC38, 65, 16, 43	
2019-04-18	01:56:20	-125.86895	14.111722	4507	Photo Taken
2019-04-18	01:56:38	-125.868956	14.111724	4507	Photo Taken
2019-04-18	01:57:34	-125.868983	14.111728	4507	Gear Received: PUC#38, 65, 43, 16 back into ROV drawer	
2019-04-18	02:04:10	-125.868963	14.111697	4506	Gear Taken Up: placing EXP-CORRAL #6&7 on ROV	

2019-04-18	02:04:32	-125.868951	14.1117	4505	ROV to lift: moving to Elevator II to put EXP-CORRAL	
2019-04-18	02:08:35	-125.868654	14.112232	4508	Photo Taken: Fish
2019-04-18	02:22:17	-125.86837	14.113238	4512	EXP-CORRAL 7 and 6 on Elevator II corral #7 on elevator	
2019-04-18	02:25:28	-125.868343	14.11322	4512	Gear Received: marker taken from Elevator II to place next to woodfall	
2019-04-18	02:26:56	-125.868377	14.113201	4511	video transect starts	
2019-04-18	02:28:28	-125.871519	14.111618	4499	end of video transect	
2019-04-18	02:29:58	-125.871618	14.111557	4497	Arrive at woodfall	
2019-04-18	03:01:12	-125.871661	14.111543	4498	Gear Deployed: 2 markers near woodfall	
2019-04-18	03:02:32	-125.871664	14.111558	4497	Photo Taken
2019-04-18	03:02:35	-125.871664	14.111556	4497	Photo Taken

2019-04-18	03:02:55	-125.871658	14.111547	4497	Photo Taken
2019-04-18	03:12:00	-125.871595	14.111383	4496	Gear Taken up: MICP-DEEP # 3 taken up and repositioned	
2019-04-18	03:16:45	-125.8716	14.111535	4497	Photo Taken
2019-04-18	03:16:48	-125.8716	14.111535	4497	Gear Deployed: MICP-DEEP#3	
2019-04-18	03:17:01	-125.871591	14.11152	4497	Photo Taken
2019-04-18	03:22:58	-125.871547	14.111254	4495	ROV to MICP-DEEP #2	
2019-04-18	03:28:45	-125.871866	14.11163	4496	Gear TakenUp: MICP-DEEP #2 taken up and repositioned	
2019-04-18	03:32:03	-125.871865	14.111581	4496	Gear Deployed: MICP-DEEP #2	

2019-04-18	03:33:08	-125.871864	14.1116	4496	Photo Taken
2019-04-18	03:33:37	-125.87187	14.111592	4496	Photo Taken
2019-04-18	03:36:02	-125.871903	14.111522	4495	Photo Taken
2019-04-18	03:36:11	-125.871899	14.111527	4495	gear checked: BFC-ROV #2 checked	
2019-04-18	03:37:06	-125.871859	14.111591	4496	ROV to BFC-ROV #3	
2019-04-18	03:42:15	-125.871564	14.111422	4497	Photo Taken: dead fish (eaten by shrimp?)
2019-04-18	03:42:59	-125.87161	14.111368	4494	BFC-ROV #3 taken up (did not work)	
2019-04-18	03:44:18	-125.871735	14.111341	4493	Gear Received: BFC-ROV #3 on porch ROV to ascend	

2019-04-18	03:45:29	-125.871703	14.111348	4490	OFF THE BOTTOM	
2019-04-18	05:43:52	-125.872189	14.111874	2	ON DECK	

Kiel 6000 Dive 20 (SO268-2_137_ROV20)

Date: 18/04/2019

Observers: WENZHOEFER Frank, BODUR Yasemin, HILÁRIO Ana, RAMALHO Sofia, ESQUETE Patricia

ROV positions (at the bottom)

Start of dive: 14°6.696'N 125°52.317'W

End of dive: 14°6.776'N 125°52.157'W

Dive duration¹⁰:

ROV in the water: 18.04.19 15:11:08

ROV at the bottom: 18.04.19 17:00:48

ROV off the bottom: 19.04.19 02:49:39

ROV on deck: 19.04.19 03:11:00

Explored sites: Belgian Trial Area

Aims of the Dive (not achieved, see below):

- Reposition of of microprofiler- and benthic chamber modules for in situ respiration measurements
- Push-Core sampling for meiofauna
- Video-Transect
- Megafauna sampling

Handled ROV Tools (including scientific payload):

- 2 fiberoptical profilers (MICP-DEEP)
- 1 ISCHAM
- Bioboxes: COLBOX- SNG and COLBOX-BIO
- Pushcores
- T-Handle
- Optical communication
- slurp gun

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- 1 ISCHAM
- 2 fiberoptical profiler (MICP-DEEP)
- *Amphipod trap (below)*
- 2 x 6 ROV push cores (PUC)

Elevator 2

¹⁰ All dates and times in the protocols refer to UTC

- *Amphipod trap (below)*
- *1 in situ pump*
- 4 corrals

Dive summary

Replace profilers, tale PUCs, fauna sampling, Video-Transect

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments	Image
2019-04-18	14:40:01	-125.873025	14.112943	55	test	
2019-04-18	15:11:08	-125.873025	14.112943	55	IN THE WATER	
2019-04-18	17:00:48	-125.871959	14.111608	4489	AT THE BOTTOM	
2019-04-18	17:14:41	-125.871956	14.111829	4496	MICP-DEEP#2 Repositioned	
2019-04-18	17:15:01	-125.871945	14.11182	4496	Photo Taken
2019-04-18	17:15:13	-125.871939	14.111819	4496	Photo Taken
2019-04-18	17:19:30	-125.871899	14.111831	4497	MICP-DEEP#2 started running	
2019-04-18	17:22:29	-125.871735	14.111659	4496	Photo Taken
2019-04-18	17:32:58	-125.871776	14.111476	4495	MICP#1 recovered and secured in elevator.	

2019-04-18	17:27:31	-125.871612	14.111347	4495	Photo Taken
2019-04-18	17:37:29	-125.871612	14.111347	4495	Photo Taken
2019-04-18	17:44:16	-125.871646	14.111312	4495	MICP-DEEP#3 Repositioned	
2019-04-18	17:45:48	-125.871636	14.111312	4495	Photo Taken
2019-04-18	17:46:04	-125.871634	14.111311	4495	Photo Taken
2019-04-18	17:47:40	-125.871657	14.111327	4495	Photo Taken
2019-04-18	17:47:45	-125.871657	14.111327	4495	Photo Taken
2019-04-18	17:50:42	-125.871634	14.111326	4495	MICP-DEEP#3 started running	
2019-04-18	17:52:00	-125.871678	14.1114	4494	PUC sixpack taken from elevator#1	

2019-04-18	18:02:05	-125.871755	14.111441	4495	Photo Taken
2019-04-18	18:02:47	-125.871765	14.111438	4495	Photo Taken
2019-04-18	18:08:38	-125.871772	14.111432	4495	PUCs #46, 5, 30, 22, inserted into de sediment	
2019-04-18	18:08:51	-125.871769	14.111426	4496	Photo Taken
2019-04-18	18:12:52	-125.87177	14.111416	4495	PUCs #5, 22, 30, 46 back into sixpack	
2019-04-18	18:18:13	-125.871906	14.111309	4494	Photo Taken
2019-04-18	18:20:16	-125.871906	14.111309	4494	Photo Taken
2019-04-18	18:20:40	-125.871905	14.111312	4494	Photo Taken

2019-04-18	18:22:42	-125.871892	14.111318	4494	PUCs #19, 33 inserted into the sediment	
2019-04-18	18:22:57	-125.871887	14.111318	4494	Photo Taken
2019-04-18	18:27:38	-125.871905	14.111316	4494	PUCs #19, 33 back into sixpack	
2019-04-18	18:40:40	-125.87177	14.111463	4495	Photo taken
2019-04-18	18:42:29	-125.871711	14.111469	4496	Photo Taken
2019-04-18	18:42:44	-125.871722	14.111461	4496	Photo Taken
2019-04-18	18:42:51	-125.871725	14.111459	4496	Photo Taken
2019-04-18	18:43:02	-125.871729	14.111455	4496	Photo Taken
2019-04-18	18:48:13	-125.871699	14.111456	4496	Fauna sampling. Echinoid lost, ophiuroid to COLBOX-SGN	

2019-04-18	18:53:15	-125.871715	14.111414	4496	Photo Taken
2019-04-18	18:53:22	-125.871713	14.111416	4495	Photo Taken
2019-04-18	18:53:36	-125.871707	14.111418	4496	Photo Taken
2019-04-18	18:53:40	-125.871704	14.111419	4496	Photo Taken
2019-04-18	18:57:26	-125.871706	14.111393	4496	COLDBOX-BIO#7 - Anthipatarian and ophiuroid	
2019-04-18	18:59:22	-125.871721	14.11139	4495	COLBOX-SGN - Galatheidæ	
2019-04-18	19:06:38	-125.871578	14.111267	4495	Photo Taken
2019-04-18	19:07:16	-125.871578	14.111267	4495	Photo Taken

2019-04-18	19:10:32	-125.871555	14.111263	4497	Photo Taken
2019-04-18	19:10:40	-125.871555	14.111262	4496	Photo Taken
2019-04-18	19:10:52	-125.871552	14.111259	4497	Photo Taken
2019-04-18	19:11:00	-125.87155	14.111257	4497	Photo Taken
2019-04-18	19:11:43	-125.871538	14.11125	4496	COLBOX-SGN - 2 echinoids	
2019-04-18	19:20:56	-125.871521	14.111179	4497	Photo Taken
2019-04-18	19:21:06	-125.87152	14.111179	4497	Photo Taken
2019-04-18	19:21:18	-125.87152	14.11118	4497	COLBOX-SGN - Galatheididae	

2019-04-18	19:28:54	-125.871479	14.111057	4496	Photo Taken
2019-04-18	19:29:02	-125.87148	14.111057	4496	Photo Taken
2019-04-18	19:29:21	-125.871476	14.111059	4496	Photo Taken
2019-04-18	19:29:33	-125.871472	14.111061	4496	Photo Taken
2019-04-18	19:29:42	-125.871468	14.111063	4496	Photo Taken
2019-04-18	19:35:02	-125.871437	14.111056	4496	COLDBOX-BIO # 3- Large actiniaria	
2019-04-18	19:38:40	-125.871444	14.111064	4496	COLBOX-SGN – 2 echinoids	
2019-04-18	19:49:20	-125.871296	14.110858	4496	Photo Taken

2019-04-18	19:49:28	-125.871297	14.110858	4496	Photo Taken
2019-04-18	19:49:36	-125.871298	14.110857	4496	COLBOX-SGN - Galatheidae	
2019-04-18	19:56:45	-125.87129	14.11081	4496	Photo Taken
2019-04-18	19:56:57	-125.87129	14.11081	4496	Photo Taken
2019-04-18	19:57:09	-125.871288	14.110809	4496	Photo Taken
2019-04-18	19:57:18	-125.871288	14.110809	4496	Photo Taken
2019-04-18	20:00:31	-125.871286	14.110831	4496	COLBOX-BIO #5 - Actiniaria	
2019-04-18	20:04:16	-125.871267	14.110825	4496	COLD BOX #4- Actiniaria	

2019-04-18	20:09:41	-125.871212	14.11078	4496	Photo Taken
2019-04-18	20:09:59	-125.871212	14.11078	4496	Photo Taken
2019-04-18	20:11:48	-125.871227	14.110772	4496	Sponge - COLBOX #9	
2019-04-18	20:20:15	-125.87122	14.110748	4495	Photo Taken
2019-04-18	20:20:20	-125.871217	14.110748	4495	Photo Taken
2019-04-18	20:22:56	-125.87114	14.110633	4495	Photo Taken
2019-04-18	20:27:38	-125.871033	14.110518	4496	Photo Taken

2019-04-18	20:27:46	-125.871031	14.110516	4496	Photo Taken
2019-04-18	20:30:15	-125.871041	14.110517	4496	COLBOX-SGN - Galatheid	
2019-04-18	20:35:01	-125.870937	14.110423	4496	Photo Taken
2019-04-18	20:35:13	-125.870944	14.110419	4497	Photo Taken
2019-04-18	20:35:20	-125.870946	14.110419	4497	COLBOX-SGN - Echinoid	
2019-04-18	20:43:13	-125.870906	14.110412	4497	Photo Taken
2019-04-18	20:43:21	-125.870909	14.110412	4497	Photo Taken
2019-04-18	20:43:36	-125.870918	14.110414	4497	Photo Taken

2019-04-18	20:43:57	-125.870918	14.110414	4497	Photo Taken
2019-04-18	20:44:18	-125.870916	14.110414	4497	Photo Taken
2019-04-18	20:49:36	-125.87087	14.110392	4497	COLBOX-BIO #1 - Alcyonacea	
2019-04-18	20:54:38	-125.870865	14.11037	4497	Photo Taken
2019-04-18	20:54:42	-125.870865	14.11037	4497	Photo Taken
2019-04-18	20:55:07	-125.870852	14.11037	4497	Photo Taken
2019-04-18	20:55:29	-125.870848	14.110373	4497	Photo Taken

2019-04-18	20:55:39	-125.870848	14.110375	4497	Photo Taken
2019-04-18	21:02:16	-125.870865	14.110334	4497	COLBOX-SGN - Porifera	
2019-04-18	21:09:07	-125.870697	14.110222	4497	Photo Taken
2019-04-18	21:11:51	-125.870664	14.110206	4497	Photo Taken
2019-04-18	21:11:59	-125.870665	14.110203	4498	Photo Taken
2019-04-18	21:17:59	-125.870687	14.110189	4497	COLD BOX-SGN - Echinoid	
2019-04-18	21:17:06	-125.870687	14.110188	4497	Photo Taken
2019-04-18	21:21:33	-125.870662	14.110202	4498	COLBOX-BIO#8 - Polyplacophora	
2019-04-18	21:27:31	-125.870627	14.110054	4497	Photo Taken

2019-04-18	21:27:53	-125.870622	14.110054	4497	Photo Taken
2019-04-18	21:28:12	-125.87062	14.110058	4497	Photo Taken
2019-04-18	21:28:31	-125.870618	14.110065	4497	Photo Taken
2019-04-18	21:43:55	-125.870259	14.109551	4497	COLBOX-SGN - Echinoid	
2019-04-18	21:50:27	-125.869974	14.109124	4498	Photo Taken
2019-04-18	21:58:50	-125.869809	14.109128	4498	video-transect starts	
2019-04-18	22:36:38	-125.871504	14.111226	4496	video-transect ends	
2019-04-18	22:38:44	-125.871531	14.11123	4496	Photo Taken
2019-04-18	22:39:42	-125.871525	14.11122	4496	Photo Taken

2019-04-18	22:39:47	-125.871525	14.11122	4496	Photo Taken
2019-04-18	22:39:55	-125.871524	14.111219	4496	MICP-DEEP #3 not repositioned	
2019-04-18	22:47:48	-125.871732	14.111594	4496	Photo Taken
2019-04-18	23:09:12	-125.871691	14.111402	4496	ISCHAM #2 taken up and secured on elevator	
2019-04-18	23:44:40	-125.871578	14.111246	4496	MICP-DEEP #2 taken up and secured on elevator	
2019-04-18	23:51:30	-125.871739	14.111393	4496	MICP-DEEP #3 taken up and secured on elevator	
2019-04-19	00:17:00	-125.871779	14.111396	4493	Lift #1 released by ROV	
2019-04-19	01:04:03	-125.868357	14.113172	4512	Lift #2 released by ROV	
2019-04-19	02:49:39	-125.869279	14.112932	543	OFF THE BOTTOM	
2019-04-19	03:11:00	-125.86932	14.112693	6	ON DECK	

Kiel 6000 Dive 21 (SO268-2_146_ROV21)

Date: 20/04/2019

Observers: Wenzhöfer, Frank

ROV positions (at the bottom)

Start of dive: 14°05.066'N 125°52.244'W

End of dive: 14° 05.018'N 125° 54.342'W

Dive duration¹¹:

ROV in the water: 20.04.19 14:10:46

ROV at the bottom: 20.04.19 15:56:48

ROV off the bottom: 20.04.19 01:32:24

ROV on deck: 20.04.19 03:38:07

Explored sites: Belgian trial area

Aims of the Dive:

- Search and rescue for in-situ modules

Handled ROV Tools (including scientific payload):

- SenckenbergBox, slurp gun, 3 hand nets, Scoop, magnet T-Handle, optical communication

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1 – not in use

Elevator 2 – not in use

Dive summary (protocol by Kristin Hamann)

This dive focused on the rescue of the insitu-chambers that were lost at the water surface during the last elevator recovery. During the elevator recovery the ship drifted and waypoints were determined every time a chamber was lost. Based on these waypoints the rescue dive was planned. All chambers were found and recovered.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-04-20	15:56:46	-125.905656	14.083608	4469	AT THE BOTTOM
2019-04-20	16:02:33	-125.905363	14.083795	4469	starting search

¹¹ All dates and times in the protocols refer to UTC

2019-04-20	16:08:05	-125.904302	14.084284	4468	<p>2019-04-20_16-06-55_Sonne_SO268-2_146ROV21_Logo.jpg</p>
2019-04-20	16:39:38	-125.902034	14.085422	4471	<p>2019-04-20_16-38-32_Sonne_SO268-2_146ROV21_Logo.jpg</p>
2019-04-20	16:41:24	-125.90185	14.085501	4471	following ship track stopping every 50m to do a sonar scan
2019-04-20	17:56:55	-125.89795	14.087364	4474	shifting course 90 degrees: heading 155 for 75m
2019-04-20	18:16:18	-125.898496	14.086715	4474	chamber found
2019-04-20	18:18:32	-125.898501	14.086677	4475	<p>2019-04-20_18-17-28_Sonne_SO268-2_146ROV21_Logo.jpg</p>
2019-04-20	18:24:01	-125.898493	14.086696	4475	Gear TakenUp
2019-04-20	18:32:50	-125.898539	14.086694	4473	<p>2019-04-20_18-33-58_Sonne_SO268-2_146ROV21_Logo.jpg</p>
2019-04-20	19:07:49	-125.900186	14.085735	4472	<p>2019-04-20_19-08-35_Sonne_SO268-2_146ROV21_Logo.jpg</p>
2019-04-20	19:10:05	-125.900221	14.085714	4473	Gear TakenUp
2019-04-20	19:10:09	-125.900221	14.085715	4473	MICP-DEEP
2019-04-20	19:10:22	-125.900218	14.085719	4472	deep-3
2019-04-20	19:12:03	-125.900138	14.085692	4472	going to elevator

2019-04-20	19:53:03	-125.897176	14.088274	4472	at elevator
2019-04-20	19:59:27	-125.897133	14.088308	4474	Gear on Lift
2019-04-20	19:59:30	-125.897134	14.088308	4474	MICP-DEEP
2019-04-20	20:05:48	-125.897145	14.088307	4473	Gear on Lift
2019-04-20	20:05:51	-125.897145	14.088307	4473	ISCHAM
2019-04-20	20:13:08	-125.897018	14.08799	4473	continue search track
2019-04-20	20:17:43	-125.896657	14.087644	4472	heading 60
2019-04-20	23:17:26	-125.884619	14.093945	4467	found MIC
2019-04-20	23:20:19	-125.884516	14.093839	4469	Gear TakenUp
2019-04-20	23:20:24	-125.884516	14.093843	4469	Gear TakenUp
2019-04-20	23:20:31	-125.884517	14.093847	4469	MICP
2019-04-20	23:59:51	-125.882793	14.095185	4460	reached end point of track
2019-04-21	00:00:10	-125.882779	14.095178	4460	shifting 75m south
2019-04-21	00:05:35	-125.882948	14.095583	4460	heading 127
2019-04-21	00:11:50	-125.882028	14.094765	4462	starting track back, heading 240
2019-04-21	00:17:39	-125.882651	14.094361	4462	found deep
2019-04-21	00:18:40	-125.882591	14.094349	4462	frame damaged
2019-04-21	00:18:55	-125.882603	14.094359	4463	trying to rescue single peaces
2019-04-21	00:24:57	-125.882658	14.09434	4464	2019-04-21_00-23-53_Sonne_SO268-2_146ROV21_Logo.jpg
2019-04-21	01:00:25	-125.88272	14.094582	4463	2019-04-21_01-00-54_Sonne_SO268-2_146ROV21_Logo.jpg
2019-04-21	01:02:03	-125.88264	14.094535	4463	2019-04-21_01-00-05_Sonne_SO268-2_146ROV21_Logo.jpg
2019-04-21	01:02:03	-125.88264	14.094535	4463	2019-04-21_01-00-05_Sonne_SO268-2_146ROV21_Logo.jpg

2019-04-21	01:03:18	-125.882541	14.094541	4463	2019-04-21_01-02-10_Sonne_SO268-2_146ROV21_Logo.jpg
2019-04-21	01:08:32	-125.882498	14.094801	4462	2019-04-21_01-07-29_Sonne_SO268-2_146ROV21_Logo.jpg
2019-04-21	01:08:47	-125.882503	14.094803	4463	2019-04-21_01-00-48_Sonne_SO268-2_146ROV21_Logo.jpg
2019-04-21	01:10:46	-125.882528	14.094868	4464	found main cylinder from deep profiler
2019-04-21	01:12:25	-125.882544	14.094855	4464	cylinder in box
2019-04-21	01:28:08	-125.882653	14.094316	4464	MIC on porch again
2019-04-21	01:31:06	-125.882644	14.094353	4464	2019-04-21_01-29-56_Sonne_SO268-2_146ROV21_Logo.jpg
2019-04-21	01:32:20	-125.882639	14.094314	4464	OFF THE BOTTOM
2019-04-21	03:38:05	-125.882585	14.093961	-1	ON DECK

Kiel 6000 Dive 22 (SO268-2_152_ROV22)

Date: 22/04/2019

Observers: URABN, Peter, HAALBOOM, Sabine; BODUR, Yasemin, HAUQUIER Freya

ROV positions (at the bottom)

Start of dive: 14°06.774'N 125°52.586'W

End of dive: 14°06.942'N 125°52.238'W

Dive duration¹²:

ROV in the water: 22.04.19 15:34:39

ROV at the bottom: 22.04.19 17:21:33

ROV off the bottom: 23.04.19 01:02:06

ROV on deck: 23.04.19 03:12:32

Explored sites: BE trial area

Aims of the Dive (not achieved, see below):

- Test EM2040 MBES integration on ROV
- Create a high resolution map of Belgium trial area using the attached EM2040 MBES
- Conduct a impact experiment to see suspended particles in the MBES water column data

Handled ROV Tools (including scientific payload):

- Kongsberg EM2040 fixed attached to the ROV

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

Elevator 2

Dive summary (protocol by Peter Urban)

After a small testing to find the correct setup the ROV started the planned track for the high resolution map. At every waypoint the ROV waited for 1 minute to gather some USBL data from a fixed position. The average speed was 0.2 m/s to 0.4 m/s. When correction the track during a line to reach the next waypoint, the ROV did not change the heading but changed it's position laterally. The line spacing was approximately 42 meters for the first lines. For the last three lines it was changed to 58 meters to speed up the experiment.

The last hour we spend by creating an artificial plume with the ROV by going very close towards the seafloor and then monitoring it with the MBES. This was done multiple times to try out different setups of the MBES.

¹² All dates and times in the protocols refer to UTC

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments	Image
2019-04-22	14:37:07	-125.877208	14.110881	38	test	
2019-04-22	15:34:38	-125.877208	14.110881	38	IN THE WATER	
2019-04-22	17:21:33	-125.876495	14.112883	4464	AT THE BOTTOM	
2019-04-22	17:43:42	-125.87622	14.112394	4464	Start line 1	
2019-04-22	18:08:25	-125.873292	14.110079	4463	End line 1	
2019-04-22	18:10:18	-125.873316	14.110097	4463	Transect L1 to L2	
2019-04-22	18:17:12	-125.873036	14.110464	4463	Start line 2	
2019-04-22	18:22:17	-125.873804	14.111126	4462	End 1 min break ROV because of thrusters	
2019-04-22	18:42:54	-125.876215	14.112991	4464	End line 2	
2019-04-22	18:42:59	-125.876217	14.112993	4464		
2019-04-22	18:43:10	-125.876219	14.112995	4464	delete	
2019-04-22	18:44:20	-125.876201	14.11301	4464	Transect L2 to L3	
2019-04-22	18:47:19	-125.87596	14.113318	4465	Arrived at L3 start	
2019-04-22	18:50:20	-125.87589	14.113272	4465	Start line 3	
2019-04-22	19:14:52	-125.872812	14.110694	4464	End of line 3 End of line 3	
2019-04-22	19:15:54	-125.872792	14.110708	4464	Transect L3 to L4	
2019-04-22	19:17:52	-125.872551	14.110983	4465	Arrived at start L4	
2019-04-22	19:19:30	-125.872592	14.110978	4465	Start L4	
2019-04-22	19:44:41	-125.875677	14.113543	4466	End of L4	
2019-04-22	19:46:56	-125.875626	14.113606	4466	End of L4 (19:44)	
2019-04-22	19:47:18	-125.875594	14.11364	4466	Transect L4 to L5	
2019-04-22	19:49:35	-125.875413	14.113879	4466	Arrived at L5	
2019-04-22	19:50:28	-125.875368	14.113832	4466	Start L5	
2019-04-22	19:55:03	-125.874533	14.113119	4463	average speed: 20-40 cm/s	
2019-04-22	19:59:58	-125.873753	14.112484	4463		
2019-04-22	19:59:58	-125.873753	14.112484	4463		
2019-04-22	20:14:33	-125.872283	14.111297	4466	End of L5	
2019-04-22	20:15:46	-125.872242	14.111373	4466	Transect L5 to L6	

2019-04-22	20:19:25	-125.872048	14.111669	4469	Start L6	
2019-04-22	20:47:19	-125.875173	14.114229	4467	End of L6	
2019-04-22	20:48:50	-125.875105	14.114262	4467	Transect L6 to L7	
2019-04-22	20:51:59	-125.874796	14.114399	4467	Start of L7	
2019-04-22	21:17:10	-125.871716	14.111905	4474	End of L7	
2019-04-22	21:18:12	-125.871709	14.111925	4473	Transect L7 to L8	
2019-04-22	21:21:36	-125.871486	14.112252	4477	Start of L8	
2019-04-22	21:22:06	-125.871501	14.112257	4477	delete	
2019-04-22	21:22:17	-125.871513	14.112265	4477	Start of L8	
2019-04-22	21:48:57	-125.874614	14.114796	4468	End of L8	
2019-04-22	21:50:19	-125.874577	14.11484	4468	Transect L8 to L9	
2019-04-22	21:54:18	-125.874375	14.115098	4469	Start of L9	
2019-04-22	22:18:11	-125.871244	14.112512	4478	End of L9	
2019-04-22	22:18:35	-125.871224	14.112501	4478	change line spacing to 58m	
2019-04-22	22:20:09	-125.87121	14.112533	4478	Transect L9 to L10	
2019-04-22	22:23:30	-125.870863	14.112958	4481	Start of L10	
2019-04-22	22:27:04	-125.870896	14.113001	4481	Start of L10	
2019-04-22	22:32:05	-125.871599	14.113546	4478	checking of cable in between so second start of L10 is the correct one	
2019-04-22	22:51:34	-125.874	14.115573	4470	End of L10	
2019-04-22	22:53:41	-125.873981	14.115578	4470	Transect L10 to L11	
2019-04-22	22:59:10	-125.873573	14.115932	4472	Start of L11	
2019-04-22	23:20:45	-125.870493	14.113276	4483	End of line 11	
2019-04-22	23:22:37	-125.870467	14.113317	4483	Transect L11 to L12	
2019-04-22	23:26:24	-125.870117	14.113719	4485	Start of line 12	
2019-04-22	23:51:04	-125.873313	14.116388	4472	End of line 12	
2019-04-23	00:04:46	-125.87196	14.1156	4505	Plume experiment 1 - make plume	
2019-04-23	00:10:15	-125.871955	14.115572	4503	Plume experiment 1 - make plume restart	
2019-04-23	00:12:04	-125.871951	14.115558	4501	Plume experiment 1 - up	
2019-04-23	00:14:09	-125.872032	14.115556	4499	Plume experiment 1 - going over plume 1	
2019-04-23	00:15:31	-125.87206	14.115573	4498	Plume experiment 1 - going over plume in opposite direction	

2019-04-23	00:19:06	-125.871597	14.115497	4501	Plume experiment 1 - end	
2019-04-23	00:22:09	-125.871542	14.115479	4504	Plume experiment 2 - make plume	
2019-04-23	00:24:44	-125.871567	14.115481	4496	Plume experiment 2 - up to 12m	
2019-04-23	00:25:22	-125.871573	14.115477	4496	Plume experiment 2 - going over plume	
2019-04-23	00:28:23	-125.871717	14.11543	4498	Plume experiment 2 - down to 9m	
2019-04-23	00:29:13	-125.871593	14.115429	4499	Plume experiment 2 - going over plume in opposite direction	
2019-04-23	00:32:03	-125.871127	14.115427	4502	Plume experiment 2 - end	
2019-04-23	00:33:04	-125.871113	14.115438	4506	Plume experiment 3 - make plume	
2019-04-23	00:34:20	-125.871123	14.115429	4509	Plume experiment 3 - up to 9m	
2019-04-23	00:36:05	-125.871155	14.115413	4502	Plume experiment 3 - going over plume	
2019-04-23	00:38:06	-125.871234	14.115311	4501	Plume experiment 3 - going into the opposite direction	
2019-04-23	00:40:55	-125.870971	14.115527	4503	Plume experiment 3 - end	
2019-04-23	00:41:54	-125.870989	14.115505	4505	Plume experiment 4 - making plume	
2019-04-23	00:43:11	-125.871052	14.115461	4510	Plume experiment 4 - up to 9m	
2019-04-23	00:43:37	-125.871049	14.115467	4502	Plume experiment 4 - going to 7m	
2019-04-23	00:45:24	-125.871112	14.115438	4505	Plume experiment 4 - going over the plume	
2019-04-23	00:47:20	-125.871124	14.115378	4504	Plume experiment 4 - going over plume in opposite direction	
2019-04-23	00:50:09	-125.870879	14.115568	4505		
2019-04-23	00:50:24	-125.870887	14.115559	4506	Plume experiment 4 - end	
2019-04-23	00:51:13	-125.870912	14.115528	4510	Plume experiment 5 - making plume	
2019-04-23	00:53:10	-125.870894	14.115489	4505	Plume experiment 5 - going up to 7m	
2019-04-23	00:54:41	-125.871027	14.115396	4505	Plume experiment 5 - going over plume	
2019-04-23	00:56:46	-125.871061	14.115355	4505	Plume experiment 5 - going over plume in opposite direction	
2019-04-23	00:59:08	-125.870831	14.115534	4509	Plume experiment 5 - going down to 4m	
2019-04-23	01:01:05	-125.870643	14.115687	4510	Plume experiment 5 - end	
2019-04-23	01:02:06	-125.870633	14.115688	4510	OFF THE BOTTOM	
2019-04-23	03:12:32	-125.871836	14.115308	-1	ON DECK	

Kiel 6000 Dive 23 (SO268-2_154_ROV23)

Date: 23/04/2019

Observers: WENZHOEFER, Frank, HILARIO, Ana

ROV positions (at the bottom)

Start of dive: 14.0333585739136 -125.924995422363

End of dive: 14.033164024353-125.925231933594

Dive duration¹³:

ROV in the water: not recorded

ROV at the bottom: 23.04.2019 117:33:27

ROV off the bottom: 24.04.19 00:52:29

ROV on deck: 24.04.19 02:49:55

Explored sites: Belgian reference area

Aims of the Dive (not achieved, see below):

- See summary

Handled ROV Tools (including scientific payload):

BioBox, SenckenbergBox, slurp gun, 3 hand nets, Scoop, magnet T-Handle, optical communication

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

Elevator 2

- Trap (below)
- InSitu Pump (stays on elevator during the dive)
- 1 SixPack
- 1 MIC
- 1 Deep-Profiler (on way up!)

Dive summary (protocol by NN (K Hamann copy from official Dive Plan))

In Situ flux measurements, PUCs, fauna sampling

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-04-23	17:33:13	-125.925055	14.033397	4539	IN THE WATER
2019-04-23	17:33:27	-125.925052	14.033393	4539	AT THE BOTTOM

¹³ All dates and times in the protocols refer to UTC

2019-04-23	17:50:00	-125.924925	14.033113	4542	MICP-DEEP-3-1
2019-04-23	17:51:06	-125.924925	14.033131	4542	<p>2019-04-23_17-51-06_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	17:51:04	-125.924938	14.033131	4542	<p>2019-04-23_17-50-52_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	17:58:24	-125.924963	14.033182	4541	Gear Operated
2019-04-23	17:58:26	-125.924966	14.033184	4541	MICP-DEEP
2019-04-23	17:58:30	-125.92497	14.03319	4541	#3
2019-04-23	18:03:29	-125.925114	14.033252	4542	ROV to Lift
2019-04-23	18:07:39	-125.925101	14.033255	4542	Gear Received
2019-04-23	18:07:41	-125.925103	14.033254	4542	MICP-DEEP
2019-04-23	18:08:28	-125.925139	14.033248	4542	MICP
2019-04-23	18:14:53	-125.925155	14.033326	4542	Gear Deployed
2019-04-23	18:15:02	-125.92515	14.033323	4542	MICP
2019-04-23	18:15:07	-125.925147	14.033322	4542	<p>2019-04-23_18-16-11_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	18:16:15	-125.925148	14.033315	4542	<p>2019-04-23_18-16-00_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	18:17:34	-125.925139	14.033331	4542	Gear Operated

2019-04-23	18:17:36	-125.92514	14.03333	4542	MICP
2019-04-23	18:22:48	-125.925107	14.03327	4541	ROV to Lift
2019-04-23	18:32:29	-125.925039	14.033267	4542	2019-04-23_18-32-25_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	18:33:53	-125.925045	14.033282	4542	2019-04-23_18-33-50_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	18:37:09	-125.925062	14.033265	4542	2019-04-23_18-37-07_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	18:47:16	-125.925022	14.033248	4542	2019-04-23_18-47-15_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	18:52:04	-125.925025	14.033163	4542	2019-04-23_18-52-03_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	18:53:37	-125.925021	14.03315	4542

					2019-04-23_18-53-34_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	18:57:39	-125.92502	14.033159	4542	moving 20m forward
2019-04-23	19:01:30	-125.924981	14.032975	4541	Gear Operated
2019-04-23	19:01:37	-125.924985	14.032976	4541	delete
2019-04-23	19:02:23	-125.924967	14.033007	4541	between 5/33 and 45/43: moved 10m
2019-04-23	19:04:43	-125.924949	14.033014	4542	#30
2019-04-23	19:04:59	-125.924951	14.033005	4542	2019-04-23_19-04-57_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	19:06:53	-125.924953	14.032971	4542	2019-04-23_19-06-51_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	19:15:05	-125.925082	14.033263	4540	SixPack on elevator
2019-04-23	19:29:38	-125.924819	14.033254	4541	start sampling fauna
2019-04-23	19:30:59	-125.924776	14.033247	4542	2019-04-23_19-30-54_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	19:33:06	-125.92468	14.033237	4542	Start sampling Actiniaria
2019-04-23	19:37:22	-125.924635	14.033207	4542	2019-04-23_19-37-20_Sonne_SO268-2_154ROV23_Logo.jpg

2019-04-23	19:37:27	-125.924636	14.033209	4543	<p>2019-04-23_19-37-27_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	19:37:51	-125.924636	14.033217	4543	<p>2019-04-23_19-37-51_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	19:50:44	-125.924456	14.033261	4540	End fauna sampling
2019-04-23	19:52:53	-125.924355	14.033256	4542	Start sampling Ophiuroid
2019-04-23	19:55:14	-125.92432	14.033239	4543	COLBOX-SGN
2019-04-23	19:57:01	-125.924325	14.033262	4543	<p>2019-04-23_19-56-59_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	19:59:50	-125.924302	14.033258	4543	End sampling ophiuroid
2019-04-23	20:04:58	-125.924222	14.033275	4542	Start sampling Echinoid
2019-04-23	20:07:14	-125.924226	14.033284	4543	<p>2019-04-23_20-07-16_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:07:27	-125.924227	14.033286	4542	<p>2019-04-23_20-07-26_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:09:31	-125.924223	14.033266	4543	End sampling echinoid

2019-04-23	20:12:56	-125.924137	14.033272	4542	Start sampling Actiniaria
2019-04-23	20:14:37	-125.924095	14.0333	4543	2019-04-23_20-14-35_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	20:14:44	-125.924094	14.033301	4542	2019-04-23_20-14-43_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	20:16:22	-125.924098	14.033305	4543	COLBOX-BIO#4
2019-04-23	20:20:01	-125.924119	14.033293	4543	End sampling Actiniaria
2019-04-23	20:22:12	-125.924082	14.033285	4542	Start sampling Echinoid
2019-04-23	20:22:32	-125.924071	14.033281	4542	2019-04-23_20-23-47_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	20:23:19	-125.924072	14.03329	4543	2019-04-23_20-23-19_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	20:23:30	-125.924075	14.033294	4543	2019-04-23_20-23-16_Sonne_SO268-2_154ROV23_Logo.jpg

2019-04-23	20:23:35	-125.924075	14.033296	4543	<p>2019-04-23_20-23-33_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:23:49	-125.924075	14.033299	4543	<p>2019-04-23_20-23-28_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:25:40	-125.924074	14.033272	4543	
2019-04-23	20:29:27	-125.924004	14.033252	4543	
2019-04-23	20:30:04	-125.924001	14.033255	4543	<p>2019-04-23_20-30-03_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:30:29	-125.924014	14.033256	4543	<p>2019-04-23_20-30-23_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:30:32	-125.924015	14.033256	4543	<p>2019-04-23_20-30-16_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:30:42	-125.92402	14.033256	4543	COLBOX-SGN
2019-04-23	20:31:07	-125.924031	14.033253	4543	Note the stalked Porifera has an Actiniaria and at least one Cirripedia attached
2019-04-23	20:32:44	-125.924027	14.033268	4543	End sampling Porifera
2019-04-23	20:36:03	-125.923904	14.033251	4542	Start sampling Ophiuroid

2019-04-23	20:37:20	-125.923881	14.033215	4543	<p>2019-04-23_20-37-19_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:37:27	-125.923881	14.03322	4543	<p>2019-04-23_20-37-25_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:37:38	-125.923886	14.033229	4543	<p>2019-04-23_20-37-37_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:39:14	-125.923884	14.033243	4542	COLBOX-SGN
2019-04-23	20:39:29	-125.92388	14.033246	4543	End sampling Ophiuroid
2019-04-23	20:41:20	-125.923839	14.033278	4542	Start sampling Actiniaria
2019-04-23	20:42:52	-125.923834	14.033268	4543	<p>2019-04-23_20-42-51_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:43:45	-125.923836	14.03326	4543	<p>2019-04-23_20-43-43_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	20:44:55	-125.923858	14.033277	4543	COLBOX-BIO #2
2019-04-23	20:47:27	-125.923817	14.033281	4543	End sampling Actiniaria
2019-04-23	20:49:41	-125.923783	14.033257	4542	Start sampling two ophiuroids

2019-04-23	20:51:54	-125.923755	14.033271	4543	2019-04-23_20-51-53_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	20:52:24	-125.923764	14.033264	4543	2019-04-23_20-52-21_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	20:53:22	-125.923765	14.033271	4543	COLBOX-SGN
2019-04-23	21:01:13	-125.923742	14.033268	4543	Lost one of the ophiuroids
2019-04-23	21:01:46	-125.923744	14.033257	4543	End sampling Ophiuroid
2019-04-23	21:05:10	-125.923682	14.033293	4543	2019-04-23_21-05-09_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:05:28	-125.923675	14.033293	4543	2019-04-23_21-05-25_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:09:52	-125.923539	14.033283	4543	2019-04-23_21-09-51_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:10:05	-125.923539	14.03328	4543	2019-04-23_21-10-04_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:11:33	-125.923537	14.033274	4543	Start sampling echinoid

2019-04-23	21:12:35	-125.923539	14.033257	4543	COLBOX-SGN
2019-04-23	21:13:07	-125.923544	14.033254	4543	end sampling echinoid
2019-04-23	21:13:43	-125.923543	14.033251	4543	<p>2019-04-23_21-13-46_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	21:15:13	-125.923525	14.033258	4543	<p>2019-04-23_21-15-11_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	21:15:33	-125.92353	14.033251	4543	<p>2019-04-23_21-15-32_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	21:16:37	-125.923508	14.033257	4543	COLBOX-SGN
2019-04-23	21:17:00	-125.923503	14.033265	4543	end sampling echinoid
2019-04-23	21:17:56	-125.923501	14.033264	4543	start sampling Actiniaria
2019-04-23	21:18:52	-125.923497	14.033258	4543	<p>2019-04-23_21-18-50_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	21:19:02	-125.923496	14.033258	4543	<p>2019-04-23_21-19-00_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	21:20:12	-125.923506	14.033259	4543	COLBOX-BIO

2019-04-23	21:21:29	-125.923527	14.033248	4543	Actiniaria in COLBOX-BIO#1
2019-04-23	21:21:53	-125.923518	14.033249	4543	end sampling Actiniaria
2019-04-23	21:28:57	-125.923406	14.033257	4543	start sampling echinoid
2019-04-23	21:29:20	-125.923402	14.033268	4543	2019-04-23_21-29-16_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:32:16	-125.923402	14.03329	4543	COLBOX-SGN
2019-04-23	21:32:49	-125.923387	14.033284	4543	end sampling echinoid
2019-04-23	21:35:14	-125.923391	14.033263	4543	strat sampling echinoid
2019-04-23	21:35:45	-125.923386	14.033281	4543	2019-04-23_21-35-42_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:38:15	-125.92341	14.033298	4543	COLBOX-SGN
2019-04-23	21:38:43	-125.923401	14.033292	4543	sampling failed
2019-04-23	21:40:10	-125.923391	14.033287	4543	2019-04-23_21-40-29_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:40:47	-125.923393	14.033283	4543	2019-04-23_21-40-46_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:41:33	-125.923388	14.033251	4543	COLBOX-BIO
2019-04-23	21:43:42	-125.923382	14.033285	4543	COLBOX-BIO#5
2019-04-23	21:44:02	-125.923387	14.033283	4543	actiniaria w nodule in #5

2019-04-23	21:45:45	-125.92337	14.033271	4543	end sampling actiniaria
2019-04-23	21:48:40	-125.92328	14.03325	4543	2019-04-23_21-48-56_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:54:54	-125.9231	14.033255	4543	
2019-04-23	21:55:12	-125.923105	14.033251	4544	2019-04-23_21-55-10_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	21:58:19	-125.923118	14.03325	4544	COLBOX-BIO
2019-04-23	21:58:29	-125.923113	14.03325	4543	COLBOX-SGN
2019-04-23	21:59:56	-125.923097	14.033258	4544	end sampling echinoid
2019-04-23	22:01:10	-125.923097	14.033293	4543	2019-04-23_22-01-16_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	22:01:41	-125.923105	14.033288	4544	2019-04-23_22-01-40_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	22:03:48	-125.923137	14.033254	4543	COLBOX-SGN
2019-04-23	22:04:00	-125.923135	14.03325	4543	end sampling echinoid
2019-04-23	22:12:14	-125.922944	14.033246	4543	Start sampling Echinoid and Ophiuroid

2019-04-23	22:12:54	-125.92294	14.033247	4543	<p>2019-04-23_22-12-56_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	22:13:01	-125.922938	14.033246	4543	<p>2019-04-23_22-13-03_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	22:13:18	-125.92293	14.033239	4543	<p>2019-04-23_22-13-18_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	22:15:36	-125.922915	14.033248	4543	COLBOX-SGN
2019-04-23	22:19:25	-125.922926	14.033252	4543	End sampling Ophiuroid and Echinoid
2019-04-23	22:21:45	-125.922877	14.033233	4544	Start sampling Ophiuroid
2019-04-23	22:21:58	-125.922877	14.033235	4544	<p>2019-04-23_22-21-57_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	22:22:35	-125.922887	14.033238	4544	<p>2019-04-23_22-22-32_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	22:24:06	-125.922899	14.033231	4543	COLBOX-SGN
2019-04-23	22:24:49	-125.922895	14.033229	4544	End sampling Ophiuroid Start sampling Actiniaria

2019-04-23	22:28:11	-125.922808	14.0332	4544	<p>2019-04-23_22-28-10_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	22:28:21	-125.922806	14.033202	4544	<p>2019-04-23_22-28-20_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	22:28:41	-125.922805	14.033207	4544	COLBOX-BIO
2019-04-23	22:29:02	-125.922802	14.033213	4544	COLBOX-BIO#9
2019-04-23	22:31:32	-125.922794	14.033222	4544	End sampling Actiniaria
2019-04-23	22:35:36	-125.922728	14.033202	4544	<p>2019-04-23_22-35-34_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	22:35:41	-125.922729	14.033203	4544	Start sampling Ophiuroid
2019-04-23	22:35:43	-125.92273	14.033203	4544	<p>2019-04-23_22-35-43_Sonne_SO268-2_154ROV23_Logo.jpg</p>
2019-04-23	22:35:49	-125.922731	14.033205	4544	COLBOX-SGN
2019-04-23	22:38:23	-125.92273	14.033216	4544	End sampling Ophiuroid
2019-04-23	22:43:02	-125.922578	14.033226	4544	Start sampling Actiniaria
2019-04-23	22:43:09	-125.922578	14.033225	4544	<p>2019-04-23_22-43-07_Sonne_SO268-2_154ROV23_Logo.jpg</p>

2019-04-23	22:43:39	-125.92258	14.033224	4544	COLBOX-BIO
2019-04-23	22:45:19	-125.922581	14.033207	4544	COLBOX-BIO#8
2019-04-23	22:47:05	-125.922562	14.033235	4544	End of sampling
2019-04-23	22:50:00	-125.922491	14.033217	4543	Start sampling Echinoid
2019-04-23	22:50:24	-125.92249	14.033216	4544	2019-04-23_22-50-22_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	22:50:38	-125.922491	14.033216	4544	2019-04-23_22-50-37_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	22:53:02	-125.92248	14.033254	4544	End sampling echinoid
2019-04-23	22:56:19	-125.922508	14.033249	4543	video transect starts
2019-04-23	23:20:47	-125.924423	14.035164	4541	end of first transect
2019-04-23	23:22:12	-125.924408	14.03519	4542	Fauna
2019-04-23	23:23:05	-125.924406	14.03517	4542	2019-04-23_23-23-20_Sonne_SO268-2_154ROV23_Logo.jpg
2019-04-23	23:24:15	-125.924406	14.035148	4542	COLBOX-BIO
2019-04-23	23:24:41	-125.924445	14.035192	4542	compartment 6 COLBOX-BIO
2019-04-23	23:31:39	-125.92447	14.035119	4541	start video transect 2
2019-04-23	23:53:28	-125.92601	14.033246	4540	no nodule area
2019-04-23	23:53:48	-125.92603	14.033223	4540	small nodules
2019-04-23	23:54:12	-125.926046	14.033203	4540	end of videotrnsect 2
2019-04-24	00:00:08	-125.925223	14.03331	4541	arriving at MIC
2019-04-24	00:02:11	-125.925198	14.033336	4542	Gear TakenUp

2019-04-24	00:02:14	-125.925199	14.033335	4542	MICP
2019-04-24	00:08:12	-125.925121	14.033245	4541	Gear on Lift
2019-04-24	00:08:18	-125.925121	14.033243	4542	MICP
2019-04-24	00:16:27	-125.924929	14.033122	4542	Gear TakenUp
2019-04-24	00:16:32	-125.92493	14.033124	4542	MICP-DEEP
2019-04-24	00:24:28	-125.925112	14.033254	4542	Gear on Lift
2019-04-24	00:24:33	-125.92511	14.033253	4542	MICP-DEEP
2019-04-24	00:35:43	-125.925102	14.033229	4542	SixPack on porch
2019-04-24	00:49:52	-125.925153	14.03322	4542	elevator released
2019-04-24	00:52:29	-125.925248	14.033152	4538	OFF THE BOTTOM
2019-04-24	02:49:55	-125.924675	14.033366	-3	ON DECK

Kiel 6000 Dive 24 (SO268-2_158_ROV24)

Date: 26/04/2019

Observers: ??

ROV positions (at the bottom)

Start of dive: 11.8499355316162 -117.38338470459

End of dive: 11.8499670028687 -117.383476257324

Dive duration¹⁴:

ROV in the water: 26.04.19 14:56:02

ROV at the bottom: 26.04.2019 16:38:11

ROV off the bottom: 27.04.19 00:28:47

ROV on deck: 27.04.19 02:15:48

Explored sites: GER No Nodule Area

Aims of the Dive (not achieved, see below):

- In Situ flux measurements,
- PUCs,
- placing of nodule frames,
- videotransect

Handled ROV Tools (including scientific payload):

16 PUCs (incl 2 drilled), SenckenbergBox, slurp gun, 3 hand nets, Scoop, magnet T-Handle, optical communication **Relevant Elevator payload** (*italic: payload not used during the dive*)

Elevator 1

Elevator 2

1 Deep-Profiler, 1 MIC, 27 nodule-frames, traps, 1 marker

Dive summary (protocol by Felix Janssen)

In Situ flux measurements, PUCs, placing of nodule frames, videotransect

¹⁴ All dates and times in the protocols refer to UTC

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments /Image
2019-04-26	14:56:02	-117.385122	11.850292	88	IN THE WATER
2019-04-26	16:38:11	-117.383346	11.849929	4271	AT THE BOTTOM
2019-04-26	16:43:13	-117.383386	11.849917	4271	search for spot
2019-04-26	16:51:19	-117.383888	11.850159	4276	Gear Deployed
2019-04-26	16:51:44	-117.383869	11.85017	4277	Nodule frame 52
2019-04-26	16:52:20	-117.383867	11.850181	4276	2019-04-26_16-52-18_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	16:58:59	-117.383467	11.849949	4275	ROV to Lift
2019-04-26	16:59:49	-117.383468	11.8499	4275	#2
2019-04-26	17:03:10	-117.383451	11.849859	4277	Gear Received
2019-04-26	17:03:15	-117.383451	11.849859	4277	MICP
2019-04-26	17:13:36	-117.383203	11.849524	4277	escaping plume
2019-04-26	17:14:56	-117.383179	11.849532	4277	Gear Deployed
2019-04-26	17:14:59	-117.383178	11.849533	4277	MICP
2019-04-26	17:19:25	-117.383197	11.849541	4277	2019-04-26_17-19-22_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	17:19:32	-117.383198	11.84954	4277

					2019-04-26_17-19-31_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	17:27:46	-117.383438	11.849864	4277	ROV to Lift
2019-04-26	17:30:01	-117.383425	11.849852	4276	Gear Received
2019-04-26	17:30:06	-117.383427	11.849853	4276	MICP-DEEP
2019-04-26	17:37:41	-117.383141	11.849646	4277	Gear Deployed
2019-04-26	17:37:45	-117.383141	11.849646	4277	MICP-DEEP
2019-04-26	17:37:49	-117.383141	11.849645	4277	2019-04-26_17-42-01_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	17:40:42	-117.383165	11.849635	4277	2019-04-26_17-43-15_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	17:41:27	-117.383193	11.849658	4277	2019-04-26_17-41-32_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	17:41:58	-117.383193	11.849624	4277	2019-04-26_17-41-23_Sonne_SO268-2_158ROV24_Logo.jpg

2019-04-26	17:42:02	-117.383192	11.849618	4277	2019-04-26_17-41-55_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	17:42:11	-117.383189	11.849607	4277	2019-04-26_17-42-09_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	17:43:44	-117.383182	11.849661	4277	2019-04-26_17-43-22_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	17:44:06	-117.383176	11.849653	4277	2019-04-26_17-43-41_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	17:46:56	-117.383166	11.849681	4277	Gear TakenUp
2019-04-26	17:47:03	-117.383161	11.849683	4277	MICP-DEEP
2019-04-26	17:52:01	-117.383079	11.849682	4277	Gear Deployed
2019-04-26	17:52:05	-117.383079	11.849678	4277	MICP-DEEP
2019-04-26	17:54:36	-117.383102	11.849658	4277	Gear Operated
2019-04-26	17:54:40	-117.383101	11.849657	4277	MICP-DEEP

2019-04-26	17:55:06	-117.383097	11.849654	4277	<p>2019-04-26_17-55-03_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	17:59:48	-117.383107	11.84965	4277	<p>2019-04-26_17-59-46_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	18:01:44	-117.383111	11.849653	4276	MICP-DEEP
2019-04-26	18:02:06	-117.383114	11.849648	4276	did not work. Re-operated with only stage 2
2019-04-26	18:07:50	-117.383135	11.849713	4277	one puc less as lit got off
2019-04-26	18:09:13	-117.383152	11.84969	4278	<p>2019-04-26_18-09-12_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	18:16:00	-117.383144	11.849694	4278	<p>2019-04-26_18-15-33_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	18:18:55	-117.383151	11.8497	4278	PUC 20 was the second lost PUC
2019-04-26	18:23:25	-117.383157	11.849711	4278	all PUCs received
2019-04-26	18:25:31	-117.383126	11.849696	4278	going to GC position
2019-04-26	18:27:36	-117.383056	11.849639	4276	video transect to GC position, 100m east, 0.2-0.3m/s, 1m above ground
2019-04-26	18:37:42	-117.382217	11.849578	4277	video transect end

2019-04-26	18:44:38	-117.382186	11.849563	4278	<p>2019-04-26_18-44-27_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	18:54:20	-117.382174	11.849537	4278	
2019-04-26	18:55:28	-117.382175	11.849537	4278	
2019-04-26	18:57:46	-117.3822	11.849548	4278	
2019-04-26	18:57:50	-117.382201	11.849549	4278	PUC
2019-04-26	18:58:08	-117.382206	11.84955	4278	PUC
2019-04-26	18:58:20	-117.382204	11.849548	4278	PUC 22
2019-04-26	18:59:32	-117.382163	11.849516	4278	PUC
2019-04-26	18:59:34	-117.382163	11.849516	4278	PUC 81 with holes
2019-04-26	19:00:13	-117.382169	11.84951	4278	<p>2019-04-26_19-00-11_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	19:14:46	-117.382202	11.849531	4278	all PUCs received
2019-04-26	19:16:47	-117.382177	11.849521	4277	short transit (5m) south to start a parallel video transect back to MIC (profiler)
2019-04-26	19:21:25	-117.382196	11.849481	4277	Video Start
2019-04-26	19:22:13	-117.382261	11.849441	4277	video transect back- 0.2-0.3m/s, 1m above ground.
2019-04-26	19:29:19	-117.383077	11.849568	4277	<p>2019-04-26_19-31-05_Sonne_SO268-2_158ROV24_Logo.jpg</p>

2019-04-26	19:30:22	-117.383133	11.849536	4277	<p>2019-04-26_19-30-34_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	19:40:09	-117.383318	11.8495	4277	<p>2019-04-26_19-40-05_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	19:40:31	-117.38331	11.849513	4277	
2019-04-26	19:43:44	-117.383298	11.849515	4276	
2019-04-26	19:45:46	-117.383388	11.849722	4276	
2019-04-26	19:48:56	-117.383384	11.849789	4278	<p>2019-04-26_19-48-55_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	19:49:38	-117.383379	11.849795	4278	PUC
2019-04-26	19:49:47	-117.383375	11.849792	4278	PUC 24
2019-04-26	19:51:52	-117.383418	11.849781	4278	PUC
2019-04-26	19:51:55	-117.383418	11.84978	4278	PUC 3
2019-04-26	19:53:04	-117.383395	11.849786	4278	<p>2019-04-26_19-53-01_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	19:56:48	-117.383398	11.849767	4278	All PUCs received

2019-04-26	19:58:18	-117.38337	11.84978	4277	arrive at elevator 2
2019-04-26	19:58:58	-117.383386	11.849785	4277	ROV to Lift
2019-04-26	20:05:09	-117.383492	11.849816	4277	take entire frame with 13 nodule frames off elevator and move to position first frame
2019-04-26	20:06:09	-117.383471	11.849818	4277	take first set of nodule frames on porch ROV
2019-04-26	20:09:50	-117.383569	11.849858	4276	Gear Received
2019-04-26	20:09:52	-117.383568	11.849859	4276	pick up marker for nodule frames from elevator 2
2019-04-26	20:12:18	-117.383675	11.850013	4276	move to nodule frame waypoint
2019-04-26	20:13:56	-117.383852	11.850159	4276	arrive at position to deploy the 26 remaining nodule frames
2019-04-26	20:14:46	-117.383919	11.850192	4276	swimming polychaete
2019-04-26	20:15:07	-117.383927	11.850188	4276	Gear Deployed
2019-04-26	20:15:09	-117.383926	11.850187	4276	place marker on seafloor
2019-04-26	20:18:50	-117.383869	11.850227	4277	Gear Deployed
2019-04-26	20:18:53	-117.383871	11.850227	4277	nodule frame #75
2019-04-26	20:19:50	-117.383881	11.850202	4277	Gear Deployed
2019-04-26	20:19:52	-117.383881	11.850202	4277	nodule frame #20
2019-04-26	20:20:50	-117.383908	11.850228	4277	Gear Deployed
2019-04-26	20:20:52	-117.383908	11.850228	4277	nodule frame #11
2019-04-26	20:21:48	-117.383872	11.850208	4277	Gear Deployed
2019-04-26	20:21:49	-117.383871	11.850208	4277	nodule frame #34
2019-04-26	20:23:05	-117.383898	11.850187	4277	Gear Deployed
2019-04-26	20:23:08	-117.383897	11.850186	4277	nodule frame #19
2019-04-26	20:24:31	-117.383866	11.850188	4277	Gear Deployed
2019-04-26	20:24:34	-117.383867	11.850189	4277	nodule frame #17
2019-04-26	20:26:22	-117.383891	11.850187	4277	Gear Deployed
2019-04-26	20:26:24	-117.383891	11.850186	4277	nodule frame #47
2019-04-26	20:28:00	-117.383886	11.850175	4277	Gear Deployed
2019-04-26	20:28:04	-117.383887	11.850177	4277	nodule frame #12
2019-04-26	20:29:04	-117.383888	11.850202	4277	Gear Deployed
2019-04-26	20:29:07	-117.383888	11.850204	4277	nodule frame #39
2019-04-26	20:29:52	-117.383874	11.850222	4277	Gear Deployed

2019-04-26	20:29:55	-117.383873	11.850222	4277	nodule frame #48
2019-04-26	20:30:39	-117.383864	11.85021	4277	Gear Deployed
2019-04-26	20:30:40	-117.383864	11.850209	4277	nodule frame #40
2019-04-26	20:31:45	-117.383847	11.850194	4277	Gear Deployed
2019-04-26	20:31:47	-117.383847	11.850195	4277	nodule frame #31
2019-04-26	20:32:57	-117.38385	11.850217	4277	Gear Deployed
2019-04-26	20:32:59	-117.38385	11.850217	4277	nodule frame #32
2019-04-26	20:33:05	-117.383849	11.850216	4277	ROV to Lift
2019-04-26	20:33:29	-117.383851	11.850207	4277	move to elevator 2 to collect rest of nodule frames
2019-04-26	20:39:28	-117.383482	11.849822	4277	Gear on Lift
2019-04-26	20:39:35	-117.38348	11.849822	4277	secure empty frame holder onto elevator 2
2019-04-26	20:51:25	-117.383401	11.849863	4277	Gear Received
2019-04-26	20:51:27	-117.383402	11.849864	4277	pick up other frame holder with 13 nodule frames from elevator 2
2019-04-26	20:53:25	-117.383435	11.849873	4276	put frame holder onto porch ROV and move to position nodule frames
2019-04-26	20:57:28	-117.383777	11.850163	4276	arrive at position nodule frames
2019-04-26	21:03:54	-117.38386	11.85014	4277	Gear Deployed
2019-04-26	21:03:56	-117.38386	11.850141	4277	nodule frame #6
2019-04-26	21:04:48	-117.383882	11.850203	4277	Gear Deployed
2019-04-26	21:04:50	-117.383883	11.850207	4277	nodule frame #44
2019-04-26	21:05:07	-117.383891	11.850239	4277	Photo Taken
2019-04-26	21:05:36	-117.383902	11.850258	4277	<p>2019-04-26_21-05-34_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:05:53	-117.383902	11.850245	4277

					2019-04-26_21-05-51_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	21:06:24	-117.383875	11.850182	4277	2019-04-26_21-06-24_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	21:06:28	-117.383873	11.850181	4277	2019-04-26_21-06-28_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	21:06:48	-117.383863	11.850176	4277	2019-04-26_21-05-59_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	21:06:51	-117.383861	11.850176	4277	nodule frame #43
2019-04-26	21:08:04	-117.383853	11.850217	4277	Gear Deployed
2019-04-26	21:08:05	-117.383852	11.850215	4277	nodule frame #35
2019-04-26	21:09:04	-117.383861	11.850185	4277	Gear Deployed
2019-04-26	21:09:06	-117.383863	11.850186	4277	nodule frame #34
2019-04-26	21:10:21	-117.383849	11.850214	4277	Gear Deployed
2019-04-26	21:10:23	-117.383848	11.850214	4277	nodule frame #41
2019-04-26	21:15:28	-117.383876	11.850191	4276	2019-04-26_21-15-25_Sonne_SO268-2_158ROV24_Logo.jpg

2019-04-26	21:16:35	-117.383946	11.850213	4276	two rows of nodule frames covered by sediment plume created by ROV
2019-04-26	21:16:48	-117.383951	11.850215	4276	sediment very fluffy, lasts long to settle
2019-04-26	21:18:10	-117.383926	11.850238	4277	nodule frame #42
2019-04-26	21:19:16	-117.383918	11.850242	4277	nodule frame #21
2019-04-26	21:20:47	-117.383967	11.850297	4277	nodule frame #22
2019-04-26	21:22:28	-117.383898	11.850241	4277	nodule frame #14
2019-04-26	21:24:42	-117.383873	11.850284	4277	nodule frame #13
2019-04-26	21:25:49	-117.383832	11.850271	4277	still foggy due to sediment plume...
2019-04-26	21:29:14	-117.38382	11.850269	4276	nodule frame #66? damaged
2019-04-26	21:29:39	-117.383817	11.850272	4276	nodule frame #56 previous comment
2019-04-26	21:32:49	-117.383847	11.8503	4277	nodule frame #56 deployed based on sonar due to sediment plume related invisibility
2019-04-26	21:35:20	-117.383829	11.850277	4277	nodule frame #55
2019-04-26	21:35:26	-117.383829	11.850277	4277	all frames deployed
2019-04-26	21:36:58	-117.383817	11.850291	4276	2019-04-26_21-39-17_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	21:37:02	-117.383818	11.85029	4276	2019-04-26_21-37-01_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	21:37:11	-117.383818	11.850289	4276	2019-04-26_21-37-12_Sonne_SO268-2_158ROV24_Logo.jpg

2019-04-26	21:38:03	-117.383847	11.850279	4276	<p>2019-04-26_21-38-02_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:38:10	-117.383865	11.850273	4276	<p>2019-04-26_21-38-08_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:38:16	-117.383882	11.850267	4276	<p>2019-04-26_21-38-14_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:39:19	-117.383922	11.850275	4276	<p>2019-04-26_21-39-40_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:39:32	-117.383919	11.850281	4276	<p>2019-04-26_21-39-29_Sonne_SO268-2_158ROV24_Logo.jpg</p>

2019-04-26	21:39:41	-117.38392	11.850285	4276	<p>2019-04-26_21-40-52_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:40:20	-117.38394	11.850285	4276	<p>2019-04-26_21-40-09_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:41:08	-117.383938	11.850274	4276	<p>2019-04-26_21-41-04_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:42:44	-117.383922	11.850207	4276	<p>2019-04-26_21-41-45_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:48:25	-117.383907	11.85012	4278	PUC
2019-04-26	21:48:27	-117.383907	11.850116	4278	PUC#71
2019-04-26	21:49:33	-117.383874	11.850141	4278	PUC
2019-04-26	21:49:35	-117.383874	11.850144	4278	PUC#7
2019-04-26	21:51:11	-117.383874	11.850195	4278	PUC
2019-04-26	21:51:13	-117.383874	11.850195	4278	PUC#57

2019-04-26	21:51:59	-117.383878	11.850181	4278	<p>2019-04-26_21-51-55_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:52:07	-117.38388	11.850178	4278	<p>2019-04-26_21-52-04_Sonne_SO268-2_158ROV24_Logo.jpg</p>
2019-04-26	21:52:23	-117.383887	11.850174	4278	take pic of three PUCs (n. 71 misses the 7 on the label)
2019-04-26	21:52:53	-117.383889	11.850165	4278	PUC#57 on ROV
2019-04-26	21:53:31	-117.383876	11.850156	4278	PUC#7 on ROV
2019-04-26	21:53:39	-117.383873	11.850156	4278	PUC#71 on ROV
2019-04-26	21:56:24	-117.383903	11.850155	4277	take empty frame to elevator 2
2019-04-26	21:56:27	-117.383901	11.850155	4277	ROV to Lift
2019-04-26	21:59:02	-117.383599	11.849986	4275	arrive at elevator 2
2019-04-26	22:01:41	-117.383445	11.849909	4277	secure empty frame holder on elevator 2
2019-04-26	22:07:01	-117.383432	11.849926	4277	empty frame holder secured on elevator2
2019-04-26	22:14:10	-117.383376	11.849881	4277	video transect started
2019-04-26	22:51:06	-117.38436	11.848155	4276	<p>2019-04-26_22-51-55_Sonne_SO268-2_158ROV24_Logo.jpg</p>

2019-04-26	22:51:54	-117.384392	11.84818	4276	2019-04-26_22-51-52_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	22:53:17	-117.384474	11.848239	4276	2019-04-26_22-51-50_Sonne_SO268-2_158ROV24_Logo.jpg
2019-04-26	23:28:40	-117.383373	11.849517	4277	End of transect
2019-04-26	23:31:09	-117.383282	11.849567	4277	MICP
2019-04-26	23:38:11	-117.383363	11.849597	4276	ROV to Lift
2019-04-26	23:40:22	-117.383413	11.849852	4276	elevator #2 spotted
2019-04-26	23:47:46	-117.383457	11.84993	4277	MICP
2019-04-26	23:47:57	-117.383456	11.849929	4277	Gear on Lift
2019-04-27	00:01:23	-117.383452	11.849926	4277	MICP
2019-04-27	00:01:29	-117.383457	11.849929	4277	secured on elevator
2019-04-27	00:07:25	-117.38323	11.849745	4275	MICP-DEEP
2019-04-27	00:07:33	-117.383208	11.849739	4275	blinking
2019-04-27	00:09:30	-117.383097	11.849727	4277	Gear Received
2019-04-27	00:11:11	-117.383179	11.849721	4276	ROV to Lift
2019-04-27	00:14:37	-117.383378	11.849893	4274	elevator #2 spotted
2019-04-27	00:17:47	-117.383437	11.849895	4277	Gear on Lift
2019-04-27	00:18:08	-117.383437	11.849896	4277	MICP
2019-04-27	00:20:57	-117.383435	11.849875	4277	#2 secured on elevator
2019-04-27	00:22:52	-117.383441	11.849893	4277	Schubleine of the elevator pulled
2019-04-27	00:23:50	-117.383415	11.849874	4277	Schubleine released
2019-04-27	00:26:11	-117.383551	11.849916	4277	MICP

2019-04-27	00:26:16	-117.383553	11.849922	4277	#2
2019-04-27	00:26:21	-117.383554	11.849929	4277	resecured on elevator
2019-04-27	00:27:45	-117.383563	11.850021	4277	elevator released
2019-04-27	00:28:47	-117.383482	11.850102	4275	OFF THE BOTTOM
2019-04-27	02:15:48	-117.383448	11.849498	-0	ON DECK

Kiel 6000 Dive 25 (SO268-2_163_ROV25)

Date: 28/04/2019-29/04/2019

Observers: RAMALHO, Sofia; HILÁRIO, Ana; ESQUETE, Patricia; ÜHLENKOTT, Katja; ROSSEL, Sven; WESSELS, Ann-Kathrin; BODUR, Yasemin; SCHILLER, Elena; WENZHOEFER, Frank

ROV positions (at the bottom)

Start of dive: 11°55.699'N 117°01.439'W

End of dive: 11°55.701'N 117°01.454'W

Dive duration¹⁵:

ROV in the water: 28/04/2019 14:44:45

ROV at the bottom: 28/04/2019 16:22:09

ROV off the bottom: 28/04/2019 23:47:35

ROV on deck: 29/04/2019 01:34:41

Explored sites: DE trial area

Aims of the Dive:

- Deployment of 2 microprofilers (MICP-DEEP and MICP) and 1 benthic chamber module (BFC-ROV) for in situ respiration measurements,
- Megafauna sampling,
- Recovery of 3 nodule frames with recolonization substrates (ARTSUBS)

Handled ROV Tools (including scientific payload):

- 1 benthic chamber module (BFC-ROV) down on the porch
- Senckenberg biobox (COLBOX)
- 9 compartment biobox (COLBOX-BIO)
- Slurp gun (SLURP)
- T-handle with magnet

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 2

- 1 NIOZ-BIOBOX for Nodule frames,
- 1 fiberoptical profiler (MICP-DEEP),
- 1 electrochemical profilers (MICP),
- *Amphipod trap,*
- *1 InSitu Pump*

Dive summary (protocol by Sofia Ramalho)

Part of the dive was dedicated to in situ respiration studies, with the deployment of one benthic chamber module (BFC-ROV) taken down on the porch, and the deployment and re-

¹⁵ All dates and times in the protocols refer to UTC

positioning of one fiberoptical microprofiler (MICP-DEEP#3) and one electrochemical microprofiler (MICP#2; deployments MICP#2-1 & MICP#2-2). The time spent at the bottom in between profilers deployment and repositioning was dedicated to opportunistic fauna sampling of various taxonomic groups. Towards the end of the dive, three nodule frames were recovered and placed inside the NIOZ BIOBOX on Elevator 2. Afterwards, the two microprofilers (MICP-DEEP#3 and MICP#2) were placed on the Elevator 2, while the benthic chamber module (BFC-ROV) was left at the bottom for later recovery (165ROV26). The Amphipod Trap was taken up on the ROV porch. Automatic release of the Elevator 2 failed, and manual recovery was planned for the next day dive (165ROV26).

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments
2019-04-28	14:44:45	-117.025168	11.928092	12	IN THE WATER
2019-04-28	16:22:09	-117.023989	11.928324	4082	AT THE BOTTOM
2019-04-28	16:33:12	-117.024128	11.928367	4089
2019-04-28	16:35:35	-117.024076	11.928389	4089	BFC-ROV #2 Deployed
2019-04-28	16:36:42	-117.024079	11.928398	4089
2019-04-28	16:41:19	-117.0241394	11.9283705	4089

2019-04-28	16:43:24	-117.024108	11.92837	4089
2019-04-28	16:47:08	-117.024104	11.928396	4089	BFC-ROV #2 Operated
2019-04-28	16:56:38	-117.024211	11.92828	4089	MICP-DEEP #3 Received
2019-04-28	17:01:20	-117.024147	11.9284382	4089
2019-04-28	17:03:02	-117.024139	11.928424	4089
2019-04-28	17:03:31	-117.024144	11.92842	4089
2019-04-28	17:05:31	-117.024122	11.928477	4089

2019-04-28	17:05:39	-117.024122	11.928477	4089
2019-04-28	17:05:52	-117.024126	11.928457	4089
2019-04-28	17:08:46	-117.024133	11.928439	4089	MICP-DEEP #3 operated
2019-04-28	17:15:43	-117.024205	11.928291	4089	MICP #2-1 Received
2019-04-28	17:20:04	-117.024111	11.928473	4089
2019-04-28	17:22:06	-117.024148	11.928492	4089	MICP #2-1 Deployed
2019-04-28	17:23:11	-117.024148	11.928472	4089

2019-04-28	17:23:29	-117.024145	11.928473	4089
2019-04-28	17:25:25	-117.024162	11.928477	4089	MICP #2-1 operated
2019-04-28	17:28:14	-117.02417	11.928496	4089
2019-04-28	17:28:28	-117.024167	11.928507	4089
2019-04-28	17:28:57	-117.024167	11.928515	4089
2019-04-28	17:39:46	-117.023978	11.928513	4090

2019-04-28	17:39:55	-117.023978	11.928513	4090	A dark, elongated, somewhat conical object with a few thin, light-colored appendages extending from its base, resting on a sandy seabed with scattered dark patches. The image is taken from an underwater perspective, showing a slightly grainy texture. A GEOMAR logo and a small circular icon are visible in the bottom right corner.
2019-04-28	17:50:20	-117.024011	11.928591	4090	A thin, vertical, light-colored object, possibly a piece of coral or a small plant, standing upright on a sandy seabed. The object has a slightly irregular, segmented appearance. The seabed is covered in fine sand and small dark particles. A GEOMAR logo and a small circular icon are visible in the bottom right corner.
2019-04-28	17:50:29	-117.024009	11.928584	4090	A thin, vertical, light-colored object, similar to the one in the previous image, standing upright on a sandy seabed. The object appears slightly more delicate and has a few small, dark spots on its surface. The seabed is sandy with some darker patches. A GEOMAR logo and a small circular icon are visible in the bottom right corner.
2019-04-28	17:53:50	-117.023986	11.928615	4090	Alcyonacea (BIO182) and Ophiuroid sampled - COLBOX-BIO #3
2019-04-28	17:58:44	-117.024013	11.9286	4090	A starfish with five arms, resting on a sandy seabed. The starfish has a light-colored body with darker, mottled patterns on its arms. The seabed is sandy with some darker patches. A GEOMAR logo and a small circular icon are visible in the bottom right corner.
2019-04-28	17:58:57	-117.024013	11.9286	4090	A starfish with five arms, resting on a sandy seabed. The starfish has a light-colored body with darker, mottled patterns on its arms. The seabed is sandy with some darker patches. A GEOMAR logo and a small circular icon are visible in the bottom right corner.

2019-04-28	17:59:06	-117.024012	11.928601	4090
2019-04-28	17:59:14	-117.02401	11.928604	4090
2019-04-28	18:01:09	-117.024026	11.928615	4090	Ophiuroid sampled - COLBOX-SGN
2019-04-28	18:03:04	-117.024005	11.928607	4090	Ophiuroid sampled - COLBOX-SGN
2019-04-28	18:07:31	-117.023992	11.928675	4090
2019-04-28	18:07:54	-117.023998	11.928673	4090

2019-04-28	18:08:22	-117.024015	11.928657	4090
2019-04-28	18:08:39	-117.024021	11.92865	4090
2019-04-28	18:12:42	-117.024023	11.928651	4090	Alcyonacea (BIO183) and undetermined black thing covering nodules sampled - COLBOX-BIO #2
2019-04-28	18:16:02	-117.024016	11.928668	4090
2019-04-28	18:16:17	-117.02401	11.928657	4090

2019-04-28	18:16:27	-117.024008	11.928654	4090
2019-04-28	18:18:52	-117.024013	11.928645	4090	Alcyonacea (BIO184) sampled - COLBOX-BIO #1
2019-04-28	18:24:08	-117.023981	11.92868	4090
2019-04-28	18:24:24	-117.024002	11.928676	4090
2019-04-28	18:27:36	-117.024004	11.92863	4090	2 Ophiuroids sampled - COLBOX-SGN
2019-04-28	18:32:38	-117.024026	11.928701	4090

2019-04-28	18:32:48	-117.024027	11.928704	4090
2019-04-28	18:36:44	-117.024023	11.928694	4090	Alcyonacea (BIO185) sampled - COLBOX-BIO #6
2019-04-28	18:46:05	-117.023933	11.929042	4089
2019-04-28	18:47:25	-117.023929	11.929042	4089
2019-04-28	18:49:32	-117.023942	11.929013	4089

2019-04-28	18:49:49	-117.023941	11.929011	4089
2019-04-28	18:51:36	-117.02392	11.929056	4089	Echinoid sampled - COLBOX-SGN
2019-04-28	18:55:35	-117.023927	11.929028	4089	Alcyonacea (BIO 188) sampled - COLBOX-SGN
2019-04-28	18:59:36	-117.023935	11.929139	4088
2019-04-28	18:59:49	-117.023936	11.929136	4088
2019-04-28	19:04:36	-117.023962	11.929142	4089

2019-04-28	19:04:44	-117.023963	11.929143	4089
2019-04-28	19:04:53	-117.023964	11.929144	4089
2019-04-28	19:05:26	-117.023968	11.929147	4089
2019-04-28	19:09:57	-117.023969	11.929118	4089	Alcyonacea (BIO 186) sampled - COLBOX-BIO #4
2019-04-28	19:18:20	-117.023932	11.929278	4089
2019-04-28	19:18:26	-117.023932	11.92928	4089

2019-04-28	19:18:39	-117.023934	11.92928	4089
2019-04-28	19:18:55	-117.023937	11.929277	4089
2019-04-28	19:19:10	-117.023942	11.929272	4089
2019-04-28	19:23:15	-117.02396	11.929276	4089	Sponge (189) and associated ophiuroid sampled - COLBOX-BIO #5
2019-04-28	19:26:59	-117.023956	11.929269	4089	Ophiuroid sampled - COLBOX-SGN
2019-04-28	19:30:27	-117.023962	11.929266	4089
2019-04-28	19:33:12	-117.023881	11.929316	4089	Undetermined black thing covering nodules sampled - COLBOX-BIO #9

2019-04-28	19:34:57	-117.023935	11.929273	4089
2019-04-28	19:36:54	-117.023966	11.929329	4089
2019-04-28	19:37:33	-117.023971	11.929326	4089
2019-04-28	19:37:37	-117.023972	11.929325	4089
2019-04-28	19:37:47	-117.023976	11.929322	4089

2019-04-28	19:37:57	-117.02398	11.929318	4089
2019-04-28	19:39:16	-117.023984	11.929309	4089	Asteroid (BIO192) sampled - COLBOX-SGN
2019-04-28	19:41:34	-117.0239639	11.9293079	4089
2019-04-28	19:44:07	-117.023996	11.929341	4089
2019-04-28	19:45:10	-117.023991	11.929362	4089

2019-04-28	19:49:07	-117.023986	11.929333	4089	<p>NOV 0011000 2019-04-28 19:49:07</p> <p>GEOMAR</p>
2019-04-28	19:49:21				<p>NOV 0011000 2019-04-28 19:49:21</p> <p>GEOMAR</p>
2019-04-28	19:52:55	-117.024008	11.929343	4089	Hermit crab (BIO 194) sampled - SLURP GUN CONTAINER #1
2019-04-28	20:03:18	-117.024014	11.929345	4089	<p>NOV 0011000 2019-04-28 20:03:18</p> <p>GEOMAR</p>
2019-04-28	20:03:26	-117.024015	11.929343	4089	<p>NOV 0011000 2019-04-28 20:03:26</p> <p>GEOMAR</p>

2019-04-28	20:03:49	-117.024018	11.929336	4089
2019-04-28	20:10:58	-117.023996	11.929332	4089
2019-04-28	20:11:08	-117.023997	11.929333	4089
2019-04-28	20:25:42	-117.024161	11.928485	4089

2019-04-28	20:25:50	-117.024159	11.928484	4089
2019-04-28	20:26:44	-117.024092	11.928493	4089	MICP#2-1 Received
2019-04-28	20:30:08	-117.02403	11.928488	4089	MICP#2-2 Deployed
2019-04-28	20:33:45	-117.024056	11.928496	4090	MICP#2-2 Operated
2019-04-28	20:43:51	-117.024261	11.928601	4090
2019-04-28	20:44:05	-117.024258	11.928597	4090
2019-04-28	20:44:10	-117.024258	11.928597	4090

2019-04-28	20:50:43	-117.024281	11.928593	4090
2019-04-28	20:53:00	-117.024259	11.928607	4090
2019-04-28	20:55:53	-117.024253	11.928596	4090	3 Nodule frames with recolonization substrates (ARTSUBS #1,#2,#3) recovered on the porch
2019-04-28	21:05:25	-117.024195	11.928267	4089	3 Nodule frames with recolonization substrates (ARTSUBS #1,#2,#3) inside the NIOZ-BIOBOX
2019-04-28	21:05:42	-117.024199	11.928266	4089
2019-04-28	21:21:47	-117.024203	11.928221	4090

2019-04-28	21:22:01	-117.024196	11.928222	4090
2019-04-28	21:22:07	-117.024193	11.928223	4090
2019-04-28	21:23:18	-117.024192	11.928231	4090	Stalked sponge (BIO190) sampled – COLBOX-SGN
2019-04-28	21:24:50	-117.024201	11.928223	4090
2019-04-28	21:24:57	-117.024201	11.928222	4090

2019-04-28	21:25:02	-117.024201	11.928221	4090
2019-04-28	21:26:20	-117.02418	11.928222	4089
2019-04-28	21:31:35	-117.024176	11.928277	4089
2019-04-28	21:32:43	-117.024183	11.928304	4089	Failed attempt to sample large Shrimp – SLURP GUN
2019-04-28	21:51:31	-117.0240555	11.9281893	4089

2019-04-28	21:51:39	-117.0240555	11.9281893	4089
2019-04-28	21:54:22	-117.024161	11.928282	4090	2 Small round Porifera sampled – SLUP GUN container#2
2019-04-28	22:04:04	-117.024081	11.928214	4088	Ophiuroid sampled - COLBOX-SGN
2019-04-28	22:05:06	-117.024047	11.928247	4089
2019-04-28	22:06:56	-117.024039	11.928202	4090
2019-04-28	22:07:15	-117.024041	11.928201	4090

2019-04-28	22:07:20	-117.024042	11.928202	4090
2019-04-28	22:07:30	-117.024042	11.928202	4090	Stalked sponge (BIO191) and associated ophiuroids (BIO200-BIO210 to BIO 215) sampled - COLBOX-SGN
2019-04-28	22:11:56	-117.024007	11.928222	4090
2019-04-28	22:12:33	-117.024017	11.928224	4090
2019-04-28	22:23:22	-117.024247	11.928276	4090

2019-04-28	22:23:34	-117.024247	11.928276	4090
2019-04-28	22:26:25	-117.024243	11.92827	4090
2019-04-28	22:26:41	-117.024243	11.92827	4090
2019-04-28	22:30:03	-117.024241	11.928299	4090	Small round Porifera sampled – SLUP GUN container #3
2019-04-28	22:39:10	-117.024181	11.928345	4090
2019-04-28	22:39:19	-117.024183	11.928345	4090

2019-04-28	22:39:20	-117.024183	11.928345	4090	Porifera (BIO207) sampled - COLBOX-SGN
2019-04-28	22:56:07	-117.024135	11.928345	4090
2019-04-28	22:56:15	-117.024138	11.928348	4090
2019-04-28	22:59:06	-117.024139	11.928336	4090	Alcyonacea (BIO 187) sampled - COLBOX-BIO #7
2019-04-28	23:08:56	-117.024131	11.928431	4090	MICP-DEEP#3 taken up
2019-04-28	23:18:25	-117.024229	11.928284	4090	MICP-DEEP#3 recieved on Lift
2019-04-28	23:23:27	-117.024054	11.9285	4089	MICP#2 Taken up
2019-04-28	23:33:25	-117.024212	11.928307	4090	MICP#2 recived on Lift
2019-04-28	23:42:10	-117.024188	11.928272	4090	Amphipod Trap recieved on porch
2019-04-28	23:47:35	-117.024236	11.928341	4088	OFF THE BOTTOM
2019-04-29	01:34:41	-117.024412	11.928596	0	ON DECK

Kiel 6000 Dive 26 (SO268-2_165_ROV26)

Date: 29/04/2019

Observers: RAMALHO, Sofia; HILÁRIO, Ana; ESQUETE, Patricia; ÜHLENKOTT, Katja; ROSSEL, Sven; BODUR, Yasemin; WENZHOEFER, Frank

ROV positions (at the bottom)

Start of dive: 11° 54.630'N 117° 00.886'W

End of dive: 11° 55.705'N 117° 01.508'W

Dive duration¹⁶:

ROV in the water: 29/04/2019 - 17:13:23

ROV at the bottom: 29/04/2019 - 18:50:59

ROV off the bottom: 30/04/2019 - 03:11:02

ROV on deck: 30/04/2019 - 04:37:17

Explored sites: DE trial area

Aims of the Dive (not achieved, see below):

- Megafauna video transect
- Recovery of 1 benthic chamber module (BFC-ROV) for in situ respiration measurements
- Elevator #2 recovery (automatic release failed after dive 163ROV25)

Handled ROV Tools (including scientific payload):

- None (see below)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 2

- 1 NIOZ-BIOBOX for Nodule frames,
- 1 *InSitu Pump*,
- 1 *electrochemical profiler (MICP)*,
- 1 *fiberoptical profiler (MICP-DEEP)*.

Dive summary (protocol by Sofia Ramalho)

The dive was primarily focused on the video transect for megafauna characterization (at 1m altitude and similar camera settings). At the end of the video transect, the ROV picked up the benthic chamber (BFC-ROV) to bring it up to the surface on the porch and attempted to manually release the Elevator 2, but without success. Due to the limited time at the bottom, it was decided to postpone the elevator recovery until the next dive, upon return from Manzanillo.

¹⁶ All dates and times in the protocols refer to UTC

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments
2019-04-29	17:13:23	-117.017981	11.909027	45	IN THE WATER
2019-04-29	18:50:59	-117.014771	11.910516	4101	AT THE BOTTOM
2019-04-29	18:56:15	-117.014795	11.910586	4121	Start video transect
2019-04-29	19:08:16	-117.0161667	11.9104805	4164
2019-04-29	21:44:18	-117.021068	11.920604	4102
2019-04-29	21:44:21	-117.021068	11.920604	4102
2019-04-29	22:11:40	-117.024086	11.9212694	4122
2019-04-29	22:11:42	-117.024086	11.9212694	4122
2019-04-29	22:11:44	-117.024086	11.9212694	4122

2019-04-29	23:11:24	-117.030652	11.92276	4074
2019-04-29	23:11:27	-117.030652	11.92276	4074
2019-04-29	23:18:40	-117.0312805	11.922699	4078
2019-04-29	23:18:41	-117.0312805	11.922699	4078
2019-04-29	23:18:49	-117.0312805	11.922699	4078
2019-04-29	23:19:46	-117.03134	11.922703	4078

2019-04-29	23:19:47	-117.03134	11.922703	4078
2019-04-29	23:19:53	-117.03134	11.922703	4078
2019-04-29	23:19:57	-117.031352	11.922704	4078
2019-04-29	23:20:12	-117.031377	11.922708	4078
2019-04-29	23:20:23	-117.031388	11.92271	4078
2019-04-29	23:23:16	-117.031588	11.922807	4080

2019-04-29	23:23:25	-117.031588	11.922807	4080
2019-04-29	23:23:39	-117.031594	11.922804	4078
2019-04-29	23:24:43	-117.031634	11.922785	4079
2019-04-29	23:24:55	-117.031644	11.922787	4079
2019-04-29	23:25:06	-117.031644	11.922787	4079
2019-04-29	23:28:33	-117.0318375	11.922905	4082

2019-04-29	23:28:59	-117.031836	11.922878	4082
2019-04-29	23:29:03	-117.031836	11.922878	4082
2019-04-29	23:39:24	-117.03256	11.92319	4109
2019-04-29	23:39:46	-117.032574	11.9232	4109
2019-04-29	23:41:02	-117.032613	11.92322	4109	Picture taken from the sonar in the large depressions area
2019-04-29	23:41:55	-117.032651	11.923239	4108

2019-04-29	23:44:30	-117.032732	11.923242	4107
2019-04-29	23:46:45	-117.032841	11.923256	4106
2019-04-29	23:46:56	-117.032841	11.923256	4106
2019-04-29	23:47:00	-117.032841	11.923256	4106
2019-04-29	23:47:01	-117.032841	11.923256	4106
2019-04-29	23:47:15	-117.032841	11.923256	4106

2019-04-29	23:47:40	-117.0327759	11.9232407	4106
2019-04-29	23:47:43	-117.0327759	11.9232407	4106
2019-04-29	23:48:04	-117.0327911	11.9232407	4106
2019-04-29	23:48:08	-117.0327911	11.9232407	4106
2019-04-30	01:25:56	-117.024489	11.928188	4089	End of video transect
2019-04-30	01:33:54	-117.024167	11.928185	4089	Arrival at Elevator #2
2019-04-30	01:40:51	-117.024126	11.928212	4089	Elevator #2 flotation released
2019-04-30	02:25:00	-117.024112	11.928329	4090	Benthic chamber module (BFC-ROV) taken up
2019-04-30	02:28:45	-117.024098	11.928336	4088	Benthic chamber module (BFC-ROV) on the porch
2019-04-30	02:43:17	-117.024239	11.928256	4088	Elevator #2 manual releaser failed
2019-04-30	02:49:49	-117.02426	11.928274	4087	Elevator #2 manual releaser failed, giving up
2019-04-30	03:11:02	-117.025135	11.928424	3292	OFF THE BOTTOM
2019-04-30	04:37:17	-117.02519	11.928397	-12	ON DECK

Kiel 6000 Dive 27 (SO268-2_169_ROV27)

Date: 07/05/2019

Observers: HAECKEL, Matthias

ROV positions (at the bottom)

Start of dive: 11°55.694'N 117°01.467'W

End of dive: 11°55.681'N 117°01.511'W

Dive duration¹⁷:

ROV in the water: 14:09

ROV at the bottom: 17:05

ROV off the bottom: 17:55

ROV on deck: 19:51

Explored sites: GER trial area

Aims of the Dive (not achieved, see below):

- Rescue of Elevator 2 by connecting to cable from the ship for heaving
- Test of LIBS laser

Handled ROV Tools (including scientific payload):

- None (see below)

Relevant Elevator payload (*italic: payload not used during the dive*)

Dive summary (protocol by Matthias Haeckel)

After 165 ROV Dive 26, Elevator 2 did not release its weight, neither by acoustic modem, nor manually by the ROV pulling the rope. Due to a medical emergency, we had to leave the elevator at the seafloor and return to Manzanillo. After our return to the GER trial area, a second cable was lowered from the ship and the ROV connected this cable to the elevator, so it could be heaved back on deck of the vessel.

This dive was used to test the LIBS system of colleagues at GEOMAR. While diving to the seafloor at 1000, 2000, 3000, and 4000 m water depth the laser was shot at different samples mounted in front of it. However, for some unknown reason, no signal of the samples could be recorded by the LIBS system.

¹⁷ All dates and times in the protocols refer to UTC

Date	Time	Longitude	Latitutde	Water Depth / m	Observations/Comments/Images
2019-05-07	14:09:33	117.025261	11.927736	57	IN THE WATER
2019-05-07	14:38:57	117.025218	11.927857	998	LIBS Test 1000 m Start
2019-05-07	14:58:43	117.024913	11.928304	1005	LIBS Test 1000 m Ende
2019-05-07	15:22:59	117.025131	11.927997	1996	LIBS Test 2000 m Start
2019-05-07	15:38:07	117.024675	11.928402	2006	LIBS Test 2000 m Ende
2019-05-07	16:00:13	117.024245	11.928268	2985	LIBS Test 3000 m Start
2019-05-07	16:15:56	117.023892	11.929021	2984	LIBS Test 3000 m Ende
2019-05-07	16:43:28	117.024317	11.928213	4002	LIBS Test 4000 m Start
2019-05-07	16:57:46	117.024485	11.928243	4002	LIBS Test 4000 m Ende
2019-05-07	17:05:25	117.024444	11.92824	4088	AT THE BOTTOM
2019-05-07	17:08:07	117.024272	11.928241	4088	Elevator gesichtet
2019-05-07	17:49:06	117.024287	11.928174	4086
2019-05-07	17:55:13	117.025179	11.928015	4085	
2019-05-07	19:50:49	117.025445	11.927981	6	ON DECK

Kiel 6000 Dive 27 (SO268-2_169_ROV27)

Date: 07/05/2019

Observers: HAECKEL, Matthias

ROV positions (at the bottom)

Start of dive: 11°55.694'N 117°01.467'W

End of dive: 11°55.681'N 117°01.511'W

Dive duration¹⁸:

ROV in the water: 14:09

ROV at the bottom: 17:05

ROV off the bottom: 17:55

ROV on deck: 19:51

Explored sites: GER trial area

Aims of the Dive (not achieved, see below):

- Rescue of Elevator 2 by connecting to cable from the ship for heaving
- Test of LIBS laser

Handled ROV Tools (including scientific payload):

- None (see below)

Relevant Elevator payload (*italic: payload not used during the dive*)

Dive summary (protocol by Matthias Haeckel)

After 165 ROV Dive 26, Elevator 2 did not release its weight, neither by acoustic modem, nor manually by the ROV pulling the rope. Due to a medical emergency, we had to leave the elevator at the seafloor and return to Manzanillo. After our return to the GER trial area, a second cable was lowered from the ship and the ROV connected this cable to the elevator, so it could be heaved back on deck of the vessel.

This dive was used to test the LIBS system of colleagues at GEOMAR. While diving to the seafloor at 1000, 2000, 3000, and 4000 m water depth the laser was shot at different samples mounted in front of it. However, for some unknown reason, no signal of the samples could be recorded by the LIBS system.

¹⁸ All dates and times in the protocols refer to UTC

Date	Time	Longitude	Latitutde	Water Depth / m	Observations/Comments/Images
2019-05-07	14:09:33	117.025261	11.927736	57	IN THE WATER
2019-05-07	14:38:57	117.025218	11.927857	998	LIBS Test 1000 m Start
2019-05-07	14:58:43	117.024913	11.928304	1005	LIBS Test 1000 m Ende
2019-05-07	15:22:59	117.025131	11.927997	1996	LIBS Test 2000 m Start
2019-05-07	15:38:07	117.024675	11.928402	2006	LIBS Test 2000 m Ende
2019-05-07	16:00:13	117.024245	11.928268	2985	LIBS Test 3000 m Start
2019-05-07	16:15:56	117.023892	11.929021	2984	LIBS Test 3000 m Ende
2019-05-07	16:43:28	117.024317	11.928213	4002	LIBS Test 4000 m Start
2019-05-07	16:57:46	117.024485	11.928243	4002	LIBS Test 4000 m Ende
2019-05-07	17:05:25	117.024444	11.92824	4088	AT THE BOTTOM
2019-05-07	17:08:07	117.024272	11.928241	4088	Elevator gesichtet
2019-05-07	17:49:06	117.024287	11.928174	4086
2019-05-07	17:55:13	117.025179	11.928015	4085	
2019-05-07	19:50:49	117.025445	11.927981	6	ON DECK

Kiel 6000 Dive 28 (SO268-2_174_ROV28)

Date: 08/05/2019

Observers: WENZHÖFER, Frank, BODUR, Yasemin, ROSSEL, Sven, UHLENKOTT, Katja, RAMALLHO, Sofia, HILÁRIO, Ana, PATEL, Tasnim

ROV positions (at the bottom)

Start of dive: 11.841354; -117.058292

End of dive: 11.843692; -117.057523

Dive duration¹⁹:

ROV in the water: 08.05.19 14:07:29

ROV at the bottom: 08.05.2019 15:46:32

ROV off the bottom: 09.05.19 02:25:08

ROV on deck: 09.05.19 04:14:51

Explored sites: DE reference area

Aims of the Dive (not achieved, see below):

- Deployment of microprofiler modules for in situ respiration measurements
- Deployment of time lapse cameras for observations of megafauna communities
- Megafauna sampling
- Pushcore sampling

Handled ROV Tools (including scientific payload):

- 16 PUC
- Fauna collection box (COLBOX-SGN)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

- 1 fiberoptical profiler (MICP-DEEP)
- *in situ pump*

Elevator 2

- 1 fiberoptical profiler (MICP-DEEP)
- 1 electrochemical profiler (MIC)
- 2 *Time-lapse cameras (PV-PICAM)*
- *amphipod trap*

Dive summary (protocol by Katja Uhlenkott)

During the dive two profilers were successfully deployed, while one profiler was not responding. The PI-CAMs mounted on the elevator did not work, but the PI-CAM mounted on a MICP-DEEP profiler was successfully positioned in front of an individual belonging to

¹⁹ All dates and times in the protocols refer to UTC

the taxon Brisingida (Asteroidea). Additionally video transects and fauna sampling were conducted.

Furthermore, the track of the multicore deployment SO268/2-172MUC could be spotted at the sea-floor as well as the amphipod trap by SGN lost during the cruise SO239. At both sites PUCs were sampled. Finally the amphipod trap was successfully recovered by attaching it to the ships wire with the ROV.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-05-08	14:07:29	-117.059989	11.840495	68	IN THE WATER
2019-05-08	15:46:32	-117.058292	11.841354	4134	AT THE BOTTOM
2019-05-08	15:56:59	-117.058332	11.841223	4142	MICP-DEEP #3 received from elevator #2
2019-05-08	16:01:42	-117.058431	11.841468	4143	of the spot the profiler will be deployed on
2019-05-08	16:02:59	-117.058434	11.841502	4143	MICP-DEEP #3 deployed
2019-05-08	16:03:40	-117.058421	11.841479	4143	2019-05-08_16-03-33_Sonne_SO268-2_174ROV28_Logo.jpg
2019-05-08	16:04:46	-117.05843	11.84148	4143	2019-05-08_16-04-45_Sonne_SO268-2_174ROV28_Logo.jpg
2019-05-08	16:09:53	-117.058548	11.841504	4143	MICP-DEEP #3 operated
2019-05-08	16:16:48	-117.058409	11.84125	4143	MICP #2 received
2019-05-08	16:23:13	-117.058511	11.841466	4143	MICP #2 deployed

2019-05-08	16:24:02	-117.05855	11.841491	4143	<p>2019-05-08_16-24-01_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:24:20	-117.058552	11.841481	4143	<p>2019-05-08_16-24-14_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:25:28	-117.058478	11.841406	4143	MICP #2 operated
2019-05-08	16:29:27	-117.058544	11.8417	4142	<p>2019-05-08_16-29-23_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:45:34	-117.058666	11.841241	4145	MICP-DEEP #1 with mounted PV-PICAM #20 received
2019-05-08	16:46:23	-117.058686	11.841239	4145	<p>2019-05-08_16-46-16_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-08	16:47:19	-117.058732	11.841281	4145	<p>2019-05-08_16-47-16_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:47:58	-117.05877	11.841284	4145	<p>2019-05-08_16-47-55_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:49:13	-117.058761	11.841289	4145	<p>2019-05-08_16-49-09_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:52:13	-117.058757	11.841315	4145	MICP-DEEP #1 with mounted PV-PICAM #20 deployed
2019-05-08	16:52:54	-117.058755	11.841304	4145	<p>2019-05-08_16-52-53_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-08	16:53:10	-117.058754	11.841303	4145	<p>2019-05-08_16-53-14_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:53:20	-117.058756	11.841304	4145	<p>2019-05-08_16-53-18_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:54:24	-117.058834	11.841286	4145	<p>2019-05-08_16-54-21_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:55:32	-117.058771	11.841336	4146	<p>2019-05-08_16-55-31_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	16:59:25	-117.058746	11.841306	4146	<p>2019-05-08_16-59-21_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-08	16:59:33	-117.058744	11.84131	4146	of communication board
2019-05-08	17:10:21	-117.058729	11.841214	4146	PV-PICAM #20 is blinking
2019-05-08	17:10:30	-117.058719	11.84122	4146	connection to MICP-DEEP #1 could not be established
2019-05-08	17:15:55	-117.058402	11.841257	4144	LEDs constantly on of PV-PICAMs on elevator #2, e.g. cameras are not working properly and are not deployed
2019-05-08	17:17:11	-117.05835	11.841248	4143	<p>2019-05-08_17-17-05_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	17:17:12	-117.05835	11.841248	4143	<p>2019-05-08_17-17-13_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	17:24:48	-117.057916	11.841098	4143	start video transect
2019-05-08	17:51:17	-117.055197	11.840882	4138	end of vido transect
2019-05-08	17:59:45	-117.055228	11.840799	4138	<p>2019-05-08_18-00-27_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:00:37	-117.055231	11.840777	4138	<p>2019-05-08_18-00-37_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-08	18:01:59	-117.055198	11.840777	4138	<p>2019-05-08_18-01-58_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:03:39	-117.055238	11.840796	4136	<p>2019-05-08_18-03-36_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:03:45	-117.055241	11.840796	4136	<p>2019-05-08_18-03-40_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:06:58	-117.055256	11.840788	4139	<p>2019-05-08_18-03-37_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:08:23	-117.055267	11.840735	4139	PUC #7, #17, #51 in sediment; #51 empties

2019-05-08	18:14:05	-117.055219	11.840756	4139	<p>2019-05-08_18-14-00_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:26:11	-117.055259	11.840714	4139	<p>2019-05-08_18-24-34_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:26:47	-117.055282	11.840752	4139	<p>2019-05-08_18-26-46_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:29:10	-117.055274	11.840776	4139	PUC #24, #27, #54, #71 in sediment; #24 empty
2019-05-08	18:35:20	-117.055271	11.840773	4139	<p>2019-05-08_18-35-14_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-08	18:40:09	-117.05526	11.840711	4139	<p>2019-05-08_18-40-08_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:41:05	-117.055245	11.840734	4139	repetition: PUC #24 in sediment
2019-05-08	18:41:44	-117.055225	11.84078	4139	<p>2019-05-08_18-41-39_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:42:05	-117.055233	11.840784	4139	<p>2019-05-08_18-42-04_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	18:53:45	-117.055338	11.840766	4138	start video transect
2019-05-08	19:19:22	-117.057821	11.841392	4141	sonar snapshot
2019-05-08	19:25:05	-117.058219	11.841459	4140	end of video transect
2019-05-08	19:31:17	-117.058522	11.841469	4143	MICP #2 taken up
2019-05-08	19:35:35	-117.058623	11.841481	4144	<p>2019-05-08_19-35-32_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-08	19:38:00	-117.058624	11.841464	4144	<p>2019-05-08_19-37-57_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	19:39:15	-117.058618	11.841464	4144	MICP #2 deployed
2019-05-08	19:46:28	-117.058777	11.841336	4146	MICP-DEEP #1 is still not responding
2019-05-08	19:51:46	-117.058376	11.841498	4141	start video transect
2019-05-08	20:15:44	-117.057516	11.843704	4135	stop video transect
2019-05-08	20:17:32	-117.057487	11.843714	4136	<p>2019-05-08_20-18-50_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	20:18:37	-117.057488	11.843735	4136	<p>2019-05-08_20-18-35_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	20:18:51	-117.057488	11.843736	4136	<p>2019-05-08_20-21-40_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-08	20:44:32	-117.057391	11.844016	4136	<p>2019-05-08_20-44-32_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	20:48:10	-117.057404	11.843998	4136	PUC #25, #11, #20, #65, #16, #46 in sediment; PUC #16 empty
2019-05-08	20:56:55	-117.057341	11.84402	4136	<p>2019-05-08_20-57-09_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	21:10:56	-117.057381	11.844004	4136	<p>2019-05-08_21-10-55_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	21:11:13	-117.057386	11.843997	4136	PUC #16 in sediment ; PUC #16 empty again
2019-05-08	21:16:24	-117.057375	11.844	4136	PUC #36 in sediment
2019-05-08	21:16:58	-117.057392	11.844002	4136	<p>2019-05-08_21-17-21_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-08	21:20:41	-117.057385	11.844004	4136	<p>2019-05-08_21-20-40_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	21:21:05	-117.057389	11.844004	4136	<p>2019-05-08_21-21-03_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	22:02:27	-117.058411	11.841312	4143	MICP #2 on elevator #2
2019-05-08	22:15:19	-117.058437	11.841303	4144	<p>2019-05-08_22-15-13_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	22:16:10	-117.058452	11.84131	4144	<p>2019-05-08_22-16-12_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	22:22:24	-117.058413	11.841566	4141	MICP-DEEP #3 received
2019-05-08	22:27:41	-117.058326	11.841709	4141	MICP-DEEP #3 on elevator #1
2019-05-08	22:33:06	-117.058251	11.841667	4140	elevator #1 released

2019-05-08	22:41:48	-117.05877	11.841309	4146	<p>2019-05-08_22-41-45_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-08	22:43:23	-117.058777	11.841329	4146	Brisingida #1 with Xenophyophora sampled in COLBOX-SGN (BIO-217)
2019-05-08	22:44:09	-117.058777	11.841333	4145	MICP-DEEP #1 with mounted PV-PICAM #20 received
2019-05-08	22:50:50	-117.058342	11.841244	4143	MICP-DEEP #1 with mounted PV-PICAM #20 on elevator #2
2019-05-08	23:44:56	-117.058513	11.841313	4142	elevator #2 released
2019-05-09	00:06:49	-117.057536	11.84374	4134	<p>2019-05-09_00-06-41_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:15:58	-117.05752	11.843747	4134	<p>2019-05-09_00-15-57_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:16:17	-117.057522	11.843747	4134	<p>2019-05-09_00-16-15_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:21:21	-117.057537	11.843752	4136	failed sampling attempt of Asteroidea

2019-05-09	00:32:39	-117.057455	11.843802	4136	<p>2019-05-09_00-32-37_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:32:51	-117.057456	11.843797	4136	<p>2019-05-09_00-32-54_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:33:04	-117.057456	11.843792	4136	<p>2019-05-09_00-33-00_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:33:35	-117.057464	11.843791	4136	<p>2019-05-09_00-33-32_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:34:00	-117.057464	11.843802	4136	<p>2019-05-09_00-33-38_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-09	00:37:17	-117.057411	11.843764	4136	Sampling of Ophiuroidea #1 in COLBOX-SGN
2019-05-09	00:38:17	-117.057439	11.84377	4136	Sampling of Ophiuroidea #2 in COLBOX-SGN
2019-05-09	00:40:37	-117.057219	11.844531	4136	<p>2019-05-09_00-40-35_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:40:48	-117.057219	11.844531	4136	<p>2019-05-09_00-40-44_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:42:36	-117.057209	11.844559	4137	Sampling of Ophiuroidea #3 in COLBOX-SGN
2019-05-09	00:43:57	-117.057222	11.844557	4136	<p>2019-05-09_00-43-54_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:44:10	-117.057222	11.844557	4136	<p>2019-05-09_00-44-06_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-09	00:44:18	-117.057222	11.844557	4136	<p>2019-05-09_00-44-16_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:44:55	-117.057258	11.844533	4136	<p>2019-05-09_00-44-52_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:45:06	-117.057258	11.844533	4136	<p>2019-05-09_00-45-06_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	00:45:41	-117.057258	11.844533	4136	Sampling of Actinaria in COLBOX-SGN (BIO-227)
2019-05-09	00:49:21	-117.057406	11.843854	4137	Sampling of Ophiuroidea #4 in COLBOX-SGN
2019-05-09	01:02:55	-117.057273	11.844585	4136	<p>2019-05-09_01-02-52_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:04:32	-117.057645	11.843776	4136	Sampling of Porifera #1 in SGN-COLBOX (BIO-228)
2019-05-09	01:06:31	-117.057651	11.843809	4136	failed sampling attempt of Ophiuroidea from under the Sponge

2019-05-09	01:13:13	-117.057822	11.843727	4136	<p>2019-05-09_01-13-10_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:15:04	-117.057825	11.843734	4136	Sampling of Ophiuroid #5 in COLBOX-SGN
2019-05-09	01:17:12	-117.057836	11.843732	4136	<p>2019-05-09_01-17-10_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:17:48	-117.057827	11.843721	4136	Sampling of Ophiuroid #6 in COLBOX-SGN
2019-05-09	01:21:15	-117.057471	11.844242	4136	<p>2019-05-09_01-21-16_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:24:50	-117.05725	11.844518	4137	<p>2019-05-09_01-24-46_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:27:07	-117.057931	11.843707	4137	Sampling of Alcyonacea #1 in COLBOX-SGN (BIO-230)

2019-05-09	01:28:12	-117.05793	11.843697	4136	<p>2019-05-09_01-28-10_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:29:28	-117.057933	11.843706	4137	Sampling of Ophiuroidea #7 in COLBOX-SGN
2019-05-09	01:31:08	-117.057694	11.843999	4137	<p>2019-05-09_01-31-05_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:32:16	-117.057256	11.844488	4137	Sampling of Ophiuroidea #8 in COLBOX-SGN
2019-05-09	01:39:11	-117.057274	11.844461	4137	<p>2019-05-09_01-39-05_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:39:30	-117.057275	11.844462	4137	Sampling of Porifera #2 in COLBOX-SGN (BIO-229)
2019-05-09	01:47:24	-117.058193	11.843603	4137	<p>2019-05-09_01-47-09_Sonne_SO268-2_174ROV28_Logo.jpg</p>

2019-05-09	01:48:08	-117.058194	11.843601	4137	<p>2019-05-09_01-48-04_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:48:38	-117.058206	11.843606	4137	<p>2019-05-09_01-48-35_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:48:47	-117.058209	11.843608	4137	<p>2019-05-09_01-48-44_Sonne_SO268-2_174ROV28_Logo.jpg</p>
2019-05-09	01:50:53	-117.058173	11.84359	4137	Sampling of Galatheidæ #1 in COLBOX-SGN (BIO-231)
2019-05-09	01:52:50	-117.058196	11.843608	4137	Sampling of Brisingida #2 in COLBOX-SGN (BIO-218)
2019-05-09	02:24:38	-117.0575027	11.8437023	4125	rescue manoeuvre for amphipod trap lost 2015: the ship's wire attached to the trap
2019-05-09	02:25:08	-117.057523	11.843692	4131	OFF THE BOTTOM
2019-05-09	02:28:51	-117.057607	11.84365	4135	ON DECK

Kiel 6000 Dive 29 (SO268-2_188_ROV29)

Date: 12.05.2019

Observers: Yasemin Bodur, Henko Destigter, Coral Diaz, Sabine Haalboom, Freija Hauquier, Timm Schoening, Peter Urban

ROV positions (at the bottom)

Start of dive: -117.012619

End of dive: 11.8600521

Dive duration²⁰: 9h 45 min

ROV in the water: 12.05.2019 13:38:09

ROV at the bottom: 12.05.2019 15:15:03

ROV off the bottom: 12.05.2019 22:43:45

ROV on deck: 13.05.2019 00:33:43

Explored sites: DE dredge area

Aims of the Dive:

- Deploy nodule frames in the EBS track and take push cores from this track.
- Deploy part of the nodule frames in the SO268 dredge track and take a push core.
- Fly over SLIC boxes and take photos.
- Deploy one AquaPix.
- Recovery of part of the sensor array.

Handled ROV Tools (including scientific payload):

- None (see below)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

Elevator 2

- PV-APIX
- Nodule frames

ROV payload

- 3 nodule frames (way down only)
- ADCP Tripod (GMR_PFM10; 24kg in water) (way up only)
- PV-APIX (way up only)

Dive summary (protocol by Yasemin Bodur)

²⁰ All dates and times in the protocols refer to UTC

After the arrival at the waypoint “Marker Fork”, three nodule frames were deployed and 13 PUCs were taken within the EBS track (4 PUCs within the track, 1 next to the nodule frames, 8 between raked stretches from fork experiment). Sensor GMR_PFM08 was collected and positioned on the elevator. PV-APIX was not deployed since LEDs were not flashing. 14 nodule frames were deployed within the dredge track and 2 PUCs were taken. Afterwards, photos of the SLICBOXes were taken. Several sensors (GMR_PFM08, RBINS_PFM02, RBINS_PFM03, NIOZ_PFM04, NIOZ_PFM08, GMR_PFM10) were collected and secured on the elevator. Elevator #1 was released.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Image
2019-05-12	13:38:09	-117.013371	11.861136	10	IN THE WATER
2019-05-12	15:15:03	-117.012634	11.860063	4120	AT THE BOTTOM
2019-05-12	15:19:29	-117.012611	11.860109	4126	move to waypoint Marker Fork
2019-05-12	15:23:03	-117.012455	11.860256	4126	arrive at marker fork in EBS track
2019-05-12	15:23:44	-117.012431	11.86026	4127	action 1 = deployment of three nodule frames in EBS track
2019-05-12	15:25:13	-117.012437	11.860282	4127	Gear Received
2019-05-12	15:26:58	-117.012443	11.860281	4127	first nodule frame deployed in EBS track
2019-05-12	15:27:42	-117.012437	11.860278	4127	Gear Received
2019-05-12	15:28:34	-117.012428	11.860267	4127	second nodule frame deployed in EBS track
2019-05-12	15:28:58	-117.01242	11.860262	4127	Gear Received
2019-05-12	15:29:58	-117.012409	11.86025	4127	third nodule frame deployed in EBS track
2019-05-12	15:31:17	-117.012412	11.860251	4126	2019-05-12_15-31-12_Sonne_SO268-2_188ROV29_Logo.jpg
2019-05-12	15:31:25	-117.012417	11.86025	4126	2019-05-12_15-31-19_Sonne_SO268-2_188ROV29_Logo.jpg
2019-05-12	15:41:45	-117.012591	11.860259	4128	action 2 = take 3 X 2 pushcores in EBS track
2019-05-12	15:42:38	-117.012592	11.860271	4128	PUC no. 20, 7, 27, 71 deployed

2019-05-12	15:47:44	-117.012583	11.860264	4128	<p>2019-05-12_15-47-39_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	15:48:54	-117.012605	11.860246	4128	<p>2019-05-12_15-48-48_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	15:49:41	-117.012596	11.860229	4128	PUC no. 20, 7, 27, 71 recieved
2019-05-12	15:56:18	-117.012543	11.860316	4127	Action 1 = take pushcore next to 3 frames
2019-05-12	15:57:55	-117.012477	11.860308	4128	PUC no. 54 deployed
2019-05-12	15:58:02	-117.012478	11.860306	4128	<p>2019-05-12_15-59-11_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	15:59:53	-117.012473	11.860299	4128	<p>2019-05-12_15-59-16_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	16:00:30	-117.012464	11.860285	4128	<p>2019-05-12_15-59-49_Sonne_SO268-2_188ROV29_Logo.jpg</p>

2019-05-12	16:00:35	-117.012463	11.860284	4128	PUC no. 54 received
2019-05-12	16:06:12	-117.012621	11.860275	4127	Action 2.2 = 3 X 2 PUC between raked stretches within EBS track
2019-05-12	16:08:57	-117.012632	11.860257	4128	PUC no. 24, 36 deployed
2019-05-12	16:10:36	-117.012595	11.860251	4128	<p>2019-05-12_16-10-34_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	16:12:07	-117.012623	11.860252	4128	PUC no. 36 received
2019-05-12	16:13:30	-117.012627	11.860262	4128	PUC no. 24 received PUC no. 11 deployed
2019-05-12	16:15:55	-117.012639	11.860238	4128	<p>2019-05-12_16-15-52_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	16:15:58	-117.012639	11.860237	4128	PUC no. 57 deployed PUC no. 57 received
2019-05-12	16:17:57	-117.012656	11.860242	4128	PUC no. 11 received
2019-05-12	16:18:43	-117.012644	11.860247	4128	<p>2019-05-12_16-18-41_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	16:21:07	-117.012675	11.860255	4128	<p>2019-05-12_16-21-05_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	16:24:17	-117.01269	11.860247	4128	PUC no. 46 deployed

2019-05-12	16:25:23	-117.012681	11.860238	4128	Gear Deployed
2019-05-12	16:25:26	-117.012681	11.860238	4128	PUC no. 12 deployed
2019-05-12	16:25:43	-117.01268	11.860242	4128	2019-05-12_16-25-41_Sonne_SO268-2_188ROV29_Logo.jpg
2019-05-12	16:27:08	-117.012687	11.860242	4128	PUC no. 12 received PUC no. 46 received, PUC no. 17 deployed
2019-05-12	16:31:06	-117.012682	11.860239	4128	2019-05-12_16-31-10_Sonne_SO268-2_188ROV29_Logo.jpg
2019-05-12	16:32:03	-117.012669	11.860242	4128	PUC no. 25 received, PUC no.17 received
2019-05-12	16:42:22	-117.012805	11.860363	4128	Gear TakenUp
2019-05-12	16:42:25	-117.012806	11.860364	4128	ROV-ADV
2019-05-12	16:42:30	-117.012808	11.860365	4127	GMR_PFM08
2019-05-12	16:43:34	-117.012815	11.860468	4127	ROV to Lift with stop at SLIC12
2019-05-12	16:46:43	-117.012565	11.860926	4127	2019-05-12_16-46-41_Sonne_SO268-2_188ROV29_Logo.jpg
2019-05-12	16:46:51	-117.012562	11.860929	4127	2019-05-12_16-46-50_Sonne_SO268-2_188ROV29_Logo.jpg

2019-05-12	16:56:43	-117.012364	11.861085	4128	GMR_PFM08 on Lift
2019-05-12	17:06:39	-117.012362	11.861073	4128	Final position GMR_PFM08
2019-05-12	17:10:52	-117.012318	11.861044	4129	2019-05-12_17-10-47_Sonne_SO268-2_188ROV29_Logo.jpg
2019-05-12	17:10:57	-117.012319	11.861045	4129	2019-05-12_17-11-21_Sonne_SO268-2_188ROV29_Logo.jpg
2019-05-12	17:14:53	-117.012299	11.861037	4129	2019-05-12_17-14-57_Sonne_SO268-2_188ROV29_Logo.jpg
2019-05-12	17:16:10	-117.012313	11.861061	4129	PUC #51 received
2019-05-12	17:16:46	-117.012317	11.861073	4129	ROV to Lift
2019-05-12	17:35:31	-117.012316	11.861118	4126	nodule frames received
2019-05-12	17:35:37	-117.012315	11.861116	4126	PV-APIX #1 not blinking
2019-05-12	17:37:42	-117.012346	11.861136	4126	PV-APIX #1 deployed on the seafloor
2019-05-12	17:42:54	-117.012478	11.861315	4127	heading towards dredge tracks
2019-05-12	17:49:09	-117.012558	11.862336	4126	heading towards waypoint "dredge frames"
2019-05-12	18:01:53	-117.011511	11.863345	4123	arrived at dredge track
2019-05-12	18:08:43	-117.011566	11.863456	4125	Nodule frame deployed
2019-05-12	18:12:02	-117.01157	11.863429	4125	Second nodule frame deployed
2019-05-12	18:13:41	-117.01158	11.863445	4125	Third nodule frame deployed
2019-05-12	18:16:18	-117.011604	11.86337	4125	Nodule frame #88 deployed

2019-05-12	18:18:58	-117.01161	11.863436	4125	Nodule frame #80 deployed
2019-05-12	18:20:29	-117.011606	11.863426	4125	Nodule frame #84 deployed
2019-05-12	18:22:25	-117.01162	11.863419	4125	Nodule frame #67 deployed
2019-05-12	18:26:39	-117.011653	11.86342	4125	Nodule frame #83 deployed
2019-05-12	18:29:16	-117.011672	11.863415	4125	Nodule frame #87 employed
2019-05-12	18:30:51	-117.011675	11.863407	4125	Nodule frame #5 deployed
2019-05-12	18:33:10	-117.011702	11.863425	4125	Nodule frame #78 deployed
2019-05-12	18:36:04	-117.011718	11.863413	4125	Nodule frame #30 (?) deployed
2019-05-12	18:42:49	-117.011734	11.863391	4125	Nodule frame #29 employed
2019-05-12	18:46:08	-117.011731	11.863381	4125	Empty nodule frame cage dropped off
2019-05-12	18:50:31	-117.011766	11.863402	4126	PUC #65 inserted deployed
2019-05-12	18:50:53	-117.011764	11.863405	4126	<p>2019-05-12_18-50-49_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	18:53:29	-117.011748	11.863394	4126	PUC #65 received
2019-05-12	18:57:03	-117.01174	11.86339	4124	<p>2019-05-12_18-57-06_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	18:57:27	-117.011738	11.863392	4124	<p>2019-05-12_18-57-24_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:04:32	-117.011735	11.863383	4124	transect to SLIC_13
2019-05-12	19:06:18	-117.011689	11.863169	4124	dredgetrack

2019-05-12	19:24:11	-117.011989	11.862925	4125	did not find SLIC_13, continued to directly to SLIC_05
2019-05-12	19:26:19	-117.01205	11.862903	4125	<p>2019-05-12_19-26-14_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:26:31	-117.012048	11.862906	4125	<p>2019-05-12_19-26-29_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:26:58	-117.012045	11.86292	4125	transect to SLIC_10
2019-05-12	19:29:01	-117.012116	11.863082	4125	<p>2019-05-12_19-29-01_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:29:03	-117.012117	11.863082	4125	<p>2019-05-12_19-29-16_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:29:37	-117.012123	11.863084	4125	<p>2019-05-12_19-29-35_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:30:09	-117.012135	11.863089	4125	transect to SLIC_02

2019-05-12	19:33:48	-117.012592	11.86311	4125	dredgetracks
2019-05-12	19:36:57	-117.012784	11.862993	4126	dredge jumped
2019-05-12	19:37:27	-117.012807	11.862989	4126	<p>2019-05-12_19-37-20_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:37:53	-117.012818	11.862986	4126	<p>2019-05-12_19-37-50_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:38:09	-117.012821	11.862978	4126	<p>2019-05-12_19-38-06_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:38:29	-117.01283	11.862955	4126	SLIC_Recolonisation
2019-05-12	19:39:44	-117.012915	11.862867	4126	transect to SLIC_19
2019-05-12	19:46:47	-117.0134	11.862532	4128	sediment lumps close to SLIC_19
2019-05-12	19:48:27	-117.013496	11.862487	4128	<p>2019-05-12_19-48-24_Sonne_SO268-2_188ROV29_Logo.jpg</p>

2019-05-12	19:48:36	-117.013495	11.862487	4128	<p>2019-05-12_19-48-34_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:48:55	-117.01349	11.862491	4128	<p>2019-05-12_19-48-52_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:49:08	-117.01348	11.862489	4128	
2019-05-12	19:51:48	-117.013254	11.862192	4129	<p>2019-05-12_19-51-43_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:51:58	-117.013253	11.862188	4129	<p>2019-05-12_19-51-57_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:52:07	-117.013252	11.862185	4129	<p>2019-05-12_19-52-09_Sonne_SO268-2_188ROV29_Logo.jpg</p>

2019-05-12	19:53:21	-117.013252	11.862155	4129	<p>2019-05-12_19-53-17_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:53:29	-117.013252	11.862152	4129	PV-APIX #2
2019-05-12	19:54:35	-117.013179	11.862138	4129	transect to SLIC_1
2019-05-12	19:55:33	-117.013036	11.862174	4129	<p>2019-05-12_19-55-26_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:58:03	-117.012649	11.862303	4128	
2019-05-12	19:58:17	-117.012639	11.862306	4128	<p>2019-05-12_19-58-15_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:58:19	-117.012638	11.862307	4128	<p>2019-05-12_19-58-22_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	19:58:36	-117.012633	11.862311	4128	<p>2019-05-12_19-58-33_Sonne_SO268-2_188ROV29_Logo.jpg</p>

2019-05-12	19:58:43	-117.012632	11.862312	4128	<p>2019-05-12_19-58-41_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:00:48	-117.012481	11.862166	4127	<p>2019-05-12_20-00-49_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:00:54	-117.012475	11.862159	4127	<p>2019-05-12_20-01-00_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:01:08	-117.012461	11.862148	4127	
2019-05-12	20:01:17	-117.012453	11.862143	4127	<p>2019-05-12_20-01-15_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:01:42	-117.012425	11.862155	4127	transect to SLIC_03
2019-05-12	20:02:21	-117.012362	11.862215	4127	big mount
2019-05-12	20:05:48	-117.012026	11.862409	4126	<p>2019-05-12_20-05-45_Sonne_SO268-2_188ROV29_Logo.jpg</p>

2019-05-12	20:05:52	-117.012025	11.862409	4126	<p>2019-05-12_20-05-51_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:06:07	-117.012024	11.862407	4126	<p>2019-05-12_20-06-01_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:06:22	-117.012024	11.862408	4126	<p>2019-05-12_20-06-20_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:06:33	-117.012021	11.862412	4126	<p>2019-05-12_20-06-29_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:07:07	-117.012005	11.862436	4126	transect to collect RBINS-03
2019-05-12	20:08:59	-117.012019	11.862446	4126	<p>2019-05-12_20-09-07_Sonne_SO268-2_188ROV29_Logo.jpg</p>

2019-05-12	20:10:02	-117.011972	11.862447	4126	<p>2019-05-12_20-09-59_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:10:10	-117.011967	11.862449	4126	<p>2019-05-12_20-10-05_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:11:05	-117.011934	11.862463	4126	<p>2019-05-12_20-11-01_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	20:12:02	-117.011927	11.862471	4126	collect RBIN_PFM_02
2019-05-12	20:12:57	-117.011951	11.862458	4125	ROV to Lift
2019-05-12	20:14:03	-117.011998	11.86234	4126	transect to elevator 1
2019-05-12	20:27:54	-117.012365	11.861094	4129	RBINS_PFM02 on Lift
2019-05-12	20:32:01	-117.012305	11.861125	4128	transect to collect RBINS_PFM03
2019-05-12	20:42:07	-117.01135	11.860704	4127	RBINS_PFM03 taken up
2019-05-12	20:42:20	-117.01135	11.860706	4127	ROV to Lift
2019-05-12	20:49:22	-117.012351	11.861108	4129	RBINS_PFM03 on Lift
2019-05-12	20:57:52	-117.012338	11.861118	4128	transit to collect NIOZ_PFM04
2019-05-12	21:02:36	-117.0118	11.861692	4126	Found SLIC13

2019-05-12	21:03:41	-117.01118	11.861711	4126	<p>2019-05-12_21-03-38_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	21:03:58	-117.011802	11.861711	4126	<p>2019-05-12_21-03-54_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	21:05:40	-117.011768	11.86168	4126	New waypoint created for SLIC13
2019-05-12	21:10:11	-117.011616	11.86161	4127	NIOZ_PFM04 TakenUp
2019-05-12	21:10:56	-117.011613	11.861595	4126	ROV to Lift
2019-05-12	21:17:36	-117.012337	11.86106	4129	NIOZ_PFM04 on Lift
2019-05-12	21:26:44	-117.01236	11.861081	4128	Transit to NIOZ_PFM08
2019-05-12	21:33:53	-117.012832	11.861263	4129	<p>2019-05-12_21-33-52_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	21:34:07	-117.012819	11.861264	4129	<p>2019-05-12_21-34-05_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	21:42:13	-117.013087	11.861278	4130	NIOZ_PFM08 TakenUp
2019-05-12	21:42:40	-117.013078	11.861271	4130	ROV to Lift
2019-05-12	21:50:02	-117.012367	11.861074	4128	NIOZ_PFM08 on Lift

2019-05-12	21:54:25	-117.012375	11.861077	4129	<p>2019-05-12_21-54-15_Sonne_SO268-2_188ROV29_Logo.jpg</p>
2019-05-12	21:54:39	-117.012369	11.861069	4129	Placement of NIOZ_PFM08
2019-05-12	22:05:15	-117.012332	11.861108	4129	Preparing release of elevator 1
2019-05-12	22:05:36	-117.012312	11.861123	4128	Elevator 1 released
2019-05-12	22:09:11	-117.012456	11.861144	4129	Aquapix TakenUp
2019-05-12	22:10:07	-117.012455	11.861146	4129	AquaPix placed on porch
2019-05-12	22:13:17	-117.012486	11.86127	4128	transit to collect GMR_PMF10
2019-05-12	22:16:17	-117.012437	11.861381	4129	GMR_PFM10 TakenUp
2019-05-12	22:17:51	-117.012426	11.86136	4128	GMR_PFM10 placed on porch
2019-05-12	22:25:28	-117.012366	11.861294	4128	GMR_PFM10 placed back, next try for better fit on the porch
2019-05-12	22:36:22	-117.012371	11.861328	4128	GMR_PFM10 TakenUp
2019-05-12	22:37:16	-117.012353	11.861328	4128	GMR_PFM10 dropped
2019-05-12	22:41:32	-117.012348	11.86131	4129	GMR_PFM10 TakenUp
2019-05-12	22:42:51	-117.012345	11.861314	4129	GMR_PFM10 placed on porch
2019-05-12	22:43:45	-117.012372	11.861336	4128	OFF THE BOTTOM
2020-01-05	00:33:43	-117.012548	11.862038	3	ON DECK

Kiel 6000 Dive 30 (SO268-2_193_ROV30)

Date: 13/05/2019

Observers: WENZHÖFER, Frank, HAMANN, Kristin, HILARIO, Ana, RAMALHO, Sofia

ROV positions (at the bottom)

Start of dive: 11° 51.725' N 117° 00.765' W

End of dive: 11° 51.732' N 117° 00.793' W

Dive duration²¹:

ROV in the water: 13.05.19 13:52:52

ROV at the bottom: 13.05.2019 17:08:09

ROV off the bottom: 14.05.19 01:42:07

ROV on deck: 14.05.19 03:37:12

Explored sites: German reference dredge experiment

Aims of the Dive (not achieved, see below):

- Deployment of microprofiler- and benthic chamber modules for in situ respiration measurements
- PUC sampling
- Fauna sampling

Handled ROV Tools (including scientific payload):

- 16 PUCs, SenckenbergBox, slurp gun, 3 hand nets, Scoop, magnet T-Handle, optical communication, 1 ISCHAM on porch

Relevant Elevator payload

Elevator 1

- 1 electrochemical profilers (MICP)
- 2 fiberoptical profiler (MICP-DEEP)
- Pump
- 1 x 6 ROV push cores (PUC)

Dive summary (protocol by Sophie Paul)

ISCHAM #2, MICP-DEEP #3, MICP-DEEP #1 and PV-PICAM #20 as well as MICP #2 successfully deployed. Pushcoring of two spots in the dredge track with 8 successful PUCs each. MICP #2 repositioned in track. During fauna sampling, 1 ophiuroid with crab, 2 ophiuroids, 1 actinaria, 1 acyonacea, 1 crinoid, 3 echinoids, 2 poriferas, and 4 holothurians were collected in the SenckenbergBox. After fauna sampling, MICP #2, MICP-DEEP #3, MICP-DEEP # 1, and PV-PICAM #20 were repositioned again. PV-APIC was received and NIOZ-PFM-07 (ROV-AQD) was collected from the sensor array and both were taken up on the porch.

²¹ All dates and times in the protocols refer to UTC

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments
2019-05-13	15:32:59	-117.013276	11.861022	35	IN THE WATER
2019-05-13	17:08:09	-117.012752	11.862086	4125	AT THE BOTTOM
2019-05-13	17:25:02	-117.012863	11.863071	4126	ISCHAM #2 deployed
2019-05-13	17:29:11	-117.012862	11.863087	4126	sediment underneath blue rim of chamber
2019-05-13	17:30:10	-117.012868	11.863095	4126	ISCHAM #2 operated
2019-05-13	17:44:24	-117.012431	11.861187	4127
2019-05-13	17:44:48	-117.012432	11.861179	4127
2019-05-13	17:45:08	-117.012431	11.861181	4127
2019-05-13	17:45:26	-117.012431	11.861185	4127
2019-05-13	17:45:37	-117.01243	11.86119	4127

2019-05-13	17:46:30	-117.012395	11.861205	4127
2019-05-13	17:47:02	-117.012361	11.8612	4127
2019-05-13	18:06:02	-117.012847	11.862972	4126	Spot where MICP-DEEP #3 will be deployed
2019-05-13	18:06:48	-117.012842	11.862979	4126
2019-05-13	18:09:18	-117.012832	11.862933	4126	communication established
2019-05-13	18:57:18	-117.013224	11.862099	4129	PV-APIX #2 deploying glasp20 in front of the same object (porifera + ophiuroid)
2019-05-13	18:59:37	-117.013204	11.862116	4129	MICP-DEEP #1 and PV-PICAM #20 deployed
2019-05-13	19:02:17	-117.013205	11.862121	4129	glasp20 blinked
2019-05-13	19:32:44	-117.012879	11.863174	4125
2019-05-13	19:36:16	-117.012895	11.863179	4126	MICP #2 deployed, operated and communication established

2019-05-13	19:38:46	-117.012913	11.863199	4126
2019-05-13	19:38:57	-117.012908	11.863197	4126
2019-05-13	19:46:51	-117.012941	11.863197	4127
2019-05-13	19:52:46	-117.012899	11.863148	4127
2019-05-13	20:02:48	-117.012917	11.863163	4127
2019-05-13	20:05:10	-117.012949	11.863198	4127
2019-05-13	20:06:25	-117.01291	11.863171	4127	PUC31 is not closed properly. PUC31 is not taken

2019-05-13	20:31:15	-117.012912	11.862983	4127
2019-05-13	20:41:16	-117.012896	11.862975	4127	PUC 6, 59, 63, 42, 38, 22, 4 taken	
2019-05-13	21:00:51	-117.012889	11.862946	4128	UC 49 repeated	P
2019-05-13	21:01:00	-117.012887	11.862939	4128
2019-05-13	21:03:59	-117.012902	11.862973	4128

2019-05-13	21:23:50	-117.01294	11.863123	4127
2019-05-13	21:32:14	-117.012877	11.863136	4126
2019-05-13	21:49:45	-117.012934	11.863111	4127
2019-05-13	21:52:44	-117.012995	11.863156	4127
2019-05-13	21:53:22	-117.012984	11.863141	4127
2019-05-13	22:01:41	-117.013003	11.863182	4128

2019-05-13	22:02:36	-117.012994	11.863184	4128
2019-05-13	22:03:01	-117.012989	11.863179	4128
2019-05-13	22:03:33	-117.012979	11.86317	4127
2019-05-13	22:06:51	-117.012977	11.863158	4127
2019-05-13	22:11:11	-117.012977	11.863188	4127
2019-05-13	22:13:25	-117.013078	11.86323	4126

2019-05-13	22:13:57	-117.013089	11.863228	4126
2019-05-13	22:14:08	-117.013095	11.863226	4126
2019-05-13	22:14:49	-117.01313	11.863221	4126
2019-05-13	22:16:53	-117.013157	11.863215	4128
2019-05-13	22:17:05	-117.013155	11.863213	4128
2019-05-13	22:18:14	-117.013119	11.863202	4128

2019-05-13	22:18:34	-117.013123	11.863203	4128
2019-05-13	22:18:53	-117.013136	11.863212	4128
2019-05-13	22:19:38	-117.013165	11.863225	4128
2019-05-13	22:27:18	-117.013157	11.863186	4127
2019-05-13	22:28:04	-117.013201	11.863199	4127
2019-05-13	22:28:26	-117.013204	11.863188	4127

2019-05-13	22:30:50	-117.013181	11.863149	4128
2019-05-13	22:35:41	-117.013207	11.863158	4128
2019-05-13	22:35:51	-117.013209	11.863159	4128
2019-05-13	22:42:31	-117.013238	11.86309	4128
2019-05-13	22:42:36	-117.013236	11.863095	4128
2019-05-13	22:42:58	-117.013235	11.863112	4128

2019-05-13	22:46:23	-117.013224	11.863063	4128
2019-05-13	22:48:50	-117.01326	11.863064	4128
2019-05-13	22:48:57	-117.013261	11.863065	4128
2019-05-13	22:49:12	-117.013264	11.863065	4128
2019-05-13	22:49:28	-117.013263	11.863057	4128
2019-05-13	22:56:53	-117.013261	11.863004	4129

2019-05-13	22:56:59	-117.013259	11.863004	4129
2019-05-13	22:57:08	-117.013255	11.863004	4129
2019-05-13	22:57:45	-117.013238	11.862999	4128
2019-05-13	23:04:52	-117.013224	11.862987	4129
2019-05-13	23:05:10	-117.013224	11.862999	4128
2019-05-13	23:14:24	-117.013099	11.862743	4129

2019-05-13	23:14:54	-117.013108	11.862743	4129
2019-05-13	23:18:31	-117.013089	11.862688	4129
2019-05-13	23:19:11	-117.01309	11.862681	4129
2019-05-13	23:22:13	-117.013076	11.86267	4128
2019-05-13	23:23:41	-117.013046	11.862625	4129
2019-05-13	23:23:56	-117.013047	11.862625	4129

2019-05-13	23:31:41	-117.012962	11.862658	4129
2019-05-13	23:46:04	-117.012797	11.862939	4128
2019-05-14	00:04:02	-117.012823	11.862948	4127
2019-05-14	00:10:03	-117.012767	11.862905	4127	MICP #2 deployed and operated	
2019-05-14	00:10:16	-117.012772	11.862912	4127
2019-05-14	00:27:53	-117.012882	11.863118	4127

2019-05-14	00:30:59	-117.012852	11.863104	4127	<p>MICP-DEEP #3 deployed</p>
2019-05-14	00:31:05	-117.012853	11.863105	4127
2019-05-14	00:31:08	-117.012854	11.863106	4127
2019-05-14	00:32:46	-117.012859	11.863124	4127
2019-05-14	00:33:13	-117.012855	11.863122	4127

2019-05-14	00:34:43	-117.012851	11.863133	4127
2019-05-14	00:39:04	-117.013209	11.862902	4128
2019-05-14	00:39:41	-117.013206	11.862897	4128
2019-05-14	00:39:41	-117.013206	11.862897	4128
2019-05-14	00:39:42	-117.013206	11.862897	4128
2019-05-14	00:39:49	-117.013201	11.862895	4128

2019-05-14	00:41:54	-117.013178	11.862878	4128
2019-05-14	00:41:55	-117.013178	11.862877	4128
2019-05-14	00:41:55	-117.013178	11.862877	4128
2019-05-14	00:41:56	-117.013179	11.862877	4128
2019-05-14	00:41:57	-117.013179	11.862877	4128
2019-05-14	00:42:28	-117.013189	11.862869	4128

2019-05-14	00:42:31	-117.01319	11.862869	4128
2019-05-14	00:42:32	-117.013191	11.862868	4128
2019-05-14	00:43:52	-117.013213	11.862873	4128
2019-05-14	00:43:52	-117.013213	11.862873	4128
2019-05-14	00:52:02	-117.013291	11.862232	4129	SLICBOX #20
2019-05-14	01:23:27	-117.013253	11.862061	4130	PV-APIX and ROV-AQD received and taken up on porch
2019-05-14	01:42:07	-117.013213	11.862197	4130	OFF THE BOTTOM
2019-05-14	03:37:12	-117.013085	11.86185	0	ON DECK

Kiel 6000 Dive 31 (SO268-2_197_ROV31)

Date: 14/05/2019

Observers: DE STIGTER, Henko, SCHOENING, Timm, HAALBOOM, Sabine, URBAN, Peter, DIAZ RECIO-LORENZO, Coral, PATEL, Tasnim, PAUL, Sophie, VOLZ, Jessica

ROV positions (at the bottom)

Start of dive: 11.864591 'N, 117.012835 'W

End of dive: 11.864499 'N, 117.012864 'W

Dive duration²²:

ROV in the water: 14.05.2019 15:01:22

ROV at the bottom: 14.05.2019 16:43:00

ROV off the bottom: 15.05.2019 00:45:57

ROV on deck: 15.05.2019 02:36:08

Explored sites: German reference post-impact

Aims of the Dive:

- Deployment of remaining nodule frames in dredge track
- Deployment of amphipod trap in dredge track
- Remaining post-impact photos of SLIC boxes
- Recovery of remaining part of the sensor array
- Push-coring in and around the dredge track

Handled ROV Tools (including scientific payload):

- 16 PUC's
- 1 ROV-ADCP platform (GMR_PFM09)

Relevant Elevator payload (*italic: payload not used during the dive*)

Elevator 1

-

Elevator 2

- 1 box with nodule frames
- 3 ROV-AQD platforms
 - NIOZ_PFM02
 - NIOZ_PFM03
 - NIOZ_PFM05
- 1 ROV-ADV platform
 - GMR_PFM07
- 1 ROV-CTD platform
 - RBINS_PFM01

²² All dates and times in the protocols refer to UTC

Dive summary (protocol by Sabine Haalboom)

The remaining nodule frames have been successfully deployed in the dredge track as well as an amphipod trap. The remaining sensor platforms have been recovered and SLICBOXES have been photographed for post-impact assessment. Push cores have been taken in and around the dredge track to cover the gradient of impact.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments	Image
2019-05-14	15:01:22	-117.013527	11.86102	16	IN THE WATER	
2019-05-14	16:43:00	-117.012835	11.864591	4109	AT THE BOTTOM	
2019-05-14	16:51:47	-117.012977	11.864371	4126	Start of deployment 13 nodule frames	
2019-05-14	17:15:54	-117.012445	11.863846	4123	Start of deployment of amphipod trap	
2019-05-14	17:19:34	-117.012114	11.863569	4123	Photo Taken of lost drone	2019-05-14_17-19-17_Sonne_SO268-2_197ROV31_Logo.jpg
2019-05-14	17:20:03	-117.012069	11.863595	4123	Deployment of 13 nodule frames in dredge track. Next to 14 which were placed earlier	
2019-05-14	17:36:19	-117.011744	11.863428	4125	Deployment of Amphipod trap in dredge track	
2019-05-14	17:37:16	-117.011742	11.863421	4125	Photo Taken of amphipod trap in dredge track next to a nodule frame	2019-05-14_17-37-15_Sonne_SO268-2_197ROV31_Logo.jpg
2019-05-14	17:42:54	-117.011525	11.863446	4125	Fish	
2019-05-14	17:59:12	-117.011423	11.863471	4125	Porifera appears flattened, but not broken from dredge impact	
2019-05-14	18:01:23	-117.01139	11.863478	4125	Polychaete	

2019-05-14	18:07:51	-117.011358	11.863481	4125	Finished deployment of nodule frames with dredge track and NIOZ marker	
2019-05-14	18:09:12	-117.011329	11.863485	4124	Photo Taken of nodule frames in dredge track	<p>2019-05-14_18-09-10_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:09:21	-117.011327	11.863484	4124	Photo Taken of nodule frames in dredge track	<p>2019-05-14_18-09-18_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:09:35	-117.011323	11.863483	4124	Polychaete	
2019-05-14	18:16:44	-117.011702	11.863386	4125	Gear Received; Empty box for nodule frames	
2019-05-14	18:17:17	-117.011717	11.863398	4124	Transit to SLIC09	
2019-05-14	18:17:18	-117.011717	11.863399	4124	Gear Deployed; Empty box for nodule frames	
2019-05-14	18:22:16	-117.012225	11.863525	4123	Photo Taken of SLICBOX 09	<p>2019-05-14_18-22-15_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:22:27	-117.012225	11.863526	4123	Photo taken of SLICBOX 09	<p>2019-05-14_18-22-24_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:33:40	-117.012085	11.863533	4125	Gear TakenUp; Lost drone; placed behind push core box	

2019-05-14	18:42:28	-117.012247	11.863878	4123	Photo Taken of SLICBOX 08	<p>2019-05-14_18-42-27_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:42:39	-117.012242	11.863885	4123	Photo Taken of SLICBOX 08	<p>2019-05-14_18-42-37_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:45:11	-117.012376	11.864188	4123	Photo Taken of SLICBOX 07	<p>2019-05-14_18-45-06_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:45:12	-117.012376	11.864189	4123	Photo taken of SLICBOX 07	<p>2019-05-14_18-45-08_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:45:30	-117.012387	11.864191	4123	Photo Taken of SLICBOX 07	<p>2019-05-14_18-45-29_Sonne_SO268-2_197ROV31_Logo.jpg</p>

2019-05-14	18:45:43	-117.012393	11.864189	4123	Photo Taken of SLICBOX07	<p>2019-05-14_18-45-43_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:46:31	-117.012435	11.864177	4123	black part of the SLIC boxes are corroded	
2019-05-14	18:49:42	-117.012955	11.8641	4125	Photo Taken of SLICBOX15 and GMR_PFM09	<p>2019-05-14_18-49-40_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:50:14	-117.012978	11.864103	4125	Photo Taken	<p>2019-05-14_18-50-13_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:50:31	-117.012986	11.864101	4125	Photo Taken of SLICBOX 15	<p>2019-05-14_18-50-29_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:55:25	-117.013684	11.863829	4126	Photo Taken of SLICBOX 16	<p>2019-05-14_18-55-26_Sonne_SO268-2_197ROV31_Logo.jpg</p>

2019-05-14	18:55:52	-117.013682	11.863822	4126	Photo Taken of SLICBOX 16	<p>2019-05-14_18-55-51_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:58:32	-117.013707	11.863426	4126	Photo Taken of SLICBOX 17	<p>2019-05-14_18-58-32_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	18:58:42	-117.013714	11.86342	4126	Photo Taken of SLICBOX 17	<p>2019-05-14_18-58-42_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	19:01:32	-117.013693	11.863076	4126	Photo Taken of SLICBOX 18	<p>2019-05-14_19-01-32_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	19:01:36	-117.013692	11.863076	4126	Photo taken of SLICBOX 18	<p>2019-05-14_19-01-37_Sonne_SO268-2_197ROV31_Logo.jpg</p>

2019-05-14	19:13:08	-117.01239	11.863267	4124	Photo Taken of ROV-AQD NIOZ_PFM-03 in dredge track	<p>2019-05-14_19-13-02_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	19:15:12	-117.012296	11.863249	4125	Gear TakenUp; ROV-AQD NIOZ_PFM-03	
2019-05-14	19:28:49	-117.012963	11.864394	4126	Gear on Lift; ROV-AQD NIOZ_PFM-03	
2019-05-14	19:34:35	-117.012647	11.865026	4122	Photo Taken of ROV-AQD NIOZ_PFM-02	<p>2019-05-14_19-34-30_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	19:36:24	-117.012638	11.865044	4124	Gear TakenUp; ROV-AQD NIOZ_PFM-02	
2019-05-14	19:52:06	-117.013213	11.864527	4125	Gear on Lift; ROV-AQD NIOZ_PFM-02	
2019-05-14	19:56:27	-117.013998	11.864663	4124	Photo Taken of ROV-AQD NIOZ_PFM-05	<p>2019-05-14_19-56-20_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	19:56:46	-117.014006	11.864668	4124	Photo Taken of ROV-AQD NIOZ_PFM-05	<p>2019-05-14_19-56-42_Sonne_SO268-2_197ROV31_Logo.jpg</p>

2019-05-14	19:56:56	-117.014011	11.864675	4124	Photo Taken of ROV-AQD NIOZ_PFM-05	<p>2019-05-14_19-56-52_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	20:00:45	-117.01403	11.86469	4126	Gear TakenUp; ROV-AQD NIOZ_PFM-05	
2019-05-14	20:11:55	-117.012974	11.864388	4126	Gear on Lift; ROV-AQD NIOZ_PFM-05	
2019-05-14	20:26:35	-117.014356	11.865587	4123	Photo Taken of ROV-ADV GMR_PFM-07	<p>2019-05-14_20-26-32_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	20:27:28	-117.01439	11.8656	4125	Photo Taken of ROV-ADV GMR_PFM-07	<p>2019-05-14_20-27-25_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	20:29:42	-117.014384	11.865576	4125	Gear TakenUp; ROV-ADV GMR_PFM-07	
2019-05-14	20:32:33	-117.014215	11.865336	4122	Photo Taken	<p>2019-05-14_20-32-35_Sonne_SO268-2_197ROV31_Logo.jpg</p>

2019-05-14	20:32:53	-117.014189	11.865318	4124	Photo Taken	<p>2019-05-14_20-32-52_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	20:33:01	-117.014182	11.865315	4124	Photo Taken	<p>2019-05-14_20-32-59_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	20:33:19	-117.014171	11.86531	4124	Photo Taken	<p>2019-05-14_20-33-16_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	20:33:39	-117.014161	11.865305	4124	Photo Taken	<p>2019-05-14_20-33-37_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	20:33:50	-117.014155	11.865302	4124	Photo Taken	<p>2019-05-14_20-33-47_Sonne_SO268-2_197ROV31_Logo.jpg</p>

2019-05-14	20:34:09	-117.014144	11.865293	4124	Photo Taken	<p>2019-05-14_20-34-08_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	20:51:16	-117.012973	11.864378	4127	Gear on Lift; ROV-ADV GMR_PFM-07	
2019-05-14	21:15:17	-117.012915	11.865841	4120	Photo Taken of ROV-CTD RBINS_PFM-01	<p>2019-05-14_21-15-17_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	21:15:28	-117.012911	11.865841	4120	Photo Taken of ROV-CTD RBINS_PFM-01	<p>2019-05-14_21-15-27_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	21:17:57	-117.012907	11.865871	4121	Gear TakenUp; ROV-CTD RBINS_PFM-01	
2019-05-14	21:24:33	-117.012986	11.864443	4123	Photo Taken of Elevator 2	<p>2019-05-14_21-24-27_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	21:24:41	-117.012989	11.864435	4123	Photo Taken of Elevator 2	<p>2019-05-14_21-24-40_Sonne_SO268-2_197ROV31_Logo.jpg</p>

2019-05-14	21:28:30	-117.012939	11.864357	4126	Gear on Lift; ROV-CTD RBINS_PFM-01	
2019-05-14	21:40:39	-117.013046	11.864273	4125	Holothurian	
2019-05-14	21:48:25	-117.013144	11.864192	4128	PUC #71 in sediment	
2019-05-14	21:48:34	-117.013145	11.864196	4128	Photo Taken of PUC #71	<p>2019-05-14_21-48-33_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	21:50:07	-117.013137	11.8642	4128	PUC #54 in sediment	
2019-05-14	21:51:21	-117.013146	11.864187	4128	PUC #41 in sediment	
2019-05-14	21:54:34	-117.013126	11.864217	4128	PUC #57 in sediment	
2019-05-14	21:55:14	-117.013109	11.864211	4128	#57 failed and will be repeated at another spot	
2019-05-14	21:56:25	-117.013114	11.864189	4128	PUC #24 in sediment	
2019-05-14	21:57:56	-117.013136	11.864218	4128	Photo Taken of PUC #71, 54, 41 and 24; Sampling spot 1 north of the dredge tracks; Presumably not covered by plume sediment	<p>2019-05-14_21-57-56_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	21:59:51	-117.013122	11.864196	4128	PUC #24 in tray	
2019-05-14	22:01:30	-117.013128	11.864217	4128	PUC #41 in tray	
2019-05-14	22:03:31	-117.013134	11.864195	4128	PUC #54 in tray	
2019-05-14	22:04:44	-117.013146	11.864197	4128	PUC #71 in tray	
2019-05-14	22:08:24	-117.013129	11.864192	4128	Photo Taken of nodule which is to be sampled	<p>2019-05-14_22-08-23_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	22:13:17	-117.013115	11.864195	4128	Nodule grabbed but it broke	

2019-05-14	22:18:09	-117.013112	11.864185	4128	Photo Taken	<p>2019-05-14_22-17-43_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	22:23:57	-117.013156	11.864152	4128	Photo Taken of sampling spot 2 north of the dredge tracks; Presumably not covered	<p>2019-05-14_22-23-56_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	22:25:38	-117.013182	11.864166	4128	PUC #57 in sediment	
2019-05-14	22:27:52	-117.013154	11.86416	4128	PUC #11 in sediment	
2019-05-14	22:29:58	-117.013161	11.864162	4128	Photo Taken of PUC #11 and #57	<p>2019-05-14_22-29-56_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	22:30:04	-117.013162	11.86416	4128	Photo Taken of PUC #11 and #57	<p>2019-05-14_22-30-04_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	22:32:33	-117.013155	11.864164	4128	PUC #57 in tray	
2019-05-14	22:33:16	-117.013172	11.864184	4128	Photo Taken of PUC #17 and shrimp	<p>2019-05-14_22-33-13_Sonne_SO268-2_197ROV31_Logo.jpg</p>

2019-05-14	22:33:32	-117.013175	11.864185	4128	shrimp	
2019-05-14	22:35:11	-117.013134	11.864162	4128	PUC #11 in tray	
2019-05-14	22:38:52	-117.01318	11.864188	4128	Crinoidea	
2019-05-14	22:39:35	-117.013194	11.864206	4128	Ophi	
2019-05-14	22:41:21	-117.013183	11.864175	4127	Holothurian	
2019-05-14	22:44:03	-117.013277	11.864164	4128	Sponge	
2019-05-14	22:44:22	-117.013304	11.864152	4128	Ophi	
2019-05-14	22:46:24	-117.013371	11.864134	4128	Photo Taken of sampling spot 3 north of dredge, presumably not covered	<p>2019-05-14_22-46-23_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	22:48:08	-117.013354	11.86411	4128	PUC #12 in sediment	
2019-05-14	22:48:15	-117.013352	11.864111	4128	Photo Taken of PUC #12	<p>2019-05-14_22-48-12_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	22:49:43	-117.013364	11.864154	4128	PUC #12 in tray	
2019-05-14	22:54:22	-117.013238	11.863754	4126	shrimp	
2019-05-14	23:04:07	-117.012839	11.863209	4126	Sponge	
2019-05-14	23:07:08	-117.012821	11.863104	4128	Photo Taken of sampling spot 1 Geochemistry medium-thick	<p>2019-05-14_23-07-08_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	23:10:41	-117.012777	11.86309	4128	PUC #36 in sediment	
2019-05-14	23:11:10	-117.012781	11.863092	4128	PUC #27 in sediment	

2019-05-14	23:13:30	-117.012764	11.863101	4128	Photo Taken of PUC #27 and #36; Geochemistry medium-thick cover	<p>2019-05-14_23-13-30_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	23:15:19	-117.012814	11.863096	4128	PUC #36 in tray	
2019-05-14	23:16:59	-117.012782	11.863082	4128	PUC #27 in tray	
2019-05-14	23:22:53	-117.012751	11.863	4128	Photo Taken of sampling spot 2; Geochemistry "covered track"	<p>2019-05-14_23-22-55_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	23:24:23	-117.012741	11.862974	4128	PUC	
2019-05-14	23:24:31	-117.01274	11.862972	4128	PUC #07 in sediment	
2019-05-14	23:25:41	-117.012739	11.862966	4128	PUC #65 in sediment	
2019-05-14	23:25:44	-117.012741	11.862968	4128	Photo Taken of PUC #07 and #65; Geochemistry "covered track"	<p>2019-05-14_23-25-47_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	23:26:59	-117.012755	11.863002	4128	PUC #65 in tray	
2019-05-14	23:28:00	-117.01275	11.862992	4128	PUC #7 in tray	
2019-05-14	23:34:09	-117.012978	11.86317	4128	Photo Taken of sampling spot 3; Geochemistry "really covered track"	<p>2019-05-14_23-34-09_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	23:35:55	-117.013008	11.863154	4128	PUC #17 in sediment	

2019-05-14	23:36:59	-117.01304	11.863142	4128	PUC #51 in sediment	
2019-05-14	23:37:12	-117.013041	11.863145	4128	Photo Taken of PUC #17 and 51; Geochemistry "really covered track"	<p>2019-05-14_23-37-10_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	23:41:20	-117.013029	11.863165	4127	Photo Taken "really covered track"	<p>2019-05-14_23-41-19_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	23:53:23	-117.013265	11.863124	4127	Photo Taken of sediment pile, potentially from 125_MUC	<p>2019-05-14_23-53-21_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	23:58:10	-117.013101	11.863562	4127	Photo Taken	<p>2019-05-14_23-59-25_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-14	23:59:32	-117.013109	11.863572	4128	Photo Taken of sampling spot 4; Geochemistry medium-thin cover north of the dredge track	<p>2019-05-14_23-59-32_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-15	00:01:22	-117.013115	11.863561	4128	PUC #20 in sediment	
2019-05-15	00:02:46	-117.013136	11.863588	4128	PUC #9 in sediment	

2019-05-15	00:04:10	-117.013118	11.863595	4128	PUC #25 in sediment	
2019-05-15	00:04:16	-117.013115	11.863593	4128	Photo Taken of PUC #20, #09 and #25; Geochemistry sampling spot 4 medium-thin cover north of the dredge track	<p>2019-05-15_00-04-18_Sonne_SO268-2_197ROV31_Logo.jpg</p>
2019-05-15	00:06:17	-117.013141	11.863582	4128	PUC #25 in tray	
2019-05-15	00:06:51	-117.013142	11.863589	4128	PUC #9 in tray	
2019-05-15	00:08:14	-117.013112	11.863594	4128	PUC #20 in tray	
2019-05-15	00:18:12	-117.013043	11.864129	4127	Gear TakenUp; ROV-ADCP GMR_PFM09	
2019-05-15	00:20:12	-117.01304	11.864205	4127	ROV to Lift (Elevator 2) with GMR_PFM09 in arm	
2019-05-15	00:24:37	-117.012865	11.864483	4127	Gear Deployed; ROV-ADCP GMR_PFM09 (to be picked up later)	
2019-05-15	00:31:30	-117.012949	11.864391	4126	Pick up buoy of elevator 2 released	
2019-05-15	00:34:09	-117.012952	11.864344	4127	Elevator 2 released manually	
2019-05-15	00:40:58	-117.012862	11.864499	4128	Gear TakenUp ROV-ADCP GMR_PFM09; placed on porch	
2019-05-15	00:45:00	-117.012865	11.864511	4126	End of dive	
2019-05-15	00:45:57	-117.012864	11.864499	4126	OFF THE BOTTOM	
2019-05-15	02:36:08	-117.012897	11.865099	0	ON DECK	

Kiel 6000 Dive 31 (SO268-2_209_ROV32)

Date: 16/05/2019

Observers: Wenzhöfer, Frank, HILARIO, Ana, RAMALHO, Sofia

ROV positions (at the bottom)

Start of dive: 11°51.689'N 117°0.821'W

End of dive: 11°51.804'N 117°0.706'W

Dive duration²³:

ROV in the water: 16.05.19 18:31:24

ROV at the bottom: 16.05.19 19:06:21

ROV off the bottom: 17.05.19 03:21:02

ROV on deck: 17.05.19 05:16:07

Explored sites: DE reference dredge impact area

Aims of the Dive (see below):

- Deployment of microprofiler- and Deep-Profiler modules for in situ respiration measurements
- Megafauna sampling

Handled ROV Tools (including scientific payload):

- 2 fiberoptical profilers (MICP-DEEP)
- 1 Microsensor profiler (MICP)
- Bioboxes: COLBOX- SNG and COLBOX-BIO
- Optical communication
- Slurp gun

Relevant Elevator payload (*italic: payload not used during the dive*)

ROV porch

- Chamber (ISCHAM #2) on the way up
- Amphipod trap on the way up

Elevator 1

- 1 Microsensor profiler (MICP)
- 2 fiberoptical profiler (MICP-DEEP)
- 1 x 6 ROV push cores (PUC)
- *In situ pump*

Elevator 2

²³ All dates and times in the protocols refer to UTC

Dive summary (protocol by Sven Rossel)

Place and re-position profilers MICP-Deep #1 and #3. Place and re-position of profiler MICP #2. Sampling of megafauna. Alcyonacea into COLBOX-BIO. Everything else into COLBOX-SNG. At the end of the dive benthic chamber (ISCHAM #2) and amphipod trap were taken up on ROV porch and brought up.

#Date	Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2019-05-16	14:46:50	-117.013081	11.862037	5	test
2019-05-16	18:31:24	-117.013081	11.862037	5	IN THE WATER
2019-05-16	19:28:26	-117.013306	11.861846	2253	HD ON
2019-05-16	20:12:53	-117.013059	11.862827	4119	AT THE BOTTOM
2019-05-16	20:15:33	-117.01284	11.862892	4125	SLICBOX spotted
2019-05-16	20:15:52	-117.012815	11.862901	4125	MICP #2 spotted
2019-05-16	20:17:54	-117.012805	11.862982	4125	Trying to establish communication with MICP #2
2019-05-16	20:19:51	-117.012811	11.862971	4125	Communication not possible
2019-05-16	20:20:13	-117.012798	11.862963	4125	Heading towards MICP-DEEP #3
2019-05-16	20:22:11	-117.012789	11.863039	4124	MICP-DEEP #3 spotted
2019-05-16	20:23:24	-117.012811	11.86311	4125	MICP-DEEP #3 blinking
2019-05-16	20:26:35	-117.012829	11.863148	4125	Communication with MICP-DEEP #3 established
2019-05-16	20:26:47	-117.012831	11.863146	4125	Communication with MICP-DEEP #3 lost again
2019-05-16	20:27:54	-117.012824	11.863142	4125	MICP-DEEP #3 stage #2 running
2019-05-16	20:32:18	-117.012832	11.863088	4126	2019-05-16_20-32-19_Sonne_SO268-2_209ROV32_Logo.jpg
2019-05-16	20:33:25	-117.012854	11.86309	4126	Echinoid collected into COLBOX-SGN
2019-05-16	20:35:36	-117.01285	11.863118	4125	MICP-DEEP #3 stage #2 still running
2019-05-16	20:38:21	-117.012832	11.863119	4126	Trying to establish communication with MICP-DEEP #3
2019-05-16	20:41:40	-117.012816	11.863121	4126	MICP-DEEP #3 stage #2 stopped

2019-05-16	20:42:18	-117.01281	11.863117	4126	Gear received MICP-DEEP #3
2019-05-16	20:45:05	-117.01285	11.863177	4126	Impacted area spotted
2019-05-16	20:46:25	-117.012868	11.863169	4126	2019-05-16_20-46-21_Sonne_SO268-2_209ROV32_Logo.jpg
2019-05-16	20:46:58	-117.012868	11.863166	4126	MICP-DEEP #3 started (before deploying)
2019-05-16	20:47:16	-117.012871	11.863171	4126	Gear Operated
2019-05-16	20:48:18	-117.012869	11.863195	4126	Gear Deployed within dredge track
2019-05-16	20:49:23	-117.01285	11.863187	4126	Heading towards MICP-DEEP #1
2019-05-16	20:57:22	-117.013254	11.862127	4129	MICP-DEEP #1 blinking
2019-05-16	21:01:20	-117.01321	11.8621	4130	2019-05-16_21-01-15_Sonne_SO268-2_209ROV32_Logo.jpg
2019-05-16	21:01:32	-117.013206	11.862102	4130	PV-PICAM #20 still blinking
2019-05-16	21:01:40	-117.013203	11.862103	4130	2019-05-16_21-01-32_Sonne_SO268-2_209ROV32_Logo.jpg
2019-05-16	21:01:46	-117.013201	11.862104	4130	2019-05-16_21-01-43_Sonne_SO268-2_209ROV32_Logo.jpg

2019-05-16	21:02:09	-117.013198	11.862105	4130	<p>2019-05-16_21-02-04_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	21:04:12	-117.013215	11.862113	4130	Sponge with Ophiuroid collected into COLBOX-SGN
2019-05-16	21:05:19	-117.013201	11.862094	4130	Gear Received MICP-DEEP #1
2019-05-16	21:06:29	-117.013152	11.862098	4129	SLICBOX spotted
2019-05-16	21:18:34	-117.0129	11.86206	4129	Gear Deployed MICP-DEEP #1
2019-05-16	21:21:27	-117.012906	11.86208	4129	<p>2019-05-16_21-21-22_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	21:22:29	-117.012889	11.862071	4129	Glasp20 blinked
2019-05-16	21:23:39	-117.012889	11.862069	4130	Trying to establish communication with MICP-DEEP #1
2019-05-16	21:28:56	-117.012897	11.862076	4129	Communication not possible to establish
2019-05-16	21:31:22	-117.012892	11.862071	4129	Start fauna sampling
2019-05-16	21:40:33	-117.013072	11.862658	4127	<p>2019-05-16_21-40-33_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	21:44:23	-117.013053	11.862652	4128	Not sampled - too much sediment when ROV landed on the seabed

2019-05-16	21:50:25	-117.013046	11.862844	4128	<p>2019-05-16_21-50-24_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	21:50:36	-117.01305	11.862843	4128	<p>2019-05-16_21-50-36_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	21:52:55	-117.013063	11.862834	4128	Lost echinoid during sampling
2019-05-16	21:58:45	-117.012893	11.862879	4127	Start sampling echinoid and ophiuroid - COLBOX-SGN
2019-05-16	21:58:49	-117.012895	11.862878	4127	<p>2019-05-16_21-58-45_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	21:59:01	-117.012903	11.862876	4127	<p>2019-05-16_21-59-00_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:00:14	-117.012899	11.862871	4127	Collected Echinoid and Ophiuroid into COLBOX-SGN
2019-05-16	22:09:00	-117.012883	11.862886	4127	<p>2019-05-16_22-08-55_Sonne_SO268-2_209ROV32_Logo.jpg</p>

2019-05-16	22:09:05	-117.012886	11.862889	4127	<p>2019-05-16_22-09-13_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:09:15	-117.012886	11.862889	4127	<p>2019-05-16_22-09-04_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:11:45	-117.012868	11.862888	4127	Sampling Alcyonacea into COLBOX-BIO #4
2019-05-16	22:12:52	-117.012858	11.862867	4127	<p>2019-05-16_22-12-52_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:15:21	-117.012854	11.862876	4127	<p>2019-05-16_22-15-18_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:15:25	-117.012855	11.862877	4127	<p>2019-05-16_22-15-23_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:15:28	-117.012856	11.862878	4127	Sampling Alcyonacea into COLBOX-BIO #1
2019-05-16	22:20:45	-117.012867	11.862944	4127	Start sampling Alcyonacea and Holothurian

2019-05-16	22:20:58	-117.012871	11.862948	4128	<p>2019-05-16_22-20-57_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:21:34	-117.012863	11.862939	4127	<p>2019-05-16_22-21-32_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:21:40	-117.01286	11.862935	4127	<p>2019-05-16_22-21-39_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:23:31	-117.012867	11.862924	4127	Collecting Ophiuroid into COLBOX-SGN
2019-05-16	22:24:02	-117.012868	11.862917	4127	Collecting Holothurian into COLBOX-SGN
2019-05-16	22:26:48	-117.012864	11.862905	4127	Collecting Alcyonacea into COLBOX-BIO #8
2019-05-16	22:27:49	-117.012877	11.862914	4127	End of fauna sampling -ophiuroid, holothurian and Alcyonacea
2019-05-16	22:35:46	-117.012806	11.862923	4127	<p>2019-05-16_22-36-23_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:36:10	-117.012803	11.862918	4127	Start sampling 2 alcyonacea

2019-05-16	22:36:24	-117.012798	11.862915	4127	<p>2019-05-16_22-36-34_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:36:29	-117.012796	11.862915	4127	<p>2019-05-16_22-36-29_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:36:36	-117.012794	11.862915	4127	<p>2019-05-16_22-37-03_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:38:15	-117.012797	11.862935	4127	<p>2019-05-16_22-38-09_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:41:28	-117.012774	11.862914	4127	Collecting Alcyonacea into COLBOX-BIO #3
2019-05-16	22:45:23	-117.012805	11.862912	4127	Collecting Alcyonacea into COLBOX-BIO #5
2019-05-16	22:50:12	-117.012711	11.8629	4127	Start sampling Alcyonacea
2019-05-16	22:50:33	-117.012708	11.862903	4127	<p>2019-05-16_22-50-24_Sonne_SO268-2_209ROV32_Logo.jpg</p>

2019-05-16	22:51:01	-117.012707	11.862901	4127	<p>2019-05-16_22-50-58_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:55:48	-117.012719	11.862925	4127	Collecting Alcyonacea into COLBOX-BIO #2
2019-05-16	22:56:08	-117.012714	11.862919	4127	End sampling Alcyonacea
2019-05-16	22:56:55	-117.012693	11.862918	4127	<p>2019-05-16_22-56-54_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	22:57:34	-117.012693	11.862919	4127	Start sampling Holothuroidea and Ophiuroidea
2019-05-16	22:58:14	-117.012693	11.862914	4127	Collecting Holothuroidea into COLBOX-SGN
2019-05-16	22:58:41	-117.012695	11.862911	4127	Ophiuroid not sampled
2019-05-16	22:58:52	-117.012698	11.86291	4127	End sampling Holothuroidea
2019-05-16	23:02:47	-117.01263	11.8629	4127	Start sampling Alcyonacea
2019-05-16	23:04:06	-117.012616	11.862938	4127	<p>2019-05-16_23-04-02_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:04:12	-117.012616	11.862942	4127	<p>2019-05-16_23-04-11_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:07:02	-117.012635	11.862949	4127	Collecting Alcyonacea into COLBOX-BIO #6

2019-05-16	23:07:45	-117.012624	11.862933	4127	End of sampling alcyonacea
2019-05-16	23:08:01	-117.012616	11.862926	4127	Start sampling Nodule for MPI - Julia Otte
2019-05-16	23:12:12	-117.01261	11.862936	4127	Collecting Nodule for MPI - Julia Otte into COLBOX-BIO #7
2019-05-16	23:12:21	-117.012608	11.862939	4127	End of sampling nodule
2019-05-16	23:14:31	-117.012629	11.862936	4127	2019-05-16_23-15-47_Sonne_SO268-2_209ROV32_Logo.jpg
2019-05-16	23:17:09	-117.012624	11.86293	4127	Start sampling Alcyonacea
2019-05-16	23:18:29	-117.0126	11.862928	4127	Collecting Alcyonacea into COLBOX-BIO #9
2019-05-16	23:18:42	-117.012592	11.862926	4127	End of fauna sampling
2019-05-16	23:21:41	-117.012665	11.86294	4127	Start sampling Porifera with an associated ophiuroid
2019-05-16	23:23:18	-117.012613	11.862917	4127	2019-05-16_23-23-19_Sonne_SO268-2_209ROV32_Logo.jpg
2019-05-16	23:23:27	-117.012604	11.862914	4127	2019-05-16_23-23-25_Sonne_SO268-2_209ROV32_Logo.jpg
2019-05-16	23:26:43	-117.012593	11.862904	4127	Collecting sponge and Ophiuroid into COLBOX-SGN
2019-05-16	23:26:52	-117.012591	11.8629	4127	Finish sampling the sponge and ophiuroid

2019-05-16	23:26:58	-117.012589	11.862898	4127	<p>2019-05-16_23-26-55_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:28:19	-117.012548	11.862846	4127	<p>2019-05-16_23-28-14_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:28:27	-117.012546	11.862843	4127	<p>2019-05-16_23-28-25_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:28:48	-117.012542	11.86284	4127	<p>2019-05-16_23-28-47_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:29:28	-117.012535	11.862845	4127	Start sampling a large echinoid
2019-05-16	23:30:05	-117.012535	11.862851	4128	<p>2019-05-16_23-30-00_Sonne_SO268-2_209ROV32_Logo.jpg</p>

2019-05-16	23:30:51	-117.012522	11.862842	4127	<p>2019-05-16_23-30-20_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:31:00	-117.012535	11.862845	4127	<p>2019-05-16_23-30-44_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:37:15	-117.012523	11.862846	4127	SLURP
2019-05-16	23:38:06	-117.012518	11.862851	4128	The echinoid is too large for the arm, trying with slurp gun
2019-05-16	23:39:24	-117.012509	11.862832	4128	Collecting large echinoid into COLBOX-SGN
2019-05-16	23:44:22	-117.012368	11.862729	4128	starting to collect two sponges
2019-05-16	23:44:56	-117.012379	11.862738	4128	<p>2019-05-16_23-44-51_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:44:58	-117.01238	11.862739	4128	<p>2019-05-16_23-44-56_Sonne_SO268-2_209ROV32_Logo.jpg</p>

2019-05-16	23:45:15	-117.012381	11.862741	4128	<p>2019-05-16_23-45-11_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:47:10	-117.012369	11.862723	4128	Collecting sponge into COLBOX-SGN
2019-05-16	23:49:20	-117.012372	11.862734	4128	COLBOX-SGN
2019-05-16	23:49:53	-117.01237	11.86274	4128	Ophiuroid fell into colbox, sponge (2nd) failed
2019-05-16	23:50:33	-117.012361	11.862737	4128	sponge recovered snd put in colbox
2019-05-16	23:52:47	-117.012338	11.862715	4127	<p>2019-05-16_23-52-41_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:52:55	-117.012338	11.862715	4127	<p>2019-05-16_23-52-47_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:55:02	-117.012373	11.862722	4128	<p>2019-05-16_23-55-51_Sonne_SO268-2_209ROV32_Logo.jpg</p>

2019-05-16	23:55:53	-117.012354	11.862718	4128	<p>2019-05-16_23-56-26_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:55:58	-117.012352	11.862716	4128	<p>2019-05-16_23-55-56_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:56:06	-117.012349	11.862714	4128	<p>2019-05-16_23-56-05_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:56:28	-117.012343	11.862713	4128	<p>2019-05-16_23-56-17_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-16	23:58:18	-117.01235	11.862737	4128	Collecting echinoid into COLBOX-SGN
2019-05-17	00:06:59	-117.012457	11.862409	4129	<p>2019-05-17_00-06-52_Sonne_SO268-2_209ROV32_Logo.jpg</p>

2019-05-17	00:07:19	-117.012456	11.862406	4129	<p>2019-05-17_00-07-17_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:08:43	-117.012454	11.862393	4129	Start sampling echinoid
2019-05-17	00:09:36	-117.012465	11.862399	4129	Collecting Echinoid into COLBOX-SGN failed
2019-05-17	00:20:37	-117.012604	11.862101	4130	Start collecting Ophiuroid
2019-05-17	00:21:38	-117.012602	11.862106	4130	<p>2019-05-17_00-21-18_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:22:35	-117.01259	11.862116	4130	Collecting Ophiuroid into COLBOX-SGN
2019-05-17	00:26:31	-117.012598	11.86212	4130	Start collecting ophiuroid
2019-05-17	00:27:12	-117.012589	11.86211	4130	<p>2019-05-17_00-27-40_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:27:46	-117.012589	11.86211	4130	<p>2019-05-17_00-28-04_Sonne_SO268-2_209ROV32_Logo.jpg</p>

2019-05-17	00:28:05	-117.012585	11.862111	4130	<p>2019-05-17_00-29-14_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:29:49	-117.012611	11.862104	4130	Collecting Ophiuroid into COLBOX-SGN
2019-05-17	00:33:39	-117.012586	11.862085	4130	Trying to collect coral, and failed
2019-05-17	00:38:06	-117.012554	11.86205	4130	Start collecting holothurian
2019-05-17	00:38:36	-117.012557	11.862047	4130	<p>2019-05-17_00-38-31_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:39:03	-117.012555	11.862051	4130	<p>2019-05-17_00-39-00_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:39:23	-117.012548	11.86205	4130	<p>2019-05-17_00-39-22_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:40:39	-117.012551	11.862058	4130	Collecting holothurian into COLBOX-SGN
2019-05-17	00:41:42	-117.012547	11.862051	4130	Start sampling Ophiuroid
2019-05-17	00:43:31	-117.012552	11.862049	4130	Sampling Ophiuroid failed
2019-05-17	00:46:25	-117.012541	11.862039	4130	Second try to sample Ophiuroid also failed

2019-05-17	00:50:43	-117.012572	11.86196	4130	<p>2019-05-17_00-50-41_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:51:01	-117.012582	11.861965	4130	<p>2019-05-17_00-50-59_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:51:53	-117.012601	11.861965	4130	Start sampling echinoid
2019-05-17	00:52:12	-117.012601	11.861957	4130	Collecting Echinoid into COLBOX-SGN
2019-05-17	00:53:50	-117.012629	11.86187	4130	<p>2019-05-17_00-53-44_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:56:00	-117.012658	11.86187	4131	<p>2019-05-17_00-55-47_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:56:18	-117.012656	11.861867	4130	Start collecting stalk with asteroids and ophiuroids
2019-05-17	00:56:14	-117.012656	11.861867	4130	<p>2019-05-17_00-56-14_Sonne_SO268-2_209ROV32_Logo.jpg</p>

2019-05-17	00:56:20	-117.012656	11.861867	4130	<p>2019-05-17_00-56-20_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:56:30	-117.012655	11.861867	4130	<p>2019-05-17_00-55-57_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	00:58:10	-117.012658	11.861872	4130	Collecting stalk with everything into COLBOX-SGN
2019-05-17	01:02:26	-117.012715	11.861899	4130	Heading towards MICP-DEEP #1
2019-05-17	01:04:00	-117.012772	11.862061	4130	Mooring found
2019-05-17	01:14:47	-117.013104	11.86223	4129	SLICBOX spotted
2019-05-17	01:16:06	-117.012972	11.86207	4130	MICP-DEEP #1 spotted
2019-05-17	01:18:50	-117.012925	11.862084	4127	Gear Received MICP-DEEP #1
2019-05-17	01:19:59	-117.012918	11.862266	4127	ROV to Lift
2019-05-17	01:36:01	-117.012374	11.861139	4129	Gear on Lift MICP-DEEP #1
2019-05-17	01:39:19	-117.012382	11.861138	4129	MICP-DEEP #1 secured on elevator #1
2019-05-17	01:40:32	-117.012413	11.861203	4127	ROV heading north
2019-05-17	01:51:15	-117.012707	11.862928	4127	MICP #2 spotted
2019-05-17	01:53:14	-117.012754	11.862956	4127	Gear Received MICP #2
2019-05-17	01:54:56	-117.01275	11.862912	4127	MICP #2 positioned on porch
2019-05-17	01:57:37	-117.012822	11.863103	4126	MICP-DEEP #3 spotted
2019-05-17	01:58:47	-117.012836	11.863162	4126	<p>2019-05-17_01-58-46_Sonne_SO268-2_209ROV32_Logo.jpg</p>

2019-05-17	01:59:20	-117.012842	11.863155	4126	<p>2019-05-17_01-59-10_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	02:03:55	-117.012842	11.86312	4125	ROV to Lift
2019-05-17	02:13:08	-117.012369	11.861355	4127	Elevator #1 spotted
2019-05-17	02:14:35	-117.012376	11.861242	4128	Gear Deployed in front of the elevator before putting it on the elevator
2019-05-17	02:16:15	-117.012327	11.86112	4127	Going to the other side of the elevator to secure MICP #2 from porch on elevator
2019-05-17	02:17:47	-117.012341	11.861091	4127	Gear Received MICP #2 from porch
2019-05-17	02:20:10	-117.012368	11.861128	4129	Gear on Lift
2019-05-17	02:23:03	-117.012358	11.861157	4130	MICP #2 secured on elevator
2019-05-17	02:26:55	-117.012381	11.861273	4129	Gear Received MICP-DEEP #3
2019-05-17	02:31:12	-117.012367	11.861138	4129	Gear on Lift
2019-05-17	02:36:36	-117.012382	11.861139	4130	MICP-DEEP #3 secured on elevator
2019-05-17	02:41:00	-117.012374	11.861093	4129	Elevator safety line pulled
2019-05-17	02:42:25	-117.012333	11.861069	4124	Elevator released
2019-05-17	02:43:59	-117.012287	11.861045	4122	Heading North
2019-05-17	02:59:22	-117.012861	11.863076	4125	<p>2019-05-17_02-59-19_Sonne_SO268-2_209ROV32_Logo.jpg</p>
2019-05-17	02:59:44	-117.012857	11.863085	4126	of chamber sunk in sediment
2019-05-17	03:00:38	-117.01285	11.863103	4125

					2019-05-17_03-00-31_Sonne_SO268-2_209ROV32_Logo.jpg
2019-05-17	03:02:39	-117.012889	11.86311	4127	of chamber sunk in sediment
2019-05-17	03:03:32	-117.012882	11.863103	4126	Gear TakenUp ISCHAM #2
2019-05-17	03:11:20	-117.012644	11.863101	4124	Heading east
2019-05-17	03:16:18	-117.011768	11.863374	4126	ROV arrives at frames and amphipod trap
2019-05-17	03:18:35	-117.011755	11.863402	4126	Gear TakenUp amphitrap on porch
2019-05-17	03:21:02	-117.01178	11.863414	4117	OFF THE BOTTOM
2019-05-17	05:16:07	-117.012008	11.862867	3	ON DECK

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9	RV ALKOR Fahrtbericht / Cruise Report AL412, 22.03.-08.04.2013, Kiel – Kiel. Eds: Peter Linke and the shipboard scientific party, 38 pp, DOI: 10.3289/GEOMAR_REP_NS_9_2013
10	Literaturrecherche, Aus- und Bewertung der Datenbasis zur Meerforelle (Salmo trutta trutta L.) Grundlage für ein Projekt zur Optimierung des Meerforellenmanagements in Schleswig-Holstein. Eds.: Christoph Petereit, Thorsten Reusch, Jan Dierking, Albrecht Hahn, 158 pp, DOI: 10.3289/GEOMAR_REP_NS_10_2013
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17	RV SONNE, Fahrtbericht / Cruise Report, SO 234/1, "SPACES": Science or the Assessment of Complex Earth System Processes, 22.06. – 06.07.2014, Walvis Bay / Namibia - Durban / South Africa, Eds.: Reinhard Werner and Hans-Joachim Wagner and the shipboard scientific party, 44 pp, DOI: 10.3289/GEOMAR_REP_NS_17_2014
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