SONNE-Berichte

Assessing the impacts of polymetallic nodule mining on the deep-sea environment after an industrial collector test in the German and Belgian contract areas in the CCZ

Cruise No. SO295

31 October 2022 – 23 December 2022,

Port Hueneme (USA) – Port Hueneme (USA)

NoduleMonitoring 2

Matthias Haeckel, Felix Janssen, Pedro Martinez Arbizu

Pedro Martinez Arbizu

Senckenberg am Meer

2023

Table of Contents

1 Cruise Summary

1.1 Summary in English

The SO295 cruise built on the results of the European collaborative JPI Oceans project MiningImpact2 and follows the cruises SO268 in February-May 2019, which collected the environmental baseline information in the GER and BEL working areas in the respective BGR and GSR license areas of the Clarion-Clipperton Zone (CCZ) in the Northeast Pacific, as well as BGR campaign MANGAN 2021 in March-May 2021, which collected independent scientific monitoring data of the first industrial nodule collector trial. Hence, SO295 established the important first data point in the time series assessing the environmental impacts induced by the mining of polymetallic nodules after 1.5 years. Since nodule mining creates two main disturbances, removal of the surface sediments and the nodule habitat where nodules are collected as well as blanketing of the surrounding unmined seafloor, both impact types were investigated in the two working areas. Within these, different sites representative for gradients and variability of the disturbances were identified, particularly addressing the impact due to varying thickness of the deposited sediment blanket. In addition, the restoration experiment started during SO268 was sampled. Temporal natural variability was addressed by sampling the established reference sites.

The conducted scientific work comprised oceanographic, biological, microbiological, biogeochemical, and geological methodologies, requiring the deployment of a multitude of seagoing equipment.

1.2 Zusammenfassung

Die SO295-Ausfahrt baut auf den Ergebnissen des JPI-Oceans Verbundprojekts MiningImpact2 auf und schließt an die Expeditionen SO268 im Februar-Mai 2019, auf der die Umwelt-Hintergrunddaten in den beiden Arbeitsgebieten in den BGR- und GSR-Lizenzgebieten in der Clarion-Clipperton-Bruchzone (CCZ) im Nordost-Pazifik erhoben wurden, sowie die im März-Mai 2021 durchgeführte Kampagne MANGAN 2021 der BGR, auf der eine unabhängige wissenschaftliche Beobachtung des ersten industriellen Knollen-Kollektortests durchgeführt wurde, an. Durch SO295 wurde der erste wichtige Zeitpunkt in der Bewertung der Umweltauswirkungen ca. 1,5 Jahre nach dem Tiefseebergbautest erhoben. In beiden Gebieten wurden jeweils die durch den Knollenkollektortest induzierten Umweltstörungen untersucht, nämlich die Entfernung der Sedimentoberfläche inklusive des Knollenhabitats, sowie die Bedeckung des umgebenden Meeresbodens und seiner Fauna durch die Ablagerung der aufgewirbelten Sedimentwolke. Innerhalb der Areale wurden jeweils Stationen identifiziert, die repräsentativ für Gradienten und Variabilität der Schädigungen sind, insbesondere in Hinsicht auf unterschiedlich mächtige Sedimentablagerungen. Außerdem wurde das auf SO268 gestartete Rekolonisierungs-Experiment beprobt. Die natürliche zeitliche Variabilität wurde mittels der etablierten Referenzgebiete adressiert.

Die durchgeführten wissenschaftlichen Arbeiten umfassten ozeanographische, biologische, mikrobiologische, biogeochemische und geologische Methoden, die den Einsatz einer Vielzahl mariner Untersuchungsgeräte erforderte.

2 Participants

2.1 Principal Investigators

Name		Institution
Haeckel, Matthias	Project Coordinator	GEOMAR
Martinez Arbizu, Pedro	Chief Scientist	SGN
Janssen, Felix	Co-Chief Scientist	MPI

2.2 Scientific Party

Name	Discipline / Task on board	Institution
Martinez Arbizu, Pedro	Chief Scientist	SGN
Schmidt, Katja	PI geochemistry	BGR
Meineke, Ricarda	Nutrient geochemistry	AWI
Baciyunjuze, Glo Aganze	Metal geochemistry	JUB
Bardenhagen, Mirja	Tech metal geochemistry	BGR
Grisat, Christine	Tech metal	BGR
Janssen, Felix	PI in situ O2 flux	MPI
Molari, Massimiliano	PI microbiology	MPI
Sevilgen, Duygu	in situ O2 flux, microsensors	MPI
Barz, Jakob	Tech microbiology	MPI
Luongo, Gabriella	Eukaryotes	UNIVPM
Vlach ,Devin	O2 microsensors	SIO
Ruehlemann, Carsten	Moorings	BGR
Henningsen, Amber Marie	Macrofauna	SGN
Bezerra Campinas, Tania	Meiofauna	UGhent
Böhringer, Lilian	OFOS surveys	MPI
Esquete, Patricia	Macrofauna	UAveiro
Stratmann, Tanja	Food web	UUtrecht
Bouriat, Alize	Infauna	IFREMER
Gollner, Sabine	Megafauna	NIOZ
Khodami, Sahar	Metabarcoding	SGN
Dambrowksi, Gina	Meiofauna	SGN
Charlet, Francois	Macrofauna	DEME-GSR
Schiller, Fritz	Meiofauna	SGN
Esteban Vasquez, Brenda	Macrofauna	SGN
Maschmann, Nils	Tech Lander, MUC, BC	Oktopus
Rothenbeck, Marcel	AUV	GEOMAR
Heger, Karl	AUV	GEOMAR
Kurbjuhn, Torge	AUV	GEOMAR

Name	Discipline / Task on board	Institution
Jäkle, Anna	AUV	GEOMAR
Abegg, Fritz	ROV	GEOMAR
Pieper, Martin	ROV	GEOMAR
Suck, Inken	ROV	GEOMAR
Matthiessen, Torge	ROV	GEOMAR
Cuno, Patrick	ROV	GEOMAR
Striewski, Peter	ROV	GEOMAR
Genz, Johannes	ROV	GEOMAR
Taylor, James	ROV	SGN
Kalvelage, Tim	Journalist	

Fig. 2.1 Group photo of SO295 participants.

2.3 Participating Institutions

AWI	Helmholtz-Zentrum für Polar und Meeresforschung, Germany
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe, Germany
DEME-GSR	DEME Group, Global Sea Mineral Resources, Belgium
GEOMAR	Helmholtz-Zentrum für Ozeanforschung Kiel, Germany
IFREMER	Institut français de recherche pour l'exploitation de la mer,France
JUB	Jakobs Universität Bremen, Germany
MPI	Max-Planck Institut für Marine Mikrobiologie in Bremen, Germany
NIOZ	Royal Netherlands Institute for Sea Research, The Netherlands
Oktopus	Oktopus GmbH, Germany
SGN	Senckenberg Gesellschaft für Naturforschung, Germany
SIO	Scripps Institute of Oceanography, USA
UAveiro	University Aveiro, Portugal
UGhent	University Ghent, Belgium
UNIVPM	Università Politecnica delle Marche, Italy
UUtrecht	University Utrecht,The Netherlands

3 Research Programme

3.1 Description of the Working Areas

SO295 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 km^2 of this 12.6 Mio km^2 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 km^2 large core area and a 100-km buffer zone around (ISA LTC, 2011).

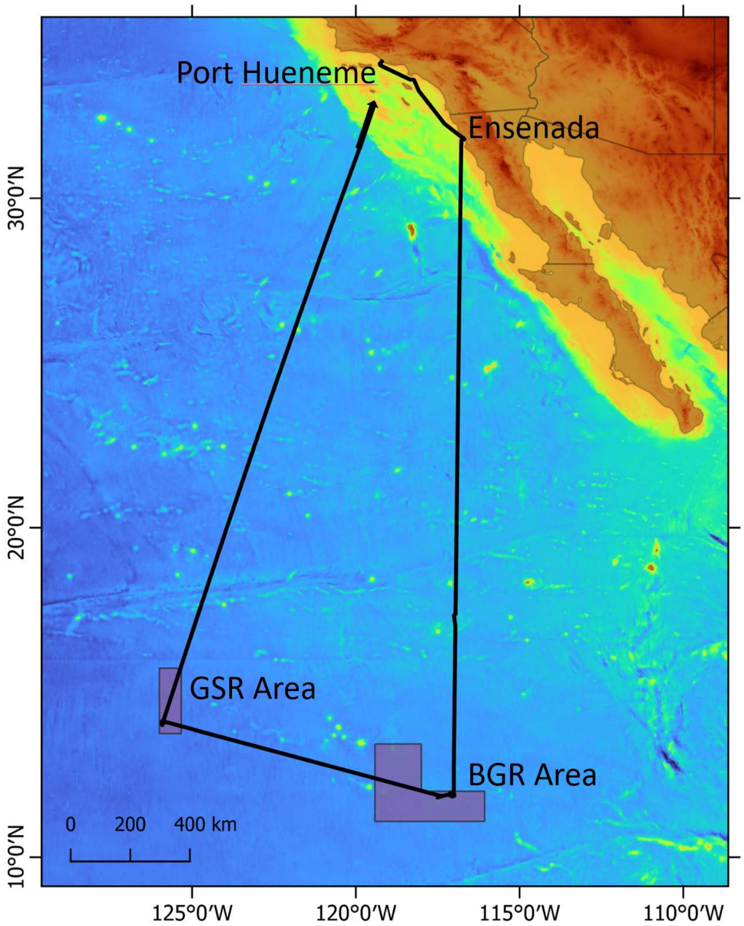


Fig. 3.1 Map of the Northeast Pacific Ocean showing the cruise track of SO295 (black lines) with the harbours Port Hueneme (USA) and Ensenada (Mexico), and the visited the exploration license areas for polymetallic nodules in the CCZ (purple areas).

The working areas of SO295 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. 3.5). In both areas the selected collector trial and reference sites have been sampled during the previous expedtions SO268 (Haeckel and Linke, 2021) and MANGAN 2021 (Vink, 2023) as well as 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.

While the German trial site (Fig. 3.3) 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/m^2 of wet weight (BGR, 2018), the Belgian trial site (Fig. 3.6) 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/m^2 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 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 and correspond to those used in the cruise report of SO268 (Haeckel & Linke, 2021): BC (red), GC (yellow), MUC (green), CTD and BWS (blue), Lander (violet), Mooring (black). Tracks of OFOS are shown, but AUV and ROV dives are omitted for graphical clarity.

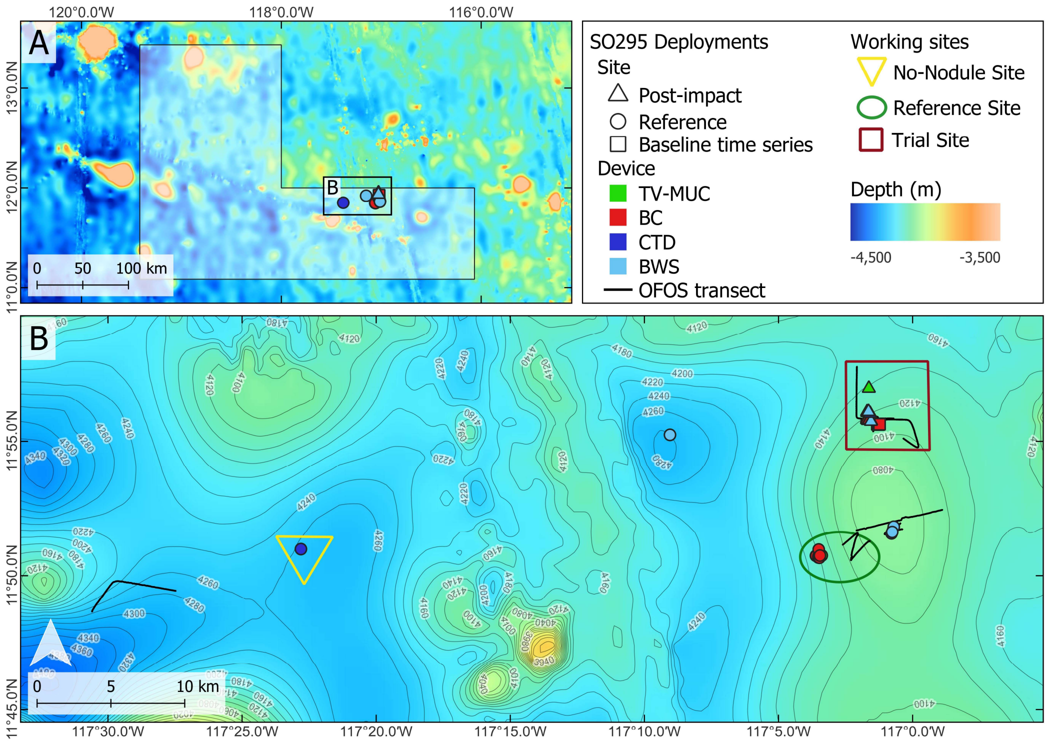


Fig. 3.2 Overview map of the German (GER) working area (located in PA1 of the license area) showing the locations of the No-Nodule Site (triangle), Reference Site (ellipse), Trial Site (square), and the SO268 Dredge Site (NE of the Reference Site and S of the Trial Site).

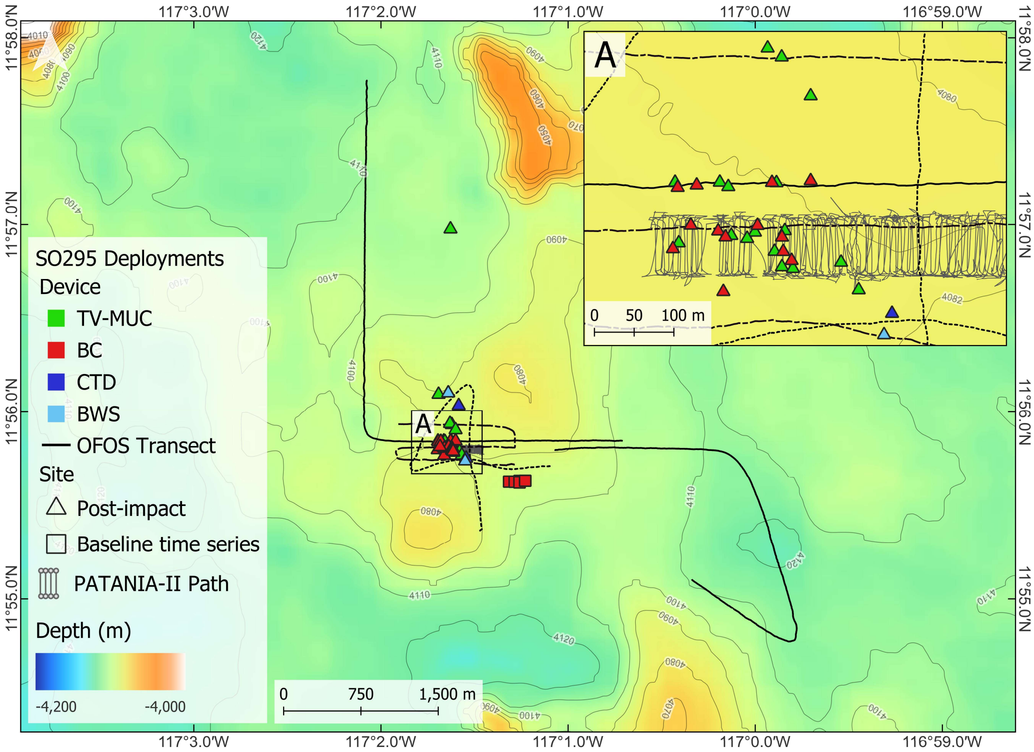


Fig. 3.3 Map of the GER Trial Site showing the gear locations. Inset A shows an enlarged map of the Collector Impact Site. AUV-based high-resolution multibeam bathymetry from SO268 is superimposed on ship-based multibeam bathymetry using different color coding.

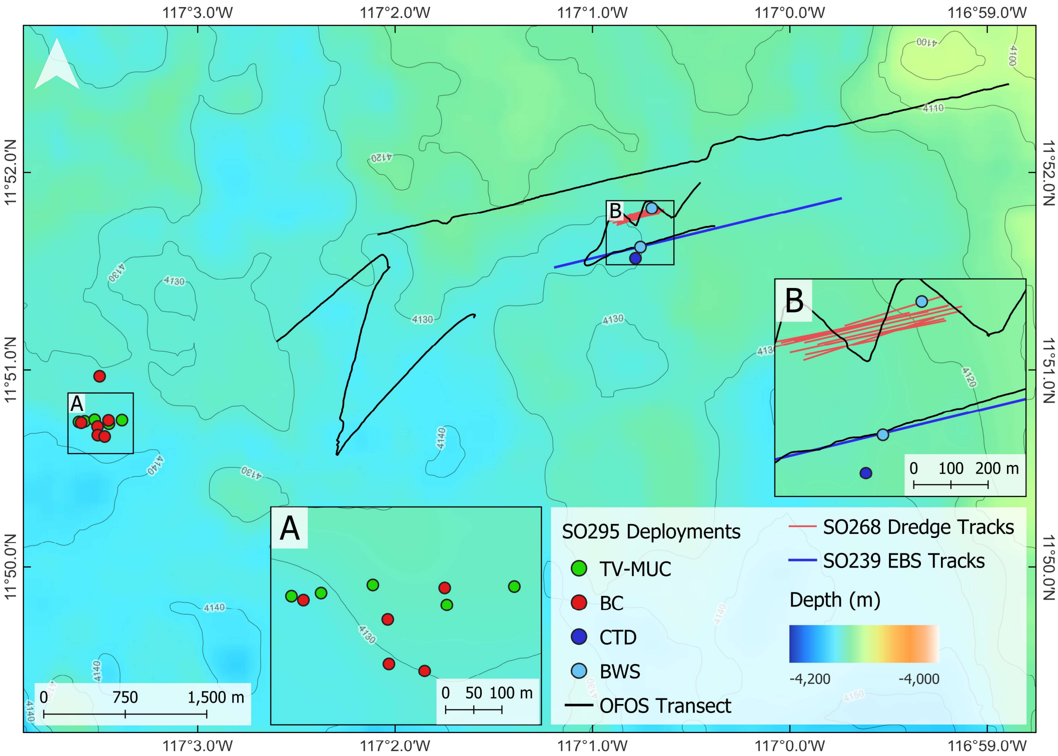


Fig. 3.4 Map of the GER Reference Site showing the gear locations. Insets A and B show enlarged maps of the Reference Site and Dredge Site, respectively. AUV-based high-resolution multibeam bathymetry from SO239 is superimposed on ship-based multibeam bathymetry using different color coding.

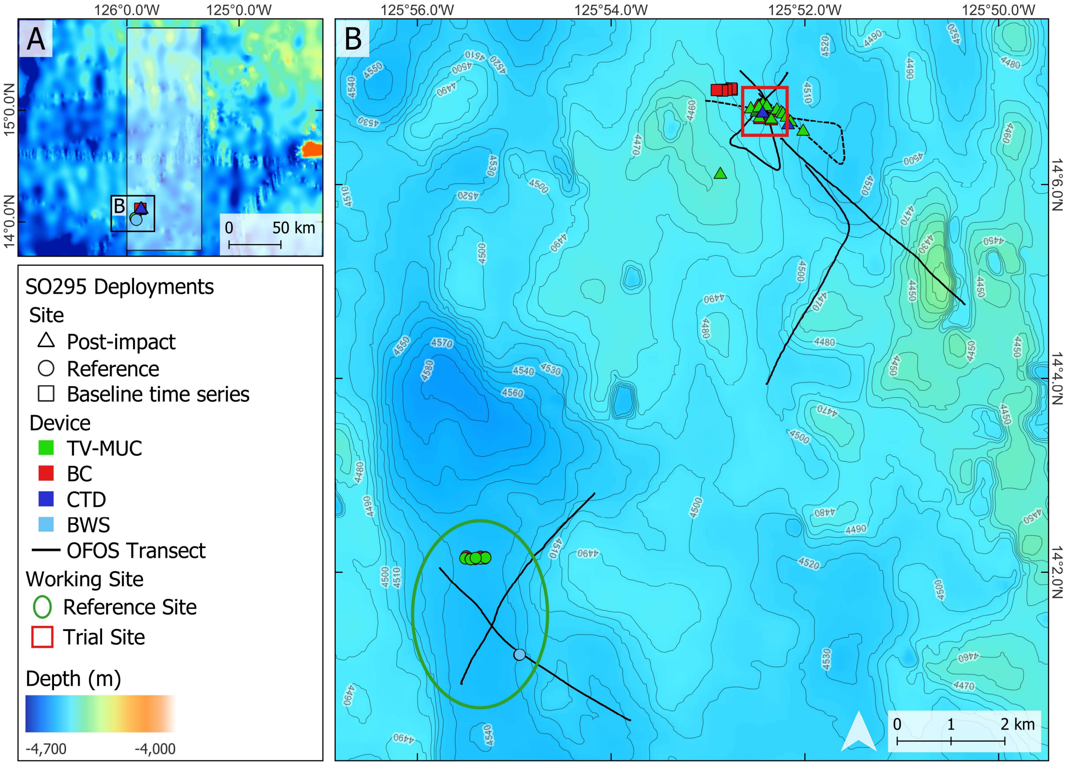


Fig. 3.5 Overview map of the BEL working area (located in GSR's B4S03 license area; inset A) showing the locations of the Reference Site (ellipse) and Trial Site (square), plotted on ship-based multibeam bathymetry of SO268.

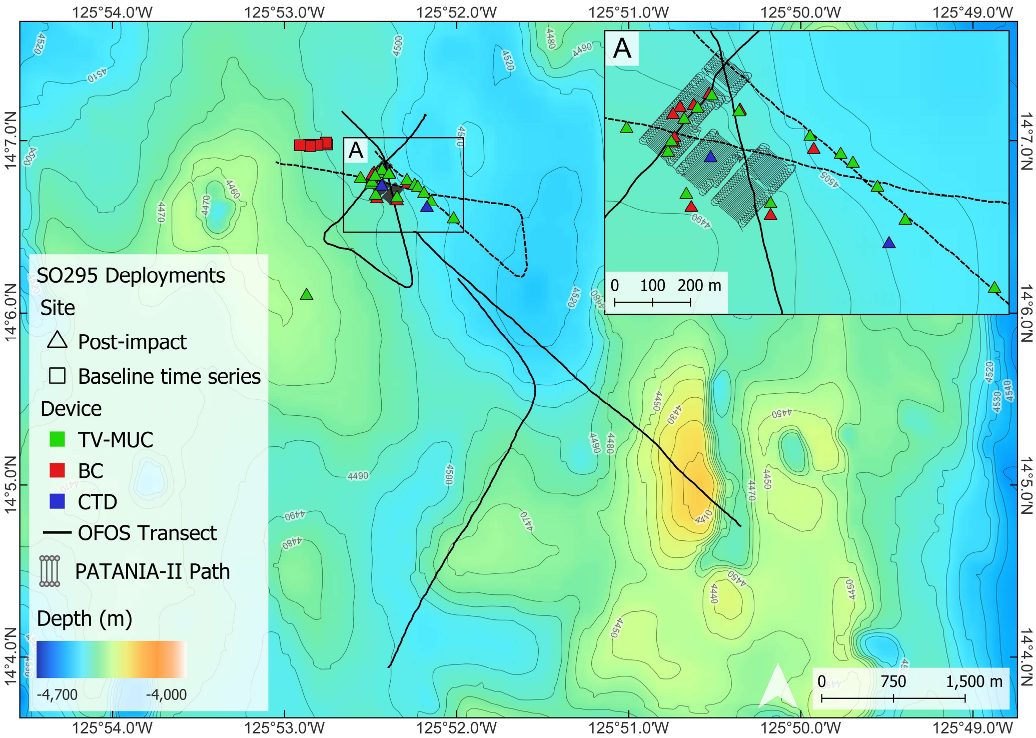


Fig. 3.6 Map of the BEL Trial Site showing the gear locations. Inset A shows an enlarged map of the Collector Impact Site. ROV-based high-resolution multibeam bathymetry of SO268 is superimposed on ship-based multibeam bathymetry using different color coding.

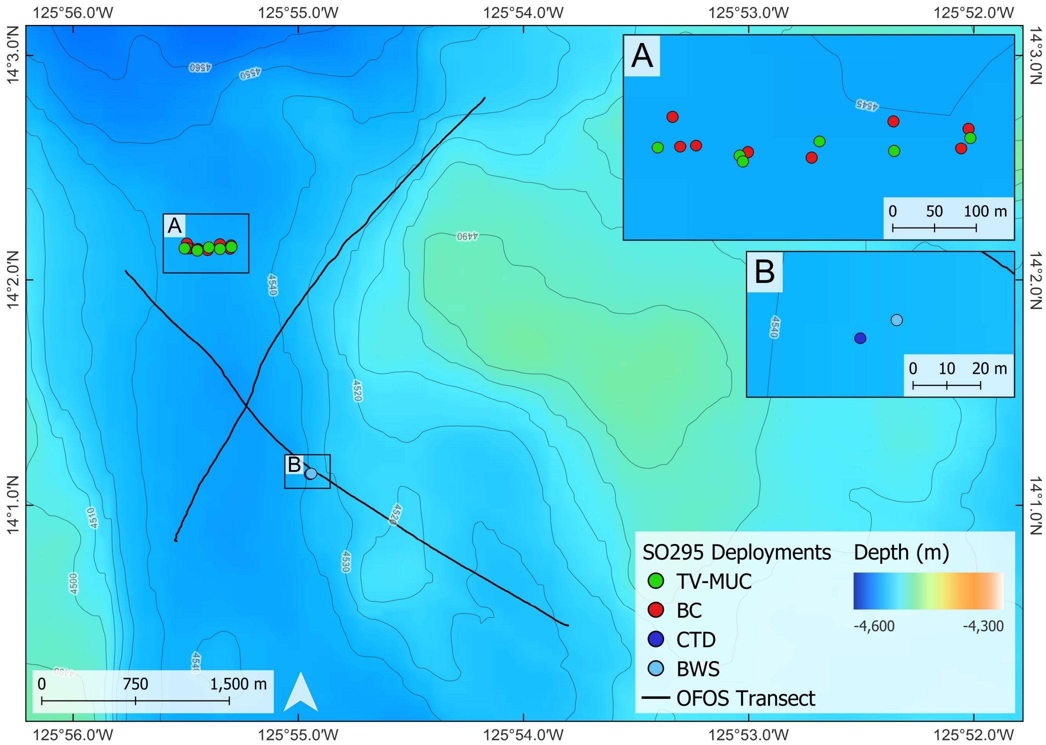


Fig. 3.7 Map of the BEL Reference Site showing the gear locations, plotted on ship-based multibeam bathymetry. Insets A and B show enlarged maps of the Reference site.

3.2 Aims of the Cruise

Cruise SO295 is 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 aimed at acquiring the environmental impact data 1.5 years after the first industrial trials of a nodule collector pre-prototype by DEME-GSR in the GSR and BGR contract areas of the Clarion-Clipperton Fracture Zone. 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 concentrations 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-/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 compaction and 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 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 variables and faunal communities on regional scale (i.e. mined area and vicinity, within license areas, across the CCZ)? How closely are abyssal populations genetically connected over these distances (tens, hundreds, thousands of kilometers)?

3.3 Agenda of the Cruise

SO295 acquired detailed environmental impact data and samples in the designated collector trial sites, consisting of collector impact and plume impact sites, and its associated reference sites in the BGR and GSR contract areas for polymetallic nodule exploration in the Clarion-Clipperton Zone. 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. AUV ABYSS was used for high-resolution photo and side-scan sonar mapping of the seafloor. This work was accompanied by video observations with the OFOS system. Moorings with acoustic and optical sensors were recovered and deployed for the measurements of physical and chemical oceanographic variables. Coring devices (i.e., box corer, TV-guided multiple corer, ROV-operated push cores) were used to collect sediment samples for biological, geochemical, and microbiological analyses, and water was collected with a CTD rosette and a bottom water sampler. In addition, recolonization experiments for nodule-associated fauna were re-visited in the working areas. The cruise fully respected the OSPAR code of conduct for responsible marine research. No hydroacoustic work was undertaken in the known presence of marine mammals. All deployed instruments were successfully recovered.

4 Narrative of the Cruise

The PATANIA II collector system of the Belgian company GSR was tested in spring 2021 on two sites within the eastern exploration contract area of the BGR and the central GSR contract area (Fig. 1) that were revisited during SO295. The cruise can be divided therefore into 4 phases, 1.) mobilization and transit to working area (October 30th – November 6th), 2.) working in the BGR contract area and transit to the GSR contract area (November 6th – December 1st), 3.) working in the GSR contract area (December 1st – December 17th) and 4.) transit back and demobilization (December 17th – December 23rd). RV SONNE arrived the 26th of October to the small harbor village Port Hueneme, located about 70 km west of Los Angeles. In the morning of the 29th Oct. most scientists were transferred to the vessel and some scientist arrived during this night. During the next days until the 31st of Oct., when we left Port Hueneme, scientists were busy with unpacking containers, mobilizing the heavy gears like ROV and AUV and their winches, and equipping the lab space on the vessel. Scientific meetings, for detailed planning of the sampling operations were held from 30th on. We departed from Port Hueneme with some delay, but without any issues, in the evening of the 31st in direction to Ensenada (Mexico). On Nov. 1st at 12:00 we reached Ensenada to pursue needed immigration formalities for the ship's crew and stayed in the roads, were we welcomed four additional crew members and some fresh proviants. In the afternoon, around 16:00 we left Ensenada heading to the first working area. On our transit, the vessel was stopped in international waters on Nov. 3rd for three hours to perform some necessary tests with the ROV and the AUV. The BGR contract area was reached on Nov. 6th and we firstly deployed and triangulated the AUV transponders. At each of the working areas we aim to sample 2 main impact sites, the collector impact site, where the collector directly operated (Fig. 2) and a plume deposition site (Fig. 4) (at different levels of sediment deposition), where most of the sediment suspended during collector operation was deposited. In addition, a reference site, which was not influenced by the impact, was sampled. At each of these sites we aimed at collecting no less than 5 replications with the Multicorer and the Boxcorer, in addition to CTD casts and Bottom water sampler deployments. The ROV was used for targeted sampling of sediments and fauna, deploying oxygen profilers (Fig 5) and other instrumentation and for recovering some colonization experiments (Fig. 3) deployed during the previous expeditions SO268 and MANGAN 2021. The AUV was launched with the mission to survey and photograph the area disturbed by the collector in 2021 and to document the impact along a gradient of plume deposition. In the BGR contract area we started at the reference site conducting CTD measurements with in-situ pumps. On Nov. 7th the ROV was used for the first time. The first deployments of ROV and AUV were marked by technical and navigation issues and some of the dives needed to be aborted. During the night of Nov. 7th to 8th, several BCs were deployed, and a lunar eclipse could be observed at about 2:45 shipboard time. We deployed the first OFOS consisting of a frame equipped with photo and video cameras that is towed about 1 m above the seabed to collect high-resolution images of the seafloor. In the morning of 8th Nov., the first successful ROV dive was performed at 4,125 m water depth devoted to sampling of sediments and organisms, and to recover the elevator that had sunk to the seafloor uncontrolled during the first deployment. Additional ROV dives in the reference site took place on Nov. 9th and Nov. 11th. Another objective of the dives was to recover recolonization experiments that we had deployed in previous years, but which could not be located due to obviously incorrect underwater navigation data. The traces of the collector prototype were clearly visible in AUV photographs and on the side-scan sonar maps. Also, artificial nodule frames that were deployed in the collector areas in 2021 were found. After taking five BCs and MUCs each in the reference site, the first MUCs were deployed in the collector impact site on November 12th. Since the MUC was equipped with a camera, we were able to see the PATANIA II tracks well and land the MUC accurately. For the box corer driven without a camera, we had to trust our luck. The exact position of the sampling in relation to the tracks was determined a posteriori based on AUV photographs taken before leaving the area. The bottom water sampler (BSW) was tested on Nov. 9th and 10th but the closing mechanism failed. It was deployed successfully on Nov. 13th. During the first week (7th – 13th Nov.) we concentrated our efforts in sampling the reference site and started the work on the collector impact site. We deployed 4 times the AUV, 2 times the CTD, 5 times the ROV, 6 times the BC, 7 times the MUC, 2 times the OFOS and 4 times the BWS. On Nov. 13th we tried to recover a mooring from BGR deployed in 2021 at station IP21_064ST and equipped with two sediment traps, a hydrophone and acoustic current meters (ADCPs). Apparently, there was communication with the Posidonia transponder, but the mooring failed to reach the water surface, which made us conclude that some floating spheres may have imploded. Additional attempts to recover the mooring on Nov. 16th and 18th were also unsuccessful. During the week 14th to 20th Nov. we focused on sampling the collector impact site alternating with sampling the closely located plume impact site with thick sediment cover. In total 7 BCs and 8 MUCs were deployed. Two successful OFOS dives documented the megafauna in the collector impact site and in the plume impact site (Fig. 6). In addition, 3 AUV dives and 4 ROV dives (to deploy oxygen respiration chambers, benthic mesocosm experiments, and to recover 5 frames with artificial nodules and deploy 20 new frames) were achieved, but we still struggled with inaccurate underwater navigation. One of the antennas of the onboard Posidonia system was exchanged and the whole system was calibrated on Nov. 19th. After this, the accuracy of the underwater navigation increased. On Nov. 15th and 19th, the BWS was successfully deployed to sample the water mass immediately above the sediment and a CTD was driven on the 16th. The following week was used to finalize sampling in the collector impact and thick plume impact sites and to sample and document a gradient of plume deposition in northwest direction of the trial area. Three OFOS, 2 AUV dives and 4 ROV dives were devoted to sample this area. In addition, 10 MUCs and 9 BCs were deployed. The last 5 BCs on Nov. 24th - 26th were devoted to resample an area already known in the pre-impact study for time series assessment. A last unsuccessful attempt to recover the mooring was undertaken on Nov. 26th when we were leaving the GER trial area in direction of a western located area without nodules on the seabed. In the No-Nodule area, a first ROV dive had to be aborted due to technical problems. A CTD (Nov. 27th) was driven and a successful OFOS dive on Nov. 28th. Finally, a successful ROV dives was achieved on Nov. 28th. After recovering all instrumentation, we left the BGR contract area on Nov. 29th heading to the central GSR contract area, where we arrived in Dec. 1st. In the GSR contract area, we first deployed the transponders for AUV navigation and a first AUV dive was started to document the gradient of plume deposition. Subsequently, a CTD was deployed, and we started the work in the collector impact site with 2 MUCs and 5 BCs until Nov. 4th. Coring during night hours was followed with ROV dives during the day on the 2nd, 3rd and 4th of December. Also, an OFOS dive (Dec. 3rd) documented the visible collector tracks, Lebensspuren and megafauna (Fig. 7) in the collector impact site and the plume impact site along the gradient of sediment blanketing. In the following week (Dec. 5th-11th) our focus was to sample the collector impact site and the close-by site of thick plume deposition. We deployed 9 MUCs, and 5 BCs between the 5th and the 9th. In addition, 2 AUV dives (5th and 8th Dec.) and 2 ROV dives (5th and 7th Dec.). Two additional OFOS dives documented the extent and intensity of plume deposition on Dec. 8th and 9th. Sampling in the collector impact site was alternated from 9th Dec. onwards with sampling of the reference site, where we deployed 6 MUCs and 6 BCs and performed one ROV and OFOS dive each. Our last week in the GSR contract area (12th-18th Dec.) was mainly devoted to finalizing the sampling at the reference site (2 BC, 1 OFOS dive and one BWS) and to document and sample along a plume deposition gradient. For this 5 MUCs were deployed and one OFOS transect. Four ROV dives (12th-15th Dec.) were devoted to sample and deploy devices in the thick cover areas, but also thin deposition cover along a gradient. Four AUV dives (12th, 14th, 16th and 17th Dec.) were devoted to produce a photomosaic of the collector impact site, but also to fill documentation gaps and to document the plume deposition gradient. On Thursday the 15th and Friday the 16th, the first containers were already packed, and the instruments were dismantled in some laboratories. We left the GSR contract area on Dec. 17th after the successful deployment of a BWS, starting our 130-hour transit to Port Hueneme, where we arrived in the afternoon of the 22nd December 2022.

5 Preliminary Results

5.1 CTD and BWS Deployments

(C. Rühlemann, K. Schmidt)

5.1.1 CTD and water sampling

CTD, Instrumentation and Bottom Water Sampler

During the SO295 cruise, seven CTD/rosette deployments were carried out to determine the vertical variations in temperature, salinity, oxygen, chlorophyll and turbidity, and to collect water samples for analysis of trace metal concentrations, dissolved and particulate matter and microbiological communities. Four casts to full water depth were performed in the BGR exploration area and three casts in the GSR exploration area (Fig. and 5.1.2;

Table 5.1.1 and 5.1.2). Furthermore, a bottom water sampler was deployed three times in the BGR area and one time in the GSR area to recover bottom water for trace metal analysis at five heights between 0.5 and 2 m above the sediment-water interface (Fig. and 5.1.2; Tab. 5.1.3).

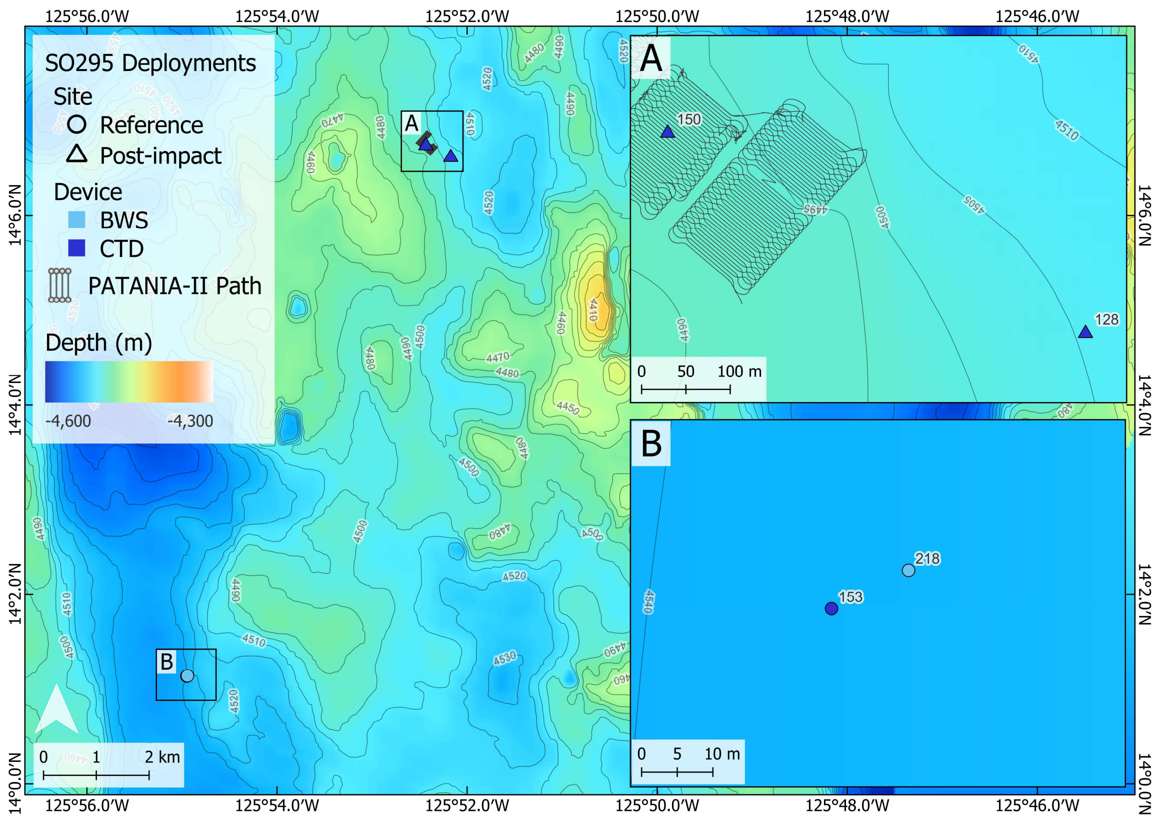


Fig. 5.1.1 Map of the BEL working area within the GSR exploration area, showing the locations of the three CTD-Rosette stations (blue) and the bottom water sampling station (BWS, light blue) taken during cruise SO295. Maps A and B are close-ups of the overview map. Map "A" shows sampling locations in the Collector Trial Site and map "B" those within the Reference Site south of the Trial Site.

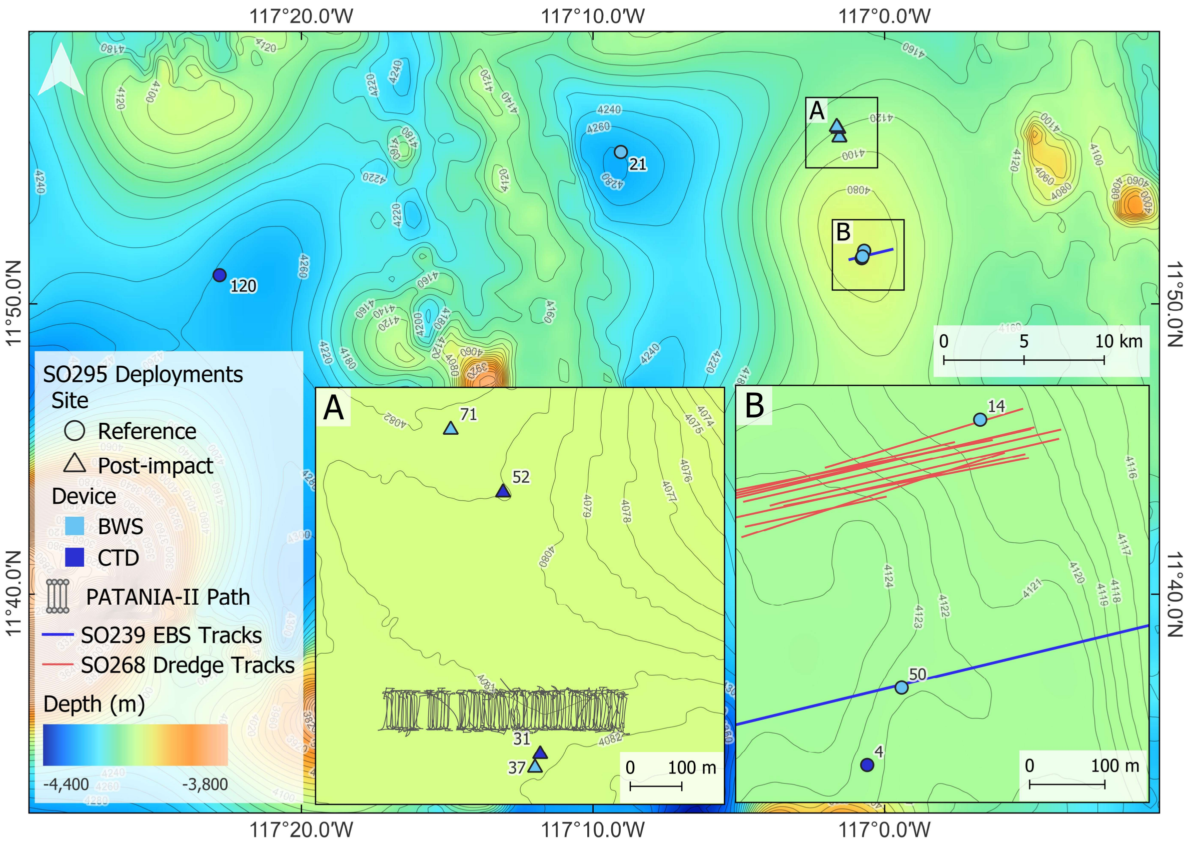


Fig. 5.1.2 Map of the GER working area within the BGR exploration area, showing the locations of the four CTD-Rosette stations (blue) and the three BWS stations (light blue) taken during cruise SO295. Maps A and B are close-ups of the overview map. Map "A" shows sampling locations in the Trial Site and map "B" those within the Reference Site south of the Trial Site.

The CTD/rosette system is comprised of a stainless steel cylindrical frame (Fig. 5.1.3), that was equipped with the following instruments:

a) One SBE 11 plus CTD supplied with titanium main housing and temperature and conductivity sensors; digiquartz pressure sensor; secondary temperature and conductivity sensors; auxiliary sensors: two SBE 43 oxygen self-regenerative Clark-sensors with Teflon membrane, one WET Labs sensor (ECO-NTU turbidity meter) and one WET Labs ECO-AFL/FL fluorometer;

b) Three in-situ pumps for the collection of microbial cells and attached to the wire, usually 10 m, 20 m and 30 m above the rosette;

d) One Benthos PSA-916 altimeter to determine the distance between the undercarriage of the rosette and the seafloor during lowering for the last 100 mab;

e) One SBE 32 carrousel water sampler (rosette) equipped with seventeen 12 L NISKIN bottles for standard water sampling, and two 5 L as well as two 2 L Teflon-coated GoFlo bottles for clean trace metal sampling.

On-board, DC power supply and data acquisition were controlled by the SBE 11 plus V2 Deck Unit and a 300-baud modem interface provided power and real-time control for the water sampler (bottles are fired sequentially). At all stations, 20 NISKIN bottles were attached in the slots 1-17 and 22-24, and 4 GoFlo bottles in the slots 18-21.

Fig. 5.1.3 Photo of the CTD/rosette system with NISKIN water samplers, GoFlo bottles and electronic sensors at the bottom. Photo: Tim Kalvelage.

Table 5.1.1 Overview of the seven CTD casts obtained during the SO295 cruise (WD is water depth, "Collec Imp" is "collector impact" and "Plume Imp" is "plume impact thin cover"). Station SO295-004CTD is a repeat of station SO268-094CTD from 2019, SO295-052CTD is a repeat of IP21-074CTD from 2021, SO295-128CTD is a repeat of IP21-015CTD from 2021 and SO295-153CTD is a repeat of SO268-151CTD from 2019.

#	Station [SO295-]	Date UTC 2022	Start UTC	At max. WD	Off max. WD	End UTC	Lat (N) at max WD	Long (W) at max WD	WD seafloor [m]	Max. WD CTD [m]	Contract Area	Site
1	004CTD	07.11.	07:31	09:07	12:10	13:48	11°51.588'	117°00.837'	4125	4120	BGR	Dredge
2	031CTD	12.11.	04:37	06:12	06:17	07:43	11°55.807'	117°01.605'	4085	4079	BGR	Collec Imp
3	052CTD	16.11.	01:51	03:33	06:36	08:13	11°56.101'	117°01.634'	4082	4080	BGR	Plume Imp
4	120CTD	27.11.	20:55	22:35	22:41	00:34	11°50.988'	117°22.801'	4272	4267	BGR	No nodule
5	128CTD	01.12.	15:15	17:06	20:32	22:16	14°06.612'	125°52.173'	4495	4492	GSR	Plume Imp
6	150CTD	05.12.	13:55	16:00	16:02	17:57	14°06.738'	125°52.435'	4483	4479	GSR	Colles Imp
7	153CTD	06.12.	06:32	08:30	11:31	13:12	14° 01.138'	125°54.949'	4535	4532	GSR	Reference

Table 5.1.2 Overview of CTD/Rosette and in-situ pump deployments carried out during cruise SO295. All depths are based on the CTD's pressure sensor and altimeter. Sampling depths of in-situ pumps were calculated based on the distance of the two pumps to the CTD/rosette and the CTD water depth during pumping.

#	Station [SO295-]	Area	Bottle #	Water depth seafloor [m]	Water depth samples [m]	Working group[1]	In-situ pump	Sampling depth [m]
1	004CTD	BGR	5,6,17	4125	4120	AWI	Sebastian	4110
			7,8		4120	MPI	Frankie	4100
			9-16,18-21		4120	BGR	Hulda	4090
			15		4120	NIOZ		
			3,4		4100	MPI		
			1,2		4090	MPI		
			13,20,21		4075	BGR		
			14		3925	BGR		
2	031CTD	BGR	12,17-19	4081	4076	BGR		
			13,15,20,21		4031	BGR		
			14,16		3881	BGR		
3	052CTD	BGR	7,8	4082	4078	MPI	Sebastian	4068
			10-12,18,19		4078	BGR	Frankie	4058
			3,4		4062	MPI	Hulda	4048
			1,2		4047	MPI		
			13,20,21		4032	BGR		
			14		3882	BGR		
4	120CTD	BGR	7,8	4271	4265	O_2 sensor calib.		
			9,22-24		4265	AWI		
			10-12,18,19		4265	BGR		
			1		4250	O_2 sensor calib.		
			13,16,20,21		4221	BGR		
			14,17		4071	BGR		
			2		3200	O_2 sensor calib.		
			3		2100	O_2 sensor calib.		
			4		1600	O_2 sensor calib.		
			5		1200	O_2 sensor calib.		
			6		750	O_2 sensor calib.		
5	128CTD	GSR	3	4495	4490	MPI	Sebastian	4480
			7-9,22		4490	AWI	Frankie	4470
			10-12,18,19		4490	BGR	Hulda	4460
			23		4475	AWI		

#	Station [SO295-]	Area	Bottle #	Water depth seafloor [m]	Water depth samples [m]	Working group[1]	In-situ pump	Sampling depth [m]
			24		4460	AWI		
			13,20,21		4445	BGR		
			14,17		4295	BGR		
6	150CTD	GSR	7-9,22,23	4482	4477	AWI		
			15		4477	O_2 sensor calib.		
			10-12,18,19		4477	BGR		
			13,20,21		4432	BGR		
			14		4282	BGR		
			2		3200	O_2 sensor calib.		
			3		2100	O_2 sensor calib.		
			4		1600	O_2 sensor calib.		
			5		1200	O_2 sensor calib.		
			6		360	O_2 sensor calib.		
			24		360	AWI		
7	153CTD	GSR	1,2,9	4534	4529	AWI	Sebastian	4519
			3,6		4529	MPI	Frankie	4509
			10-12,18,19		4592	BGR	Hulda	4499
			4,7		4514	MPI		
			5,8		4499	MPI		
			13,20,21		4484	BGR		
			14		4334	BGR		

[1] MPI = Max-Planck-Institut für Marine Mikrobiologie / Max Planck Institute for Marine Microbiology (Bremen, Germany); NIOZ = Koninklijk Nederlands Instituut voor Onderzoek der Zee / Royal Netherlands Istitute for Sea Research (Texel, the Netherlands); AWI = Alfred-Wegener-Institut: Helmholtz-Zentrum für Polar- und Meeresforschung / Alfred Wegener Institute: Helmholtz Centre for Polar and Marine Research (Bremerhaven, Germany)

In situ pumps

In order to collect sufficiently large quantities of microbial cells for transcriptomic and genomic analyses by the Max Planck Institute for Marine Microbiology (MPI), two CTD rosette casts at the BGR and one CTD cast at the GSR collector test sites (Tab. 5.1.2) were each equipped with three in-situ pumps (WTS-LV Large Volume Pumps, McLane) fitted with polycarbonate filters (142 mm diameter; 0.2 µm pore size; Millipore). The pumps were attached to the cable at 10 m, 20 m and 30 m above the frame of the rosette (Tab. 5.1.2). For ease of differentiation, the three pumps have been named "Sebastian" (10 m), "Frankie" (20 m) and "Hulda" (30 m). All three pumps were pre-programmed to start pumping for 180 min, on average after 2 hours after the start of deployment, when the CTD/rosette was planned to reach maximum water depth. The pumps on average filtered 380 L of seawater.

NISKIN bottle sampling

For microbiological analyses, seawater samples were collected by MPI from the 12 L NISKIN bottles originating from two CTD casts in the BGR and two CTD casts in the GSR area. These were processed for cell counting (DAPI and fluorescent in situ hybridisation [FISH]), DNA extraction (for molecular analysis), characterisation of dissolved organic carbon (DOC; analyses at ICBM Oldenburg), quantification of particulate organic carbon (POC; analyses at Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, AWI Bremerhaven), organic matter composition, extracellular enzymatic activities (EEA), microbial activity via radio-isotopes uptake, viral production and oxygen respiration measurements.

To obtain POC, 6 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 the Marine Geochemistry Section of AWI.

Furthermore, samples were taken by BGR to investigate the trace metal composition of bottom seawater and the concentrations of suspended particulate matter (SPM) in ambient seawater (for details see below).

Trace metal clean water samplers

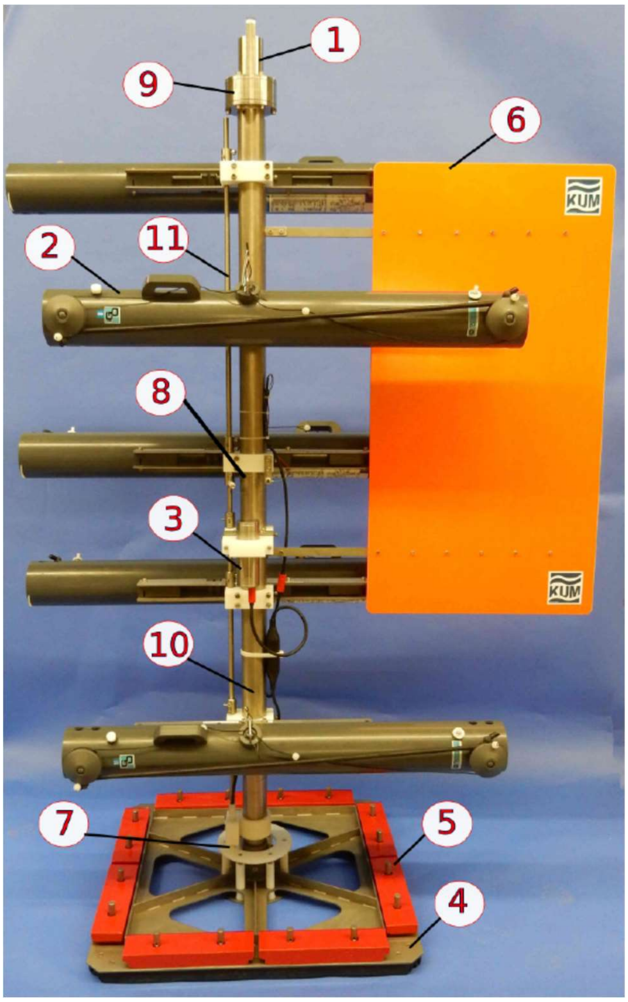
For collecting seawater for trace metal analyses, we also used four C-Free Chamber Water Samplers from OTE (Ocean Test Equipment, two with 2 L and two with 5 L sample volume, respectively), whose internal chambers are free of any source of contamination. Additionally, the interior is Teflon-coated, and the sample valve has been replaced by a Teflon valve. The closing mechanism is of a ball-valve type activated by an external power cord, and the bottles were deployed in a close-open-close setting. Activated by a pressure release valve, the bottles open at 10 meters below sea surface, and are then closed at the desired depth. The bottles were mounted on the Seabird CTD rosette system and released about 5 to 200 m above the seafloor. To minimise contamination from the frame, we closed the bottles during heaving.

Prior to deployment, the OTE bottles were rinsed with DI, top and bottom ball valves and the sample valve were covered with plastic bags and Parafilm, and the bottles were put under tension in the CTD rosette frame. The plastic covers were only removed shortly before deployment. After recovery, the bottles were transferred to a specifically designed rack in the on board laboratory and sampling of the water was conducted immediately (a detailed method description can be found below).

5.1.2 Bottom water sampler (BWS)

The Bottom Water Sampler (BWS) is a multi-horizon sampling device for the sampling of bottom seawater just above the sediment-water interface (Fig. 5.1.4). The frame is made of titanium, and five 12-liter Teflon-coated GoFlo bottles are mounted on a central axis at 0.5 m, 0.9 m, 1.3 m, 1.7 m and 2.1 m above the bottom plate, allowing for high-resolution, trace-metal-clean sampling of water. During all four deployments, the BWS was lowered at 0.3 m/s to 200 m water depth and then at 0.5 m/s to the seafloor. Simultaneous closing of the five bottles was initialised by heating wire electronics. The time of closure was pre-programmed on board and set to one hour after reaching the seafloor. This time delay was necessary in order to allow sediment particles stirred up during touchdown of the BWS to be carried away by bottom currents.

Prior to deployment, the sampling bottles were mounted to the frame and purged with DI. The upper and lower ball valves and the sampling valves were covered with plastic bags and parafilm. The release mechanism of the bottles was then clamped. The plastic covers were removed shortly before deployment. After recovery, the bottles were immediately sampled by placing them vertically on a work bench.



(1) Upper suspension
(2) 12 liter GoFlo bottle
(3) Electronics device
(4) Bottom plate
(5) Lead weights
(6) Fin
(7) Bottom contact switch
(8) Heating wire to release bottles
(9) Bearing
(10) Central axis
(11) Trigger shaft

Fig. 5.1.1 Photo of the bottom water sampler (BWS) with bottles attached horizontally. Explanation of the different parts of the BWS is provided on the right-hand side.

Table 5.1.3 Overview of the four BWS deployments carried out during the SO295 cruise (WD is water depth, "Collec Imp" is "collector impact” and "Plume Imp" is "plume impact thin cover").

#	Station [SO295-]	Date UTC 2022	Start UTC	At max. WD	Off max. WD	End UTC	Lat (N) at max WD	Long (W) at max WD	WD seafloor [m]	Contract Area	Site
1	037BWS	13.11.	05:32	08:20	10:11	12:09	11°55.799'	117°01.606'	4084	BGR	Collec Imp
2	050BWS	15.11.	16:42	19:37	20:51	22:58	11°51.600'	117°00.844'	4126	BGR	Reference
3	071BWS	19.11.	05:41	08:35	10:14	11:52	11°56.107'	117°01.630'	4081	BGR	Plume Imp
4	218BWS	17.12.	07:52	11:04	12:35	14:54	14°01.141'	125°54.943'	4789	GSR	Reference

5.2 AUV Missions

(K. Heger, A. Jäkle, T. Kurbjuhn, M. Rothenbeck)

5.2.1 Introduction

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 and determine its geological structure with applications from geology to biology to mineral exploration. Purchased in 2007, the AUV fulfilled many dives until 2020 and after a major water damage on its 355th dive the AUV was subject of a major restoration at Woods Hole Oceanographic Institution. Since 2022 AUV Abyss is used again on research expeditions around the world.

The system 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 starboard side of the working deck of RV SONNE. The self-contained LARS was developed by Woods Hole Oceanographic Institution 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. The AUV missions were usually planned based on ships bathymetry. In some cases, such as photo survey, a more detailed bathymetry is needed to dive at an altitude of 4 meters.

Depending on scientific needs different sensors can be used: Reson T-50 multibeam echosounder, a camera, a 4-24 kHz Sub Bottom Profiler, an Edgetech 2205 sidescan sonar (designed to provide 120/410 kHz Side Scan), a Seabird SBE 49 FastCat CTD and a Wet Labs ECO FLNTU fluorometer and turbidity sensor. During the dives on the cruise SO295 only the camera configuration was used: Deep Survey Cam with different LED settings (4m and 7m Altitude), Edgetech Sidescan, the CTD and the ECO sensor.

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 to aid. The LBL concept make 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.

5.2.2 System AUV ABYSS on RV SONNE

The AUV system and its corresponded container were placed on the starboard side of the vessels working deck. This means the LARS and the Ops-Van. The OPS Van is placed next to the LARS with its main doors directed to the LARS. The container for the LARS and the spare container are not needed for AUV operations, and placed on other places of the ship. The AUV needs two subsystems for proper operation, that are apart from the Ops-Van. The acoustic positioning and communication system is placed in one or the tubes next to the moonpool in the hangar of the vessel. An antenna system which maintains wifi and iridium connection is placed on the Ops-Van, to get a line of sight to the vehicle when it is in the water.

Fig. 5.2.2 (left) Ops-Van with AUV ABYSS; (right) AUV ABYSS after a dive.

5.2.3 AUV ABYSS mission and preparation summary

During the cruise SO295, 17 AUV mission were flown by AUV Abyss. There were 10 mission in the first part of the cruise in the GER area and 7 mission in the second part within the BEL area.

Dives Abyss0371, 0373 and 0375 (GER area) were done with a proper navigation and delivered both sidescan and image data in a line spacing of 2.5 m.

Dive Abyss0372 (GER area) was supposed to be an overview mission inside the plume impact area. The data are good (images and sidecan data) both due to the drift in the navigation, the positions can have an error of +/- 300 m.

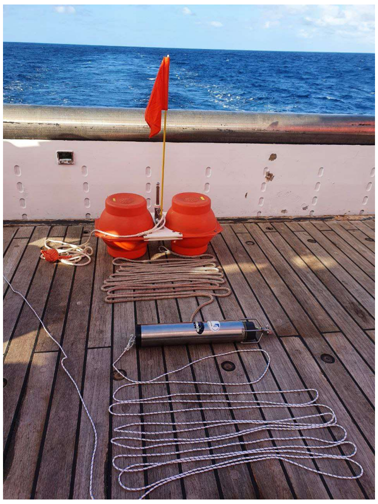
Only one dive (Abyss0381) of the 7 dives in the BEL area came up without camera issues. Each dive had images but, since the camera tended to stop unpredictably, not the expected amount. Nevertheless the images of each dive contribute to a final dataset.

The first dive of the BEL area (Abyss0376) happened on an altitude of 9 m since the area was more challenging and the positioning was not predictable in a mission with such long and straight legs. During the following missions we decided for 5 m altitude.

Table 5.2.1 Overview of AUV ABYSS missions.

No.	Station Number	Dive	Area	Sensors	Date	Mission Time (h)	Distance travelled (m)
01	SO295_003-1_AUV	Abyss0366	GER collector impact	Cam 4 m / SSS	07.11.2022	13.15	70003
02	SO295_017-1_AUV	Abyss0367	GER plume impact	Cam 4 m / SSS	09.11.2022	4.95	8735
03	SO295_030-1_AUV	Abyss0368	GER plume impact	Cam 4 m / SSS	12.11.2022	3.60	6054
04	SO295_041-1_AUV	Abyss0369	GER plume impact	Cam 4 m / SSS	13.11.2022	2.50	3760
05	SO295_051-1_AUV	Abyss0370	GER collector impact	Cam 4 m / SSS	16.11.2022	8.22	41450
06	SO295_063-1_AUV	Abyss0371	GER collector impact	Cam 4 m / SSS	18.11.2022	17.13	90382
07	SO295_075-1_AUV	Abyss0372	GER plume impact	Cam 4 m / SSS	20.11.2022	17.75	89249
08	SO295_084-1_AUV	Abyss0373	GER SE collector impact	Cam 4 m / SSS	22.11.2022	16.60	86324
09	SO295_096-1_AUV	Abyss0374	GER reference area	Cam 4 m / SSS	24.11.2022	21.83	104162
10	SO295_108-1_AUV	Abyss0375	GER overview	Cam 4 m / SSS	26.11.2022	19.00	100392
11	SO295_127-1_AUV	Abyss0376	BEL plume impact	Cam 9 m / SSS	01.12.2022	15.70	80860
12	SO295_137-1_AUV	Abyss0377	BEL plume impact	Cam 5 m / SSS	03.12.2022	18.57	97105
13	SO295_149-1_AUV	Abyss0378	BEL collector impact	Cam 5 m / SSS	05.12.2022	18.78	98321
14	SO295_164-1_AUV	Abyss0379	BEL collector impact	Cam 5 m / SSS	08.12.2022	18.67	98323
15	SO295_186-1_AUV	Abyss0380	BEL collector impact	Cam 5 m / SSS	12.12.2022	19.53	103115
16	SO295_199-1_AUV	Abyss0381	BEL plume impact	Cam 5 m / SSS	14.12.2022	18.63	97162
17	SO295_211-1_AUV	Abyss0382	BEL thick plume	Cam 5 m / SSS	16.12.2022	19.65	103751
						254.27	**1279148**

No.	Station Number	Dive	Sensors
01	SO295_003-1_AUV	Abyss0366	[GER] Data good (photo/SSS) / huge navigational drift
02	SO295_017-1_AUV	Abyss0367	[GER] Mission aborted
03	SO295_030-1_AUV	Abyss0368	[GER] Mission aborted
04	SO295_041-1_AUV	Abyss0369	[GER] Mission aborted
05	SO295_051-1_AUV	Abyss0370	[GER] Mission okay / no images
06	SO295_063-1_AUV	Abyss0371	[GER] Mission okay
07	SO295_075-1_AUV	Abyss0372	[GER] Data good (photo/SSS) / large navigational drift
08	SO295_084-1_AUV	Abyss0373	[GER] Mission okay
09	SO295_096-1_AUV	Abyss0374	[GER] Navigation wrong / Bottom contact for a long time
10	SO295_108-1_AUV	Abyss0375	[GER] Mission okay
11	SO295_127-1_AUV	Abyss0376	[BEL] Photo overview of northern and southern part of plume impact (9 m altitude for safety); Camera stopped taking pictures after 9,5 h
12	SO295_137-1_AUV	Abyss0377	[BEL] Re-do of SO295_127 (Abyss0376) at 4 m altitude; Camera stopped taking pictures after 8 h
13	SO295_149-1_AUV	Abyss0378	[BEL] Map collector impact part 1 (Cam stopped after 4 h)
14	SO295_164-1_AUV	Abyss0379	[BEL] Finalize collector impact area (Cam stopped after 6 h)
15	SO295_186-1_AUV	Abyss0380	[BEL] Finalize collector impact area, adding lines in the North and South there
16	SO295_199-1_AUV	Abyss0381	[BEL] Finalize collector impact area (filling gaps), adding two corridors to the south
17	SO295_211-1_AUV	Abyss0382	[BEL] Thick plume area Southeast of the Patania track (Cam stopped several times)



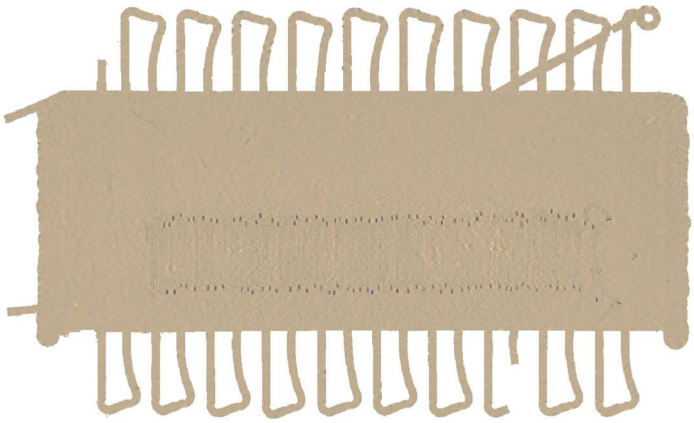


Fig. 5.2.2 (Left) Transponder setup on deck; (right) Photomosaic Abyss0371 provided on the GEO-Server.

5.2.4 Transponder Deployments

In both working areas, the GER area and the BEL area, only one set of Transponders was used. The deployment went smooth from the stern of the vessel with help of the a crane for the benthos spheres. The transponder was deployed by hand. When the ship was on position the ground weight was slipped from the crane and dropped.

Transponder	Type	Position	Transducer depth (m)	Deployment	Released	Recovered
1A	DT4A-LF	11° 55.521' N 117° 02.175' W	4070	07.11.2022 00:31	27.11.2022 00:49	27.11.2022 01:55
2B	DT4B-LF	11° 56.135' N 117° 02.188' W	4075	07.11.2022 00:48	27.11.2022 02:00	27.11.2022 03:06

Transponder	Type	Position	Transducer depth (m)	Deployment	Released	Recovered
3A	DT4A-LF	14° 07.011' N 125° 51.617' W	4485	01.12.2022 10:19	17.12.2022 05:07	17.12.2022 06:41
4B	DT4B-LF	14° 06.679' N 125° 52.230' W	4465	01.12.2022 10:46	17.12.2022 04:16	17.12.2022 05:56

5.2.5 Mission tables

The tables detailing the 17 dives of AUV ABYSS and their dates are found in Appendix 12.1.

5.3 OFOS Transects and Deep-Sea Camera Deployments

(L. Boehringer, M. Haeckel, A. Purser)

Description of OFOS and the applied setup

The OFOS (Ocean Floor Observation System) on board of RV SONNE (Fig. 5.3.1) consists of a steel frame (approx. 160 cm x 115 cm, height: 117 cm) which was equipped with a CANON EOS 5D Mark IV still camera with a 24-mm lens and a HD-SDI video camera with 65° x 40° field of view. Both cameras were 50 cm spaced apart and directed in vertical position to the seafloor together with 2 strobe lights (Sea & Sun YS-250), 4 LED (lights) (SeaLite Sphere), 3 laser pointers (FlexPoint Dot Lazer Modules, 50 mW), an altimeter (Tritech) and a USBL positioning system (POSIDONIA). The USBL device was mounted at the top of the frame, while all lights, lasers, cameras and the altimeter were mounted at the same height at the frame bottom. The lasers were positioned in 40 cm distance to one another around the still camera. Electricity and data were transmitted through ship telemetry (isitec).

The video camera recorded continuously while the still camera was triggered automatically every 20 sec. Additional images were taken manually when features of particular interest appeared on the screen. 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 centred with the dome. The video was streamed from the camera as HD interlaced to the OFOS lab and recorded using a Blackmagic capture system that allowed several encodings and the overlay of USBL and other meta data. Using the ProResHQ CoDec the system recorded 108GB per hour onto 2TB SSDs. Additionally, the video was also recorded using a Shogun Inferno recorder that was connected via HDMI to the Blackmagic system.

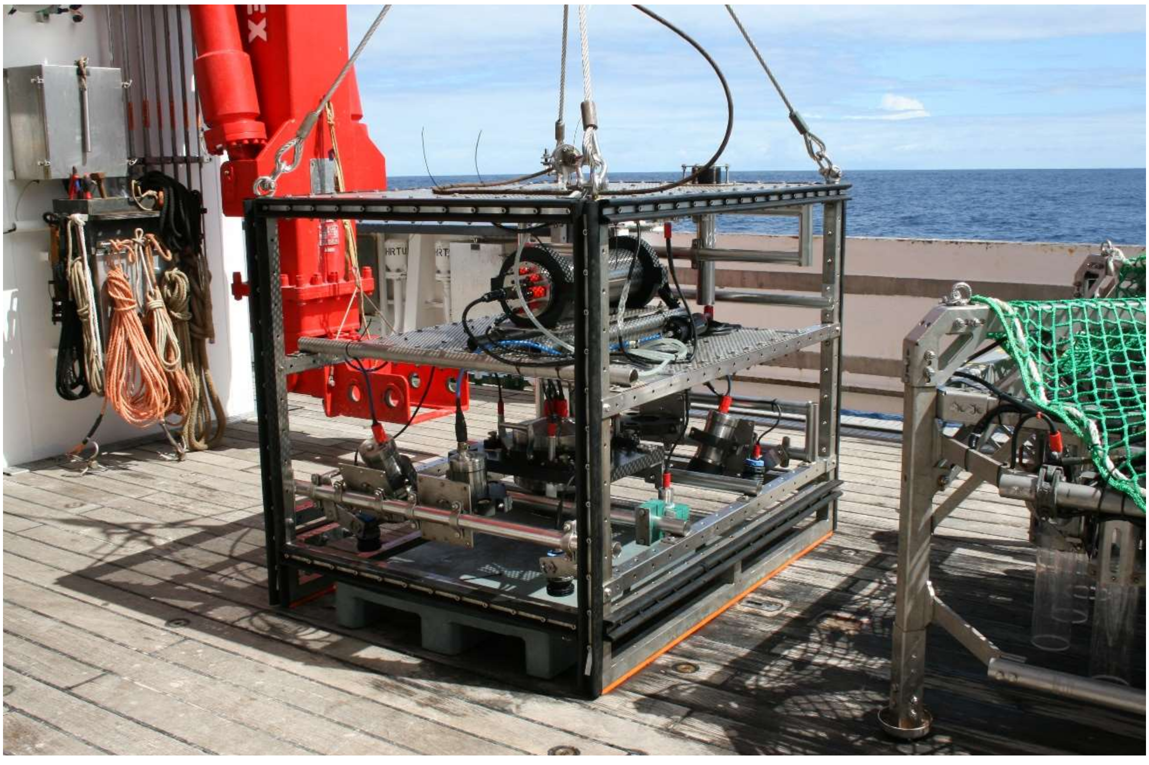


Fig. 5.3.1 The OFOS (Ocean Floor Observation System) of RV SONNE. Photo: L. Boehringer

Targeted towing speed and distance to the seafloor for each dive were 0.5 knots and 1.5 m, respectively. The altitude was controlled by the winch operator, supported by the ship-based winch control. The OFOS dive transects were planned in order to (1) cover the Collector Impact site and image the sediment deposition in the Plume Impact site and (2) to cover transects similar to those of SO268 in the Reference site.

OFOS transects

In total, 14 successful dives (Table 3.5.1) with a total bottom time of 93.7 h were accomplished. The total length of all transects was 69.5 km, from which 40.1 km were in the GER area and 29.4 km in the BEL area. It is important to note that problems with the POSIDONIA system led to uncertain coordinates of the position data for the first four OFOS dives (010_OFOS-01, 026_OFOS-02, 043_OFOS-03, 056_OFOS-04). The actual course of those transects cannot be determined because the offset towards the ship's position was different depending on the angle of the OFOS POSIDONIA transmitter towards the ship's POSIDONIA receiver.

GER area

Nine OFOS transects were conducted in the GER area (Fig. 5.3.2). Two of those (010_OFOS-01, 026_OFOS-02) were conducted in the Reference site and planned to follow the OFOS transects from SO268, however time constraints did not permit to cover the entire length of the SO268 transects. In the GER Trial site, five OFOS transects were conducted (043_OFOS-03, 056_OFOS-04, 076_OFOS-05, 081_OFOS-06, 103_OFOS-07). The OFOS dives 043_OFOS-03 and 056_OFOS-04 directly imaged the Collector Impact site, while the other dives imaged the Plume Impact site. The OFOS dive 076_OFOS-05 failed as the camera connection was lost at approx. 1500 m depth due to a problem with the glass fibre-optic cable. All successful transects had an estimated length of 18.6 km with an approx. bottom time of 25.9 h.

Two additional transects were conducted in the GER area. The OFOS transect 110_OFOS-08 crossed the dredge track, which was created during SO268, in a criss-cross manner. The last transect in the GER area (121_OFOS-09) was conducted 13 km west of the No-Nodule site within the BGR license area. During the transect two small hills with an approximate height of 10 m were crossed.

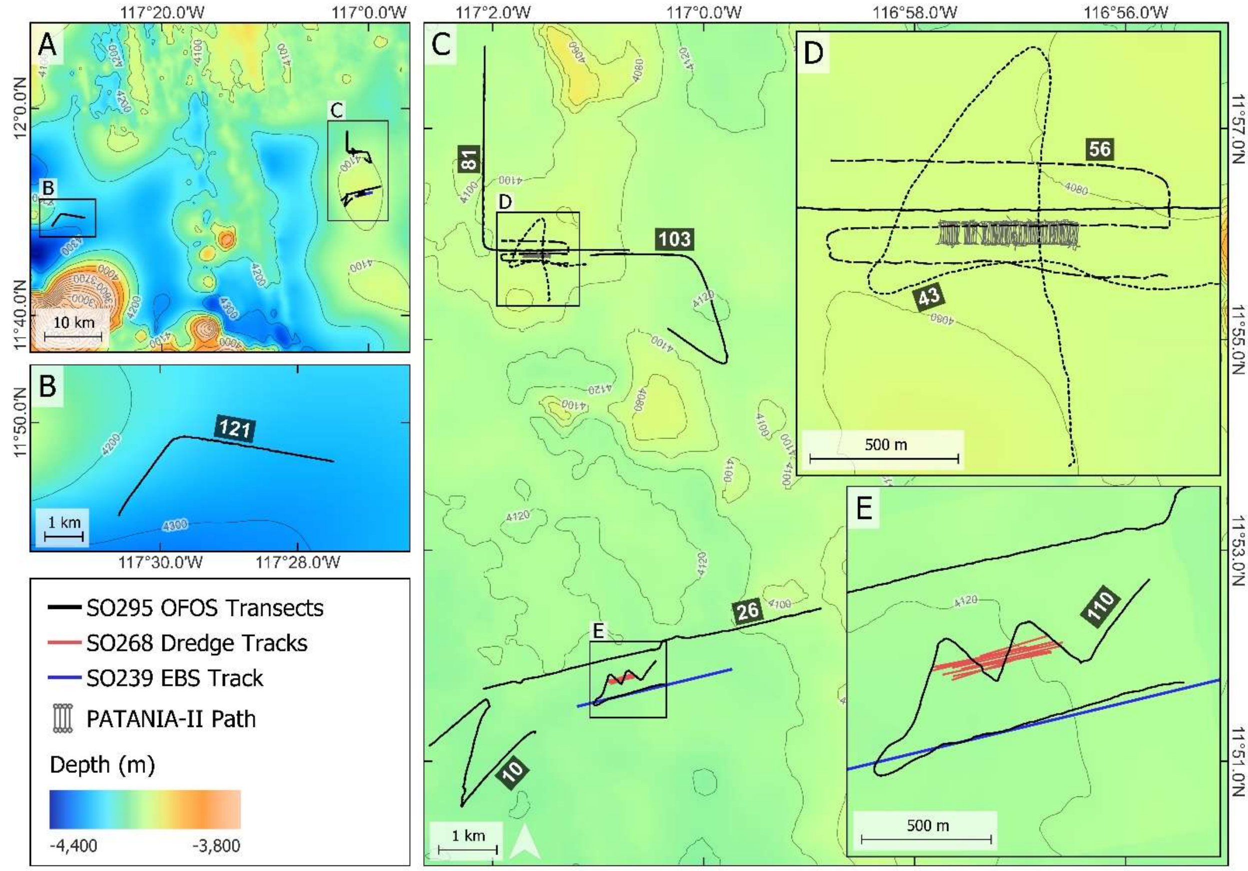


Fig. 5.3.2 OFOS transects in the GER area (located in the BGR contract area), with (A) an overview of all transects and enlarged views of (B) No-Nodule site, (C) Trial and Reference site, (D) Collector and Plume Impact site and (E) Decompaction Experiment site. Map source: (A-B) GEBCO, (C) MBES SO268, (D) AUV Bathymetry SO268, (E) AUV Bathymetry SO239

BEL area

In total, six OFOS transects were conducted in the BEL area (Fig. 5.3.3). Two OFOS transects (181_OFOS-13, 214_OFOS-15) were conducted in the Reference site with an intersection point in a small patch without nodules. The estimated length of both transects was 9.8 km with an approx. bottom time of 11.65 h. Four OFOS transects (136_OFOS-10, 165_OFOS-11, 171_OFOS-12, 200_OFOS-14) were conducted in the Trial site with a total estimated length of 20.2 km and an approx. bottom time of 27.9 h. Two OFOS dives (136_OFOS-10 and 165_OFOS-11) imaged the Collector Impact site, where PATANIA-II removed nodules and the bioactive surface sediment layer. The two other dives (171_OFOS-12 and 200_OFOS-14) imaged the Plume Impact site, where redeposited sediment blanketed the seafloor nodule habitat. During 171_OFOS-12, three limestone craters with an approx. diameter of 10 m were passed over. The transect 200_OFOS-14 crossed over a ridge structure of 80 m height, which ended in a cliff.

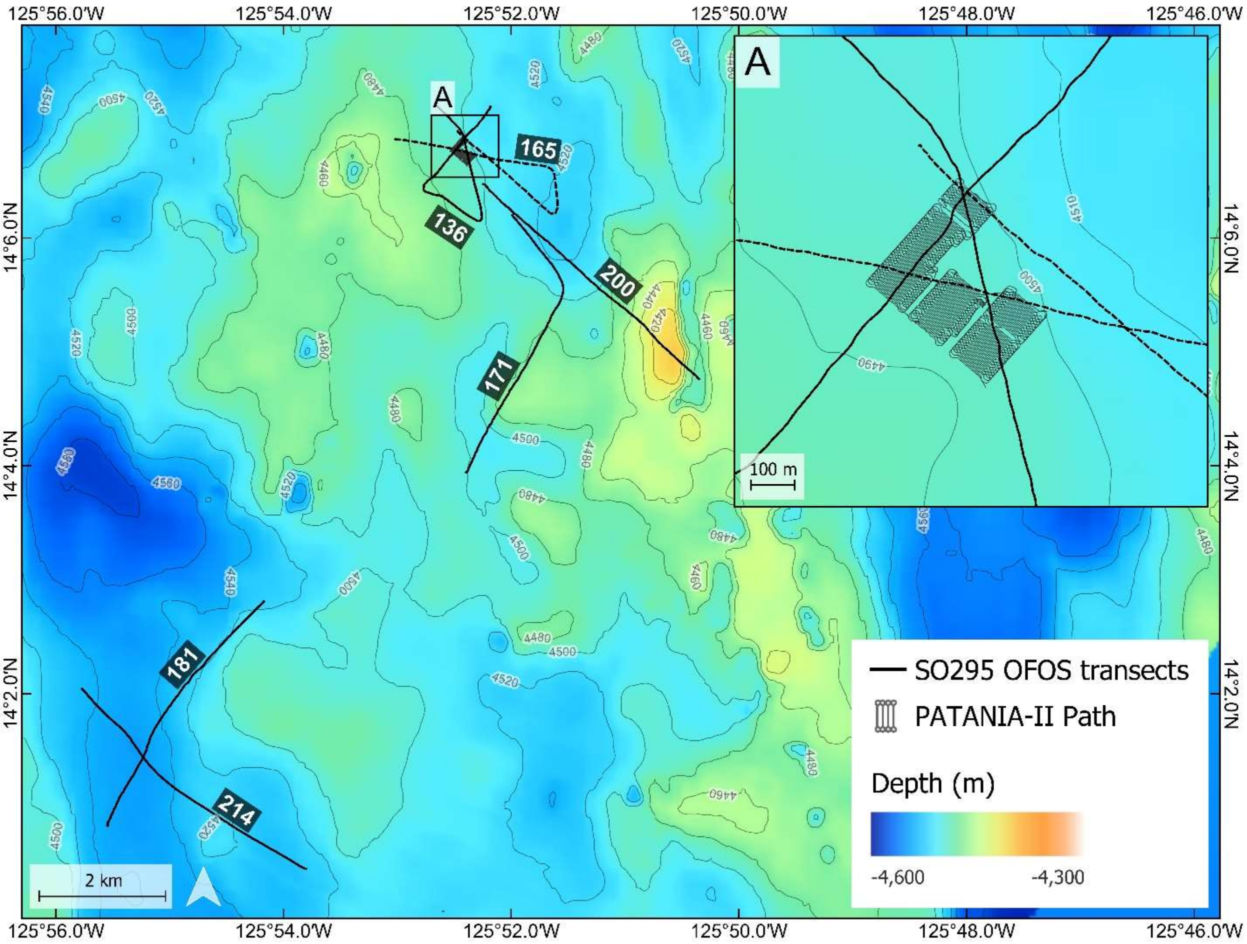


Fig. 5.3.3 Overview of OFOS transects in the BEL area (located in the central part of the GSR contract area) with (A) enlarged view of Collector and Plume Impact site. Map source: MBES SO268

Table 5.3.1 Overview of the OFOS deployments. *Uncertain coordinates

Station No. SO295	OFOS Station	Site		Date/Time (UTC)	USBL OFOS position		Water Depth [m]	approx. Track length [km]	approx. Bottom time [h]	Number of images taken at the seafloor
					Latitude [N]	Longitude [W]				
010	OFOS-01	GER Reference	Start	08.11.2022 06:13	11° 51.340’ *	117° 01.673’ *	4128	5.3	6.87	1028
			End	08.11.2022 16:01	11° 50.759’ *	117° 03.541’ *	4124			
026	OFOS-02	GER Reference	Start	10.11.2022 20:58	11° 52.432’ *	116° 58.987’ *	4098	6.2	7.37	1335
			End	11.11.2022 06:53	11° 51.596’ *	117° 02.412’ *	4123			
043	OFOS-03	GER Collector Impact	Start	14.11.2022 04:10	11° 55.425’ *	117° 01.520’ *	4081	3.9	5.6	1004
			End	14.11.2022 13:05	11° 55.795’ *	117° 00.889’ *	4089			
056	OFOS-04	GER Collector Impact	Start	16.11.2022 15:58	11° 55.824’ *	117° 01.349’ *	4081	3.7	6.4	1079
			End	17.11.2022 01:31	11° 56.038’ *	117° 02.139’ *	4099			
076	OFOS-05	GER Collector Impact	failed	20.11.2022 04:34	11° 57.782’	117° 02.050’	1500	0	0	0
				20.11.2022 05:56	11° 57.781’	117° 02.081’	1500			
081	OFOS-06	GER Plume Impact	Start	21.11.2022 02:21	11° 57.780’	117° 02.079’	4113	6.0	7.62	1374
			End	21.11.2022 12:53	11° 55.840’	117° 00.476’	4098			
103	OFOS-07	GER Plume Impact	Start	25.11.2022 04:24	11° 55.814’	117° 01.080’	4085	4.9	6.32	1175
			End	25.11.2022 13:42	11° 55.218’	117° 00.486’	4104			
110	OFOS-08	GER Dredge Impact	Start	26.11.2022 04:42	11° 51.715’	117° 00.392’	4117	3.2	5.83	1101
			End	26.11.2022 13:55	11° 52.063’	117° 00.312’	4124			
121	OFOS-09	GER No Nodule	Start	28.11.2022 01:37	11° 48.664’	117° 30.589’	4372	6.9	8.13	1512
			End	28.11.2022 12:46	11° 49.366’	117° 27.129’	4321			
136	OFOS-10	BEL Collector Impact	Start	03.12.2022 02:09	14° 07.166’	125° 52.185’	4520	5.0	7.8	1360
			End	03.12.2022 12:36	14° 07.399’	125° 52.880’	4481			
165	OFOS-11	BEL Collector Impact	Start	08.12.2022 03:05	14° 06.958’	125° 52.444’	4490	5.4	7.42	1391
			End	08.12.2022 13:47	14° 06.994’	125° 53.432’	4461			

171	OFOS-12	BEL Plume Impact	Start	09.12.2022 05:53	14° 03.940’	125° 52.425’	4494	5.0	6.32	1156
			End	09.12.2022 15:30	14° 06.656’	125° 52.298’	4495			
181	OFOS-13	BEL Reference	Start	10.12.2022 22:05	14° 00.875’	125° 55.550’	4536	4.5	5.65	1044
			End	11.12.2022 07:00	14° 03.064’	125° 53.947’	4513			
200	OFOS-14	BEL Plume Impact	Start	14.12.2022 05:10	14° 06.486’	125° 52.244’	4490	4.7	6.38	1182
			End	14.12.2022 13:00	14° 04.722’	125° 50.265’	4482			
214	OFOS-15	BEL Reference	Start	16.12.2022 10:39	14° 00.465’	125° 53.815’	4520	4.7	6	1082
			End	16.12.2022 20:03	14° 02.310’	125° 55.929’	4518			

Preliminary Results

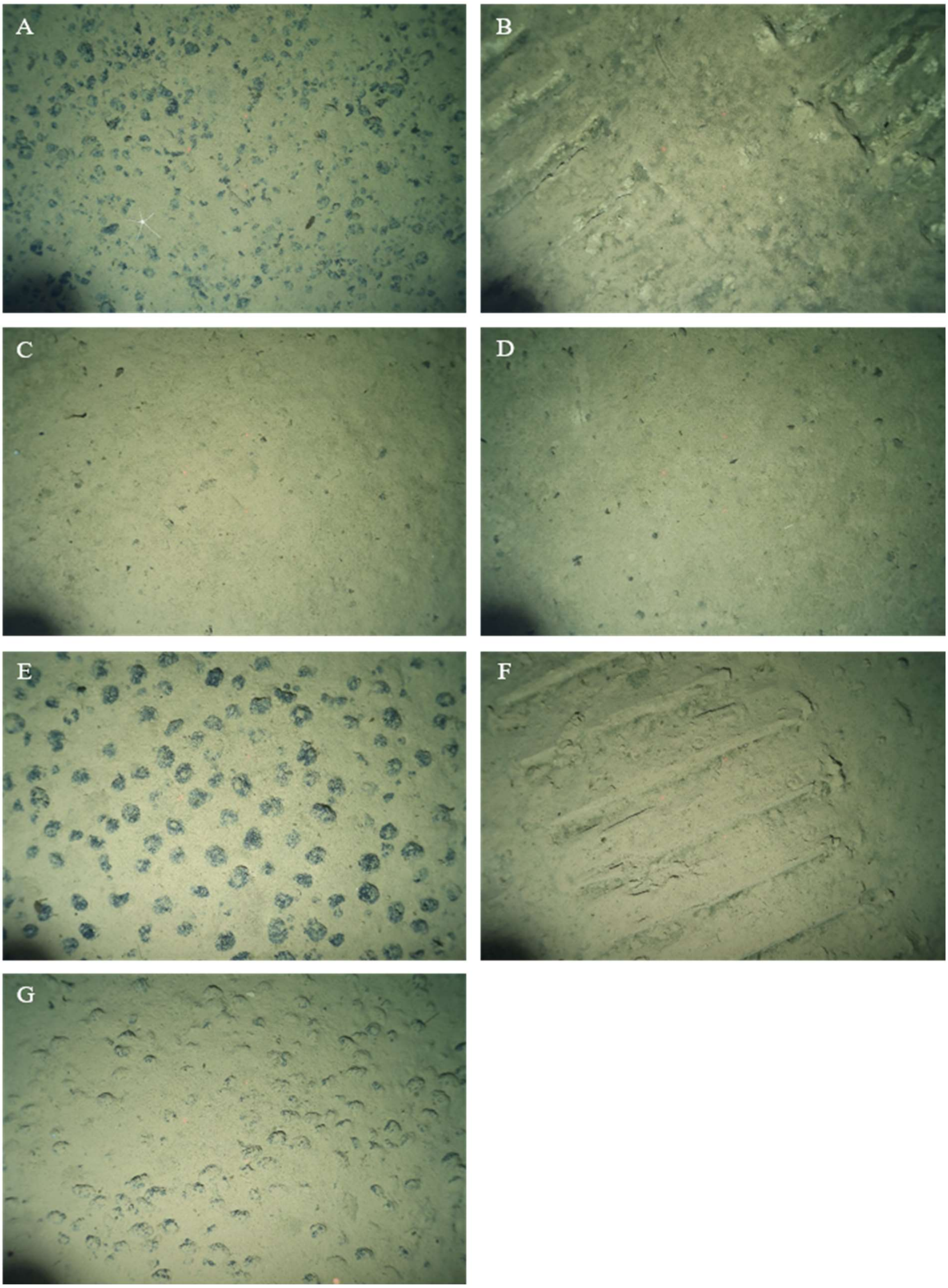


Fig. 5.3.4 Example images of the different sites within the German (GER) (A-D) and the Belgian (BEL) (E-F) area. (A) GER Reference site, (B) GER Collector Impact site, (C) GER Plume Impact site, (D) GER No-Nodule site, (E) BEL Reference site, (F) BEL Collector Impact site, (G) BEL Plume Impact site.

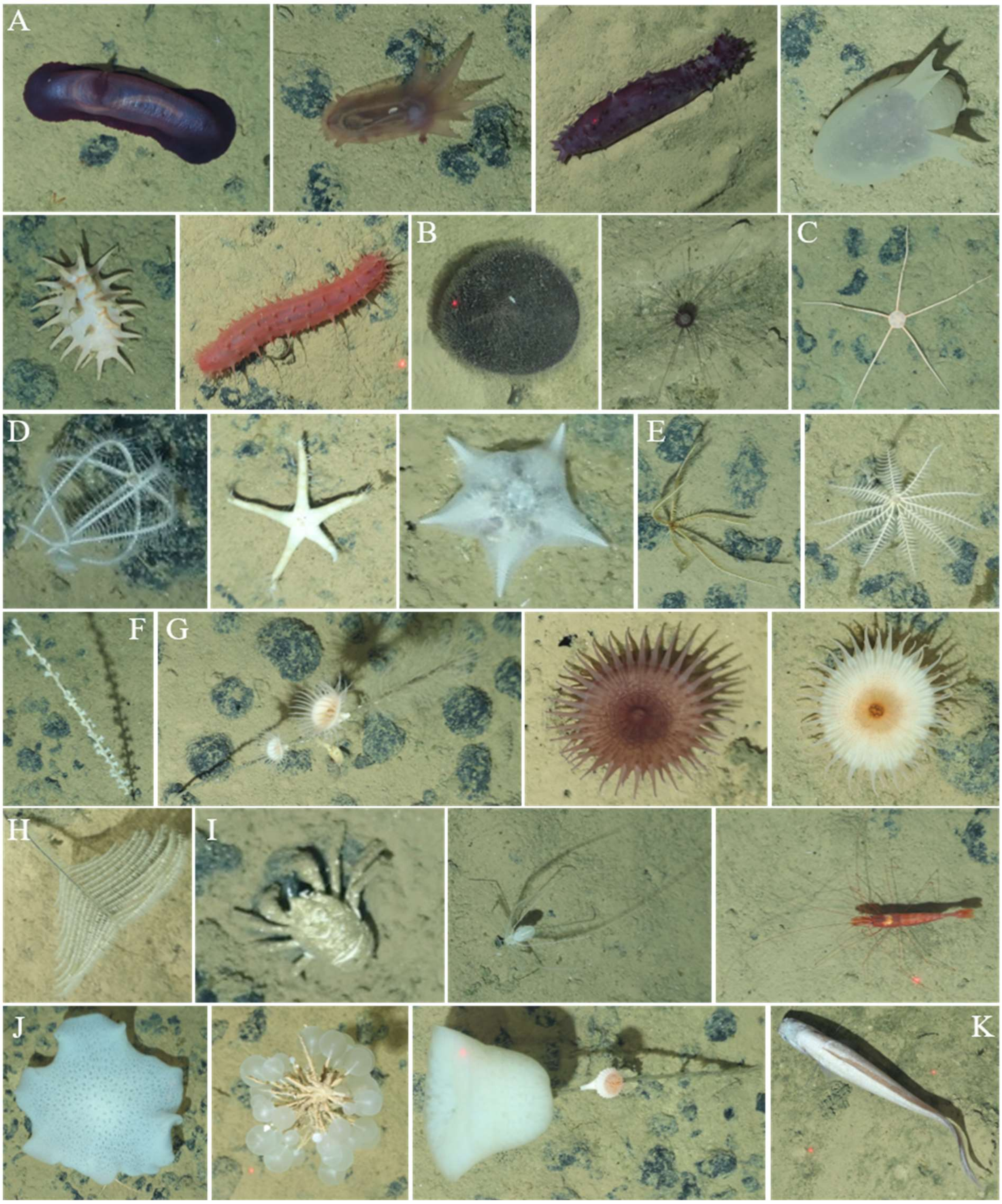


Fig. 5.3.5 Selection of fauna observed during OFOS transects in the GER and BEL area. (A) Holothuroidea (Echinodermata), (B) Echinoidea (Echinodermata), (C) Ophiuroidea (Echinodermata), (D) Asteroidea (Echinodermata), (E) Crinoidea (Echinodermata), (F) Alcyonacea (Cnidaria), (G) Actiniaria (Cnidaria), (H) Antipatharia (Cnidaria), (I) Decapoda, (J) Porifera, (K) Actinopterygii.

5.4 Mooring Deployments

(C. Rühlemann, A. Vink)

On November 13th and the following days several attempts were made to recover the 600-m-long sediment trap mooring (IP21_064ST) equipped with two sediment traps, a Scripps hydrophone, and two Nortek Aquadopps that had been deployed at the end of the MANGAN 2021 campaign in the BGR contract area (position 11° 55.689' N; 117° 01.319' W). Ranging one of the two ixBlue Oceano releasers on the mooring indicated that the mooring was surfacing, albeit at much slower speed than anticipated. At a water depth of 1800 m, the mooring seemed to stop, and after that the releaser did not send back any signals on ranging requests anymore. The other releaser never responded. Searches for a surfaced mooring were to no avail, neither during day, nor at night where the flashing light may have helpd in spotting the mooring. Attempts were made to contact the releasers by Posidonia USBL, but no trustworthy fix positions were received. One could speculate that either the battery power was too low after 1.5 years of deployment and the ranging during surfacing may have used up the remaining power, or the mooring may have drifted off in mid- or surface-waters to a position too far away from the ship to respond adequately. AUV images show that the mooring was indeed released - its clump weight was found on the photos, but no other remains of the mooring were found in the vicinity during AUV and ROV dives. Hence, we assume that several of the 17 Vitronex buoys must have imploded on the way up through the water column - it requires at least 5 or 6 to reduce the speed of surfacing to almost nothing. So, either the mooring is still drifting around in midwaters, or it has slowly reached the sea surface beyond any location where it might be seen, or if more buoys have imploded it may have sunk back to the seafloor at an unknown position away from the survey area. Unfortunately, the mooring was not equipped with an iridium beacon.

As a consequence of this failure to retrieve the mooring, it was not possible to carry out any of the intended mooring deployments during SO295.

5.5 ROV and Elevator Operations

(F. Abegg, P. Cuno, J. Genz, T. Matthiessen, M. Pieper, P. Striewski, I. Suck, J. Taylor, N. Maschmann)

5.5.1 Elevator deployments

To transport ROV-operated scientific modules, sampling, and experimental gear to the seafloor and back to the surface, increasing the efficiency of the ROV's bottom time, two elevators were used during cruise SO295.

In comparison to the use of elevator landers during cruise SO268, the elevators have been modified at GEOMAR by the ROV-Team into a kind of elevator 'basket'; meaning the buoyancy and releaser have been removed. The continued experience of the ROV-Team with two-wire operations onboard RV SONNE allowed lowering an elevator at the same time as the descending ROV. The advantages of this procedure are manifold. There is almost no restriction to the payload of the elevators in respect to weight, with the elevators no longer requiring balancing before deployment. The deployment does not need additional significant ship time for lowering the elevator, with video-guided seeking for a good spot to deploy and recovery of the launcher. Also, there is no weight to be released and left at the seafloor, preserving the deep sea environment, which is imperative to the scientific integrity of the CCZ study areas, and helping to save resources. Also, the user groups do not have to load and deploy their equipment approximately six to seven hours before the ROV deployment.

The procedure turned out to be viable to place the elevator very close (on a meter scale) to the required position using the ROV for the observation of the elevator while moving the ship. While the deployment position was confirmed by the scientist, the ship's winch deployed the elevator to the seabed. The connection to the ship's wire was released by the ROV using a specially designed ROV shackle.

When released, the ship's wire was lifted and the ROV commenced the scientific tasks with the tools taken from the elevator.

Recovery of the elevator was done almost vice versa. When the ROV was still at the seafloor continuing with its tasks, a so-called recovery frame was lowered on the second wire. The recovery frame was equipped again with the ROV shackle, two lights, a permanent flasher, a Posidonia transponder, and a Homer beacon to navigate the ROV to the recovery frame. When the frame is down, approx. 20m above seafloor, the ROV locates the frame and grabs the ROV shackle. Then the shackle is connected to the elevator and a safety lock is pulled. When done, the ROV clears from the elevator and frame, and the ships winch starts lifting the elevator. When at the sea surface another advantage gets clear: the elevator is already at the wire and does not swim free and has to be caught by ship and crew.

In total 8 deployments of elevator 1 have been conducted, with elevator 2 being used 4 times. Time of the elevator at seafloor varied between hours and days.

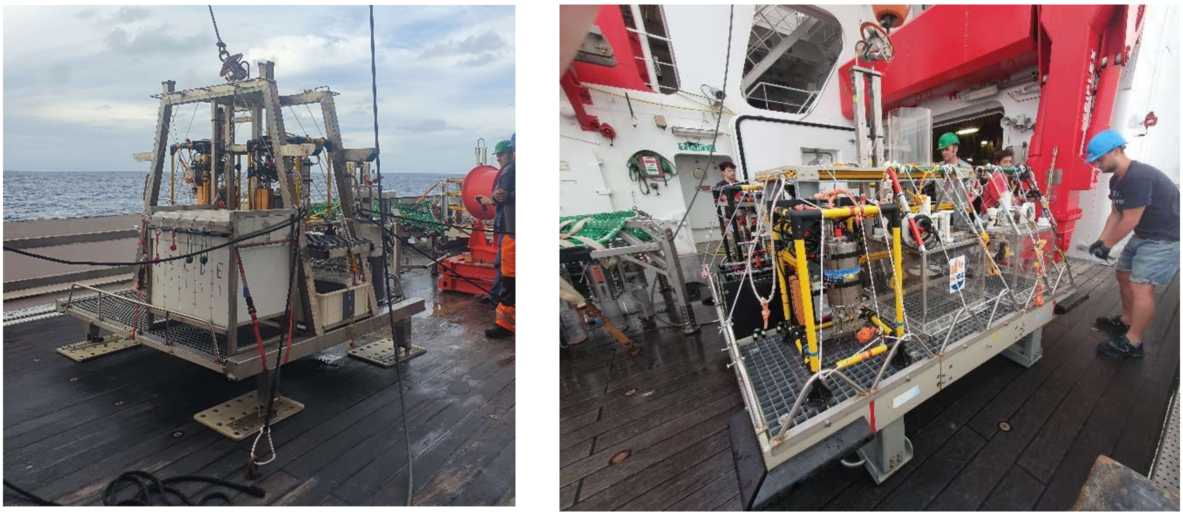


Fig. 5.5.1 (Left) Elevator 1 on deck with frame boxes, profilers and pushcores; (right) Elevator 2 with cubes, profiler, and quiver for PSP (Photo: James Taylor).

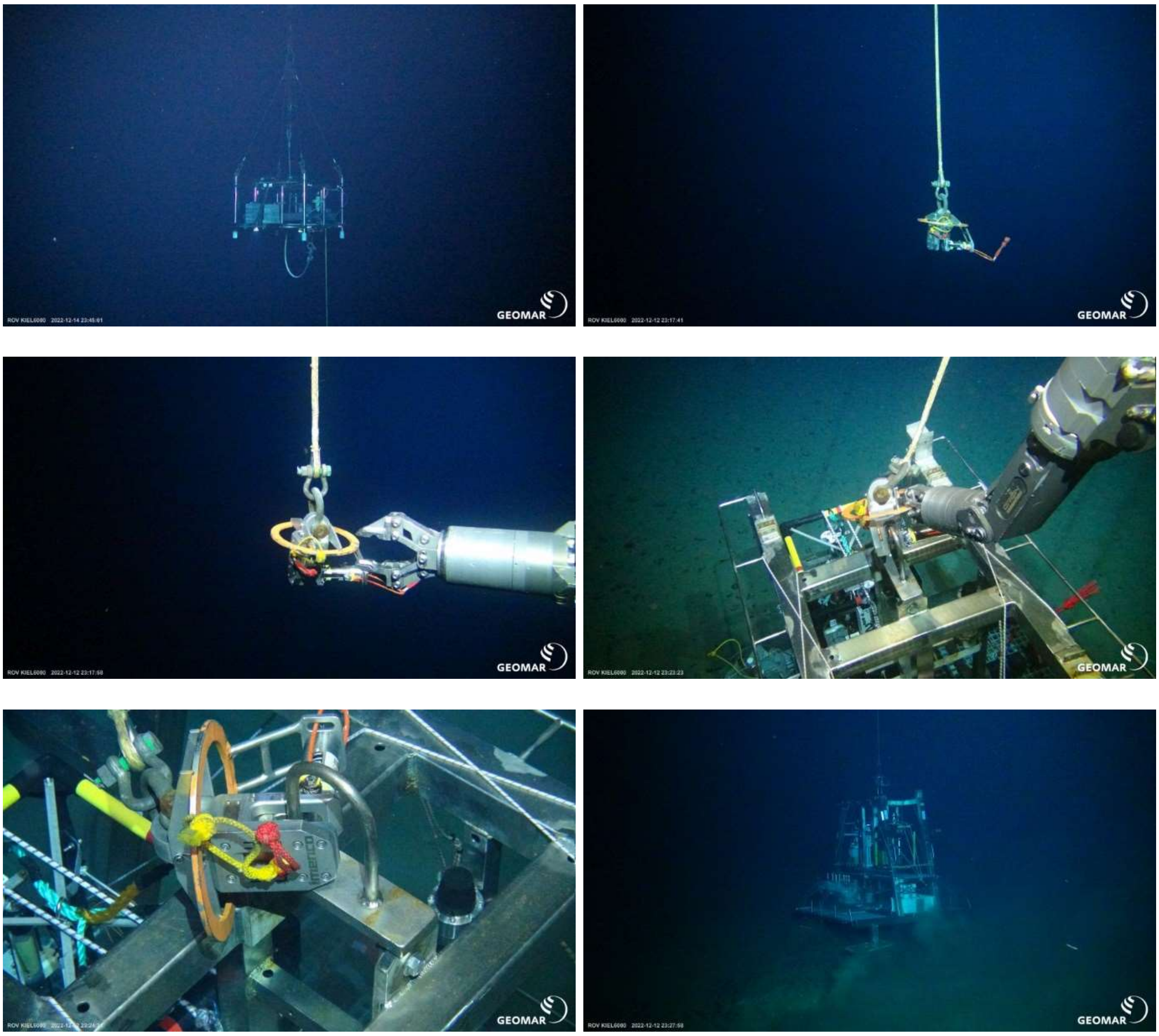


Fig. 5.5.2 From top left to bottom right: Recovery Frame with ROV shackle, ROV manipulator grabbing the shackle and hooking it, connection done, and 'lift off' of elevator.

5.5.2 ROV KIEL 6000 deployments

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 customised 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.

ROV KIEL 6000 is standardly equipped with two manipulators (seven function ORION, proportional, and five function RIGMASTER (rate controlled)), a Seabird 49 CTD, and two drawers which can be adapted to demand. Cameras include two Kongsberg/Imenco SD cameras, one AlphaC HDTV and foto camera, and one Sulis HDTV camera. Footage from these four cameras is permanently recorded.

The ship's Posidonia USBL system is used for underwater navigation, visualised within the OFOP (Ocean Floor Observation Protocol) software (© Jens Greinert). Science protocols, as well as ROV immanent navigation protocols, are saved and provided directly after each dive; as are the images taken during the dive.

Fig. 5.5.3 Left front view of ROV KIEL 6000 during SO295 with standard setup of 16 push cores in portside drawer and ICBM XL biobox in the starboard drawer. Upper right: two boxes with 10 frames each for deployment at the seafloor. Lower left: 16 push cores in portside drawer, 2 x 6 push cores in starboard drawer, two nets and quiver with magnetic stick in front of starboard drawer.

Including this cruise, ROV KIEL 6000 has accomplished 345 dives during 27 missions. During SO295, 22 scientific dives (Table 1) were completed, one dive was needed to recover an elevator

(012ROV02) and two dives had to be aborted due to technical issues. Maximum diving depth was approximately 4500 m and maximum bottom time was almost nine hours. In total, bottom time accumulated to approximately almost 161 hours (total dive time approx. 250 hours).

ROV Tasks during SO295

During SO295, tasks of ROV KIEL 6000 included placing and operating different scientific tools on the seafloor. These included MPI profilers, MPI Benthic chambers (Fig. 3), NIOZ Nodule frames, Passive ampler platforms, and Food pulse chambers (for trophic studies). In addition, fauna sampling was conducted, with the main focus on holothurians, corals, anemones, ophiuroids, and sponges. These were collected by the ORION manipulator or a scoop and brought up in different biobox(es). Sediment was sampled by means of push cores.

Table 5.5.1 ROV station list SO295.

Station Number SO268	Dive No.	Date Start (UTC)	Time Start (UTC)	At Bottom (UTC)	Off Bottom (UTC)	Time End (UTC)	Location	Depth (m)	ROV Bottom Time
Test	320	03.11.2022	TestDive on transit to working area						
006ROV01	321	07.11.2022	15:30			18:30	GER EBS Track / Dredge	2100	aborted
012ROV02	322	08.11.2022	21:02	22:45	02:00	04:03	EBS Track / Dredge/ GER Reference	4200	03:15
019ROV03	323	09.11.2022	16:32	18:11	02:02	03:49	GER Reference	4200	07:51
029ROV04	324	11.11.2022	15:30	17:17	00:30	02:33	GER Reference	4200	07:13
035ROV05	325	12.11.2022	15:40	17:31	02:19	04:32	GER Reference	4200	08:48
045ROV06	326	14.11.2022	15:16	17:00	00:46	03:11	GER Trial	4080	07:46
061ROV07	327	17.11.2022	17:02	18:38	01:46	03:33	GER Trial	4080	07:08
068ROV08	328	18.11.2022	16:25	18:02	23:38	01:37	GER Trial	4080	05:36
073ROV09	329	19.11.2022	15:41	17:11	00:49	02:39	GER Trial	4080	07:38
083ROV10	330	21.11.2022	15:30	17:05	23:59	01:46	GER Thick Cover	4085	06:54
089ROV11	331	22.11.2022	15:13	17:10	00:27	02:03	GER Reference	4136	07:17
095ROV12	332	23.11.2022	15:08	16:47	00:23	02:04	GER Decompaction	4125	07:36
100ROV13	333	24.11.2022	15:16	16:50	00:23	02:15	GER Thick Cover	4085	07:33
119ROV14	334	27.11.2022	15:57			18:05	No Nodule	2200	aborted
123ROV15	335	28.11.2022	15:09	17:20	01:16	03:05	No Nodule	4275	07:56
135ROV16	336	02.12.2022	15:10	16:53	23:41	01:45	GSR Trial	4485	06:48
139ROV17	337	03.12.2022	15:14	17:08	00:25	02:12	GSR Trial	4487	07:17
144ROV18	338	04.12.2022	15:08	16:59	00:34	02:22	GSR Trial	4497	07:35
151ROV19	339	04.12.2022	18:15	20:03	02:50	04:49	GSR Trial	4487	06:47
163ROV20	340	07.12.2022	15:37	17:33	00:11	02:07	GSR Thick Cover	4491	06:38
185ROV21	341	11.12.2022	17:24	19:14	00:18	02:10	GSR Reference	4537	05:04
190ROV22	342	12.12.2022	15:09	16:54	23:29	01:20	GSR Thick Cover	4494	06:35
197ROV23	343	13.12.2022	15:15	17:02	00:24	02:07	GSR Thin Plume	4497	07:22
202ROV24	344	14.12.2022	15:09	17:01	00:00	01:48	GSR Control Site	4492	06:59
209ROV25	345	15.12.2022	15:54	17:46	00:26	02:12	GSR Thick Cover	4498	06:40
Total: 22 scientific dives, 2 aborted, 1 recovery only and 1 test									160:16

For more details of the dives please see respective dive protocols in Appendix 12.2.

Tools used during SO295/ handled by the ROV:

- Push cores (ROV KIEL 6000)
- Slurp gun w/ eight sampling containers (ROV KIEL 6000)
- Rescue Hook (ROV KIEL 6000)
- ROV Shackle (ROV KIEL 6000)
- Elevators (ROV KIEL 6000)
- Scoop (MPI / ROV KIEL 6000)
- Lasers (integrated) (Alpha Cam, ROV KIEL 6000)
- Nodule frames and Nodule frame boxes (S .Gollner, NIOZ)
- CUBEs (NIOZ)
- “Senckenberg” Biobox (large) (ROV KIEL 6000)
- „ICBM“ Biobox (XL) (ROV KIEL 6000)
- Benthic chambers (incl. magnet T-Handle and/or optical communication) (MPI)
- Profilers (incl. magnet T-Handle and/or optical communication) (MPI)
- Small round (sealing) bioboxes (A. Hilário, Aveiro)
- Passive sampler platform (PSP) (Katja Schmidt, BGR)
- Blade corer (MPI)
- Food pulse chambers (FPC) (Teresa Amaro, CIMAR)

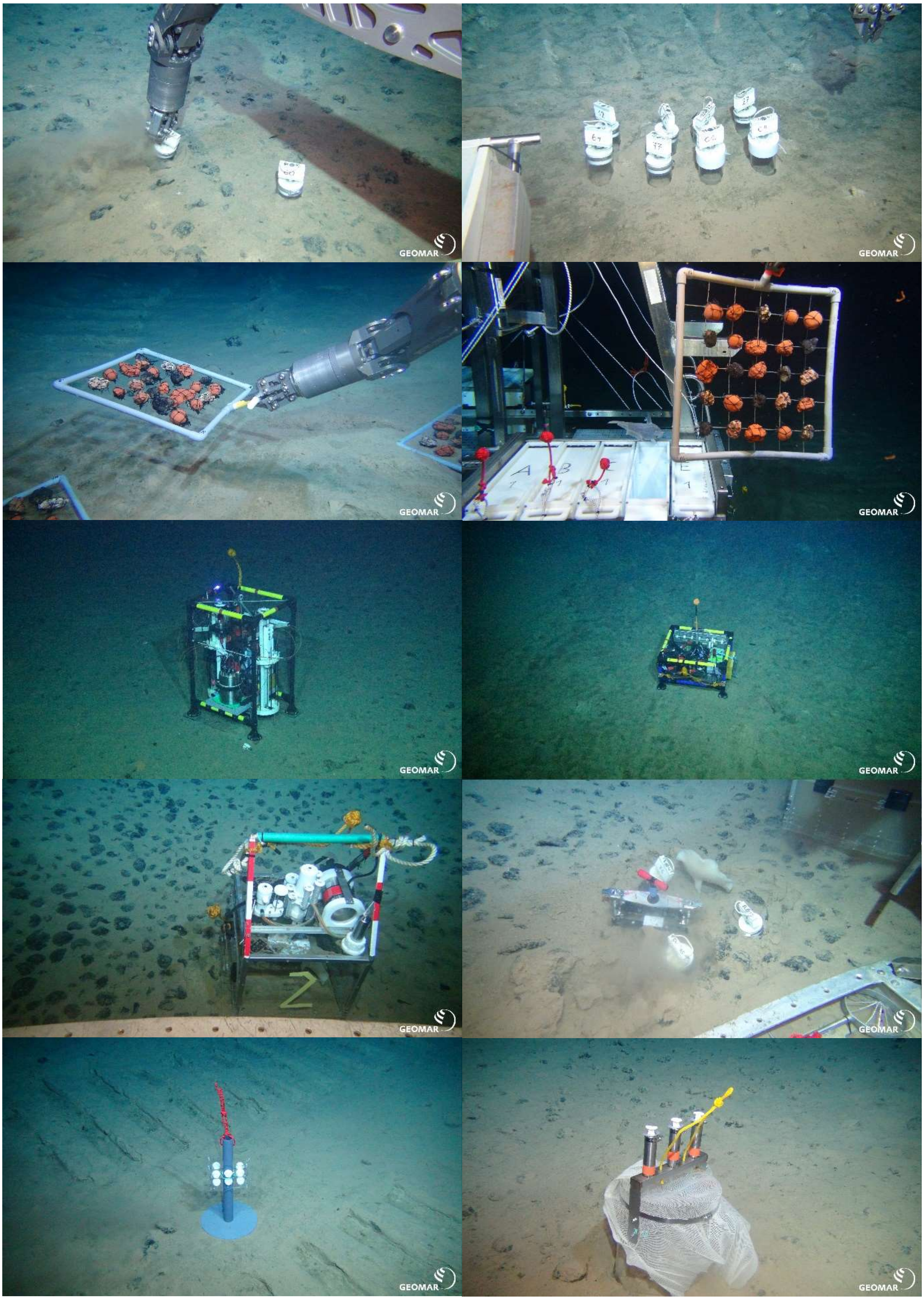


Fig. 5.5.4 Tools deployed by the ROV (from top left to bottom right): Taking Push cores / Deployed Push cores / Deploying new Nodule Frames / Recovery of Nodule Frames / Microprofiler / Benthic Chamber on collector tracks / Cube / Porifera surrounded by Blade core and Push cores after removal of Cube / Passive Sampler Platform / Food Pulse Chamber.

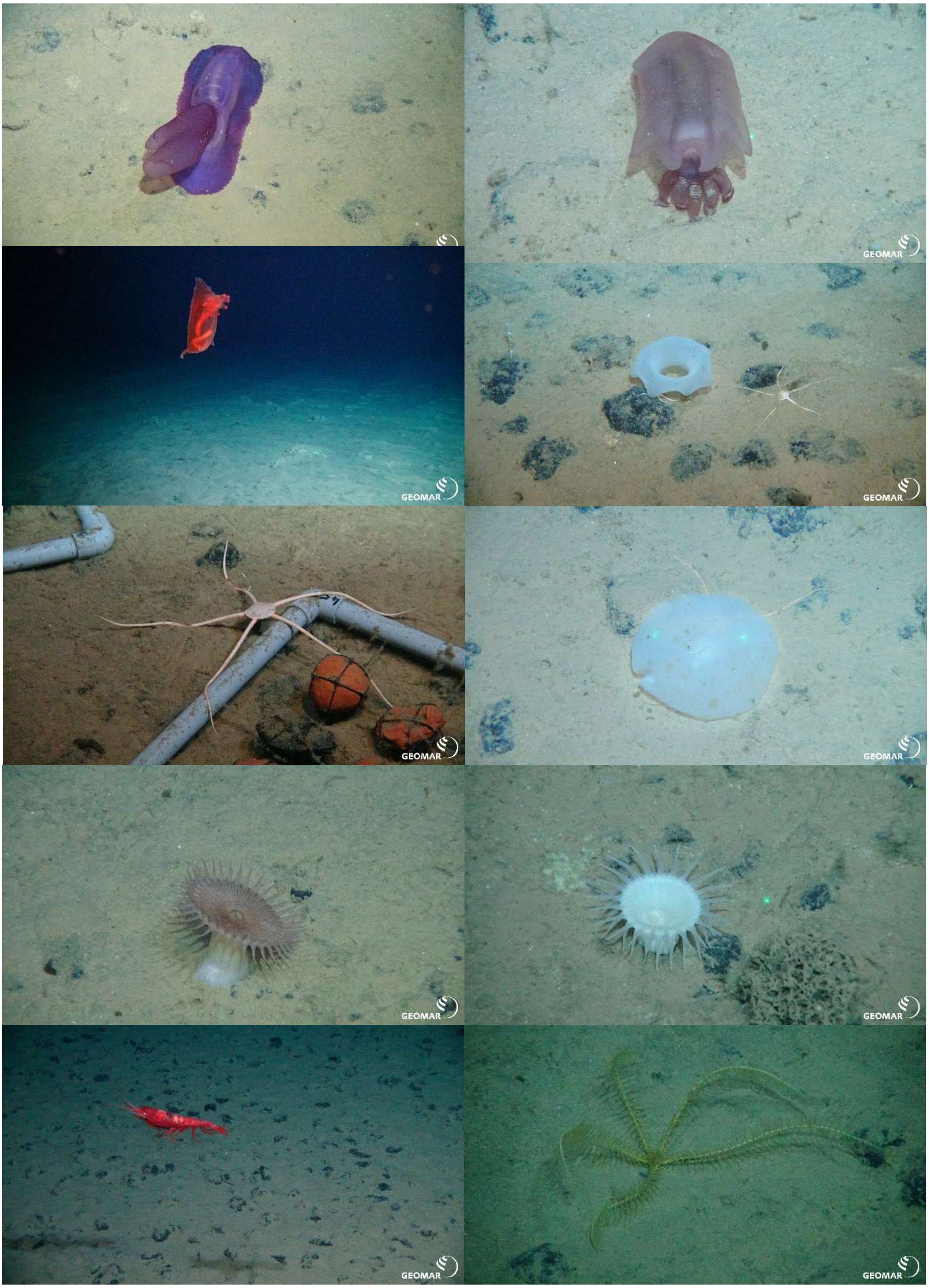


Fig. 5.5.5 Fauna of the CCZ (from top left to bottom right): holothurian (Psychropotidae) / holothurian (Elipiidae) / holothurian (Elipiidae) / corals, Porifera, and ophiuroid / ophiuroid on a nodule frame / ophiuroid underneath Porifera / Actiniaria (anemone) /Actiniaria (anemone) /decapod shrimp / crinoid.

5.6 Multiple Corer Deployments

(S. Khodami, F. Schiller, B. Estévan Vazquez, G. Dambrowski, T. Bezerra Campinas, F. Charlet, A. Henningsen, R. Meineke, G. Baciyunjuze, M. Bardenhagen, C. Grisat, F. Janssen, M. Molari, J. Barz, G. Luongo, K. Schmidt, P. Martinez Arbizu)

During SO295 the 20-corer Multiple corer was deployed equipped with a video camera. The camera system called VIRP was provided by BGR allowing for a controlled landing of the multicorer at target levels of benthic disturbance.

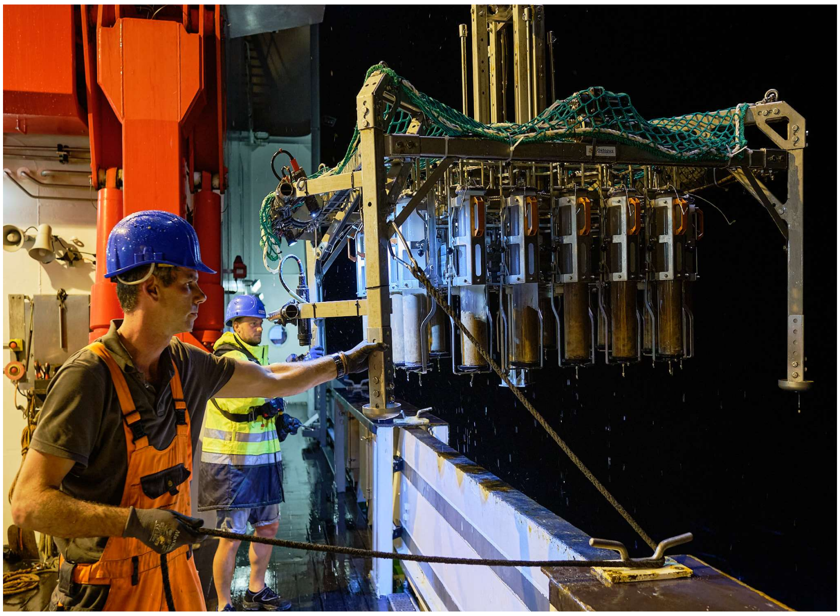


Fig. 5.6.1 Recovering the 20-liner Multiple corer equipped with video camera.

Fig. 5.6.2 Retrieving cores from the 20-liner Multiple corer on deck.

The following scheme was adopted for the distribution of the cores (Tab. 5.6.1). In case of incomplete retrieval of corers, the corers were distributed prioritizing the minimum requirements across research topics. Main treatments were applied on every deployment (when possible) and the shared cores have been considered for one deployment per station.

Table 5.6.1 General plan for the distribution of cores from the multiple corer. Main treatments were considered for every deployment (when possible) and the shared cores have been applied for one deployment per station.

	Research topics	Additional variables possible from that core(s)	Main discipline	Number of allocated cores	Shared with
Main treatments for each deployment	Meiofauna communities (morphology)		Biology	3	
	Meiofauna communities (metabarcoding)	eDNA	Biology	4/5	
	Meiofauna (proteomics)		Biology	2	
	Abiotic	TOC, TN, granule, pigments	Biology	1	
	Microbial communities (DNA, RNA, FISH, AODC, tracer incubations)	Chlorophyll	Microbiology	2	
	Nutrients, Porosity, mineralogy, 230Th, 210Pb, CNS	Mn, grain size, Bioturbation rate from 210Pb 226Ra	Geochemistry	1	
	Trace metals, DOC, alkalinity		Geochemistry	1	
	Pore water Cu ligands	solid phase amino acids	Geochemistry	1	
	CT-scan (x-ray density)	radionuclides	Sedimentology	1	
	Lipids		Biogeochemistry	1	
	Micro eukaryotes, viruses	Pigments, Organic matter compounds	Microbiology	1	
	Ecotoxicology bioassays	grain size / metals	Ecotoxicology	1	
Shared cores for 1 deployment per station	Shear strength	sold phase amino acids	Geochemistry	1	Ecotoxicology
	Foraminifera		Biology	1	Lipids
	DGT Labile trace metals	solid phase, analyses (grain size etc.), flocculation experiments etc.	Geochemistry	3	TM, DOC + nutrients
	Resuspension experiments		Geochemistry		Ecotoxicology
	Trace metal diffusion		Geochemistry	1	
	Solid phase amino acids	Cu ligands	Geochemistry		Cu ligands
	Metal-microbe toxicity experiments		Microbiology/ Ecotoxicology		Ecotoxicology
	Pore water rare earth elements, trace metals		Geochemistry	2	TM, DOC + nutrients

5.6.1 Deployment strategy

Prior to deployment, the correct working of the video camera and the lights was tested on deck. The multicorer was deployed into the ocean and lowered to 50m depth with 0.5 m/s speed. The winch was stopped and a Posidonia pinger was then attached to the wire. After that the gear was lowered with 1m/s until 50 m above the bottom. Winch was stopped and the camera system was turned on. Then the gear was lowered with 0.5 m/s until bottom could be seen at the screen, which was typically about 3-10 m above ground and the gear was stopped at 2 m above ground. The video image was inspected and if corresponding with desired disturbance level, the gear was deployed for landing at 0.3 m/s. Landing was recorded on video. Appendix 12.1 shows the list of stations where the Multiple corer was deployed including coordinates, water depth, working area and landing screenshot from the seafloor.

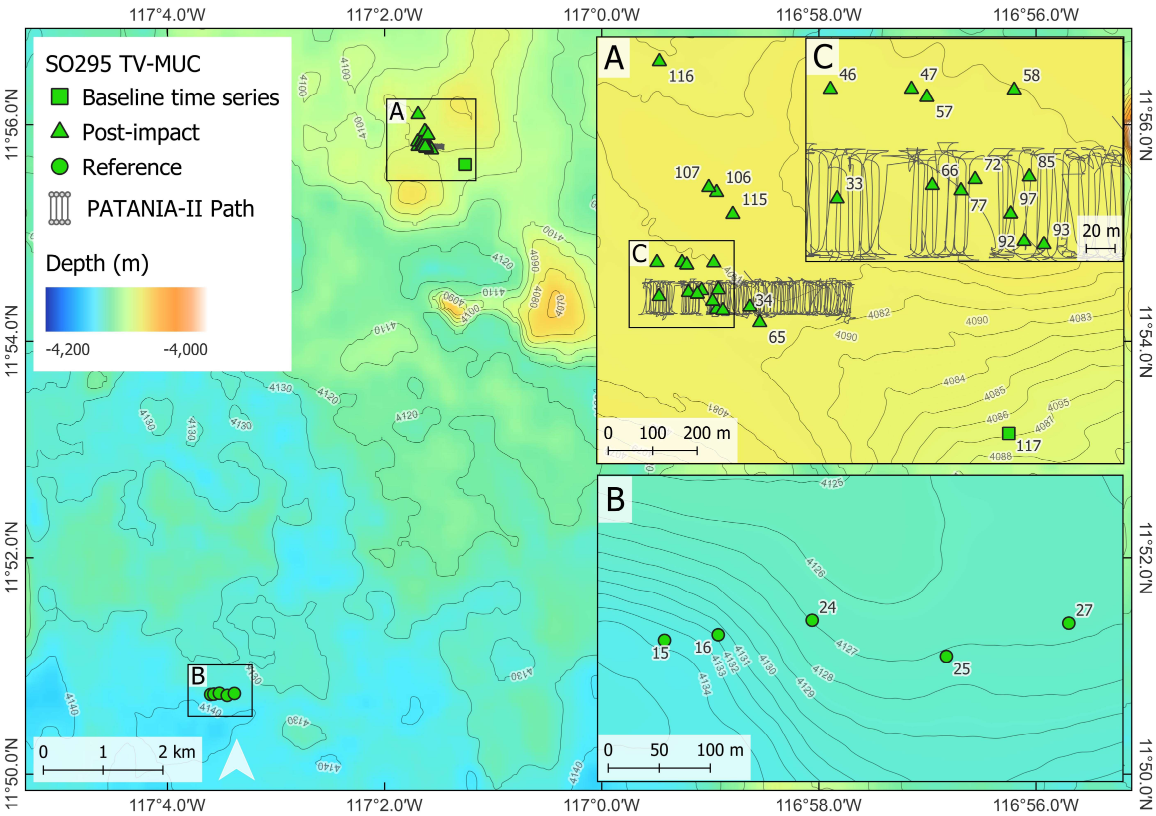


Fig. 5.6.3 Overview map of MUC deployments in the GER working area. Insets: (A) and (C) Collector and Plume Impact Sites; (B) Reference Site. Numbers correspond to the station numbers.

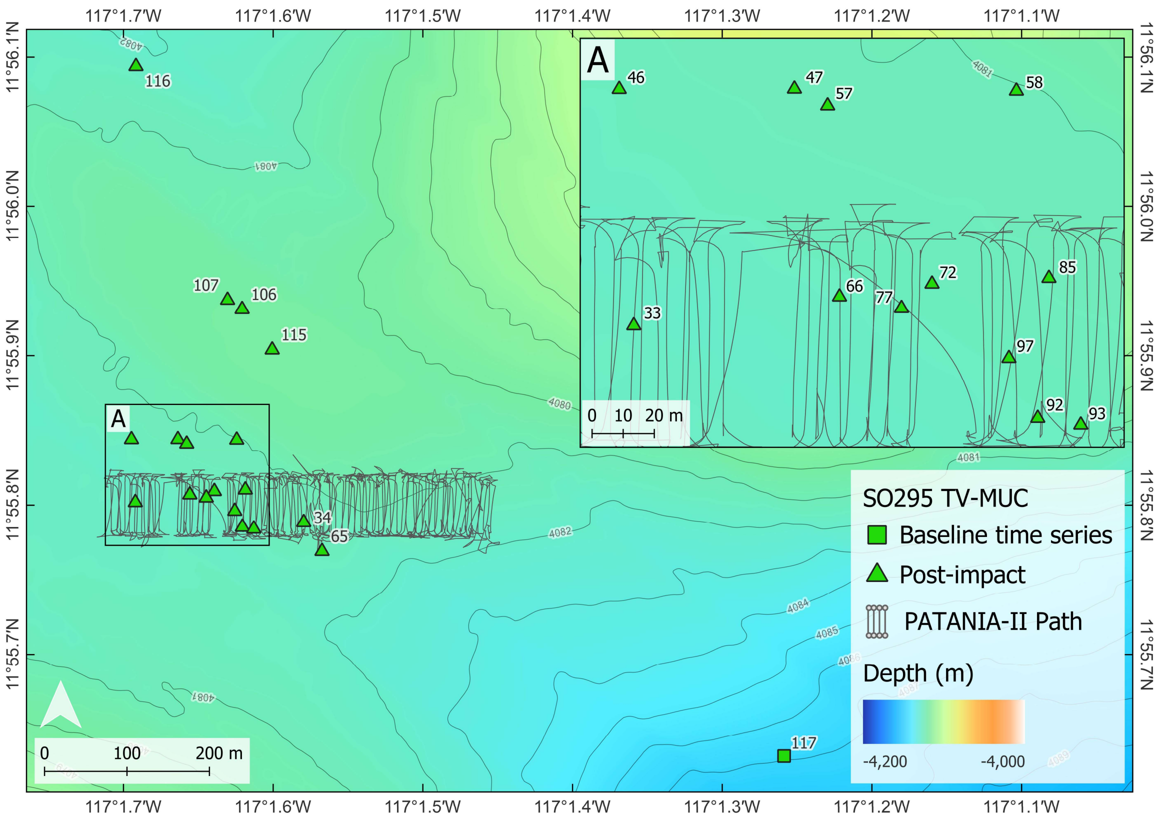


Fig. 5.6.4 Enlarged map of MUC deployments in the GER Trial Site. Inset A: Collector Impact Site. Numbers correspond to the station numbers.

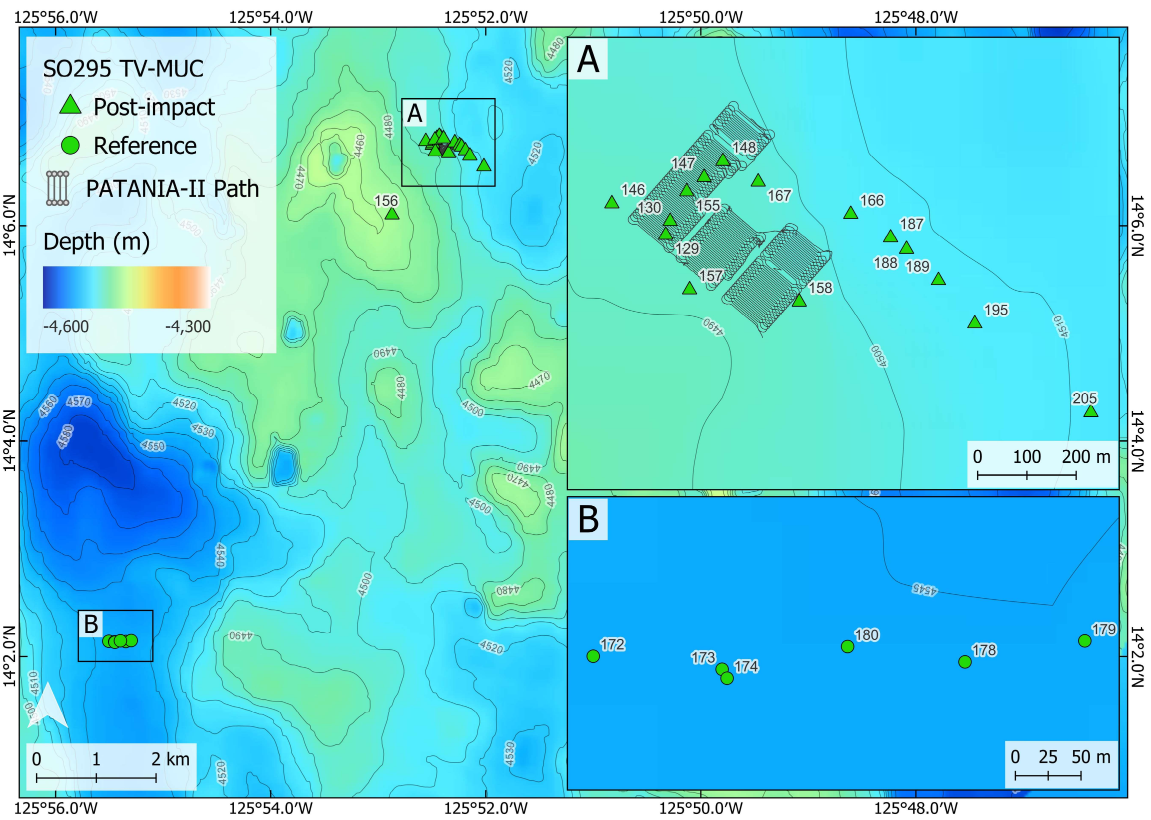


Fig. 5.6.5 Overview map of MUC deployments in the BEL working area. Insets: (A) Collector and Plume Impact Sites; (B) Reference Site. Numbers correspond to the station numbers.

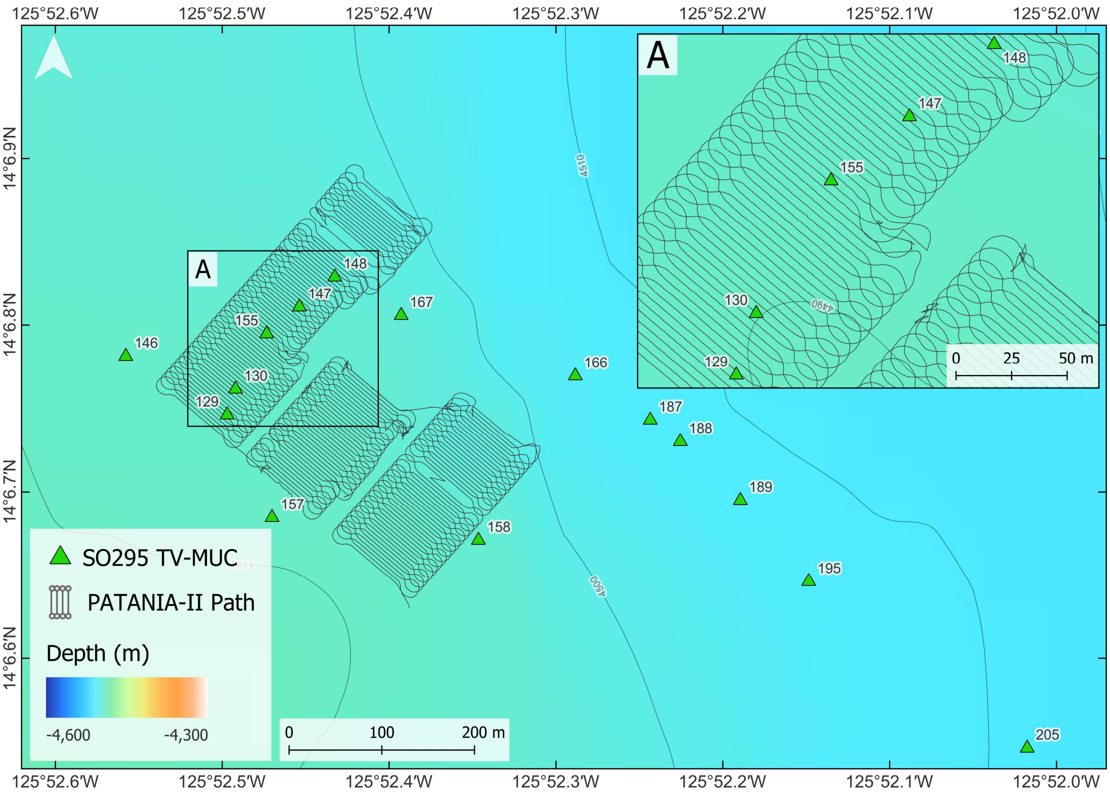


Fig. 5.6.6 Enlarged map of MUC deployments in the BEL Trial Site. Inset A: Collector Impact Site. Numbers correspond to the station numbers.

5.7 Boxcorer Deployments

(P. Esquete, A. Bouriat, F. Charlet, B. Esteban, S. Gollner, A. Henningsen, N. Maschmann, M. Molari, C. Rühlemann)

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 SO295, 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 Chapter 5.17.3) 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 Chapter 5.13).

5.7.2 The equipment

Fig 5.7.1 The boxcorer on deck of RV SONNE.

A USNEL Spade Corer (Fig. 5.7.1) was used for sampling the sediment and nodules. It consists on a box of 50 cm x 50 cm x 60 cm that sinks into the seafloor. The penetration of the box into de sediment is limited by stoppers located on the side 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.

Operation of the gear

The stoppers were positioned to allow a penetration of aprox. 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 0.4 m/s. Landing and pull out were monitored on a plot of rope tension (Fig. 5.7.2). Landing was 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 0.3 m/s. Pull out tension for a successful box-core was visualized as a peak in rope tension. That ranged from 62 to 70 kN.

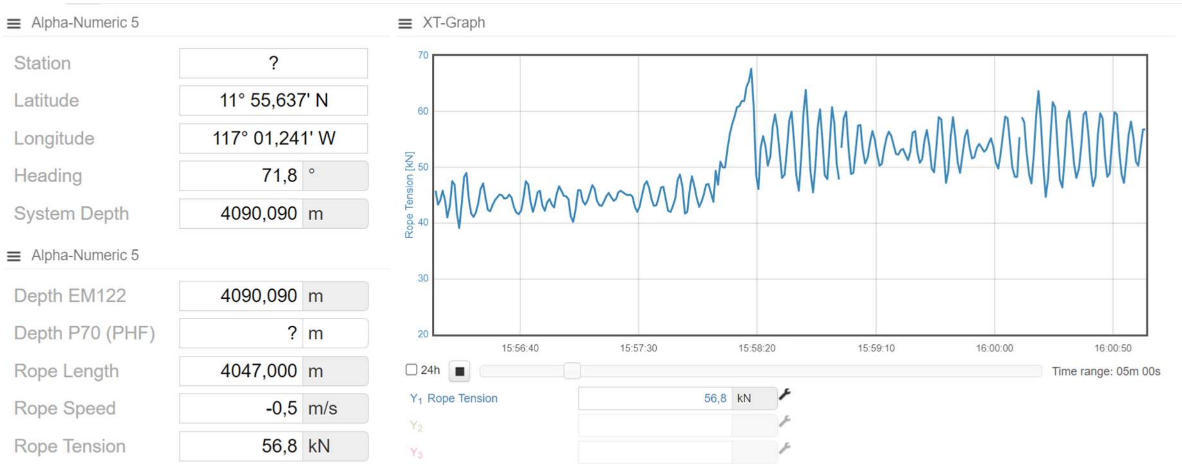


Fig. 5.7.2 Variations in rope tension during landing and pull of a box corer.

5.7.3 Treatment of the samples onboard

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 µm mesh. The residue was kept for live-sorting.

2. Pictures of the untouched sample with the nodules were taken under controlled illumination for later quantitative analysis of the visual, apparent, nodule size distribution.

3. A small pushcore (3 cm diameter) 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 and stored at -20ºC.

4. Sample treatment

a) Nodule treatment:

The nodules from the surface layer were first hand-picked and treated for microbiological analyses (see Chapter 5.13), and for epifauna analyses (see Chapters 5.10 and 5.11)

b) Sediment treatment:

The boxcore sediment sample was sliced into three layers (0-3, 3-5, 5-10 cm) that were sieved separately through a 300 µm mesh. The first layer was sieved in cold filtered sea water at 4ºC and live sorted. The faunal specimens were preserved in either ethanol at 80% (Polychaeta) or 96% (rest) and stored at 4ºC. The remaining sediment, as well as the residue of the second and third layers were fixed in ethanol and stored at 4ºC. After 24 hours, the ethanol was changed in order to assure a high percentage of ethanol and the sample stored at -20ºC for later sorting and identification of the fauna (see Chapter 5.11).

5.7.4 Preliminary results

In total, the box-corer was deployed 47 times, of which 43 were successful (Tab. 5.7.1).

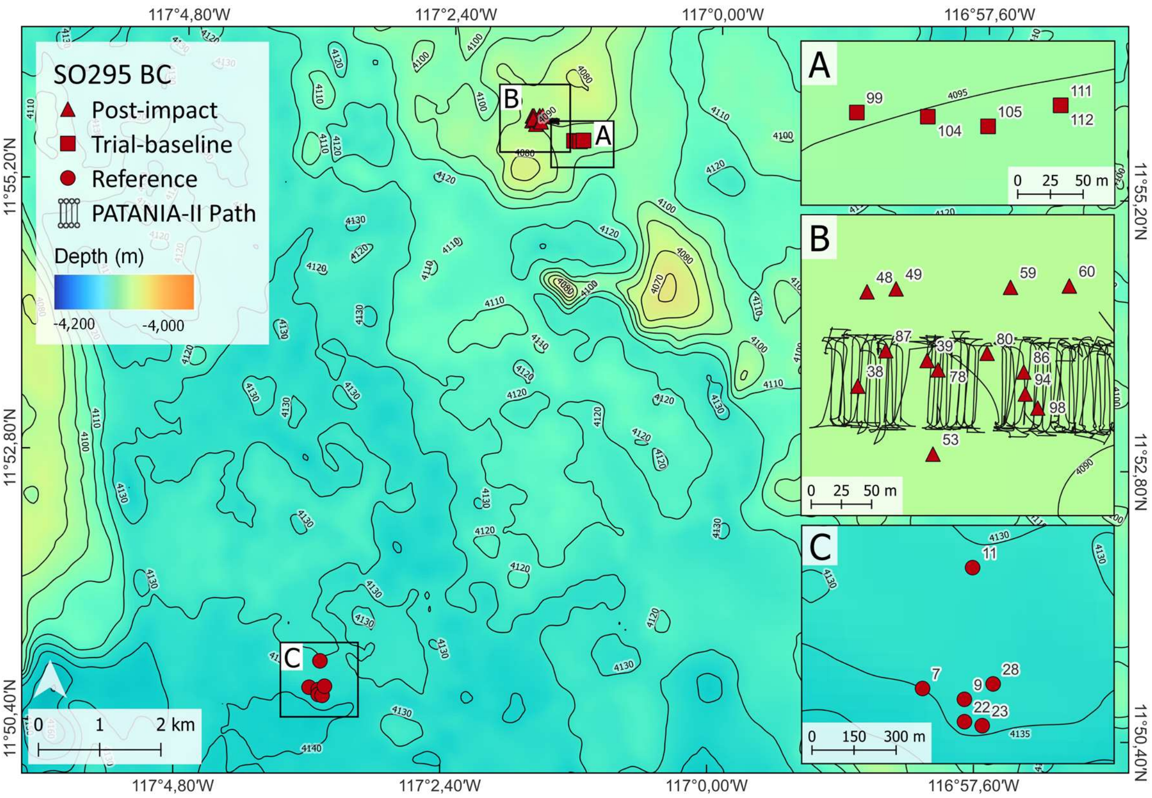


Fig. 5.7.3 Overview map of boxcore deployments in the GER working area. Insets: (A) Trial baseline time series; (B) Collector and Plume Impact Sites; (C) Reference Site. Numbers correspond to the station numbers.

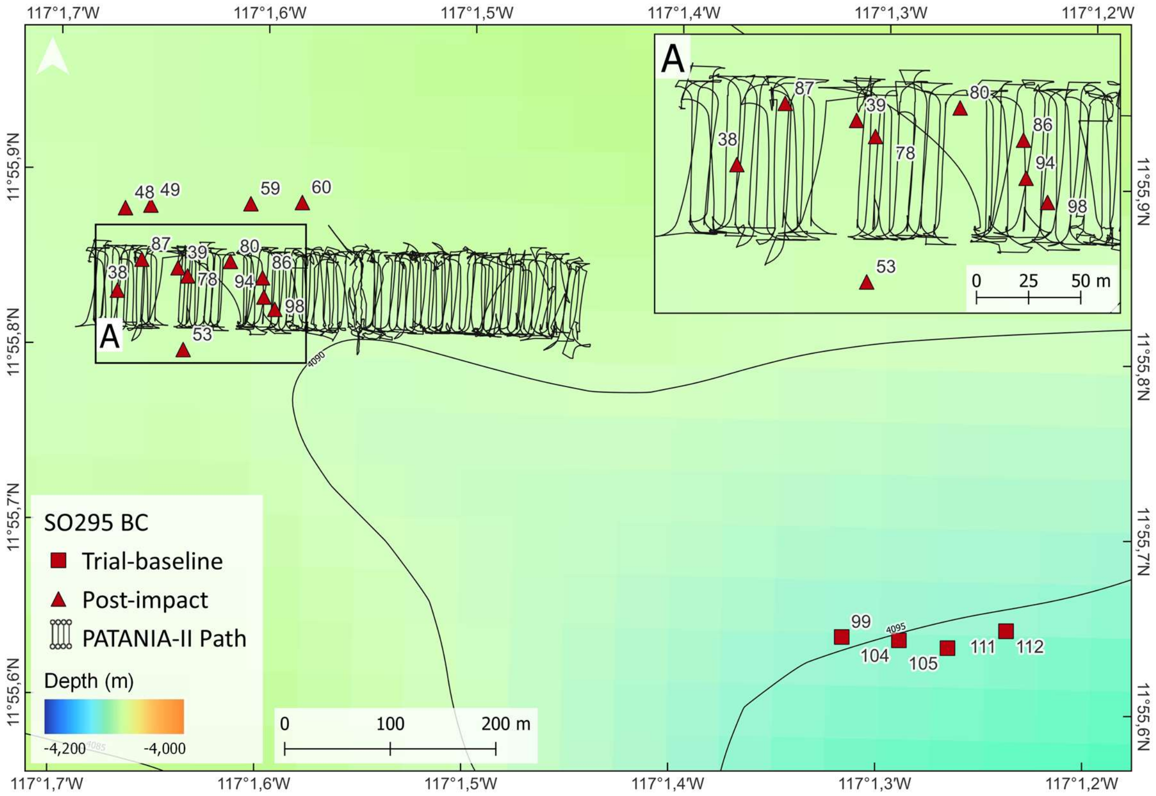


Fig. 5.7.4 Enlarged map of boxcore deployments in the GER Trial Site. Inset A: Collector Impact Site. Numbers correspond to the station numbers.

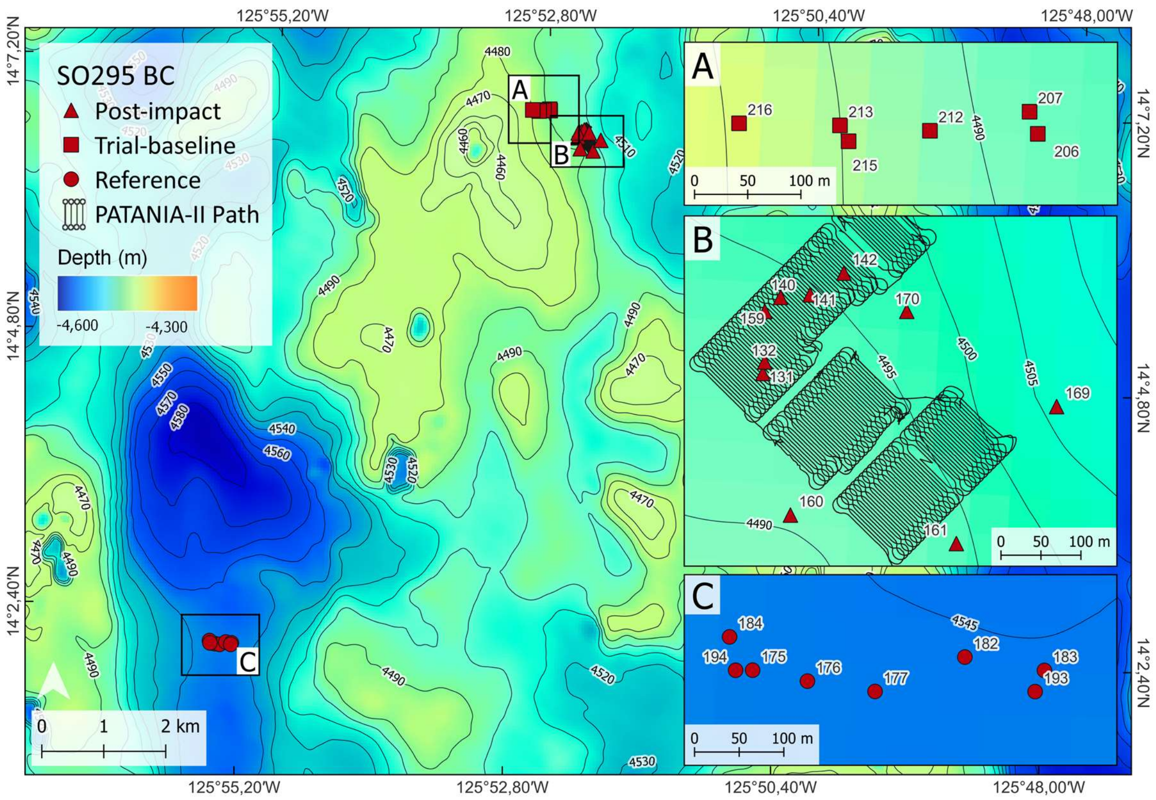


Fig. 5.7.5 Overview map of boxcore deployments in the BEL working area. Insets: (A) Trial baseline time series; (B) Collector and Plume Impact Sites; (C) Reference Site. Numbers correspond to the station numbers.

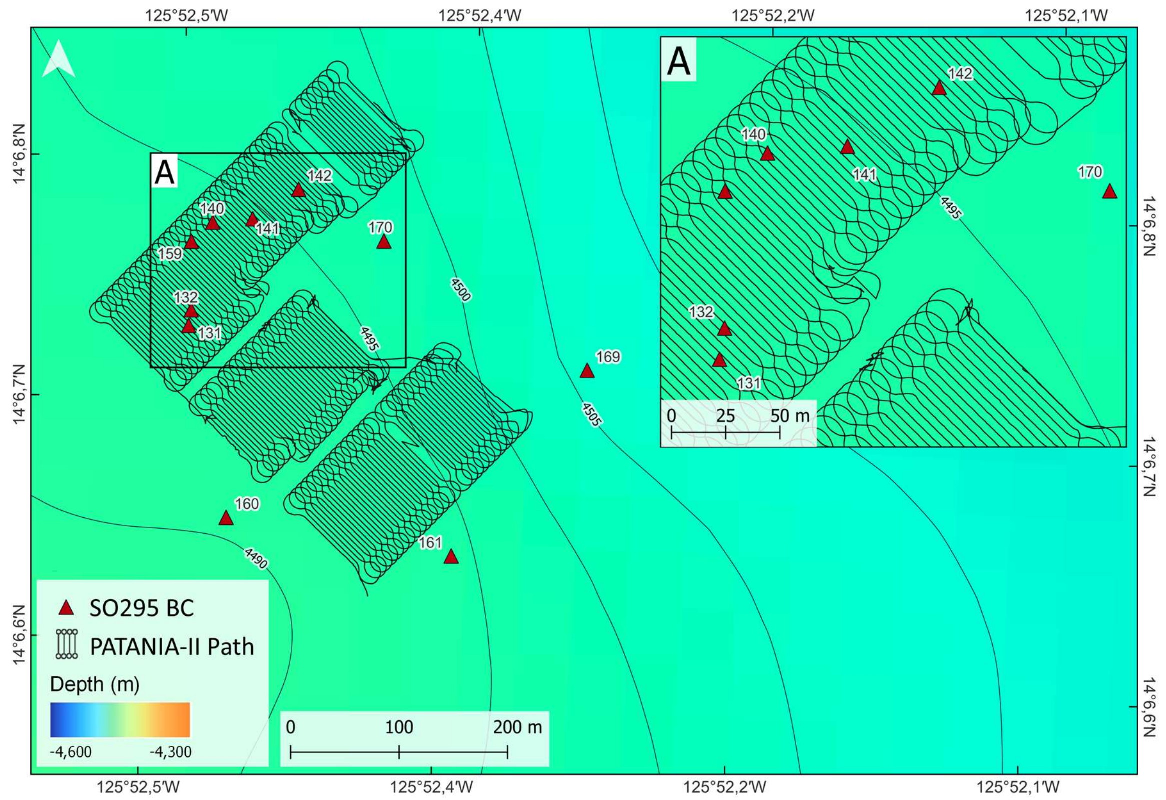


Fig. 5.7.6 Enlarged map of boxcore deployments in the BEL Trial Site. Inset A: Collector Impact Site. Numbers correspond to the station numbers.

A visual examination of the samples from the first three deployments attempted in the collector site showed the presence of high numbers of nodules below a thick layer of watery, dark brown sediment. This, together with the fails on the positioning system of the vessel, led to the conclusion that they had been taken out of the tracks in sites where the plume redeposited, and were hence considered as such and repeated.

A complete list of the deployed box corer, accompanied by photos of the recovered sediment surface can be found in Appendix 12.2.

5.8 Gravity Corer Deployments

(M. Haeckel)

Due to logistical problems no gravity cores could be taken during SO295.

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

(M. Haeckel)

EM 122 and ADCP measurements

In July 2022 the Leitstelle Deutsche Forschungsschiffe had decided to stop any routine (i.e. related solely to the DAM Underway programme) ship-based multibeam and ADCP measurements on all large-scale research vessels in order to reduce the wear of the transducers and thus to contribute to reducing the running costs of the vessels. Since there was no scientific request for such measurements by the SO295 Nodule Monitoring 2 project, hydroacoustic measurements were not conducted, except for a short transect on the way back from the BEL working area to Port Hueneme. These data were processed by the DAM group and made available in PANGAEA.

EK 60 measurements

Collection of single-beam echosounder data of the upper and mid water column would have been of high scientific interest and relevance for the project, because currently only very little data is available from the Clarion-Clipperton Zone. Such data would be, for example, important to analyse the diel migration of pelagic fauna in the working areas, in order to assess how this important part of the biological carbon pump may be impacted by future deep-sea mining activities.

Until now the EK60 system of RV SONNE has not been calibrated and thus recorded data cannot be used for scientific work at the moment. This is very unfortunate. During the previous cruise SO294 GEOMAR colleagues attempted a calibration, but did not succeed. A proper calibration can only be performed in the harbour by the EK60 manufacturer Kongsberg. We would very much appreciate, if this could be done in the near future, so the system can be properly used for scientific purposes.

5.10 Megafauna

(S. Gollner)

Megafauna has been collected by boxcoring and by ROV. From each boxcorer (see Tab. 5.7.1), all visible fauna and foraminifera have been scratched off with a razorblade or knife from each of the surface nodules (visible nodules once boxcore is on deck). Each sample from each nodule has been fixed in 96% EtOH in an 2 ml Eppendorf tube or small jar. More than 1600 nodules have been sampled (Tab. 5.10.1). Back on land, samples will be analysed for biodiversity, which will also serve as a control for the recolonization experiment (Chapter 5.17). In addition to the faunal samples, from each boxcorer 3 nodules were scratched for microbes (for MPI) and fixed in 96% EtOH. Please note that Table 5.10.1 does not contain nodules taken for respiration experiments (AWI/MPI) and detailed microbial analyses (MPI).

Table 5.10.1 Number of surface nodules in boxcores (excluding nodules collected for microbiology and respiration experiments).

station	claim	Site	nodule #
SO295_009_BC01	BGR	GER Reference	33
SO295_011_BC02	BGR	GER Reference	38
SO295_022_BC03	BGR	GER Reference	71
SO295_023_BC04	BGR	GER Reference	99
SO295_028_BC05	BGR	GER Reference	57
SO295_038_BC06	BGR	GER Collector impact	20
SO295_039_BC07	BGR	GER Collector impact	33
SO295_048_BC08	BGR	GER Plume Impact	58
SO295_049_BC09	BGR	GER Plume Impact	109
SO295_053_BC10	BGR	GER Plume Impact	93
SO295_059_BC11	BGR	GER Plume Impact	78
SO295_060_BC12	BGR	GER Plume Impact	36
SO295_078_BC13	BGR	GER Collector impact	1
SO295_080_BC14	BGR	GER Collector impact	25
SO295_086_BC15	BGR	GER Collector impact	0
SO295_087_BC16	BGR	GER Collector impact	35
SO295_094_BC17	BGR	GER Collector impact	1
SO295_098_BC18	BGR	GER Collector impact	0
SO295_099_BC19	BGR	GER Trial baseline time series	128
SO295_104_BC20	BGR	GER Trial baseline time series	81
SO295_105_BC21	BGR	GER Trial baseline time series	73
SO295_111_BC22	BGR	GER Trial baseline time series	52
SO295_112_BC23	BGR	GER Trial baseline time series	142
SO295_131_BC24	GSR	BEL Collector impact	1
SO295_140_BC26	GSR	BEL Collector impact	23
SO295_142_BC28	GSR	BEL Collector impact	14
SO295_159_BC29	GSR	BEL Collector impact	1
SO295_160_BC30	GSR	BEL Plume impact	30

station	claim	Site	nodule #
SO295_161_BC31	GSR	BEL Plume impact	38
SO295_169_BC32	GSR	BEL Plume impact	37
SO295_170_BC33	GSR	BEL Plume impact	28
SO295_176_BC35	GSR	BEL Reference	7
SO295_177_BC36	GSR	BEL Reference	14
SO295_182_BC37	GSR	BEL Reference	7
SO295_193_BC40	GSR	BEL Reference	10
SO295_194_BC41	GSR	BEL Reference	8
SO295_206_BC42	GSR	BEL Trial baseline time series	21
SO295_212_BC44	GSR	BEL Trial baseline time series	20
SO295_213_BC45	GSR	BEL Trial baseline time series	24
SO295_215_BC46	GSR	BEL Trial baseline time series	29
SO295_216_BC47	GSR	BEL Trial baseline time series	35

During several ROV dives dedicated megafauna sampling has been carried out. The main purpose of collections included an assessment of parameters related to ecotoxicology, such as biomarkers and bioaccumulation, from baseline and post Patania2 impact areas for Nélia Mestre from University of Algarve and Joana Raimundo from IPMA. The main purpose of collections included for Ana Colaço from Okeanos-University of Azores/IMAR is to assess organisms energetic budget, condition index, and morphological potential changes from the baseline and post-Patania 2 impacted areas.

During ROV dives, specimens have been collected by the ROV-arm or by nets and were placed into the boxes mounted on the ROV-porch (for details please see ROV-protocols). From each specimen, a picture with and without laser has been taken by ROV, and samples were labelled in the protocols according to ascending numbers, starting with “Mega1”, “Mega2”, “Mega3”, etc. and the main taxon name (sponge, coral, brittlestar, anemone, seacucumber). On board, a photo from each specimen was taken (with a scale, specimen-number and ROV-number). Specimens were frozen at -80°C (for Nelia Mestre), or were dissected into three parts and frozen at -80°C, fixed in 96% EtOH and 4% buffered formaldehyde (for Ana Colaco). In addition, from several brittlestars one of the legs were fixed in 96%EtOH for Pedro Martinez Arbizu. An overview of collected samples is provided in Table 5.10.2. The following specimen were lost during ROV-collection/not found back in the ROV-box once on deck: Mega8, mega29, mega46, mega51, mega67, mega83, mega91, mega92, mega111. In case an additional specimen was found in the ROV-box after recovery (and thus no ROV-picture exists), a new “meganumber” was assigned and this is noted as well in the table. A total of 130 megafauan specimens could be collected during ROV dives. Samples were collected in the GER Reference site, GER Plume impact site (thick cover), GER Dredge site (seacucumbers collected directly next to dredge; other megafauna collected further south with no/limited impacted of dredge plume coverage), BEL Reference site, BEL Plume impact site (thick and thin cover; note that a proper thick and thin classification needs to be determined).

Table 5.10.2 ROV megafauna collections, including sampling area (GER/BEL reference/thick/thin cover/dredge), individuals (ind.) per area and faunal group, collector (coll) (PI in ROV container), preserver (pres) (person who preserved the specimens), person for whom specimens have been collected, name of megafauna as in ROV-protocol, comment, and ROV dive number. Collectors and preservers on board of SO295 inlcuded S (S. Gollner), P (P. Esquete), L (L. Boehringer), F (F. Janssen), T (T. Stratmann).

GER-Reference	ind.	Coll	Pres	Ana	Nelia	Teresa	Pedro	name as in ROV-protocol	Comment	ROV-Dive
Anemone	1	F	S		x			Mega1Anemone		ROV3
Anemone	2	S	S/P		x			Mega4Anemone		ROV4
Anemone	3	S	S/P		x			Mega7Anemone		ROV4
Sponge	1	F	S/P		x			Mega3Sponge		ROV4
Sponge	2	P	S/L		x			Mega31Sponge		ROV11
Sponge	3	P	S/L		x			Mega33sponge		ROV11
Sponge	4	P	S/L		x			Mega34sponge		ROV11
Sponge	5	S	S/L		x			Mega25sponge		ROV11
Coral	1	F	S	x				Mega2Coral		ROV3
Coral	2	S	S/P	x				Mega5Coral		ROV4
Coral	3	S	S/P	x				Mega6Coral		ROV4
Coral	4	S	S/L	x				Mega27Coral		ROV11
Brittlestar	1	P	S/L		x			Mega35brittlestar		ROV11
Brittlestar	2	F	S/L		x			Mega23brittlestar		ROV11
Brittlestar	3	S	S/L		x			Mega24brittlestar		ROV11
Brittlestar	4	S	S/L		x			Mega28brittlestar		ROV11
Brittlestar	5	S	S/L		x			Mega26brittlestar		ROV11
Starfish	1	P	S/L	x				Mega32Starfish		
Seacucumber	1	S	S/L		x			Mega30Seacucumber		ROV11
GER thick plume										
Anemone	1	T	S		x			Mega22Anemone	no ROV pic	ROV10
Sponge	1	P	S/P		x			Mega9Sponge		ROV8
Sponge	2	P	S/P		x			Mega12Sponge		ROV8
Sponge	3	P	S/P		x			Mega16Sponge		ROV8
Sponge	4	T	T					Mega19Ssponge	for Tanja	ROV10
Sponge	5	T	T					Mega21 Sponge	for Tanja	ROV10
Coral	1	P	S/P	x				Mega10Coral		ROV8
Coral	2	P	S/P	x				Mega13Coral		ROV8
Coral	3	P	S/P	x				Mega14Coral		ROV8
Coral	4	P	S/P	x				Mega18Coral		ROV8
Brittlestar	1	P	S/P		x			Mega11brittlestar		ROV8
Brittlestar	2	P	S/P		x			Mega15brittlestar		ROV8
Brittlestar	3	P	S/P		x			Mega17brittlestar		ROV8

Brittlestar	4	T	T					Mega20brittlestar	for Tanja	ROV10
GER-Reference/dredge										
Anemone	1	T	S/L		x			Mega42Anemone		ROV12
Sponge	1	T	S/L		x			Mega48Sponge		ROV12
Coral	1	T	S/L	x				Mega45/47Coral	no discrimination possible between 45/47	ROV12
Coral	2	T	S/L	x				Mega45/47Coral	no discrimination possible between 45/47	ROV12
Coral	3	T	S/L	x				Mega49Coral		ROV12
Brittlestar	1	T	S/L	x			x	Mega 41/43/44/50brittlestar	no discrimination between specimens possible	ROV12
Brittlestar	2	T	S/L	x			x	Mega 41/43/44/50brittlestar	no discrimination between specimens possible	ROV12
Brittlestar	3	T	S/L	x			x	Mega 41/43/44/50brittlestar	no discrimination between specimens possible	ROV12
Brittlestar	4	T	S/L	x			x	Mega 41/43/44/50brittlestar	no discrimination between specimens possible	ROV12
Seacucumber	1	L	P			x		Mega36seacucumber		ROV12
Seacucumber	2	L	P			x		Mega37seacucumber		ROV12
Seacucumber	3	L	P			x		Mega38seacucumber		ROV12
Seacucumber	4	L	P			x		Mega39seacucumber		ROV12
BEL-Reference										
Anemone	1	S	S/L		x			Mega81Anemone		ROV21
Anemone	2	S	S/L		x			Mega80Anemone		ROV21
Anemone	3	S	S/L		x			Mega88Anemone		ROV21
Anemone	4	S	S/L		x			Mega90Aneomone		ROV21
Anemone	5	S	S/L		x			Mega86Anemone		ROV21
Anemone	6	S	S/L		x			Mega85Anemone		ROV21
Anemone	7	S	S/L		x			Mega87Anemone		ROV21
Anemone	8	S	S/L		x			Mega103Anemone	no ROV pic	ROV21
Sponge	1	S	S/L		x			Mega82Sponge		ROV21
Sponge	2	S	S/L		x			Mega99Sponge		ROV21
Sponge	3	S	S/L		x			Mega98Sponge		ROV21
Sponge	4	S	S/L		x			Mega100Sponge		ROV21
Coral	1	S	S/L	x				Mega97Coral		ROV21
Coral	2	S	S/L	x				Mega104Coral	no ROV pic	ROV21
Brittlestar	1	S	S/L		x			Mega79Brittlestar		ROV21

Brittlestar	2	S	S/L		x			Mega84Brittlestar		ROV21
Brittlestar	3	S	S/L		x			Mega101Brittlestar		ROV21
Brittlestar	4	S	S/L		x			Mega102Brittlestar	no ROV pic	ROV21
Brittlestar	5	S	S/L	x			x	Mega89Brittlestar		ROV21
Brittlestar	6	S	S/L	x			x	Mega94Brittlestar		ROV21
Brittlestar	7	S	S/L	x			x	Mega93Brittlestar		ROV21
Brittlestar	8	S	S/L	x			x	Mega95Brittlestar		ROV21

BEL-ThickPlume

Anemone	1	S	S/L		x			Mega59Anemone		ROV17
Anemone	2	S	S/L		x			Mega57Anemone		ROV17
Anemone	3	S	S/L		x			Mega58Anemone		ROV17
Anemone	4	S	S/L		x			Mega53Anemone		ROV17
Anemone	5	S	S/L		x			Mega62Anemone		ROV17
Anemone	6	S	S		x			Mega119Anemone		ROV25
Anemone	7	S	S		x			Mega120Anemone		ROV25
Anemone	8	S	S		x			Mega121Anemone		ROV25
Anemone	9	S	S		x			Mega125Anemone		ROV25
Anemone	10	S	S		x			Mega126Anemone		ROV25
Sponge	1	S	S/L		x			Mega61Sponge	maybe61 is 54	ROV17
Sponge	2	S	S/L		x			Mega54Sponge	maybe61 is 54	ROV17
Sponge	3	S	S/L		x			Mega70SPonge		ROV17
Sponge	4	S	P		x			Mega73Sponge		ROV18
Sponge	5	S	S		x			Mega128Sponge		ROV25
Sponge	6	S	S		x			Mega123Sponge		ROV25
Coral	1	P	S/L	x				Mega63Coral		ROV17
Coral	2	P	S/L	x				Mega66Coral		ROV17
Coral	3	P	S/L	x				Mega72Coral	no ROV pic	ROV17
Coral	4	S	S	x				Mega117Coral		ROV25
Brittlestar	1	S	S/L		x			Mega55brittlestar		ROV17
Brittlestar	2	P	S/L		x			Mega64brittlestar		ROV17
Brittlestar	3	S	S/L		x			Mega65brittlestar		ROV17
Brittlestar	4	S	S/L	x			x	Mega56brittlestar		ROV17
Brittlestar	5	P	S/L	x			x	Mega69brittlestar		ROV17
Brittlestar	6	P	S/L	x			x	Mega68brittlestar		ROV17
Brittlestar	7	S	P		x			Mega106Brittlestar		ROV22
Brittlestar	8	S	S	x			x	Mega118Brittlestar		ROV25
Brittlestar	9	S	S		x			Mega129brittlestar		ROV25
Brittlestar	10	S	S		x			Mega122brittlestar		ROV25
Brittlestar	11	S	S	x				Mega124brittlestar		ROV25
Brittlestar	12	S	S	x				Mega127brittlestar		ROV25
Brittlestar	13	S	S		x			Mega130brittlestar	no ROV pic	ROV25
Seacucumber	1	S	P			x		Mega52Seacucumber		ROV17

Seacucumber	2	S	P		x	Mega60Seacucumber	ROV17
Seacucumber	3	S	P	x	x	Mega71Seacucumber	ROV17
Seacucumber	4	S	P		x	Mega74Seacucumber	ROV18
Seacucumber	5	S	P		x	Mega75Seacucumber	ROV20
Seacucumber	6	S	P		x	Mega76Seacucumber	ROV20
Seacucumber	7	S	P		x	Mega77Seacucumber	ROV20
Seacucumber	8	S	P		x	Mega78Seacucumber	ROV20
Seacucumber	9	S	P		x	Mega105Seacucumber	ROV22
BEL-ThinPlume							
Anemone	1	S	S	x		Mega107Anemone	ROV23
Anemone	2	S	S	x		Mega109Anemone	ROV23
Anemone	3	S	S	x		Mega110Anemone	ROV23
Brittlestar	1	S	S	x		Mega108Brittlestar	ROV23

5.11 Macrofauna

(P. Esquete, A. Bouriat, B. Esteban, A. Henningsen)

5.11.1 Research objectives

In terms of macrofauna sampling, the objectives of the SO295 cruises were twofold:

1. Monitoring the direct impact of Patania II collector in the macrofaunal community structure and composition 1.5 years after the test in the GER and BEL areas.

2. Monitoring the impact of the re-sedimentation of the sediment plume generated during Patania II collector test in the macrofaunal community structure and composition after 1.5 years, in the the GER and BEL areas.

5.11.2 Sampling strategy

The macrofauna was quantitatively sampled by means of a spade box-corer (see chapter 5.7). A balanced Before/After Control/Impact sampling design was planned for the baseline study. In each of the GER and BEL areas, 5 box-core samples were planned in the Reference, (i.e. control) and collector (i.e. direct impact), thick cover (i. e. thicker sediment redeposition of the plume) and thin cover (i. e. thinner sediment redeposition of the plume) sites. However, it was noted that a) The video and photo imaging obtained during SO295 does not allow to visually distinguish a “thin cover” resedimentation from the natural variability within an area, and b) preliminary results from previous cruises indicate that the size and abundance of nodules, as well as the macrofaunal communities from the reference sites are significantly different and hence not representative of the trial sub-areas. Consequently, it was decided to a) cancel the sampling in “thin cover” sites and b) select and sample one site at GER and another at BEL trial sites that were not influenced by the plume (i. e., at least 100 m to the SE and NW of the collector sites, respectively) and use them as control sites. For both, we selected a site already sampled during IP21 cruise.

Due to the problems with the positioning system three of the deployments planned for the collector site of the GER area (BC07, B13, BC14) and one for the collector site of the BEL area (BC26) touched the seafloor out of the collector tracks. That was assessed by visual examination of the sample on deck (see Tab. 5.7.1) and verified by visualizing the photo mosaic and side-scan sonar map taken with the AUV in a GIS software (see Chapter 5.2). The three deployments were considered “thick cover” sites because of their actual location, proximity to collector site and consistency of the sediment.

5.11.3 Preliminary results

Metazoans of the upper 0-3 cm sediment layer of each box-core were sorted, identified down to the lowest practical taxonomic level and counted on board. Preliminary results are limited to the infaunal taxa and exclude epifaunal taxa, such Bryozoa, Cnidaria and Brachiopoda.

A total of 2715 specimens from 43 succesful box-core deployments were sorted onboard. At phylum level, the Arthropoda and Annelida were the two dominant taxa.

Table 5.11.1 Abundance of infaunal phyla from the top layer of quantitative box-cores study. Samples are ordered by areas (GER, BEL) and by sites (Reference, REF; Collector, COL; Plume, PLU; Control, CTL).

site	BC	Annelida	Arthropoda	Mollusca	Echinodermata	Nematoda	Others	total
GER REF	BC01	31	22	5	1	23	2	**84**
GER REF	BC02	23	47	3		26	2	**101**
GER REF	BC03	17	25	4	2	6	4	**58**
GER REF	BC04	26	28		3	7	1	**65**
GER REF	BC05	45	64	14	2	15	1	**141**
GER COL	BC06	9	24	1	1	1	2	**38**
GER PLU	BC07	15	14	7		1	2	**39**
GER PLU	BC08	23	39	6	2	10		**80**
GER PLU	BC09	21	48	11	2	7		**89**
GER PLU	BC10	16	23	1	2	8	2	**52**
GER PLU	BC11	20	43	4	2	10	1	**80**
GER PLU	BC12	23	23	3		6	3	**58**
GER COL	BC13	17	59	8	3	14	1	**102**
GER PLU	BC14	19	54	5	2	17	2	**99**
GER COL	BC15	6	17	4	2	7		**36**
GER COL	BC16	15	29	3	1	7	1	**56**
GER COL	BC17	4	23	1	2	4		**34**
GER COL	BC18	7	22			3	1	**33**
GER CTL	BC19	27	38	5	3	9		**82**
GER CTL	BC20	23	19	11	2		1	**56**
GER CTL	BC21	26	48	5	1	4		**84**
GER CTL	BC22	25	34	3		9		**71**
GER CTL	BC23	22	36	5		9		**72**
BEL COL	BC24	6	22	1		3	1	**33**
BEL COL	BC25	6	21	5		2		**34**
BEL PLU	BC26	12	25	9	1	7	2	**56**
BEL COL	BC27	1	19	2		7		**29**
BEL COL	BC28	7	24			4	2	**37**
BEL COL	BC29	12	35	5		3		**55**
BEL PLU	BC30	15	39	7		5	1	**67**
BEL PLU	BC31	10	21	2		4		**37**
BEL PLU	BC32	8	33	4		6	3	**54**
BEL PLU	BC33	17	30	4	1	8	1	**61**
BEL REF	BC35	9	26	6		15	2	**58**
BEL REF	BC36	11	36	1		6	1	**55**
BEL REF	BC37	8	23	1		9	1	**42**
BEL REF	BC40	5	53	2	2	4	2	**68**
BEL REF	BC41	16	45	5	1	14	3	**84**
BEL CTL	BC42	17	33	1	1	7	2	**61**
BEL CTL	BC44	14	35	1	2	7	1	**60**
BEL CTL	BC45	10	49	8		10	3	**80**
BEL CTL	BC46	21	36	2	1	12	2	**74**
BEL CTL	BC47	16	27	4		9	4	**60**
Total		**681**	**1411**	**179**	**42**	**345**	**57**	**2715**

For both areas, the abundances were significantly lower in the collector sites. There were no significant differences between the reference, control or thick cover sites, not between areas (Fig. 5.11.1).

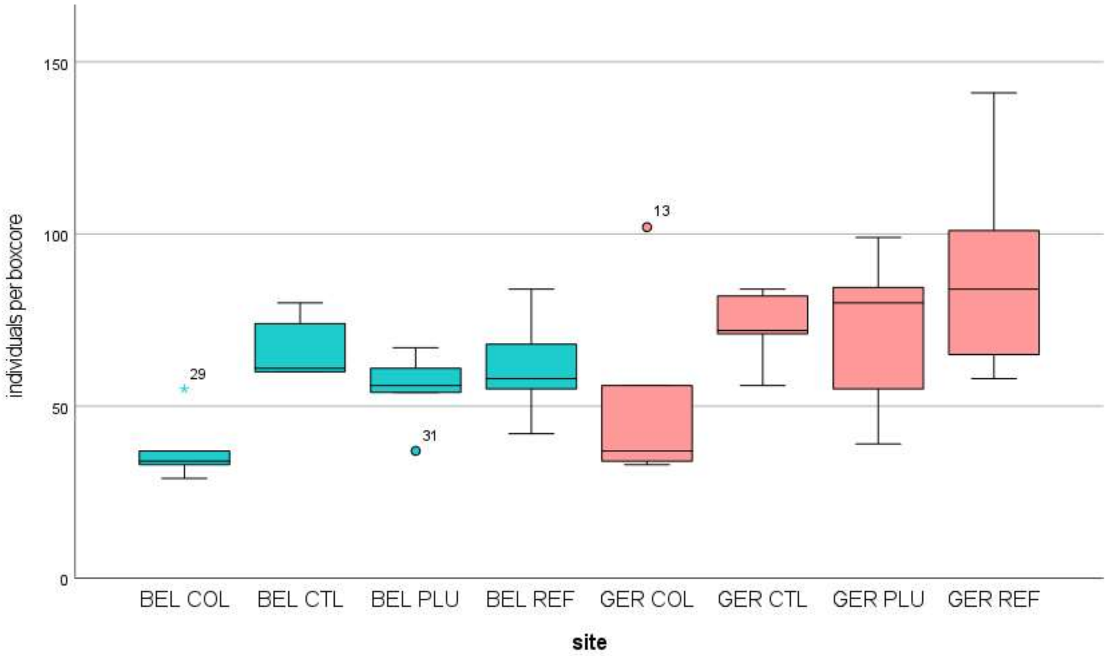


Fig. 5.11.1 Box-plots of the bundances of infaunal macrofauna from the top layer of quantitative study. Samples are ordered by working areas (GER, BEL) and by sites (Reference, REF; Collector, COL; Plume, PLU; Control, CTL).

5.11.4 Upcoming 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

(S. Khodami, F. Schiller, B. Estévan Vazquez, G. Dambrowski, T. Naira, A. Henningsen, P. Martinez Arbizu)

5.12.1 Research objectives

The aim of the study was to assess the recovery of the meiofauna communities from the PATANIA II collector test 1.5 years after disturbance. The abundance (standing stocks) of the meiofauna will be determined using sampled fixed in formalin. These samples can also be used to assed the diversity of the meiofauna communities. Diversity will also be determined using genetic and proteomics methods. For metabarcoding and proteomics studies, samples were fixed in ethanol.

5.12.2 Sampling strategy

Samples were taken on 3 levels of disturbance, a.) directly in the collector area, b.) in the thick plume deposition area and in a reference area. In addition, samples were taken across a gradient of plume deposition. Same strategy was applied to in the BGR and the GSR contractor areas.

At each of these disturbance levels at least 5 multicorers were deployed. The cores have been photographed prior processing (Fig. 5.12.1). From each deployment up to 7 cores have been fixed in 96% undenatured ethanol for genetics and proteomics and 3 cores in 4% formaldehyde solution for abundance and morphological analyses. For both treatments the meiofauna community has been separated from overlaying water of each core using a 40 µm sieve and washed into a 1000 ml jar. Then the cores were inserted into an extruder and 0-5 cm of the sediment has been sliced and transferred to the same jar. Nodules have been separated from the cores (when present at upper 5 cm layer) and washed through the 40 µm sieve to collect the meiofauna from the surface of the nodules into the sample jar and the nodules were fixed in separate jars. Ethanol or formalin were used as fixative for each treatment. The Ethanol samples were stored at -20°C and the formalin samples at room temperature. To ensure the suitable concentration of ethanol (more than 70%) the ethanol of each sample has been exchanged after 24-48 h. Table 5.12.1 refers to the distribution of cores per deployment for meiofauna.

Fig. 5.12.1 Examples of cores prior processing for meiofauna.

Table 5.12.1 List of the allocated cores of the multiple corers per deployment for meiofauna.

Station	Core	Treatment	Jar_ID	Stored at	Sample unit	Fixative	Area
15	12	Morphology	16	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
15	13	Morphology	17	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
15	14	Metabarcoding	18	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
15	15	Metabarcoding	19	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
15	17	Metabarcoding	20	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
15	18	Morphology	21	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
15	19	Proteomics	22	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
16	17	Morphology	23	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
16	18	Morphology	24	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
16	14	Metabarcoding	25	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
16	16	Metabarcoding	26	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
16	12	Metabarcoding	27	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
16	13	Metabarcoding	28	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
16	19	Proteomics	29	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
16	20	Proteomics	30	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
24	12	Morphology	31	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
24	13	Morphology	32	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
24	16	Metabarcoding	33	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
24	17	Metabarcoding	34	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
24	18	Metabarcoding	35	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
24	19	Proteomics	36	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
25	12	Morphology	37	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
25	13	Morphology	38	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
25	15	Metabarcoding	39	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
25	16	Metabarcoding	40	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
25	17	Metabarcoding	41	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
25	18	Metabarcoding	42	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
25	19	Proteomics	43	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
25	20	Proteomics	44	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
27	12	Morphology	45	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
27	13	Morphology	46	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Reference
27	14	Metabarcoding	47	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
27	15	Metabarcoding	48	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
27	16	Metabarcoding	49	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
27	17	Metabarcoding	50	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
27	18	Metabarcoding	51	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
27	20	Proteomics	52	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Reference
33	12	Morphology	53	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
33	13	Morphology	54	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
33	14	Metabarcoding	55	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
33	15	Metabarcoding	56	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
33	16	Metabarcoding	57	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
33	17	Metabarcoding	58	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
33	18	Metabarcoding	59	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
33	19	Proteomics	60	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact

Station	Core	Treatment	Jar_ID	Stored at	Sample unit	Fixative	Area
33	20	Proteomics	61	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
34	12	Morphology	62	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
34	13	Morphology	63	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
34	14	Metabarcoding	64	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
34	15	Metabarcoding	65	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
34	16	Metabarcoding	66	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
34	17	Metabarcoding	67	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
34	18	Metabarcoding	68	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
34	19	Proteomics	69	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
34	20	Proteomics	70	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
46	12	Morphology	72	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick
46	13	Morphology	73	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick
46	14	Metabarcoding	75	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
46	15	Metabarcoding	77	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
46	16	Metabarcoding	79	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
46	17	Metabarcoding	80	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
46	18	Metabarcoding	82	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
46	19	Proteomics	84	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
46	20	Proteomics	86	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
47	12	Morphology	88	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick
47	13	Morphology	90	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick
47	14	Metabarcoding	92	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
47	15	Metabarcoding	94	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
47	16	Metabarcoding	96	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
47	17	Metabarcoding	98	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
47	18	Metabarcoding	100	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
47	19	Proteomics	102	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
47	20	Proteomics	104	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
57	12	Morphology	106	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick
57	13	Morphology	108	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick
57	14	Metabarcoding	112	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
57	15	Metabarcoding	114	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
57	16	Metabarcoding	116	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
57	17	Metabarcoding	118	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
57	18	Metabarcoding	120	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
57	19	Proteomics	122	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
57	20	Proteomics	124	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
58	12	Morphology	126	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick
58	13	Morphology	128	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick
58	14	Metabarcoding	129	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
58	15	Metabarcoding	131	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
58	16	Metabarcoding	133	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
58	17	Metabarcoding	135	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
58	18	Metabarcoding	137	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
58	19	Proteomics	139	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
58	20	Proteomics	141	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
65	12	Morphology	144	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick

Station	Core	Treatment	Jar_ID	Stored at	Sample unit	Fixative	Area
65	13	Morphology	146	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact thick
65	14	Metabarcoding	148	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
65	15	Metabarcoding	149	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
65	16	Metabarcoding	150	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
65	17	Metabarcoding	151	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
65	18	Metabarcoding	152	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
65	19	Proteomics	153	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
65	20	Proteomics	154	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact thick
66	12	Morphology	162	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
66	13	Morphology	163	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
66	14	Metabarcoding	164	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
66	15	Metabarcoding	165	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
66	16	Metabarcoding	166	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
66	17	Metabarcoding	167	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
66	18	Metabarcoding	168	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
66	19	Proteomics	169	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
66	20	Proteomics	170	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
72	12	Morpholgy	174	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
72	13	Morpholgy	175	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
72	14	Metabarcoding	176	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
72	15	Metabarcoding	177	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
72	16	Metabarcoding	178	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
72	17	Metabarcoding	179	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
72	18	Metabarcoding	180	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
72	19	Proteomics	181	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
72	20	Proteomics	182	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
85	12	Morphology	202	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
85	13	Morphology	203	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
85	14	Metabarcoding	204	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
85	15	Metabarcoding	205	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
85	16	Metabarcoding	206	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
85	17	Metabarcoding	207	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
85	18	Metabarcoding	208	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
85	19	Proteomics	209	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
85	20	Proteomics	210	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
92	05	Metabarcoding_SaltTest	329	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Collector Impact
92	12	Morphology	231	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
92	13	Morphology	232	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
92	14	Metabarcoding	233	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
92	15	Metabarcoding	234	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
92	16	Metabarcoding	235	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
92	17	Metabarcoding	236	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
92	18	Metabarcoding	237	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
92	19	Proteomics	238	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
92	20	Proteomics	239	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
93	02	Morphology	274	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
93	04	Morphology	275	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact

Station	Core	Treatment	Jar_ID	Stored at	Sample unit	Fixative	Area
93	09	Morphology	276	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
93	12	Morphology	248	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
93	13	Morphology	249	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
93	14	Metabarcoding	250	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
93	15	Metabarcoding	251	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
93	16	Metabarcoding	252	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
93	17	Metabarcoding	253	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
93	18	Metabarcoding	254	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
93	19	Proteomics	255	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
93	20	Proteomics	256	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
97	02	Morphology	269	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
97	03	Morphology	270	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
97	04	Morphology	271	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
97	07	Morphology	272	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
97	12	Morphology	260	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
97	13	Morphology	261	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Collector Impact
97	14	Metabarcoding	262	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
97	15	Metabarcoding	263	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
97	16	Metabarcoding	264	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
97	17	Metabarcoding	265	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
97	18	Metabarcoding	266	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
97	19	Proteomics	267	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
97	20	Proteomics	268	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Collector Impact
106	02	Metabarcoding_SaltTest	286	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 220m NW of tracks
106	04	Metabarcoding_SaltTest	287	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 220m NW of tracks
106	06	Metabarcoding_SaltTest	288	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 220m NW of tracks
106	07	Metabarcoding_SaltTest	289	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 220m NW of tracks
106	08	Metabarcoding_SaltTest	290	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 220m NW of tracks
106	12	Morphology	277	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 220m NW of tracks
106	13	Morphology	278	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 220m NW of tracks
106	14	Metabarcoding	279	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
106	15	Metabarcoding	280	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
106	16	Metabarcoding	281	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
106	17	Metabarcoding	282	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
106	18	Metabarcoding	283	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
106	19	Proteomics	284	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
106	20	Proteomics	285	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
107	01	Metabarcoding_SaltTest	316	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 220m NW of tracks
107	02	Metabarcoding_SaltTest	315	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 220m NW of tracks
107	04	Metabarcoding_SaltTest	314	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 220m NW of tracks
107	08	Metabarcoding_SaltTest	353	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 220m NW of tracks
107	12	Morphology	305	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 220m NW of tracks
107	13	Morphology	306	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 220m NW of tracks
107	14	Metabarcoding	307	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
107	15	Metabarcoding	308	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
107	16	Metabarcoding	309	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
107	17	Metabarcoding	310	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks

Station	Core	Treatment	Jar_ID	Stored at	Sample unit	Fixative	Area
107	18	Metabarcoding	311	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
107	19	Proteomics	312	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
107	20	Proteomics	313	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 220m NW of tracks
113	12	Morphology	331	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 290m NW of tracks
113	13	Morphology	332	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 290m NW of tracks
113	14	Metabarcoding	333	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 290m NW of tracks
113	15	Metabarcoding	334	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 290m NW of tracks
113	16	Metabarcoding	335	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 290m NW of tracks
113	17	Metabarcoding	336	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 290m NW of tracks
113	18	Metabarcoding	337	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 290m NW of tracks
113	19	Proteomics	338	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 290m NW of tracks
113	20	Proteomics	339	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 290m NW of tracks
113	04	Metabarcoding_SaltTest	340	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 290m NW of tracks
113	01	Metabarcoding_SaltTest	341	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 290m NW of tracks
115	04	Metabarcoding_SaltTest	365	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 150m NW of tracks
115	05	Metabarcoding_SaltTest	366	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 150m NW of tracks
115	08	Metabarcoding_SaltTest	378	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 150m NW of tracks
115	12	Morphology	356	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 150m NW of tracks
115	13	Morphology	357	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 150m NW of tracks
115	14	Metabarcoding	358	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 150m NW of tracks
115	15	Metabarcoding	359	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 150m NW of tracks
115	16	Metabarcoding	360	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 150m NW of tracks
115	10	Metabarcoding	361	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 150m NW of tracks
115	18	Metabarcoding	362	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 150m NW of tracks
115	19	Proteomics	363	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 150m NW of tracks
115	20	Proteomics	364	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 150m NW of tracks
116	08	Metabarcoding_SaltTest	389	RT	0-5 cm + surfacewater	Salt (NaOH) saturated	GER Plume impact 500m NW of tracks
116	12	Morphology	380	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 500m NW of track
116	13	Morphology	381	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 500m NW of tracks
116	14	Metabarcoding	382	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m NW of tracks
116	15	Metabarcoding	383	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m NW of tracks
116	16	Metabarcoding	384	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m NW of tracks
116	17	Metabarcoding	385	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m NW of tracks
116	18	Metabarcoding	386	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m NW of tracks
116	19	Proteomics	387	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m NW of tracks
116	20	Proteomics	388	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m NW of tracks
117	12	Morphology	403	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 500m SE of tracks
117	13	Morphology	404	RT	0-5 cm + surfacewater	4% Formaldehyd	GER Plume impact 500m SE of tracks
117	14	Metabarcoding	405	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m SE of tracks
117	15	Metabarcoding	406	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m SE of tracks
117	16	Metabarcoding	407	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m SE of tracks
117	17	Metabarcoding	408	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m SE of tracks
117	18	Metabarcoding	409	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m SE of tracks
117	19	Proteomics	410	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m SE of tracks
117	20	Proteomics	411	-20°C	0-5 cm + surfacewater	96% EtOH undenatured	GER Plume impact 500m SE of tracks

5.12.3 Preliminary results

No preliminary observations from Meiofauna were done on board.

5.12.4 Upcoming work

At home laboratories meiofauna have been extracted from the sediment using a density separation method with a coloidal gel (Levasil or Ludox). For metabarcoding, genomic DNA will be extracted from the bulk meiofauna samples, and a gene fragment will be amplified for each sample. The frequently used hypervariable V1V2 fragment of 18S rDNA gene which is proved to be adequate to assess the biodiversity of metazoan meiofauna will be investigated here for the metabarcoding approach. For quantitative assessment of the standing stocks, formalin-fixed samples will be used, as the fixation of the specimens is better.

5.13 Microbiology

(M. Molari, J. Barz, G. Luongo, D. Sevilgen, D. Vlach, F. Janssen)

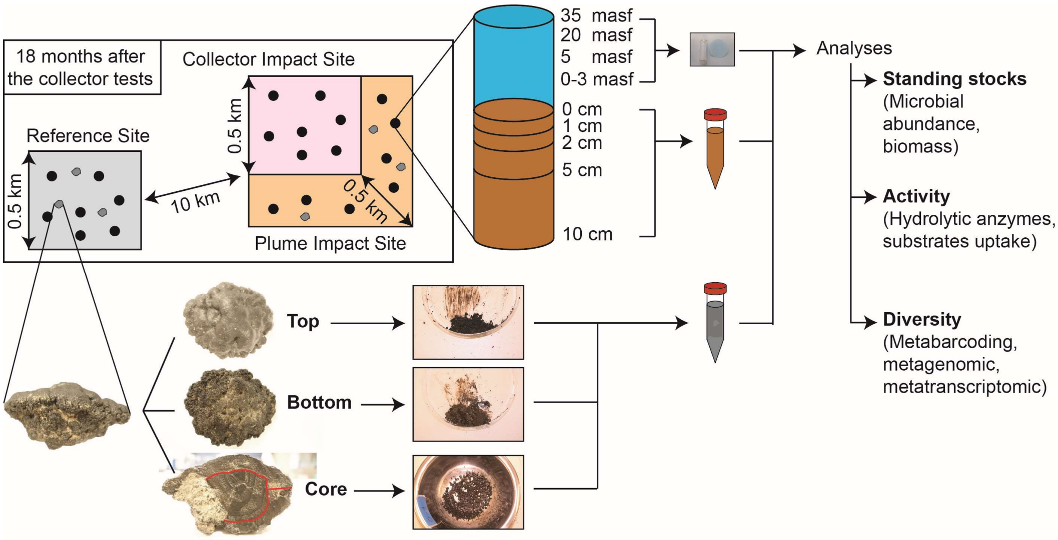


Fig. 5.13.1 Organizational chart of work programme to study the impact of an industrial pre-prototype collector ('PATANIA II' of the Belgian company DEME GSR) for mining polymetallic nodules on microbial communities after 18 months after the tests. (masf: meters above sea floor).

Seawater

Seawater samples were collected by MPI with 12 L Niskin bottles from CTD casts at the Reference and Thick Sediment Coverage sites in BEL and GER working areas. Additionally, bottom seawater samples were collected at Reference, Thick Sediment Coverage and Collector sites in BGR area using Bottom Water Sampler (BWS; Table 5.13.1). Seawater samples from Niskin bottles of BWS were combined and mixed to have 0.3−2 m asf bottom seawater layer, which was then subsampled for different analyses. The seawater samples were processed for cell counting (DAPI and fluorescent in situ hybridization [FISH]), DNA extraction (for microbial taxonomic diversity), characterization of dissolved organic carbon (DOC; analyses at ICBM Oldenburg), quantification of particulate organic carbon (POC; analyses at AWI Bremerhaven), extracellular enzymatic activities (EEA), and microbial activity based on radio-isotopes uptake.

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.

To retrieve POC, 6 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 the AWI (S. Kasten).

The hydrolysis of the fluorogenic substrate analogous β-glucoside (MUF-β), N-acetyl-glucosamine (MUF-N-Ac), leucine (MCA), and fluorescein diacetate (FDA) was measured to estimate potential activity rates of β-glucosidase, chitobiase, aminopeptidase, and esterase, respectively. Seawater samples (3 mL) were incubated in the dark at a final concentration of 10 µM for MUF-B and FDA, 100 µM for MUF-N-Ac, and 500 µM MCA. Due to a malfunctioning of the fluorometer, the anzyme assays were not measured on board. The incubations were stopped at four different interval times (0, 12, 24, 48 h) by freezing at −80°C. The fluorechse will be measured in the MPI laboratory.

The microbial activity of pelagic microbes was assessed by measuring the incorporation rates of ^{3}H-leucine and ^{14}C-bicarbonate. For each water assay, 40 mL of seawater was amended with 14C-bicarbonate at final activity of 0.5 µCi/mL or with ^{3}H-leucine and leucine mix (1:4) at final concentration of 5 nM, and incubated in the dark at *in situ* temperature. Incubation times were of 12 and 72 hours for leucine and bicarbonate, respectively. All incubations were stopped with addition of 2.2 mL of formaldehyde 37%. The 14C-bicarbonate samples were stored at 4°C until further analysis at the MPI laboratories. 3H-leucine samples were filtered through 0.2-um polycarbonate filter (Millipore), rinsed three times with 5 mL of 5% TCA (ice-cold), and then placed in 6 mL scintillation vial and stored at −20°C until further analysis at the MPI laboratories

Table 5.13.1 Descrition of samples collected for microbiology at CTD and BWS stations. masf: meters above sea floor; POC: particulate organic carbon; DOC: dissolved organic carbon.

Station	Gear	Niskin no.	Depth [masf]	Purpose
SO295_004	CTD	7	5	microbial taxonomic diversity
SO295_004	CTD	8	5	microbial abundance, activity, POC and DOC
SO295_004	CTD	3	20	microbial taxonomic diversity
SO295_004	CTD	4	20	microbial abundance, activity, POC and DOC
SO295_004	CTD	1	35	microbial taxonomic diversity
SO295_004	CTD	2	35	microbial abundance, activity, POC and DOC
SO295_037	BWS	all	0.3-2	microbial taxonomic diversity, abundance, activity, POC and DOC
SO295_050	BWS	all	0.3-2	microbial taxonomic diversity, abundance, activity, POC and DOC
SO295_052	CTD	7	5	microbial taxonomic diversity
SO295_052	CTD	8	5	microbial abundance, activity, POC and DOC
SO295_052	CTD	3	20	microbial taxonomic diversity
SO295_052	CTD	4	20	microbial abundance, activity, POC and DOC

SO295_052	CTD	1	35	microbial taxonomic diversity
SO295_052	CTD	2	35	microbial abundance, activity, POC and DOC
SO295_071	BWS	all	0.3-2	microbial taxonomic diversity, abundance, activity, POC and DOC
SO295_128	CTD	22	5	microbial taxonomic diversity
SO295_128	CTD	3	5	microbial abundance, activity, POC and DOC
SO295_128	CTD	23	20	microbial taxonomic diversity
SO295_128	CTD	4	20	microbial abundance, activity, POC and DOC
SO295_128	CTD	24	35	microbial taxonomic diversity
SO295_128	CTD	5	35	microbial abundance, activity, POC and DOC
SO295_153	CTD	3	5	microbial taxonomic diversity
SO295_153	CTD	6	5	microbial abundance, activity, POC and DOC
SO295_153	CTD	4	20	microbial taxonomic diversity
SO295_153	CTD	7	20	microbial abundance, activity, POC and DOC
SO295_153	CTD	5	35	microbial taxonomic diversity
SO295_153	CTD	8	35	microbial abundance, activity, POC and DOC

The CTD rosette casts at GSR and BGR were equipped with *in situ* pumps (ISP; WTS-LV Large Volume Pumps, McLane) to retrieve large sufficient amounts of microbial cells for metatranscriptomic and genomic analyses (Table 5.13.1). The ISPs were operated at 5 m, 20 m and 35 m above CTD rosette, and the start time and duration of pumping was pre-programmed on board before the deployment. The pumps operated about 180 minutes, and they filter more than 70 L of deep seawater on polycarbonate filters (142 mm diameter; 0.2 µm pore size; Millipore). Directly after retrieval on deck, the filters were sectioned in 6 equal pieces and shock-frozen in liquid nitrogen (each piece into 15 mL Sarstedt tubes) and stored at −80°C until further analysis at the MPI laboratory.

Table 5.13.2 Description of samples collected with In Situ Pumps (ISP).

Station	**Gear**	**ISP**	**m above CTD**	**Volume filtered (L)**	**Purpose**
SO295_004	CTD	Sebastian	10	127	microbial functional diversity and activity
SO295_004	CTD	Frankie	20	103	microbial functional diversity and activity
SO295_004	CTD	Hulda	30	78	microbial functional diversity and activity
SO295_052	CTD	Sebastian	10	252	microbial functional diversity and activity
SO295_052	CTD	Frankie	20	260	microbial functional diversity and activity
SO295_052	CTD	Hulda	30	81	microbial functional diversity and activity
SO295_128	CTD	Sebastian	10	459	microbial functional diversity and activity
SO295_128	CTD	Frankie	20	194	microbial functional diversity and activity
SO295_128	CTD	Hulda	30	0	
SO295_153	CTD	Hulda	10	74	microbial functional diversity and activity
SO295_154	CTD	Frankie	20	310	microbial functional diversity and activity
SO295_155	CTD	Sebastian	30	295	microbial functional diversity and activity

Sediments

Sediment samples for microbiological and phytopigments (e.g. Chlorophyl-*a*) analyses were collected at Reference, Collector, Thick Sediment Covegare sites and along sediment coverage gradient in BGR and GRS areas (Table 5.13.3), for a total of more than 3500 samples. In a temperature controlled laboratory (0-4°C), the cores were subsampled in seven layers of 0-1 cm, 1-2 cm, 2-3 cm, 3-4 cm, 5-7 cm, 7-10 cm. For DNA and RNA extractions, sediment samples were shock-frozen in liquid nitrogen (in 15 mL centrifuge tubes; Sarstedt) and then stored at −20°C and −80°C, respectively. Further samples were fixed with formaldehyde (2% final concentration) for total cell counts via AODC and FISH. After 5-6 hour of fixation at 4°C, FISH samples were washed three times with PBS buffer (with subsequent centrifugation), resuspended in PBS-Ethanol solution (1:1), and stored at −20°C.

Potential organic matter degradation was assessed by measuring extracellular enzymatic activity (EEA). The assays were prepared mixing sediment with filtered bottom seawater at the proportion of 1:1, and adding fluorescent substrates at the final concentration of 100 µM for MUF-B, FDA and MUF-N-Ac, and of 500 µM MCA. The samples are incubated in the dark and at *in situ* temperature on a test tube shaker, and the incubations were stopped by centrifugation and frezzing (at −80°C) of the supernatant at 3 time intervals (60, 180 and 360 minutes). The fluorechse will be measured in the MPI laboratory.

The microbial activity of benthic microbes was assessed by measuring the incorporation rates of ^{3}H-leucine and ^{14}C-bicarbonate. Sediment slurry was prepared mixing sediment and filtered bottom seawater at the proportion of 1:1. For each assay, 1 mL of sediment slurries was amended with 14C-bicarbonate at final activity of 2 µCi/mL or with 3H-leucine and leucine mix (1:4) at final concentration of 300 nM. For sediment layers below 2 cm 70 nM concentration of 3H-leucine and leucine mix (1:4) was applied. The leucine and bicarbonate assays were incubated for 6 and 12 hours in the dark at *in situ* temperature, respectively. All leucine assays were stopped by adding 1 mL of ethanol (99%), while bicarbonate assays were stopped with the addition of 1 mL of formaldehyde 4%. All samples were stored at 4°C until further analysis at the MPI laboratories.

A total of 33 multicorer cores were collected for Computed Tomography (CT; i.e., 3D X-ray analyses) of physical and biogenic sediment structures – 14 in the GSR and 19 in the BGR area (Table 5.13.3). Cores were transferred to the cold lab (4°C) immediately after recovery. Overlying water was removed and discs of polyethylene bubble wrap of the same size as the core liner inner diameter (90mm) were carefully placed on the sediment surface. An agarose-seawater solution (concentration 18g per L) was gently poured on top of the bubble foil. The foil disc minimized mechanical disturbance of the sediment surface by the stream of agarose solution and kept floating on top of the agarose while pouring. This procedure resulted in an agarose-layer of approx. 2 cm thickness that protects the core surface and stabilizes the entire core in preparation for the scanning performed later on horizontally aligned cores. The rubber stopper at the lower end of the core was additionally sealed with insulation tape (33+ Scotch, 3M). At the end of the expedition, the cores were transported back in upright position by airfreight in a cooled container. Before scanning, the air-filled space between the agarose plug and the rubber stopper sealing the upper end of the core liner will be filled with Styrofoam chips for additional mechanical stability. The cores will be scanned by a Philips computer tomography (CT) Brilliance iCT Elite 256 at the hospital 'Klinikum

Bremen-Mitte', Bremen, Germany, with an X-ray source voltage of 120 kV and a current of 300 mA and a resolution of 0.293 mm in the x and y directions and 0.625 mm resolution in the z-direction (0.3 mm reconstruction interval).

Biochemistry work

During the 8 weeks at sea sediment samples for addressing UNIVPM tasks were collected at the Reference, Collector, Thick Sediment Covegare sites and along sediment coverage gradient in the GER and BEL working areas using a TV-guided multicorer (TV-MUC) (Tab. 5.13.3). Additionally, Push Cores were collected from 5 locations within the Collector site in the BGR and GSR area, and 3 Push Cores were collected from the Reference site of the GSR area (Tab. 5.13.3).

Immediately after each deployment, undisturbed cores were sliced in a climate room (4°C) in 5 sediment layers: 0-1 cm, 1-3 cm, 3-5 cm, 5-10 cm, and 10-15 cm.

Samples collected for the biochemical composition of organic matter (OM) were immediately frozen at -20°C, while sub-samples for the analyses of microeukaryotic diversity were frozen at -80°C. Sediment aliquots from the top 1 cm of each core were immediately processed for the analyses of viral production according to Dell'Anno et al. (2009). Briefly, homogenous sediment slurries from each station were prepared by transferring an aliquot of wet sediment into a sterile tube with *in situ* 0.02 µm pre-filtered seawater (dilution 1:1 vol/vol). An aliquot from each slurry was transferred in sterile tubes and diluted with virus-free seawater (final dilution of sediment 1:10 vol/vol). The control sediment sample (T0) was immediately stored at -20°C, while the other samples were incubated in the dark at *in situ* temperature conditions for 3, 6 and 12 hours before being stored at -20°C.

To assess extracellular enzymatic activities, sediment slurries were prepared with *in situ* 0.02 µm pre-filtered seawater (dilution 1:4 vol/vol) and stored at -20°C before further analyses into lab facilities.

Table 5.13.3 Description of samples collected for microbiology at TV-MUC and ROV stations.

Station	Gear	Cores	depth bsf [cm]	Purpose
015	MUC	4	0-10	microbial diversity, abundance and Chlorophyl-a
015	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
015	MUC	6	entire core	sediment structure analysis (X-ray)
015	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
016	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
016	MUC	6	0-10	microbial diversity, abundance and Chlorophyl-a
016	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
024	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
024	MUC	10	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
024	MUC	6	entire core	sediment structure analysis (X-ray)
024	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
025	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a

025	MUC	8	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
025	MUC	6	entire core	sediment structure analysis (X-ray)
025	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
027	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
027	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
027	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
033	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
033	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
033	MUC	6	entire core	sediment structure analysis (X-ray)
033	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
034	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
034	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
034	MUC	6	entire core	sediment structure analysis (X-ray)
034	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
046	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
046	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
046	MUC	6	entire core	sediment structure analysis (X-ray)
046	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
047	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
047	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
047	MUC	6	entire core	sediment structure analysis (X-ray)
047	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
057	MUC	9	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
057	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
057	MUC	6	entire core	sediment structure analysis (X-ray)
057	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
058	MUC	6	0-10	microbial diversity, abundance and Chlorophyl-a
058	MUC	10	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
058	MUC	8	entire core	sediment structure analysis (X-ray)
058	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
065	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
065	MUC	6	0-10	microbial diversity, abundance and Chlorophyl-a
065	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
066	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
066	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
066	MUC	6	entire core	sediment structure analysis (X-ray)
066	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
068	PUC	C1+77	0-10	microbial diversity, abundance and Chlorophyl-a
068	PUC	D5+C8	0-10	microbial diversity, abundance and Chlorophyl-a
068	PUC		0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
068	PUC		0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
068	PUC		0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
068	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production

072	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
072	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
072	MUC	6	entire core	sediment structure analysis (X-ray)
072	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
073	PUC	73+49	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
073	PUC	2+35	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
073	PUC	37+A0	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
073	PUC	23	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
073	PUC	11	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
073	PUC	82	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
085	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
085	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
085	MUC	8	entire core	sediment structure analysis (X-ray)
085	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
092	MUC	8	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
092	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
092	MUC	6	entire core	sediment structure analysis (X-ray)
092	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
093	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
093	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
093	MUC	6	entire core	sediment structure analysis (X-ray)
093	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
097	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
097	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
097	MUC	6	entire core	sediment structure analysis (X-ray)
097	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
100	PUC	C0+9 (50 m)	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
100	PUC	B7 (100 m)	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
106	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
106	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
106	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
107	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
107	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
107	MUC	6	entire core	sediment structure analysis (X-ray)
107	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
113	MUC	9	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
113	MUC	8	0-10	microbial diversity, abundance and Chlorophyl-a
113	MUC	6	entire core	sediment structure analysis (X-ray)
113	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
115	MUC	1	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
115	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
115	MUC	6	entire core	sediment structure analysis (X-ray)
115	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
116	MUC	9	0-10	microbial diversity, abundance, activities, and Chlorophyl-a

116	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
116	MUC	6	entire core	sediment structure analysis (X-ray)
116	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
117	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
117	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
117	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
129	MUC	2	0-10	microbial diversity, abundance and Chlorophyl-a
129	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
129	MUC	8	entire core	sediment structure analysis (X-ray)
129	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
130	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
130	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
130	MUC	6	entire core	sediment structure analysis (X-ray)
130	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
135	PUC	D0+C7 (site A)	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
135	PUC	37+D7 (site B)	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
135	PUC	17+B2 (site C)	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
135	PUC	B5	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
135	PUC	B7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
135	PUC	22	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
139	PUC	C1+54 (site E)	0-10	microbial diversity, abundance and Chlorophyl-a
139	PUC	76+C4 (site D)	0-10	microbial diversity, abundance and Chlorophyl-a
139	PUC	(Site E)	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
139	PUC	(Site D)	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
146	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
146	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
146	MUC	6	entire core	sediment structure analysis (X-ray)
146	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
147	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
147	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
147	MUC	6	entire core	sediment structure analysis (X-ray)
147	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
148	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
148	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
148	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
155	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
155	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
155	MUC	6	entire core	sediment structure analysis (X-ray)
155	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
157	MUC	3	0-10	microbial diversity, abundance and Chlorophyl-a
157	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
157	MUC	6	entire core	sediment structure analysis (X-ray)
157	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production

158	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
158	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
158	MUC	19	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
163	PUC	D7+B2	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
166	MUC	6	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
166	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
166	MUC	10	entire core	sediment structure analysis (X-ray)
166	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
167	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
167	MUC	10	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
167	MUC	6	entire core	sediment structure analysis (X-ray)
167	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
172	MUC	4	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
172	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
172	MUC	6	entire core	sediment structure analysis (X-ray)
172	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
174	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
174	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
174	MUC	7	entire core	sediment structure analysis (X-ray)
174	MUC	9	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
178	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
178	MUC	14	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
178	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
179	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
179	MUC	19	0-10	microbial diversity, abundance and Chlorophyl-a
179	MUC	6	entire core	sediment structure analysis (X-ray)
179	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
180	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
180	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
180	MUC	20	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
187	MUC	14	0-10	microbial diversity, abundance and Chlorophyl-a
187	MUC	20	0-10	microbial diversity, abundance and Chlorophyl-a
187	MUC	5	entire core	sediment structure analysis (X-ray)
187	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
188	MUC	5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
189	MUC	1	0-10	microbial diversity, abundance and Chlorophyl-a
189	MUC	8	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
189	MUC	6	entire core	sediment structure analysis (X-ray)
189	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
195	MUC	20	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
195	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
195	MUC	6	entire core	sediment structure analysis (X-ray)
195	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
197	PUC	D3+11	0-10	microbial diversity, abundance and Chlorophyl-a
202	PUC	75+74	0-10	microbial diversity, abundance, activities, and Chlorophyl-a

202	PUC	78+44	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
202	PUC	66+B5	0-10	microbial diversity, abundance, activities, and Chlorophyl-a
202	PUC	9+22	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
202	PUC	A2+41	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production
205	MUC	5	0-10	microbial diversity, abundance and Chlorophyl-a
205	MUC	10	0-10	microbial diversity, abundance and Chlorophyl-a
205	MUC	7	0-15	OM quantity and composition, microeukaryotic diversity, viral abundance and production

Polymetallic nodules

A total of 3 polymetallic nodules were collected from the surface of Box Corers (BC; Table 5.13.4) at each Reference site and Thick Sediment Covergage site in BGR and GSR areas. The nodules were washed gently with *in situ* temperature and 0.2-µm filtered bottom water, photographed, and stored in sterile filtered bottom seawater at 0-2°C in the dark until further processing. The nodules were subsampled in a temperature-controlled laboratory (0-4°C) within 3 to 12 hours after the nodules collection. Nodules were subsampled in three layers: upper layer exposed to seawater, core layer, and bottom layer buried in the sediments.

Nodule fragments from each layer were processed for RNA extractions (functional diversity) and microbial activity measurements based on radioisotope uptake. To retrieve material for RNA extraction ca. 5-10 mL of nodule fragments were mixed with 35 mL of RNAlater (Ambion) in 50 mL tubes (Sarstedt), incubated for 6-8 hours at 4°C, and then stored at −20°C until further processing at MPI laboratory. For each radioisotope uptake assay, ca. 0.5 mL of manganese fragments was mixed with 0.5 mL of filtered bottom-seawater and the same amount of [14C]-bicarbonate and leucine mix was applied as for the sediment samples. For core and bottom nodule layers 70 nM concentration of leucine mix (1:4) was applied. The leucine and bicarbonate assays were incubated for 6 and 12 hours in the dark at *in situ* temperature, respectively. Both leucine assays and bicarbonate assays were stopped by adding 1 mL of ethanol (99%), and stored at 4°C until further analysis at the MPI laboratories.

Addictionally, polymetaalic nodules from each BC deployment were inspected for fauna, and any visible organism were collected and stored in ethanol (99%) at −20°C. The surface of three nodules from each BC deployment was also scaped with a razor blade, and the removed material was stored at −20°C in 5 mL eppendorf tube contining 2 mL of ethanol (99%). These samples will be used for study taxonomic diversity. The sampling activities were carried out in a temperature-controlled laboratory (0-4°C) by Amber Henningsen (University of Bremen), and coordinated by Sabine Gollner (NIOZ).

Table 5.13.4 Descrition of polymetallic nodules collected and sampled for microbiology.

Station	Gear	Nodule no.	Layers	Purpose
SO295_009	BC	2	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_009	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_011	BC	2	3 (surface, core, bottom)	microbial functional diversity and activity

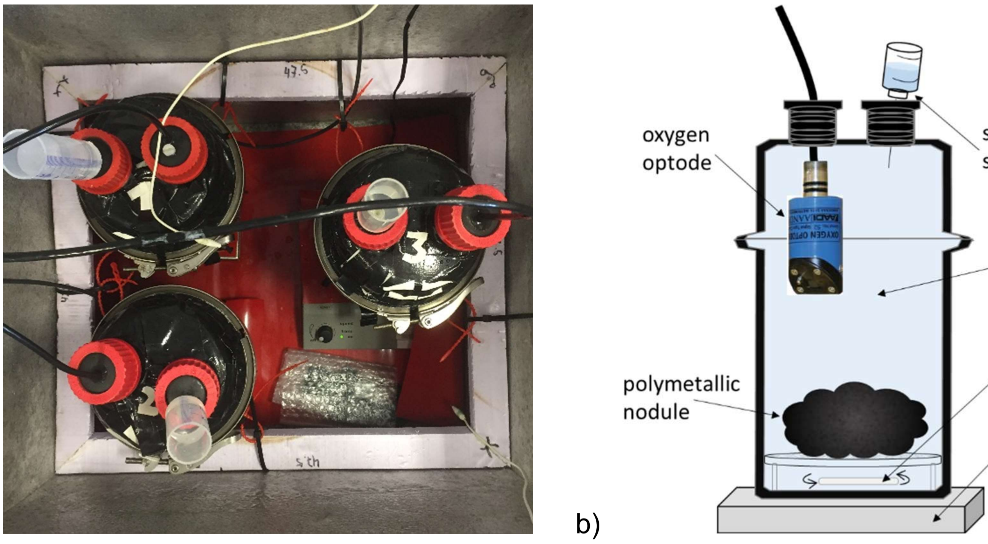
SO295_011	BC	2	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_011	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_022	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_023	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_028	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_038	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_039	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_048	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_049	BC	3	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_049	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_053	BC	3	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_053	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_059	BC	3	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_059	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_060	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_080	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_087	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_099	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_104	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_105	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_111	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_112	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_140	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_142	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_160	BC	1	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_160	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_161	BC	1	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_161	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_169	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_170	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_176	BC	1	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_176	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_177	BC	1	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_177	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_182	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_193	BC	1	3 (surface, core, bottom)	microbial functional diversity and activity
SO295_193	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_194	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_206	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_212	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_213	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_215	BC	3	1 (surface)	microbial taxonomic diversity and fauna
SO295_216	BC	3	1 (surface)	microbial taxonomic diversity and fauna

Nodule incubations to assess nodule-related oxygen respiration rates

Nodule incubations were conducted on board to investigate oxygen respiration rates of the microbiota associated with polymetallic nodules.

Methods and Equipment

For each experiment, three borosilicate glass incubation vessels were installed in a temperature-controlled top loader freezer that was kept at a constant temperature of 1.93 +/- 0.16 °C (Fig. 5.13.2) by means of a custom-built temperature control unit that was connected to two temperature sensors (positioned in the middle of the freezer) and a fan (at the bottom of the freezer) to mix the air in the freezer and keep the temperature distribution homogenous.

a)


b)

Fig. 5.13.2 Nodule incubation setup during SO295. a) three incubation vessels in the freezer seen from above. b) schematic overview of a fully equipped incubation vessel as used during the experiments and seen in a). Photo & schematic: D. Sevilgen.

Each incubation vessel had a total volume of approximately 2900 ml and consisted of a flat flange beaker with a bell-shaped glass lid (Fig. 5.13.2) that were fixed together by a metal ring. Each lid was equipped with two screw cap openings which were closed gastight with butyl rubber stoppers that were fixed with open-topped screw caps. One opening was used to introduce an oxygen optode (type 4330, Aanderaa Data Instruments, Bergen, NO) for continuous and simultaneous monitoring of oxygen concentrations and temperature at one min. intervals. The optode cable was passed through the rubber stopper and fixed with a polyurethane sealing compound to ensure a water- and gastight sealing. The second opening was closed with a stopper that was pierced with a syringe cannula connected to a seawater filled syringe. This allowed for volume compensation when the vessel was closed and served to compensate for small changes in the enclosed water volume by thermal expansion/reduction in response to temperature changes upon handling. Following instructions by the manufacturer, prior to and after the experiments, 2-

point calibrations of the optodes were performed with air saturated and chemically deoxygenated water (sodium dithionite) in the vessels at experimental temperatures.

Each vessel was set on a stirring plate (MIXdrive 1 Eco, 2mag AG, Munich, DE and Variomag Mono Direct, Thermo Fisher Scientific, Waltham, MA, US) that were set to a stirring speed of approx. 200 rpm) and equipped with a Teflon-coated magnetic stirrer bar that was placed at the bottom of the vessel. A perforated plastic disc (diameter 11.5 cm) was placed approx. 2 cm above the bottom of the vessel to serve as a platform for the nodules (Fig. 5.13.2b).

Before each experiment, the vessels, magnetic stirrer bars, stoppers, screw caps and nodule platforms were washed with distilled water, rinsed three times with 0.1M HCl and three times with ultrapure water. Everything but the magnetic stirrer bars were additionally autoclaved for 20 min at 121°C.

Each experiment consisted of three parts: a seawater baseline recording before nodule incubation, the nodule incubation in seawater and a seawater baseline recording after nodule incubation. We aimed at running each part for a duration of 48hrs, however times sometimes varied depending on technical or logistic restraints regarding the sampling schedule on board (see Table 5.13.5). After each part, approximately 1 L of seawater was removed from each vessel using an autoclaved tube until the vessel could easily be opened and offered enough space to place/remove nodules without spilling further contents. The removed water was subsampled for the following analyses:

a) Radiotracer analyses, microbial diveristy, DOC (500ml, unfiltered, Massimiliano Molinari, MPI MM; methods details are described in section 5.13.1)
b) Dissolved organic carbon content (DOC, 25 ml, filtered, Katja Schmidt, BGR)
c) Trace Metal Analyses (TM, 5 ml, filtered, Katja Schmidt, BGR).

Following the removal of the seawater after the first baseline, one to two nodules, depending on their size, were placed on the platform of each vessel. The vessels were re-closed and topped up with fresh seawater from the corresponding sampling site using a tube and taking care to avioid the introduction of air bubbles during filling. After the nodule incubation, water removal and subsampling as detailed above were repeated and the nodule was removed and stored for subsequent epifauna analyses (Sabine Gollner, NIOZ). The incubation vessels were re-closed and topped up with seawater as described above for the recording of the post incubation baseline.

The seawater that was used during the incubations originated from bottom water of the same regions from which nodules were sampled. A detailed overview of all conducted experiments with the origin of nodules and seawater that was used is given in Table 5.13.5.

Prior to each incubation experiment, water from the CTD or Niskin bottles was filled in autoclaved Duran bottles and/or HCL and MQ cleaned canisters, sealed as gastight as possible, to avoid or slow down introduction of atmospheric oxygenation beyond *in situ* concentrations at depth, and stored at 1.5°C in the dark.

Table 5.13.5 Nodule_incubation experiments carried out during SO295. Details are given on experiment names with their respective experimental duration, origin of nodules and seawater used.

Incubation	Incubation part	Nodule origin	Water & nodule sampling Stations	Start times	End times
Nodule incubation 1	baseline before lab 1	GER Ref	004-1_CTD-01	22-11-08 18:00	22-11-22 23:20
	no nodule incubation lab 1		*n.a.*	*n.a.*	*n.a.*
	no baseline after lab 1		*n.a.*	*n.a.*	*n.a.*
Nodule incubation 2	baseline before lab 2	GER Dredge (non-impacted)	004-1_CTD-01	22-11-22 23:34	
	nodule incubation lab 2		089-1_ROV-11, 095-1_ROV-12	22-11-25 16:38	22-11-27 16:37
	no baseline after lab 2		*n.a.*	*n.a.*	*n.a.*
Nodule incubation 3	baseline before lab 3	GER Plume impact thin & Trial baseline time series	120-1_CTD-04 (5 mab)	22-11-28 03:41	
	nodule incubation lab 3		116-1_TVMUC-24, 117-1_TVMUC-25	22-11-29 17:17	
	no baseline after lab 3		*n.a.*	*n.a.*	*n.a.*
Nodule incubation 4	baseline before lab 4	BEL Trial site 1200 m SW of tracks	150-1_CTD-06 (5 mab)	22-12-06 23:27	
	nodule incubation lab 4		156-1_TVMUC-32	22-12-08 04:23	
	baseline after lab 4		150-1_CTD-06 (5 mab)	22-12-10 03:01	22-12-11 23:22
Nodule incubation 5	baseline before lab 5	BEL Trial baseline time series	185-1_ROV-21 (Niskin bottle)	22-12-14 02:08	
	nodule incubation lab 5		206-1_BC-42	22-12-16 03:26	
	baseline after lab 5		185-1_ROV-21 (Niskin bottle)	22-12-19 00:44	22-12-20 04:24

Of the five experiments that were conducted (see Tab. 5.13.5), one from the German (BGR) and one from the Belgian (GSR) license area were fully successful and will primarily be used to derive oxygen consumption rates (*Nodule incubation 3* & *Nodule incubation 4*). *Nodule incubation 1* served to optimize experimental conditions and was run for too many days, finally exhibiting extraordinarily high respiration rates that were considered laboratory artifacts. The incubation was aborted without recording a baseline after the nodule incubation. In *Nodule incubation 2* seawater from *Nodule incubation 1* was used. Once recently sampled water from the same region became available, *Nodule incubation 2* was prematurely aborted and *Nodule Incubation 3* was started. During *Nodule incubation 5* an electricity outage in the laboratory resulted in significantly elevated temperatures for a period of several hours while the nodules were incubated, again leading to stongly elevated respiration rates. Figure 5.13.3 shows data from a successful experiment (Nodule_incubation 4) with water and nodules from the Belgian license area.

Oxygen consumption rates of each experimental part and incubation vessel will be calculated by means of linear regression applied to experimental periods where oxygen decrease was linear (i.e., avoiding periods where the system had not stabilized yet after manipulation). A first analysis shows a tendency of respiration to increase with incubation time and higher respiration rates in seawater baseline recordings after nodule incubations as compared to pre-incubation recordings. It may be hypothesized, that compounds (e.g., DOM) and / or microorganisms are released from the nodules and stimulate respiration in the water column after nodules were removed. While this could be an artifact connected, e.g., to depressurization and warming of the nodules upon recovery, it cannot be ruled out that compounds released from nodules also contribute to bottom water respiration in the natural environment.

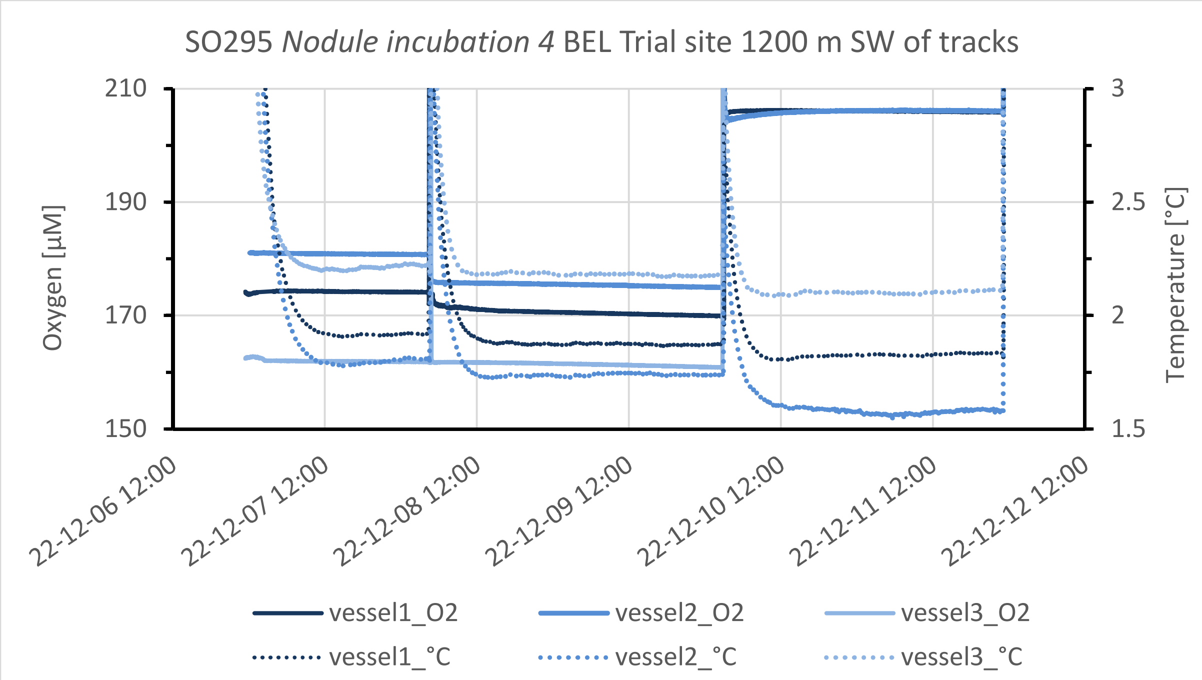


Fig. 5.13.3 Example of Nodule incubation 4 with nodules from a non-impacted site in the Belgian trial area 1200 m SW of the tracks. Baselines seawater respiration without nodules were recorded before and after the nodule incubation. different shades of blue indicate data from the three simultaneously incubated glass vessels. Steep increases in temperature and oxygen concentration are due to handling before, between after the three experimental parts (removing incubation vessel from freezer and opening them to add or remove nodules and remove or add seawater). Changes in oxygen concentration in part two and three of the incubation experiment are due to mixing with bottom water of low concentration that was kept in sealed jars (part 2) and mixing with bottom water that had increased in oxygenation during storage with air headspace (part 3).

5.14 Sediment and Porewater Geochemistry

(K. Schmidt)

Sediment and pore water sampling during SO295

Objectives

In 2021, DEME GSR conducted two trials with the nodule collector pre-prototype Patania II, one 40-hour trial in the GSR contract area B4S03 (37.000 m^2) and another 24-hour trial in the BGR contract area East (22.000 m^2). The tests were accompanied by an independent environmental monitoring by BGR/MiningImpact project (campaign MANGAN2021, cruise IP21; Vink et al., 2022). The Patania II collector removed the upper surface sediment in the course of the collector path and caused the formation of particle plumes, with subsequent particle resettling in the direction of plume dispersal within the collector sites and in the plume impact sites. Such impacts have direct consequences on seafloor integrity and biogeochemical conditions and processes in the surface sediments (König et al. 2001; Haffert et al. 2020; Volz et al. 2020). As biogeochemical processes are directly linked to habitat characteristics and food availability, e.g. through nutrient regeneration during organic matter degradation, changes that result from sediment removal, sediment compaction, and sediment blanketing after resettling of particles form the operational plume will also affect ecosystem functions.

The newly formed sediment surfaces resulting from the collector activity will have a different structure, physical properties, as well as biogeochemical composition compared to undisturbed surface sediment depending on the type of impact, and resulting ecosystem consequences will differ accordingly. A removal of the upper active benthic surface layer is associated with the loss of reactive labile organic carbon and significantly decreases sediment porosity, while sediment blanketing not only influences the environment by smothering of benthic communities, but it will also affect the degree of organic matter degradation, oxygen uptake and respiration rates, fluxes of pore water constituents, and potentially impose toxic effects due to higher metal concentrations. The composition of the resettled sediment is expected to change along the plume dispersal gradient, related to gravitational forces and particle interaction in the plume. Furthermore, the mobilization of trace metals at the sediment-water interface may impose toxic effects on benthic and pelagic fauna and need to be well characterised. Trace metals in surface pore water that are controlled by organic matter degradation and/or reductive oxide mineral dissolution, such as Mn, Co, Ni, Cu, V, REY, typically show a peak close to the sediment-water interface (Paul et al., submitted). Sediment removal and the release of surface pore water may lead to (short-term?) elevated trace metal concentrations in bottom seawater. Mobility and fate of trace metals in the environment and biotic uptake processes are governed by physical fractionation and chemical speciation and hence, a detailed characterisation of trace metal signatures in surface sediments and bottom seawater is important.

In order to be able to evaluate mining-related consequences of sediment removal, re suspension and -deposition, investigations of the pre- and post impact geochemical sediment conditions are crucial. With our investigations during SO295, important first data point in the time series assessing the environmental impacts induced by the mining of polymetallic nodules in the deep seabed after 1.5 years, we aim to characterize the physical disturbances in surface sediments and address the impacts on biogeochemical processes 1.5 years after the Patania II collector operation at the seafloor. We will further investigate potential changes in biogeochemical conditions related to reactive compounds (such as TOC, oxygen, nutrients, dissolved trace metals) over the past 1.5 years, i.e., we will compare the situations at days after the impact to 1.5 years after the impact and deduce potential biogeochemical processes.

The natural variability of the biogeochemical conditions was addressed by continuing the sampling of reference sites established in both working areas.

A comprehensive set of sediment and pore water samples were taken for analyses jointly planned at AWI, JUB, BGR and GEOMAR. Surface sediments (upper 15 to 30 cm) were obtained from with the multi-corer and ROV-operated push cores in the BEL and GER working areas, within the reference sites, the collector sites, and plume impact sites. The pore water fluxes of dissolved organic carbon, total alkalinity, nutrients, and dissolved trace elements as well as sediment porosity and sediment solid phase composition including mineral composition, total organic carbon contents, carbon/nitrogen ratios, amino acid and elemental composition are suggested to be impacted by mining-related activities due to sediment removal and compaction, re-suspension and deposition. Data for these pore water and solid-phase constituents will be used to characterize the geochemical conditions 1.5 years after the impact.

Multicorer sediment sampling

During cruise SO295, a 20-liner Multicorer (MUC) built by Oktopus GmbH was used for multiple sampling, operated with the RV SONNE fibre-optic cable (Fig. 5.14.1 left). The instrument from Senckenberg Institute (SGN) is equipped with twenty 60-cm-long tubes with 100 mm outside diameter each. With an inner diameter of 96 mm, the surface area of each core is 72 cm². With each tube, an intact column (core) of sediment with overlying water and the transitional thick fluffy layer that is formed at the water-sediment interface is sampled.

Fig. 5.14.1 Left: Deployment of the multicorer from RV SONNE (picture: Mirja Bardenhagen). Right: filled sediment cores arrived on deck (picture: Time Kalvelage).

During all deployments the MUC was equipped with the underwater acoustic positioning system Posidonia, mounted 50m above the gear. The MUC was further equipped with a camera (DeepSea Power & Light Nano SeaCam) and telemetry (BGR-VIPR) system customized and provided by BGR, to allow targeted sampling at the seafloor, especially in the collector impact and plume impact sites, and to have video and photo footage of the exact landing positions. The MUC was lowered with 1.0 m/sec down to ca. 50 m above the sea floor. After stopping for few seconds and switching on the camera, the MUC was further lowered with 0.3 m/s until seafloor observation (video monitor). Lowering was stopped and the exact landing position was chosen, than the MUC was placed into the sebed with 0.3-0.5m/s. The gear stayed on the seafloor for about 2 minutes and was then heaved with 0.5 m/s for the first meters of ascent. 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 and brought on board to recover the samples (Fig. 5.14.1 right). The individual cores were distributed between the different working groups and immediately processed.

ROV-guided push core sediment sampling

Surface sediment was also sampled by means of push cores (PUCs) that were handled by an remotely operated vehicle (ROV). ROV KIEL 6000 is a 6000 m rated deep diving platform manufactured by Schilling Robotics LLC, Davis, USA, customized and operated by GEOMAR. The PUCs that were specifically manufactured for the GEOMAR ROV, have an inner diameter of 74 mm and a length of 25 cm. The quivers holding the PUCs were filled with fresh water prior to ROV dives to prevent crushing due to high pressure. The PUCs are operated by the ROV manipulator arm in the following way: The PUC is pulled out of the quiver mounted in a drawer or 6-pack, first shaken to exchange the freshwater with seawater and then pushed into the sediment at a location determined by the observing scientist until satisfied with the length of the core (Fig. 5.14.2).

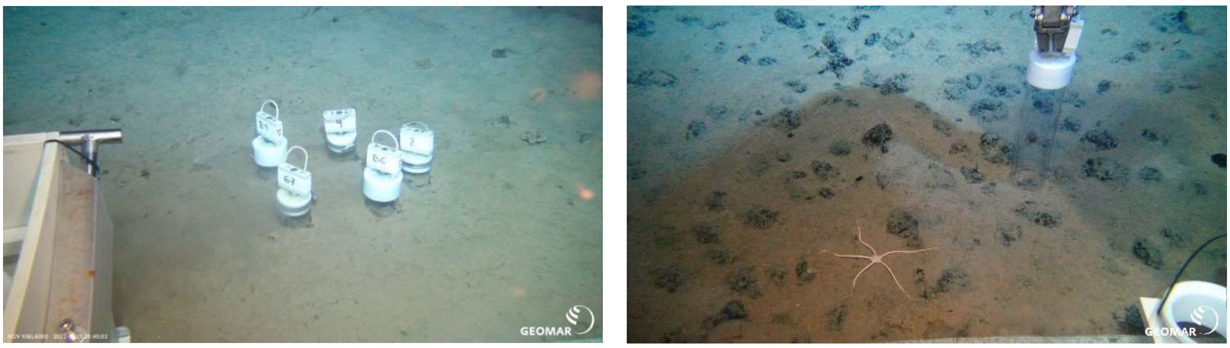


Fig. 5.14.2 Push core sampling during SO295. Left: 083 ROV GER plume impact site, right: 089 ROV GER reference site.

Pictures were taken and the PUC is then pulled out again off the sediment. Due to a rubber lid at the top, under-pressure in the liner is generated that prevents the core from slipping out of the liner. The PUC liner is placed back in the quiver with a stopper at the bottom to secure the sediment core until the ROV finishes its dive and returns to the deck of the vessel. The typical core length is about 20 cm. ROV-guided sediment sampling allows precise selection of the sampling location, e.g. within or between caterpillar tracks in the collector impact sites, between nodules in nodule-covered seafloor, or at a defined sediment coverage in the plume impact sites. Part of the biogeochemistry PUCs were taken in the nodule frame imprints after the restoration experiment frames were recovered. Figure 5.14.3 and 5.14.4 show all PUC sampling locations in the two working areas.

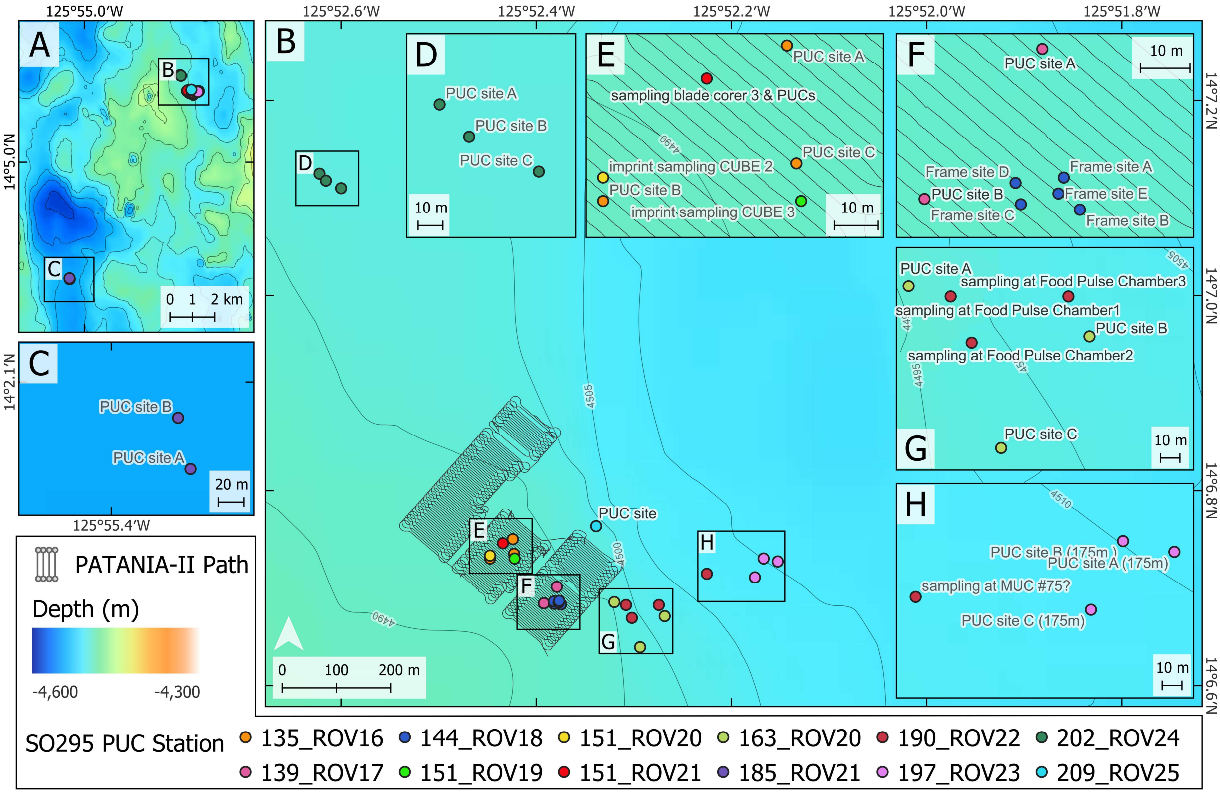


Fig. 5.14.3 Push coring locations in the BEL working area. A: Overview map; B: Trial site with collector impact site and plume impact site (D-H: enlarged maps of sampling locations); C: Reference site.

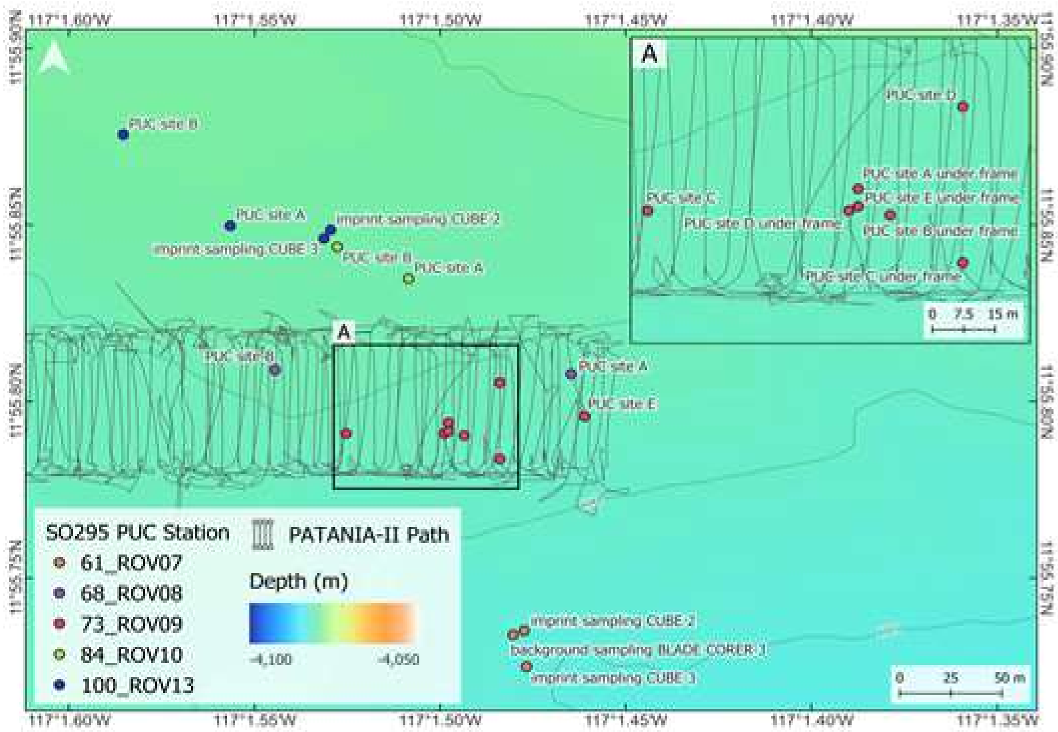


Fig. 5.14.4 Push coring locations in the GER Trial Site. A: Trial site with collector impact site and plume impact site, B: enlarged map of Collector impact site.

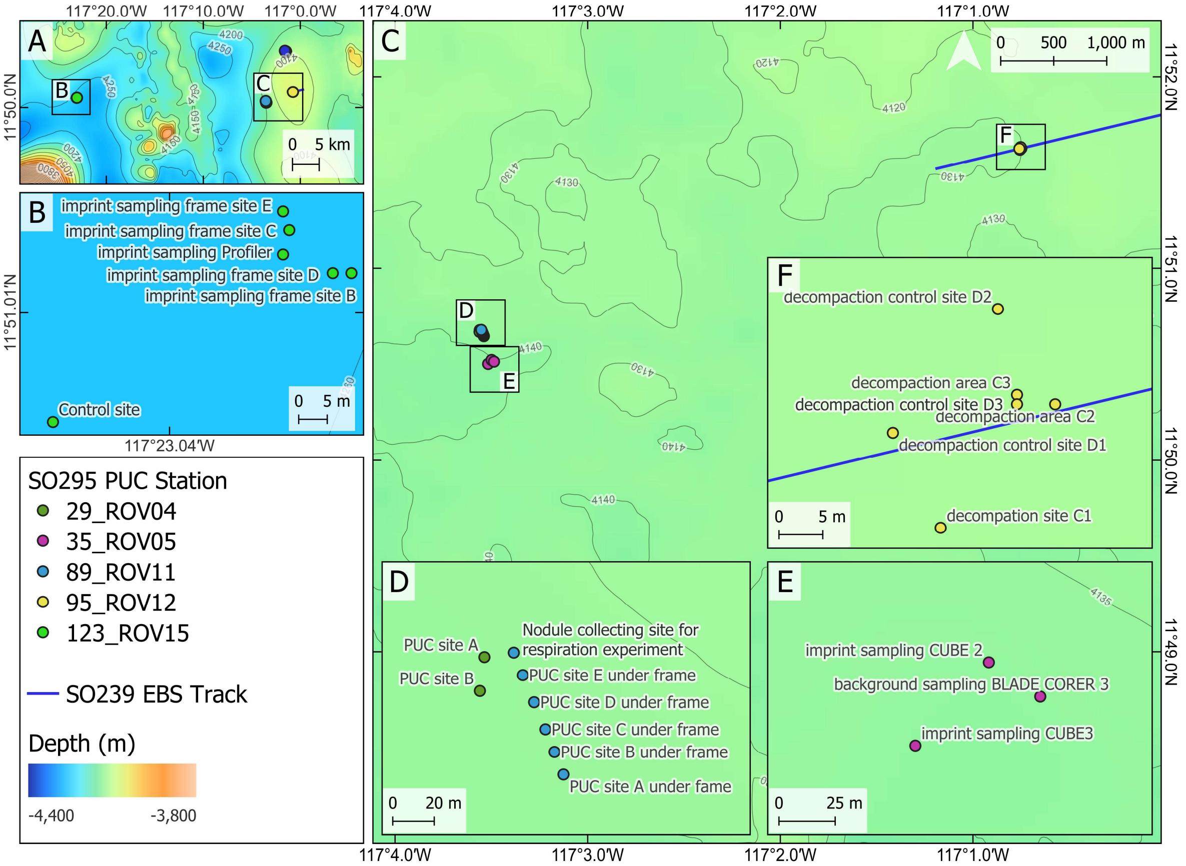


Fig. 5.14.5 Push coring locations in the GER Reference, Dredge Site, and No-Nodule Site. A: Overview map; B: No-Nodule Site; C: Reference Site (insets D+E show details of sampling locations) and Dredge Site (inset F shows details of sampling locations).

Sampling strategy

For sediment biogeochemistry investigations, we usually sampled 2-3 replicate locations per site. In total, 21 MUC stations in the BEL working area and 23 MUC stations in the GER working area were sampled for biogeochemical, mineralogical, and sediment property investigations. We further took two PUC cores in the GER reference site, two cores in the collector impact site and three cores along the plume dispersal gradient in the GER plume impact site. One core was taken in the GER no nodule site. In the BEL working area, we took one core in the reference site, three cores in the collector impact site, two cores in the plume impact site and one core about 600 m NW of the collector impact site. Sampling of the plume deposition gradient was done towards NNW in the GER working area, and towards SE in the BEL working area. Sampling locations are summarized in Table 5.14.1 and 5.14.2.

The imprint of the collector as it drives over the seafloor comprises the two 1.5 m wide caterpillar tracks and the 1 m wide, nodule mined stripe in between. Ideally, the individual tracks should align to each other. However, the caterpillar tracks especially in the GER working area were quite irregular and unmined stripes are found in between. With the MUC, it was difficult to allocate the exact envisaged landing spot between the caterpillar tracks and sometimes, we seemed to miss the collector imprints at the seafloor completely. Collected MUC samples represent a heterogeneous suite of collector track impacts including blanketing. Push coring in the collector impact sites was located between the caterpillar tracks. In the BEL working area, the PUC locations were about 40 m apart, similar to the sampling distances in the reference site. In the GER area, only one successful PUC deployment was conducted in the collector site.

Table 5.14.1 Overview sampling locations for surface sediment collected with MUC.

Station_ID	Area	Site	Latitude [N]	Longitude [W]
S0295_015 MUC	GER	Reference	11° 51.921'	117° 03.057'
S0295_016 MUC	GER	Reference	11° 51.921'	117° 03.057'
S0295_024 MUC	GER	Reference	11° 50.748'	117° 03.522'
S0295_025 MUC	GER	Reference	11° 50.728'	117° 03.450'
S0295_027 MUC	GER	Reference	11° 50.746'	117° 03.384'
S0295_033 MUC	GER	Collector impact	11° 55.716'	117° 01.672'
S0295_034 MUC	GER	Collector impact	11° 55.789'	117° 01.580'
S0295_046 MUC	GER	Plume impact thick	11° 55.768'	117° 01.742'
S0295_047 MUC	GER	Plume impact thick	11° 55.781'	117° 01.614'
S0295_057 MUC	GER	Plume impact thick	11° 55.841'	117° 01.658'
S0295_058 MUC	GER	Plume impact thick	11° 55.844'	117° 01.625'
S0295_065 MUC	GER	Plume impact thick	11° 55.769'	117° 01.568'
S0295_066 MUC	GER	Collector impact	11° 55.577'	117° 01.254'
S0295_072 MUC	GER	Collector impact	11° 55.809'	117° 01.640'
S0295_085 MUC	GER	Collector impact	11° 55.810'	117° 01.619'
S0295_092 MUC	GER	Collector impact	11° 55.785'	117° 01.621'
S0295_093 MUC	GER	Collector impact	11° 55.784'	117° 01.613'
S0295_097 MUC	GER	Collector Impact	11° 55.796'	117° 01.626'
S0295_107 MUC	GER	Plume impact gradient, distance to tracks (m): 220 m NW	11° 55.937'	117° 01.631'
S0295_113 MUC	GER	Plume impact gradient, distance to tracks (m): 2000 m N	11° 56.973'	117° 01.628'
S0295_115 MUC	GER	Plume impact gradient, distance to tracks (m): 150 m NW	11° 55.904'	117° 01.601'
S0295_116 MUC	GER	Plume impact gradient, distance to tracks (m): 500m NW	11° 56.094'	117° 01.692'
S0295_117 MUC	GER	Trial baseline time series 500 m SE	11° 55.632'	117° 01.259'
S0295_129 MUC	BEL	Collector impact	14° 06.746'	125° 52.498'
S0295_130 MUC	BEL	Collector impact	14° 06.761'	125° 52.493'
S0295_146 MUC	BEL	Plume impact thick	14° 06.781'	125° 52.558'
S0295_147 MUC	BEL	Collector impact	14° 06.811'	125° 52.454'
S0295_148 MUC	BEL	Collector impact	14° 06.829'	125° 52.433'
S0295_155 MUC	BEL	Collector Impact	14° 06.795'	125° 52.474'
S0295_156 MUC	BEL	Trial site 1200m SW of tracks	14° 06.101'	125° 52.872'
S0295_157 MUC	BEL	Plume Impact thick	14° 06.685'	125° 52.471'
S0295_158 MUC	BEL	Plume Impact thick	14° 06.672'	125° 52.347'
S0295_166 MUC	BEL	Plume impact thick	14° 06.770'	125° 52.289'
S0295_167 MUC	BEL	Plume impact thick	14° 06.806'	125° 52.393'
S0295_172 MUC	BEL	Reference	14° 02.141'	125° 55.506'
S0295_174 MUC	BEL	Reference	14° 02.132'	125° 55.449'
S0295_178 MUC	BEL	Reference	14° 02.139'	125° 55.349'
S0295_179 MUC	BEL	Reference	14° 02.148'	125° 55.298'
S0295_180 MUC	BEL	Reference	14° 02.146'	125° 55.398'

Station_ID	Area	Site	Latitude [N]	Longitude [W]
S0295_187 MUC	BEL	Plume impact gradient, distance to tracks (m): 25 m	14° 06.743'	125° 52.244'
S0295_188 MUC	BEL	Plume impact gradient, distance to tracks (m): 75 m	14° 06.730'	125° 52.226'
S0295_189 MUC	BEL	Plume impact gradient, distance to tracks (m): 175 m	14° 06.695'	125° 52.190'
S0295_195 MUC	BEL	Plume impact gradient, distance to tracks (m): 275 m	14° 06.646'	125° 52.149'
S0295_205 MUC	BEL	Plume impact gradient, distance to tracks (m): 600 m	14° 06.546'	125° 52.018'

Table 5.14.2 Overview sampling locations for surface sediment collected with PUC.

Station_ID	Liner	Area	Site	Latitude [N]	Longitude [W]	Remarks
S0295_029 PUC	60	GER	Reference	11° 50.670'	117° 03.562'	
S0295_029 PUC	64	GER	Reference	11° 50.679'	117° 03.560'	
S0295_068 ROV	C4	GER	Collector Impact	11° 55.808'	117° 01.465'	PUC location A
S0295_068 ROV	1	GER	Collector Impact	11° 55.809'	117° 01.544'	PUC location B
S0295_073 ROV	74	GER	Collector Impact	11° 55.784'	117° 01.484'	Frame imprint 107-C
S0295_083 ROV	B9	GER	Plume impact thick	11° 55.844'	117° 01.528'	
S0295_083 ROV	37	GER	Plume impact thick	11° 55.835'	117° 01.508'	
S0295_089 ROV	58	GER	Reference	11° 50.667'	117° 03.547'	
S0295_100 PUC	78	GER	Plume impact gradient	11° 55.876'	117° 01.585'	
S0295_123 PUC	A5	GER	No nodule	11° 51.016'	117° 23.023'	Frame imprint 13-B
S0295_123 PUC	68	GER	No nodule	11° 51.002'	117° 23.051'	Frame control A
S0295_123 PUC	22	GER	No nodule	11° 51.002'	117° 23.051'	Frame control D
S0295_123 PUC	27	GER	No nodule	11° 51.002'	117° 23.051'	Frame control E
S0295_123 PUC	60*	GER	No nodule	11° 51.002'	117° 23.051'	Frame control A
S0295_135 PUC	B0	BEL	Collector Impact	14° 06.750'	125° 52.424'	site A
S0295_135 PUC	B7	BEL	Collector Impact	14° 06.750'	125° 52.424'	site A
S0295_139 PUC	44	BEL	Collector Impact	14° 06.701'	125° 52.379'	site D
S0295_139 PUC	C9	BEL	Collector Impact	14° 06.685'	125° 52.392'	site E
S0295_144 PUC	C0	BEL	Collector Impact	14° 06.684'	125° 52.381'	Frame imprint 98-C
S0295_163 PUC	D6	BEL	Plume impact thick	14° 06.686'	125° 52.320'	
S0295_163 PUC	66	BEL	Plume impact thick	14° 06.640'	125° 52.294'	
S0295_163 PUC	B5	BEL	Plume impact thick	14° 06.686'	125° 52.320'	
S0295_185 PUC	C2	BEL	Reference	14° 02.063'	125° 55.364'	
S0295_185 PUC	C6	BEL	Reference	14° 02.085'	125° 55.370'	
S0295_202 PUC	D9	BEL	Trial Site NW of the collector site	14° 07.109'	125° 52.600'	
S0295_209 PUC	35	BEL	Plume impact thick	14° 06.763'	125° 52.339'	

**In the ROV-protocols this liner has number 66

The cores were processed in the cold room, usually immediately following the photo documentation, to obtain depth resolved pore water and solid-phase sediment samples (in 0.5 to 2 cm slices). From the collected material, the following variables will be determined: sediment porosity, total alkalinity (TA), total organic/inorganic carbon (TOC, TC), nitrogen and sulphur (CNS), grain size distribution, bulk mineral composition and bulk solid-phase elemental compositions, solid-phase radiotracers (^{230}Th, ^{210}Pb, ^{226}Ra) dissolved nutrients (nitrate, nitrite, phosphate, silica), dissolved trace metals (TM) including rare earth elements and yttrium (REY), dissolved major elements, dissolved organic carbon (DOC), total alkalinity (TA), dissolved metal-binding ligands (Me-L), dissolved Sr isotopes, and solid-phase amino acids (AA). Passive sampler sticks were deployed in additional core liners, allowing for high-resolution sampling of labile-bound trace metals in the surface sediments.

Sub-sampling methods

Sediment sampling with pore water extraction

Immediately after core recovery, the multicorer (MUC) and push-corer (PUC) sediment liners were transferred into the cold room with a temperature of approximately 4°C and, after a short visual inspection and description, treated according to the sampling scheme as shown in Figure 5.14.6. Typically, we sampled two cores per station for geochemical investigations:

One MUC/PUC core was used for (1) bulk sediment sampling at depth resolutions of 0.5 cm to 2 cm for the determination of sediment porosity and total organic/inorganic carbon (TOC, TC), nitrogen and sulphur (CNS) contents at GEOMAR and BGR, as well as the analysis of grain size, mineral composition and bulk elemental compositions at BGR and (2), for the retrieval of the supernatant bottom water and of pore water by rhizon extraction at the same depth resolution as (1) for nutrients (nitrate, nitrite, phosphate, silica and ammonia (to be analysed at AWI), and major elements (to be measured at AWI). In order to best resolve the top layer with resettled plume material, we sliced the MUC cores in 0.5 cm thick layers in the first cm, continuing with 1-cm-thick layers down to 10 cm depth and 2-cm-thick layers below. The total length of the cores that could be sampled varied between 20 cm and 26 cm for MUCs and between 14 cm and 20 cm for PUCs. Push cores were sampled the same way, except for the first cm that was sampled as 1 cm section because less material is available related to the smaller liner diameter. One half of the sliced sediment was collected in plastic, screw cap beakers and stored at 4°C (for bulk sediment). For the pore water extraction, the second half of the sliced sediments were transferred into 50 mL Falcon tubes and the pore water was extracted by means of rhizons with an average pore size of 0.1 µM (Seeberg-Elverfeld et al., 2005; Fig. 5.14.7 middle). 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. Before use, rhizons were soaked in DI for some days. For sampling, a 20 ml syringe was attached to the rhizon and the created vacuum after pulling out the piston and fixing it with a wooden stick led to pore water extraction. Usually, the sampling was finished within 1 hour. Afterwards, the extracted pore water was transferred into 30 ml HDPE bottles and splitted. Pore water aliquots (4 ml) for nutrients were stored frozen at -80°C, pore water aliquots for major elements (“OES” aliquots, 1 ml) and the remaining volume (“PW” aliquots) were acidified with 25 µl HCl and 20 µl HCl, respectively, and stored at 4°C. Pore water extracted sediment was stored at 4°C and will be used for the measurement of radionuclides (^{230}Th, ^{210}Pb, ^{226}Ra) at NIOZ and AWI and major element contents at AWI.

A second MUC/PUC core was separately sampled to collect pore water for the analysis of trace metals (TM) including rare earth elements and yttrium (REY), dissolved organic carbon (DOC) at JUB, total alkalinity (TA), and potentially Sr isotopes (at GEOMAR). The MUCs and ROV-PUCs were sliced in 0.5 cm layers in the topmost centimetre, then down to 10 cm depth in 1 cm layers, and below 10 cm in 2 cm layers. Sampling was conducted with HNO3 and deionised water (DI) pre-cleaned plastic spoons into HNO3-HCL-DI pre-cleaned 50 mL centrifuge vials (Fig. 5.14.7 left). 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. 5.14.7 right) that 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 colloidal-bound metals such as Fe, Mn, Cu, and Co. Anotop filters were cleaned with 0.015 M suprapure HCl and DI. Filtration was performed under a clean bench. Syringes and filters were rinsed with a few ml of sample first, which was discarded. The first millilitre of each sample was collected in 1.5 ml Eppendorf vials for TA measurements. Pore water samples for TM were acidified to pH 1.7 with ultrapure HCl. Aliquots for DOC were acidified to pH 2 with ultrapure HCl. TM and DOC samples were stored at ca. 4°C. The centrifuged sediment will be used for solid phase TM analyses at BGR and was stored at 4°C. Because of a shortage on PES sysringe filters towards the end of the cruise, the pore water from stations 174 MUC, 178 MUC and 195 MUC was filtered with syringe filters with RC (regenerated cellulose) membrane.

To retrieve larger volumes of pore water (50-120 ml), we pooled at 4 stations the sediment of two MUC liners. At three of those stations (166 MUC – BEL plume impact thick, 179 MUC and 180 MUC – both BEL Reference), we applied ultrafiltration for some depths, using 10 KDa Vivaspin20 or 10 KDa Vivaspin Turbo15 centrifuge vials, or, as also partly applied for seawater (see chapter xxx), using 10 KDa Vivaflow50 cassettes (only 2 depths at station 180 MUC). Depth resolution at stations 166 MUC and 179 MUC were the same as for the typical sampling, while at station 180 MUC the depth resolution was as follows: 0-2 cm, 2-4 cm, 4-8 cm, 8-12 cm, 12-16 cm, 16-22 cm. Both, the UF centrifuge vials and the membrane cassettes were precleaned with 0.1M HCl and DI. The relatively large volumes that are required to precondition the UF membranes and to filter the samples (about 30 ml for Vivaspin vials, 80 ml for Vivaflow cassettes), plus the required time to process the ultrafiltration methods limited to total amount of ultrafiltered samples to 16.

Table 5.14.3 summarizes all subsamples that were taken per station. Blanks were taken from all filtration devices used during the cruise.

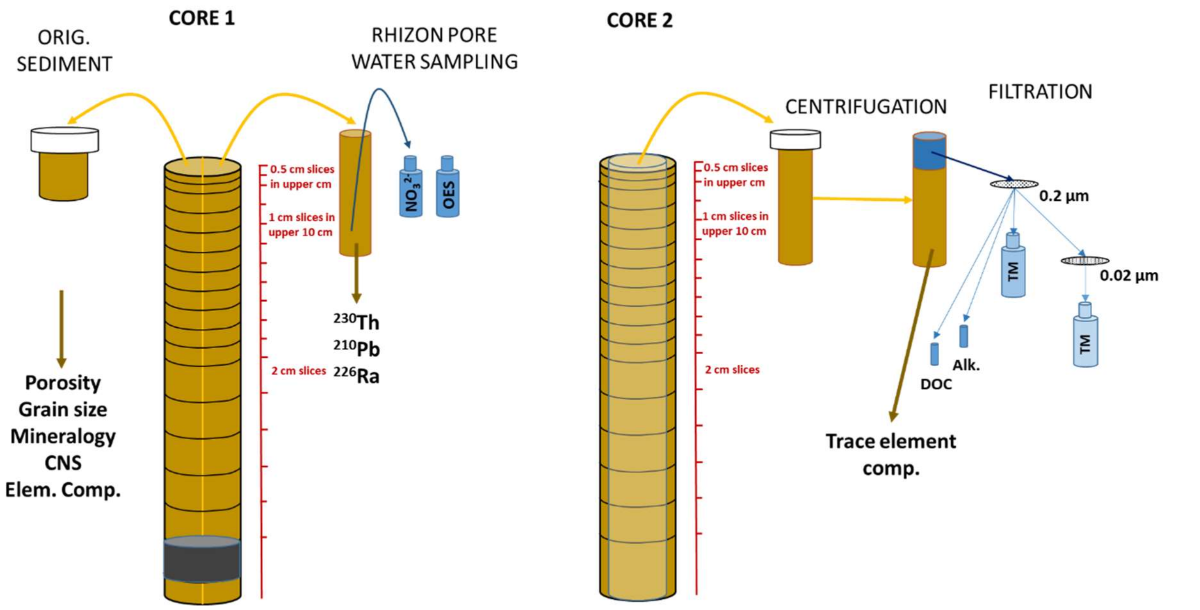


Fig. 5.14.6 Generalized slicing and sampling scheme for MUC and PUC cores to collect sediment and pore water for geochemical analyses during cruise SO295.



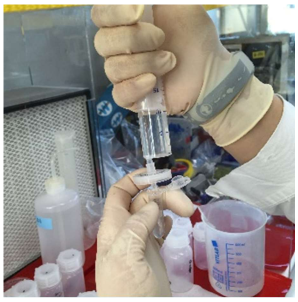


Fig. 5.14.7 Sediment sampling from core slices in the cold room (left), pore water extraction using rhizons (middle), syringe filtration of centrifuged pore water for alkalinity measurements (right). Pictures from cruise MANGAN2021: K. Schmidt (middle and left) and T. Aigner (left).

Table 5.14.3 Overview of MUC and ROV-PUC stations sampled by AWI, JUB and BGR, and subsamples taken for (bio)geochemical variables in sediment and pore water (to be analysed at AWI, BGR, GEOMAR, JUB). PW = pore water, TM = trace metals, DOC = dissolved organic carbon, AA = amino acids (particulate), Me-L = metal binding ligands, Nut. = nutrients, OES = samples for major element measurements with optical emission spectrometry, Alk. = alkalinity, cen. sed. = centrifuged sediment, ori. sed. = original sediment, rhi. sed. = rhizon sediment, Diff. Exp. = core for diffusion experiment. BLOS = Bigelow Laboratory for Ocean Sciences.

Station:	Alk.	PW TM 0.2µm	PW TM 0.02µm	PW TM 10 Kda UF	PW DOC 0.2 µm	O2	Sed.Centr.	Sed. Orig	Me-L	AA	Sediment	DGT	Diff. exp.	Microecotox	Ecotox	Sed. Susp. Exp.	PW Nut.	PW OES	PW	Sed. Rhiz.
S0295_015_MUC	x	x					x	x									x	x	x	x
S0295_016_MUC												x		x		x				
S0295_024_MUC	x	x					x	x							x		x			
S0295_025_MUC						x			x					x						
S0295_027_MUC	x	x			x		x					x								
S0295_029_PUC								x									x	x		
S0295_033_MUC	x	x			x		x	x				x		x			x	x	x	x
S0295_034_MUC	x	x			x	x	x										x	x	x	x
S0295_046_MUC	x	x				x	x								x		x	x	x	x
S0295_047_MUC												x				x				
S0295_057_MUC	x	x				x	x	x					x				x		x	x
S0295_058 MUC												x								
S0295_065_MUC	x	x			x		x							x						
S0295_066_MUC												x								
S0295_068_ROV								x									x	x		x
S0295_072_MUC									x											
S0295_073_ROV								x									x	x		x
S0295_083_ROV								x												
S0295_085_MUC	x	x			x	x	x	x												
S0295_089_ROV								x									x	x		x

Station:	Alk.	PW TM 0.2µm	PW TM 0.02µm	PW TM 10 Kda UF	PW DOC 0.2 µm	O2	Sed.Centr.	Sed. Orig	Me-L	AA	Sediment	DGT	Diff. exp.	Microecotox	Ecotox	Sed. Susp. Exp.	PW Nut.	PW OES	PW	Sed. Rhiz.
S0295_092_MUC								x							x	x				
S0295_093_MUC								x												
S0295_097_MUC		x					x	x					x				x	x	x	x
S0295_100_PUC								x												
S0295_107MUC						x		x							x		x	x	x	x
S0295_113MUC								x			x									
S0295_115MUC						x									x		x		x	x
S0295_116MUC								x			x									
S0295_117MUC	x	x				x	x	x							x		x		x	x
S0295_123PUC	x	x					x	x				x					x	x		x
S0295_129MUC	x	x				x	x										x		x	x
S0295_130MUC	x	x					x				x						x		x	x
S0295_135PUC	x	x					x	x									x	x		x
S0295_139PUC	x							x									x	x		x
S0295_144 PUC								x									x	x		x
S0295_146MUC	x	x			x	x	x	x	x	x										
S0295_147MUC	x	x					x		x	x							x	x	x	x
S0295_148MUC												x	x							
S0295_155MUC									x	x		x		x						
S0295_156MUC								x												
S0295_157MUC	x	x					x										x	x	x	x
S0295_158MUC								x							x		x	x	x	x
S0295_163PUC								x				x					x	x		x
S0295_166MUC	x	x	x	x		x	x				x									
S0295_167MUC									x	x		x								
S0295_172MUC	x	x	x			x	x										x		x	x
S0295_174MUC	x	x			x		x	x									x	x	x	x
S0295_178MUC	x	x				x	x		x	x	x	x	x						x	x
S0295_179MUC	x	x	x	x			x				x									
S0295_180MUC	x	x		x			x		x	x		x		x	x					
S0295_185PUC								x									x	x		x
S0295_187MUC								x			x	x								
S0295_188MUC						x		x			x	x					x		x	x
S0295_189MUC								x							x					
S0295_195MUC		x			x		x	x									x	x	x	x
S0295_202PUC								x												
S0295_205MUC						x		x			x									
S0295_209PUC								x									x	x		x

Sampling for metal binding organic ligands

For the analysis of metal-binding ligands (Me-L), we collected bottom water and pore water with rhizons (pore size 0.12 - 0.18 µm, from Rhizosphere) and a syringe. After the bottom water sample was taken, the overlying water was siphoned off to avoid percolation into the sediment while extracting the pore water. The rhizons were placed into the sediment through pre-drilled, small holes (covered with Tesa during deployment), about 2-3 cm apart (Fig. 5.14.8), and typically, the pore water from two rhizon spots was pooled, except for the uppermost part. Two obtain the required volume of 50-100 ml, the pore water from two cores was pooled. We sampled two stations each in the BEL collector, plume impact and reference sites, while in the GER area, we sampled one location in the reference site and one in the collector impact site. Pore water was collected in pre-cleaned, fluorinated HDPE bottles 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 sample was used to rinse the syringe and was subsequently discarded. After sampling, pH and conductivity was measured and the samples were subsequently frozen at -20°C and will be analysed by adsorptive cathodic stripping voltammetry (AdCSV) at JUB.

In the BEL working area, one of the Me-L cores per station was used to sample for solid phase AA, after extraction of the pore water. Material from one cm thick slices were sampled in the upper 2 cm of the cores, then down to 10 cm from 2 cm slices and below from 5 cm thick slices. All samples were stored in glass bottles and frozen at -20°C. They will be analysed at the University of Hamburg for amino acid composition and TOC concentrations.

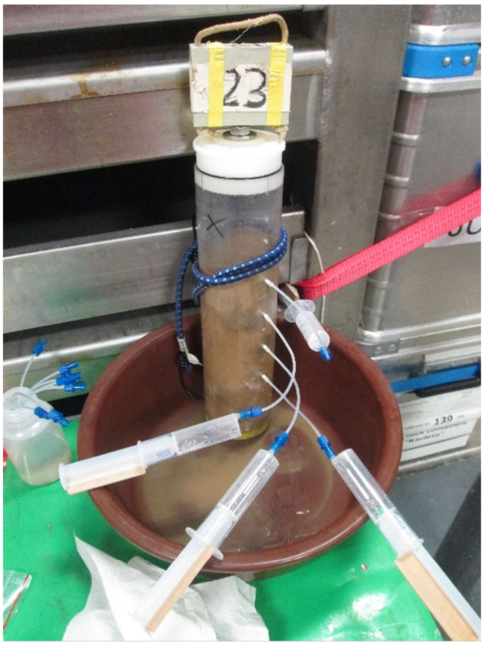


Fig. 5.14.8 Rhizon pore water sampling for Me-L analyses (picture: SO268, Sophie Paul).

DGT sampling for labile metals

For the investigation of labile-bound trace metal concentrations in the sediments, we deployed 15-cm-long DGT stripes in MUC or PUC cores from 15 sediment sampling locations (Fig. 5.14.9, Tab. 5.14.4). The sample treatment occurred in the cold room at 4°C. After siphoning off the overlying water except for the bottom-most few cm, the stripes were gently pushed into the cores from the top and left there for approx. three days, with the upper 1-2 cm of the DGT sampling window remaining outside of the sediment. The stripes were then carefully removed from the core and the position of the sediment surface was marked. Remaining sediment was rinsed off with DI and the stripes were placed in sealed plastic bags. At several of these MUC/PUC stations, associated pore water sampling by sediment centrifugation and subsequent filtration (see above), will allow for a comparison of elemental concentrations in the <0.2 µm/ <0.02 µm filtered size fractions of pore water and the labile-bound fraction obtained from passive samplers. We deployed DGT stripes at four locations in the GSR trial area (one pre-impact, one covered track, and two in the thick-covered area) and at three locations in the BGR contract area (one pre-impact Trial, one post-impact Trial, and one in the reference site). The stripes will provide high-resolution profiles of labile pore water trace metal concentrations. In the home laboratory, the sediment stick membranes will be cut into similar intervals as done for the associated pore water sampling (i.e., in 0.5 cm to 2 cm intervals, see above).

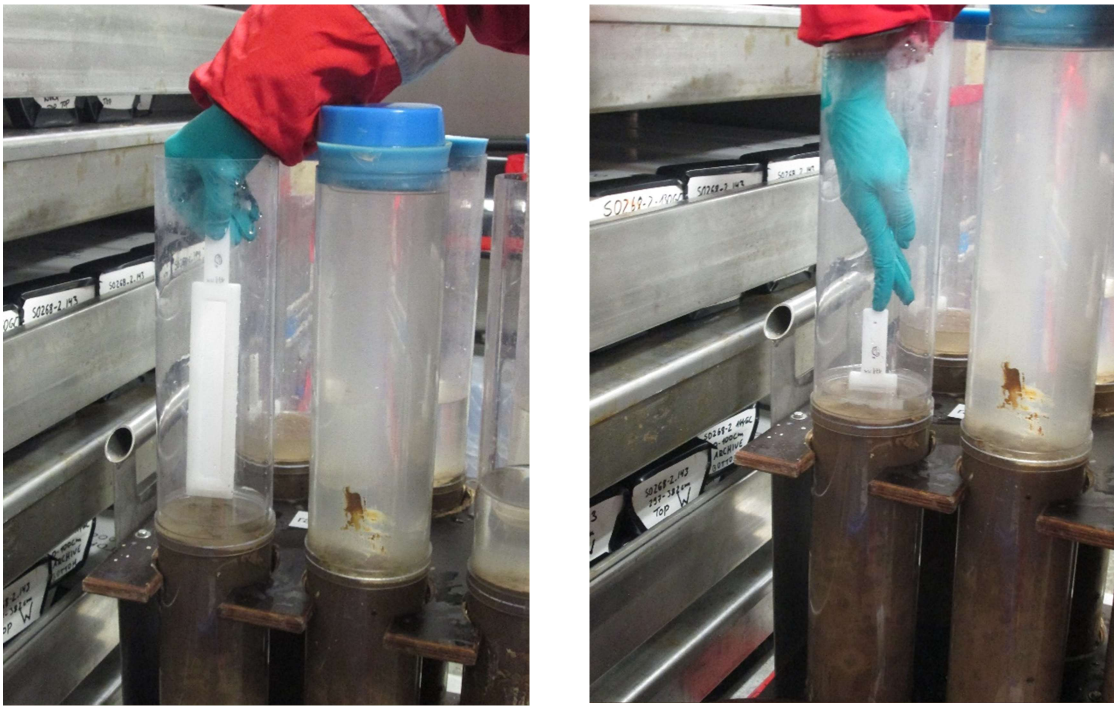


Fig. 5.14.9 DGT passive sampling in MUC cores. Picture: Timm Schoening, SO268.

Table 5.14.4 Overview of DGT deployments in MUC or ROV-PUC cores.

SO295 Station	Liner	Areal/Site	DGT type	Depl.start date (LT)	Depl. start time (LT)	Depl. end date (LT)	Depl. end time (LT)	Depl. time [s]
016 MUC	2	GER Reference	PM	09.11.2022	16:12	12.11.2022	19:41	271740
016 MUC	3	GER Reference	PX	09.11.2022	16:18	12.11.2022	19:42	271440
016 MUC	8	GER Reference	PT	10.11.2022	11:16	13.11.2022	16:45	278940
027 MUC	2	GER Reference	PM	11.11.2022	18:33	15.11.2022	00:42	281340
047 MUC	1	GER plume impact thick	PT	15.11.2022	04:40	18.11.2022	04:46	259560
047 MUC	2	GER plume impact thick	PX	15.11.2022	04:40	18.11.2022	04:46	259560
047 MUC	3	GER plume impact thick	PM	15.11.2022	04:40	18.11.2022	04:46	259560
058 MUC	1	GER plume impact thick	PM	17.11.2022	02:16	19.11.2022	16:15	223140
058 MUC	3	GER plume impact thick	PX	17.11.2022	02:16	19.11.2022	16:15	223140
058 MUC	4	GER plume impact thick	PT	17.11.2022	02:16	19.11.2022	16:15	223140

SO295 Station	Liner	Areal/Site	DGT type	Depl.start date (LT)	Depl. start time (LT)	Depl. end date (LT)	Depl. end time (LT)	Depl. time [s]
066 MUC	1	GER collector impact	PT	18.11.2022	20:00	21.11.2022	18:15	252900
066 MUC	2	GER collector impact	PX	18.11.2022	20:00	21.11.2022	18:15	252900
066 MUC	4	GER collector impact	PM	18.11.2022	20:00	21.11.2022	18:15	252900
123 ROV-PUC	68	GER no nodule area	PX	29.11.2022	01:10	02.12.2022	01:50	261600
123 ROV-PUC	27	GER no nodule	PT	29.11.2022	01:10	02.12.2022	01:55	261900
148 MUC	1	BEL collector impact	PM	05.12.2022	13:20	08.12.2022	14:35	263700
148 MUC	2	BEL collector impact	PT	05.12.2022	13:20	08.12.2022	14:35	263700
148 MUC	4	BEL collector impact	PX	05.12.2022	13:20	08.12.2022	14:35	263700
155 MUC	20	BEL collector impact	PB	08.12.2022	21:45	11.12.2022	21:00	256500
163 ROV-PUC	B5	BEL plume impact thick	PX	07.12.2022	20:40	10.12.2022	20:35	258900
167 MUC	1	BEL plume impact thick	PM	08.12.2022	21:50	11.12.2022	21:00	256200
167 MUC	20	BEL plume impact thick	PX	08.12.2022	21:50	11.12.2022	21:00	256200
178 MUC	15	BEL Reference	PX	11.12.2022	09:15	14.12.2022	10:05	262200
180 MUC	4	BEL Reference	PM	11.12.2022	09:20	14.12.2022	10:05	261900

Additional sediment sampling

At two stations (097 MUC, 178 MUC), we splitted one core for pore water sampling: one half was used to extract the pore water via centrifugation, as usually done for TM, the other half was used to extract the pore water with rhizons, as usually done for nutrients and OES aliquots. We here intended to compare the two pore water extraction methods with regard to potential fractionation and contamination issues.

In addition to high resolution sampling of surface sediment, we took an extra set of complete sediment cores back to home laboratories for trace metal diffusion experiments (stored at 4°C, JUB). For ecotoxicological investigations to be conducted at UAlgarve, we sampled at nine stations the upper 10 cm (0.2 cm, 2-5 cm, 5-10 cm), and for microbial ecotox investigations at Bigelow Laboratory for Ocean Sciences we sampled at six stations the upper 10 cm in a resolution of 0-2 cm, 2-5 cm and 5-10 cm (Table 5.14.3). We further kept sediment of the upper 10 cm for (sediment repsuspension) experiments in variable depth resolutions from 12 cores taken in undisturbed and plume impacted settings. In addition to high resolution sampling of surface sediment, we took an extra set of complete sediment cores back to home laboratories for trace metal diffusion experiments (stored at 4°C, JUB).

Total alkalinity

Aliquots for total alkalinity (TA) were taken from 0.2 µm PES syringe filtered pore water samples except for cores 117 MUC and 178 MUC, where pore water sampled with rhizons was measured in parallel to the centrifuged pore water. The TA of the pore water was determined within 12 hours after sampling by titration with 0.02 N HCl using a mixture of methyl red and methylene blue as indicator. The titration vessel was bubbled with argon to strip any CO2 produced during the titration. The IAPSO seawater standard was used for calibration with a known TA of 2.325 meq/l.

First results - Alkalinity

Total alkalinity (TA) profiles in the surface sediments of the GER and BEL Reference Sites differ considerably (Fig, 5.14.10). TA is lower at the BEL Reference Site (around 2.4 meq/l with a slight downcore decrease) and more comparable to the GER No-Nodule Site, whereas the GER Reference Site exhibits a downcore increase of TA from ~2.4 meq/l in the bottom water to ~2.8 meq/l in 17 cm depth. This gradual increase indicates a partial utilisation of nitrate for microbial POC degradation.

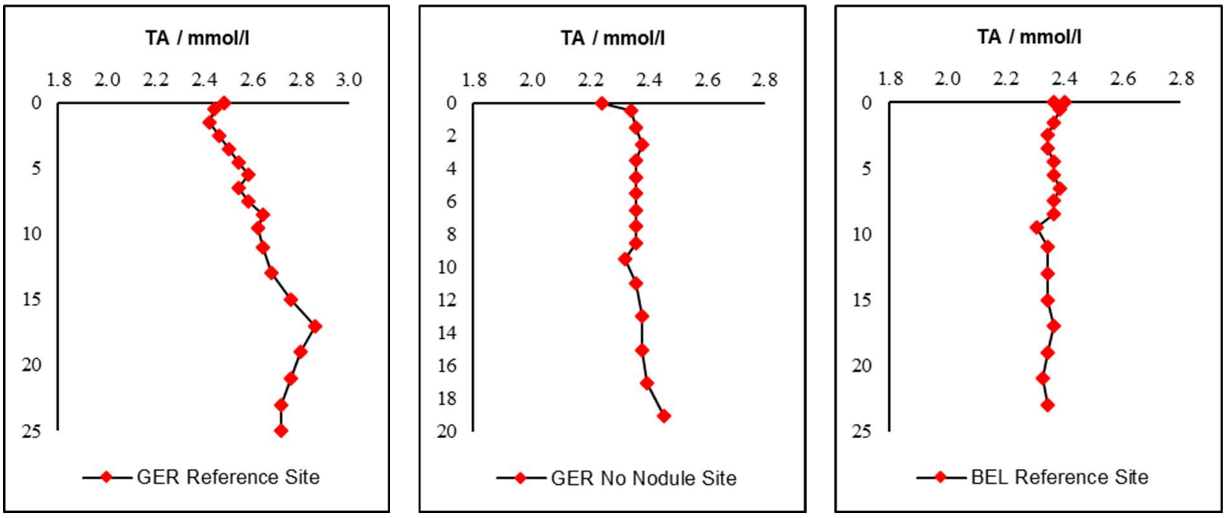


Fig. 5.14.10 Typical porewater TA profiles at the GER Reference (left) and No-Nodule Sites (center) and the BEL Reference Site (right).

Cores from impacted sites (Collector Impact and Plume Impact) show largely similar profiles, but overall more variability. Hence, an integrated analysis consulting other geochemical variables is needed.

5.15 Water Column Geochemistry

(K. Schmidt, C. Rühlemann)

Seawater geochemistry

Objectives

Mining-related activities in the deep-sea are expected to create an operational resuspension sediment plume in the bottom waters, with sediment re-deposition and blanketing near the mining sites (e.g., (Gillard et al. 2019) as well as a release of pore water into the water column. The removal of the top sediment layer and the formation of resuspension and dewatering particle plumes will have several ecosystem consequences in bottom seawater and at the seafloor, such as smothering, clogging of surfaces and filter nets of suspension feeders, diluting particulate organic carbon concentrations as the main food source, and an increasing risk of toxic effects on pelagic and benthic fauna due to changes in habitat trace metal budgets. The mobility and fate of trace metals in the environment and biotic uptake processes are governed by physical fractionation and chemical speciation which makes it important to assess these properties of trace metals and not only total concentrations, for a better understanding of chemical and ecotoxic impacts of mining plumes. Different biotic metal uptake routes may occur in mining-repated settings: (1) the ingestion of metals bound in or adsorbed to particles that become enriched in the guts of suspension feeders extracting their food from the water column (e.g., sponges, corals and some fish species or larvae), (2) a diffusional uptake of truly dissolved metals across the cell membranes of gills, body walls and digestive tracts of exposed organisms (Hauton et al. 2017). Trace metals in the sediment plume can either be bound in the suspended particles, mobilized from the suspended sediment into the dissolved phase during remineralisation and desorption/dissolution processes, or are scavenged onto oxide particles from surrounding seawater. Dissolved trace metals <0.2 µm can be either associated with (secondary) oxide nanoparticles or organic compounds or are present in truly dissolved form.

In order to address the impact of sediment removal, sediment resuspension and plume dispersal on trace metal geochemical processes in the water column and in the benthic layer and potential ecotoxic effects for pelagic and benthic fauna, profound pre- and post-impact data on trace metals in the bottom water and the water column are required. Baseline water sampling in the German and Belgian working areas was conducted during cruise SO262 (only GER contract area) and during SO268 (Haeckel and Linke, 2021). Impact sampling was conducted in 2021 during the collector trials in the GSR and BGR contract areas (MANGAN2021/IP21; Vink et al., 2022). The trials lasted for 40 and 24 hours, respectively, and produced a near bottom sediment plume of several meters height. Video footings showed relatively clear (sharp) boundaries between the particle-laden plume and the apparently unaffected, particle-poor seawater surrounding. Plume dispersal occurred along with predominant currents, but with additional rotational components due to diurnal tidal effects. In both contract areas, we were able to sample the particle plume with the CTD.

SO295 water sampling was conducted to collect baseline data on trace metals such as Fe, Mn, Co, Cu, Zn, Ni, Cd, V, As, Mo, Pb and REY in bottom seawater including their distribution between different physical and chemical species. We herewith continue the baseline data collection started during campaigns in 2018 (SO262) and continued in 2019 (SO268), and 2021 (IP21), and hence contribute to the evaluation of the temporal and spatial variability in bottom seawater of the BGR and GSR contract areas required for the definition of a robust baseline. Sampling for trace metals (TM) was complemented by sampling for dissolved organic carbon (DOC) and nutrients (i.e., nitrate, phosphate, silicic acid), and by on board measurements of pH and conductivity and oxygen. While the CTD casts allowed water sampling at the depth range from 5-200 meters above seafloor, we used the BWS to collected water to study benthic trace element fluxes at the sediment-water interface in undisturbed and disturbed surface areas.

Another approach to obtain information about trace metals in CCZ bottom seawater is the in situ passive sampling technique that provides additional information on trace metal speciation. DGT trace metal passive samplers accumulate labile dissolved trace metals from solution over time, using the technique of diffusive gradients. The labile-bound metal fraction includes the fraction that in theory is easily available for bio-uptake through cell membranes and may mimic bio-uptake. Hence, this sampling tool can be used as speciation method to differentiate between the type of complexation (organic vs. inorganic) and to determine the lability degree of trace metals in ambient seawater, as well as to study and potentially monitor the mobilisation and (bio)availability of trace metals in mining-related settings. With the DGT approach, metals can be preconcentrated in situ under ambient conditions, for several days to weeks. Comparing DGT concentration data with total concentrations derived from discrete water sampling finally provides information on the DGT-accessible fraction of trace metals in seawater. With the DGT methodological approach, we aim to contribute (1) to the evaluation of DGT samplers as a suitable tool to investigate relative trace metal labilities and to quantify trace metal concentrations of fully labile elements in the deep sea, (2) to study benthic trace metal fluxes at the sediment-water boundary, and (3) to the evaluation of DGTs as a potential monitoring tool for environmental impact studies as well as in the regulatory context of deep sea mining.

DGTs were previously deployed in lower water column above the GER and BEL working areas during cruises SO268 (2019) and MANGAN2021 (2021), at distances of 0.5 m to 500 m to the seafloor. Based on these samples, we published the first baseline dataset for labile-bound trace metals (Cu, Mn, Ni, V, As, Cd, REY) in ambient bottom seawater in the GER working area (Schmidt et al. 2022). We further studied the mobilisation of labile-bound metals in response to sediment resuspension during the Patania II tests (Vink et al., 2022). During SO295, we aimed to (1) recover DGT probes that were mounted in 2021 on two sediment traps during MANGAN 2021 in the GER working area, (2) to obtain baseline data for the benthic layer in the BEL and GER working areas, (3) post-impact data for the two trial sites both within the collector tracks and in the plume impact sites, and (4) to deploy DGTs at sediment traps for another long-term observation. The DGT plates that were mounted to the sediment trap mooring could however not been recovered, and the planned new long-term DGT deployment also had to be cancelled, as no ocean bottom mooring could be deployed.

Seawater sampling strategy

In both contract areas, we re-sampled locations that were sampled during the MANGAN 2021 cruise (before and during the Patania trials), and during the cruise SO268 in 2019. For geochemical investigations of the lower water column up to 200 meters above the seafloor, seawater was sampled in distances of 5 meters above bottom (mab), 50 mab and 200 mab. The locations of the 4 successful BWS stations match those of the CTD stations in respective sites.

Subsampling and on board sample treatment

Once on board, the seawater was immediately subsampled and treated for different purposes, and subsequently stabilised. A sampling scheme is provided in Figure 5.15.1 and explained shortly below; an overview of the different aliquots of each water sample is given in Table 5.15.1.

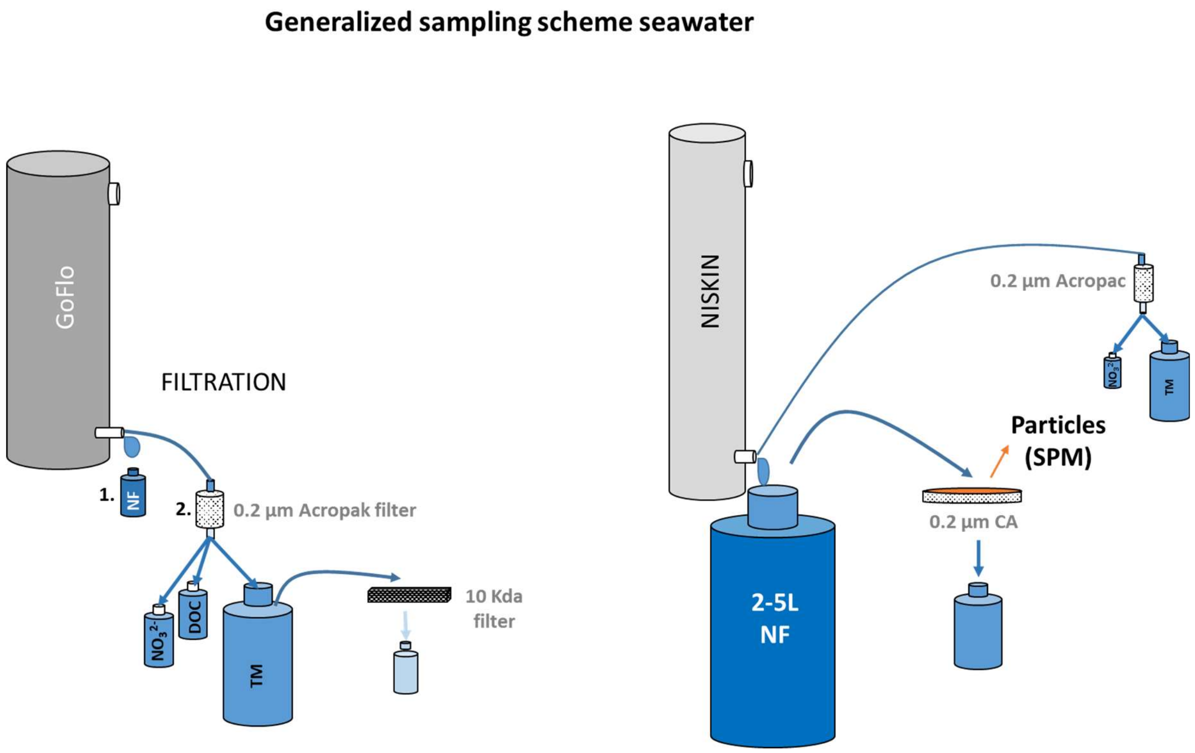


Fig. 5.15.1 Sampling scheme for water sample aliquots from GoFlo bottles and NISKIN bottles.

GoFlo bottles were shaken and a small aliquot was obtained for pH, temperature and conductivity measurements (WTW 3320). After taking non-filtered aliquots (about 50 ml) of each GoFlo bottle (that closed properly) to determine total dissolvable element concentrations and to calculate labile particulate (> 0.2 µm) concentrations in the seawater, samples were filtered through 0.8 µm/0.2 µm Acropak capsule filters (200 cm^3) and aliquots for DOC (~30 ml), nutrients (~4 ml) and trace metals (about 1L) were collected. At three stations (two in the GSR area, one on the BGR area), the samples were further ultrafiltered through a 10 KDa membrane (Vivaflow50 cassettes or Vivaspin20 centrifuge vials) to separate colloids larger than 10 KDa and smaller than 0.2 µm and to obtain the metal fraction in the ultrafiltrates. All trace metal samples were acidified with HCl ultra (Roth) to pH of ~1.6-1.7 and stored at 4°C, DOC samples were acidified to pH 2 and stored at 4°C, and nutrient samples were frozen at -20°C. Sample acidification was carried out under clean air in the clean bench. Acropak capsule filters were rinsed with 0.01M HCl and stored in the oven for several hours, subsequently rinsed with DI, filled with DI and stored in the oven for 24 hours, rinsed and filled with DI again and stored in the fridge until use. With the first use, about three litres of sample were used to rinse the filter, and subsequently the first litre of each individual sample was filtered and discarded. The 10 KDa Vivaflow membrane cassettes and the Vivaspin centrifuge vials were cleaned with 0.1 M HCl and DI before use.

Water sampling with trace metal clean GoFlo bottles was complemented by sampling with three NISKIN bottles, two of them mainly dedicated to obtain particulate material >0.2 µm. After shaking the NISKIN bottles, we separated about 5L of the non-filtered water for particle filtration. Following this, we started filtering through 0.8 µm/0.2 µm Acropak capsule filters (1000 cm^3) connected to the NISKIN bottles and subsampled for major and minor elements, and for nutrients. The non-filtered water was then filtered in the on board laboratory through pre-weighted 0.2 µm cellulose acetate (CA) membrane filters to collect particles >0.2 µm on the filter for subsequent geochemical investigations and for the determination of suspended particulate matter (SPM) weight. Filtration was carried out under a clean bench and filters were pre-cleaned by rinsing them with 0.1M HCl and DI before use. After filtration, the filters were dried at 45°C in the oven and stored in petri dishes (Parafilm-sealed). From two samples, about 100 ml of the filtered volume were kept for additional trace metal analyses.

With the BWS samples, we generally followed the same procedure as with CTD sampling, i.e., after taking 50 ml aliquots for pH, temperature and salinity, we sampled Acropak-filtered water for nutrients, DOC and trace metals. The lowermost (at 0.5 m) and the uppermost (at 2.1 m) bottles were additionally sampled for particle filtration and for non-filtered water.

The SPM concentration in the BWS GoFlo bottles was visibly higher than during the CTD casts at 5 mab, which likely reflects the inefficiency of the bottom currents to wash all particles that may have entered the horizontal GloFlo bottles during landing away. The SPM concentrations were highest in the bottom bottle and lowest in the top bottle. However, the higher particle concentrations could also be caused by natural turbidity close to the seafloor (benthic layer).

Trace metal samples will be analysed in the home laboratory at BGR with SeaFAST-TQ-ICPMS, to obtain concentrations of Mn, (Fe), Cu, Ni, Zn, Cd, Ba, Ga, V, and REY in different physical size classes. The nutrient samples will be analysed at AWI, the DOC samples and the particle filters at Jacobs University, Bremen (JUB).

Large volume bottom seawater samples (in total about 100 litres, not filtered) from NISKIN bottles closed at 5 meter above seafloor were collected for planned experiments in the home laboratories (e.g., sediment suspension ecotoxicity experiments). Furthermore, two 1L-sized samples of non-filtered bottom seawater were collected for micro-ecotoxicity studies planned at the Bigelow Laboratory for Ocean Sciences.

Table 5.15.1 List of water samples taken during SO295 with GoFlo (GF) bottles and NISKIN (N) bottles mounted on the CTD/rosette, and individual aliquots for trace metals (TM) and associated variables. Acro: Acropak filter, NF: not filtered, DOC: dissolved organic carbon, SPM: suspended particulate matter, UF: ultrafiltration, VF: Vivaflow50 cassettes, VS: Vivaspin ultrafiltration centrifuge vials, mab: meters above seafloor.

Station ID	CTD/BWS bottle #	Depth (mab)	Area and site	TM 0.2 µm	DOC 0.2 µm	Nutrients 0.2 µm	NF	10 Kda UF VF	10 Kda UF VS	TM 0.02µm	SPM	Large V. NF
004 CTD-01	N12	5	GER Dredge	x		x					x	
004 CTD-01	N13	50	GER Dredge	x		x					x	
004 CTD-01	N14	200	GER Dredge	x		x						
004 CTD-01	GF18	5	GER Dredge	x		x						
004 CTD-01	GF19	5	GER Dredge	x	x	x	x					
004 CTD-01	GF20	50	GER Dredge									
004 CTD-01	GF21	50	GER Dredge	x	x	x	x					
004 CTD-01	N10-12	5	GER Dredge									x
031 CTD_02	N2	5	GER collector impact	x		x						
031 CTD_02	N13	50	GER collector impact	x		x						
031 CTD_02	N14	200	GER collector impact	x		x						
031 CTD_02	GF18	5	GER collector impact	x		x						
031 CTD_02	GF19	5	GER collector impact	x		x	x					
031 CTD_02	GF20	50	GER collector impact									

Station ID	CTD/BWS bottle #	Depth (mab)	Area and site	TM 0.2 µm	DOC 0.2 µm	Nutrients 0.2 µm	NF	10 Kda UF VF	10 Kda UF VS	TM 0.02µm	SPM	Large V. NF
031 CTD_02	GF21	50	GER collector impact	x		x	x					
037 BWS_01	GF11	0.55m	GER collector impact	x		x	x				x	
037 BWS_01	GF10	0.9m	GER collector impact	x		x						
037 BWS_01	GF09	1.3m	GER collector impact	x		x						
037 BWS_01	GF08	1.7m	GER collector impact	x		x						
037 BWS_01	GF07	2.1m	GER collector impact	x		x	x				x	
050 BWS_02	GF11	0.55m	GER Reference	x	x	x	x	x			x	
050 BWS_02	GF10	0.9m	GER Reference	x		x						
050 BWS_02	GF09	1.3m	GER Reference	x		x						
050 BWS_02	GF08	1.7m	GER Reference	x		x						
050 BWS_02	GF07	2.1m	GER Reference	x	x	x	x	x			x	
052 CTD_03	N12	5	GER plume impact	x	x	x						
052 CTD_03	N13	50	GER Plume impact	x		x						
052 CTD_03	N14	200	GER Plume impact	x		x						
052 CTD_03	N22	5	GER Plume impact								x	
052 CTD_03	GF18	5	GER Plume impact									
052 CTD_03	GF19	5	GER Plume impact	x	x	x	x	x				
052 CTD_03	GF20	50	GER Plume impact									
052 CTD_03	GF21	50	GER Plume impact									
052 CTD_03	N11-12, N22-24	5	GER Plume impact									x
071 BWS_03	GF11	0.55m	GER Plume impact	x	x	x	x				x	
071 BWS_03	GF10	0.9m	GER Plume impact	x		x						
071 BWS_03	GF09	1.3m	GER Plume impact	x		x						
071 BWS_03	GF08	1.7m	GER Plume impact	x		x						
071 BWS_03	GF07	2.1m	GER Plume impact	x	x	x	x	x			x	
120 CTD_04	N12	5	GER no nodule	x		x						
120 CTD_04	N13	50	GER no nodule	x		x						
120 CTD_04	N14	200	GER no nodule	x		x						
120 CTD_04	GF18	5	GER no nodule									
120 CTD_04	GF19	5	GER no nodule	x	x	x	x					
120 CTD_04	GF20	50	GER no nodule	x	x	x						
120 CTD_04	GF21	50	GER no nodule									
120 CTD_04	N15-17	5	GER no nodule									x
128 CTD_05	N12	5	BEL plume impact	x		x					x	
128 CTD_05	N13	50	BEL plume impact	x		x					x	
128 CTD_05	N14	200	BEL plume impact	x		x						

Station ID	CTD/BWS bottle #	Depth (mab)	Area and site	TM 0.2 µm	DOC 0.2 µm	Nutrients 0.2 µm	NF	10 Kda UF VF	10 Kda UF VS	TM 0.02µm	SPM	Large V. NF
128 CTD_05	GF19	5	BEL plume impact	x	x	x	x		x	x	x	
128 CTD_05	GF21	50	BEL plume impact	x	x	x	x					
150 CTD_06	N12	5	BEL collector impact	x		x					x	
150 CTD_06	N13	50	BEL collector impact	x		x						
150 CTD_06	N14	200	BEL collector impact	x		x					x	
150 CTD_06	N08	5	BEL collector impact				x					
150 CTD_06	GF19	5	BEL collector impact				x					
150 CTD_06	GF21	50	BEL collector impact	x	x	x	x					
150 CTD_06	N7-8, N10-11	5	BEL collector impact				x					x
150 CTD_06	N	5	BEL collector impact									
153 CTD_07	N12	5	BEL Reference	x		x					x	
153 CTD_07	N13	50	BEL Reference	x		x						
153 CTD_07	N14	200	BEL Reference	x		x						
153 CTD_07	GF19	5	BEL Reference	x	x	x		x	x			
153 CTD_07	GF20	50	BEL Reference				x					
153 CTD_07	GF21	50	BEL Reference	x	x	x	x					
153 CTD_07	N9-11	5	BEL Reference									x
153 CTD_07	N22	5	BEL Reference									
218 BWS_04	GF11	0.55m	BEL Reference	x	x	x	x		x		x	
218 BWS_04	GF10	0.9m	BEL Reference	x	x	x						
218 BWS_04	GF09	1.3m	BEL Reference	x	x	x	x					
218 BWS_04	GF08	1.7m	BEL Reference	x	x	x	x					
218 BWS_04	GF07	2.1m	BEL Reference	x	x	x	x		x		x	

Oxygen measurements (Winkler titration)

On board oxygen measurements were conducted on bottom seawater samples (0.5 mab to 5 mab) from nine seawater sampling stations, taken with NISKIN bottles during CTD stations or with GoFlo bottles during the BWS deployments. Further measurements were conducted on bottom water from MUC cores (see Chapter 5.14). For CTD calibration purposes, two of the CTD stations (120 CTD, 150 CTD) were used to sample seawater from six different depths between 360 m and 4477 m (12 samples in total). Typically, triplicate samples were taken at each of the stations.

Iodometric titration after Winkler (1888) is performed using a multi-step oxidation of dissolved oxygen to iodine using the iodide ion in the presence of an alkaline manganese(II) ion solution, while the amount of generated iodine is then determined by titration with a standard thiosulfate solution following the method of Grasshoff et al. (1999).

In the cold room, the bottom water was filled into Winkler bottles immediately after recovery of the sampling device. The Winkler bottle was rinsed several times with the sample to get the sample completely free of air bubbles. To do this, a tube was held to the bottom of the bottle so that the sample runs slowly into the bottle without forming air bubbles, and the bottle was allowed to overflow until the water was completely free of air bubbles. Then, using syringes with long needles, we carefully added 500 µl of manganese-II-chloride solution and 500 µl of iodide solution to fix the oxygen. Bottles were carefully closed with stoppers and vigorously shaken. The precipitate was allowed to settle for 30 min (stored in a cool, dark place). Before the titration with Titrisol® sodium thiosulfate solution ($Na_2S_2O_3$, 0.02M, Merck) at room temperature (with a Dosimat), 1ml of H_2SO_4 (9 M) was carefully added and the recapped bottle was shaken strongly to re-dissolve the Mn-hydroxide. After that, the solution was titrated in the Winkler bottle with sodium thiosulfate until a bright yellow colour was obtained. Subsequently, 1ml of zinc iodide starch solution (Merck) was added, which gives the titrated solution a deep blue colour, and titration continued until the blue colour disappeared and a clear solution was reached. The consumption of thiosulfate solution (ml) was noted and used to calculate the oxygen concentration in mg/l. Several blanks were measured using local bottom water, which was flushed with Argon for about 30 min and then treated according to the same procedure as described above.

DGT passive samplers

The DGT 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. The accumulated element concentrations increase linearly with exposure time, and applying Ficks laws of diffusion, the passive sampling thin film technique provides averaged in-situ concentrations of elements in the surrounding seawater during the time of deployment. The technique has some advantages in comparison to point sampling, as it minimises metal contamination risks that could be a major problem during point sampling, avoids speciation changes during sampling and storage, reflects longer-term average concentrations, overcomes the partly extremely low trace metal concentrations in seawater, which are in pico- to nanomolar range, and is easy to use, easy to analyse, and time efficient.

During SO295, the passive samplers were mounted onto small platforms (Passive Sampler Platform - PSP) that were handled by ROV. We deployed the PSPs at four different sites, for periods of 3 to 5 days (Tab. 5.15.2): in the GER reference site (Fig. 5.15.2 right), in the GER thick cover site, in the BEL collector impact site (Fig. 5.15.2. left) and in the BEL plume impact site with thick cover. Due to time constraints because of bad weather conditions, the GSR reference site was cancelled as a DGT sampling site. The PSPs were deployed with the Elevator, and placed on the seafloor with the ROV. During the PSP-1 deployment in the BGR reference site, some sediment suspension occurred, which may be reflected in the metal uptake. Sampling height was 30-40 cm above the seafloor.

We prepared two polyacryl plates per PSP deployment, with six individual probes in each. Usually we deployed triplicates of three different DGT types: (1) probes with a Chelex-binding resin for metals such as Fe, Mn, Cu, Co, Cr, Ni, Pb, Zn, Cd, and REY, (2) probes with a titanium dioxide-binding resin (Metsorb) for oxyanions such as V and As, as well as for metal cations such as Mn and Al, and (3) probes with a mixed binding layer of Chelex-Metsorb. The plates were prepared under a clean bench in the lab. As handling of the holder plates during deployment/recovery on deck bears the risk of contamination from air and gear, the plates were covered with clean plastic bags after fixing them on the PSPs until deployment. Before and after sampling, the DGT probes were rinsed with DI.

Fig. 5.15.2 Passive Sampler Platforms (PSP) with DGT membranes at the seafloor. Left: BEL Collector impact site, between caterpillar tracks, right: GER Reference site. Photos: GEOMAR Team ROV Kiel 6000.

After recovery, all DGT units were rinsed with DI, placed in plastic bags and kept at 4°C. In the home laboratory, the DGT membranes will be removed from the holders and subsequently leached with either 1 ml of 1M HNO_3 (for transition metals), or 1 ml of 1M NaOH (for oxyanions).

Table 5.15.2 Overview of DGT deployments during SO295.

SO295 Station ID deployment / recovery	ROV dive deployment/ recovery	PSP Platform No.	Area and site	DGT Plate No.	Latitude	Longitude	Water depth [m]	DGT type	Deployment start date/time (UTC)	Deployment end date/time (UTC)	Remarks
018 LIFTER / 036 LIFTER	019 ROV-03 / 035 ROV-05	PSP1	GER Reference	1	11°50.519'W	117°03.523'N	4174	3xLSNM-NP; 3x LSNX-NP	09.11.2022 15:13	13.11.2022 04:14	some suspension plume during deployment
018 LIFTER / 036 LIFTER	019 ROV-03 / 035 ROV-05	PSP1	GER Reference	2	11°50.519'W	117°03.523'N	4174	3xLSNM-NP; 3x LSNT-NP	09.11.2022 15:13	13.11.2022 04:14	
044 LIFTER / 062 LIFTER	045 ROV-06 / 061 ROV-07	PSP2	GER Plume impact thick	1	11°55.757'W	117°01.559'N	4121	3xLSNM-NP; 3x LSNX-NP	14.11.2022 13:39	18.11.2022 04:03	few m north of tracks
044 LIFTER / 062 LIFTER	045 ROV-06 / 061 ROV-07	PSP2	GER Plume impact thick	2	11°55.757'W	117°01.559'N	4121	3xLSNM-NP; 3x LSNT-NP	14.11.2022 13:39	18.11.2022 04:03	
134 LIFTER / 152 LIFTER	135 ROV-16 / 151 ROV-19	PSP3	GER Collector impact	1	14°06.717'W	125°52.436'N	4530	3xLSNM-NP; 3x LSNX-NP	02.12.2022 13:31	06.12.2022 05:10	between caterpillar tracks
134 LIFTER / 152 LIFTER	135 ROV-16 / 151 ROV-19	PSP3	GER Collector impact	2	14°06.717'W	125°52.436'N	4530	3xLSNM-NP; 3x LSNT-NP	02.12.2022 13:31	06.12.2022 05:10	
162 LIFTER / 191 LIFTER	163 ROV-20 / 190 ROV-22	PSP4	GER Plume impact thick	1	14°06.660'W	125°52.326'N	4532	3xLSNM-NP; 3x LSNX-NP	07.12.2022 14:46	13.12.2022 01:43	30-40 m away from tracks
162 LIFTER / 191 LIFTER	163 ROV-20 / 190 ROV-22	PSP4	GER Plume impact thick	2	14°06.660'W	125°52.326'N	4532	3xLSNM-NP; 3x LSNT-NP	07.12.2022 14:46	13.12.2022 01:43	

Oxygen sensor calibration

To ensure the quality of dissolved oxygen measurements, the SeaBird SBE 43 oxygen sensor mounted on the rosette was re-calibrated with shipboard analysis of 12 discrete rosette samples of stations SO295-120CTD and SO295-150CTD from water depths between 360 and 4477 m by Winkler titration. The calibration shows a consistent linear relation between the sensor and Winkler data for oxygen concentrations ranging between 1.9 and 163.5 µmol/kg ($r2 = 0.99996$). The thin dashed line in Figure 5.15.3 indicates a one-to-one correspondence. The blue solid line is obtained from the linear regression of the Winkler titration data as a function of oxygen sensor output. The function given at the top of Figure 5.15.3 was used to re-calibrate the oxygen sensor data shown in Figures 5.16.2, 5.16.3, 5.16.4.

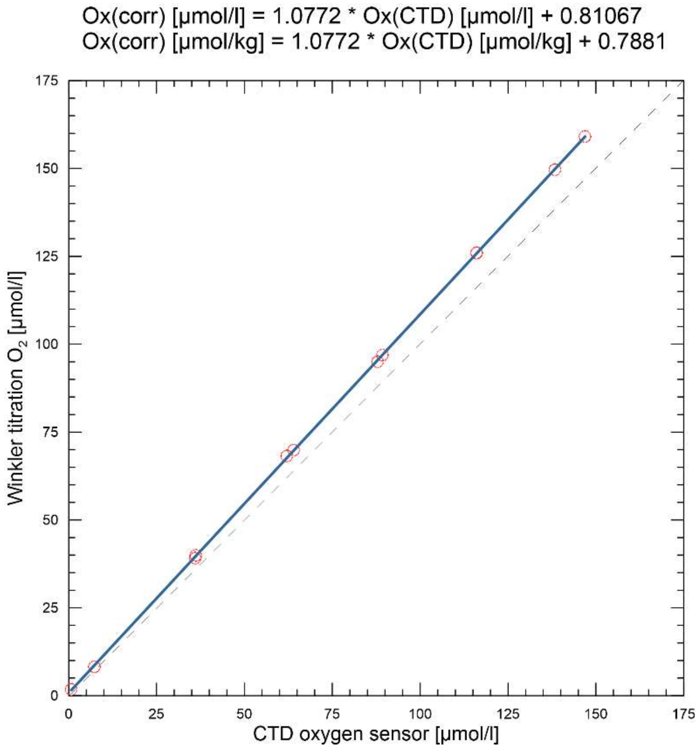


Fig. 5.15.3 Comparison of oxygen concentrations measured by Winkler titration as a function of the output from the oxygen sensor mounted on the CTD/Rosette.

5.16 Physical Properties of Seawater

(K. Schmidt, C. Rühlemann)

Objectives

BGR's program of work within its polymetallic nodule exploration area follows the "Recommendations for the guidance of contractors for the assessment of the possible environmental impacts arising from exploration for marine minerals in the Area" (see ISA document "ISBA/25/LTC/6/Rev.2"). According to these recommendations, contractors performing a test of mining components are required to resample the local environmental baseline data and evaluate the environmental impacts after a certain time. In order to (1) investigate the potential mining-induced transfer of pore water into the overlying water column, and to (2) address the impact of potential sediment resuspension on geochemical processes in the water column and in the benthic layer, pre- and post-impact data on geochemical characteristics of the bottom water and the water column are required. Baseline data were acquired during previous exploration campaigns of the BGR and during the MiningImpact cruise SO268 with RV SONNE in 2019. To study the impact, data and samples were collected during and shortly after the mining test in 2021 with the MANGAN 2021 expedition. During the SO295 expedition, we focused on measuring physical and biogeochemical water characteristics as well as collecting and sampling the bottom water and the overlying water column one and a half year after the collector trials to quantify potential pore water release into the bottom water, and for the analysis of trace metal concentrations, dissolved and particulate matter and microbiological communities. Temperature, salinity, turbidity, fluorescence (chlorophyll a) and oxygen concentration were recorded through the deployment of the CTD/rosette water sampler at four sites in the BGR exploration area and three sites in the GSR area.

Shipboard results

The exploration areas of BGR and GSR are influenced by the North Equatorial Current, flowing westward under the influence of the NE trade winds (Fig. 5.16.1). The areas are situated within the westward extension of the eastern Pacific warm pool. As examples for the water masses occurring in these ocean areas, downcast profiles of different parameters from surface to seafloor are shown for stations SO295-004CTD (BGR area) and SO295-CTD (GSR area) in Figure 5.16.2 and for the upper 200 m in Figure 5.16.3. A comparison of temperature, salinity, fluorescence and oxygen in the upper 400 m is shown for all seven CTD casts from the two areas in Figure 5.16.4. Because the electrical supply to the CTD had to remain switched off until the two in situ-pumps were attached to the cable or taken off, the data for the upper ca. 30 m of the water column is lacking for a few casts.

Figures 5.16.3 and 5.16.4 show that sea surface temperature (SST) was 27.5°C to 28.0°C in the BGR area in November 2022 and 25.0°C to 26.0°C in the GSR area in December. Sea surface salinities (SSS) were 33.0 to 33.6 (psu) in the BGR area and 33.2 to 33.7 in the GSR area. The relatively low surface salinities are the result of precipitation exceeding evaporation in this area just north of the mean position of the Intertropical Convergence Zone (ITCZ).

The temperature and salinity profiles in figure 5.16.3 reveal that the mixed layer depth (MLD) ranged between 10 m and 30 m in the BGR exploration area and it was 20-30 m in the GSR area; typical values for these sites in this season (Fiedler and Talley, 2006). In the BGR area, the maximum temperature gradient was 1.1°C m-1 and the temperature difference between the top and bottom of the thermocline was 13.5°C, and it was 0.9°C m-1 and 11.8°C in the GSR area.

Fluorescence is mainly a measure of chlorophyll a concentration and thus of the level of phytoplankton biomass. It shows a similar pattern for each of the seven stations in the two areas, with a sudden increase coinciding with the lower limit of the mixed layer (Figs. 5.16.3 and 5.16.4), below which nutrient concentrations increase significantly. Slightly less pronounced deeper fluorescence maxima occur at 70-90 m water depth in the BGR area and at 70-120 m in the GSR area, a typical pattern that we also observed during the collector test in April/May 2021.

The oxygen concentration drops from values of ~200 µmol kg-1 at 10-30 m water depth in the two exploration area to 1.6 µmol kg-1 below 40 m to 60 m (Figs. 5.16.3 and 5.16.4). This sharp decrease within 30 m marks the beginning of the oxygen minimum zone, which extends to about 700 m. The strong increase in fluorescence concentrations to maximum values coincides with the depths where oxygen concentrations sharply drop in either area, indicating that primary production in the sunlit zone and subsequent remineralisation of particulate organic matter under oxygen consumption at depth is an important factor for the formation of this O_2 minimum zone.

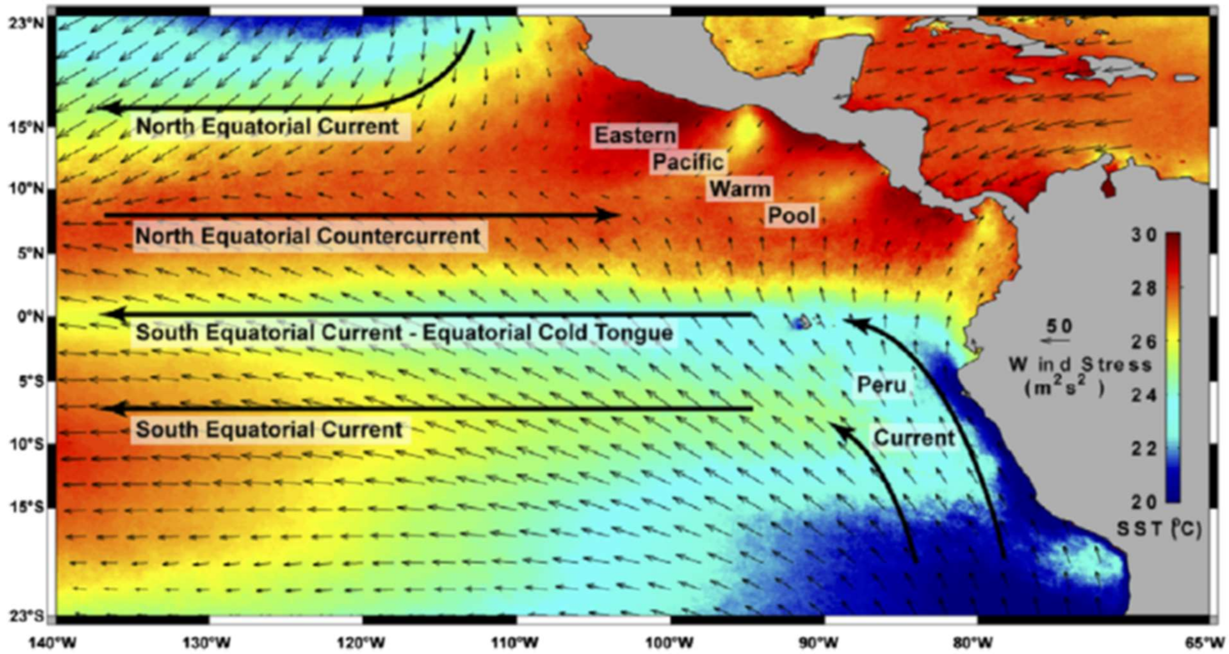


Fig. 5.16.1 Average sea surface temperature, wind stress and overview of major surface currents in the eastern tropical Pacific (from Pennington et al., 2006). STSW: Subtropical Surface Water; TSW: Tropical Surface Water. Heavy black lines denote major currents, thin black lines represent FSU/COAPS wind stress climatology (1999-2003), and colours reflect six-year Aqua-MODIS sea surface temperature climatology (1997-2003). The white rectangles denote the positions of the exploration areas of GSR (west) and BGR (east), where the collector tests took place.

Northern and southern source low-salinity intermediate (subpycnocline) water masses (between 500 and 1000 m) meet approximately at 10° N, somewhat south of the two test sites. Antarctic Intermediate Water (AAIW) forms from the deep, winter mixed layer north of the Subantarctic Front in the southeast Pacific (Hanawa and Talley, 2001) and spreads equatorward and westward in the Pacific. North Pacific Intermediate Water (NPIW) originates from subsidence in the Sea of Okhotsk and at the Oyashio Front in the western North Pacific, with some contribution from the Gulf of Alaska (You, 2003).

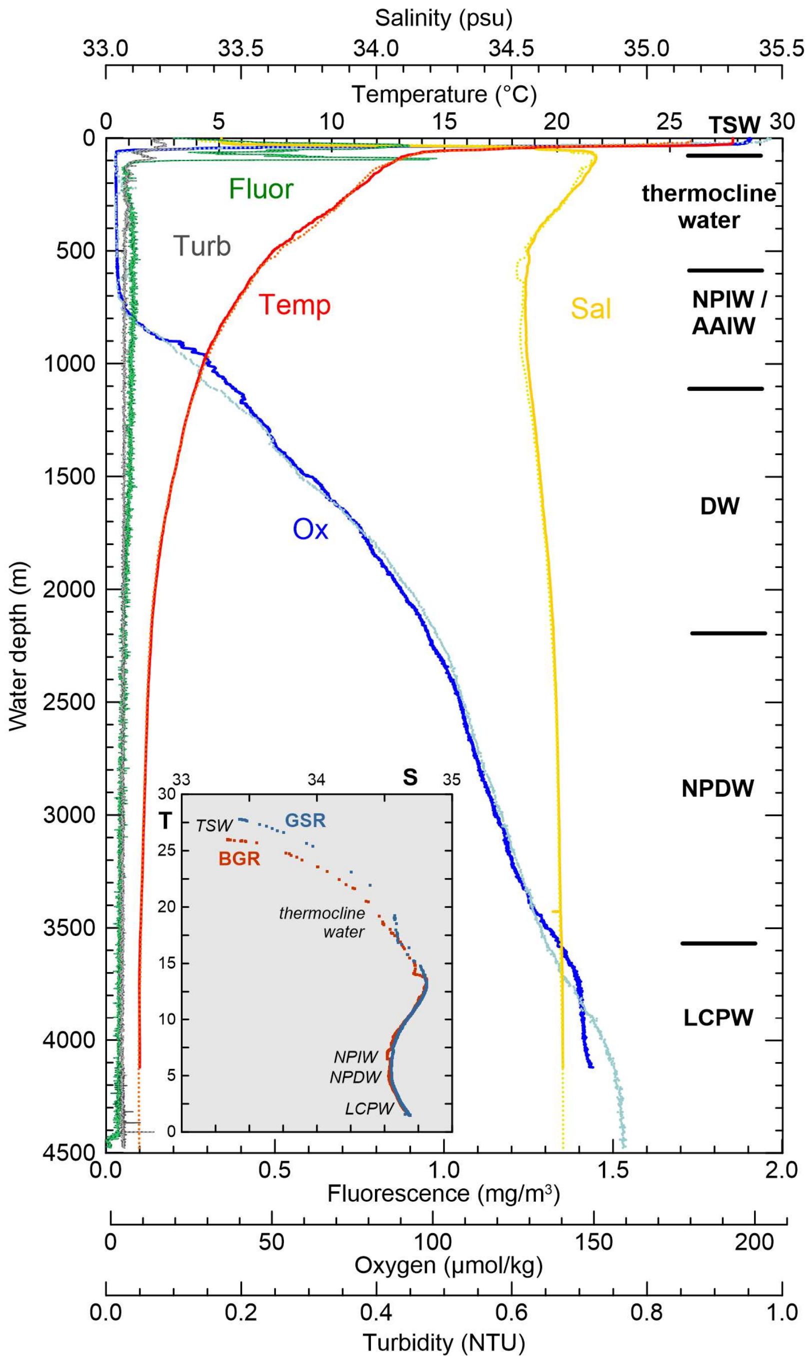


Fig. 5.16.20 Water mass characteristics of the exploration areas of GSR and BGR, exemplified by the downcast profiles at sites SO295-004CTD (BGR, solid lines) and SO295-150CTD (GSR, stippled lines) in November and December 2022, respectively. The vertical distribution of water masses in BGR's exploration area is indicated on the right: Tropical Surface Water (TSW), North Pacific Intermediate Water (NPIW), Antarctic Intermediate Water (AAIW), Pacific deep water (DW), North Pacific Deep Water (NPDW), Lower Circumpolar Water (LCPW). A temperature-salinity plot with data from the two CTD casts is shown in the inset. The water masses of the upper 150 m (>12°C) show a high variability in temperature and salinity.

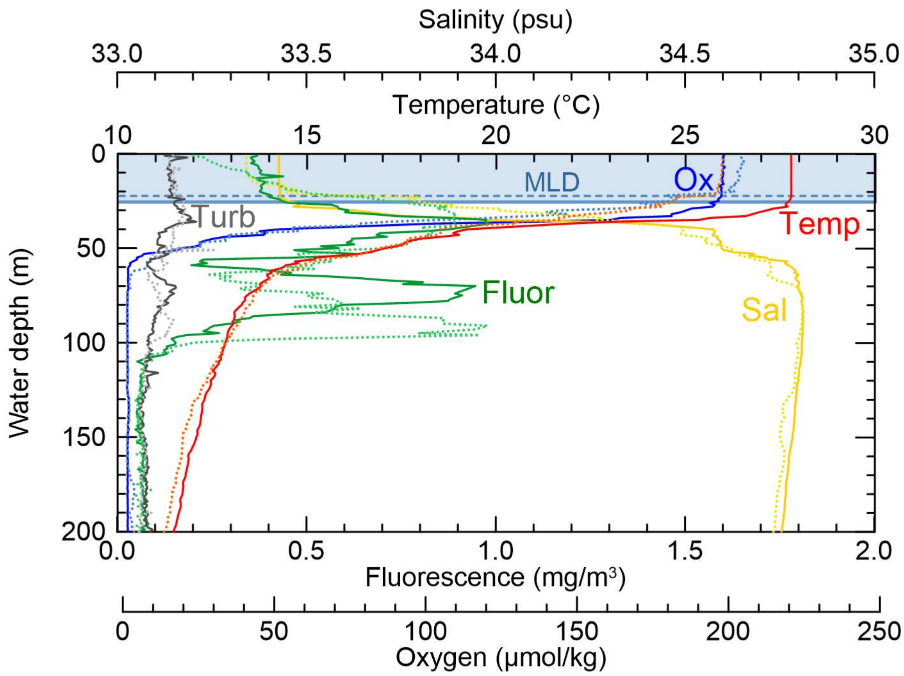


Fig. 5.16.3 Close-up and comparison of water mass characteristics of the upper 200 m, exemplified by stations SO295-004CTD from the BGR exploration area (solid lines) and SO295-150CTD from the GSR area (stippled lines), situated 990 km apart. MLD is mixed layer depth.

The profiles of temperature, salinity and oxygen reflect the vertical distribution of water masses. Most of the density stratification is due to a vertical temperature gradient, but is reinforced by a halocline. Beneath the warm, low-salinity Tropical Surface Water (TSW; T >25°, S <34) a pronounced thermocline/halocline separates surface and subpycnocline waters, but does not contain a distinct water mass of any substantial volume (Fiedler and Talley, 2006). This cooler, more saline thermocline water is upwelled at the equator and contributes to the formation of Equatorial Surface Water.

In general, the eastern tropical Pacific subpycnocline waters are very low in oxygen. This extreme oxygen deficiency in the open ocean is mainly attributable to three factors: (1) high phytoplankton production at the surface; (2) a sharp permanent pycnocline that prevents local ventilation of subsurface waters; and (3) a sluggish and convoluted deep circulation and therefore old age of subpycnocline waters (Fiedler and Talley, 2006).

The properties of deep and bottom waters in the Pacific are set by their distant sources in the Antarctic and North Atlantic. The deep water (DW) between 1000 and 2500 m is relatively featureless, with a steady decrease in temperature and increase in salinity. North Pacific Deep Water (NPDW) is the 1.2-2°C cold water mass occurring at a depth > 2500 m. The bottom water in the Pacific is Lower Circumpolar Water (LCPW), a mixture of Antarctic Bottom Water formed in the Weddell Sea and North Atlantic Deep Water formed in the northern North Atlantic. LCPW in the eastern tropical Pacific north of the equator is characterized by relatively high oxygen concentrations. This water mass flows from the Northeast Pacific Basin along the western flank of the East Pacific Rise into the eastern tropical Pacific. LCPW is present below a water depth of ~3600 m in the BGR area and below 4000 m in the GSR area (Fig. 5.16.2).

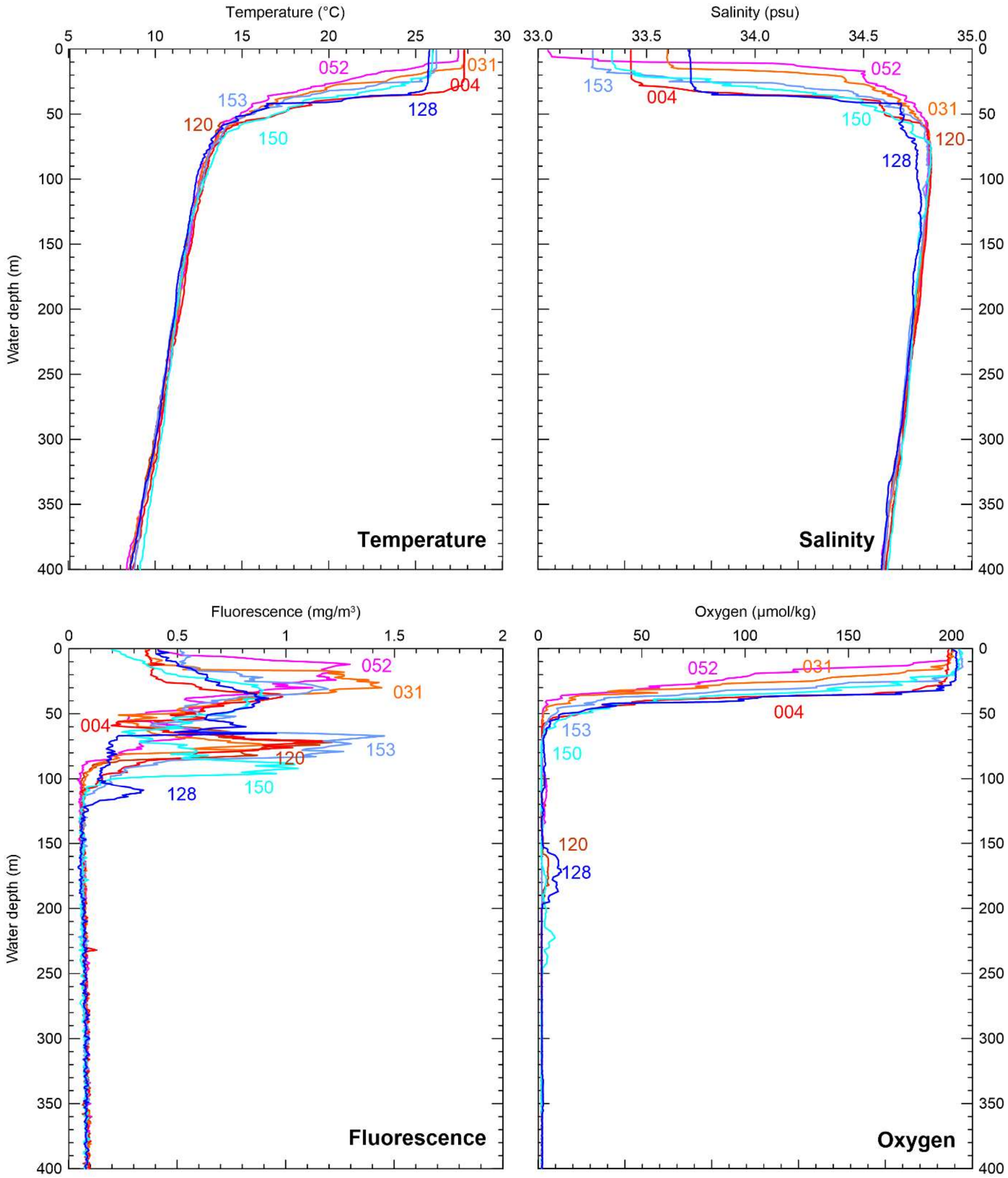


Fig. 5.16.4 Synopsis of water mass properties for the upper 400 m based on seven CTD casts measured in the exploration areas of BGR and GSR. Reddish colours show the four CTD casts from the BGR area and bluish colours the three CTD casts from the GSR area.

5.17 In-situ Experiments (foodweb, O_2 consumption, restoration)

5.17.1 In-situ experiments with incubation chambers CUBEs

(T. Stratmann)

The extraction of manganese nodules will significantly impact deep-sea benthic ecosystems both directly, by disturbing the seafloor, and indirectly, by dispersion of sediment plumes and mining debris. It is however challenging to predict or even quantify mining impacts, because these deep-sea ecosystems are so poorly understood. The revisit of the Patania II pre-prototype collector test area in the BGR and GSR exploration license area provides a unique opportunity to investigate how the trophic interactions in the benthic food web have changed since the collector test was performed ~1.5 years ago. This will allow a unique assessment of how an ecosystem of a nodule area is affected by industrial polymetallic nodule extraction and how much time is required to establish a new equilibrium.

To quantify the trophic interactions in the benthic food web, *in-situ* pulse-chase studies with phytodetritus (*Phaeodactylum* sp.) and bacteria enriched in the stable isotopes ^{13}C and ^{15}N, and deuterium oxide (D_2O, also known as heavy water) were performed. The use of $^{13}C/^{15}N$ enriched phytodetritus and bacteria allows tracing the assimilation of phytodetritus-derived and bacteria-derived carbon and nitrogen into microbes, faunal size-classes (meio-, and macrofauna, sponges) and into dissolved inorganic carbon (DIC) following respiration. A novelty is that the benthic incubation chambers CUBES were modified to allow the injection of deuterium oxide (1% concentration in seawater) by the ROV KIEL 6000. Deuterium oxide is used as food-source independent tracer to measure the metabolic activity of individual deep-sea organisms in their natural environment.

During the cruise, CUBEs were placed at the seafloor over sponges in the reference area (GSR exploration license area) and in the thick plume cover area (GSR exploration license area), at without larger invertebrate megafauna in the collector area (GSR & BGR exploration license area). After the placement of a CUBE at the seafloor (Fig. 5.17.1 left), the ROV started the incubation program of 3 days. Each CUBE was equipped with a bacteria/ phytodetritus injection system, a syringe-sampling rosette, a deuterium oxide injection system, a stirrer and an oxygen optode. At the end of the incubation period, the ROV displaced the CUBEs and sampled the sponge (if present), took three pushcorers) (for sediment, microbes, and meiofauna), and a MPI-bladecorer (for macrofauna) (Fig. 5.17.1 right).

Fig. 5.17.1 (left) CUBE deployed over a sponge in the GSR reference area. (right) Collection of pushcores, blade cores, and sponge sample after the end of the incubation.

Table 5.17.1 Overview of the in-situ CUBE experiments conducted during SO295.

Site	Reference area	Thick plume cover area	Collector area
With sponges	2x GSR area; food source: bacteria culture		
Without sponges		2x GSR area; food source: bacteria culture	2x GSR area + 2x BGR area; food source: phytodetritus

Table 5.17.2 Sample list.

Station #	ROV dive # (D = deployment, R = recovery)	CUBE incubation/ background sample	CUBE #	PUC #	Blade corer #	Sponge
SO295_19-1	D: ROV3, R: ROV5	CUBE incubation	2	54, 44, 82	1	x
		CUBE incubation	3	D7, D8, 37	2	x
		background		74, C2, 69	3	
SO295_45-1	D: ROV6, R: ROV7	CUBE incubation	2	67, 75, 78	1	
		CUBE incubation	3	C3, D4, 6	2	
		background		D3, C5, 41	3	
SO295_83-1	D: ROV10, R: ROV13	CUBE incubation	2	37, C6, 58	3	
		CUBE incubation	3	D0, 2, C2	4	
		background		B9, A9, 42	2	
SO295_135-1	D: ROV16, R: ROV19	CUBE incubation	2	27, 44, 11	1	
		CUBE incubation	3	59, 54, 68	4	
		background		A0, 74, 41	3	

5.17.2 Benthic chambers and Microprofilers

(F. Janssen, D. Sevilgen, D. Vlach)

Oxygen distribution in the sediment and oxygen fluxes were measured directly at the seafloor (‘*in situ*’) to assess sediment community activity and organic matter remineralization rates of seafloor communities. These measurments were done with special emphasis on potential mid-term effects connected to nodule removal, sediment redistribution, and blanketing. By performing measurements *in situ*, artifacts connected to depressurization and warming when recovering sediments from depth were avoided. Three types of *in situ* modules, all manipulated by ROV were used for *in situ* measurements: Benthic chamber modules, electrochemical-, and fiberoptical microprofilers. Table 5.17.3 provides an overview of all *in situ* module deployments that took place during SO295.

Benthic flux chamber modules (‘BFC’) were used to quantify total oxygen uptake (‘TOU’) by enclosing a 0.0284 m^2 large area of the seafloor with a circular polycarbonate chamber (ID=0.19 m) for a period of approx. 3 days. Optical oxygen sensors (‘optodes’, type 4430, Aanderaa Data Instruments AS, NO) were used to record time series of oxygen concentration in the water overlying the enclosed patch of seafloor sediment and nodules. In combination with the chamber volume / overlying water height, TOU is calculated from the rate of oxygen decrease. Following instructions by the manufacturer, 2-point calibrations of the oxygen optodes were performed in sea water once before the first and once after the last chamber deployment in the ship’s cooled storage room (~6°C) and in a temperature controlled laboratory fridge (~2°C), respectively. Optodes were immersed first sea water that was purged with air (i.e., air saturated) and then transferred to seawater that was chemically deoxygenated by sodium dithionite addition (i.e., anoxic). The air pressure at the time of the calibration and the bottom water salinity was stored internally in the optodes so oxygen concentrations could be correctly calculated from phase angle and temperature measurements by the sensor’s firmware. As stated in the manufacturer’s manual, optode measurements tend to underestimate oxygen concentrations at depth and show a misreading of approx. 3% per 1000 m water depth. In order to correct for this effect, optode measurements at depth will be corrected to the true bottom water value. The correction factor is determined by dividing the bottom water oxygen concentration as measured with the calibrated CTD (~164 µmol L^{-1} in the GSR and ~154 µmol L^{-1} in the BGR area, respectively; see Chapter 5.16) by the apparent concentrations in the bottom water and in the chamber at the beginning of the incubations as measured with the BFC’s oxygen optodes. Further corrections are necessary to account for the initial drift of the optodes. For this correction sensor drift behavior will be characterized in post processing based on recordings in the bottom water by the sensors outside the chambers (see example data in Fig. 5.17.7). The chamber volume (or overlying water height) will be calculated based on the salinity decrease detected with conductivity sensors (type 5860, Aanderaa Data Instruments AS, NO) in the overlying water after injection of 50 mL of deionized water at the start of the deployment by means of the BFC’s syringe sampler (grey curve in Fig. 5.17.7). Additionally, the overlying water height was determined visually during deployment based on the penetration depth of the chamber as observed in the ROV’s video stream. Over the time course of the deployments the same syringe sampler took six samples from the overlying water at pre-programmed times for later analyses of dissolved inorganic carbon (DIC) and nutrients. After instrument retrieval, nutrient samples were frozen while DIC samples were preserved by addition of saturated $HgCl_2$ solution (~1.7% of the sample volume) and stored at 4°C**.**

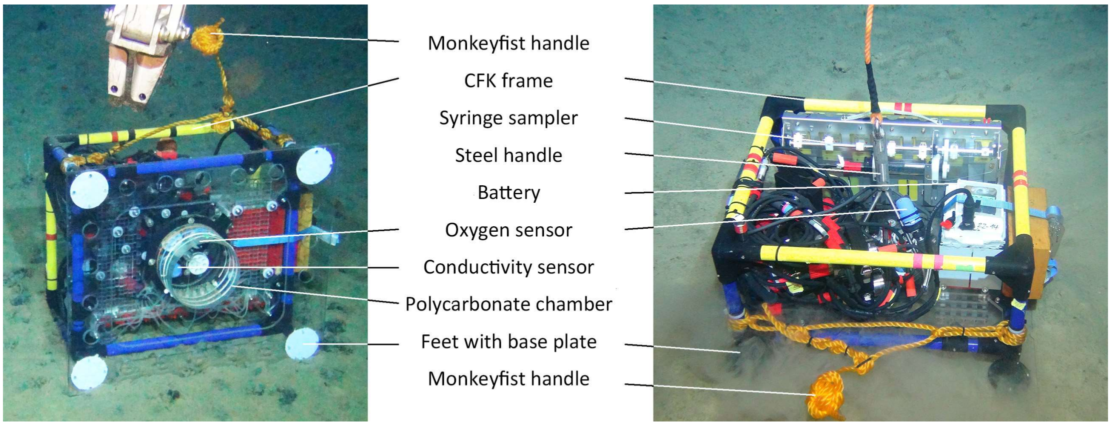


Fig. 5.17.2 Benthic chamber module (left panel: lying on the side, right panel: regular position upon deployment.

Electrochemical microprofiler (MICP) and fiberoptical microprofiler modules (MICP-DEEP) were used for recording high resolution vertical profiles of pore water oxygen concentrations in the top 150 to 250 mm of the sediment. Measurements were obtained at sub-millimeter resolution by lowering the oxygen microsensors in steps from slightly above the sediment-water interface down into the sediment. From the concentration profiles diffusive oxygen uptake (DOU) will be determined by fitting 1D models of concentration profiles to measurements. The fitting procedure will either be based on simple diffusion respiration models that adjust local volumetric respiration rates in pore waters to match measured oxygen distributions (e.g., software PROFILE, Berg et al. 1998), or on more complex biogeochemical models that take rates and quality of organic matter supply into account (e.g., Haeckel et al., 2001). The Clark-type amperometric glass oxygen microsensors, that were used in case of the electrochemical profiler (MICP) were custom-built at the Max-Planck-Institute for Marine Microbiology in Bremen, DE and had typical tip diameters of some tens of micrometers. With their particular thin tip they can resolve vertical changes in oxygen concentration at particularly high resolution, especially near the sediment surface where concentration gradients are steepest. In addition to up to ten individual oxygen sensors, a conductivity sensor (custom-built as well) was attached to the MICP to detect the sediment surface and allow for later assessment of the vertical distribution of sediment porosity / tortuosity. Fiberoptical microprofilers (MICP-DEEP) were equipped with more robust, fiberoptical oxygen microsensors with tip diameters of 430µm (OXB430-CV, Pyroscience, Aachen DE). Two sets of four sensors each were attached to separate motorized profiling stages. The fiberoptical sensors were embedded in hypodermic needles mounted to carbon-reinforced plastic shafts. This setup allowed to record longer profiles, that are particularly 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. Fiberoptical as well as electrochemical microsensors were calibrated by means of 2-point calibrations in seawater purged with air (i.e., at air saturation) and in seawater that was de-oxygenated by the addition of sodium dithionite (i.e., anoxic). To keep the water at a constant temperature of 1°C (i.e., close to *in situ* temperature) during the calibration, the supply bottles with aerated and de-oxygenated seawater were installed in larger vessels filled with freshwater/ice mix that were kept in a temperature-controlled fridge. Directly before calibrating the indivual sensors in the lab, aliquots from the supply bottles were transferred to 50 ml plastic centrifuge tubes that were again kept in beakers filled with freshwater/ice mix. In case of the fiberoptical microsensors, the calibration readings were saved to the individual oxygen meters (Pico-O2, Pyroscience) installed in the main electronics. The air pressure at the time of the calibration and the bottom water salinity and temperature were stored in the oxygen meters so oxygen concentrations could be calculated internally from raw phase angle readings by the sensor's firmware. For the electrochemical microsensors the raw picoampere readings were logged duing calibration. Calibrations typically happened within a few hours and not more than one day before deployment. Oxygen measurements obtained in the bottom water above the sediment-water interface at the beginning of each profile will be used to correct the measurements of the respective microsensors. The correction factor is calculated by dividing the true bottom water concentration measured with the calibrated CTD (~164 µmol L-1 in the GSR and ~154 µmol L-1 in the BGR area, respectively; see Chapter 5.16) by the picoampere readings (MICP) or the uncorrected concentration reading (MICP-DEEP) recorded by the respective microsensors in the bottom water above the sediment.

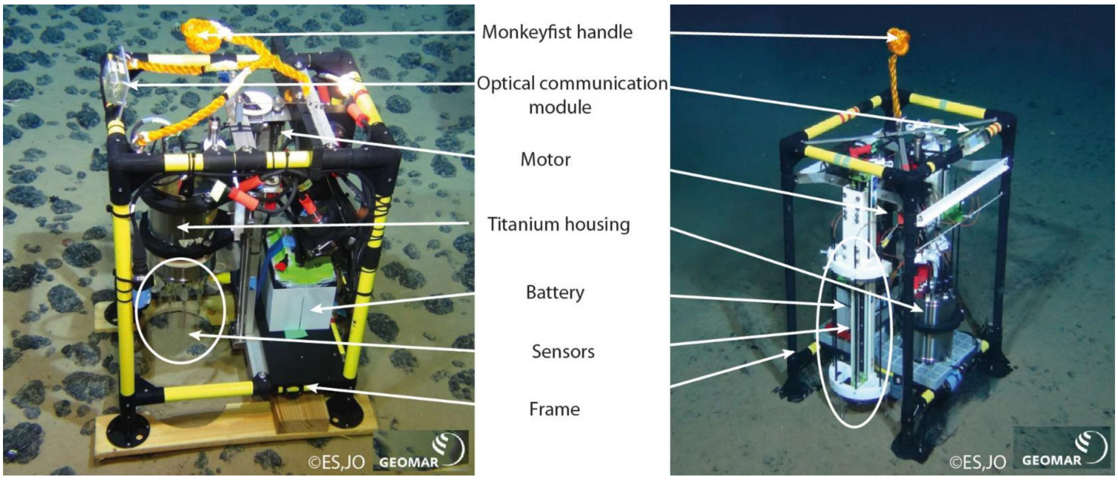


Fig. 5.17.3 Electrochemical (left) and fiberoptical microprofilers (right). Image: J. Otte & E. Schiller. Photograph: ROV Kiel6000 Team, GEOMAR.

Overall, 47 deployments of *in situ* benthic chamber (BFC) and microprofiler modules (MICP and MICP-DEEP, respectively) took place during the expedition, 32 in the BGR and 25 in the GSR contract area (Figs. 5.17.4, 5.17.5, 5.17.6; Tab. 5.17.3). Deployments addressing the direct and indirect effects of nodule mining on seafloor oxygenation and oxygen fluxes took place at the trial sites where collector tests happended in 2021. Specifically, instruments were deployed (1) between caterpillar tracks where nodules have been harvested ('collector impact site'), (2) in close vicinity to the collector impact sites were nodules and sediments were covered with a thick layer of the fine material settling from the mining plume ('plume impact site thick cover'), and (3) further away from the collector impact sites where less fine material settled ('plume impact site thin cover'). For comparison, measurements under natural / undisturbed conditions took place (1) at 'reference sites', approx. 10 km south west of the trial areas as well as (2) in undisturbed areas within the trial sites upstream of the collector impact areas under prevailing current conditions at the time of the collector test ('trial baseline time series sites').

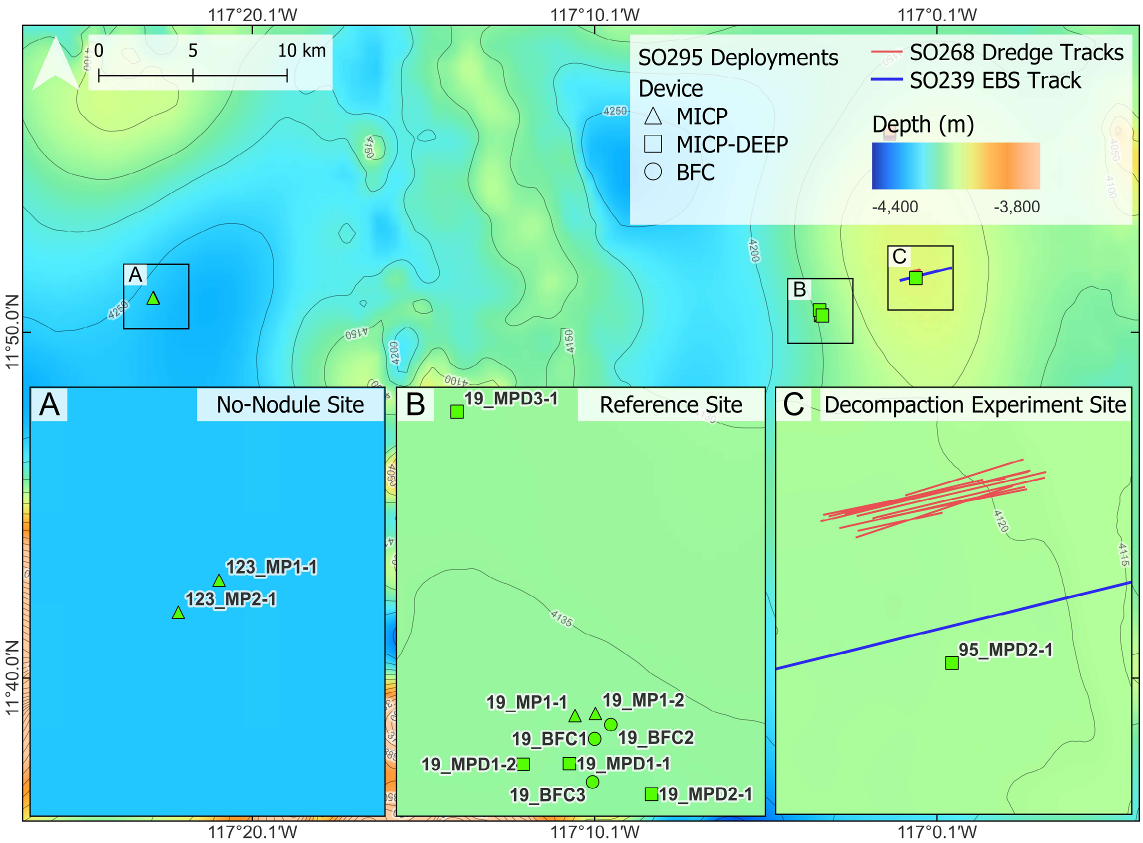


Fig. 5.17.4 Deployment locations of benthic flux chambers (BFC, circles), electrochemical (MICP, triangles), and fiberoptical microsensor profilers (MICP-DEEP, squares) in the GER reference area. The first part of the enumeration next to the symbols represents a short form of station numbers (e.g.,19' referring to ROV station 019-1_ROV-03).

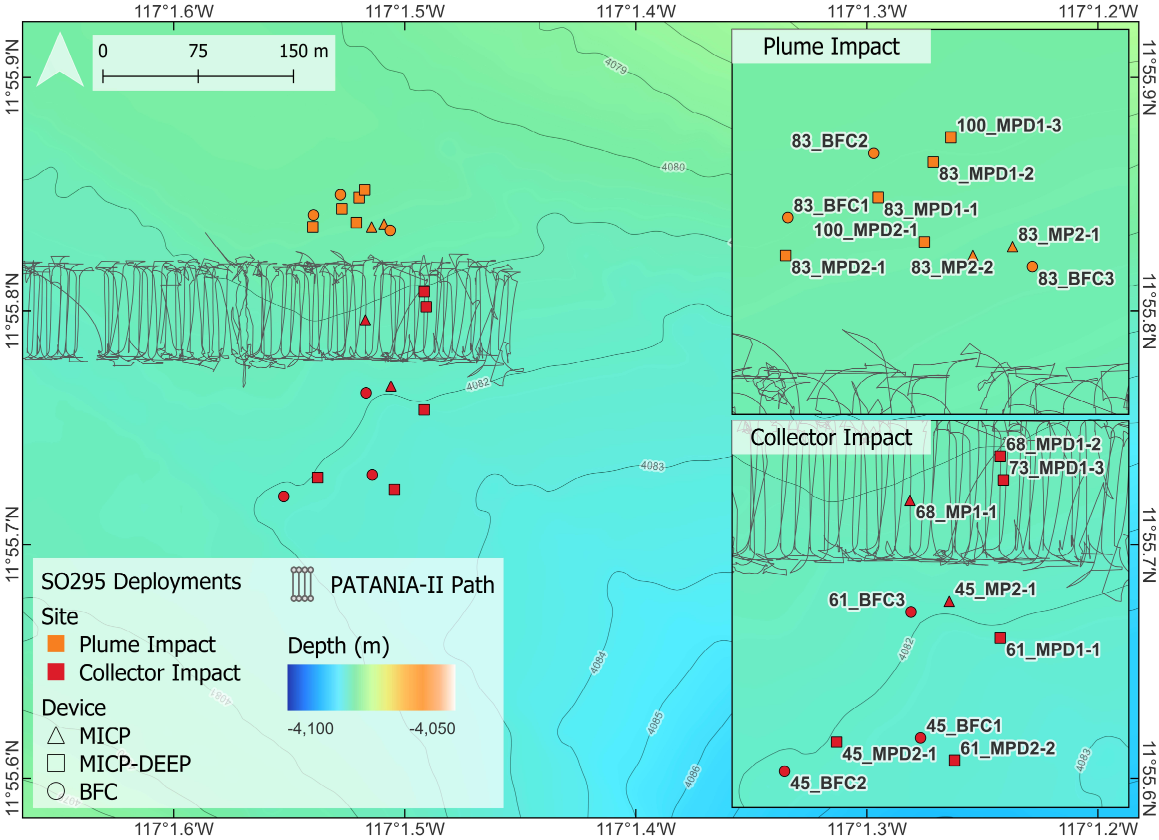


Fig. 5.17.5 Deployment locations of benthic flux chambers (BFC, circles), electrochemical (MICP, triangles), and fiberoptical microsensor profilers (MICP-DEEP, squares) in the GER plume (orange) and collector impact areas (red). The first part of the enumeration next to the symbols represents a short form of station numbers (e.g.‚45' referring to ROV station 045-1_ROV-06). The shortcomings in underwater navigation in the first part of the cruise (prior to station 089-1_ROV-11, see Chapter 7) led to uncertainties in positioning that are reflected in some of the locations of the instruments deployed in the collector impact area plotting off the PATANIA II tracks.

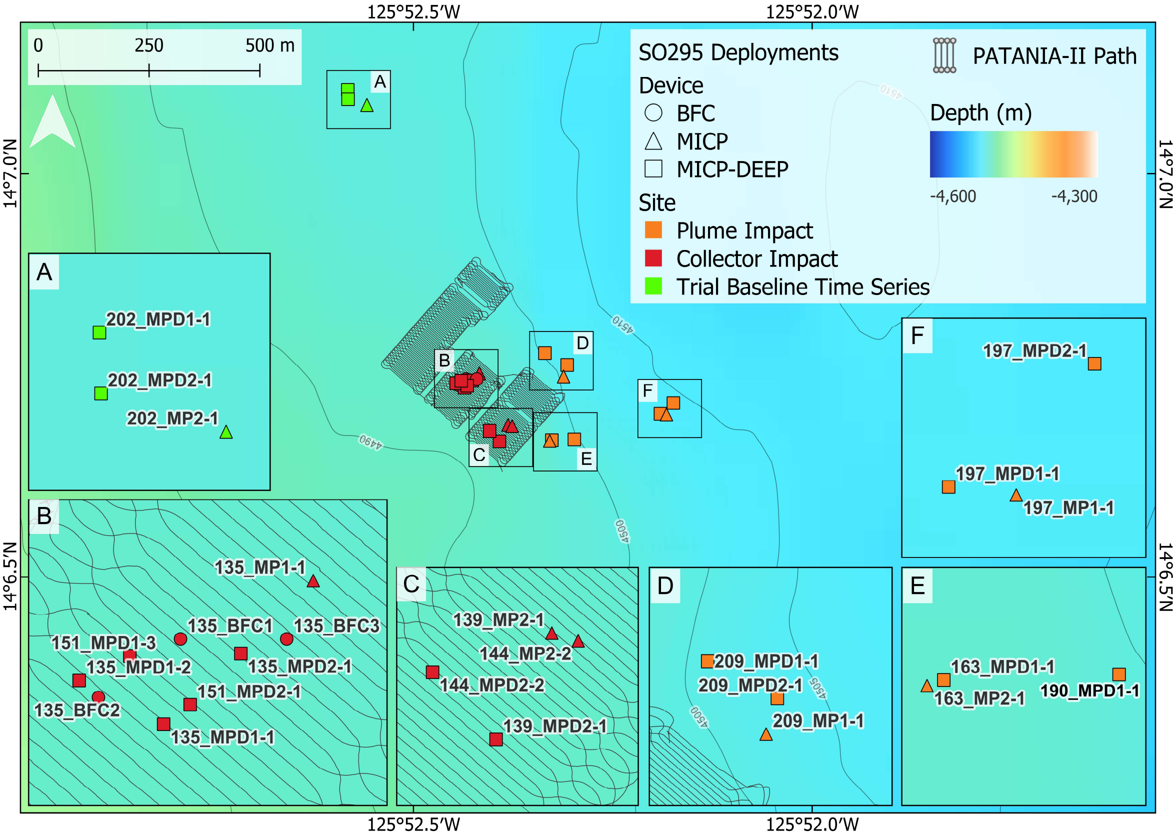


Fig. 5.17.6 Deployment locations of benthic flux chambers (BFC, circles), electrochemical (MICP, triangles), and fiberoptical microsensor profilers (MICP-DEEP, squares) in the BEL plume (orange) and collector impact areas (red), as well as in the trial baseline time series area (green). The first part of the enumeration next to the symbols represents a short form of station numbers (e.g.‚135' referring to ROV station 135-1_ROV-16).

Table 5.17.3 Overview of *in situ* module deployments during SO295.

Deployment station *recovery station*	Event label (deployment) *Instrument*	Deployment start (UTC) *deployment end*	Area *characteristics*	Position	Water depth
BGR / GER					
SO295_019-1_ROV-03 *SO295_035-1_ROV-05*	SO295_019ROV03_BFC1 *benthic flux chamber 1*	09.11.2022 19:40:36 *13.11.2022 00:57:38*	GER Reference	11° 50.5218'N* 117° 3.5166'W*	4174 m
SO295_019-1_ROV-03 *SO295_035-1_ROV-05*	SO295_019ROV03_BFC2 *benthic flux chamber 2*	09.11.2022 20:07:45 *13.11.2022 01:02:56*	GER Reference	11° 50.5278'N* 117° 3.5076'W*	4174 m
SO295_019-1_ROV-03 *SO295_035-1_ROV-05*	SO295_019ROV03_BFC3 *benthic flux chamber 3*	09.11.2022 20:43:21 *12.11.2022 23:55*	GER Reference	11° 50.5035'N* 117° 3.5142'W*	4175 m
SO295_019-1_ROV-03 SO295_019-1_ROV-03	SO295_019ROV03_MICP-DEEP1-1 *fiberoptical microprofiler 1*	09.11.2022 21:59:13 *10.11.2022 00:41:55*	GER Reference	11° 50.5113'N* 117° 3.5184'W*	4174 m
SO295_019-1_ROV-03 *SO295_019-1_ROV-03*	SO295_019ROV03_MICP1-1 *electrochemical microprofiler 1*	09.11.2022 22:31:51 *10.11.2022 01:55:00*	GER Reference	11° 50.5317'N* 117° 3.5214'W*	4174 m
SO295_019-1_ROV-03 *SO295_035-1_ROV-05*	SO295_019ROV03_MICP-DEEP1-2 *fiberoptical microprofiler 1*	10.11.2022 00:54:49 *12.11.2022 23:17:59*	GER Reference	11° 50.511'N* 117° 3.5406'W*	4175 m
SO295_019-1_ROV-03 *SO295_035-1_ROV-05*	SO295_019ROV03_MICP1-2 *electrochemical microprofiler 1*	10.11.2022 02:02:47 *12.11.2022 22:35:37*	GER Reference	11° 50.5326'N* 117° 3.5142'W*	4174 m
SO295_029-1_ROV-04 *SO295_029-1_ROV-04*	SO295_029ROV03_MICP-DEEP3-1 *fiberoptical microprofiler 3*	11.11.2022 19:59:26 *11.11.2022 22:00:06*	GER Reference	11° 50.6601'N* 117° 3.5724'W*	4174 m
SO295_035-1_ROV-05 *SO295_035-1_ROV-05*	SO295_035ROV05_MICP-DEEP2-1 *fiberoptical microprofiler 2*	12.11.2022 18:04:24 *13.11.2022 00:24:04*	GER Reference	11° 50.4984'N* 117° 3.4902'W*	4173 m
SO295_045-1_ROV-06 *SO295_061-1_ROV-07*	SO295_045ROV06_BFC2 *benthic flux chamber 2*	14.11.2022 20:15:08 *18.11.2022 01:43:10*	GER Collector impact *between caterpillar tracks*	11° 55.7205'N* 117° 1.5882'W*	4121 m
SO295_045-1_ROV-06 *SO295_061-1_ROV-07*	SO295_045ROV06_MICP-DEEP2-1 *fiberoptical microprofiler 2*	14.11.2022 21:24:54 *17.11.2022 19:36:52*	GER Collector impact *between caterpillar tracks*	11° 55.7286'N* 117° 1.566'W*	4121 m
SO295_045-1_ROV-06 *SO295_061-1_ROV-07*	SO295_045ROV06_BFC1 *benthic flux chamber 1*	14.11.2022 23:28:22 *17.11.2022 23:13:37*	GER Collector impact *between caterpillar tracks*	11° 55.7298'N* 117° 1.5504'W*	4121 m
SO295_045-1_ROV-06 *SO295_061-1_ROV-07*	SO295_045ROV06_MICP2-1 *electrochemical microprofiler 2*	15.11.2022 00:45:40 *17.11.2022 23:47:32*	GER Collector impact *between caterpillar tracks*	11° 55.7679'N* 117° 1.5438'W*	4121 m
SO295_061-1_ROV-07 *SO295_068-1_ROV-08*	SO295_061ROV07_MICP-DEEP1-1 *fiberoptical microprofiler 1*	17.11.2022 19:18:26 *18.11.2022 19:53:41*	GER Collector impact *between caterpillar tracks*	11° 55.7577'N* 117° 1.488'W*	4121 m
SO295_061-1_ROV-07 *SO295_061-1_ROV-07*	SO295_061ROV07_MICP-DEEP2-2 *fiberoptical microprofiler 2*	17.11.2022 19:42:41 *18.11.2022 00:30:00*	GER Collector impact *between caterpillar tracks*	11° 55.7235'N* 117° 1.5138'W*	4121 m
SO295_061-1_ROV-07 *SO295_073-1_ROV-09*	SO295_061ROV07_BFC3 *benthic flux chamber 3*	17.11.2022 20:09:29 *20.11.2022 00:46:32*	GER Collector impact *between caterpillar tracks*	11° 55.7649'N* 117° 1.5132'W*	4120 m
SO295_068-1_ROV-08 *SO295_073-1_ROV-09*	SO295_068ROV08_MICP1-1 *electrochemical microprofiler 1*	18.11.2022 19:35:17 *19.11.2022 23:37:38*	GER Collector impact *between caterpillar tracks*	11° 55.7961'N* 117° 1.521'W*	4121 m
SO295_068-1_ROV-08 *SO295_073-1_ROV-09*	SO295_068ROV08_MICP-DEEP1-2 *fiberoptical microprofiler 1*	18.11.2022 19:59:53 *19.11.2022 19:09:28*	GER Collector impact *between caterpillar tracks*	11° 55.8084'N* 117° 1.4976'W*	4121 m
SO295_073-1_ROV-09 *SO295_073-1_ROV-09*	SO295_073ROV09_MICP-DEEP1-3 *fiberoptical microprofiler 1*	19.11.2022 19:15:25 *19.11.2022 23:34:40*	GER Collector impact *between caterpillar tracks*	11° 55.8018'N* 117° 1.4922'W*	4120 m
SO295_083-1_ROV-10 *SO295_100-1_ROV-13*	SO295_083ROV10_BFC1 *benthic flux chamber 1*	21.11.2022 17:18:51 *25.11.2022 00:16:42*	GER Plume impact *thick cover*	11° 55.8411'N 117° 1.5396'W	4120 m
SO295_083-1_ROV-10 *SO295_100-1_ROV-13*	SO295_083ROV10_BFC2 *benthic flux chamber 2*	21.11.2022 17:26:24 *24.11.2022 22:50:56*	GER Plume impact *thick cover*	11° 55.8498'N 117° 1.5246'W	4119 m
SO295_083-1_ROV-10 *SO295_083-1_ROV-10*	SO295_083ROV10_MICP-DEEP2-1 *fiberoptical microprofiler 2*	21.11.2022 18:23:16 *21.11.2022 23:52:34*	GER Plume impact *thick cover*	11° 55.836'N* 117° 1.5408'W*	4119 m
SO295_083-1_ROV-10 *SO295_083-1_ROV-10*	SO295_083ROV10_MICP-DEEP1-1 *fiberoptical microprofiler 1*	21.11.2022 18:45:09 *21.11.2022 23:30:59*	GER Plume impact *thick cover*	11° 55.8438'N 117° 1.5306'W	4120 m
SO295_083-1_ROV-10 *SO295_083-1_ROV-10*	SO295_083ROV10_MICP2-1 *electrochemical microprofiler 2*	21.11.2022 19:08:38 *21.11.2022 23:16:02*	GER Plume impact *thick cover*	11° 55.8372'N 117° 1.5084'W	4120 m
SO295_083-1_ROV-10 *SO295_100-1_ROV-13*	SO295_083ROV10_BFC3 *benthic flux chamber 3*	21.11.2022 19:25:17 *24.11.2022 21:37:14*	GER Plume impact *thick cover*	11° 55.8345'N 117° 1.5072'W	4120 m
SO295_083-1_ROV-10 *SO295_100-1_ROV-13*	SO295_083ROV10_MICP2-2 *electrochemical microprofiler 2*	21.11.2022 23:23:54 *24.11.2022 21:52:09*	GER Plume impact *thick cover*	11° 55.836'N 117° 1.5174'W	4120 m
SO295_083-1_ROV-10 *SO295_100-1_ROV-13*	SO295_083ROV10_MICP-DEEP1-2 *fiberoptical microprofiler 1*	21.11.2022 23:39:42 *24.11.2022 17:21:05*	GER Plume impact *thick cover*	11° 55.8486'N 117° 1.5216'W	4120 m
SO295_095-1_ROV-12 *SO295_095-1_ROV-12*	SO295_095ROV12_MICP-DEEP2-1 *fiberoptical microprofiler 2*	23.11.2022 17:15:42 *23.11.2022 00:19:29*	GER Reference *dredge / decompaction experiment*	11° 51.5811'N 117° 0.7542'W	4162 m
SO295_100-1_ROV-13 *SO295_100-1_ROV-13*	SO295_100ROV13_MICP-DEEP2-1 *fiberoptical microprofiler 2*	24.11.2022 17:13:01 *24.11.2022 22:30:20*	GER Plume impact *thick cover*	11° 55.8378'N 117° 1.524'W	4120 m
SO295_100-1_ROV-13 *SO295_100-1_ROV-13*	SO295_100ROV13_MICP-DEEP1-3 *fiberoptical microprofiler 1*	24.11.2022 17:27:54 *24.11.2022 22:07:51*	GER Plume impact *thick cover*	11° 55.8519'N 117° 1.5174'W	4119 m
SO295_123-1_ROV-15 *SO295_123-1_ROV-15*	SO295_123ROV15_MICP1-1 *electrochemical microprofiler 1*	28.11.2022 18:45:50 *29.11.2022 00:05:13*	GER NoNodule *Imprint of nodule frame 'A'*	11° 51.0207'N 117° 23.0328'W	4314 m
SO295_123-1_ROV-15 *SO295_123-1_ROV-15*	SO295_123ROV15_MICP2-1 *electrochemical microprofiler 2*	28.11.2022 19:20:45 *29.11.2022 00:36:02*	GER NoNodule	11° 51.0102'N 117° 23.0418'W	4313 m

Table 5.17.3 (continued)

Deployment station *recovery station*	Event label (deployment) *Instrument*	Deployment start (UTC) *deployment end*	Area *characteristics*	Position	Water depth
GSR / BEL					
SO295_135-1_ROV-16 *SO295_151-1_ROV-19*	SO295_135ROV16_BFC2 *benthic flux chamber 2*	02.12.2022 17:48:02 *06.12.2022 01:15:45*	BEL Collector impact *between caterpillar tracks*	14° 6.738'N 125° 52.4478'W	4530 m
SO295_135-1_ROV-16 *SO295_151-1_ROV-19*	SO295_135ROV16_BFC1 *benthic flux chamber 1*	02.12.2022 18:03:34 *06.12.2022 01:09:10*	BEL Collector impact *between caterpillar tracks*	14° 6.7452'N 125° 52.4292'W	4529 m
SO295_135-1_ROV-16 *SO295_135-1_ROV-16*	SO295_135ROV16_MICP-DEEP1-1 *fiberoptical microprofiler 1*	02.12.2022 18:40:26 *02.12.2022 22:46:46*	BEL Collector impact *between caterpillar tracks*	14° 6.7347'N 125° 52.437'W	4530 m
SO295_135-1_ROV-16 *SO295_135-1_ROV-16*	SO295_135ROV16_MICP-DEEP2-1 *fiberoptical microprofiler 2*	02.12.2022 18:59:47 *02.12.2022 23:35:46*	BEL Collector impact *between caterpillar tracks*	14° 6.7434'N 125° 52.4244'W	4530 m
SO295_135-1_ROV-16 *SO295_151-1_ROV-19*	SO295_135ROV16_MICP1-1 *electrochemical microprofiler 1*	02.12.2022 19:33:18 *06.12.2022 00:08:55*	BEL Collector impact *between caterpillar tracks*	14° 6.7524'N 125° 52.4166'W	4530 m
SO295_135-1_ROV-16 *SO295_151-1_ROV-19*	SO295_135ROV16_BFC3 *benthic flux chamber 3*	02.12.2022 19:58:55 *06.12.2022 00:28:42*	BEL Collector impact *between caterpillar tracks*	14° 6.7452'N 125° 52.422'W	4530 m
SO295_135-1_ROV-16 *SO295_151-1_ROV-19*	SO295_135ROV16_MICP-DEEP1-2 *fiberoptical microprofiler 1*	02.12.2022 22:54:28 *05.12.2022 20:35:01*	BEL Collector impact *between caterpillar tracks*	14° 6.7401'N 125° 52.4394'W	4530 m
SO295_139-1_ROV-17 *SO295_144-1_ROV-18*	SO295_139ROV17_MICP2-1 *electrochemical microprofiler 2*	03.12.2022 18:35:57 *04.12.2022 19:29:06*	BEL Collector impact *between caterpillar tracks*	14° 6.6882'N 125° 52.3788'W	4531 m
SO295_139-1_ROV-17 *SO295_144-1_ROV-18*	SO295_139ROV17_MICP-DEEP2-1 *fiberoptical microprofiler 2*	03.12.2022 19:02:35 *04.12.2022 19:09:37*	BEL Collector impact *between caterpillar tracks*	14° 6.6678'N 125° 52.3884'W	4530 m
SO295_144-1_ROV-18 *SO295_144-1_ROV-18*	SO295_144ROV18_MICP-DEEP2-2 *fiberoptical microprofiler 2*	04.12.2022 19:21:35 *05.12.2022 00:04:19*	BEL Collector impact *between caterpillar tracks*	14° 6.6807'N 125° 52.407'W	4529 m
SO295_144-1_ROV-18 *SO295_144-1_ROV-18*	SO295_144ROV18_MICP2-2 *electrochemical microprofiler 2*	04.12.2022 19:46:02 *04.12.2022 23:25:16*	BEL Collector impact *Imprint of nodule frame 'A'*	14° 6.6867'N 125° 52.3746'W	4532 m
SO295_151-1_ROV-19 *SO295_151-1_ROV-19*	SO295_151ROV19_MICP-DEEP2-1 *fiberoptical microprofiler 2*	05.12.2022 20:25:54 *06.12.2022 00:44:25*	BEL Collector impact *between caterpillar tracks*	14° 6.7371'N 125° 52.4376'W	4529 m
SO295_151-1_ROV-19 *SO295_151-1_ROV-19*	SO295_151ROV19_MICP-DEEP1-3 *fiberoptical microprofiler 1*	05.12.2022 20:43:58 *06.12.2022 01:38:36*	BEL Collector impact *between caterpillar tracks*	14° 6.7431'N 125° 52.4442'W	4529 m
SO295_163-1_ROV-20 *SO295_163-1_ROV-20*	SO295_163ROV20_MICP-DEEP1-1 *fiberoptical microprofiler 1*	07.12.2022 18:23:57 *07.12.2022 23:53:03*	BEL Plume impact *thick cover SW of PATANTA II tracks*	14° 6.6693'N 125° 52.329'W	4532 m
SO295_163-1_ROV-20 *SO295_190-1_ROV-22*	SO295_163ROV20_MICP2-1 *electrochemical microprofiler 2*	07.12.2022 23:44:06 *12.12.2022 17:27:45*	BEL Plume impact *thick cover SW of PATANTA II tracks*	14° 6.6684'N 125° 52.3266'W	4532 m
SO295_190-1_ROV-22 *SO295_190-1_ROV-22*	SO295_190ROV22_MICP-DEEP1-1 *fiberoptical microprofiler 1*	12.12.2022 17:17:33 *12.12.2022 22:02:59*	BEL Plume impact *thick cover SW of PATANTA II tracks*	14° 6.6702'N 125° 52.2996'W	4535 m
SO295_197-1_ROV-23 *SO295_197-1_ROV-23*	SO295_197ROV23_MICP-DEEP1-1 *fiberoptical microprofiler 1*	13.12.2022 18:32:22 *13.12.2022 22:40:11*	BEL Plume impact *thin cover 200m SE of collector impact area*	14° 6.702'N 125° 52.1946'W	4546 m
SO295_197-1_ROV-23 *SO295_197-1_ROV-23*	SO295_197ROV23_MICP-DEEP2-1 *fiberoptical microprofiler 2*	13.12.2022 18:54:06 *13.12.2022 23:22:11*	BEL Plume impact *thin cover 200m SE of collector impact area*	14° 6.7155'N 125° 52.1748'W	4546 m
SO295_197-1_ROV-23 *SO295_197-1_ROV-23*	SO295_197ROV23_MICP1-1 *electrochemical microprofiler 1*	13.12.2022 19:24:01 *13.12.2022 22:57:14*	BEL Plume impact *thin cover 200m SE of collector impact area*	14° 6.7011'N 125° 52.1832'W	4546 m
SO295_202-1_ROV-24 *SO295_202-1_ROV-24*	SO295_202ROV24_MICP-DEEP1-1 *fiberoptical microprofiler 1*	14.12.2022 17:54:20 *14.12.2022 23:28:46*	BEL Trial baseline time series *450m N of collector impact area*	14° 7.1037'N 125° 52.5846'W	4537 m
SO295_202-1_ROV-24 *SO295_202-1_ROV-24*	SO295_202ROV24_MICP-DEEP2-1 *fiberoptical microprofiler 2*	14.12.2022 18:37:25 *14.12.2022 22:46:03*	BEL Trial baseline time series *450m N of collector impact area*	14° 7.0923'N 125° 52.5828'W	4537 m
SO295_202-1_ROV-24 *SO295_202-1_ROV-24*	SO295_202ROV24_MICP2-1 *electrochemical microprofiler 2*	14.12.2022 19:14:48 *14.12.2022 23:07:39*	BEL Trial baseline time series *450m N of collector impact area*	14° 7.0851'N 125° 52.5606'W	4537 m
SO295_209-1_ROV-25 *SO295_209-1_ROV-25*	SO295_209ROV25_MICP-DEEP1-1 *fiberoptical microprofiler 1*	15.12.2022 18:44:35 *15.12.2022 23:28:59*	BEL Plume impact *thick cover E of PATANTA II tracks*	14° 6.7773'N 125° 52.338'W	4539 m
SO295_209-1_ROV-25 *SO295_209-1_ROV-25*	SO295_209ROV25_MICP-DEEP2-1 *fiberoptical microprofiler 2*	15.12.2022 19:25:00 *15.12.2022 23:43:15*	BEL Plume impact *thick cover E of PATANTA II tracks*	14° 6.7626'N 125° 52.3086'W	4541 m
SO295_209-1_ROV-25 *SO295_209-1_ROV-25*	SO295_209ROV25_MICP1-1 *electrochemical microprofiler 1*	15.12.2022 19:46:13 *15.12.2022 23:10:32*	BEL Plume impact *thick cover E of PATANTA II tracks*	14° 6.7485'N 125° 52.3092'W	4540 m

* Asterisks indicate positions that were recorded before the USBL antenna was replaced and calibrated and are, hence, prone to deviate from true positions by several tens of meters to more than 100 m (see Chapter 7 on USBL positioning issues). In the areas where exact positioning was most important (i.e., in and close to the collector area) visual observation made sure that the deployments took place at target sites (e.g., spot between caterpillar tracks, plume impact area close to collector impact area).

The ROV positioned the instruments at the seafloor. In case of profiler module deployments in areas where nodules were present and visible, the MICPs and MICP-DEEPs were positioned by the ROV with the fragile sensors pointing at nodule-free patches / gaps in nodule coverage where possible. Measurements of the modules were either started at pre-programmed times or by touching a switch on the instruments with a magnetic stick that was operated by the ROV manipulator. Typically, instruments were brought to the seafloor for deployment and back up by means of the Elevator. To save time or to transport more gear than possible with the elevator alone, instruments were sometime also put on the porch of the ROV during descent and ascent. BFCs were recovered after each deployment for taking the samples from the syringes and preparing the syringe sampler for the the next deployment. Microprofilers were often repositioned at depth for a second or even a third deployment before recovery. In Table 5.17.3 this is indicated with the last digit in the deployment ID (e.g., MICP1-2 signifies the second deployment of the electrochemical microprofiler 1).

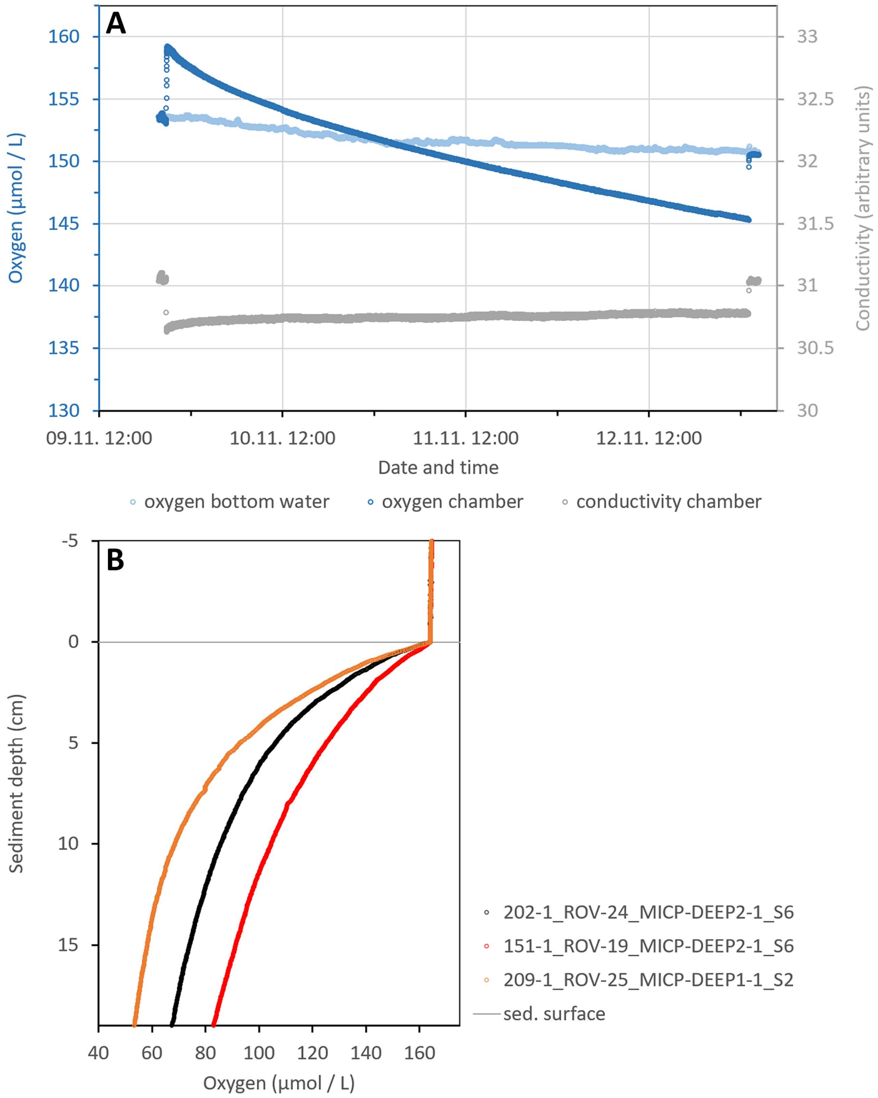


Fig. 5.17.7 Example data from *in situ* modules. Panel A: Oxygen (dark blue) and conductivity (grey) measurements recorded druing deployment 019-1_ROV-03_BFC1 at the BGR reference site. Oxygen measurements outside the chamber (light blue) serve to assess sensor drift. Panel B: Oxygen profiles obtained with the fiberoptical microprofiler in the GSR area at the collector impact site (red), the plume impact site at thick sediment coverage (orange), and at the trial baseline time series site north west of the collector impact site that was not affected by the collector test (black).

Figure 5.17.7 provides examples of data obtained during deployments of the benthic flux chamber (BFC) in the BGR reference area (panel A) as well as example profiles obtained with the fiberoptical profiler at different sites of the GSR trial site.

When weather conditions worsened towards the end of the station work in the GSR / Belgian license area a fiberoptical oxygen microprofiling setup was installed in the cold room and a number of *ex-situ* profiles were recorded in Multiple Corer (MUC) cores to compensate for potential cancellations of ROV dives. Table 5.17.4 provides an overview of the measurements that were carried out and the data that were obtained.

The setup consisted of (1) a micromanipulator that combines a manual micromanipulator (z-range ~48 mm) with a motorized stage that covers a z-range of 75mm (type MU1, Pyroscience, Aachen, DE), (2) an optical oxygen meter (type FireSting-O2, Pyroscience) and fiberoptical laboratory sensors with tips of 50 and 230 µm, respectively (type OXR50 and OXR230, Pyroscience). Prior to profiling, sensors were calibrated in air-saturated and chemically de-oxygenated seawater as described above for the MICP-DEEP sensors. The entire setup was run with the control software Profix of the same company. To record profiles of the maximum possible length (approx. 110 mm), the profiler was moved back up after recording the first 75 mm of the profile. In that position, the sensors were lowered by hand by 48 mm (the full range covered by the manual z adjustment unit. Then the second part was recorded.

To minimize the oxygenation of the overlying water in the MUC cores by contact with air during profiling, the water surface was covered with a disc of bubble foil with a hole at the position of the sensor. To keep the overlying water mixed, a circulating current was created by means of a peristaltic pump with the inlet and outlet installed close to the liner wall a few centimeters above the sediment surface. The inlet and outlet openings were oriented horizontally while pointing in opposite directions. A temperature probe was also installed in the overlying water and connected to the FireSting-O2 oxygen meter for automated temperature compensation of the oxygen measurements.

Table 5.17.4 Overview of *ex situ* profiles.

Sample origin	Core liner	Site	Measurement date	No of profiles / usable profiles (no. of optodes used)
174-1_TVMUC-39	1	BEL Reference	2022-12-10	3/2-3 (1*)
180-1_TVMUC-42	6	BEL Reference	2022-12-10/11	4/4 (1*)
187-1_TVMUC-43	8	BEL Plume imp. 25m SE of tracks	2022-12-12	2/1-2 (1*&1**)
188-1_TVMUC-44	8	BEL Plume imp. 75m SE of tracks	2022-12-12	2/1-2 (1*)
205-1_TVMUC-47	2	BEL Plume imp. 600m SE of tracks	2022-12-15	2/1 (1*)

* sensor type OXR230; ** sensor type OXR 50

5.17.3 Restoration experiment: Hard-substrate and soft-substrate

(S. Gollner)

Research Objectives hard-substrate (artificial nodules)

Deep-seabed polymetallic nodule mining can have multiple adverse effects on benthic communities, such as permanent loss of habitat by removal of nodules and habitat modification of sediments. One tool to manage biodiversity risks is the mitigation hierarchy, including avoidance, minimization of impacts, rehabilitation and/or restoration, and offset. We initiated long-term restoration experiments at sites in polymetallic nodule exploration contract areas in the Clarion-Clipperton Zone that were (i) cleared of nodules by a preprototype mining vehicle, (ii) disturbed by dredge or sledge, (iii) undisturbed, and (iv) naturally devoid of nodules. To accommodate for habitat loss, we deployed >2000 artificial ceramic nodules to study the possible effect of substrate provision on the recovery of biota and its impact on sediment biogeochemistry during SO268 and IP21. Considering the slow natural recovery rates of deep-sea communities, these experiments represent the beginning of a ~30-year study during which we expect to gain insights into the nature and timing of the development of hard-substrate communities and the influence of nodules on the recovery of disturbed sediment communities. Results will help us understand adverse long-term effects of nodule removal, providing an evidence base for setting criteria for the definition of “serious harm” to the environment. (text includes excerpt from abstract from Gollner et al. 2022).

Sampling strategy hard-substrate (artificial nodules)

During SO268 the following strategy for recovery of artificial nodules - of which 25 had been mounted on each frame - was used.

1) elevator#1 with two mounted frame-recovery boxes (each with 5 compartments) deployment on the cable ~1-1.5 hours before the dive (GPS ship location = position of frames on the seafloor)

2) ROV descend and location of frames

3) Location of elevator and guidance of elevator near to frames

4) Unhook elevator (see elevator operations)

5) Start frame and pushcore collection: The ROV collected the frame (with nodules) by the ROV arm and placed it on the ROV porch. Afterwards the ROV-arm took push-cores in the nodule-frame inprint. Then, the ROV put each frame into a nodule-frame recovery box that was mounted on the elevator that had been placed in ~10-15 meter distance to the area were frames have been deployed during SO268 and IP21. This distance was choosen in order to minimize sediment plumes created by ROV operations onto other frames. In addition, in the no nodule area (GER) and BEL collector area microprofiles were taken below one frame inprint each.

6) After the collections were finished, the elevator was recovered with the help of the “Bergefuchs”, hooking the elevator to the ships cable.

In total, 4 out of 5 sites could be sampled as planned; one site (GER dredge impact) had to be skipped. The collection of frames and PUCs went very well, but there had been severe problems with the USBL underwater navigation of the ship (Posidonia) at the beginning of the expedition (please see chapter underwater navigation during SO295, and dive-report ROV02, ROV04).

During SO268 the following strategy for frame deployment was used during ROV09 and ROV18.

1) 2 plastic boxes, each holding 10 frames were mounted on the ROV porch

2) 20 new frames were deployed by the ROV arm near the previous deployed frames (IP21). In the German collector area the previously deployed marker (with a >2m long line) was placed near the close-by nodule pile to avoid conflict with the ROV during sampling. The new spot for frames is in ~10-20 meters distance from the old spot. In the Belgium collector area the new frames were also placed in ~10-20 meters to the previous deployed ones (Table 5.17.5, Figure 5.17.8).

Fig. 5.17.8 (from left to right). Deployment of frame by ROV arm. New deployed frames in BGR area. New deployed frames in GSR area. New deployed frames in GSR area. Pushcores in frame inprint. Elevator with frame recovery boxes.

Table 5.17.5 Station number, deployment time, ROV dive for frame deployments and frame recovery. In bold actions carried out during SO295.

Station number Deployment	Date Deployment (UTC)	ROV Dive #	Latitude	Longitude	Latitude	Longitude	Contract holder	Site	Depth (m)	# Frames deployed	# Nodules	Station number Recovery	Date Recovery (UTC)	#frames recovered
SO268/1_026_1	05.03.2019 20:36	3	11° 55.719'N	117° 1.456' W	11.92865	117.0242667	BGR / GER	MI2 trial site (before Patania II impact)	4088	3	75		28.04.2019	3
SO268/1_035_1	08.03.2019 21:20	6	11° 50.646'N	117° 3.554' W	11.8441	117.0592333	BGR / GER	MI2 reference site	4136	26	650 (2)	**SO295_089_ROV11**	**22.11.2022 17:45**	**5**
SO268/2_158-1	26.04.2019 20:18	24	11° 51.011' N	117° 23.033' W	11.85018333	117.3838833	BGR / GER	No-nodule site (naturally)	4277	27	675 (3)	**SO295_123_ROV15**	**28.11.2022 18:38**	**5**
SO268/2_188_1	12.05.2019 15:23	29	11° 51.617' N	117° 00.747' 'W	11.86028333	117.01245	BGR / GER	MI2 decompaction experiment site	4127	3	75	tbd		
SO268/2_188	12.05.2019 18:08	29	11° 51.807' N	117° 00.694' W	11.86345	117.0115667	BGR / GER	MI2 dredge site	4125	14	350 (3)	tbd		
SO268/2_197	14.05.2019 16:51	31	11° 51.862' N	117° 00.779' W	11.86436667	117.0129833	BGR / GER	MI2 dredge site	4126	13	325	tbd		
IP21-075ROV1	9.05.2021 09:45	HD14-190	11°55.783'N	117°01.503'W	11.92971667	117.02505	BGR / GER	MI2 trial site (after Patania II impact)	4089	15	375 (3)	**SO295_073_ROV09**	**19.11.2022 19:30**	**5**
IP21-044ROV1	28.04.2021	HD14-183	14°06.676'N	125°52.379'W	14.11126667	125.8729833	GSR / BEL	MI2 trial site (after Patania II impact)	4497	15	375	**SO295_144_ROV18**	**4.12.2022 19:39**	**5**
SO295_073_ROV09	**19.11.2022 17:36**	**ROV09**	**11°55.783'N**	**117°01.503'W**	**11.92971667**	**117.02505**	**BGR / GER**	**MI2 trial site (after Patania II impact)**		**20**	**500**	tbd		
SO295_144_ROV18	**4.12.2022 17:53**	**ROV18**	**14°06.676'N**	**125°52.379'W**	**14.11126667**	**125.8729833**	**GSR / BEL**	**MI2 trial site (after Patania II impact)**		**20**	**500 (3)**	tbd		

Obtained samples hard-substrate (artificial nodules)

In total 4 x 5 frames could be recovered, with each frame holding 25 nodues and a total of 499 nodules could be collected (one nodule was lost). Each nodule was first visually checked for fauna/foraminifera. Then each nodule was scratched for microbial samples with a razorblade, the razorblade was put into a 5 ml Eppendorf tube filled with 2 ml of 96% EtOH, and vortexed for 10 seconds to remove microbes/nodule surface scratches from the razorblade. Afterwards, each artificial nodule was put into a 100 ml jar and fixed in 96% EtOH. All work was carried out in the climate lab (at ~5°C) on board of the vessel, all EtOH samples are stored at -20°C.

In total 74 PUCs were taken in the nodule frame inprint, and in the no nodule area in addition in several meters distance to the nodule frames as control (as no multicore deployments were made in the BGR no nodule area) (Table 5.17.6). PUCs were distributed to different teammembers/purposes including study of abiotics (UGhent), biogeochemistry (GEOMAR, Haeckel), microbes (MPI Bremen, Molari), fauna DNA (NIOZ, Gollner), fauna morphology (NIOZ, Gollner).

Table 5.17.6 Number of frames with artificial nodules and pushcores (PUCs) collected below nodule frames. BG – biogeochemistry, MB – microbiology, F-DNA (fauna DNA), F-Morph (fauna morphology), Abio – abiotics.

station	area	site	Frame#	Frame#	PUC#	BG	MB	F-DNA	F-Mor	Abio	comment
SO295_073_ROV09	GER	Collector	106	A	B8						lost
SO295_073_ROV09	GER	Collector	106	A	C2					1	
SO295_073_ROV09	GER	Collector	106	A	D8			1			
SO295_073_ROV09	GER	Collector	108	B	D7			1	1		
SO295_073_ROV09	GER	Collector	108	B	B0						
SO295_073_ROV09	GER	Collector	108	B	76		1				
SO295_073_ROV09	GER	Collector	107	C	74	1					
SO295_073_ROV09	GER	Collector	107	C	54				1		
SO295_073_ROV09	GER	Collector	107	C	B6		1				
SO295_073_ROV09	GER	Collector	118	D	69			1			
SO295_073_ROV09	GER	Collector	118	D	44				1		
SO295_073_ROV09	GER	Collector	120	E	B9						
SO295_073_ROV09	GER	Collector	120	E	A9		1	1			
SO295_089_ROV11	GER	Reference	72	A	A9					1	
SO295_089_ROV11	GER	Reference	72	A	C2						lost
SO295_089_ROV11	GER	Reference	72	A	C7			1			
SO295_089_ROV11	GER	Reference	65	B	C4		1				
SO295_089_ROV11	GER	Reference	65	B	41			1			
SO295_089_ROV11	GER	Reference	65	B	69				1		
SO295_089_ROV11	GER	Reference	45	C	42		1				
SO295_089_ROV11	GER	Reference	45	C	D7				1		
SO295_089_ROV11	GER	Reference	45	C	74			1			
SO295_089_ROV11	GER	Reference	8	D	A0			1			
SO295_089_ROV11	GER	Reference	8	D	D8				1		
SO295_089_ROV11	GER	Reference	8	D	58		1				
SO295_089_ROV11	GER	Reference	78	E	B8		1				
SO295_089_ROV11	GER	Reference	78	E	12			1			
SO295_123_ROV15	GER	No Nodule-Frame	21	A	75			1			
SO295_123_ROV15	GER	No Nodule-Frame	21	A	A2				1		
SO295_123_ROV15	GER	No Nodule-Frame	21	A	6			1			
SO295_123_ROV15	GER	No Nodule-Frame	13	B	D4			1			
SO295_123_ROV15	GER	No Nodule-Frame	13	B	B5		1				
SO295_123_ROV15	GER	No Nodule-Frame	13	B	A5	1					
SO295_123_ROV15	GER	No Nodule-Frame	14	C	B0					1	
SO295_123_ROV15	GER	No Nodule-Frame	14	C	A7			1			
SO295_123_ROV15	GER	No Nodule-Frame	14	C	D6		1				
SO295_123_ROV15	GER	No Nodule-Frame	55	D	B2		1				
SO295_123_ROV15	GER	No Nodule-Frame	55	D	B8			1			
SO295_123_ROV15	GER	No Nodule-Frame	55	D	C1				1		
SO295_123_ROV15	GER	No Nodule-Frame	32	E	C4			1			
SO295_123_ROV15	GER	No Nodule-Frame	32	E	B4				1		
SO295_123_ROV15	GER	No Nodule-Frame	32	E	B6				1		
SO295_123_ROV15	GER	No Nodule-Control	NA	A	82			1			
SO295_123_ROV15	GER	No Nodule-Control	NA	A	66		1				
SO295_123_ROV15	GER	No Nodule-Control	NA	A	60	1					

SO295_123_ROV15	GER	No Nodule-Control	NA	A	68	1					
SO295_123_ROV15	GER	No Nodule-Control	NA	B	44					1	
SO295_123_ROV15	GER	No Nodule-Control	NA	B	19		1				
SO295_123_ROV15	GER	No Nodule-Control	NA	B	C9			1			
SO295_123_ROV15	GER	No Nodule-Control	NA	C	77			1			
SO295_123_ROV15	GER	No Nodule-Control	NA	C	23			1			
SO295_123_ROV15	GER	No Nodule-Control	NA	C	76				1		
SO295_123_ROV15	GER	No Nodule-Control	NA	D	5				1		
SO295_123_ROV15	GER	No Nodule-Control	NA	D	D2			1			
SO295_123_ROV15	GER	No Nodule-Control	NA	D	22	1					
SO295_123_ROV15	GER	No Nodule-Control	NA	E	27	1					
SO295_123_ROV15	GER	No Nodule-Control	NA	E	54				1		
SO295_123_ROV15	GER	No Nodule-Control	NA	E	17		1				
SO295_144_ROV18	BEL	collector	100	A	55			1			
SO295_144_ROV18	BEL	collector	100	A	42						lost
SO295_144_ROV18	BEL	collector	100	A	B9				1		below MICP
SO295_144_ROV18	BEL	collector	56	B	A9				1		
SO295_144_ROV18	BEL	collector	56	B	58		1				
SO295_144_ROV18	BEL	collector	56	B	78			1			
SO295_144_ROV18	BEL	collector	98	C	D3			1			
SO295_144_ROV18	BEL	collector	98	C	C2						lost
SO295_144_ROV18	BEL	collector	98	C	C0	1					
SO295_144_ROV18	BEL	collector	97	D	9			1			
SO295_144_ROV18	BEL	collector	97	D	64		1				
SO295_144_ROV18	BEL	collector	97	D	C5					1	
SO295_144_ROV18	BEL	collector	96	E	C8		1				
SO295_144_ROV18	BEL	collector	96	E	B1			1			
SO295_144_ROV18	BEL	collector	96	E	73				1		
SO295_144_ROV18	BEL	collector	96	E	C6			1			

5.18 Sediment Geomechanics

(F. Charlet, 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 was determined before (SO268) and directly after the collector trial (IP21) as well as 1.5 years after the trial (SO295) (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 SO295 the vane shear strength of the surface sediments in the Reference, Collector Impact and Plume Impact Sites of the GER and BEL working areas (Tab. 5.18.1) was 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. 5.18.1). 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 ± 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*).

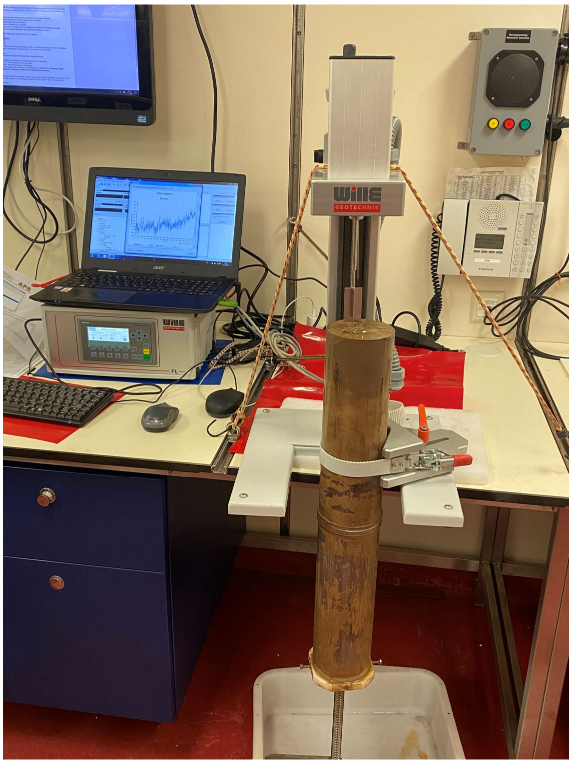


Fig. 5.18.1 Setup for Vane shear strength during SO295 with a core liner taken with the multicorer. Photo: F. Charlet

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 sequence of tests was alternating shear strength measurement using vane G with two measurement using vane C (Fig. 5.18.2), every 6cm, from the top to the bottom of the MUC sample.

The sample was sheared with constant vane rotation of 6°/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 up to 10% of the maximum value. Immediately afterwards the vane was rotated for 720° at 60°/min, again up to 10% of the maximum value. 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. 5.18.3).

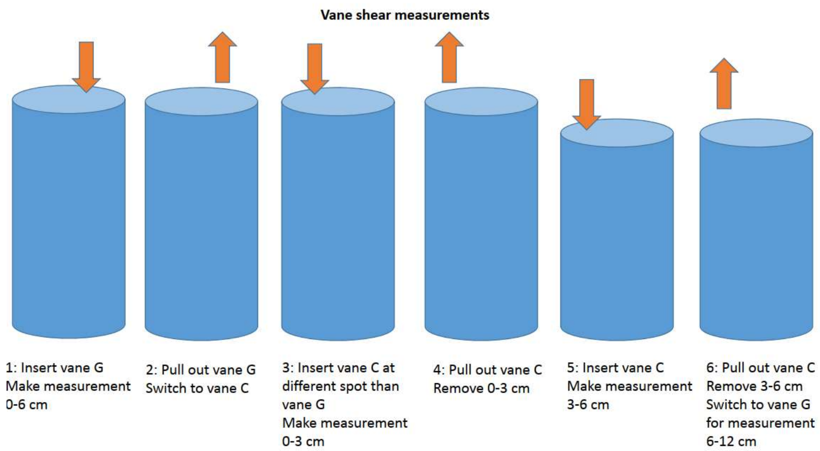


Fig. 5.18.2 Example of measurement steps followed for shear strength measurement, here from 0 – 6cm, also applied for the deeper sediment layers.

Preliminary Results

Shear strength generally increases only slightly with depth in the bioturbated layer, but very pronounced below reaching maximum values in approx. 10 cm depth (Reference site, Fig. 5.18.3 right). While the profiles in the Plume impact site are quite similar to those of the Reference site (Fig. 5.18.3 left), the core from the Collector impact site shows higher shear strength in the upper 5 cm, which indicates the loss of the weak bioturbated sediment layer during the nodule collection process. Maximum shear strength values in both impact sites are similar to those of the Reference site.

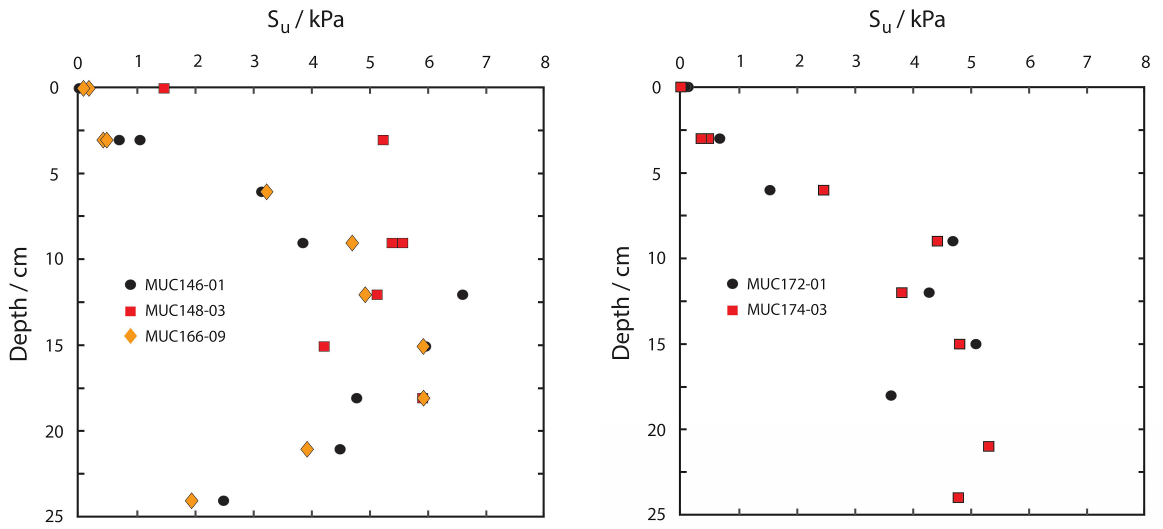


Fig. 5.18.3 Depth profiles of vane (model C) shear strength in surface sediments of the BEL working area. (left) Collector impact (148) and Plume impact (146, 166) sites; (right) Reference site (172, 174).

Table 5.18.1 List of cores measured for vane shear strength.

Station	MUC liner	Latitude	Longitude	Water Depth / m	Study Site
015 MUC-01	09	11° 50,737' N	117° 03,602' W	4129	GER Reference
024 MUC-03	08	11° 50,750' N	117° 03,612' W	4119	GER Reference
027 MUC-04	03	11° 50,750' N	117° 03,502' W	4127	GER Reference
033 MUC-06	02	11° 55,802' N	117° 01,692' W	4085	GER Collector impact
034 MUC-07	04	11° 55,805' N	117° 01,663' W	4084	GER Collector impact
034 MUC-07	08	11° 55,805' N	117° 01,663' W	4084	GER collector impact
046 MUC-08	08	11° 55,844' N	117° 01,695' W	4082	GER Plume impact thick cover
065 MUC-12	01	11° 55,847' N	117° 01,606' W	4105	GER Plume impact thick cover
065 MUC-12	08	11° 55,847' N	117° 01,606' W	4105	GER Plume impact thick cover
072 MUC-14	08	11° 55,809' N	117° 01,635' W	4104	GER Collector impact
093 MUC-18	01	11° 55,791' N	117° 01,608' W	4105	GER Collector impact
117 MUC-25	04	11° 55,632' N	117° 01,259' W	4109	GER Trial baseline times series
129 MUC-26	01	14° 06,748' N	125° 52,468' W	4510	BEL Collector impact
146 MUC-28	01	14° 06,812' N	125° 52,602' W	4505	BEL Plume impact thick
148 MUC-30	03	14° 06,844' N	125° 52,437' W	4513	BEL Collector impact
166 MUC-35	09	14° 06,777' N	125° 52,297' W	4524	BEL Plume impact thick
172 MUC-37	01	14° 02,160' N	125° 55,501' W	4562	BEL Reference
174 MUC-38	03	14° 02,158' N	125° 55,456' W	4562	BEL Reference
188 MUC-44	01	14° 06,730' N	125° 52,226' W	4526	BEL Plume impact thin 75m
189 MUC-45	04	14° 06,695' N	125° 52,190' W	4523	BEL Plume impact thin 175m
195 MUC-46	02	14° 06,658' N	125° 52,147' W	4517	BEL Plume impact thin 275m

6 Ship's Meteorological Station

No data available.

7 Station List SO295

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
07/11/22 00:30	001-1_TP	11° 55.488' N	117° 02.077' W	Ship	no data	GER	Transponder 1A deployment
07/11/22 00:47	002-1_TP	11° 56.118' N	117° 02.089' W	Ship	no data	GER	Transponder 2B deployment
07/11/22 02:54	002-1_TP	11° 55.754' N	117° 01.041' W	Ship	4079.0	GER	Transponder calibration
07/11/22 05:15	003-1_AUV-01	11° 56.074' N	117° 02.095' W	Ship	4080.3	GER Collector impact	Start transect / navigational drift
07/11/22 09:06	004-1_CTD-01	11° 51.5670' N	117° 00.7817' W	USBL	4116.9	GER Dredge	Max. depth, repetition SO268_094_CTD
07/11/22 14:14	005-1_LIFT-01	11° 51.796' N	117° 00.704' W	Ship	4111.6	GER Dredge	Elevator 1 deployment
07/11/22 17:09	006-1_ROV-01	11° 51.806' N	117° 00.700' W	Ship	4120.9	GER	Failed
07/11/22 20:50	007-1_BC	11° 50.7332' N	117° 03.5903' W	USBL	4127.0	GER Reference	Failed deployment
08/11/22 01:56	008-1_AUV-01	11° 52.208' N	117° 06.785' W	Ship	no data		Recovery
08/11/22 04:03	009-1_BC-01	11° 50.7139 N	117° 03.5077' W	USBL*	4125.8	GER Reference	
08/11/22 07:48	010-1_OFOS-01	11° 51.371' N	117° 01.650' W	Ship	4129.7	GER Reference	Start transect
08/11/22 18:19	011-1_BC-02	11° 50.9691' N	117° 03.4973' W	USBL	4124.4	GER Reference	
08/11/22 22:45	012-1_ROV-02	11° 51.810' N	117° 00.711' W	Ship	4120.3	GER Dredge	Start transect
09/11/22 03:42	013-1_LIFT-01	11° 51.827' N	117° 00.698' W	Ship	4119.4		Elevator 1 recovery
09/11/22 05:19	014-1_BWS-01	11° 51.821' N	117° 00.699' W	Ship*,#	4119.0	GER	Test deployment
09/11/22 07:43	015-1_TVMUC-01	11° 50.737' N	117° 03.602' W	Ship #	4129.1	GER Reference	
09/11/22 10:43	016-1_TVMUC-02	11° 50.740' N	117° 03.573' W	Ship	4125.7	GER Reference	
09/11/22 13:12	017-1_AUV-02	11° 56.074' N	117° 02.097' W	Ship	4092.4	GER Plume impact gradient	Start transect
09/11/22 19:19	018-1_LIFT-02	11° 50.586' N	117° 03.554' W	Ship	4131.5	GER Reference	Elevator 2 deployment
09/11/22 18:12	019-1_ROV-03	11° 50.584' N	117° 03.546' W	Ship	4130.1	GER Reference	Start transect
10/11/22 05:32	020-1_AUV-02	11° 55.278' N	117° 09.010' W	Ship	4061.8		Recovery / mission aborted
10/11/22 05:46	021-1_BWS-02	11° 55.240' N	117° 09.044' W	Ship	4070.7	GER	Test deployment

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
10/11/22 08:31	022-1_BC-03	11° 50.6707' N	117° 03.5066' W	USBL	4127.6	GER Reference	
10/11/22 11:40	023-1_BC-04	11° 50.6637' N	117° 03.4716' W	USBL	4127.3	GER Reference	
10/11/22 15:06	024-1_TVMUC-03	11° 50.7479' N	117° 03.5223' W	USBL	4124.9	GER Reference	
10/11/22 18:29	025-1_TVMUC-04	11° 50.7283' N	117° 03.4499' W	USBL	4125.4	GER Reference	
10/11/22 22:16	026-1_OFOS-02	11° 52.434' N	116° 58.980' W	Ship	4093.7	GER Reference	Start transect
11/11/22 09:06	027-1_TVMUC-05	11° 50.7463 N	117° 03.3838' W	USBL	4126.9	GER Reference	
11/11/22 12:33	028-1_BC-05	11° 50.745' N	117° 03.452' W	Ship [#]	4126.8	GER Reference	
11/11/22 17:17	029-1_ROV-04	11° 50.791' N	117° 03.444' W	Ship	4127.5	GER Reference	Start transect
12/11/22 04:11	030-1_AUV-03	11° 56.059' N	117° 02.108' W	Ship	4088.9	GER Plume impact gradient	Start transect
12/11/22 06:12	031-1_CTD-02	11° 55.7531' N	117° 01.5446' W	USBL*	4085.0	GER Collector impact	max. depth
12/11/22 08:26	032-1_AUV-03	11° 56.415' N	117° 01.688' W	Ship	4092.0		Recovery / mission aborted
12/11/22 10:18	033-1_TVMUC-06	11° 55.802' N	117° 01.692' W	Ship [usbl]	4085.0	GER Collector impact	
12/11/22 13:12	034-1_TVMUC-07	11° 55.7886' N	117° 01.5799' W	USBL	4084.0	GER Collector impact	Likely sampled off tracks
12/11/22 17:34	035-1_ROV-05	11° 50.535' N	117° 03.447' W	Ship	no data	GER Reference	Start transect
13/11/22 04:14	036-1_LIFT-02	11° 50.596' N	117° 03.548' W	Ship	no data		Elevator 2 recovery
13/11/22 08:19	037-1_BWS-03	11° 55.7384' N	117° 01.5501' W	USBL	4084.3	GER Collector impact	Max. depth
13/11/22 13:38	038-1_BC-06	11° 55.798' N	117° 01.697' W	Ship [usbl]	4083.0	GER Collector impact	
13/11/22 16:36	039-1_BC-07	11° 55.810' N	117° 01.665' W	Ship [usbl]	4083.8	GER Plume impact thick	
13/11/22 18:55	040-1_MOOR	11° 55.304' N	117° 00.388' W	Ship	no data	GER	Failed recovery IP21_064ST
13/11/22 23:51	041-1_AUV-04	11° 56.119' N	117° 02.167' W	Ship	no data	GER Plume impact gradient	Start transect
14/11/22 03:30	042-1_AUV-04	11° 56.174' N	117° 02.920' W	Ship	no data		Recovery / mission aborted
14/11/22 05:55	043-1_OFOS-03	11° 55.438' N	117° 01.511' W	Ship	4081.1	GER Collector impact, plume impact gradient	Start transect
14/11/22 18:29	044-1_LIFT-03	11° 55.7534' N	117° 01.5484' W	USBL	no data	GER Collector impact	Elevator 2 deployment
14/11/22 17:02	045-1_ROV-06	11° 55.841' N	117° 01.490' W	Ship	no data	GER Collector impact	Start transect

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
15/11/22 04:52	046-1_TVMUC-08	11° 55.844' N	117° 01.695' W	Ship [usbl]	4081.5	GER Plume impact thick	
15/11/22 07:49	047-1_TVMUC-09	11° 55.844' N	117° 01.664' W	Ship [usbl]	4080.9	GER Plume impact thick	
15/11/22 11:13	048-1_BC-08	11° 55.840' N	117° 01.693' W	Ship [usbl]	4081.0	GER Plume impact thick	
15/11/22 14:08	049-1_BC-09	11° 55.842' N	117° 01.680' W	Ship [#]	4081.3	GER Plume impact thick	
15/11/22 19:37	050-1_BWS-04	11° 51.6237' N	117° 00.7565' W	USBL	4126.2	GER Dredge	Max. depth
16/11/22 00:48	051-1_AUV-05	11° 56.080' N	117° 02.093' W	Ship	4088.2	GER Collector impact	Start transect / no images
16/11/22 03:32	052-1_CTD-03	11° 56.0340' N	117° 01.5843' W	USBL*	4083.2	GER Plume impact thin	Max. depth, repetition IP21_074_CTD
16/11/22 09:52	053-1_BC-10	11° 55.7681' N	117° 01.6615' W	USBL	4085.7	GER Plume impact thick	
16/11/22 12:47	054-1_AUV-05	11° 52.524' N	117° 07.968' W	Ship	4135.7		Recovery
16/11/22 14:31	055-1_MOOR	11° 55.397' N	117° 00.645' W	Ship	no data	GER	Failed recovery IP21_064ST
16/11/22 17:38	056-1_OFOS-04	11° 55.807' N	117° 01.252' W	Ship	4085.9	GER Collector impact, plume impact thick	Start transect
17/11/22 03:14	057-1_TVMUC-10	11° 55.8409' N	117° 01.6581' W	USBL*	4081.3	GER Plume impact thick	
17/11/22 06:06	058-1_TVMUC-11	11° 55.8436' N	117° 01.6247' W	USBL	4081.7	GER Plume impact thick	
17/11/22 09:21	059-1_BC-11	11° 55.8438' N	117° 01.6278' W	USBL	4081.4	GER Plume impact thick	
17/11/22 14:56	060-1_BC-12	11° 55.845' N	117° 01.601' W	Ship [#]	4082.4	GER Plume impact thick	Second deployment after initial failure
17/11/22 18:38	061-1_ROV-07	11° 55.811' N	117° 01.469' W	Ship	4081.7	GER Collector impact	Start transect
18/11/22 04:03	062-1_LIFT-03	11° 55.817' N	117° 01.476' W	Ship	4080.7		Elevator 2 recovery
18/11/22 04:53	063-1_AUV-06	11° 56.063' N	117° 02.127' W	Ship	no data	GER Collector impact	Start transect
18/11/22 05:36	064-1_MOOR	11° 55.665' N	117° 01.276' W	Ship	no data	GER	Failed recovery IP21_064ST
18/11/22 09:22	065-1_TVMUC-12	11° 55.7693' N	117° 01.5677' W	USBL	4084.2	GER Plume impact thick	
18/11/22 12:12	066-1_TVMUC-13	11° 55.807' N	117° 01.656' W	Ship [#]	4082.7	GER Collector impact	
18/11/22 18:45	067-1_LIFT-04	11° 55.7780' N	117° 01.4971' W	USBL	4084.8	GER Collector impact	Elevator 1 deployment
18/11/22 18:01	068-1_ROV-08	11° 55.792' N	117° 01.502' W	Ship	4082.9	GER Collector impact, plume impact thick	Start transect
19/11/22 02:29	069-1_AUV-06	11° 58.170' N	117° 07.457' W	Ship	4130.9		Recovery

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
19/11/22 03:49	070-1_POSIDONIA	11° 55.792' N	117° 01.492' W	Ship	4085.1	GER	Transponder calibration
19/11/22 08:34	071-1_BWS-05	11° 56.1015' N	117° 01.6405' W	USBL	4080.7	GER Plume impact thin	Max. depth
19/11/22 13:28	072-1_TVMUC-14	11° 55.8093' N	117° 01.6396' W	USBL	4085.9	GER Collector impact	
19/11/22 17:12	073-1_ROV-09	11° 55.749' N	117° 01.455' W	Ship	4084.9	GER Collector impact	Start transect
20/11/22 03:01	074-1_LIFT-04	11° 55.7755' N	117° 01.5097' W	USBL	4084.2		Elevator 1 recovery
20/11/22 03:57	075-1_AUV-07	11° 56.084' N	117° 02.065' W	Ship	4096.1	GER Plume impact gradient	Start transect / navigational drift
20/11/22 05:23	076-1_OFOS-05	11° 57.779' N	117° 02.080' W	Ship	4112.3	GER Plume impact gradient	Failed
20/11/22 16:39	077-1_TVMUC-15	11° 55.805' N	117° 01.645' W	Ship #	4082.3	GER Collector impact	Failed
20/11/22 20:06	078-1_BC-13	11° 55.806' N	117° 01.660' W	Ship*	4082.2	GER Collector impact	
20/11/22 22:06	079-1_AUV-07	11° 55.235' N	117° 01.021' W	Ship	4108.4		Recovery
20/11/22 23:59	080-1_BC-14	11° 55.8139' N	117° 01.6378' W	USBL	4081.9	GER Collector impact	Deployed in collector turns; considered thick cover
21/11/22 03:53	081-1_OFOS-06	11° 57.773' N	117° 02.086' W	Ship	4107.9	GER Plume impact gradient	Start transect, repetition 076-1_OFOS_05
21/11/22 18:00	082-1_LIFT-05	11° 55.843' N	117° 01.511' W	Ship	4085.1	GER Plume impact thick	Elevator 2 deployment
21/11/22 17:04	083-1_ROV-10	11° 55.837' N	117° 01.510' W	Ship	4086.3	GER Plume impact thick	Start transect
22/11/22 02:25	084-1_AUV-08	11° 56.143' N	117° 02.058' W	Ship	4096.2	GER Trial baseline time series	Start transect
22/11/22 04:03	085-1_TVMUC-16	11° 55.8103' N	117° 01.6189' W	USBL	4083.8	GER Collector impact	
22/11/22 07:11	086-1_BC-15	11° 55.8059' N	117° 01.6209 W	USBL	4082.2	GER Collector impact	
22/11/22 10:13	087-1_BC-16	11° 55.8141' N	117° 01.6841 W	USBL	4083.5	GER Collector impact	
22/11/22 17:22	088-1_LIFT-06	11° 50.650' N	117° 03.543' W	Ship	4135.4	GER Reference	Elevator 1 deployment
22/11/22 17:11	089-1_ROV-11	11° 50.645' N	117° 03.549' W	Ship	4136.0	GER Reference	Start transect
22/11/22 23:44	090-1_LIFT-06	11° 50.635' N	117° 03.548' W	Ship	4136.9		Elevator 1 recovery
23/11/22 03:27	091-1_AUV-08	11° 56.717' N	117° 06.439' W	Ship	4122.8		Recovery
23/11/22 05:40	092-1_TVMUC-17	11° 55.7855' N	117° 01.6209' W	USBL*	4085.3	GER Collector impact	

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
23/11/22 08:36	093-1_TVMUC-18	11° 55.7843' N	117° 01.6133' W	USBL	4084.6	GER Collector impact	
23/11/22 11:55	094-1_BC-17	11° 55.796' N	117° 01.620' W	Ship	4083.9	GER Collector impact	
23/11/22 16:45	095-1_ROV-12	11° 51.571' N	117° 00.693' W	Ship	4122.4	GER Dredge, decompaction exp.	Start transect
24/11/22 02:56	096-1_AUV-09	11° 56.091' N	117° 02.079' W	Ship	4091.3	GER Reference	Start transect / navigation problems
24/11/22 04:49	097-1_TVMUC-19	11° 55.7961' N	117° 01.6260' W	USBL	4082.2	GER Collector impact	
24/11/22 07:51	098-1_BC-18	11° 55.7898' N	117° 01.6142' W	USBL	4082.6	GER Collector impact	
24/11/22 10:43	099-1_BC-19	11° 55.6277' N	117° 01.3146' W	USBL	4087.9	GER Trial baseline time series	
24/11/22 16:51	100-1_ROV-13	11° 55.807' N	117° 01.468' W	Ship	4087.3	GER Plume impact thick	Start transect
25/11/22 01:40	101-1_LIFT-05	11° 55.832' N	117° 01.502' W	Ship	4081.7		Elevator 2 recovery
25/11/22 03:24	102-1_AUV-09	11° 56.773' N	117° 07.666' W	Ship	4132.9		Recovery
25/11/22 05:58	103-1_OFOS-07	11° 55.793' N	117° 01.061' W	Ship	4084.2	GER Plume impact gradient	Start transect
25/11/22 15:34	104-1_BC-20	11° 55.6266' N	117° 01.2847' W	USBL	4090.3	GER Trial baseline time series	
25/11/22 18:30	105-1_BC-21	11° 55.6231' N	117° 01.2593 W	USBL	4091.1	GER Trial baseline time series	
25/11/22 22:13	106-1_TVMUC-20	11° 55.9311' N	117° 01.6211' W	USBL	4079.4	GER Plume impact 220m NW of tracks	Sediment surface disturbed
26/11/22 01:03	107-1_TVMUC-21	11° 55.9373' N	117° 01.6308' W	USBL	4081.3	GER Plume impact 220m NW of tracks	Repetition 106-1_TVMUC-20
26/11/22 02:33	108-1_AUV-10	11° 55.947' N	117° 01.621' W	Ship	4081.5	GER Collector impact, plume impact gradient	Start transect
26/11/22 02:49	109-1_MOOR	11° 55.940' N	117° 01.612' W	Ship	no data	GER	Failed recovery IP21_064ST
26/11/22 06:20	110-1_OFOS-08	11° 51.730' N	117° 00.368' W	Ship	4116.5	GER Dredge, decompaction exp.	Start transect
26/11/22 15:56	111-1_BC-22	11° 55.6325' N	117° 01.2289' W	USBL	4089.8	GER Trial baseline time series	
26/11/22 18:46	112-1_BC-23	11° 55.6283' N	117° 01.2050' W	USBL*	4089.0	GER Trial baseline time series	

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
26/11/22 22:11	113-1_TVMUC-22	11° 56.9726' N	117° 01.6282' W	USBL	4096.9	GER Plume impact 2000m N of tracks	
27/11/22 00:21	114-1_AUV-10	11° 58.604' N	117° 05.614' W	Ship	4118.5		Recovery
27/11/22 03:34	114-1_AUV-10	11° 56.420' N	117° 02.515' W	Ship	4100.2	GER	Transponder recovery
27/11/22 05:19	115-1_TVMUC-23	11° 55.904' N	117° 01.601' W	Ship	4082.7	GER Plume impact 150m NW of tracks	
27/11/22 08:16	116-1_TVMUC-24	11° 56.094' N	117° 01.692' W	Ship	4082.3	GER Plume impact 500m NW of tracks	
27/11/22 11:11	117-1_TVMUC-25	11° 55.632' N	117° 01.259' W	Ship	4090.2	GER Trial baseline time series	
27/11/22 16:59	118-1_LIFT	11° 51.015' N	117° 23.024' W	Ship	4275.0	GER NoNodule	Elevator 1 failed deployment
27/11/22 17:00	119-1_ROV-14	11° 51.015' N	117° 23.024' W	Ship	4274.6	GER	Failed
27/11/22 22:34	120-1_CTD-04	11° 50.9847' N	117° 22.8071' W	USBL	4275.4	GER NoNodule	Max. depth
28/11/22 03:17	121-1_OFOS-09	11° 48.653' N	117° 30.585' W	Ship	4373.4	GER NoNodule	Start transect
28/11/22 17:53	122-1_LIFT-07	11° 51.0121' N	117° 23.0352' W	USBL*	4275.8	GER NoNodule	Elevator 1 deployment
28/11/22 17:21	123-1_ROV-15	11° 51.016' N	117° 23.031' W	Ship	4272.9	GER NoNodule	Start transect
29/11/22 03:30	124-1_LIFT-07	11° 51.0090' N	117° 23.0531' W	USBL	4277.0		Elevator 1 recovery
01/12/22 10:19	125-1_TP	14° 06.938' N	125° 51.762' W	Ship	4502.9	BEL	Transponder 3A deployment
01/12/22 10:46	126-1_TP	14° 06.560' N	125° 52.372' W	Ship	4485.0	BEL	Transponder 4B deployment
01/12/22 12:35	126-1_TP	14° 06.778' N	125° 52.941' W	Ship	4468.5	BEL	Transponder calibration
01/12/22 14:34	127-1_AUV-11	14° 06.798' N	125° 52.035' W	Ship	4504.6	BEL Plume impact gradient & trial baseline time series	Start transect / gaps in imaging
01/12/22 17:05	128-1_CTD-05	14° 06.612' N	125° 52.173' W	Ship	4497.3	BEL Plume impact thin	Max. depth, repetition IP21_015_CTD
02/12/22 00:28	129-1_TVMUC-26	14° 06.7461' N	125° 52.4976' W	USBL	4488.8	BEL Collector impact	Likely sampled collector turn area
02/12/22 03:30	130-1_TVMUC-27	14° 06.7615' N	125° 52.4926' W	USBL	4486.1	BEL Collector impact	
02/12/22 06:54	131-1_BC-24	14° 06.7597' N	125° 52.4889' W	USBL	4487.3	BEL Collector impact	
02/12/22 10:00	132-1_BC-25	14° 06.7676' N	125° 52.4881' W	USBL	4490.1	BEL Collector impact	

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
02/12/22 12:15	133-1_AUV-11	14° 06.786' N	125° 54.795' W	Ship	4514.2		Recovery
02/12/22 17:23	134-1_LIFT-08	14° 06.7194' N	125° 52.4166' W	USBL	4489.4	BEL Collector impact	Elevator 2 deployment
02/12/22 17:13	135-1_ROV-16	14° 06.729' N	125° 52.421' W	Ship	4488.4	BEL Collector impact	Start transect
03/12/22 03:51	136-1_OFOS-10	14° 07.158' N	125° 52.181' W	Ship	4506.5	BEL Collector impact, plume impact thick & gradient	Start transect
03/12/22 13:11	137-1_AUV-12	14° 06.818' N	125° 52.027' W	Ship	4503.2	BEL Plume impact gradient & trial baseline time series	Start transect / gaps in imaging
03/12/22 18:05	138-1_LIFT-09	14° 06.703' N	125° 52.381' W	Ship	4482.9	BEL Collector impact	Elevator 1 deployment
03/12/22 17:09	139-1_ROV-17	14° 06.674' N	125° 52.375' W	Ship	4484.9	BEL Collector impact, plume impact thick	Start transect
04/12/22 03:57	140-1_BC-26	14° 06.812' N	125° 52.480' W	Ship	4486.2	BEL Collector impact	Deployed in collector turns; considered thick cover
04/12/22 07:02	141-1_BC-27	14° 06.8150' N	125° 52.4597' W	USBL	4488.4	BEL Collector impact	
04/12/22 10:12	142-1_BC-28	14° 06.8312' N	125° 52.4372' W	USBL	4492.8	BEL Collector impact	
04/12/22 12:19	143-1_AUV-12	14° 05.975' N	125° 53.022' W	Ship	4456.3		Recovery
04/12/22 17:04	144-1_ROV-18	14° 06.715' N	125° 52.344' W	Ship	4497.6	BEL Collector impact	Start transect
05/12/22 02:50	145-1_LIFT-09	14° 06.758' N	125° 52.452' W	Ship	4487.8		Elevator 1 recovery
05/12/22 05:51	146-1_TVMUC-28	14° 06.7813' N	125° 52.5584' W	USBL	4486.0	BEL Plume impact thick	
05/12/22 08:56	147-1_TVMUC-29	14° 06.8109' N	125° 52.4543' W	USBL	4494.8	BEL Collector impact	
05/12/22 11:55	148-1_TVMUC-30	14° 06.8290' N	125° 52.4331' W	USBL	4490.8	BEL Collector impact	
05/12/22 13:34	149-1_AUV-13	14° 06.846' N	125° 52.441' W	Ship	4494.3	BEL Collector impact, Plume impact thick	Start transect / gaps in imaging
05/12/22 15:59	150-1_CTD-06	14° 06.738' N	125° 52.435' W	Ship	4488.9	BEL Collector impact	Max. depth
05/12/22 20:02	151-1_ROV-19	14° 06.748' N	125° 52.379' W	Ship	4494.4	BEL Collector impact	Start transect
06/12/22 05:10	152-1_LIFT-08	14° 06.838' N	125° 52.497' W	Ship	4485.7		Elevator 2 recovery
06/12/22 08:29	153-1_CTD-07	14° 01.138' N	125° 54.949' W	Ship	4529.8	BEL Reference	Max. depth, repetition SO268_151_CTD
06/12/22 14:29	154-1_AUV-13	14° 08.625' N	125° 53.826' W	Ship	4495.6		Recovery

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
06/12/22 16:33	155-1_TVMUC-31	14° 06.7948' N	125° 52.4739' W	USBL	4488.8	BEL Collector impact	
06/12/22 19:59	156-1_TVMUC-32	14° 06.1013' N	125° 52.8725' W	USBL*	4457.9	BEL Trial site 1200m SW of tracks	
06/12/22 23:14	157-1_TVMUC-33	14° 06.6846' N	125° 52.4707' W	USBL	4483.6	BEL Plume impact thick	
07/12/22 02:26	158-1_TVMUC-34	14° 06.671' N	125° 52.347' W	Ship	4491.1	BEL Plume impact thick	
07/12/22 05:59	159-1_BC-29	14° 06.8018' N	125° 52.4903' W	USBL	4489.0	BEL Collector impact	Deployed in collector turns
07/12/22 09:05	160-1_BC-30	14° 06.6651' N	125° 52.4634' W	USBL	4486.6	BEL Plume impact thick	
07/12/22 12:19	161-1_BC-31	14° 06.6531' N	125° 52.3470' W	USBL	4490.8	BEL Plume impact thick	
07/12/22 17:59	162-1_LIFT-10	14° 06.6752' N	125° 52.3249' W	USBL	4492.3	BEL Plume impact thick	Elevator 1 deployment
07/12/22 17:34	163-1_ROV-20	14° 06.692' N	125° 52.328' W	Ship	4493.5	BEL Plume impact thick	Start transect
08/12/22 02:37	164-1_AUV-14	14° 06.795' N	125° 52.045' W	Ship	4503.9	BEL Collector impact, Plume impact thick	Start transect / gaps in imaging
08/12/22 04:51	165-1_OFOS-11	14° 06.944' N	125° 52.471' W	Ship	4488.1	BEL Collector impact, plume impact thick & gradient	Start transect
08/12/22 17:22	166-1_TVMUC-35	14° 06.7695' N	125° 52.2889' W	USBL	4504.1	BEL Plume impact thick	
08/12/22 20:23	167-1_TVMUC-36	14° 06.8058' N	125° 52.3933' W	USBL	4488.8	BEL Plume impact thick	
08/12/22 22:17	168-1_AUV-14	14° 07.119' N	125° 52.487' W	Ship	4491.6		Recovery
09/12/22 00:17	169-1_BC-32	14° 06.7502' N	125° 52.2836' W	USBL	4501.6	BEL Plume impact thick	
09/12/22 03:26	170-1_BC-33	14° 06.8081' N	125° 52.3918' W	USBL	4490.4	BEL Plume impact thick	
09/12/22 07:44	171-1_OFOS-12	14° 03.952' N	125° 52.396' W	Ship	4493.9	BEL Plume impact gradient	Start transect
09/12/22 18:10	172-1_TVMUC-37	14° 02.1414' N	125° 55.5058' W	USBL	4536.9	BEL Reference	
09/12/22 21:15	173-1_TVMUC-38	14° 02.1359' N	125° 55.4513' W	USBL	4540.7	BEL Reference	Failed
10/12/22 00:26	174-1_TVMUC-39	14° 02.1321' N	125° 55.4492' W	USBL	4538.4	BEL Reference	Repetition 173-1_TVMUC-38
10/12/22 03:55	175-1_BC-34	14° 02.1427' N	125° 55.4803' W	USBL	4543.5	BEL Reference	Failed
10/12/22 07:08	176-1_BC-35	14° 02.1382' N	125° 55.4458' W	USBL	4536.3	BEL Reference	
10/12/22 10:02	177-1_BC-36	14° 02.1346' N	125° 55.4034' W	USBL	4535.8	BEL Reference	

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
10/12/22 13:40	178-1_TVMUC-40	14° 02.1390' N	125° 55.3485' W	USBL	4491.8	BEL Reference	
10/12/22 16:51	179-1_TVMUC-41	14° 02.1479' N	125° 55.2978' W	USBL	4535.7	BEL Reference	
10/12/22 20:01	180-1_TVMUC-42	14° 02.1455' N	125° 55.3982' W	USBL	4536.0	BEL Reference	
10/12/22 23:51	181-1_OFOS-13	14° 00.868' N	125° 55.552' W	Ship	4538.6	BEL Reference	Start transect
11/12/22 09:17	182-1_BC-37	14° 02.159' N	125° 55.349' W	Ship	4536.2	BEL Reference	
11/12/22 12:25	183-1_BC-38	14° 02.154' N	125° 55.299' W	Ship	4783.8	BEL Reference	Discarded / sampled unidentified track
11/12/22 15:30	184-1_BC-39	14° 02.162' N	125° 55.496' W	Ship	4538.3	BEL Reference	Failed
11/12/22 19:12	185-1_ROV-21	14° 02.031' N	125° 55.332' W	Ship	4537.9	BEL Reference	Start transect
12/12/22 03:06	186-1_AUV-15	14° 06.792' N	125° 52.014' W	Ship	4502.2	BEL Collector impact, Plume impact thick	Start transect
12/12/22 04:58	187-1_TVMUC-43	14° 06.743' N	125° 52.244' W	Ship	4500.8	BEL Plume impact 25m SE of tracks	
12/12/22 08:11	188-1_TVMUC-44	14° 06.730' N	125° 52.226' W	Ship	4501.2	BEL Plume impact 75m SE of tracks	
12/12/22 11:12	189-1_TVMUC-45	14° 06.695' N	125° 52.190' W	Ship	4500.9	BEL Plume impact 175m SE of tracks	
12/12/22 16:55	190-1_ROV-22	14° 06.688' N	125° 52.249' W	Ship	4503.4	BEL Plume impact thick	Start transect
13/12/22 01:43	191-1_LIFT-10	14° 06.680' N	125° 52.311' W	Ship	4488.0		Elevator 1 recovery
13/12/22 02:32	192-1_AUV-15	14° 08.279' N	125° 54.715' W	Ship	4520.5		Recovery
13/12/22 04:55	193-1_BC-40	14° 02.1408' N	125° 55.3039' W	USBL*	4537.7	BEL Reference	Repetition 183-1_BC-38
13/12/22 08:06	194-1_BC-41	14° 02.1420' N	125° 55.4909' W	USBL	4536.1	BEL Reference	Repetition 175-1_BC-34
13/12/22 12:07	195-1_TVMUC-46	14° 06.6462' N	125° 52.1490' W	USBL	4503.0	BEL Plume impact 275m SE of tracks	
13/12/22 17:59	196-1_LIFT-11	14° 06.7129' N	125° 52.1913' W	USBL	4502.4	BEL Plume impact 200m SE of tracks	Elevator 1 deployment
13/12/22 17:05	197-1_ROV-23	14° 06.682' N	125° 52.203' W	Ship	4499.5	BEL Plume impact gradient, distance to tracks (m): 200m SE	Start transect
14/12/22 02:40	198-1_LIFT-11	14° 06.727' N	125° 52.173' W	Ship	4499.1		Elevator 1 recovery

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
14/12/22 02:53	199-1_AUV-16	14° 06.725' N	125° 52.183' W	Ship	4500.3	BEL Collector impact, Plume impact gradient, trial baseline time series	Start transect
14/12/22 05:10	200-1_OFOS-14	14° 06.486' N	125° 52.244' W	Ship	4489.8	BEL Plume impact gradient	Start transect
14/12/22 17:17	201-1_LIFT-12	14° 07.0957' N	125° 52.5711' W	USBL	4494.8	BEL Trial baseline time series	Elevator 1 deployment
14/12/22 17:01	202-1_ROV-24	14° 07.103' N	125° 52.567' W	Ship	4492.3	BEL Trial baseline time series	Start transect
15/12/22 02:20	203-1_LIFT-12	14° 07.082' N	125° 52.556' W	Ship	4489.7		Elevator 1 recovery
15/12/22 03:18	204-1_AUV-16	14° 09.471' N	125° 56.646' W	Ship	4536.6		Recovery
15/12/22 05:40	205-1_TVMUC-47	14° 06.546' N	125° 52.018' W	Ship	4505.4	BEL Plume impact 600m SE of tracks	
15/12/22 09:25	206-1_BC-42	14° 06.981' N	125° 52.754' W	Ship	4484.7	BEL Trial baseline time series	
15/12/22 12:25	207-1_BC-43	14° 06.992' N	125° 52.759' W	Ship	4482.4	BEL Trial baseline time series	Discarded / sample disturbed
15/12/22 18:21	208-1_LIFT-13	14° 06.7459' N	125° 52.3259' W	USBL	4498.1	BEL Plume impact thick	Elevator 1 deployment
15/12/22 17:46	209-1_ROV-25	14° 06.761' N	125° 52.324' W	Ship	4497.1	BEL Plume impact thick	Start transect
16/12/22 02:40	210-1_LIFT-13	14° 06.753' N	125° 52.311' W	Ship	4497.9		Elevator 1 recovery
16/12/22 03:01	211-1_AUV-17	14° 06.798' N	125° 52.067' W	Ship	4505.6	BEL Plume impact gradient, trial baseline time series	Start transect / gaps in imaging
16/12/22 04:59	212-1_BC-44	14° 06.9790' N	125° 52.8103' W	USBL	4482.5	BEL Trial baseline time series	
16/12/22 08:05	213-1_BC-45	14° 06.9788' N	125° 52.8574' W	USBL	4473.0	BEL Trial baseline time series	
16/12/22 12:18	214-1_OFOS-15	14° 00.469' N	125° 53.797' W	Ship	4519.0	BEL Reference	Start transect
16/12/22 22:28	215-1_BC-46	14° 06.9710' N	125° 52.8524' W	USBL	4480.7	BEL Trial baseline time series	
17/12/22 01:43	216-1_BC-47	14° 06.9765' N	125° 52.9101' W	USBL	4479.3	BEL Trial baseline time series	
17/12/22 04:10	217-1_AUV-17	14° 06.785' N	125° 54.893' W	Ship	4512.5		Recovery
17/12/22 06:41	217-1_AUV-17	14° 07.027' N	125° 51.872' W	Ship	4505.4	BEL	Transponder recovery

Date Time (UTC)	Station_Device	Latitude	Longitude	Position	Water Depth / m	Area	Comment
17/12/22 11:03	218-1_BWS-06	14° 01.141' N	125° 54.943' W	Ship	4789.0	BEL Reference	Max. depth

* Ship GPS track shows sudden jumps of several tens of meters (sometimes >100 m). Thus position data should be treated with caution.

[#] Ship position is given, because USBL position is considered incorrect or unreliable after checking coordinates on the map. USBL position is showing an almost vertical shift to the N or S by 700-2000 m with respect to the ship's position.

[usbl] USBL position does not match with targeted site or cored sediment (see also BC or MUC photo in respective chapters), ship's GPS position appears more reliable.

Note: USBL and Ship positions have been calculated as median of the respective DSHIP data extracted for the time of maximum water depth, being the inferred deployment time at the seafloor. Ship position is provided where no USBL position is available (either entire failure or around time of deployment at bottom).

For ROV, AUV, OFOS, and TP deployments always the ship position at the start of the mission or transect is given. Please refer to the ROV protocols for USBL positions of the conducted work.

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.

Problems with USBL underwater navigation during SO295

Already during the first ROV dives there was some concern regarding the reliability of the Ultra Short Baseline (USBL) underwater positioning with the Posidonia system installed on RV SONNE. During ROV dive 2 (SO295_012-1_ROV-02) an attempt to locate recolonization frames that were deployed at the seafloor at the so-called dredge site in the BGR license area during SO268/2 failed. Also, a nearby experimental site (‘decompaction experiment’) originating from the same expedition could not be found. By coincidence the ROV came across a so-called SLIC box (SLIC BOX#10) that was deployed during SO268. Comparing the position where SLIC BOX#10 was found during ROV dive 2 with the position of its deployment during SO268-2_111ROV dive 16 and subsequent sightings during the seam expedition (SO268-2_118 ROV dive 17, SO268-2_124 ROV dive 18, and SO268-2_188 ROV dive 29) the recent localization differed by more than 120m in southwesterly direction (247°). The comparison of positions of tracks originating from Epibenthic Sledge (EBS) deployments during previous cruises to observations during the same dive (SO295_012-1_ROV02) indicated an even larger offset in a similar direction. Assuming a systematic and reproducible offset between the USBL positions of both cruises, target positions for the next dive were ‘corrected’ according to the observed discrepancy in the SLIC BOX 10 position. However, during SO205_019-1_ROV-03 the recolonization frames deployed in 2019 in the reference site in the BGR License area were again not found, neither at the ‘corrected’ nor at the original positions from SO268 or in the surrounding areas. This indicated an uncertainty in positioning during the two expeditions that was somewhat indeterminate or depending on factors not yet understood. A variable offset was also indicated by the difference observed between Posidonia and GPS positions during Multicorer and Boxcorer deployments with USBL transponder installed on the cable. In some deployments, ship and instrument positions deviated by distances in the 100m range which did not seem very plausible while in other deployments common lateral differences of a few tens of meters or smaller were observed. Strong changes in relative positions of the USBL pinger on the OFOS and the ship when RV SONNE changed heading during OFOS transects indicated that the offset was dependent on the relative position of RV SONNE and the USBL transponder. This was supported by observations done by ROV where absolute positions of instruments and elevator differed considerably between consecutive dives with different relative positions of vessel and ROV. Luckily, relative positions of the instruments at the seafloor were largely stable within a dive so that navigation at the seafloor was most of the time straightforward once the elevator was found with the help of the ROV sonar and homer beacons installed on the elevators. During several dives, however, sudden jumps in USBL positions exceeding the typical USBL position scatter and lasting for longer periods of time as well as continuing drift in position while the ROV was in fact not moving were observed even without changes in the ship’s heading or relative position of ship and ROV. Poor GPS reception that occurred in the first half of November was identified as one possible source leading to sudden jumps in the USBL position of the ROV as well as of the vessel. Unstable GPS positions were observed during the same period of time also for RV SONNE’s navigation systems, the echo sounders, and the AUV. As the primary Global Navigation Satellite System (GNSS) receiver of RV SONNE (Seapath) cannot process corrections signals provided by the Differential Global Positioning System (DGPS), the Posidonia System was connected to another GNSS receiver (Trimble) instead. In addition to DGPS correction signals, the Trimble system is also capable to receive and process additional GNSS systems including GLONASS and

Galileo. After switching to the Trimble system around the 12.11.2022, the USBL positioning stabilized significantly. However, the general problem with the inconsistent and drifting USBL positions remained. A test of the ROV transponder did not indicate any malfunction. From the observations it was concluded that an offset correction or USBL recalibration was most likely not feasible and that we were rather facing a technical problem of the ship's system. An inspection of the performance of the IXBLUE USBL Antenna permanently installed in RV SONNE's hull revealed that one of the four transducers showed a reduced signal. This provided a plausible explanation for the observed offsets in position and their dependency on the relative position of the USBL transponders and the vessel. It also seemed likely that an instable performance of the transducer could be the reason for the sudden jumps and drift in position that have been observed.

After the Posidonia Antenna was identified as the likely source of the problem, a spare USBL antenna was installed in RV SONNE's open shaft on 14. Nov. 2022. Even without calibration, the USBL navigation improved immediately. It was first used during ROV dive SO295_061-1_ROV-07 in the collector impact area. Based on the available sidescan maps from expedition IP21 with MV Island Pride and the nodule piles created by PATANIA II a quite precise knowledge of the absolute position of the elevator (and the instruments deployed at the seafloor) existed at this site. A calibration of the spare antenna was performed on 19. Nov. 2022 (SO295-070) using a transponder that has been deployed with Elevator 1 in parallel to ROV dive 8 (SO295_068). After successful transfer of calibration data to the Posidonia system and after solving network problems that led to USBL navigation failure in the beginning of ROV dive SO295_089-1_ROV-11 , the new USBL system was used routinely from station SO295_090 on 23. Nov. 2022 on. Due to the stronger winds and higher waves in the GSR / Belgian area we noticed a higher scatter of Posidonia signals as with the permanently installed antenna. While the spare antenna made the work possible for the SO295 expedition the setup is hence not to be considered a long-term solution.

The USBL problems obviously led to uncertainties in positioning of ROV and sampling instruments in the first phase of the expedition. In the areas, where precise location of the gear was most important (i.e., in the collector area and the nearby plume impact areas) several sources of information were used to assess and ensure successful positioning. For the ROV, on board sonar (Kongsberg MS 1000) and cameras allowed recognition of features of known position (e.g., nodule piles, recolonization frames) and target features (e.g., caterpillar tracks, thickly blanketed nodules). Target features could also be recognized during Multiple Corer deployments with online video transmission (TV-MUC) and after Boxcorer deployments from visual inspection of the surface of the obtained samples. However, for the time being, there is an immanent uncertainty about the real positions where samples were MUC and BC samples were taken. We intend to improve the positioning record by identifying sampler imprints on the sediment in post-sampling photomosaics obtained by the AUV once post processing and georeferencing is accomplished. The ship's GPS positions at the time of sampling are so far the best approximation of sampling positions for stations SO295_001 to SO295_089, where the calibrated spare USBL antenna was not yet operational. USBL / Posidonia positions provided always represent averages of filtered position data at the time where instruments arrived at the deepest point of the deployment (seafloor for sediment samplers and bottom water sampler, some meters above bottom for CTD).

8 Data and Sample Storage and Availability

All data generated from SO295 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. NoduleMonitoring2 possesses a project data policy specifying time schedules from data creation during SO295 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. January 2026) 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 Seeschiffahrt 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). The positioning data for the OFOS platform will be integrated with the image date and stored as an iFDO file for each image. 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.

Table 8.1 Overview of data availability. All data will be made publically available in January 2026 or at the time of earlier scientific publication.

Type of data	Chapter	Contact Person, Institute, Email address
Hydroacoustic survey data	5.9	Matthias Haeckel, GEOMAR, mhaeckel@geomar.de
AUV photos	5.2	Matthias Haeckel, GEOMAR, mhaeckel@geomar.de
OFOS photos	5.3	Autun Purser, AWI, autun.purser@awi.de
CTD data	5.16	Carsten Rühlemann, BGR, carsten.ruehlemann@bgr.de Matthias Haeckel, GEOMAR, mhaeckel@geomar.de
Water column chemical data	5.15	Katja Schmidt, BGR, katja.schmidt@bgr.de
Sediment biogeochemical data	5.14	Sabine Kasten, AWI, sabine.kasten@awi.de Matthias Haeckel, GEOMAR, mhaeckel@geomar.de
Metal geochemical data	5.14	Katja Schmidt, BGR, katja.schmidt@bgr.de 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	Patricia Esquete, UA, pesquete@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
In situ food web data	5.17	Tanja Stratmann, NIOZ, tanja.stratmann@nioz.nl Teresa Amaro, CIIMAR, tamaro@ciimar.up.pt
Recolonization experiment	5.17	Sabine Gollner, NIOZ, sabine.gollner@nioz.nl

9 Acknowledgements

We look back at a very challenging cruise with shipping logistics for a total of eighteen containers and a demanding schedule for deploying a suite of large-gear, such as ROV, AUV, benthic landers and in situ ROV tools. Despite some technical problems a comprehensive set of samples and data from the deep sea was collected and the overall goals of the cruise were achieved. This would not have been possible without the professional collaboration and constant support by captain Tilo Birnbaum and his great crew. Furthermore, we thank all the shore-based colleagues (technicians, administration, and scientists) involved in this cruise.

The German Federal Ministry of Education and Research (BMBF) is gratefully acknowledged for the funding of this cruise (grant no. 03G0295A-E).

The European collaborative project MiningImpact is funded under the framework of the Joint Programmining Initiative Healthy and Productive Seas and Oceans (JPI Oceans) by the national research ministries from Belgium, Germany, Norway, the Netherlands and Portugal.

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.

10 References

Aleynik, D. et al. (2017) Impact of remotely generated eddies on plume dispersion at abyssal mining sites in the Pacific. Scientific Reports 7, 16959.

BGR (2018) Environmental Impact Assessment for the testing of a pre-protoype manganese nodule collector vehicle in the Eastern German license area (Clarion-Clipperton Zone) in the framework of the European JPI-O MiningImpact 2 research project. Hannover, Germany, 209 p.

Dell'Anno, A. (2009) Determination of viral production in aquatic sediments using the dilution-based approach. Nature Protocols 4, 1013-1022.

Dorgan, K.M. et al. (2005) Burrow extension by crack propagation. Nature 433, 475.

Fiedler, P.C., Talley, L.D. (2006) Hydrography of the eastern tropical Pacific: A review. Progress in Oceanography 69 (2-4), 143-180.

Gillard, B. et al. (2019) Physical and hydrodynamic properties of deep sea mining-generated, abyssal sediment plumes in the Clarion Clipperton Fracture Zone (eastern-central Pacific). Elementa Science of the Anthropocene 7 (1), 5.

Global Sea Mineral Resources (2018) Environmental Impact Statement: Small-scale testing of nodule collector components on the seafloor of the Clarion-Clipperton Fracture Zone and its environmental impact. ISA_EIA_2018_GSRNOD2019, Zwijndrecht, Belgium, 337 p.

Gollner S. et al. (2022) Restoration experiments in polymetallic nodule areas. Integrated Environmental Assessment and Management 18(3), 682-696.

Grasshoff, K., Ehrhardt, M., Kremling, K. (1999). Methods of Seawater Analysis. Weinheim, Wiley-VCH, 600 p.

Haeckel et al. (2001) Pore water profiles and numerical modelling of biogeochemical processes in Peru Basin deep-sea sediments. Deep-Sea Research II 48(17-18), 3713-3736.

Haeckel, M., Linke, P. (2021) RV SONNE Cruise Report SO268: Assessing the Impacts of Nodule Mining on the Deep-sea Environment: NoduleMonitoring. GEOMAR Report 59. GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel, Kiel, Germany, 802 p.

Haffert, L. et al. (2020) Assessing the temporal scale of deep-sea mining impacts on sediment biogeochemistry. Biogeosciences 17(10), 2767-2789.

Hanawa, K., Talley, L.D. (2001) Chapter 5.4 Mode waters. In: Siedler G., Church J., Gould J. (eds.) Ocean circulation and climate. Observing and modelling the global ocean, Vol. 77, Academic Press, p.373-386.

Hauton, C. et al. (2017) Identifying toxic impacts of metals potentially released during deep-sea mining - a synthesis of the challenges to quantifying risk. Frontiers in Marine Science 4, 15.

International Seabed Authority (2010) A Geological Model of Polymetallic Nodule Deposits in the Clarion-Clipperton Fracture Zone. ISA Technical Study No. 6, Kingston, Jamaica, 211 p.

International Seabed Authority Legal and Technical Commission (2011) Environmental Management Plan for the Clarion-Clipperton Zone. ISBA/17/LTC/7, Kingston, Jamaica, 18 p.

König, I. et al. (2001) A geochemical model of the Peru Basin deep-sea floor and the system's response to technical impacts. Deep-Sea Research II, 3737-3756.

Martinez-Arbizu, P., Haeckel, M. (2015) RV SONNE Cruise Report SO239: EcoResponse Assessing the Ecology, Connectivity and Resilience of Polymetallic Nodule Field Systems. GEOMAR Report No. 25, 204 p.

Meysman, F.J.R., Middelburg, J.J., Heip, C.H.R. (2006) Bioturbation: a fresh look at Darwin's last idea. Trends in Ecology and Evolution 21, 688-695.

Pennington, J.T. et al. (2006) Primary production in the eastern tropical Pacific: A review. Progress in Oceanography 69, 285-317.

Schmidt, K., Paul, S.A.L., Achterberg, E. P. (2022) Assessing the availability of trace metals including rare earth elements in deep ocean waters of the Clarion Clipperton Zone, NE Pacific: Application of an in situ DGT passive sampling method. Trends in Analytical Chemistry 155, 116657.

Seeberg-Elverfeldt, J. et al. (2005) Rhizon sampling of pore waters near the sediment/water interface of aquatic systems. Limnology and Oceanography: Methods 3, 361-371.

Vink, A. (2022) MANGAN 2021 Cruise Report: Independent scientific monitoring of two collector tests in the BGR and GSR contract areas for the exploration of polymetallic nodules in the equatorial NE Pacific. BGR, Hannover, Germany, 363 p.

Volz, J. et al. (2020) Impact of small-scale disturbances on geochemical conditions, biogeochemical processes and element fluxes in surface sediments of the eastern Clarion–Clipperton Zone, Pacific Ocean. Biogeosciences 17(4), 1113-1131.

Winkler, L. W. (1888) Die Bestimmung des im Wasser gelösten Sauerstoffes. Berichte der Deutschen Chemischen Gesellschaft 21(2), 2843–2854.

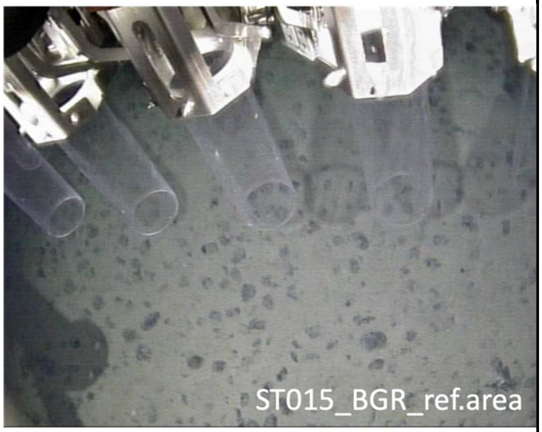
You, Y. (2003) The pathway and circulation of North Pacific intermediate water. Geophysical Research Letters 30(24).

11 Abbreviations

ADCP	Acoustic Doppler Current Profiler
AODC	Acridine Orange Direct Count
AUV	Autonomous Underwater Vehicle
BC	Box Corer
BEL	Working area in the central GSR 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
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	Working area in the BGR 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
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
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 Multiple Corer Deployments

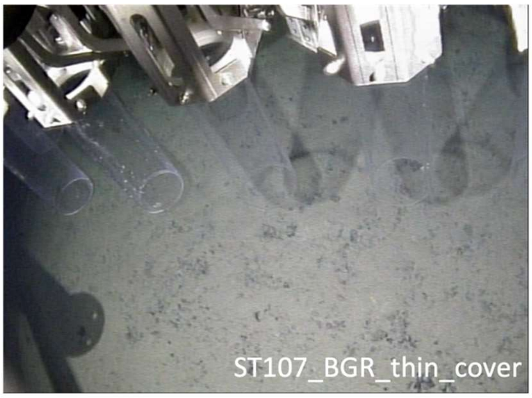
Date Time (UTC)	Station_ Device	Latitude	Longitude	Water Depth (m)	Area	Seafloor photo prior to deployment (2 m above ground)
22.11.09 07:43	015-1_ TVMUC-01	11° 50,737' N	117° 03,602' W	4129.1	GER Reference	
22.11.09 10:43	016-1_ TVMUC-02	11° 50,740' N	117° 03,573' W	4125.7	GER Reference	
22.11.10 15:06	024-1_ TVMUC-03	11° 50,750' N	117° 03,612' W	4124.9	GER Reference	

22.11.10 18:29	025-1_ TVMUC-04	11° 50,745' N	117° 03,536' W	4125.4	GER Reference	
22.11.11 09:06	027-1_ TVMUC-05	11° 50,750' N	117° 03,502' W	4126.9	GER Reference	No screenshot
22.11.12 10:18	033-1_ TVMUC-06	11° 55,802' N	117° 01,692' W	4085.0	GER Collector impact	
22.11.12 13:12	034-1_ TVMUC-07	11° 55,805' N	117° 01,663' W	4084.0	GER Collector impact	

22.11.15 04:52	046-1_ TVMUC-08	11° 55,844' N	117° 01,695' W	4081.5	GER Plume impact thick	
22.11.15 07:49	047-1_ TVMUC-09	11° 55,844' N	117° 01,664' W	4080.9	GER Plume impact thick	
22.11.17 03:14	057-1_ TVMUC-10	11° 55,848' N	117° 01,658' W	4081.3	GER Plume impact thick	
22.11.17 06:06	058-1_ TVMUC-11	11° 55,859' N	117° 01,626' W	4081.7	GER Plume impact thick	

22.11.18 09:22	065-1_ TVMUC-12	11° 55,847' N	117° 01,606' W	4084.2	GER Plume impact thick	
22.11.18 12:12	066-1_ TVMUC-13	11° 55,807' N	117° 01,656' W	4082.7	GER Collector impact	
22.11.19 13:28	072-1_ TVMUC-14	11° 55,809' N	117° 01,635' W	4085.9	GER Collector impact	
22.11.20 16:39	077-1_ TVMUC-15	11° 55,805' N	117° 01,645' W	4082.3	GER Collector impact	Failed deployment

22.11.22 04:03	085-1_ TVMUC-16	11° 55,809' N	117° 01,617' W	4083.8	GER Collector impact	
22.11.23 05:40	092-1_ TVMUC-17	11° 55,803' N	117° 01,626' W	4085.3	GER Collector impact	
22.11.23 08:36	093-1_ TVMUC-18	11° 55,791' N	117° 01,608' W	4084.6	GER Collector impact	
22.11.24 04:49	097-1_ TVMUC-19	11° 55,803' N	117° 01,622' W	4082.2	GER Collector impact	

22.11.25 22:13	106-1_ TVMUC-20	11° 55,946' N	117° 01,616' W	4079.4	GER Plume impact 220m NW of tracks	No screenshot; second touchdown on disturbed/resuspended sediment
22.11.26 01:03	107-1_ TVMUC-21	11° 55,949' N	117° 01,622' W	4081.3	GER Plume impact 220m NW of tracks (repetition of st. 106)	
22.11.26 22:11	113-1_ TVMUC-22	11° 56,980' N	117° 01,632' W	4096.9	GER Plume impact 2000m N of tracks	
22.11.27 05:19	115-1_ TVMUC-23	11° 55,904' N	117° 01,601' W	4082.7	GER Plume impact 150m NW of tracks	

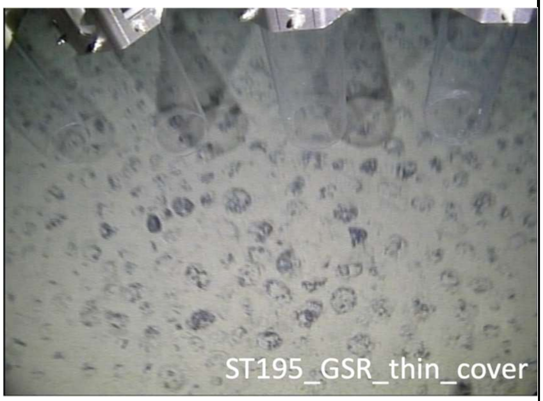
22.11.27 08:16	116-1_ TVMUC-24	11° 56,094' N	117° 01,692' W	4082.3	GER Plume impact 500m NW of tracks	
22.11.27 11:11	117-1_ TVMUC-25	11° 55,632' N	117° 01,259' W	4090.2	GER Trial baseline time series	
22.12.02 00:28	129-1_ TVMUC-26	14° 06,748' N	125° 52,468' W	4488.8	BEL Collector impact	
22.12.02 03:30	130-1_ TVMUC-27	14° 06,772' N	125° 52,494' W	4486.1	BEL Collector impact	

22.12.05 05:51	146-1_ TVMUC-28	14° 06,812' N	125° 52,602' W	4486.0	BEL Plume impact thick	
22.12.05 08:56	147-1_ TVMUC-29	14° 06,827' N	125° 52,462' W	4494.8	BEL Collector impact	
22.12.05 11:55	148-1_ TVMUC-30	14° 06,844' N	125° 52,437' W	4490.8	BEL Collector impact	
22.12.06 16:33	155-1_ TVMUC-31	14° 06,813' N	125° 52,488' W	4488.8	BEL Collector impact	

22.12.06 19:59	156-1_ TVMUC-32	14° 06,119' N	125° 52,876' W	4457.9	BEL Trial site 1200m SW of tracks	No screenshot
22.12.06 23:14	157-1_ TVMUC-33	14° 06,701' N	125° 52,473' W	4483.6	BEL Plume impact thick	
22.12.07 02:26	158-1_ TVMUC-34	14° 06,671' N	125° 52,347' W	4491.1	BEL Plume impact thick	
22.12.08 17:22	166-1_ TVMUC-35	14° 06,777' N	125° 52,297' W	4504.1	BEL Plume impact thick	

22.12.08 20:23	167-1_ TVMUC-36	14° 06,815' N	125° 52,398' W	4488.8	BEL Plume impact thick	
22.12.09 18:10	172-1_ TVMUC-37	14° 02,160' N	125° 55,501' W	4536.9	BEL Reference	
22.12.09 21:15	173-1_ TVMUC-38	14° 02,168' N	125° 55,452' W	4540.7	BEL Reference	Failed deployment
22.12.10 00:26	174-1_ TVMUC-39	14° 02,158' N	125° 55,456' W	4538.4	BEL Reference (repetition of st. 173)	

22.12.10 13:40	178-1_ TVMUC-40	14° 02,158' N	125° 55,351' W	4491.8	BEL Reference	
22.12.10 16:51	179-1_ TVMUC-41	14° 02,165' N	125° 55,300' W	4535.7	BEL Reference	
22.12.10 20:01	180-1_ TVMUC-42	14° 02,159' N	125° 55,403' W	4536.0	BEL Reference	No screenshot
22.12.12 04:58	187-1_ TVMUC-43	14° 06,743' N	125° 52,244' W	4500.8	BEL Plume impact 25m SE of tracks	

22.12.12 08:11	188-1_ TVMUC-44	14° 06,730' N	125° 52,226' W	4501.2	BEL Plume impact 75m SE of tracks	
22.12.12 11:12	189-1_ TVMUC-45	14° 06,695' N	125° 52,190' W	4500.9	BEL Plume impact 175m SE of tracks	
22.12.13 12:07	195-1_ TVMUC-46	14° 06,658' N	125° 52,147' W	4503.0	BEL Plume impact 275m SE of tracks	
22.12.15 05:40	205-1_ TVMUC-47	14° 06,546' N	125° 52,018' W	4505.4	BEL Plume impact 600m SE of tracks	

12.2 Box Corer Deployments

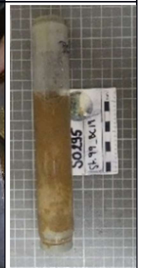
Station	Lat N	Lon W	Depth (m)	Date	Area	Description/Remarks	Box-core surface	Tube core profile
7-1_BC1	11° 50.807'	117° 03.650'	4127.1	07/11/2022	GER_reference	Failed; safety cable entangled		
9-1_BC1	11° 50.762'	117° 03.575'	4125.8	08/11/2022	GER_reference	Very high penetration, <5m of overlying water. 3 nodules for MPI		
11-1_BC2	11° 50.756'	117° 03.561'	4124.4	08/11/2022	GER_reference	3 nodules for MPI		

22-1_BC3	11° 50.752'	117° 03.535'	4127.6	10/11/2022	GER_reference	3 nodules for MPI		
23-1_BC4	11° 50.748'	117° 03.489'	4127.3	10/11/2022	GER_reference	Surface with slight inclination		
28-1_BC5	11° 50.745'	117° 03.452'	4126.8	11/11/2022	GER_reference	Hit the ship when recovering		**No photo**

38-1_BC6	11° 55.798'	117° 01.697'	4083.1	13/11/2022	GER_collector	Irregular surface, white clay visible, few fragmented nodules		
39-1_BC7	11° 55.810'	117° 01.665'	4083.8	13/11/2022	GER_collector*	Presence of nodules, covered by a thick layer of watery sediment		
48-1_BC8	11° 55.840'	117° 01.693'	4080.9	15/11/2022	GER_thick cover	Nodules on the edges visible after retiring overlying water. Sediment covering rest of the nodules		

49-1_BC9	11° 55.842'	117° 01.680'	4081.3	15/11/2022	GER_thick cover	Watery layer of sediment on top of the nodules, washed off when retiring the overlying water 3 nodules for MPI		
53-1_BC10	11° 55.854'	117° 01.655'	4085.7	16/11/2022	GER_thick cover	Watery layer of sediment on top of the nodules, washed off when retiring the overlying water 3 nodules for MPI		**No photo**
59-1_BC11	11° 55.851'	117° 01.623'	4081.3	17/11/2022	GER_thick cover	Watery layer of sediment on top of the nodules, washed off when retiring the overlying water 3 nodules for MPI		
60-1_BC12	11° 55.855'	117° 01.604'	4080.7	17/11/2022	GER_thick cover	Failed; trigger stuck		
60-1_BC12	11° 55.845'	117° 01.601'	4082.4	17/11/2022	GER_thick cover	Presence of nodules, covered by a thick layer of dark, watery sediment		

78-1_BC13	11° 55.806'	117° 01.660'	4082.9	20/11/2022	GER_collector	Few visible nodules but present, very watery upper layer		
80-1_BC14	11° 55.811'	117° 01.640'	4081.9	20/11/2022	GER_collector*	Usual quantity of nodules for the area, covered by a thick layer of dark, watery sediment		
86-1_BC15	11° 55.807'	117° 01.616'	4082.1	22/11/2022	GER_collector	No nodules		
87-1_BC16	11° 55.807'	117° 01.674'	4083.5	22/11/2022	GER_collector	Disturbed, apparent caterpillar trace but containing high quantity of nodules. Most of them crumbs or broken nodules		

94-1_BC17	11° 55.796'	117° 01.620'	4083.9	23/11/2022	GER_collector	Disturbed, only one nodule. Visible caterpillar trace		
98-1_BC18	11° 55.798'	117° 01.611'	4082.6	24/11/2022	GER_collector	Disturbed, with no nodules on surface. Visible caterpillar trace		
99-1_BC19	11° 55.635'	117° 01.308'	4087.9	24/11/2022	GER_control SE			
104-1_BC20	11° 55.629'	117° 01.281'	4090.3	25/11/2022	GER_control SE			

105-1_BC21	11° 55.629'	117° 01.256'	4091.2	25/11/2022	GER_control SE			
111-1_BC22	11° 55.637'	117° 01.237'	4089.7	26/11/2022	GER_control SE	The push-core was inserted after the slicing of the sample started, and aprox. 0.5 cm was missing. This was corrected when slicing the push-core by taking a 2.5 cm upper layer		
112-1_BC23	11° 55.630'	117° 01.209'	4088.9	26/11/2022	GER_control SE			
131-1_BC24	14° 06.768'	117° 03.650'	4487.3	02/12/2022	BEL_collector	Smooth surface, no nodules		

132-1_BC25	14° 06.773'	117° 03.575'	4490.1	02/12/2022	BEL_collector	Visibly disturbed		
140-1_BC26	14° 06.812'	117° 03.561'	4486.2	04/12/2022	BEL_collector*	With nodules, apparently not disturbed. Considered not in the collector (considered (thick cover)		
141-1_BC27	14° 06.826'	117° 03.535'	4488.4	04/12/2022	BEL_collector	Visibly disturbed, no nodules		
142-1_BC28	14° 06.844'	117° 03.489'	4492.8	04/12/2022	BEL_collector	Visibly disturbed, presence of nodules		

159-1_BC29	14° 06.820'	117° 03.452'	4488.9	07/12/2022	BEL_collector	Visibly disturbed, presence of nodules below 3 cm		
160-1_BC30	14° 06.683'	117° 01.697'	4486.6	07/12/2022	BEL_thick cover	Thin "blanketing" layer that was washed off when retiring the overlying water Minicore taken under a nodule 2 nodules for MPI		
161-1_BC31	14° 06.672'	117° 01.665'	4490.9	07/12/2022	BEL_thick cover	Thin "blanketing" layer that was washed off when retiring the overlying water 1 nodule for MPI		
169-1_BC32	14° 06.778'	117° 01.693'	4501.6	08/12/2022	BEL_thick cover			

170-1_BC33	14° 06.818'	117° 01.680'	4490.3	09/12/2022	BEL_thick cover			
175-1_BC34	14° 02.160'	117° 01.655'	4543.5	10/12/2022	BEL_reference	Failed		N/A
176-1_BC35	14° 02.158'	117° 01.623'	4536.3	10/12/2022	BEL_reference	1 nodule for MPI		
177-1_BC36	14° 02.156'	117° 01.604'	4535.7	10/12/2022	BEL_reference			

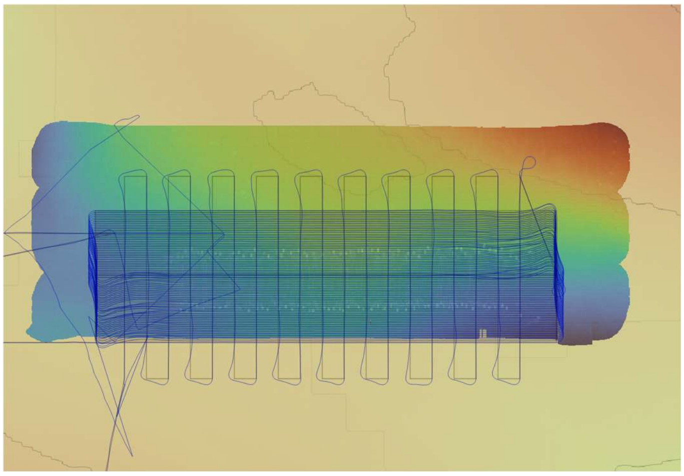
182-1_BC37	14° 02.159'	117° 01.601'	4536.2	11/12/2022	BEL_reference	1 nodule for MPI		
183-1_BC38	14° 02.154'	117° 01.660'	4783.8	11/12/2022	BEL_reference	Failed: seems to have landed on an unidentified old track		N/A
184-1_BC39	14° 02.162'	117° 01.640'	4538.3	11/12/2022	BEL_reference	Failed (did not close)		
193-1_BC40	14° 02.161'	117° 01.616'	4537.7	13/12/2022	BEL_reference	1 nodule for MPI		
194-1_BC41	14° 02.153'	117° 01.674'	4536.1	13/12/2022	BEL_reference			

206-1_BC42	14° 06.981'	117° 01.620'	4484.7	15/12/2022	BEL_control NW	3 nodules for MPI		
207-1_BC43	14° 06.992'	117° 01.611'	4482.4	15/12/2022	BEL_control NW*	Disturbed; nodules upside-down, sediment mobilized		N/A
212-1_BC44	14° 06.993'	117° 01.308'	4482.5	15/12/2022	BEL_control NW			
213-1_BC45	14° 06.991'	117° 01.281'	4473	16/12/2022	BEL_control NW			

215-1_BC46	14° 06,980'	125° 52,858'	4480.7	16/12/2022	BEL_control NW			
216-1_BC47	14° 06,986'	125° 52,903'	4479.3	17/12/2022	BEL_control NW			

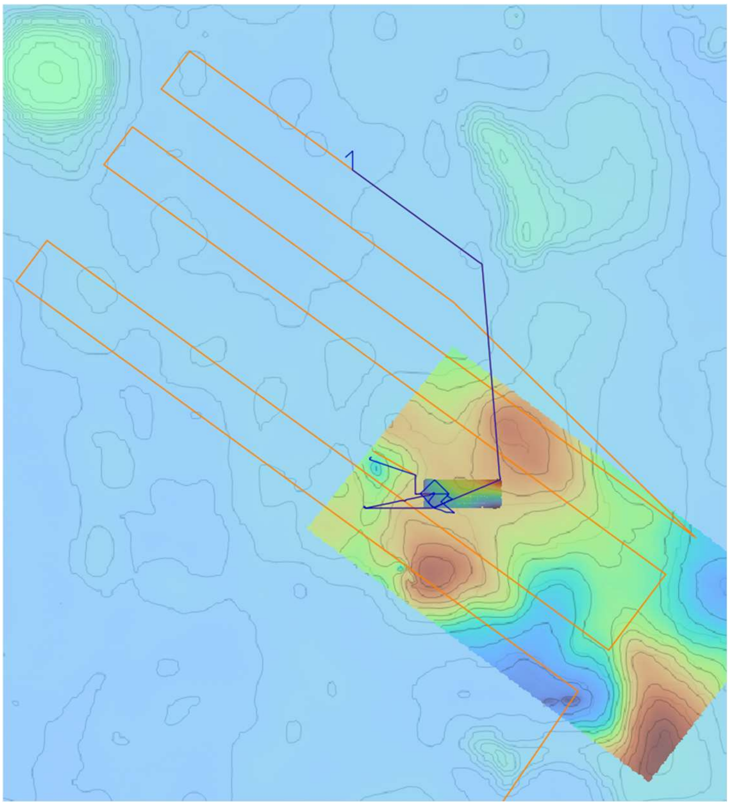
12.3 AUV Mission Tables

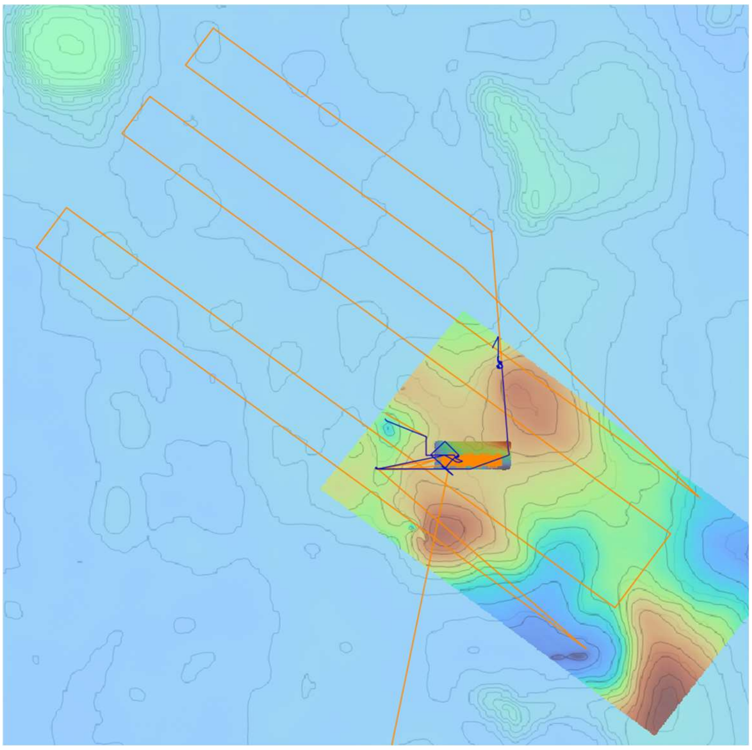
Station	**SO295_003-1_AUV**	Day (UTC)	**07.11.2022 (05:14)**
Dive	**Abyss0366**		



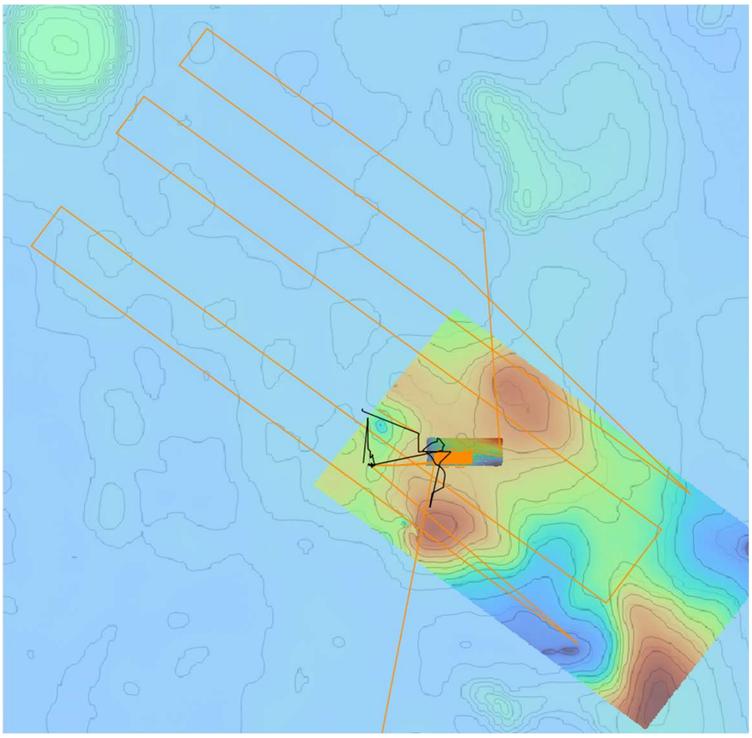
Mission goal:	Mapping (photomosaic) Collector Impact area BGR (@ 4m altitude) (Sidescan 410 kHz / Photo)
Times (UTC)	
Launch	05:10
Mission start	05:14
Survey start	06:25
Survey finished	17:46
Mission finished	18:23
Recovery	05:00
Distance travelled	70003 m
Mission comments	Mission was planned in a circular lawnmower pattern approach to achieve an even illumination of the images. The mission used only an initially LBL position fix. The drift of navigation is huge and not comprehensible.

Depth / Altitude	4073-4079 m / 4 m (3.5-5.5 m)
Main Sensor 1	**DSC Deep Survey Camera** 39622 images / Format: jpg / 226 GB / each file 5.4 MB / Resolution: 5472 x 3648 Pixel
Main Sensor 2	**Sidescan Edgetech 2205** 70 Files / Format: jsf / 12.75 GB / each File 185 MB / 410 kHz
Sensor 3	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor 4	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	-Recovery station number: SO295_0008-1_AUV -Navigation is not comprehensible also because of the new approache in combination with dead reckoning / navigation is not corrected

Station	**SO295_017-1_AUV**	Day (UTC)	**09.11.2022 (13:10)**
Dive	**Abyss0367**		
		Mission goal:	Mapping (Overview survey) Plume Impact area around the Collector Impact area BGR (@ 4m altitude) (Sidescan 410 kHz / Photo)
		Times (UTC)	
		Launch	13:05
		Mission start	13:10
		Survey start	14:55
		Survey finished	15:14
		Mission finished	18:07
		Recovery	05:32
		Distance travelled	8735 m
		Mission comments	Mission aborted due to power problems of the AUV navigation system.
Depth / Altitude	-----		
Main Sensor	**DSC Deep Survey Camera** No images recorded		
Main Sensor	**Sidescan Edgetech 2205** 24 Files / Format: jsf / 4.15 GB / each File 185 MB / 410 kHz		
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)		
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)		
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Recovery station number: SO295_0020-1_AUV		

Station	**SO295_030-1_AUV**	Day (UTC)	**12.11.2022 (04:10)**
Dive	**Abyss0368**		
		Mission goal:	Mapping (Overview survey) Plume Impact area around the Collector Impact area BGR (Re-Do of Abyss0367) (@ 4m altitude) (Sidescan 410 kHz / Photo)
		Times (UTC)	
		Launch	04:05
		Mission start	04:10
		Survey start	05:27
		Survey finished	05:28
		Mission finished	07:46
		Recovery	08:26
		Distance travelled	6054 m
		Mission comments	Mission aborted due to power problems of the AUV navigation system.
Depth / Altitude	4030-4080 m / 4 m (3.5-5.5 m)		
Main Sensor	**DSC Deep Survey Camera** No images (camera was out of focus)		
Main Sensor	**Sidescan Edgetech 2205** No file recorded		
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)		
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)		
Comments	No data recorded since AUV could reach working altitude Recovery station number: SO295_0032-1_AUV		

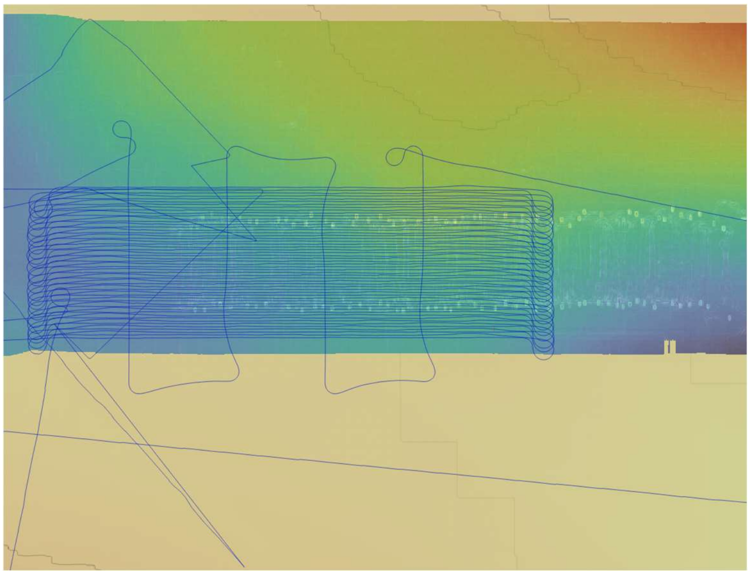
Station	**SO295_041-1_AUV**	Day (UTC)	**13.11.2022 (23:50)**
Dive	**Abyss0369**		



Mission goal:	Mapping (Overview survey) Plume Impact area around the Collector Impact area BGR (Re-Do of Abyss0368) (@ 4m altitude) (Sidescan 410 kHz / Photo)
Times (UTC)	
Launch	23.45
Mission start	23:50
Survey start	00:54
Survey finished	00:55
Mission finished	02:20
Recovery	03:30
Distance travelled	3760 m
Mission comments	Mission aborted due to power problems of the AUV navigation system.

Depth / Altitude	------
Main Sensor	**DSC Deep Survey Camera** No images (camera was out of focus)
Main Sensor	**Sidescan Edgetech 2205** No file recorded
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	Recovery station number: SO295_0042-1_AUV

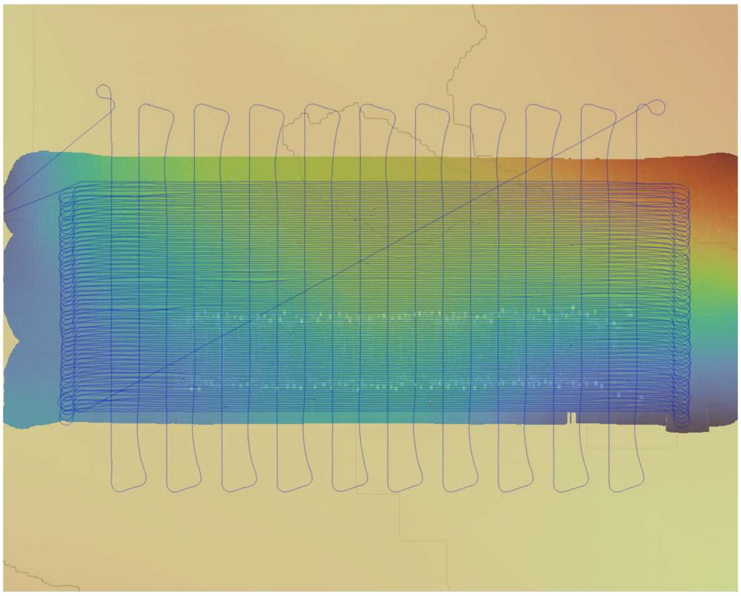
Station	**SO295_051-1_AUV**	Day (UTC)	**16.11.2022 (00:47)**
Dive	**Abyss0370**		



Mission goal:	Mapping (photomosaic) the Western part of Collector Impact area BGR (@ 4m altitude) (Sidescan 410 kHz / Photo)
Times (UTC)	
Launch	00:42
Mission start	00:47
Survey start	01:53
Survey finished	06:44
Mission finished	09:00
Recovery	12:47
Distance travelled	41450 m
Mission comments	The AUV itself performed the mission ok. LBL navigation was used constantly. **No images recorded**.

Depth / Altitude	4076-4078 m / 4 m (3.5-4.75 m)
Main Sensor	**DSC Deep Survey Camera** No images recorded
Main Sensor	**Sidescan Edgetech 2205** 34 Files / Format: jsf / 5.99 GB / each File 185 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Recovery station number: SO295_0054-1_AUV

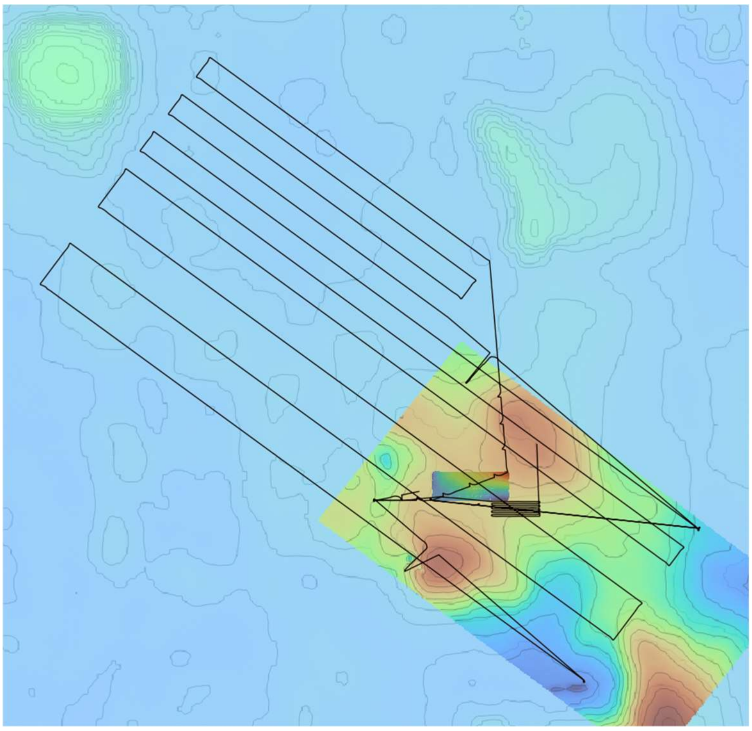
Station	**SO295_063-1_AUV**	Day (UTC)	**18.11.2022 (04:52)**
Dive	**Abyss0371**		



Mission goal:	
Mapping (photomosaic) Collector Impact area BGR and Thick Plume (@ 4m altitude) (Sidescan 410 kHz / Photo)	
Times (UTC)	
Launch	04:45
Mission start	04:52
Survey start	06:09
Survey finished	20:42
Mission finished	22:00
Recovery	02:29
Distance travelled	90382 m
Mission comments	
The AUV itself performed the mission ok.	

Depth / Altitude	4073-4080 m / 4 m (3.3-4.8 m)
Main Sensor	**DSC Deep Survey Camera** 53838 Images / Format: jpg / 316 GB / each file 6.5 MB / Resolution: 5472 x 3648 Pixel
Main Sensor	**Sidescan Edgetech 2205** 81 Files / Format: jsf / 14.8 GB / each File 185 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Recovery station number: SO295_0069-1_AUV

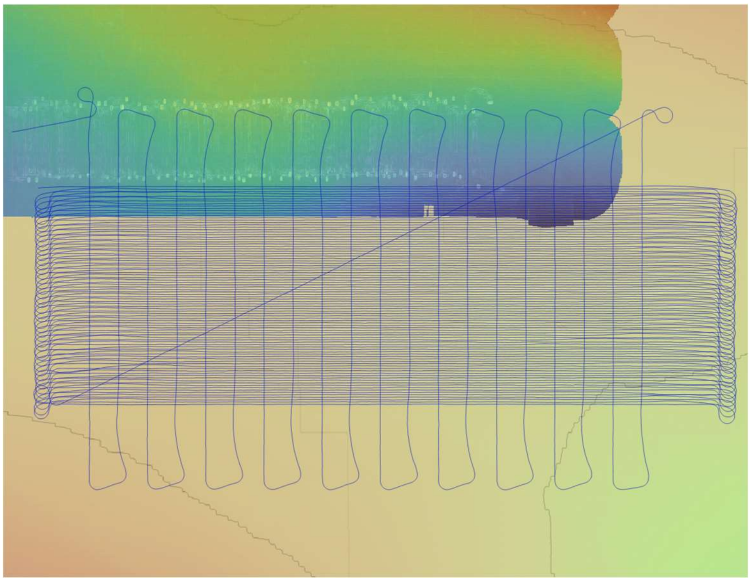
Station	**SO295_075-1_AUV**	Day (UTC)	**20.11.2022 (03:55)**
Dive	**Abyss0372**		



Mission goal:	Mapping (Overview survey) Plume Impact area around the Collector Impact area (@ 4m altitude) and smaller overview survey Southeast of the Patania track to search for a BGR mooring (@ 9m altitude for safety reasons) (Sidescan 410 kHz / Photo)
Times (UTC)	
Launch	03:50
Mission start	03:55
Survey start	05:27
Survey finished	20:19
Mission finished	21:40
Recovery	22:06
Distance travelled	89249 m
Mission comments	Comparable large navigational drift because of long track lines without LBL positioning

Depth / Altitude	Plume impact overview survey: 4060-4110 m / 4 m (3,5-4,7 m) / small overview survey box: 4074-4078 / 9 m (7,5-10,5)
Main Sensor	**DSC Deep Survey Camera** 53735 Images / Format: jpg / 306.9 GB / each file 5.7 MB / Resolution: 5472 x 3648 Pixel
Main Sensor	**Sidescan Edgetech 2205** 92 Files / Format: jsf / 16.5 GB / each File 185 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Recovery station number: SO295_0079-1_AUV

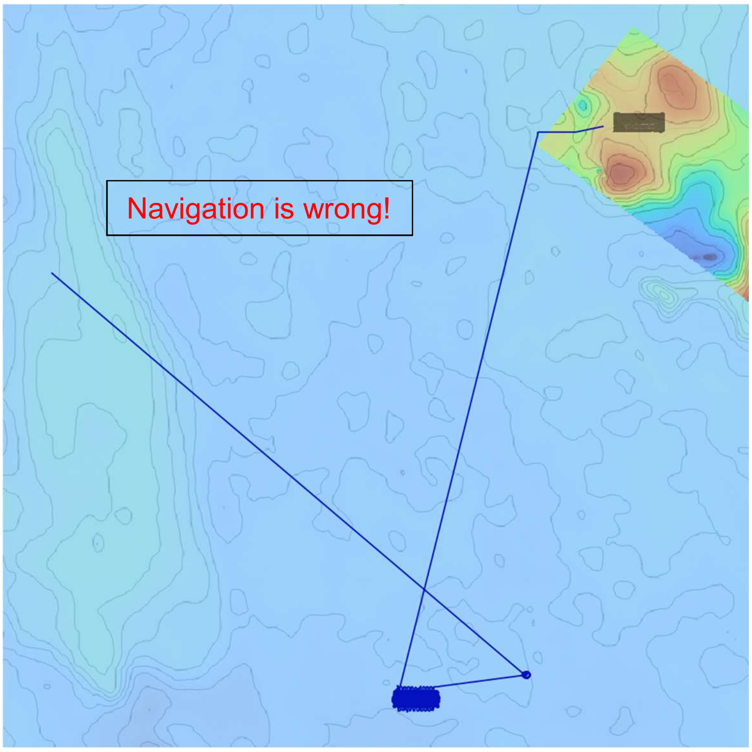
Station	**SO295_084-1_AUV**	Day (UTC)	**22.11.2022**
Dive	**Abyss0373**		



Mission goal:	Mapping (photomosaic) area southeast of Collector Impact area BGR (@ 4m altitude) (Sidescan 410 kHz / Photo)
Times (UTC)	
Launch	02:20
Mission start	02:24
Survey start	03:39
Survey finished	17:38
Mission finished	19:00
Recovery	03:27
Distance travelled	86324 m
Mission comments	The AUV itself performed the mission ok.

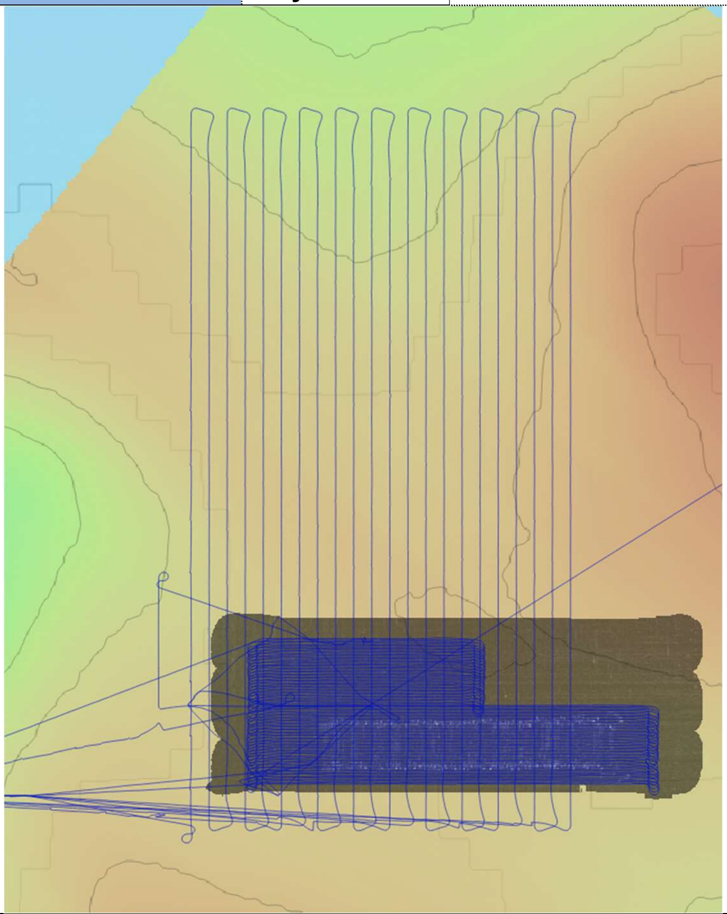
Depth / Altitude	4075-4085 m / 4 m (3.5-5 m)
Main Sensor	**DSC Deep Survey Camera** 51471 Images / Format: jpg / 283.6 GB / each file 5.4 MB / Resolution: 5472 x 3648 Pixel
Main Sensor	**Sidescan Edgetech 2205** 88 Files / Format: jsf / 16.1 GB / each File 185 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Recovery station number: SO295_0091-1_AUV

Station	**SO295_096-1_AUV**
Dive	**Abyss0374**
Day (UTC)	**24.11.2022**
Mission goal:	Mapping (photomosaic) the BGR reference area (@ 4m altitude) (Sidescan 410 kHz / Photo) / preventing LBL transponder set up in reference area
Times (UTC)	
Launch	02:50
Mission start	02:56
Survey start	05:53
Survey finished	23:39
Mission finished	00:46
Recovery	03:24
Distance travelled	104162 m
Mission comments	Large navigational drift because of long transit lines (10 km) without LBL positioning. Huge position offset at the end of the mission. Vehicle had bottom contact for several hours.



Depth / Altitude	4055-4140 m / erratic altitude values
Main Sensor	**DSC Deep Survey Camera** 63365 Images / Format: jpg / 607.5 GB / each file 8.9 MB / Resolution: 5472 x 3648 Pixel
Main Sensor	**Sidescan Edgetech 2205** 108 Files / Format: jsf / 19.73 GB / each File 185 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	Position drift is huge and can't be trusted. Wrong DVL data because of mud?? Recovery station number: SO295_0102-1_AUV

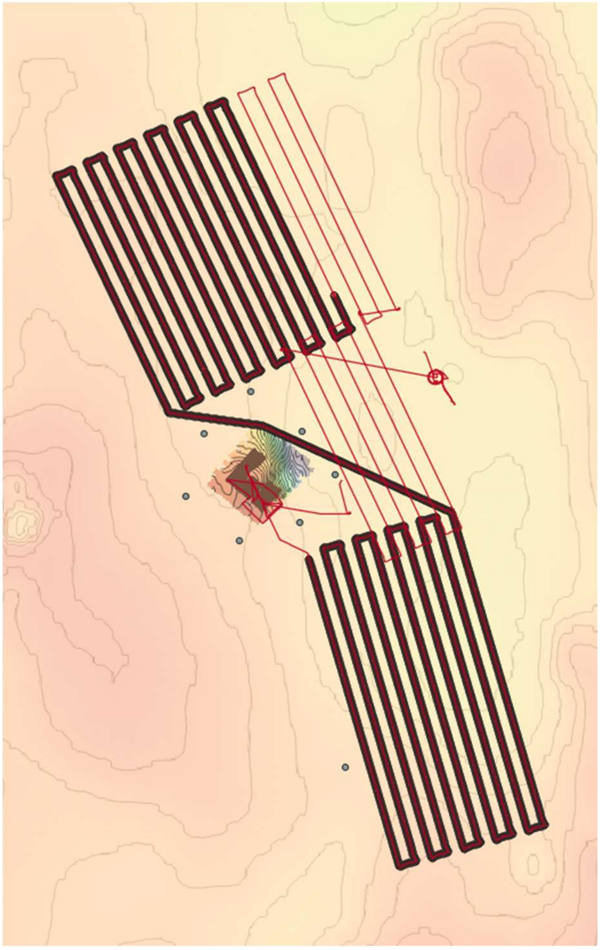
Station	**SO295_0108-1_AUV**	Day (UTC)	**26.11.2022**
Dive	**Abyss0375**		

	**Mission goal:** Mapping (photomosaic) of the Collector Impact area BGR plus the western part of the thick plume area / Overview survey in the Northern plume impact area (@ 4 m altitude) (Sidescan 410 kHz / Photo)

Times (UTC)	
Launch	02:25
Mission start	02:32
Survey start	03:43
Survey finished	20:25
Mission finished	21:32
Recovery	00:21
Distance travelled	100392 m
Mission comments	The AUV itself performed the mission ok.

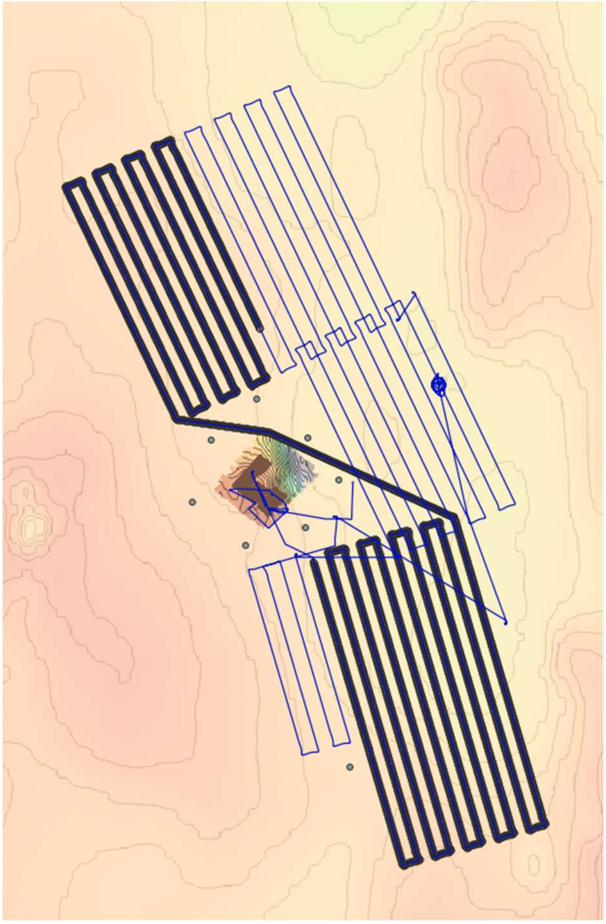
Depth / Altitude	4073-4088 m / 4 m (3.5-5 m)
Main Sensor	**DSC Deep Survey Camera** 60427 Images / Format: jpg / 347.6 GB / each file 5.9 MB / Resolution: 5472 x 3648 Pixel
Main Sensor	**Sidescan Edgetech 2205** 103 Files / Format: jsf / 18.9 GB / each File 185 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Recovery station number: SO295_0114-1_AUV

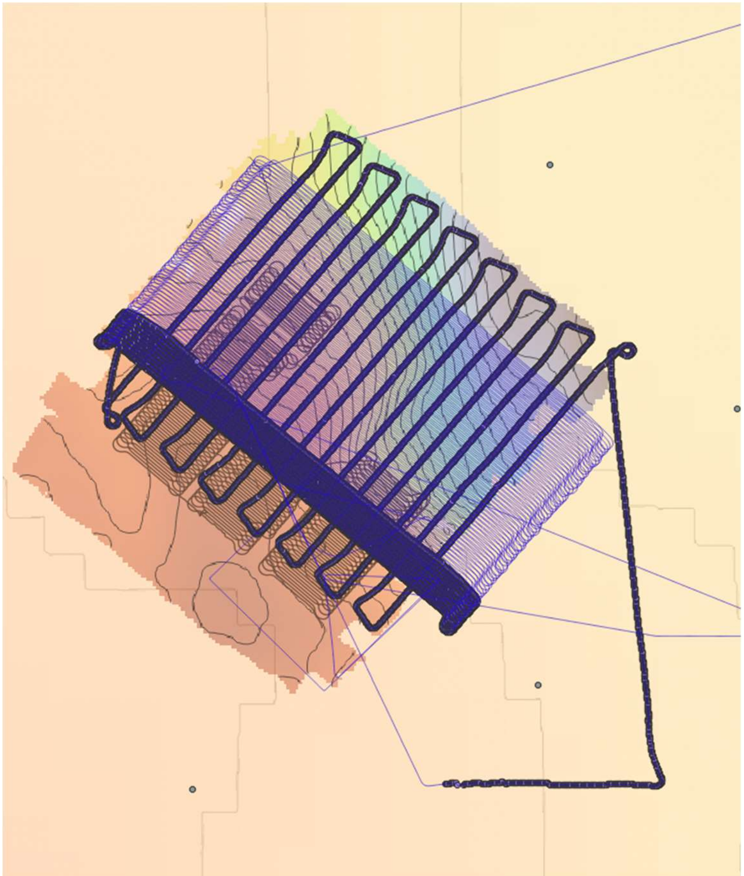
Station	**SO295_0127-1_AUV**	Day (UTC)	**01.12.2022 (14:34)**
Dive	**Abyss0376**		

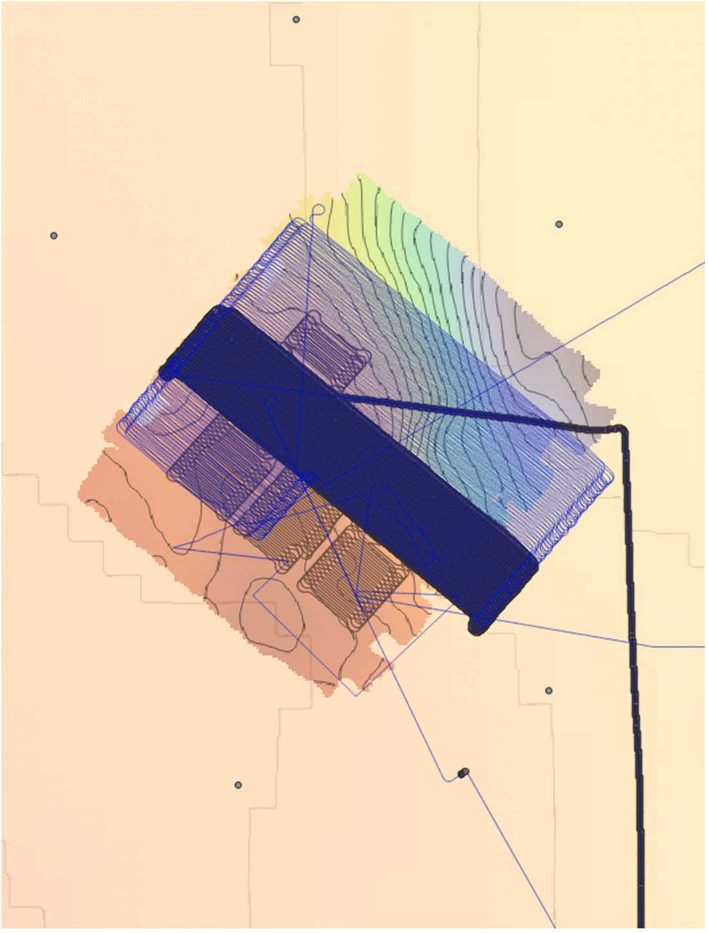


Mission goal:	
Mapping Plume (Overview survey) Impact area North, East and South of Collector Impact area (@ 9 m altitude for safety reasons) (Sidescan 410 kHz / Photo)	
Times (UTC)	
Launch	14:30
Mission start	14:34
Survey start	15:51
Survey finished	05:17
Mission finished	06:16
Recovery	12:15
Distance travelled	80860 m
Mission comments	
The AUV itself performed the mission ok. Camera stopped working at 01:40 UTC (02.12.2022). (Red lines: total AUV track / Black lines: camera works)	

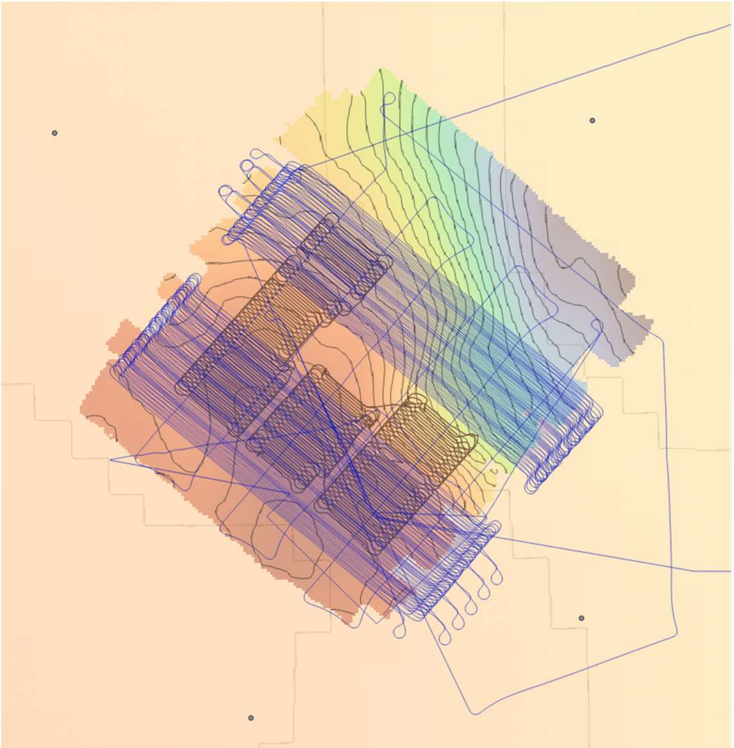
Depth / Altitude	4460-4510 m / 9 m (8-10.5 m)
Main Sensor	**DSC Deep Survey Camera** 33315 Images / Format: jpg / 295 GB / each file 8.9 MB / Resolution: 5472 x 3648 Pixel
Main Sensor	**Sidescan Edgetech 2205** 82 Files / Format: jsf / 9.6 GB / each File 120 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Camera stopped working at 01:40 UTC (02.12.2022). Recovery station number: SO295_0133-1_AUV

Station	**SO295_0137-1_AUV**	GEOMAR	Day (UTC)	**03.12.2022 (13:10)**
Dive	**Abyss0377**			
			Mission goal:	
			Mapping Plume (Overview survey) Impact area North, East and South of Collector Impact area / Re-Do of Abyss0376 with less altitude and additional tracks (@ 5m altitude) (Sidescan 410 kHz / Photo)	
			Times (UTC)	
			Launch	13:05
			Mission start	13:10
			Survey start	14:25
			Survey finished	06:16
			Mission finished	07.44
			Recovery	12:19
			Distance travelled	97105 m
			Mission comments	
			The AUV itself performed the mission ok. Camera stopped working at 22:37 UTC (03.12.2022) even earlier in the dive than Abyss0376. (Blue lines: total AUV track / Black lines: camera works)	
Depth / Altitude	4430-4515 m / 5 m (4-7 m)			
Main Sensor	**DSC Deep Survey Camera** 28490 Images / Format: jpg / 359.1 GB / each file 7.4 MB / Resolution: 5472 x 3648 Pixel			
Main Sensor	**Sidescan Edgetech 2205** 100 Files / Format: jsf / 18.3 GB / each File 185 MB / 410 kHz			
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)			
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)			
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Camera stopped working at 22:37 UTC (03.12.2022) even earlier in the dive than Abyss0376. Recovery station number: SO295_0143-1_AUV			

<table>
<tr><td>Station</td><td>SO295_0149-1_AUV</td><td rowspan="2">GEOMAR</td><td>Day (UTC)</td><td>05.12.2022 (13:33)</td></tr>
<tr><td>Dive</td><td>Abyss0378</td><td></td><td></td></tr>
<tr><td colspan="3" rowspan="13"></td><td colspan="2">Mission goal:
Mapping (photomosaic) Northern half of the Collector Impact area GSR (@ 5m altitude) (Sidescan 410 kHz / Photo)</td></tr>
<tr><td colspan="2">Times (UTC)</td></tr>
<tr><td>Launch</td><td>13:25</td></tr>
<tr><td>Mission start</td><td>13:33</td></tr>
<tr><td>Survey start</td><td>15:05</td></tr>
<tr><td>Survey finished</td><td>07:15</td></tr>
<tr><td>Mission finished</td><td>08:20</td></tr>
<tr><td>Recovery</td><td>14:29</td></tr>
<tr><td>Distance travelled</td><td>98321 m</td></tr>
<tr><td colspan="2">Mission comments
The AUV itself performed the mission ok. Camera stopped working at 18:50 UTC (05.12.2022); Photo Tie lines and only 1/6th of the southern survey box above the Patania track done (Blue lines: total AUV track / Black lines: camera works)</td></tr>
<tr><td>Depth / Altitude</td><td colspan="4">4475-4503 m / 5 m (3.5 -6.5 m)</td></tr>
<tr><td>Main Sensor</td><td colspan="4">DSC Deep Survey Camera
13937 Images / Format: jpg / 156.5 GB / each file 5.8 MB / Resolution: 5472 x 3648 Pixel</td></tr>
<tr><td>Main Sensor</td><td colspan="4">Sidescan Edgetech 2205
100 Files / Format: jsf / 18.2 GB / each File 185 MB / 410 kHz</td></tr>
<tr><td>Sensor</td><td colspan="4">SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)</td></tr>
<tr><td>Sensor</td><td colspan="4">Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)</td></tr>
<tr><td>Comments</td><td colspan="4">There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet.
Camera stopped working at 18:50 UTC (05.12.2022); Recovery station number: SO295_0154-1_AUV</td></tr>
</table>

Station	**SO295_0164-1_AUV**	Day (UTC)	**08.12.2022 (02:38 am)**
Dive	**Abyss0379**		
		Mission goal:	Mapping (photomosaic) Northern half of the Collector Impact area GSR (Partly Re-Do of Abyss0378) with one additional box (@ 5m altitude) (Sidescan 410 kHz / Photo)
		Times (UTC)	
		Launch	02:36
		Mission start	02:38
		Survey start	04:11
		Survey finished	20:15
		Mission finished	21:18
		Recovery	22:17
		Distance travelled	98323 m
		Mission comments	The AUV itself performed the mission ok. Camera stopped working at 09:46 UTC (08.12.2022); less than half of the larger survey box in the Northern part of the Patania track part done (Blue lines: AUV track / Black lines: camera works)
Depth / Altitude	4475-4498 m / 5 m (4-6.5 m)		
Main Sensor	**DSC Deep Survey Camera** 20967 Images / Format: jpg / 232 GB / each file 5.4 MB / Resolution: 5472 x 3648 Pixel		
Main Sensor	**Sidescan Edgetech 2205** 100 Files / Format: jsf / 18.3 GB / each File 185 MB / 410 kHz		
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)		
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)		
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Camera stopped working at 09:46 UTC (08.12.2022) Recovery station number: SO295_0168-1_AUV		

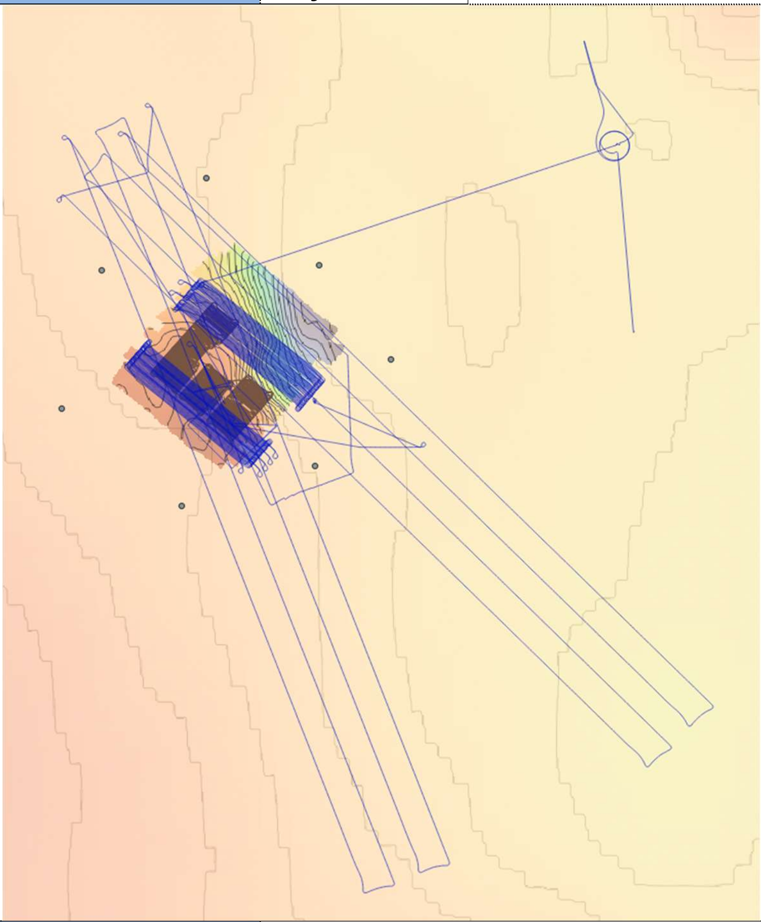
Station	**SO295_0186-1_AUV**	Day (UTC)	**12.12.2022 (03:05)**
Dive	**Abyss0380**		



Mission goal:	
Mapping (photomosaic) Collector Impact area GSR / Filling gaps of Abyss0378 and 0379 (@ 5m altitude) (Sidescan 410 kHz / Photo)	
Times (UTC)	
Launch	03:03
Mission start	03:05
Survey start	04:32
Survey finished	21:36
Mission finished	22:37
Recovery	02:32
Distance travelled	103115 m
Mission comments	
The AUV itself performed the mission ok. Mission was done with a new approach to takle the camera issue: Segmentation of the survey boxes each starting with repowering the camera. Camera stopped working several time in each survey segments (Blue lines: AUV track / Black lines: camera works)	

Depth / Altitude	4475 – 4497 m / 5 m (4-6.5 m)
Main Sensor	**DSC Deep Survey Camera** 40815 Images / Format: jpg / 446.4 GB / each file 5.7 MB / Resolution: 5472 x 3648 Pixel
Main Sensor	**Sidescan Edgetech 2205** 109 Files / Format: jsf / 19 GB / each File 185 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. Camera stopped working several time in each survey segments Recovery station number: SO295_0192-1_AUV

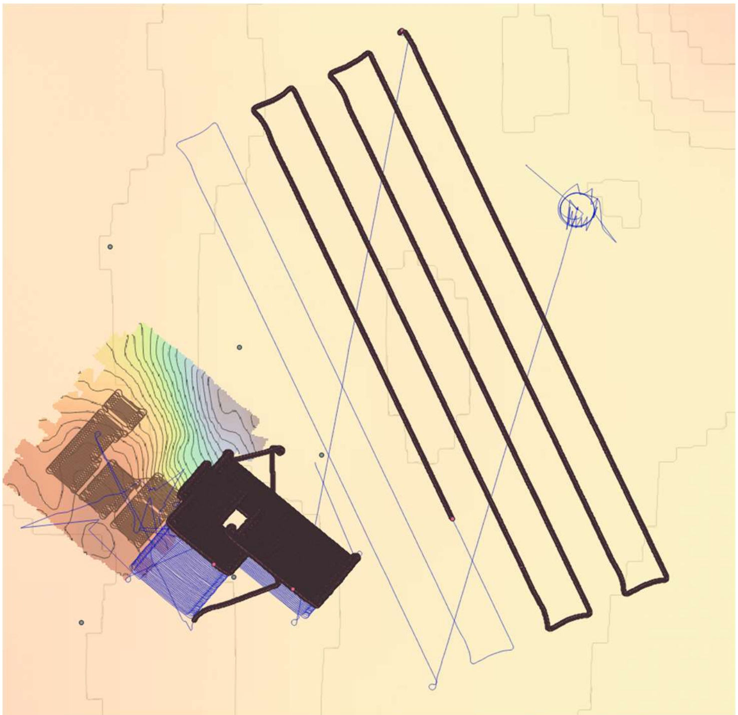
Station	**SO295_0199-1_AUV**	Day (UTC)	**14.12.2022 (02:51)**
Dive	**Abyss0381**		



Mission goal:	2 Corridors (Overview surveys) in N/S direction for transition thick to thin plume area and gaps filling (photomosaic) of dive Abyss0380 in Collector impact area (@ 5m altitude) (Sidescan 410 kHz / Photo)
Times (UTC)	
Launch	02:49
Mission start	02:51
Survey start	04:28
Survey finished	20:23
Mission finished	21:29
Recovery	03:19
Distance travelled	97162 m
Mission comments	The AUV itself performed the mission ok.

Depth / Altitude	4465 – 4515 m / 5 m (4-6,5 m)
Main Sensor	**DSC Deep Survey Camera** 70215 Images / Format: jpg / 722.5 GB / each file 5.4 MB / Resolution: 5472 x 3648 Pixel
Main Sensor	**Sidescan Edgetech 2205** 100 Files / Format: jsf / 17.6 GB / each File 185 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. A new camera was installed for this dive. The camera worked well no stopping. Recovery station number: SO295_0204-1_AUV

Station	**SO295_0211-1_AUV**	Day (UTC)	**16.12.2022 (03:01)**
Dive	**Abyss0382**		



Mission goal:	Mapping (photomosaic) the thick plume area Southeast of the Collector Impact area GSR and Overview survey in the Western area (Re-Do of Abyss0377) (@ 5m altitude) (Sidescan 410 kHz / Photo)
Times (UTC)	
Launch	02:59
Mission start	03:01
Survey start	04:20
Survey finished	21:35
Mission finished	22:40
Recovery	04:10
Distance travelled	103751 m
Mission comments	The AUV itself performed the mission ok. The camera stopped working severa times during the last 3 survey boxes (Blue lines: AUV track / Black lines: camera works)

Depth / Altitude	4475-4510 m / 5 m (4-8 m)
Main Sensor	**DSC Deep Survey Camera** 40553 Images / Format: jpg / 495.2 GB / each file 5.4 MB / Resolution: 5472 x 3648 Pixel
Main Sensor	**Sidescan Edgetech 2205** 105 Files / Format: jsf / 18.9 GB / each File 185 MB / 410 kHz
Sensor	SeaBird SBE49 FastCAT CTD (S/N: 4955482-0198)
Sensor	Wetlabs ECO FLNTU (Chlorophyll / Turbidity) (S/N: FLNTURTD-939)
Comments	There is a navigational offset due to LBL transponder position inaccuracies which is not corrected yet. The camera stopped working severa times during the last 3 survey boxes. Recovery station number: SO295_0217-1_AUV

12.4 ROV Dive Protocols

Kiel 6000 Dive 2[1] (SO295_012-1_ROV-02)

Date: 08.Nov.2022[2]

Principal Investigators: Sabine Gollner

Observers: Mirja Bardenhagen

Protocol: Sabine Gollner

ROV positions (at the bottom)
Start of dive: 11°51.764' N 117°0.706' W
End of dive: 11°51.778' N 117°0.652' W

Dive duration:

ROV in the water:	08.Nov.2022	21:01:48
ROV at the bottom:	08.Nov.2022	22:45:48
ROV off the bottom:	09.Nov.2022	02:00:54
ROV on deck:	09.Nov.2022	04:10:58

Explored sites: GER reference (EBS track/dredge)

Aims of the Dive:

- Rescue Elevator 1
- Search for frames with artificial nodules and decompaction experiment

Handled ROV Tools (including scientific payload)[3]:

- *16 PUCs in 16 Core Rack*
- *SGN Biobox + 3 small pots*

Relevant Elevator payload

Elevator 1

- *2 NIOZ-frame boxes*
- *24 PUCs in 4 Core Sixpacks*

Dive summary

The dive was dedicated to the recovery of Elevator 1 that sank uncontrolled to the seafloor after the rope broke during deployment (SO295_005-1_LIFT-01 on 7. Nov. 2022). The broken rope was replaced with a rope of twofold larger capacity (8 tons), allowing for save elevator deployment during the remaining expedition.

Once the ROV arrived at the bottom, Elevator 1 was readily located. When the ROV arrived at the elevator, a distance of 120 m north east from the original deployment position was

---

[1] No protocols are presented for dive 1 (SO295_006-1_ROV-01) and dive 14 (SO295_119-1_ROV-14): these two dives were aborted and no scientific tasks could be addressed

[2] All dates and times **in all protocols** refer to UTC

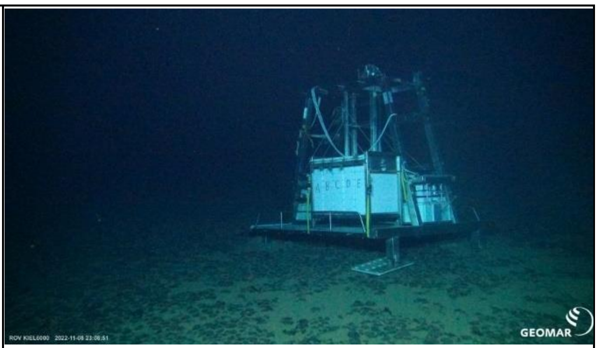
[3] *Italic font* indicates payload not used / actions and tasks not accomplished **in all protocols**

observed. The elevator had landed slightly tilted in an upright position but the elevator and scientific payload had not been damaged. The broken rope was cut by the ROV, and lowering of the Elevator Recovery System ('Bergefuchs') started. The remaining time was used to search for the Recolonization Frames with artificial nodules (FRAMEs) while transiting towards the position where they had been deployed during SO268/2. The frames could not be located but the ROV came across EBS tracks and SLIC BOX 10 – at locations that differed from the nominal locations where they were produced / deployed.

Comparing the position where SLIC BOX 10 was found during this dive with the position from the dives where it was deployed in 2019 (SO268-2_111ROV dive 16) and revisited (SO268-2_118 ROV dive 17, SO268-2_124 ROV dive 18, and SO268-2_188 ROV dive 29) a mismatch of more than 120m was observed with the recent sighting being shifted in southwesterly direction (247°). The comparison of EBS track positions from SO268 to observations during this dive even indicated a larger offset but a similar direction (see also SO295 cruise report section on underwater navigation).

Once the Elevator Recovery System was in view, the ROV connected the ROV operated shackle to Elevator 1, and left the seafloor for ascent.

Date	UTC Time	SUB1_Lon*	SUB1_Lat*	SUB1_Depth*	Observations/Comments / Image
2022-11-08	21:01:48	-117.01433	11.89152	1.19	IN THE WATER
2022-11-08	22:45:48	-117.01177	11.86274	4156.36	AT THE BOTTOM
2022-11-08	22:47:48	-117.01183	11.86271	4161.28	Coral
2022-11-08	22:48:27	-117.01184	11.86271	4161.39	brittle star
2022-11-08	22:51:38	-117.01184	11.86268	4161.42	Small nodules
2022-11-08	22:52:50	-117.01177	11.86270	4161.37	Small mound
2022-11-08	22:53:50	-117.01170	11.86272	4161.39	Coral
2022-11-08	22:54:48	-117.01167	11.86274	4161.21	Transit 120m northeast to search for elevator
2022-11-08	22:55:02	-117.01166	11.86274	4161.16	White spots
2022-11-08	22:55:43	-117.01155	11.86278	4161.01	Sponge
2022-11-08	22:56:35	-117.01147	11.86278	4160.79	Brittle star
2022-11-08	22:56:55	-117.01146	11.86278	4160.73	Brittle star
2022-11-08	22:57:22	-117.01143	11.86278	4160.66	Brittle star
2022-11-08	22:57:46	-117.01139	11.86280	4160.58	Brittle star
2022-11-08	22:58:21	-117.01137	11.86280	4160.45	Brittle stars
2022-11-08	22:58:40	-117.01135	11.86280	4160.39	Coral
2022-11-08	22:59:18	-117.01125	11.86285	4160.29	Brittle star
2022-11-08	22:59:23	-117.01123	11.86285	4160.28	Coral
2022-11-08	23:00:01	-117.01122	11.86285	4160.21	Brittle stars
2022-11-08	23:00:44	-117.01119	11.86286	4160.15	Sediment mound
2022-11-08	23:00:57	-117.01118	11.86289	4160.12	Snemone
2022-11-08	23:01:26	-117.01118	11.86295	4160.03	Coral
2022-11-08	23:03:14	-117.01101	11.86289	4159.72	Brittle star on fauna
2022-11-08	23:03:37	-117.01099	11.86293	4159.69	EBS track?
2022-11-08	23:04:39	-117.01091	11.86305	4159.57	EBS track?
2022-11-08	23:04:57	-117.01087	11.86306	4159.54	Brittle star
2022-11-08	23:06:18	-117.01077	11.86309	4159.38	Brittle star
2022-11-08	23:06:56	-117.01072	11.86313	4159.35	elevator in sight
2022-11-08	23:07:40	-117.01065	11.86319	4159.32	Brittle star
2022-11-08	23:08:28	-117.01065	11.86321	4159.28	Brittle stars and coral

2022-11-08	23:08:51	-117.01065	11.86321	4159.27	 Elevator 1 located 20221108_230851_Sonne_SO295_012ROV02_Logo_thumb.jpg
2022-11-08	23:09:11	-117.01064	11.86321	4159.25	 Elevator 1 20221108_230911_Sonne_SO295_012ROV02_Logo_thumb.jpg
2022-11-08	23:13:23	-117.01059	11.86329	4158.88	Jellyfish
2022-11-08	23:20:01	-117.01057	11.86326	4158.67	Cut the broken rope for recovery of Elevator 1
2022-11-08	23:22:14	-117.01052	11.86328	4158.07	Sea cucumber
2022-11-08	23:23:05	-117.01054	11.86329	4158.05	Polychaete
2022-11-08	23:28:11	-117.01060	11.86334	4158.1	Polychaete swimming
2022-11-08	23:30:39	-117.01058	11.86327	4158.14	Rope cut successfully
2022-11-08	23:32:59	-117.01058	11.86332	4158.14	Polychaete swimming
2022-11-08	23:41:51	-117.01058	11.86325	4158.93	Put rope into the box C
2022-11-08	23:44:55	-117.01059	11.86326	4158.81	Polychaete swimming
2022-11-08	23:55:09	-117.01058	11.86327	4158.85	Fish (rat tail; picture not displayed) 20221108_235509_Sonne_SO295_012ROV02_Logo_thumb.jpg
2022-11-08	23:55:18	-117.01058	11.86327	4158.85	Fish (rat tail)
2022-11-08	23:55:36	-117.01058	11.86327	4158.86	Coral
2022-11-08	23:58:17	-117.01061	11.86325	4158.9	 Fish (rat tail) 20221108_235817_Sonne_SO295_012ROV02_Logo_thumb.jpg
2022-11-09	00:04:05	-117.01073	11.86316	4159.07	Elevator Recovery System (‚Bergefuchs') is lowered
2022-11-09	00:04:22	-117.01075	11.86315	4159.12	Looking for frames while Elevator Recovery System is lowered
2022-11-09	00:06:48	-117.01107	11.86359	4159.62	Polychaete swimming
2022-11-09	00:09:27	-117.01135	11.86304	4160.19	Brittle star
2022-11-09	00:09:41	-117.01136	11.86304	4160.19	Brittle star
2022-11-09	00:10:20	-117.01140	11.86305	4160.2	Epibenthic sledge (EBS) track in view
2022-11-09	00:11:27	-117.01141	11.86325	4160.16	Corals
2022-11-09	00:14:31	-117.01151	11.86352	4160.14	Metallic wheel
2022-11-09	00:15:39	-117.01150	11.86355	4160.15	Small white jellyfish

2022-11-09	00:16:47	-117.01147	11.86356	4160.14	Polychaete swimming
2022-11-09	00:19:49	-117.01147	11.86355	4160.15	Grey sea cucumber
2022-11-09	00:25:52	-117.01147	11.86317	4160.58	EBS track in view
2022-11-09	00:28:56	-117.01139	11.86311	4160.29	EBS track in view
2022-11-09	00:41:27	-117.01166	11.86392	4160.89	Sea cucumber
2022-11-09	00:41:42	-117.01166	11.86391	4160.9	Sea cucumber
2022-11-09	00:47:55	-117.01175	11.86327	4160.83	Sea cucumber
2022-11-09	00:48:40	-117.01167	11.86327	4160.64	white sea cucumber
2022-11-09	00:54:33	-117.01077	11.86307	4159.64	Brittle star
2022-11-09	00:56:41	-117.01077	11.86316	4159.63	SLIC BOX deployed during SO268 (photo not displayed) 20221109_005641_Sonne_SO295_012ROV02_Logo_thumb.jpg
2022-11-09	00:56:48	-117.01084	11.86326	4159.63	SLIC box 10 found by coincidence
2022-11-09	00:57:08	-117.01106	11.86355	4159.64	 SLIC BOX deployed during SO268 20221109_005708_Sonne_SO295_012ROV02_Logo_thumb.jpg
2022-11-09	00:58:38	-117.01138	11.86395	4159.64	SLIC BOX 10 is colleced and put on Elevator 1. Frames were not found although area around SO268 deployment position was inspected
2022-11-09	01:29:52	-117.01021	11.86339	4138.9	Elevator Recovery System ('Bergefuchs') in view
2022-11-09	01:37:18	-117.01022	11.86318	4155.21	ROV operated shackle grabbed
2022-11-09	01:46:08	-117.01061	11.86347	4157.63	Approaching elevator with ROV operated shackle
2022-11-09	01:52:32	-117.01050	11.86344	4158.2	Shackle attached to Elevator 1
2022-11-09	01:58:38	-117.01054	11.86334	4158.26	Lift off Elevator 1
2022-11-09	02:00:54	-117.01087	11.86297	4149.34	OFF THE BOTTOM
2022-11-09	04:10:58	None	None	None	ON DECK

* Reported navigation data (latitude, longitude, depth) **in all ROV dive protocols** have been curated as follows: Outliers were removed by defining thresholds in max. lateral distance from neighboring data and max. lateral and vertical velocities. After outlier removal, positions were smoothed by means of a Gaussian filter and a 2D-median filter to reduce noise.

Shortcomings in underwater navigation that lasted until station SO295_089-1_ROV-11 led to uncertainties in positioning ranging between some tens of meters to >100 m (see also section on underwater navigation in this cruise report). These intrinsic offsets could not be removed by the curation routines applied to navigation raw data.

Kiel 6000 Dive 03 (SO295_019-1_ROV-03)

Date: 09.Nov.2022

Principal Investigators: Felix Janssen, Tanja Stratmann

Observers: Devin Vlach, Ricarda Meineke, Brenda Esteban, Carsten Rühlemann

Protocol: Felix Janssen

ROV positions (at the bottom)
Start of dive: 11°50.519' N 117°3.579' W
End of dive: 11°50.534' N 117°3.515' W

Dive duration:

ROV in the water:	09.Nov.2022	16:31:40
ROV at the bottom:	09.Nov.2022	18:11:30
ROV off the bottom:	10.Nov.2022	02:04:50
ROV on deck:	10.Nov.2022	03:48:14

Explored sites: GER reference

Aims of the Dive:

- Deployment of 3 Benthic Flux Chambers (BFC1, 2, 3)
- Deployment of Passive Trace Metal Sampler (PSP)
- Deployment and repositioning of an Electrochemical Microsensor Profiler (MICP1)
- Deployment and repositioning of a Fiberoptical Microsensor Profiler (MICP-DEEP1)
- Deployment of 3 Benthic Incubators (*CUBE1*, CUBE 2, 3)
- Megafauna sampling

Handled ROV Tools (including scientific payload):

- 2 Benthic Flux Chambers (BFC1, 2)
- Magnet stick to start instruments
- SGN biobox large
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- *16 Push Cores (PUCs) in 16 Core Rack*

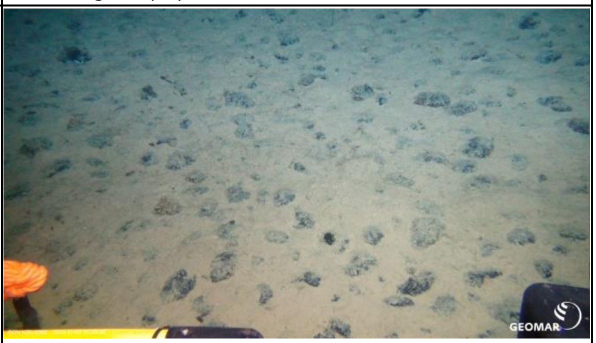
Relevant Elevator payload

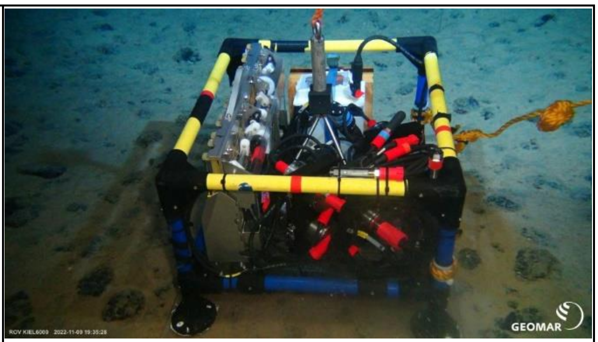
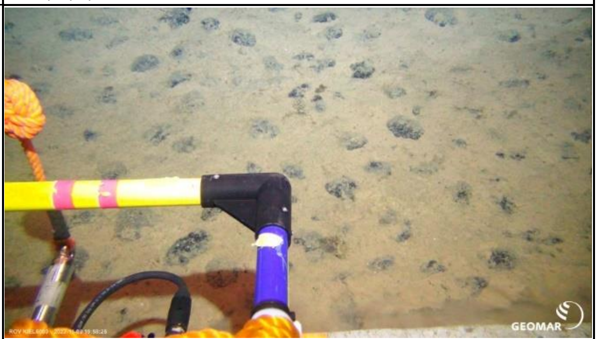
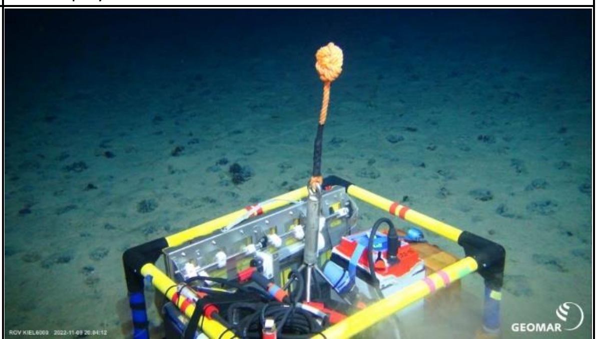
Elevator 2

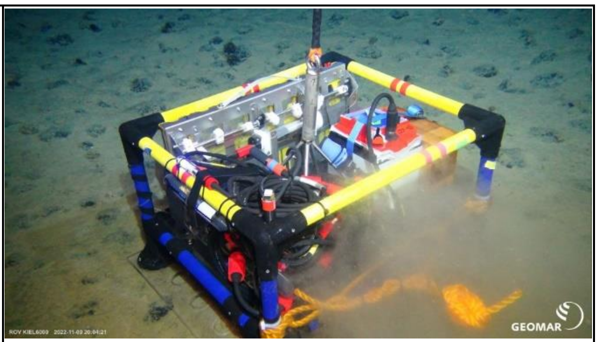
- Benthic Flux Chamber (BFC3)
- Electrochemical Microsensor Profiler (MICP1)
- Fiberoptical Microsensor Profiler (MICP-DEEP1)
- Passive Trace Metal Sampler (PSP)
- 3 Benthic Incubators (*CUBE1*, CUBE2, 3)
- *4 Blade Corers*

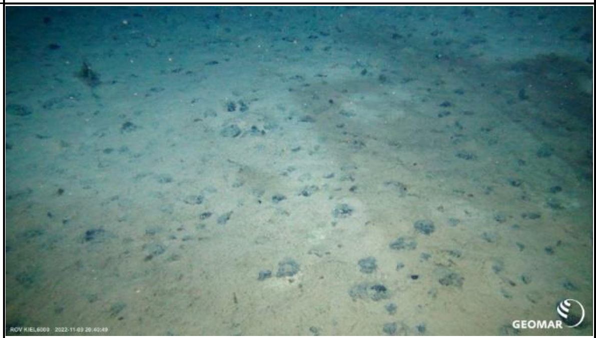
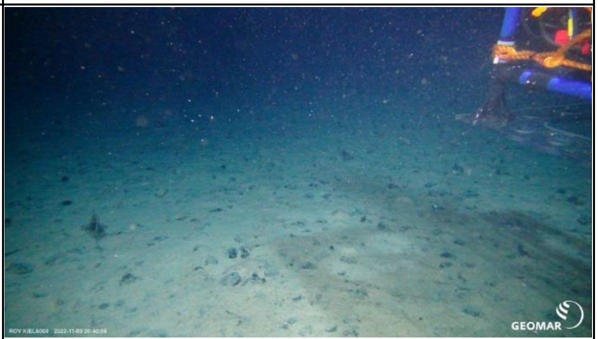
Dive summary

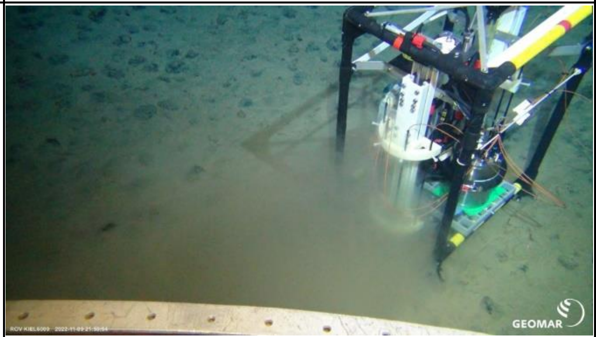
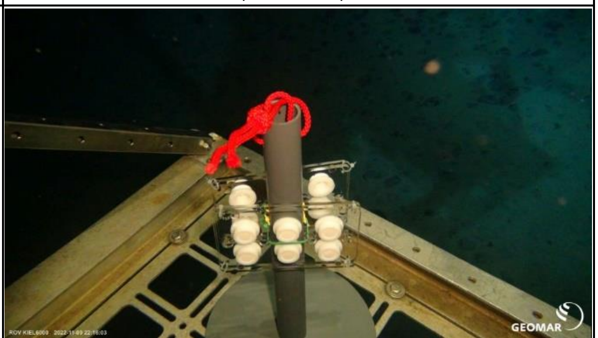
The ROV descended with BFC1 and 2 on the porch while Elevator 2 was lowered on the ship's cable. After unhooking Elevator 2 at the target site at depth, BFC1, 2 (from ROV porch) and 3 (from elevator) were deployed and started. The PSP was taken from Elevator 2 and placed at the seafloor. MICP1 and MICP-DEEP 1 were collected from Elevator 2, deployed, and started. CUBE1 was lost from Elevator 2 during descent. CUBE2 and 3 were taken from Elevator 2, deployed on top of sponges, and started. For a short period, megafauna was sampled before MICP1 and MICP-DEEP1 were relocated to a new position nearby and restarted.

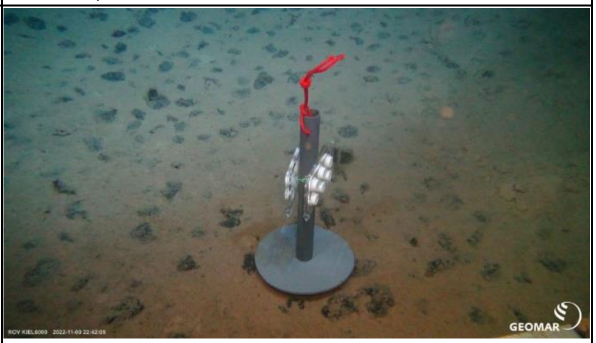
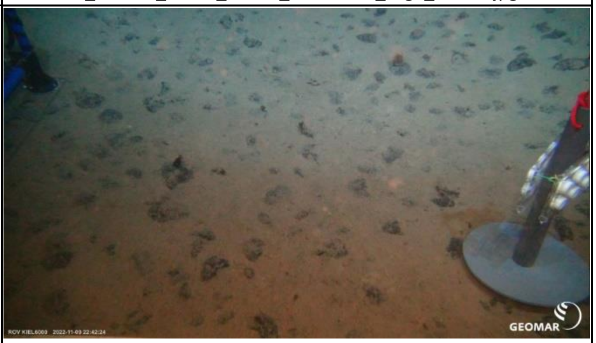
Date	UTC Time	SUB1_Lon*	SUB1_Lat*	SUB1_Depth	Observations/Comments / Image
2022-11-09	16:31:40	None	None	None	IN THE WATER
2022-11-09	18:11:30	-117.05965	11.84199	4170.01	AT THE BOTTOM
2022-11-09	18:14:17	-117.05947	11.84204	4173.1	Polychaete *swima* sp.
2022-11-09	18:14:49	-117.05945	11.84205	4173.07	Bottom with sediment and nodules
2022-11-09	18:34:44	-117.05954	11.84209	4172.2	ROV moving towards Elevator 2
2022-11-09	18:37:49	-117.05896	11.84212	4172.04	Polychaete *swima* sp. in water column
2022-11-09	18:39:05	-117.05893	11.84213	4172.07	Coryphaenoides
2022-11-09	19:04:49	-117.05849	11.84185	4147.5	Elevator in sight
2022-11-09	19:07:50	-117.05844	11.84187	4171.91	Elevator touches bottom
2022-11-09	19:09:38	-117.05842	11.84188	4171.06	Large sediment plume
2022-11-09	19:11:38	-117.05839	11.84187	4170.49	Trying to release elevator
2022-11-09	19:13:30	-117.05839	11.84186	4171.46	Poor visibility
2022-11-09	19:16:45	-117.05840	11.84184	4171.87	ROV grabbing elevator hook
2022-11-09	19:17:08	-117.05840	11.84184	4171.59	Elevator hook successfully released by ROV, free in the water column
2022-11-09	19:20:01	-117.05843	11.84188	4170.62	ROV backing away from elevator to avoid entanglement
2022-11-09	19:23:20	-117.05849	11.84179	4170.82	Large sediment plume - poor visibility
2022-11-09	19:25:04	-117.05855	11.84181	4170.97	Pelagic shrimp
2022-11-09	19:25:36	-117.05866	11.84191	4171.04	Sponge and grenadier fish
2022-11-09	19:27:10	-117.05868	11.84194	4174.06	ROV landing to deploy BFC1
2022-11-09	19:28:38	-117.05868	11.84194	4174.85	 BFC1 deployment site 20221109_192838_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	19:29:36	-117.05868	11.84194	4174.85	Stirrer of BFC1 turning
2022-11-09	19:32:45	-117.05861	11.84192	4174.78	BFC1 taken from porch
2022-11-09	19:33:46	-117.05861	11.84194	4174.76	BFC1 positioned on bottom

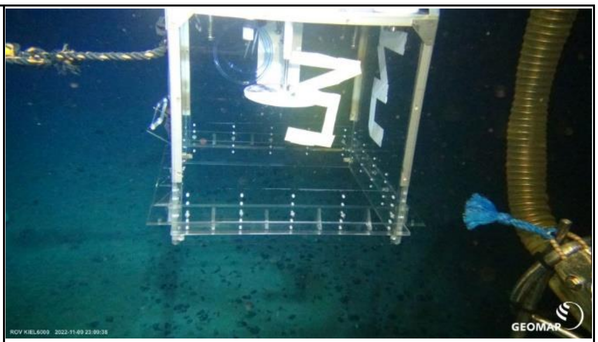
2022-11-09	19:35:28	-117.05858	11.84192	4174.79	 BFC1 deployed on bottom 20221109_193528_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	19:37:00	-117.05859	11.84192	4174.79	White ring of BFC1 chamber close to sediment surface
2022-11-09	19:37:25	-117.05859	11.84191	4174.81	BFC2 stirrer is turning
2022-11-09	19:38:23	-117.05860	11.84190	4174.82	Moving BFC2 to porch in order to reach magnet switch on BFC1 to start deployment
2022-11-09	19:40:36	-117.05861	11.84191	4174.79	Start BFC1 with magnet: deployment BFC1-1
2022-11-09	19:48:57	-117.05858	11.84191	4174.71	Moving east towards target position of BFC2
2022-11-09	19:51:39	-117.05846	11.84186	4173.58	Ophiuroids
2022-11-09	19:54:33	-117.05841	11.84194	4173.27	Sea cucumber track *Pannychia*?
2022-11-09	19:55:23	-117.05846	11.84204	4173.32	Sea cucumber track
2022-11-09	19:56:20	-117.05845	11.84206	4173.34	Xenophyophore
2022-11-09	19:58:25	-117.05845	11.84206	4174.28	 BFC2 deployment site 20221109_195825_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:03:25	-117.05848	11.84204	4174.2	BFC2 deployed on the seafloor
2022-11-09	20:04:12	-117.05847	11.84205	4174.21	 BFC2 deployment 20221109_200412_Sonne_SO295_019ROV03_Logo_thumb.jpg

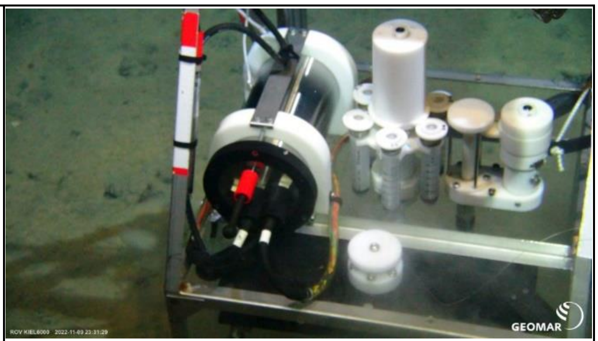
2022-11-09	20:04:21	-117.05847	11.84205	4174.21	 BFC2 deployment 20221109_200421_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:04:32	-117.05847	11.84205	4174.21	 BFC2 deployment 20221109_200432_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:07:45	-117.05846	11.84203	4174.2	BFC2 started with magnet: deployment BFC2-1
2022-11-09	20:08:00	-117.05846	11.84203	4174.2	BFC2 chamber in sediment down to the green ring
2022-11-09	20:11:11	-117.05842	11.84202	4173.37	Arriving at elevator 2 to get BFC3
2022-11-09	20:17:41	-117.05840	11.84185	4173.49	Taking BFC3 from elevator 2, heading south-west for deployment
2022-11-09	20:23:01	-117.05842	11.84181	4173.45	Brittle star
2022-11-09	20:25:23	-117.05848	11.84176	4173.54	Interesting
2022-11-09	20:25:39	-117.05848	11.84176	4173.6	White organism, looks like a sponge
2022-11-09	20:26:51	-117.05858	11.84173	4173.89	ROV manipulator (photo not displayed) 20221109_202651_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:27:30	-117.05859	11.84172	4174.35	BFC3 is about to be deployed
2022-11-09	20:31:09	-117.05858	11.84175	4174.78	BFC3 deployment site first trial (photo not displayed) 20221109_203109_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:31:20	-117.05858	11.84175	4174.78	 BFC3 deployment site first trial 20221109_203120_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:31:35	-117.05858	11.84174	4174.78	BFC3 deployment site first trial (photo not displayed) 20221109_203135_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:32:13	-117.05857	11.84174	4174.78	Trying to deploy BFC3 at seafloor
2022-11-09	20:35:19	-117.05856	11.84175	4174.77	Sediment is disturbed when BFC3 is deployed
2022-11-09	20:36:14	-117.05853	11.84175	4174.77	Searching for new spot for BFC3 deployment
2022-11-09	20:38:11	-117.05856	11.84174	4174.53	Syringe 1 of BFC3 is already triggered so program may be running already, still proceeding with deployment

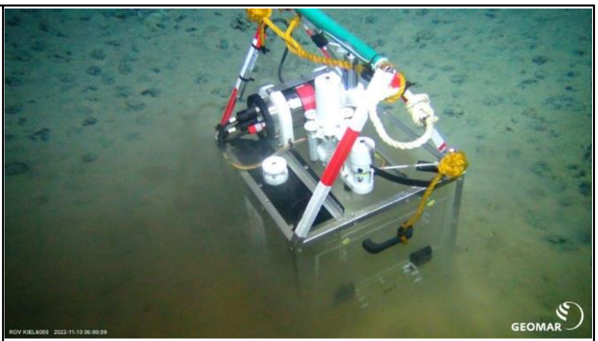
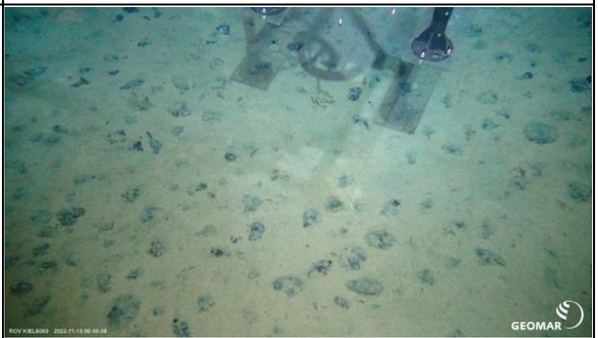
2022-11-09	20:40:44	-117.05856	11.84166	4175.15	 BFC3 deployment site 20221109_204044_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:40:49	-117.05856	11.84166	4175.15	 BFC3 deployment site 20221109_204049_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:40:56	-117.05856	11.84166	4175.16	 BFC3 deployment site 20221109_204056_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:43:12	-117.05857	11.84165	4175.16	BFC3 deployment site (photo not displayed) 20221109_204312_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:43:21	-117.05857	11.84165	4175.16	 BFC3 deployed at the seafloor 20221109_204321_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:43:29	-117.05857	11.84166	4175.16	BFC3 deployed at the seafloor (photo not displayed) 20221109_204329_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	20:44:58	-117.05856	11.84167	4175.16	Green ring of the BFC3 chamber is at the sediment surface
2022-11-09	20:46:15	-117.05860	11.84170	4174.87	Deployment BFC3-1
2022-11-09	20:49:00	-117.05854	11.84171	4172.88	Brittle star
2022-11-09	20:50:29	-117.05839	11.84186	4172.25	Anemone, Brittle star
2022-11-09	21:03:43	-117.05835	11.84185	4173.14	MICP-DEEP1 taken from elevator 2
2022-11-09	21:14:39	-117.05794	11.84097	4172.49	ROV position is not displayed on the OFOP map anymore. Trying to sort the issue out

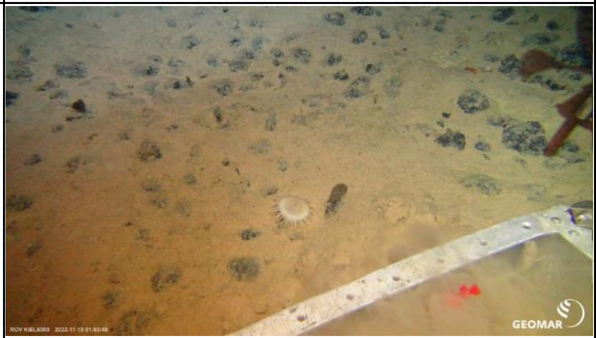
2022-11-09	21:29:30	-117.05827	11.84140	4172.13	Move southwards in search of a deployment spot for MICP-DEEP 1. still no ROV navigation data
2022-11-09	21:30:21	-117.05827	11.84140	4172.23	Swimming Polychaete
2022-11-09	21:32:01	-117.05859	11.84194	4172.41	BFC 1 in view. First attempt to position MICP-DEEP1 at the seafloor
2022-11-09	21:44:33	-117.05866	11.84187	4174.48	Patch got disturbed upon deployment, lifting MICP-DEEP1 up to search for alternative spot with fewer nodules
2022-11-09	21:48:55	-117.05872	11.84192	4173.72	Long and grey sea cucumber
2022-11-09	21:49:40	-117.05869	11.84196	4173.98	White crab
2022-11-09	21:52:33	-117.05873	11.84188	4174.16	Tiny brittle star close to MICP-DEEP1 deployment position
2022-11-09	21:55:55	-117.05869	11.84187	4174.11	MICP-DEEP 1 deployed on the seafloor after first having problems with opening the manipulator gripper: deployment MICP-DEEP1-1
2022-11-09	21:59:13	-117.05864	11.84180	4174.12	MICP-DEEP1 started: deployment MICP-DEEP1-1
2022-11-09	21:59:54	-117.05866	11.84180	4174.11	 MICP-DEEP1 deployed at the seafloor 20221109_215954_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	22:00:39	-117.05865	11.84180	4174.12	 MICP-DEEP1 deployed at the seafloor 20221109_220039_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	22:03:53	-117.05851	11.84223	4172.34	Glass Sponge in vicinity of BFC2-1
2022-11-09	22:04:01	-117.05846	11.84236	4172.28	Sea cucumber
2022-11-09	22:04:25	-117.05831	11.84278	4172.12	Moving towards elevator to pick up the PSP
2022-11-09	22:09:36	-117.05845	11.84195	4172.59	PSP taken from elevator and put on ROV porch
2022-11-09	22:16:03	-117.05853	11.84195	4172.25	 PSP on ROV porch. MICP1 is located to the right of the PSP 20221109_221603_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	22:19:47	-117.05865	11.84210	4173.28	Searching for nodule poor place to position MICP1
2022-11-09	22:21:37	-117.05869	11.84215	4173.77	Sea urchin
2022-11-09	22:26:17	-117.05868	11.84216	4173.86	First attempt to position MICP1 did not work – again problems with opening of ROV manipulator gripper
2022-11-09	22:30:27	-117.05869	11.84220	4173.85	MICP1 deployed at the seafloor
2022-11-09	22:31:53	-117.05869	11.84220	4173.87	MICP1 started with Magnet Stick: Deployment MICP1-1

2022-11-09	22:33:06	-117.05870	11.84219	4173.89	 MICP1 at the seafloor 20221109_223306_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	22:33:19	-117.05870	11.84219	4173.88	 MICP1 at the seafloor (Detail) 20221109_223319_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	22:37:44	-117.05870	11.84201	4173.15	PSP will be placed in short distance to BFC1
2022-11-09	22:42:05	-117.05872	11.84198	4174.31	 PSP at the seafloor 20221109_224205_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	22:42:24	-117.05871	11.84198	4174.07	 Seafloor next to PSP 20221109_224224_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	22:44:30	-117.05856	11.84188	4172.15	Litter
2022-11-09	22:49:14	-117.05837	11.84187	4173.46	Next step: Cube deployment on a sponge observed earlier near the elevator
2022-11-09	22:51:34	-117.05837	11.84188	4173.49	CUBE1 missing from Elevator 2. It was obviously lost during the decent of the elevator
2022-11-09	22:55:43	-117.05832	11.84186	4173.19	CUBE-3 taken from Elevator and temporarily placed on seafloor to be taken up again with the monkey fist
2022-11-09	23:04:59	-117.05844	11.84189	4172.19	ROV moving towards sponge carrying CUBE 3
2022-11-09	23:09:22	-117.05858	11.84175	4172.87	Sponge in view

2022-11-09	23:09:38	-117.05856	11.84176	4172.89	 CUBE3 in front of the ROV while moving towards sponge 20221109_230938_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:10:40	-117.05853	11.84178	4173.42	 Target sponge for CUBE3 deployment 20221109_231040_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:11:41	-117.05851	11.84180	4173.49	 Target sponge for CUBE3 deployment 20221109_231141_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:17:37	-117.05851	11.84181	4174.25	CUBE3 placed on sponge
2022-11-09	23:17:51	-117.05851	11.84181	4174.26	Pushing CUBE3 a little into the sediment
2022-11-09	23:19:13	-117.05850	11.84183	4174.27	Fish
2022-11-09	23:24:50	-117.05849	11.84181	4174.29	 CUBE3 placed on sponge 20221109_232450_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:24:58	-117.05849	11.84181	4174.29	CUBE3 placed on sponge (photo not displayed) 20221109_232458_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:28:21	-117.05850	11.84181	4174.29	CUBE3 started by ROV
2022-11-09	23:28:58	-117.05850	11.84181	4174.29	Fish next to CUBE3

2022-11-09	23:31:29	-117.05850	11.84180	4174.2	 CUBE3 right after Waterbag is punctured 20221109_233129_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:33:09	-117.05844	11.84184	4170.31	Waterbag is punctured to release tracer to the CUBE3 interior
2022-11-09	23:39:40	-117.05834	11.84188	4173.35	CUBE2 picked up from the elevator
2022-11-09	23:46:31	-117.05833	11.84190	4171.31	Looking for a sponge for CUBE-2
2022-11-09	23:48:38	-117.05836	11.84192	4173.59	CUBE2 temporarily placed at bottom to be taken up again with monkey fist
2022-11-09	23:53:22	-117.05858	11.84198	4173.34	Sponge found for CUBE2 deployment
2022-11-09	23:53:53	-117.05859	11.84198	4173.72	Target sponge for CUBE2 deployment (photo not displayed) 20221109_235353_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:54:08	-117.05859	11.84198	4173.82	 Target sponge for CUBE2 deployment 20221109_235408_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:54:50	-117.05860	11.84199	4173.9	Target sponge for CUBE2 deployment (photo not displayed) 20221109_235450_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:55:03	-117.05860	11.84198	4173.91	 Target sponge for CUBE2 deployment 20221109_235503_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-09	23:59:00	-117.05864	11.84206	4174.33	CUBE2 deployed on sponge
2022-11-10	00:00:32	-117.05864	11.84206	4174.38	Window of CUBE2 closed
2022-11-10	00:00:48	-117.05864	11.84206	4174.37	CUBE2 pushed into the sediment
2022-11-10	00:01:31	-117.05864	11.84206	4174.36	WIndow opened and closed again
2022-11-10	00:02:53	-117.05859	11.84212	4174.37	CUBE2 started by ROV
2022-11-10	00:08:56	-117.05837	11.84239	4174.4	CUBE-2 Waterbag is punctured to release tracer to the CUBE2 interior

2022-11-10	00:09:59	-117.05833	11.84243	4174.41	 CUBE2 on the sediment 20221110_000959_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	00:13:24	-117.05821	11.84259	4174.42	ROV navigation data not displayed on OFOP map since 00:03
2022-11-10	00:13:51	-117.05819	11.84261	4174.43	Marker for CUBE2 could not be set because ROV navigation data are not available
2022-11-10	00:18:17	-117.05853	11.84195	4174.44	ROV Posidonia navigation data back, marker for CUBE2 position set
2022-11-10	00:22:57	-117.05863	11.84198	4173.7	Attempt to collect sponge
2022-11-10	00:27:28	-117.05866	11.84197	4171.8	Rattail fish
2022-11-10	00:27:46	-117.05867	11.84195	4172.14	Collection of sponge cancelled
2022-11-10	00:41:55	-117.05871	11.84191	4173.49	Pick up MICP-DEEP1 for redeployment west of current position (deployment MICP-DEEP1-1)
2022-11-10	00:48:48	-117.05902	11.84182	4174.96	 Site chosen for MICP-DEEP1 redeployment 20221110_004848_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	00:51:10	-117.05900	11.84186	4175.03	MICP DEEP1 positioned at the seafloor
2022-11-10	00:54:49	-117.05901	11.84182	4175.11	MICP–DEEP1 started: deployment MICP-DEEP1-2
2022-11-10	00:55:45	-117.05902	11.84182	4175.14	MICP-DEEP1 positioned on the seafloor (photo not displayed) 20221110_005545_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	00:56:05	-117.05902	11.84182	4175.14	 MICP-DEEP1 positioned on the seafloor (deployment MICP-DEEP1-2) 20221110_005605_Sonne_SO295_019ROV03_Logo_thumb.jpg

2022-11-10	00:56:30	-117.05903	11.84181	4175.14	 MICP-DEEP1 positioned on the seafloor (detail) 20221110_005630_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	01:01:11	-117.05903	11.84181	4175.09	Attempt to catch an anemone
2022-11-10	01:03:40	-117.05904	11.84182	4176.1	 Anemone selected for sampling 20221110_010340_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	01:04:32	-117.05904	11.84181	4176.1	 Anemone selected for sampling 20221110_010432_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	01:04:48	-117.05904	11.84181	4176.1	Anemone selected for sampling (photo not displayed) 20221110_010448_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	01:09:39	-117.05905	11.84176	4176.12	Collection of anemone with the nodule it is attached to (sample Mega1Anemone)
2022-11-10	01:12:34	-117.05904	11.84182	4176.14	Rattail fish
2022-11-10	01:28:58	-117.05914	11.84182	4176.23	Coral selected for sampling (photo not displayed) 20221110_012858_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	01:33:12	-117.05911	11.84184	4176.22	 Coral selected for sampling 20221110_013312_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	01:33:37	-117.05911	11.84184	4176.22	Coral selected for sampling (photo not displayed) 20221110_013337_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	01:38:58	-117.05903	11.84190	4176.21	Coral sampled in Biopot 2 (sample Mega2Coral)

2022-11-10	01:46:46	-117.05891	11.84199	4175.15	Posidonia signal lost again (at 01:33)
2022-11-10	01:48:15	-117.05884	11.84205	4174.9	Heading towards MICP1
2022-11-10	01:50:31	-117.05863	11.84214	4174.48	 MICP1 before redeployment (following deployment MICP1-1) 20221110_015031_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	01:50:52	-117.05862	11.84216	4174.47	 MICP1 before redeployment (detail) 20221110_015052_Sonne_SO295_019ROV03_Logo_thumb.jpg
2022-11-10	01:55:00	-117.05858	11.84219	4173.96	MICP1 lifted from sediment for redeployment
2022-11-10	01:55:13	-117.05857	11.84219	4173.97	Search for new position to deploy MICP1
2022-11-10	01:58:37	-117.05860	11.84224	4174.77	MICP-1 redeployed 10m west of previous site
2022-11-10	02:02:47	-117.05857	11.84218	4174.64	MICP1 started with Magnet Stick: deployment MICP1-2
2022-11-10	02:03:30	-117.05857	11.84215	4174.44	Preparing to leave the seafloor
2022-11-10	02:04:50	-117.05858	11.84223	4161.94	OFF THE BOTTOM
2022-11-10	03:48:14	None	None	None	ON DECK

* Shortcomings in underwater navigation that lasted until station SO295_089-1_ROV-11 led to uncertainties in positioning ranging between some tens of meters to >100 m (see also section on underwater navigation in this cruise report). These intrinsic offsets could not be removed by the curation routines applied to navigation raw data (for a description see comment to first dive protocol).

Kiel 6000 Dive 4 (SO295_029-1_ROV-04)

Date: 11.Nov.2022

Principal Investigators: Sabine Gollner, Felix Janssen

Observers: Ricarda Meineke, Duygu Sevilgen, Lilian Böhringer, Mirja Bardenhagen

Protocol: Amber Henningsen

ROV positions (at the bottom)
Start of dive: 11°50.749' N 117°3.505' W
End of dive: 11°50.660' N 117°3.563' W

Dive duration:
ROV in the water: 11.Nov.2022 15:33:53
ROV at the bottom: 11.Nov.2022 17:16:39
ROV off the bottom: 11.Nov.2022 01:04:40
ROV on deck: 11.Nov.2022 02:33:15

Explored sites: GER Reference Area

Aims of the Dive

- *Find Recolonization Frames (FRAMES)*
- Deploy Fiberoptical Microsensor Profiler (MICP-DEEP3)
- Reposition MICP-DEEP 1
- *Lower Elevator 1, move Elevator towards frames and unhook*
- *Recover 5 nodule frames*
- *Sample sediments in FRAMES footprint (PUCs from 16 Core Rack)*
- *Deploy 2 Amphipod Traps (AMPHITRAPs)*
- Sample PUCs for Geochemistry Group
- *Recover MICP-DEEP 1 on ROV porch / Elevator 1*
- Recover MICP-DEEP3 on ROV porch / Elevator 1
- Megafauna sampling

Handled ROV Tools (including scientific payload):

- 16 Push Cores (PUCs) in 16 Core Rack
- SGN Biobox large
- 3 Biopots
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- MICP-DEEP3

Relevant Elevator payload

Elevator 1 (down)

- *2 FRAME BOXES (empty)*
- *4 Core Sixpack*

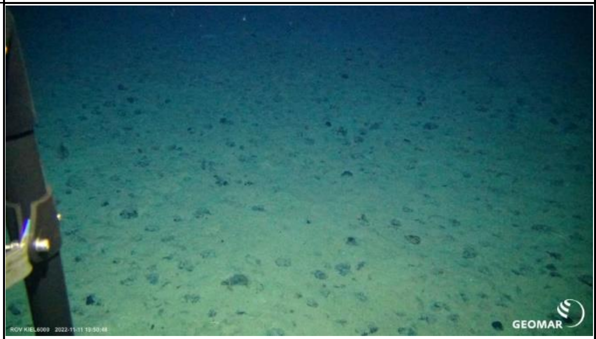
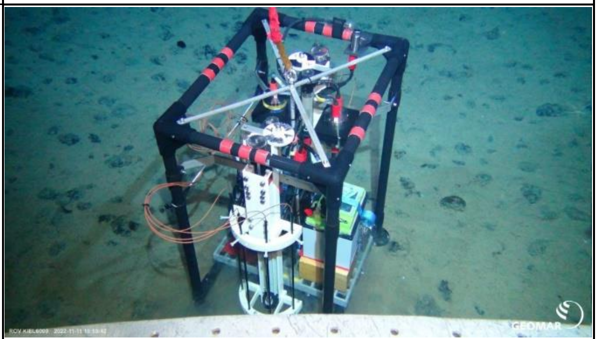
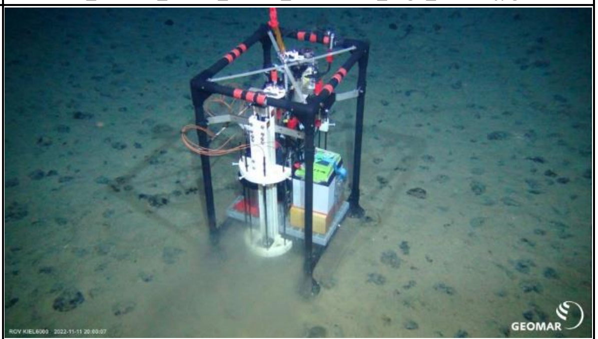
- *Electrochemical Microsensor Profiler (MICP2)*
- *2 AMPHITRAPS*

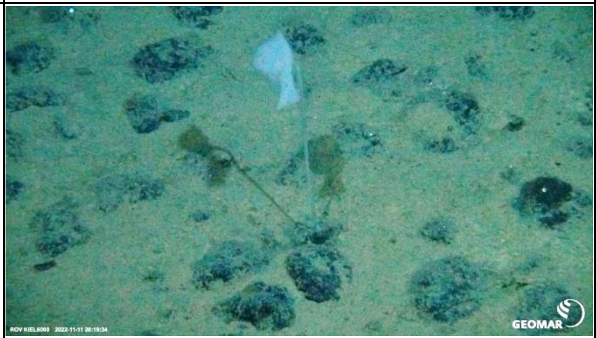
Elevator 1 deployment skipped as FRAMEs could not be found

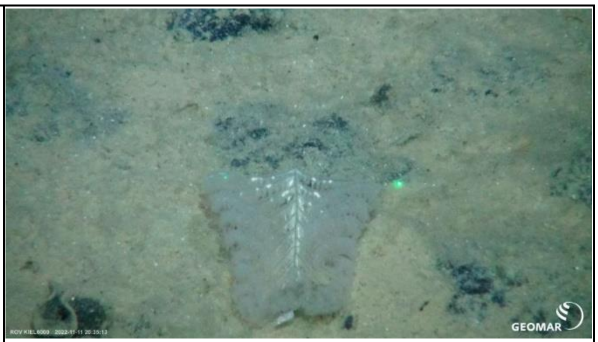
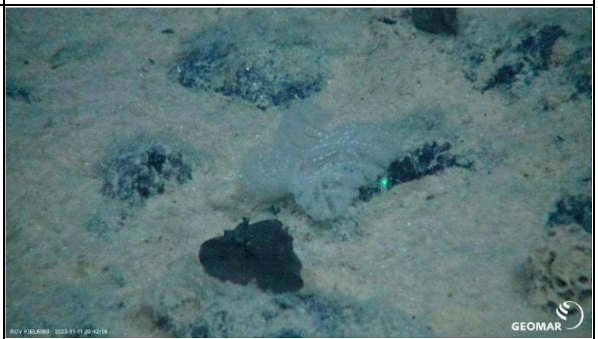
Dive summary

The ROV descended with MICP-DEEP3 on the porch. Recolonization frames (FRAMEs), deployed during SO268 could not be found and Elevator 1 with boxes for FRAME recovery was not lowered to the seafloor. MICP-DEEP3 was deployed but could not be started and was later taken back on the porch for retrieval. MICP-DEEP1, deployed during the previous dive (deployment MICP-DEEP1-2) was relocated and started again (deployment MICP-DEEP1-3). While searching for FRAMEs, some megafauna specimen were sampled. Two sets of PUCs for geochemical analyses were taken at two different sites.

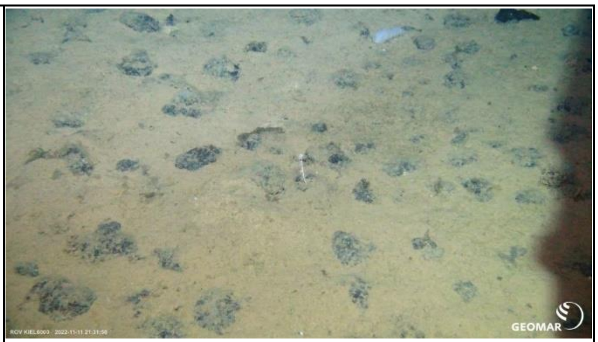
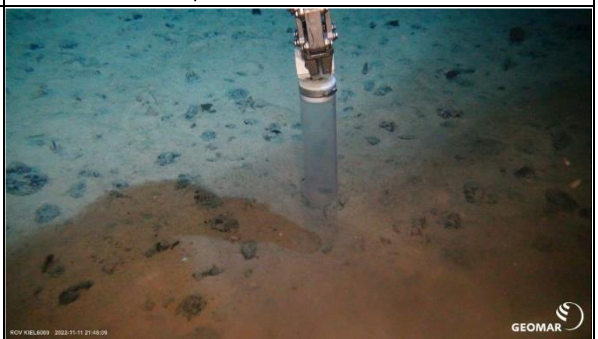
Date	UTC Time	SUB1_Lon*	SUB1_Lat*	SUB1_Depth	Observations/Comments / Image
2022-11-11	15:33:53	None	None	None	IN THE WATER
2022-11-11	17:16:39	-117.05841	11.84581	4162.18	AT THE BOTTOM
2022-11-11	17:38:31	-117.05893	11.84470	4166.47	Sponge
2022-11-11	17:42:49	-117.05912	11.84449	4166.71	Brittlestar
2022-11-11	17:44:21	-117.05943	11.84443	4167.02	 Sampling gear footprint 20221111_174421_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	17:44:22	-117.05943	11.84443	4167.03	Traces of Boxcorer deployment (?)
2022-11-11	17:44:45	-117.05943	11.84442	4167.14	Traces of Multicorer deployment (?)
2022-11-11	17:47:07	-117.05925	11.84423	4167.09	 Traces of animals 20221111_174707_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	17:56:45	-117.05958	11.84418	4167.51	Search for Recolonization Frames (FRAMES)
2022-11-11	18:00:03	-117.05960	11.84391	4167.9	Anemone
2022-11-11	18:27:57	-117.05445	11.84420	4166.33	USBL underwater navigation (Posidonia) jumping by 20-30 m
2022-11-11	18:43:14	-117.05793	11.84477	4166.11	Traces of Boxcorer deployment
2022-11-11	19:07:23	-117.05833	11.84493	4167.16	Discussing plans for further dive (FRAMES search)
2022-11-11	19:21:02	-117.05867	11.84450	4169.84	Continuing search for FRAMES
2022-11-11	19:24:02	-117.05897	11.84441	4172.61	Sponge
2022-11-11	19:25:22	-117.05879	11.84435	4171.49	Sea cucumber

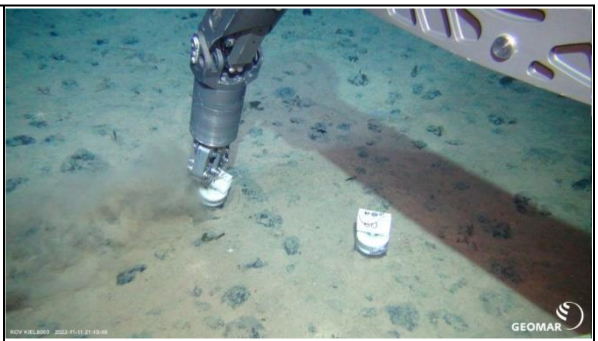
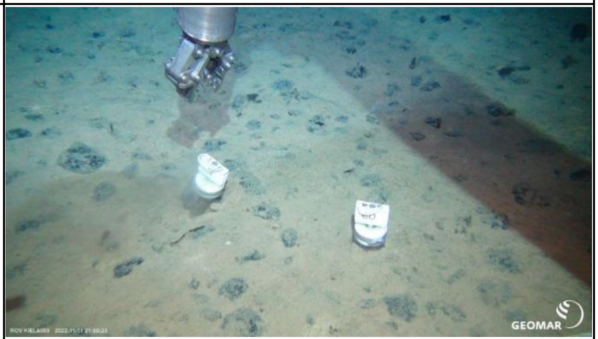
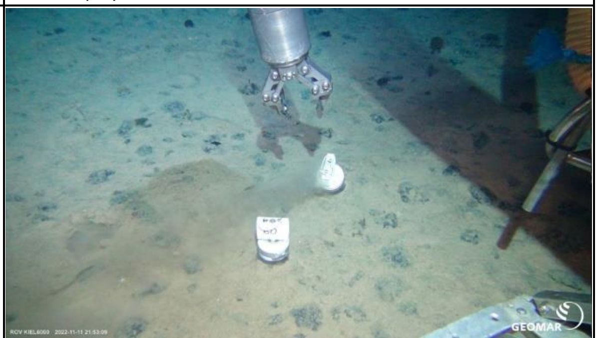
2022-11-11	19:49:32	-117.05953	11.84417	4174.17	Decision to proceed with MICP-DEEP3 deployment, then continue FRAME search and start Megafauna sampling
2022-11-11	19:50:48	-117.05951	11.84418	4174.17	 MICP-DEEP3 deployment site 20221111_195048_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	19:54:16	-117.05953	11.84418	4174.11	MICP-DEEP3 taken from ROV porch
2022-11-11	19:59:26	-117.05954	11.84418	4174.4	MICP-DEEP3 placed at seafloor
2022-11-11	19:59:42	-117.05954	11.84418	4174.41	 MICP-DEEP3 at seafloor 20221111_195942_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	20:00:07	-117.05955	11.84417	4174.42	 MICP-DEEP3 at seafloor 20221111_200007_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	20:02:44	-117.05955	11.84414	4174.41	Taking Magnet Stick from ROV drawer to start MICP-DEEP3
2022-11-11	20:05:09	-117.05954	11.84414	4174.4	LED of MICP-DEEP3 not blinking – indication of technical issue with the instrument
2022-11-11	20:05:33	-117.05955	11.84414	4174.4	MICP-DEEP3 switch touched with Magnet Stick, wait a minute for gear wheels to turn
2022-11-11	20:08:00	-117.05955	11.84417	4174.4	Switch touched with Magnet Stick 2nd time
2022-11-11	20:09:31	-117.05955	11.84416	4174.39	Gear wheels not turning
2022-11-11	20:10:42	-117.05957	11.84415	4174.4	Switch touched with Magnet Stick 3rd time
2022-11-11	20:11:12	-117.05956	11.84416	4174.4	Gear wheels not turning
2022-11-11	20:16:12	-117.05953	11.84416	4174.23	Leaving Profiler at site although it is not working, continue flying in search of FRAMES, heading towards North-northeast
2022-11-11	20:16:44	-117.05954	11.84410	4174.27	Plan is to collect megafauna on the fly
2022-11-11	20:18:04	-117.05948	11.84422	4174.37	Sponge

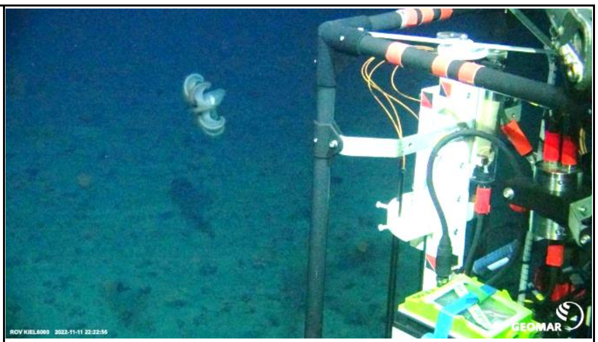
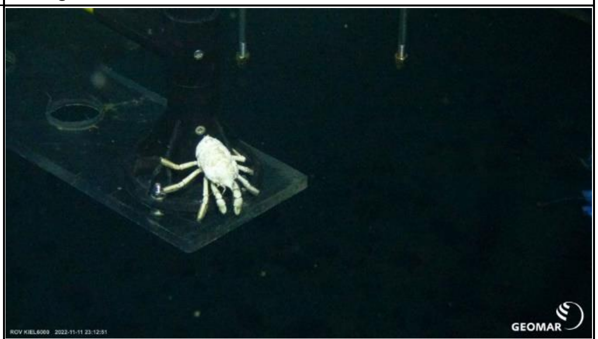
2022-11-11	20:19:24	-117.05927	11.84465	4174.37	 Sponge 20221111_201924_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	20:19:31	-117.05926	11.84465	4174.37	Sponge close up
2022-11-11	20:19:34	-117.05926	11.84464	4174.37	 Sponge close up 20221111_201934_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	20:20:19	-117.05927	11.84455	4174.36	Sponge close up (photo not displayed) 20221111_202019_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	20:20:23	-117.05927	11.84455	4174.36	 Sponge close up 20221111_202023_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	20:28:18	-117.05932	11.84471	4175.35	Sponge sampled without nodule
2022-11-11	20:29:20	-117.05929	11.84476	4175.33	Sample MEGA3Sponge stored in SGN Biobox large
2022-11-11	20:33:41	-117.05932	11.84478	4175.05	Anemone
2022-11-11	20:34:41	-117.05934	11.84482	4175.27	 Anemone 20221111_203441_Sonne_SO295_029ROV04_Logo_thumb.jpg

2022-11-11	20:35:13	-117.05931	11.84480	4175.27	 Soft coral 20221111_203513_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	20:38:57	-117.05929	11.84494	4175.26	Anemone sampled
2022-11-11	20:39:25	-117.05930	11.84496	4175.26	Anemone transferred to SGN Biobox large, Sample MEGA4Anemone
2022-11-11	20:40:14	-117.05933	11.84487	4175.25	Coral sampled
2022-11-11	20:40:44	-117.05944	11.84466	4175.25	Cora transferred to SGN Biobox large, Sample MEGA5Coral
2022-11-11	20:42:16	-117.05930	11.84477	4175.25	 Soft coral 20221111_204216_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	20:46:13	-117.05970	11.84441	4175.2	Coral sampled
2022-11-11	20:49:11	-117.05937	11.84461	4175.2	Coral dropped and picked again
2022-11-11	20:51:08	-117.05935	11.84467	4175.2	Coral sticking to claw upon transfer to SGN Biobox large
2022-11-11	20:52:15	-117.05938	11.84464	4175.19	Coral transferred to SGN Biobox large, sample MEGA6Coral
2022-11-11	20:53:16	-117.05938	11.84461	4175.2	Next activity: push coring with PUCs from 16 Core Rack
2022-11-11	20:57:16	-117.05934	11.84466	4175.19	PUC1 deployed
2022-11-11	20:58:49	-117.05937	11.84462	4175.19	PUC64 deployed
2022-11-11	20:59:22	-117.05937	11.84462	4175.2	 PUC site with deployed cores 20221111_205922_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:00:16	-117.05926	11.84442	4175.19	Retrieving PUCs back into 16 Core Rack
2022-11-11	21:00:40	-117.05907	11.84405	4175.19	PUC64 retrieved
2022-11-11	21:01:14	-117.05895	11.84383	4175.18	PUC1 retrieved
2022-11-11	21:03:51	-117.05895	11.84384	4175.19	Next Action: fly back to MICP-DEEP3, take two PUCs, try to find another coral and anemone,then continue search for FRAMES

2022-11-11	21:07:46	-117.05897	11.84386	4175.15	 Anemone 20221111_210746_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:09:59	-117.05900	11.84387	4175.16	Anemone sampled with nodule
2022-11-11	21:10:13	-117.05900	11.84388	4175.15	Anemone transferred to SGN Biobox large, sample MEGA7Anemone
2022-11-11	21:14:18	-117.05944	11.84463	4174.99	Anemone (photo not displayed) 20221111_211418_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:20:45	-117.05946	11.84461	4175.1	 Anemone 20221111_212045_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:21:28	-117.05945	11.84461	4175.12	Anemone (photo not displayed) 0221111_212128_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:21:34	-117.05945	11.84461	4175.12	Anemone (photo not displayed) 20221111_212134_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:21:40	-117.05945	11.84461	4175.12	Anemone (photo not displayed) 20221111_212140_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:21:50	-117.05945	11.84461	4175.12	 Anemone (close up) 20221111_212150_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:22:01	-117.05945	11.84461	4175.11	Anemone (photo not displayed) 20221111_212201_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:24:30	-117.05944	11.84462	4175.08	Attempt to sample Anemone sampled with nodule (failed)
2022-11-11	21:27:56	-117.05943	11.84456	4174.7	Flying back to MICP-DEEP3 to take PUCs in the vicinity

2022-11-11	21:31:50	-117.05940	11.84454	4174.97	 Coral 20221111_213150_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:32:04	-117.05940	11.84455	4174.99	 Coral 20221111_213204_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:32:29	-117.05940	11.84455	4174.99	 Coral (close up) 20221111_213229_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:38:14	-117.05937	11.84454	4174.93	Coral probably sampled
2022-11-11	21:39:14	-117.05937	11.84454	4174.95	Coral transferred toSGN Biobox large
2022-11-11	21:41:33	-117.05935	11.84451	4174.35	MICP-DEEP3 in view
2022-11-11	21:43:32	-117.05934	11.84449	4174.93	Sea cucumber
2022-11-11	21:44:28	-117.05935	11.84447	4174.8	Brittle star
2022-11-11	21:47:15	-117.05936	11.84450	4174.91	PUC sampling start near MICP-DEEP3 with PUCs from 16 Core Rack
2022-11-11	21:47:28	-117.05936	11.84450	4174.92	PUC60 taken out of tray
2022-11-11	21:48:09	-117.05936	11.84449	4174.91	 PUC60 taken out of 16 PUC Rack / PUC site prior to coring 20221111_214809_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:48:36	-117.05935	11.84449	4174.9	PUC60 deployed

2022-11-11	21:49:49	-117.05934	11.84448	4174.9	 PUC9 upon deployment 20221111_214949_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:50:12	-117.05934	11.84448	4174.9	PUC9 deployed
2022-11-11	21:50:23	-117.05934	11.84448	4174.9	 PUC9 and PUC60 20221111_215023_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:50:26	-117.05934	11.84448	4174.9	Retrieving PUCs back into 16 Core Rack
2022-11-11	21:51:34	-117.05935	11.84449	4174.9	PUC9 retrieved – looks disturbed
2022-11-11	21:52:16	-117.05935	11.84449	4174.9	Next action: take additional PUC to compensate for disturbed PUC9
2022-11-11	21:52:53	-117.05935	11.84448	4174.9	PUC17 deployed
2022-11-11	21:53:09	-117.05934	11.84448	4174.9	 PUC17 and PUC60 20221111_215309_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	21:53:25	-117.05935	11.84448	4174.91	PUC17 looks tilted
2022-11-11	21:54:03	-117.05935	11.84448	4174.91	PUC17 retrieved
2022-11-11	21:55:37	-117.05940	11.84447	4174.9	PUC60 retrieved
2022-11-11	22:00:06	-117.05941	11.84449	4174.08	Collecting MICP-DEEP3 from seafloor
2022-11-11	22:08:24	-117.05945	11.84445	4172.98	Continue search for FRAMES with MICP-DEEP3 in gripper of right ROV manipulator (ORION)
2022-11-11	22:13:23	-117.05972	11.84381	4172.85	Moving South-southwest
2022-11-11	22:22:20	-117.05983	11.84293	4174.76	Octopus

2022-11-11	22:22:55	-117.05982	11.84290	4174.52	 Octopus 20221111_222255_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	22:22:57	-117.05983	11.84289	4174.5	Octopus (photo not displayed) 20221111_222257_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	22:26:23	-117.05955	11.84258	4173.27	Moving East searching for FRAMES
2022-11-11	22:32:16	-117.05863	11.84257	4173.29	Microprofiler in view
2022-11-11	22:36:21	-117.05866	11.84247	4173.35	Fish
2022-11-11	22:38:15	-117.05859	11.84240	4173.32	Identified as MICP-DEEP1 deployed during previous dive as MICP-DEEP1-2
2022-11-11	22:42:50	-117.05860	11.84241	4173.36	Located approx. 80 m Northeast of deployment site from previous dive
2022-11-11	22:49:36	-117.05604	11.84265	4173.95	Next action: relocate MICP-DEEP1 and restart it
2022-11-11	22:50:48	-117.05604	11.84265	4173.52	A lot of sediment blocks view
2022-11-11	22:52:12	-117.05626	11.84260	4173.47	Waiting for sediment to settle
2022-11-11	23:05:59	-117.05926	11.84173	4171.9	MICP-DEEP3 placed on porch
2022-11-11	23:12:01	-117.05934	11.84166	4173.84	MICP-DEEP1 picked up
2022-11-11	23:12:19	-117.05936	11.84166	4173.62	LED of MICP-DEEP1 is flashing: program of deployment MICP-DEEP1-2 was finished
2022-11-11	23:12:50	-117.05936	11.84164	4173.43	Moving West
2022-11-11	23:12:51	-117.05936	11.84164	4173.43	 Galatheid crab on MICP-DEEP1 20221111_231251_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	23:13:04	-117.05942	11.84164	4173.41	 Galatheid crab on MICP-DEEP1 (close up) 20221111_231304_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-11	23:15:16	-117.05947	11.84164	4173.96	Looking for appropriate site to redeploy MICP-DEEP1
2022-11-11	23:16:33	-117.05948	11.84164	4174.41	Resuspended sediment hinders view and redeployment of MICP-DEEP1
2022-11-11	23:16:50	-117.05950	11.84163	4174.41	MICP-DEEP1 deployed at seafloor
2022-11-11	23:18:05	-117.05950	11.84164	4174.41	Waypoint MICP-DEEP1-3 is probably off due to difficulties with USBL underwater navigation (Posidonia)
2022-11-11	23:19:55	-117.05942	11.84168	4174.42	MICP-DEEP_1 started: deployment MICP-DEEP1-3

2022-11-12	00:17:16	-117.05951	11.84412	4172.59	 Seafloor with bright patches (sampling gear footprint?) 20221112_001716_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-12	00:17:32	-117.05950	11.84409	4172.59	Seafloor with bright patches (photo not displayed) 20221112_001732_Sonne_SO295_029ROV04_Logo_thumb.jpg
2022-11-12	01:04:40	-117.05939	11.84433	2965.46	OFF THE BOTTOM
2022-11-12	02:33:15	None	None	None	ON DECK

* Shortcomings in underwater navigation that lasted until station SO295_089-1_ROV-11 led to uncertainties in positioning ranging between some tens of meters to >100 m (see also section on underwater navigation in this cruise report). These intrinsic offsets could not be removed by the curation routines applied to navigation raw data (for a description see comment to first dive protocol).

Kiel 6000 Dive 5 (SO295_035-1_ROV-05)

Date: 12.Nov.2022

Principal Investigators: Felix Janssen, Tanja Stratmann

Observers: Amber Henningsen, Brenda Esteban Vasquez, Devin Vlach, Lilian Böhringer

Protocol: Felix Janssen

ROV positions (at the bottom)
Start of dive: 11°50.496' N 117°3.505' W
End of dive: 11°50.500' N 117°3.541' W

Dive duration:
ROV in the water: 12.Nov.2022 15:41:13
ROV at the bottom: 12.Nov.2022 17:31:36
ROV off the bottom: 13.Nov.2022 02:19:24
ROV on deck: 13.Nov.2022 04:35:41

Explored sites: GER reference

Aims of the Dive:

- Deployment of Fiberoptical Microsensor Profiler (MICP-DEEP2)
- Passive Trace Metal Sampler (PSP) recovery
- Recovery of Benthic Incubators (CUBE2, CUBE3) incl. sampling of incubated sponges and sediments
- Recovery of three Benthic Flux Chamber (BFC1, BFC2, BFC3)
- Revovery of Electrochemcial and Fiberoptical Microsensor Profilers (MICP1, MICP-DEEP1, MICP-DEEP2)

Handled ROV Tools (including scientific payload):

- MICP-DEEP2 (on descent)
- Benthic Flux Chambers (BFC2, BFC3) on porch (on ascent)
- Magnet Stick
- 16 Push Cores (PUCs) in 16 Core Rack
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- ICBM Biobox extra large

Relevant Elevator payload

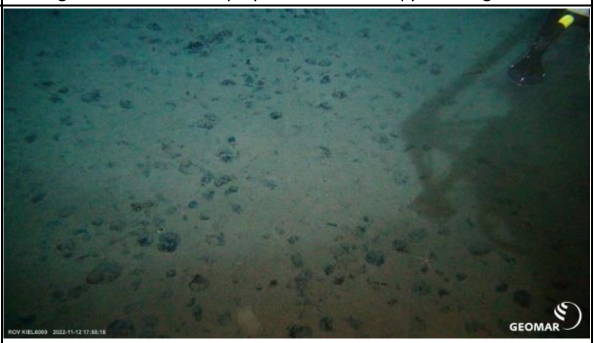
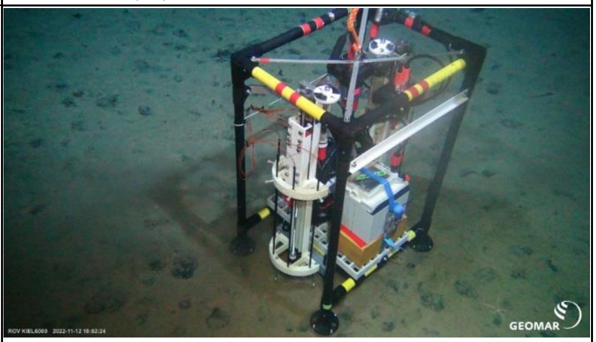
Elevator 2 (already on the bottom)

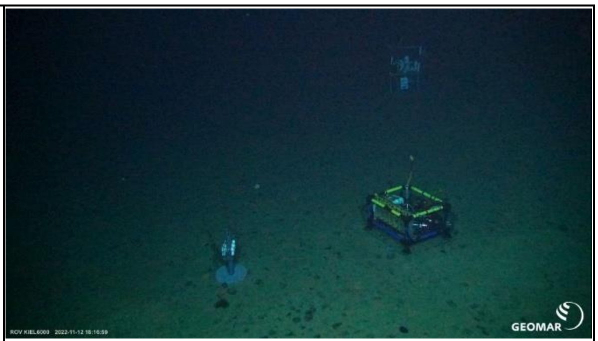
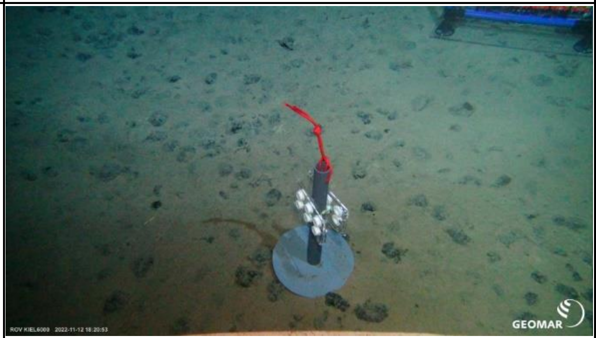
- CUBE2, CUBE3
- 4 Blade Corers
- PSP
- BFC1
- MICP1

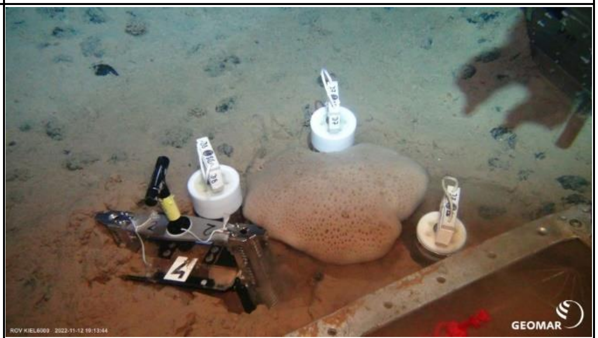
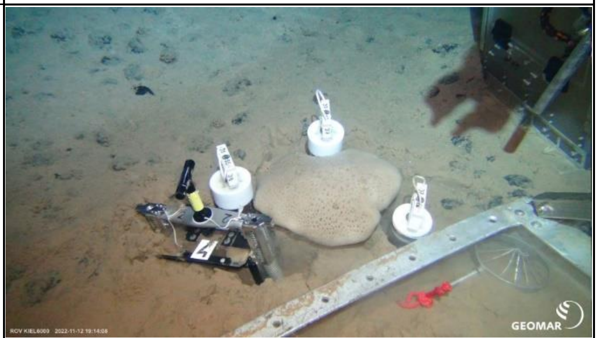
- MICP-DEEP1, MICP-DEEP2

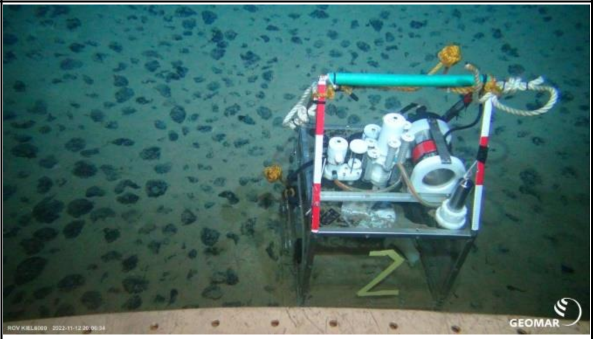
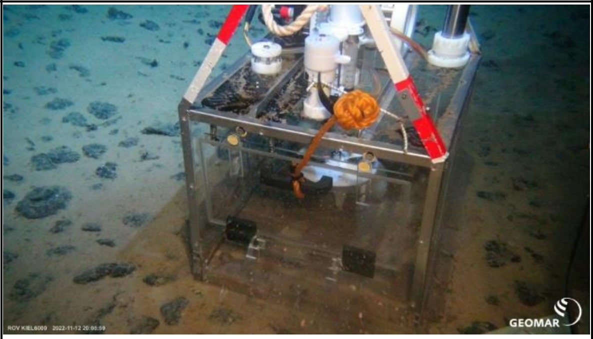
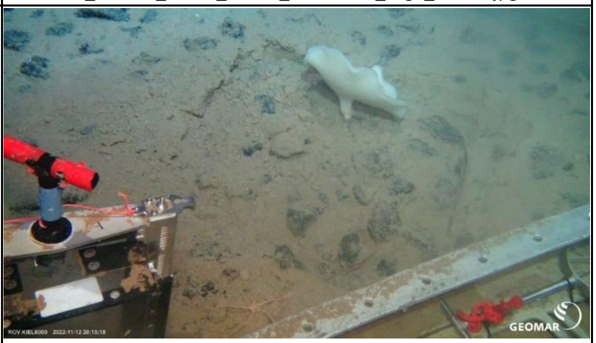
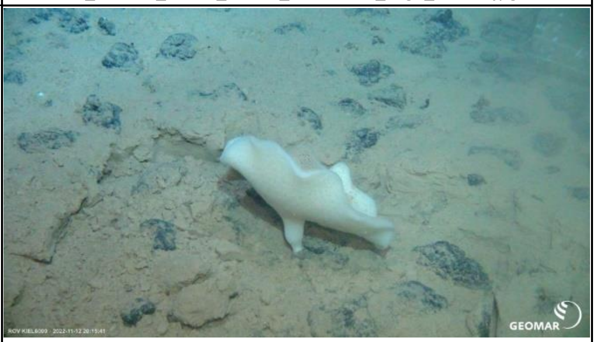
Dive summary

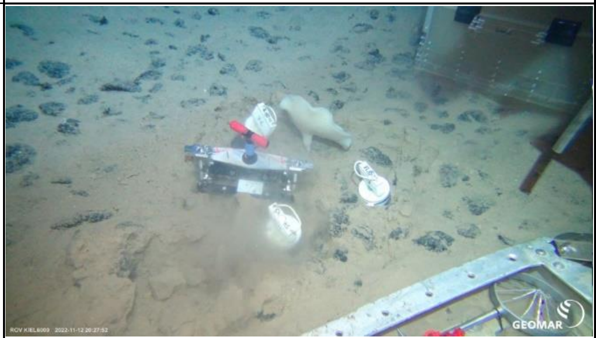
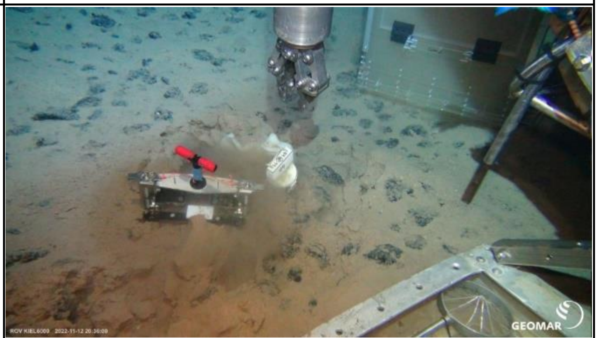
The ROV was descending with a Fiberoptical Microsensor Profiler (MICP-DEEP2) on the porch that was deployed upon arrival at the bottom. After that, instruments deployed during dive SO295_019ROV03 were recovered and transported to Elevator 2 starting with the Passive Trace Metal Sampler (PSP). Benthic Incubators (CUBE1, CUBE2) were collected afterwards and samples of incubated sponges and sediments were taken as well as background sediment samples. In the following, the Electrochemical and Fiberoptical Microsensor Profilers MICP1 and MICP-DEEP1 as well as one of the Benthic Flux Chambers (BFC1) were recovered – followed by Profiler MICP-DEEP2 that was deployed at the beginning of the dive. Finally, the remaining two chambers (BFC2 and BFC3) were retrieved and placed temporarily at the seafloor at some distance to the position of SONNE to attach Elevator 2 to the Elevator Recovery System lowered from the ship. After Elevator 2 was lifted off the seafloor, BFC2 and BFC3 were collected on the porch and the ROV returned to the surface.

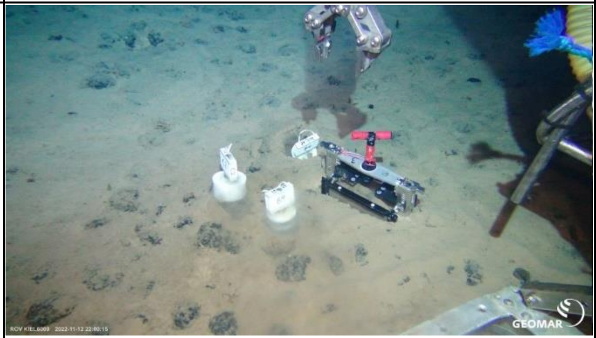
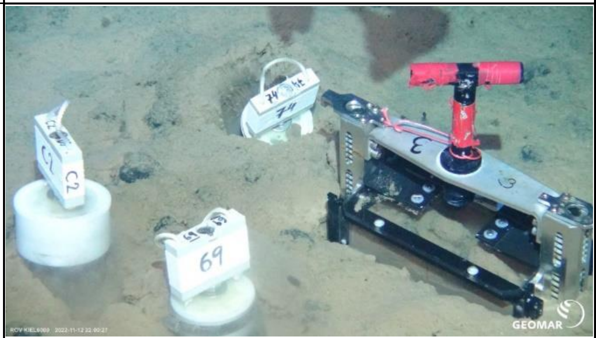
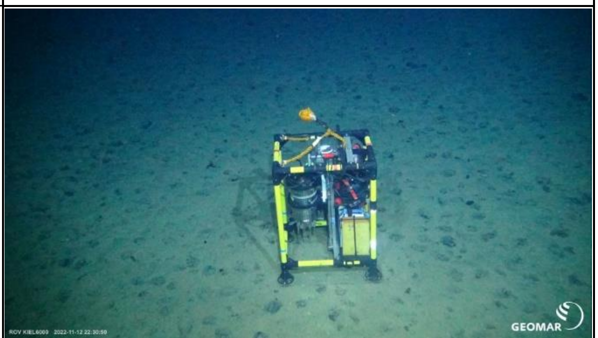
Date	UTC Time	SUB1_Lon*	SUB1_Lat*	SUB1_Depth	Observations/Comments / Image
2022-11-12	15:41:13	None	None	None	IN THE WATER
2022-11-12	17:31:36	-117.05842	11.84160	4169.94	AT THE BOTTOM
2022-11-12	17:41:00	-117.05861	11.84164	4170.91	Looking for MICP-DEEP2 deployment site while approaching Elevator 2
2022-11-12	17:58:18	-117.05834	11.84148	4174.3	 MICP-DEEP2 deployment site 20221112_175818_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	17:58:38	-117.05831	11.84151	4174.3	MICP-DEEP2 deployed at seafloor
2022-11-12	18:02:24	-117.05822	11.84156	4174.75	 MICP-DEEP2 at seafloor 20221112_180224_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	18:04:00	-117.05821	11.84152	4174.8	MICP-DEEP2 started with Magnet Stick: deployment MICP-DEEP2-1
2022-11-12	18:04:24	-117.05817	11.84151	4174.8	Both stages running: program started. Next action: PSP recovery

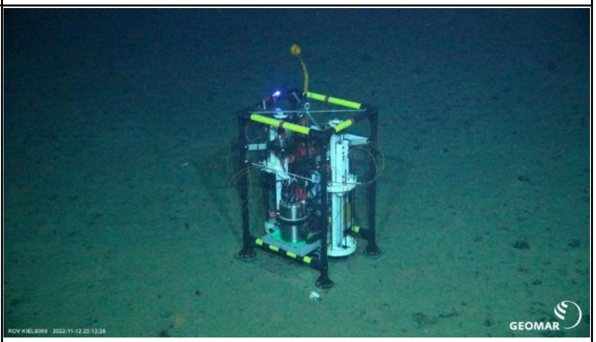
2022-11-12	18:16:59	-117.05861	11.84173	4173.98	 PSP, BFC1 and microprofiler 20221112_181659_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	18:17:13	-117.05862	11.84174	4173.97	Arrival at PSP
2022-11-12	18:20:53	-117.05856	11.84177	4175.29	 PSP at seafloor before recovery 20221112_182053_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	18:23:09	-117.05862	11.84179	4174.35	PSP1 taken up by ROV
2022-11-12	18:24:20	-117.05853	11.84173	4173.99	ROV approaching Elevator 2
2022-11-12	18:28:36	-117.05842	11.84177	4173.4	PSP deployed in PSP quiver on Elevator 2
2022-11-12	18:31:08	-117.05918	11.84172	4173.79	PSP secured with elastic bands
2022-11-12	18:37:52	-117.05849	11.84184	4173.79	Blade corer 2 taken from Elevator 2
2022-11-12	18:39:34	-117.05849	11.84185	4173.03	ROV flying towards CUBE3
2022-11-12	18:44:35	-117.05863	11.84173	4173.58	CUBE3 in view
2022-11-12	18:45:41	-117.05864	11.84174	4173.68	CUBE3 at seafloor before recovery (photo not displayed) 20221112_184541_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	18:45:56	-117.05863	11.84175	4173.69	 CUBE3 at seafloor before recovery 20221112_184556_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	18:50:28	-117.05861	11.84172	4175.8	CUBE3 at seafloor before recovery (photo not displayed 20221112_185028_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	18:51:28	-117.05856	11.84168	4175.77	Blade Corer temporarily set down next to CUBE 3
2022-11-12	18:53:56	-117.05857	11.84173	4175.79	Door of CUBE3 opened to avoid vacuum when pulling out
2022-11-12	18:55:05	-117.05859	11.84172	4175.76	Lifting up CUBE3
2022-11-12	18:55:28	-117.05859	11.84172	4175.77	CUBE3 placed on sediment close to original position

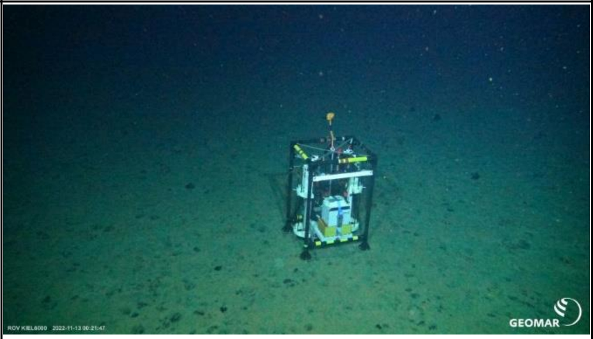
2022-11-12	18:56:14	-117.05859	11.84171	4175.78	 Sponge after incubation in CUBE3 20221112_185614_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	18:56:28	-117.05859	11.84171	4175.77	Sponge after incubation in CUBE3 (photo not displayed) 20221112_185628_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	19:07:30	-117.05861	11.84172	4175.78	Blade Corer 2 deployed
2022-11-12	19:09:25	-117.05862	11.84175	4175.78	PUC sampling start in CUBE 3 imprint with PUCs from 16 Core Rack
2022-11-12	19:09:38	-117.05862	11.84174	4175.78	PUCD7 deployed
2022-11-12	19:10:46	-117.05862	11.84173	4175.78	PUCD8 deployed
2022-11-12	19:13:41	-117.05865	11.84176	4175.79	PUC37 deployed
2022-11-12	19:13:44	-117.05865	11.84176	4175.79	 Incubated sponge with Blade Corer and PUCs 20221112_191344_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	19:14:08	-117.05865	11.84176	4175.78	 Incubated sponge with Blade Corer and PUCs 20221112_191408_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	19:14:18	-117.05866	11.84176	4175.78	Incubated sponge with Blade Corer and PUCs (photo not displayed) 20221112_191418_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	19:14:27	-117.05866	11.84176	4175.79	Photo taken of the three PUC deployed (2)
2022-11-12	19:14:29	-117.05866	11.84176	4175.79	Incubated sponge with Blade Corer and PUCs (photo not displayed) 20221112_191429_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	19:14:54	-117.05865	11.84176	4175.79	Retrieving PUCs back into 16 Core Rack
2022-11-12	19:18:52	-117.05863	11.84177	4175.76	PUC37 retrieved
2022-11-12	19:19:56	-117.05861	11.84176	4175.75	PUCD8 retrieved
2022-11-12	19:21:08	-117.05858	11.84176	4175.75	PUCD7 retrieved
2022-11-12	19:25:45	-117.05861	11.84176	4175.72	Sponge collected into right compartment of ICBM Biobox extra large
2022-11-12	19:27:16	-117.05860	11.84174	4175.72	Brittle star
2022-11-12	19:31:57	-117.05858	11.84172	4175.37	Returning to Elevator 2
2022-11-12	19:38:51	-117.05846	11.84171	4174.13	Elevator in view
2022-11-12	19:53:58	-117.05821	11.84197	4174.2	CUBE3 fixed to Elevator 2
2022-11-12	19:59:09	-117.05820	11.84199	4174.07	Blade Corer 1 taken from Elevator 2
2022-11-12	20:01:36	-117.05831	11.84200	4173.04	Brittle stars

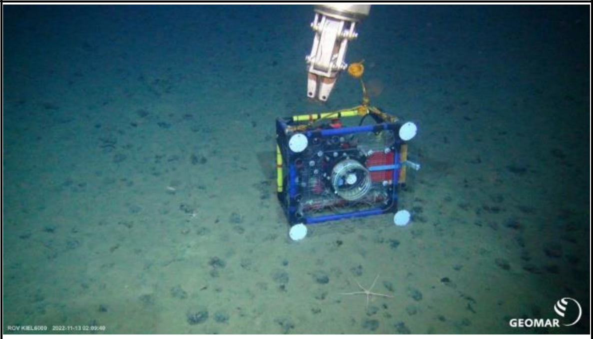
2022-11-12	20:02:28	-117.05837	11.84204	4173.29	Approaching CUBE2
2022-11-12	20:06:26	-117.05844	11.84207	4174.29	CUBE2 in view
2022-11-12	20:06:29	-117.05844	11.84207	4174.31	CUBE2 at seafloor before recovery (photo not displayed) 20221112_200629_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:06:34	-117.05844	11.84207	4174.35	 CUBE2 at seafloor before recovery 20221112_200634_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:08:14	-117.05842	11.84209	4175.09	CUBE2 at seafloor before recovery (photo not displayed) 20221112_200814_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:08:51	-117.05841	11.84209	4175.4	CUBE2 at seafloor before recovery (photo not displayed) 20221112_200851_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:08:59	-117.05841	11.84209	4175.42	 CUBE2 at seafloor before recovery 20221112_200859_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:11:31	-117.05841	11.84211	4175.47	Lifting up CUBE2
2022-11-12	20:15:06	-117.05847	11.84209	4175.5	Sponge after incubation in CUBE2 (photo not displayed) 20221112_201506_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:15:18	-117.05847	11.84209	4175.5	 Sponge after incubation in CUBE2 20221112_201518_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:15:41	-117.05846	11.84209	4175.5	 Sponge after incubation in CUBE2 20221112_201541_Sonne_SO295_035ROV05_Logo_thumb.jpg

2022-11-12	20:15:43	-117.05846	11.84209	4175.5	Photo Taken
2022-11-12	20:15:58	-117.05846	11.84209	4175.49	Photo taken of blade coer (3)
2022-11-12	20:16:07	-117.05846	11.84209	4175.49	Sponge after incubation in CUBE2 (photo not displayed) 20221112_201607_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:19:14	-117.05843	11.84208	4175.5	Blade corer and PUC sampling start in CUBE2 imprint with PUCs from 16 Core Rack
2022-11-12	20:23:18	-117.05836	11.84206	4175.5	Blade Corer 1 deployed
2022-11-12	20:24:55	-117.05832	11.84208	4175.5	PUC76 deployed
2022-11-12	20:26:17	-117.05832	11.84206	4175.5	PUC82 deployed
2022-11-12	20:27:47	-117.05833	11.84203	4175.48	PUC54 deployed
2022-11-12	20:27:52	-117.05833	11.84203	4175.48	 Incubated sponge with Blade Corer 1 and PUCs 20221112_202752_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:29:56	-117.05828	11.84206	4175.47	Retrieving PUCs back into 16 Core Rack
2022-11-12	20:30:03	-117.05828	11.84206	4175.48	PUC54 retrieved
2022-11-12	20:31:57	-117.05831	11.84201	4175.49	PUC7 retrieved
2022-11-12	20:32:12	-117.05832	11.84202	4175.49	PUC76 retrieved
2022-11-12	20:33:32	-117.05839	11.84205	4175.48	PUC82 retrieved
2022-11-12	20:36:00	-117.05839	11.84212	4175.46	 Incubated sponge with Blade Corer and additional PUC44 20221112_203600_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:36:04	-117.05839	11.84211	4175.46	Additional sampling in CUBE2 imprint with PUC44 from 16 Core Rack
2022-11-12	20:36:19	-117.05839	11.84210	4175.46	PUC44 deployed
2022-11-12	20:37:05	-117.05839	11.84210	4175.47	PUC44 retrieved back into 16 core rack
2022-11-12	20:41:47	-117.05844	11.84206	4175.44	 Incubated sponge upon recovery 20221112_204147_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	20:42:38	-117.05844	11.84208	4175.45	Sponge collected into left compartment of ICBM Biobox extra large, heading towards elevator
2022-11-12	21:00:35	-117.05751	11.84070	4173.19	Blade Corer 1 put back to Elevator 2 and returning to CUBE2
2022-11-12	21:15:20	-117.05848	11.84206	4174.43	CUBE2 in view
2022-11-12	21:17:22	-117.05848	11.84206	4174.2	Heading back to Elevator 2 with CUBE2

2022-11-12	21:24:08	-117.05820	11.84196	4173.6	CUBE2 placed on Elevator 2
2022-11-12	21:33:01	-117.05823	11.84199	4173.27	CUBE2 secured on Elevator 2
2022-11-12	21:42:57	-117.05822	11.84191	4173.51	Blade corer 3 taken from Elevator 2 for background sampling
2022-11-12	21:50:14	-117.05807	11.84187	4174.21	Blade corer and PUC background sampling start with PUCs from 16 Core Rack
2022-11-12	21:52:31	-117.05813	11.84190	4174.21	Blade Corer 3 deployed in sediment and triggered
2022-11-12	21:55:04	-117.05811	11.84194	4174.21	PUC74 deployed
2022-11-12	21:57:13	-117.05814	11.84192	4174.23	PUCC2 deployed
2022-11-12	21:59:44	-117.05814	11.84197	4174.22	PUC69 deployed
2022-11-12	22:00:15	-117.05814	11.84197	4174.22	 Background sampling with PUCs and Blade Corer 3 20221112_220015_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	22:00:27	-117.05814	11.84197	4174.22	 Background sampling with PUCs and Blade Corer 3 20221112_220027_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	22:01:00	-117.05813	11.84197	4174.21	Retrieving Blade Corer 3 and retrieving PUCs back into 16 Core Rack
2022-11-12	22:02:57	-117.05815	11.84197	4174.2	PUC69 retrieved
2022-11-12	22:05:23	-117.05816	11.84198	4174.21	PUCC2 retrieved
2022-11-12	22:05:32	-117.05816	11.84198	4174.21	PUC74 retrieved
2022-11-12	22:09:45	-117.05821	11.84199	4173.31	Returning to Elevator 2 with Blade Corer 3
2022-11-12	22:16:27	-117.05824	11.84198	4173.64	Blade Corer 3 placed on Elevator 2
2022-11-12	22:20:21	-117.05823	11.84199	4173.55	Clearing elastic strap on Elevator 2
2022-11-12	22:26:58	-117.05824	11.84205	4172.33	Moving towards MICP1 deployed in dive SO295_019ROV03 (deployment MICP1-2)
2022-11-12	22:29:15	-117.05838	11.84222	4172.55	BFC2 (deployed in dive SO295_019ROV03) in view
2022-11-12	22:30:38	-117.05842	11.84224	4173.38	Arrival at MICP1
2022-11-12	22:30:50	-117.05843	11.84224	4173.51	 MICP1 deployed as MICP-1-2 during dive 3 prior to retrieval 20221112_223050_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	22:35:37	-117.05841	11.84224	4174.03	MICP1 retrieved from seafloor
2022-11-12	22:35:45	-117.05840	11.84224	4174	Heading back to Elevator 2
2022-11-12	22:40:33	-117.05823	11.84205	4171.88	Arrival at Elevator 2

2022-11-12	22:45:26	-117.05823	11.84201	4173.42	MICP1 placed on Elevator 2
2022-11-12	22:51:16	-117.05822	11.84194	4173.68	MICP1 secured on Elevator 2
2022-11-12	23:02:18	-117.05821	11.84196	4172.42	Heading west to collect MICP-DEEP1 deployed in dive SO295_019ROV03 (deployment MICP-DEEP1-2)
2022-11-12	23:04:25	-117.05819	11.84190	4172.38	MICP-DEEP1 observed on forward looking sonar
2022-11-12	23:05:00	-117.05822	11.84187	4172.55	Sponge
2022-11-12	23:05:33	-117.05826	11.84186	4172.76	Rattail Fish
2022-11-12	23:06:17	-117.05829	11.84186	4172.95	Fish (rattail; photo not displayed) 20221112_230617_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	23:06:27	-117.05829	11.84186	4172.99	 Fish (rattail) 20221112_230627_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	23:08:22	-117.05849	11.84182	4173.87	BFC3 (deployed in dive SO295_019ROV03) in view
2022-11-12	23:09:47	-117.05857	11.84181	4174.08	LED of MICP-DEEP1 observed
2022-11-12	23:11:48	-117.05874	11.84188	4174.37	MICP-DEEP1 in view
2022-11-12	23:13:28	-117.05897	11.84184	4174.39	 MICP-DEEP1 deployed as MICP-DEEP1-2 in dive 3 prior to retrieval 20221112_231328_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	23:13:40	-117.05897	11.84184	4174.39	MICP-DEEP1 before retrieval (photo not displayed) 20221112_231340_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	23:14:12	-117.05899	11.84186	4174.39	 MICP-DEEP1-2 detail with galatheid crab before retrieval 20221112_231412_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	23:17:59	-117.05900	11.84188	4174.78	MICP-DEEP1 retrieved
2022-11-12	23:19:39	-117.05900	11.84189	4174.12	Moving towards Elevator 2 with MICP-DEEP1 in manipulator gripper
2022-11-12	23:19:53	-117.05899	11.84189	4173.89	Anemone
2022-11-12	23:21:11	-117.05896	11.84187	4173.69	MICP-DEEP1 is held by manipulator gripper on monkey fist
2022-11-12	23:29:39	-117.05819	11.84203	4173.71	MICP-DEEP1 placed at the left side on Elevator 2
2022-11-12	23:31:18	-117.05818	11.84201	4173.57	Issues with entangled monkey fist of MICP-DEEP1
2022-11-12	23:32:34	-117.05811	11.84197	4173.64	MICP-DEEP1 secured on Elevator
2022-11-12	23:42:25	-117.05816	11.84200	None	OFOP Computer from ROV needs restart
2022-11-12	23:43:55	-117.05814	11.84198	1238.02	Next action: retrieval of BFC3 deployed in dive SO295_019ROV03

2022-11-12	23:49:03	-117.05843	11.84186	4173.54	 BFC3 deployed in dive SO295_019ROV03 before retrieval 20221112_234903_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-12	23:54:21	-117.05843	11.84176	4174.8	Disturbed sediments obscure the view of BCF3
2022-11-12	23:55:20	-117.05845	11.84179	4174.8	BFC3 picked up by monkey fist on the side and set on porch (second attempt successful)
2022-11-12	23:58:31	-117.05838	11.84184	4172.85	Moving back to Elevator 2 with BFC3 on porch
2022-11-13	00:04:56	-117.05823	11.84199	4173.62	BFC3 placed on Elevator 2
2022-11-13	00:10:41	-117.05815	11.84200	4173.7	BFC3 secured on Elevator 2
2022-11-13	00:13:26	-117.05815	11.84199	4173.7	Next activity is flying to MICP-DEEP2 to retrieve the instrument after deployment MICP-DEEP2-1
2022-11-13	00:21:47	-117.05802	11.84176	4172.92	 MICP-DEEP2 prior to retrieval 20221113_002147_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-13	00:24:04	-117.05801	11.84177	4171.96	MICP-DEEP2 picked up
2022-11-13	00:24:52	-117.05807	11.84187	4171.81	MICP-DEEP2 to be carried back to Elevator 2
2022-11-13	00:29:59	-117.05811	11.84206	4173.63	MICP-DEEP2 placed on Elevator 2 (second attempt successful)
2022-11-13	00:33:38	-117.05811	11.84202	4173.71	Some confusion regarding waypoints for deployments MICP-DEEP2-1 and MICP-DEEP1-2
2022-11-13	00:47:53	-117.05821	11.84200	4173.83	MICP-DEEP2 secured on Elevator 2 with elastic strap
2022-11-13	00:50:50	-117.05817	11.84199	4172.25	Shrimp
2022-11-13	00:55:12	-117.05835	11.84207	4174.44	BFC1 deployed in dive SO295_019ROV03 in view
2022-11-13	00:55:31	-117.05836	11.84207	4174.48	BFC1 chamber penetrates sediment up to white ring
2022-11-13	00:57:38	-117.05838	11.84215	4172.41	BFC1 retrieved with manipulator gripper by pulling the monkey fist on the side
2022-11-13	00:59:50	-117.05837	11.84213	4173.48	Flying towards BFC2 deployed in dive SO295_019ROV03 with BFC1 still held by manipulator gripper
2022-11-13	01:01:23	-117.05833	11.84217	4173.315	Placing BFC1 on ROV porch
2022-11-13	01:02:56	-117.05830	11.84223	4173.23	BFC2 retrieved
2022-11-13	01:04:39	-117.05856	11.84211	4172.7	Sponge
2022-11-13	01:05:10	-117.05860	11.84210	4173.02	Flying with BFC1 on porch and BFC2 held by gripper away from the position of the ship to make space for lowering of Elevator Recovery System (‘Bergefuchs’)
2022-11-13	01:07:34	-117.05905	11.84183	4174.48	BFC2 and BFC1 temporarily placed on seafloor to be able to manipulate Elevator Recovery System
2022-11-13	01:34:26	-117.05800	11.84206	4167.13	Elevator Recovery System in view
2022-11-13	01:36:43	-117.05792	11.84203	4169.13	Collecting ROV operated shackle from Elevator Recovery System
2022-11-13	01:37:32	-117.05794	11.84205	4169.48	Moving backwards towards Elevator 2
2022-11-13	01:42:08	-117.05817	11.84209	4172.63	ROV operated shackle connected to Elevator 2
2022-11-13	01:54:42	-117.05814	11.84202	4171.7	ROV operated shackle secured
2022-11-13	01:55:10	-117.05814	11.84202	4170.76	Elevator is being pulled up slowly
2022-11-13	01:58:12	-117.05824	11.84200	4169.81	Elevator off the ground
2022-11-13	02:03:05	-117.05889	11.84181	4175.09	Arrival at BFC1&2 ‘dump site’

2022-11-13	02:05:41	-117.05900	11.84176	4175.52	BFC2 picked up and placed on ROV porch
2022-11-13	02:06:40	-117.05902	11.84174	4175.52	BFC2 placed on porch of ROV
2022-11-13	02:09:40	-117.05905	11.84169	4175.25	 BFC1 at site where it was temporarily placed with brittle star in front 20221113_020940_Sonne_SO295_035ROV05_Logo_thumb.jpg
2022-11-13	02:10:46	-117.05908	11.84165	4175.55	BFC1 picked up and placed on ROV porch
2022-11-13	02:14:29	-117.05904	11.84167	4173.64	BFC1 moved into place on the porch
2022-11-13	02:16:09	-117.05908	11.84171	4173.61	BFC1 secured with right manipulator arm
2022-11-13	02:19:01	-117.05902	11.84167	4173.02	End of scientific work
2022-11-13	02:19:24	-117.05901	11.84167	4171.2	OFF THE BOTTOM
2022-11-13	04:35:41	None	None	None	ON DECK

* Shortcomings in underwater navigation that lasted until station SO295_089-1_ROV-11 led to uncertainties in positioning ranging between some tens of meters to >100 m (see also section on underwater navigation in this cruise report). These intrinsic offsets could not be removed by the curation routines applied to navigation raw data (for a description see comment to first dive protocol).

Kiel 6000 Dive 6 (SO295_045-1_ROV-06)

Date: 14.Nov.2022

Principal Investigators: Felix Janssen, Tanja Stratmann

Observers: Devin Vlach, Ricarda Meineke, Brenda Esteban, Lilian Böhringer

Protocol: Devin Vlach

ROV positions (at the bottom)
Start of dive: 11°55.825' N 117°1.585' W
End of dive: 11°55.732N 117°1.543' W

Dive duration:
ROV in the water: 14.Nov.2022 15:16:39
ROV at the bottom: 14.Nov.2022 17:01:31
ROV off the bottom: 15.Nov.2022 00:47:31
ROV on deck: 15.Nov.2022 03:11:39

Explored sites: GER collector impact

Aims of the Dive

- Deployment of PSP sampler
- Deployment of *3 benthic chambers* (BFCs; 2 accomplished)
- Deployment of Electrochemical Microprofiler (MICP2)
- Deployment of Fiberoptical Microprofiler (MICP-DEEP2)
- Deployment of 2 Benthic Incubators (CUBEs)
- *Reposition MICP-DEEP2 at the end of the dive to frame site*
- *Recover MICP2 with ROV*
- Locate FRAMES

Handled ROV Tools (including scientific payload):

- *16 Push Cores (PUCs) in 16 Core Rack*
- *Megafauna sampling tools:*
  Handnets, Scoop, Shovel, Suction Pump
- Magnet stick
- *ICBM Biobox extra large*
- BFC2 (on descent)

Relevant Elevator payload

Elevator 2

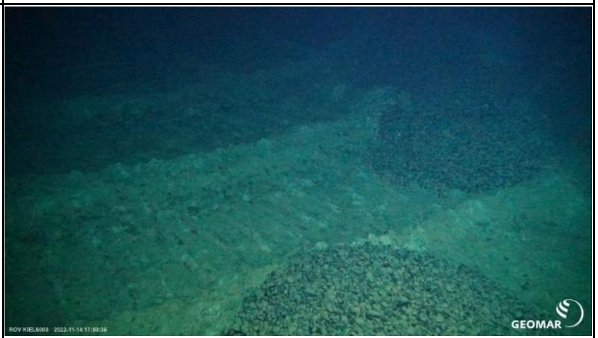
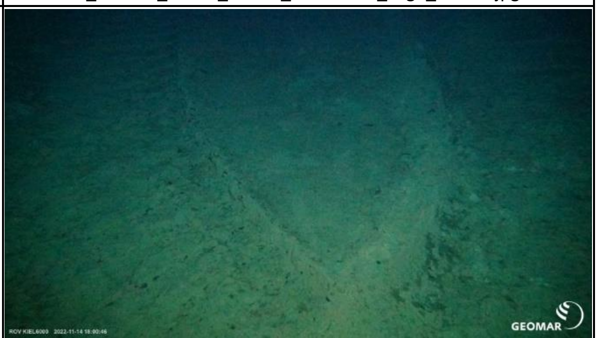
- 2 BFCs (BFC1, *BFC3*)
- MICP2
- MICP-DEEP2
- CUBE2, CUBE3
- PSP in quiver

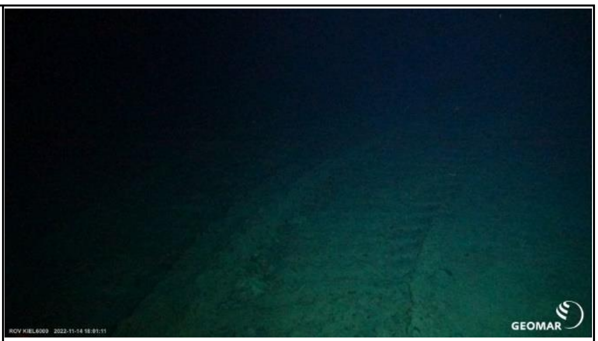
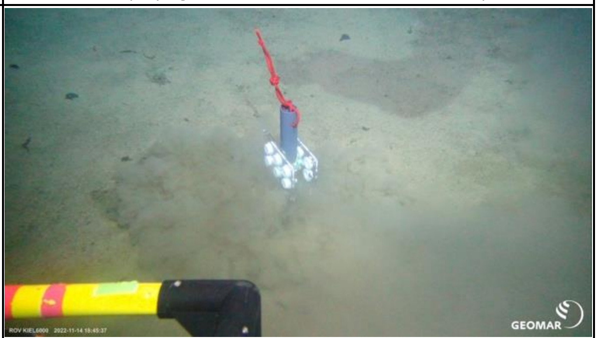
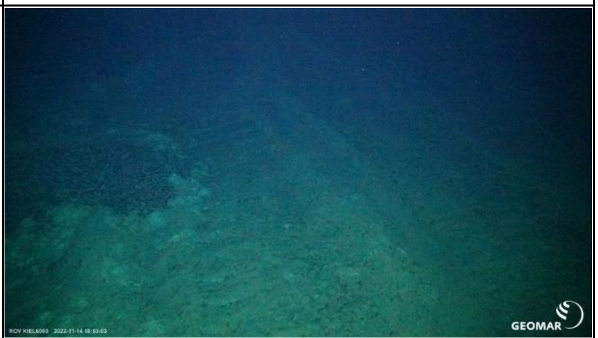
- *4 Blade corers*

Dive summary

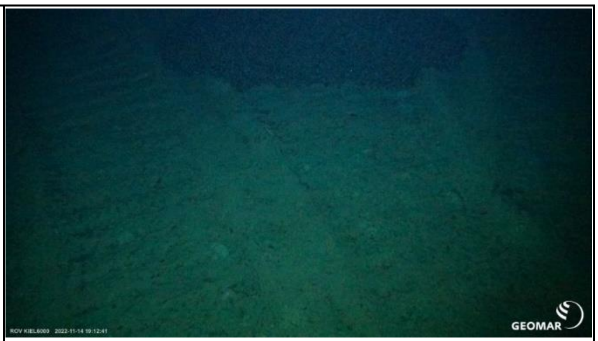
The ROV guided Elevator 2 to the seafloor to a position at the northern line of nodule piles. After deploying the PSP near Elevator 2 the exact position of the Elevator was identified by traveling to the western end of the northern line of nodule piles while logging the distance and counting piles. Returning to Elevator 2, BFC2 was deployed nearby from the porch. In the following, instruments were collected one after the other from Elevator 2 and deployed between caterpillar tracks: MICP-DEEP2, CUBE2, CUBE3, and BFC1. As the last instrument, MICP2 was collected from Elevator 2 and the ROV went searching for FRAMEs near the southern line of piles. After locating the FRAMES in preparation for the next dive, MICP2 was deployed in the vicinity.

Date	UTC Time	SUB1_Lon*	SUB1_Lat*	SUB1_Depth	Observations/Comments / Image
2022-11-14	15:16:39	None	None	None	IN THE WATER
2022-11-14	17:01:31	-117.02641	11.93041	4113.21	AT THE BOTTOM
2022-11-14	17:11:06	-117.02622	11.93024	4118.67	Heading Southeast towards Position where Elevator 2 is hanging on the ship's cable, no nodule pile in sight
2022-11-14	17:40:32	-117.02569	11.92973	4119.18	Taking ROV sonar image of northern line of nodule piles and PATANIA tracks to compare with AUV imaging to determine lateral position (comparison turns out later to be impossible during the dive)
2022-11-14	17:43:10	-117.02574	11.92972	4119.19	ROV travelling Southwest to keep free of Elevator 2
2022-11-14	17:48:28	-117.02624	11.92935	4119.46	Taking second sonar screenshot (about 55m west of previous sonar screenshot)
2022-11-14	17:55:09	-117.02622	11.92927	4119.54	Nodule pile in view
2022-11-14	17:55:20	-117.02622	11.92927	4119.56	 Nodule pile with animal tracks 20221114_175520_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	17:55:30	-117.02622	11.92926	4119.57	Nodule pile (photo not displayed) 20221114_175530_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	17:55:49	-117.02623	11.92925	4119.57	 Nodule pile (photo not displayed) 20221114_175549_Sonne_SO295_045ROV06_Logo_thumb.jpg

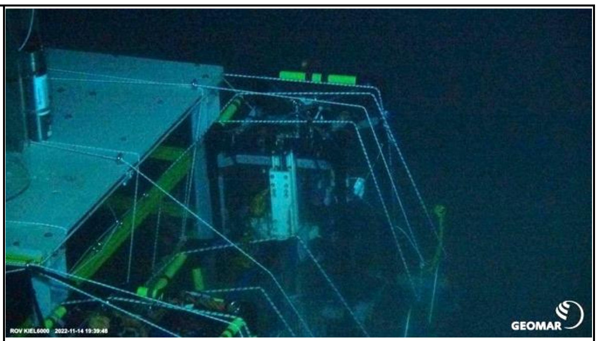
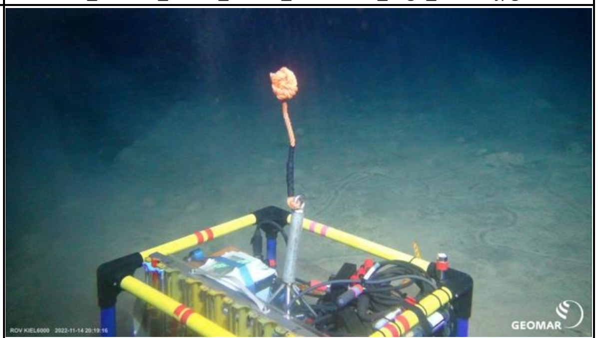
2022-11-14	17:57:24	-117.02658	11.92927	4119.58	 Sea urchin track near nodule pile 20221114_175724_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	17:57:43	-117.02679	11.92929	4119.58	Sea urchin track near nodule pile (photo not displayed) 20221114_175743_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	17:59:36	-117.02623	11.92921	4119.57	 Nodule pile and PATANIA tracks 20221114_175936_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	17:59:54	-117.02623	11.92921	4119.55	Nodule pile and tracks (photo not displayed) 20221114_175954_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:00:10	-117.02624	11.92920	4119.54	Nodule pile and PATANIA tracks (photo not displayed) 20221114_180010_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:00:35	-117.02624	11.92919	4119.56	Nodule pile and PATANIA tracks (photo not displayed) 20221114_180035_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:00:46	-117.02625	11.92919	4119.57	 Nodule pile and PATANIA tracks 20221114_180046_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:00:59	-117.02624	11.92918	4119.58	 PATANIA tracks 20221114_180059_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:01:01	-117.02624	11.92917	4119.58	ROV traveling south

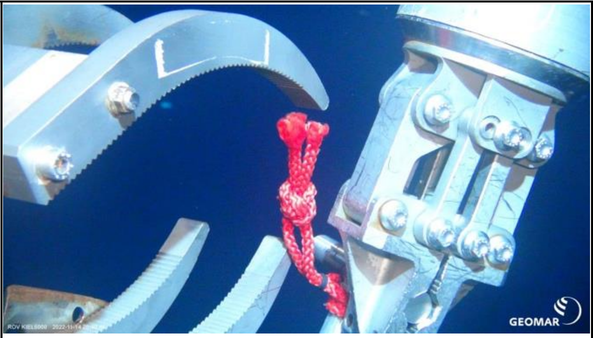
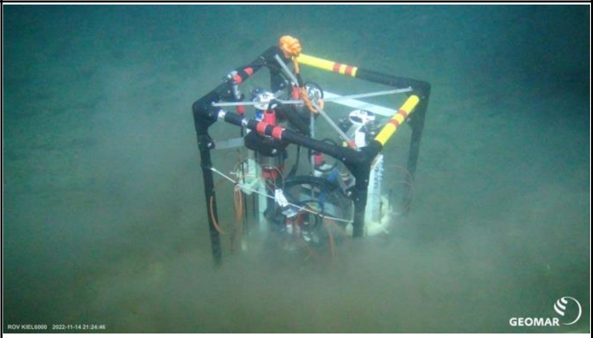
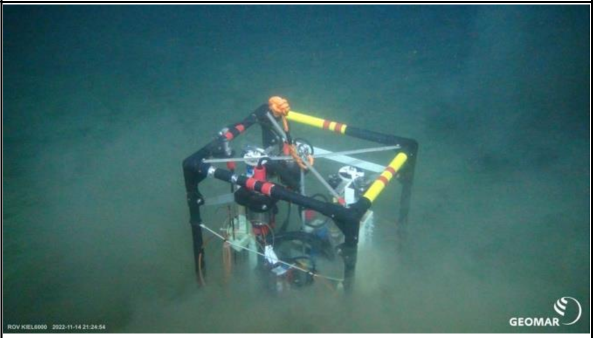
2022-11-14	18:01:11	-117.02623	11.92916	4119.59	 PATANIA tracks 20221114_180111_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:01:20	-117.02623	11.92913	4119.6	PATANIA tracks (photo not displayed) 20221114_180120_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:02:22	-117.02624	11.92910	4118.82	ROV travelling towards Elevator 2
2022-11-14	18:14:30	-117.02610	11.92919	4099.73	Elevator 2 appears in ROV sonar
2022-11-14	18:15:22	-117.02608	11.92921	4099.75	Elevator 2 in view
2022-11-14	18:19:25	-117.02603	11.92921	4104.41	Putting down elevator ‘blindly’ near the northern line of nodule piles, position will be determined later
2022-11-14	18:22:04	-117.02598	11.92922	4115.96	Fish (grenadier)
2022-11-14	18:23:54	-117.02592	11.92922	4117.66	Elevator 2 touches bottom
2022-11-14	18:25:30	-117.02589	11.92918	4118.82	Elevator 2 sinks down in sediment to lower level of payload
2022-11-14	18:26:38	-117.02599	11.92919	4119.04	ROV preparing to unhook elevator
2022-11-14	18:27:56	-117.02586	11.92916	4119.47	Fish (grenadier)
2022-11-14	18:29:32	-117.02589	11.92919	4119.42	Elevator 2 unhooked
2022-11-14	18:30:02	-117.02590	11.92919	4118.68	ROV operated shackle is returning to the ship
2022-11-14	18:33:54	-117.02596	11.92924	4117.08	Elevator 2 USBL position is moving, exact location of Elevator 2 questionable
2022-11-14	18:36:49	-117.02597	11.92926	4117.08	Assuming ROV position is around nodule pile N20 in the northern line
2022-11-14	18:38:02	-117.02597	11.92926	4117.79	Preparing deployment of Passive Trace Metal Sampler (PSP)
2022-11-14	18:45:25	-117.02599	11.92929	4120.89	Next action: deploying PSP north of norther line of nodule piles
2022-11-14	18:45:37	-117.02599	11.92929	4120.99	 Passive Trace Metal Sampler (PSP) on sediment 20221114_184537_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:45:37	-117.02599	11.92929	4120.99	PSP sampler deployed
2022-11-14	18:52:49	-117.02640	11.92919	4118.7	Moving along the northern line of piles to the west to figure out where on the northern line we are
2022-11-14	18:53:03	-117.02641	11.92919	4118.81	 PATANIA track 20221114_185303_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:54:16	-117.02643	11.92916	4118.88	Assuming we are quite east on the northern track

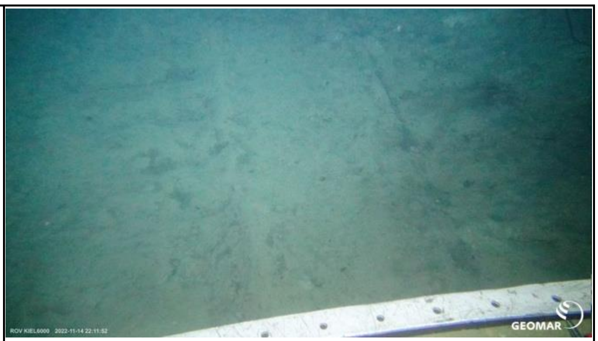
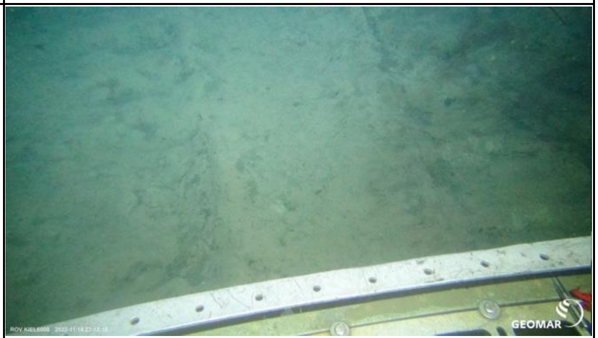
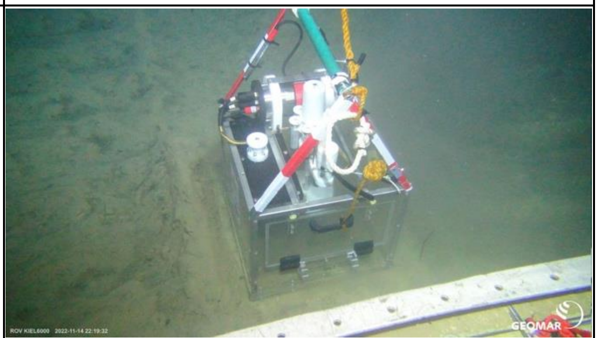
2022-11-14	18:54:17	-117.02643	11.92916	4118.88	PATANIA track (photo not displayed) 20221114_185417_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:58:54	-117.02694	11.92920	4118.29	ROV transiting to the end of the track and then examining distance travelled for analysis
2022-11-14	18:58:57	-117.02696	11.92920	4118.29	 PATANIA tracks 20221114_185857_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:59:08	-117.02702	11.92919	4118.31	 Nodule pile and PATANIA tracks 20221114_185908_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:59:22	-117.02705	11.92918	4118.33	PATANIA tracks (photo not displayed) 20221114_185922_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	18:59:43	-117.02707	11.92917	4118.35	 Nodule pile 20221114_185943_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:01:40	-117.02726	11.92922	4118.35	Looking for the western end pattern of the northern line of nodules (in sonar and visually)
2022-11-14	19:11:39	-117.02833	11.92921	4118.77	 PATANIA tracks 20221114_191139_Sonne_SO295_045ROV06_Logo_thumb.jpg

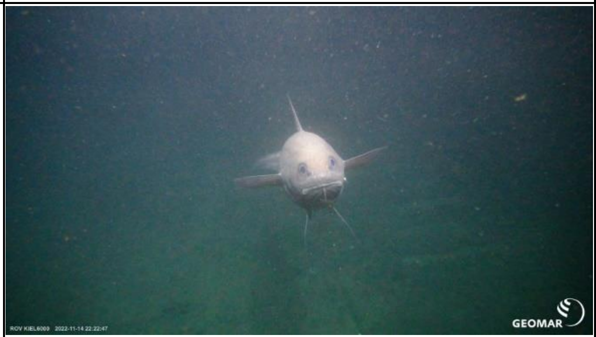
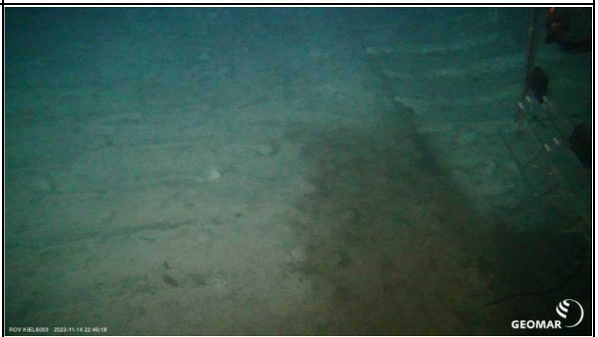
2022-11-14	19:12:41	-117.02841	11.92918	4118.87	 PATANIA tracks and nodule pile 20221114_191241_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:12:43	-117.02841	11.92918	4118.87	PATANIA tracks and nodule pile (photo not displayed) 20221114_191243_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:12:58	-117.02846	11.92917	4118.88	Nodule pile and PATANIA tracks (photo not displayed) 20221114_191258_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:13:02	-117.02847	11.92917	4118.89	 Nodule pile 20221114_191302_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:13:06	-117.02847	11.92917	4118.89	Nodule pile (photo not displayed) 20221114_191306_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:13:56	-117.02850	11.92919	4118.88	 Nodule pile and PATANIA tracks 20221114_191356_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:13:56	-117.02850	11.92919	4118.88	Stopping to take a sonar image of the last piles
2022-11-14	19:20:54	-117.02842	11.92918	4118.71	Starting to make way back to elevator anlong the northern line of nodule piles
2022-11-14	19:23:31	-117.02776	11.92921	4118.54	 Nodule piles and PATANIA tracks 20221114_192331_Sonne_SO295_045ROV06_Logo_thumb.jpg

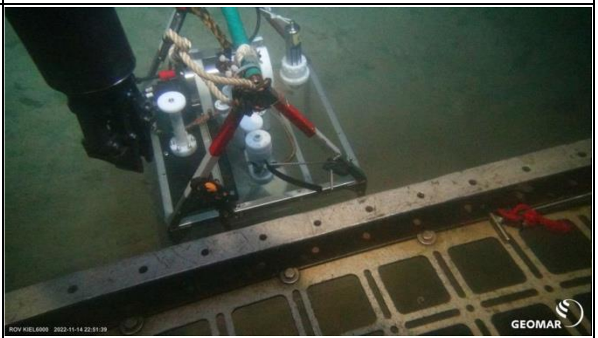
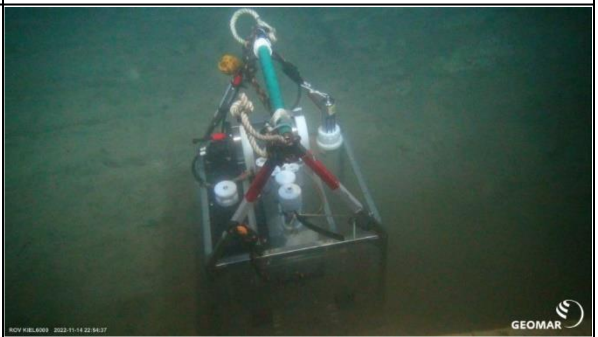
2022-11-14	19:24:53	-117.02762	11.92918	4118.39	 Nodule piles and PATANIA tracks 20221114_192453_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:24:55	-117.02761	11.92918	4118.39	Nodule piles and PATANIA tracks (photo not displayed) 20221114_192455_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:25:05	-117.02750	11.92919	4118.37	 Nodule piles and PATANIA tracks 20221114_192505_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:25:31	-117.02741	11.92921	4118.32	Nodule piles and PATANIA tracks (photo not displayed) 20221114_192531_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:27:20	-117.02711	11.92922	4118.16	 Nodule piles and PATANIA tracks 20221114_192720_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:27:23	-117.02709	11.92922	4118.16	Nodule piles and PATANIA tracks (photo not displayed) 20221114_192723_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:28:57	-117.02686	11.92921	4118.27	PATANIA tracks (photo not displayed) 20221114_192857_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:29:40	-117.02672	11.92919	4118.3	 PATANIA tracks 20221114_192940_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:36:01	-117.02606	11.92917	4118.53	Elevator 2 in view

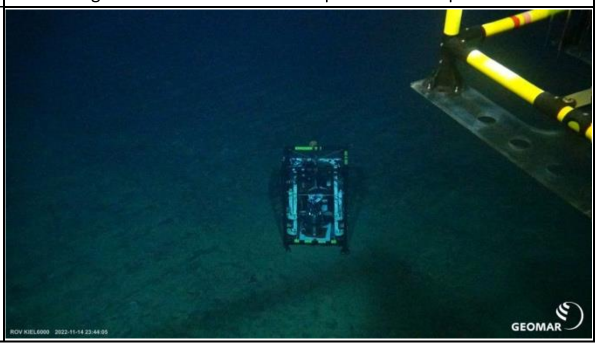
2022-11-14	19:39:48	-117.02590	11.92912	4118.61	 BFC1 and MICP-DEEP2 on elevator 20221114_193948_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	19:42:51	-117.02600	11.92918	4118.61	Next Action: deploying Benthic Flux Chamber (BFC2) to the right of elevator
2022-11-14	19:52:33	-117.02644	11.92884	4120.1	Looking for a spot between caterpillar tracks to deploy BFC
2022-11-14	19:53:14	-117.02643	11.92883	4120.09	Taking BFC2 from the ROV porch
2022-11-14	19:55:12	-117.02643	11.92882	4120.05	Waiting for better visibilty, lots of particles in the water column
2022-11-14	19:55:51	-117.02643	11.92884	4119.89	ROV experiencing thruster faults
2022-11-14	19:59:03	-117.02644	11.92882	4119	ROV repositioning to get a better view
2022-11-14	20:05:40	-117.02651	11.92877	4121.43	Poor visibility while landing the ROV
2022-11-14	20:06:22	-117.02654	11.92878	4121.95	Big particle cloud, even ROV porch not visible
2022-11-14	20:13:03	-117.02653	11.92876	4122.01	Confirmed deployment site for BFC2 on the left edge of the stretch between caterpillar tracks
2022-11-14	20:15:08	-117.02647	11.92874	4122.01	BFC2 started with magnet, deployment BFC2
2022-11-14	20:15:08	-117.02647	11.92874	4122.01	White ring on chamber approx. 3cm above the sediment surface, on the left site the green ring under the white ring is slightly visible
2022-11-14	20:18:58	-117.02646	11.92877	4120	 BFC2 20221114_201858_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	20:19:16	-117.02646	11.92877	4120	 BFC2 deployment site 20221114_201916_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	20:26:02	-117.02648	11.92878	4118.79	ROV heading towards Elevator 2
2022-11-14	20:36:53	-117.02607	11.92910	4118.29	Trying to attach the Magnet Stick on the gripper of the left manipulator (RigMaster) arm, passing it with the next gear to activate the gear bevor deployment in order to avoid extra movement and risking bad sight again

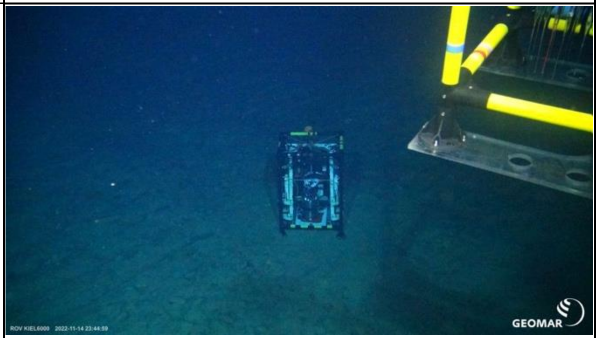
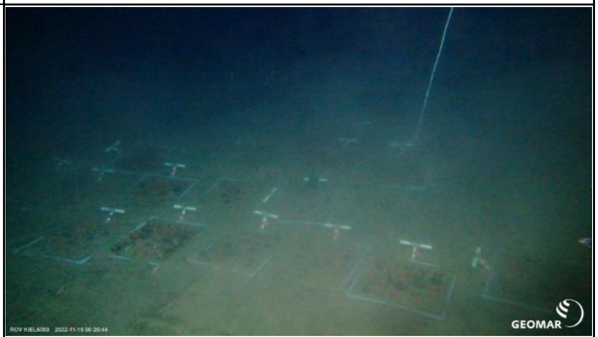
2022-11-14	20:40:46	-117.02606	11.92909	4118.27	 ROV attempting to position Magnet Stick on gripper of RigMaster 20221114_204046_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	20:41:36	-117.02605	11.92908	4118.28	Magnet Stick attached to gripper of RigMaster
2022-11-14	20:44:58	-117.02606	11.92908	4118.26	Readjusting Magnet Stick
2022-11-14	20:47:30	-117.02607	11.92909	4118.27	Magnet Stick finally secured on gripper of RigMaster
2022-11-14	20:48:00	-117.02608	11.92911	4118.28	ROV continuing towards Elevator 2
2022-11-14	20:49:13	-117.02602	11.92910	4118.24	Next Action: taking MICP-DEEP2 off Elevator 2
2022-11-14	20:58:14	-117.02592	11.92922	4120.63	Releasing MICP-DEEP2 from Elevator 2
2022-11-14	21:09:40	-117.02590	11.92920	4120.43	MICP-DEEP2 collected from Elevator 2
2022-11-14	21:10:13	-117.02591	11.92919	4119.62	Trying to activate MICP-DEEP2 with the Magnet Stick on the RigMaster
2022-11-14	21:10:27	-117.02591	11.92919	4119.27	Fish
2022-11-14	21:11:06	-117.02591	11.92918	4118.52	ROV transiting west
2022-11-14	21:19:47	-117.02607	11.92889	4119.67	Searching for get a spot at the stretch between caterpillar tracks to deploy MICP-DEEP2
2022-11-14	21:21:21	-117.02607	11.92895	4119.58	MICP-DEEP started successfully, gear wheels are turning
2022-11-14	21:24:46	-117.02610	11.92894	4120.91	 MICP-DEEP2 at seafloor 20221114_212446_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	21:24:54	-117.02610	11.92893	4120.86	 MICP-DEEP2 at seafloor 20221114_212454_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	21:25:02	-117.02610	11.92893	4120.76	Deployment MICP-DEEP2-1
2022-11-14	21:25:17	-117.02610	11.92893	4120.43	Next action: returning to Elevator 2 to collect CUBES for deployment
2022-11-14	21:49:26	-117.02595	11.92925	4119.99	CUBE2 picked up from Elevator
2022-11-14	22:01:50	-117.02591	11.92923	4119.2	Light is on
2022-11-14	22:08:24	-117.02577	11.92907	4119.95	Selecting site to place CUBE2
2022-11-14	22:08:57	-117.02576	11.92908	4120.45	CUBE2 deployment site (photo not displayed) 20221114_220857_Sonne_SO295_045ROV06_Logo_thumb.jpg

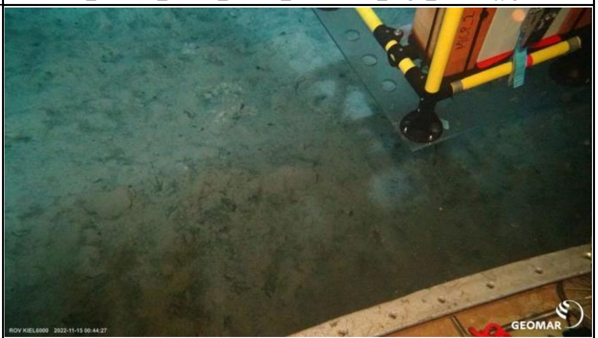
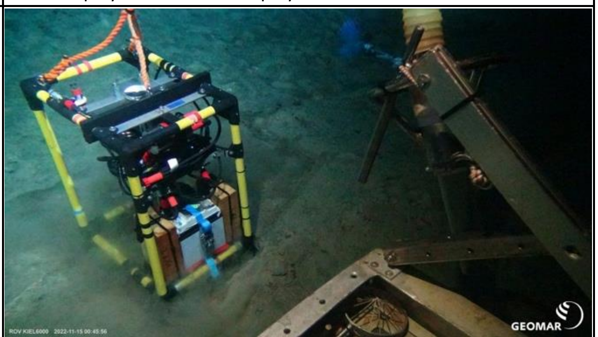
2022-11-14	22:11:52	-117.02577	11.92905	4120.44	 CUBE2 deployment site 20221114_221152_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:12:01	-117.02576	11.92904	4120.49	CUBE2 deployment site (photo not displayed) 20221114_221201_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:12:10	-117.02575	11.92905	4120.54	 CUBE2 deployment site 20221114_221210_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:14:31	-117.02577	11.92909	4120.8	CUBE2 deployed
2022-11-14	22:16:48	-117.02578	11.92908	4120.78	CUBE2 started
2022-11-14	22:17:35	-117.02578	11.92908	4120.77	Fish
2022-11-14	22:19:32	-117.02575	11.92908	4120.81	 CUBE2 right after deployment 20221114_221932_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:19:48	-117.02574	11.92908	4120.81	 CUBE2 right after deployment (close up) 20221114_221948_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:20:13	-117.02575	11.92908	4120.81	Returning to Elevator 2

2022-11-14	22:22:35	-117.02573	11.92909	4120.08	 Grenadier fish and CUBE2 20221114_222235_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:22:47	-117.02574	11.92909	4120	 Fish (grenadier) 20221114_222247_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:34:34	-117.02590	11.92922	4120.25	CUBE3 collected from Elevator 2, searching for deployment site
2022-11-14	22:46:18	-117.02582	11.92888	4121	 CUBE3 deployment site 20221114_224618_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:46:38	-117.02582	11.92887	4121	 CUBE3 deployment site 20221114_224638_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:47:57	-117.02575	11.92888	4120.98	CUBE 3 deployed at the seafloor

2022-11-14	22:49:35	-117.02576	11.92889	4120.99	 CUBE3 right after deployment (close up) 20221114_224935_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:51:39	-117.02577	11.92890	4120.94	 CUBE3 right after deployment (close up) 20221114_225139_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	22:51:54	-117.02577	11.92890	4120.93	CUBE3 started
2022-11-14	22:53:42	-117.02581	11.92888	4120.97	Water bag punched
2022-11-14	22:54:37	-117.02580	11.92888	4120.96	 CUBE3 after starting the program 20221114_225437_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	23:03:00	-117.02583	11.92907	4119.51	Next action: collect BFC1 from Elevator 2 for deployment
2022-11-14	23:09:55	-117.02588	11.92918	4120.14	BFC1 collected from Elevator 2
2022-11-14	23:12:40	-117.02590	11.92917	4119.57	BFC1 put back on Elevator 2 to turn by gripping the side monkey fist
2022-11-14	23:13:19	-117.02590	11.92917	4119.56	BFC1 will be started while hanging on the gripper of the right manipulator (ORION)
2022-11-14	23:13:41	-117.02591	11.92917	4119.55	Magnet Stick is still hanging from gripper of left manipulator (RigMaster)
2022-11-14	23:15:26	-117.02591	11.92917	4119.56	BFC1 started
2022-11-14	23:19:12	-117.02587	11.92914	4119.57	The first track line to the right of Elevator 2 will be pursued to find a spot to deploy BFC1
2022-11-14	23:20:59	-117.02582	11.92903	4119.82	BFC1 will be placed in stretch between caterpillar tracks

2022-11-14	23:22:07	-117.02582	11.92899	4119.88	 First site selected for BFC1 deployment 20221114_232207_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	23:24:30	-117.02583	11.92897	4120.47	Lots of sediment resuspended even though BFC1 is not yet touching the seafloor
2022-11-14	23:25:46	-117.02586	11.92894	4120.56	Second site selected for BFC1 deployment (photo not displayed) 20221114_232546_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	23:25:55	-117.02585	11.92894	4120.58	 Second site selected for BFC1 deployment 20221114_232555_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	23:28:22	-117.02584	11.92892	4120.97	BFC1 deployed on stretch between caterpillar tracks, deployment BFC1
2022-11-14	23:28:34	-117.02584	11.92892	4120.98	 BFC1 on stretch between caterpillar tracks 20221114_232834_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	23:32:23	-117.02583	11.92903	4118.94	Next action: collect MIPC2 from Elevator 2 and carry it towards the site where the Recolonization Frames (FRAMES) have been deployed during SO268
2022-11-14	23:39:42	-117.02595	11.92922	4120.53	Elastic straps removed from MICP2
2022-11-14	23:40:31	-117.02600	11.92922	4120.18	MICP2 collected from Elevator 2
2022-11-14	23:41:53	-117.02597	11.92915	4118.51	Taking a turn at Elevator 2 towards direction 190/200° to arrive at southern line of piles in the west of nodule frames
2022-11-14	23:43:19	-117.02601	11.92910	4118.53	Transecting from Elevator 2 towards expected FRAME position
2022-11-14	23:44:05	-117.02602	11.92899	4118.58	

					Passing by MICP-DEEP2 (deployed earlier) 20221114_234405_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	23:44:43	-117.02611	11.92896	4118.6	MICP-DEEP2 (photo not displayed) 20221114_234443_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	23:44:59	-117.02616	11.92899	4118.6	 MICP-DEEP2 20221114_234459_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-14	23:46:00	-117.02630	11.92894	4118.77	Transect continues with MICP2 held with right manipulator arm (ORION)
2022-11-14	23:47:10	-117.02625	11.92866	4119.17	Boxcorer footprint in seafloor(?)
2022-11-14	23:47:15	-117.02625	11.92865	4119.18	Fish
2022-11-14	23:47:37	-117.02628	11.92862	4119.18	Reached southern line nodule piles
2022-11-14	23:48:02	-117.02629	11.92861	4119.17	Turn left to follow southern nodule line to find FRAMES
2022-11-14	23:48:48	-117.02627	11.92859	4119.17	Traveling towards east
2022-11-15	00:06:04	-117.02510	11.92861	4119.95	Continue search further east
2022-11-15	00:10:00	-117.02476	11.92850	4120.13	Reaching end of PATANIA tracks
2022-11-15	00:23:33	-117.02578	11.92863	4119.56	Marker from frames in view
2022-11-15	00:25:11	-117.02584	11.92860	4119.87	Arriving at frames
2022-11-15	00:26:30	-117.02585	11.92857	4120.86	FRAMES deployed during SO268 (photo not displayed) 20221115_002630_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-15	00:26:44	-117.02585	11.92857	4120.9	 FRAMES deployed during SO268 20221115_002644_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-15	00:27:39	-117.02582	11.92863	4120.93	 FRAMES (close up) 20221115_002739_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-15	00:29:13	-117.02582	11.92863	4120.95	FRAMES (photo not displayed) 20221115_002913_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-15	00:39:17	-117.02567	11.92888	4119.41	MICP2 deployment site (photo not displayed) 20221115_003917_Sonne_SO295_045ROV06_Logo_thumb.jpg

2022-11-15	00:39:23	-117.02567	11.92887	4119.44	 MICP2 deployment site 20221115_003923_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-15	00:39:40	-117.02567	11.92887	4119.53	Site selected for MICP2 deployment
2022-11-15	00:42:53	-117.02571	11.92885	4119.83	MICP2 started with Magnet Stick hanging from RigMaster gripper
2022-11-15	00:43:40	-117.02570	11.92888	4120.16	 MICP2 deployment site 20221115_004340_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-15	00:43:48	-117.02569	11.92888	4120.2	MICP2 deployment site (photo not displayed) 20221115_004348_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-15	00:44:27	-117.02569	11.92887	4120.45	 MICP2 deployment site 20221115_004427_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-15	00:45:40	-117.02573	11.92887	4120.82	MICP2 deployed at seafloor: deployment MICP2-1
2022-11-15	00:45:56	-117.02574	11.92888	4120.84	 MICP2 deployed at seafloor, last Action of the scientific program 20221115_004556_Sonne_SO295_045ROV06_Logo_thumb.jpg
2022-11-15	00:47:31	-117.02571	11.92886	4118.28	OFF THE BOTTOM
2022-11-15	03:11:39	None	None	None	ON DECK

* Shortcomings in underwater navigation that lasted until station SO295_089-1_ROV-11 led to uncertainties in positioning ranging between some tens of meters to >100 m (see also section on

underwater navigation in this cruise report). These intrinsic offsets could not be removed by the curation routines applied to navigation raw data (for a description see comment to first dive protocol). Positioning at the target disturbance structures (e.g., in collector tracks) was ensured visually.

Kiel 6000 Dive 7 (SO295_061-1_ROV-07)

Date: 18.Nov.2022

Principal Investigators: Felix Janssen, Tanja Stratmann

Observers: Duygu Sevilgen, Carsten Rühlemann, Lilian Böringer, Devin Vlach

Protocol: Felix Janssen

ROV positions (at the bottom)
Start of dive: 11°55.697' N 117°1.552' W
End of dive: 11°55.727' N 117°1.534' W

Dive duration:

ROV in the water:	17.Nov.2022	17:07:50
ROV at the bottom:	17.Nov.2022	18:38:34
ROV off the bottom:	18.Nov.2022	01:46:28
ROV on deck:	18.Nov.2022	03:33:28

Explored sites: GER collector impact

Aims of the Dive:

- Deployment of Fiberoptical Microsensor Profiler (MICP-DEEP1) from porch
- Repositioning of MICP-DEEP2
- Deployment of Benthic Flux Chamber (BFC3)
- Recovery of Passive Trace Metal Sampler (PSP)
- Recovery of Benthic Incubator (CUBEs)
  with Push Core (PUC) & Blade Corer sampling
- Recovery of BFC1 & 2, MICP-DEEP2, Electrochemical Microsensor Profiler (MICP2)
- Recovery of Elevator 2
- *Repositioning of MICP-DEEP1*

Handled ROV Tools (including scientific payload):

- 16 Push Cores in 16 Core Rack
- *Megafauna sampling tools:*
  Handnets, Scoop, Shovel, Suction Pump
- ICBM Biobox extra large
- MICP-DEEP1 (on descent)
- BFC2 (on ascent)

Relevant Elevator payload

Elevator 2

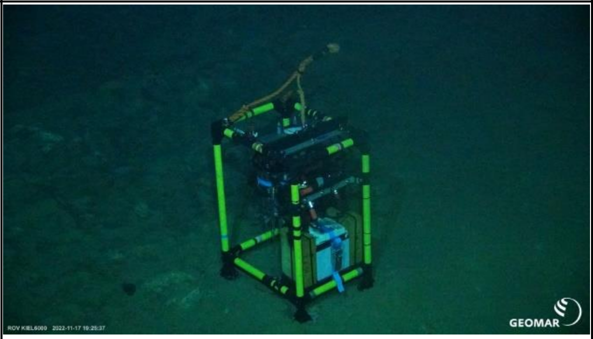
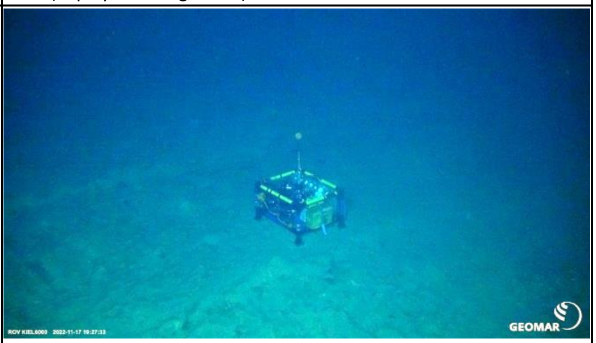
- BFC1 & *BFC2 (BFC2 recovered on porch)*
- MICP2
- MICP-DEEP2

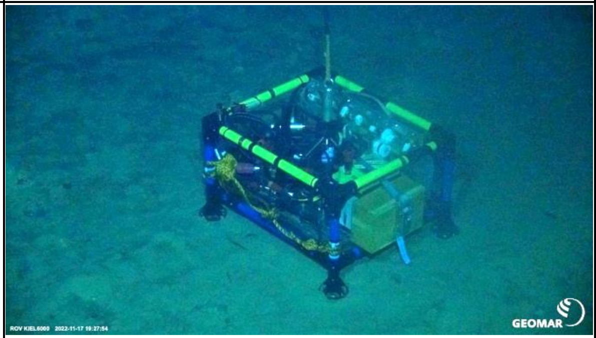
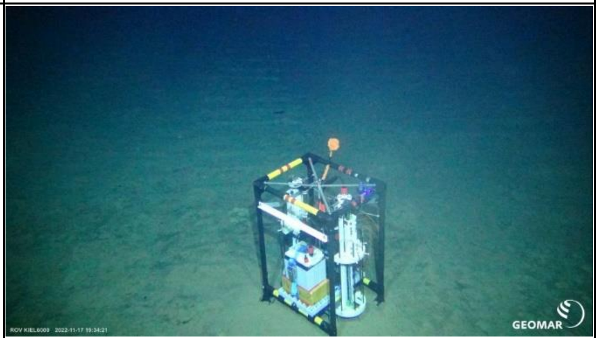
- CUBE2 & CUBE3
- PSP in quiver
- 4 Blade Corers in their boxes

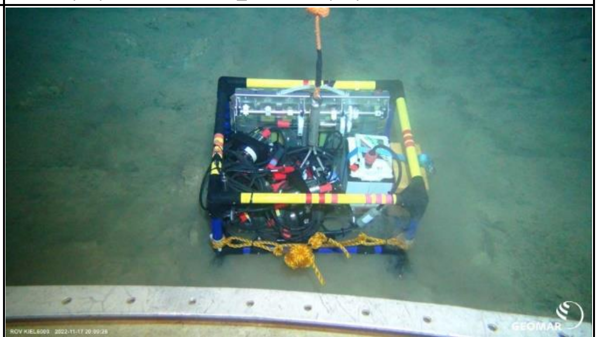
Dive summary

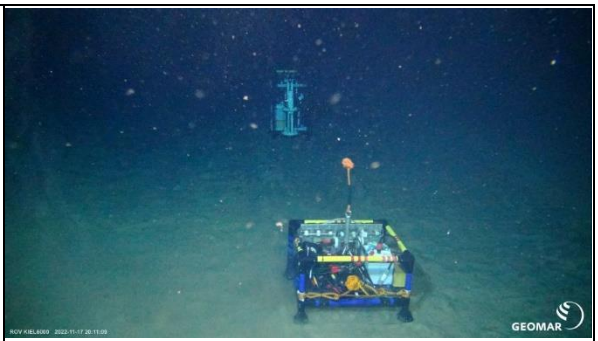
The ROV descended with MICP-DEEP1 on the porch. After successfully locating the FRAMEs, MICP-DEEP1 was deployed on the stretch between caterpillar tracks. MICP-DEEP2 deployed as MICP-DEEP2-1 during dive 6 was relocated and restarted. BFC3 was collected from Elevator 2 and deployed between caterpillar tracks as well. The PSP that was deployed during dive 6 was recovered and put back into its quiver on Elevator 2. CUBE2 and CUBE3, also deployed in dive 6, were recovered, their footprints were sampled with three PUCs and a Blade Corer each, and the CUBEs were placed and secured on Elevator 2. As background samples, additional PUCs and an additional Blade Corer were taken between caterpillar tracks. BFC1, MICP2, and MICP-DEEP2 were recovered and secured on Elevator 2. Elevator 2 was connected to the recovery frame for retrieval by the ship. Finally, BFC2 was retrieved and secured on the ROV porch after which the ROV ascended.

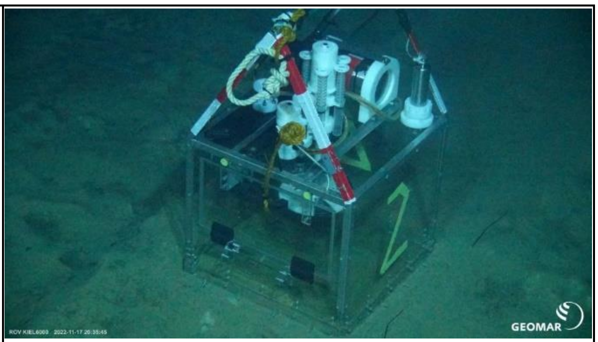
Date	UTC Time	SUB1_Lon*	SUB1_Lat*	SUB1_Depth	Observations/Comments / Image
2022-11-17	17:07:50	None	None	None	IN THE WATER
2022-11-17	18:38:34	-117.02587	11.92829	4111.62	AT THE BOTTOM
2022-11-17	18:51:36	-117.02504	11.92838	4119.85	Flying along the Southern nodule line to the East to find FRAMES and check position
2022-11-17	18:51:48	-117.02503	11.92838	4119.88	FRAMES spotted in sonar
2022-11-17	18:52:47	-117.02496	11.92837	4119.93	FRAMES in vision
2022-11-17	18:53:53	-117.02497	11.92835	4119.92	Next action: fly south out of track and then find a clear turn of a PATANIA tracks leading into collector impact area, so conjugate caterpillar tracks and the stretch in between can be clearly recognized, then follow it to find spot for deployment
2022-11-17	18:54:51	-117.02496	11.92832	4119.49	Searching for a spot to deploy MICP_DEEP1
2022-11-17	19:00:28	-117.02485	11.92855	4118.95	MICP2 in view(MICP2-1 deployed in dive 6)
2022-11-17	19:01:17	-117.02485	11.92856	4118.98	Next action: staying in the same track, start MICP-DEEP1 on the porch and then place it next to MICP2
2022-11-17	19:02:47	-117.02479	11.92855	4118.96	Looking at MICP2 now it is not sure if it was really positioned between conjugate caterpillar tracks for deployment MICP2-1 or between neighboring PATANIA tracks
2022-11-17	19:05:04	-117.02484	11.92856	4118.93	MICP-DEEP1 taken off porch
2022-11-17	19:08:10	-117.02480	11.92856	4119	MICP-DEEP1 switch touched with Magnet stick
2022-11-17	19:08:47	-117.02477	11.92856	4119.02	MICP-DEEP1 started (gear wheels of both stages turning)
2022-11-17	19:11:07	-117.02478	11.92850	4119.12	Moving into another track east of MICP2
2022-11-17	19:15:34	-117.02475	11.92860	4120.78	 Deployment spot for MICP-DEEP1 20221117_191534_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:15:40	-117.02475	11.92860	4120.88	Upper HD is fogged, taking pictures nonetheless
2022-11-17	19:16:06	-117.02472	11.92862	4121.15	Deployment spot for MICP-DEEP1 (photo not displayed) 20221117_191606_Sonne_SO295_061ROV07_Logo_thumb.jpg

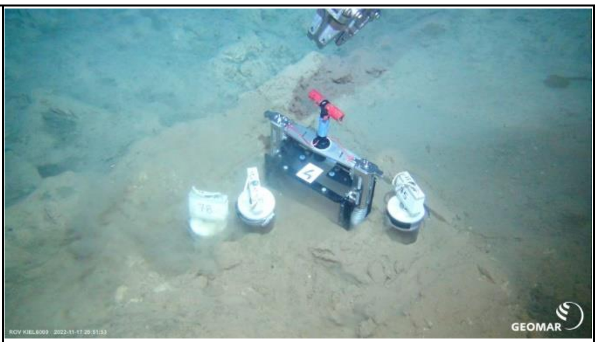
2022-11-17	19:18:07	-117.02480	11.92863	4121.16	MICP-DEEP1 deployment assuming that this is the stretch cleared of nodules between two conjugate caterpillar tracks
2022-11-17	19:18:26	-117.02480	11.92863	4121.17	MICP-DEEP1 deployed at seafloor: deployment MICP-DEEP1-1
2022-11-17	19:20:55	-117.02470	11.92860	4121.21	 MICP-DEEP1 deployed between two caterpillar tracks 20221117_192055_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:25:16	-117.02476	11.92869	4120.07	MICP2 deployed during dive 6 (‘MICP2-1’; photo not displayed) 20221117_192516_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:25:28	-117.02476	11.92869	4120.06	MICP2 (deployment MICP2-1 during dive 6) in view
2022-11-17	19:25:32	-117.02476	11.92869	4120.06	MICP2 deployed during dive 6 (‘MICP2-1’; photo not displayed) 20221117_192532_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:25:37	-117.02476	11.92868	4120.06	 MICP2-1 deployed during dive 6 (deployment MICP2-1) 20221117_192537_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:26:45	-117.02487	11.92865	4119.98	 CUBE3 (deployed during dive 6) 20221117_192645_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:27:08	-117.02490	11.92867	4119.96	CUBE3 deployed during dive 6 in view
2022-11-17	19:27:16	-117.02491	11.92868	4119.95	Sea cucumber
2022-11-17	19:27:24	-117.02491	11.92868	4119.96	BFC1 (deployed during dive 6) in view
2022-11-17	19:27:33	-117.02492	11.92868	4119.96	 BFC1 (deployed during dive 6) 20221117_192733_Sonne_SO295_061ROV07_Logo_thumb.jpg

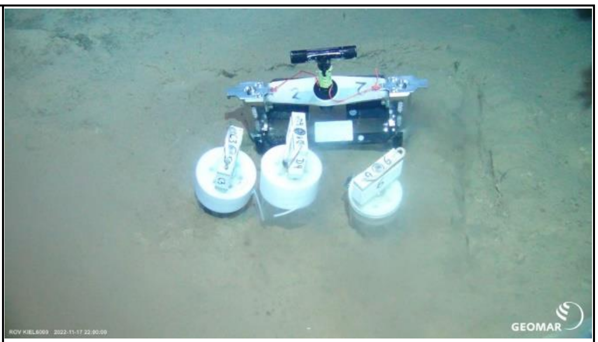
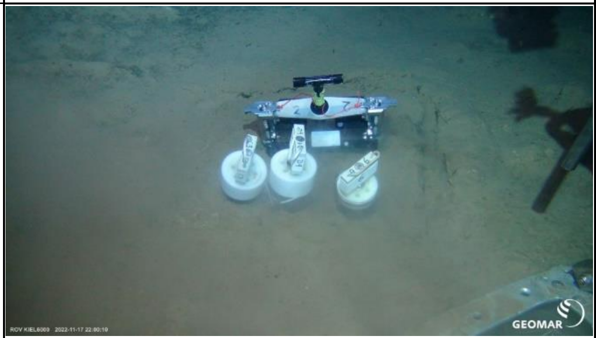
2022-11-17	19:27:35	-117.02492	11.92869	4119.96	BFC1 does not blink
2022-11-17	19:27:54	-117.02493	11.92869	4119.98	 BFC1 (deployed during dive 6) 20221117_192754_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:29:20	-117.02501	11.92863	4119.83	MICP-DEEP2 in view
2022-11-17	19:34:21	-117.02513	11.92869	4120.5	 MICP-DEEP2 deployed as MICP-DEEP2-1 during dive 6 20221117_193421_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:36:15	-117.02518	11.92868	4120.8	MICP-DEEP2 blinking (program deployment MICP-DEEP2-1 finished)
2022-11-17	19:36:52	-117.02518	11.92869	4120.73	MICP-DEEP2-1 collected from sediment for redeployment
2022-11-17	19:38:20	-117.02517	11.92868	4120.69	Moving with MICP-DEEP2 to next tracks
2022-11-17	19:38:30	-117.02518	11.92868	4120.69	Brittle star
2022-11-17	19:39:10	-117.02523	11.92867	4120.68	New stretch between caterpillar tracks selected for redeployment of MICP-DEEP2
2022-11-17	19:39:25	-117.02524	11.92867	4120.68	 MICP-DEEP2 deployment site 20221117_193925_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:39:37	-117.02524	11.92868	4120.69	 MICP-DEEP2 deployment site 20221117_193937_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:39:44	-117.02524	11.92868	4120.69	MICP-DEEP2 deployment site (photo not displayed) 20221117_193944_Sonne_SO295_061ROV07_Logo_thumb.jpg

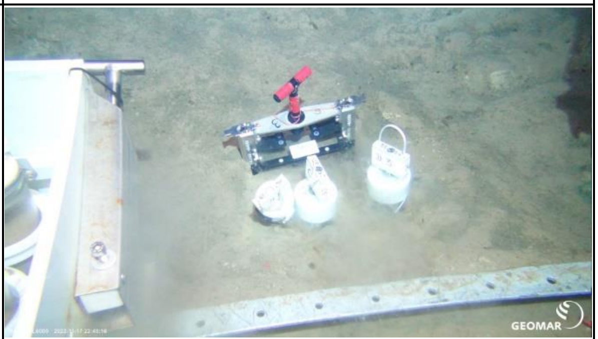
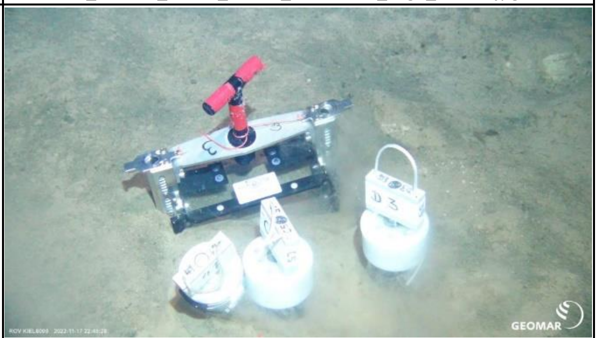
2022-11-17	19:41:41	-117.02523	11.92869	4120.87	MICP-DEEP2 started before setting down with Magnet Stick handing from gripper of manipulator (RigMaster)
2022-11-17	19:42:41	-117.02523	11.92869	4121.15	MICP-DEEP2 deployed: deployment MICP-DEEP2-2
2022-11-17	19:43:00	-117.02523	11.92869	4121.19	 MICP-DEEP2 at seafloor (deployment MICP-DEEP2-2) 20221117_194300_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	19:43:17	-117.02523	11.92869	4121.21	Gear wheel of stage 1 is turning
2022-11-17	19:45:25	-117.02523	11.92871	4121.21	Flying to elevator now to get BFC3 and deploy next to MICP-DEEP2
2022-11-17	19:47:39	-117.02511	11.92882	4119.72	Elevator in view
2022-11-17	19:55:09	-117.02501	11.92897	4120.42	BFC3 collected from elevator, blinking (waiting for program start)
2022-11-17	20:01:32	-117.02506	11.92878	4118.89	BFC3 started before deployment by Magnet Stick hanging from RigMaster gripper
2022-11-17	20:08:36	-117.02525	11.92874	4120.84	 BFC3 deployment site 20221117_200836_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:09:05	-117.02524	11.92876	4120.98	BFC3 deployed next to MICP_DEEP2, deployment BFC3
2022-11-17	20:09:26	-117.02522	11.92876	4121.01	 BFC3 right after deployment 20221117_200926_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:11:01	-117.02520	11.92876	4121.05	BFC3 and MICP-DEEP2 (photo not displayed) 20221117_201101_Sonne_SO295_061ROV07_Logo_thumb.jpg

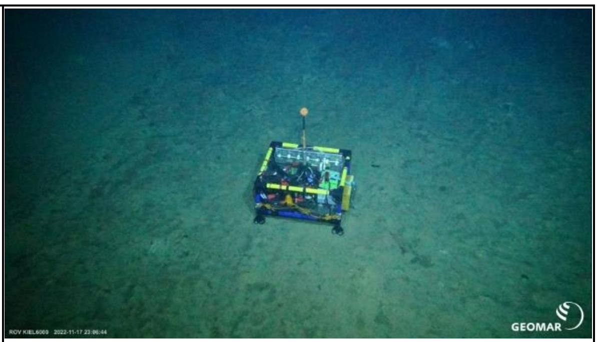
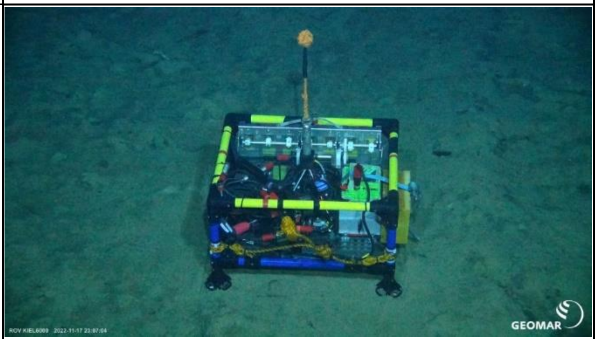
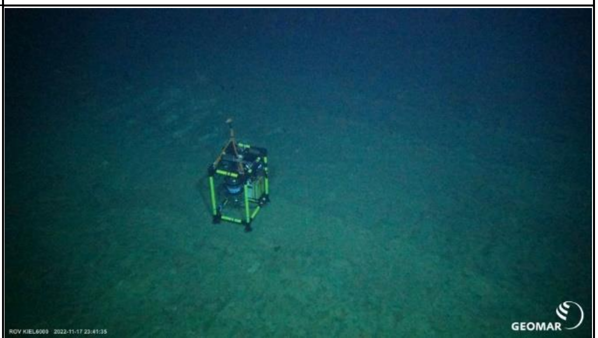
2022-11-17	20:11:09	-117.02520	11.92876	4121.05	 BFC3 and MICP-DEEP2 20221117_201109_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:12:31	-117.02502	11.92880	4121.05	White ring of BFC3 chamber almost not visible anymore, blue ring above visible
2022-11-17	20:14:29	-117.02499	11.92882	4120.07	Next Action: heading towards PSP
2022-11-17	20:20:01	-117.02486	11.92909	4120.25	 PSP deployed during dive 6 20221117_202001_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:21:32	-117.02486	11.92910	4120.1	PSP retrieved
2022-11-17	20:24:21	-117.02477	11.92902	4119.8	PSP positioned in quiver on Elevator 2
2022-11-17	20:30:44	-117.02481	11.92900	4120.64	Collecting Blade Corer 1 from Elevator 2
2022-11-17	20:32:37	-117.02475	11.92903	4119.42	Fish
2022-11-17	20:33:21	-117.02474	11.92898	4119.46	Flying towards CUBE2
2022-11-17	20:33:56	-117.02472	11.92896	4119.61	CUBE2 in view
2022-11-17	20:34:28	-117.02469	11.92895	4119.82	CUBE2, deployed during dive 6 (photo not displayed) 20221117_203428_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:34:39	-117.02467	11.92894	4119.88	CUBE2, deployed during dive 6 (photo not displayed) 20221117_203439_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:34:41	-117.02466	11.92894	4119.89	CUBE2 stirrer turning
2022-11-17	20:35:22	-117.02461	11.92892	4120.08	CUBE2, deployed during dive 6 (photo not displayed) 20221117_203522_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:35:40	-117.02460	11.92891	4120.25	 CUBE2, deployed during dive 6 (detail) 20221117_203540_Sonne_SO295_061ROV07_Logo_thumb.jpg

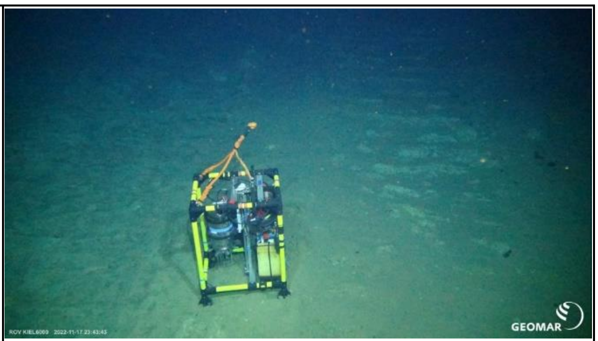
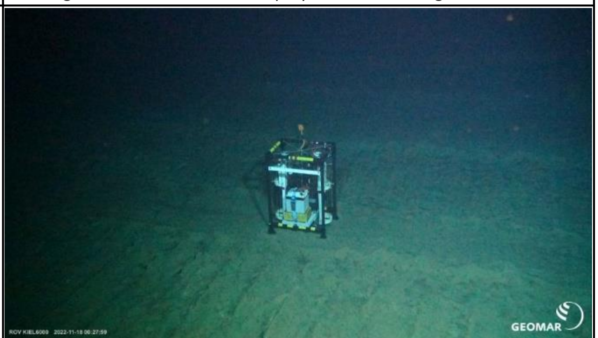
2022-11-17	20:35:45	-117.02459	11.92891	4120.3	 CUBE2 right before retrieval 20221117_203545_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:36:05	-117.02459	11.92891	4120.54	 CUBE2 right before retrieval 20221117_203605_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:37:20	-117.02458	11.92896	4121.69	ROV landing
2022-11-17	20:37:32	-117.02459	11.92896	4121.82	Waiting for sediment plume to settle
2022-11-17	20:39:03	-117.02462	11.92894	4121.97	Door of CUBE2 opened
2022-11-17	20:40:04	-117.02461	11.92891	4121.98	CUBE2 lifted from the seafloor
2022-11-17	20:41:25	-117.02459	11.92889	4122.01	CUBE2 set to side, waiting for plume to settle
2022-11-17	20:41:41	-117.02460	11.92888	4122	 CUBE2 footprint 20221117_204141_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:41:43	-117.02460	11.92888	4122	Photo Taken
2022-11-17	20:41:45	-117.02460	11.92888	4122	Start of sampling of CUBE2 footprint with Blade Corer and PUCs from 16 Core Rack
2022-11-17	20:46:09	-117.02461	11.92890	4122	Blade Corer1 deployed
2022-11-17	20:47:43	-117.02462	11.92892	4122.03	PUC67 deployed
2022-11-17	20:50:28	-117.02462	11.92889	4122.03	PUC75 deployed
2022-11-17	20:51:46	-117.02462	11.92892	4122.05	PUC78 deployed

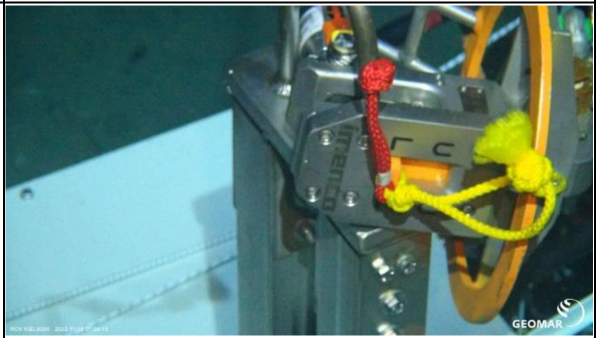
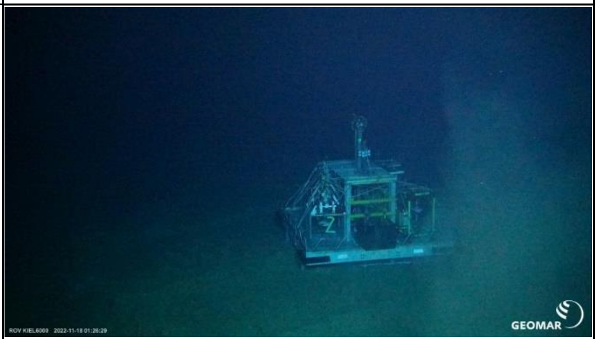
2022-11-17	20:51:53	-117.02462	11.92892	4122.05	 Blade Corer and PUCs on CUBE2 footprint 20221117_205153_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	20:52:32	-117.02462	11.92891	4122.04	Blade Corer2 triggered
2022-11-17	20:56:05	-117.02460	11.92892	4122.03	All PUCs collected
2022-11-17	21:02:32	-117.02465	11.92891	4121.24	Blade corer1 recovered
2022-11-17	21:03:07	-117.02466	11.92892	4120.4	Returning to Elevator 2
2022-11-17	21:09:22	-117.02481	11.92899	4120.91	Blade Corer1 deposited in box
2022-11-17	21:17:12	-117.02474	11.92905	4121.06	CUBE2 fastened on elevator and secured with extra elastic strap
2022-11-17	21:36:47	-117.02481	11.92902	4120.98	Collect Blade Corer2 from Elevator
2022-11-17	21:39:15	-117.02480	11.92900	4119.96	Heading towards CUBE3
2022-11-17	21:41:12	-117.02471	11.92880	4120.19	Approaching CUBE3
2022-11-17	21:42:41	-117.02468	11.92880	4120.24	 CUBE3 deployed during dive 6 20221117_214241_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	21:43:16	-117.02465	11.92880	4120.2	 CUBE3 deployed during dive 6 20221117_214316_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	21:43:17	-117.02465	11.92880	4120.2	Start of sampling of CUBE3 footprint with Blade Corer and PUCs from 16 Core Rack
2022-11-17	21:52:39	-117.02465	11.92873	4122.21	Blade Corer2 placed, picked up with sediment, cleaned
2022-11-17	21:53:16	-117.02464	11.92873	4122.21	Blade Corer2 deployed in CUBE3 footprint
2022-11-17	21:55:19	-117.02462	11.92875	4122.22	PUCC3 deployed
2022-11-17	21:57:46	-117.02463	11.92872	4122.21	PUCD4 deployed directly beside PUCC3
2022-11-17	21:59:34	-117.02461	11.92875	4122.23	PUC6 deployed directly beside PUC D4

2022-11-17	22:00:00	-117.02461	11.92877	4122.23	 Blade Corer and PUCs on CUBE2 footprint 20221117_220000_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	22:00:10	-117.02462	11.92878	4122.23	 Blade Corer and PUCs on CUBE2 footprint 20221117_220010_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	22:02:21	-117.02466	11.92874	4122.22	Blade Corer2 triggered
2022-11-17	22:03:46	-117.02465	11.92876	4122.24	PUC6 retrieved
2022-11-17	22:05:16	-117.02465	11.92873	4122.25	PUCD4 retrieved
2022-11-17	22:06:37	-117.02464	11.92872	4122.24	PUCC3 retrieved
2022-11-17	22:08:40	-117.02460	11.92876	4122.23	CUBE3 collected
2022-11-17	22:09:20	-117.02462	11.92874	4122.23	Blade Corer2 pulled out of sediment
2022-11-17	22:15:06	-117.02470	11.92893	4119.65	Approaching Elevator 2
2022-11-17	22:19:16	-117.02476	11.92903	4120.81	Blade Corer2 deposited in box on Elevator 2
2022-11-17	22:23:39	-117.02475	11.92904	4120.87	CUBE3 placed on elevator
2022-11-17	22:27:26	-117.02476	11.92905	4121.14	CUBE3 secured with elastic strap
2022-11-17	22:33:46	-117.02474	11.92900	4120.81	Collecting Blade Corer3 from Elevator 2
2022-11-17	22:38:35	-117.02471	11.92894	4120.05	Next Action: Blade Corer3 deployment in between caterpillar tracks for control sampling
2022-11-17	22:39:58	-117.02467	11.92888	4120.5	 Site selected for control sampling 20221117_223958_Sonne_SO295_061ROV07_Logo_thumb.jpg

2022-11-17	22:40:11	-117.02466	11.92888	4120.54	 Site selected for control sampling 20221117_224011_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	22:40:25	-117.02465	11.92889	4120.65	ROV landing, start of control sampling with Blade Corer and PUCs from 16 Core Rack
2022-11-17	22:43:07	-117.02467	11.92889	4121.96	Blade Corer 3 deployed in between two caterpillar tracks
2022-11-17	22:44:09	-117.02466	11.92888	4121.98	Blade Corer3 triggered
2022-11-17	22:45:51	-117.02467	11.92890	4121.99	Shrimp
2022-11-17	22:46:16	-117.02467	11.92890	4121.99	PUCD3 deployed next to blade corer
2022-11-17	22:47:05	-117.02466	11.92891	4121.99	PUCC5 deployed next to blade corer and PUCD3
2022-11-17	22:47:50	-117.02466	11.92890	4122	PUC41 deployed next to other PUCs and blade corer
2022-11-17	22:48:16	-117.02466	11.92890	4122	 Blade Corer3 and PUCs deployed on stretch between caterpillar tracks 20221117_224816_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	22:48:28	-117.02465	11.92890	4122	 Blade Corer3 and PUCs (detail) 20221117_224828_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	22:48:56	-117.02465	11.92890	4122	Retrieving PUCs back into 16 Core Rack
2022-11-17	22:49:08	-117.02465	11.92890	4122	PUC41 retrieved
2022-11-17	22:49:54	-117.02465	11.92890	4122.01	PUCC5 retrieved
2022-11-17	22:50:43	-117.02469	11.92889	4122	PUCD3 retrieved
2022-11-17	22:51:56	-117.02469	11.92889	4122	Blade Corer3 retrieved
2022-11-17	22:58:49	-117.02475	11.92903	4120.76	Blade Corer3 deposited in box 3 on Elevator 2
2022-11-17	23:02:03	-117.02475	11.92901	4118.66	Next Action: Heading towards BFC1 (direction 170°)
2022-11-17	23:04:59	-117.02461	11.92875	4118.79	Sea cucumber

2022-11-17	23:06:44	-117.02466	11.92872	4119.76	 BFC1 deployed during dive 6 20221117_230644_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	23:07:04	-117.02467	11.92873	4120.13	 BFC1 deployed during dive 6 20221117_230704_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	23:10:58	-117.02467	11.92876	4121.7	Chamber of BFC1 inserted into sediment to the level of the white line
2022-11-17	23:13:37	-117.02465	11.92874	4121.39	BFC1 collected from seafloor
2022-11-17	23:14:35	-117.02467	11.92872	4119.46	BFC1 carried to Elevator 2 hanging from the manipulator gripper, stirrer is working
2022-11-17	23:21:32	-117.02471	11.92903	4120.27	BFC1 is placed in the middle of the payload section of Elevator 2 on the opposite side of the CUBES (too little space at the original place next to CUBES)
2022-11-17	23:24:49	-117.02475	11.92904	4120.72	BFC1 placed on Elevator 2 and pushed gently closer further inside
2022-11-17	23:36:31	-117.02454	11.93014	4120.96	BFC1 secured on Elevator 2 with elastic straps on two screws
2022-11-17	23:38:03	-117.02454	11.93013	4119.17	Next action: picking up MICP2
2022-11-17	23:38:15	-117.02454	11.93012	4118.86	Heading towards MICP2 (direction 145°, 40 m from elevator) to collect instrument
2022-11-17	23:39:52	-117.02454	11.93012	4118.75	Sea cucumber
2022-11-17	23:40:22	-117.02454	11.93013	4118.78	MICP2 in view
2022-11-17	23:41:35	-117.02456	11.93013	4118.89	 MICP2 (deployment MICP2-1) prior to retrieval 20221117_234135_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	23:41:47	-117.02456	11.93013	4118.91	MICP2 (photo not displayed) 20221117_234147_Sonne_SO295_061ROV07_Logo_thumb.jpg

2022-11-17	23:43:43	-117.02453	11.93010	4119.96	 MICP2 (deployment MICP2-1) prior to retrieval 20221117_234343_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	23:44:05	-117.02452	11.93009	4120.31	MICP2 (photo not displayed) 20221117_234405_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	23:45:24	-117.02451	11.93008	4120.87	LED of MICP2 is flashing (deployment MICP2-1 is completed)
2022-11-17	23:46:20	-117.02450	11.93008	4120.94	USBL underwater navigation (Posidonia) seems to be off: MICP2-1 position seems to be too close to the ship
2022-11-17	23:47:32	-117.02449	11.93006	4120.58	MICP2 retrieved
2022-11-17	23:48:24	-117.02451	11.93005	4119.94	Moving with MICP2 along the tracks towards Elevator 2
2022-11-17	23:48:40	-117.02451	11.93004	4119.89	 Collector tracks (MICP2 in foreground) 20221117_234840_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-17	23:55:26	-117.02456	11.93008	4120.73	MICP2 placed on Elevator 2 at the left side of BFC1
2022-11-18	00:13:08	-117.02451	11.93006	4121	MICP2 secured with elastic strap on two screws
2022-11-18	00:16:42	-117.02449	11.93004	4120.89	POSIDONIA of ROV moved back the usual off set
2022-11-18	00:17:42	-117.02451	11.93004	4120.91	After USBL underwater navigation (Posidonia) seemed to improve, position jumped again very close to the ship
2022-11-18	00:20:11	-117.02447	11.93008	4120.91	Heading towards MICP-DEEP2 deployed earlier during this dive
2022-11-18	00:27:59	-117.02494	11.92877	4119.94	 MICP-DEEP2 (deployment MICP-DEEP2-2) prior to retrieval 20221118_002759_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-18	00:28:03	-117.02494	11.92877	4119.96	MICP-DEEP2 (photo not displayed) 20221118_002803_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-18	00:29:38	-117.02494	11.92876	4120.43	MICP-DEEP2 is blinking (deployment MICP-DEEP2-2 completed)
2022-11-18	00:51:08	-117.02471	11.92902	4119.39	OFOP crashed and had to be restarted, recovery of MIPC-DEEP2 missing from notes
2022-11-18	00:56:14	-117.02480	11.92896	4117.65	Elevator Recovery System ('Bergefuchs') is lowered towards the seafloor
2022-11-18	01:03:34	-117.02451	11.92893	4109.85	Heading towards recovery frame
2022-11-18	01:09:31	-117.02434	11.92884	4100.91	Light on recovery frame not working
2022-11-18	01:10:34	-117.02434	11.92884	4100.85	Recovery frame in view
2022-11-18	01:11:34	-117.02433	11.92885	4100.95	ROV arriving at recovery frame

2022-11-18	01:14:36	-117.02427	11.92885	4113.36	ROV approaching ROV operated shackle
2022-11-18	01:16:16	-117.02427	11.92880	4113.87	ROV gripper has hold of hook
2022-11-18	01:17:58	-117.02429	11.92888	4114.91	Moving back towards Elevator 2
2022-11-18	01:21:27	-117.02485	11.92902	4115.59	Elevator 2 in view
2022-11-18	01:23:57	-117.02475	11.92903	4119.14	ROV operated shackle attached to Elevator 2
2022-11-18	01:24:13	-117.02475	11.92904	4119.17	 ROV operated shackle secured on Elevator 2 20221118_012413_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-18	01:24:30	-117.02475	11.92904	4119.19	Backing up from Elevator 2
2022-11-18	01:26:29	-117.02482	11.92904	4119.06	 Elevator 2 right before lift-off 20221118_012629_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-18	01:29:33	-117.02486	11.92904	4119.01	 Elevator 2 lift off 20221118_012933_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-18	01:29:39	-117.02486	11.92904	4119.01	Elevator 2 off the bottom, Next Action: collecting BFC2
2022-11-18	01:33:32	-117.02496	11.92889	4119.91	BFC 3 in view while approaching BFC2
2022-11-18	01:38:01	-117.02523	11.92865	4120.28	BFC 2 in view
2022-11-18	01:38:32	-117.02524	11.92865	4120.46	Checking BFC2 penetration depth and sampler (photo not displayed) 20221118_013832_Sonne_SO295_061ROV07_Logo_thumb.jpg

2022-11-18	01:39:03	-117.02526	11.92865	4120.49	 Checking BFC2 penetration depth and sampler status 20221118_013903_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-18	01:39:29	-117.02525	11.92864	4120.47	White ring seems flush with sediment and all samples are taken
2022-11-18	01:40:28	-117.02523	11.92864	4120.5	BFC2 shortly before retrieval (photo not displayed) 20221118_014028_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-18	01:40:32	-117.02524	11.92864	4120.51	 BFC2 shortly before retrieval 20221118_014032_Sonne_SO295_061ROV07_Logo_thumb.jpg
2022-11-18	01:43:10	-117.02530	11.92861	4120.21	LED on BFC 2 blinking (deployment completed)
2022-11-18	01:46:20	-117.02556	11.92879	4115.57	BFC2 secured with manipulators on porch, BFC2 stirrer is working
2022-11-18	01:46:28	-117.02557	11.92879	4113.8	OFF THE BOTTOM
2022-11-18	03:33:28	-117.02586	11.92945	1.43553719	ON DECK

* Shortcomings in underwater navigation that lasted until station SO295_089-1_ROV-11 led to uncertainties in positioning ranging between some tens of meters to >100 m (see also section on underwater navigation in this cruise report). These intrinsic offsets could not be removed by the curation routines applied to navigation raw data (for a description see comment to first dive protocol). Positioning at the target disturbance structures (e.g., in collector tracks) was ensured visually.

Kiel 6000 Dive 8 (SO295_068-1_ROV-08)

Date: 18.Nov.2022

Principal Investigators: Sabine Gollner, Sahar Khodami, Patricia Esquete, Felix Janssen

Observers: Duygu Sevilgen, Lilian Böhringer, Amber Henningsen

Protocol: Lilian Böhringer

ROV positions (at the bottom)
Start of dive: 11°55.750' N 117°1.533' W
End of dive: 11°55.836' N 117°1.548' W

Dive duration:
ROV in the water: 18.Nov.2022 16:25:25
ROV at the bottom: 18.Nov.2022 18:02:56
ROV off the bottom: 18.Nov.2022 23:38:19
ROV on deck: 19.Nov.2022 01:37:52

Explored sites: GER collector impact and plume impact (thick cover)

Aims of the Dive

- Deployment of Elevator 1 near Recolonization Frames (FRAMEs)
- Deployment of Electrochemical Microsensor Profiler (MICP1) from Elevator 1
- Repositioning Fiberoptical Microsensor Profiler (MICP-DEEP1)
- Pushcore (PUC) sampling in collector impact area (8+8 PUCs)
- Megafauna sampling in the plume impact area (thick cover)
- *Recovery of BFC3 on porch*

Handled ROV Tools (including scientific payload):

- 16 Push Cores (PUCs) in 16 Core Rack
- 2 Magnet Sticks
- ICBM Biobox extra large
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump

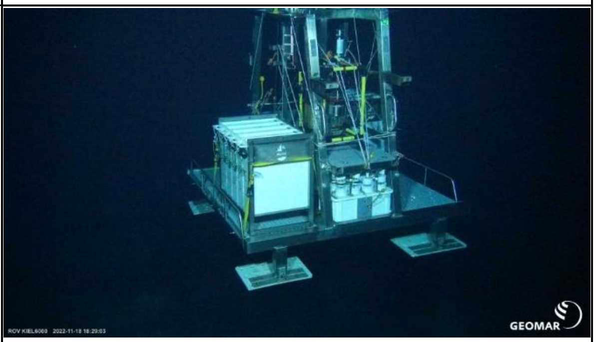
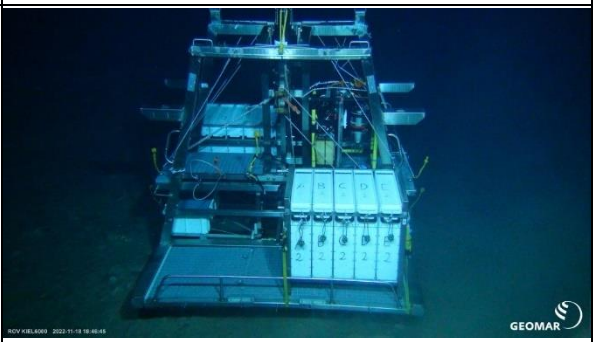
Relevant Elevator payload

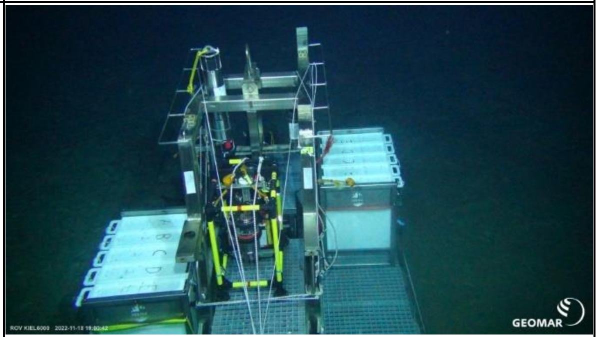
Elevator 1

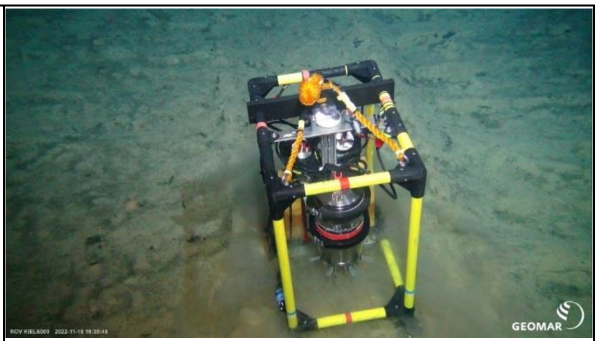
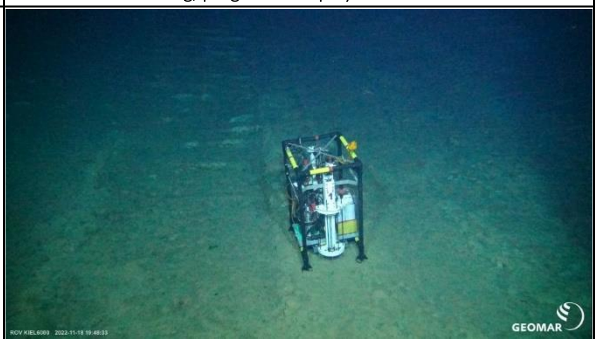
- *12 PUCs in 2 Core Sixpacks*
- MICP1
- *2 FRAME boxes*
- *2 Amphipod traps*
- *Posidonia transponder (for calibration of Posidonia antenna of SONNE)*

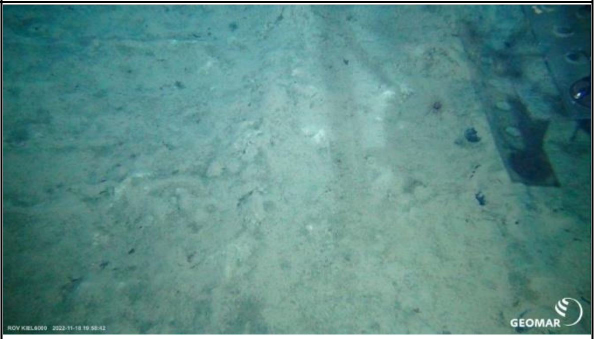
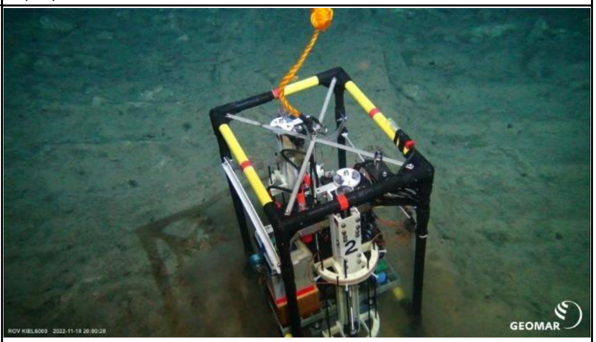
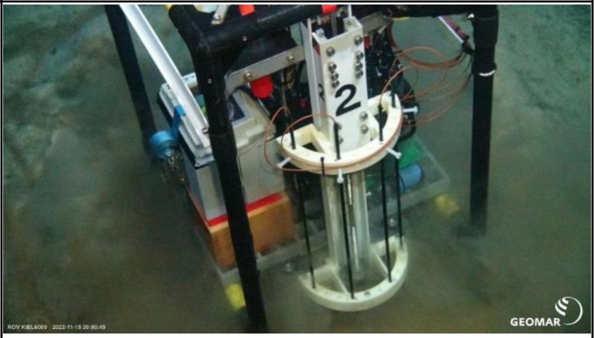
Dive summary

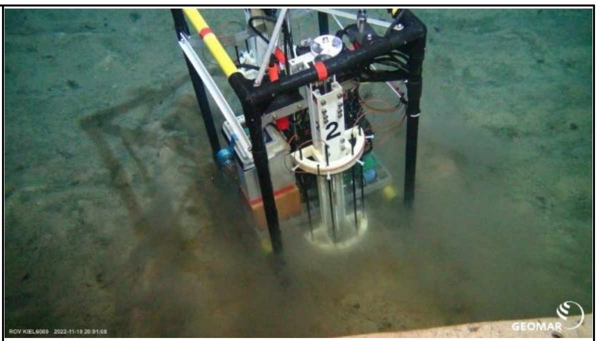
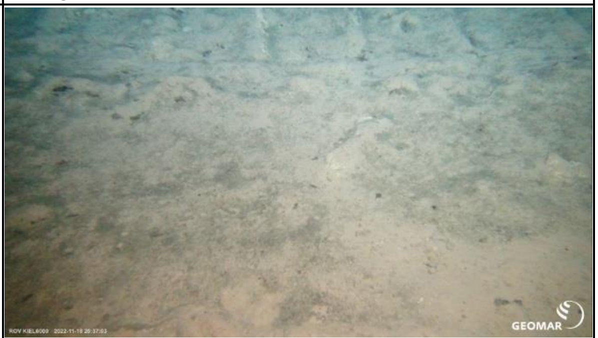
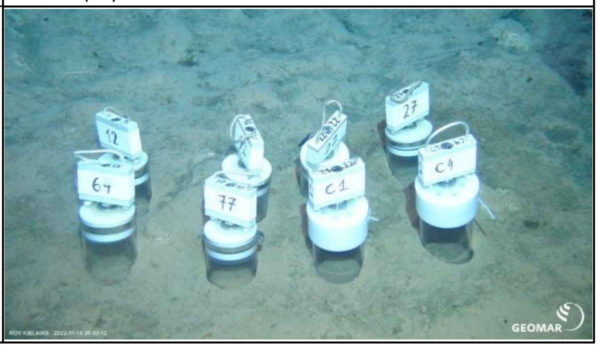
Elevator 1 was lowered on the ship's cable and deployed near the FRAMEs north of nodule pile S16 in the southern line of nodule piles (in preparation for the collection of FRAMEs during the following dive). After unhooking Elevator 1 at the target site, the ROV started MICP1 on Elevator 1 with the Magnet Stick and carried the instrument to the nearby deployment location in the stretch between PATANIA II caterpillar tracks. After deploying MICP1 at the seafloor, the ROV proceeded to the location of MICP-DEEP1 (deployment MICP-DEEP1-1 during the previous dive), restarted the instrument with the Magnet Stick and repositioned it by a few meters within the same track. After this, 8 PUCs each were collected in PUC site A and PUC site B, both inside the collector impact area. In the following, the ROV collected megafauna specimen in the plume impact site at thick cover (3 sponges, 4 corals, and 3 brittle stars).

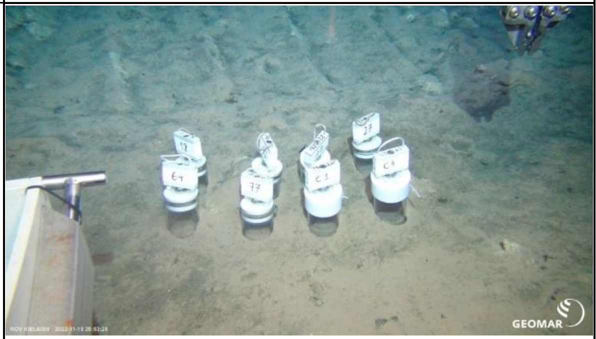
Date	UTC Time	SUB1_Lon*	SUB1_Lat*	SUB1_Depth	Observations/Comments / Image
2022-11-18	16:25:25	None	None	None	IN THE WATER
2022-11-18	18:02:56	-117.02555	11.92917	4118.3	AT THE BOTTOM
2022-11-18	18:07:05	-117.02542	11.92931	4119.24	Trying to find FRAMEs to deploy Elevator1 near them
2022-11-18	18:09:46	-117.02527	11.92965	4119.09	Blinking profiler in sight
2022-11-18	18:10:20	-117.02522	11.92968	4119.14	Marker of FRAMEs in sight
2022-11-18	18:13:11	-117.02518	11.92966	4119	Elevator 1 is lowered closer to the seafloor
2022-11-18	18:13:28	-117.02518	11.92966	4118.6	Fish
2022-11-18	18:14:08	-117.02518	11.92967	4114.51	Flying up to meet Elevator 1
2022-11-18	18:24:35	-117.02526	11.92968	4105.13	Elevator in view
2022-11-18	18:29:03	-117.02523	11.92957	4117.28	 Elevator 1 in the water column 20221118_182903_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	18:29:13	-117.02522	11.92958	4117.28	Elevator 1 in the water column (photo not displayed) 20221118_182913_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	18:29:22	-117.02522	11.92959	4117.28	Elevator 1 in the water column (photo not displayed) 20221118_182922_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	18:41:14	-117.02518	11.92973	4117.33	Lowering Elevator 1 down on sediment
2022-11-18	18:41:45	-117.02527	11.92973	4117.92	Elevator 1 landed at seafloor
2022-11-18	18:42:55	-117.02525	11.92973	4119.7	ROV approaching Elevator 1 to release ROV operated shackle
2022-11-18	18:45:14	-117.02511	11.92976	4120	Elevator1 unhooked
2022-11-18	18:46:45	-117.02512	11.92977	4120	 Elevator 1 at the seafloor 20221118_184645_Sonne_SO295_068ROV08_Logo_thumb.jpg

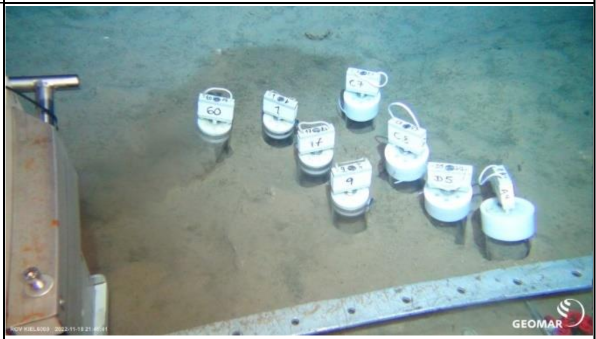
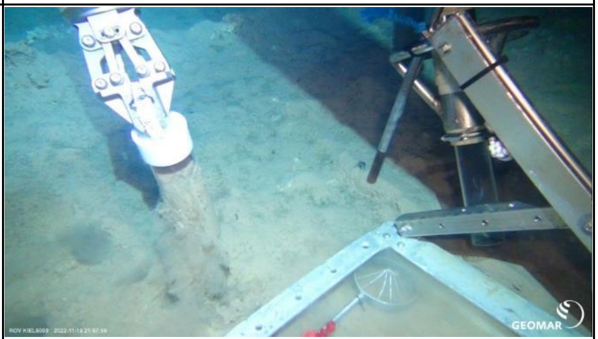
2022-11-18	19:00:36	-117.02508	11.92973	4119.18	Approaching Elevator 1 to collect MICP1
2022-11-18	19:00:42	-117.02507	11.92991	4119.19	 Electrochemical Microsensor Profiler (MICP1) on Elevator 1 20221118_190042_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:06:01	-117.02515	11.92981	4120.71	Removing elastic straps from MICP1
2022-11-18	19:10:02	-117.02522	11.92975	4120.9	Starting MICP1 by touching the switch with the Magnet Stick
2022-11-18	19:10:17	-117.02522	11.92975	4120.9	MICP1 started, geared wheel turning
2022-11-18	19:13:34	-117.02510	11.92976	4120.91	Fish
2022-11-18	19:14:45	-117.02468	11.92957	4120.91	Taking MICP1 off Elevator 1
2022-11-18	19:16:15	-117.02512	11.92987	4120.78	Flying with MICP1 westwards to find a spot for deployment
2022-11-18	19:22:20	-117.02509	11.92967	4119.03	Turning towards North into collector impact area
2022-11-18	19:30:30	-117.02529	11.92986	4119.44	Benthic Flux Chamber (BFC3) in view
2022-11-18	19:30:54	-117.02529	11.92986	4119.44	Preparing to set MICP1 into the same track
2022-11-18	19:32:35	-117.02541	11.92996	4119.44	PATANIA II track near chamber (photo not displayed) 20221118_193235_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:33:09	-117.02542	11.92996	4119.49	 MICP1 deployment spot with BFC3 in the background 20221118_193309_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:33:24	-117.02542	11.92996	4119.58	 MICP1 deployment spot 20221118_193324_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:35:17	-117.02535	11.93001	4120.99	MICP1 positioned at the seafloor in the stretch between caterpillar tracks: deployment MICP1-1

2022-11-18	19:35:45	-117.02534	11.93002	4121	 MICP1 at the seafloor (deployment MICP1-1) 20221118_193545_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:36:06	-117.02536	11.93002	4121.01	 MICP1 sensors shortly after deployment (close up) 20221118_193606_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:36:13	-117.02537	11.93002	4121.01	MICP1 sensors shortly after deployment (close up, photo not displayed) 20221118_193613_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:36:30	-117.02538	11.93002	4121.02	Next action: flying towards Fiberoptical Microsensor Profiler (MICP-DEEP1, deployed as MICP-DEEP1-1 during previous dive)
2022-11-18	19:42:29	-117.02538	11.92988	4119.56	MICP-DEEP1 in view
2022-11-18	19:42:40	-117.02538	11.92988	4119.56	Approaching MICP-DEEP1 to reposition and restart
2022-11-18	19:46:50	-117.02486	11.92984	4119.8	MICP-DEEP1 is blinking, program of deployment MICP-DEEP1-1 finished
2022-11-18	19:48:33	-117.02490	11.93002	4120.23	 MICP-DEEP1 at the seafloor 20221118_194833_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:50:50	-117.02492	11.92996	4120.9	MICP-DEEP1 restarted with Magnet Stick
2022-11-18	19:52:28	-117.02499	11.92997	4120.93	MICP-DEEP1 started while still at previous deployment spot, gear wheels are turning (program started)
2022-11-18	19:53:41	-117.02494	11.92996	4120.59	MICP-DEEP1 picked up
2022-11-18	19:55:43	-117.02493	11.92997	4119.98	Moving direction West to find clear tracks for MICP-DEEP1 deployment
2022-11-18	19:56:45	-117.02497	11.92999	4120.07	Deployment spot for MICP-DEEP1 (photo not displayed) 20221118_195645_Sonne_SO295_068ROV08_Logo_thumb.jpg

2022-11-18	19:56:56	-117.02498	11.92999	4120.1	 Deployment spot for MICP-DEEP1 20221118_195656_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:58:42	-117.02501	11.93011	4120.91	 Deployment spot for MICP-DEEP1 (close up) 20221118_195842_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	19:59:53	-117.02496	11.93011	4120.98	MICP-DEEP1 deployed at seafloor on stretch between caterpillar tracks: deployment MICP-DEEP1-2
2022-11-18	20:00:20	-117.02496	11.93012	4120.99	 MICP-DEEP1 shortly after start of deployment MICP-DEEP1-2 20221118_200020_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	20:00:49	-117.02501	11.93015	4121.01	 MICP-DEEP1 sensor stage 2 (close up) 20221118_200049_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	20:01:02	-117.02514	11.93029	4121	MICP-DEEP1 sensor stage 2 (photo not displayed) 20221118_200102_Sonne_SO295_068ROV08_Logo_thumb.jpg

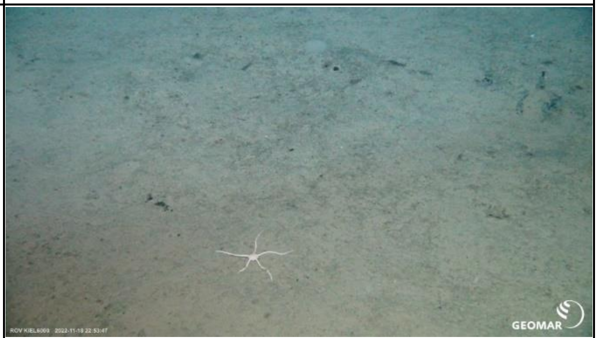
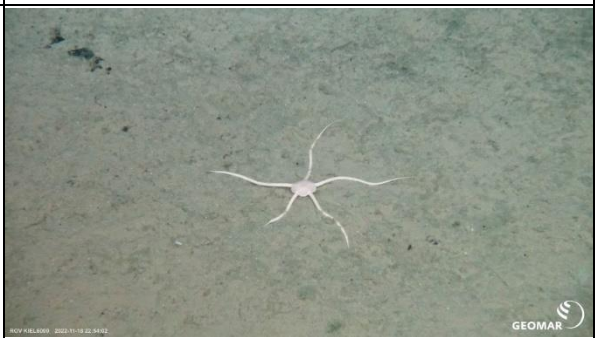
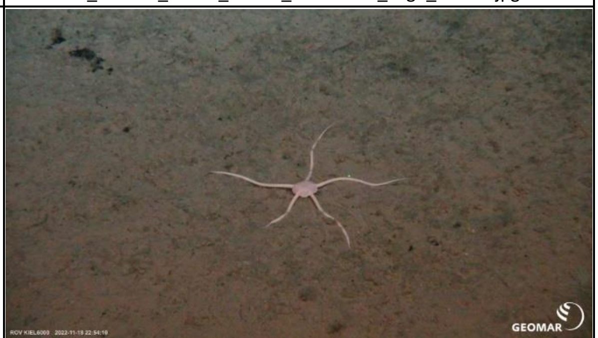
2022-11-18	20:01:08	-117.02514	11.93029	4121	 MICP-DEEP1 sensor stage 2 20221118_200108_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	20:06:20	-117.02500	11.93011	4120.46	Start transit towards Northeast end of caterpillar track to take 8 PUCs at PUC location A
2022-11-18	20:17:32	-117.02489	11.93008	4120.73	 Comb Jelly 20221118_201732_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	20:34:54	-117.02437	11.93014	4121.2	Arriving at PUC site A
2022-11-18	20:37:03	-117.02433	11.93013	4122.1	 PUC site A prior to sampling 20221118_203703_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	20:37:46	-117.02435	11.93012	4122.12	PUC sampling start at site A with PUCs from 16 Core Rack
2022-11-18	20:39:47	-117.02441	11.93013	4122.14	PUC27 deployed
2022-11-18	20:42:01	-117.02438	11.93015	4122.16	PUC22 deployed
2022-11-18	20:43:34	-117.02436	11.93013	4122.19	PUC42 deployed
2022-11-18	20:45:35	-117.02434	11.93015	4122.19	PUC12 deployed
2022-11-18	20:47:12	-117.02435	11.93015	4122.19	PUCC4 deployed
2022-11-18	20:48:50	-117.02437	11.93014	4122.2	PUCC1 deployed
2022-11-18	20:51:05	-117.02447	11.93003	4122.21	PUC77 deployed
2022-11-18	20:52:27	-117.02426	11.93011	4122.21	PUC64 deployed
2022-11-18	20:53:12	-117.02428	11.93011	4122.21	

					PUCs in the sediment prior to retrieval 20221118_205312_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	20:53:28	-117.02431	11.93014	4122.21	 PUCs in the sediment prior to retrieval 20221118_205328_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	20:53:44	-117.02430	11.93015	4122.21	Retrieving PUCs back into 16 Core Rack
2022-11-18	20:55:30	-117.02437	11.93011	4122.22	PUC64 retrieved
2022-11-18	20:57:16	-117.02435	11.93013	4122.22	PUC12 retrieved
2022-11-18	20:58:33	-117.02435	11.93014	4122.22	PUC77 retrieved
2022-11-18	21:00:46	-117.02439	11.93018	4122.21	PUC42 retrieved
2022-11-18	21:01:52	-117.02429	11.93013	4122.22	PUCC1 retrieved
2022-11-18	21:03:31	-117.02431	11.93010	4122.23	PUC22 retrieved
2022-11-18	21:04:43	-117.02432	11.93012	4122.23	PUCC1 retrieved
2022-11-18	21:05:48	-117.02436	11.93009	4122.23	PUC27 retrieved
2022-11-18	21:16:56	-117.02523	11.93037	4120.59	Transit to PUC site B to take another 8 PUCs
2022-11-18	21:24:01	-117.02573	11.93022	4120.44	PUC site B prior to sampling (photo not displayed) 20221118_212401_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	21:24:09	-117.02573	11.93022	4120.57	PUC site B prior to sampling (photo not displayed) 20221118_212409_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	21:24:14	-117.02573	11.93022	4120.63	 PUC site B with neighboring caterpillar tracks 20221118_212414_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	21:28:53	-117.02574	11.93013	4121.1	 PUC site B prior to sampling 20221118_212853_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	21:29:12	-117.02574	11.93012	4121.3	PUC sampling start at site B with PUCs from 16 Core Rack
2022-11-18	21:34:12	-117.02574	11.93015	4121.85	PUCA4 deployed
2022-11-18	21:35:54	-117.02573	11.93007	4121.88	PUCD5 deployed
2022-11-18	21:38:38	-117.02578	11.93012	4121.89	PUCC8 deployed
2022-11-18	21:39:47	-117.02574	11.93009	4121.88	PUCC7 deployed
2022-11-18	21:42:20	-117.02575	11.93011	4121.89	PUC1 deployed
2022-11-18	21:44:26	-117.02576	11.93010	4121.9	PUC17 deployed

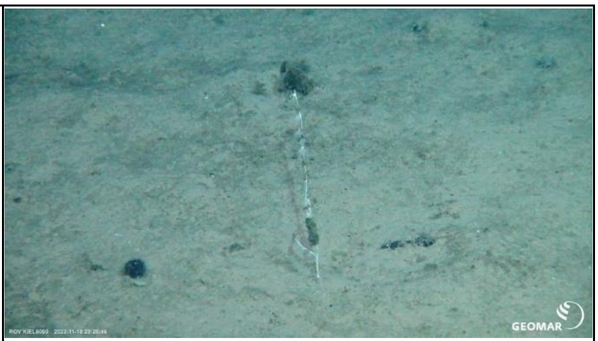
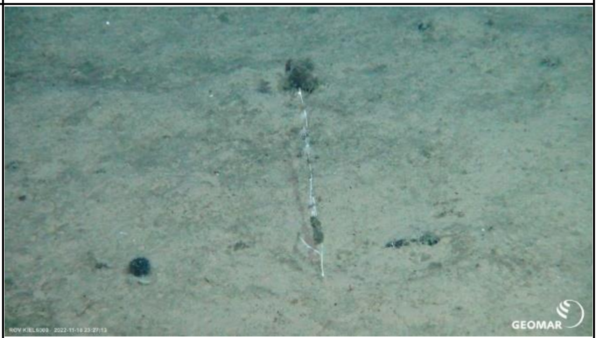
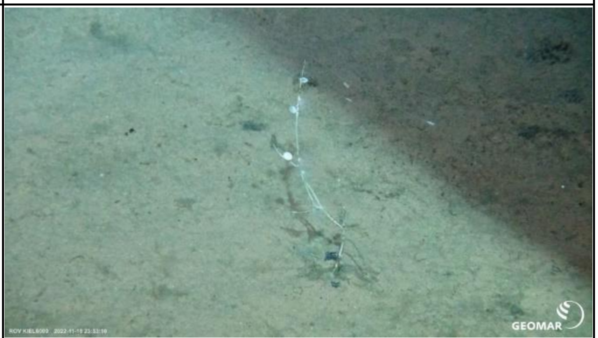
2022-11-18	21:45:19	-117.02576	11.93010	4121.9	PUC9 deployed
2022-11-18	21:46:40	-117.02575	11.93009	4121.9	PUC60 deployed
2022-11-18	21:46:41	-117.02575	11.93009	4121.9	 PUCs in the sediment prior to retrieval 20221118_214641_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	21:47:07	-117.02575	11.93009	4121.9	Retrieving PUCs back into 16 Core Rack
2022-11-18	21:48:08	-117.02577	11.93011	4121.91	PUC60 retrieved
2022-11-18	21:49:11	-117.02578	11.93008	4121.91	PUC9 retrieved
2022-11-18	21:50:02	-117.02577	11.93010	4121.9	PUC17 retrieved
2022-11-18	21:50:34	-117.02576	11.93013	4121.9	PUC1 retrieved
2022-11-18	21:53:43	-117.02571	11.93006	4121.9	PUCC7 retrieved
2022-11-18	21:54:44	-117.02575	11.93009	4121.9	PUCC8 retrieved
2022-11-18	21:56:55	-117.02576	11.93009	4121.93	PUCD5 retrieved
2022-11-18	21:57:56	-117.02575	11.93007	4121.9	 PUCA4 during retrieval 20221118_215756_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	21:58:44	-117.02573	11.93007	4121.9	PUC A4 retrieved
2022-11-18	21:58:56	-117.02571	11.93008	4121.9	 PUC site B after retrieval 20221118_215856_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	21:59:12	-117.02570	11.93009	4121.91	Next Action: collecting Megafauna in nearby plume impact area with thick cover
2022-11-18	22:12:01	-117.02583	11.93048	4121.59	Sponge
2022-11-18	22:12:47	-117.02582	11.93049	4121.59	Sponge and coral (photo not displayed) 20221118_221247_Sonne_SO295_068ROV08_Logo_thumb.jpg

2022-11-18	22:13:05	-117.02581	11.93048	4121.58	 Sponge and coral 20221118_221305_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:13:54	-117.02581	11.93050	4121.59	 Sponge (close up) 20221118_221354_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:14:30	-117.02581	11.93049	4121.59	 Coral 20221118_221430_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:19:12	-117.02581	11.93045	4121.6	Collecting Coral in right compartment of ICBM Biobox extra large, sample MEGA10Coral
2022-11-18	22:21:27	-117.02582	11.93046	4121.6	Collecting Sponge in right compartment of ICBM Biobox extra large, sample MEGA9Sponge
2022-11-18	22:21:43	-117.02583	11.93047	4121.57	Collecting brittle star (found on sponge) in right compartment of ICBM Biobox extra large, sample MEGA11Brittletar
2022-11-18	22:24:36	-117.02582	11.93045	4121.55	 Partially buried sponge 20221118_222436_Sonne_SO295_068ROV08_Logo_thumb.jpg

2022-11-18	22:24:52	-117.02582	11.93045	4121.56	 Partially buried sponge (with lasers switched on) 20221118_222452_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:31:40	-117.02581	11.93048	4121.56	Collecting sponge in right compartment of ICBM Biobox extra large, sample MEGA12Sponge
2022-11-18	22:35:59	-117.02581	11.93054	4121.52	 Coral 20221118_223559_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:36:08	-117.02581	11.93054	4121.53	Coral (photo not displayed) 20221118_223608_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:36:18	-117.02582	11.93054	4121.52	 Coral (with lasers switched on) 20221118_223618_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:39:45	-117.02582	11.93053	4121.54	Coral collected into right compartment of ICBM Biobox extra large, sample MEGA13Coral
2022-11-18	22:40:23	-117.02580	11.93055	4121.45	Fish (rattail)
2022-11-18	22:43:37	-117.02579	11.93056	4121.51	Coral (photo not displayed) 20221118_224337_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:44:00	-117.02581	11.93056	4121.52	 Coral 20221118_224400_Sonne_SO295_068ROV08_Logo_thumb.jpg

2022-11-18	22:44:12	-117.02583	11.93056	4121.52	 Coral with lasers switched on 20221118_224412_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:46:49	-117.02586	11.93056	4121.52	Fish (rattail) in the background
2022-11-18	22:47:39	-117.02589	11.93056	4121.52	While coral was being picked up it fell off the manipulator gripper
2022-11-18	22:50:17	-117.02590	11.93072	4121.52	Coral picked up again
2022-11-18	22:51:20	-117.02581	11.93063	4121.51	Coral collected into right compartment of ICBM Biobox extra large, sample MEGA14Coral
2022-11-18	22:53:47	-117.02579	11.93051	4121.55	 Brittle star 20221118_225347_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:54:02	-117.02578	11.93051	4121.56	 Brittle star (close up) 20221118_225402_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:54:10	-117.02578	11.93051	4121.56	 Brittle star with lasers switched on 20221118_225410_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	22:56:27	-117.02581	11.93056	4121.56	Brittle star collected into right compartment of ICBM Biobox extra large, sample MEGA15Brittlestar

2022-11-18	23:08:39	-117.02580	11.93060	4121.51	 Sponge 20221118_230839_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	23:09:00	-117.02580	11.93060	4121.51	 Sponge with lasers switched on 20221118_230900_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	23:14:22	-117.02581	11.93057	4121.5	Sponge collected into left compartment of ICBM Biobox extra large, sample MEGA16Sponge
2022-11-18	23:18:57	-117.02582	11.93053	4121.47	 Brittle star underneath foraminifer 20221118_231857_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	23:19:20	-117.02580	11.93055	4121.48	 Brittle star underneath foraminifer with lasers switched on 20221118_231920_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	23:22:18	-117.02580	11.93061	4121.48	Brittle star collected into left compartment of ICBM Biobox extra large, sample MEGA17Brittlestar
2022-11-18	23:23:54	-117.02580	11.93066	4121.3	Fish (rattail)

2022-11-18	23:26:46	-117.02585	11.93064	4121.48	 Coral 20221118_232646_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	23:27:13	-117.02583	11.93065	4121.47	 Coral with lasers switched on 20221118_232713_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	23:31:17	-117.02584	11.93062	4121.46	Attempt to sample coral is failing twice
2022-11-18	23:32:50	-117.02556	11.93074	4121.46	Given up: part of the coral fell onto the porch and it cannot be recovered and another coral will be collected instead
2022-11-18	23:33:10	-117.02579	11.93065	4121.46	 Coral 20221118_233310_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	23:33:28	-117.02589	11.93043	4121.45	 Coral with lasers switched on 20221118_233328_Sonne_SO295_068ROV08_Logo_thumb.jpg
2022-11-18	23:35:48	-117.02584	11.93054	4121.45	Coral collected into left compartment of ICBM Biobox extra large, sample MEGA18Coral
2022-11-18	23:35:59	-117.02583	11.93055	4121.45	End of scientific work
2022-11-18	23:38:19	-117.02580	11.93060	4119.23	OFF THE BOTTOM
2022-11-19	01:37:52	None	None	None	ON DECK

* Shortcomings in underwater navigation that lasted until station SO295_089-1_ROV-11 led to uncertainties in positioning ranging between some tens of meters to >100 m (see also section on underwater navigation in this cruise report). These intrinsic offsets could not be removed by the curation routines applied to navigation raw data (for a description see comment to first dive protocol). Positioning at the target disturbance structures (e.g., in collector tracks) was ensured visually.

Kiel 6000 Dive 9 (SO295_073-1_ROV-09)

Date: 19.Nov.2022

Principal Investigators: Sabine Gollner, Felix Janssen

Observers: Duygu Sevilgen, Devin Vlach, Ricarda Meineke, Amber Henningsen

Protocol: Ricarda Meineke

ROV positions (at the bottom)
Start of dive: 11°55.779' N 117°1.515' W
End of dive: 11°55.814' N 117°1.507' W

Dive duration:
ROV in the water: 19.Nov.2022 15:41:04
ROV at the bottom: 19.Nov.2022 17:12:08
ROV off the bottom: 20.Nov.2022 00:49:37
ROV on deck: 20.Nov.2022 02:39:39

Explored sites: GER collector impact

Aims of the Dive

- Deployment of 20 Recolonization frames (FRAMEs)
- Relocation of a Fiberoptical Microsensor Profiler (MICP-DEEP1)
- Recover 5 FRAMEs deployed in 2021 and sample sediments in FRAME footprint
- Take Push cores (PUCs) between tracks
- Redeploy and retrieve Fiberoptical Microsensor Profiler (MICP-DEEP1)
- Retrieve Electrochemical Microsensor Profiler (MICP1)

Handled ROV Tools (including scientific payload):

- FRAMEs in 2 White NIOZ boxes
- Benthic Flux Chamber (BFC3; upon ascent)
- Push Cores in 16 Core Rack
- 12 PUCs in Core two Sixpacks
- Magnet Stick
- *Megafauna sampling tools:*
  Handnets, Scoop, Shovel, Suction Pump

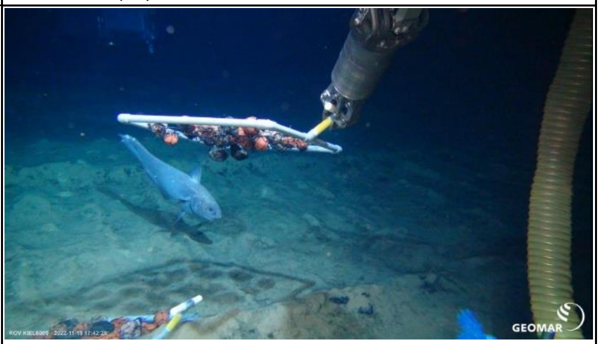
Relevant Elevator payload

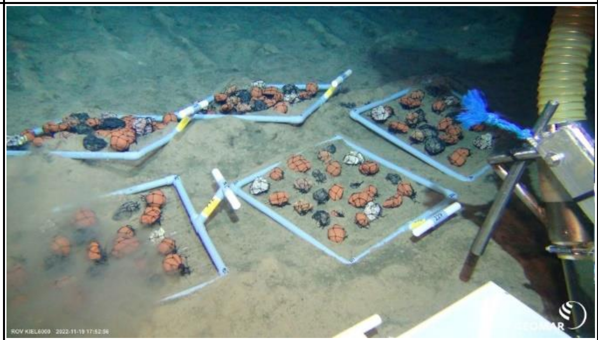
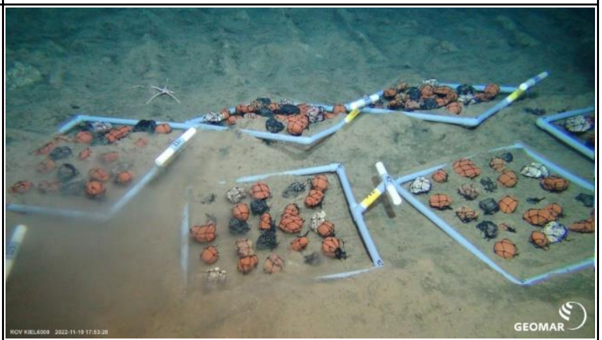
Elevator 1

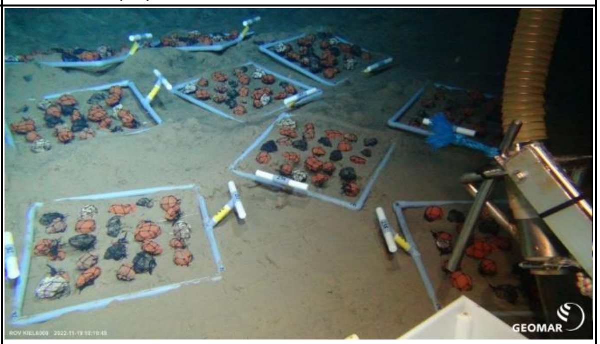
- MICP1
- MICP-DEEP1
- 2 FRAME boxes, one filled with retrieved FRAMES on the way up
- *2 Amphipod traps*
- 2 white NIOZ boxes
- *Posidonia transponder*

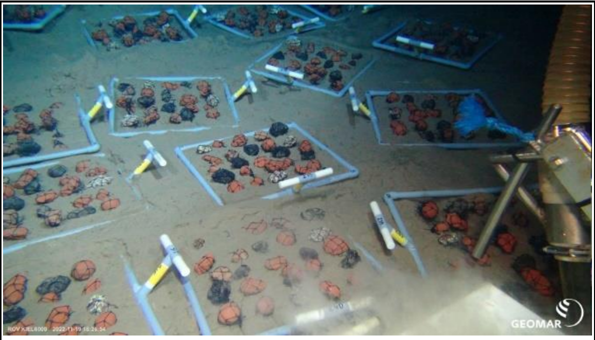
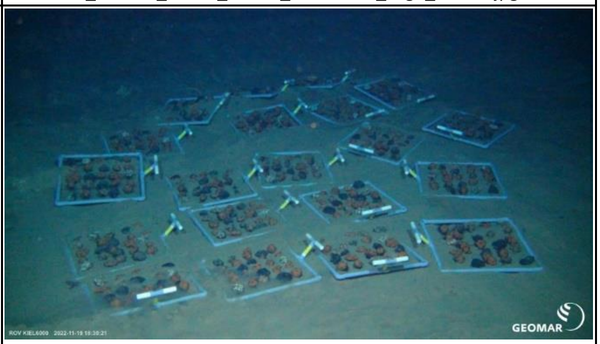
Dive summary

20 FRAMEs were brought down on the ROV porch in two white NIOZ boxes. After arrival at the bottom, the FRAMEs were deployed on the seafloor. After that, MICP-DEEP1 was positioned 5 m further North from previous position (deployment MICP-DEEP1-2 from previous dive) on the stretch between caterpillar tracks and restarted. After that, 5 FRAMEs were collected from different sites and PUCs were taken in the respective FRAME footprints and another 6 + 6 PUCs were sampled between in the stretches between caterpillar tracks. MICP1 and MICP-DEEP1 were retrieved and secured on Elevator 1. After that, Elevator 1 was connected to the Elevator Recovery System ('Bergefuchs') for recovery by the ship. Finally, BFC3 was recovered from and secured to the porch of the ROV for ascent.

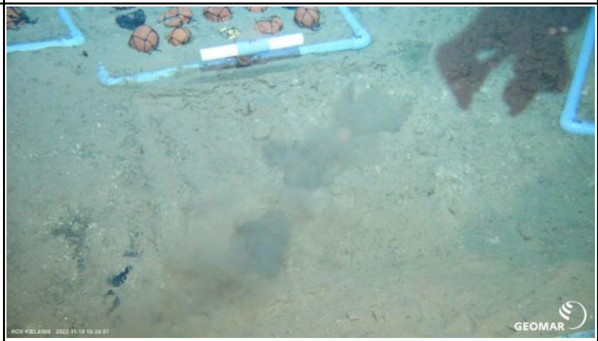
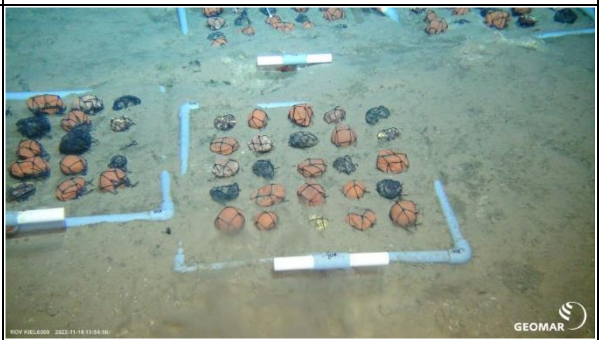
Date	UTC Time	SUB1_Lon*	SUB1_Lat*	SUB1_Depth	Observations/Comments / Image
2022-11-19	15:41:04	None	None	None	IN THE WATER
2022-11-19	17:12:08	-117.02525	11.92965	4116.96	AT THE BOTTOM
2022-11-19	17:22:43	-117.02506	11.92983	4118.76	Arrival at the location of the FRAMEs deployed at the site in 2021, the Frame marker moved out of the way
2022-11-19	17:23:26	-117.02505	11.92985	4118.14	Next action: deploying 20 more FRAMEs next to the already existing ones.
2022-11-19	17:23:57	-117.02504	11.92986	4118.03	Shrimp passing by
2022-11-19	17:29:34	-117.02494	11.92986	4120.37	Looking for a good spot for the frames
2022-11-19	17:31:11	-117.02494	11.92990	4121.88	Landed the ROV, waiting for clear sight
2022-11-19	17:32:30	-117.02493	11.92990	4121.85	 Location selected for FRAME deployment 20221119_173230_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	17:32:50	-117.02490	11.92991	4121.84	Location selected for FRAME deployment (photo not displayed) 20221119_173250_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	17:34:19	-117.02489	11.92994	4121.83	Untying the FRAMEs on the porch, preparing for deployment
2022-11-19	17:36:39	-117.02486	11.92989	4121.81	FRAME222 deployed
2022-11-19	17:38:40	-117.02494	11.92992	4121.8	FAME deployed (#223?)
2022-11-19	17:40:11	-117.02490	11.92992	4121.82	FRAME deployed (#223?)
2022-11-19	17:41:24	-117.02490	11.92990	4121.82	FRAME224 deployed
2022-11-19	17:42:25	-117.02489	11.92990	4121.82	 Fish at FRAME deployment site 20221119_174225_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	17:42:50	-117.02490	11.92990	4121.84	FRAME225 deployed

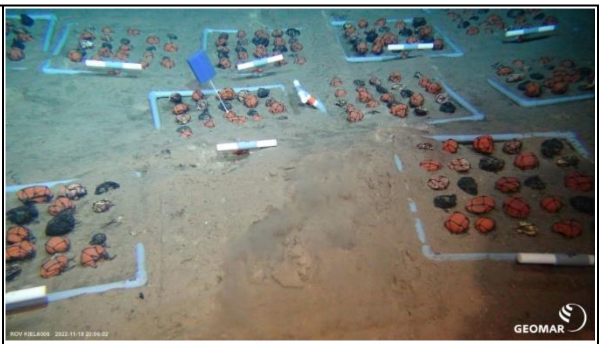
2022-11-19	17:45:17	-117.02487	11.92993	4121.84	FRAME226 deployed
2022-11-19	17:47:24	-117.02492	11.92993	4121.84	FRAME227 deployed
2022-11-19	17:49:36	-117.02489	11.92996	4121.84	FRAME deployed (number not visible)
2022-11-19	17:51:35	-117.02483	11.92996	4121.84	Rearranging FRAME to make space for two more
2022-11-19	17:52:56	-117.02488	11.92993	4121.86	 FRAMEs at the seafloor after deployment 20221119_175256_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	17:53:25	-117.02487	11.92994	4121.86	FRAMEs at the seafloor after deployment (photo not displayed) 20221119_175325_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	17:53:28	-117.02488	11.92994	4121.86	 FRAMEs at the seafloor after deployment 20221119_175328_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	17:53:36	-117.02489	11.92994	4121.85	 FRAMEs at the seafloor after deployment 20221119_175336_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	17:53:40	-117.02489	11.92994	4121.84	 FRAMEs at the seafloor after deployment 20221119_175340_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	17:54:18	-117.02489	11.92993	4121.79	Repositioning ROV for further frame deployments, visibility bad
2022-11-19	17:55:38	-117.02487	11.92993	4121.85	ROV landed again, continuing with FRAME deployment
2022-11-19	17:57:13	-117.02487	11.92991	4121.84	FRAME217 deployed
2022-11-19	17:58:29	-117.02487	11.92991	4121.83	FRAME235 deployed

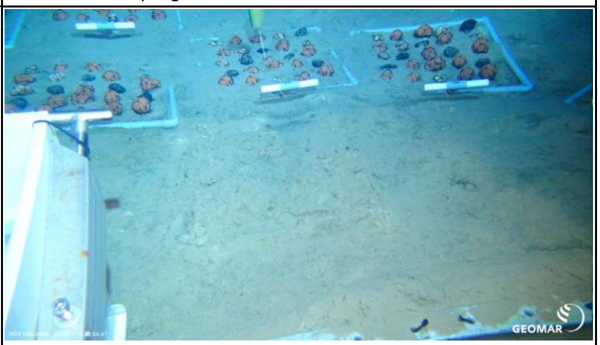
2022-11-19	17:59:07	-117.02487	11.92991	4121.83	Untying second white NIOZ box to prepare for deployment of second set of 10 FRAMEs
2022-11-19	18:01:51	-117.02486	11.92988	4121.85	FRAME252 (maybe #232?) deployed
2022-11-19	18:04:13	-117.02490	11.92987	4121.86	FRAME258 (maybe #238?) deployed
2022-11-19	18:06:17	-117.02494	11.92989	4121.86	FRAME254 (maybe #235?) deployed
2022-11-19	18:08:20	-117.02489	11.92990	4121.86	FRAME deployed (#238?)
2022-11-19	18:10:09	-117.02489	11.92988	4121.86	FRAME231 deployed
2022-11-19	18:10:49	-117.02490	11.92991	4121.85	 FRAMEs at the seafloor after deployment 20221119_181049_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	18:11:04	-117.02490	11.92993	4121.81	 FRAMEs at the seafloor after deployment 20221119_181104_Sonne_SO295_073ROV09_Logo_thumb.jpg
					Repositioning ROV backwards for further frame deployment, bad visibility
2022-11-19	18:15:48	-117.02493	11.92989	4121.87	Fish passing by
2022-11-19	18:17:09	-117.02488	11.92989	4121.88	FRAME233 deployed
2022-11-19	18:19:09	-117.02485	11.92992	4121.87	FRAME239 deployed
2022-11-19	18:21:11	-117.02490	11.92993	4121.88	FRAME237 deployed
2022-11-19	18:23:26	-117.02499	11.92983	4121.86	FRAME240 deployed
2022-11-19	18:25:04	-117.02489	11.92986	4121.88	FRAME215 deployed
2022-11-19	18:25:10	-117.02488	11.92986	4121.88	End of FRAME deployment: all 20 FRAMES deployed
2022-11-19	18:26:48	-117.02488	11.92979	4121.84	 Last set of FRAMEs at the seafloor after deployment 20221119_182648_Sonne_SO295_073ROV09_Logo_thumb.jpg

2022-11-19	18:26:54	-117.02488	11.92979	4121.82	 Last set of FRAMEs at the seafloor after deployment 20221119_182654_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	18:27:26	-117.02493	11.92981	4121.56	Repositioning ROV to take overview pictures of deployed FRAMEs, temporarily bad visibility
2022-11-19	18:30:07	-117.02490	11.92991	4120.83	 Overview picture of FRAMEs deployed at the seafloor 20221119_183007_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	18:30:21	-117.02488	11.92990	4120.83	 Overview picture of FRAMEs deployed at the seafloor 20221119_183021_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	18:31:47	-117.02482	11.92987	4120.8	Short break during ROV pilot change
2022-11-19	18:34:12	-117.02487	11.93004	4120.16	Flying to the elevator
2022-11-19	18:35:55	-117.02498	11.93005	4119.5	Fish at the elevator
2022-11-19	18:36:17	-117.02502	11.93005	4119.5	Elevator with FRAME BOXes (photo not displayed) 20221119_183617_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	18:36:18	-117.02502	11.93005	4119.5	Elevator with FRAME BOXes (photo not displayed) 20221119_183618_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	18:37:49	-117.02502	11.93000	4119.6	Two fish at the elevator
2022-11-19	18:39:34	-117.02501	11.92999	4120.62	Start transferring the empty white NIOZ boxes from the ROV porch onto Elevator 1 – turns out to be a complicated task
2022-11-19	18:48:14	-117.02498	11.92995	4121.3	First box positioned on Elevator 1
2022-11-19	18:48:28	-117.02496	11.92996	4121.3	Picking up second box from the porch
2022-11-19	18:49:46	-117.02494	11.93002	4121.3	Second box positioned on Elevator 1
2022-11-19	18:50:27	-117.02497	11.92996	4121.31	Securing white NIOZ boxes on the elevator
2022-11-19	18:54:55	-117.02501	11.92995	4121.32	Fish returning to Elevator 1
2022-11-19	19:05:18	-117.02488	11.92998	4121.15	Compartment A of FRAME BOX 1 opened. Next Action: relocation of MICP-DEEP1
2022-11-19	19:08:22	-117.02478	11.93018	4120.95	MICP-DEEP1 in view (deployment MICP-DEEP1-2 from previous dive)
2022-11-19	19:09:28	-117.02478	11.93017	4120.75	LED blinking on MICP-DEEP1, deployment finished, still powered up
2022-11-19	19:11:17	-117.02488	11.93020	4120.67	MICP-DEEP1 repositioned by a few meters in the same stretch between the caterpillar tracks
2022-11-19	19:12:53	-117.02496	11.93022	4120.63	Restarted MICP-DEEP1 with magnet

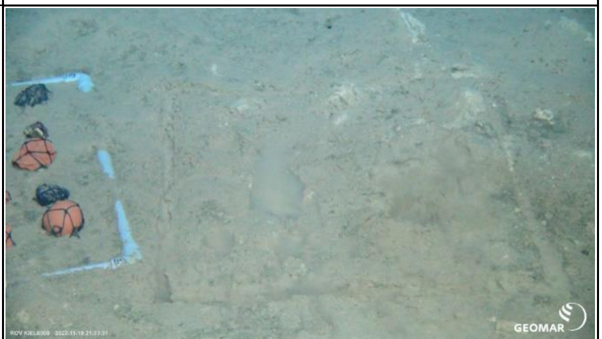
2022-11-19	19:15:25	-117.02487	11.93024	4120.62	Repositioned MICP-DEEP1 5 m direction North: deployment MICP-DEEP1-3
2022-11-19	19:16:16	-117.02487	11.93024	4120.67	 MICP-DEEP1 after relocation (deployment MICP-DEEP1-3) 20221119_191616_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	19:16:57	-117.02487	11.93023	4120.7	MICP-DEEP1 after relocation (photo not displayed) 20221119_191657_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	19:16:58	-117.02487	11.93023	4120.7	Next action: traveling to FRAMEs deployed in 2021 for retrieval
2022-11-19	19:21:59	-117.02479	11.92994	4121.01	Fish (grenadier) near elevator
2022-11-19	19:22:35	-117.02486	11.92990	4121.17	Fish (2 grenadiers)
2022-11-19	19:23:16	-117.02494	11.92988	4121.57	ROV arrived at FRAME A selected for recovery
2022-11-19	19:24:29	-117.02496	11.92986	4121.97	 FRAME A (#106) 20221119_192429_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	19:24:41	-117.02496	11.92986	4121.98	 FRAME A (#106; close up) 20221119_192441_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	19:30:00	-117.02497	11.92990	4122.04	Frame A (#106) lifted from the seafloor and deposited next to footprint to start PUC sampling from 16 Core Rack
2022-11-19	19:31:06	-117.02496	11.92990	4122.02	PUCB8 deployed in FRAME A footprint
2022-11-19	19:31:56	-117.02496	11.92989	4122.05	PUCC2 and PUCD8 deployed in FRAME A footprint
2022-11-19	19:32:46	-117.02496	11.92988	4122.06	

					PUCs in FRAME A footprint (D8, C2, B8 from left to right) 20221119_193246_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	19:34:23	-117.02496	11.92985	4122.06	Start to recover PUCs back into 16 Core Rack
2022-11-19	19:34:29	-117.02496	11.92985	4122.06	PUCD8 recovered
2022-11-19	19:35:03	-117.02495	11.92985	4122.07	PUCC2 recovered
2022-11-19	19:35:49	-117.02495	11.92987	4122.08	PUCB8 recovered
2022-11-19	19:36:57	-117.02494	11.92988	4122.07	 FRAME A (#106) footprint after PUC recovery 20221119_193657_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	19:37:49	-117.02495	11.92988	4122.07	Next Action: taking FRAME A (#106) up for transport to Elevator 1
2022-11-19	19:42:16	-117.02490	11.92991	4121.08	Transporting FRAME A (#106) to Elevator 1
2022-11-19	19:48:08	-117.02486	11.92995	4120.94	Frame A (#106) placed in compartment A of FRAME BOX 1
2022-11-19	19:49:38	-117.02490	11.92994	4120.94	Lid of FRAME BOX compartment B opened
2022-11-19	19:50:24	-117.02489	11.92993	4120.94	Lid of FRAME BOX compartment A closed, Next Action: traveling back to FRAMEs for retrieval of FRAME B
2022-11-19	19:54:50	-117.02487	11.92984	4122.01	 FRAME B (#108) before retrieval 20221119_195450_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	19:57:02	-117.02491	11.92983	4122.09	FRAME B (#108) lifted from the seafloor and deposited next to footprint to start PUC sampling from 16 Core Rack
2022-11-19	20:00:08	-117.02489	11.92984	4122.11	PUCD7 deployed in FRAME B footprint
2022-11-19	20:00:37	-117.02488	11.92982	4122.11	PUCB0 deployed in FRAME B footprint
2022-11-19	20:01:21	-117.02488	11.92982	4122.1	PUC76 deployed in FRAME B footprint
2022-11-19	20:01:24	-117.02488	11.92982	4122.1	 PUCs in FRAME B footprint 20221119_200124_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	20:01:39	-117.02488	11.92982	4122.1	Retrieving PUCs back into 16 Core Rack
2022-11-19	20:02:43	-117.02489	11.92984	4122.1	PUC76 recovered
2022-11-19	20:03:43	-117.02489	11.92982	4122.1	PUCB0 and PUCD7 recovered

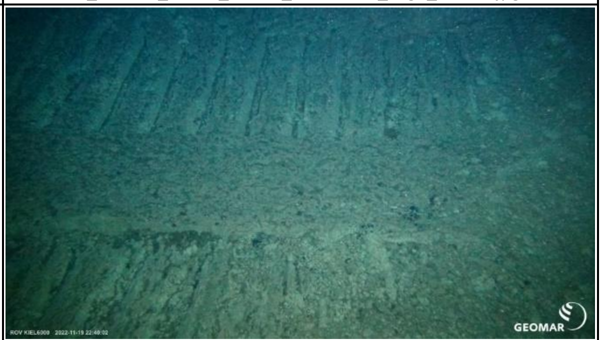
2022-11-19	20:06:02	-117.02492	11.92984	4122.12	 FRAME B (#108) footprint after PUC recovery 20221119_200602_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	20:06:15	-117.02492	11.92984	4122.11	Next Action: lift up FRAME B (#108) and take to Elevator 1
2022-11-19	20:18:52	-117.02489	11.92988	4121.03	FRAME B (#108) placed in compartment B of FRAME BOX 1
2022-11-19	20:21:30	-117.02484	11.92984	4121.04	Lid of FRAME BOX compartment C opened, Next Action: traveling back to FRAMEs for retrieval of FRAME C
2022-11-19	20:26:06	-117.02487	11.92981	4122.06	 FRAME C (#107) selected for recovery 20221119_202606_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	20:26:53	-117.02492	11.92984	4122.13	FRAME C (#107) lifted from the seafloor and deposited next to footprint to start PUC sampling from 16 Core Rack
2022-11-19	20:30:01	-117.02473	11.92973	4122.16	PUC74 deployed in FRAME C footprint
2022-11-19	20:31:10	-117.02484	11.92982	4122.19	PUC54 and PUCB6 deployed in FRAME C footprint
2022-11-19	20:31:58	-117.02495	11.92987	4122.18	 PUCs in FRAME C footprint 20221119_203158_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	20:31:58	-117.02495	11.92987	4122.18	PUC B6 deployed
2022-11-19	20:32:22	-117.02487	11.92988	4122.18	Retrieving PUCs back into 16 Core Rack
2022-11-19	20:32:46	-117.02489	11.92991	4122.17	PUCB6 recovered
2022-11-19	20:33:32	-117.02494	11.92993	4122.17	PUC54 recovered
2022-11-19	20:34:59	-117.02507	11.93004	4122.19	PUC74 recovered

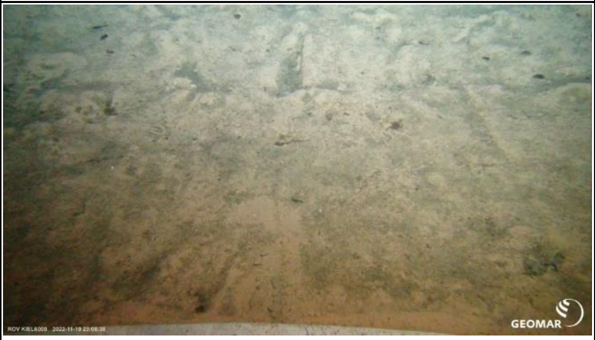
2022-11-19	20:35:19	-117.02508	11.93004	4122.19	 FRAME C (#107) footprint after PUC recovery 20221119_203519_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	20:35:34	-117.02508	11.93004	4122.19	Next Action: lift up FRAME C (#107) and take to Elevator 1
2022-11-19	20:43:50	-117.02498	11.92990	4121.15	FRAME C (#107) placed in compartment C of FRAME BOX 1, Next Action: traveling back to FRAMEs for retrieval of FRAME D
2022-11-19	20:50:57	-117.02493	11.92986	4122.16	 FRAME D (#118) selected for recovery 20221119_205057_Sonne_SO295_073ROV09_Logo_thumb.jpg continue here!
2022-11-19	20:51:17	-117.02493	11.92987	4122.2	 FRAME D (#118) close up 20221119_205117_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	20:51:21	-117.02493	11.92987	4122.21	FRAME D (#118) lifted from the seafloor and deposited next to footprint to start PUC sampling from 16 Core Rack
2022-11-19	20:54:47	-117.02494	11.92987	4122.23	 FRAME D footprint prior to PUC sampling 20221119_205447_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	20:56:04	-117.02498	11.92985	4122.22	PUC69 deployed in FRAME D footprint
2022-11-19	20:57:14	-117.02497	11.92983	4122.24	PUC44 deployed in FRAME D footprint

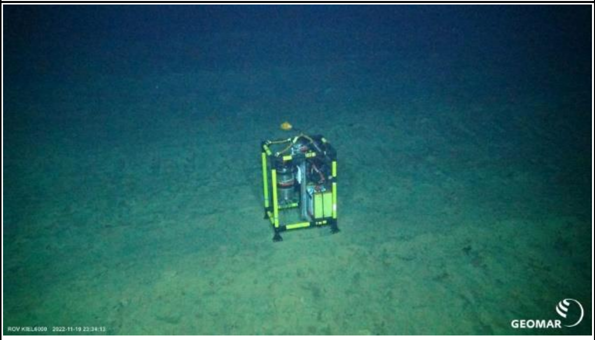
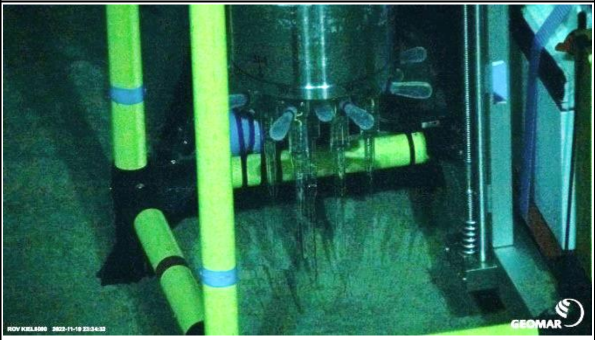
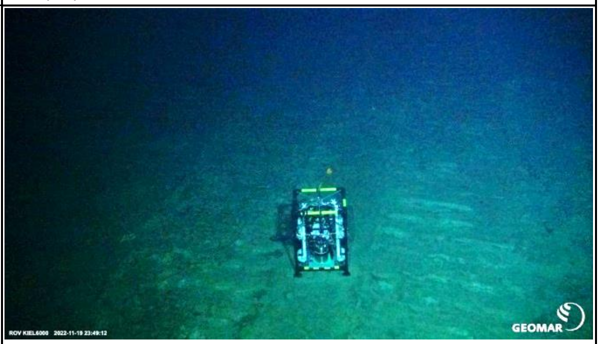
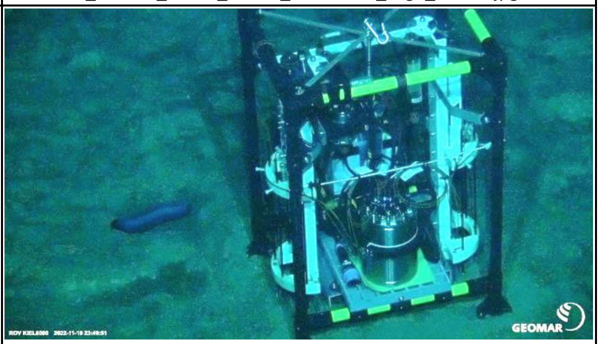
2022-11-19	20:57:33	-117.02496	11.92984	4122.24	 PUCs in FRAME D footprint 20221119_205733_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	20:57:47	-117.02496	11.92986	4122.23	Retrieving PUCs back into 16 Core Rack
2022-11-19	20:58:46	-117.02497	11.92989	4122.24	PUC44 recovered
2022-11-19	20:59:42	-117.02497	11.92986	4122.23	PUC69 recovered
2022-11-19	21:00:11	-117.02498	11.92986	4122.24	 FRAME D footprint after PUC sampling 20221119_210011_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	21:02:40	-117.02492	11.92986	4121.59	FRAME D (118) lifted up
2022-11-19	21:04:31	-117.02482	11.92979	4121.24	Moving towards Elevator 1
2022-11-19	21:11:23	-117.02484	11.92983	4121.17	FRAME D (#118) placed in compartment D of FRAME BOX 1. Next Action: traveling back to FRAMEs for retrieval of FRAME E
2022-11-19	21:17:26	-117.02478	11.92981	4121.18	Fish (sand devil) next to Elevator 1
2022-11-19	21:21:48	-117.02482	11.92988	4122.22	 FRAME E (#120, to the right) selected for recovery 20221119_212148_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	21:22:02	-117.02478	11.92983	4122.25	 FRAME E (#120) selected for recovery 20221119_212202_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	21:24:15	-117.02465	11.92966	4122.29	FRAME E (#120) lifted from the seafloor and deposited next to footprint to start PUC sampling from 16 Core Rack

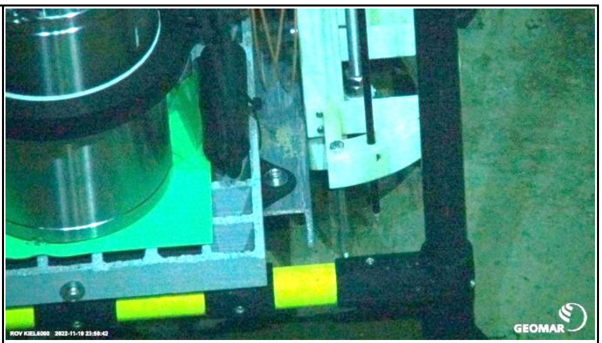
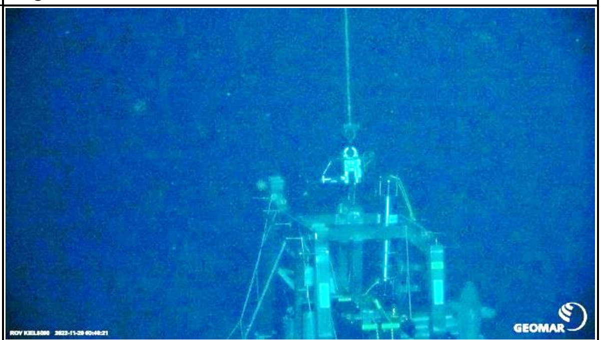
2022-11-19	21:25:07	-117.02484	11.92981	4122.29	 FRAME E footprint prior to PUC sampling 20221119_212507_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	21:27:19	-117.02496	11.92986	4122.29	PUCB9 deployed
2022-11-19	21:29:13	-117.02491	11.92977	4122.3	PUC#A9 deployed
2022-11-19	21:29:46	-117.02487	11.92969	4122.31	 PUCs in FRAME E footprint 20221119_212946_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	21:29:54	-117.02487	11.92969	4122.31	 PUCs in FRAME E footprint (photo not displayed) 20221119_212954_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	21:30:23	-117.02487	11.92967	4122.31	Retrieving PUCs back into 16 Core Rack
2022-11-19	21:31:27	-117.02486	11.92970	4122.32	PUCA9 retrieved
2022-11-19	21:33:09	-117.02489	11.92982	4122.32	PUCB9 retrieved
2022-11-19	21:33:51	-117.02483	11.92977	4122.33	 FRAME E footprint after PUC sampling 20221119_213351_Sonne_SO295_073ROV09_Logo_thumb.jpg Frame No.120 post PUC recovery
2022-11-19	21:36:18	-117.02494	11.92985	4122.22	FRAME E (#120) lifted up
2022-11-19	21:36:57	-117.02494	11.92985	4121.63	Moving towards Elevator 1
2022-11-19	21:40:10	-117.02480	11.92983	4120.88	Fish
2022-11-19	21:43:50	-117.02491	11.92993	4121.29	FRAME E (#120) placed in compartment E of FRAME BOX 1

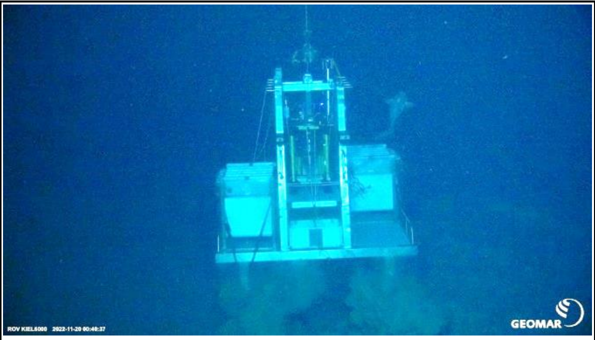
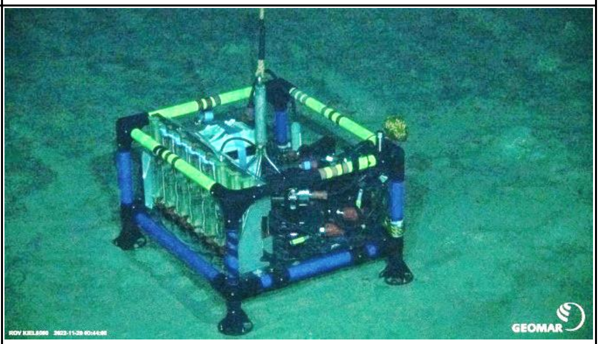
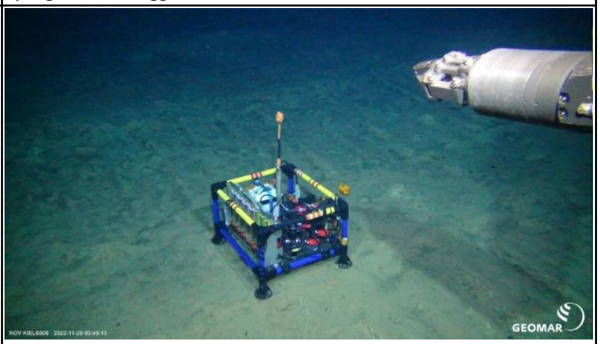
2022-11-19	21:44:43	-117.02493	11.92998	4121.26	Box E1 closed
2022-11-19	21:50:45	-117.02497	11.92990	4121.35	Releasing elastic straps at Elevator 1 already for later placement of instruments
2022-11-19	21:51:47	-117.02499	11.92988	4121.36	Elevator Recovery System ('Bergefuchs') is lowered towards the seafloor
2022-11-19	21:55:52	-117.02496	11.92972	4121.38	Next action: continue with PUC sampling started during previous dive (6 + 3 + 3 in three different sites)
2022-11-19	21:58:43	-117.02462	11.93001	4118.67	Flying direction West towards PUC site C
2022-11-19	22:05:37	-117.02537	11.92989	4122.08	PUC site C prior to coring (photo not displayed) 20221119_220537_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	22:05:47	-117.02548	11.92994	4122.09	 PUC site C prior to coring 20221119_220547_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	22:05:55	-117.02550	11.92995	4122.09	PUC sampling start at site C with PUCs from Core Sixpack 1
2022-11-19	22:08:47	-117.02542	11.92985	4122.09	PUC73 deployed
2022-11-19	22:10:01	-117.02550	11.92992	4122.1	PUC49 deployed
2022-11-19	22:11:26	-117.02525	11.92979	4122.1	PUC23 deployed
2022-11-19	22:12:30	-117.02512	11.92967	4122.11	PUC58 deployed
2022-11-19	22:13:43	-117.02548	11.92996	4122.11	PUC55 deployed
2022-11-19	22:15:46	-117.02547	11.92982	4122.12	PUC5 deployed
2022-11-19	22:16:19	-117.02530	11.92981	4122.11	 PUC site C with deployed cores 20221119_221619_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	22:16:22	-117.02530	11.92981	4122.11	Retrieving PUCs back into Core Sixpack 1
2022-11-19	22:18:02	-117.02556	11.93005	4122.12	PUC5 retrieved
2022-11-19	22:19:32	-117.02547	11.92984	4122.12	PUC23 retrieved
2022-11-19	22:21:28	-117.02555	11.92990	4122.14	PUC55 retrieved
2022-11-19	22:23:54	-117.02538	11.92988	4122.15	PUC49 retrieved
2022-11-19	22:25:18	-117.02541	11.92977	4122.15	PUC58 retrieved
2022-11-19	22:26:47	-117.02548	11.92980	4122.14	PUC73 retrieved
2022-11-19	22:28:34	-117.02573	11.92977	4122.15	 PUC site C post coring (photo not displayed) 20221119_222834_Sonne_SO295_073ROV09_Logo_thumb.jpg

2022-11-19	22:28:43	-117.02573	11.92977	4122.15	 PUC site C post coring 20221119_222843_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	22:31:20	-117.02541	11.92978	4122.12	Flying direction Notheast to PUC site D
2022-11-19	22:35:15	-117.02530	11.92984	4119.81	Elevator 1 in view
2022-11-19	22:35:36	-117.02528	11.92985	4119.33	Fish
2022-11-19	22:38:24	-117.02478	11.92996	4119.82	Anemone(?)
2022-11-19	22:39:25	-117.02458	11.93026	4120.5	Arrival at PUC site D
2022-11-19	22:39:38	-117.02458	11.93026	4120.61	PUC site D prior to coring (photo not displayed) 20221119_223938_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	22:39:40	-117.02458	11.93026	4120.62	PUC site D prior to coring (photo not displayed) 20221119_223940_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	22:40:02	-117.02458	11.93026	4120.71	 PUC site D prior to coring 20221119_224002_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	22:42:16	-117.02473	11.93007	4122.11	ROV parked, PUC sampling start at site D with PUCs from Core Sixpack 2
2022-11-19	22:45:17	-117.02473	11.93009	4122.46	PUC2 deployed
2022-11-19	22:47:27	-117.02467	11.93001	4122.49	PUC35 deployed
2022-11-19	22:49:54	-117.02471	11.93027	4122.49	PUC11 deployed
2022-11-19	22:50:11	-117.02468	11.93031	4122.49	 PUC site D with deployed cores 20221119_225011_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	22:50:25	-117.02467	11.93031	4122.5	Retrieving PUCs back into Core Sixpack 2
2022-11-19	22:52:39	-117.02462	11.93007	4122.5	PUC11 retrieved
2022-11-19	22:54:22	-117.02452	11.93004	4122.51	PUC35 retrieved
2022-11-19	22:56:24	-117.02446	11.92996	4122.5	PUC2 retrieved

2022-11-19	22:57:10	-117.02469	11.93024	4122.52	 PUC site D post coring 20221119_225710_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	22:57:36	-117.02486	11.93046	4122.42	Next action: flying to PUC site E
2022-11-19	23:06:38	-117.02425	11.92999	4122.47	 PUC site E prior to coring 20221119_230638_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	23:07:14	-117.02427	11.92999	4122.58	PUC sampling start at site E with PUCs from Core Sixpack 2
2022-11-19	23:09:59	-117.02435	11.92993	4122.6	PUC82 deployed
2022-11-19	23:12:11	-117.02435	11.93001	4122.6	PUC37 deployed
2022-11-19	23:14:35	-117.02426	11.92990	4122.6	PUCA0 deployed
2022-11-19	23:14:58	-117.02432	11.92998	4122.6	 PUC site E with deployed cores 20221119_231458_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	23:15:29	-117.02432	11.93001	4122.61	Retrieving PUCs back into Core Sixpack 2
2022-11-19	23:19:57	-117.02442	11.92987	4122.61	PUCA0 retrieved
2022-11-19	23:21:42	-117.02432	11.92988	4122.61	PUC37 retrieved
2022-11-19	23:23:18	-117.02435	11.92978	4122.61	PUC82 retrieved
2022-11-19	23:25:29	-117.02431	11.92982	4122.61	 PUC site E post coring 20221119_232529_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	23:25:41	-117.02431	11.92981	4122.62	PUC site E post coring (photo not displayed)

					20221119_232541_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	23:25:53	-117.02430	11.92980	4122.62	Next action: retrieval of MICP1
2022-11-19	23:31:18	-117.02472	11.92975	4120.11	ROV is heading towards MICP1 (deployment site MICP1-1)
2022-11-19	23:34:13	-117.02538	11.92994	4120.24	 MICP1 at the seafloor (deployment site MICP1-1) prior to recovery 20221119_233413_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	23:34:32	-117.02537	11.92993	4120.33	 MICP1 at the seafloor prior to recovery (close up) 20221119_233432_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	23:37:38	-117.02524	11.92986	4120.45	MICP1 lifted up from the seafloor
2022-11-19	23:42:02	-117.02510	11.92983	4120.43	Arriving at Elevator 1 with MICP1 in manipulator gripper
2022-11-19	23:46:03	-117.02501	11.92980	4121.15	MICP1 secured on Elevator 1, next action: heading towards MICP-DEEP 1 (deployment site MICP-DEEP1-3)
2022-11-19	23:49:12	-117.02495	11.92994	4119.09	 MICP-DEEP1 at deployment site MICP-DEEP1-3 prior to recovery 20221119_234912_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	23:49:51	-117.02494	11.92994	4119.21	 MICP-DEEP1 prior to recovery 20221119_234951_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	23:50:24	-117.02484	11.92982	4119.76	MICP-DEEP1 prior to recovery (photo not displayed) 20221119_235024_Sonne_SO295_073ROV09_Logo_thumb.jpg

2022-11-19	23:50:42	-117.02484	11.92982	4120.11	 MICP-DEEP1 prior to recovery (close up) 20221119_235042_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-19	23:52:49	-117.02504	11.92989	4119.29	Program of MICP-DEEP1 still running (not yet blinking): waiting for program to finish
2022-11-19	23:54:40	-117.02528	11.92998	4119.08	MICP-DEEP1 program finished
2022-11-20	00:03:58	-117.02502	11.92978	4119.97	MICP-DEEP1 picked up from the seafloor, heading back to Elevator 1 with MICP-DEEP1 in manipulator gripper
2022-11-20	00:09:11	-117.02491	11.92929	4121.57	MICP-DEEP1 secured on Elevator 1
2022-11-20	00:16:38	-117.02499	11.92980	4118.14	Fish (photo not displayed) 20221120_001638_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-20	00:16:57	-117.02499	11.92980	4118.13	Fish, Next action: approaching Elevator Recovery System ('Bergefuchs')
2022-11-20	00:27:53	-117.02505	11.92967	4111.52	 Elevator Recovery system in view 20221120_002753_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-20	00:34:10	-117.02502	11.92977	4119.78	ROV operated shackle Elevator 1 hooked into Bergefuchs
2022-11-20	00:37:25	-117.02503	11.92975	4119.76	Bergefuchs - Elevator Connection secured
2022-11-20	00:40:21	-117.02495	11.92985	4118.6	 Elevator 1 connected to the Elevator Recovery System 20221120_004021_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-20	00:40:33	-117.02495	11.92985	4118.6	Elevator 1 upon lift off (photo not displayed) 20221120_004033_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-20	00:40:35	-117.02495	11.92985	4118.6	Elevator 1 upon lift off (photo not displayed) 20221120_004035_Sonne_SO295_073ROV09_Logo_thumb.jpg

2022-11-20	00:40:37	-117.02495	11.92985	4118.6	 Elevator 1 upon lift off 20221120_004037_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-20	00:41:22	-117.02499	11.92990	4118.59	Elevator 1 on its way back to the surface
2022-11-20	00:41:41	-117.02501	11.92989	4118.65	ROV heading towards BFC3 (deployed during dive 7)
2022-11-20	00:43:56	-117.02531	11.92998	4119.76	BFC3 at deployment site (photo not displayed) 20221120_004356_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-20	00:43:56	-117.02531	11.92998	4119.76	BFC3 in view
2022-11-20	00:44:06	-117.02532	11.92999	4119.81	 BFC3 at deployment site 20221120_004406_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-20	00:44:31	-117.02534	11.93002	4120.03	Syringe 1-4 are triggered
2022-11-20	00:45:13	-117.02538	11.93003	4120.63	 BFC3 prior to retrieval 20221120_004513_Sonne_SO295_073ROV09_Logo_thumb.jpg
2022-11-20	00:46:32	-117.02536	11.93007	4118.88	BFC3 retrieved from the seafloor
2022-11-20	00:48:03	-117.02530	11.93016	4112.92	BFC3 positioned on ROV porch
2022-11-20	00:48:48	-117.02524	11.93016	4112.04	BFC3 stirrer is not turning
2022-11-20	00:49:37	-117.02511	11.93024	4103.28	OFF THE BOTTOM
2022-11-20	02:39:39	None	None	None	ON DECK

* Shortcomings in underwater navigation that lasted until station SO295_089-1_ROV-11 led to uncertainties in positioning ranging between some tens of meters to >100 m (see also section on underwater navigation in this cruise report). These intrinsic offsets could not be removed by the curation routines applied to navigation raw data (for a description see comment to first dive protocol). Positioning at the target disturbance structures (e.g., in collector tracks) was ensured visually.

Kiel 6000 Dive 10 (SO295_083-1_ROV-10)

Date: 21.Nov.2022

Principal Investigators: Felix Janssen, Tanja Stratmann

Observers: Duygu Sevilgen, Ricarda Meineke, Brenda Esteban, Amber Henningsen

Protocol: Brenda Esteban

ROV positions (at the bottom)
Start of dive: 11°55.831' N 117°1.564' W
End of dive: 11°55.834' N 117°1.540' W

Dive duration:

ROV in the water:	21.Nov.2022	15:30:15
ROV at the bottom:	21.Nov.2022	17:05:55
ROV off the bottom:	21.Nov.2022	23:59:43
ROV on deck:	22.Nov.2022	01:46:49

Explored sites: GER plume impact (thick cover)

Aims of the Dive:

- Deployment of 3 Benthic Flux Chambers (BFC1, 2, & 3)
- Deployment and repositioning of Electrochemical Microsensor Profiler (MICP2)
- Deployment 2 Fiberoptical Microsensor Profilers (MICP-DEEP1 & MICP-DEEP2)
- Repositioning of MICP-DEEP1
- Deployment of 2 Benthic Incubators (CUBE2, CUBE3)
- Push Cores (PUCs) sampling at 3 sites
- Megafauna sampling
- Recovery MICP-DEEP2, taking up with ROV

Handled ROV Tools (including scientific payload):

- Benthic Flux Chambers (BFC1 & 2; on descent)
- Magnet Stick
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- 16 Push Cores (PUCs) in 16 Core Rack
- ICBM Biobox extra large
- MICP-DEEP2 (on ascent)

Relevant Elevator payload

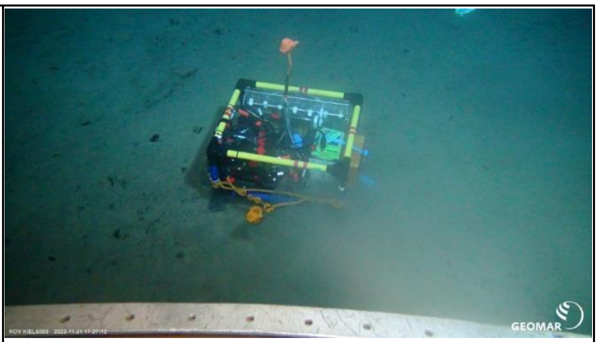
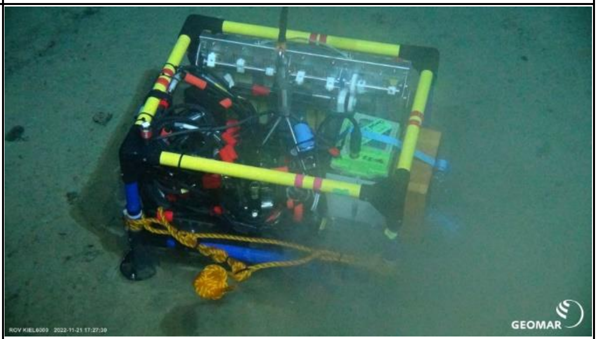
Elevator 2

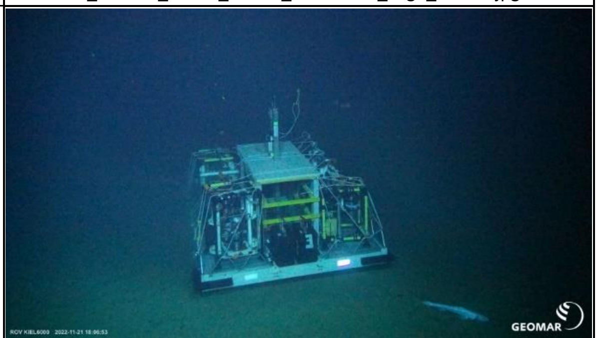
- BFC3
- MICP2
- MICP-DEEP1, MICP-DEEP2
- CUBE2, CUBE3

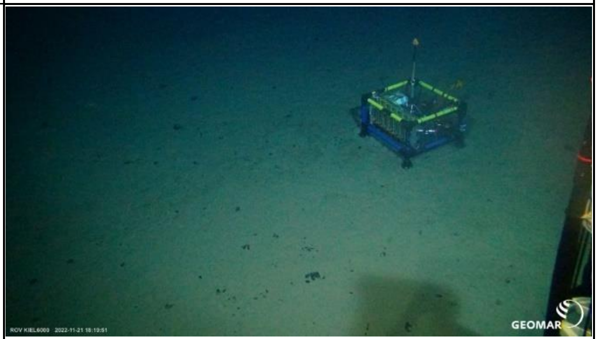
Dive summary

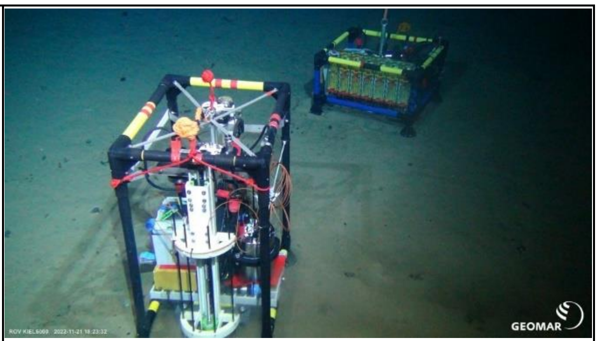
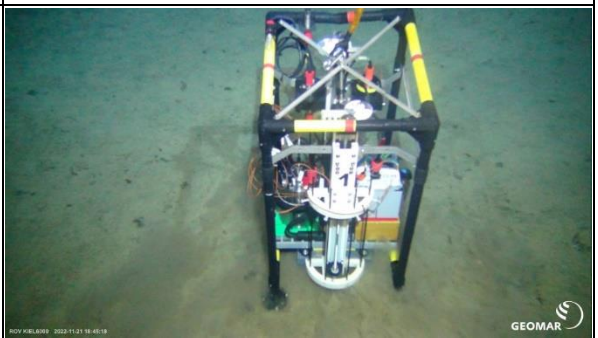
The ROV descended with BFC1 and 2 on the porch while Elevator 2 was lowered from the ship towards the seafloor. Once the ROV was at the position for BFC deployment, BFC1 and BFC2 were subsequently deployed. After that, Elevator 2 was guided to the seafloor and the ROV operated shackle detached. MICP-DEEP2 was taken from Elevator 2 and deployed close to BFC1. As the next step, MICP-DEEP1 was taken from Elevator 2 and deployed next to BFC2. Later, MICP2 was taken from Elevator 2 as well and deployed in the vicinity of the other instruments after which BFC3 was taken from Elevator 2 and positioned next to MICP2. CUBE2 and CUBE3 were taken from Elevator 2 and deployed on top of what looked like partially decayed sponges. Between and after CUBE deployments, a total of 14 PUCs were sampled at three locations (PUC site A, B, C). Three megafauna specimen were collected (2 sponges and a brittle star). Later on, MICP2 and MICP-DEEP1 were both restarted and relocated by approx. 10 m for a second deployment. Finally, MICP-DEEP2 was taken on the porch for recovery after which the ROV started to ascend.

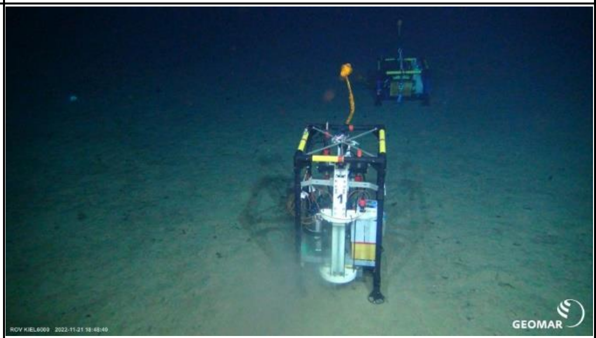
Date	UTC Time	SUB1_Lon*	SUB1_Lat*	SUB1_Depth	Observations/Comments / Image
2022-11-21	15:30:15	None	None	None	IN THE WATER
2022-11-21	17:05:55	-117.02606	11.93051	4117.36	AT THE BOTTOM
2022-11-21	17:12:01	-117.02601	11.93055	4117.85	First action: fly direction East towards Elevator 2 to deploy BFC 1 and BFC 2 from the porch and then guide Elevator2 down
2022-11-21	17:15:40	-117.02569	11.93068	4117.81	Arrival at position for BFC deployments.
2022-11-21	17:15:53	-117.02569	11.93068	4117.79	BFC1 stirrer is stirring
2022-11-21	17:16:57	-117.02567	11.93070	4117.92	 BFC1 deployment site 20221121_171657_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	17:17:09	-117.02567	11.93070	4118.11	BFC1 deployment site (photo not displayed) 20221121_171709_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	17:18:51	-117.02566	11.93069	4119.58	Deployment BFC1, program already started
2022-11-21	17:21:50	-117.02564	11.93071	4118.62	moving Northeast to deploy BFC2
2022-11-21	17:24:33	-117.02548	11.93076	4118.31	BFC2 stirrer is stirring
2022-11-21	17:24:55	-117.02546	11.93078	4118.35	 BFC1 deployment site 20221121_172455_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	17:26:24	-117.02541	11.93084	4118.97	Deployment BFC2

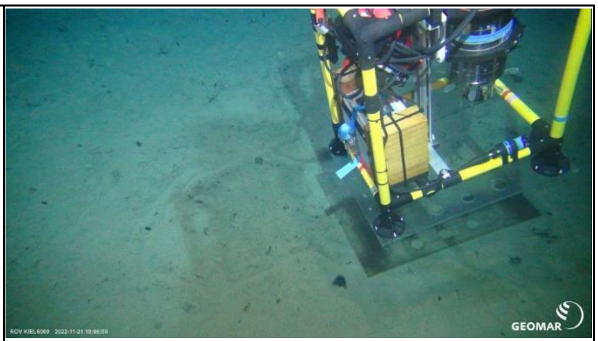
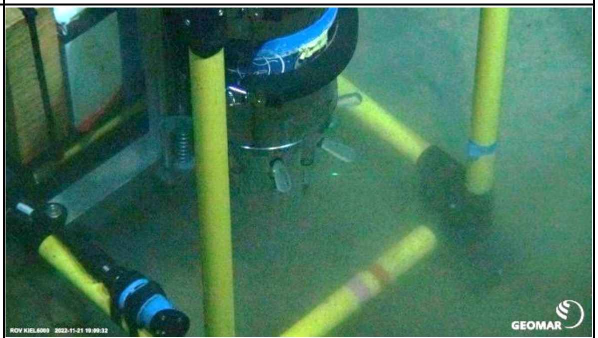
2022-11-21	17:27:12	-117.02541	11.93084	4119.24	 BFC2 at seafloor 20221121_172712_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	17:27:30	-117.02543	11.93083	4119.28	 BFC2 at seafloor (close up) 20221121_172730_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	17:28:12	-117.02543	11.93083	4119.53	Sponge?
2022-11-21	17:28:42	-117.02544	11.93081	4119.69	 Sponge? 20221121_172842_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	17:29:55	-117.02548	11.93077	4119.75	 BFC2 chamber close up 20221121_172955_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	17:30:23	-117.02548	11.93078	4119.75	White ring of BFC2 about 1 cm above the sediment surface
2022-11-21	17:31:17	-117.02548	11.93077	4119.75	Turning ROV back to nearby BFC1 to assess chamber penetration depth

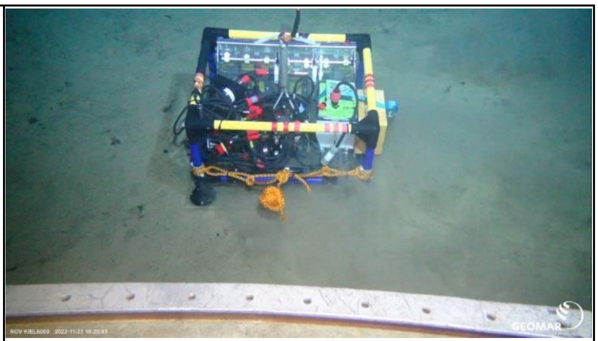
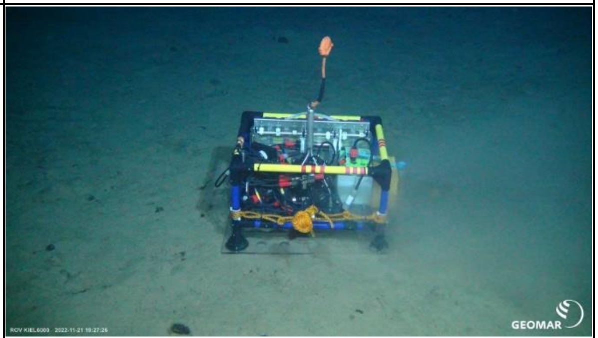
2022-11-21	17:34:31	-117.02559	11.93076	4119.2	 BFC1 chamber close up 20221121_173431_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	17:35:38	-117.02570	11.93070	4119.17	White ring of BFC1 is just above the sediment surface with a bit of a gap
2022-11-21	17:35:47	-117.02570	11.93070	4119.17	Next action: moving towards elevator
2022-11-21	17:41:39	-117.02536	11.93061	4110.81	Ascending to meet Elevator 2
2022-11-21	17:44:15	-117.02537	11.93061	4105.4	Jellyfish?
2022-11-21	17:48:48	-117.02555	11.93051	4098.23	Elevator 2 in view
2022-11-21	17:56:00	-117.02530	11.93058	4115.72	Fish
2022-11-21	17:57:13	-117.02534	11.93056	4117.92	Seemingly dead fish
2022-11-21	17:57:33	-117.02534	11.93055	4117.93	Elevator lowered to the seafloor
2022-11-21	17:57:36	-117.02535	11.93054	4117.92	Elevator 2 arriving at the seafloor (photo not displayed) 20221121_175736_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	17:57:39	-117.02536	11.93054	4117.91	 Elevator 2 with sediment cloud 20221121_175739_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:02:03	-117.02538	11.93067	4117.59	ROV operated shackle removed from Elevator 2 to release cable
2022-11-21	18:03:22	-117.02534	11.93057	4115.07	Next action: taking MICP-DEEP2 off Elevator 2 for deployment
2022-11-21	18:06:01	-117.02532	11.93054	4115.8	Fish seems to be alive
2022-11-21	18:06:49	-117.02518	11.93059	4117.65	Elevator 2 and fish (photo not displayed) 20221121_180649_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:06:53	-117.02518	11.93059	4117.78	 Elevator 2 and fish 20221121_180653_Sonne_SO295_083ROV10_Logo_thumb.jpg

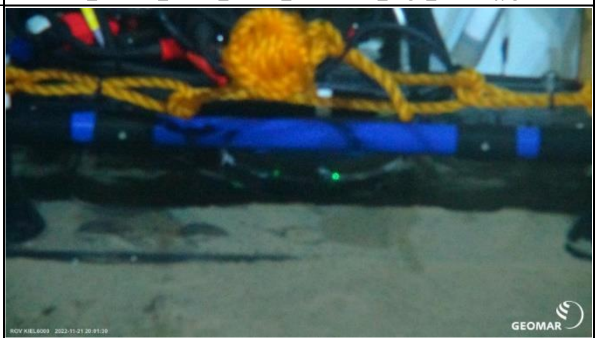
2022-11-21	18:07:05	-117.02518	11.93059	4118.08	 Fish close to Elevator 2 20221121_180705_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:11:21	-117.02524	11.93050	4119.42	Elastic straps of MICP-DEEP2 removed
2022-11-21	18:12:13	-117.02518	11.93053	4118.82	MICP-DEEP2 taken from Elevator 2
2022-11-21	18:12:39	-117.02518	11.93053	4118.28	Moving direction West to deploy MICP-DEEP2 close to BFC1
2022-11-21	18:15:52	-117.02556	11.93059	4118.17	Sponge(?), potential target for later CUBE deployments
2022-11-21	18:19:15	-117.02571	11.93062	4118.52	MICP-DEEP2 started with Magnet Stick hanging from RigMaster
2022-11-21	18:19:41	-117.02572	11.93062	4118.53	Toothed wheel of profiling stage 1 turning: MICP-DEEP2 program started
2022-11-21	18:19:51	-117.02572	11.93062	4118.53	 MICP-DEEP2 deployment site 20221121_181951_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:20:08	-117.02572	11.93062	4118.52	 MICP-DEEP2 deployment site 20221121_182008_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:23:16	-117.02568	11.93065	4119.49	MICP-DEEP2 positioned at seafloor: deployment MICP-DEEP2-1
2022-11-21	18:23:20	-117.02568	11.93065	4119.5	 MICP-DEEP2 at seafloor 20221121_182320_Sonne_SO295_083ROV10_Logo_thumb.jpg

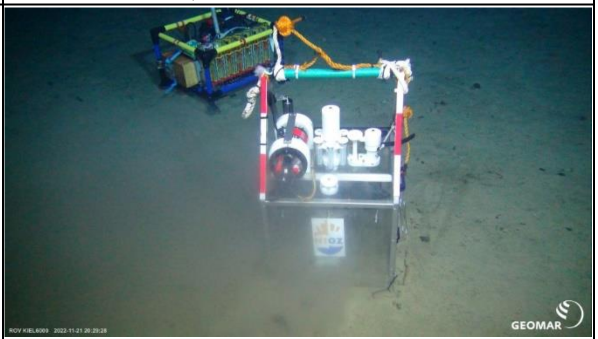
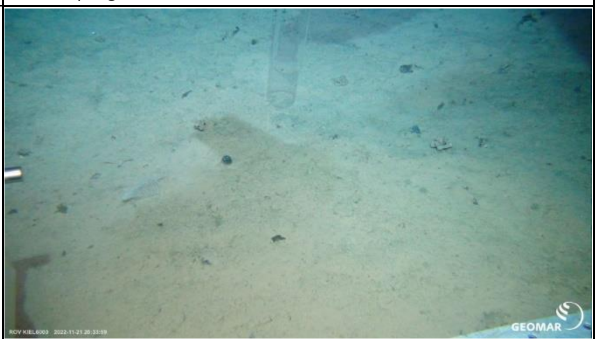
2022-11-21	18:23:32	-117.02568	11.93065	4119.54	 MICP-DEEP2 and BFC1 at seafloor 20221121_182332_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:25:08	-117.02569	11.93045	4119.4	Going back to Elevator 2 to to pick up MICP-DEEP1 for deployment
2022-11-21	18:35:31	-117.02537	11.93044	4119.07	MICP-DEEP1 taken up from Elevator 2
2022-11-21	18:36:43	-117.02539	11.93037	4117.13	Moving towards BFC2 to deploy MICP-DEEP1 nearby
2022-11-21	18:39:11	-117.02533	11.93073	4117.52	Sponges(?) to the left and right of BFC2 – potential targets for later CUBE deployments
2022-11-21	18:40:32	-117.02538	11.93074	4118.84	MICP-DEEP1 is started with Magnet Stick hanging from RigMaster
2022-11-21	18:41:00	-117.02538	11.93074	4118.85	Toothed wheel of stage 1 turning: program started
2022-11-21	18:42:13	-117.02550	11.93073	4119.08	MICP-DEEP1 deployment site (photo not displayed) 20221121_184213_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:42:21	-117.02550	11.93073	4119.1	 MICP-DEEP1 deployment site 20221121_184221_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:45:09	-117.02551	11.93081	4119.35	MICP-DEEP1 positioned at seafloor: deployment MICP-DEEP1-1
2022-11-21	18:45:18	-117.02551	11.93081	4119.37	 MICP-DEEP1 at seafloor 20221121_184518_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:47:23	-117.02541	11.93079	4119.48	 Sponge(?) and fish 20221121_184723_Sonne_SO295_083ROV10_Logo_thumb.jpg

2022-11-21	18:47:47	-117.02541	11.93079	4119.48	 Sponge(?) 20221121_184747_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:48:32	-117.02539	11.93075	4119.38	MICP-DEEP1 and BFC2 mat seafloor (photo not displayed) 20221121_184832_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:48:40	-117.02539	11.93075	4119.29	 MICP-DEEP1 and BFC2 at seafloor 20221121_184840_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:48:55	-117.02539	11.93075	4119.03	Heading back to Elevator 2
2022-11-21	18:52:39	-117.02524	11.93063	4118.49	Something red in front of the camera
2022-11-21	18:52:54	-117.02523	11.93063	4118.59	 Fish near Elevator 2 20221121_185254_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:53:00	-117.02523	11.93062	4118.63	 Fish near Elevator 2 20221121_185300_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	18:56:16	-117.02518	11.93061	4118.88	MICP2 taken from Elevator 2
2022-11-21	19:04:07	-117.02513	11.93068	4119.27	MICP2 started with Magnet Stick hanging from RigMaster
2022-11-21	19:04:29	-117.02514	11.93067	4119.28	Geared wheel of stage turning: program started

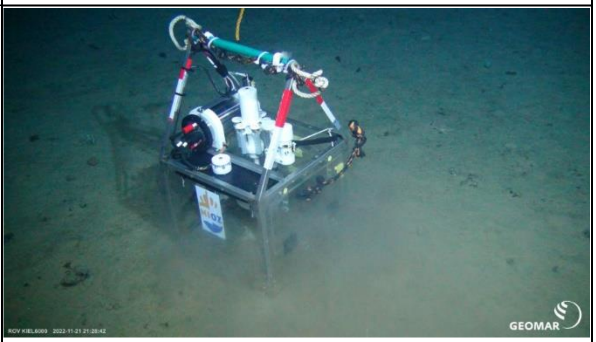
2022-11-21	19:06:00	-117.02516	11.93064	4119.23	 MICP2 deployment site 20221121_190600_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	19:08:38	-117.02514	11.93064	4119.18	MICP2 positioned at seafloor: deployment MICP2-1
2022-11-21	19:09:18	-117.02513	11.93064	4119.17	 MICP2 at seafloor: deployment MICP2-1 20221121_190918_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	19:09:32	-117.02513	11.93064	4119.1	 MICP2 at seafloor (close up) 20221121_190932_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	19:09:46	-117.02513	11.93064	4118.95	Moving back to Elevator 2
2022-11-21	19:13:17	-117.02520	11.93059	4119.7	BFC3's stirrer is not turning
2022-11-21	19:15:42	-117.02524	11.93056	4119.77	BFC3 is taken from Elevator 2
2022-11-21	19:17:23	-117.02522	11.93053	4119.78	BFC3 placed on the ROV's porch
2022-11-21	19:20:06	-117.02519	11.93057	4119.32	Going to MICP2 position to deploy BFC3 nearby
2022-11-21	19:23:10	-117.02508	11.93058	4119.79	 BFC3 deployment site 20221121_192310_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	19:25:17	-117.02512	11.93058	4119.77	Deployment BFC3 at seafloor

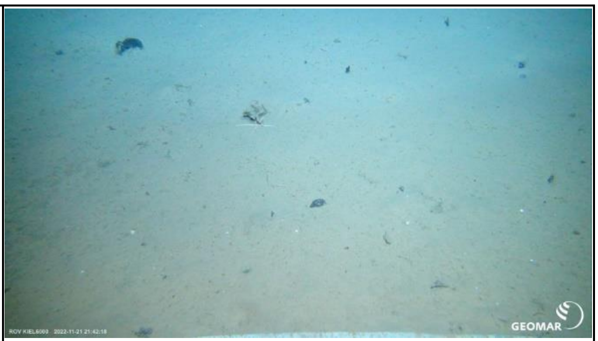
2022-11-21	19:25:55	-117.02511	11.93061	4119.81	 BFC3 at seafloor 20221121_192555_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	19:27:26	-117.02511	11.93062	4119.84	 BFC3 at seafloor 20221121_192726_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	19:28:34	-117.02518	11.93058	4119.86	Next action: PUC sampling at site A with PUCs from 16 Core Rack
2022-11-21	19:29:14	-117.02518	11.93057	4120.13	Landing the ROV for PUC sampling, waiting for visibility to improve
2022-11-21	19:32:20	-117.02514	11.93059	4120.6	PUC37 deployed
2022-11-21	19:33:14	-117.02516	11.93057	4120.59	 PUC site A at the beginning of coring 20221121_193314_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	19:34:16	-117.02513	11.93056	4120.59	PUC5 deployed
2022-11-21	19:36:52	-117.02512	11.93057	4120.59	Hydraulic failure: PUC 1 dropped to the seafloor, will be picked up later
2022-11-21	19:38:22	-117.02521	11.93054	4120.59	PUCs 77, 76 and 1 are missing the hose clamp on the top and should not be used
2022-11-21	19:39:33	-117.02518	11.93056	4120.59	PUC49 deployed
2022-11-21	19:41:45	-117.02519	11.93053	4120.6	PUC64 deployed
2022-11-21	19:43:00	-117.02514	11.93056	4120.61	PUC73 deployed
2022-11-21	19:43:15	-117.02514	11.93056	4120.61	 20221121_194315_Sonne_SO295_083ROV10_Logo_thumb.jpg PUCs deployed.

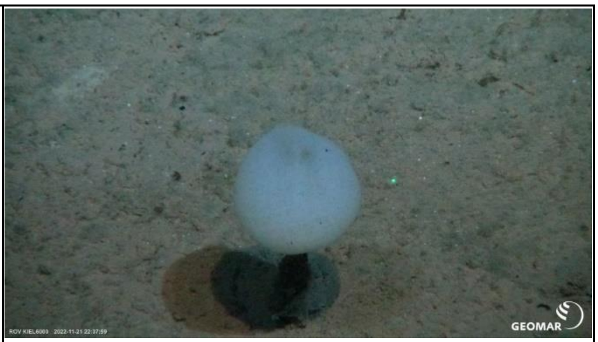
2022-11-21	19:43:39	-117.02513	11.93058	4120.62	Retrieving PUCs back into 16 Core Rack
2022-11-21	19:44:45	-117.02514	11.93058	4120.61	PUC73 retrieved
2022-11-21	19:46:29	-117.02517	11.93061	4120.61	PUC64 retrieved
2022-11-21	19:48:16	-117.02508	11.93061	4120.61	PUC49 retrieved
2022-11-21	19:49:57	-117.02509	11.93061	4120.62	PUC5 retrieved, sediment lost from core
2022-11-21	19:52:16	-117.02506	11.93060	4120.64	PUC37 retrieved
2022-11-21	19:53:21	-117.02507	11.93060	4120.65	Picking up PUC 1 that dropped to the seafloor earlier
2022-11-21	19:55:51	-117.02504	11.93064	4120.68	PUC1 deployed
2022-11-21	19:57:04	-117.02505	11.93065	4120.66	 PUC1 deployed 20221121_195704_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	19:58:45	-117.02511	11.93062	4120.66	PUC1 retrieved
2022-11-21	19:59:34	-117.02511	11.93062	4120.66	 PUC site A post coring 20221121_195934_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:00:44	-117.02512	11.93060	4120.66	BFC3 chamber (close up; photo not displayed) 20221121_200044_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:01:30	-117.02510	11.93057	4120.6	 BFC3 chamber (close up) 20221121_200130_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:02:04	-117.02522	11.93049	4120.15	Moving back to Elevator 2
2022-11-21	20:07:35	-117.02531	11.93050	4119.54	Removing elastic straps from CUBE2
2022-11-21	20:09:18	-117.02550	11.93052	4119.51	CUBE2 taken from Elevator 2
2022-11-21	20:10:06	-117.02550	11.93052	4119.13	Looking for deployment site for CUBE2

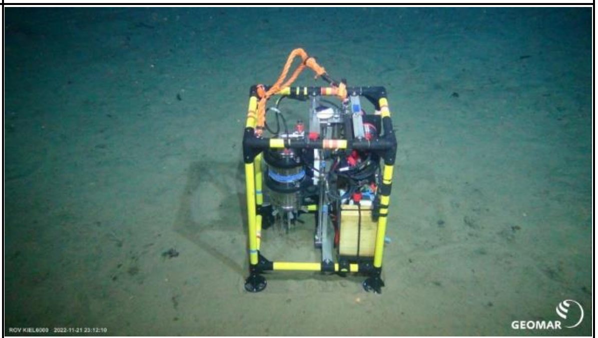
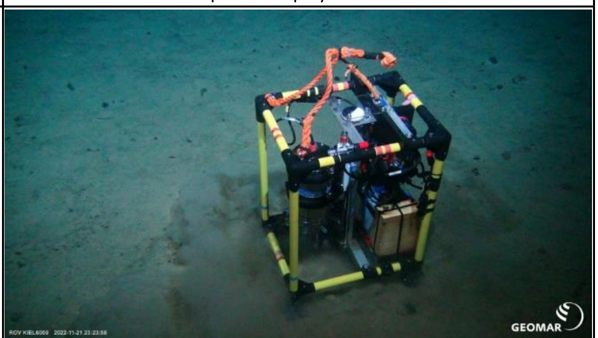
2022-11-21	20:14:41	-117.02543	11.93073	4118.31	 Sponge(?) 20221121_201441_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:14:57	-117.02544	11.93071	4118.31	 Sponge(?), CUBE2 deployment site 20221121_201457_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:15:47	-117.02545	11.93068	4118.39	Placing CUBE2 over sponge(?)
2022-11-21	20:20:27	-117.02551	11.93072	4119.32	CUBE2 deployed
2022-11-21	20:24:29	-117.02547	11.93071	4119.58	CUBE2 door closed
2022-11-21	20:27:07	-117.02549	11.93069	4119.61	CUBE2 activated
2022-11-21	20:28:31	-117.02547	11.93065	4119.59	CUBE2 door is now fully closed.
2022-11-21	20:29:28	-117.02546	11.93069	4119.58	 CUBE2 deployed near BFC2 20221121_202928_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:29:58	-117.02548	11.93069	4119.58	ROV landing 2m to the right of CUBE2 for PUC sampling.
2022-11-21	20:33:10	-117.02543	11.93071	4120.39	PUC sampling start at site B with PUCs from 16 Core Rack
2022-11-21	20:33:59	-117.02545	11.93073	4120.39	 PUC sampling site B prior to coring 20221121_203359_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:34:43	-117.02546	11.93073	4120.4	PUC2 deployed
2022-11-21	20:36:36	-117.02545	11.93073	4120.41	PUC9 deployed
2022-11-21	20:39:06	-117.02551	11.93073	4120.43	PUC35 cannot be used as the lid comes off

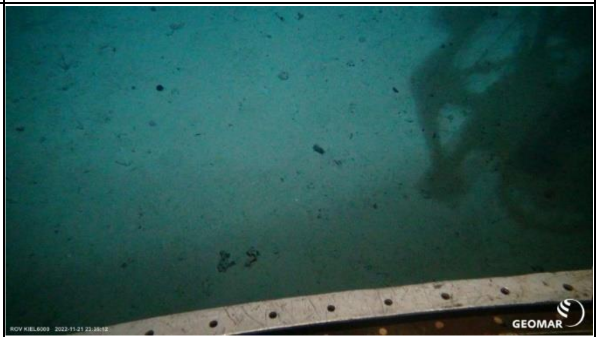
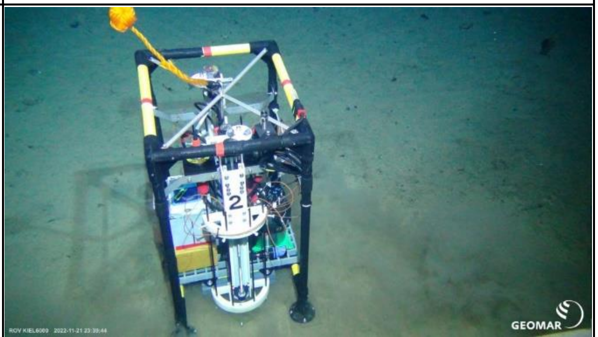
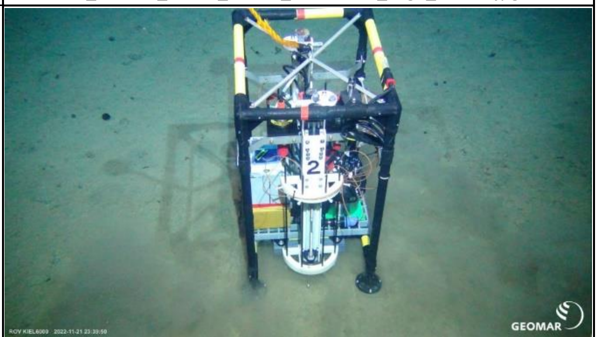
2022-11-21	20:40:35	-117.02545	11.93072	4120.44	PUCB6 deployed
2022-11-21	20:42:40	-117.02544	11.93070	4120.44	PUCB9 deployed
2022-11-21	20:44:57	-117.02544	11.93069	4120.47	PUC67 deployed
2022-11-21	20:45:03	-117.02544	11.93069	4120.48	 PUC site with deployed cores 20221121_204503_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:45:17	-117.02545	11.93069	4120.48	 PUC site with deployed cores (close up) 20221121_204517_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:45:40	-117.02546	11.93070	4120.47	Retrieving PUCs back into 16 Core Rack
2022-11-21	20:46:47	-117.02546	11.93071	4120.45	PUC67 retrieved
2022-11-21	20:48:21	-117.02547	11.93072	4120.46	PUCB9 retrieved
2022-11-21	20:50:52	-117.02544	11.93070	4120.47	PUCB6 retrieved
2022-11-21	20:52:36	-117.02545	11.93070	4120.48	PUC9 retrieved
2022-11-21	20:54:03	-117.02546	11.93071	4120.48	PUC2 retrieved
2022-11-21	20:54:21	-117.02546	11.93071	4120.48	 PUC site B post coring 20221121_205421_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	20:55:21	-117.02546	11.93071	4119.64	Moving back to Elevator 2
2022-11-21	21:01:23	-117.02528	11.93044	4119.9	Taking up CUBE3 from Elevator 2
2022-11-21	21:12:49	-117.02528	11.93043	4119.7	Moving back to deployment site of CUBE2 to deploy CUBE3 on the other nearby sponge(?)

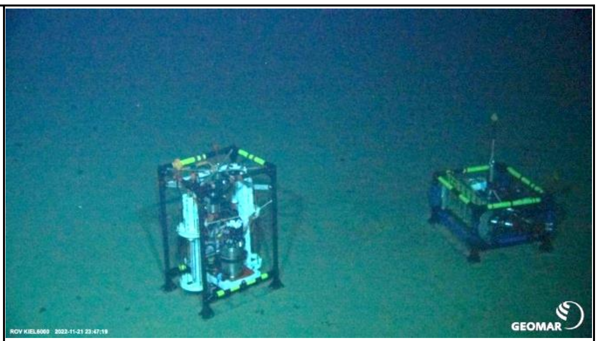
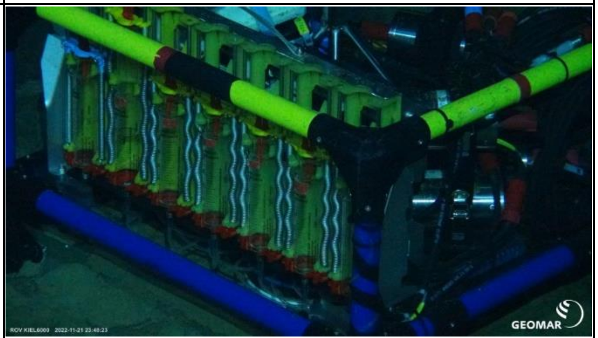
2022-11-21	21:18:50	-117.02552	11.93065	4118.57	 Sponge(?) at CUBE3 deployment site 20221121_211850_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	21:19:53	-117.02551	11.93065	4118.56	 Sponge(?) at CUBE3 deployment site 20221121_211953_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	21:25:10	-117.02551	11.93066	4119.54	Deployment CUBE3 on top of sponge(?)
2022-11-21	21:26:27	-117.02553	11.93067	4119.68	CUBE3 activated
2022-11-21	21:28:42	-117.02554	11.93068	4119.76	 CUBE3 at seafloor 20221121_212842_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	21:29:07	-117.02554	11.93068	4119.76	 CUBE3 at seafloor (close up) 20221121_212907_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	21:37:43	-117.02535	11.93046	4119.38	Landing ROV at target site for PUC sampling

2022-11-21	21:42:18	-117.02530	11.93046	4120.9	 PUC site C prior to coring 20221121_214218_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	21:42:36	-117.02530	11.93046	4120.9	PUC sampling start at site C with PUCs from 16 Core Rack
2022-11-21	21:44:43	-117.02533	11.93046	4120.91	PUCC8 deployed
2022-11-21	21:46:31	-117.02528	11.93043	4120.93	PUC78 deployed
2022-11-21	21:49:22	-117.02531	11.93045	4120.94	PUC35 deployed
2022-11-21	21:49:36	-117.02531	11.93045	4120.93	 PUC site C with deployed cores 20221121_214936_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	21:49:54	-117.02531	11.93045	4120.93	Retrieving PUCs back into 16 Core Rack
2022-11-21	21:50:58	-117.02531	11.93046	4120.94	PUC35 retrieved
2022-11-21	21:52:03	-117.02532	11.93046	4120.96	PUC78 retrieved
2022-11-21	21:53:25	-117.02532	11.93046	4120.96	PUCC8 retrieved
2022-11-21	22:15:19	-117.02499	11.93056	4119.82	Shrimp swimming
2022-11-21	22:37:31	-117.02467	11.93051	4121.06	 Sponge selected for sampling 20221121_223731_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	22:37:34	-117.02467	11.93051	4121.07	Next action: megafauna sampling
2022-11-21	22:37:40	-117.02467	11.93051	4121.08	Sponge selected for sampling (photo not displayed) 20221121_223740_Sonne_SO295_083ROV10_Logo_thumb.jpg

2022-11-21	22:37:59	-117.02467	11.93051	4121.09	 Sponge selected for sampling (close up) 20221121_223759_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	22:44:40	-117.02470	11.93052	4121.06	Collecting sponge into ICBM Biobox extra large, sample MEGA19 sponge
2022-11-21	22:48:38	-117.02463	11.93055	4121.03	Sponge and brittle star selected for sampling (photo not displayed) 20221121_224838_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	22:48:48	-117.02463	11.93056	4121.07	 Sponge and brittle star selected for sampling 20221121_224848_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	22:49:07	-117.02464	11.93056	4121.09	 Sponge selected for sampling 20221121_224907_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	22:51:40	-117.02464	11.93057	4121.07	Failed attempt to collect sponge into ICBM Biobox extra large
2022-11-21	22:52:06	-117.02465	11.93057	4121.06	Collecting brittle star (from the same location) into ICBM Biobox extra large, sample MEGA20Brittlestar
2022-11-21	22:58:06	-117.02469	11.93052	4121.02	 Sponge selected for sampling 20221121_225806_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	22:58:14	-117.02470	11.93052	4121.02	Sponge selected for sampling (photo not displayed) 20221121_225814_Sonne_SO295_083ROV10_Logo_thumb.jpg

2022-11-21	22:58:40	-117.02469	11.93051	4121.03	 Sponge selected for sampling (close up) 20221121_225840_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:04:03	-117.02482	11.93059	4121.1	Collecting sponge (second attempt as it was first lost upon transfer to biobox) into ICBM biobox extra large, sample MEGA21Sponge
2022-11-21	23:08:30	-117.02480	11.93046	4119.82	Moving towards MICP2
2022-11-21	23:12:10	-117.02518	11.93060	4120.25	 MICP2 at seafloor before relocation 20221121_231210_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:15:06	-117.02502	11.93051	4120.28	MICP2 is blinking. Program is finished
2022-11-21	23:16:02	-117.02505	11.93044	4119.89	Relocating MICP2 10 m direction West
2022-11-21	23:19:09	-117.02521	11.93053	4120.22	 Deployment site MICP2 20221121_231909_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:22:20	-117.02526	11.93058	4120.21	MICP2 started with Magnet Stick hanging from RigMaster
2022-11-21	23:22:41	-117.02526	11.93058	4120.21	Toothed wheel is turning: program started
2022-11-21	23:23:54	-117.02529	11.93058	4120.24	Relocation of MICP2 completed: deployment MICP2-2
2022-11-21	23:23:58	-117.02529	11.93058	4120.25	 MICP2 at seafloor after relocation 20221121_232358_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:24:02	-117.02529	11.93057	4120.25	MICP2 at seafloor after relocation (photo not displayed) 20221121_232402_Sonne_SO295_083ROV10_Logo_thumb.jpg

2022-11-21	23:26:16	-117.02522	11.93050	4119.31	Heading towrds MIC-DEEP1
2022-11-21	23:28:51	-117.02545	11.93065	4118.79	 MICP-DEEP1, BFC2, CUBES 20221121_232851_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:30:59	-117.02542	11.93065	4120.15	MICP-DEEP1 is blinking: deployment MICP-DEEP1-1 finished.
2022-11-21	23:32:40	-117.02538	11.93065	4118.34	Relocating MICP-DEEP1 10 m direction Northeast
2022-11-21	23:35:12	-117.02531	11.93073	4119.43	 MICP-DEEP1 redeployment site 20221121_233512_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:37:45	-117.02533	11.93074	4119.52	MICP-DEEP1 started with Magnet Stick hanging from RigMaster
2022-11-21	23:39:42	-117.02536	11.93077	4120.17	Relocation of MICP-DEEP1 relocation completed: deployment MICP-DEEP1-2
2022-11-21	23:39:44	-117.02536	11.93077	4120.17	 MICP-DEEP1 at seafloor after relocation 20221121_233944_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:39:50	-117.02536	11.93077	4120.18	 MICP-DEEP1 at seafloor after relocation 20221121_233950_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:42:49	-117.02532	11.93071	4118.78	Moving towards MICP-DEEP2
2022-11-21	23:47:05	-117.02566	11.93052	4118.99	MICP-DEEP2 and BFC1 (photo not displayed) 20221121_234705_Sonne_SO295_083ROV10_Logo_thumb.jpg

2022-11-21	23:47:19	-117.02567	11.93053	4119.17	 MICP-DEEP2 and BFC1 before retrieval of MICP-DEEP2 20221121_234719_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:48:23	-117.02569	11.93054	4119.99	 Syringe sampler of BFC1 20221121_234823_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:48:30	-117.02569	11.93054	4120.06	 BFC 1 at seafloor 20221121_234830_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:48:33	-117.02569	11.93054	4120.08	BFC1 at seafloor (photo not displayed) 20221121_234833_Sonne_SO295_083ROV10_Logo_thumb.jpg
2022-11-21	23:52:34	-117.02567	11.93055	4118.4	MICP-DEEP2 lifted from seafloor for retrieval with ROV
2022-11-21	23:56:15	-117.02566	11.93057	4118.38	MICP-DEEP2 placed on the porch.
2022-11-21	23:59:10	-117.02566	11.93056	4118.28	End of scientific work
2022-11-21	23:59:43	-117.02567	11.93056	4115.92	OFF THE BOTTOM
2022-11-22	01:46:49	None	None	None	ON DECK

* Shortcomings in underwater navigation that lasted until station SO295_089-1_ROV-11 led to uncertainties in positioning ranging between some tens of meters to >100 m (see also section on underwater navigation in this cruise report). These intrinsic offsets could not be removed by the curation routines applied to navigation raw data (for a description see comment to first dive protocol).

Kiel 6000 Dive 11 (SO295_089-1_ROV-111)

Date: 22.Nov.2022

Principal Investigators: Sabine Gollner, Felix Janssen, Patricia Esquete, Tanja Stratmann

Observers: Devin Vlach, Duygu Sevilgen, Tania Bezzerra, Lilian Böhringer

Protocol: Mirja Bardenhagen

ROV positions (at the bottom)

Start of dive: 11°84.399' N -117°05.893' W
End of dive: 11°84.496' N -117°25.926' W

Dive duration:

ROV in the water:	22.Nov.2022	15:13:13
ROV at the bottom:	22.Nov.2022	17:11:07
ROV off the bottom:	23.Nov.2022	00:27:48
ROV on deck:	23.Nov.2022	02:04:11

Explored sites: GER reference

Aims of the Dive:

- Elevator 1 deployment
- Recovery of 5 Recolonization Frames (FRAMEs)
- *Deployment and recovery of Electrochemical Microsensor Profiler (MICP1)*
- *Deployment and recovery of Fiberoptical Microsensor Profiler (MICP-DEEP2)*
- Push Core (PUC) sampling
- Megafauna and nodule sampling
- Elevator 1 retrieval

Handled ROV Tools (including scientific payload):

- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- *Magnet Stick*
- PUCs in 16 Core Rack
- ICBM Biobox extra large

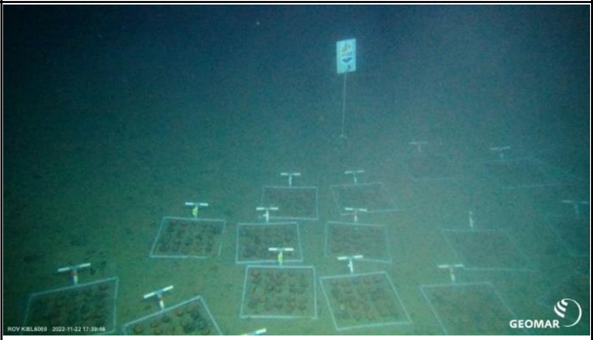
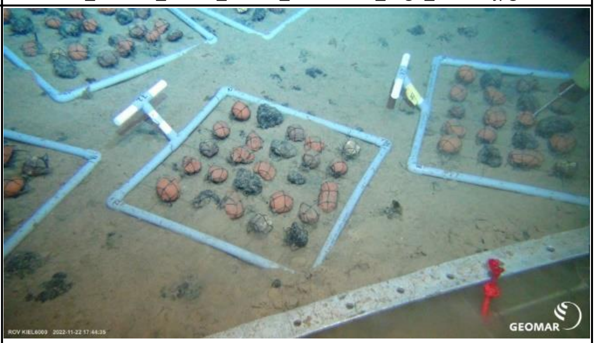
Relevant Elevator payload

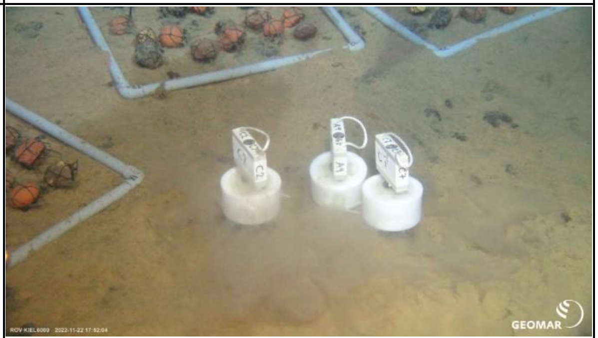
Elevator 1

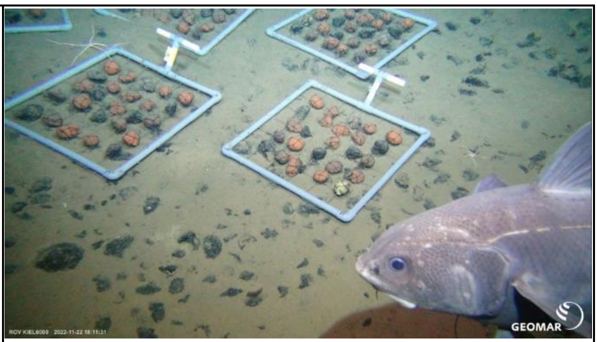
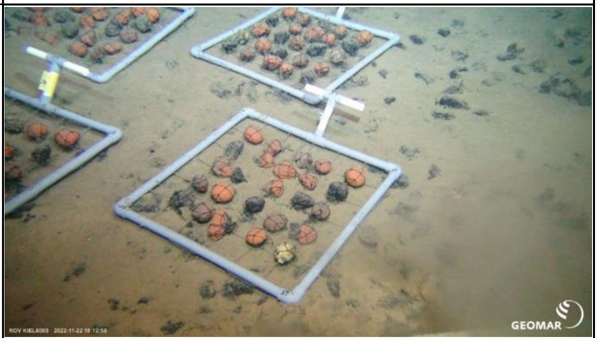
- 12 PUCs in 2 Core Sixpacks
- FRAME BOX
- *MICP1*
- *MICP-DEEP2*

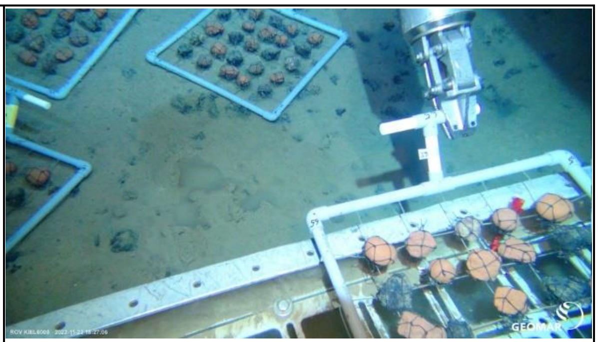
Dive summary

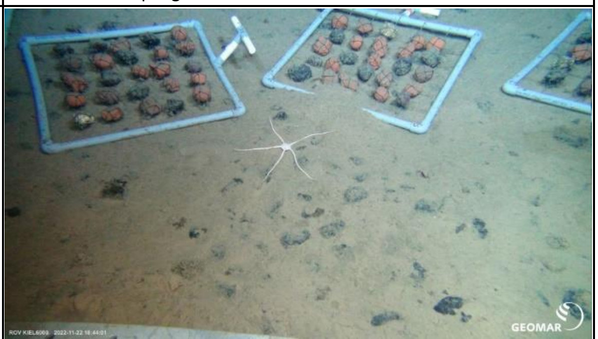
Elevator 1 was positioned near FRAMES and released by ROV with the ROV-manipulated shackle (not mentioned in below protocol). 5 FRAMEs were collected into FRAME BOX on Elevator 1 and PUC sampling took place in FRAME footprints. Elevator 1 was connected to the Elevator Recovery System for retrieval to deck. Megafauna specimen (sponges, brittle stars, brisingid starfisch, corals, sea cucumbers) were collected as well as nodules (some with scoop into biobox, some with PUCs).

Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-11-22	15:13:13	None	None	None	IN THE WATER
2022-11-22	17:11:07	-117.05893	11.84399	4167.24	AT THE BOTTOM
2022-11-22	17:33:33	-117.05896	11.84407	4169.71	2 sponges near Elevator 1 (after Elevator 1 was lowered to seafloor and detached from the cable by the ROV)
2022-11-22	17:36:43	-117.05897	11.84408	4170.35	FRAME BOX A on Elevator 1 opened
2022-11-22	17:38:32	-117.05897	11.84409	4169.38	FRAME deployment site (photo not displayed) 20221122_173832_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	17:38:48	-117.05897	11.84409	4169.39	FRAME deployment site (photo not displayed) 20221122_173848_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	17:39:07	-117.05897	11.84409	4169.43	 FRAME deployment site 20221122_173907_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	17:39:46	-117.05897	11.84409	4169.7	 FRAME deployment site 20221122_173946_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	17:44:35	-117.05898	11.84411	4171.37	 FRAME A (#72) 20221122_174435_Sonne_SO295_089ROV11_Logo_thumb.jpg

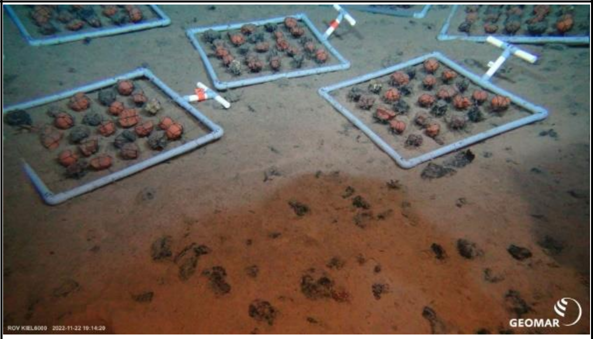
2022-11-22	17:46:46	-117.05898	11.84412	4171.33	FRAME A lifted from the seafloor and deposited next to footprint to start PUC sampling from 16 Core Rack
2022-11-22	17:47:00	-117.05898	11.84412	4171.33	FRAME A footprint (photo not displayed) 20221122_174700_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	17:47:12	-117.05898	11.84412	4171.33	 FRAME A (#72) footprint 20221122_174712_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	17:47:28	-117.05898	11.84412	4171.33	PUC sampling start in FRAME A (#72) footprint with PUCs from 16 Core Rack
2022-11-22	17:49:16	-117.05899	11.84413	4171.32	PUCA9 deployed in FRAME A footprint
2022-11-22	17:50:06	-117.05899	11.84413	4171.34	PUCC2 deployed in FRAME A footprint
2022-11-22	17:51:56	-117.05899	11.84414	4171.38	PUCC7 deployed in FRAME A footprint
2022-11-22	17:52:04	-117.05899	11.84414	4171.38	 PUCs in FRAME A footprint (C2, A9, C7 from left to right) 20221122_175204_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	17:52:31	-117.05899	11.84414	4171.38	Retrieving PUCs back into 16 Core Rack
2022-11-22	17:53:14	-117.05899	11.84414	4171.39	PUCC7 retrieved
2022-11-22	17:53:35	-117.05899	11.84414	4171.39	FISH (grenadier) at FRAME site
2022-11-22	17:54:23	-117.05900	11.84415	4171.39	PUCA9 retrieved
2022-11-22	17:56:07	-117.05900	11.84415	4171.37	PUCC2 retrieved
2022-11-22	17:56:35	-117.05900	11.84416	4171.37	 FRAME A footprint post coring 20221122_175635_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:05:13	-117.05901	11.84419	4170.69	Frame A (#72) placed in compartment A of FRAME BOX on Elevator 1
2022-11-22	18:11:11	-117.05902	11.84421	4171.07	Fish (grenadier)

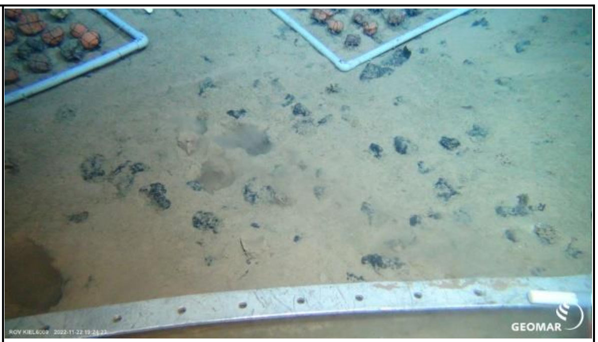
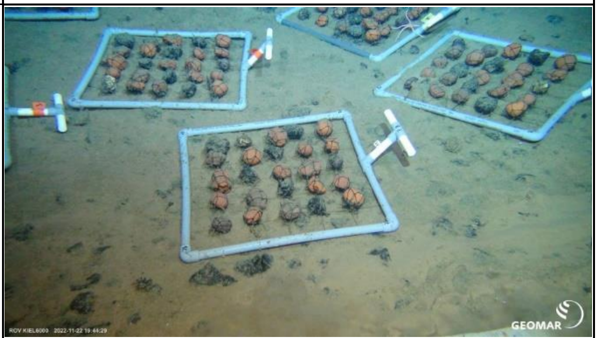
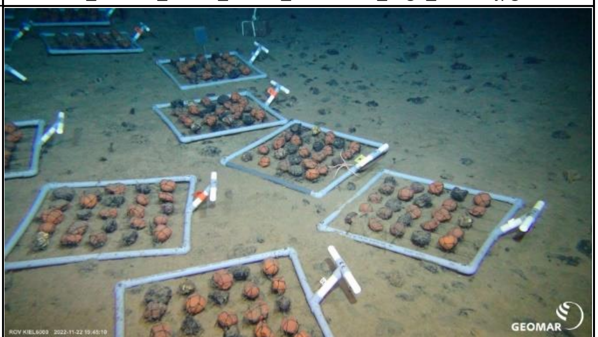
2022-11-22	18:11:31	-117.05902	11.84421	4171.11	 Grenadier fish 20221122_181131_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:12:50	-117.05902	11.84421	4171.48	 FRAME B (#65) 20221122_181250_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:15:39	-117.05903	11.84422	4171.52	FRAME B (#65) lifted from the seafloor and deposited next to footprint to start PUC sampling from 16 Core Rack
2022-11-22	18:16:06	-117.05903	11.84423	4171.51	 FRAME B (#65) footprint 20221122_181606_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:16:09	-117.05903	11.84423	4171.51	PUC sampling start in FRAME B footprint with PUCs from 16 Core Rack
2022-11-22	18:18:01	-117.05903	11.84423	4171.5	PUCC4 deployed in FRAME B footprint
2022-11-22	18:20:31	-117.05903	11.84424	4171.51	PUC41 deployed in FRAME B footprint
2022-11-22	18:22:01	-117.05904	11.84425	4171.51	PUC 69 deployed in FRAME B footprint
2022-11-22	18:22:09	-117.05904	11.84425	4171.5	 FRAME B footprint with deployed cores (69, C4, 41 from left to right) 20221122_182209_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:22:46	-117.05904	11.84425	4171.49	Retrieving PUCs back into 16 Core Rack
2022-11-22	18:22:53	-117.05904	11.84425	4171.49	PUC9 retrieved
2022-11-22	18:24:07	-117.05904	11.84425	4171.5	PUC41 retrieved
2022-11-22	18:25:25	-117.05904	11.84426	4171.49	PUCC4 retrieved

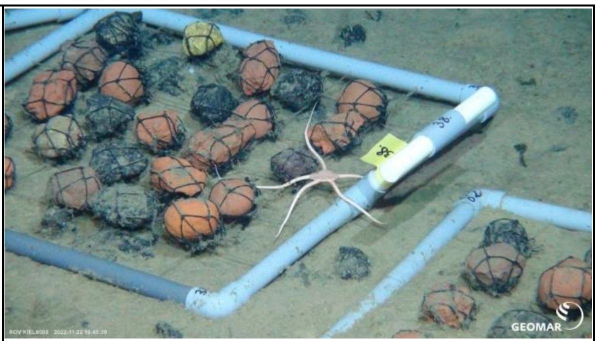
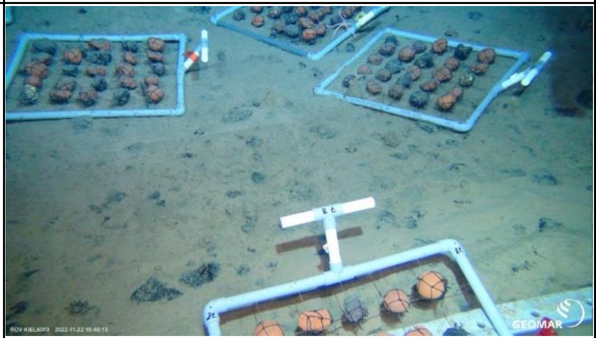
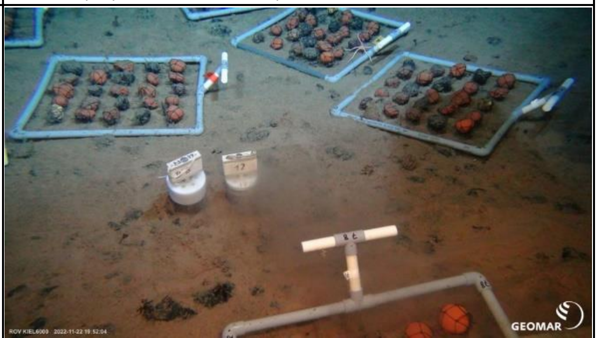
2022-11-22	18:27:06	-117.05904	11.84427	4171.02	 FRAME B footprint post coring 20221122_182706_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:31:33	-117.05905	11.84428	4170.41	FRAME B(#65) placed in compartment B of FRAME BOX on Elevator 1
2022-11-22	18:38:27	-117.05906	11.84431	4170.86	Sponge near FRAME (photo not displayed) 20221122_183827_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:38:30	-117.05906	11.84431	4170.88	 Sponge near FRAME 20221122_183830_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:38:48	-117.05906	11.84431	4170.99	Shrimp near FRAME (photo not displayed) 20221122_183848_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:38:51	-117.05906	11.84431	4171	 Shrimp near FRAME 20221122_183851_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:38:56	-117.05906	11.84431	4171.03	 Shrimp near FRAME 20221122_183856_Sonne_SO295_089ROV11_Logo_thumb.jpg

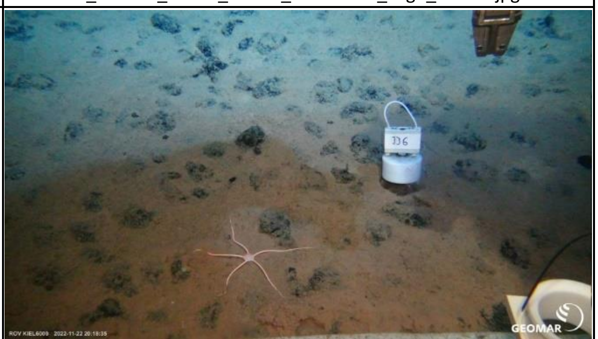
2022-11-22	18:40:40	-117.05906	11.84431	4171.39	 FRAME #72 20221122_184040_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:41:05	-117.05907	11.84432	4171.4	 Brittle star near FRAME 20221122_184105_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:41:52	-117.05907	11.84432	4171.39	 FRAME C (#45) 20221122_184152_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:43:51	-117.05907	11.84433	4171.35	FRAME C (#45) lifted from the seafloor and deposited next to footprint to start PUC sampling from 16 Core Rack
2022-11-22	18:44:01	-117.05907	11.84433	4171.35	 FRAME C footprint 20221122_184401_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:44:06	-117.05907	11.84433	4171.35	PUC sampling start at FRAME C footprint with PUCs from 16 Core Rack
2022-11-22	18:46:10	-117.05907	11.84433	4171.32	PUC42 deployed in FRAME C footprint
2022-11-22	18:48:22	-117.05908	11.84434	4171.3	PUCD7 deployed in FRAME C footprint
2022-11-22	18:50:07	-117.05908	11.84435	4171.3	PUC74 deployed in FRAME C footprint

2022-11-22	18:50:23	-117.05908	11.84435	4171.3	 FRAME C footprint with deployed cores (42, D7, 74 from left to right) 20221122_185023_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:50:45	-117.05908	11.84435	4171.3	 FRAME C footprint with deployed cores (42, D7, 74 from left to right)20221122_185045_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:51:04	-117.05908	11.84435	4171.3	FRAME C footprint with deployed cores (photo not displayed) 20221122_185104_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:51:22	-117.05908	11.84435	4171.3	 FRAME C footprint with deployed cores (42, D7, 74 from left to right) 20221122_185122_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	18:51:28	-117.05908	11.84435	4171.3	Retrieving PUCs back into 16 Core Rack
2022-11-22	18:52:28	-117.05908	11.84436	4171.31	PUC74 retrieved
2022-11-22	18:53:43	-117.05908	11.84436	4171.32	PUCD7 retrieved
2022-11-22	18:55:09	-117.05909	11.84437	4171.32	PUC42 retrieved
2022-11-22	18:55:38	-117.05909	11.84437	4171.32	 FRAME C footprint post coring 20221122_185538_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:01:38	-117.05910	11.84439	4170.73	Fish
2022-11-22	19:06:27	-117.05910	11.84441	4171.04	Frame C (#45) placed in compartment C of FRAME BOX 2
2022-11-22	19:07:59	-117.05911	11.84441	4171.07	Compartment D of FRAME BOX 2 opened
2022-11-22	19:08:17	-117.05911	11.84442	4171.08	Compartment C of FRAME BOX 2 closed

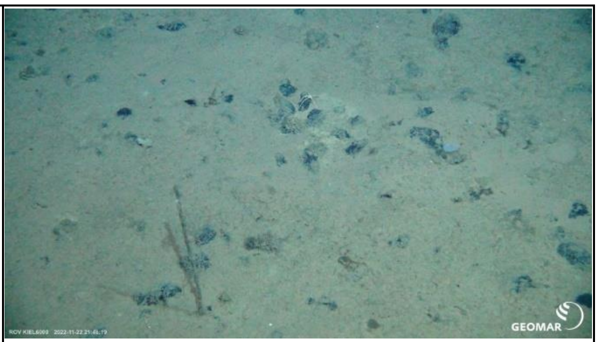
2022-11-22	19:09:12	-117.05911	11.84442	4170.93	Moving back to FRAMES
2022-11-22	19:12:17	-117.05911	11.84443	4171.4	 FRAME D (#88) 20221122_191217_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:14:08	-117.05911	11.84444	4171.48	FRAME D (#88) lifted from the seafloor and taken on porch to start PUC sampling from 16 Core Rack
2022-11-22	19:14:20	-117.05911	11.84444	4171.47	 FRAME D (#88) footprint 20221122_191420_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:15:38	-117.05912	11.84444	4171.43	PUC sampling start in FRAME D footprint with PUCs from 16 Core Rack
2022-11-22	19:17:40	-117.05912	11.84445	4171.41	PUCA0 deployed in FRAME D footprint
2022-11-22	19:18:45	-117.05912	11.84445	4171.42	PUCD8 deployed in FRAME D footprint
2022-11-22	19:20:30	-117.05912	11.84446	4171.42	PUC58 deployed in FRAME D footprint
2022-11-22	19:20:35	-117.05912	11.84446	4171.42	 FRAME D footprint with deployed cores (58, D8, A0) 20221122_192035_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:21:12	-117.05912	11.84446	4171.42	Retrieving PUCs back into 16 Core Rack
2022-11-22	19:21:38	-117.05913	11.84446	4171.42	PUC58 retrieved
2022-11-22	19:22:33	-117.05913	11.84447	4171.43	PUCD8 retrieved
2022-11-22	19:23:35	-117.05913	11.84447	4171.43	PUCA0 retrieved

2022-11-22	19:24:23	-117.05913	11.84447	4171.44	 FRAME D (#88) post coring 20221122_192423_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:29:07	-117.05914	11.84449	4170.67	Moving back to Elevator 1
2022-11-22	19:37:25	-117.05915	11.84452	4170.98	FRAME D (88) placed in compartment D of FRAME BOX 2
2022-11-22	19:38:20	-117.05915	11.84452	4171	Compartment E of FRAME BOX 2 opened
2022-11-22	19:40:32	-117.05915	11.84453	4171	Compartment D of FRAME BOX 2 closed
2022-11-22	19:40:46	-117.05915	11.84453	4171.01	Moving back to FRAMES
2022-11-22	19:42:04	-117.05916	11.84454	4170.85	Sponge
2022-11-22	19:44:29	-117.05916	11.84455	4171.32	 FRAME E (#78) 20221122_194429_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:44:45	-117.05916	11.84455	4171.44	 FRAME E (#78) close up 20221122_194445_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:45:10	-117.05916	11.84455	4171.48	 Several FRAMEs 20221122_194510_Sonne_SO295_089ROV11_Logo_thumb.jpg

2022-11-22	19:45:30	-117.05916	11.84455	4171.48	 Brittle star on FRAME '38 20221122_194530_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:48:10	-117.05917	11.84456	4171.41	FRAME E (#78) lifted from the seafloor and taken on porch to start PUC sampling from 16 Core Rack
2022-11-22	19:48:13	-117.05917	11.84456	4171.41	 FRAME E (#78) footprint 20221122_194813_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:48:43	-117.05917	11.84456	4171.39	PUC sampling start in FRAME E footprint with PUCs from 16 Core Rack
2022-11-22	19:50:19	-117.05917	11.84457	4171.39	PUCB8 deployed in FRAME E footprint
2022-11-22	19:51:44	-117.05917	11.84457	4171.38	PUC12 deployed in FRAME E footprint
2022-11-22	19:52:04	-117.05917	11.84457	4171.38	 FRAME E footprint with deployed cores (B8, 12) 20221122_195204_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:52:17	-117.05917	11.84457	4171.38	Retrieving PUCs back into 16 Core Rack
2022-11-22	19:53:30	-117.05917	11.84458	4171.39	PUC12 retrieved
2022-11-22	19:54:58	-117.05918	11.84458	4171.4	PUCB8 retrieved
2022-11-22	19:56:26	-117.05918	11.84459	4171.4	 FRAME E (#78) footprint post-coring 20221122_195626_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	19:59:27	-117.05918	11.84460	4170.33	Moving back to Elevator 1
2022-11-22	19:59:31	-117.05918	11.84460	4170.35	Fish

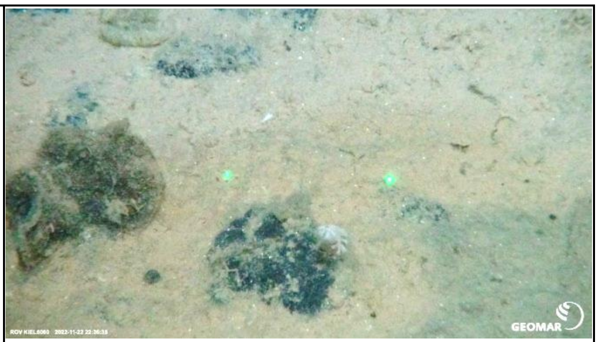
2022-11-22	20:02:57	-117.05919	11.84461	4170.98	FRAME E (#78) placed in compartment E of FRAME BOX 2
2022-11-22	20:04:16	-117.05919	11.84462	4170.99	Compartment E of FRAME BOX 2 closed
2022-11-22	20:07:54	-117.05919	11.84463	4171.12	Red shrimp
2022-11-22	20:08:41	-117.05920	11.84463	4171.24	 Shrimp near Elevator 1 20221122_200841_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	20:08:46	-117.05920	11.84463	4171.25	 Photo of shrimp 20221122_200846_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	20:09:51	-117.05920	11.84464	4171.37	Next Action: get PUC Sixpack from Elevator 1 drawer to pick up three PUCs for nodules (to be collected for shipboard nodule incubation experiment)
2022-11-22	20:12:48	-117.05920	11.84465	4171.4	Core Sixpack taken from Elevator 1
2022-11-22	20:15:06	-117.05921	11.84466	4171.34	PUC sampling start with PUCs from Core Sixpack few meters Southeast of Elevator 1
2022-11-22	20:15:11	-117.05921	11.84466	4171.36	Brittle star
2022-11-22	20:18:06	-117.05921	11.84467	4172.18	 Nodule #1 before sampling 20221122_201806_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	20:18:35	-117.05921	11.84467	4172.18	 PUC site with deployed core(D6) 20221122_201835_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	20:18:43	-117.05921	11.84467	4172.18	PUCD6 deployed on nodule #1

2022-11-22	20:19:31	-117.05921	11.84467	4172.18	Fish
2022-11-22	20:19:42	-117.05921	11.84467	4172.18	sampling spot SE of Elevator, only a few meters
2022-11-22	20:20:50	-117.05921	11.84468	4172.18	 PUC site with deployed cores (D6, C0) 20221122_202050_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	20:20:58	-117.05921	11.84468	4172.18	PUCC0 deployed on nodule #2
2022-11-22	20:24:11	-117.05922	11.84469	4172.21	PUCC6 (maybe) deployed on nodule #3
2022-11-22	20:24:19	-117.05922	11.84469	4172.21	 PUC site with deployed cores (C6, D6, C0 from left to right) 20221122_202419_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	20:26:05	-117.05922	11.84470	4172.2	Next Action: collect Brittle star
2022-11-22	20:31:38	-117.05923	11.84472	4172.23	Brittlestar (MEGA23Brittlestar) collected in ICBM Biobox extra large
2022-11-22	20:34:41	-117.05923	11.84473	4172.28	PUCC6 retrieved
2022-11-22	20:35:08	-117.05924	11.84473	4172.3	PUCD6 retrieved
2022-11-22	20:36:57	-117.05924	11.84474	4172.29	PUCC0 retrieved
2022-11-22	20:37:32	-117.05924	11.84474	4172.29	Fish
2022-11-22	20:38:41	-117.05924	11.84474	4171.63	Moving back to Elevator 1
2022-11-22	20:41:34	-117.05924	11.84475	4171.22	Core Sixpack put back into PUC drawer on the right side of Elevator 1
2022-11-22	20:43:19	-117.05925	11.84476	4171.26	PUC drawer closed
2022-11-22	20:45:34	-117.05925	11.84477	4171.4	Next Action: receive the Elevator Recovery System ('Bergefuchs') to get the Elevator 1 up
2022-11-22	20:47:38	-117.05925	11.84478	4171.5	Fauna
2022-11-22	20:55:28	-117.05927	11.84480	4167.03	Sponge
2022-11-22	20:59:02	-117.05927	11.84482	4165.99	Moving 120m away from Elevator 1
2022-11-22	21:01:30	-117.05927	11.84483	4165.98	Ship arrived on at Elevator 1 position
2022-11-22	21:04:38	-117.05928	11.84484	4166.02	Elevator Recovery System is lowered down
2022-11-22	21:06:12	-117.05928	11.84484	4159.09	ROV moving upwards to meet Elevator Recovery System
2022-11-22	21:08:42	-117.05929	11.84485	4146.98	Approaching position of the ship / Elevator Recovery System from North
2022-11-22	21:11:40	-117.05931	11.84483	4147.76	Posidonia signal received
2022-11-22	21:15:52	-117.05931	11.84454	4148.94	Moving South wards towards Elevator Recovery System
2022-11-22	21:17:03	-117.05932	11.84428	4149.86	Elevator Recovery System in view
2022-11-22	21:22:09	-117.05932	11.84391	4148.88	Grabbing the ROV operated shackle
2022-11-22	21:29:32	-117.05921	11.84416	4169.48	ROV operated shackle connected to Elevator 1
2022-11-22	21:30:21	-117.05918	11.84415	4169.3	ROV backing up from Elevator 1 / Elevator Recovery System
2022-11-22	21:32:37	-117.05921	11.84421	4168.55	Elevator 1 lifted up, retrieval to deck begins
2022-11-22	21:35:00	-117.05921	11.84436	4169.13	Moving away from ship position for safe megafauna sampling
2022-11-22	21:43:49	-117.05926	11.84472	4169.33	Next Action: collecting sponges, corals, and brittle stars

2022-11-22	21:48:19	-117.05917	11.84465	4169.2	 Unrecognizable structure 20221122_214819_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	21:48:46	-117.05917	11.84465	4169.2	Brittle star
2022-11-22	21:48:51	-117.05917	11.84465	4169.2	Brittle star (photo not displayed) 20221122_214851_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	21:49:51	-117.05918	11.84466	4169.24	 Brittle star 20221122_214951_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	21:50:12	-117.05919	11.84467	4169.25	Brittle star collected into ICBM biobox extra large (MEGA24Brittlestar)
2022-11-22	21:50:27	-117.05919	11.84467	4169.25	 Sponge (MEGA25Sponge) 20221122_215027_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	21:50:44	-117.05919	11.84467	4169.26	Sponge (MEGA25Sponge; photo not displayed) 20221122_215044_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	21:51:11	-117.05919	11.84468	4169.27	 Sponge (MEGA25Sponge, close up) 20221122_215111_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	21:57:31	-117.05919	11.84468	4169.99	Sponge sampled
2022-11-22	21:58:25	-117.05919	11.84467	4169.98	Sponge collected into ICBM biobox extra large (MEGA25Sponge)
2022-11-22	22:01:37	-117.05920	11.84469	4170	Brittle star sampled
2022-11-22	22:02:17	-117.05919	11.84467	4169.98	Brittle star collected into ICBM biobox extra large (MEGA26Brittlestar)

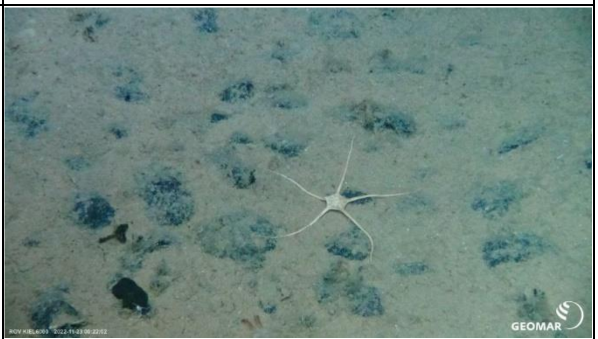
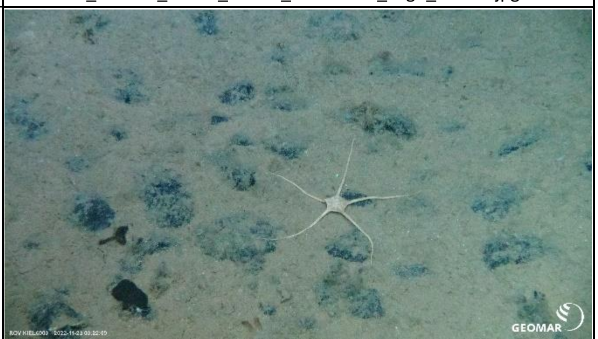
2022-11-22	22:06:33	-117.05917	11.84466	4169.26	 Brittle star (MEGA26Brittlestar) 20221122_220633_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:06:43	-117.05917	11.84465	4169.29	Brittle star (MEGA26Brittlestar; photo not displayed) 20221122_220643_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:10:31	-117.05916	11.84465	4170.23	Brittle star sampled
2022-11-22	22:12:35	-117.05917	11.84464	4170.23	Brittle star (MEGA26Ophiuroid) collected in the left compartment of ICBM biobox extra large
2022-11-22	22:12:58	-117.05918	11.84465	4170.23	Nodule collected with ROV manipulator gripper
2022-11-22	22:13:16	-117.05917	11.84466	4170.23	Nodule released
2022-11-22	22:19:52	-117.05914	11.84465	4170.08	Coral (MEGA27Coral; photo not displayed) 20221122_221952_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:19:58	-117.05914	11.84465	4170.09	 Coral (MEGA27Coral) 20221122_221958_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:20:18	-117.05914	11.84465	4170.11	 Coral on nodule (MEGA27Coral; close up) 20221122_222018_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:20:24	-117.05914	11.84465	4170.11	 Coral on nodule (MEGA27Coral; with laser points) 20221122_222024_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:22:22	-117.05917	11.84463	4170.15	Coral on nodule (MEGA27Coral) sampled

2022-11-22	22:23:15	-117.05915	11.84463	4170.17	Coral an nodule (MEGA27Coral) collected into left compartment of ICBM biobox extra large
2022-11-22	22:28:21	-117.05913	11.84465	4169.34	Brittle star
2022-11-22	22:29:08	-117.05912	11.84464	4169.34	Brittle star (MEGA28Brittlestar; photo not displayed) 20221122_222908_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:29:13	-117.05912	11.84464	4169.34	Brittle star (MEGA28Brittlestar; photo not displayed) 20221122_222913_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:29:23	-117.05912	11.84464	4169.35	 Brittle star (MEGA28Brittlestar) 20221122_222923_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:29:34	-117.05911	11.84463	4169.35	 Brittle star (MEGA28 Brittlestar; close up) 20221122_222934_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:29:44	-117.05911	11.84463	4169.35	 Brittle star (MEGA28 Brittlestar) 20221122_222944_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:29:51	-117.05911	11.84463	4169.35	 Brittle star (MEGA28Brittlestar; close up) 20221122_222951_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:33:27	-117.05914	11.84465	4170	Brittle star (MEGA28Brittlestar) sampled
2022-11-22	22:34:29	-117.05914	11.84466	4170	Brittle star (MEGA28Brittlestar) collected into left compartment of ICBM Biobox extra large

2022-11-22	22:36:35	-117.05914	11.84462	4170.03	 Coral selected for sampling (with laser points) 20221122_223635_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:36:43	-117.05914	11.84462	4170.04	 Coral selected for sampling 20221122_223643_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:39:13	-117.05914	11.84464	4170.04	Coral lost – sampling failed
2022-11-22	22:44:06	-117.05903	11.84469	4168.99	Sea cucumber
2022-11-22	22:46:38	-117.05904	11.84470	4168.92	 Sea cucumber (MEGA30Seacucumber) 20221122_224638_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:46:44	-117.05904	11.84470	4168.92	Sea cucumber (MEGA30Seacucumber; photo not displayed) 20221122_224644_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:47:43	-117.05903	11.84470	4168.91	Sea cucumber (MEGA30Seacucumber; photo not displayed) 20221122_224743_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	22:56:29	-117.05904	11.84472	4169.69	Fish
2022-11-22	23:02:44	-117.05902	11.84472	4169.71	Sea cucumber (MEGA30Seacucumber) sampled with manipulator claw, content expelled
2022-11-22	23:04:30	-117.05903	11.84470	4169.71	Sea cucumber (MEGA30Seacucumber) collected into ICBM biobox extra large
2022-11-22	23:15:20	-117.05897	11.84476	4168.43	Next action: sampling 3 sponges
2022-11-22	23:21:19	-117.05901	11.84484	4169.17	Tulip sponge with brisingid starfish on stalk
2022-11-22	23:21:26	-117.05901	11.84485	4169.19	Sponge with brisingid starfish (photo not displayed) 20221122_232126_Sonne_SO295_089ROV11_Logo_thumb.jpg

2022-11-22	23:23:05	-117.05903	11.84485	4169.2	 Sponge with brisingid starfish 20221122_232305_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	23:23:28	-117.05903	11.84485	4169.21	 Sponge with brisingid starfish (close up) 20221122_232328_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	23:23:44	-117.05903	11.84485	4169.21	Sponge sampled (MEGA31Sponge)
2022-11-22	23:28:29	-117.05903	11.84486	4169.23	Sponge (MEGA31Sponge) and brisingid starfish (MEGA32Starfish) collected into left drawer of ICBM biobox extra large
2022-11-22	23:30:33	-117.05903	11.84483	4168.47	Fish
2022-11-22	23:32:19	-117.05908	11.84484	4168.5	Sponge
2022-11-22	23:33:52	-117.05906	11.84484	4169.28	 Sponge 20221122_233352_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	23:40:05	-117.05907	11.84485	4169.4	Fish
2022-11-22	23:40:24	-117.05907	11.84486	4169.4	 Sponge (photo with laser points) 20221122_234024_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	23:43:46	-117.05907	11.84487	4167.42	Fish got into thruster
2022-11-22	23:43:56	-117.05907	11.84487	4167.31	Failed to collect sponge
2022-11-22	23:44:04	-117.05907	11.84486	4167.25	searching for next sponge
2022-11-22	23:46:28	-117.05908	11.84495	4168.01	Sponge attached to nodules

2022-11-22	23:48:22	-117.05909	11.84495	4169.09	 Sponge (MEGA33Sponge; with laser points) 20221122_234822_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	23:48:34	-117.05908	11.84495	4169.1	 Sponge MEGA33sponge 20221122_234834_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-22	23:52:14	-117.05904	11.84495	4169.09	Sponge with nodule (MEGA33Sponge) sampled
2022-11-22	23:52:18	-117.05903	11.84495	4169.09	Sponge with nodule (MEGA33Sponge) collected into left compartment of ICBM biobox extra large
2022-11-22	23:58:01	-117.05905	11.84495	4169.1	Nodule sampled with scoop for shipboard nodule incubation experiment
2022-11-22	23:58:19	-117.05904	11.84494	4169.1	Nodule collected into right drawer of ICBM biobox extra large
2022-11-22	23:59:39	-117.05904	11.84494	4169.11	Realizing that mud was sampled instead nodule
2022-11-23	00:01:36	-117.05904	11.84494	4169.13	New nodule sampled and collected into right compartment of ICBM biobox extra large
2022-11-23	00:02:56	-117.05903	11.84494	4169.13	1-2 additional nodules are sampled
2022-11-23	00:03:16	-117.05903	11.84493	4169.14	Nodules collected into right compartment of ICBM biobox extra large (covered with mud, might be 1 or 2 nodules)
2022-11-23	00:03:52	-117.05904	11.84494	4169	Spoon placed in right compartment of ICBM biobox extra large
2022-11-23	00:06:21	-117.05912	11.84497	4168.53	Sponge
2022-11-23	00:08:26	-117.05915	11.84498	4169.37	Sponge (MEGA34Sponge; photo not displayed) 20221123_000826_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-23	00:09:17	-117.05916	11.84499	4169.4	 Sponge (MEGA34Sponge) 20221123_000917_Sonne_SO295_089ROV11_Logo_thumb.jpg

2022-11-23	00:09:33	-117.05916	11.84498	4169.4	 Sponge (MEGA34Sponge; close up with laser points) 20221123_000933_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-23	00:09:39	-117.05916	11.84498	4169.4	 Sponge (MEGA34Sponge; close up with laser points) 20221123_000939_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-23	00:13:56	-117.05913	11.84500	4169.41	Sponge (MEGA34Sponge) sampled
2022-11-23	00:14:11	-117.05913	11.84500	4169.41	Sponge (MEGA34Sponge) collected into left compartment of ICBM biobox extra large
2022-11-23	00:15:20	-117.05915	11.84498	4169.07	Next Action: collect Brittle star
2022-11-23	00:21:20	-117.05931	11.84497	4169.82	Brittle Star (MEGA35Brittlestar)
2022-11-23	00:22:02	-117.05930	11.84494	4169.93	 Brittle star (MEGA35Brittlestar) 20221123_002202_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-23	00:22:09	-117.05930	11.84494	4169.93	 Brittle star (MEGA35Brittlestar; with laser points) 20221123_002209_Sonne_SO295_089ROV11_Logo_thumb.jpg
2022-11-23	00:24:12	-117.05926	11.84493	4169.95	Handle of ICBM biobox extra large detached and placed into left compartment
2022-11-23	00:25:43	-117.05928	11.84496	4169.95	Brittle star (MEGA35Brittlestar) sampled
2022-11-23	00:25:48	-117.05928	11.84496	4169.95	Brittle star (MEGA35Brittlestar collected into left drawer of ICBM biobox extra large
2022-11-23	00:26:58	-117.05928	11.84494	4169.64	Biobox handle taken out of ICBM biobox extra large compartment again

2022-11-23	00:27:01	-117.05928	11.84494	4169.58	End of Scientific program
2022-11-23	00:27:48	-117.05926	11.84496	4168.04	OFF THE BOTTOM
2022-11-23	02:04:11	None	None	None	ON DECK

ROV Dive 12 (SO295_095-1_ROV-12)

Date: 23.Nov.2022

Principal Investigators: Felix Janssen, Tania Nara Bezerra, Tanja Stratmann

Observers: Duygu Selvigen, Mirja Bardenhagen, Carsten Rühlemann, Lilian Böhringer

Protocol: Sabine Gollner

ROV positions (at the bottom)
Start of dive: 11° 51.556' N 117° 0.769' W
End of dive: 11° 51.578' N 117° 0.758' W

Dive duration:
ROV in the water: 23.Nov.2022 15:09:09
ROV at the bottom: 23.Nov.2022 16:48:02
ROV off the bottom: 23.Nov.2022 00:23:25
ROV on deck: 23.Nov.2022 02:04:28

Explored sites: BGR Dredge, Decompaction Experiment

Aims of the Dive:

- Deployment Fiberoptical Microsensor Profiler (MICP-DEEP2)
  ~100m south of Epibenthic Sledge (EBS) track
- Localization of decompaction experiment site
- Push core (PUC) sampling of control (C1, 2, 3) and decompacted sites (D1, 2, 3) in decompaction experiment within EBS track
- Sea cucumber sampling in dredge impact area
  (north of decompaction experiment site)
- Transit south towards MICP-DEEP2 deployment site, collect further megafauna
- collect MICP-DEEP2 on porch

Handled ROV Tools (including scientific payload):

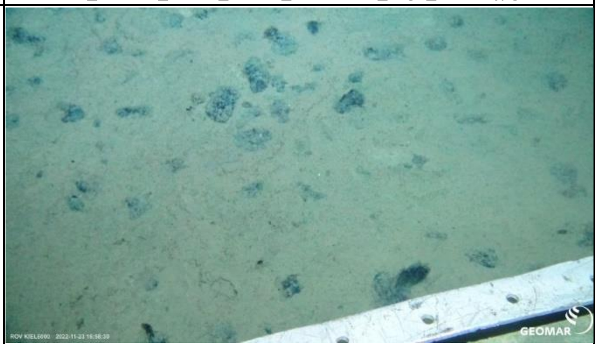
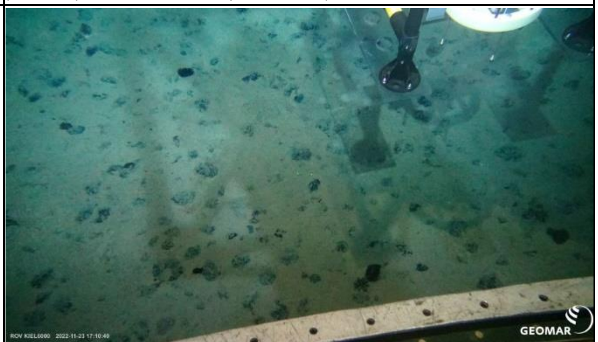
- MICP-DEEP2
- 16 PUCs in 16 Core Rack
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- Magnet Stick

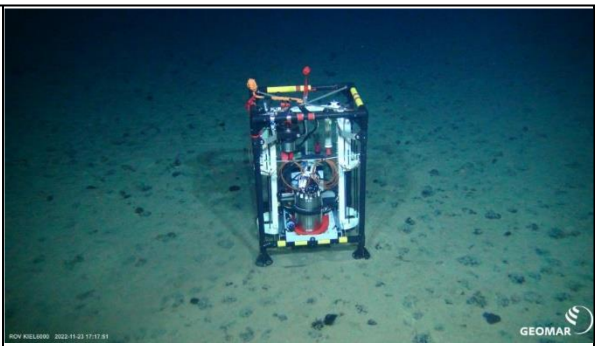
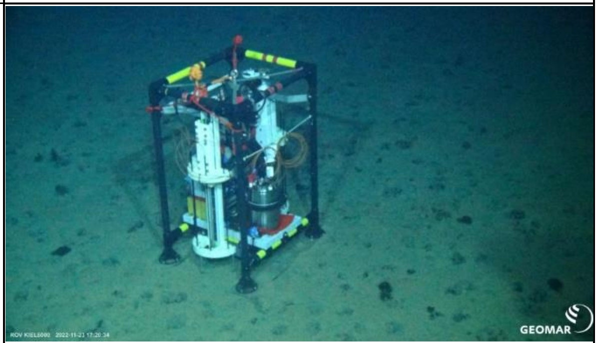
Relevant Elevator payload

no elevator used during the dive

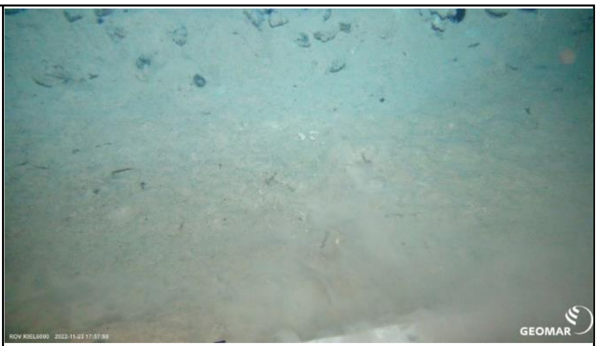
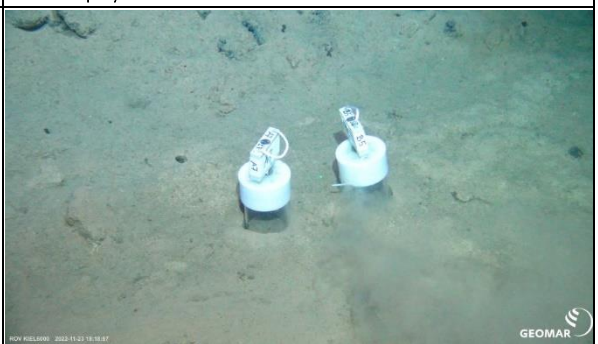
Dive summary

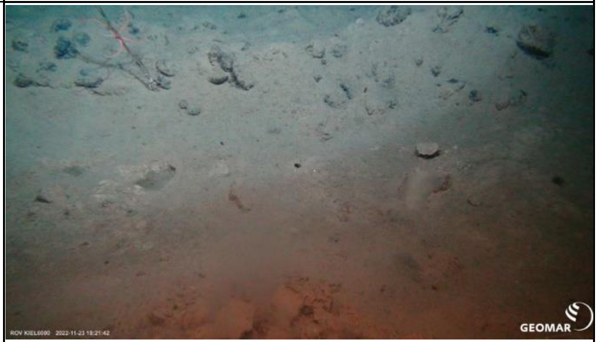
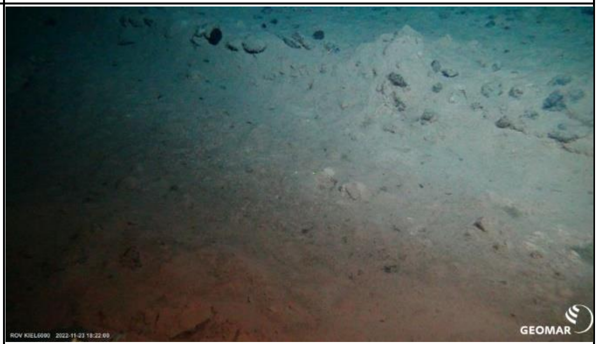
MICP-DEEP2 was deployed approx. 100 meters south of the decompaction experiment conducted during SO268/2 in 2019. After that, the decompaction experiment was revisited taking PUCs from control sites and experimentally decompacted stretches within the EBS track and recording a ROV video transect along the experimental part of the track. Moving direction North afterwards, several EBS tracks were visited and sea cucumbers were sampled. Moving towards the MICP-DEEP2 deployment positon, other megafauna specimen (sponges, brittle stars, anemones, brittle stars, more sea cucumbers) were collected at distance from the EBS track in (presumably) rather undisturbed parts of the area. MICP-DEEP2 was collected from the sediment and transported back up on the ROV porch.

Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-11-23	15:09:09	None	None	None	IN THE WATER
2022-11-23	16:48:02	-117.01281	11.85926	4159.98	AT THE BOTTOM
2022-11-23	16:51:52	-117.01251	11.85941	4160.98	Looking for spot to deploy MICP-DEEP2
2022-11-23	16:53:46	-117.01255	11.85950	4161.11	Brittle star
2022-11-23	16:54:48	-117.01258	11.85957	4161.22	Brittle star
2022-11-23	16:57:22	-117.01258	11.85962	4161.59	Potential spot for MICP-DEEP2 deployment located
2022-11-23	16:58:08	-117.01258	11.85962	4161.75	MICP-DEEP2 deployment site (photo not displayed) 20221123_165808_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	16:58:12	-117.01258	11.85962	4161.76	MICP-DEEP2 deployment site (photo not displayed) 20221123_165812_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	16:58:24	-117.01257	11.85962	4161.78	MICP-DEEP2 deployment site (photo not displayed) 20221123_165824_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	16:58:30	-117.01257	11.85962	4161.79	 MICP-DEEP2 deployment site selected initially 20221123_165830_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	16:59:14	-117.01256	11.85961	4161.79	Starting MICP-DEEP2 with magnet hanging from RigMaster
2022-11-23	17:05:40	-117.01256	11.85962	4161.7	Geared wheel started turning: program started
2022-11-23	17:06:51	-117.01257	11.85962	4161.74	MICP-DEEP2 unvoluntarily dropped
2022-11-23	17:07:52	-117.01257	11.85960	4161.72	picked up MICP-DEEP2 to fly to a new spot
2022-11-23	17:10:40	-117.01258	11.85963	4161.5	 MICP-DEEP2 deployment site finally taken 20221123_171040_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	17:15:42	-117.01257	11.85966	4161.72	MICP-DEEP2 placed on the seafloor: deployment MICP-DEEP2-1

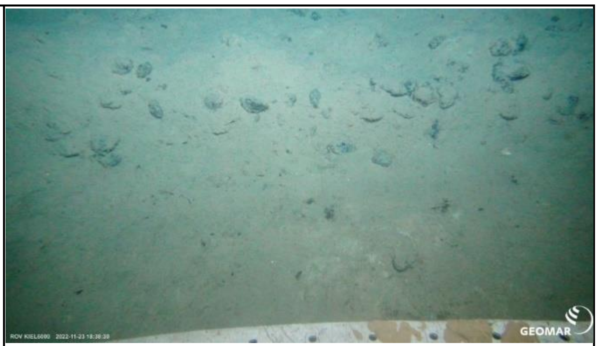
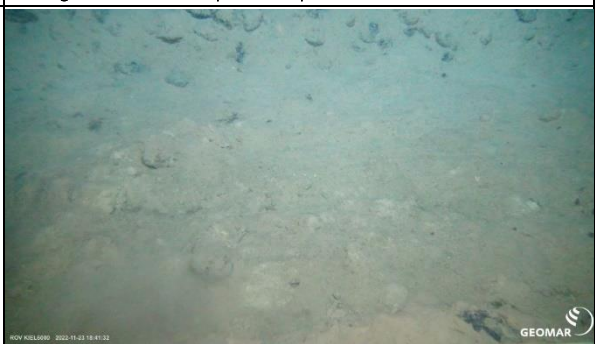
2022-11-23	17:17:51	-117.01257	11.85966	4161.71	 MICP-DEEP2 at seafloor (deployment MICP-DEEP2-1) 20221123_171751_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	17:20:34	-117.01260	11.85966	4161.3	 MICP-DEEP2 at seafloor (view on one of the profiling stages) 20221123_172034_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	17:21:56	-117.01264	11.85973	4161.41	 Sea cucumber 20221123_172156_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	17:23:34	-117.01263	11.85982	4161.42	Moving direction North towards EBS decompaction experiment
2022-11-23	17:25:09	-117.01257	11.86003	4161.52	Fish
2022-11-23	17:26:12	-117.01254	11.86015	4161.65	EBS track visible in Sonar
2022-11-23	17:27:10	-117.01251	11.86026	4161.8	EBS track in view
2022-11-23	17:34:47	-117.01252	11.86040	4162.09	Anemone
2022-11-23	17:45:57	-117.01244	11.86041	4161.56	 Decompaction experiment marker 20221123_174557_Sonne_SO295_095ROV12_Logo_thumb.jpg

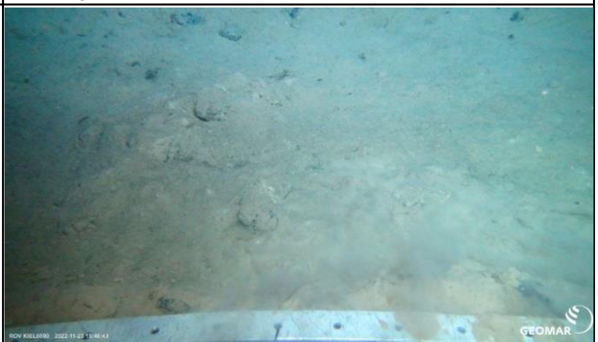
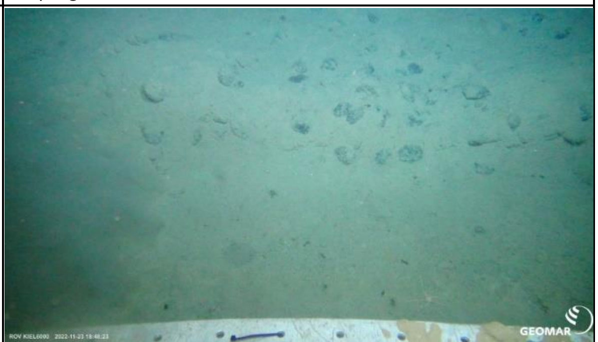
2022-11-23	17:46:01	-117.01244	11.86041	4161.59	 Decompacted area(?) right of the marker 20221123_174601_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	17:46:10	-117.01244	11.86041	4161.65	 Decompacted area(?) right of the marker (close up) 20221123_174610_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	17:47:55	-117.01243	11.86037	4163.14	Recolonization Frames (FRAMEs) visible to the left of the marker in some distance)
2022-11-23	17:48:33	-117.01246	11.86038	4163.27	The decompaction experiment is located towards the right of the marker (judging from ROV protocols and ROV imagery from 2019 / SO268)
2022-11-23	17:49:13	-117.01246	11.86039	4163.23	Landing ROV to start sampling at with PUCs from 16 Core Rack
2022-11-23	17:54:16	-117.01248	11.86044	4163.17	PUCA5 deployed in decompaction area D3
2022-11-23	17:55:10	-117.01246	11.86043	4163.17	PUCA2 deployed in decompaction area D3
2022-11-23	17:55:27	-117.01247	11.86043	4163.16	 Decompaction area D3 with deployed cores (A5, A2) 20221123_175527_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	17:55:50	-117.01246	11.86043	4163.15	Retrieving PUCs back into 16 Core Rack
2022-11-23	17:56:31	-117.01244	11.86042	4163.14	PUCA2 retrieved
2022-11-23	17:57:17	-117.01243	11.86041	4163.14	PUCA5 retrieved
2022-11-23	17:57:41	-117.01245	11.86040	4163	Fish

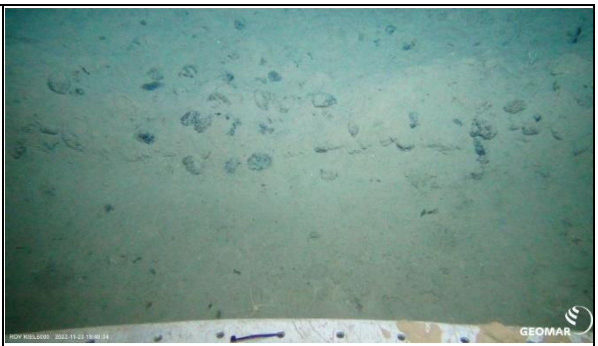
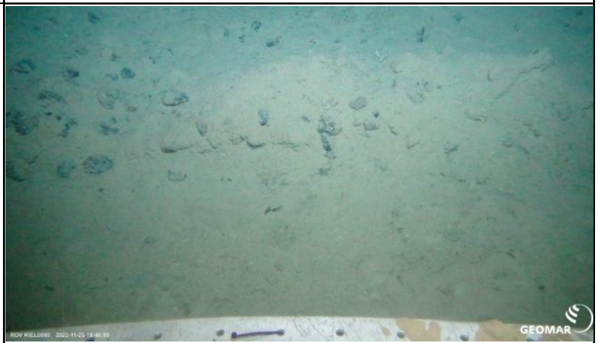
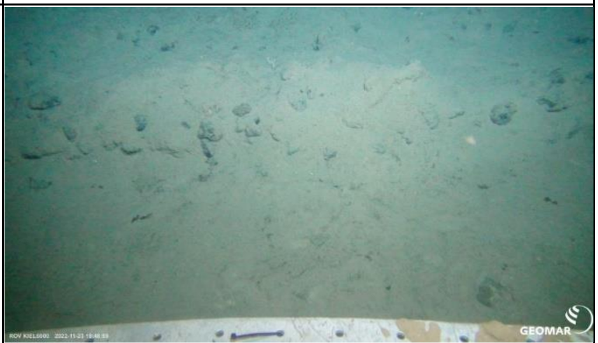
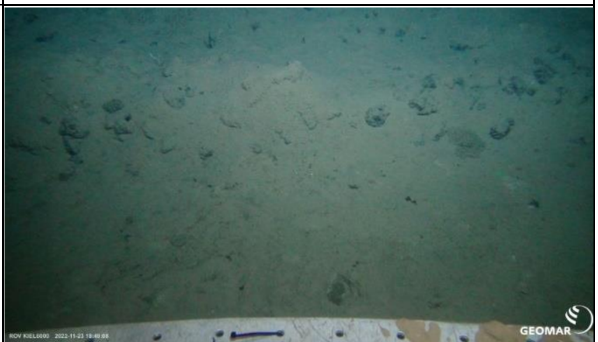
2022-11-23	17:57:50	-117.01244	11.86040	4162.88	 Decompaction area D3 post coring 20221123_175750_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	17:58:37	-117.01247	11.86039	4161.98	Next Action: move further right along track to find next decompaction area
2022-11-23	18:07:59	-117.01249	11.86037	4161.87	 Brittle star 20221123_180759_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:10:30	-117.01249	11.86040	4162.25	Moved 3 m towards the right to (compacted) control area C3
2022-11-23	18:14:14	-117.01247	11.86035	4163.14	Brittle star
2022-11-23	18:14:26	-117.01247	11.86035	4163.13	More Brittle stars
2022-11-23	18:15:00	-117.01247	11.86036	4163.11	 Control site C3 20221123_181500_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:15:31	-117.01248	11.86039	4163.1	PUC sampling start at site C3 with PUCs from 16 Core Rack
2022-11-23	18:18:43	-117.01250	11.86043	4163.07	PUCA7 deployed in C3
2022-11-23	18:18:57	-117.01249	11.86042	4163.07	 Control site C3 with deployed cores 20221123_181857_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:19:04	-117.01249	11.86042	4163.07	PUCB5 deployed in C3
2022-11-23	18:19:18	-117.01248	11.86040	4163.07	Retrieving PUCs back into 16 Core Rack

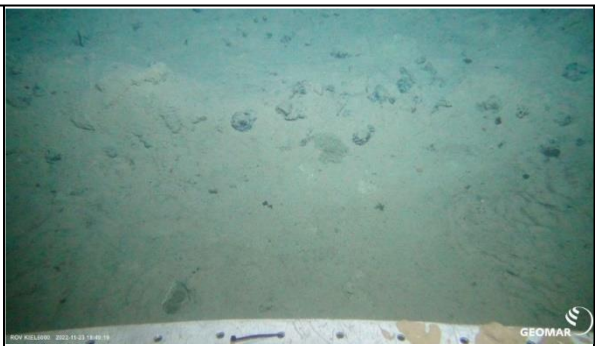
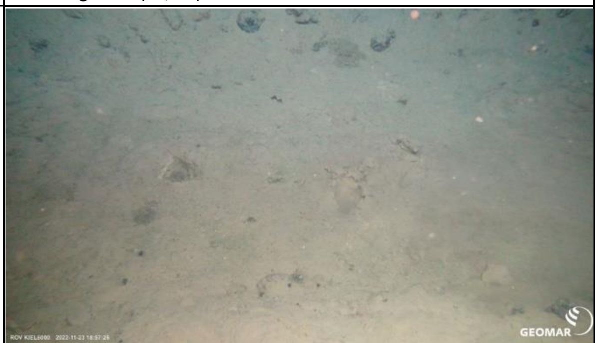
2022-11-23	18:20:12	-117.01248	11.86037	4163.07	PUCB5 retrieved
2022-11-23	18:21:13	-117.01251	11.86039	4163.07	PUCA7 retrieved
2022-11-23	18:21:42	-117.01251	11.86040	4163.06	 Control site C3 post coring 20221123_182142_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:22:00	-117.01251	11.86040	4163.06	 Control site C3 post coring 20221123_182200_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:22:14	-117.01251	11.86039	4163.05	Moving on westwards towards next experimental site
2022-11-23	18:29:18	-117.01250	11.86038	4163.02	Control site C2 (photo not displayed) 20221123_182918_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:29:33	-117.01250	11.86038	4163.05	 Control site C2 prior to coring 20221123_182933_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:29:49	-117.01251	11.86039	4163.06	PUC sampling start at control site C2 with PUCs from 16 Core Rack
2022-11-23	18:32:09	-117.01252	11.86041	4163.06	PUCD3 deployed in site C2
2022-11-23	18:33:21	-117.01254	11.86042	4163.07	PUCD4 deployed in site C2
2022-11-23	18:33:36	-117.01254	11.86042	4163.07	 Control site C2 with deployed cores (D4, D3 from left to right) 20221123_183336_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:33:42	-117.01254	11.86042	4163.07	Retrieving PUCs back into 16 Core Rack

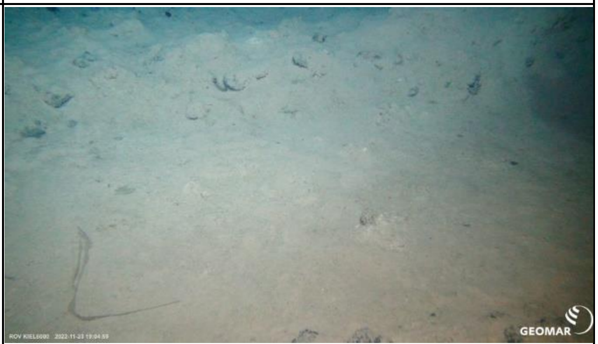
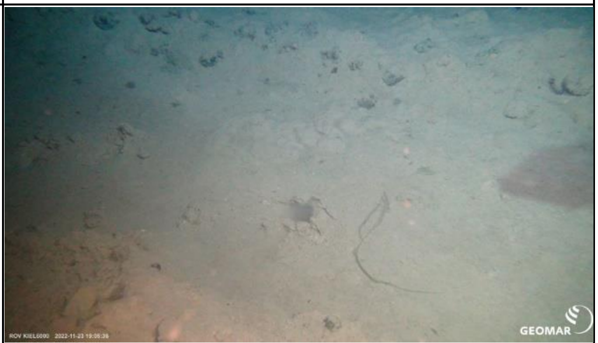
2022-11-23	18:35:10	-117.01258	11.86043	4163.07	PUCD4 retrieved
2022-11-23	18:35:20	-117.01259	11.86044	4163.06	PUCD3 retrieved
2022-11-23	18:36:26	-117.01259	11.86044	4163.04	 Control site C2 post coring 20221123_183626_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:36:37	-117.01257	11.86045	4162.98	Taking photos while moving further westwards
2022-11-23	18:37:41	-117.01252	11.86045	4162.42	 EBS track / decompaction experiment 20221123_183741_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:37:50	-117.01253	11.86044	4162.39	 EBS track / decompaction experiment 20221123_183750_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:37:59	-117.01254	11.86043	4162.38	 EBS track / decompaction experiment 20221123_183759_Sonne_SO295_095ROV12_Logo_thumb.jpg

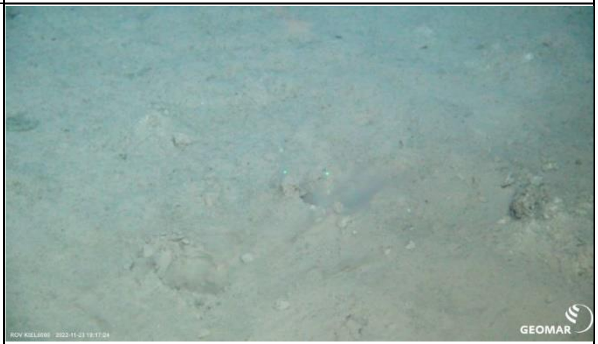
2022-11-23	18:38:30	-117.01254	11.86043	4162.36	 EBS track / decompaction experiment 20221123_183830_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:38:38	-117.01255	11.86041	4162.36	 EBS track / decompaction experiment 20221123_183838_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:38:46	-117.01255	11.86040	4162.36	 20221123_183846_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:40:03	-117.01257	11.86041	4162.72	Landing in front of decompaction experiment site D2
2022-11-23	18:41:32	-117.01256	11.86040	4163.07	 Decompaction experiment site D2 prior to sampling 20221123_184132_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:41:55	-117.01257	11.86039	4163.07	PUC sampling start at site D2 with PUCs from 16 Core Rack
2022-11-23	18:42:49	-117.01258	11.86039	4163.06	PUCB0 deployed in site D2
2022-11-23	18:43:59	-117.01257	11.86041	4163.06	PUC6 deployed in site D2
2022-11-23	18:44:05	-117.01257	11.86040	4163.06	Fish (grenadier; photo not displayed) 20221123_184405_Sonne_SO295_095ROV12_Logo_thumb.jpg

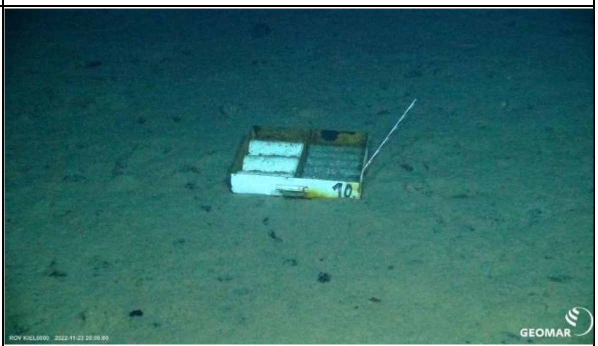
2022-11-23	18:44:11	-117.01256	11.86040	4163.06	 Fish (grenadier) 20221123_184411_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:44:17	-117.01256	11.86040	4163.06	Fish (grenadier; photo not displayed) 20221123_184417_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:44:25	-117.01256	11.86040	4163.06	 Site D2 with deployed cores (B0, 6) 20221123_184425_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:44:30	-117.01256	11.86040	4163.06	Retrieving PUCs (B0, 6) back into 16 Core Rack
2022-11-23	18:46:43	-117.01258	11.86037	4163.05	 Site D2 post coring 20221123_184643_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:46:48	-117.01258	11.86037	4163.04	Taking photos while moving further westwards towards control sampling site C1
2022-11-23	18:48:23	-117.01260	11.86033	4162.26	 EBS track / decompaction experiment 20221123_184823_Sonne_SO295_095ROV12_Logo_thumb.jpg

2022-11-23	18:48:34	-117.01261	11.86033	4162.25	 EBS track / decompaction experiment 20221123_184834_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:48:50	-117.01261	11.86034	4162.26	 EBS track / decompaction experiment 20221123_184850_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:48:59	-117.01261	11.86034	4162.27	 EBS track / decompaction experiment 20221123_184859_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:49:08	-117.01261	11.86034	4162.27	 EBS track / decompaction experiment 20221123_184908_Sonne_SO295_095ROV12_Logo_thumb.jpg

2022-11-23	18:49:19	-117.01260	11.86033	4162.3	 EBS track / decompaction experiment 20221123_184919_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:50:49	-117.01257	11.86038	4163.08	Arrival at control sampling site C1
2022-11-23	18:51:07	-117.01257	11.86038	4163.12	 Control sampling site C1 prior to sampling 20221123_185107_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:51:23	-117.01257	11.86038	4163.13	PUC sampling start at site C1 with PUCs from 16 Core Rack
2022-11-23	18:53:15	-117.01257	11.86038	4163.05	PUC75 deployed in control site C1
2022-11-23	18:54:07	-117.01256	11.86038	4163.04	PUCC3 deployed in control site C1
2022-11-23	18:54:27	-117.01257	11.86037	4163.05	 PUC site C1 with deployed cores (C3, 75 from left to right) 20221123_185427_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:54:30	-117.01257	11.86037	4163.05	Retrieving PUCs (75, C3) back into 16 Core Rack
2022-11-23	18:57:26	-117.01257	11.86040	4162.91	 PUC site C1 post coring (?) 20221123_185726_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	18:57:42	-117.01258	11.86040	4162.76	Moving to decompaction experiment sampling site D1

2022-11-23	18:58:41	-117.01257	11.86038	4162.21	 Decompaction experiment sampling site D1 prior to coring(?) 20221123_185841_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	19:02:28	-117.01259	11.86041	4163.05	Landed in front of decompaction experiment sampling site D1
2022-11-23	19:04:59	-117.01261	11.86043	4163.06	 Decompaction experiment sampling site D1 prior to coring 20221123_190459_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	19:05:36	-117.01261	11.86043	4163.05	 Decompaction experiment sampling site D1 with PUC coring hole 20221123_190536_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	19:05:44	-117.01260	11.86043	4163.05	PUC sampling start at site A with PUCs from 16 Core Rack
2022-11-23	19:07:45	-117.01260	11.86041	4163.06	PUC55 deployment in site D1 failed (fell down - to be used for abiotic analyses)
2022-11-23	19:12:08	-117.01264	11.86047	4163.04	PUC C5 deployed in site D1
2022-11-23	19:12:32	-117.01262	11.86048	4163.04	 PUC site D1 with deployed cores 20221123_191232_Sonne_SO295_095ROV12_Logo_thumb.jpg

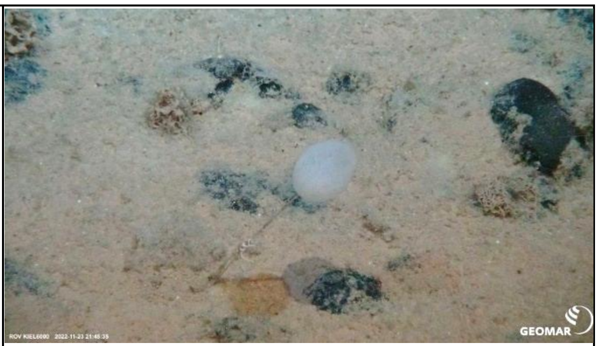
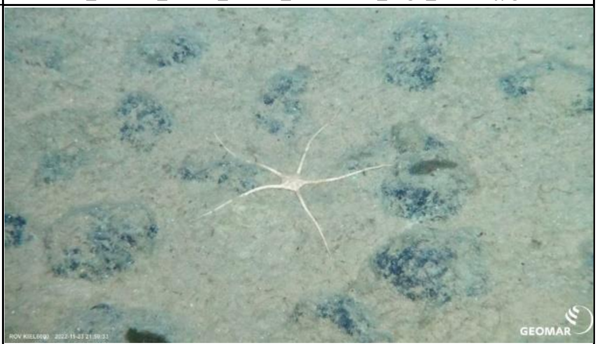
2022-11-23	19:12:47	-117.01262	11.86047	4163.04	 PUC site D1 with deployed cores (close up) 20221123_191247_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	19:17:24	-117.01257	11.86037	4163.01	 PUC site D1 post coring 20221123_191724_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	19:17:32	-117.01258	11.86037	4163.02	PUC site D1 post coring (photo not displayed) 20221123_191732_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	19:17:34	-117.01259	11.86037	4163.02	Collecting video imagery while traveling along sampling sites back direction east 7 towards markers
2022-11-23	19:29:59	-117.01245	11.86042	4161.82	End of video transect
2022-11-23	19:30:29	-117.01248	11.86044	4161.6	Next action: moving to dredge area for megafauna sampling
2022-11-23	19:37:17	-117.01240	11.86086	4162.25	Brittle stars
2022-11-23	19:38:22	-117.01235	11.86093	4162.38	Brittle star
2022-11-23	19:39:36	-117.01239	11.86099	4162.48	SLICK BOX
2022-11-23	19:40:34	-117.01238	11.86110	4162.47	Anemone
2022-11-23	19:40:56	-117.01237	11.86117	4162.46	Sea cucumber and anemone
2022-11-23	19:42:27	-117.01234	11.86123	4162.37	Sponge
2022-11-23	19:43:02	-117.01232	11.86126	4162.26	Starfish
2022-11-23	19:43:06	-117.01232	11.86126	4162.25	Brittle star
2022-11-23	19:43:40	-117.01229	11.86133	4162.14	Brittle star
2022-11-23	19:44:05	-117.01227	11.86135	4162.07	Small sponges
2022-11-23	19:44:17	-117.01226	11.86137	4162.04	Trail
2022-11-23	19:45:51	-117.01223	11.86143	4161.9	Brittle star
2022-11-23	19:46:19	-117.01222	11.86147	4161.87	Bryozoans
2022-11-23	19:46:40	-117.01223	11.86150	4161.83	Coral, brittle star
2022-11-23	19:47:51	-117.01222	11.86164	4161.67	Brittle star
2022-11-23	19:48:31	-117.01223	11.86172	4161.61	Crinoid
2022-11-23	19:48:40	-117.01224	11.86174	4161.6	Brittle star
2022-11-23	19:48:52	-117.01224	11.86175	4161.57	Small brittle star
2022-11-23	19:49:11	-117.01223	11.86177	4161.54	Brittle star
2022-11-23	19:49:49	-117.01220	11.86187	4161.5	Brittle star
2022-11-23	19:50:22	-117.01218	11.86190	4161.46	Anemone, Brittle star
2022-11-23	19:50:43	-117.01217	11.86194	4161.43	Anemone, sponge
2022-11-23	19:51:02	-117.01217	11.86196	4161.4	Sponge
2022-11-23	19:51:26	-117.01217	11.86197	4161.35	Brittle star
2022-11-23	19:52:01	-117.01214	11.86202	4161.28	Brittle star
2022-11-23	19:52:48	-117.01213	11.86212	4161.2	Brittle star
2022-11-23	19:53:21	-117.01212	11.86214	4161.16	Coral
2022-11-23	19:53:30	-117.01212	11.86216	4161.14	Anemone
2022-11-23	19:53:38	-117.01211	11.86217	4161.13	Brittle star

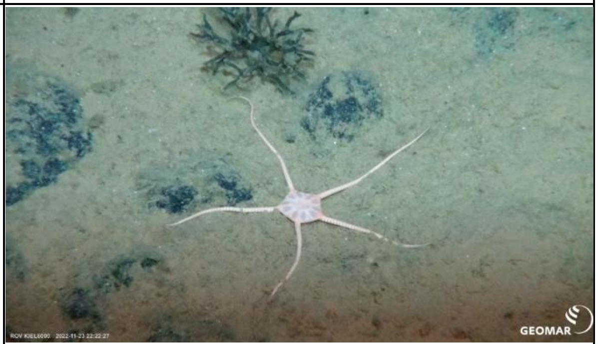
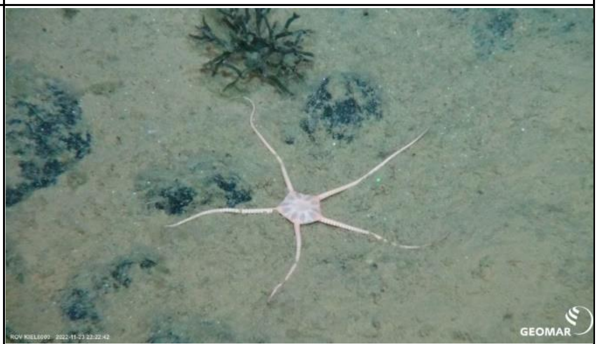
2022-11-23	19:53:48	-117.01209	11.86219	4161.11	Sponge
2022-11-23	19:54:19	-117.01208	11.86221	4161.06	Two brittle stars
2022-11-23	19:54:27	-117.01208	11.86222	4161.04	Coral
2022-11-23	19:55:07	-117.01206	11.86223	4160.96	Brittle star
2022-11-23	19:55:16	-117.01206	11.86224	4160.94	Sponge
2022-11-23	19:55:24	-117.01205	11.86224	4160.92	Brittle star
2022-11-23	19:55:30	-117.01205	11.86225	4160.9	Brittle star
2022-11-23	19:55:49	-117.01202	11.86229	4160.85	Sponge
2022-11-23	19:56:15	-117.01199	11.86234	4160.78	Sponge
2022-11-23	19:57:17	-117.01199	11.86244	4160.61	Brittle star
2022-11-23	19:57:37	-117.01199	11.86245	4160.57	Sea cucumber
2022-11-23	19:57:50	-117.01199	11.86247	4160.54	Sea cucumber
2022-11-23	19:57:59	-117.01199	11.86248	4160.53	Fish
2022-11-23	19:58:08	-117.01200	11.86249	4160.52	Brittle star
2022-11-23	19:59:04	-117.01199	11.86255	4160.43	Brittle star, sponge(?)
2022-11-23	20:00:26	-117.01196	11.86264	4160.28	Brittle star
2022-11-23	20:01:33	-117.01195	11.86272	4160.13	Fish Ipmopidae
2022-11-23	20:01:44	-117.01195	11.86273	4160.1	Brittlestar
2022-11-23	20:02:59	-117.01194	11.86284	4159.88	Coral
2022-11-23	20:03:39	-117.01195	11.86287	4159.76	Sea cucumber
2022-11-23	20:05:40	-117.01199	11.86299	4159.5	SLICK BOX #5 (photo not displayed) 20221123_200540_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:05:47	-117.01199	11.86300	4159.5	 SLICK BOX #5 20221123_200547_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:05:51	-117.01199	11.86300	4159.49	SLICK BOX #5
2022-11-23	20:07:02	-117.01199	11.86307	4159.41	Dredge track
2022-11-23	20:08:00	-117.01199	11.86310	4159.26	Sponges
2022-11-23	20:08:21	-117.01199	11.86314	4159.19	SLICK BOX #10
2022-11-23	20:09:00	-117.01200	11.86318	4159.12	 SLICK BOX #10 20221123_200900_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:11:25	-117.01197	11.86323	4159.06	Fish
2022-11-23	20:12:26	-117.01194	11.86324	4159.08	Dredge track
2022-11-23	20:13:29	-117.01191	11.86324	4159.07	Following dredge track in direction East
2022-11-23	20:15:26	-117.01182	11.86324	4158.99	Small sediment hills
2022-11-23	20:15:49	-117.01178	11.86326	4158.97	Brittle star
2022-11-23	20:16:44	-117.01168	11.86328	4158.92	Sea cucumber

2022-11-23	20:16:54	-117.01167	11.86326	4158.92	 Sea cucumber next to dredge track 20221123_201654_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:17:27	-117.01167	11.86325	4158.92	Sea cucumber next to dredge track (photo not displayed) 20221123_201727_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:17:42	-117.01167	11.86324	4158.92	 Sea cucumber next to dredge track (close up) 20221123_201742_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:18:23	-117.01167	11.86324	4158.91	Shrimp
2022-11-23	20:19:12	-117.01167	11.86325	4158.92	Sea cucumber next to dredge track (close up, photo not displayed) 20221123_201912_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:21:00	-117.01163	11.86325	4159.09	 Sea cucumber next to dredge track (close up) 20221123_202100_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:24:50	-117.01166	11.86326	4159.69	Worm
2022-11-23	20:27:09	-117.01161	11.86325	4159.69	Sea cucumber (MEGA36Seacucumber) sampled
2022-11-23	20:27:13	-117.01161	11.86325	4159.69	Sea cucumber MEGA36Seacucumber collected into right compartment of ICBM biobox extra large
2022-11-23	20:29:25	-117.01162	11.86327	4159.32	Continuing following track in direction East
2022-11-23	20:30:14	-117.01158	11.86327	4158.99	Brittle star
2022-11-23	20:31:04	-117.01155	11.86329	4158.89	Coral
2022-11-23	20:31:35	-117.01150	11.86331	4158.87	Brittle star
2022-11-23	20:31:40	-117.01149	11.86330	4158.86	Reaching end of track
2022-11-23	20:32:04	-117.01142	11.86331	4158.85	Moving in direction North
2022-11-23	20:33:14	-117.01143	11.86338	4158.88	Starfish
2022-11-23	20:33:23	-117.01146	11.86341	4158.88	Brittle star
2022-11-23	20:36:11	-117.01146	11.86346	4158.92	Starfish
2022-11-23	20:37:49	-117.01150	11.86351	4158.92	Next dredge track
2022-11-23	20:38:03	-117.01150	11.86351	4158.92	Following track in direction West
2022-11-23	20:39:13	-117.01152	11.86352	4158.93	FRAMES and other things
2022-11-23	20:39:43	-117.01151	11.86352	4158.92	Fish

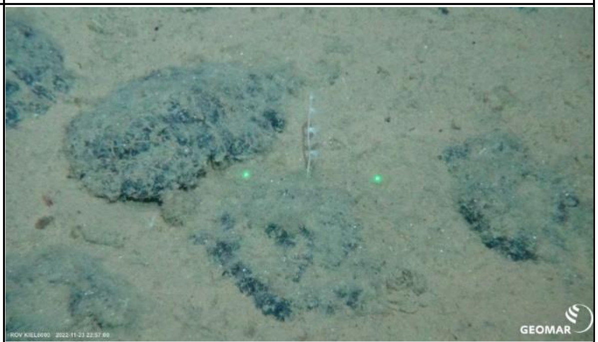
2022-11-23	20:40:02	-117.01151	11.86352	4158.92	 Fish (grenadier) 20221123_204002_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:40:11	-117.01150	11.86352	4158.91	Fish
2022-11-23	20:42:33	-117.01163	11.86348	4158.88	Sponge
2022-11-23	20:43:17	-117.01170	11.86350	4158.87	Sponge
2022-11-23	20:43:43	-117.01170	11.86350	4158.87	Sea cucumber
2022-11-23	20:44:14	-117.01170	11.86350	4158.89	Sea cucumber
2022-11-23	20:44:29	-117.01170	11.86350	4158.89	Sea cucumber
2022-11-23	20:44:42	-117.01170	11.86350	4158.9	Sea cucumber
2022-11-23	20:46:07	-117.01171	11.86351	4159.16	Sea cucumber, small brittle star
2022-11-23	20:50:30	-117.01170	11.86346	4159.58	Sea cucumber (MEGA37Seacucumber) sampled
2022-11-23	20:50:46	-117.01171	11.86345	4159.52	Sea cucumber (MEGA37Seacucumber) collected into right compartment of ICBM biobox extra large
2022-11-23	20:52:03	-117.01178	11.86345	4158.89	Following track in direction West
2022-11-23	20:53:38	-117.01186	11.86341	4158.87	Anemone
2022-11-23	20:55:23	-117.01202	11.86340	4158.93	Moving towards next track in direction North
2022-11-23	20:55:30	-117.01202	11.86340	4158.93	Sea cucumber
2022-11-23	20:56:04	-117.01203	11.86341	4158.9	Brittle star
2022-11-23	20:56:12	-117.01203	11.86342	4158.9	 Sea cucumber (MEGA38Seacucumber) 20221123_205612_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:56:18	-117.01202	11.86342	4158.89	Sea cucumber (MEGA38Seacucumber)
2022-11-23	20:56:27	-117.01202	11.86345	4158.89	 Sea cucumber (MEGA38Seacucumber; close up) 20221123_205627_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:56:33	-117.01201	11.86346	4158.89	Sea cucumber (MEGA38Seacucumber; close up; photo not displayed) 20221123_205633_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	20:56:46	-117.01200	11.86347	4158.89	Sea cucumber (MEGA38Seacucumber; close up; photo not displayed) 20221123_205646_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	21:01:38	-117.01201	11.86345	4159.59	Sea cucumber (MEGA38Seacucumber sampled

2022-11-23	21:01:48	-117.01201	11.86345	4159.59	Sea cucumber (MEGA38Seacucumber) collected into right compartment of ICBM biobox extra large
2022-11-23	21:13:15	-117.01228	11.86342	4158.56	Moving direction West along the northernmost dredge track
2022-11-23	21:14:11	-117.01235	11.86338	4158.6	Starfish
2022-11-23	21:15:00	-117.01237	11.86338	4158.66	Sea cucumber
2022-11-23	21:16:36	-117.01237	11.86340	4158.54	Plenty of xenophyophora (foraminiferans)
2022-11-23	21:19:24	-117.01237	11.86339	4159.74	ROV landed, large suspension plume
2022-11-23	21:24:40	-117.01234	11.86332	4159.94	White sea cucumber (MEGA39Seacucumber)
2022-11-23	21:25:17	-117.01234	11.86332	4159.94	Sea cucumber(MEGA39Seacucumber) collected into right compartment of ICBM biobox extra large
2022-11-23	21:29:56	-117.01237	11.86323	4158.98	Moving direction South across the dredge tracks
2022-11-23	21:30:18	-117.01237	11.86321	4159.09	Box corer imprint
2022-11-23	21:33:05	-117.01239	11.86300	4159.66	Heading towards MICP-DEEP2
2022-11-23	21:34:30	-117.01237	11.86300	4160.04	 Sponge (MEGA40 Sponge) 20221123_213430_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	21:34:52	-117.01238	11.86300	4160.05	 Sponge (MEGA40 Sponge) 20221123_213452_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	21:34:52	-117.01238	11.86300	4160.05	Sponge (MEGA40 Sponge)
2022-11-23	21:36:15	-117.01236	11.86300	4160.59	ROV landed
2022-11-23	21:37:51	-117.01236	11.86300	4160.8	Sponge (MEGA40 Sponge; photo not displayed) 20221123_213751_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	21:40:30	-117.01237	11.86301	4160.8	Sponge (MEGA40 Sponge) sampled and collected into left compartment of ICBM biobox extra large
2022-11-23	21:45:05	-117.01231	11.86300	4160.68	Sponge (photo not displayed) 20221123_214505_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	21:45:25	-117.01231	11.86300	4160.69	 Sponge 20221123_214525_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	21:45:28	-117.01231	11.86300	4160.69	Sponge

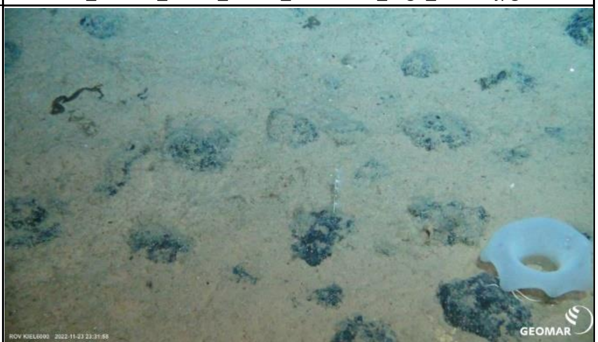
2022-11-23	21:45:35	-117.01232	11.86300	4160.69	 Sponge 20221123_214535_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	21:49:36	-117.01234	11.86299	4160.68	Attempt to sample sponge failed, broken off from stalk
2022-11-23	21:50:08	-117.01233	11.86298	4160.71	Fish
2022-11-23	21:55:33	-117.01241	11.86272	4160.44	Leaving dredge tracks direction South following map
2022-11-23	21:56:07	-117.01241	11.86267	4160.53	Dredge tracks are located more towards North as compared to locations on map
2022-11-23	21:58:46	-117.01242	11.86271	4161.44	Brittle star, ROV landed
2022-11-23	21:59:12	-117.01242	11.86272	4161.73	Brittle star (MEGA41Brittlestar; photo not displayed) 20221123_215912_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	21:59:33	-117.01240	11.86265	4161.82	 Brittle star (MEGA41Brittlestar) 20221123_215933_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	21:59:44	-117.01236	11.86253	4161.83	Brittle star (close up, blurred; photo not displayed) 20221123_215944_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:03:01	-117.01242	11.86271	4161.79	Brittle star (MEGA41Brittlestar) sampled
2022-11-23	22:03:04	-117.01241	11.86271	4161.79	Brittle star (MEGA41Brittlestar) collected into left compartment of ICBM biobox extra large
2022-11-23	22:05:36	-117.01241	11.86271	4161.52	Anemone
2022-11-23	22:06:24	-117.01239	11.86267	4161.72	Fish
2022-11-23	22:06:29	-117.01239	11.86266	4161.75	 Fish (grenadier) 20221123_220629_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:09:09	-117.01240	11.86267	4161.98	Anemone (MEGA42Anemone; photo not displayed) 20221123_220909_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:09:13	-117.01240	11.86267	4161.98	Anemone (MEGA42Anemone)

2022-11-23	22:09:28	-117.01240	11.86266	4161.98	 Anemone (MEGA42Anemone) 20221123_220928_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:09:40	-117.01239	11.86266	4161.98	Anemone (MEGA42Anemone; photo not displayed) 20221123_220940_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:10:00	-117.01240	11.86265	4161.99	Anemone (MEGA42Anemone) sampled
2022-11-23	22:15:23	-117.01238	11.86263	4162	Anemone (MEGA42Anemone) collected into left compartment of ICBM biobox extra large, squeezed by manipulator claw during sampling
2022-11-23	22:21:18	-117.01237	11.86263	4161.85	Brittle star, ROV landed
2022-11-23	22:22:27	-117.01239	11.86264	4162.07	 Brittle star (MEGA43Brittlestar) 20221123_222227_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:22:40	-117.01240	11.86265	4162.07	Brittle star
2022-11-23	22:22:42	-117.01241	11.86265	4162.07	 Brittle star (MEGA43Brittlestar) 20221123_222242_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:23:17	-117.01242	11.86267	4162.07	Coral (photo not displayed) 20221123_222317_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:23:26	-117.01243	11.86267	4162.06	 Coral 20221123_222326_Sonne_SO295_095ROV12_Logo_thumb.jpg

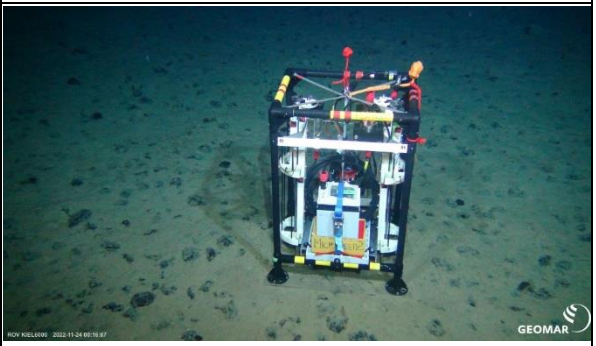
2022-11-23	22:24:08	-117.01243	11.86268	4162.06	 Coral 20221123_222408_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:27:03	-117.01248	11.86272	4162.03	Brittle star (MEGA43Brittlestar) sampled
2022-11-23	22:27:22	-117.01248	11.86272	4162.03	Brittle star (MEGA43Brittlestar) collected into left compartment of ICBM biobox extra large
2022-11-23	22:38:07	-117.01243	11.86263	4161.3	Continue to move direction South towards MICP-DEEP2
2022-11-23	22:39:25	-117.01242	11.86260	4161.36	 Sea cucumber 20221123_223925_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:39:35	-117.01243	11.86259	4161.39	 Sea cucumber (close up) 20221123_223935_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:39:47	-117.01244	11.86259	4161.42	Pink sea cucumber
2022-11-23	22:41:45	-117.01250	11.86261	4162.4	Unsuccessful attempt to collect pink sea cucumber
2022-11-23	22:49:52	-117.01247	11.86258	4162.45	Brittle star (MEGA43Brittlestar; photo not displayed) 20221123_224952_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:50:03	-117.01247	11.86258	4162.46	 Brittle star (MEGA43Brittlestar) 20221123_225003_Sonne_SO295_095ROV12_Logo_thumb.jpg

2022-11-23	22:50:11	-117.01247	11.86258	4162.46	 Brittle star (MEGA43Brittlestar) 20221123_225011_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:53:21	-117.01248	11.86257	4162.47	Brittle star (MEGA43Brittlestar) sampled
2022-11-23	22:53:34	-117.01248	11.86257	4162.47	Brittle star (MEGA43Brittlestar) collected into left compartment of ICBM biobox extra large
2022-11-23	22:55:43	-117.01250	11.86258	4162.54	Coral, ROV landed
2022-11-23	22:56:52	-117.01250	11.86258	4162.6	Coral (MEGA45Coral; photo not displayed) 20221123_225652_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:57:00	-117.01250	11.86258	4162.6	 Coral (MEGA45Coral) 20221123_225700_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:57:09	-117.01250	11.86258	4162.6	Coral (MEGA45Coral; photo not displayed) 20221123_225709_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	22:57:20	-117.01250	11.86259	4162.6	 Coral (MEGA45Coral) 20221123_225720_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:08:15	-117.01251	11.86258	4162.69	Coral (MEGA45Coral) sampled together with nodule and a lot of sediment
2022-11-23	23:08:28	-117.01251	11.86258	4162.69	Coral (MEGA45Coral) collected into left compartment of ICBM biobox extra large
2022-11-23	23:10:47	-117.01247	11.86257	4162.68	Nodule for shipboard nodule incubations with loads of sediment sampled and collected into left compartment of ICBM biobox extra large
2022-11-23	23:16:32	-117.01247	11.86243	4162.06	Sponge and big coral (maybe Isididae)

2022-11-23	23:18:24	-117.01247	11.86241	4163	 Sponge and big coral 20221123_231824_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:18:57	-117.01247	11.86242	4163.02	 Sponge (MEGA46Sponge) 20221123_231857_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:19:05	-117.01247	11.86242	4163.03	 Sponge (MEGA46Sponge) 20221123_231905_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:19:24	-117.01247	11.86243	4163.03	 Coral (MEGA47Coral) 20221123_231924_Sonne_SO295_095ROV12_Logo_thumb.jpg

2022-11-23	23:19:30	-117.01247	11.86243	4163.03	 Coral (MEGA47Coral) 20221123_231930_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:22:50	-117.01248	11.86246	4163	Sponge (MEGA46Sponge) sampled, semitransparent specimen without stalk
2022-11-23	23:23:35	-117.01248	11.86245	4163.01	Sponge (MEGA46Sponge) collected into left compartment of ICBM biobox extra large
2022-11-23	23:26:26	-117.01238	11.86233	4163.04	Coral (MEGA47Coral) sampled
2022-11-23	23:26:39	-117.01238	11.86233	4163	Coral (MEGA47Coral) collected into left compartment of ICBM biobox extra larger
2022-11-23	23:28:02	-117.01239	11.86233	4161.99	Continuation of transit towards MICP-DEEP2
2022-11-23	23:30:21	-117.01250	11.86213	4162.9	Sponge (MEGA48Sponge), Brittle star (MEGA50Brittlestar), Coral (MEGA49Coral)
2022-11-23	23:31:37	-117.01250	11.86206	4163.86	Sponge, Brittle star, Coral (photo not displayed) 20221123_233137_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:31:45	-117.01252	11.86207	4163.88	 Sponge, Brittle star, Coral 20221123_233145_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:31:58	-117.01254	11.86207	4163.91	 Sponge (MEGA48Sponge), Coral (MEGA49Coral) 20221123_233158_Sonne_SO295_095ROV12_Logo_thumb.jpg

2022-11-23	23:32:11	-117.01256	11.86207	4163.92	 Coral (MEGA49Coral; approx. 6 cm in length) 20221123_233211_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:35:08	-117.01259	11.86221	4163.94	Sponge (MEGA48Sponge) sampled
2022-11-23	23:35:10	-117.01259	11.86221	4163.94	Sponge (MEGA48Sponge) collected into right compartment of ICBM biobox extra large – probably successful
2022-11-23	23:38:56	-117.01246	11.86206	4163.95	Coral (MEGA49Coral) sampled
2022-11-23	23:39:10	-117.01247	11.86207	4163.95	Coral (MEGA49Coral) sampled into right compartment of ICBM biobox extra large
2022-11-23	23:40:41	-117.01257	11.86216	4163.97	Brittle star (MEGA50Brittlestar) sampled
2022-11-23	23:40:43	-117.01257	11.86216	4163.97	Brittle star (MEGA50Brittlestar) collected into right compartment of ICBM biobox extra large
2022-11-23	23:42:34	-117.01259	11.86211	4163.41	Continuation of transit towards MICP-DEEP2
2022-11-23	23:43:18	-117.01261	11.86206	4163.3	Fish (Ipnopidae)
2022-11-23	23:44:39	-117.01275	11.86185	4163.97	Fish
2022-11-23	23:47:50	-117.01278	11.86152	4163.92	Brittle star
2022-11-23	23:49:07	-117.01276	11.86139	4163.81	Sponge
2022-11-23	23:50:41	-117.01280	11.86128	4163.78	Crinoid
2022-11-23	23:53:28	-117.01282	11.86109	4163.71	 Fish (*Bathysaurus* sp.?) 20221123_235328_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:53:30	-117.01282	11.86109	4163.71	Fish (*Bathysaurus* sp.?)
2022-11-23	23:53:32	-117.01282	11.86109	4163.7	 Fish (*Bathysaurus* sp.?) 20221123_235332_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-23	23:54:28	-117.01285	11.86102	4163.56	Coral
2022-11-23	23:54:50	-117.01286	11.86101	4163.52	Brittle Star
2022-11-23	23:56:21	-117.01282	11.86083	4163.32	Some signs of disturbance or mounds created by infauna?
2022-11-23	23:56:51	-117.01278	11.86075	4163.27	Brittle star
2022-11-23	23:59:15	-117.01268	11.86045	4163.01	Brittle star
2022-11-24	00:00:28	-117.01268	11.86031	4162.91	Brittle star
2022-11-24	00:00:43	-117.01267	11.86029	4162.88	EBS track in view, moving on

2022-11-24	00:03:06	-117.01277	11.86023	4162.58	Sea cucumber
2022-11-24	00:09:24	-117.01271	11.85992	4161.7	MICP-DEEP2 in view
2022-11-24	00:10:31	-117.01267	11.85982	4161.85	Sea cucumber
2022-11-24	00:11:41	-117.01261	11.85973	4161.89	Brittle star
2022-11-24	00:13:27	-117.01262	11.85970	4161.82	Scoop put away into left ROV drawer
2022-11-24	00:14:11	-117.01265	11.85971	4161.81	Fish
2022-11-24	00:15:36	-117.01261	11.85970	4161.77	MICP-DEEP2 LED light is blinking: the program of deployment MICP-DEEP2-1 has finished
2022-11-24	00:16:07	-117.01260	11.85969	4161.73	 MICP-DEEP2 (deployment MICP-DEEP2-1) prior to recovery 20221124_001607_Sonne_SO295_095ROV12_Logo_thumb.jpg
2022-11-24	00:19:29	-117.01261	11.85971	4161.62	MICP-DEEP2 lifted and taken on ROV porch
2022-11-24	00:22:50	-117.01264	11.85965	4161.34	MICP-DEEP2 secured with manipulator
2022-11-24	00:23:01	-117.01264	11.85965	4160.9	End of scientific work
2022-11-24	00:23:25	-117.01264	11.85964	4158.25	OFF THE BOTTOM
2022-11-24	02:04:28	None	None	None	ON DECK

Kiel 6000 Dive 13 (SO295_100-1_ROV-13)

Date: 21.Nov.2022

Principal Investigators: Felix Janssen, Tanja Stratmann

Observers: Duygu Sevilgen, Ricarda Meineke, Brenda Esteban, Amber Henningsen

Protocol: Tanja Stratmann

ROV positions (at the bottom)
Start of dive: 11°55.848' N 117°01.541' E
End of dive: 11°55.860' N 117°01.561' E

Dive duration:
ROV in the water: 24.Nov.2022 15:16:25
ROV at the bottom: 24.Nov.2022 16:51:07
ROV off the bottom: 25.Nov.2022 00:23:36
ROV on deck: 25.Nov.2022 02:15:09

Explored sites: GER plume impact

Aims of the Dive:

- Deployment, reposition, and recovery of Fiberoptical Microsensor Profilers (MICP-DEEP1 & 2)
- Recovery of 2 Benthic Incubators (CUBE) with subsequent PUC and blade core sampling
- Recovery of 3 Benthic Flux Chambers (BFC1, 2, & 3)
- Recovery of Electrochemical Microsensor Profiler (MICP2)
- Recovery of Elevator 2

Handled ROV Tools (including scientific payload):

- MICP-DEEP2 (descent)
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- ICBM Biobox extra large
- Push cores (PUCs) in 16 Core Rack
- Magnet stick (to start MICP-DEEP2)
- BFC1 & 2 (ascent)

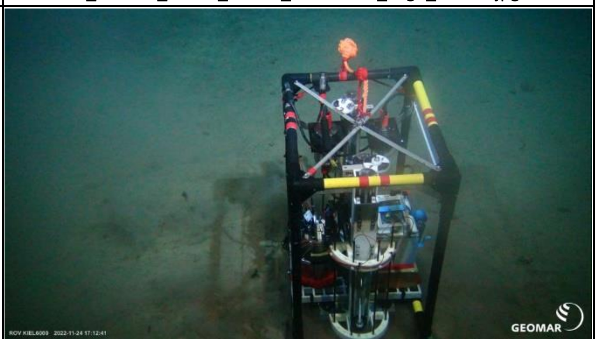
Relevant Elevator payload:

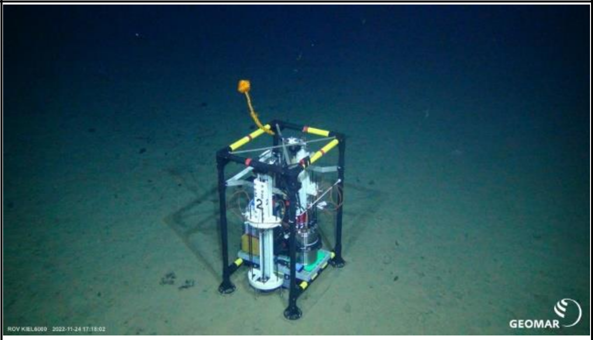
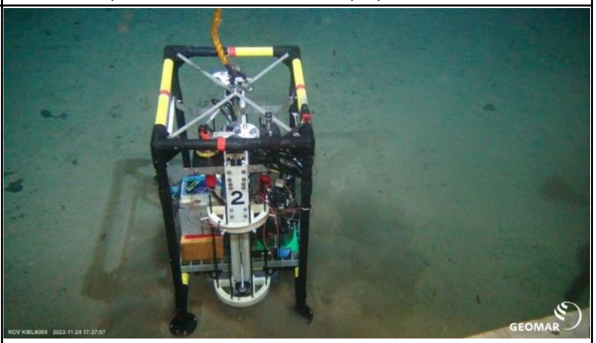
Elevator 2

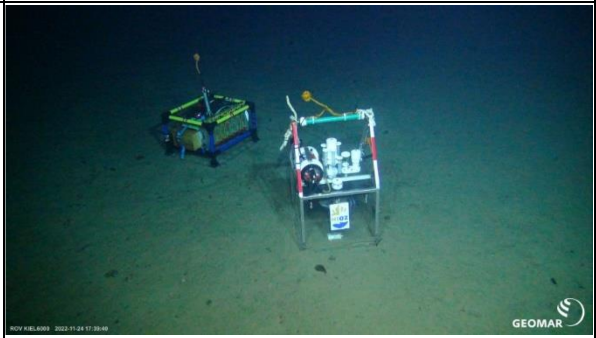
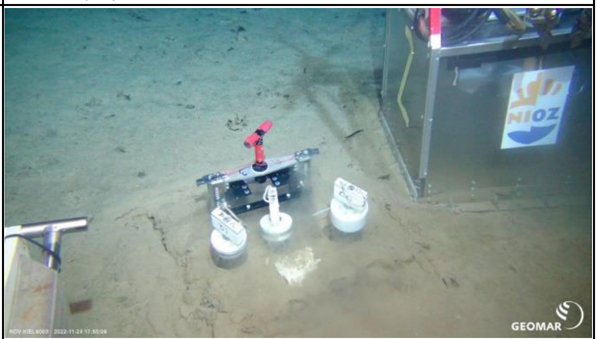
- BFC3
- MICP2
- CUBE2 & 3
- Blade corers
- MICP-DEEP1 & 2

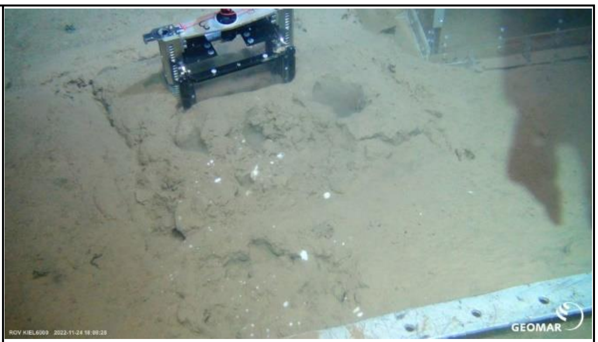
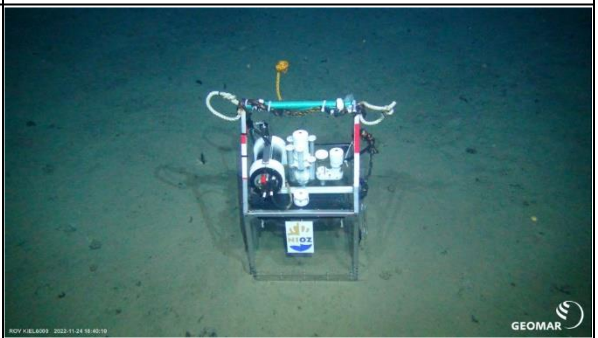
Dive summary

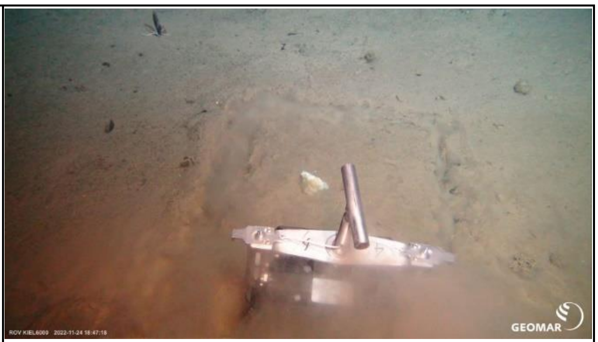
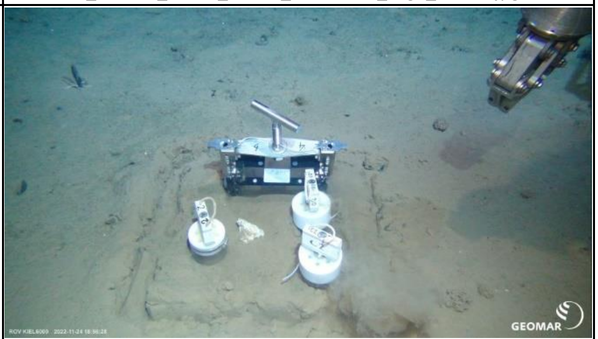
The ROV descended with MICP-DEEP2 on the porch. MICP-DEEP2 was deployed close to Elevator 2. MICP-DEEP1 was restarted and relocated. CUBE 2 and 3 were recovered, PUCs and Blade Corer sampling took place in the respective imprints of the CUBEs and the material incubated in the CUBEs was collected. Background samples were taken with an additional Blade Corer and PUCs. BFC3, MICP2, MICP-DEEP1 and MICP-DEEP2 were recovered and positioned on Elevator 2. After attaching the Elevator Recovery System to Elevator 2 the Elevator was retrieved while megafauna specimen (anemones) were collected. At the end of the dive BFC1 and BFC2 were taken on the porch for ascent of the ROV.

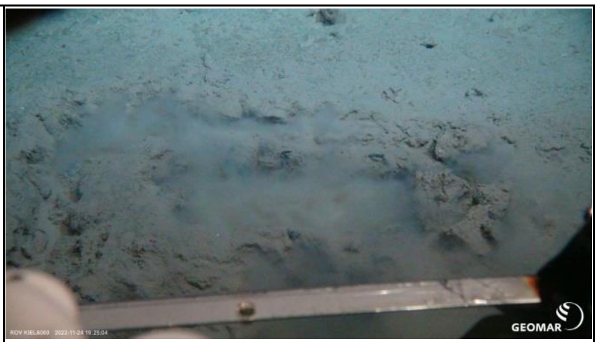
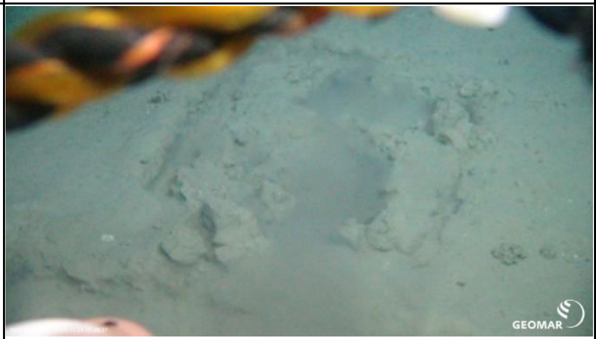
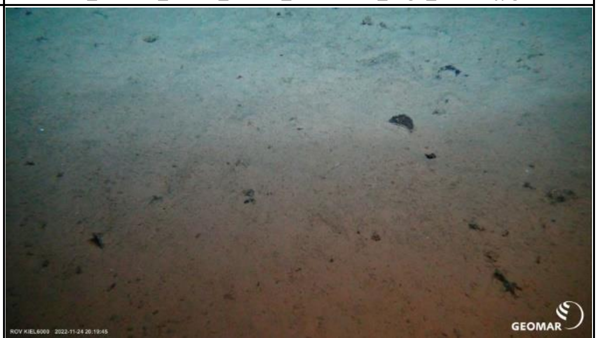
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-11-24	15:16:25	None	None	None	IN THE WATER
2022-11-24	16:51:07	-117.02569	11.93080	4105.46	AT THE BOTTOM
2022-11-24	16:58:41	-117.02549	11.93068	4119.92	First Action: deploy MICP-DEEP2 from porch
2022-11-24	17:00:47	-117.02549	11.93067	4120.56	MICP-DEEP2 blinking (waiting for start)
2022-11-24	17:05:26	-117.02541	11.93066	4120.54	MICP-DEEP2 was dropped on the seafloor, monkey fist seems too small
2022-11-24	17:06:47	-117.02547	11.93063	4120.57	MICP-DEEP2 dropped again
2022-11-24	17:07:53	-117.02547	11.93062	4120.63	MICP-DEEP grabbed on thicker rope now
2022-11-24	17:08:10	-117.02547	11.93063	4120.64	MICP-DEEP2 started with magnet hanging from RigMaster
2022-11-24	17:08:29	-117.02547	11.93064	4120.64	Toothed wheel of stage1 turning
2022-11-24	17:09:05	-117.02545	11.93064	4120.64	Moving towards Elevator 2 to deploy MICP-DEEP in its vicinity
2022-11-24	17:10:10	-117.02539	11.93063	4120.67	MICP-DEEP2 deployment site (photo not displayed) 20221124_171010_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:10:20	-117.02539	11.93062	4120.67	MICP-DEEP2 deployment site (photo not displayed) 20221124_171020_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:10:48	-117.02537	11.93064	4120.66	 MICP-DEEP2 deployment site 20221124_171048_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:12:41	-117.02540	11.93063	4120.61	 MICP-DEEP2 deployed at the seafloor (deployment MICP-DEEP2-1) 20221124_171241_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:12:54	-117.02540	11.93063	4120.62	MICP-DEEP2 deployed at the seafloor (photo not displayed) 20221124_171254_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:13:01	-117.02540	11.93064	4120.63	MICP-DEEP2 positioned at the seafloor: deployment MICP-DEEP2-1

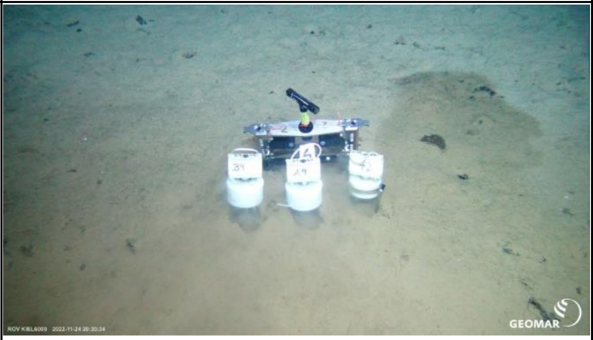
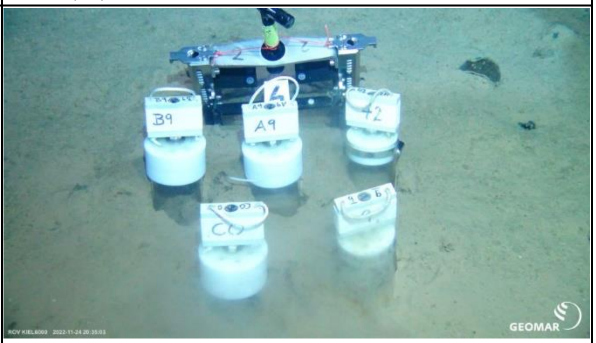
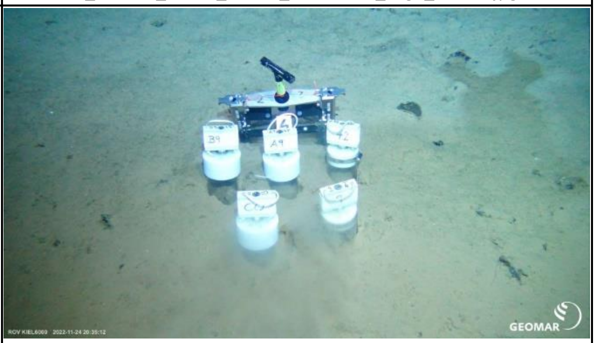
2022-11-24	17:13:10	-117.02540	11.93064	4120.63	 MICP-DEEP2 deployed at the seafloor 20221124_171310_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:15:36	-117.02540	11.93064	4120.02	Transit towards MICP-DEEP1 deployed as MICP-DEEP1-2 during SO295_083-1_ROV-10 for relocation and redeployment
2022-11-24	17:18:02	-117.02530	11.93082	4120.22	 MICP-DEEP1 (deployment MICP-DEEP1-2) prior to relocation 20221124_171802_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:21:05	-117.02532	11.93085	4120.49	Taking up MICP-DEEP1 to start on porch and then redeploy close by
2022-11-24	17:23:07	-117.02530	11.93083	4120.52	MICP-DEEP1 started with Magnet Stick hanging from RigMaster, geared wheel of stage 1 turning
2022-11-24	17:25:13	-117.02529	11.93087	4120.52	 MICP-DEEP1 deployment site 20221124_172513_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:27:54	-117.02529	11.93088	4120.48	MICP-DEEP1 positioned at the seafloor: deployment MICP-DEEP1-3
2022-11-24	17:27:57	-117.02529	11.93088	4120.48	 MICP-DEEP1 at seafloor (deployment MICP-DEEP1-3) 20221124_172757_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:28:10	-117.02529	11.93088	4120.5	Moving towards Elevator 2 to pick up blade corers for sampling of CUBE imprints
2022-11-24	17:31:37	-117.02527	11.93080	4119.33	Fish
2022-11-24	17:33:51	-117.02525	11.93059	4119.42	Arrival at Elevator 2

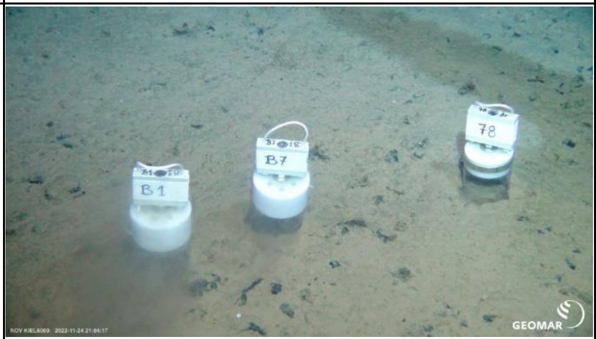
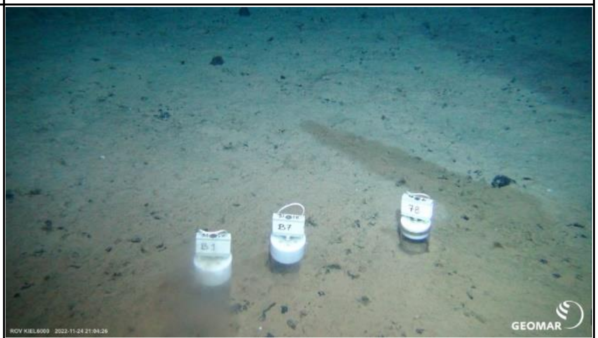
2022-11-24	17:36:17	-117.02524	11.93058	4120.49	Blade Corer #3 collected
2022-11-24	17:37:33	-117.02525	11.93060	4120.19	Moving to CUBE2
2022-11-24	17:39:40	-117.02544	11.93080	4120	 CUBE2 with BFC2 in the background 20221124_173940_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:41:47	-117.02547	11.93083	4121.06	Landed in front of CUBE2
2022-11-24	17:43:55	-117.02547	11.93081	4121.31	Placed Blade Corer on sediment for now
2022-11-24	17:45:02	-117.02546	11.93082	4121.29	Opened door, lifted CUBE2
2022-11-24	17:45:41	-117.02547	11.93082	4121.28	Set CUBE2 aside
2022-11-24	17:46:42	-117.02547	11.93083	4121.29	 CUBE2 imprint 20221124_174642_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:49:43	-117.02545	11.93082	4121.22	Blade Corer#3 deployed and triggered
2022-11-24	17:50:28	-117.02546	11.93080	4121.21	PUC sampling start in CUBE2 imprint with PUCs from 16 Core Rack
2022-11-24	17:52:21	-117.02549	11.93081	4121.22	PUC37 deployed
2022-11-24	17:53:33	-117.02546	11.93083	4121.21	PUCC6 deployed
2022-11-24	17:54:48	-117.02544	11.93082	4121.2	PUC58 deployed
2022-11-24	17:55:06	-117.02545	11.93082	4121.2	 CUBE2 imprint with CUBE2 and deployed cores 20221124_175506_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	17:55:12	-117.02545	11.93082	4121.2	Retrieving PUCs back into 16 Core Rack
2022-11-24	17:56:02	-117.02546	11.93081	4121.19	PUC58 retrieved
2022-11-24	17:57:16	-117.02546	11.93081	4121.19	PUCC6 retrieved
2022-11-24	17:58:01	-117.02546	11.93081	4121.19	PUC#37 retrieved
2022-11-24	18:01:39	-117.02546	11.93081	4121.19	Sponge from CUBE2 retrieved and collected into the left compartment of ICBM Biobox extra large
2022-11-24	18:03:02	-117.02547	11.93081	4121.18	Picking up remaining sponge pieces and collecting into ICBM biobox extra large

2022-11-24	18:08:28	-117.02547	11.93082	4121.17	 Remains of 'sponge' on the seafloor 20221124_180828_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	18:09:09	-117.02547	11.93082	4121.16	 Remains of 'sponge' on the seafloor (close up) 20221124_180909_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	18:12:08	-117.02546	11.93082	4121.14	CUBE 2 picked up and placed on porch
2022-11-24	18:13:12	-117.02548	11.93080	4121.12	Retrieval Blade Corer #3
2022-11-24	18:14:31	-117.02548	11.93081	4120.09	BFC1(?) blinking in the background; all syringes seem to be triggered
2022-11-24	18:14:32	-117.02548	11.93081	4120.06	Heading back to Elevator 2
2022-11-24	18:20:18	-117.02524	11.93055	4120.46	Blade Corer #3 placed in its box on Elevator 2
2022-11-24	18:30:23	-117.02526	11.93055	4120.72	CUBE2 placed on Elevator 2 and fixed with elastic straps
2022-11-24	18:35:54	-117.02523	11.93057	4120.54	Blade Corer #4 picked up from Elevator 2
2022-11-24	18:36:10	-117.02524	11.93057	4120.41	Heading towards CUBE3
2022-11-24	18:38:13	-117.02530	11.93063	4118.8	Fish
2022-11-24	18:38:52	-117.02543	11.93072	4118.64	Arrival at CUBE3
2022-11-24	18:40:10	-117.02553	11.93080	4119.43	 CUBE3 before retrieval 20221124_184010_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	18:41:34	-117.02551	11.93080	4120.64	ROV landed in front of CUBE3
2022-11-24	18:41:56	-117.02551	11.93080	4120.8	Red shrimp
2022-11-24	18:44:13	-117.02554	11.93079	4120.87	Blade Corer #4 placed on sediment for the moment
2022-11-24	18:45:18	-117.02553	11.93082	4120.88	Opened door of CUBE3
2022-11-24	18:45:55	-117.02553	11.93082	4120.88	CUBE3 was hit a couple of times with manipulator arm and shook up a bit
2022-11-24	18:46:10	-117.02553	11.93081	4120.87	Lifted CUBE3 from seafloor and set aside

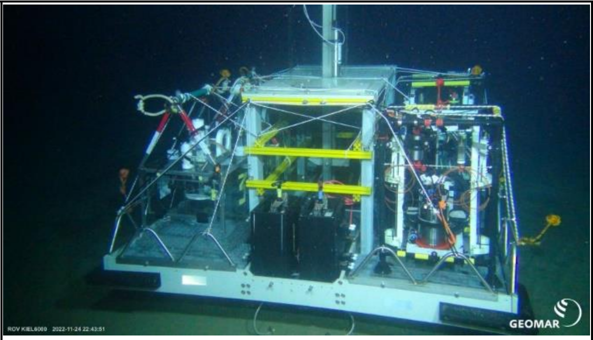
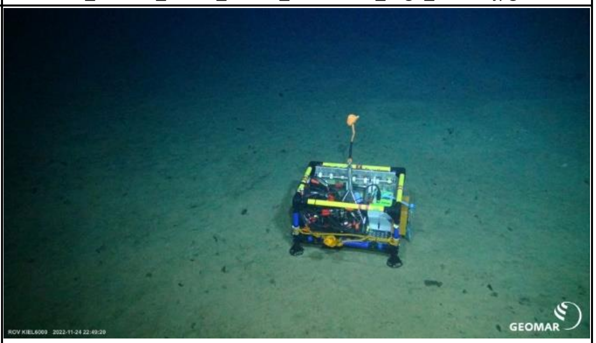
2022-11-24	18:47:18	-117.02554	11.93078	4120.86	 CUBE3 imprint before sampling 20221124_184718_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	18:47:54	-117.02553	11.93080	4120.86	'Sponge' in CUBE3 imprint (photo not displayed) 20221124_184754_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	18:48:22	-117.02553	11.93079	4120.85	 'Sponge' in CUBE3 imprint 20221124_184822_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	18:50:54	-117.02552	11.93079	4120.85	Blade Corer #4 deployed and triggered in CUBE3 imprint
2022-11-24	18:51:29	-117.02553	11.93080	4120.85	PUC sampling start in CUBE3 imprint with PUCs from 16 Core Rack
2022-11-24	18:53:37	-117.02552	11.93077	4120.84	PUCD0 deployed
2022-11-24	18:55:35	-117.02554	11.93080	4120.83	PUC2 deployed
2022-11-24	18:56:26	-117.02551	11.93080	4120.83	PUCC2 deployed
2022-11-24	18:56:28	-117.02551	11.93080	4120.83	CUBE3 imprint with Blade Corer and cores (photo not displayed) 20221124_185628_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	18:58:28	-117.02550	11.93077	4120.81	 CUBE3 imprint with Blade Corer #4 and deployed cores 20221124_185828_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	19:16:51	-117.02552	11.93080	4120.7	'Sponge' fragment retrieved and collected into right compartment of ICBM biobox extra large
2022-11-24	19:17:55	-117.02553	11.93079	4120.7	Fish (grenadier)
2022-11-24	19:20:37	-117.02552	11.93077	4120.68	CUBE3 picked up and placed on porch
2022-11-24	19:24:20	-117.02552	11.93078	4120.65	Blade Corer #4 retrieved

2022-11-24	19:25:04	-117.02552	11.93079	4120.58	 CUBE3 imprint post sampling 20221124_192504_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	19:26:37	-117.02553	11.93078	4119.78	 CUBE3 imprint post sampling 20221124_192637_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	19:26:55	-117.02553	11.93077	4119.46	Blade Corer #4 placed on porch
2022-11-24	19:27:49	-117.02554	11.93075	4118.66	Heading back to Elevator 2
2022-11-24	19:34:22	-117.02525	11.93057	4118.79	Arrival at Elevator 2
2022-11-24	19:37:55	-117.02524	11.93057	4119.71	Blade Corer 4 placed on Elevator 2
2022-11-24	19:48:00	-117.02529	11.93054	4120.02	CUBE3 placed on elevator, door closed
2022-11-24	19:52:24	-117.02529	11.93053	4120.17	CUBE3 secured on Elevator 2 with elastic straps
2022-11-24	20:08:16	-117.02469	11.93046	4119.98	Blade Corer #2 retrieved from Elevator 2
2022-11-24	20:11:57	-117.02535	11.93060	4119.22	Moving towards target site A for background samping
2022-11-24	20:16:02	-117.02589	11.93076	4118.85	Arrival at sampling target area A
2022-11-24	20:19:30	-117.02603	11.93074	4120.25	Sampling target site A (photo not displayed) 20221124_201930_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	20:19:45	-117.02603	11.93075	4120.25	 Sampling target site A 20221124_201945_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	20:22:17	-117.02605	11.93073	4120.24	Blade Corer #2 deployed and triggered, PUC sampling start at site A with PUCs from 16 Core Rack
2022-11-24	20:25:26	-117.02594	11.93083	4120.23	PUCB9 deployed
2022-11-24	20:27:41	-117.02600	11.93081	4120.25	PUCA9 deployed
2022-11-24	20:30:07	-117.02604	11.93077	4120.24	PUC42 deployed

2022-11-24	20:30:24	-117.02604	11.93077	4120.24	 Site A with Blade Corer #2 and deployed cores (B9, A9, 42 from l. to r.) 20221124_203024_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	20:30:34	-117.02604	11.93077	4120.24	 Sampling site with Blade Corer #2 and deployed cores 20221124_203034_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	20:32:57	-117.02597	11.93084	4120.23	PUCC0 deployed
2022-11-24	20:34:47	-117.02593	11.93084	4120.22	PUC9 deployed
2022-11-24	20:35:03	-117.02594	11.93083	4120.23	 Site A with deployed cores (B9, C0, A9, 9, 42 from left to right) 20221124_203503_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	20:35:12	-117.02595	11.93083	4120.23	 Site A with deployed cores (B9, C0, A9, 9, 42 from left to right) 20221124_203512_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	20:35:27	-117.02598	11.93080	4120.23	Retrieving PUCs back into 16 Core Rack
2022-11-24	20:37:18	-117.02602	11.93078	4120.23	PUC9 retrieved
2022-11-24	20:38:47	-117.02602	11.93080	4120.21	PUCC0 retrieved
2022-11-24	20:40:47	-117.02599	11.93078	4120.22	PUC42 retrieved
2022-11-24	20:42:34	-117.02598	11.93081	4120.21	PUCA9 retrieved
2022-11-24	20:44:20	-117.02599	11.93079	4120.2	PUCB9 retrieved
2022-11-24	20:49:22	-117.02610	11.93080	4118.78	Moving towards target site B for background sampling with Blade Corer #2 in manipulator claw

2022-11-24	20:52:50	-117.02643	11.93125	4118.66	Arrival at target site B
2022-11-24	20:55:58	-117.02642	11.93127	4119.91	Blade Corer#2 set aside on sediment, PUC sampling start at site B with PUCs from 16 Core Rack
2022-11-24	20:58:53	-117.02642	11.93126	4119.91	PUC78 deployed
2022-11-24	21:01:18	-117.02642	11.93124	4119.91	PUCB7 deployed
2022-11-24	21:03:39	-117.02639	11.93127	4119.9	PUCB1 deployed
2022-11-24	21:04:17	-117.02640	11.93126	4119.89	 Sampling site B with deployed cores (B1, B7, 78 from left to right) 20221124_210417_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	21:04:26	-117.02639	11.93126	4119.89	 Sampling site B with deployed cores (B1, B7, 78 from left to right) 20221124_210426_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	21:04:46	-117.02640	11.93125	4119.9	Retrieving PUCs back into 16 Core Rack
2022-11-24	21:06:14	-117.02640	11.93128	4119.9	PUC78 retrieved
2022-11-24	21:08:31	-117.02639	11.93126	4119.91	PUCB7 retrieved
2022-11-24	21:10:47	-117.02636	11.93129	4119.91	PUCB1 retrieved
2022-11-24	21:13:22	-117.02640	11.93127	4119.83	Snail
2022-11-24	21:13:44	-117.02639	11.93127	4119.56	Blade corer #2 picked up from sediment and held in manipulator claw while heading back to Elevator 2
2022-11-24	21:19:46	-117.02577	11.93068	4118.73	Passing by BFC1
2022-11-24	21:20:15	-117.02570	11.93063	4118.81	Jellyfish (probably got into thruster)
2022-11-24	21:22:00	-117.02540	11.93055	4118.94	Passing by MICP-DEEP2
2022-11-24	21:22:07	-117.02540	11.93055	4118.95	Arrival at Elevator 2
2022-11-24	21:25:07	-117.02525	11.93054	4119.55	Blade corer put into its box on Elevator 2
2022-11-24	21:28:01	-117.02524	11.93052	4118.29	Heading towards BFC3
2022-11-24	21:28:51	-117.02518	11.93055	4118.23	BFC3 in view
2022-11-24	21:29:08	-117.02517	11.93055	4118.21	Approaching from the side so that the chamber can be seen to check penetration depth
2022-11-24	21:32:25	-117.02514	11.93059	4119.76	 BFC3 deployed during SO295_083-1_ROV-10 20221124_213225_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	21:33:33	-117.02512	11.93059	4119.76	BFC3 inserted until al little above the white ring

2022-11-24	21:35:04	-117.02515	11.93056	4119.81	All syringes seem to be released
2022-11-24	21:35:19	-117.02516	11.93055	4119.85	BFC3 is blinking: program finished
2022-11-24	21:37:14	-117.02511	11.93057	4119.9	BFC3 retrieved from the sediment
2022-11-24	21:38:31	-117.02511	11.93058	4119.66	Stirrer is stirring
2022-11-24	21:40:20	-117.02514	11.93059	4119.1	Heading towards Elevator 2
2022-11-24	21:44:24	-117.02526	11.93051	4119.36	BFC3 on elevator
2022-11-24	21:45:56	-117.02525	11.93054	4119.75	BFC3 placed on Elevator 2 and secured with elastic straps
2022-11-24	21:49:38	-117.02520	11.93055	4119.62	Heading towards MICP2 (deployment MICP2-2 during SO295_083-1_ROV-10)
2022-11-24	21:51:08	-117.02521	11.93060	4119.57	 MICP2 deployed during SO295_083-1_ROV-10 20221124_215108_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	21:51:44	-117.02521	11.93063	4119.35	Anemone(?) behind MICP2
2022-11-24	21:52:01	-117.02521	11.93063	4119.11	MICP2 blinking: program of deployment MICP2-2 is finished
2022-11-24	21:52:09	-117.02521	11.93062	4119	MICP2 retrieved from sediment
2022-11-24	21:52:56	-117.02522	11.93062	4118.76	Heading towards Elevator 2
2022-11-24	21:54:44	-117.02526	11.93058	4119.27	MICP2 placed next to cubes on the elevator
2022-11-24	21:56:46	-117.02528	11.93054	4119.48	MICP2 placed on Elevator 2 next to CUBES and secured with eleastic straps
2022-11-24	21:59:20	-117.02524	11.93058	4119.43	Fish (swimming above elevator towards ROV
2022-11-24	22:00:54	-117.02524	11.93056	4119.68	Heading towards MICP-DEEP1
2022-11-24	22:05:03	-117.02523	11.93074	4118.76	Anemone
2022-11-24	22:05:27	-117.02525	11.93078	4118.72	Approaching MICP-DEEP1
2022-11-24	22:07:51	-117.02531	11.93085	4118.32	MICP-DEEP1 retrieved from seafloor, blinking: program of deployment MICP-DEEP1-3 finished
2022-11-24	22:08:49	-117.02530	11.93085	4118.2	Heading back to elevator with MICP-DEEP1
2022-11-24	22:10:04	-117.02521	11.93073	4118.46	Elevator 2 in view
2022-11-24	22:18:31	-117.02520	11.93055	4119.78	MICP-DEEP1 placed on Elevator 2 next to BFC3 and secured with elastic straps
2022-11-24	22:20:45	-117.02523	11.93051	4119.35	Heading towards MICP-DEEP2
2022-11-24	22:20:48	-117.02523	11.93051	4119.33	Fish
2022-11-24	22:22:36	-117.02533	11.93054	4119.13	Sea urchin and pronounced Lebensspuren
2022-11-24	22:27:14	-117.02545	11.93068	4119	Arrival at MICP-DEEP2, blinking: program of deployment MICP-DEEP2-1 finished
2022-11-24	22:27:42	-117.02544	11.93067	4119.1	 MICP-DEEP2 before retrieval with Elevator 2 in the background 20221124_222742_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	22:30:20	-117.02532	11.93062	4118.94	MICP-DEEP2 retrieved from seafloor, transported to Elevator 2
2022-11-24	22:35:19	-117.02524	11.93054	4119.6	Fish in the back of Elevator 2
2022-11-24	22:38:10	-117.02518	11.93054	4119.86	MICP-DEEP2 placed onto elevator to the left of BFC3 and secured with elastic straps

2022-11-24	22:43:51	-117.02526	11.93053	4119.78	 Elevator 2 loaded with instruments and samplers 20221124_224351_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	22:45:35	-117.02536	11.93059	4118.8	Next Action: Picking up BFC2 move it out of the way when ship is relocated to pick up Elevator 2
2022-11-24	22:47:30	-117.02548	11.93078	4119.14	BFC2 in view
2022-11-24	22:48:56	-117.02550	11.93082	4119.24	Small sediment elevation under BFC2, chamber inserted down to white line
2022-11-24	22:49:08	-117.02535	11.93097	4119.27	 BFC2 deployed during SO295_083-1_ROV-10 20221124_224908_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	22:49:20	-117.02535	11.93097	4119.31	 BFC2 deployed during SO295_083-1_ROV-10 20221124_224920_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	22:50:56	-117.02554	11.93082	4118.66	BFC2 retrieve from seafloor, blinking: program finished, moving towards BFC1
2022-11-24	22:51:29	-117.02556	11.93080	4118.61	BFC1 (deployed curing SO295_083-1_ROV-10) in view
2022-11-24	22:53:01	-117.02569	11.93073	4119.19	BFC2 deposited on seafloor next to BFC1
2022-11-24	22:54:24	-117.02565	11.93069	4118.89	Next Action: Moving towards Elevator Recovery System (‘Bergefuch’) and Elevator 2
2022-11-24	22:56:54	-117.02551	11.93065	4118.91	Waiting for Elevator Recovery System being lowered
2022-11-24	23:05:16	-117.02548	11.93075	4118.16	Elevator Recovery System in view
2022-11-24	23:13:18	-117.02520	11.93051	4112.37	Grabbing the ROV operated shackle
2022-11-24	23:13:45	-117.02521	11.93050	4112.49	Moving backwards to Elevator 2
2022-11-24	23:15:38	-117.02523	11.93052	4111.77	ROV operated shackle lost 2 times and grabbed again
2022-11-24	23:21:57	-117.02525	11.93057	4118.54	ROV operated shackle was closed,opened again
2022-11-24	23:23:13	-117.02514	11.93085	4118.59	ROV operated shackle attached to Elevator 2
2022-11-24	23:24:51	-117.02534	11.93062	4118.64	ROV operated shackle locked
2022-11-24	23:25:21	-117.02535	11.93049	4118.66	Backing up from the elevator
2022-11-24	23:28:52	-117.02533	11.93062	4116.94	Elevator 2 retrieval starts (photo not displayed) 20221124_232852_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:28:58	-117.02533	11.93062	4116.94	Elevator 2 starts to ascend

2022-11-24	23:28:59	-117.02533	11.93062	4116.94	 Elevator 2 retrieval starts 20221124_232859_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:29:56	-117.02533	11.93064	4116.88	Next action: sampling anemones
2022-11-24	23:31:28	-117.02558	11.93077	4117.51	Moving northwest to stay clear of Elevator 2 while looking for anemones
2022-11-24	23:34:58	-117.02595	11.93096	4119.4	 Anemone (close up) 20221124_233458_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:35:17	-117.02598	11.93096	4119.4	 Anemone 20221124_233517_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:35:47	-117.02599	11.93096	4119.41	Anemone (close up; photo not displayed) 20221124_233547_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:38:40	-117.02603	11.93107	4119.36	 Brisingid Starfish 20221124_233840_Sonne_SO295_100ROV13_Logo_thumb.jpg

2022-11-24	23:39:26	-117.02594	11.93105	4119.38	 Unidentified specimen 20221124_233926_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:41:33	-117.02593	11.93108	4119.92	 Anemone (MEGA51Anemone) 20221124_234133_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:41:35	-117.02593	11.93108	4119.92	Anemone (MEGA51Anemone; photo not displayed) 20221124_234135_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:41:47	-117.02593	11.93108	4119.93	Anemone (MEGA51Anemone; photo not displayed) 20221124_234147_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:41:51	-117.02593	11.93108	4119.93	Anemone (MEGA51Anemone; photo not displayed) 20221124_234151_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:42:00	-117.02591	11.93108	4119.94	 Anemone (MEGA51Anemone) 20221124_234200_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:55:51	-117.02602	11.93110	4119.38	Restarted OFOP protocol software after crash
2022-11-24	23:55:59	-117.02601	11.93111	4119.44	Anemone (MEGA51Anemone collected into ICBM biobox extra large
2022-11-24	23:56:20	-117.02599	11.93113	4119.53	Fish
2022-11-24	23:57:24	-117.02583	11.93125	4119.66	 Anemone (MEGA52Anemone) 20221124_235724_Sonne_SO295_100ROV13_Logo_thumb.jpg

2022-11-24	23:57:49	-117.02582	11.93124	4119.67	 Anemone (MEGA52Anemone) 20221124_235749_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-24	23:58:12	-117.02583	11.93124	4119.7	Anemone (MEGA52Anemone, photo not displayed) 20221124_235812_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-25	00:01:05	-117.02590	11.93120	4120.34	 Anemone (MEGA52Anemone) 20221125_000105_Sonne_SO295_100ROV13_Logo_thumb.jpg
2022-11-25	00:01:21	-117.02590	11.93120	4120.35	Anemone (MEGA52Anemone; photo not displayed) 20221125_000121_Sonne_SO295_100ROV13_Logo_thumb.jpg Mega 52 (anemone)
2022-11-25	00:08:58	-117.02587	11.93117	4120.4	Anemone (MEGA52Anemone) sampled and collected into right compartment of ICBM biobox extra large
2022-11-25	00:12:29	-117.02582	11.93104	4119.41	Heading towards BFC1 and BFC2
2022-11-25	00:14:51	-117.02571	11.93081	4119.67	Both BFC1 and BFC2 are blinking: programs finished
2022-11-25	00:16:42	-117.02568	11.93068	4120.06	BFC1 lifted from the seafloor and taken on ROV porch
2022-11-25	00:19:54	-117.02566	11.93067	4119.47	BFC2 lifted from the seafloor and taken on ROV porch, stirring
2022-11-25	00:21:18	-117.02555	11.93080	4118.08	BFC1 and BFC2 secured on porch with manipulators
2022-11-25	00:23:36	-117.02601	11.93100	4114.98	OFF THE BOTTOM
2022-11-25	02:15:09	None	None	None	ON DECK

Kiel 6000 Dive 15 (SO295_123-1_ROV-15)

Date: 28.Nov.2022

Principal Investigators: Sabine Gollner, Felix Janssen

Observers: Amber Henningsen, Duygu Seviligen, Carsten Rühlemann, Brenda Esteban Vasquez

Protocol: Sabine Gollner

ROV positions (at the bottom)
Start of dive: 11°51.000' N 117°23.078' W
End of dive: 11°50.999' N 117°23.047' W

Dive duration:
ROV in the water: 28.Nov.2022 15:09:57
ROV at the bottom: 28.Nov.2022 17:20:26
ROV off the bottom: 29.Nov.2022 01:16:48
ROV on deck: 29.nov.2022 03:05:33

Explored sites: GER no-nodule

Aims of the Dive:

- Guide Elevator 1 to deployment site of Recolonization Frames (FRAMEs)
- Retrieve FRAMEs
- Push Core (PUC) sampling in FRAME footprints and in the vicinity of the FRAMEs
- Deployment of Electrochemical Microsensor Profilers (MICP1 & 2) in FRAME footprint and in the vicinity of FRAMEs
- Pore Water Sampler (PSW) deployment and recovery
- Connect Elevator 1 to Elevator Recovery System (‘Bergefuchs’) for retrieval

Handled ROV Tools (including scientific payload):

- 16 PUCs in 16 Core Rack
- 12 PUCs in Core Sixpacks in starboard drawer
- Magnet Stick

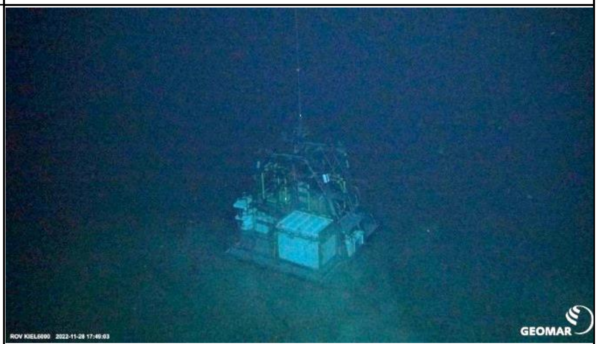
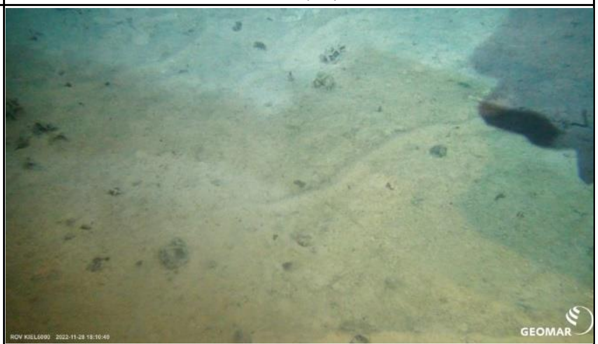
Relevant Elevator payload:

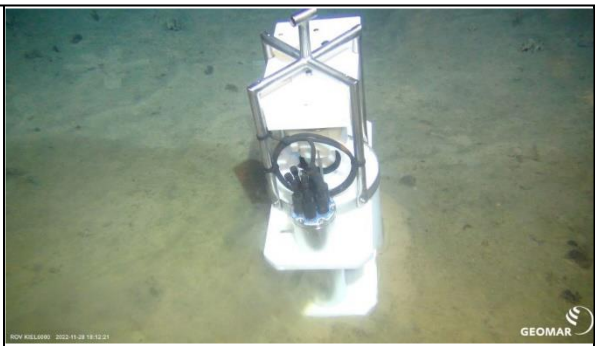
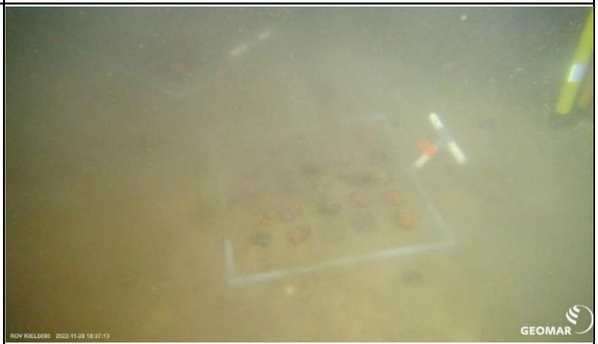
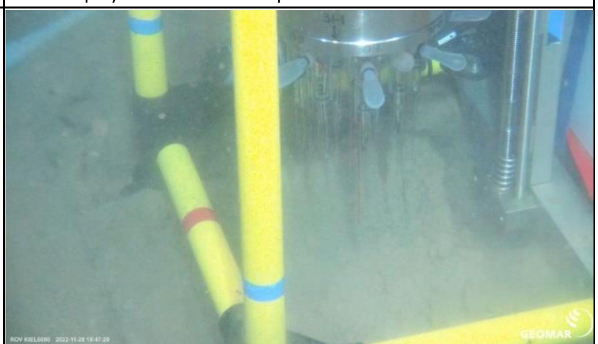
Elevator 1

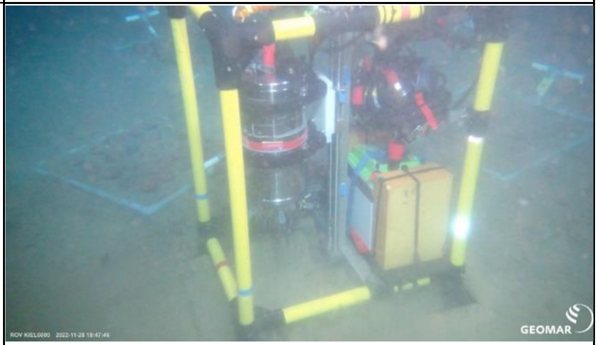
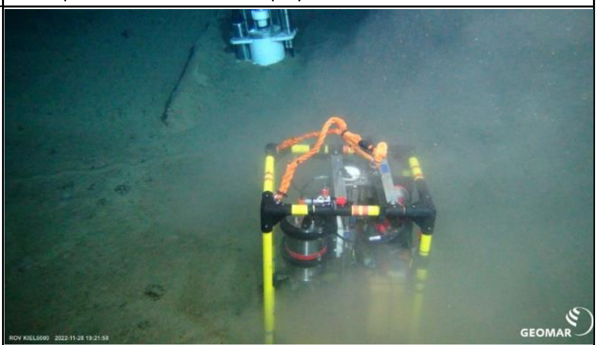
- 2 FRAME BOXes
- PSW in quiver
- MICP1 & 2
- *Backup PUC Core Sixpack*

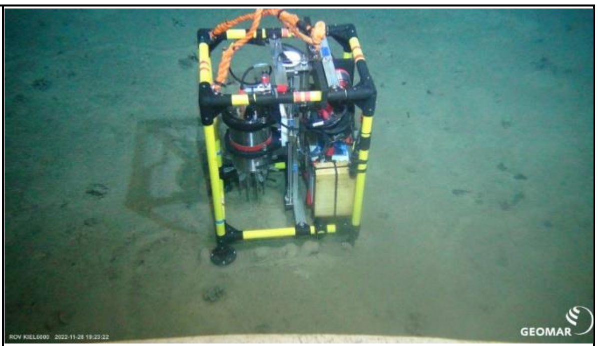
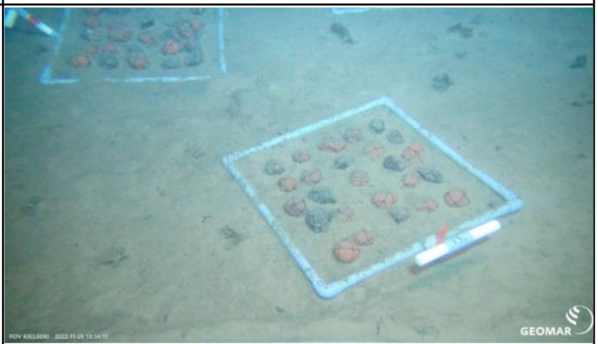
Dive summary

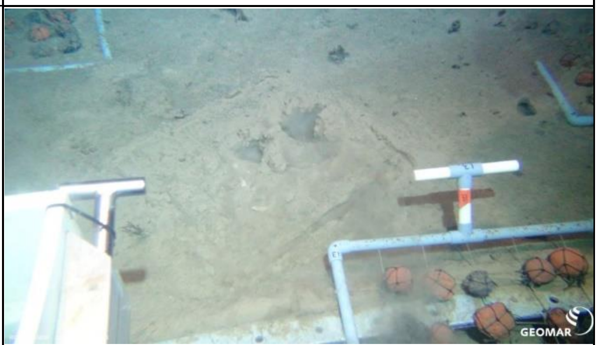
Network problems led to USBL navigation failure during descent. Since the ROV directly found the FRAMES deployed at the seafloor and Elevator 1 had been lowered at the right position, it was decided to continue the dive. After guiding Elevator 1 to the seafloor and detaching it from the cable, the PWS was deployed. The first of five FRAMEs (FRAME A) was collected and stored in the FRAME BOX on Elevator 1. MICP1 was deployed for measurement in the footprint of FRAME A. Subsequently, MICP2 was deployed for a background measurement next to the PWS. FRAMES B, C, D, and E were collected and PUC sampling took place in each of the FRAME footprints after which the respective FRAMEs were transferred to the FRAME BOX as well. Afterwards, 5 sets of 3-4 PUCs each were collected at different spots in the vicinity of the FRAMEs. MICP1 was retrieved and final PUC sampling took place in the footprint of FRAME A. Finally, the PWS (that had not fully released the sampling syringes) and MICP2 were collected. After connecting Elevator 1 to the Elevator Recovery System, the ROV returned to the surface.

Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-11-28	15:09:57	None	None	None	IN THE WATER
2022-11-28	17:20:26	-117.38464	11.85000	4307.38	AT THE BOTTOM
2022-11-28	17:29:58	-117.38385	11.85018	4311.23	FRAMES detected at the seafloor
2022-11-28	17:41:49	-117.38411	11.85013	4293.16	Elevator 1 in view
2022-11-28	17:49:03	-117.38388	11.85005	4310.67	 Elevator 1 arriving at the seafloor 20221128_174903_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	17:53:14	-117.38394	11.85016	4312.74	Elevator 1 released from cable with ROV manipulated shackle
2022-11-28	17:58:26	-117.38400	11.85009	4312.59	Bad visibility due to suspended material
2022-11-28	17:59:13	-117.38405	11.85017	4312.59	Elevator 1 situated in 18m distance to FRAMEs
2022-11-28	18:06:38	-117.38393	11.85012	4312.32	PWS retrieved from Elevator 1 for deployment
2022-11-28	18:10:40	-117.38402	11.85014	4315.2	 PWS deployment site 20221128_181040_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	18:12:09	-117.38403	11.85017	4315.21	PWS deployment

2022-11-28	18:12:21	-117.38404	11.85017	4315.21	 PWS after deployment 20221128_181221_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	18:27:35	-117.38390	11.85015	4313.48	MICP1 collected from Elevator 1
2022-11-28	18:35:54	-117.38372	11.85016	4315.09	MICP1 activated with Magnet Stick hanging from RigMaster
2022-11-28	18:37:13	-117.38376	11.85025	4315.46	 FRAME A before recovery 20221128_183713_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	18:37:39	-117.38392	11.85045	4315.45	MICP1 temporarily deposited next to FRAME A
2022-11-28	18:38:20	-117.38392	11.85045	4315.45	FRAME A lifted from the seafloor
2022-11-28	18:39:27	-117.38383	11.85027	4315.44	FRAME A deposited on porch
2022-11-28	18:42:21	-117.38376	11.85027	4315.43	 Footprint FRAME A 20221128_184221_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	18:42:36	-117.38377	11.85027	4315.43	Footprint FRAME A (photo not displayed) 20221128_184236_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	18:42:46	-117.38378	11.85027	4315.43	Footprint FRAME A (photo not displayed) 20221128_184246_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	18:45:50	-117.38388	11.85039	4315.45	MICP1 deployed in FRAME A footprint
2022-11-28	18:47:20	-117.38385	11.85029	4315.44	 MICP1 deployed in FRAME A footprint (close up) 20221128_184720_Sonne_SO295_123ROV15_Logo_thumb.jpg

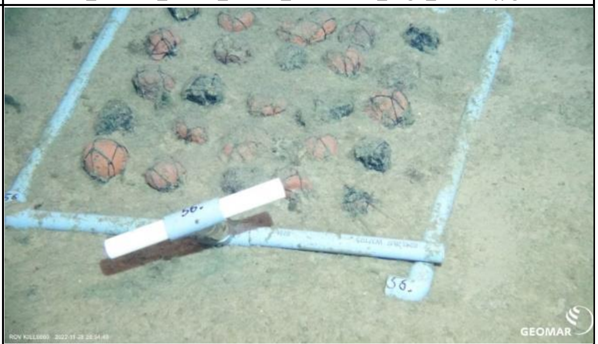
2022-11-28	18:47:30	-117.38384	11.85029	4315.44	MICP1 deployed in FRAME A footprint (close up; photo not displayed) 20221128_184730_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	18:47:46	-117.38384	11.85029	4315.44	 MICP1 deployed in FRAME A footprint 20221128_184746_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	18:50:09	-117.38377	11.85025	4315.44	FRAME A taken by manipulator claw
2022-11-28	18:50:43	-117.38377	11.85028	4315.31	MICP1 wheels are turning: program has started. Start deployment MICP1-1
2022-11-28	18:52:01	-117.38382	11.85023	4313.22	FRAME A is transported to Elevator 1
2022-11-28	18:54:28	-117.38392	11.85027	4312.28	Elevator 1 located
2022-11-28	18:59:05	-117.38395	11.85018	4314.28	FRAME A placed in compartment A of FRAME BOX 1
2022-11-28	19:08:11	-117.38393	11.85018	4314.01	MICP2 collected from Elevator 1
2022-11-28	19:12:27	-117.38398	11.85018	4312.94	Next action: Deployment of MICP2 close to PWS
2022-11-28	19:13:58	-117.38406	11.85017	4312.71	Starting MICP2 with Magnet Stick hanging from RigMaster before deployment
2022-11-28	19:16:21	-117.38406	11.85017	4312.72	MICP2 started
2022-11-28	19:18:48	-117.38403	11.85012	4314.16	 MICP2 deployment site 20221128_191848_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	19:20:45	-117.38403	11.85015	4314.13	MICP2 placed at the seafloor: deployment MICP2-1
2022-11-28	19:21:58	-117.38403	11.85021	4314.18	 MICP2 positioned at the seafloor with PWS in the background 20221128_192158_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	19:22:11	-117.38404	11.85018	4314.18	MICP2 positioned at the seafloor (photo not displayed) 20221128_192211_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	19:22:42	-117.38405	11.85013	4314.18	MICP2 positioned at the seafloor (photo not displayed) 20221128_192242_Sonne_SO295_123ROV15_Logo_thumb.jpg

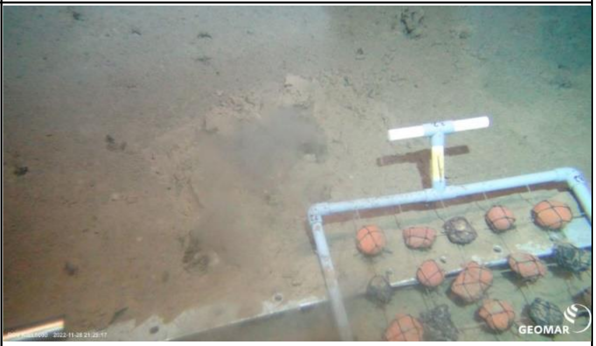
2022-11-28	19:23:22	-117.38404	11.85014	4314.16	 MICP2 positioned at the seafloor 20221128_192322_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	19:23:32	-117.38404	11.85014	4314.14	 MICP2 positioned at the seafloor (close up) 20221128_192332_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	19:23:56	-117.38404	11.85014	4313.96	Next Action: back to FRAMEs
2022-11-28	19:30:04	-117.38394	11.85034	4312.52	Arriving at FRAMEs and MICP1
2022-11-28	19:33:58	-117.38376	11.85028	4315.23	ROV landed on the seafloor
2022-11-28	19:34:11	-117.38370	11.85023	4315.28	 FRAME B (#13) before retrieval 20221128_193411_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	19:35:31	-117.38366	11.85018	4315.31	FRAME B (#13) lifted from the seafloor
2022-11-28	19:37:19	-117.38385	11.85030	4315.34	FRAME B deposited on porch
2022-11-28	19:37:35	-117.38383	11.85028	4315.34	 Footprint FRAME B 20221128_193735_Sonne_SO295_123ROV15_Logo_thumb.jpg

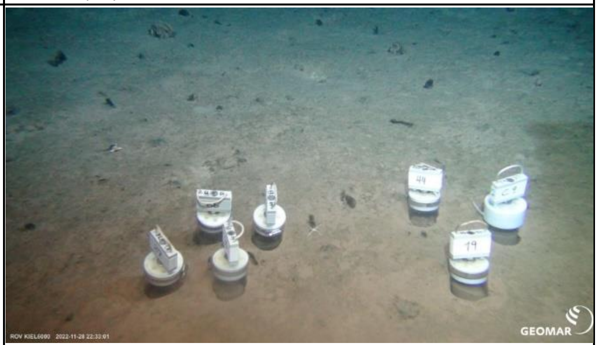
2022-11-28	19:37:52	-117.38374	11.85028	4315.34	 Footprint FRAME B (close up) 20221128_193752_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	19:38:02	-117.38371	11.85027	4315.34	PUC sampling start in FRAME B footprint with PUCs from 16 Core Rack
2022-11-28	19:39:11	-117.38371	11.85027	4315.33	PUCD4 deployed in FRAME B footprint
2022-11-28	19:40:17	-117.38381	11.85031	4315.34	PUCB5 deployed in FRAME B footprint
2022-11-28	19:43:17	-117.38374	11.85028	4315.34	PUCA5 deployed in FRAME B footprint
2022-11-28	19:43:30	-117.38374	11.85028	4315.34	 FRAME B footprint with deployed cores (D4, B5, A5) 20221128_194330_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	19:43:47	-117.38373	11.85028	4315.34	Retrieving PUCs back into 16 Core Rack
2022-11-28	19:44:53	-117.38392	11.85010	4315.32	PUCA5 retrieved
2022-11-28	19:46:13	-117.38392	11.85010	4315.32	PUCB5 retrieved
2022-11-28	19:47:37	-117.38367	11.85033	4315.31	PUCD4 retrieved
2022-11-28	19:48:03	-117.38367	11.85033	4315.31	 FRAME B footprint post sampling 20221128_194803_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	19:48:53	-117.38370	11.85033	4315.28	Moving to Elevator 1
2022-11-28	19:57:40	-117.38384	11.85014	4314.14	FRAME B (#13) placed in compartment B of FRAME BOX 1
2022-11-28	19:58:53	-117.38394	11.85021	4314.16	FRAME BOX 1 compartment B closed, compartment C opened
2022-11-28	19:59:56	-117.38401	11.85024	4313.98	Moving back to FRAMEs

2022-11-28	20:07:26	-117.38377	11.85028	4315.17	 FRAME C (#14) before retrieval 20221128_200726_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:07:27	-117.38377	11.85028	4315.17	Landing in front of FRAME B (#14), very close to MICP1
2022-11-28	20:09:42	-117.38374	11.85036	4315.2	FRAME C (#14) lifted from seafloor and deposited on porch
2022-11-28	20:09:58	-117.38378	11.85037	4315.2	 FRAME C (#14) footprint 20221128_200958_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:10:04	-117.38377	11.85036	4315.2	PUC sampling start in FRAME C footprint with PUCs from 16 Core Rack
2022-11-28	20:12:53	-117.38381	11.85034	4315.2	PUCB0 deployed in FRAME C footprint
2022-11-28	20:14:15	-117.38376	11.85026	4315.2	PUCA7 deployed in FRAME C footprint
2022-11-28	20:15:32	-117.38378	11.85027	4315.2	PUCD6 deployed in FRAME C footprint
2022-11-28	20:16:13	-117.38379	11.85028	4315.2	 FRAME C footprint with deployed cores (B0, D6, A7 from left to right) 20221128_201613_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:16:16	-117.38379	11.85028	4315.2	Retrieving PUCs back into 16 Core Rack
2022-11-28	20:18:37	-117.38377	11.85030	4315.2	PUCA7 retrieved
2022-11-28	20:19:43	-117.38375	11.85032	4315.2	PUCB0 retrieved
2022-11-28	20:20:58	-117.38374	11.85028	4315.2	PUCD6 retrieved
2022-11-28	20:21:24	-117.38374	11.85028	4315.2	 FRAME C footprint post sampling

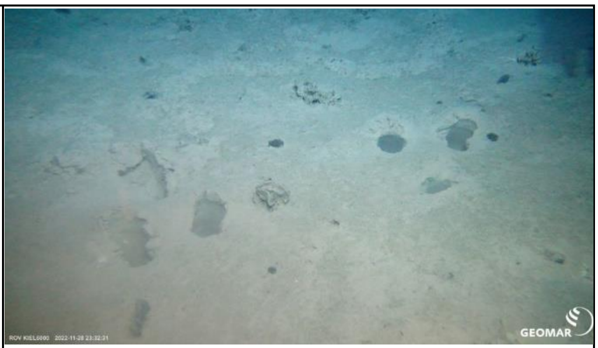
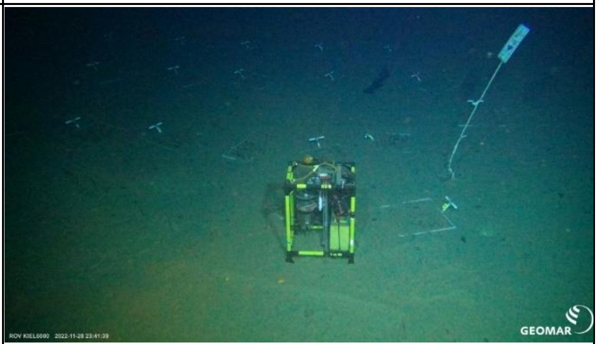
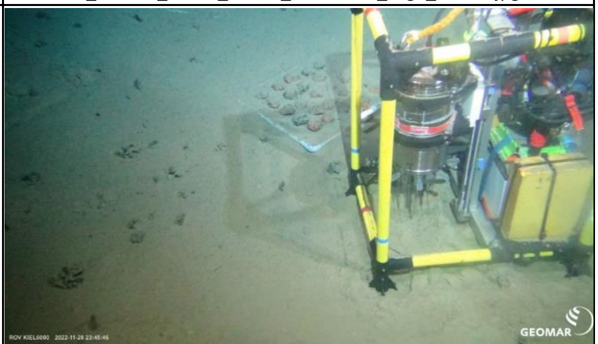
					20221128_202124_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:22:40	-117.38378	11.85029	4314.36	Moving back to Elevator 1
2022-11-28	20:30:12	-117.38394	11.85018	4313.96	FRAME C (#14) placed in compartment C of FRAME BOX 1
2022-11-28	20:31:25	-117.38395	11.85019	4313.95	FRAME BOX 1, compartment C closed,
2022-11-28	20:31:46	-117.38395	11.85020	4313.9	FRAME BOX 1, compartment D opened
2022-11-28	20:32:10	-117.38394	11.85020	4313.65	Moving back to FRAMEs
2022-11-28	20:40:57	-117.38374	11.85028	4315.09	Landed in front of FRAME D (#55)
2022-11-28	20:41:04	-117.38374	11.85028	4315.09	 FRAME D (#55) before retrieval (close up) 20221128_204104_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:41:17	-117.38375	11.85029	4315.1	 FRAME D (#55) before retrieval 20221128_204117_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:42:41	-117.38372	11.85031	4315.11	FRAME D (#55) lifted from seafloor
2022-11-28	20:44:05	-117.38373	11.85025	4315.12	FRAME D deposited on porch
2022-11-28	20:44:18	-117.38372	11.85024	4315.12	 FRAME D (#55) footprint 20221128_204418_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:44:35	-117.38370	11.85023	4315.12	PUC sampling start footprint FRAME D with PUCs from 16 Core Rack
2022-11-28	20:45:52	-117.38361	11.85027	4315.11	PUCB2 deployed in FRAME D footprint
2022-11-28	20:47:42	-117.38367	11.85035	4315.11	PUCB8 deployed in FRAME D footprint
2022-11-28	20:48:55	-117.38374	11.85035	4315.11	PUCC1 deployed in FRAME D footprint

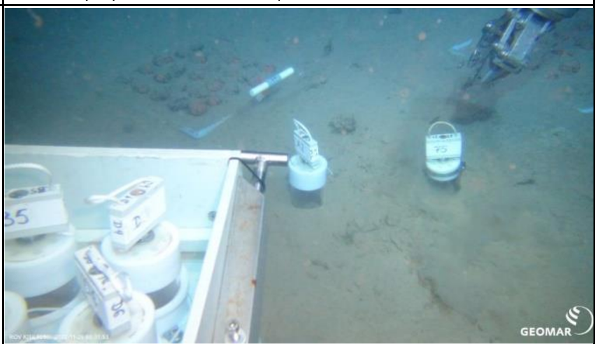
2022-11-28	20:49:04	-117.38375	11.85034	4315.11	 Footprint FRAME D with deployed cores (B8, B2, C1 from left to right) 20221128_204904_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:49:13	-117.38375	11.85034	4315.11	Retrieving PUCs back into 16 Core Rack
2022-11-28	20:49:50	-117.38373	11.85030	4315.12	PUCC1 retrieved
2022-11-28	20:51:01	-117.38372	11.85031	4315.12	PUCB8 retrieved
2022-11-28	20:52:11	-117.38372	11.85033	4315.09	PUCB2 retrieved
2022-11-28	20:53:00	-117.38371	11.85033	4315.1	 Footprint Frame D 20221128_205300_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:54:40	-117.38367	11.85027	4315.01	 FRAME 56 to the left side of where FRAME D (#55) was 20221128_205440_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	20:55:01	-117.38367	11.85029	4314.61	FRAME 56 (lying left of where FRAME D (#55) was) is broken in the corner
2022-11-28	20:55:11	-117.38368	11.85030	4314.25	Moving back to Elevator 1
2022-11-28	21:02:08	-117.38396	11.85014	4313.83	FRAME D (#55) fell down to the seafloor (unintendedly released from manipulator claw
2022-11-28	21:03:10	-117.38396	11.85019	4313.8	Upper part of the FRAME D T handle broke / came off
2022-11-28	21:03:32	-117.38396	11.85020	4313.8	Handle FRAME D deposited in drawer behind PUCs
2022-11-28	21:05:47	-117.38396	11.85024	4314.08	FRAME D (#55) lifted up from seafloor where it was lying upside down in the sediment
2022-11-28	21:08:47	-117.38382	11.85006	4313.89	FRAME D (#55) placed in compartment D of FRAME BOX 1
2022-11-28	21:09:46	-117.38392	11.85014	4313.89	FRAME BOX 1 compartment D closed
2022-11-28	21:10:13	-117.38394	11.85014	4313.89	FRAME BOX 1 compartment E opened, moving to FRAMES
2022-11-28	21:15:16	-117.38372	11.85027	4312.62	FRAMEs in view

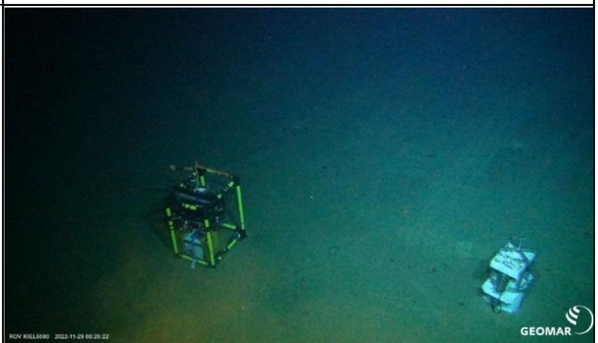
2022-11-28	21:18:32	-117.38367	11.85026	4314.87	 FRAME E (#32) before retrieval 20221128_211832_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	21:20:25	-117.38353	11.85030	4314.93	FRAME E (#32) lifted up from the seafloor and deposited on porch
2022-11-28	21:20:47	-117.38355	11.85030	4314.94	 FRAME E (#32) footprint 20221128_212047_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	21:21:48	-117.38382	11.85037	4314.91	PUC sampling start at FRAME E footprint with PUCs from 16 Core Rack
2022-11-28	21:22:41	-117.38382	11.85037	4314.92	PUCC4 deployed in FRAME E (#32) footprint
2022-11-28	21:23:44	-117.38375	11.85029	4314.91	PUCB4 deployed in FRAME E (#32) footprint
2022-11-28	21:24:48	-117.38373	11.85031	4314.92	PUCB6 deployed in FRAME E (#32) footprint
2022-11-28	21:24:53	-117.38373	11.85031	4314.92	 FRAME E footprint with deployed cores (B4, B6, C4 from left to right) 20221128_212453_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	21:26:14	-117.38371	11.85029	4314.91	PUCB6 retrieved back into 16 core rack
2022-11-28	21:27:52	-117.38375	11.85030	4314.91	PUCB4 retrieved back into 16 core rack
2022-11-28	21:28:52	-117.38376	11.85031	4314.91	PUCC4 retrieved back into 16 core rack
2022-11-28	21:29:17	-117.38374	11.85029	4314.91	 FRAME E footprint post sampling 20221128_212917_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	21:40:43	-117.38395	11.85018	4313.62	FRAME E (#32) placed in compartment E of FRAME BOX 1

2022-11-28	21:42:12	-117.38397	11.85026	4313.57	Compartment E of FRAME BOX 1 closed
2022-11-28	21:47:20	-117.38407	11.85042	4313.28	Next action: background sampling with 16 PUCs
2022-11-28	21:59:31	-117.38397	11.85019	4312.95	Taking PUC Core Sixpack from Elevator 1
2022-11-28	22:04:51	-117.38413	11.85005	4313.7	Moving to sampling site 'PUC Control'
2022-11-28	22:09:38	-117.38420	11.85002	4314.27	PUC sampling start at Control site with PUCs from Core Six Packs in ROV drawer and 16 Core Rack
2022-11-28	22:11:56	-117.38417	11.85007	4314.27	PUC82 deployed at site PUC control A
2022-11-28	22:13:56	-117.38413	11.85002	4314.23	PUC66 deployed at site PUC control A next to PUC82
2022-11-28	22:16:20	-117.38413	11.85000	4314.25	PUC80 (60 according to sample protocol)deployed at site PUC control A in front of PUC66 and PUC82
2022-11-28	22:18:08	-117.38422	11.85004	4314.23	PUC68 deployed at site PUC control A
2022-11-28	22:20:45	-117.38423	11.85002	4314.2	PUC44 deployed at site PUC control B
2022-11-28	22:23:23	-117.38420	11.85002	4314.2	PUC19 deployed at site PUC control B
2022-11-28	22:25:38	-117.38418	11.84999	4314.21	PUCC9 deployed at site PUC control B
2022-11-28	22:28:09	-117.38418	11.85005	4314.2	PUC77 deployed at site PUC control C
2022-11-28	22:30:20	-117.38419	11.85005	4314.2	PUC23 deployed at site PUC control C
2022-11-28	22:32:31	-117.38418	11.85003	4314.2	PUC76 deployed at site PUC control C
2022-11-28	22:33:01	-117.38417	11.85003	4314.2	 Site PUC Control A & B with deployed cores (#82, 66, 80, 68; 44, 19, C9) 20221128_223301_Sonne_SO295_123ROV15_Logo_thumb.jpg
				4314.2	
2022-11-28	22:33:11	-117.38417	11.85003	4314.2	 Site PUC Control (A), B & C with deployed cores 20221128_223311_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	22:33:16	-117.38416	11.85003	4314.2	 Site PUC Control B & C with deployed cores (#44, 19, C9; 23, 27, 76) 20221128_223316_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	22:33:58	-117.38416	11.85004	4314.19	Retrieving PUCs back into 16 Core Rack and Core Sixpacks
2022-11-28	22:35:33	-117.38419	11.85003	4314.2	PUC 76 retrieved
2022-11-28	22:38:00	-117.38415	11.84994	4314.2	PUC23 retrieved
2022-11-28	22:41:21	-117.38415	11.84997	4314.18	PUC19 retrieved

2022-11-28	22:43:32	-117.38416	11.84998	4314.17	PUCC9 retrieved
2022-11-28	22:47:07	-117.38417	11.84997	4314.17	PUC44 retrieved
2022-11-28	22:49:09	-117.38418	11.85000	4314.18	PUC68 retrieved
2022-11-28	22:54:18	-117.38420	11.85004	4314.14	PUC82 retrieved
2022-11-28	22:56:27	-117.38413	11.85001	4314.14	PUC66 retrieved
2022-11-28	23:00:51	-117.38422	11.85004	4314.12	PUC77 retrieved, continuing sampling at site 'PUC Control' with PUCs from Core Sixpack
2022-11-28	23:09:32	-117.38421	11.85003	4314.1	PUC5 deployed at site PUC control D
2022-11-28	23:11:25	-117.38418	11.85005	4314.11	PUCD2 deployed at site PUC control D
2022-11-28	23:13:13	-117.38421	11.85004	4314.09	PUC22 deployed at site PUC control D
2022-11-28	23:14:50	-117.38421	11.85000	4314.08	PUC27 deployed at site PUC control E
2022-11-28	23:18:15	-117.38420	11.84999	4314.08	PUC54 and PUC17 deployed at site PUC control E
2022-11-28	23:20:32	-117.38420	11.85004	4314.07	 Site PUC Control D & E with deployed cores (#5, D2, 22; 27, 17, 54) 20221128_232032_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:20:43	-117.38420	11.85004	4314.07	 Site PUC Control D with deployed cores (#5, D2, 22 from left to right) 20221128_232043_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:20:50	-117.38420	11.85004	4314.06	 Site PUC Control E with deployed cores (#27, 17, 54 from left to right) 20221128_232050_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:21:25	-117.38422	11.85005	4314.04	Retrieving PUCs back into Core Sixpack
2022-11-28	23:22:34	-117.38420	11.84998	4314.05	PUC17 retrieved
2022-11-28	23:24:24	-117.38417	11.85002	4314.05	PUC54 retrieved
2022-11-28	23:26:13	-117.38415	11.84999	4314.04	PUC27 retrieved
2022-11-28	23:27:51	-117.38420	11.85002	4314.03	PUC22 retrieved
2022-11-28	23:29:58	-117.38420	11.85008	4314.03	PUCD2 retrieved
2022-11-28	23:31:48	-117.38427	11.85015	4314.03	PUC5 retrieved

2022-11-28	23:32:31	-117.38428	11.85018	4314.04	 Site PUC Control D & E post sampling 20221128_233231_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:32:59	-117.38428	11.85014	4314.02	Next Action: retrieving MICP1 (end of deployment MICP1-1)
2022-11-28	23:41:39	-117.38381	11.85026	4312.15	 MICP1 in FRAME A footprint prior to retrieval 20221128_234139_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:44:37	-117.38382	11.85027	4312.25	Sea cucumber swimming
2022-11-28	23:45:28	-117.38381	11.85028	4312.98	 MICP1 in FRAME A footprint prior to retrieval 20221128_234528_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:45:46	-117.38383	11.85028	4313.47	 MICP1 in FRAME A footprint prior to retrieval (close up) 20221128_234546_Sonne_SO295_123ROV15_Logo_thumb.jpg

2022-11-28	23:47:53	-117.38381	11.85028	4314.27	 MICP1 in FRAME A footprint prior to retrieval (close up) 20221128_234753_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:50:50	-117.38381	11.85025	4314.25	MICP1 is blinking: program deployment MICP1-1 is finished. MICP1 removed from FRAME A footprint and deposited nearby for final PUC sampling from 16 Core Rack
2022-11-28	23:55:38	-117.38381	11.85033	4314.24	PUCA2 deployed in FRAME A footprint
2022-11-28	23:56:39	-117.38383	11.85029	4314.24	FRAME A footprint with deployed core (#A2; photo not displayed) 20221128_235639_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:56:49	-117.38382	11.85030	4314.23	 FRAME A footprint with deployed core (#A2) 20221128_235649_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:57:28	-117.38382	11.85030	4314.23	PUC6 deployed in FRAME A footprint
2022-11-28	23:57:55	-117.38384	11.85031	4314.24	 FRAME A footprint with deployed core (#A2, 6 from left to right) 20221128_235755_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-28	23:58:52	-117.38385	11.85030	4314.25	PUC6 retrieved
2022-11-29	00:01:46	-117.38379	11.85028	4314.24	PUC75 deployed in FRAME A footprint
2022-11-29	00:01:53	-117.38379	11.85029	4314.24	 FRAME A footprint with deployed core (#A2, 75 from left to right) 20221129_000153_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-29	00:03:16	-117.38378	11.85033	4314.24	PUC75 retrieved

2022-11-29	00:03:24	-117.38378	11.85032	4314.25	PUCA2 retrieved
2022-11-29	00:03:51	-117.38375	11.85031	4314.25	 FRAME A footprint post sampling 20221129_000351_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-29	00:05:13	-117.38375	11.85030	4313.1	MICP1 lifted from sediment
2022-11-29	00:08:09	-117.38395	11.85023	4311.05	Going back to the Elevator 1
2022-11-29	00:12:01	-117.38394	11.85019	4312.47	MICP1 positioned on Elevator 1
2022-11-29	00:16:25	-117.38392	11.85018	4313.19	PUC Six Pack positioned on Elevator 0031
2022-11-29	00:23:25	-117.38395	11.85019	4312.52	MICP1 secured with elastic straps on Elevator 1. Next action: retrieve PWS
2022-11-29	00:25:06	-117.38396	11.85021	4311.51	PWS before retrieval (photo not displayed) 20221129_002506_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-29	00:25:14	-117.38396	11.85020	4311.55	 PWS before retrieval 20221129_002514_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-29	00:25:22	-117.38396	11.85020	4311.62	 PWS and MICP2 before retrieval 20221129_002522_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-29	00:26:02	-117.38399	11.85020	4312.42	MICP2 is blinking: program deployment MICP2-1 finished
2022-11-29	00:27:25	-117.38407	11.85017	4312.03	PWS collected from the seafloor
2022-11-29	00:27:45	-117.38406	11.85017	4311.54	Seems like PWS didn’t work, next action: moving to Elevator 1
2022-11-29	00:31:28	-117.38377	11.84989	4312.64	PWS put back in quiver on Elevator 1 and secured with elastic straps, next action: moving to MICP2
2022-11-29	00:36:02	-117.38405	11.85019	4312.16	MICP2 lifted from seafloor (end of deployment MICP2-1), next action: returning to Elevator 1
2022-11-29	00:45:00	-117.38385	11.85020	4312.96	MICP2 positioned on Elevator 1 and secured with elastic straps
2022-11-29	00:51:52	-117.38421	11.84965	4310.71	Looking for the Elevator Recovery System
2022-11-29	00:59:02	-117.38424	11.85012	4307.24	Collecting ROV operated shackle from Elevator Recovery System
2022-11-29	01:05:01	-117.38396	11.85021	4310.99	ROV operated shackle connected to Elevator 1
2022-11-29	01:11:18	-117.38394	11.85015	4311.29	ROV-operated shackle is locked
2022-11-29	01:12:01	-117.38398	11.85015	4310.75	Elevator 1 before recovery (photo not displayed) 20221129_011201_Sonne_SO295_123ROV15_Logo_thumb.jpg

2022-11-29	01:14:42	-117.38390	11.85007	4310.55	Elevator 1 is lifted off the seafloor, going up
2022-11-29	01:14:47	-117.38389	11.85005	4310.55	 Elevator 1 lifting off the seafloor 20221129_011447_Sonne_SO295_123ROV15_Logo_thumb.jpg
2022-11-29	01:16:48	-117.38411	11.84999	4304.07	OFF THE BOTTOM
2022-11-29	03:05:33	None	None	None	ON DECK

Kiel 6000 Dive 16 (SO295_135-1_ROV16-1)

Date: 2.Dec.2022

Principal Investigators: Felix Janssen, Tanja Stratmann

Observers: Duygu Sevilgen, Carsten Rühlemann, Brenda Esteban Vasquez, Ricarda Meineke

Protocol: Devin Vlach

ROV positions (at the bottom)
Start of dive: 14°6.701' N 125°52.437' W
End of dive: 14°6.744' N 125°52.427' W

Dive duration:

ROV in the water:	2.Dec.2022	15:10:52
ROV at the bottom:	2.Dec.2022	16:53:45
ROV off the bottom:	2.Dec.2022	23:42:06
ROV on deck:	3.Dec.2022	01:45:56

Explored sites: BEL Collector Impact Site

Aims of the Dive:

- Deployment of 3 Benthic Flux Chambers (BFC1, 2, 3)
- Deployment of Passive Trace Metal Sampler (PSP)
- Deployment of Electrochemical Microsensor Profiler (MICP1)
- Deployment of 2 Fiberoptical Microsensor Profilers (MICP-DEEP1 & 2)
- Deployment of 2 Benthic incubators (CUBE2 & 3)
- *Repositioning of MICP1*
- Repositioning of MICP-DEEP1
- Retrieval of MICP-DEEP2

Handled ROV Tools (including scientific payload):

- 16 Pushcores
- 2 Handnets
- 2 Magnet sticks
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- 1 ICBM Biobox
- BFC1 & BFC2 (on descent)
- MICP-DEEP2 (on ascent)

Relevant Elevator payload:

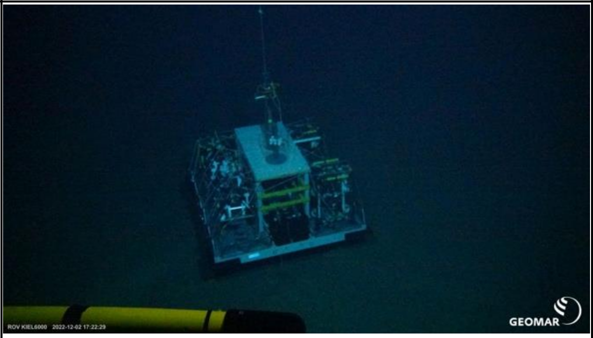
Elevator 2

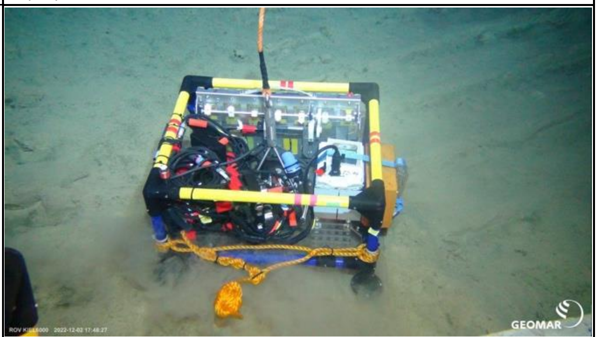
- BFC3
- MICP1

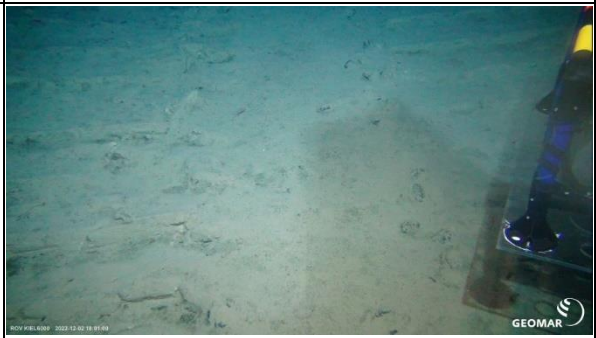
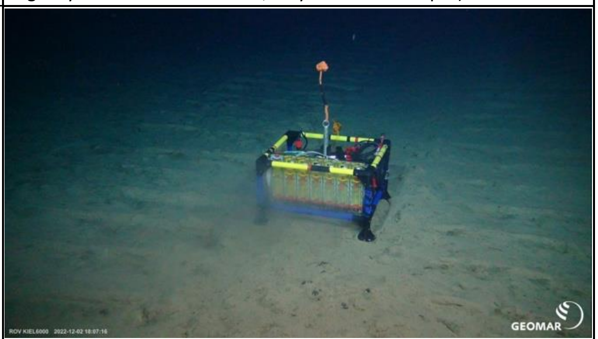
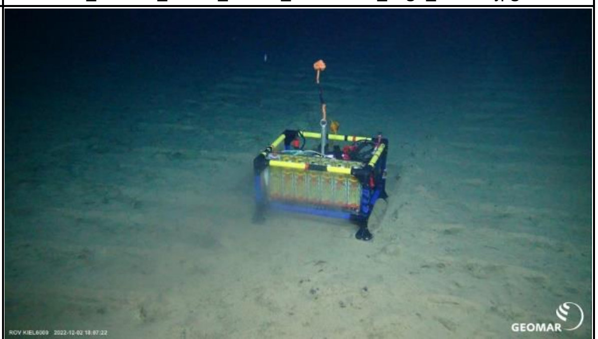
- MICP-DEEP1 & 2
- CUBE2 & 3
- PSP in quiver
- 4 Blade Corers

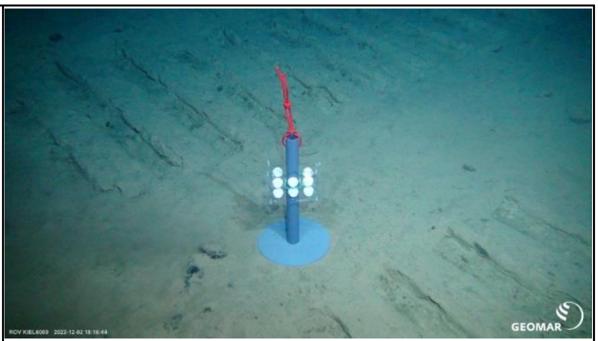
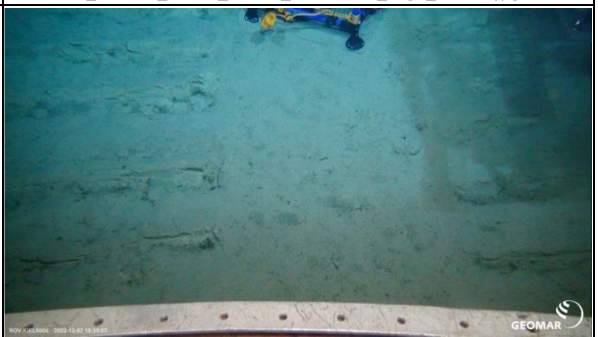
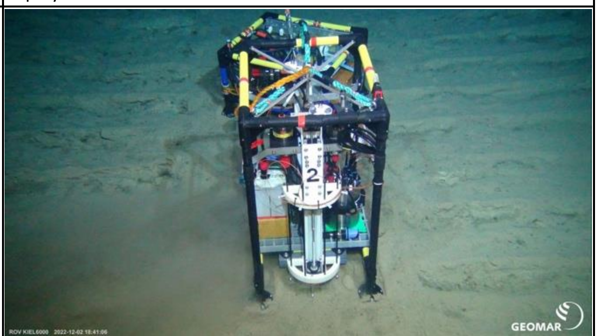
Dive summary

The ROV descended with BFC1 and BFC 2 on the porch. Elevator 2 was lowered to the seafloor north of the southern rim of the second PATANIA stretch and unhooked close to a nodule pile. BFC1 and BFC2 were deployed from the porch in PATANIA II tracks in between caterpillar tracks. The PSP was positioned between caterpillar tracks as well after it was collected from Elevator 2. Next, all three microsensor profilers (MICP-DEEP1, MICP-DEEP2, and MICP1) were collected from Elevator 2, started, and positioned at the seafloor one after the other. After deployment of the third benthic flux chamber (BFC3), both CUBE2 and CUBE3 were deployed and PUCs were sampled at three sites. MICP-DEEP1 was relocated for a second deployment while MICP1 was left untouched after the first deployment as it showed technical problems. One sea cucumber was sampled with the suction pump. Finally, MICP-DEEP2 was retrieved and collected onto the porch for ascent.

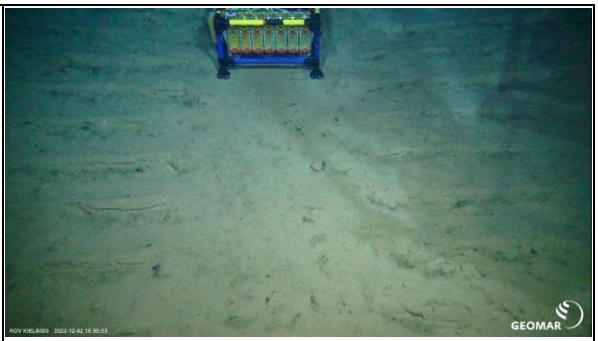
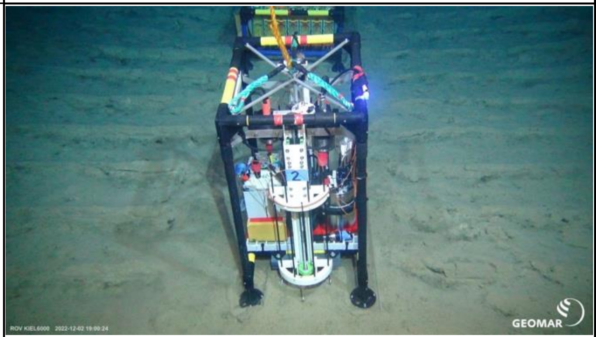
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-02	15:10:52	None	None	None	IN THE WATER
2022-12-02	16:53:45	-125.87395	14.11168	4525.07	AT THE BOTTOM
2022-12-02	17:00:21	-125.87392	14.11170	4524.59	Heading towards Elevator 2 lowered from the ship (50m away)
2022-12-02	17:04:59	-125.87366	14.11185	4509.17	Elevator in view
2022-12-02	17:13:42	-125.87373	14.11190	4525.06	Elevator 2 too close to nodule piles, the ship is moving 10m to the North to be in safe distance
2022-12-02	17:22:06	-125.87367	14.11193	4525.18	Next action: lower Elevator 2 to the seafloor
2022-12-02	17:22:29	-125.87366	14.11194	4525.59	 Elevator 2 at the seafloor 20221202_172229_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	17:22:35	-125.87366	14.11194	4525.79	Elevator 2 sat down
2022-12-02	17:22:40	-125.87366	14.11194	4525.99	Elevator 2 at the seafloor (photo not displayed) 20221202_172240_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	17:25:55	-125.87364	14.11197	4528.19	Elevator Recovery System ('Bergefuchs') detached by opening ROV operated shackle
2022-12-02	17:28:51	-125.87370	14.11198	4528.19	Flying West into collector tracks to deploy BFC2 and BFC1 from porch
2022-12-02	17:32:14	-125.87387	14.11200	4528.02	We seem to be just right of the gap / empty stripe between PATANIA II tracks now (looks a bit further away in the sonar)
2022-12-02	17:37:06	-125.87391	14.11212	4528.47	Next action: deploy BFC in the stripe between the tracks of the caterpillar tracks pair right next to the empty strip left (Southwest) of the ROV

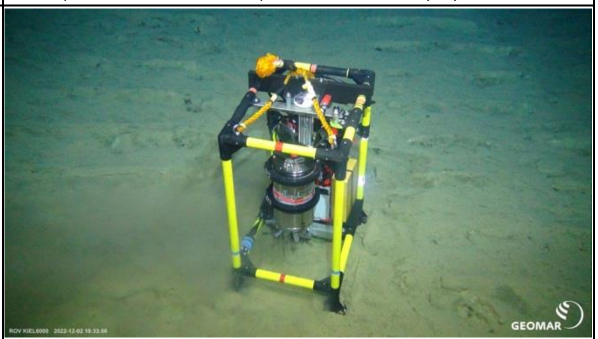
2022-12-02	17:37:14	-125.87391	14.11212	4528.6	 BFC2 deployment site (pre-deployment first trial) 20221202_173714_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	17:40:30	-125.87393	14.11210	4528.87	BFC2 off porch grabbing the handle (not the monkey fist)
2022-12-02	17:42:11	-125.87390	14.11210	4529.51	BFC2 dropped
2022-12-02	17:43:51	-125.87391	14.11211	4529.27	Released monkey fist and lifted BFC2 back up
2022-12-02	17:44:41	-125.87403	14.11215	4528.97	Flying forward in track in search of undisturbed deployment spot
2022-12-02	17:44:53	-125.87402	14.11213	4528.95	 BFC2 deployment site (pre-deployment second trial) 20221202_174453_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	17:48:02	-125.87413	14.11226	4529.66	Deployment BFC2
2022-12-02	17:48:27	-125.87413	14.11226	4529.68	 BFC2 deployed at seafloor 20221202_174827_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	17:53:35	-125.87395	14.11212	4529.67	 Penetration of the flux chamber of BFC2 (close up) 20221202_175335_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	17:53:42	-125.87395	14.11212	4529.67	Pentration depth of BFC2 (photo not displayed) 20221202_175342_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	17:53:51	-125.87395	14.11212	4529.67	Penetration depth of the flux chamber of BFC2 checked (white (10cm) ring visible just above the sediment surface)
2022-12-02	17:55:50	-125.87394	14.11214	4529.67	Moving Northeast to look select tracks for deployment of BFC1
2022-12-02	17:59:53	-125.87379	14.11234	4529.6	BFC1 lifted off porch

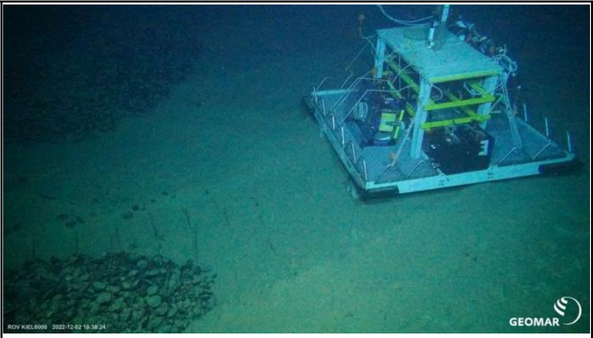
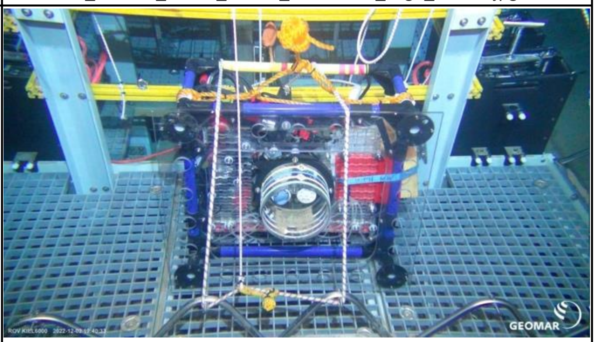
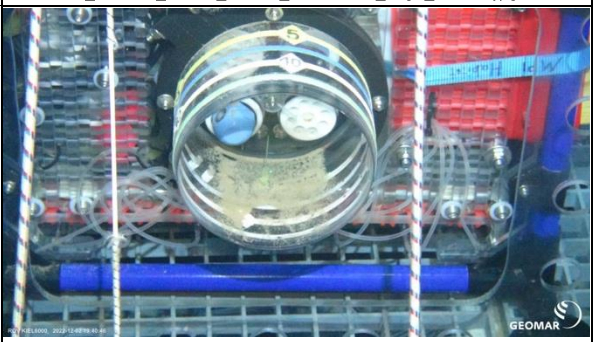
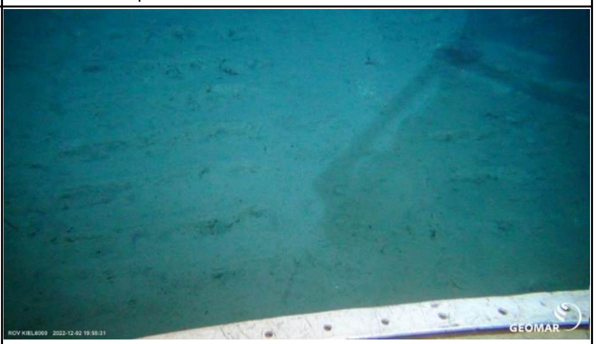
2022-12-02	18:00:37	-125.87380	14.11232	4529.61	Note: stirrer of both BFC2 and BFC1 are stirring
2022-12-02	18:01:00	-125.87380	14.11232	4529.62	 BFC1 deployment site (pre-deployment) 20221202_180100_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:03:34	-125.87382	14.11230	4529.84	Deployment BFC1
2022-12-02	18:03:54	-125.87382	14.11230	4529.89	 BFC1 deployed at seafloor 20221202_180354_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:06:27	-125.87382	14.11232	4529.91	Penetration depth of the flux chamber of BFC1 checked (white (10cm) ring fully immersed in sediment, only visible in one spot)
2022-12-02	18:07:16	-125.87382	14.11232	4529.83	 BFC1 deployed at seafloor 20221202_180716_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:07:22	-125.87382	14.11232	4529.79	 BFC1 deployed at seafloor (photo not displayed) 20221202_180722_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:07:49	-125.87381	14.11231	4529.46	Heading back to Elevator 2 to get PSP
2022-12-02	18:12:00	-125.87367	14.11201	4528.29	PSP picked up from Elevator 2
2022-12-02	18:12:10	-125.87367	14.11201	4528.26	Moving direction Southwest
2022-12-02	18:16:02	-125.87394	14.11196	4529.53	PSP deployed between caterpillar tracks of first track left of the empty stripe
2022-12-02	18:16:18	-125.87394	14.11195	4529.62	PSP deployed between caterpillar tracks (photo not displayed) 20221202_181618_Sonne_SO295_135ROV16_Logo_thumb.jpg

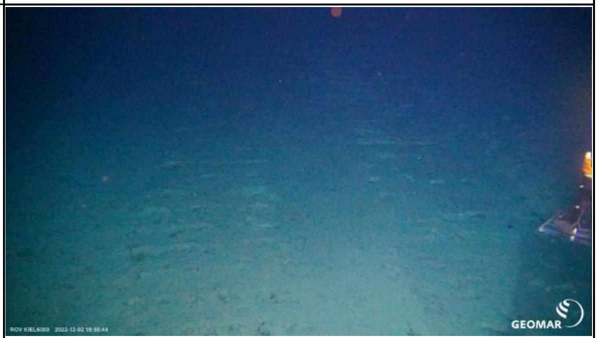
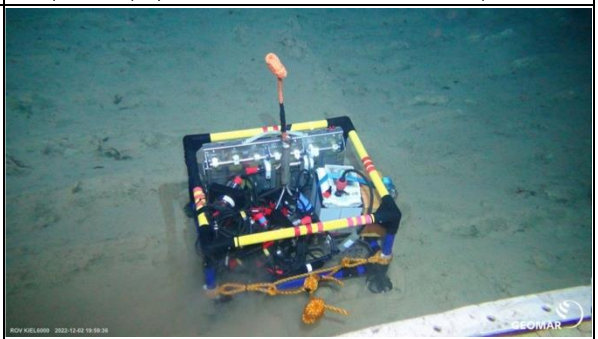
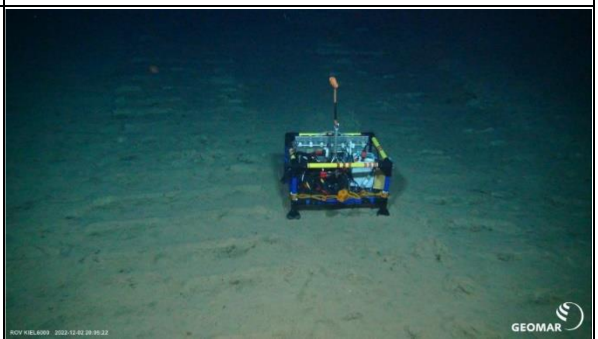
2022-12-02	18:16:44	-125.87393	14.11195	4529.59	 PSP deployed between caterpillar tracks 20221202_181644_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:17:12	-125.87393	14.11196	4529.3	ROV moving back to Elevator 2
2022-12-02	18:20:38	-125.87367	14.11200	4528.63	Sea cucumber?
2022-12-02	18:29:14	-125.87364	14.11203	4528.74	Picked up MICP-DEEP1 from Elevator 2 (got a bit stuck in the first place)
2022-12-02	18:30:32	-125.87363	14.11200	4526.44	Moving direction Northwest 5towards BFC2 to place MICP-DEEP1 just behind
2022-12-02	18:32:19	-125.87381	14.11205	4526.22	Jellyfish
2022-12-02	18:32:58	-125.87386	14.11212	4526.24	MICP-DEEP1 deployment site (photo not displayed) 20221202_183258_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:35:30	-125.87393	14.11217	4528.77	 MICP-DEEP1 deployment site (pre deployment) 20221202_183530_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:35:57	-125.87395	14.11216	4528.98	 MICP-DEEP1 deployment site (pre deployment) 20221202_183557_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:37:25	-125.87397	14.11217	4529.12	MICP-DEEP1 started with Magnet Stick hanging from RigMaster
2022-12-02	18:37:36	-125.87397	14.11218	4529.12	Geared wheels of both stages turning: program started
2022-12-02	18:40:26	-125.87395	14.11220	4529.61	MICP-DEEP1 deployed at the seafloor right in front of BFC2: deployment MICP-DEEP1-1 started
2022-12-02	18:41:06	-125.87396	14.11223	4529.63	 MICP-DEEP1 deployed at the seafloor

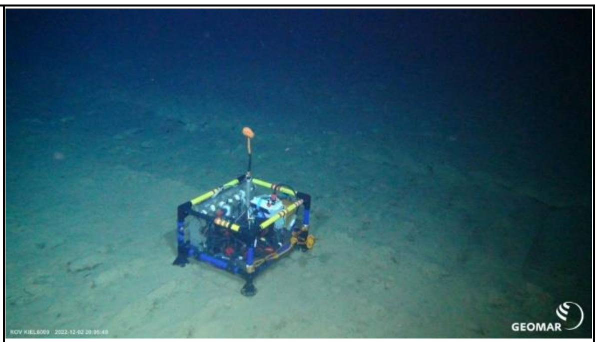
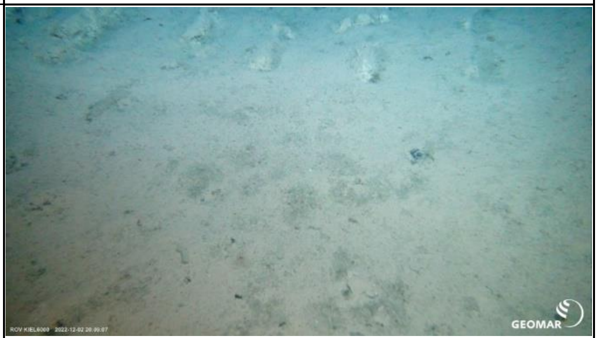
					20221202_184106_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:41:23	-125.87396	14.11222	4529.59	MICP-DEEP1 at the seafloor (detail stage 2, photo not displayed) 20221202_184123_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:41:28	-125.87397	14.11222	4529.56	 MICP-DEEP1 deployed at the seafloor (detail stage 2)) 20221202_184128_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:41:54	-125.87395	14.11220	4529.26	Moving back to Elevator 2
2022-12-02	18:43:51	-125.87379	14.11204	4528.03	 Flying sea cucumber 20221202_184351_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:43:57	-125.87377	14.11203	4527.99	flying sea cucumber
2022-12-02	18:45:01	-125.87363	14.11197	4528.13	Seacucumber
2022-12-02	18:47:09	-125.87362	14.11205	4529.67	Flying sea cucumber at Elevator 2
2022-12-02	18:47:14	-125.87362	14.11205	4529.73	Flying sea cucumber (photo not displayed) 20221202_184714_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:47:22	-125.87362	14.11205	4529.8	 Flying sea cucumber 20221202_184722_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:47:49	-125.87362	14.11206	4529.97	Flying sea cucumber (photo not displayed) 20221202_184749_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:47:53	-125.87362	14.11206	4529.98	Flying sea cucumber (photo not displayed) 20221202_184753_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:51:08	-125.87356	14.11206	4529.3	MICP-DEEP2 collected from Elevator 2
2022-12-02	18:51:25	-125.87355	14.11207	4528.91	Moving towards deployment position of BFC1
2022-12-02	18:55:22	-125.87376	14.11236	4529.19	MICP-DEEP2 deployment site near BFC1 (photo not displayed) 20221202_185522_Sonne_SO295_135ROV16_Logo_thumb.jpg

2022-12-02	18:55:33	-125.87377	14.11236	4529.25	 MICP-DEEP2 deployment site near BFC1 (pre deployment) 20221202_185533_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	18:56:52	-125.87378	14.11238	4529.26	MICP-DEEP2 started with Magnet Stick hanging from RigMaster
2022-12-02	18:57:20	-125.87376	14.11237	4529.3	Geared wheels of both stages turning: program started
2022-12-02	18:59:47	-125.87374	14.11235	4529.78	MICP-DEEP2 deployed at seafloor right in front of BFC1: start deployment MICP-DEEP2-1
2022-12-02	19:00:24	-125.87374	14.11235	4529.81	 MICP-DEEP2 deployed at the seafloor 20221202_190024_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:00:36	-125.87374	14.11235	4529.82	 MICP-DEEP2 deployed at the seafloor with BFC1 in the background 20221202_190036_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:03:49	-125.87375	14.11237	4529.61	Moving back to Elevator 2 to pick up MICP1
2022-12-02	19:06:47	-125.87358	14.11212	4528.92	Arriving at Elevator 2
2022-12-02	19:10:39	-125.87363	14.11210	4530.09	CUBE2 has moved to the left on Elevator 2. It is standing inclined
2022-12-02	19:11:51	-125.87362	14.11216	4530.09	Move CUBE2 to its correct place
2022-12-02	19:16:13	-125.87364	14.11212	4530.09	Release elastic straps from MICP1
2022-12-02	19:18:32	-125.87366	14.11212	4529.9	Collect MICP1 from Elevator 2
2022-12-02	19:20:50	-125.87361	14.11218	4528.75	Moving to a position Northeast of Elevator 2, searching for track to deploy MICP1
2022-12-02	19:26:29	-125.87361	14.11252	4529.59	MICP1 deployment site (photo not displayed) 20221202_192629_Sonne_SO295_135ROV16_Logo_thumb.jpg

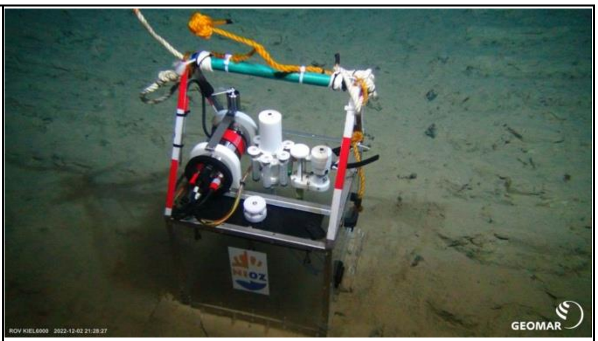
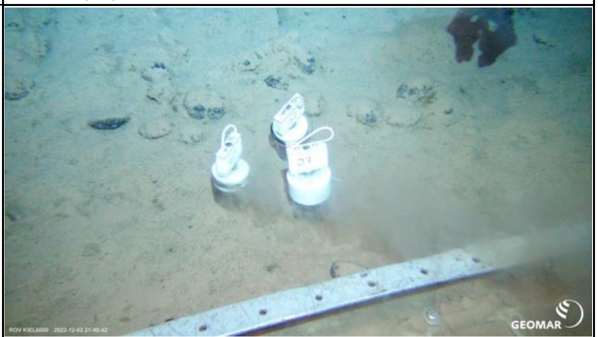
2022-12-02	19:26:45	-125.87361	14.11252	4529.63	 MICP1 deployment site (pre deployment) 20221202_192645_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:26:56	-125.87361	14.11252	4529.67	 MICP1 deployment site (pre deployement) 20221202_192656_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:29:20	-125.87362	14.11253	4529.8	MICP1 started with Magnet Stick hanging from RigMaster
2022-12-02	19:33:18	-125.87361	14.11254	4530.24	MICP1 placed in between caterpillar tracks: start deployment MICP1-1
2022-12-02	19:33:56	-125.87361	14.11253	4530.29	 MICP1 after deployment on seafloor 20221202_193356_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:34:10	-125.87362	14.11253	4530.3	MICP1 after deployment on seafloor (photo not displayed) 20221202_193410_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:34:15	-125.87362	14.11253	4530.31	 MICP1 after deployment on seafloor (close up) 20221202_193415_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:37:29	-125.87360	14.11232	4528.11	Moving back to Elevator 2 to pick up BFC 3
2022-12-02	19:38:12	-125.87359	14.11218	4528.34	Arriving at Elevator 2 (photo not displayed) 20221202_193812_Sonne_SO295_135ROV16_Logo_thumb.jpg

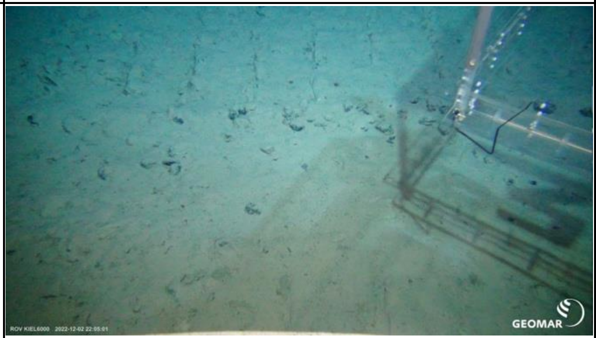
2022-12-02	19:38:24	-125.87360	14.11217	4528.41	 Arriving at Elevator 2 20221202_193824_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:40:33	-125.87361	14.11208	4529.94	 BFC3 on Elevator 2 20221202_194033_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:40:46	-125.87361	14.11208	4529.98	 BFC3 on Elevator 2 (sediments collected in BFC cylinder) 20221202_194046_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:41:08	-125.87361	14.11207	4529.99	2 photos of BFC3 on elevator
2022-12-02	19:42:15	-125.87362	14.11205	4529.98	Releasing elastic straps from BFC3
2022-12-02	19:44:26	-125.87363	14.11208	4529.74	Collecting BFC3 from Elevator 2
2022-12-02	19:46:21	-125.87362	14.11210	4528.9	Next action: Moving towards MICP1 deployment site for BFC3 placement
2022-12-02	19:53:27	-125.87362	14.11239	4528.85	BFC3 turned for placement
2022-12-02	19:55:31	-125.87371	14.11243	4529.04	 BFC3 deployment site (photo not displayed) 20221202_195531_Sonne_SO295_135ROV16_Logo_thumb.jpg

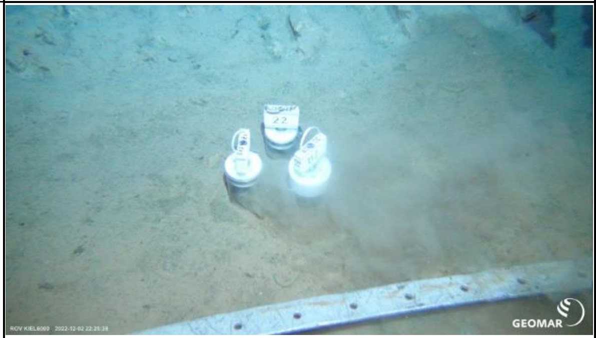
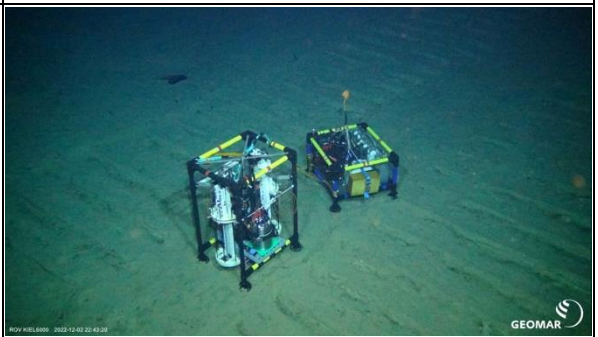
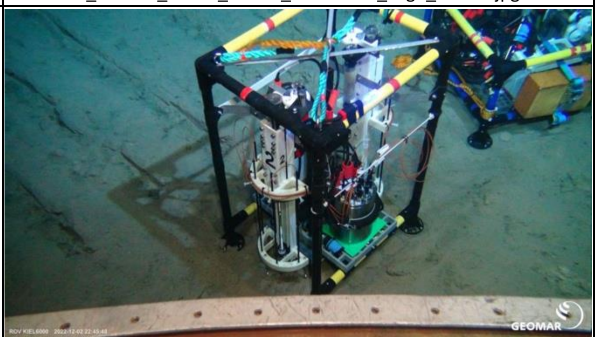
2022-12-02	19:55:39	-125.87371	14.11243	4529.07	 BFC3 deployment site (pre deployment) 20221202_195539_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:55:44	-125.87371	14.11243	4529.08	 BFC3 deployment site (pre deployment) 20221202_195544_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	19:58:55	-125.87370	14.11246	4530.09	BFC3 placed deployed inside collector track between caterpillar tracks
2022-12-02	19:59:36	-125.87371	14.11246	4530.15	 BFC3 deployed at sediment (close up) 20221202_195936_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	20:01:30	-125.87369	14.11246	4530.29	BFC3 deployment site is located 15 m Southwest of MICP1
2022-12-02	20:04:33	-125.87369	14.11241	4530.18	Penetration depth of the flux chamber of BFC3 checked white ring of chamber is 1-2 cm above sediment
2022-12-02	20:05:22	-125.87370	14.11241	4529.98	 BFC3 deployed at sediment 20221202_200522_Sonne_SO295_135ROV16_Logo_thumb.jpg

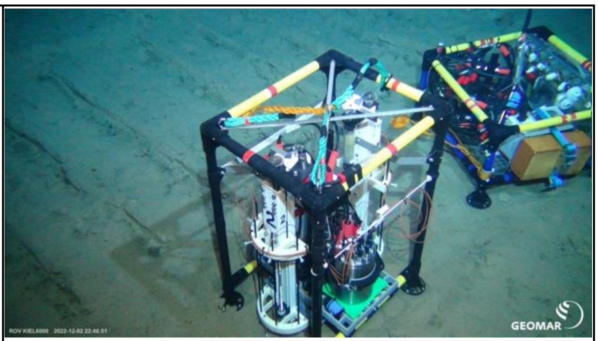
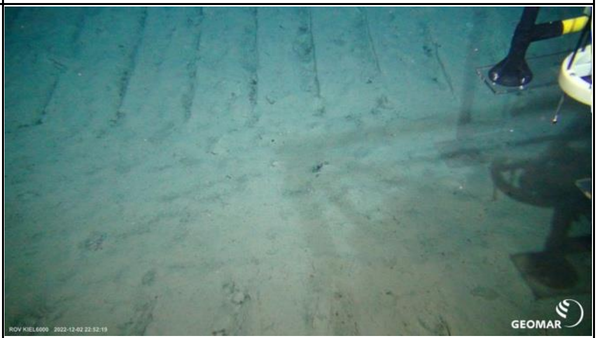
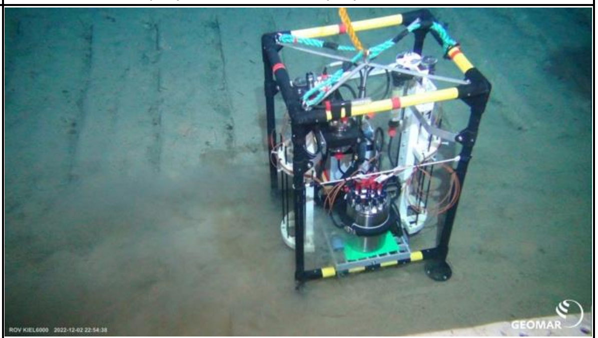
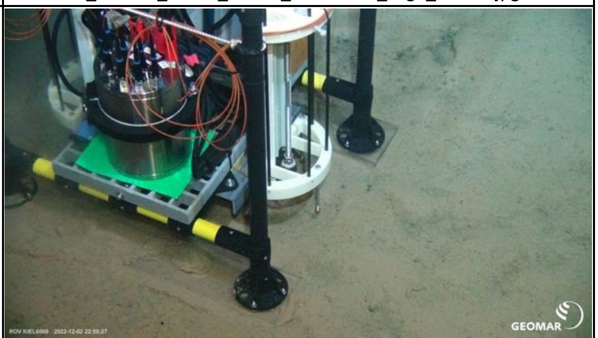
2022-12-02	20:05:40	-125.87371	14.11242	4529.95	 BFC3 deployed at sediment 20221202_200540_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	20:09:07	-125.87375	14.11249	4530.92	 PUC site A prior to coring 20221202_200907_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	20:09:39	-125.87374	14.11249	4531	PUC sampling start at site A with PUCs from 16 Core Rack (originally planned 5 cores – 8 cores taken because of mistake in dive plan
2022-12-02	20:12:16	-125.87373	14.11245	4531	PUCB5 deployed
2022-12-02	20:14:47	-125.87372	14.11247	4531.03	PUCD8 stored away because lower cap got stuck in the tube
2022-12-02	20:16:47	-125.87373	14.11250	4531.04	PUCD0 deployed
2022-12-02	20:18:42	-125.87374	14.11252	4531.04	PUCC7 deployed
2022-12-02	20:21:21	-125.87372	14.11246	4531.05	PUCB7 deployed
2022-12-02	20:23:08	-125.87372	14.11245	4531.07	PUC41 deployed
2022-12-02	20:25:06	-125.87372	14.11249	4531.07	PUC12 deployed
2022-12-02	20:26:49	-125.87373	14.11248	4531.08	PUC69 deployed
2022-12-02	20:28:41	-125.87375	14.11246	4531.09	PUCA0 deployed
2022-12-02	20:29:06	-125.87375	14.11246	4531.09	 PUC site A with deployed cores 20221202_202906_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	20:29:14	-125.87375	14.11246	4531.1	 PUC site A with deployed cores (close up)

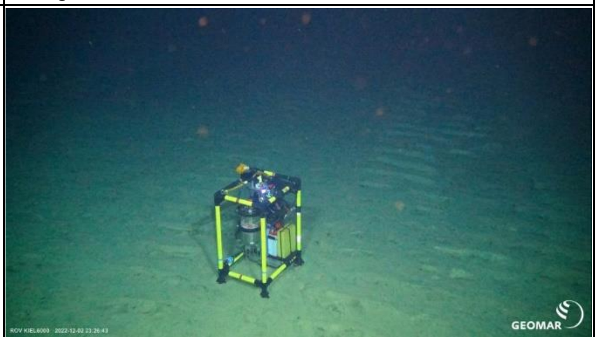
					20221202_202914_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	20:30:45	-125.87374	14.11246	4531.1	Retrieving PUCs back into 16 Core Rack
2022-12-02	20:31:40	-125.87373	14.11248	4531.09	PUCA0 retrieved
2022-12-02	20:33:34	-125.87373	14.11250	4531.07	PUC69 retrieved
2022-12-02	20:34:50	-125.87373	14.11251	4531.08	PUC12 retrieved
2022-12-02	20:37:11	-125.87371	14.11247	4531.08	PUC41 retrieved, sediment pressed out of top of the tube during placement in rack
2022-12-02	20:38:52	-125.87374	14.11247	4531.09	PUCB0 deployed as substitute for PUC41
2022-12-02	20:41:05	-125.87373	14.11248	4531.09	PUCB5 retrieved
2022-12-02	20:42:58	-125.87370	14.11250	4531.1	PUCDO retrieved
2022-12-02	20:45:04	-125.87375	14.11252	4531.1	PUCC7 retrieved
2022-12-02	20:45:56	-125.87375	14.11252	4531.09	PUCB7 retrieved
2022-12-02	20:47:33	-125.87373	14.11251	4531.1	PUCB0 retrieved
2022-12-02	20:49:14	-125.87374	14.11254	4531.11	 PUC site A post coringx 20221202_204914_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	20:53:37	-125.87385	14.11253	4529.56	Movuing back to Elevator 2
2022-12-02	21:01:39	-125.87376	14.11210	4529.98	CUBE2 taken from Elevator 2 for deployment
2022-12-02	21:06:16	-125.87394	14.11222	4529.01	Shrimp
2022-12-02	21:09:19	-125.87392	14.11212	4528.91	Still looking for a place to deploy CUBE2. Search complicated by mismatch between the map and the actual position
2022-12-02	21:17:46	-125.87420	14.11226	4529.48	 CUBE2 deployment site (before deployment, close up) 20221202_211746_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	21:17:58	-125.87420	14.11226	4529.48	 CUBE2 deployment site (before deployment) 20221202_211758_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	21:18:04	-125.87420	14.11226	4529.47	CUBE2 deployment site (photo not displayed) 20221202_211804_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	21:20:05	-125.87418	14.11222	4529.51	CUBE2 placed on seafloor
2022-12-02	21:25:06	-125.87410	14.11216	4529.99	Deployment (program) started

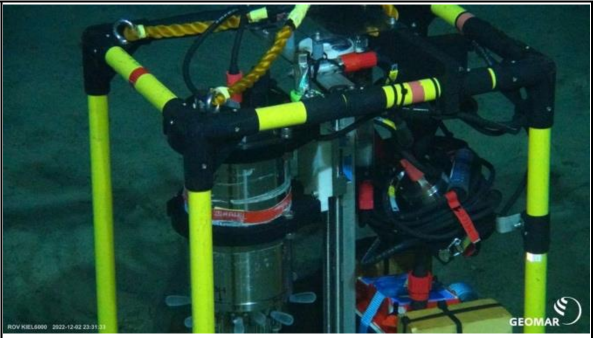
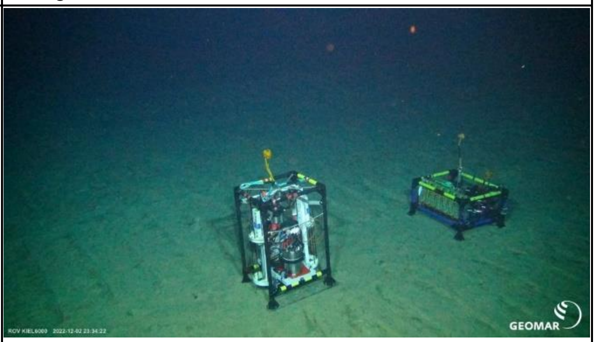
2022-12-02	21:28:27	-125.87410	14.11215	4530.01	 CUBE2 deployed 20221202_212827_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	21:28:39	-125.87410	14.11215	4530.01	Next action: Push coring
2022-12-02	21:35:44	-125.87412	14.11218	4530.71	 PUC site B prior to coring 20221202_213544_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	21:36:02	-125.87412	14.11218	4530.71	PUC sampling start at site B with PUCs from 16 Core Rack
2022-12-02	21:37:26	-125.87412	14.11217	4530.73	PUC37 deployed
2022-12-02	21:39:08	-125.87411	14.11217	4530.73	PUCD7 deployed
2022-12-02	21:40:28	-125.87410	14.11217	4530.73	PUC60 deployed
2022-12-02	21:40:42	-125.87410	14.11217	4530.73	 PUC site B with deployed cores 20221202_214042_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	21:40:55	-125.87410	14.11217	4530.73	Retrieving PUCs back into 16 Core Rack
2022-12-02	21:41:54	-125.87412	14.11218	4530.72	PUC60 retrieved
2022-12-02	21:43:09	-125.87412	14.11217	4530.72	PUC37 retrieved
2022-12-02	21:44:39	-125.87412	14.11219	4530.74	PUCD7 retrieved
2022-12-02	21:45:05	-125.87410	14.11223	4530.63	 PUC site B post coring 20221202_214505_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	21:45:21	-125.87410	14.11223	4530.4	Next action: CUBE3 deployment

2022-12-02	21:49:26	-125.87371	14.11210	4529.6	Elevator 2 in view
2022-12-02	21:58:14	-125.87375	14.11221	4529.2	Collecting CUBE3 from Elevator 2. Next action: searching for deployment site
2022-12-02	22:05:01	-125.87373	14.11227	4529.91	 CUBE3 deployment site (pre deployment) 20221202_220501_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:05:21	-125.87373	14.11227	4530.02	CUBE3 deployment site (photo not displayed) 20221202_220521_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:08:35	-125.87367	14.11217	4530.06	CUBE3 deployed
2022-12-02	22:11:30	-125.87367	14.11221	4530.27	CUBE3 program started
2022-12-02	22:15:35	-125.87372	14.11223	4530.52	 CUBE3 deployed 20221202_221535_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:18:07	-125.87371	14.11223	4530.52	 CUBE3 deployed (close up) 20221202_221807_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:18:20	-125.87371	14.11223	4530.53	Next action: push coring
2022-12-02	22:20:13	-125.87372	14.11224	4530.68	 PUC site C prior to coring 20221202_222013_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:20:55	-125.87373	14.11225	4531.05	PUC site C prior to coring (photo not displayed) 20221202_222055_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:21:09	-125.87373	14.11225	4531.11	PUC sampling start at site C with PUCs from 16 Core Rack

2022-12-02	22:22:57	-125.87371	14.11225	4531.09	PUC22 deployed
2022-12-02	22:24:23	-125.87372	14.11224	4531.11	PUCB2 deployed, PUC 17 deployed
2022-12-02	22:25:38	-125.87373	14.11224	4531.14	 PUC site A with deployed cores 20221202_222538_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:25:53	-125.87374	14.11224	4531.16	 PUC site C with deployed cores (close up) 20221202_222553_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:26:19	-125.87374	14.11225	4531.19	Retrieving PUCs back into 16 Core Rack
2022-12-02	22:26:59	-125.87374	14.11225	4531.17	PUC17 retrieved
2022-12-02	22:28:26	-125.87375	14.11225	4531.14	PUCB2 retrieved
2022-12-02	22:30:17	-125.87373	14.11228	4531.11	PUC22 retrieved
2022-12-02	22:38:59	-125.87358	14.11256	4529.57	Next action: MICP-DEEP1 redeployment. Sea cucumber swimming
2022-12-02	22:42:38	-125.87386	14.11229	4529.08	BFC2 and MICP-DEEP1 (photo not displayed) 20221202_224238_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:43:20	-125.87388	14.11227	4529.07	 BFC2 and MICP-DEEP1 before relocation 20221202_224320_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:45:48	-125.87391	14.11228	4529.91	 MICP-DEEP1 before relocation 20221202_224548_Sonne_SO295_135ROV16_Logo_thumb.jpg

2022-12-02	22:46:01	-125.87391	14.11228	4530.01	 BFC2 and MICP-DEEP1 before relocation 20221202_224601_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:46:46	-125.87391	14.11229	4530.03	Next action: retrieving MICP-DEEP1 from seafloor (end of deployment MICP-DEEP1-1) for relocation
2022-12-02	22:52:19	-125.87399	14.11237	4529.83	 New MICP-DEEP1 deployment site (pre deployment) 20221202_225219_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:52:31	-125.87399	14.11237	4529.84	MICP-DEEP1 program restarted at new location with Magnet Stick hanging from RigMaster
2022-12-02	22:54:28	-125.87399	14.11231	4530.05	MICP-DEEP1 redeployed at seafloor: deployment MICP-DEEP1-2
2022-12-02	22:54:38	-125.87399	14.11230	4530.07	 MICP-DEEP1 redeployed at seafloor 20221202_225438_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:55:27	-125.87400	14.11229	4530.08	 MICP-DEEP1 redeployed at seafloor (close up) 20221202_225527_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	22:55:40	-125.87400	14.11229	4530.08	Next action: redeployment of MICP1
2022-12-02	22:59:58	-125.87373	14.11244	4529.11	Moving to MICP1
2022-12-02	23:02:33	-125.87360	14.11253	4529.81	Arriving at MICP1
2022-12-02	23:05:30	-125.87355	14.11238	4530.01	Waiting for MICP1 to finalized deployment MICP1-1, looking for fauna to collect in the mean time
2022-12-02	23:08:30	-125.87343	14.11254	4530.16	Sea cucumber spotted

2022-12-02	23:10:30	-125.87341	14.11254	4532.02	 Sea cucumber selected for collection 20221202_231030_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	23:11:25	-125.87340	14.11254	4531.87	Sea cucumber collection failed
2022-12-02	23:14:07	-125.87326	14.11262	4531.06	Sea cucumber spotted, preparing for collection
2022-12-02	23:15:48	-125.87326	14.11259	4531.09	Taking the suction pump
2022-12-02	23:17:49	-125.87325	14.11258	4531.63	 Sea cucumber selected for collection 20221202_231749_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	23:21:30	-125.87321	14.11266	4531.84	Collected sea cucumber with suction pump
2022-12-02	23:23:04	-125.87324	14.11269	4531.82	MEGA51(?)Sea cucumber
2022-12-02	23:24:12	-125.87328	14.11272	4531.69	Moving back to MICP1
2022-12-02	23:26:43	-125.87360	14.11263	4530.07	 MICP1 at the end of deployment MICP1-1 20221202_232643_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	23:27:25	-125.87361	14.11263	4530.12	 MICP1 at the end of deployment MICP1-1 (close up sensors) 20221202_232725_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	23:27:54	-125.87362	14.11262	4530.31	Next planned action: relocating MICP1 for deployment MICP1-2
2022-12-02	23:29:56	-125.87363	14.11261	4530.48	Checking again if MICP1 is done or still going before relocation. Geared wheel still turning but profiler stage seems to be all the way up already

2022-12-02	23:31:33	-125.87360	14.11262	4530.54	 MICP1 close up, geared wheel still turning 20221202_233133_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	23:31:39	-125.87360	14.11261	4530.54	MICP1 close up (photo not displayed) 20221202_233139_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	23:32:06	-125.87358	14.11260	4530.49	MICP1 close up (photo not displayed) 20221202_233206_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	23:33:00	-125.87358	14.11258	4529.99	MICP1 left on sea floor without relocation as it shows technical problems and relocation would make no sense. Next action: collecting MICP-DEEP2 for recovery
2022-12-02	23:33:31	-125.87360	14.11257	4529.72	Moving to MICP-DEEP2
2022-12-02	23:34:22	-125.87375	14.11247	4529.54	 MICP-DEEP2 finished with deployment MICP-DEEP2-1 20221202_233422_Sonne_SO295_135ROV16_Logo_thumb.jpg
2022-12-02	23:35:46	-125.87380	14.11243	4529.71	Collecting MICP-DEEP2 from the seafloor (end of deployment MICP-DEEP2-1)
2022-12-02	23:39:19	-125.87379	14.11236	4529.93	MICP-DEEP2 placed on the porch
2022-12-02	23:41:41	-125.87377	14.11239	4529.27	Securing MICP-DEEP2 with the manipulator gripper
2022-12-02	23:42:06	-125.87378	14.11240	4525.93	OFF THE BOTTOM
2022-12-03	01:45:56	None	None	None	ON DECK

Kiel 6000 Dive 17 (SO295_139-1_ROV-17)

Date: 03.Dec.2022

Principal Investigators: Sabine Gollner, Felix Janssen, Tania Nara

Observers: Ricarda Meineke, Mirja Bardenhagen, Amber Henningsen, Brenda Esteban

Protocol: Ricarda Meineke

ROV positions (at the bottom)
Start of dive: 14°6.679' N 125°52.394' W
End of dive: 14°6.621' N 125°52.334' W

Dive duration:
ROV in the water: 03.Dec.2022 15:14:49
ROV at the bottom: 03.Dec.2022 17:08:27
ROV off the bottom: 04.Dec.2022 00:25:36
ROV on deck: 04.Dec.2022 02:12:54

Explored sites: BEL collector impact & plume impact thick

Aims of the Dive:

- Deployment of Elevator 1 near Recolonization Frames (FRAMEs)
- Deployment of Electrochemical Microsensor Profiler (MICP2)
- Deployment of Fiberoptical Microsensor Profiler (MICP-DEEP2)
- Deployment of Pore Water Sampler (PWS)
- Push cores (PUCs) sampling
- Megafauna sampling

Handled ROV Tools (including scientific payload):

- Magnet Stick
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- SGN Biobox large
- ICBM Biobox

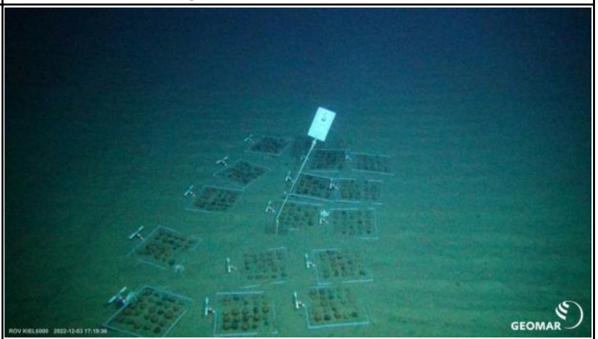
Relevant Elevator payload:

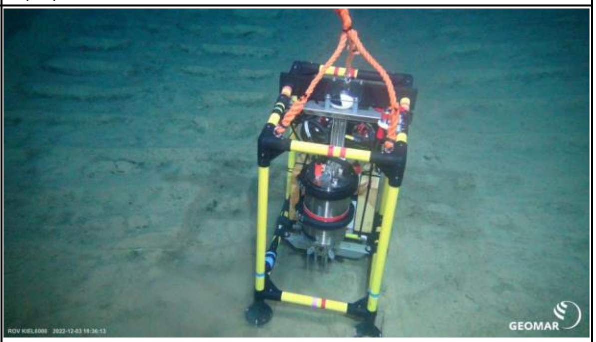
Elevator 1

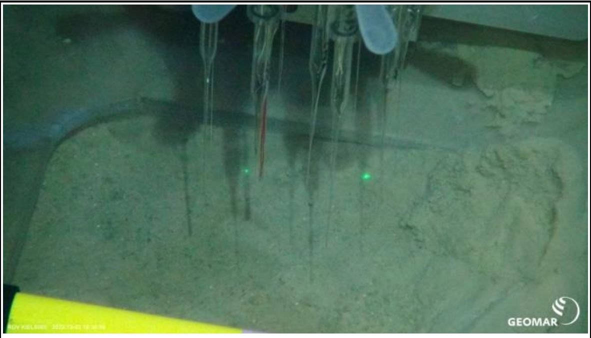
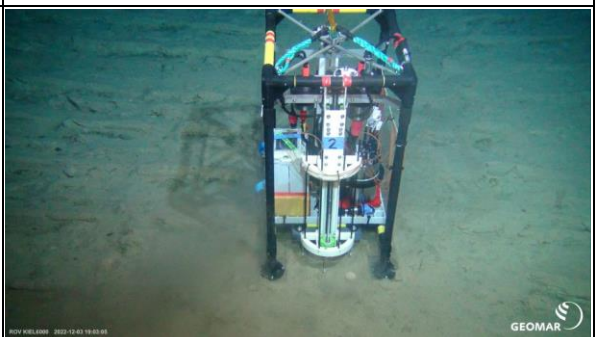
- 12 PUCs in 2 Core Sixpacks
- MICP2
- MICP-DEEP2
- *2 FRAME BOXes*
- PWS
- *2 amphipod traps (AMPHITRAPs)*

Dive summary

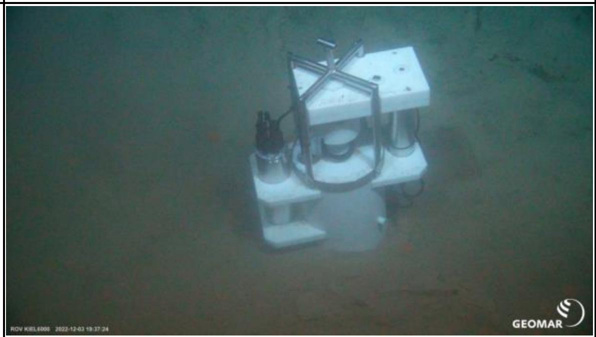
The dive started with the search for the FRAMEs, which were quickly found. Elevator 1, lowered from the ship, was located and guided to the FRAMEs for nearby deployment. After Elevator 1 was detached from the ship's cable, MICP2 was collected from Elevator 1 and deployed successfully on second attempt. As the next action, MICP-DEEP2 was collected from Elevator 1 and deployed. Then the PWS was deployed at the seafloor which proved difficult in the first place. PUC sampling was conducted at two sample sites. The rest of the dive was dedicated to sampling of megafauna specimen.

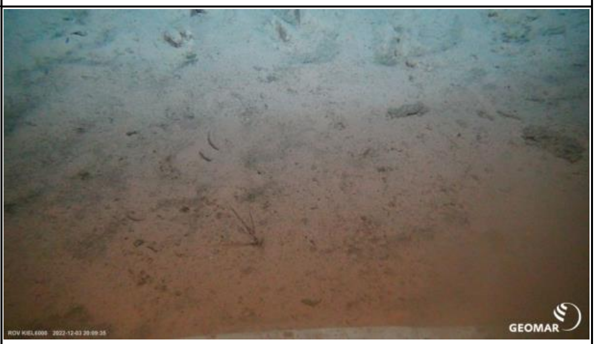
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-03	15:14:49	None	None	None	IN THE WATER
2022-12-03	17:08:27	-125.87324	14.11131	4517	AT THE BOTTOM
2022-12-03	17:15:19	-125.87326	14.11157	4511.69	Searching for FRAMEs
2022-12-03	17:18:21	-125.87300	14.11128	4527.27	FRAMEs in sight
2022-12-03	17:19:34	-125.87293	14.11127	4528.97	Bottom current flowing direction North
2022-12-03	17:19:36	-125.87293	14.11127	4529	 FRAMES at the seafloor, marker indicating current20221203_171936_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	17:20:01	-125.87293	14.11127	4529.2	FRAMES at the seafloor (photo not displayed) 20221203_172001_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	17:20:05	-125.87292	14.11127	4529.22	FRAMES at the seafloor (photo not displayed) 20221203_172005_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	17:20:18	-125.87292	14.11127	4529.25	 FRAMES at the seafloor 20221203_172018_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	17:22:48	-125.87308	14.11134	4515.34	Moving upwards with the ROV to look for Elevator 1 lowered from the ship
2022-12-03	17:25:14	-125.87301	14.11112	4513.35	Elevator 1 in view
2022-12-03	17:28:32	-125.87297	14.11107	4527.16	Guiding elevator to FRAMEs location
2022-12-03	17:36:32	-125.87290	14.11124	4528.81	FRAMEs found again
2022-12-03	17:40:01	-125.87300	14.11133	4528.8	Guiding the ship into the right position for Elevator 1 positioning
2022-12-03	18:00:02	-125.87292	14.11129	4526.28	Positioning the ship is still ongoing
2022-12-03	18:01:37	-125.87294	14.11129	4526.27	Lowering Elevator 1 towardsthe bottom
2022-12-03	18:03:08	-125.87294	14.11124	4527.6	Elevator 1 deployed at the seafloor
2022-12-03	18:04:11	-125.87303	14.11117	4528.44	Detaching Elevator 1 from the ship's cable with ROV operated shackle
2022-12-03	18:05:26	-125.87301	14.11117	4528.62	Elevator 1 detached
2022-12-03	18:14:27	-125.87300	14.11119	4530.19	Collecting MICP2 from the elevator

2022-12-03	18:16:52	-125.87294	14.11122	4529.18	MICP2 in manipulator jaw
2022-12-03	18:17:21	-125.87291	14.11127	4528.91	Starting to look for deployment location of MICP2 in collector impact area between caterpillar tracks
2022-12-03	18:23:20	-125.87284	14.11125	4528.51	Following the tracks starting from the FRAMEs in direction Northwest
2022-12-03	18:25:02	-125.87293	14.11140	4529.55	 MICP2 deployment site (first trial) 20221203_182502_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	18:26:05	-125.87293	14.11140	4529.61	Starting MICP2 with the Magnet Stick
2022-12-03	18:27:29	-125.87295	14.11137	4529.56	MICP2 program started
2022-12-03	18:30:10	-125.87295	14.11139	4530.91	First attempt to deploy MICP2
2022-12-03	18:31:22	-125.87294	14.11138	4530.95	MICP2 deployed but unsatisfying
2022-12-03	18:31:48	-125.87293	14.11137	4530.95	Lifting MICP2 up again for second deployment trial
2022-12-03	18:33:23	-125.87298	14.11135	4530.89	Looking for another location for MICP2 deployment
2022-12-03	18:33:38	-125.87300	14.11137	4530.85	 MICP2 deployment site (second trial) 20221203_183338_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	18:35:10	-125.87299	14.11140	4530.89	MICP2 deployment (second trial)
2022-12-03	18:35:57	-125.87298	14.11140	4530.92	MICP2deployed on PATATNIA II track between caterpillar tracks: deployment MICP2-1
2022-12-03	18:36:13	-125.87298	14.11140	4530.95	 MICP2 deployed between caterpillar tracks 20221203_183613_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	18:36:44	-125.87299	14.11138	4530.97	MICP2 deployed between caterpillar tracks (photo not displayed) 20221203_183644_Sonne_SO295_139ROV17_Logo_thumb.jpg

2022-12-03	18:36:55	-125.87299	14.11138	4530.98	 MICP2 deployed between caterpillar tracks (close up) 20221203_183655_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	18:39:52	-125.87296	14.11131	4529.33	Moving back to Elevator 1
2022-12-03	18:42:59	-125.87304	14.11117	4530.23	Collecting MICP-DEEP2 from Elevator 1
2022-12-03	18:46:52	-125.87290	14.11116	4529.65	MICP-DEEP2 collected from Elevator 2
2022-12-03	18:47:57	-125.87293	14.11114	4529.24	Moving to southeast turning point of PATANIA II in order to follow the track from there and look for deployment location
2022-12-03	18:56:56	-125.87314	14.11105	4528.42	First MICP-DEEP2 deployment site considered (photo not displayed) 20221203_185656_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	18:57:08	-125.87314	14.11105	4528.42	 First MICP-DEEP2 deployment site considered 20221203_185708_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	18:59:09	-125.87316	14.11103	4528.42	Place considered inappropriate, looking for a new spot
2022-12-03	19:00:15	-125.87317	14.11105	4529.17	 MICP-DEEP2 deployment site 20221203_190015_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:00:39	-125.87316	14.11107	4529.39	MICP-DEEP2 deployment site (photo not displayed) 20221203_190039_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:02:35	-125.87314	14.11105	4529.67	MICP-DEEP2 deployed between caterpillar tracks: deployment MICP-DEEP2-1
2022-12-03	19:03:05	-125.87314	14.11105	4529.73	 MICP-DEEP2 deployed between caterpillar tracks

					20221203_190305_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:03:29	-125.87313	14.11105	4529.75	Unknown object near MICP-DEEP2 (close up) 20221203_190329_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:03:40	-125.87313	14.11105	4529.73	 MICP-DEEP2 deployed between caterpillar tracks (close up) 20221203_190340_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:04:52	-125.87314	14.11103	4529.13	Moving back to Elevator 1
2022-12-03	19:06:43	-125.87312	14.11102	4529.01	Sea cucumber
2022-12-03	19:08:56	-125.87302	14.11121	4530.3	Next action: PWS deployment
2022-12-03	19:12:20	-125.87298	14.11118	4530.35	PWS collected from Elevator 1, moving direction North for deployment between caterpillar tracks
2022-12-03	19:13:35	-125.87295	14.11123	4530.18	Passing FRAMEs
2022-12-03	19:15:37	-125.87294	14.11139	4530.2	Shrimp or crab
2022-12-03	19:17:43	-125.87293	14.11140	4530.53	PWS deployment site selected for first trial (photo not displayed) 20221203_191743_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:17:52	-125.87293	14.11140	4530.6	PWS deployment site selected for first trial (photo not displayed) 20221203_191752_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:18:01	-125.87293	14.11141	4530.66	 PWS deployment site selected for first trial 20221203_191801_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:20:42	-125.87293	14.11143	4531.04	First attempt of PWS deployment failed, preparing for next trial
2022-12-03	19:21:54	-125.87294	14.11142	4530.95	Some Sediment on the end of the "sword"
2022-12-03	19:23:44	-125.87293	14.11141	4530.83	PWS deployed second time, tilted
2022-12-03	19:25:44	-125.87296	14.11144	4530.92	Trial to correct with the ROV arm
2022-12-03	19:26:22	-125.87297	14.11145	4530.82	Second deployment failed
2022-12-03	19:26:47	-125.87298	14.11146	4530.72	Moving forward for next trial
2022-12-03	19:28:29	-125.87294	14.11145	4531.3	Landing ROV
2022-12-03	19:30:37	-125.87297	14.11151	4531.57	 PWS deployment site selected for successful trial 20221203_193037_Sonne_SO295_139ROV17_Logo_thumb.jpg

2022-12-03	19:30:46	-125.87299	14.11152	4531.58	 PWS deployment site selected for successful trial 20221203_193046_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:33:19	-125.87297	14.11145	4531.59	PWS deployed between caterpillar tracks
2022-12-03	19:35:19	-125.87298	14.11145	4531.03	ROV leaving seafloor
2022-12-03	19:36:58	-125.87296	14.11149	4530.53	PWS deployed at seafloor (photo not displayed) 20221203_193658_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:37:24	-125.87297	14.11148	4530.52	 PWS deployed at seafloor 20221203_193724_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:38:33	-125.87294	14.11147	4530.41	Moving direction North to select site for PUC sampling
2022-12-03	19:44:23	-125.87295	14.11170	4531.25	ROV landing
2022-12-03	19:44:55	-125.87296	14.11169	4531.38	PUC sampling site A prior to coring (photo not displayed) 20221203_194455_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:45:01	-125.87297	14.11169	4531.39	 PUC sampling site A prior to coring 20221203_194501_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:45:18	-125.87297	14.11168	4531.4	PUC sampling start at site A with PUCs from 16 Core Rack
2022-12-03	19:47:09	-125.87298	14.11169	4531.41	PUC19 deployed
2022-12-03	19:47:50	-125.87298	14.11171	4531.42	PUC66 deployed
2022-12-03	19:48:33	-125.87297	14.11173	4531.43	PUCD6 deployed
2022-12-03	19:49:59	-125.87294	14.11171	4531.43	PUCA2 deployed
2022-12-03	19:50:40	-125.87294	14.11171	4531.44	PUC75 deployed
2022-12-03	19:51:15	-125.87295	14.11170	4531.44	PUC44 deployed
2022-12-03	19:51:59	-125.87298	14.11170	4531.45	PUCC4 deployed
2022-12-03	19:52:55	-125.87300	14.11171	4531.46	PUC 76 deployed

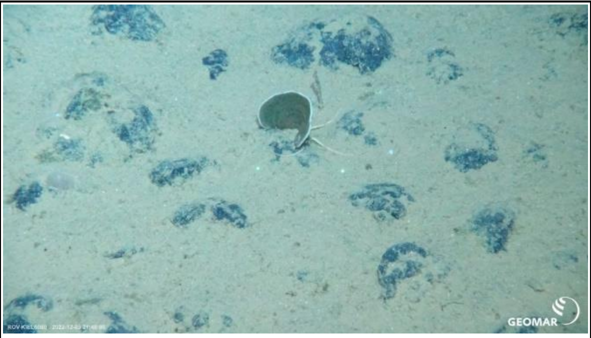
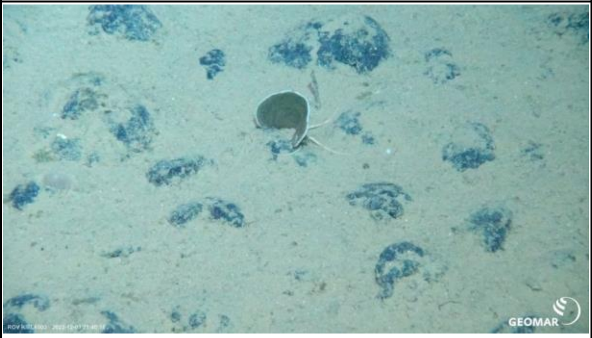
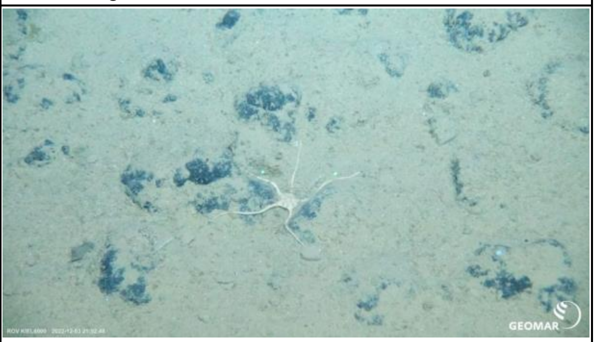
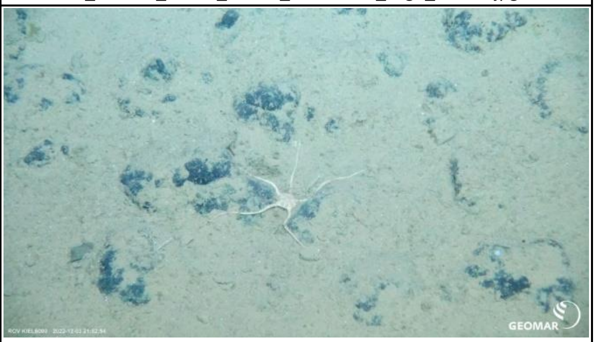
2022-12-03	19:52:55	-125.87300	14.11171	4531.46	 PUC site A with deployed cores 20221203_195255_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:53:12	-125.87300	14.11171	4531.47	PUC site A with deployed cores (photo not displayed) 20221203_195312_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	19:53:28	-125.87300	14.11171	4531.48	Retrieving PUCs back into 16 Core Rack
2022-12-03	19:54:00	-125.87299	14.11171	4531.47	PUC76 retrieved
2022-12-03	19:55:12	-125.87298	14.11171	4531.46	PUCC4 retrieved
2022-12-03	19:56:00	-125.87298	14.11170	4531.47	PUC44 retrieved
2022-12-03	19:57:01	-125.87297	14.11170	4531.47	PUC75 retrieved
2022-12-03	19:58:57	-125.87296	14.11170	4531.5	PUCA2 retrieved
2022-12-03	19:59:40	-125.87298	14.11171	4531.49	PUCD6 retrieved
2022-12-03	20:00:41	-125.87298	14.11172	4531.5	PUC66 retrieved
2022-12-03	20:01:44	-125.87298	14.11172	4531.5	PUC 19 retrieved
2022-12-03	20:02:31	-125.87297	14.11170	4531.47	 PUC site A post coring 20221203_200231_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:03:14	-125.87295	14.11169	4530.92	Moving direction Southwest, looking for another PUC coring location
2022-12-03	20:08:53	-125.87329	14.11143	4531.27	ROV landing
2022-12-03	20:09:08	-125.87329	14.11143	4531.34	Coral
2022-12-03	20:09:35	-125.87328	14.11144	4531.38	 PUC site B prior to coring 20221203_200935_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:10:12	-125.87323	14.11142	4531.39	PUC site B prior to coring (photo not displayed) 20221203_201012_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:10:27	-125.87321	14.11142	4531.39	PUC sampling start at site B with PUCs from 16 Core Rack
2022-12-03	20:11:55	-125.87320	14.11141	4531.4	PUC82 deployed
2022-12-03	20:13:44	-125.87323	14.11141	4531.4	PUC B4 fell down, lost
2022-12-03	20:14:46	-125.87329	14.11146	4531.41	PUCC9 deployed
2022-12-03	20:16:06	-125.87327	14.11144	4531.42	PUC54 deployed
2022-12-03	20:18:46	-125.87331	14.11147	4531.43	PUCD4 deployed
2022-12-03	20:20:26	-125.87332	14.11150	4531.44	PUC5 deployed

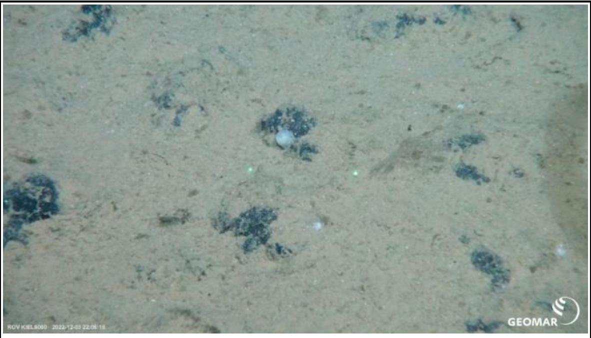
2022-12-03	20:21:20	-125.87333	14.11152	4531.45	PUC6 deployed
2022-12-03	20:22:05	-125.87333	14.11153	4531.47	PUCC1 deployed
2022-12-03	20:22:21	-125.87333	14.11153	4531.46	 PUC site B with deployed cores 20221203_202221_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:22:29	-125.87333	14.11153	4531.46	 PUC site B with deployed cores (close up) 20221203_202229_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:22:43	-125.87333	14.11153	4531.45	Retrieving PUCs back into 16 Core Rack
2022-12-03	20:23:47	-125.87336	14.11155	4531.47	PUCC1 retrieved
2022-12-03	20:25:14	-125.87340	14.11155	4531.46	PUC6 retrieved
2022-12-03	20:26:31	-125.87342	14.11156	4531.46	PUC5 retrieved
2022-12-03	20:28:17	-125.87338	14.11154	4531.47	PUCD4 retrieved, only little Sediment collected
2022-12-03	20:29:05	-125.87337	14.11159	4531.47	PUC54 retrieved
2022-12-03	20:31:05	-125.87339	14.11154	4531.49	PUCC9 retrieved
2022-12-03	20:32:15	-125.87335	14.11150	4531.5	PUC82 retrieved
2022-12-03	20:33:03	-125.87335	14.11149	4531.51	 PUC site B post coring 20221203_203303_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:34:43	-125.87336	14.11147	4531.51	Next action: megafauna sampling
2022-12-03	20:41:00	-125.87339	14.11157	4531.05	Moving in direction Southeast

2022-12-03	20:42:39	-125.87341	14.11145	4530.58	 Sea cucumber in front of an anemone 20221203_204239_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:47:38	-125.87339	14.11084	4528.98	Shrimp
2022-12-03	20:47:42	-125.87339	14.11083	4528.96	Shrimp (photo not displayed) 20221203_204742_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:47:48	-125.87339	14.11083	4528.94	 Shrimp 20221203_204748_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:55:11	-125.87322	14.11061	4530.37	 Sea cucumber and anemone 20221203_205511_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:55:44	-125.87322	14.11062	4530.36	 Sea cucumber (with laser points) 20221203_205544_Sonne_SO295_139ROV17_Logo_thumb.jpg

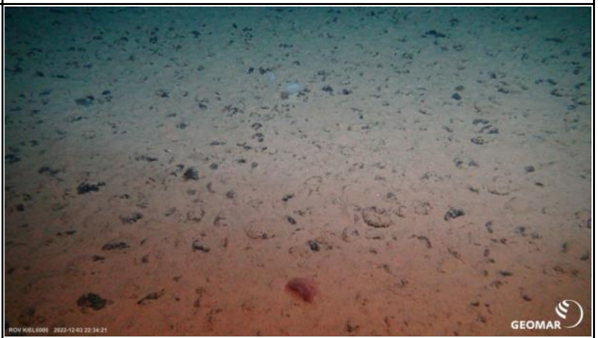
2022-12-03	20:55:50	-125.87322	14.11062	4530.36	 Sea cucumber (close up) 20221203_205550_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:56:06	-125.87323	14.11062	4530.36	 Anemone (close up, with laser points) 20221203_205606_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:56:14	-125.87323	14.11062	4530.36	 Anemone 20221203_205614_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	20:59:52	-125.87320	14.11059	4530.35	Sample MEGA52Sea cucumber collected with gripper
2022-12-03	21:11:33	-125.87314	14.11048	4529.95	Shrimp
2022-12-03	21:11:46	-125.87314	14.11048	4529.99	Shrimp (photo not displayed) 20221203_211146_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	21:11:55	-125.87314	14.11048	4530.04	 Shrimp 20221203_211155_Sonne_SO295_139ROV17_Logo_thumb.jpg

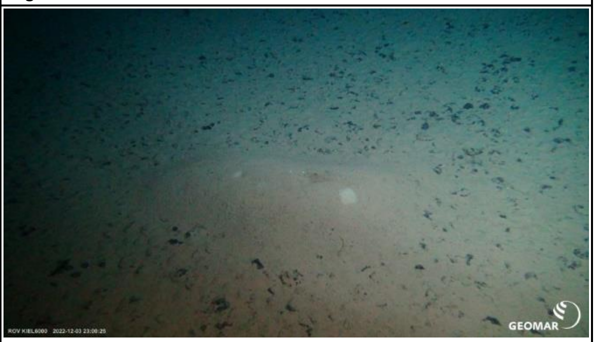
2022-12-03	21:13:00	-125.87311	14.11044	4530.47	 Anemone (with laser points) 20221203_211300_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	21:13:08	-125.87310	14.11044	4530.48	 Anemone 20221203_211308_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	21:25:01	-125.87302	14.11040	4530.52	MEGA53Anemone collected with scoop and transferred into right compartment of ICBM Biobox extra large
2022-12-03	21:28:04	-125.87301	14.11039	4529.96	ROV heading towards East to continue megafauna collection
2022-12-03	21:31:04	-125.87292	14.11035	4530.8	 Sponge (with laser points) 20221203_213104_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	21:31:12	-125.87292	14.11035	4530.81	 Sponge 20221203_213112_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	21:39:50	-125.87291	14.11043	4530.81	MEGA54Sponge collected into right compartment of ICBM Biobox extra large

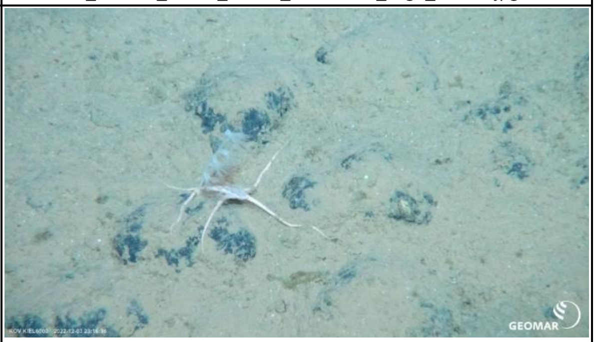
2022-12-03	21:40:08	-125.87291	14.11042	4530.82	 Brittle star (with laser points) 20221203_214008_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	21:40:15	-125.87291	14.11041	4530.82	 Brittle star 20221203_214015_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	21:43:44	-125.87298	14.11042	4530.83	MEGA55Brittlestar collected into right compartment of ICBM Biobox extra large
2022-12-03	21:50:36	-125.87286	14.11041	4530.34	Continue megafauna collection further in direction East
2022-12-03	21:52:48	-125.87282	14.11039	4530.99	 Brittle star (with laser points) 20221203_215248_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	21:52:54	-125.87282	14.11039	4530.99	 Brittle star 20221203_215254_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	21:57:25	-125.87286	14.11038	4530.99	MEGA56Brittlestar collected into right compartment of ICBM Biobox extra large

2022-12-03	22:06:18	-125.87286	14.11032	4531.03	 Anemone (with laser points) 20221203_220618_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:06:25	-125.87286	14.11032	4531.03	 Anemone 20221203_220625_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:06:58	-125.87286	14.11033	4531.04	MEGA57Anemone taken up with scoop and collected into right compartment of ICBM Biobox extra large
2022-12-03	22:12:08	-125.87283	14.11037	4530.63	Heading Northeast (40 deg)
2022-12-03	22:15:50	-125.87272	14.11041	4530.63	Anemone on Nodule
2022-12-03	22:17:00	-125.87273	14.11044	4531.14	 Anemone (with laser points) 20221203_221700_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:17:13	-125.87273	14.11044	4531.17	 Anemone 20221203_221713_Sonne_SO295_139ROV17_Logo_thumb.jpg

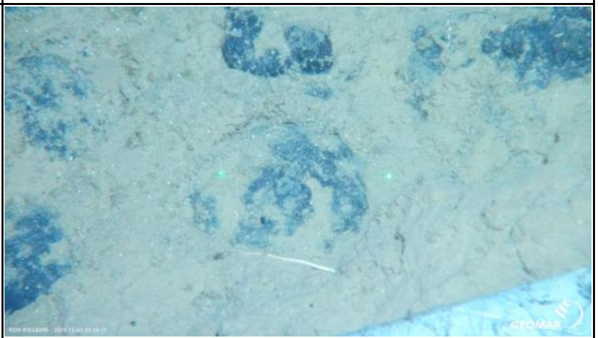
2022-12-03	22:17:59	-125.87274	14.11045	4531.18	 Unknown specimen near anemone 20221203_221759_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:22:13	-125.87276	14.11043	4531.18	MEGA58Anemone collected
2022-12-03	22:23:11	-125.87275	14.11042	4531.19	 Anemone on nodule (with laser points) 20221203_222311_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:23:19	-125.87275	14.11042	4531.19	 Anemone on nodule 20221203_222319_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:24:29	-125.87271	14.11043	4531.18	MEGA59Anemone with nodule collected into right compartment of ICBM Biobox extra large
2022-12-03	22:33:37	-125.87258	14.11049	4531.22	 Sea cucumber (close up with laser points) 20221203_223337_Sonne_SO295_139ROV17_Logo_thumb.jpg

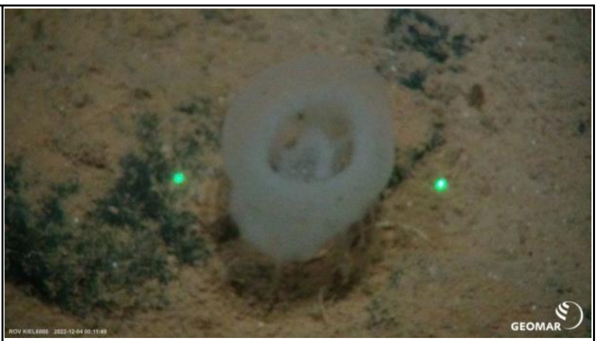
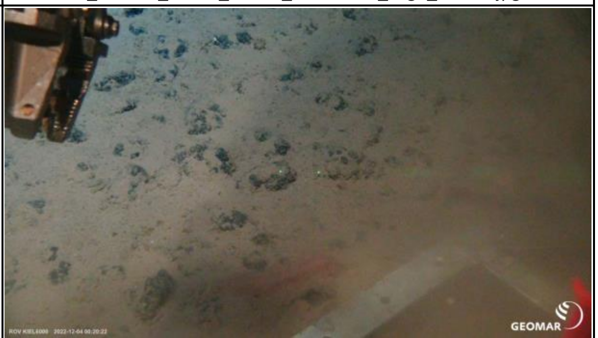
2022-12-03	22:33:47	-125.87257	14.11049	4531.27	 Sea cucumber (close up) 20221203_223347_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:34:21	-125.87256	14.11050	4531.32	 Sea cucumber, sponge, and anemone 20221203_223421_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:36:13	-125.87256	14.11054	4531.33	Swimming shrimp
2022-12-03	22:38:52	-125.87249	14.11048	4531.33	MEGA60Seacucumber collected into left compartment of ICBM Biobox extra large
2022-12-03	22:41:42	-125.87254	14.11055	4531.36	 Sponge and anemone (close up, with laser points) 20221203_224142_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:41:46	-125.87254	14.11055	4531.36	 Sponge and anemone (close up) 20221203_224146_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:44:58	-125.87257	14.11057	4531.36	MEGA61Sponge collected into right compartment of ICBM biobox extra large
2022-12-03	22:48:37	-125.87256	14.11055	4531.36	MEGA62Anemone collected into right compartment of ICBM Biobox extra large

2022-12-03	22:50:55	-125.87260	14.11050	4531.35	 Coral with laser points 20221203_225055_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:51:02	-125.87259	14.11049	4531.36	 Coral 20221203_225102_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	22:55:14	-125.87260	14.11050	4531.4	MEGA63Coral collected into right compartment of ICBM Biobox extra large
2022-12-03	23:00:25	-125.87253	14.11052	4530.79	 Sediment pile (with laser points) 20221203_230025_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:00:44	-125.87252	14.11052	4530.81	 Sediment pile 20221203_230044_Sonne_SO295_139ROV17_Logo_thumb.jpg

2022-12-03	23:03:53	-125.87246	14.11065	4531.62	 Brittle star (with laser points) 20221203_230353_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:04:01	-125.87247	14.11065	4531.62	 Brittle star 20221203_230401_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:09:49	-125.87240	14.11059	4531.62	MEGA64Brittlestar collected into right compartment of ICBM Biobox extra large
2022-12-03	23:16:30	-125.87238	14.11069	4531.7	Brittle star (light pink) and coral (photo not displayed) 20221203_231630_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:16:36	-125.87238	14.11069	4531.7	 Brittle star (light pink) and coral (with laser points) 20221203_231636_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:16:43	-125.87238	14.11069	4531.7	 Brittle star (light pink) and coral 20221203_231643_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:22:44	-125.87237	14.11076	4531.71	MEGA65Brittlestar and MEGA66Coral collected into right compartment of ICBM Biobox exrtra large

2022-12-03	23:25:55	-125.87241	14.11075	4531.6	 Coral? (with laser points) 20221203_232555_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:26:07	-125.87242	14.11077	4531.68	Coral? (photo not displayed) 20221203_232607_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:26:14	-125.87242	14.11077	4531.7	 Coral? 20221203_232614_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:35:52	-125.87240	14.11069	4531.81	MEGA67Coral (probably) taken into right compartment of ICBM Biobox extra large
2022-12-03	23:37:51	-125.87241	14.11073	4531.8	MEGA67Coral lost from biobox
2022-12-03	23:41:36	-125.87237	14.11066	4531.82	 Brittle star (with laser points) 20221203_234136_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:41:46	-125.87237	14.11065	4531.82	 Brittle star 20221203_234146_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:43:31	-125.87239	14.11062	4531.81	MEGA67Brittle star collected into right compartment of ICBM Biobox extra large

2022-12-03	23:51:31	-125.87238	14.11050	4531.71	 Sea cucumber faeces 20221203_235131_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-03	23:56:11	-125.87237	14.11055	4531.67	 Brittle star under nodule (with laser points) 20221203_235611_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:03:58	-125.87240	14.11079	4531.64	MEGA68Brittle star from under the nodule collected into right compartment of ICBM Biobox extra large According to later protocol entry another Brittle star was collected as MEGA69Brittle star
2022-12-04	00:07:53	-125.87237	14.11061	4531.37	 Snail 20221204_000753_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:08:00	-125.87236	14.11060	4531.38	Snail (photo not displayed) 20221204_000800_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:08:15	-125.87235	14.11058	4531.39	Snail is not being collected
2022-12-04	00:09:17	-125.87234	14.11055	4531.39	 Anemone 20221204_000917_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:09:18	-125.87234	14.11055	4531.39	Anemone (photo not displayed) 20221204_000918_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:09:42	-125.87233	14.11055	4531.39	Anemone in not being collected

2022-12-04	00:11:49	-125.87228	14.11039	4531.88	 Sponge (close up with laser points) 20221204_001149_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:12:11	-125.87228	14.11038	4531.89	 Sponge 20221204_001211_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:15:50	-125.87228	14.11038	4531.88	MEGA70Sponge) collected into right compartment of ICBM Biobox extra large
2022-12-04	00:19:49	-125.87231	14.11032	4531.94	Sea cucumber (poor visibility, photo not displayed) 20221204_001949_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:20:00	-125.87231	14.11032	4531.94	Sea cucumber (poor visibility, photo not displayed) 20221204_002000_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:20:22	-125.87229	14.11031	4531.94	 Sea cucumber reddish and spiny (with laser point) 20221204_002022_Sonne_SO295_139ROV17_Logo_thumb.jpg
2022-12-04	00:25:16	-125.87224	14.11035	4531.21	MEGA71Sea cucumber (reddish and spiny) collected into right compartment of ICBM Biobox extra large End of scientific program
2022-12-04	00:25:36	-125.87223	14.11035	4528.95	OFF THE BOTTOM
2022-12-04	02:12:54	None	None	None	ON DECK

Kiel 6000 Dive 18 (SO295_144-1_ROV-18)

Date: 04.Dec.2022

Principal Investigators: Sabine Gollner, Felix Janssen

Observers: Devin Vlach, Lilian Boehringer, Tania Campinas Bezerra

Protocol: Felix Janssen

ROV positions (at the bottom)
Start of dive: 14°6.669' N 125°52.393' W
End of dive: 14°6.671' N 125°52.388' W

Dive duration:
ROV in the water: 04.Dec.2022 15:07:25
ROV at the bottom: 04.Dec.2022 17:01:18
ROV off the bottom: 05.Dec.2022 00:33:49
ROV on deck: 05.Dec.2022 02:22:38

Explored sites: BEL collector impact

Aims of the Dive:

- Deploy 20 Recolonization Frames (FRAMEs)
- Reposition Fiberoptical Microsensor Profiler (MICP-DEEP2)
- Reposition Electrochemical Microsensor Profiler (MICP2) for redeployment in FRAME footprint
- Recover 5 FRAMEs deployed in 2021
- Push Core (PUC) sampling in FRAME footprints
- Retrieve Pore Water Sampler (PWS)
- Retrieve MICP2, MICP-DEEP2
- Retrieve Elevator 1

Handled ROV Tools (including scientific payload):

- 2 White NIOZ boxes with FRAMEs (on descent)
- ICBM Biobox extra large
- Magnet Stick
- 19 PUCs in 16 Core Rack
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump

Relevant Elevator payload:

Elevator 1

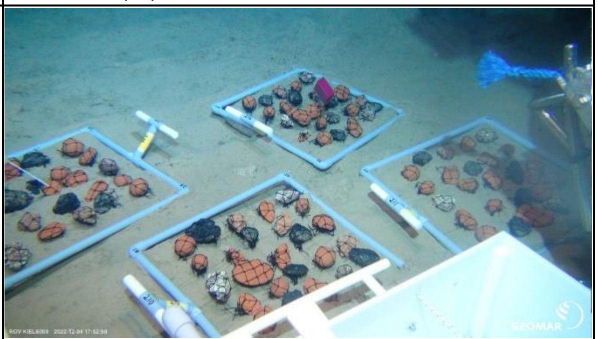
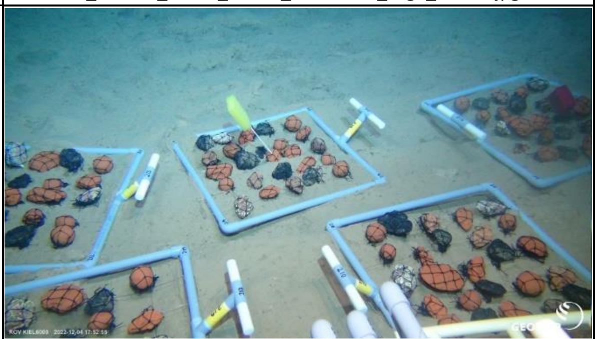
- 12 PUCs in 2 Core Sixpacks
- MICP2
- MICP-DEEP2
- 2 FRAME BOXes

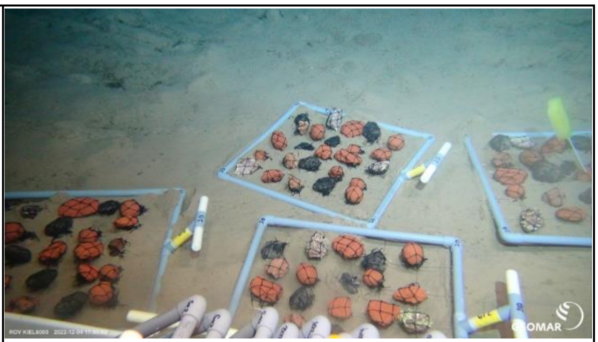
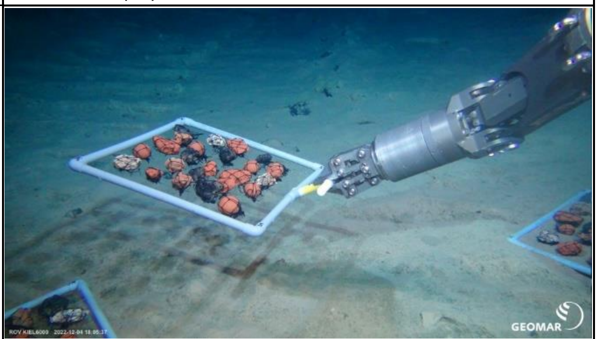
- *2 amphipod traps*
- 2 empty White NIOZ boxes (on way up)
- PWS

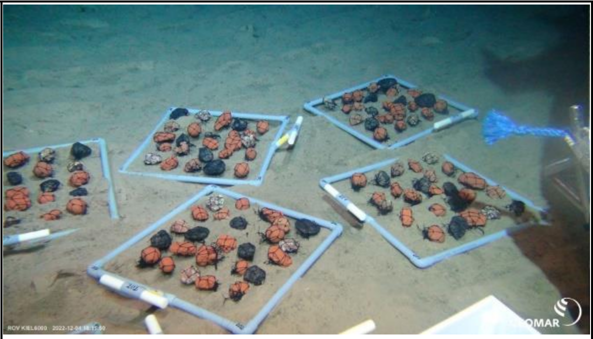
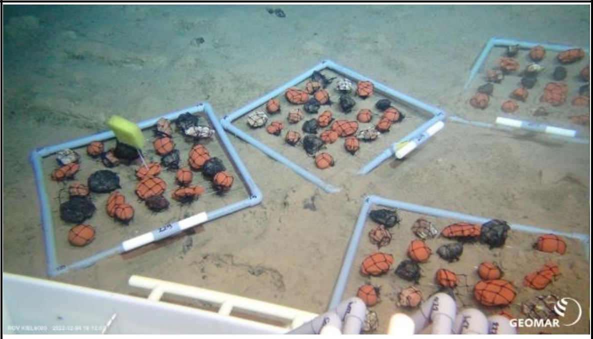
Dive summary

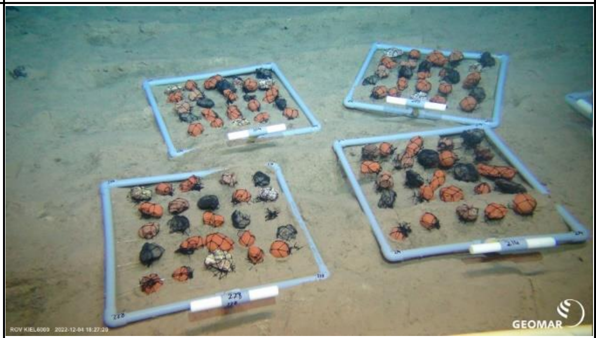
Elevator 1 (deployed at the seafloor during previous dive) was located. 20 FRAMEs were taken from 2 White NIOZ boxes installed on the ROV porch and deployed at the collector impact site. White NIOZ boxes were then fixed on Elevator 1. MICP-DEEP2, deployed during the previous dive, was relocated and restarted in a collector track. MICP2, also deployed during the previous dive was collected and transferred to FRAMEs deployed in 2021. After retrieval of one FRAME, MICP2 was deployed in the FRAME's footprint. 4 more FRAMEs were collected, transferred to the FRAME BOX on Elevator 1, and PUCs taken in FRAME footprints. The PWS was collected and fixed on Elevator 1 and some megafauna sampling took place. PUC samples were taken in the first FRAME footprint directly next to MICP2 while the profiling was finishing. MICP2 and MICP-DEEP2 were collected and fixed on Elevator 1. The Elevator Recovery System, lowered from the ship, was attached to Elevator 1 for recovery. After Elevator 1 was lifted of the seafloor the ROV started the ascent.

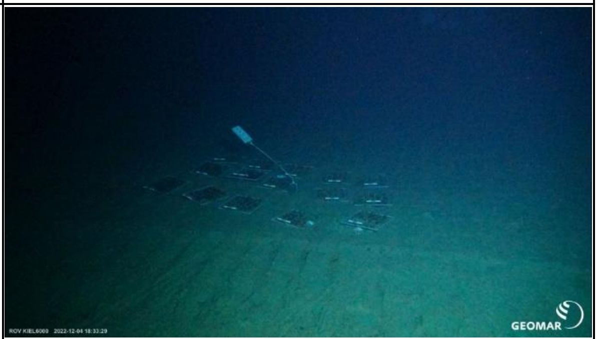
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-04	15:07:25	-125.87247	14.11044	2.23	IN THE WATER
2022-12-04	17:01:18	-125.87321	14.11115	4525.8	AT THE BOTTOM
2022-12-04	17:09:05	-125.87315	14.11124	4526.83	Arriving at Elevator 1
2022-12-04	17:15:40	-125.87297	14.11142	4529.23	Arriving at previous FRAME deployment site
2022-12-04	17:16:45	-125.87291	14.11147	4529.21	Galatheid crab near FRAME (photo not displayed) 20221204_171645_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	17:16:54	-125.87291	14.11147	4529.2	White galatheid crab
2022-12-04	17:17:05	-125.87290	14.11148	4529.19	 Galatheid crab near FRAME 20221204_171705_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	17:26:40	-125.87289	14.11147	4529.23	Grenadier fish at FRAME site
2022-12-04	17:28:26	-125.87282	14.11152	4529.5	 FRAME deployment site 20221204_172826_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	17:28:28	-125.87282	14.11152	4529.54	Photo Taken

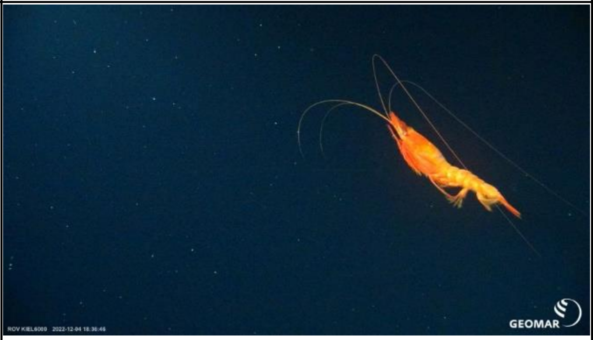
2022-12-04	17:28:38	-125.87283	14.11152	4529.79	photo taken of new frame deployment site
2022-12-04	17:29:58	-125.87284	14.11152	4531.19	Landing at new FRAME deployment site
2022-12-04	17:33:37	-125.87285	14.11145	4529.54	Sediment resuspended
2022-12-04	17:35:47	-125.87290	14.11155	4531.75	 FRAME deployment site 1 with sediment cloud 20221204_173547_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	17:36:07	-125.87291	14.11158	4531.75	Start deployment of FRAMES from white NIOZ boxes installed on the ROV
2022-12-04	17:40:33	-125.87283	14.11146	4531.72	FRAME 218 deployed
2022-12-04	17:43:48	-125.87283	14.11150	4531.71	FRAME 216 deployed
2022-12-04	17:45:31	-125.87281	14.11147	4531.71	FRAME 211 deployed
2022-12-04	17:47:18	-125.87285	14.11144	4531.73	FRAME 210 deployed
2022-12-04	17:49:03	-125.87287	14.11143	4531.72	FRAME 212 deployed
2022-12-04	17:50:59	-125.87287	14.11147	4531.72	FRAME 213 deployed
2022-12-04	17:52:50	-125.87288	14.11147	4531.7	FRAME 219 deployed
2022-12-04	17:52:54	-125.87287	14.11147	4531.69	 Panorama of deployed FRAMEs (1) 20221204_175250_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	17:52:55	-125.87287	14.11147	4531.69	 Panorama of deployed FRAMEs (2) 20221204_175255_Sonne_SO295_144ROV18_Logo_thumb.jpg

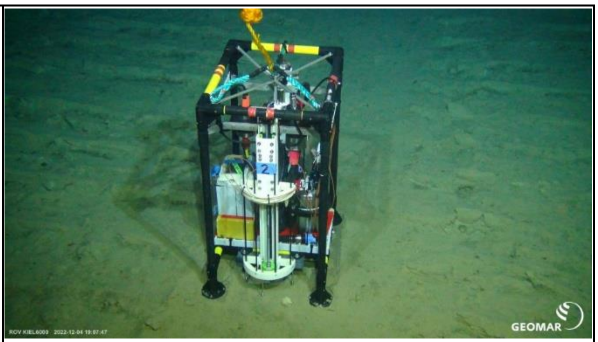
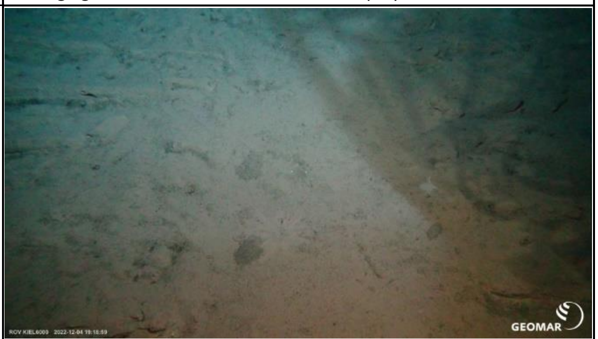
2022-12-04	17:53:02	-125.87288	14.11147	4531.66	 Panorama of deployed FRAMEs (3) 20221204_175302_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	17:55:53	-125.87282	14.11148	4531.05	Relocating to next FRAME deployment site
2022-12-04	17:57:10	-125.87280	14.11151	4531.65	 FRAME deployment site 2 20221204_175710_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	17:57:28	-125.87280	14.11151	4531.68	Start deployment of FRAMES from white NIOZ boxes installed on the ROV
2022-12-04	17:59:12	-125.87282	14.11150	4531.7	FRAME 207 deployed
2022-12-04	18:00:40	-125.87282	14.11152	4531.7	FRAME 206 deployed
2022-12-04	18:02:22	-125.87280	14.11153	4531.71	FRAME 208 deployed
2022-12-04	18:05:11	-125.87281	14.11154	4531.7	FRAME 229 deployed
2022-12-04	18:05:37	-125.87281	14.11153	4531.7	 FRAME deployment 20221204_180537_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:06:46	-125.87282	14.11150	4531.7	FRAME 209 deployed
2022-12-04	18:07:54	-125.87282	14.11150	4531.7	FRAME 205 deployed, later protocol not says that this was in fact not number 205
2022-12-04	18:09:39	-125.87282	14.11152	4531.7	FRAME 202 deployed
2022-12-04	18:11:37	-125.87280	14.11149	4531.7	FRAME 201 deployed

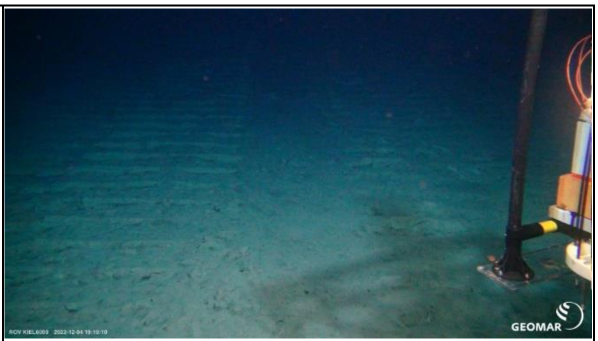
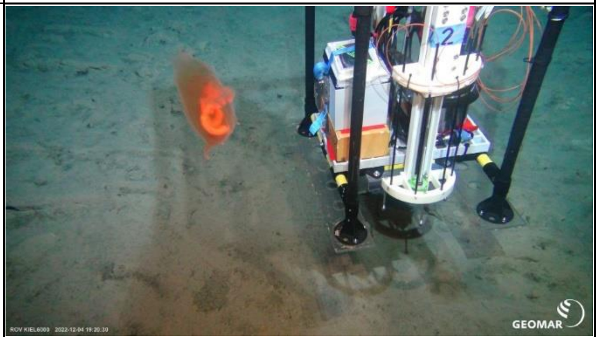
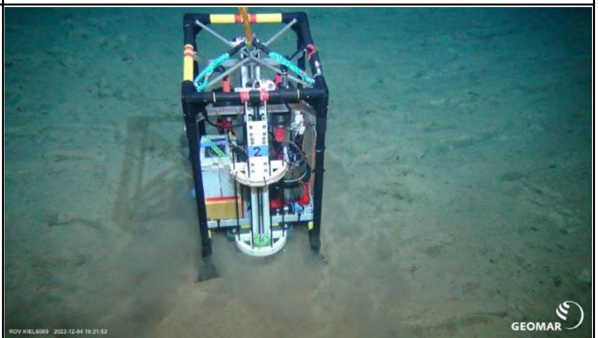
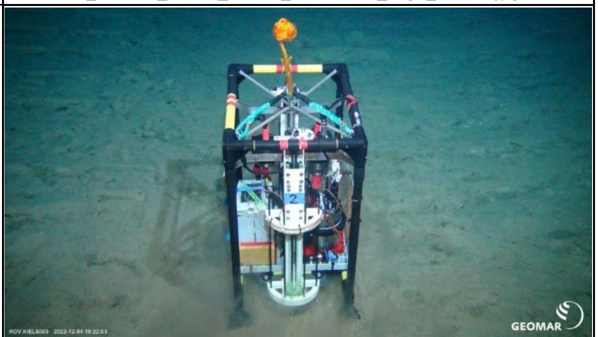
2022-12-04	18:11:50	-125.87280	14.11149	4531.68	 Panorama of deployed FRAMEs (1) 20221204_181150_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:11:57	-125.87281	14.11148	4531.65	Panorama of deployed FRAMEs (2, photo not displayed) 20221204_181157_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:12:02	-125.87281	14.11148	4531.62	 Panorama of deployed FRAMEs (3) 20221204_181202_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:12:05	-125.87281	14.11148	4531.6	First photo of central part of deployed FRAMEs too dark – trying again
2022-12-04	18:12:08	-125.87281	14.11148	4531.58	 Panorama of deployed FRAMEs (2) 20221204_181208_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:14:08	-125.87279	14.11153	4530.76	Relocating to next FRAME deployment site
2022-12-04	18:17:11	-125.87277	14.11156	4531.51	 FRAME deployment site 3 20221204_181711_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:17:31	-125.87278	14.11155	4531.53	Start deployment of FRAMES from white NIOZ boxes installed on the ROV
2022-12-04	18:18:34	-125.87277	14.11154	4531.54	FRAME 205 deployed
2022-12-04	18:19:41	-125.87276	14.11155	4531.54	FRAME 204 deployed
2022-12-04	18:21:13	-125.87278	14.11152	4531.56	FRAME 220 deployed
2022-12-04	18:23:54	-125.87276	14.11154	4531.56	FRAME 214 deployed

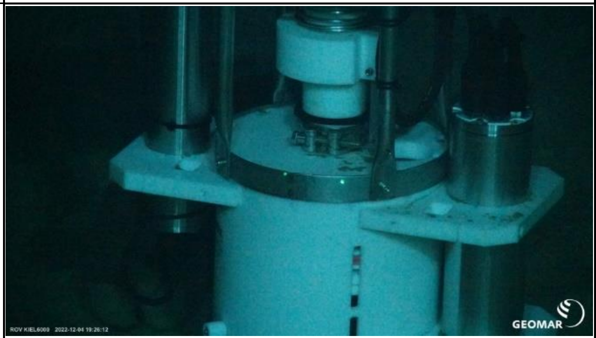
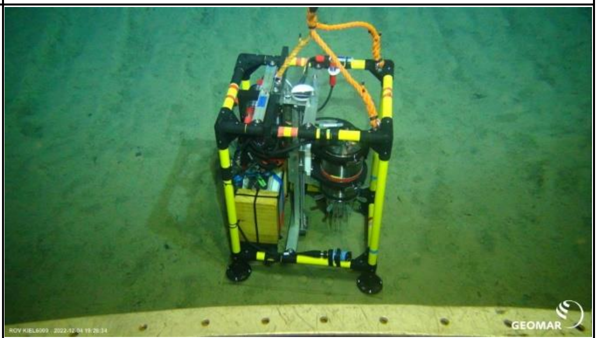
2022-12-04	18:27:11	-125.87273	14.11152	4531.55	FRAME 228 deployed
2022-12-04	18:27:15	-125.87273	14.11152	4531.55	 Panorama of deployed FRAMEs (1) 20221204_182715_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:27:20	-125.87274	14.11152	4531.53	 Panorama of deployed FRAMEs (2) 20221204_182720_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:28:05	-125.87274	14.11154	4531.08	All 20 frames deployed
2022-12-04	18:31:12	-125.87274	14.11161	4530.55	 Overview FRAME deployment sites 20221204_183112_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:32:06	-125.87276	14.11158	4530.56	Overview FRAME deployment sites (photo not displayed) 20221204_183206_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:32:17	-125.87277	14.11156	4530.57	20221204_183217_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:32:22	-125.87278	14.11155	4530.57	 Overview FRAME deployment sites 20221204_183222_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:32:33	-125.87278	14.11155	4530.58	Overview FRAME deployment sites (photo not displayed) 20221204_183233_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:32:46	-125.87281	14.11153	4530.57	Overview FRAME deployment sites (photo not displayed) 20221204_183246_Sonne_SO295_144ROV18_Logo_thumb.jpg

2022-12-04	18:32:53	-125.87283	14.11151	4530.55	 Overview FRAME deployment sites 20221204_183253_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:33:01	-125.87284	14.11151	4530.51	Overview FRAME deployment sites (photo not displayed) 20221204_183301_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:33:14	-125.87285	14.11150	4530.42	Previous FRAME deployment site (photo not displayed) 20221204_183314_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:33:29	-125.87286	14.11149	4530.29	 Previous FRAME deployment site 20221204_183329_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:33:48	-125.87287	14.11147	4530.14	Previous FRAME deployment site (photo not displayed) 20221204_183348_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:33:56	-125.87287	14.11147	4530.1	 Previous FRAME deployment site with galatheid crab 20221204_183356_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:34:00	-125.87287	14.11146	4530.09	 Previous FRAME deployment site with galatheid crab 20221204_183400_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:35:21	-125.87293	14.11138	4530.02	Moving back to Elevator 1
2022-12-04	18:36:13	-125.87295	14.11134	4529.83	2 galatheid crabs near Elevator 1

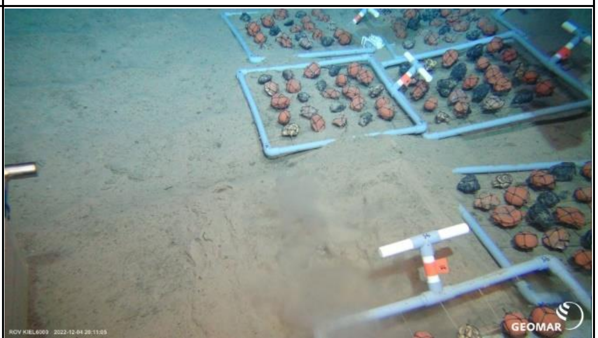
2022-12-04	18:36:38	-125.87297	14.11129	4529.74	 Large pelagic shrimp 20221204_183638_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:36:43	-125.87298	14.11126	4529.73	 Large pelagic shrimp 20221204_183643_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:36:46	-125.87298	14.11126	4529.73	 Large pelagic shrimp 20221204_183646_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	18:40:02	-125.87300	14.11128	4530.07	White NIOZ box 1 placed on Elevator 1
2022-12-04	18:42:35	-125.87302	14.11131	4530.52	White NIOZ box 2 placed on Elevator 1
2022-12-04	18:44:48	-125.87303	14.11133	4530.75	White NIOZ boxes secured on Elevator 1
2022-12-04	19:00:52	-125.87303	14.11128	4530.47	Next actions: Relocate and redeploy MICP-DEEP2 in the collector impact area. After that MICP1 is collected for redeployment in footprint of recovered FRAME
2022-12-04	19:00:58	-125.87303	14.11128	4530.47	 Zoarcic fish 20221204_190058_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:03:27	-125.87303	14.11131	4530.55	Opening compartment A of FRAME box Elevator 1
2022-12-04	19:06:20	-125.87307	14.11133	4528.73	Sea cucumber

2022-12-04	19:07:47	-125.87322	14.11125	4529.3	 MICP-DEEP2 deployed during previous dive 20221204_190747_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:08:51	-125.87326	14.11121	4529.35	MICP-DEEP2 is blinking, the program has finished
2022-12-04	19:09:37	-125.87326	14.11121	4529.37	MICP-DEEP2 collected from seafloor
2022-12-04	19:10:12	-125.87326	14.11122	4529.37	Moving with MICP-DEEP2 across the collector tracks to new location
2022-12-04	19:11:53	-125.87333	14.11133	4529.31	Swimming sea cucumber
2022-12-04	19:12:12	-125.87335	14.11133	4529.31	Sea cucumber on collector track
2022-12-04	19:13:00	-125.87339	14.11136	4529.31	Site considered for MICP-DEEP2 deployment (photo not displayed) 20221204_191300_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:13:02	-125.87339	14.11136	4529.31	Stopping at location considered for MICP-DEEP2 deployment
2022-12-04	19:13:04	-125.87339	14.11136	4529.31	Site considered for MICP-DEEP2 deployment (photo not displayed) 20221204_191304_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:13:10	-125.87340	14.11136	4529.31	Site considered for MICP-DEEP2 deployment (photo not displayed) 20221204_191310_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:13:50	-125.87341	14.11138	4529.29	Moving to a different location, few meters ahead
2022-12-04	19:14:08	-125.87341	14.11138	4529.3	Selected MICP-DEEP2 deployment site (photo not displayed) 20221204_191408_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:14:14	-125.87341	14.11138	4529.3	Selected MICP-DEEP2 deployment site (photo not displayed) 20221204_191414_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:14:18	-125.87341	14.11138	4529.3	Selected MICP-DEEP2 deployment site (photo not displayed) 20221204_191418_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:16:28	-125.87339	14.11138	4529.26	MICP-DEEP2 started with Magnet Stick hanging from the RigMaster
2022-12-04	19:16:56	-125.87339	14.11137	4529.28	MICP-DEEP2 dropped to the seafloor accidentally
2022-12-04	19:17:27	-125.87339	14.11136	4529.32	MICP-DEEP2 picked up again
2022-12-04	19:18:27	-125.87342	14.11137	4529.29	Moving again a few meters ahead to new deployment site
2022-12-04	19:18:59	-125.87343	14.11138	4529.28	 MICP-DEEP2 deployment site (close up) 20221204_191859_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:19:05	-125.87343	14.11139	4529.29	 MICP-DEEP2 deployment site 20221204_191905_Sonne_SO295_144ROV18_Logo_thumb.jpg

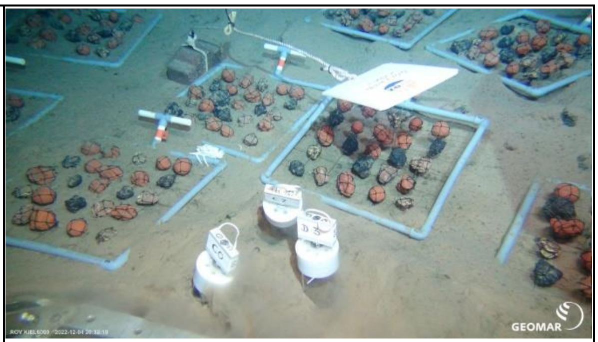
2022-12-04	19:19:10	-125.87343	14.11139	4529.29	 MICP-DEEP2 deployment site 20221204_191910_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:20:30	-125.87347	14.11138	4529.44	 Swimming sea cucumber 20221204_192030_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:21:35	-125.87345	14.11140	4529.43	MICP-DEEP2 deployed at the seafloor: deployment MICP-DEEP2-2
2022-12-04	19:21:52	-125.87344	14.11139	4529.37	 MICP-DEEP2 at seafloor 20221204_192152_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:22:03	-125.87344	14.11139	4529.28	 MICP-DEEP2 at seafloor 20221204_192203_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:22:56	-125.87342	14.11138	4528.56	Next action: pick up MICP2 for redeployment in FRAME footprint
2022-12-04	19:24:37	-125.87318	14.11148	4529.48	MICP2 in view
2022-12-04	19:25:03	-125.87308	14.11152	4530.01	MICP2 with PWS in the background (photo not displayed) 20221204_192503_Sonne_SO295_144ROV18_Logo_thumb.jpg

2022-12-04	19:25:11	-125.87307	14.11153	4530.15	 MICP2 with PWS in the background deployed during previous dive 20221204_192511_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:26:12	-125.87304	14.11155	4530.56	 PWS (close up) 20221204_192612_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:26:12	-125.87304	14.11155	4530.56	PWS is examined - probably did not work
2022-12-04	19:26:34	-125.87304	14.11156	4530.56	 MICP2, deployed during previous dive 20221204_192634_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:27:03	-125.87304	14.11155	4530.55	 MICP2, deployed during previous dive (close up) 20221204_192703_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:28:48	-125.87307	14.11152	4530.53	Small shrimps is passing by at distance
2022-12-04	19:29:06	-125.87306	14.11154	4530.54	MICP2 collected from seafloor, LED blinking: program finished
2022-12-04	19:30:14	-125.87306	14.11157	4530.29	Shrimp roaming around at distance
2022-12-04	19:30:39	-125.87305	14.11156	4529.78	Moving with MICP2 to the location of the FRAMES
2022-12-04	19:31:20	-125.87306	14.11151	4529.14	Elevator 1 in view
2022-12-04	19:31:57	-125.87303	14.11145	4529.06	FRAMEs in view
2022-12-04	19:34:54	-125.87292	14.11142	4531.51	Landing next to the FRAMEs with MICP2 in manipulator gripper

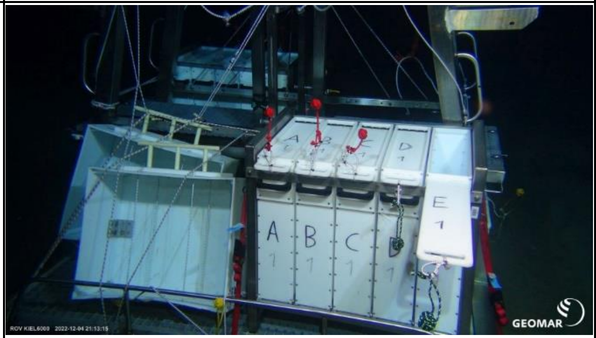
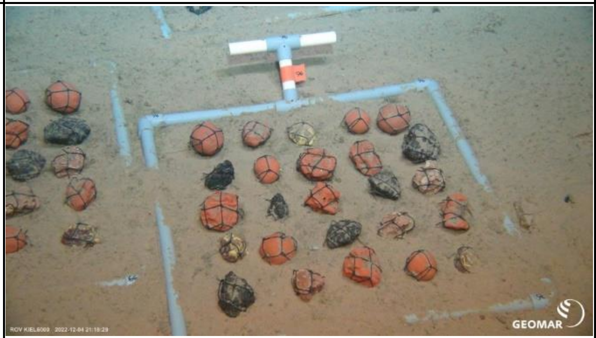
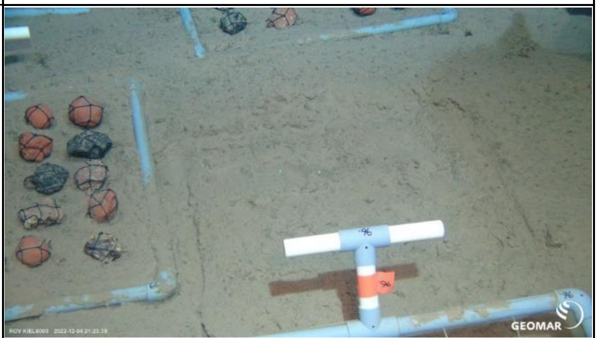
2022-12-04	19:35:18	-125.87293	14.11141	4531.69	 FRAMES deployed in 2021 in collector impact area 20221204_193518_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:36:50	-125.87292	14.11143	4531.75	MICP2 deposited at the seafloor next to the FRAMEs
2022-12-04	19:37:52	-125.87292	14.11143	4531.77	FRAME A picked up
2022-12-04	19:39:02	-125.87289	14.11142	4531.79	FRAME A placed onto porch of ROV
2022-12-04	19:41:35	-125.87290	14.11139	4531.78	MICP2 picked up from seafloor
2022-12-04	19:41:48	-125.87291	14.11139	4531.77	 FRAME A footprint 20221204_194148_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:43:03	-125.87290	14.11141	4531.81	MICP2 restarted with Magnet Stick hanging from RigMaster
2022-12-04	19:46:02	-125.87291	14.11142	4531.82	MICP2 positioned in FRAME A footprint: deployment MICP2-2
2022-12-04	19:46:50	-125.87292	14.11141	4531.82	MICP2 at seafloor in FRAME A footprint (photo not displayed) 20221204_194650_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:46:58	-125.87292	14.11142	4531.83	 MICP2 at seafloor in FRAME A footprint 20221204_194658_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	19:48:32	-125.87289	14.11142	4530.86	Moving to Elevator 1 with FRAME A on porch being held with manipulator gripper
2022-12-04	19:49:44	-125.87297	14.11138	4530.35	Elevator 1 in view
2022-12-04	19:54:49	-125.87301	14.11134	4530.4	FRAME A transferred into compartment A of FRAME box 1
2022-12-04	19:55:15	-125.87301	14.11134	4530.41	compartment A of FRAME BOX closed using monkey fist
2022-12-04	19:55:57	-125.87300	14.11133	4530.42	FRAME BOX 1, compartment B opened
2022-12-04	19:57:21	-125.87298	14.11134	4530.54	Moving back to FRAMEs to pick up more

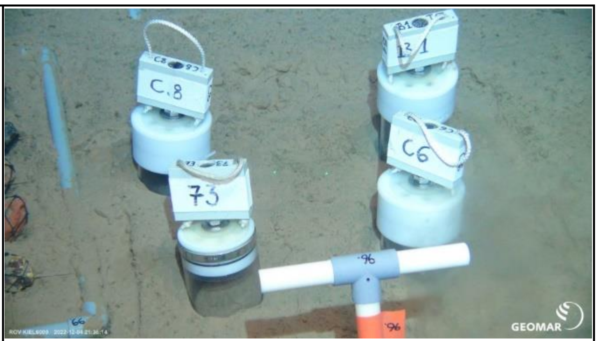
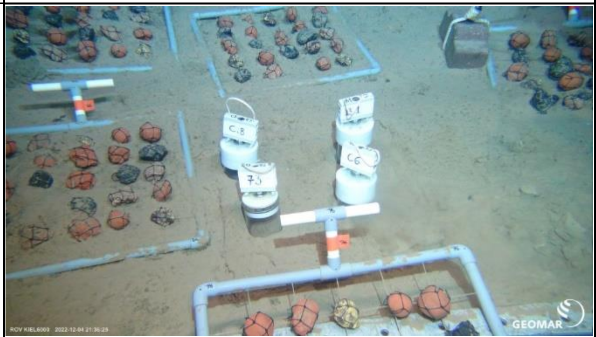
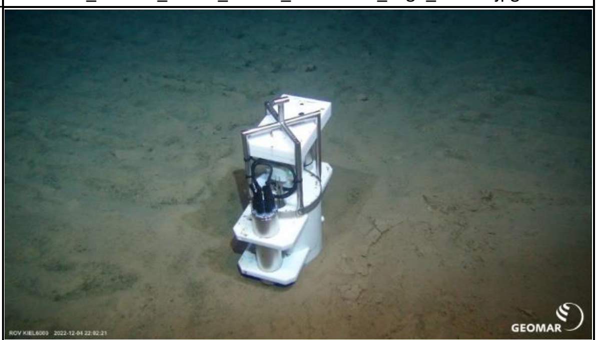
2022-12-04	20:01:37	-125.87292	14.11140	4531.7	 FRAME B and other FRAMEs deployed in 2021 in collector impact area 20221204_200137_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:03:57	-125.87292	14.11141	4531.78	 FRAME B footprint prior to coring 20221204_200357_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:03:57	-125.87292	14.11141	4531.78	FRAME B picked up and placed on ROV porch
2022-12-04	20:05:04	-125.87291	14.11140	4531.82	PUC sampling start in FRAME B footprint with PUCs from 16 Core Rack
2022-12-04	20:05:22	-125.87291	14.11139	4531.82	PUC shaken a little bit before it was pushed into the sediment
2022-12-04	20:05:38	-125.87291	14.11139	4531.82	PUCA9 deployed (shaken a little bit before being pushed into sediment)
2022-12-04	20:07:39	-125.87291	14.11137	4531.81	PUC58 deployed
2022-12-04	20:07:43	-125.87291	14.11137	4531.81	PUC78 deployed
2022-12-04	20:07:44	-125.87291	14.11137	4531.81	 FRAME B footprint with deployed cores 20221204_200743_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:08:23	-125.87291	14.11137	4531.8	Retrieving PUCs back into 16 Core Rack
2022-12-04	20:08:50	-125.87292	14.11137	4531.8	PUC78 retrieved
2022-12-04	20:09:49	-125.87292	14.11137	4531.82	PUC58 retrieved
2022-12-04	20:10:22	-125.87293	14.11139	4531.82	PUCA9 retrieved
2022-12-04	20:11:05	-125.87300	14.11143	4531.83	 FRAME B footprint post coring 20221204_201105_Sonne_SO295_144ROV18_Logo_thumb.jpg

2022-12-04	20:12:36	-125.87302	14.11143	4531.83	 Galatheid crab next to ROV and FRAMEs 20221204_201236_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:15:06	-125.87307	14.11140	4530.68	Moving back to Elevator 1 with FRAME B on the porch being held by manipulator gripper
2022-12-04	20:16:41	-125.87311	14.11141	4530.59	Arriving at Elevator 1
2022-12-04	20:18:13	-125.87311	14.11137	4530.6	FRAME placed in compartment B of FRAME BOX 1
2022-12-04	20:19:00	-125.87311	14.11135	4530.6	FRAME BOS 1, compartment B closed
2022-12-04	20:19:51	-125.87309	14.11139	4530.61	Compartment C opened
2022-12-04	20:20:36	-125.87307	14.11140	4530.72	Moving back to FRAMEs to pick up more
2022-12-04	20:23:16	-125.87301	14.11147	4531.5	Landing in front of FRAMEs
2022-12-04	20:23:35	-125.87301	14.11147	4531.7	 FRAME C (#98) 20221204_202335_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:26:14	-125.87302	14.11142	4531.8	FRAME C (#98) picked up placed on ROV porch
2022-12-04	20:27:01	-125.87301	14.11142	4531.8	 FRAME C (#98) footprint prior to coring 20221204_202701_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:28:20	-125.87302	14.11141	4531.79	PUC sampling start in FRAME C footprint with PUCs from 16 Core Rack
2022-12-04	20:29:02	-125.87302	14.11140	4531.8	PUCD3 deployed
2022-12-04	20:30:41	-125.87296	14.11132	4531.85	PUCC2 deployed
2022-12-04	20:31:59	-125.87296	14.11133	4531.87	PUCC0 deployed

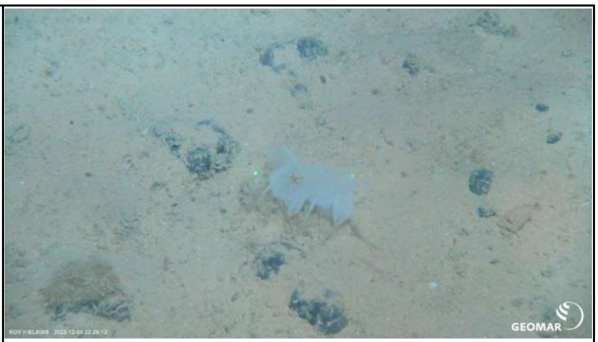
2022-12-04	20:32:10	-125.87296	14.11134	4531.86	 Footprint FRAME C with deployed cores 20221204_203210_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:32:27	-125.87296	14.11135	4531.85	Retrieving PUCs back into 16 Core Rack
2022-12-04	20:33:02	-125.87295	14.11137	4531.85	PUCC0 retrieved
2022-12-04	20:34:28	-125.87299	14.11149	4531.88	PUCD3 retrieved
2022-12-04	20:34:57	-125.87303	14.11149	4531.88	PUCC2 retrieved (only little sediment)
2022-12-04	20:39:52	-125.87310	14.11156	4531.89	Trial to deploy PUC9 to replace PUCC2
2022-12-04	20:40:04	-125.87310	14.11157	4531.89	PUC9 failed as sediment seemed very hard
2022-12-04	20:40:47	-125.87312	14.11155	4531.81	PUC9 placed back into 16 Core Rack empty after shaking out sediment
2022-12-04	20:41:08	-125.87313	14.11153	4531.55	Moving back to Elevator 1 with FRAME C on porch held in place by manipulator gripper
2022-12-04	20:42:58	-125.87319	14.11142	4530.67	Arriving at Elevator 1
2022-12-04	20:45:37	-125.87314	14.11143	4530.66	FRAME C placed into compartment C of FRAME BOX 1
2022-12-04	20:46:24	-125.87311	14.11140	4530.66	FRAME BOX 1 compartment C1 closed
2022-12-04	20:48:03	-125.87312	14.11140	4530.71	FRAME BOX D opened with monkey fist
2022-12-04	20:48:35	-125.87311	14.11140	4530.78	Moving back to FRAMEs to pick up more
2022-12-04	20:50:29	-125.87304	14.11143	4531.68	Landing in front of FRAMEs
2022-12-04	20:50:49	-125.87304	14.11144	4531.84	 FRAME D (#97) 20221204_205049_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:51:46	-125.87304	14.11144	4531.92	FRAME D (#97) picked up
2022-12-04	20:52:43	-125.87303	14.11144	4531.93	 FRAME D footprint prior to coring 20221204_205243_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:53:02	-125.87303	14.11144	4531.93	FRAME D placed on porch
2022-12-04	20:53:16	-125.87303	14.11144	4531.94	PUC sampling start at site A with PUCs from 16 Core Rack
2022-12-04	20:54:35	-125.87303	14.11144	4531.96	Before deployments PUCs are all shaken a little bit for rinsing
2022-12-04	20:54:44	-125.87303	14.11144	4531.96	PUC9 deployed
2022-12-04	20:56:10	-125.87302	14.11151	4532	PUC64 deployed
2022-12-04	20:57:45	-125.87299	14.11146	4531.99	PUCC5 deployed

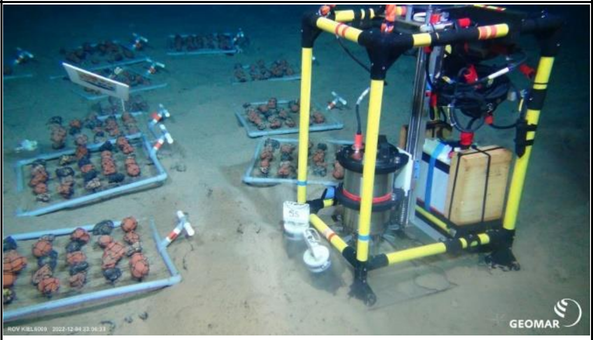
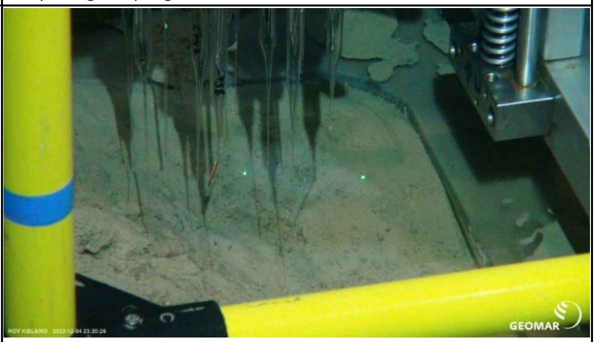
2022-12-04	20:57:50	-125.87299	14.11146	4531.99	 FRAME D footprint with deployed cores 20221204_205750_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	20:58:02	-125.87299	14.11146	4531.99	Retrieving PUCs back into 16 Core Rack
2022-12-04	20:59:16	-125.87299	14.11145	4531.99	PUCC5 retrieved
2022-12-04	21:00:34	-125.87298	14.11146	4532.01	PUC64 retrieved
2022-12-04	21:01:43	-125.87299	14.11144	4532	PUC9 retrieved
2022-12-04	21:02:21	-125.87299	14.11144	4532.01	 FRAME D footprint post coring 20221204_210221_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	21:03:28	-125.87300	14.11144	4532.04	 Exoskeleton of galatheid crab 20221204_210328_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	21:04:25	-125.87298	14.11144	4531.8	Moving back to Elevator 1 with FRAME D on onto porch held by manipulator gripper
2022-12-04	21:07:02	-125.87304	14.11136	4530.6	Arriving at Elevator 1
2022-12-04	21:08:27	-125.87310	14.11141	4530.82	 FRAME D is being placed in FRAME BOX 1 compartment D 20221204_210827_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	21:09:40	-125.87309	14.11138	4530.72	Fish close to the FRAME
2022-12-04	21:09:58	-125.87309	14.11138	4530.71	FRAME D placed in compartment D of FRAME BOX 1
2022-12-04	21:11:38	-125.87313	14.11133	4530.71	FRAME BOX 1 compartment D closed

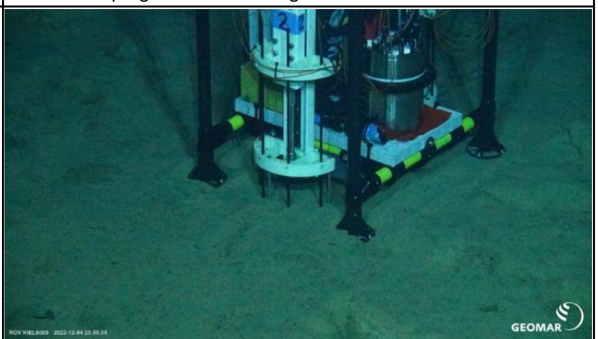
2022-12-04	21:12:45	-125.87314	14.11134	4530.74	Compartment E opened
2022-12-04	21:13:15	-125.87312	14.11137	4530.75	 White NIOZ boxes and FRAME BOX 1 on Elevator 1 20221204_211315_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	21:18:29	-125.87294	14.11141	4532.08	 FRAME E (#96) 20221204_211829_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	21:21:15	-125.87295	14.11143	4532.07	FRAME E (#)96 picked up
2022-12-04	21:23:39	-125.87294	14.11138	4532.08	 FRAME E footprint prior to coring 20221204_212339_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	21:23:45	-125.87294	14.11138	4532.08	Photo Taken
2022-12-04	21:24:44	-125.87296	14.11137	4532.1	4 push cores will be taken instead of three with the extra one compensating for the one in the FRAME C footprint that only collected little sediment
2022-12-04	21:25:30	-125.87295	14.11139	4532.13	PUC sampling start in FRAME E footprint with PUCs from 16 Core Rack
2022-12-04	21:28:21	-125.87295	14.11142	4532.15	PUCC8 deployed
2022-12-04	21:30:37	-125.87295	14.11140	4532.19	PUCB1 deployed
2022-12-04	21:33:18	-125.87293	14.11142	4532.17	PUC73 deployed
2022-12-04	21:35:39	-125.87294	14.11142	4532.14	PUCC6 deployed

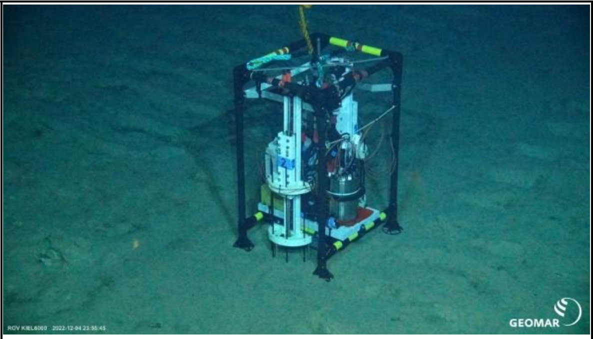
2022-12-04	21:36:14	-125.87293	14.11147	4532.15	 FRAME E footprint with deployed cores 20221204_213614_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	21:36:25	-125.87293	14.11147	4532.15	 FRAME E footprint with deployed cores 20221204_213625_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	21:36:29	-125.87293	14.11147	4532.15	Retrieving PUCs back into 16 Core Rack
2022-12-04	21:37:07	-125.87293	14.11148	4532.14	PUCC6 retrieved
2022-12-04	21:38:55	-125.87293	14.11149	4532.14	PUC73 retrieved
2022-12-04	21:40:58	-125.87298	14.11151	4532.15	PUCB1 retrieved
2022-12-04	21:42:40	-125.87297	14.11150	4532.17	PUCC8 retrieved
2022-12-04	21:44:16	-125.87295	14.11154	4532.2	 FRAME E footprint post coring 20221204_214416_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	21:48:03	-125.87306	14.11142	4530.98	FRAME E 96 transported to Elevator 1
2022-12-04	21:52:58	-125.87306	14.11144	4531.01	FRAME E placed in compartment E of FRAME BOX 1
2022-12-04	21:54:00	-125.87310	14.11154	4531.02	Compartment E closed
2022-12-04	21:57:39	-125.87303	14.11145	4529.71	Moving to PWS
2022-12-04	22:02:12	-125.87303	14.11160	4531.35	PWS (photo not displayed) 20221204_220212_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:02:21	-125.87303	14.11160	4531.36	 PWS before recovery

					20221204_220221_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:06:09	-125.87308	14.11165	4530.69	Collecting PWS from seafloor, deployment probably failed (PWS did not work)
2022-12-04	22:08:08	-125.87309	14.11162	4530.06	Moving to Elevator 1
2022-12-04	22:13:54	-125.87307	14.11137	4530.78	Placing PWS in the quiver on Elevator 1
2022-12-04	22:15:02	-125.87309	14.11141	4530.81	The PWS spring released while putting the PWS into the quiver
2022-12-04	22:19:55	-125.87307	14.11139	4530.89	PWS fixed with elastic straps in quiver
2022-12-04	22:23:02	-125.87294	14.11128	4530.27	Next action: collecting megafauna while waiting for the microprofilers to finish (approx. half an hour)
2022-12-04	22:23:11	-125.87293	14.11128	4530.2	 Whitish object on seafloor next to nodule pile 20221204_222311_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:24:00	-125.87290	14.11130	4530.11	 Nodule pile with whitish opject 20221204_222400_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:25:30	-125.87286	14.11107	4530.26	Floating sea cucumber (photo not displayed) 20221204_222530_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:25:32	-125.87286	14.11107	4530.28	Floating sea cucumber (photo not displayed) 20221204_222532_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:25:34	-125.87286	14.11107	4530.31	 Floating sea cucumber 20221204_222534_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:26:58	-125.87283	14.11105	4530.9	Sponge

2022-12-04	22:29:12	-125.87282	14.11106	4531.44	 Sponge (with laser spots) 20221204_222912_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:29:29	-125.87283	14.11106	4531.44	 Sponge 20221204_222929_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:30:45	-125.87282	14.11110	4531.43	ICBM Biobox extra large opened
2022-12-04	22:33:40	-125.87282	14.11104	4531.42	Sponge collected and deposited in left compartment of ICBM Biobox extra large: MEGA73Sponge
2022-12-04	22:35:11	-125.87282	14.11107	4531.42	Brittle star
2022-12-04	22:36:40	-125.87281	14.11104	4530.89	Fish
2022-12-04	22:39:48	-125.87278	14.11101	4530.94	Sea cucumber
2022-12-04	22:40:21	-125.87277	14.11104	4531.29	 Sea cucumber 20221204_224021_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:40:29	-125.87277	14.11104	4531.34	 Sea cucumber 20221204_224029_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	22:43:49	-125.87274	14.11101	4531.46	Collecting sea cucumber
2022-12-04	22:45:10	-125.87274	14.11101	4531.48	Sea cucumber transferred into left compartment of ICBM Biobox extra large: MEGA74Seacucumber
2022-12-04	22:48:37	-125.87287	14.11111	4530.32	Nodule pile

2022-12-04	22:48:49	-125.87288	14.11112	4530.35	Elevator 1 in view
2022-12-04	22:49:37	-125.87288	14.11119	4530.575	Moving to FRAME A footprint past Elevator 1
2022-12-04	22:55:54	-125.87290	14.11132	4530.84	Arriving at FRAME A footprint / MICP2-2 deployment site
2022-12-04	22:56:07	-125.87290	14.11132	4530.85	MICP2 not yet finished, took longer than expected
2022-12-04	22:57:54	-125.87290	14.11136	4531.98	PUC sampling start in FRAME A footprint left of MICP2 with PUCs from 16 Core Rack
2022-12-04	23:03:26	-125.87291	14.11139	4532.37	PUC55 deployed
2022-12-04	23:03:50	-125.87291	14.11139	4532.37	PUC42 deployed, somewhat tilted
2022-12-04	23:06:08	-125.87291	14.11137	4532.37	 FRAME A footprint with MICP2 & deployed cores (close up) 20221204_230608_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	23:06:23	-125.87291	14.11137	4532.38	FRAME A footprint with MICP2 & deployed cores (photo not displayed) 20221204_230623_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	23:06:33	-125.87291	14.11137	4532.38	 FRAME A footprint with MICP2 & deployed cores 20221204_230633_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	23:07:35	-125.87289	14.11136	4532.39	Retrieving PUCs back into 16 Core Rack
2022-12-04	23:08:14	-125.87291	14.11135	4532.38	PUC42 retrieved, core liner empty
2022-12-04	23:11:34	-125.87290	14.11137	4532.39	PUC55 retrieved, core liner empty
2022-12-04	23:20:15	-125.87296	14.11152	4532.41	Postponing sampling until MICP2 is finished
2022-12-04	23:20:26	-125.87297	14.11151	4532.41	 MICP2 (close up) 20221204_232026_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	23:25:16	-125.87296	14.11147	4532.43	MICP2 still running with sensors already out of the sediment
2022-12-04	23:26:54	-125.87295	14.11149	4532.43	Collecting MICP and depositing it at the sediment a little to the right
2022-12-04	23:27:38	-125.87298	14.11145	4532.42	Taking PUCs from FRAME A footprint
2022-12-04	23:29:32	-125.87294	14.11145	4532.42	PUC55 deployed
2022-12-04	23:32:56	-125.87295	14.11145	4532.42	PUCB9 deployed

2022-12-04	23:33:36	-125.87295	14.11147	4532.44	 FRAME A footprint with deployed cores (close up) 20221204_233336_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	23:33:52	-125.87295	14.11146	4532.45	 FRAME A footprint with deployed cores 20221204_233352_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	23:34:57	-125.87292	14.11148	4532.44	Retrieving PUCs back into 16 Core Rack
2022-12-04	23:36:51	-125.87293	14.11149	4532.44	PUCB9 retrieved
2022-12-04	23:37:41	-125.87294	14.11146	4532.44	PUC55 retrieved
2022-12-04	23:38:37	-125.87293	14.11146	4532.44	 FRAME A footprint post coring 20221204_233837_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	23:39:53	-125.87292	14.11146	4532.44	MICP2 collected from sediment, program finished
2022-12-04	23:43:13	-125.87290	14.11135	4530.52	Carrying MICP2 to Elevator 1
2022-12-04	23:47:19	-125.87305	14.11129	4530.44	Placing MICP2 on Elevator 1
2022-12-04	23:50:04	-125.87302	14.11130	4531.02	Securing MICP2 with elastic straps on Elevator 1
2022-12-04	23:52:30	-125.87302	14.11135	4530.71	Moving to MICP-DEEP2
2022-12-04	23:55:33	-125.87342	14.11152	4529.39	MICP-DEEP2 program is still running
2022-12-04	23:55:35	-125.87342	14.11152	4529.41	 MICP-DEEP2 at the end of deployment MICP-DEEP2-2 (close up) 20221204_235535_Sonne_SO295_144ROV18_Logo_thumb.jpg

2022-12-04	23:55:45	-125.87343	14.11152	4529.49	 MICP-DEEP2 at the end of deployment MICP-DEEP2-2 20221204_235545_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-04	23:57:51	-125.87343	14.11158	4529.63	Waiting for MICP-DEEP2 to finish measurement
2022-12-05	00:04:19	-125.87336	14.11129	4529.39	MICP-DEEP2 program finished, collecting instrument from seafloor
2022-12-05	00:04:39	-125.87336	14.11125	4528.97	Carrying MICP-DEEP2 to Elevator 1
2022-12-05	00:08:39	-125.87302	14.11124	4530.03	Placing MICP-DEEP2 on Elevator 1
2022-12-05	00:10:27	-125.87297	14.11123	4530.47	Securing MICP-DEEP2 with elastic straps on Elevator 1
2022-12-05	00:15:52	-125.87295	14.11115	4521.15	Waiting for Elevator Recovery System ('Bergefuchs'), lowered from the ship
2022-12-05	00:18:26	-125.87296	14.11120	4520.99	Elevator Recovery System in view
2022-12-05	00:25:02	-125.87269	14.11116	4522.51	Taking ROV operated shackle from Elevator Recovery System to Elevator 1
2022-12-05	00:27:10	-125.87299	14.11119	4522.79	Elevator 1 in view
2022-12-05	00:29:38	-125.87300	14.11119	4529.42	ROV operated shackle connected to Elevator 1
2022-12-05	00:30:02	-125.87303	14.11117	4528.62	Elevator 1 is going up
2022-12-05	00:32:49	-125.87308	14.11124	4526.09	Elevator 1 leaving the seafloor (photo not displayed) 20221205_003249_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-05	00:32:57	-125.87309	14.11125	4526.07	 Elevator 1 leaving the seafloor 20221205_003257_Sonne_SO295_144ROV18_Logo_thumb.jpg
2022-12-05	00:33:08	-125.87309	14.11125	4526.02	Elevator is on its way up
2022-12-05	00:33:49	-125.87314	14.11119	4523.43	OFF THE BOTTOM
2022-12-05	02:22:38	None	None	None	ON DECK

Kiel 6000 Dive 19 (SO295_151-1_ROV-19)

Date: 5.Dec.2022

Principal Investigators: Felix Janssen, Tanja Stratmann

Observers: Duygu Sevilgen, Ricarda Meineke, Brenda Esteban, Devin Vlach

Protocol: Tanja Stratmann

ROV positions (at the bottom)
Start of dive: 14°6.717' N 125°52.420' W
End of dive: 14°6.704' N 125°52.462' W

Dive duration:
ROV in the water: 5.Dec.2022 18:15:50
ROV at the bottom: 5.Dec.2022 20:04:00
ROV off the bottom: 6.Dec.2022 02:50:17
ROV on deck: 6.Dec.2022 04:49:13

Explored sites: BEL collector impact

Aims of the Dive:

- Deployment / reposition and recovery of 2 Fiberoptical Microsensor Profilers (MICP-DEEP1 & 2)
- Recovery of 2 Benthic Incubators (CUBE2 & 3) with subsequent Push Core (PUC) and Blade Corer sampling
- Recovery of Passive Trace Metal Sampler (PSP)
- Recovery of 3 Benthic Flux Chambers (BFC1, 2, 3)
- Recovery of Electrochemical Microsensor Profiler (MICP1)
- Recovery of Elevator 2

Handled ROV Tools (including scientific payload):

- MICP-DEEP2 (on descent)
- *ICBM Biobox extra large*
- *Megafauna sampling tools:*
  Handnets, Scoop, Shovel, Suction Pump
- Magnet Stick
- 16 PUCs in 16 Core Rack
- 2 BFCs (BFC1, 2 on ascent)

Relevant Elevator payload

Elevator 2

- BFC3
- Electrochemical Microsensor Profiler (MICP2)
- 2 Benthic Incubators (CUBE2, CUBE3)
- 4 Blade corers

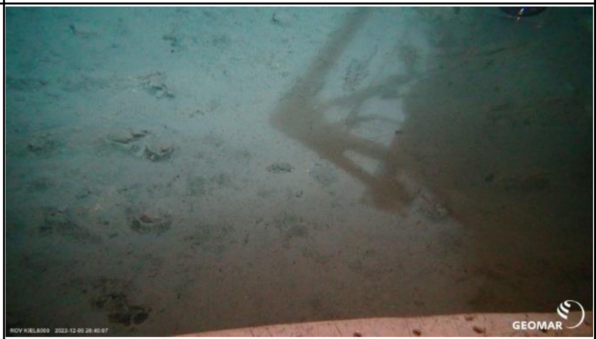
- 2 Fiberoptical Microsensor Profilers (MICP-DEEP1, MICP-DEEP2)
- PSP in quiver

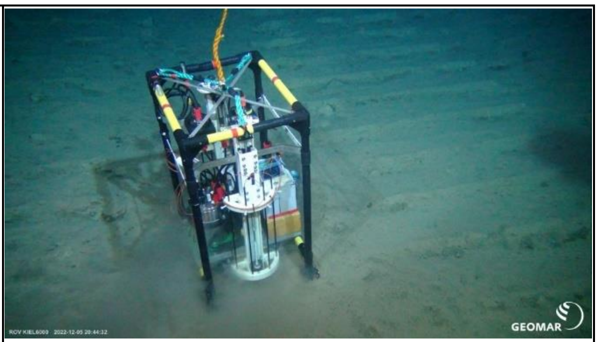
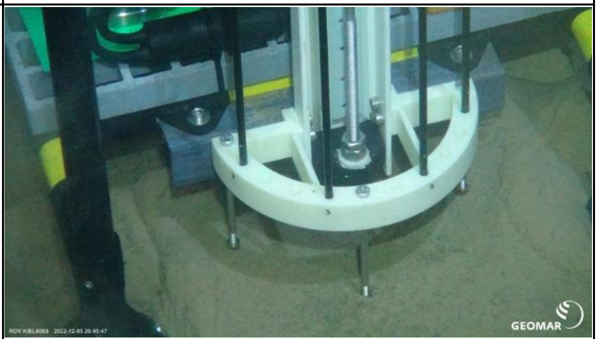
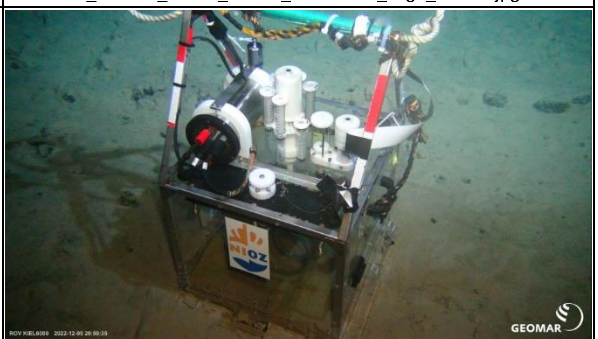
Dive summary

MICP-DEEP2 was deployed between two caterpillar tracks and started. MICP-DEEP1, deployed during ROV dive 16 was repositioned and started. CUBE2 and 3 were recovered, PUCs and Blade Corers were taken in the imprint of the CUBEs, and samples for background analysis (Blade Corer, PUCs) were collected. Afterwards, PSP, MICP1, BFC3, MICP-DEEP2 and MICP-DEEP1 were recovered and placed on Elevator 2. After connecting the Elevator Recovery System to Elevator 2, the elevator was retrieved by the ship. BFC1 and BFC2 were collected onto the porch after which the ROV returned to the surface.

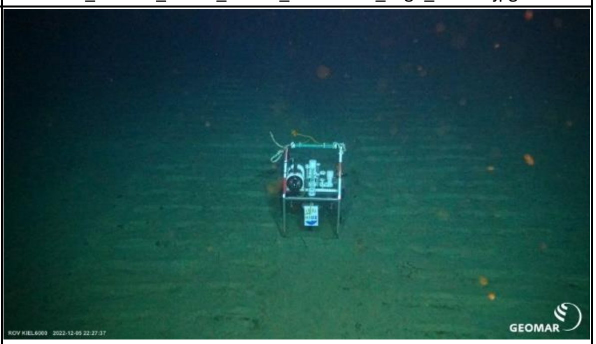
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-05	18:15:50	None	None	None	IN THE WATER
2022-12-05	20:04:00	-125.87367	14.11195	4525.99	AT THE BOTTOM
2022-12-05	20:06:50	-125.87378	14.11207	4527.65	Searching for a spot to deploy MICP-DEEP2 in collector impact area
2022-12-05	20:10:33	-125.87398	14.11239	4528.79	Deployment site for MICP-DEEP2 between two caterpillar tracks identified
2022-12-05	20:17:09	-125.87403	14.11237	4528.8	MICP-DEEP2 started with Magnet Stick hanging from RigMaster
2022-12-05	20:17:37	-125.87404	14.11236	4528.81	Geared wheel turning: program started
2022-12-05	20:20:17	-125.87398	14.11231	4528.97	Moving backwards to get further away from the region where PATANIA II turned – current location seems too close to nodule piles
2022-12-05	20:22:07	-125.87391	14.11229	4528.94	 MICP-DEEP2 deployment site 20221205_202207_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:22:18	-125.87391	14.11229	4528.94	MICP-DEEP2 deployment site (photo not displayed) 20221205_202218_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:22:23	-125.87392	14.11229	4528.94	 MICP-DEEP2 deployment site 20221205_202223_Sonne_SO295_151ROV19_Logo_thumb.jpg

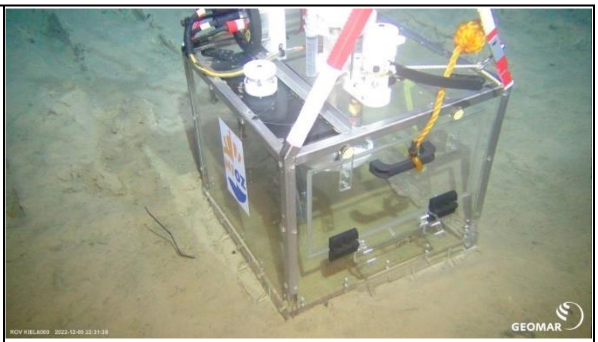
2022-12-05	20:22:31	-125.87392	14.11229	4528.93	 MICP-DEEP2 deployment site (close up) 20221205_202231_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:25:54	-125.87396	14.11234	4528.88	MICP-DEEP2 positioned at seafloor between caterpillar tracks: deployment MICP-DEEP2-1
2022-12-05	20:27:03	-125.87394	14.11234	4528.8	 MICP-DEEP2 at seafloor 20221205_202703_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:28:13	-125.87397	14.11234	4528.03	Next action: relocation and redeployment of MICP-DEEP1 (deployed as MICP-DEEP1-2 during dive 16)
2022-12-05	20:31:46	-125.87411	14.11229	4528.59	Arriving at MICP-DEEP1-2 deployment site
2022-12-05	20:32:01	-125.87411	14.11229	4528.77	MICP-DEEP1 prior to relocation (photo not displayed) 20221205_203201_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:32:06	-125.87411	14.11229	4528.82	 MICP-DEEP1 prior to relocation 20221205_203206_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:32:58	-125.87414	14.11232	4528.98	MICP-DEEP1-2 is blinking: program is finished and instrument can be restarted
2022-12-05	20:35:01	-125.87422	14.11236	4528.98	MICP-DEEP1-2 picked up, moving direction Northeast towards new deployment location between caterpillar tracks
2022-12-05	20:36:27	-125.87414	14.11231	4528.58	Sea cucumber
2022-12-05	20:36:28	-125.87413	14.11231	4528.57	 Sea cucumber

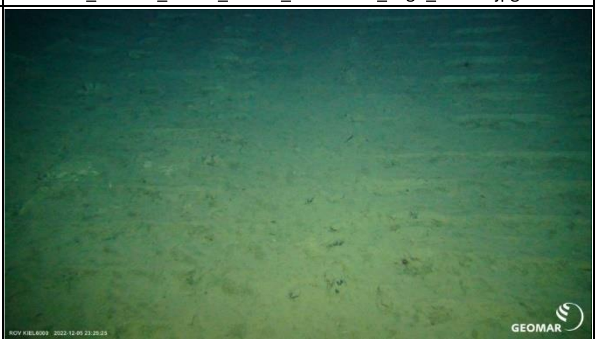
					20221205_203628_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:36:37	-125.87411	14.11232	4528.54	 Sea cucumber (close up with laser spots) 20221205_203637_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:38:06	-125.87407	14.11239	4528.52	New deployment spot between caterpillar tracks identified
2022-12-05	20:40:07	-125.87410	14.11242	4529.07	 MICP-DEEP1 deployment site (close up) 20221205_204007_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:40:12	-125.87410	14.11242	4529.07	 MICP-DEEP1 deployment site 20221205_204012_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:40:17	-125.87410	14.11242	4529.07	 MICP-DEEP1 deployment site 20221205_204017_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:41:59	-125.87411	14.11241	4529.06	MICP-DEEP1 started with Magnet Stick hanging from RigMaster
2022-12-05	20:42:07	-125.87411	14.11241	4529.06	Geared wheel turning: program started
2022-12-05	20:43:58	-125.87407	14.11242	4529.06	MICP-DEEP1 positioned at the seafloor: deployment MICP-DEEP1-3

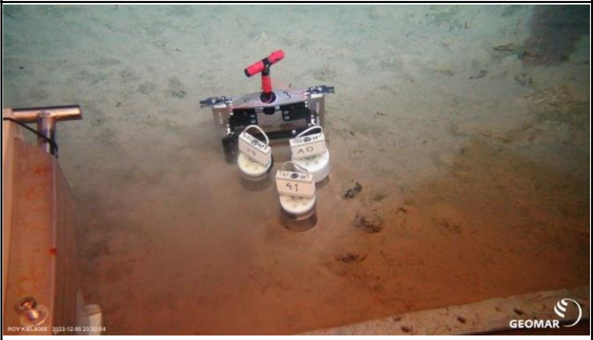
2022-12-05	20:44:32	-125.87407	14.11245	4529.09	 MICP-DEEP1 at seafloor 20221205_204432_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:45:02	-125.87407	14.11246	4529.11	MICP-DEEP1 at seafloor (close up, photo not displayed) 20221205_204502_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:45:38	-125.87407	14.11243	4528.99	MICP-DEEP1 at seafloor (close up, photo not displayed) 20221205_204538_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:45:47	-125.87408	14.11241	4528.89	 MICP-DEEP1 at seafloor (close up) 20221205_204547_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:48:09	-125.87401	14.11234	4527.9	Next action: moving to Elevator 2 to pick up blade corer for sampling in theCUBE imprint upon CUBE recovery
2022-12-05	20:48:31	-125.87400	14.11233	4527.9	Fish
2022-12-05	20:54:00	-125.87375	14.11209	4529.73	Blade Corer 4 collected from Elevator 2
2022-12-05	20:54:47	-125.87373	14.11209	4529.28	Moving to CUBE3
2022-12-05	20:56:12	-125.87377	14.11218	4528.92	 CUBE3 prior to recovery 20221205_205612_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	20:59:35	-125.87386	14.11226	4529.55	 CUBE3 prior to recovery 20221205_205935_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	21:00:45	-125.87386	14.11229	4529.71	Sea cucumber

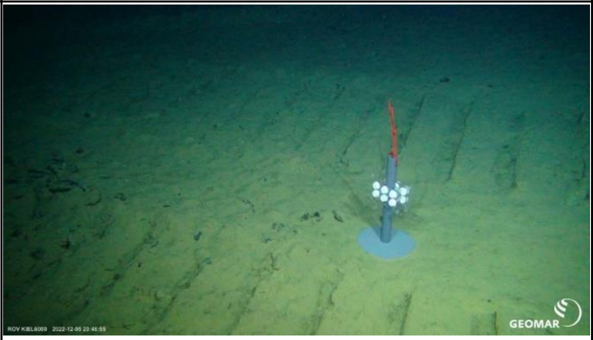
2022-12-05	21:00:47	-125.87386	14.11229	4529.72	 Sea cucumber 20221205_210047_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	21:00:51	-125.87386	14.11230	4529.74	Sea cucumber (photo not displayed) 20221205_210051_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	21:01:16	-125.87388	14.11230	4529.97	Landing on seafloor
2022-12-05	21:05:29	-125.87391	14.11236	4530.31	Blade Corer 4 deposited on sediment to better handling CUBE3
2022-12-05	21:08:35	-125.87388	14.11227	4530.35	CUBE3 picked up after opening the door and deposited on sediment nearby
2022-12-05	21:09:13	-125.87388	14.11237	4530.37	 CUBE3 imprint 20221205_210913_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	21:09:26	-125.87388	14.11237	4530.37	 CUBE3 imprint 20221205_210926_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	21:14:11	-125.87363	14.11214	4530.4	Blade Corer 4 deployed in CUBE3 imprint. PUC sampling start in CUBE3 imprint with PUCs from 16 Core Rack
2022-12-05	21:16:39	-125.87369	14.11221	4530.38	PUCB7 deployed
2022-12-05	21:18:44	-125.87370	14.11217	4530.41	PUC69 deployed
2022-12-05	21:20:17	-125.87372	14.11217	4530.41	PUC54 deployed
2022-12-05	21:22:55	-125.87377	14.11226	4530.35	PUC68 deployed
2022-12-05	21:23:00	-125.87377	14.11226	4530.35	

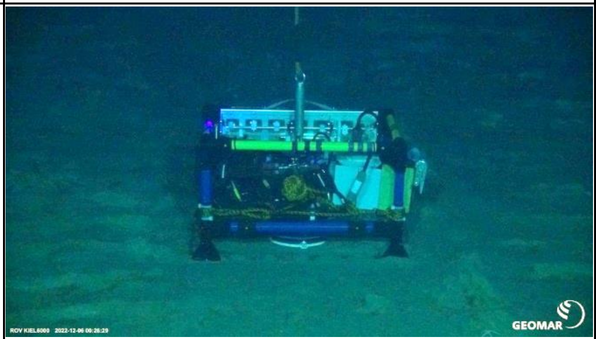
					CUBE3 imprint with deployed Blade Corer and PUCs 20221205_212300_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	21:23:02	-125.87377	14.11226	4530.35	Sea cucumber
2022-12-05	21:23:12	-125.87376	14.11225	4530.35	 CUBE3 imprint with deployed Blade Corer and PUCs 20221205_212312_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	21:23:55	-125.87371	14.11220	4530.35	It seems that there are many nodules below the sediment surface in this spot. According to the Sonar we are very close to the turns and not (as indicated by the POSIDONIA underwater navigation) in the middle of the track
2022-12-05	21:24:54	-125.87369	14.11221	4530.32	CUBE3 seems to sit partly on a caterpillar track and not entirely between the two caterpillar tracks
2022-12-05	21:25:06	-125.87369	14.11220	4530.32	Blade Corer 4 released, start retrieving PUCs back into 16 core rack
2022-12-05	21:27:09	-125.87368	14.11219	4530.38	PUC68 retrieved
2022-12-05	21:29:25	-125.87367	14.11217	4530.43	PUC54 retrieved
2022-12-05	21:30:56	-125.87372	14.11220	4530.43	PUC69 retrieved
2022-12-05	21:33:28	-125.87370	14.11218	4530.44	PUCB7 retrieved – did not collect sediment
2022-12-05	21:43:28	-125.87371	14.11219	4529.91	Moving to Elevator 2 with CUBE3 on porch and retrieved Blade Corer 4 in manipulator gripper
2022-12-05	21:48:17	-125.87367	14.11210	4528.01	Arrival at Elevator 2
2022-12-05	21:54:32	-125.87363	14.11210	4529.75	Blade Corer 4 placed in its Box on Elevator 2
2022-12-05	22:17:36	-125.87371	14.11207	4529.61	CUBE3 placed on Elevator 2 and secured with elastic straps
2022-12-05	22:20:27	-125.87369	14.11206	4529.69	Blade Corer 1 collected from Elevator 2
2022-12-05	22:22:30	-125.87370	14.11205	4528.78	Nodule pile
2022-12-05	22:27:19	-125.87403	14.11208	4528.44	 CUBE2 prior to recovery 20221205_222719_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	22:27:37	-125.87404	14.11210	4528.45	 CUBE2 prior to recovery 20221205_222737_Sonne_SO295_151ROV19_Logo_thumb.jpg

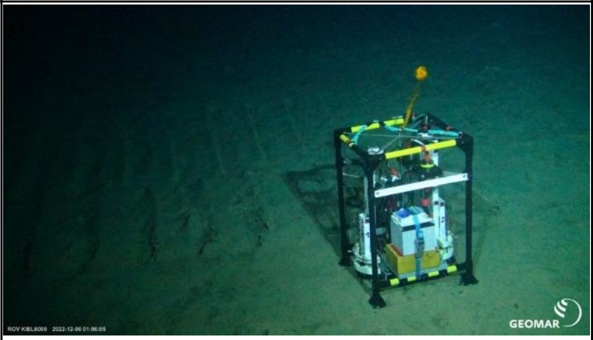
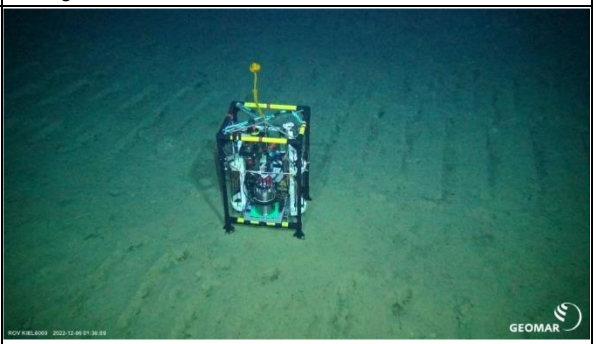
2022-12-05	22:31:38	-125.87412	14.11220	4530.18	 CUBE2 prior to recovery (close up) 20221205_223138_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	22:34:14	-125.87410	14.11218	4530.33	Blade Corer 1 deposited on seafloor
2022-12-05	22:34:20	-125.87410	14.11217	4530.32	CUBE2 lifted from the seafloor
2022-12-05	22:34:37	-125.87410	14.11218	4530.32	Swimming sea cucumber
2022-12-05	22:35:50	-125.87412	14.11219	4530.32	 CUBE2 imprint 20221205_223550_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	22:36:01	-125.87412	14.11219	4530.33	 CUBE2 imprint (close up) 20221205_223601_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	22:36:56	-125.87411	14.11219	4530.34	CUBE 2 deposited on seafloor next to Blade Corer 1
2022-12-05	22:37:03	-125.87411	14.11219	4530.34	Blade core 1 taken up
2022-12-05	22:38:43	-125.87411	14.11221	4530.36	Blade Core 1 deployed in CUBE2 imprint
2022-12-05	22:40:13	-125.87412	14.11222	4530.39	PUC sampling start in CUBE2 imprint with PUCs from 16 Core Rack
2022-12-05	22:40:19	-125.87412	14.11222	4530.39	PUC27 deployed
2022-12-05	22:41:31	-125.87413	14.11219	4530.39	PUC11 deployed
2022-12-05	22:43:04	-125.87414	14.11216	4530.4	PUC44 deployed
2022-12-05	22:43:11	-125.87414	14.11216	4530.4	 CUBE2 imprint with deployed Blade Corer and cores 20221205_224311_Sonne_SO295_151ROV19_Logo_thumb.jpg

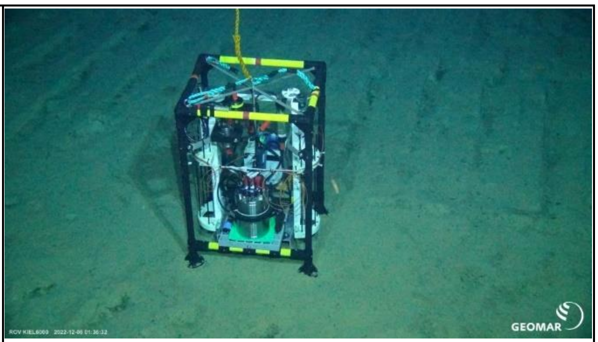
2022-12-05	22:43:32	-125.87413	14.11214	4530.4	 CUBE2 imprint with deployed Blade Corer and cores (close up) 20221205_224332_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	22:43:45	-125.87415	14.11215	4530.4	Retrieving PUCs back into 16 Core Rack
2022-12-05	22:47:34	-125.87407	14.11219	4530.42	PUC44 retrieval
2022-12-05	22:47:38	-125.87407	14.11219	4530.43	PUC11 retrieval
2022-12-05	22:48:04	-125.87408	14.11221	4530.43	PUC27 retrieval
2022-12-05	22:50:55	-125.87407	14.11215	4530.45	CUBE 2 lifted from seafloor
2022-12-05	22:52:53	-125.87410	14.11220	4530.45	CUBE 2 placed on ROV porch
2022-12-05	22:54:01	-125.87409	14.11221	4530.45	Blade Corer 1 retrieval, heading towards Elevator 2
2022-12-05	22:58:21	-125.87369	14.11207	4528.97	Elevator 2 in view
2022-12-05	23:02:45	-125.87357	14.11205	4529.83	Blade Corer 1 placed in box on Elevator 2
2022-12-05	23:06:14	-125.87370	14.11221	4530	Door of CUBE2 closed
2022-12-05	23:08:18	-125.87359	14.11209	4530.08	CUBE2 placed on Elevator 2
2022-12-05	23:12:23	-125.87373	14.11223	4530.19	CUBE2 secured on Elevator 2 with elastic straps
2022-12-05	23:19:59	-125.87373	14.11222	4530.17	Blade Corer 3 collected from Elevator 2, moving to site for background sediment sampling
2022-12-05	23:25:15	-125.87386	14.11243	4529.52	MICP-DEEP2(?, photo not displayed) 20221205_232515_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	23:25:18	-125.87386	14.11243	4529.53	 MICP-DEEP2(?) 20221205_232518_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	23:25:25	-125.87385	14.11242	4529.56	 Site selected for background sampling with Blade Corer & PUCs 20221205_232525_Sonne_SO295_151ROV19_Logo_thumb.jpg Site for background sampling (blade corer, push cores)

2022-12-05	23:25:31	-125.87385	14.11242	4529.59	 Site selected for background sampling (close up) 20221205_232531_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	23:27:59	-125.87378	14.11232	4530.74	Blade Corer 3 deployed
2022-12-05	23:29:12	-125.87388	14.11237	4530.76	PUC sampling start at background sampling site near Blade Corer 3 with PUCs from 16 Core Rack
2022-12-05	23:30:17	-125.87390	14.11243	4530.78	PUCA0 deployed
2022-12-05	23:31:10	-125.87389	14.11247	4530.79	PUC74 deployed
2022-12-05	23:32:25	-125.87388	14.11248	4530.8	 Floating orange sea cucumber 20221205_233225_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	23:32:25	-125.87388	14.11248	4530.8	PUC41 deployed
2022-12-05	23:32:54	-125.87389	14.11243	4530.81	 Background sampling site with deployed cores 20221205_233254_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	23:32:56	-125.87389	14.11243	4530.81	Small light pink sea cucumber swimming
2022-12-05	23:33:06	-125.87388	14.11243	4530.81	 Background sampling site with deployed cores (close up) 20221205_233306_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	23:35:06	-125.87388	14.11242	4530.81	Retrieving PUCs back into 16 Core Rack
2022-12-05	23:35:12	-125.87388	14.11242	4530.81	PUC41 retrieved
2022-12-05	23:35:32	-125.87388	14.11242	4530.82	PUC74 retrieved

2022-12-05	23:36:27	-125.87387	14.11242	4530.82	PUCA0 retrieved
2022-12-05	23:39:44	-125.87375	14.11227	4529.16	Blade Corer 3 retrieved, moving back to Elevator 2
2022-12-05	23:40:24	-125.87373	14.11226	4529.11	Elevator 2 in view
2022-12-05	23:43:18	-125.87359	14.11206	4530.21	Blade Corer 3 placed in box on Elevator 2. Next action: collecting PSP
2022-12-05	23:48:55	-125.87397	14.11206	4529.64	 PSP prior to recovery 20221205_234855_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-05	23:52:03	-125.87386	14.11207	4529.17	PSP lifted from the seafloor, moving back to Elevator 2
2022-12-05	23:52:46	-125.87376	14.11204	4529.28	Elevator in view
2022-12-05	23:53:25	-125.87368	14.11203	4529.34	Nodule pile
2022-12-05	23:56:37	-125.87365	14.11215	4529.19	PSP placed in quiver on Elevator 2
2022-12-06	00:00:13	-125.87363	14.11215	4529.46	PSP secured on Elevator 2
2022-12-06	00:02:42	-125.87368	14.11209	4529.45	Moving to MICP1 deployed during dive 16
2022-12-06	00:07:04	-125.87365	14.11249	4529.51	 MICP1 prior to recovery 20221206_000704_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	00:07:10	-125.87365	14.11249	4529.64	Ctenophore
2022-12-06	00:07:30	-125.87363	14.11250	4529.98	 MICP1 prior to recovery 20221206_000730_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	00:08:55	-125.87363	14.11254	4529.54	MICP1 picked up from sediement
2022-12-06	00:09:28	-125.87364	14.11253	4529.07	Transporting MICP1 to Elevator 2
2022-12-06	00:13:17	-125.87360	14.11209	4529.68	MICP1 placed on Elevator 2
2022-12-06	00:13:29	-125.87357	14.11211	4529.73	Shrimp swimming by

2022-12-06	00:13:38	-125.87356	14.11211	4529.76	 Shrimp 20221206_001338_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	00:21:42	-125.87362	14.11211	4530.26	MICP1 secured on Elevator 2 with elastic straps
2022-12-06	00:22:11	-125.87363	14.11212	4530.05	Moving to BFC3
2022-12-06	00:26:29	-125.87359	14.11237	4530.06	 BFC3 prior to recovery 20221206_002629_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	00:27:21	-125.87363	14.11245	4530.08	 BFC3 prior to recovery (close up) 20221206_002721_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	00:28:42	-125.87365	14.11238	4529.52	BFC3 picked up from seafloor
2022-12-06	00:32:17	-125.87362	14.11224	4529.03	Transporting BF3 to Elevator 2
2022-12-06	00:35:53	-125.87355	14.11212	4529.97	BFC3 placed on Elevator 2
2022-12-06	00:39:07	-125.87358	14.11207	4530.29	BFC3 secured on Elevator 2 with elastic straps
2022-12-06	00:41:12	-125.87367	14.11215	4527.28	Heading to MICP-DEEP2
2022-12-06	00:42:48	-125.87379	14.11229	4529.64	 MICP-DEEP2 prior to recovery 20221206_004248_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	00:43:50	-125.87380	14.11227	4529.72	MICP-DEEP1 is in the same track as MICP-DEEP2 further towards Northwest
2022-12-06	00:44:17	-125.87379	14.11224	4529.16	MICP-DEEP2 is blinking: program is finished

2022-12-06	00:44:25	-125.87379	14.11223	4528.91	MICP-DEEP2 picked up from the seafloor
2022-12-06	00:45:19	-125.87371	14.11219	4528	Transporting MICP-DEEP2 to Elevator 2
2022-12-06	00:50:51	-125.87367	14.11220	4528.09	Poor visibility near Elevator 2
2022-12-06	00:53:00	-125.87369	14.11221	4528.91	Visibility slowly improving
2022-12-06	00:56:10	-125.87371	14.11224	4530.27	MICP-DEEP2 placed on Elevator 2
2022-12-06	00:58:41	-125.87375	14.11220	4530.41	MICP-DEEP2 secured on Elevator 2 with elastic straps
2022-12-06	01:00:29	-125.87369	14.11226	4529.52	Heading towards MICP-DEEP1
2022-12-06	01:04:18	-125.87405	14.11248	4529.46	MICP-DEEP1's program is still running
2022-12-06	01:05:28	-125.87408	14.11250	4529.53	Little crab at MICP-DEEP1
2022-12-06	01:06:05	-125.87406	14.11254	4529.55	 MICP-DEEP 1 towards the end of deployment MICP-DEEP1-3 20221206_010605_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	01:07:33	-125.87400	14.11257	4529.56	Next action: collecting BFCs while waiting for MICP-DEEP1 to finish
2022-12-06	01:09:10	-125.87397	14.11254	4528.67	BFC1 picked up from seafloor
2022-12-06	01:10:34	-125.87401	14.11246	4528.17	BFC1 placed on the porch
2022-12-06	01:11:14	-125.87404	14.11242	4528.99	Heading towards BFC2
2022-12-06	01:14:55	-125.87400	14.11234	4529.67	BFC2 prior to recovery (close up, photo not displayed) 20221206_011455_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	01:14:58	-125.87400	14.11234	4529.67	 BFC2 prior to recovery (close up) 20221206_011458_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	01:15:45	-125.87400	14.11234	4529.69	BFC2 picked up from sealoor
2022-12-06	01:17:51	-125.87411	14.11224	4528.35	Sea cucumber on the seafloor
2022-12-06	01:18:34	-125.87412	14.11219	4528.19	Sea cucumber on the seafloor
2022-12-06	01:22:01	-125.87433	14.11160	4528.26	BFC1 deposited on the seafloor close to BFC2
2022-12-06	01:26:50	-125.87433	14.11164	4528.5	Heading to MICP-DEEP1
2022-12-06	01:36:09	-125.87391	14.11235	4529.05	 MICP-DEEP1 prior to recovery 20221206_013609_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	01:36:22	-125.87393	14.11235	4529.09	MICP-DEEP1 finished its program

2022-12-06	01:36:32	-125.87395	14.11236	4529.14	 MICP-DEEP1 prior to recovery 20221206_013632_Sonne_SO295_151ROV19_Logo_thumb.jpg
2022-12-06	01:38:36	-125.87393	14.11235	4529.2	MICP-DEEP1 picking up from the seafloor
2022-12-06	01:38:51	-125.87392	14.11234	4528.93	Transporting MICP-DEEP1 to Elevator 2
2022-12-06	01:43:39	-125.87367	14.11206	4529.49	MICP-DEEP1 placed on Elevator 2
2022-12-06	01:51:44	-125.87360	14.11210	4530.36	MICP-DEEP2 secured on Elevator 2 with elastic straps
2022-12-06	01:57:29	-125.87360	14.11212	4520.11	Elevator Recovery System ('Bergefuchs') is being lowered towards the seafloor
2022-12-06	02:08:55	-125.87360	14.11205	4519.69	Elevator Recovery Systemin view
2022-12-06	02:09:13	-125.87360	14.11203	4519.69	USBL navigation is quite off
2022-12-06	02:10:35	-125.87360	14.11202	4519.71	Ship moving to get Elevator Recovery System closer to Elevator 2 position
2022-12-06	02:12:49	-125.87345	14.11202	4520.11	Moving towards Elevator Recovery System
2022-12-06	02:13:09	-125.87330	14.11202	4520.62	Arriving at Elevator Recovery System
2022-12-06	02:18:36	-125.87340	14.11191	4522.29	Taking ROV operated shackle from Elevator Recovery System
2022-12-06	02:23:59	-125.87362	14.11205	4528.88	ROV operated shackle attached to Elevator 2
2022-12-06	02:28:08	-125.87363	14.11207	4528.11	Elevator 2 lifted of the seafloor for recovery to the ship
2022-12-06	02:29:31	-125.87380	14.11203	4527.84	Next action: picking up BFC1 and BFC2
2022-12-06	02:32:31	-125.87425	14.11161	4527.61	Arriving at BFC1 & BFC2
2022-12-06	02:42:59	-125.87429	14.11165	4528.7	BFC1 collected on porch
2022-12-06	02:48:24	-125.87438	14.11173	4528.03	BFC2 collected on porch
2022-12-06	02:50:14	-125.87435	14.11173	4527.2	End of scientific program
2022-12-06	02:50:17	-125.87436	14.11173	4526.96	OFF THE BOTTOM
2022-12-06	04:49:13	None	None	None	ON DECK

Kiel 6000 Dive 20 (SO295_163-1_ROV-20)

Date: 07.Dec.2022

Principal Investigators: Patricia Esquete, Sabine Gollner, Duygu Sevilger & Felix Janssen

Observers: Felix Janssen, Lilian Böhringer, Carsten Rühlemann, Amber Henningsen

Protocol: Patricia Esquete

ROV positions (at the bottom)
Start of dive: 14°6.693' N 125°52.371' W
End of dive: 14°6.666' N 125°52.323' W

Dive duration:
ROV in the water: 07.Dec.2022 15:37:41
ROV at the bottom: 07.Dec.2022 17:34:00
ROV off the bottom: 08.Dec.2022 00:11:19
ROV on deck: 08.Dec.2022 02:07:39

Explored sites: BEL plume impact thick

Aims of the Dive:

- Guide Elevator 1 to seafloor
- Deploy Fiberoptical Microsensor Profiler (MICP-DEEP1)
- Deploy Passive Trace Metal Sampler (PSP)
- Collect Push Cores (PUCs)
- Deploy three Food Pulse Chambers (FPC1, 2, 3)
- Collect 4 sea cucumbers
- Collect additional megafauna
- Deploy Electrochemical Microsensor Profiler (MICP2)
- Collect MICP-DEEP1 on porch

Handled ROV Tools (including scientific payload):

- Pushcores (PUCs) in 16 Core Rack
- 2 Magnet Sticks
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- ICBM Biobox extra large
- MICP-DEEP1 (on ascent)

Relevant Elevator payload:

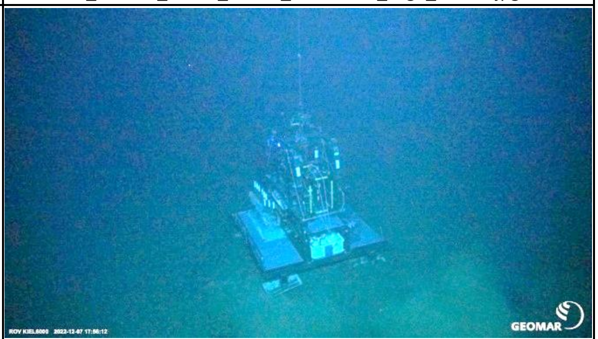
Elevator 1

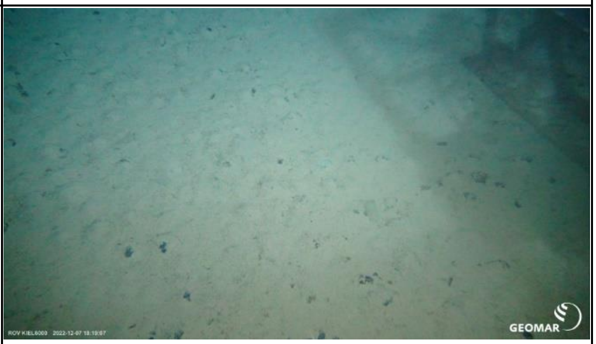
- MICP2
- MICP-DEEP1
- PSP in quiver
- *2 Amphipod traps (AMPHITRAPs)*

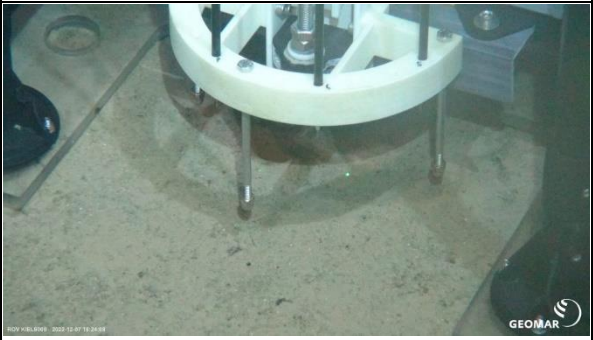
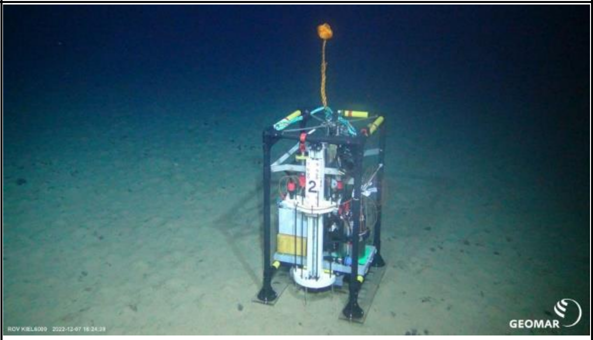
- 3 FPCs in quivers

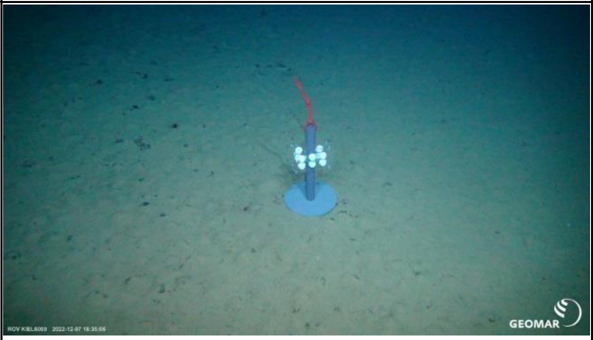
Dive summary

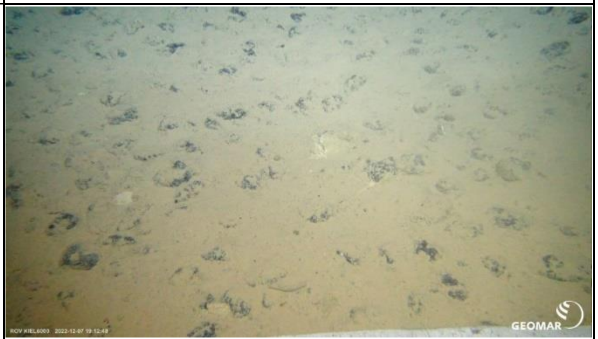
Elevator 1 was guided to the seafloor and unhooked from the ship's cable. MIPC-DEEP1 was collected from Elevator 1 and deployed nearby. The PSP was taken off Elevator 1 and positioned at the seafloor. 5 to 6 PUCs each were collected at three different locations (PUC sites A, B, and C). FPC1, 3, and 2 were collected from Elevator 1 and deployed one after the other on top of individual sea cucumbers after which syringes with labeled phytodetritus were injected into the FPCs. Sea cucumber specimen were collected. Subsequently, MIPC2 was collected from Elevator 1 and deployed. Finally, MICP-DEEP1 was retrieved from the seafloorand collected onto the porch before the ROV started to ascend.

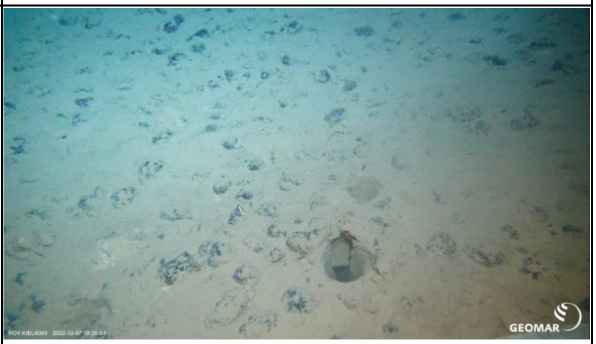
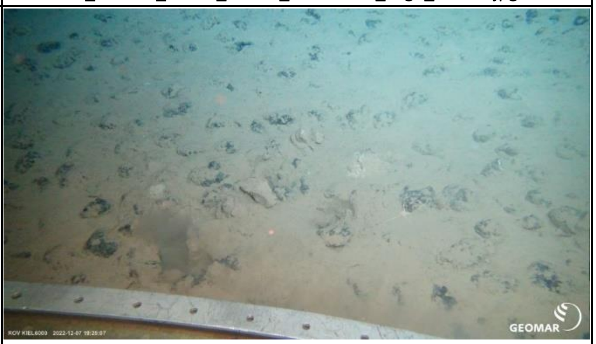
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-07	15:37:41	None	None	None	IN THE WATER
2022-12-07	17:34:00	-125.87285	14.11155	4515.92	AT THE BOTTOM
2022-12-07	17:40:49	-125.87239	14.11147	4524.29	Searching for Elevator 1
2022-12-07	17:43:55	-125.87246	14.11140	4515.81	Waiting in position for the ship/Elevator 1 to approach target position
2022-12-07	17:44:13	-125.87246	14.11139	4515.79	Lowering Elevator 1 close to the seafloor
2022-12-07	17:45:46	-125.87247	14.11149	4515.8	Elevator 1 some 60m away from ROV (according to Homer beacon signal)
2022-12-07	17:48:20	-125.87244	14.11148	4515.79	Elevator 1 in view
2022-12-07	17:49:15	-125.87243	14.11149	4515.77	Posidonia underwater navigation seems to be running OK (relative positions ROV and Elevator 1, sonar position relative to nodule piles)
2022-12-07	17:53:25	-125.87231	14.11143	4522.09	Approaching Elevator 1
2022-12-07	17:54:54	-125.87212	14.11134	4527.34	10m between Elevator 1 and ROV
2022-12-07	17:55:12	-125.87209	14.11131	4528.12	Bottom and Elevator 1 in view
2022-12-07	17:55:23	-125.87208	14.11129	4528.36	Elevator 1 lowered to seafloor
2022-12-07	17:56:07	-125.87209	14.11127	4528.69	Elevator 1 close to the seafloor (photo not displayed) 20221207_175607_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	17:56:12	-125.87209	14.11127	4528.76	 Elevator 1 arriving at the seafloor 20221207_175612_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	17:56:18	-125.87209	14.11127	4528.86	Elevator 1 landed at seafloor
2022-12-07	17:57:05	-125.87221	14.11131	4530.04	Sediment cloud develops around landing position but is carried away by currents
2022-12-07	17:57:20	-125.87222	14.11132	4530.41	Approaching Elevator 1 to unhook
2022-12-07	17:58:15	-125.87221	14.11132	4531.24	One foot of Elevator 1 is standing on Box Corer imprint
2022-12-07	17:58:44	-125.87214	14.11128	4531.32	Opening ROV operated shackle
2022-12-07	17:58:58	-125.87214	14.11127	4531.33	Elevator 1 unhooked. Cable is being retrieved to ship

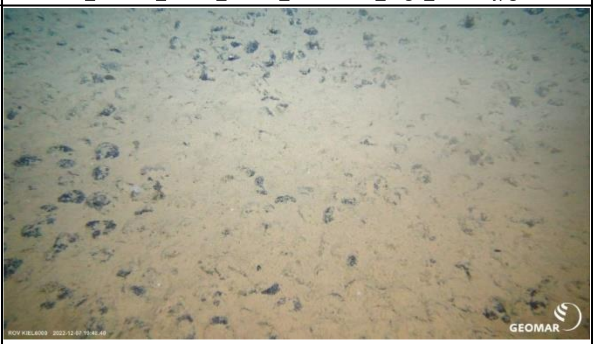
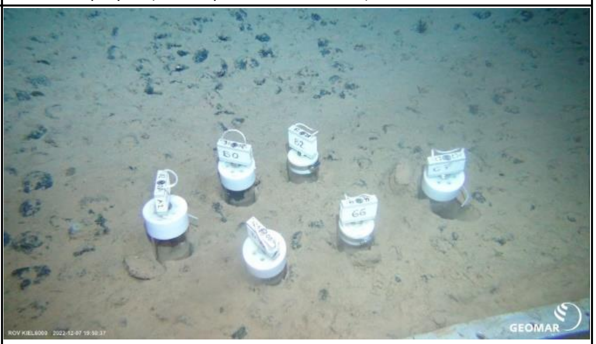
2022-12-07	18:01:09	-125.87207	14.11134	4531.27	 Elevator 1 standing on Box Corer imprint 20221207_180109_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:01:24	-125.87207	14.11135	4531.27	Calling the ship to move away from Elevator 1 position (100m, 115 deg.)
2022-12-07	18:01:26	-125.87207	14.11135	4531.27	 Elevator 1 standing on Box Corer imprint (close up) 20221207_180126_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:05:15	-125.87218	14.11144	4530.73	Moving a little away from Elevator 1 to keep safety distance to the ship's cable while the ROV operated shackle is still close to the seafloor
2022-12-07	18:06:34	-125.87223	14.11138	4530.69	Nodules are often sticking out of the sediment - not all covered
2022-12-07	18:07:47	-125.87220	14.11133	4531.02	Approaching Elevator 1 to collect MICP-DEEP1
2022-12-07	18:10:56	-125.87211	14.11132	4531.9	MICO-DEEP1 blinking
2022-12-07	18:12:36	-125.87209	14.11129	4531.59	MICP-DEEP collected from Elevator 1
2022-12-07	18:13:56	-125.87207	14.11124	4531.56	Moving direction Southwest (210 deg.) towards MICP-DEEP1 deployment position
2022-12-07	18:14:48	-125.87208	14.11120	4531.74	Most of the nodules are clearly covered here
2022-12-07	18:17:44	-125.87212	14.11117	4532.01	Looking for promising deployment spot approx. 10m away from Elevator 1
2022-12-07	18:19:07	-125.87214	14.11117	4532.34	 MICP-DEEP1 deployment site 20221207_181907_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:20:24	-125.87207	14.11118	4532.29	Starting MICP-DEEP1 with Magnet Stick hanging from RigMaster
2022-12-07	18:21:52	-125.87208	14.11116	4532.28	MICP-DEEP 1 started: LED stopped blinking, geared wheels turning
2022-12-07	18:23:57	-125.87215	14.11115	4532.7	MICP-DEEP1 positioned at the seafloor with stage 2 at site that appears to be free of nodules: deployment MICP-DEEP1-1

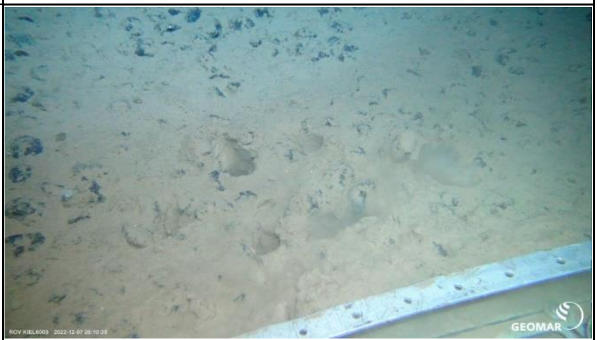
2022-12-07	18:23:59	-125.87215	14.11115	4532.71	 MICP-DEEP1 at seafloor 20221207_182359_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:24:08	-125.87215	14.11115	4532.74	 MICP-DEEP1 at seafloor (close up) 20221207_182408_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:24:38	-125.87214	14.11113	4532.58	 MICP-DEEP1 at seafloor 20221207_182438_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:25:08	-125.87213	14.11113	4532.1	Heading to Elevator 1
2022-12-07	18:26:19	-125.87213	14.11111	4531.74	Next action: deploying PSP
2022-12-07	18:27:07	-125.87214	14.11112	4531.8	Unknown object / litter at the seafloor (photo not displayed) 20221207_182707_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:27:15	-125.87214	14.11112	4531.8	 Unknown object / litter at the seafloor 20221207_182715_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:27:44	-125.87208	14.11125	4531.81	Strange object / litter on seafloor on the way to Elevator 1
2022-12-07	18:28:06	-125.87207	14.11128	4531.93	Fish (rattail) near Elevator 1
2022-12-07	18:31:43	-125.87208	14.11123	4531.58	Collecting PSP from Elevator 1
2022-12-07	18:33:03	-125.87220	14.11125	4530.96	Moving direction Southwest toward PSP deployment position between MICP-DEEP1 and nodule piles

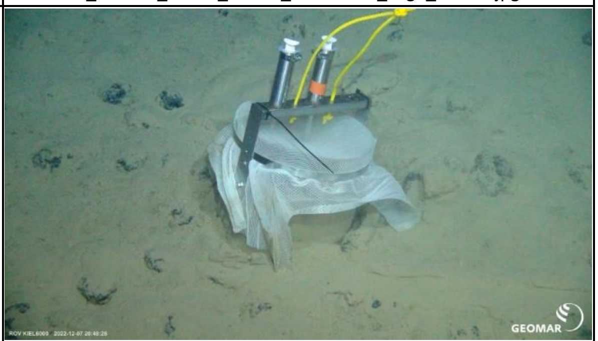
2022-12-07	18:34:37	-125.87214	14.11111	4531.77	Setting PSP down on seafloor approx. 40 m off nodule piles and 30m away from closest PATANIA II turns
2022-12-07	18:35:06	-125.87211	14.11100	4531.87	 PSP at seafloor 20221207_183506_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:37:30	-125.87211	14.11115	4530.52	Waypoint PSP seems to be a bit closer to MICP-DEEP1 than real distance. Next action: PUC sampling
2022-12-07	18:39:22	-125.87205	14.11139	4530.16	Flying over elevator towards PUC sampling site A
2022-12-07	18:41:02	-125.87185	14.11144	4532.74	Thick cover but still some of the nodules sticking out
2022-12-07	18:43:01	-125.87185	14.11139	4534.37	Landing near chosen PUC sampling site A
2022-12-07	18:43:32	-125.87183	14.11140	4534.54	 PUC site A prior to coring 20221207_184332_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:44:58	-125.87174	14.11150	4534.57	PUC sampling start at site A with PUCs from 16 Core Rack
2022-12-07	18:46:00	-125.87178	14.11154	4534.54	All PUCs are shaken before deployment to get rid of the water the quivers were filled with (will be done also for following cores)
2022-12-07	18:47:32	-125.87200	14.11143	4534.51	PUCD6 deployed
2022-12-07	18:49:09	-125.87193	14.11132	4534.49	PUCB5 deployed
2022-12-07	18:50:16	-125.87185	14.11133	4534.49	Visibility a bit poor
2022-12-07	18:51:21	-125.87175	14.11138	4534.49	PUCD4 deployed
2022-12-07	18:53:30	-125.87186	14.11131	4534.54	PUCC3 deployed
2022-12-07	18:55:09	-125.87189	14.11140	4534.57	Moving a tiny bit backwards as ROV was slowly moving forward towards PUCs while coring
2022-12-07	18:55:12	-125.87189	14.11140	4534.57	PUC60 deployed
2022-12-07	18:55:40	-125.87189	14.11140	4534.58	 PUC site A with deployed cores 20221207_185540_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	18:55:48	-125.87189	14.11139	4534.59	Retrieving PUCs back into 16 Core Rack
2022-12-07	18:56:42	-125.87188	14.11137	4534.59	Core are sediment covered on the outside upon retrieval – sediments seems particularly sticky
2022-12-07	18:57:41	-125.87184	14.11138	4534.58	PUCB5 retrieved
2022-12-07	18:58:21	-125.87184	14.11138	4534.56	PUCD6 retrieved

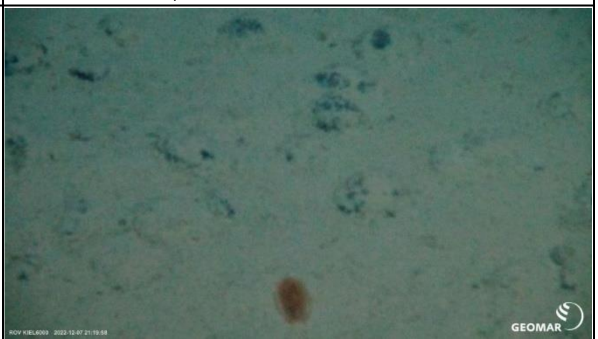
2022-12-07	18:59:31	-125.87185	14.11136	4534.51	PUCD4 retrieved
2022-12-07	19:00:37	-125.87186	14.11132	4534.49	PUC60 retrieved
2022-12-07	19:01:47	-125.87188	14.11135	4534.49	PUCC3 retrieved
2022-12-07	19:02:14	-125.87188	14.11136	4534.47	 PUC site A post coring 20221207_190214_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	19:04:37	-125.87181	14.11136	4533.93	Swimming sea cucumber
2022-12-07	19:05:25	-125.87176	14.11132	4533.02	Moving to PUC sampling site B
2022-12-07	19:06:08	-125.87168	14.11127	4533.14	Sea cucumber on seafloor
2022-12-07	19:09:32	-125.87126	14.11120	4536.05	Arriving in PUC target area B
2022-12-07	19:10:04	-125.87122	14.11124	4536.41	Selecting suitable spot place to place PUCs
2022-12-07	19:12:48	-125.87121	14.11126	4537.93	 PUC site B prior to coring 20221207_191248_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	19:13:06	-125.87120	14.11126	4537.98	PUC sampling start at site B with PUCs from 16 Core Rack
2022-12-07	19:15:24	-125.87114	14.11119	4537.98	PUCD7 deployed
2022-12-07	19:16:58	-125.87115	14.11123	4538	PUCB2 deployed
2022-12-07	19:18:39	-125.87115	14.11123	4538.01	PUCC1 deployed
2022-12-07	19:20:05	-125.87115	14.11132	4538.02	PUC5 deployed
2022-12-07	19:21:54	-125.87116	14.11124	4538.01	PUCB4 deployed
2022-12-07	19:21:54	-125.87116	14.11124	4538.01	 PUC site B with deployed cores (all PUCs) 20221207_192154_Sonne_SO295_163ROV20_Logo_thumb.jpg

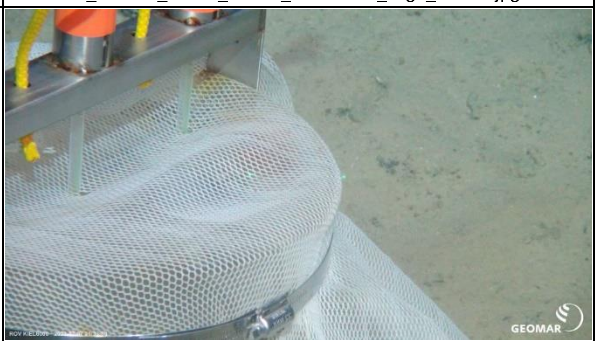
2022-12-07	19:22:05	-125.87117	14.11123	4538.01	 PUC site B with deployed cores (PUCB4, 5) 20221207_192205_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	19:22:12	-125.87117	14.11123	4538.01	 PUC site B with deployed cores (PUCC1, B2, D7) 20221207_192212_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	19:22:41	-125.87117	14.11123	4538.01	Retrieving PUCs back into 16 Core Rack
2022-12-07	19:23:10	-125.87117	14.11124	4538	PUCB4 retrieved
2022-12-07	19:24:06	-125.87117	14.11123	4538	PUC5 retrieved
2022-12-07	19:25:24	-125.87116	14.11123	4538	PUCC1 retrieved
2022-12-07	19:26:13	-125.87115	14.11124	4538	PUCB2 retrieved
2022-12-07	19:27:22	-125.87117	14.11121	4538	PUCD7 retrieved
2022-12-07	19:28:01	-125.87116	14.11124	4537.82	 PUC site B post coring (right part) 20221207_192801_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	19:28:07	-125.87115	14.11126	4537.74	 PUC site B post coring (left part) 20221207_192807_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	19:28:55	-125.87113	14.11126	4536.75	Some broken shell

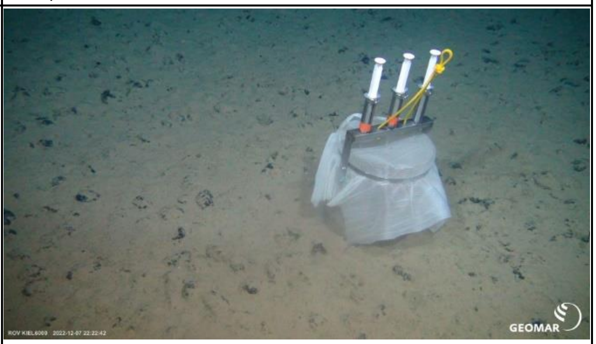
2022-12-07	19:30:03	-125.87114	14.11126	4536.91	 Broken shell and brittle star 20221207_193003_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	19:31:00	-125.87118	14.11122	4536.56	Moving to PUC C target site
2022-12-07	19:33:38	-125.87124	14.11106	4533.98	Something that looks like an agglomeration of nodules
2022-12-07	19:36:18	-125.87151	14.11070	4532.15	Arriving in PUC target area C
2022-12-07	19:39:09	-125.87152	14.11068	4532.68	Searching for appropriated sampling spot between the nodules
2022-12-07	19:47:57	-125.87156	14.11066	4533.67	Landing at the seafloor
2022-12-07	19:48:32	-125.87157	14.11065	4533.69	PUC site C prior to coring (photo not displayed) 20221207_194832_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	19:48:40	-125.87157	14.11065	4533.69	 PUC site C prior to coring 20221207_194840_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	19:48:53	-125.87157	14.11065	4533.69	PUC sampling start at site C with PUCs from 16 Core Rack
2022-12-07	19:50:58	-125.87156	14.11066	4533.68	PUCA2 deployed
2022-12-07	19:52:10	-125.87155	14.11066	4533.68	PUCB0 deployed
2022-12-07	19:53:56	-125.87156	14.11066	4533.67	PUC82 deployed
2022-12-07	19:55:46	-125.87154	14.11064	4533.67	PUC66 deployed
2022-12-07	19:57:15	-125.87152	14.11069	4533.68	PUCC7 deployed (sliding away as it was pushed into sediment)
2022-12-07	19:59:21	-125.87160	14.11082	4533.68	PUC D0 deployed (to compensate for PUCC7)
2022-12-07	19:59:37	-125.87160	14.11082	4533.69	 PUC site C with deployed cores 20221207_195937_Sonne_SO295_163ROV20_Logo_thumb.jpg

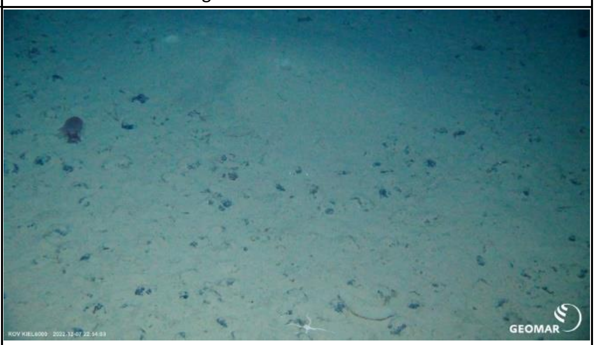
2022-12-07	19:59:53	-125.87160	14.11082	4533.69	 PUC site A with deployed cores (close up) 20221207_195953_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	20:00:10	-125.87158	14.11079	4533.69	Retrieving PUCs back into 16 Core Rack
2022-12-07	20:02:25	-125.87153	14.11069	4533.66	PUCD0 retrieved
2022-12-07	20:04:45	-125.87154	14.11077	4533.62	PUCB0 retrieved
2022-12-07	20:06:09	-125.87156	14.11076	4533.63	PUCA2 retrieved
2022-12-07	20:07:28	-125.87157	14.11075	4533.63	PUC82 retrieved
2022-12-07	20:08:45	-125.87155	14.11076	4533.66	PUC 66 retrieved
2022-12-07	20:10:08	-125.87152	14.11078	4533.66	PUC C7 retrieved, seems empty
2022-12-07	20:10:35	-125.87153	14.11079	4533.52	 PUC site C post coring 20221207_201035_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	20:11:15	-125.87154	14.11079	4532.65	Heading towards Elevator 1. Next action: Food Pulse Experiment deployment
2022-12-07	20:14:28	-125.87186	14.11097	4531.28	Sea cucumber taking off the seafloor
2022-12-07	20:16:48	-125.87195	14.11114	4531.45	Shrimp
2022-12-07	20:18:14	-125.87193	14.11119	4531.8	Elevator 1 in view
2022-12-07	20:19:59	-125.87202	14.11135	4531.83	Arriving at Elevator 1
2022-12-07	20:22:07	-125.87204	14.11143	4532.13	Fish swimming at distance
2022-12-07	20:26:02	-125.87199	14.11139	4532.46	Picked up FPC1
2022-12-07	20:27:44	-125.87198	14.11142	4532.03	Moving towards PUC A sampling site with FPC1 in manipulator gripper
2022-12-07	20:29:43	-125.87188	14.11136	4532.05	Looking for sea cucumber to incubate in FPC1
2022-12-07	20:31:37	-125.87174	14.11134	4532.25	Sea cucumber spotted, light purple with pointy sails
2022-12-07	20:33:18	-125.87171	14.11136	4533.42	Sea cucumber selected for FPC1 deployment (photo not displayed) 20221207_203318_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	20:33:34	-125.87171	14.11136	4533.59	 Sea cucumber selected for FPC1 deployment 20221207_203334_Sonne_SO295_163ROV20_Logo_thumb.jpg

2022-12-07	20:33:43	-125.87171	14.11137	4533.65	 Sea cucumber selected for FPC1 deployment (close up) 20221207_203343_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	20:33:57	-125.87170	14.11138	4533.7	Sea cucumber selected for FPC1 deployment (photo not displayed) 20221207_203357_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	20:37:48	-125.87170	14.11134	4533.78	FPC1 put over sea cucumber while ROV is hovering
2022-12-07	20:38:07	-125.87170	14.11135	4533.76	FPC1 fell over with the sea cucumber still inside
2022-12-07	20:40:04	-125.87168	14.11135	4534.57	FPC1 rolling with the current a little bit
2022-12-07	20:40:50	-125.87168	14.11136	4534.59	Trying to lift the chamber grabbing syringe
2022-12-07	20:40:55	-125.87168	14.11136	4534.59	Syringe broke off and placed in drawer behind 16 core rack
2022-12-07	20:43:05	-125.87168	14.11138	4534.61	Pushing FPC1 into the sediment
2022-12-07	20:44:03	-125.87168	14.11138	4534.63	It is not known if the holothurian made it out in time
2022-12-07	20:44:23	-125.87168	14.11138	4534.64	Sea cucumber probably still in the chamber
2022-12-07	20:45:20	-125.87168	14.11139	4534.65	Injecting the two remaining syringes into FPC1
2022-12-07	20:45:53	-125.87166	14.11138	4534.64	 FPC1 on the seafloor (close up) 20221207_204553_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	20:48:26	-125.87170	14.11138	4533.61	 FPC1 on the seafloor 20221207_204826_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	20:48:54	-125.87170	14.11137	4533.44	Heading back to Elevator 1 to get next FPC
2022-12-07	20:50:56	-125.87184	14.11139	4531.93	Elevator 1 in view
2022-12-07	20:51:55	-125.87195	14.11144	4531.76	The fish is still in the background of Elevator 1
2022-12-07	20:52:29	-125.87197	14.11143	4531.93	Shrimp at distance
2022-12-07	20:56:40	-125.87209	14.11137	4532.47	FPC 3 collected from Elevator 1
2022-12-07	21:00:25	-125.87202	14.11142	4532.64	FPC3 grabbed on the metal bar between the syringes to have a better grip
2022-12-07	21:04:32	-125.87188	14.11132	4532.08	Moving to site for FPC3 deployment, searching for sea cucumber

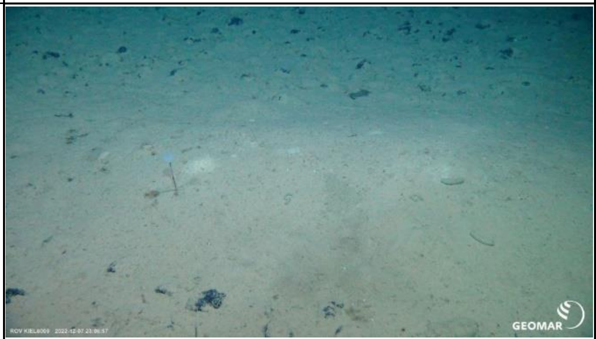
2022-12-07	21:07:45	-125.87169	14.11115	4533.34	 First sea cucumber selected for FPC3 incubation 20221207_210745_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:07:54	-125.87169	14.11115	4533.36	Holothuria in front of ROV
2022-12-07	21:08:00	-125.87169	14.11115	4533.38	First sea cucumber selected for FPC3 incubation (photo not displayed) 20221207_210800_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:08:25	-125.87169	14.11115	4533.4	First sea cucumber selected for FPC3 incubation (photo not displayed) 20221207_210825_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:08:38	-125.87169	14.11115	4533.4	 First sea cucumber selected for FPC3 incubation (close up) 20221207_210838_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:11:42	-125.87168	14.11123	4534.84	Sea cucumber moved by water current caused by thrusters
2022-12-07	21:15:32	-125.87146	14.11126	4535.37	Searching for another sea cucumber for FPC3 incubation
2022-12-07	21:19:52	-125.87129	14.11131	4536.67	New sea cucumber spotted
2022-12-07	21:19:58	-125.87129	14.11131	4536.72	 Sea cucumber selected for FPC3 incubation 20221207_211958_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:20:54	-125.87129	14.11132	4537.03	Sea cucumber selected for FPC3 incubation (photo not displayed) 20221207_212054_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:21:05	-125.87129	14.11133	4537.05	 Sea cucumber selected for FPC3 incubation 20221207_212105_Sonne_SO295_163ROV20_Logo_thumb.jpg

2022-12-07	21:23:32	-125.87130	14.11130	4537.16	FPC3 placed above sea cucumber
2022-12-07	21:24:09	-125.87129	14.11129	4537.09	Sediments brought into suspension, poor visibility
2022-12-07	21:25:12	-125.87126	14.11131	4536.99	 FPC3 on the seafloor (close up) 20221207_212512_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:26:25	-125.87126	14.11134	4537	 FPC3 on the seafloor while injecting syringes 20221207_212625_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:27:10	-125.87128	14.11137	4537.01	First Syringe pressed down, labeled phytodetritus released
2022-12-07	21:28:54	-125.87134	14.11128	4536.99	Second syringe (middle) pressed down
2022-12-07	21:29:57	-125.87133	14.11129	4536.99	FPC3 pressed a little further into sediment, especially on the left side
2022-12-07	21:33:11	-125.87129	14.11131	4537.58	Third syringe pressed down
2022-12-07	21:33:33	-125.87129	14.11130	4537.58	 FPC3 on the seafloor with injected syringes 20221207_213333_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:33:50	-125.87129	14.11130	4537.58	 FPC3 on the seafloor (close up) 20221207_213350_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:37:22	-125.87129	14.11126	4535.97	Heading away from FPC3 and towards Elevator 1
2022-12-07	21:37:32	-125.87129	14.11125	4535.68	Sediments brought into suspension: poor visibility
2022-12-07	21:41:16	-125.87180	14.11129	4532.65	Elevator 1 in view
2022-12-07	21:43:55	-125.87203	14.11136	4532.29	Big shrimp next to Elevator 1

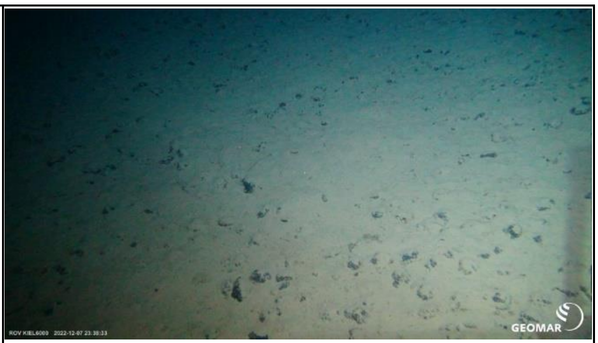
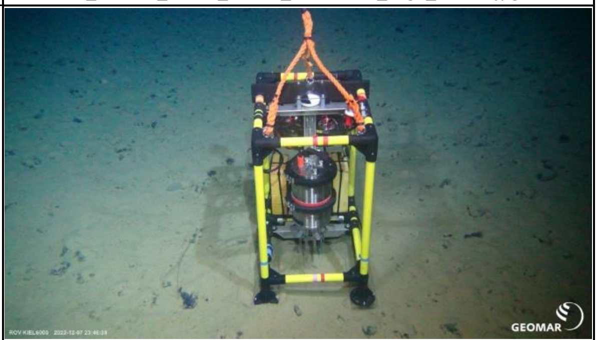
2022-12-07	21:48:55	-125.87201	14.11137	4532.62	FPC2 collected from Elevator 1
2022-12-07	21:49:14	-125.87201	14.11137	4532.62	Fish (rattail) again moving slowly along the sediment surface next to Elevator 1
2022-12-07	21:51:50	-125.87196	14.11138	4532.51	Moving direction West to FPC2 deployment site with FPC2 collected from Elevator 1
2022-12-07	21:56:47	-125.87164	14.11108	4533.27	Sea cucumber spotted
2022-12-07	21:58:44	-125.87156	14.11106	4533.62	 Frist sea cucumber selected for FPC2 incubation 20221207_215844_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	21:58:58	-125.87156	14.11106	4533.63	Frist sea cucumber selected for FPC2 incubation (photo not displayed) 20221207_215858_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:02:51	-125.87165	14.11102	4533.67	Red shrimp
2022-12-07	22:03:48	-125.87167	14.11102	4533.65	FPC2 placed on side to get a better grip on top
2022-12-07	22:09:05	-125.87165	14.11103	4533.68	FPC2 picked up at metal handle
2022-12-07	22:10:06	-125.87164	14.11101	4533.66	Selected sea cucumber disappeared
2022-12-07	22:16:17	-125.87170	14.11102	4533.46	Spotting another sea cucumber (pinkish) for FPC2 incubation
2022-12-07	22:17:01	-125.87171	14.11101	4533.68	 Sea cucumber selected for FPC2 incubation 20221207_221701_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:17:09	-125.87171	14.11101	4533.7	Sea cucumber selected for FPC2 incubation (photo not displayed) 20221207_221709_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:21:06	-125.87168	14.11104	4533.89	FPC2 placed above sea cucumber
2022-12-07	22:22:42	-125.87166	14.11108	4533.94	 FPC2 on the seafloor 20221207_222242_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:27:13	-125.87170	14.11104	4534.49	FPC2 pressed deeper into sediment
2022-12-07	22:27:33	-125.87171	14.11107	4534.49	First (middle) syringe with labeled phytodetritus pressed down
2022-12-07	22:27:43	-125.87172	14.11110	4534.49	Second syringe pressed down
2022-12-07	22:28:38	-125.87176	14.11114	4534.49	Third syringe pressed down

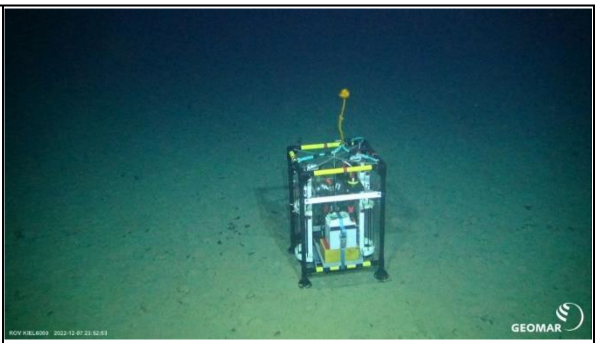
2022-12-07	22:29:03	-125.87176	14.11114	4534.5	 FPC2 on the seafloor with injected syringes 20221207_222903_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:29:12	-125.87176	14.11113	4534.51	FPC2 on the seafloor with injected syringes (photo not displayed) 20221207_222912_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:34:17	-125.87168	14.11109	4534.55	Starting megafauna sampling with focus on sea cucumbers
2022-12-07	22:36:53	-125.87164	14.11108	4534.24	Sea cucumber
2022-12-07	22:36:56	-125.87164	14.11108	4534.24	 Sea cucumber selected for sampling (with laser points) 20221207_223656_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:37:02	-125.87162	14.11108	4534.25	 Sea cucumber selected for sampling 20221207_223702_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:40:55	-125.87164	14.11108	4534.84	Sea cucumber collected
2022-12-07	22:42:35	-125.87161	14.11114	4534.85	Sea cucumber placed in left compartment of ICBM Biobox extra large, MEGA75Seacucumber
2022-12-07	22:47:48	-125.87174	14.11082	4533.1	Two sponges
2022-12-07	22:53:43	-125.87189	14.11091	4532.06	Two Sea cucumbers in sight
2022-12-07	22:54:03	-125.87189	14.11092	4532.06	 2 sea cucumbers selected for sampling 20221207_225403_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:54:11	-125.87189	14.11092	4532.05	Two sea cucumbers selected for sampling (photo not displayed)

					20221207_225411_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:54:34	-125.87189	14.11092	4532.07	 First sea cucumber selected for sampling (with laser points) 20221207_225434_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:54:39	-125.87189	14.11092	4532.07	 First sea cucumber selected for sampling 20221207_225439_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	22:55:40	-125.87191	14.11093	4532.33	Sea cucumber has the same color as the sediment
2022-12-07	22:59:16	-125.87196	14.11095	4533	Collecting holothuria
2022-12-07	23:00:37	-125.87192	14.11097	4533.01	Sea cucumber transferred to left compartment of of ICBM Biobox extra large: MEGA76Seacucumber
2022-12-07	23:00:52	-125.87191	14.11097	4533.02	 Rattail fish 20221207_230052_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:00:53	-125.87191	14.11097	4533.02	Rattail fish
2022-12-07	23:02:59	-125.87184	14.11098	4532.9	 Second sea cucumber selected for sampling (with laser spots) 20221207_230259_Sonne_SO295_163ROV20_Logo_thumb.jpg

2022-12-07	23:03:05	-125.87182	14.11100	4532.93	 Second sea cucumber selected for sampling 20221207_230305_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:05:03	-125.87184	14.11089	4533	Sea cucumber collected
2022-12-07	23:05:51	-125.87184	14.11086	4533	Holothuria placed in right compartment of ICBM Biobox extra large: MEGA77Seacucumber
2022-12-07	23:06:57	-125.87183	14.11083	4533.01	 Sediment mound with stalked sponge (?) 20221207_230657_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:07:15	-125.87181	14.11082	4533.01	Sediment mound with stalked sponge (? photo not displayed) 20221207_230715_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:09:38	-125.87179	14.11080	4532.36	Shrimp
2022-12-07	23:09:51	-125.87180	14.11080	4532.37	 Shrimp 20221207_230951_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:10:01	-125.87180	14.11081	4532.4	 20221207_231001_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:11:06	-125.87182	14.11083	4532.5	Sea cucumber spotted

2022-12-07	23:11:39	-125.87184	14.11083	4532.53	 Sea cucumber selected for sampling (with laser spots) 20221207_231139_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:11:46	-125.87184	14.11083	4532.53	 Sea cucumber selected for sampling 20221207_231146_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:15:30	-125.87180	14.11086	4533.2	Sea cucumber collected and claced in right compartment of ICBM Biobox extra large: MEGA78Seacucumber
2022-12-07	23:16:34	-125.87180	14.11087	4533.2	Small, antenna–shaped part lost upon sampling
2022-12-07	23:23:07	-125.87191	14.11094	4531.61	Heading to Elevator 1 to collect MICP2 for deployment
2022-12-07	23:24:12	-125.87190	14.11109	4531.98	Shrimp
2022-12-07	23:24:36	-125.87188	14.11118	4532.12	 Shrimp 20221207_232436_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:30:23	-125.87206	14.11133	4532.28	MICP2 collected from Elevator 1, searching for appropriate deployment site
2022-12-07	23:37:13	-125.87215	14.11119	4531.9	 First site selected for MICP2 deployment 20221207_233713_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:38:18	-125.87211	14.11115	4531.94	Decided for another deployment site

2022-12-07	23:38:33	-125.87211	14.11115	4531.95	 MICP2 deployment site 20221207_233833_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:41:56	-125.87212	14.11120	4532.05	MICP2 started with Magnet Stick hanging from RigMaster
2022-12-07	23:44:06	-125.87211	14.11115	4532.07	MICP2 positioned on the seafloor: deployment MICP2-1
2022-12-07	23:44:59	-125.87207	14.11115	4532.14	 MICP2 at seafloor (close up) 20221207_234459_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:46:38	-125.87208	14.11122	4532.11	 MICP2 at seafloor 20221207_234638_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:46:59	-125.87208	14.11123	4531.92	Heading to MICP-DEEP1 to collect instrument on porch
2022-12-07	23:51:10	-125.87211	14.11113	4530.92	 MICP-DEEP1 prior to recovery 20221207_235110_Sonne_SO295_163ROV20_Logo_thumb.jpg

2022-12-07	23:52:53	-125.87207	14.11116	4531.91	 MICP-DEEP1 prior to recovery 20221207_235253_Sonne_SO295_163ROV20_Logo_thumb.jpg
2022-12-07	23:59:17	-125.87201	14.11111	4532.34	MIC-DEEP1 collected onto porch
2022-12-08	00:06:51	-125.87196	14.11111	4532.39	MIC-DEEP1 secured with manipulators
2022-12-08	00:10:48	-125.87198	14.11121	4529.92	End of scientific program, ascending
2022-12-08	00:11:19	-125.87205	14.11110	4522.82	OFF THE BOTTOM
2022-12-08	02:07:39	None	None	None	ON DECK

Kiel 6000 Dive 21 (SO295_185-1_ROV-21)

Date: 11.Dec.2022

Principal Investigators: Sabine Gollner

Observers: Brenda Esteban, Carsten Rühlemann, Lilian Böringer

Protocol: Brenda Esteban

ROV positions (at the bottom)
Start of dive: 14°2.059' N 125°55.370' W
End of dive: 14°2.051' N 125°55.341' W

Dive duration:
ROV in the water: 11.Dec.2022 17:24:33
ROV at the bottom: 11.Dec.2022 19:14:48
ROV off the bottom: 12.Dec.2022 00:18:33
ROV on deck: 12.Dec.2022 02:10:55

Explored sites: BEL reference area

Aims of the Dive:

- Push Core (PUC) sampling (2 cores each at 2 sites).
- Megafauna sampling
- Bottom water sampling mit Niskin bottles

Handled ROV Tools (including scientific payload):

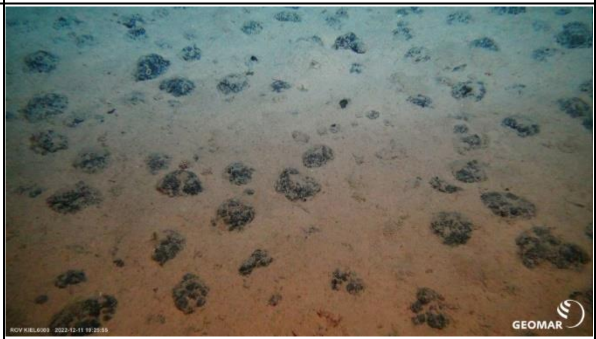
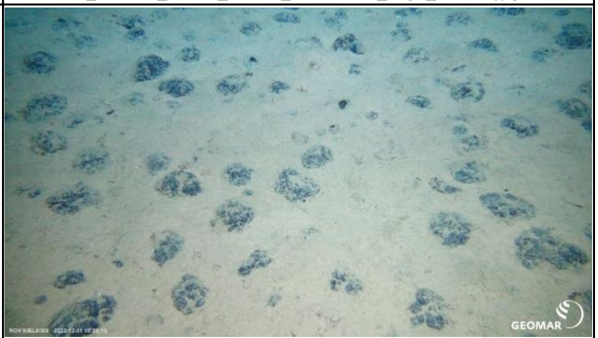
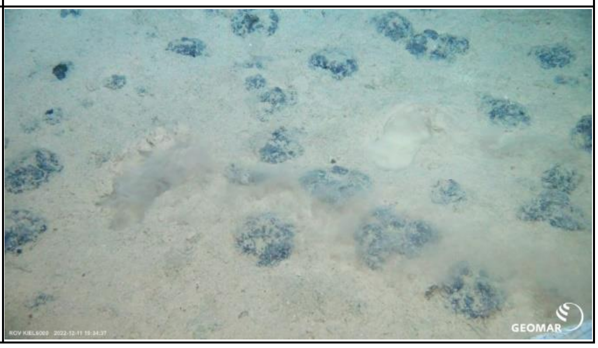
- 16 PUCs in 16 Core Rack
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- Magnet Stick
- ICBM Biobox extra large
- 3 Niskin bottles

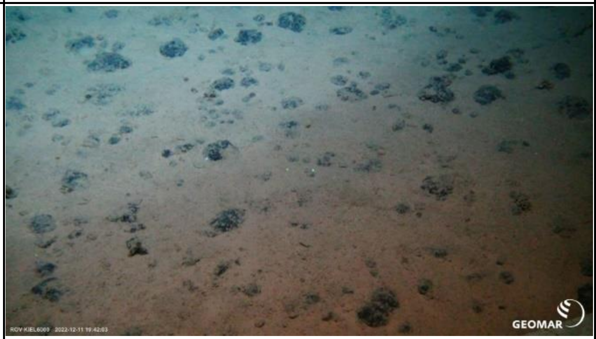
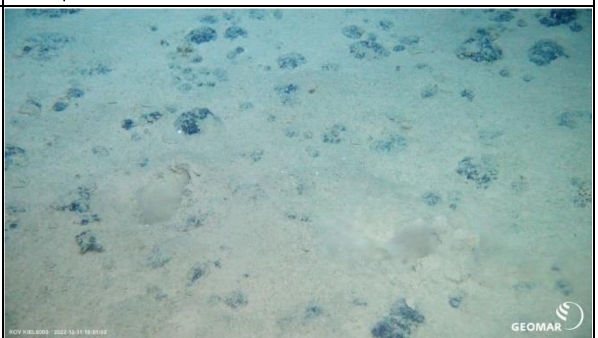
Relevant Elevator payload

no elevator used during the dive

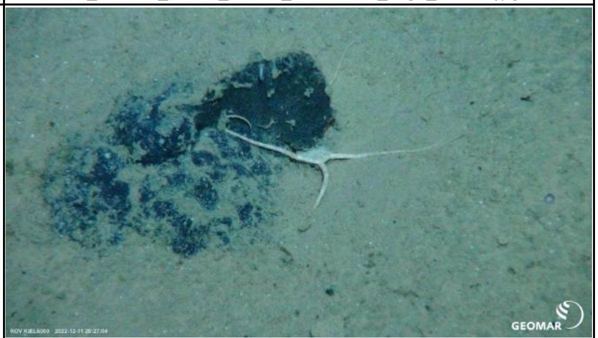
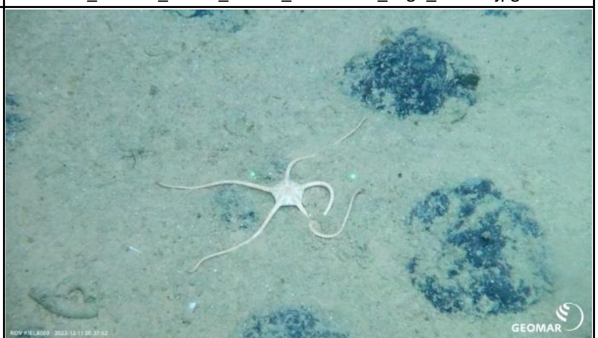
Dive summary

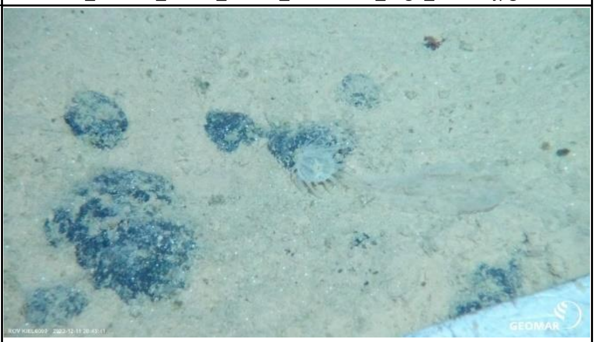
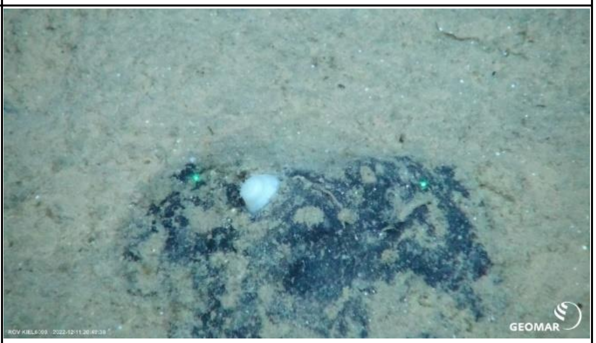
The ROV descended with 3 Niskin bottles arriving at the seafloor at about 300 m Northeast of a 20 m long GSR mooring deployed in 2021. Once the ROV was at the position for PUC sampling (site A), 2 PUCs were taken. After moving approx. 40 meters for the second PUC sampling position (site B) two further PUCs were collected. After that, sampling of megafauna specimen started, with brittle stars, anemones, and sponges as target groups. For each specimen collected, the surrounding area was described in terms of coverage and size of nodules. Other fauna observed during the dive were tubeworms, brittle stars, anemones and sea cucumbers. After fauna sampling finished, the Niskin bottles were closed at approx. 10m above the seafloor after which the ROV ascended.

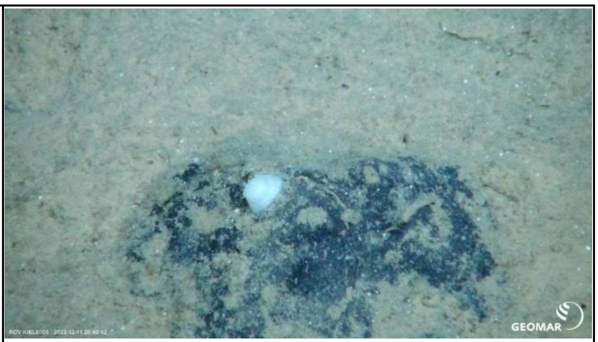
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-11	17:24:33	None	None	None	IN THE WATER
2022-12-11	19:14:48	-125.92284	14.03431	4582.22	AT THE BOTTOM
2022-12-11	19:25:45	-125.92280	14.03439	4585.85	PUC site A prior to coring (photo not displayed) 20221211_192545_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	19:25:50	-125.92280	14.03439	4585.85	First action: PUC sampling
2022-12-11	19:25:55	-125.92279	14.03439	4585.85	 PUC site A prior to coring 20221211_192555_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	19:26:13	-125.92279	14.03438	4585.83	 PUC site A prior to coring (close up) 20221211_192613_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	19:26:30	-125.92280	14.03439	4585.82	PUC sampling start at site A with PUCs from 16 Core Rack
2022-12-11	19:29:16	-125.92274	14.03438	4585.81	PUCC8 deployed.
2022-12-11	19:30:13	-125.92275	14.03436	4585.78	PUCC2 deployed.
2022-12-11	19:30:27	-125.92277	14.03434	4585.77	 PUC site A with deployed cores 20221211_193027_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	19:30:41	-125.92279	14.03433	4585.77	Retrieving PUCs back into 16 Core Rack
2022-12-11	19:32:59	-125.92285	14.03439	4585.73	PUCC2 retrieved
2022-12-11	19:34:05	-125.92277	14.03445	4585.75	PUC C8 retrieved
2022-12-11	19:34:37	-125.92288	14.03445	4585.74	

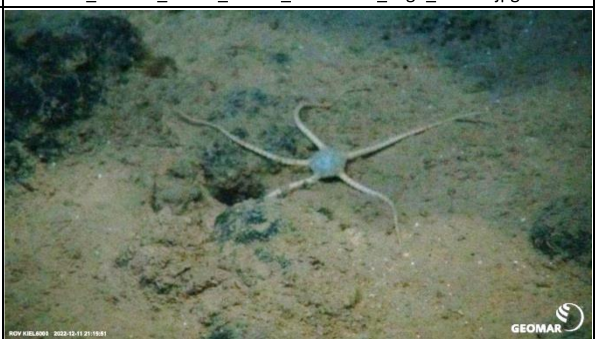
					PUC site A post coring 20221211_193437_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	19:34:56	-125.92288	14.03445	4585.73	Next action: moving to PUC site B for sampling more PUCs
2022-12-11	19:42:03	-125.92281	14.03480	4585.67	 PUC site B prior to coring 20221211_194203_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	19:42:16	-125.92281	14.03480	4585.67	PUC sampling start at site B with PUCs from 16 Core Rack
2022-12-11	19:44:37	-125.92283	14.03475	4585.62	PUCC6 deployed
2022-12-11	19:46:34	-125.92280	14.03485	4585.62	PUCCO deployed
2022-12-11	19:47:00	-125.92278	14.03491	4585.64	 PUC site B with deployed cores 20221211_194700_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	19:47:11	-125.92281	14.03490	4585.65	Retrieving PUCs back into 16 Core Rack
2022-12-11	19:48:25	-125.92284	14.03490	4585.62	PUCCO and PUCC6 retrieved
2022-12-11	19:49:38	-125.92281	14.03484	4585.61	PUC site B has a mix of large and small nodules, medium coverage with some spaces
2022-12-11	19:51:02	-125.92281	14.03474	4585.57	 PUC site B post coring 20221211_195102_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	19:52:16	-125.92278	14.03469	4584.43	Next action: megafauna sampling
2022-12-11	19:58:12	-125.92280	14.03484	4585.41	 Brittle star selected for sampling (with laser spots)

					20221211_195812_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	19:58:20	-125.92280	14.03484	4585.49	 Brittle star selected for sampling (partially below nodule) 20221211_195820_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:02:11	-125.92285	14.03464	4585.59	Site description: medium coverage, mix of big and small nodules
2022-12-11	20:03:05	-125.92285	14.03464	4585.58	Brittle star collected and transferred into ICBM Biobox extra large: MEGA79Brittlestar
2022-12-11	20:09:44	-125.92283	14.03506	4585.54	Two anemones selected for sampling (photo not displayed) 20221211_200944_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:09:53	-125.92284	14.03506	4585.54	 Two close by anemones selected for sampling 20221211_200953_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:09:59	-125.92284	14.03506	4585.54	 Two close by anemones selected for sampling 20221211_200959_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:11:11	-125.92285	14.03507	4585.5	Site description: coverage more dense than MEGA79 sampling site, but still with some empty patches. Most nodules are big.
2022-12-11	20:13:10	-125.92290	14.03507	4585.48	First anemone collected and transferred into ICBM Biobox extra large: MEGA80Anemone
2022-12-11	20:16:05	-125.92300	14.03489	4585.43	Second anemone collected and transferred into ICBM Biobox extra large: MEGA81Anemone
2022-12-11	20:19:31	-125.92290	14.03500	4585.42	 Sponge selected for sampling (with laser spots)

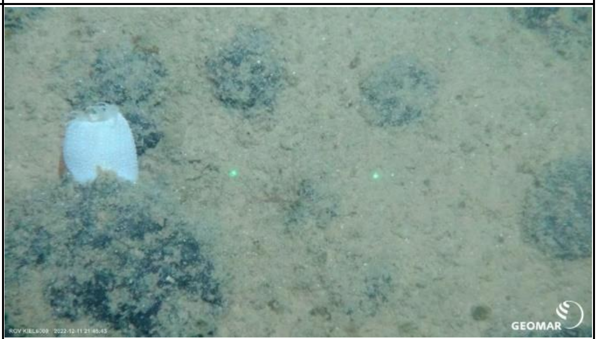
					20221211_201931_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:19:37	-125.92290	14.03500	4585.43	 Sponge selected for sampling 20221211_201937_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:20:47	-125.92286	14.03506	4585.45	Site description: big nodules, coverage medium with some empty patches
2022-12-11	20:24:09	-125.92285	14.03512	4585.44	Sponge collected and transferred into ICBM Biobox extra large: MEGA82Sponge
2022-12-11	20:26:59	-125.92287	14.03507	4585.37	 Brittle star selected for sampling (with laser spots) 20221211_202659_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:27:04	-125.92287	14.03507	4585.38	 Brittle star selected for sampling (partially beneath nodule) 20221211_202704_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:28:29	-125.92289	14.03506	4585.4	Site description: big nodules and medium coverage, some empty patches.
2022-12-11	20:30:55	-125.92291	14.03509	4585.38	Unsuccessful attempt to sample Brittle star: lost upon transfer to Biobox.
2022-12-11	20:37:46	-125.92286	14.03512	4585.28	Brittle star selected for sampling (photo not displayed) 20221211_203746_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:37:52	-125.92286	14.03512	4585.28	 Brittle star selected for sampling (with laser spots) 20221211_203752_Sonne_SO295_185ROV21_Logo_thumb.jpg

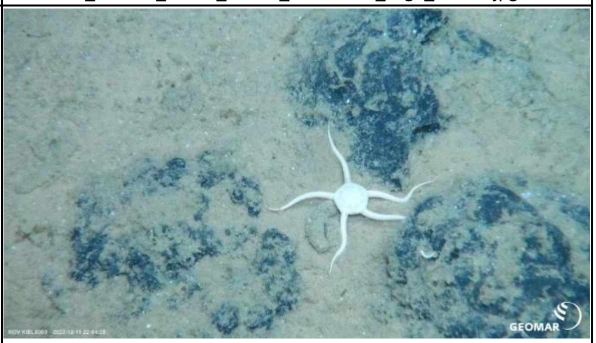
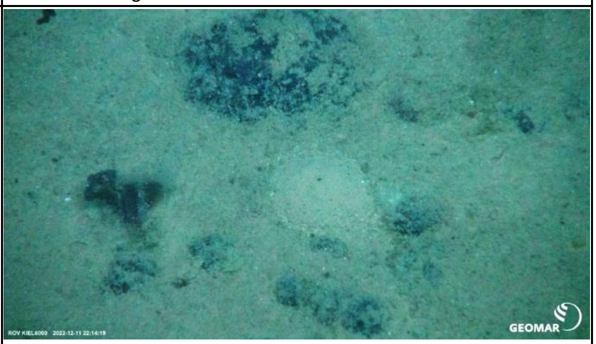
2022-12-11	20:37:59	-125.92286	14.03512	4585.29	 Brittle star selected for sampling 20221211_203759_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:38:17	-125.92286	14.03513	4585.31	Hand net used for sampling (?)
2022-12-11	20:39:45	-125.92282	14.03516	4585.33	Site description (also valid for MEGA85): higher coverage of big nodules
2022-12-11	20:40:59	-125.92285	14.03507	4585.31	Brittle star collected and transferred into ICBM Biobox extra large: MEGA84Brittlestar
2022-12-11	20:43:35	-125.92287	14.03505	4585.3	 Anemone selected for sampling (with laser spots) 20221211_204335_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:43:41	-125.92287	14.03505	4585.3	 Anemone selected for sampling 20221211_204341_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:47:54	-125.92275	14.03501	4585.3	Anemone collected and transferred to ICBM Biobox extra large: MEGA85Anemone
2022-12-11	20:49:30	-125.92275	14.03498	4585.29	 Anemone selected for sampling (with laser spots) 20221211_204930_Sonne_SO295_185ROV21_Logo_thumb.jpg

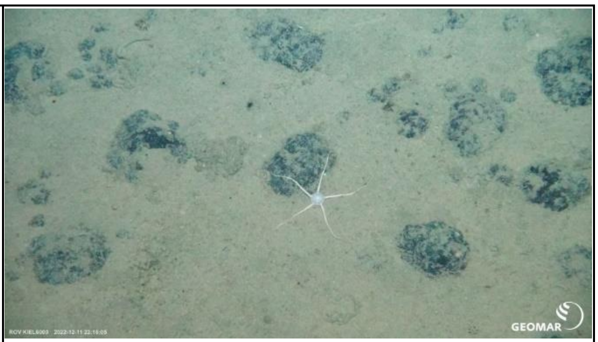
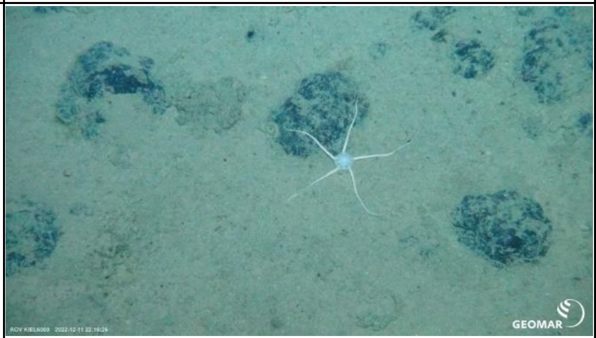
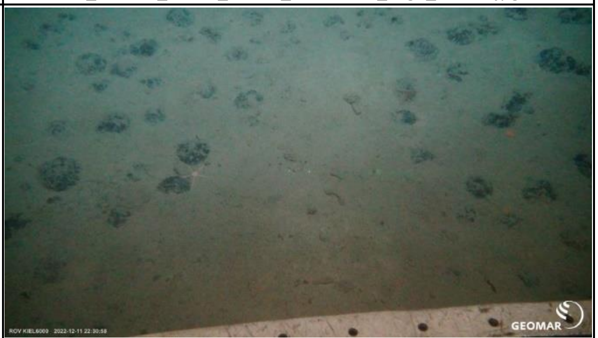
2022-12-11	20:49:42	-125.92275	14.03498	4585.29	 Anemone selected for sampling 20221211_204942_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	20:54:08	-125.92271	14.03505	4585.3	Anemone collected and transferred into right compartment of ICBM Biobox extra large: MEGA86Anemone
2022-12-11	20:57:42	-125.92273	14.03497	4584.79	Fish
2022-12-11	21:00:44	-125.92266	14.03502	4585.15	 Anemone selected for sampling (with laser spots) 20221211_210044_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:00:52	-125.92266	14.03502	4585.2	 Anemone selected for sampling 20221211_210052_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:04:41	-125.92273	14.03495	4585.22	Site description: big nodules, medium coverage as far as visible
2022-12-11	21:06:19	-125.92270	14.03501	4585.21	Anemone collected and transferred to right compartment of ICBM Biobox extra large: MEGA87Anemone
2022-12-11	21:08:14	-125.92270	14.03505	4585.14	 Anemone selected for sampling (with laser spots?) 20221211_210814_Sonne_SO295_185ROV21_Logo_thumb.jpg

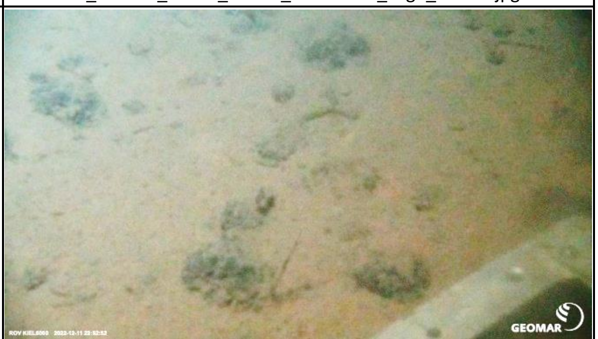
2022-12-11	21:08:40	-125.92271	14.03504	4585.23	 Anemone selected for sampling 20221211_210840_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:08:46	-125.92271	14.03505	4585.24	Anemone is sitting on an old sponge
2022-12-11	21:08:55	-125.92270	14.03506	4585.25	 Anemone selected for sampling (close up) 20221211_210855_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:10:22	-125.92272	14.03502	4585.25	Site desciption: big nodules, medium to high coverage
2022-12-11	21:13:28	-125.92271	14.03502	4585.28	Anemone collected and transferred into left compartment of ICBM Biobox extra large: MEGA88Anemone
2022-12-11	21:15:01	-125.92277	14.03506	4585.27	Brittle star selected for sampling (photo not displayed) 20221211_211501_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:15:33	-125.92277	14.03507	4585.28	 Brittle star selected for sampling (with laser spots) 20221211_211533_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:15:51	-125.92277	14.03506	4585.28	 Brittle star selected for sampling 20221211_211551_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:16:53	-125.92274	14.03508	4585.29	Site description: big nodules, medium to high coverage
2022-12-11	21:18:42	-125.92276	14.03512	4585.24	Brittle star collected and transferred into right compartment of ICBM Biobox extra large: MEGA89Brittlestar

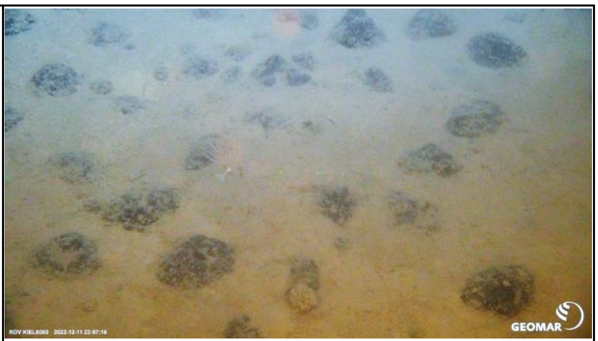
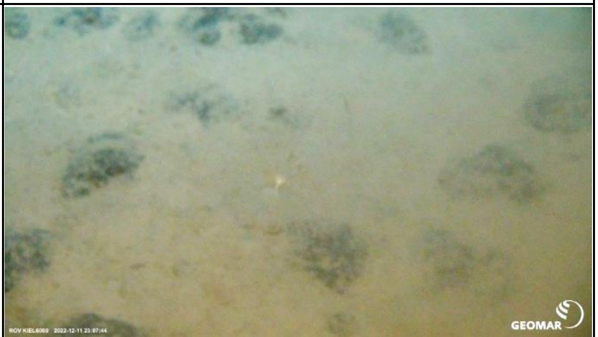
2022-12-11	21:22:09	-125.92279	14.03507	4585.18	 Anemone selected for sampling (with laser points?) 20221211_212209_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:22:34	-125.92281	14.03508	4585.2	Anemone selected for sampling (photo not displayed) 20221211_212234_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:22:39	-125.92282	14.03509	4585.2	 Anemone selected for sampling 20221211_212239_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:23:03	-125.92282	14.03509	4585.21	 Anemone selected for sampling 20221211_212303_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:27:54	-125.92284	14.03506	4585.23	Anemone collected and transferred into left compartment of ICBM Biobox extra large: MEGA90Anemone
2022-12-11	21:32:33	-125.92266	14.03498	4585.12	 Sponge selected for sampling (with laser spots) 20221211_213233_Sonne_SO295_185ROV21_Logo_thumb.jpg

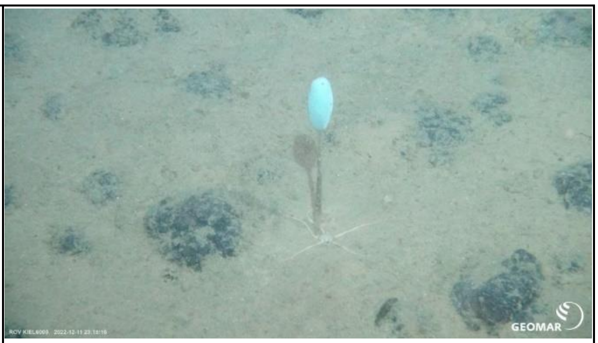
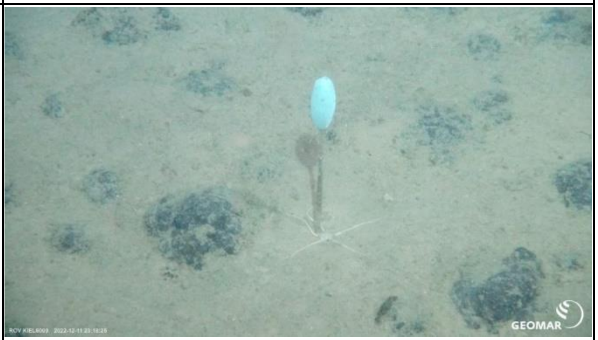
2022-12-11	21:32:54	-125.92264	14.03498	4585.16	 Sponge selected for sampling 20221211_213254_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:37:25	-125.92269	14.03501	4585.1	Site description: big nodules, medium coverage
2022-12-11	21:39:37	-125.92271	14.03499	4585.1	Sponge lost during sampling
2022-12-11	21:45:43	-125.92259	14.03496	4585.1	 Coral selected for sampling (with laser spots) 20221211_214543_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:46:06	-125.92259	14.03495	4585.1	 Brittle star selected for sampling (with laser spots) 20221211_214606_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:46:13	-125.92259	14.03495	4585.1	 Brittle star selected for sampling 20221211_214613_Sonne_SO295_185ROV21_Logo_thumb.jpg

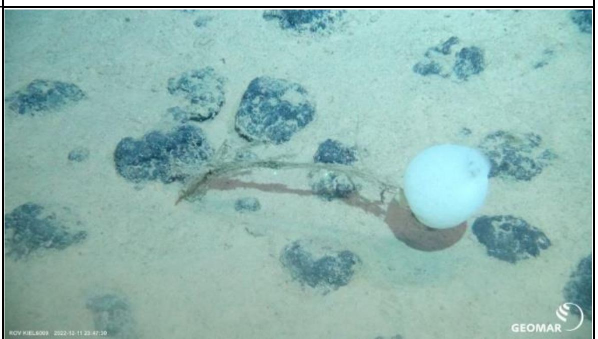
2022-12-11	21:46:56	-125.92260	14.03494	4585.1	 20221211_214656_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	21:54:37	-125.92250	14.03494	4585.09	Attempt to collect coral into left compartment of ICBM Biobox extra large. Later it turned out that it was lostbiobox left.
2022-12-11	22:01:09	-125.92254	14.03493	4585.07	Site description (valid for coral and MEGA93): big nodules, medium coverage.
2022-12-11	22:01:23	-125.92254	14.03492	4585.07	Brittle star collected and transferred into right compartment of ICBM Biobox extra large: MEGA93Brittlestar
2022-12-11	22:03:52	-125.92249	14.03489	4585.03	 Brittle star selected for sampling (with laser spots) 20221211_220352_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:04:28	-125.92249	14.03489	4585.07	 Brittle star selected for sampling 20221211_220428_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:04:33	-125.92249	14.03489	4585.07	Brittle star selected for sampling (photo not displayed) 20221211_220433_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:06:12	-125.92250	14.03486	4585.09	Site description: big nodules, medium to high coverage
2022-12-11	22:09:38	-125.92247	14.03496	4585.06	Brittle star collected and transferred into right compartment of ICBM Biobox extra large: MEGA94Brittlestar
2022-12-11	22:14:19	-125.92241	14.03488	4584.14	 Small mound 20221211_221419_Sonne_SO295_185ROV21_Logo_thumb.jpg

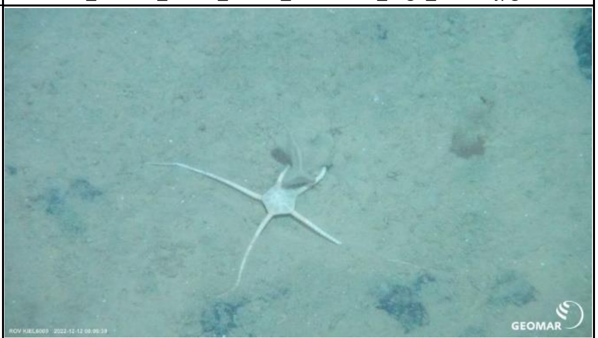
2022-12-11	22:16:05	-125.92243	14.03487	4584.21	 Brittle star selected for sampling (with laser spots?) 20221211_221605_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:16:26	-125.92242	14.03488	4584.36	 Brittle star selected for sampling 20221211_221626_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:19:42	-125.92247	14.03491	4585.08	Fish
2022-12-11	22:23:31	-125.92250	14.03489	4585.04	Brittle star collected and transferred into right compartment of ICBM Biobox extra large: MEGA95Brittlestar
2022-12-11	22:30:50	-125.92251	14.03473	4584.33	Sediment pile (photo not displayed) 20221211_223050_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:30:58	-125.92250	14.03473	4584.34	 Sediment pile 20221211_223058_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:31:18	-125.92250	14.03472	4584.35	Sediment pile with holes.
2022-12-11	22:31:40	-125.92249	14.03470	4584.35	 Sea cucumber (with laser spots) 20221211_223140_Sonne_SO295_185ROV21_Logo_thumb.jpg

2022-12-11	22:35:32	-125.92253	14.03463	4584.4	 Two anemones 20221211_223532_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:37:30	-125.92253	14.03458	4584.45	 Shrimp 20221211_223730_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:49:46	-125.92268	14.03427	4584.64	Coral spotted
2022-12-11	22:50:50	-125.92266	14.03429	4585.23	Sediment cloud evolved after landing
2022-12-11	22:52:32	-125.92273	14.03433	4585.31	Coral selected for sampling (photo not displayed) 20221211_225232_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:52:41	-125.92273	14.03433	4585.31	 Coral selected for sampling (with laser spots) 20221211_225241_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:52:52	-125.92273	14.03434	4585.31	 Coral selected for sampling 20221211_225252_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	22:55:51	-125.92279	14.03441	4585.32	Coral collected and transferred into right compartment of ICBM Biobox extra large: MEGA96Coral
2022-12-11	22:56:55	-125.92276	14.03442	4584.84	Site description: big nodules, medium coverage
2022-12-11	22:59:38	-125.92268	14.03427	4584.6	Sea cucumber
2022-12-11	23:01:11	-125.92268	14.03422	4584.63	Stalked hydroid growing on a nodule that is referred to as coral for now
2022-12-11	23:04:28	-125.92270	14.03415	4585.27	Sediment cloud evolves after landing

2022-12-11	23:07:16	-125.92265	14.03416	4585.27	 Coral selected for sampling (with laser spots) 20221211_230716_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	23:07:21	-125.92265	14.03416	4585.27	 Coral selected for sampling (with laser spots) 20221211_230721_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	23:07:44	-125.92264	14.03415	4585.27	 Coral selected for sampling (close up) 20221211_230744_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	23:09:54	-125.92267	14.03417	4585.24	Hydroid is growing on a nodule.
2022-12-11	23:10:15	-125.92267	14.03417	4585.24	Site description: medium to large nodules, medium coverage.
2022-12-11	23:12:43	-125.92262	14.03419	4585.25	Coral collected and transferred into left compartment of ICBM Biobox extra large: MEGA97Coral
2022-12-11	23:16:59	-125.92257	14.03412	4584.64	Sponge spotted that appears like cotton candy
2022-12-11	23:18:06	-125.92257	14.03408	4585.28	 Sponge selected for sampling (with laser spots, close up) 20221211_231806_Sonne_SO295_185ROV21_Logo_thumb.jpg

2022-12-11	23:18:16	-125.92256	14.03408	4585.3	 Sponge selected for sampling (with laser spots) 20221211_231816_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	23:18:25	-125.92255	14.03408	4585.31	 Sponge selected for sampling 20221211_231825_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	23:21:15	-125.92255	14.03410	4585.32	Site description: medium to large nedules, medium coverage
2022-12-11	23:22:02	-125.92256	14.03411	4585.32	Sponge collected and transferred into right compartment of ICBM Biobox extra large: MEGA98Sponge
2022-12-11	23:24:27	-125.92249	14.03419	4584.6	Anemone
2022-12-11	23:26:47	-125.92244	14.03437	4584.68	Tubeworm
2022-12-11	23:27:33	-125.92242	14.03442	4584.69	Brittle star
2022-12-11	23:28:33	-125.92238	14.03448	4584.65	Sea cucumber
2022-12-11	23:28:46	-125.92237	14.03449	4584.64	Sea cucumber
2022-12-11	23:29:59	-125.92233	14.03454	4584.55	Sea cucumber swimming
2022-12-11	23:32:04	-125.92224	14.03457	4584.36	Anemone
2022-12-11	23:32:28	-125.92221	14.03459	4584.32	Another anemone
2022-12-11	23:33:02	-125.92219	14.03463	4584.26	Unknown white material stuck on a nodule
2022-12-11	23:33:45	-125.92219	14.03465	4584.24	Sponge spotted
2022-12-11	23:34:12	-125.92218	14.03466	4584.23	 Sponge selected for sampling (with laser spots) 20221211_233412_Sonne_SO295_185ROV21_Logo_thumb.jpg

2022-12-11	23:34:23	-125.92218	14.03466	4584.22	 Sponge selected for sampling 20221211_233423_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	23:35:11	-125.92216	14.03466	4584.33	Site description: medium to large nodules, medium to no coverage
2022-12-11	23:36:05	-125.92216	14.03461	4584.96	 Sponge selected for sampling (close up, with laser spots) 20221211_233605_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	23:36:52	-125.92215	14.03460	4585.08	Sponge seems to sit very tightly on nodule without a stalk, diameter approx. 9 cm
2022-12-11	23:38:27	-125.92214	14.03460	4585.04	Landing with very little resuspension of sediment.
2022-12-11	23:41:17	-125.92213	14.03458	4585.09	Sponge collected and transferred into right compartment of ICBM Biobox extra large: MEGA99Sponge
2022-12-11	23:42:03	-125.92213	14.03458	4585.1	Reddish sea cucumber
2022-12-11	23:42:13	-125.92213	14.03458	4585.09	 Reddish sea cucumber 20221211_234213_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	23:44:39	-125.92207	14.03458	4583.97	Beautiful sponge spotted
2022-12-11	23:47:01	-125.92201	14.03453	4584.84	Sponge has a stalk and a balloon-like shape with a diameter of approx. 7 cm
2022-12-11	23:47:30	-125.92200	14.03452	4585.05	 Sponge selected for sampling (with laser spots) 20221211_234730_Sonne_SO295_185ROV21_Logo_thumb.jpg

2022-12-11	23:47:47	-125.92200	14.03452	4585.07	 Sponge selected for sampling 20221211_234747_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-11	23:50:32	-125.92203	14.03456	4585.06	Sponge picked up
2022-12-11	23:52:02	-125.92202	14.03455	4585.05	Sponge transferred into right compartment of ICBM Biobox extra large: MEGA100Sponge
2022-12-11	23:53:02	-125.92203	14.03455	4584.86	Site description: medium to large nodules, medium coverage to no nodules
2022-12-11	23:53:45	-125.92204	14.03453	4584.48	Anemone.
2022-12-11	23:56:58	-125.92213	14.03441	4584.91	Sea cucumber swimming
2022-12-11	23:58:17	-125.92211	14.03437	4584.68	Landing but no megafauna in reach
2022-12-11	23:58:30	-125.92211	14.03437	4584.52	Moving on
2022-12-12	00:00:15	-125.92220	14.03430	4584.54	Anemone on nodule
2022-12-12	00:01:03	-125.92226	14.03428	4584.6	Tiny anemone.
2022-12-12	00:02:25	-125.92227	14.03426	4585.4	Landed with quite some sediment resuspension
2022-12-12	00:08:54	-125.92232	14.03423	4585.6	Brittle star spotted
2022-12-12	00:09:12	-125.92233	14.03423	4585.6	 Brittle star selected for sampling (with laser spots) 20221212_000912_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-12	00:09:21	-125.92233	14.03423	4585.6	Sea cucumber swimming.
2022-12-12	00:09:26	-125.92234	14.03423	4585.6	Brittle star selected for sampling (photo not displayed) 20221212_000926_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-12	00:09:38	-125.92234	14.03423	4585.6	 Brittle star selected for sampling 20221212_000938_Sonne_SO295_185ROV21_Logo_thumb.jpg
2022-12-12	00:12:06	-125.92230	14.03427	4585.6	Brittle star collected and transferred into left compartment of ICBM Biobox extra large: MEGA101Brittlestar
2022-12-12	00:12:28	-125.92230	14.03429	4585.6	Site description: medium to large nodules, medium coverage.
2022-12-12	00:13:19	-125.92230	14.03430	4585.61	Right compartment of ICBM biobox extra large closed and secured with elastic strap
2022-12-12	00:14:19	-125.92230	14.03430	4585.55	Left compartment of iCBM biobox extra large closed and secured with elastic strap
2022-12-12	00:15:51	-125.92232	14.03425	4581.42	End of megafauna sampling.

2022-12-12	00:18:05	-125.92234	14.03421	4578.03	Three niskin bottles closed at approximately 10 m distance to the seafloor in clear water
2022-12-12	00:18:33	-125.92235	14.03419	4575.83	OFF THE BOTTOM
2022-12-12	02:10:55	None	None	None	ON DECK

Kiel 6000 Dive 22   (SO295_190-1_ROV-22)

Date: 12.Dec.2022

Principal Investigators: Patricia Esquete, Sabine Gollner, Felix Janssen

Observers: Amber Henningsen, Carsten Rühlemann, Brenda Esteban, Lilian Böhringer

Protocol: Patricia Esquete

ROV positions (at the bottom)
Start of dive: 14°06.675' N   125°52.322' W
End of dive: 14°06.688' N   125°52.352' W

Dive duration:
ROV in the water: 12.Dec.2022   15:09:14
ROV at the bottom: 12.Dec.2022   16:54:40
ROV off the bottom: 12.Dec.2022   23:30:06
ROV on deck: 13.Dec.2022   01:20:04

Explored sites: BEL collector impact thick

Aims of the Dive:

- Deploy and recover Fiberoptical Microsensor Profiler (MICP-DEEP1)
- *Redeploy and* recover Electrochemical Microsensor Profiler (MICP2)
- Recover 3 Food Pulse Chambers (FPC1, 2, 3), collect Sea cucumbers and sample FPC imprints with Push Cores (PUCs)
- PUC sampling
- Recover Passive Trace Metal Sampler (PSP)
- Megafauna sampling
- Recover Elevator 1

Handled ROV Tools (including scientific payload):

- 16 PUCs in 16 Core Rack
- Magnet Stick
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- IBCM biobox extra large
- 2 Biopots (Larval pots)
- MICP-DEEP1 on descent

Relevant Elevator payload

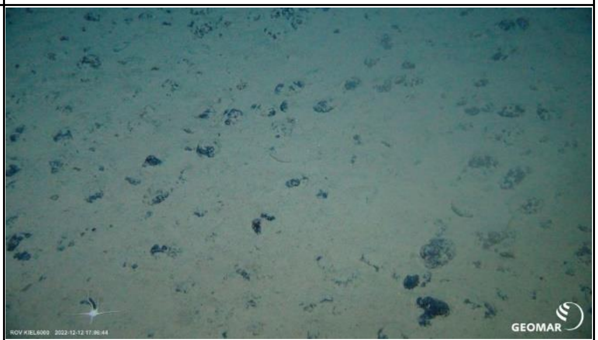
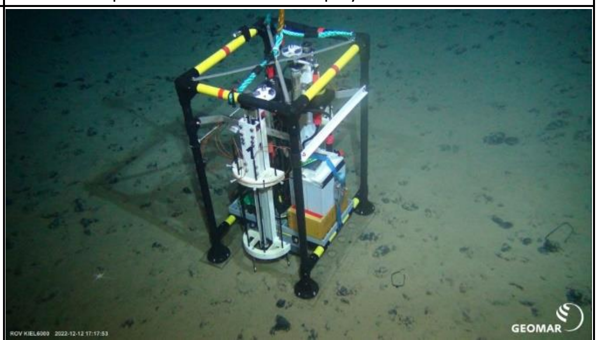
Elevator 1

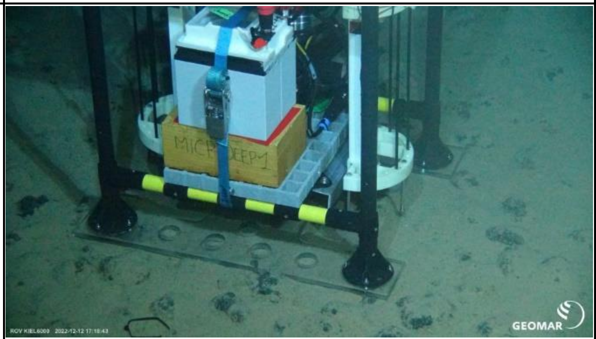
- MICP2
- MICP-DEEP1
- PSP in quiver
- *2 Amphipod traps (AMPHITRAPs)*

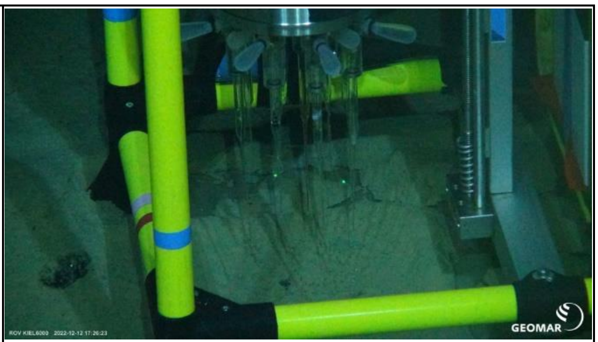
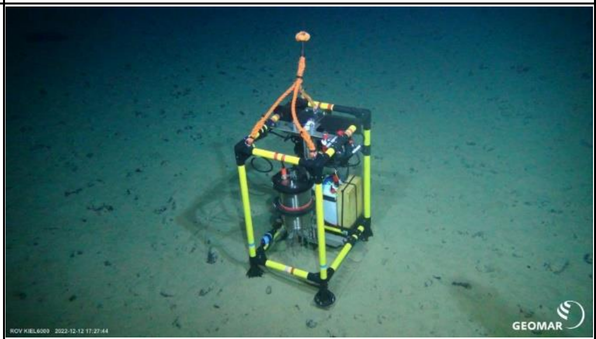
- 3 FPCs in quivers

Dive summary (protocol by Patricia Esquete)

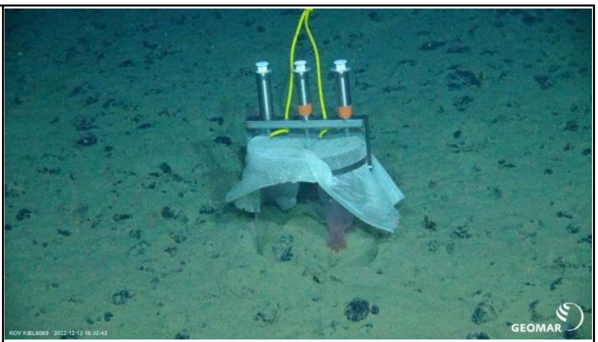
The ROV descended with MICP-DEEP1 on the porch. Upon arrival at the seafloor, MICP-DEEP1 was deployed near the planned PUC site A. MICP2, deployed during dive 20 ran out of power and could not be redeployed. It was hence collected and placed on Elevator 1 for recovery. 3 FPCs (deployed during dive 20) were retrieved, the incubated sea cucumbers collected with the claw / suction pump, and PUCs sampled in the FPC's footprints. Subsequently video transects were carried out, interrupted by PUC sampling. After this, the PSP and MIPC-DEEP1 were collected onto Elevator 1. After collecting a sea cucumber, the Elevator Recovery System was connected to Elevator 1 for retrieval with the ship's cable and the ROV started its ascent.

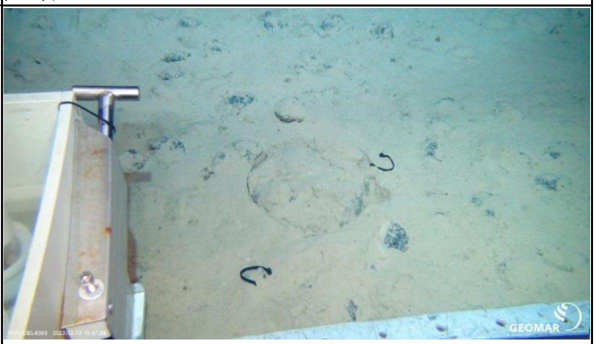
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-12	15:09:14	None	None	None	IN THE WATER
2022-12-12	16:54:40	-125.87204	14.11125	4528.23	AT THE BOTTOM
2022-12-12	17:01:22	-125.87190	14.11125	4532.67	Heading towards assigned PUC Site A to find a suitable deployment spot for MICP-DEEP1
2022-12-12	17:06:44	-125.87174	14.11122	4535.51	 20221212_170644_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	17:11:51	-125.87167	14.11120	4535.51	MICP-DEEP1 taken from porch after being started at 10:08
2022-12-12	17:17:33	-125.87167	14.11119	4535.42	MICP-DEEP1 placed on the seafloor: deployment MICP-DEEP1-1
2022-12-12	17:17:53	-125.87166	14.11118	4535.41	 MICP-DEEP1 at seafloor 20221212_171753_Sonne_SO295_190ROV22_Logo_thumb.jpg

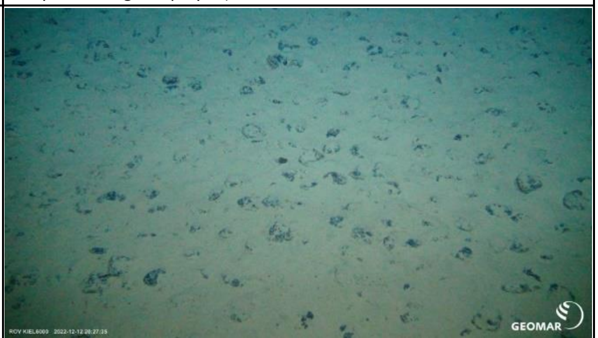
2022-12-12	17:18:18	-125.87166	14.11117	4535.39	 MICP-DEEP1 at seafloor (close up) 20221212_171818_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	17:18:43	-125.87164	14.11116	4535.4	 MICP-DEEP1 at seafloor (close up) 20221212_171843_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	17:18:56	-125.87164	14.11115	4535.41	 MICP-DEEP1 at seafloor (close up) 20221212_171856_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	17:20:42	-125.87163	14.11115	4535.06	Heading towards MICP2, deployed during dive 20
2022-12-12	17:25:22	-125.87213	14.11113	4532.25	 MICP2 prior to recovery 20221212_172522_Sonne_SO295_190ROV22_Logo_thumb.jpg

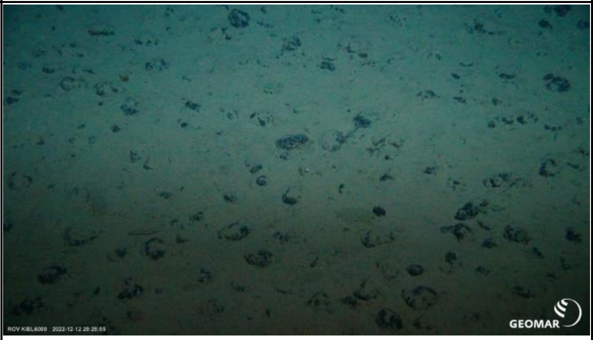
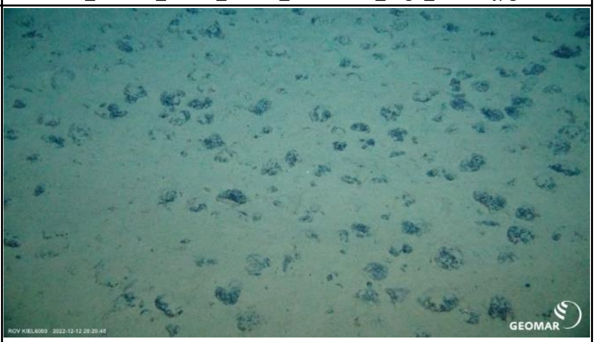
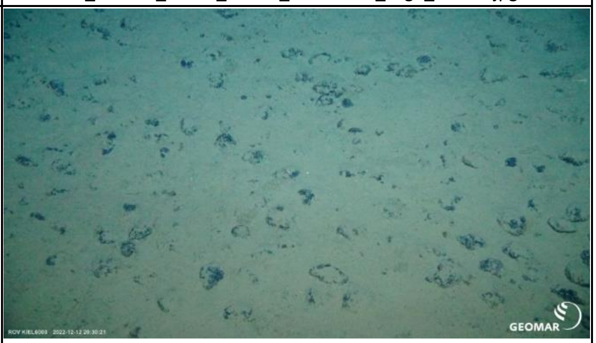
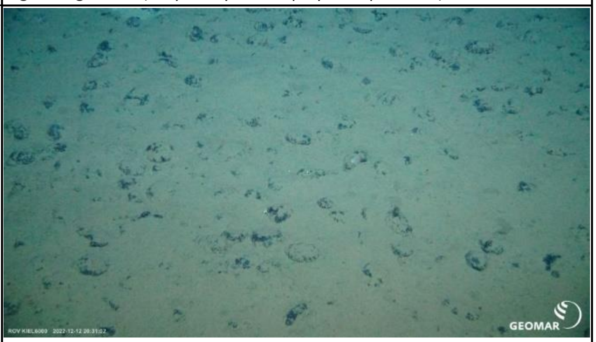
2022-12-12	17:26:23	-125.87217	14.11114	4532.55	 MICP2 prior to recovery (close up) 20221212_172623_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	17:26:35	-125.87218	14.11114	4532.58	MICP2 prior to recovery (photo not displayed) 20221212_172635_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	17:27:44	-125.87219	14.11113	4532.63	 MICP2 prior to recovery 20221212_172744_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	17:27:45	-125.87219	14.11113	4532.63	MICP2 retrieved from seafloor
2022-12-12	17:32:35	-125.87212	14.11138	4532.78	Transporting MICP2 to Elevator 1
2022-12-12	17:45:45	-125.87212	14.11142	4533.02	MICP2 placed on Elevator 1 and secured with elastic straps
2022-12-12	17:49:20	-125.87211	14.11138	4532.22	Heading towards FPC1 for retrieval and sampling
2022-12-12	17:51:49	-125.87185	14.11139	4533.31	FPC1 in view, tilted in sediment
2022-12-12	17:52:37	-125.87182	14.11139	4533.87	 FPC1 prior to recovery 20221212_175237_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	17:56:58	-125.87181	14.11140	4535.9	 FPC1 prior to recovery (close up) 20221212_175658_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	17:58:51	-125.87179	14.11141	4535.89	Lifting of FPC1 with gripper of RigMaster
2022-12-12	17:59:39	-125.87182	14.11140	4535.86	Opening left compartment of ICBM Biobox extra large
2022-12-12	18:01:15	-125.87181	14.11139	4535.83	Sediment quite disturbed

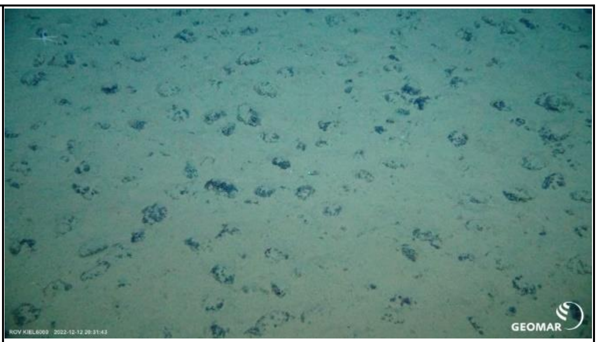
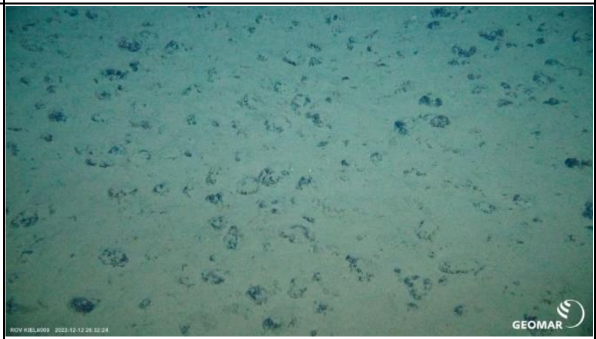
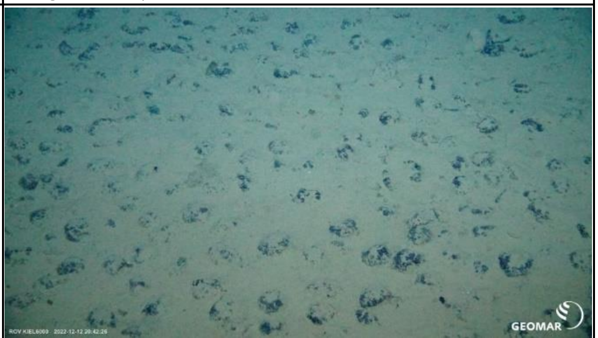
2022-12-12	18:02:01	-125.87181	14.11137	4535.83	Looking for sea cucumber
2022-12-12	18:03:14	-125.87183	14.11135	4535.9	Grabbing sea cucumber with gripper
2022-12-12	18:03:45	-125.87182	14.11135	4535.94	Transferred to left compartment of ICBM Biobox extra large
2022-12-12	18:07:12	-125.87182	14.11139	4535.98	Brittle star collected
2022-12-12	18:07:44	-125.87183	14.11138	4535.97	Stored in right compartment of ICBM Biobox extra large: MEGA106Brittlestar (taken from sample overview table; original notes say 'MEGA102Brittlestar')
2022-12-12	18:07:54	-125.87183	14.11138	4535.97	PUC sampling start in FPC1 imprint with PUCs from 16 Core Rack
2022-12-12	18:08:15	-125.87183	14.11138	4535.97	 FPC1 imprint prior to coring 20221212_180815_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	18:09:26	-125.87180	14.11138	4535.94	PUCC3 deployed
2022-12-12	18:10:11	-125.87182	14.11138	4535.93	PUC68 deployed
2022-12-12	18:10:25	-125.87181	14.11138	4535.93	PUC82 deployed (looks as if it failed)
2022-12-12	18:12:33	-125.87181	14.11138	4535.89	PUCA0 deployed
2022-12-12	18:13:54	-125.87179	14.11132	4535.9	 FPC1 imprint with deployed cores 20221212_181354_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	18:13:55	-125.87179	14.11132	4535.9	Retrieving PUCs back into 16 Core Rack
2022-12-12	18:14:34	-125.87179	14.11133	4535.89	PUC82 retrieved (only 1/3 full)
2022-12-12	18:16:43	-125.87181	14.11139	4535.87	PUC68 retrieved
2022-12-12	18:17:07	-125.87181	14.11138	4535.86	PUCA0 retrieved
2022-12-12	18:19:05	-125.87168	14.11130	4535.79	PUCC3 retrieved
2022-12-12	18:20:35	-125.87164	14.11125	4535.26	Taking FPC1 to Elevator 1
2022-12-12	18:25:48	-125.87196	14.11130	4533.5	FPC1 stored in quiver
2022-12-12	18:28:23	-125.87193	14.11133	4532.87	Heading towards FPC2
2022-12-12	18:31:12	-125.87185	14.11117	4533.63	FPC2 in view
2022-12-12	18:32:28	-125.87173	14.11116	4534.67	 FPC2 prior to recovery (close up) 20221212_183228_Sonne_SO295_190ROV22_Logo_thumb.jpg

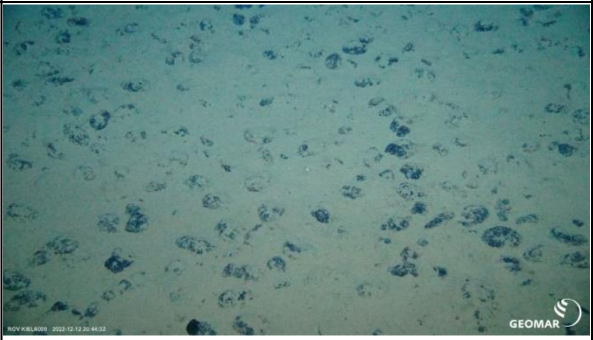
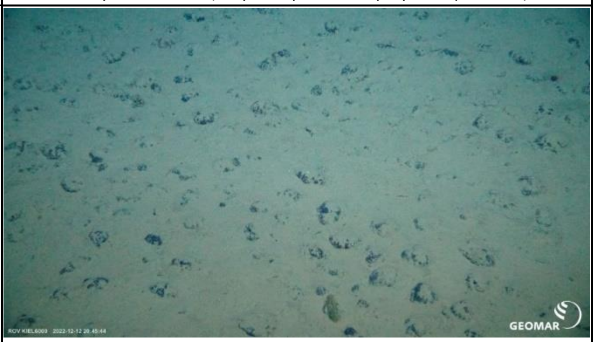
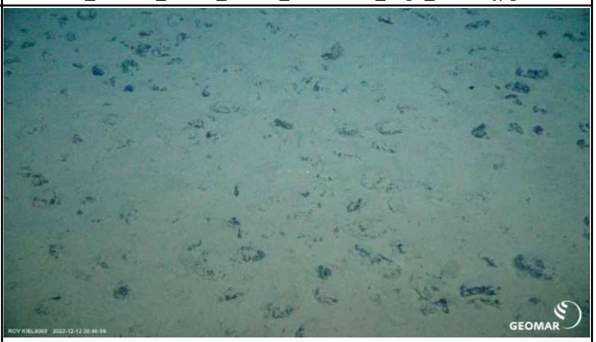
2022-12-12	18:32:43	-125.87173	14.11116	4534.7	 FPC2 prior to recovery 20221212_183243_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	18:32:53	-125.87173	14.11116	4534.73	FPC2 looks better, quite undisturbed
2022-12-12	18:38:34	-125.87174	14.11115	4535.43	Lifting FPC2 off the sediment
2022-12-12	18:47:23	-125.87170	14.11111	4535.42	Sea cucumber grabbed with gripper of right manipulator
2022-12-12	18:49:02	-125.87174	14.11111	4535.4	Sea cucumber transferred successfully into right compartment of ICBM Biobox extra large
2022-12-12	18:52:32	-125.87173	14.11115	4535.37	FPC2 imprint prior to coring (image not displayed) 20221212_185232_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	18:52:37	-125.87173	14.11115	4535.37	 FPC2 imprint prior to coring 20221212_185237_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	18:52:38	-125.87173	14.11115	4535.37	PUC sampling start in FCP2 imprint with PUCs from 16 Core Rack
2022-12-12	18:53:35	-125.87172	14.11115	4535.38	PUCB1 deployed
2022-12-12	18:58:03	-125.87171	14.11115	4535.33	PUC37 deployed, as well as PUC12 and PUC 58
2022-12-12	18:58:28	-125.87170	14.11116	4535.33	 FPC1 imprint with deployed cores 20221212_185828_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	18:58:59	-125.87170	14.11117	4535.32	Retrieving PUCs back into 16 Core Rack
2022-12-12	18:59:13	-125.87170	14.11117	4535.32	PUC12 retrieved
2022-12-12	19:00:33	-125.87172	14.11115	4535.35	PUCB1 retrieved
2022-12-12	19:01:38	-125.87173	14.11115	4535.34	PUC58 retrieved
2022-12-12	19:02:43	-125.87174	14.11115	4535.33	PUC37 retrieved
2022-12-12	19:08:56	-125.87182	14.11120	4533.75	Fish
2022-12-12	19:10:09	-125.87200	14.11127	4533.31	Transporting FPC2 back to Elevator 1
2022-12-12	19:16:05	-125.87211	14.11143	4533.56	FPC2 placed on Elevator 1
2022-12-12	19:18:35	-125.87189	14.11133	4533.17	Heading towards FPC3
2022-12-12	19:19:36	-125.87173	14.11125	4533.18	Nodules appear largely covered by plume sediments
2022-12-12	19:22:24	-125.87136	14.11128	4535.37	FPC3 in view

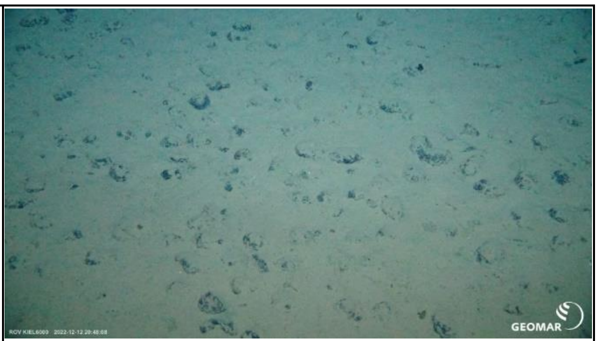
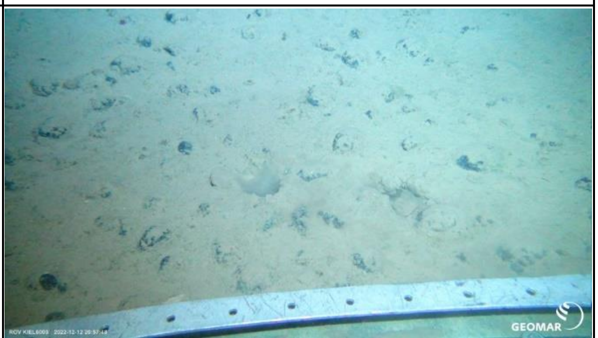
2022-12-12	19:23:47	-125.87137	14.11134	4536.29	 FPC3 prior to recovery 20221212_192347_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	19:25:55	-125.87135	14.11136	4536.74	 FPC3 prior to recovery 20221212_192555_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	19:26:37	-125.87135	14.11136	4537.42	 FPC3 prior to recovery (close up) 20221212_192637_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	19:37:27	-125.87136	14.11139	4538.75	Sea cucumber is swimming at the top part of FPC3
2022-12-12	19:41:29	-125.87128	14.11142	4538.76	FPC3 slightly lifted up with gripper of RigMaster
2022-12-12	19:41:51	-125.87128	14.11142	4538.76	Suction pump nozzle in right-hand manipulator
2022-12-12	19:42:37	-125.87128	14.11142	4538.75	FPC3 lifted off the sediment
2022-12-12	19:42:52	-125.87128	14.11142	4538.74	Sea Cucumber caught with suction pump
2022-12-12	19:45:26	-125.87132	14.11146	4538.71	Sea cucumber transferred to left-hand larval pot (reversing suction pump)
2022-12-12	19:47:58	-125.87128	14.11142	4538.67	 FPC3 imprint prior to coring 20221212_194758_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	19:48:54	-125.87124	14.11138	4538.65	PUC sampling start in FPC3 imprint with PUCs from 16 Core Rack
2022-12-12	19:49:11	-125.87124	14.11138	4538.64	PUC42 deployed
2022-12-12	19:50:39	-125.87125	14.11136	4538.62	PUC17 deployed

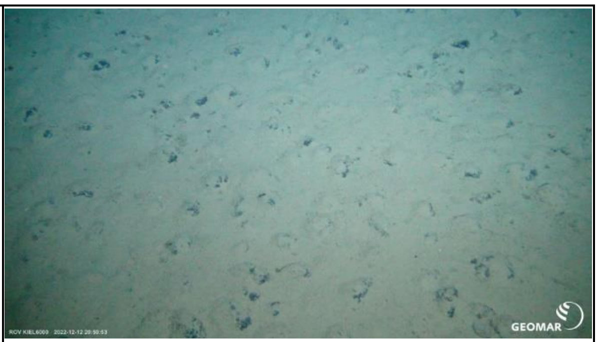
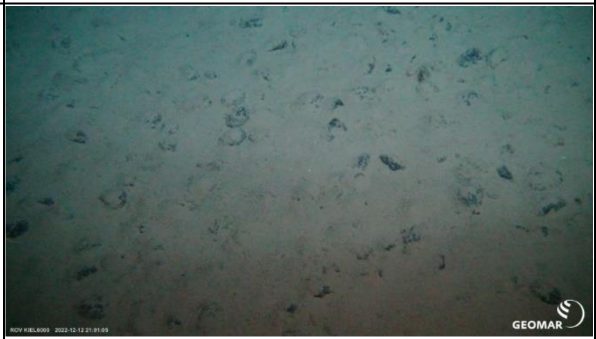
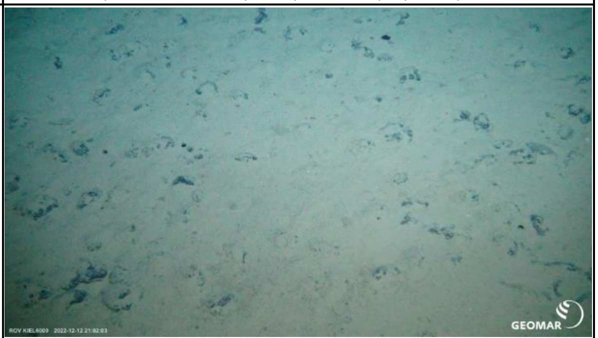
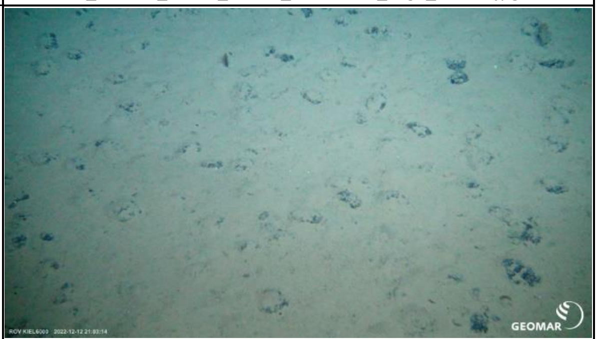
2022-12-12	19:51:15	-125.87125	14.11135	4538.62	PUC6 deployed
2022-12-12	19:52:58	-125.87128	14.11140	4538.62	PUCA9 deployed
2022-12-12	19:53:34	-125.87128	14.11142	4538.62	 FPC3 imprint with deployed cores 20221212_195334_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	19:53:50	-125.87128	14.11142	4538.58	Retrieving PUCs back into 16 Core Rack
2022-12-12	19:55:09	-125.87129	14.11142	4538.48	PUCA9 retrieved
2022-12-12	19:55:54	-125.87127	14.11141	4538.47	PUC42 retrieved
2022-12-12	19:57:51	-125.87124	14.11139	4538.45	PUC6 retrieved
2022-12-12	19:58:11	-125.87125	14.11138	4538.45	PUC17 retrieved
2022-12-12	19:58:39	-125.87125	14.11137	4538.44	 FPC3 imprint post coring 20221212_195839_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:01:32	-125.87133	14.11137	4538.52	3 tie wraps collected from seafloor
2022-12-12	20:05:10	-125.87133	14.11136	4538.53	FPC3 handed over to right-hand manipulator for transport to Elevator 1
2022-12-12	20:10:45	-125.87194	14.11142	4532.97	Elevator 1 in view
2022-12-12	20:13:54	-125.87210	14.11142	4533.21	FPC3 placed on Elevator 1
2022-12-12	20:14:37	-125.87210	14.11143	4533.2	Fish behind Elevator 1
2022-12-12	20:16:47	-125.87209	14.11142	4533.4	FPCs fixed with elastic strap
2022-12-12	20:19:35	-125.87210	14.11141	4533.5	Next action: photo transect
2022-12-12	20:26:57	-125.87192	14.11142	4533.72	Nodules largely covered by plume sediment (imaging series follow - every fifth image displayed)
2022-12-12	20:27:35	-125.87186	14.11144	4533.99	 20221212_202735_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:27:54	-125.87185	14.11144	4534.11	Fish

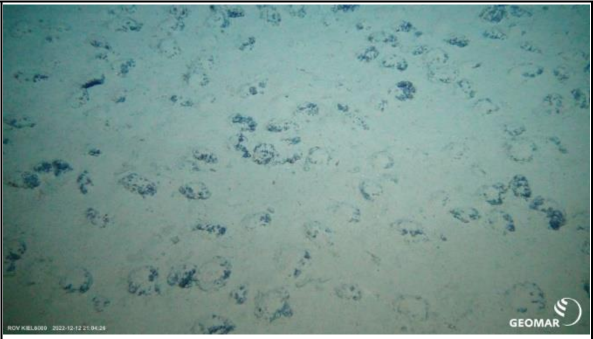
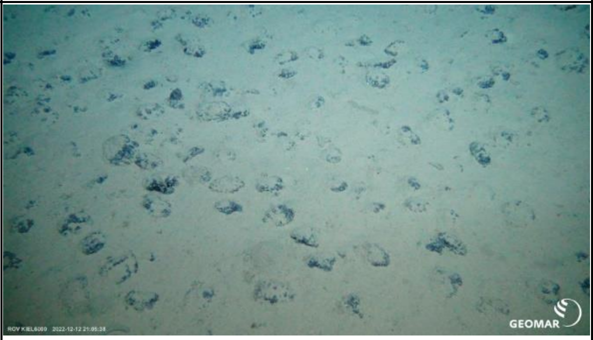
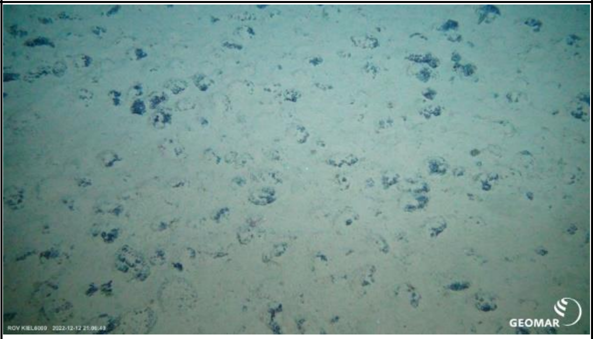
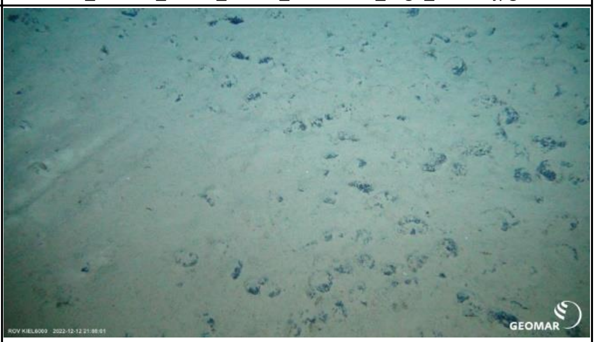
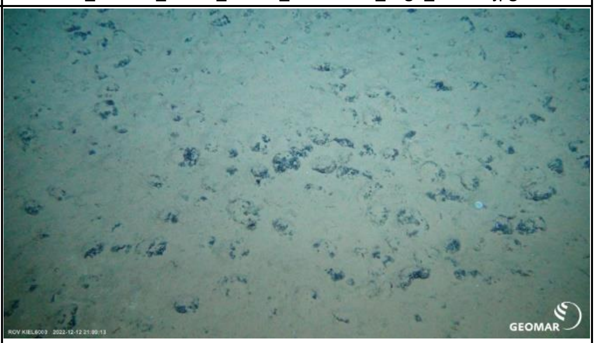
2022-12-12	20:28:27	-125.87181	14.11146	4534.33	 20221212_202827_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:28:55	-125.87177	14.11149	4534.53	 20221212_202855_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:29:40	-125.87172	14.11151	4534.85	 20221212_202940_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:30:21	-125.87169	14.11151	4535.11	 20221212_203021_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:30:34	-125.87167	14.11151	4535.2	ROV moves to MUC position #75 (ca. 200 m), picture every 5 seconds, flight height 1 m (only every 5th displayed in protocol)
2022-12-12	20:31:02	-125.87165	14.11152	4535.42	 20221212_203102_Sonne_SO295_190ROV22_Logo_thumb.jpg

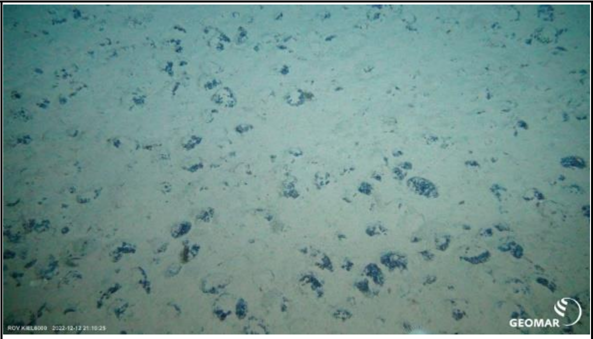
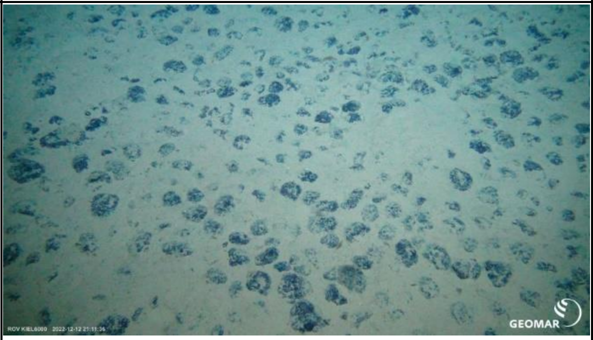
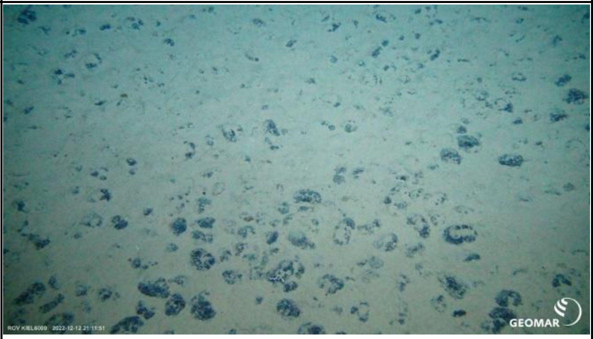
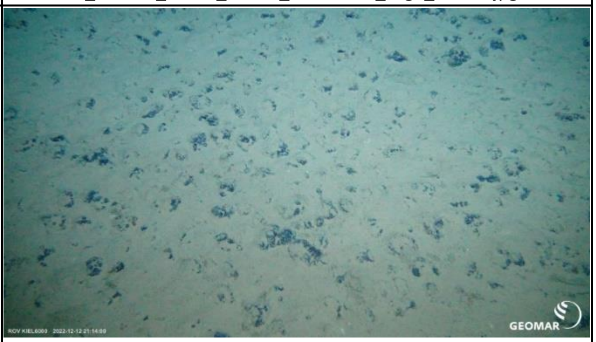
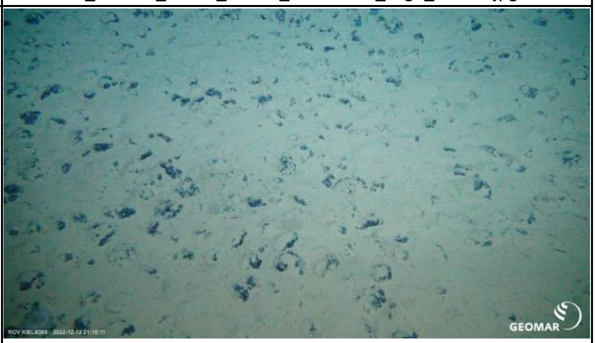
2022-12-12	20:31:43	-125.87162	14.11155	4535.73	 20221212_203143_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:32:24	-125.87161	14.11156	4535.99	 20221212_203224_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:32:45	-125.87160	14.11157	4536.07	ROV stops to store photos on storage drive
2022-12-12	20:42:15	-125.87103	14.11181	4540.13	Storage was not possible
2022-12-12	20:42:26	-125.87102	14.11181	4540.23	 20221212_204226_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:43:01	-125.87097	14.11181	4540.58	 20221212_204301_Sonne_SO295_190ROV22_Logo_thumb.jpg

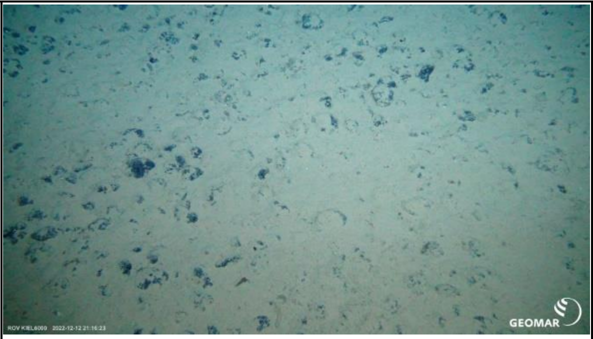
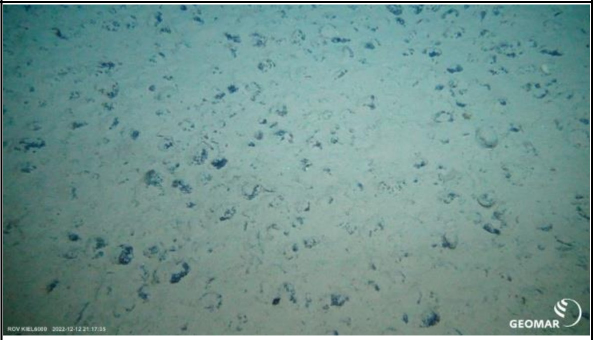
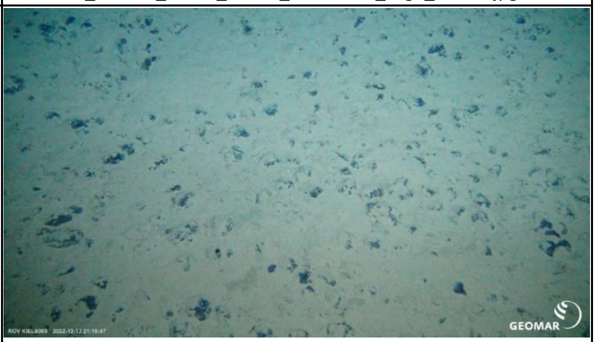
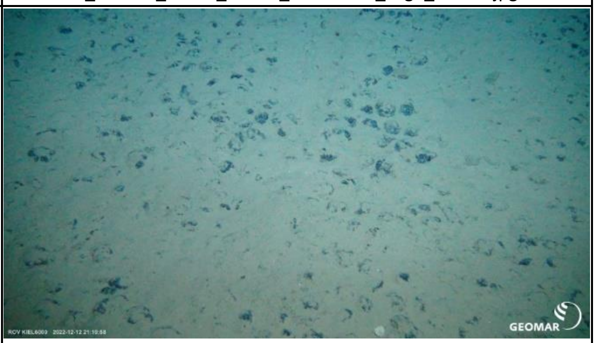
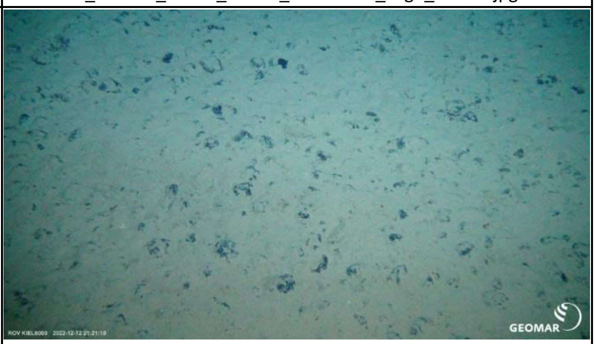
2022-12-12	20:43:43	-125.87092	14.11180	4541	 20221212_204343_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:44:32	-125.87083	14.11181	4541.48	 20221212_204432_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:45:34	-125.87077	14.11181	4542.09	Photos every 14 seconds (only every 5th is displayed in protocol)
2022-12-12	20:45:44	-125.87074	14.11180	4542.17	 20221212_204544_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:46:56	-125.87062	14.11181	4542.75	 20221212_204656_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:47:02	-125.87061	14.11182	4542.81	nodules still largely covered by plume sediment

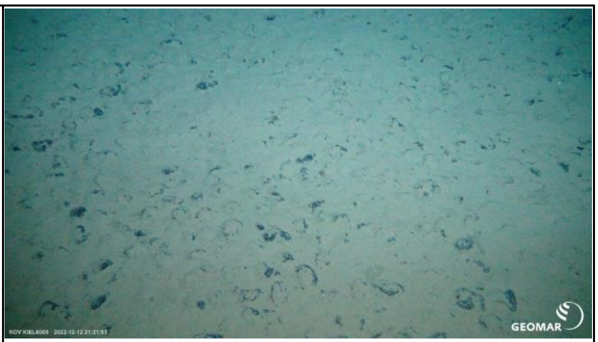
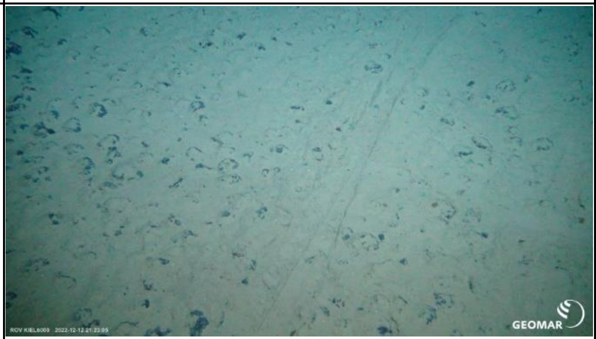
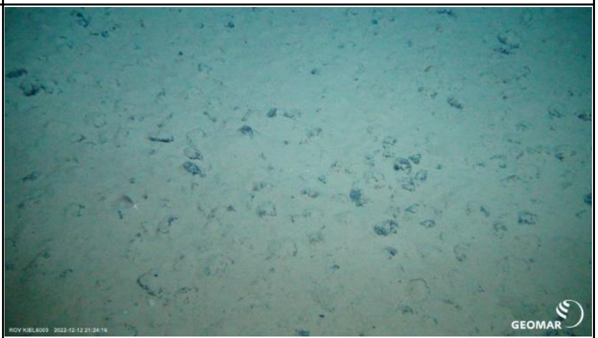
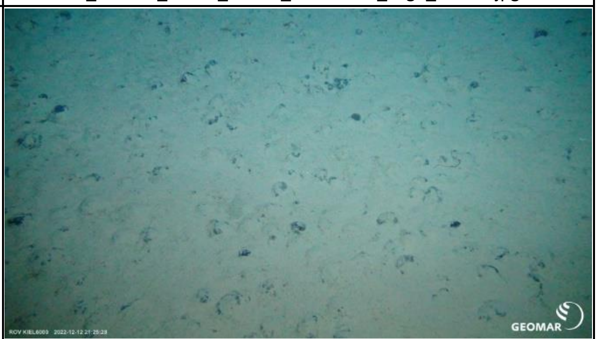
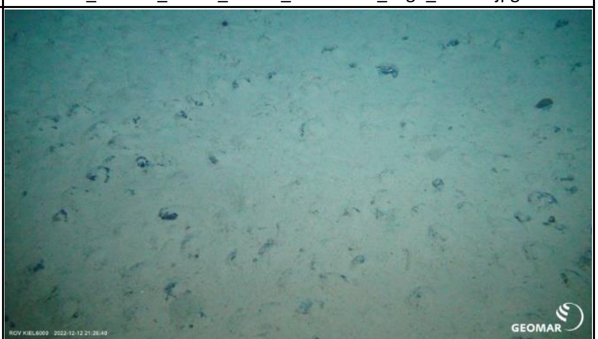
2022-12-12	20:48:08	-125.87057	14.11184	4543.38	 20221212_204808_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:49:19	-125.87051	14.11187	4543.88	 20221212_204919_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:51:20	-125.87043	14.11192	4544.63	Arrived at MUC #75
2022-12-12	20:52:45	-125.87042	14.11191	4545.36	Landing on seafloor, PUC sampling start with PUCs from 16 Core Rack
2022-12-12	20:53:43	-125.87042	14.11191	4545.33	PUCB9 deployed
2022-12-12	20:55:05	-125.87042	14.11192	4545.33	PUC64 deployed
2022-12-12	20:55:05	-125.87042	14.11192	4545.33	 PUC sampling site with deployed cores 20221212_205505_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:55:33	-125.87043	14.11193	4545.36	Retrieving PUCs back into 16 Core Racksediment
2022-12-12	20:56:15	-125.87044	14.11193	4545.37	PUC64 retrieved
2022-12-12	20:57:05	-125.87044	14.11193	4545.37	PUCB9 retrieved
2022-12-12	20:57:48	-125.87043	14.11191	4545.37	 PUC sampling site post coring 20221212_205748_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	20:58:20	-125.87042	14.11192	4545.08	Image series starting again - only every 5th displayed in protocol

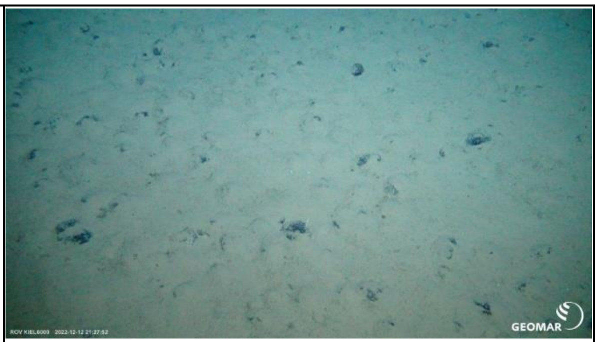
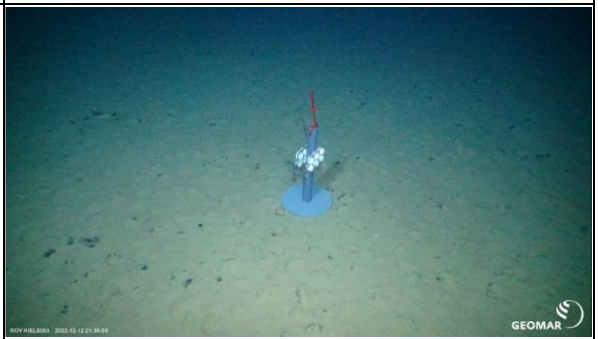
2022-12-12	20:59:53	-125.87050	14.11187	4544.15	 20221212_205953_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:01:05	-125.87059	14.11176	4543.62	 20221212_210105_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:01:16	-125.87059	14.11176	4543.55	ROV moves back to elevator, first course 200 deg., then 300 deg.
2022-12-12	21:01:48	-125.87061	14.11172	4543.36	Photos every 14 seconds (only every 5th is displayed in protocol)
2022-12-12	21:02:03	-125.87062	14.11171	4543.28	 20221212_210203_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:03:14	-125.87064	14.11158	4542.75	 20221212_210314_Sonne_SO295_190ROV22_Logo_thumb.jpg

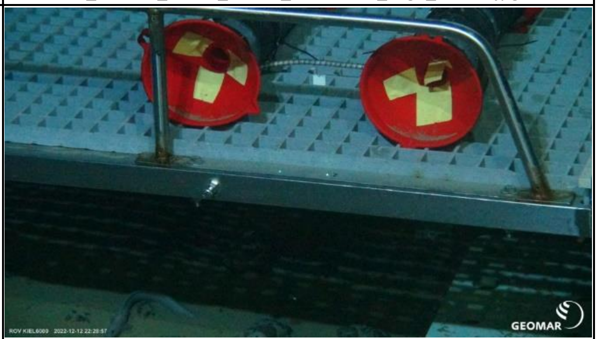
2022-12-12	21:04:26	-125.87068	14.11154	4542.11	 20221212_210426_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:05:38	-125.87073	14.11150	4541.36	 20221212_210538_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:06:49	-125.87081	14.11144	4540.61	 20221212_210649_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:08:01	-125.87088	14.11139	4539.91	 20221212_210801_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:09:13	-125.87094	14.11133	4539.3	 20221212_210913_Sonne_SO295_190ROV22_Logo_thumb.jpg

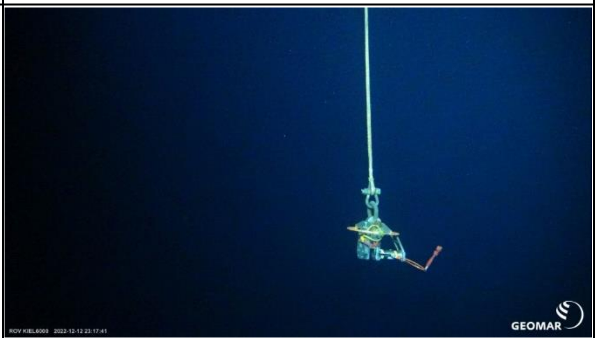
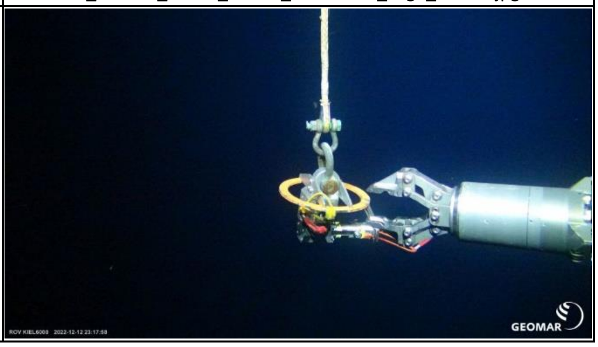
2022-12-12	21:10:25	-125.87096	14.11130	4538.7	 20221212_211025_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:11:36	-125.87105	14.11126	4538.18	 20221212_211136_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:12:48	-125.87111	14.11123	4537.67	 20221212_211248_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:14:00	-125.87118	14.11119	4537.02	 20221212_211400_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:15:11	-125.87126	14.11116	4536.41	 20221212_211511_Sonne_SO295_190ROV22_Logo_thumb.jpg

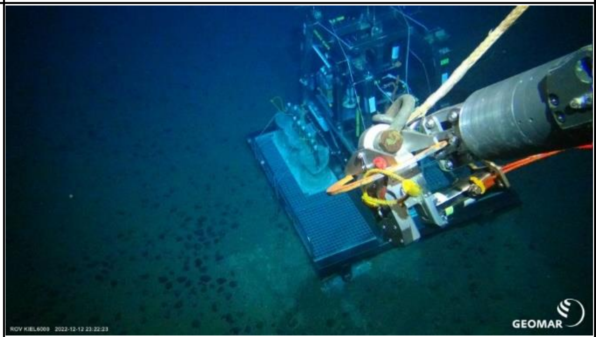
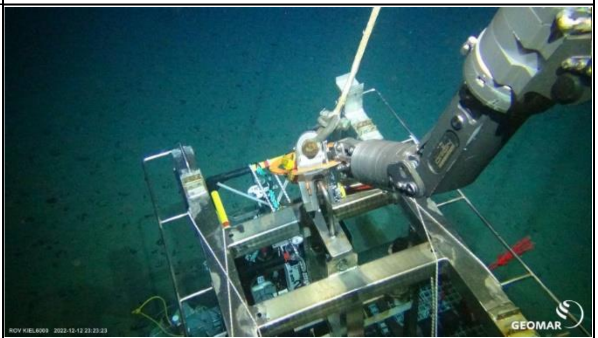
2022-12-12	21:16:23	-125.87133	14.11110	4535.79	 20221212_211623_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:17:35	-125.87140	14.11103	4535.16	 20221212_211735_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:18:47	-125.87143	14.11098	4534.57	 20221212_211847_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:19:58	-125.87151	14.11099	4534.16	 20221212_211958_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:21:10	-125.87156	14.11102	4534.01	 20221212_212110_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:21:48	-125.87160	14.11106	4533.99	Moving back to Elevator 1 as part of the transect, photos still collected every 14 seconds (only every 5th is displayed in protocol)

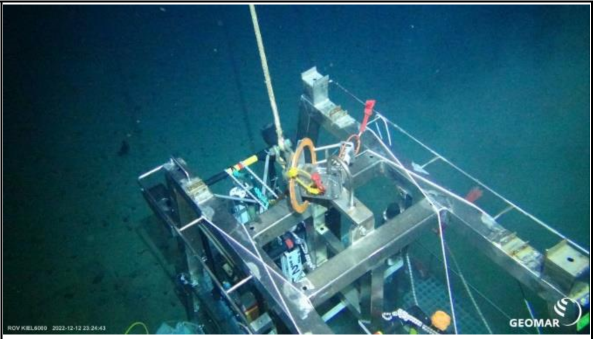
2022-12-12	21:21:53	-125.87161	14.11107	4533.98	 20221212_212153_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:23:05	-125.87164	14.11109	4533.93	 20221212_212305_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:24:16	-125.87173	14.11114	4533.8	 20221212_212416_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:25:28	-125.87183	14.11122	4533.63	 20221212_212528_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:26:40	-125.87190	14.11126	4533.56	 20221212_212640_Sonne_SO295_190ROV22_Logo_thumb.jpg

2022-12-12	21:27:52	-125.87198	14.11133	4533.38	 20221212_212752_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:30:20	-125.87200	14.11135	4533.2	Arriving in the area where Elevator 1 is sitting. Next action: PSP recovery
2022-12-12	21:31:34	-125.87202	14.11126	4532.9	Fish
2022-12-12	21:36:06	-125.87217	14.11119	4532.19	 PSP prior to recovery 20221212_213606_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	21:39:29	-125.87218	14.11124	4532.15	PSP lifted off the seafloor
2022-12-12	21:42:06	-125.87209	14.11137	4532.46	Elevator 1 in view
2022-12-12	21:45:50	-125.87209	14.11143	4532.78	Fish
2022-12-12	21:46:00	-125.87209	14.11143	4532.79	PSP placed on Elevator 1
2022-12-12	21:49:59	-125.87209	14.11143	4532.97	PSP secured on Elevator 1. Next action: collecting MICP-DEEP1
2022-12-12	21:58:59	-125.87161	14.11118	4533.79	 MICP-DEEP1 prior to recovery 20221212_215859_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	22:02:13	-125.87160	14.11116	4534.33	MICP-DEEP1 blinking: program finished
2022-12-12	22:02:59	-125.87161	14.11117	4534.3	MICP-DEEP1 lifted off the seafloor, heading towards Elevator 1
2022-12-12	22:06:21	-125.87175	14.11123	4533.44	 Sediment with patches were nodules are uncovered with sediment 20221212_220621_Sonne_SO295_190ROV22_Logo_thumb.jpg

2022-12-12	22:07:15	-125.87181	14.11123	4533.35	On the way back to Elevator 1, there are patches without visible nodules, and areas with many. This could be an effect of ROV thrusters when hovering, ascending, or landing
2022-12-12	22:10:46	-125.87199	14.11138	4532.18	Elevator 1 in view
2022-12-12	22:15:25	-125.87207	14.11139	4532.08	MICP-DEEP1 placed on Elevator 1
2022-12-12	22:22:04	-125.87210	14.11139	4532.51	Swimming shrimp
2022-12-12	22:22:53	-125.87209	14.11140	4532.6	MICP-DEEP1 secured on Elevator 1 with elastic straps
2022-12-12	22:28:43	-125.87211	14.11137	4532.53	 AMPHITRAPs on Elevator 1 20221212_222843_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	22:28:57	-125.87211	14.11136	4532.53	 AMPHITRAPs on Elevator 1 (close up) 20221212_222857_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	22:29:05	-125.87212	14.11135	4532.52	 Zoarcid fish below AMPHITRAPs 20221212_222905_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	22:29:09	-125.87212	14.11135	4532.52	 Zoarcid fish below AMPHITRAPs (close up) 20221212_222909_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	22:30:03	-125.87212	14.11136	4532.51	Next action: megafauna sampling
2022-12-12	22:38:11	-125.87217	14.11111	4531.68	Swimming sea cucumber
2022-12-12	22:42:01	-125.87215	14.11092	4531.01	Swimming polychaete

2022-12-12	22:52:12	-125.87217	14.11074	4531.89	 Sea cucumber selected for sampling (with laser spots) 20221212_225212_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	22:52:17	-125.87217	14.11074	4531.89	Sea cucumber selected for sampling (photo not displayed) 20221212_225217_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	22:52:24	-125.87217	14.11073	4531.89	 Sea cucumber selected for sampling 20221212_225224_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	22:54:44	-125.87216	14.11075	4531.88	Sea cucumber (transparent/whitish appearance) collected with suction pump
2022-12-12	22:56:29	-125.87213	14.11074	4531.89	Sea cucumber transferred into right compartment of ICBM Biobox extra large (reversing suction pump): MEGA105Seacucumber
2022-12-12	23:03:21	-125.87226	14.11109	4530.36	Sea cucumber (the same close to the Elevator 1)
2022-12-12	23:03:34	-125.87227	14.11110	4529.92	Swimming sea cucumber
2022-12-12	23:04:26	-125.87229	14.11118	4528.67	Elevator 1 in view
2022-12-12	23:06:32	-125.87230	14.11134	4522.43	Waiting for Elevator Recovery System ('Bergefuchs') to be lowered
2022-12-12	23:08:04	-125.87230	14.11132	4521.63	Lights from Elevator Recovery System in view
2022-12-12	23:16:43	-125.87209	14.11133	4525.61	Elevator Recovery System in view
2022-12-12	23:17:41	-125.87198	14.11120	4525.08	 ROV operated shackle hanging from Elevator Recovery System 20221212_231741_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:17:58	-125.87197	14.11120	4524.78	

					Grabbing ROV operated shackle 20221212_231758_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:18:20	-125.87197	14.11120	4524.21	Grabbing ROV operated shackle (photo not displayed) 20221212_231820_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:18:57	-125.87198	14.11121	4522.88	ROV operated shackle grabbed
2022-12-12	23:19:15	-125.87199	14.11123	4522.78	ROV operated shackle held down on porch
2022-12-12	23:19:20	-125.87201	14.11124	4522.84	Moving towards Elevator 1
2022-12-12	23:21:54	-125.87227	14.11151	4527.34	Fauna
2022-12-12	23:22:23	-125.87225	14.11153	4529.26	 Pulling the ROV operated shackle towards Elevator 1 20221212_232223_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:22:24	-125.87225	14.11153	4529.31	A darkish item crossed the screen (maybe the purple sea cucumber from before that was now swimming)
2022-12-12	23:22:33	-125.87225	14.11153	4529.77	Pulling the ROV operated shackle (photo not displayed) 20221212_232233_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:22:37	-125.87225	14.11153	4529.94	Arriving at Elevator 1
2022-12-12	23:23:23	-125.87222	14.11153	4530.75	 Attaching the ROV operated shackle to Elevator 1 20221212_232323_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:23:29	-125.87222	14.11153	4530.76	Attaching the ROV operated shackle to Elevator 1 (photo not displayed) 20221212_232329_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:23:31	-125.87222	14.11153	4530.77	ROV operated shackle connected to Elevator 1
2022-12-12	23:24:13	-125.87214	14.11147	4530.81	ROV operated shackle connected to Elevator 1 (photo not displayed) 20221212_232413_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:24:14	-125.87214	14.11147	4530.81	Connector secured
2022-12-12	23:24:31	-125.87214	14.11147	4530.8	 ROV operated shackle connected to Elevator 1 20221212_232431_Sonne_SO295_190ROV22_Logo_thumb.jpg

2022-12-12	23:24:43	-125.87214	14.11147	4530.78	 Elevator 1 is pulled off the ground (close up) 20221212_232443_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:24:55	-125.87214	14.11147	4530.75	Elevator 1 is pulled off the ground (photo not displayed) 20221212_232455_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:25:28	-125.87213	14.11146	4530.67	Elevator 1 is pulled off the ground (photo not displayed) 20221212_232528_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:26:24	-125.87215	14.11145	4530.6	Elevator 1 is pulled off the ground (photo not displayed) 20221212_232624_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:27:01	-125.87215	14.11144	4530.58	Swimming sea cucumber
	23:27:37	-125.87217	14.11145	4530.56	Elevator 1 is pulled off the ground (photo not displayed) 20221212_232737_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:27:55	-125.87218	14.11146	4530.57	 Elevator 1 is pulled off the ground 20221212_232755_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:27:58	-125.87218	14.11146	4530.57	 Elevator 1 leaving the seafloor 20221212_232758_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:28:03	-125.87218	14.11147	4530.57	Elevator 1 leaving the seafloor (photo not displayed) 20221212_232803_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:28:09	-125.87219	14.11147	4530.57	Elevator 1 leaving the seafloor (photo not displayed) 20221212_232809_Sonne_SO295_190ROV22_Logo_thumb.jpg
2022-12-12	23:28:31	-125.87220	14.11148	4530.53	Elevator 1 left seafloor
2022-12-12	23:29:22	-125.87227	14.11148	4529.39	Purple sea cucumber
2022-12-12	23:30:06	-125.87253	14.11147	4524.33	OFF THE BOTTOM
2022-12-13	01:20:04	None	None	None	ON DECK

Kiel 6000 Dive 23 (SO295_197-1_ROV-23)

Date: 13.Dec.2022

Principal Investigators: Felix Janssen, Sabine Gollner, Lilian Böhringer

Observers: Devin Vlach, Ricarda Meineke, Carsten Rühlemann, Tanja Campinas Bezerra

Protocol: Tanja Campinas Bezerra

ROV positions (at the bottom)
Start of dive: 14°6.687' N 125°52.240' W
End of dive: 14°6.725' N 125°52.223' W

Dive duration:
ROV in the water: 13.Dec.2022 15:22:29
ROV at the bottom: 13.Dec.2022 17:05:09
ROV off the bottom: 14.Dec.2022 00:24:16
ROV on deck: 14.Dec.2022 02:07:24

Explored sites: BEL plume impact thin cover

Aims of the Dive:

- Deployment of Elevator 2
- Deployment of Fiberoptical Microsensor Profilers (MICP-DEEP1&2)
- Deployment of Electrochemical Microsensor Profiler (MICP1)
- Photo transect
- Megafauna sampling
- Sampling of push cores (PUCs)
- Retrieval of MICP1, MICP-DEEP1&2
- Recovery of Elevator 2

Handled ROV Tools (including scientific payload):

- 16 PUCs in 16 Core Rack
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- Magnet Stick
- ICBM Biobox extra large

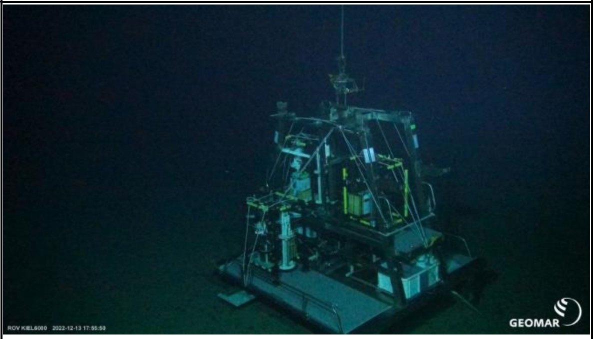
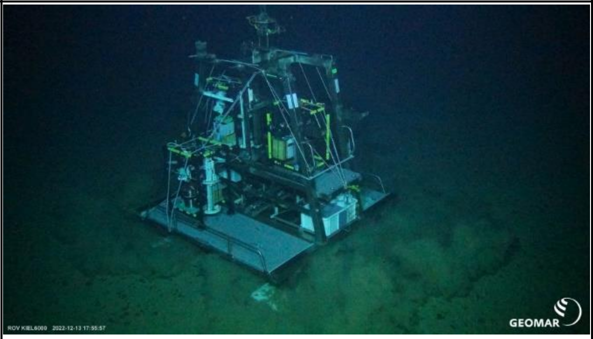
Relevant Elevator payload

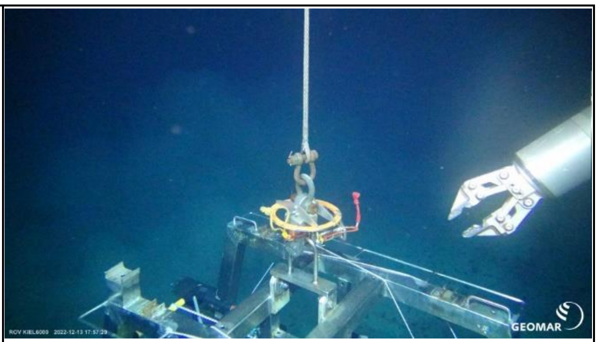
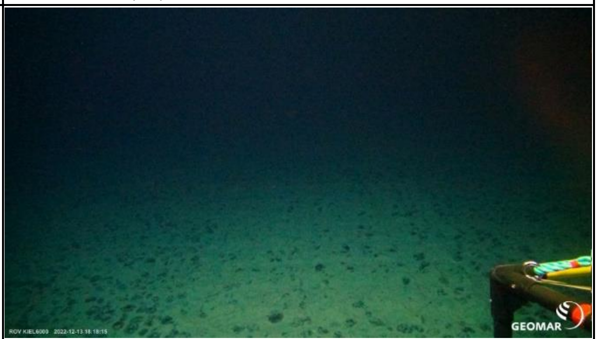
Elevator 1

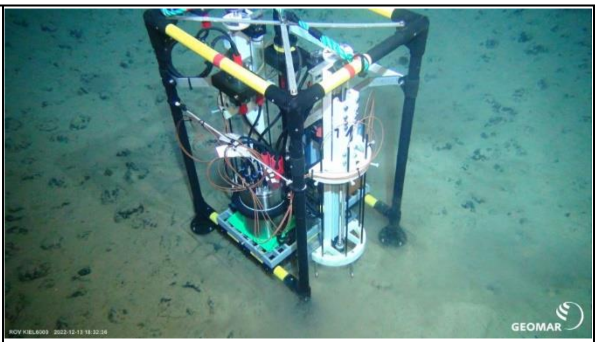
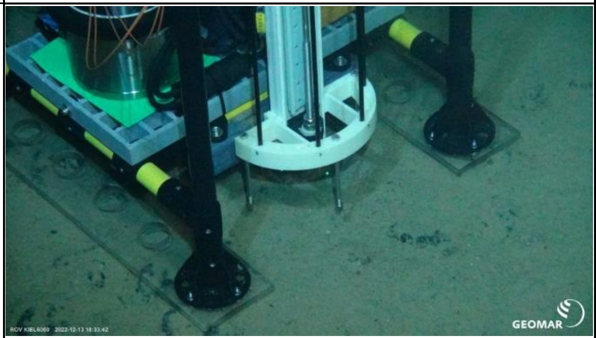
- MICP1
- MICP-DEEP1 & 2

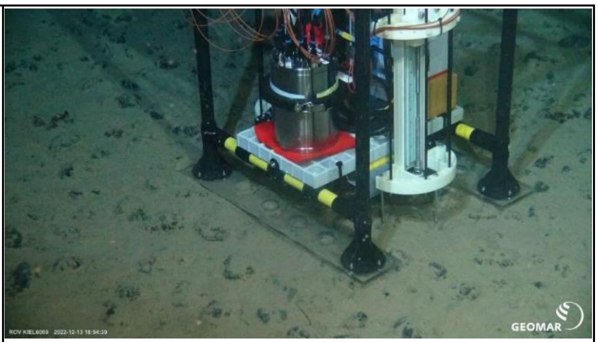
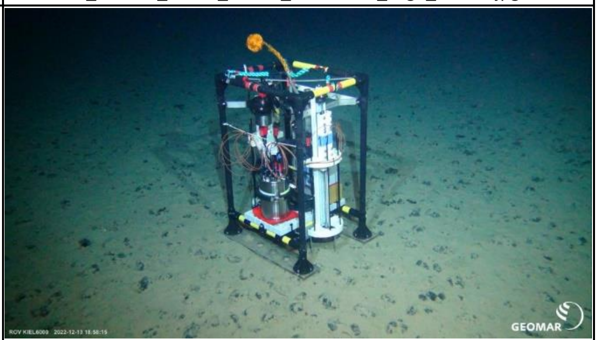
Dive summary

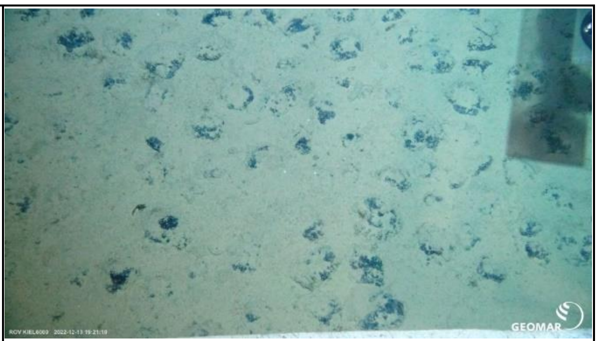
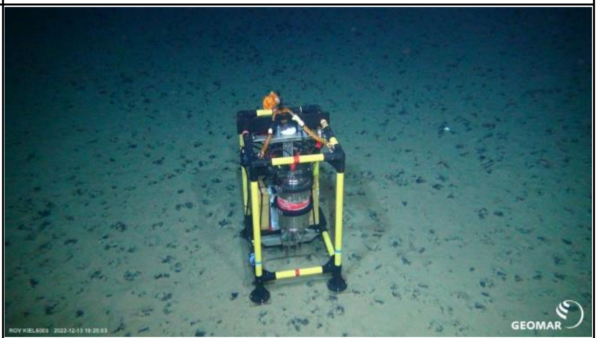
Elevator 1 was guided to the seafloor and released from the ship's cable. MICP-DEEP1, MICP-DEEP2, and MICP1 were subsequently collected from Elevator 1 and deployed. Photo transects were carried out, mapping the gradient in plume impact / blanketing thickness. After that, sampling of megafauna specimen targeting anemones was carried out while approaching the area selected for PUC sampling. PUC sampling took place subsequently at 3 locations (PUC sites A, B, and C). Towards the end of the dive, all microsensor profilers were collected and placed on Elevator 1, starting with MICP-DEEP1. After MICP1 and MICP-DEEP2 were collected and secured on Elevator 1 as well, the Elevator Recovery System was used to connect the ship's cable to the elevator. Once Elevator 1 left the seafloor the ROV began its ascent.

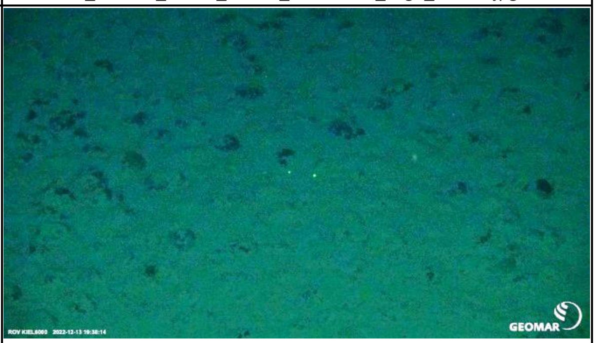
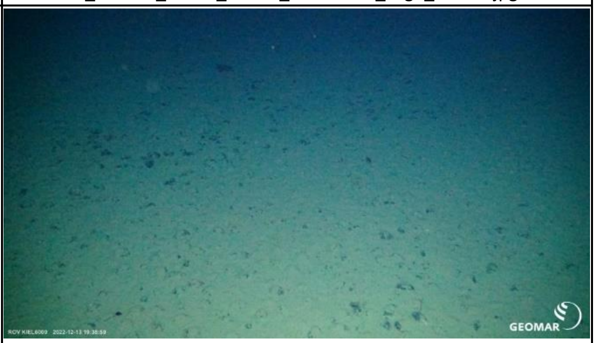
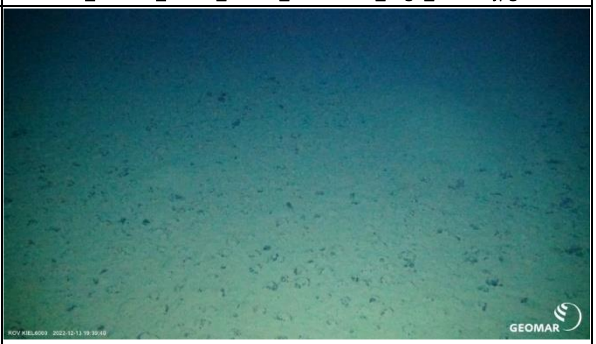
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-13	15:22:29	None	None	None	IN THE WATER
2022-12-13	17:05:09	-125.87066	14.11145	4536.58	AT THE BOTTOM
2022-12-13	17:23:55	-125.87048	14.11215	4531.14	Start of scientific work delayed as ROV was landing at AUV transponder position
2022-12-13	17:26:27	-125.87049	14.11215	4530.63	Ship moved north, waiting for Elevator 1 to follow
2022-12-13	17:48:31	-125.87016	14.11196	4525.57	Elevator 1 in view
2022-12-13	17:49:12	-125.87015	14.11198	4525.56	Approaching Elevator1
2022-12-13	17:52:11	-125.86996	14.11194	4526.88	Arriving at Elevator1
2022-12-13	17:53:57	-125.86992	14.11188	4538.33	Elevator 1 close to the seafloor (photo not displayed) 20221213_175357_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	17:55:50	-125.86990	14.11197	4544.57	 Elevator 1 close to the seafloor 20221213_175550_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	17:55:52	-125.86990	14.11197	4544.63	Elevator1 touching bottom
2022-12-13	17:55:57	-125.86989	14.11197	4544.78	 Elevator 1 arriving at the seafloor 20221213_175557_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	17:56:04	-125.86987	14.11198	4544.9	Elevator 1 arriving at the seafloor (photo not displayed) 20221213_175604_Sonne_SO295_197ROV23_Logo_thumb.jpg

2022-12-13	17:57:29	-125.86985	14.11190	4545.11	 Grabbing ROV operated shackle 20221213_175729_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	17:59:28	-125.86983	14.11188	4544.47	Elevator1 cable released
2022-12-13	18:10:24	-125.86968	14.11195	4546.13	MICP-DEEP1 collected from Elevator1
2022-12-13	18:12:24	-125.86973	14.11191	4545.87	Searching for deployment site for MICP-DEEP1
2022-12-13	18:17:17	-125.86993	14.11173	4546	 Blanketing-free areas while searching for deployment position 20221213_181717_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	18:17:20	-125.86993	14.11173	4545.99	MICP-DEEP1 deployment site
2022-12-13	18:18:15	-125.86993	14.11171	4545.93	 Basket- (Elevator-) imprint from expedition IP21 in 2021 20221213_181815_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	18:26:25	-125.86987	14.11172	4546.32	 MICP-DEEP1 deployment site 20221213_182625_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	18:28:44	-125.86987	14.11165	4546.39	MICP-DEEP1 activated with Magnet Stick hanging from RigMaster
2022-12-13	18:32:22	-125.86991	14.11165	4546.48	MICP-DEEP1 positioned at the seafloor: deployment MICP-DEEP1-1

2022-12-13	18:32:36	-125.86991	14.11165	4546.5	 MICP-DEEP1 at seafloor 20221213_183236_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	18:33:42	-125.86988	14.11170	4546.21	 MICP-DEEP1 at seafloor (close up stage 1) 20221213_183342_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	18:34:40	-125.86987	14.11170	4545.89	Returning to Elevator1
2022-12-13	18:41:02	-125.86979	14.11194	4545.57	MICP-DEEP2 collected from Elevator 1, looking for deployment site
2022-12-13	18:51:57	-125.86961	14.11186	4546.94	 MICP-DEEP2 deployment site 20221213_185157_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	18:52:03	-125.86961	14.11186	4546.94	 MICP-DEEP2 deployment site (close up) 20221213_185203_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	18:54:06	-125.86958	14.11184	4547.11	MICP-DEEP2 positioned at seafloor after starting with Magnet Stick hanging from RigMaster: deployment MICP-DEEP2-1

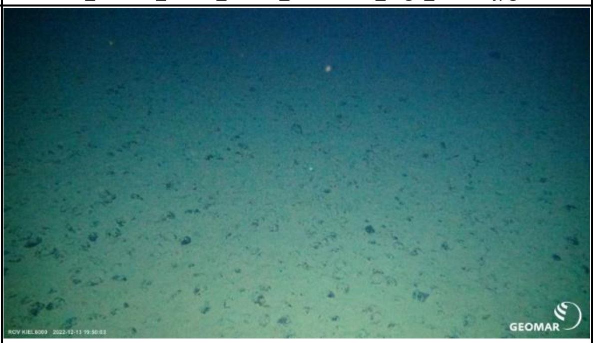
2022-12-13	18:54:39	-125.86960	14.11183	4547.14	 MICP-DEEP2 at seafloor (close up) 20221213_185439_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	18:54:44	-125.86960	14.11183	4547.14	 MICP-DEEP2 at seafloor (close up) 20221213_185444_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	18:58:15	-125.86962	14.11179	4547.05	 MICP-DEEP2 at seafloor 20221213_185815_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:00:20	-125.86963	14.11182	4546.25	Moving back to Elevator 1
2022-12-13	19:08:54	-125.86982	14.11187	4546.05	MICP1 collected from Elevator 1
2022-12-13	19:10:03	-125.86980	14.11184	4545.8	Looking for deployment site
2022-12-13	19:14:38	-125.86977	14.11168	4546.09	First site selected for MICP1 deployment (photo not displayed) 20221213_191438_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:17:12	-125.86971	14.11168	4546.08	Starting MICP1 with Magnet Stick hanging from RigMaster
2022-12-13	19:17:45	-125.86972	14.11168	4546.1	MICP1 program running
2022-12-13	19:19:08	-125.86970	14.11169	4546.19	Rejecting deployment site selected first, looking for a different one
2022-12-13	19:20:13	-125.86975	14.11166	4546.32	 MICP1 deployment site 20221213_192013_Sonne_SO295_197ROV23_Logo_thumb.jpg

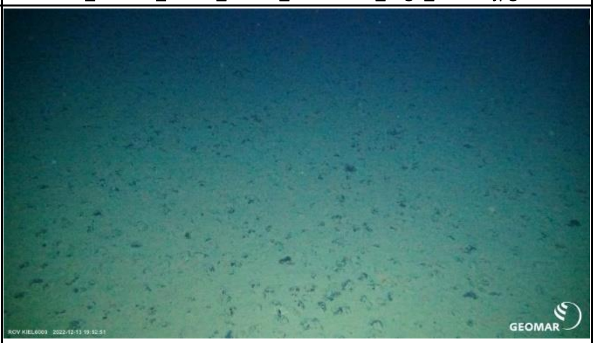
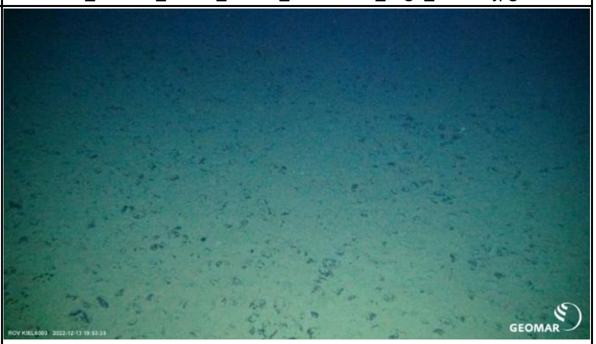
2022-12-13	19:21:10	-125.86977	14.11165	4546.41	 MICP1 deployment site (close up) 20221213_192110_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:24:01	-125.86972	14.11169	4546.42	MICP1 positioned at seafloor: deployment MICP1-1
2022-12-13	19:24:25	-125.86972	14.11170	4546.4	 MICP1 at seafloor (close up) 20221213_192425_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:25:03	-125.86971	14.11170	4546.31	 MICP1 at seafloor 20221213_192503_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:31:39	-125.86973	14.11169	4545.64	Next action: photo transect while moving direction Northwest to the waypoints 75m & 25m off collector impact area
2022-12-13	19:32:25	-125.86973	14.11170	4545.61	 Photo transect starting point 20221213_193225_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:32:37	-125.86973	14.11170	4545.61	beginning of the transect (only every 5th image displayed in protocol)

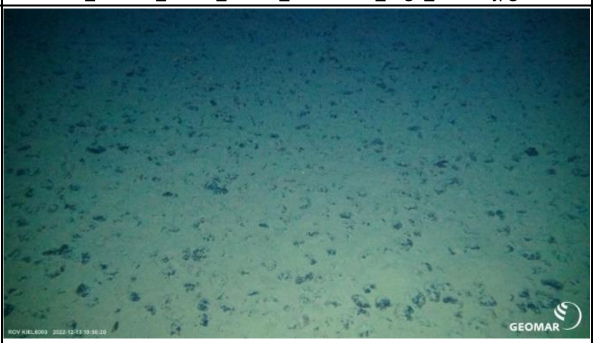
2022-12-13	19:32:40	-125.86973	14.11170	4545.61	 20221213_193240_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:37:39	-125.87016	14.11200	4545.56	 20221213_193739_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:38:14	-125.87002	14.11195	4545.56	 20221213_193814_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:38:59	-125.86984	14.11187	4545.66	 20221213_193859_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:39:40	-125.86982	14.11192	4545.7	 20221213_193940_Sonne_SO295_197ROV23_Logo_thumb.jpg

2022-12-13	19:40:23	-125.86987	14.11189	4545.67	 20221213_194023_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:41:04	-125.86993	14.11189	4545.6	 20221213_194104_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:41:46	-125.87004	14.11189	4545.49	 20221213_194146_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:42:28	-125.87010	14.11188	4545.38	 20221213_194228_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:43:10	-125.87013	14.11183	4545.34	 20221213_194310_Sonne_SO295_197ROV23_Logo_thumb.jpg

2022-12-13	19:43:52	-125.87017	14.11188	4545.35	 20221213_194352_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:44:34	-125.87020	14.11195	4545.37	 20221213_194434_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:45:16	-125.87022	14.11196	4545.34	 20221213_194516_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:45:58	-125.87027	14.11196	4545.31	 20221213_194558_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:46:40	-125.87031	14.11199	4545.27	 20221213_194640_Sonne_SO295_197ROV23_Logo_thumb.jpg

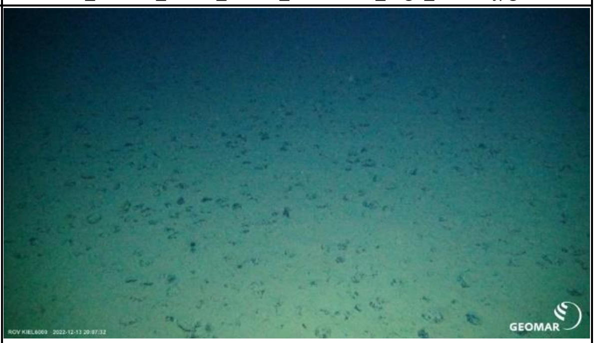
2022-12-13	19:47:22	-125.87032	14.11202	4545.2	 20221213_194722_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:48:04	-125.87035	14.11202	4545.11	 20221213_194804_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:48:46	-125.87042	14.11204	4545.04	 20221213_194846_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:49:21	-125.87043	14.11204	4545	 20221213_194921_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:50:03	-125.87043	14.11206	4545	 20221213_195003_Sonne_SO295_197ROV23_Logo_thumb.jpg

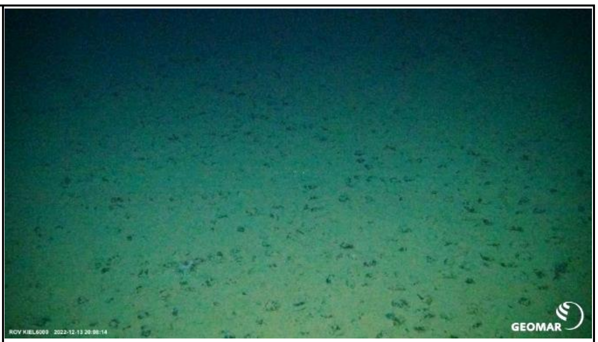
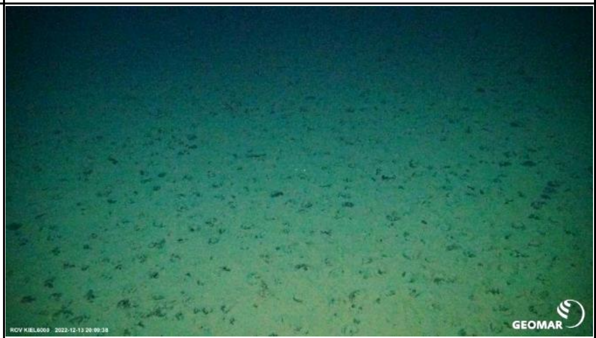
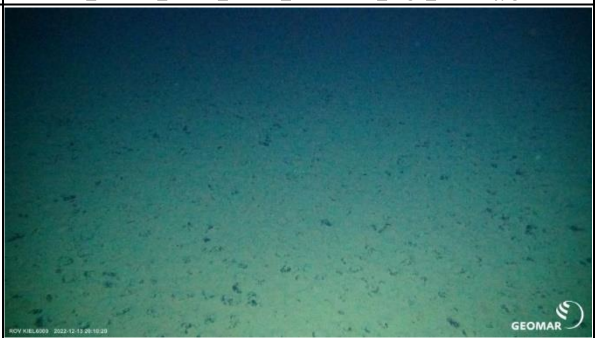
2022-12-13	19:50:45	-125.87041	14.11214	4544.99	 20221213_195045_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:51:27	-125.87050	14.11221	4544.98	 20221213_195127_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:52:09	-125.87053	14.11221	4544.99	 20221213_195209_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:52:51	-125.87056	14.11223	4545.01	 20221213_195251_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:53:33	-125.87057	14.11224	4545.03	 20221213_195333_Sonne_SO295_197ROV23_Logo_thumb.jpg

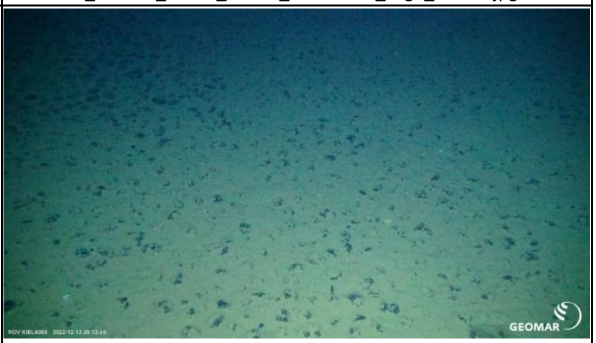
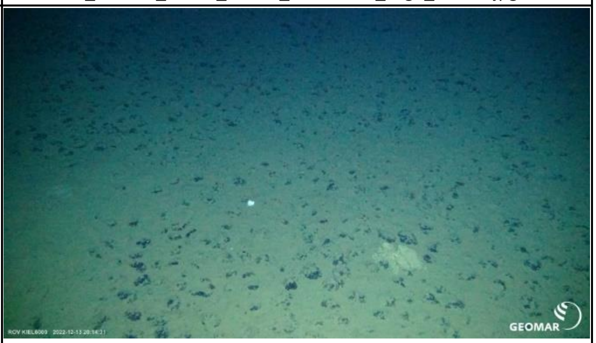
2022-12-13	19:54:15	-125.87059	14.11228	4545.06	 20221213_195415_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:54:57	-125.87062	14.11234	4545.09	 20221213_195457_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:55:39	-125.87063	14.11237	4545.11	 20221213_195539_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:56:20	-125.87063	14.11238	4545.16	 20221213_195620_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:57:02	-125.87059	14.11237	4545.13	 20221213_195702_Sonne_SO295_197ROV23_Logo_thumb.jpg

2022-12-13	19:57:44	-125.87060	14.11229	4544.98	 20221213_195744_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:58:26	-125.87061	14.11225	4544.8	 20221213_195826_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:59:08	-125.87058	14.11217	4544.6	 20221213_195908_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	19:59:50	-125.87059	14.11208	4544.35	 20221213_195950_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:00:33	-125.87058	14.11208	4544.28	 20221213_200033_Sonne_SO295_197ROV23_Logo_thumb.jpg

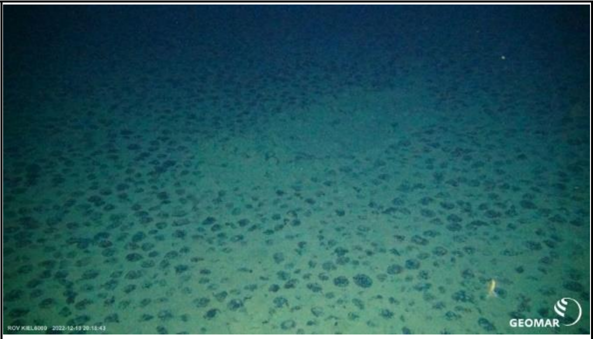
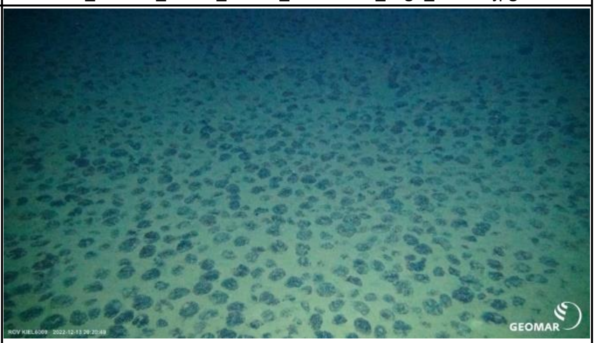
2022-12-13	20:01:14	-125.87051	14.11209	4544.51	 20221213_200114_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:01:56	-125.87048	14.11209	4544.87	 20221213_200156_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:02:38	-125.87041	14.11214	4545.18	 20221213_200238_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:03:20	-125.87034	14.11216	4545.31	 20221213_200320_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:04:02	-125.87034	14.11214	4545.18	 20221213_200402_Sonne_SO295_197ROV23_Logo_thumb.jpg

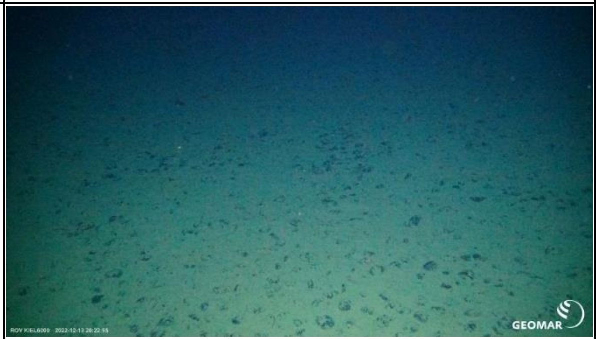
2022-12-13	20:04:44	-125.87038	14.11201	4545.04	 20221213_200444_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:05:26	-125.87040	14.11194	4544.95	 20221213_200526_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:06:08	-125.87040	14.11193	4544.81	 20221213_200608_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:06:50	-125.87040	14.11189	4544.63	 20221213_200650_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:07:32	-125.87038	14.11184	4544.59	 20221213_200732_Sonne_SO295_197ROV23_Logo_thumb.jpg

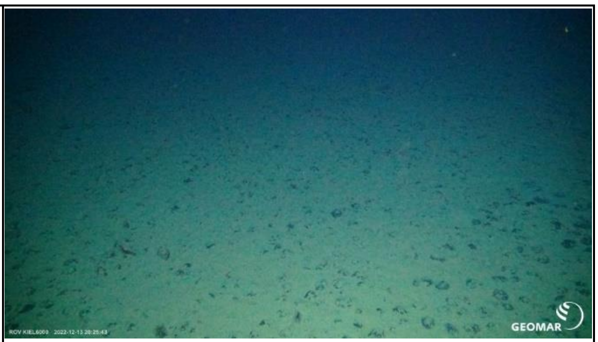
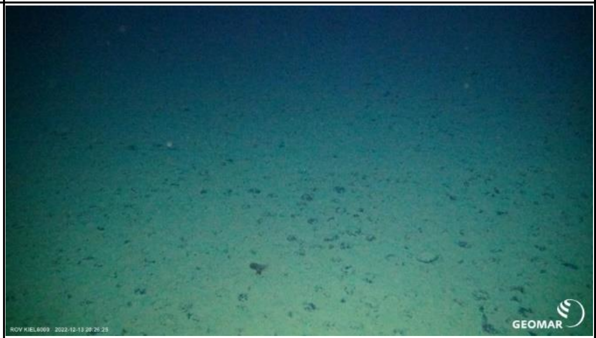
2022-12-13	20:08:14	-125.87034	14.11185	4544.8	 20221213_200814_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:08:56	-125.87028	14.11192	4544.98	 20221213_200856_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:09:38	-125.87026	14.11196	4545.12	 20221213_200938_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:10:20	-125.87019	14.11200	4545.25	 20221213_201020_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:11:02	-125.87017	14.11202	4545.38	 20221213_201102_Sonne_SO295_197ROV23_Logo_thumb.jpg

2022-12-13	20:11:44	-125.87015	14.11201	4545.47	 20221213_201144_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:12:26	-125.87015	14.11199	4545.38	 20221213_201226_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:13:08	-125.87018	14.11189	4545.19	 20221213_201308_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:13:49	-125.87018	14.11189	4545	 20221213_201349_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:14:31	-125.87020	14.11185	4544.83	 20221213_201431_Sonne_SO295_197ROV23_Logo_thumb.jpg

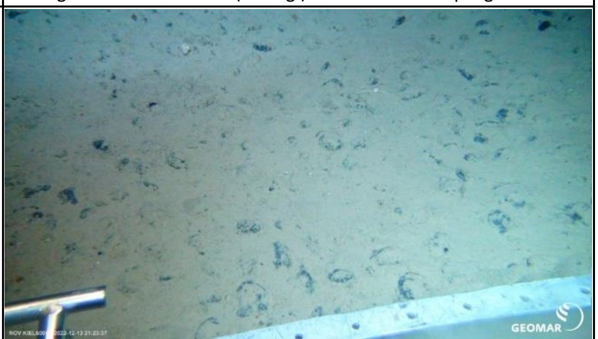
2022-12-13	20:15:13	-125.87024	14.11174	4544.61	 20221213_201513_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:15:55	-125.87024	14.11172	4544.45	 20221213_201555_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:16:37	-125.87021	14.11170	4544.48	 20221213_201637_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:17:19	-125.87017	14.11174	4544.68	 20221213_201719_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:18:01	-125.87008	14.11181	4544.86	 20221213_201801_Sonne_SO295_197ROV23_Logo_thumb.jpg

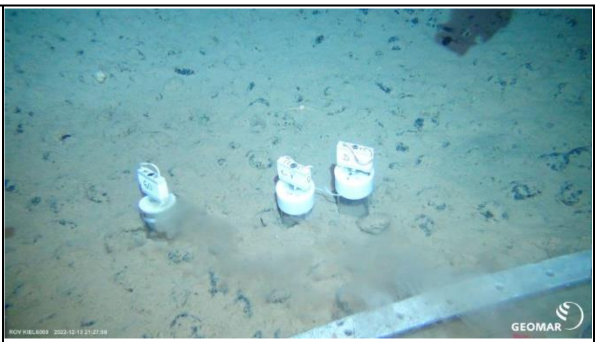
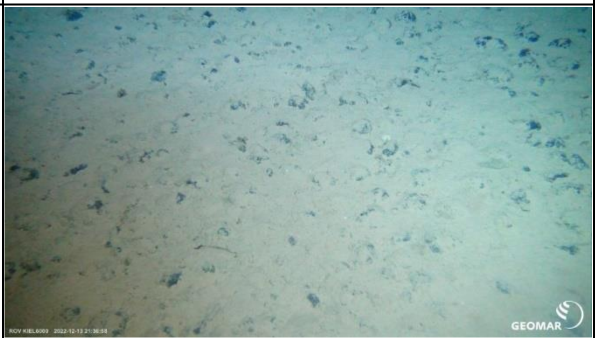
2022-12-13	20:18:43	-125.87005	14.11183	4545.03	 20221213_201843_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:19:25	-125.87004	14.11187	4545.21	 20221213_201925_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:20:07	-125.87002	14.11190	4545.38	 20221213_202007_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:20:49	-125.87001	14.11190	4545.41	 20221213_202049_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:21:31	-125.87000	14.11187	4545.23	 20221213_202131_Sonne_SO295_197ROV23_Logo_thumb.jpg

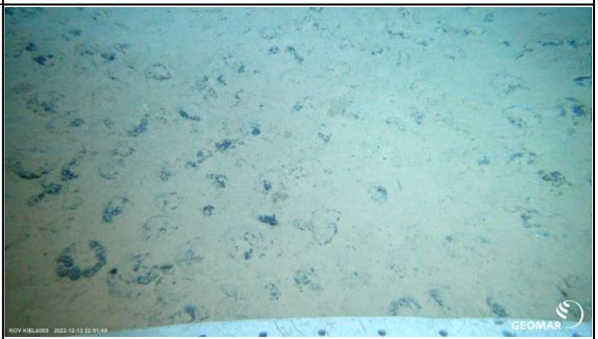
2022-12-13	20:22:13	-125.87002	14.11180	4544.99	 20221213_202213_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:22:55	-125.87002	14.11178	4544.85	 20221213_202255_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:23:37	-125.87001	14.11176	4544.87	 20221213_202337_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:24:19	-125.86995	14.11175	4544.97	 20221213_202419_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:25:01	-125.86990	14.11173	4545.09	 20221213_202501_Sonne_SO295_197ROV23_Logo_thumb.jpg

2022-12-13	20:25:43	-125.86989	14.11173	4545.22	 20221213_202543_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:26:25	-125.86988	14.11174	4545.39	 20221213_202625_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:27:07	-125.86980	14.11177	4545.54	 20221213_202707_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:32:57	-125.86972	14.11182	4545.32	Next actions: going to PUC sites, collecting anemones on the way on occasion
2022-12-13	20:33:34	-125.86965	14.11180	4545.16	PUC locations had to be relocated from where they were originally planned as those positions turned out too close to the AUV transponder mooring
2022-12-13	20:34:41	-125.86958	14.11184	4545.33	Anemone and brittle star spotted, preparing to collect
2022-12-13	20:37:22	-125.86954	14.11190	4547.06	Landing at the seafloor
2022-12-13	20:37:43	-125.86954	14.11190	4547.25	 Anemone selected for sampling (with laser spots?) 20221213_203743_Sonne_SO295_197ROV23_Logo_thumb.jpg

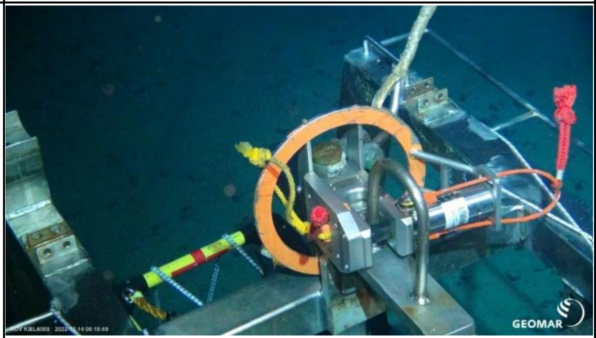
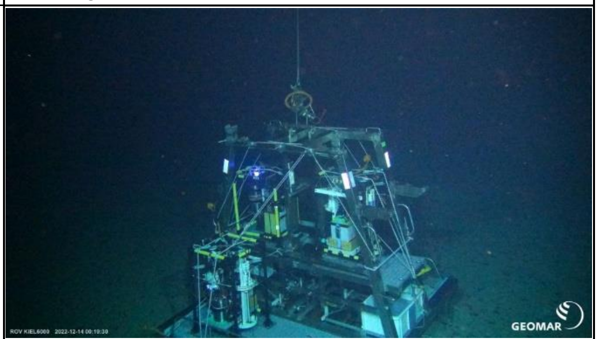
2022-12-13	20:37:48	-125.86954	14.11190	4547.27	 Anemone selected for sampling 20221213_203748_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:40:42	-125.86950	14.11181	4547.29	Brittle star collected and transferred into left compartment of ICBM Biobox extra large: MEGA108Brittle star
2022-12-13	20:43:55	-125.86951	14.11177	4547.33	Anemone collected and transferred into left compartment of ICBM Biobox extra large: MEGA107Anemone
2022-12-13	20:45:36	-125.86948	14.11183	4546.87	Continuing transit to the PUC site
2022-12-13	20:48:49	-125.86936	14.11196	4546.31	Anemones spotted
2022-12-13	20:50:38	-125.86935	14.11177	4547.44	Landing at seafloor for sampling
2022-12-13	20:50:40	-125.86935	14.11177	4547.45	 First anemone selected for sampling (with laser spots?) 20221213_205040_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:50:46	-125.86935	14.11178	4547.47	 First anemone selected for sampling 20221213_205046_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	20:55:22	-125.86929	14.11188	4547.5	Anemone (the bigger one) collected and transferred into the left compartment of ICBM Biobox extra large: MEGA109Anemone
2022-12-13	21:02:02	-125.86940	14.11197	4547.48	 Second anemone selected for sampling (with laser spots) 20221213_210202_Sonne_SO295_197ROV23_Logo_thumb.jpg

2022-12-13	21:02:16	-125.86940	14.11197	4547.5	 Second anemone selected for sampling 20221213_210216_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	21:04:23	-125.86945	14.11193	4547.49	sediment plume caused by ROV, poor visibility
2022-12-13	21:07:57	-125.86944	14.11197	4547.48	Anemone with big nodule collected and transferred to left compartment of ICBM Biobox extra large: MEGA110Anemone
2022-12-13	21:10:11	-125.86942	14.11198	4546.54	Nodules largely covered with sediment
2022-12-13	21:11:52	-125.86941	14.11202	4547.26	 Anemone selected for sampling attempt (with laser spots) 20221213_211152_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	21:12:04	-125.86942	14.11205	4547.34	 Anemone selected for sampling attempt 20221213_211204_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	21:17:41	-125.86942	14.11201	4547.42	Anemone lost during sampling
2022-12-13	21:20:06	-125.86930	14.11192	4546.99	Moving direction Northeast (40 deg.) towards PUC sampling site
2022-12-13	21:23:37	-125.86916	14.11220	4547.98	 PUC site A prior to coring 20221213_212337_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	21:23:59	-125.86916	14.11221	4547.99	PUC sampling start at site A with PUCs from 16 Core Rack
2022-12-13	21:26:03	-125.86921	14.11212	4547.97	PUCD4 deployed
2022-12-13	21:26:44	-125.86920	14.11210	4547.97	PUCC7 deployed
2022-12-13	21:27:41	-125.86920	14.11211	4547.97	PUC 60 deployed

2022-12-13	21:27:56	-125.86920	14.11211	4547.97	 PUC site A with deployed cores 20221213_212756_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	21:28:30	-125.86920	14.11217	4547.97	Retrieving PUCs back into 16 Core Rack
2022-12-13	21:29:09	-125.86917	14.11234	4547.98	PUC60 retrieved
2022-12-13	21:29:47	-125.86908	14.11227	4547.98	PUCC7 retrieved
2022-12-13	21:30:51	-125.86920	14.11213	4547.98	PUCD4 retrieved
2022-12-13	21:31:32	-125.86922	14.11213	4547.96	 PUC site A post coring 20221213_213132_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	21:34:22	-125.86925	14.11200	4546.89	Moving to new PUC site B
2022-12-13	21:36:56	-125.86938	14.11202	4547.49	Arriving at PUC site B
2022-12-13	21:36:58	-125.86938	14.11201	4547.5	 PUC site B prior to coring 20221213_213658_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	21:38:13	-125.86942	14.11211	4547.51	PUC sampling start at site B with PUCs from 16 Core Rack
2022-12-13	21:40:19	-125.86945	14.11217	4547.48	PUC5 deployed
2022-12-13	21:40:43	-125.86946	14.11217	4547.47	PUCB7 deployed
2022-12-13	21:43:04	-125.86945	14.11209	4547.52	PUCB2 deployed
2022-12-13	21:44:04	-125.86941	14.11210	4547.51	 PUC site B with deployed cores 20221213_214404_Sonne_SO295_197ROV23_Logo_thumb.jpg

2022-12-13	21:44:09	-125.86942	14.11210	4547.51	Retrieving PUCs back into 16 Core Rack
2022-12-13	21:45:18	-125.86940	14.11209	4547.51	PUCB2 retrieved
2022-12-13	21:46:33	-125.86938	14.11205	4547.5	PUCB7 retrieved
2022-12-13	21:47:45	-125.86935	14.11211	4547.47	PUCB4 deployed additionally
2022-12-13	21:48:44	-125.86934	14.11208	4547.48	PUC site B with deployed cores 5 and B4 (photo not displayed) 20221213_214844_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	21:49:08	-125.86938	14.11204	4547.47	 PUC site B with deployed cores 5 and B4 20221213_214908_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	21:49:08	-125.86938	14.11204	4547.47	Photo with bad quality due to plume generation by ROV operations
2022-12-13	21:51:11	-125.86936	14.11207	4547.38	Continuing to retrieve PUCs back into 16 Core Rack
2022-12-13	21:52:07	-125.86936	14.11207	4547.41	PUCB4 retrieved
2022-12-13	21:52:39	-125.86939	14.11208	4547.42	PUC5 retrieved
2022-12-13	21:53:27	-125.86939	14.11206	4547.25	Moving to new PUC site C
2022-12-13	21:58:53	-125.86959	14.11179	4546.29	Arriving at PUC site C
2022-12-13	22:00:12	-125.86964	14.11177	4546.25	Big nodules, largely covered by sediment
2022-12-13	22:01:48	-125.86961	14.11181	4546.79	 PUC site C prior to coring 20221213_220148_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	22:02:05	-125.86961	14.11181	4546.81	PUC sampling start at site C with PUCs from 16 Core Rack
2022-12-13	22:04:01	-125.86960	14.11185	4546.8	PUC69 deployed
2022-12-13	22:05:32	-125.86958	14.11185	4546.8	PUCD0 deployed
2022-12-13	22:06:31	-125.86960	14.11186	4546.8	PUCC4 deployed
2022-12-13	22:07:37	-125.86961	14.11186	4546.79	PUCD3 deployed
2022-12-13	22:09:00	-125.86957	14.11179	4546.79	PUCD7 deployed
2022-12-13	22:10:56	-125.86964	14.11172	4546.79	PUCD6 deployed
2022-12-13	22:11:15	-125.86965	14.11172	4546.8	Attempt to deploy PUC27 failed
2022-12-13	22:12:57	-125.86962	14.11173	4546.8	PUC11 deployed
2022-12-13	22:15:57	-125.86961	14.11174	4546.78	PUC73 deployed
2022-12-13	22:16:30	-125.86961	14.11174	4546.77	 PUC site C with deployed cores 20221213_221630_Sonne_SO295_197ROV23_Logo_thumb.jpg

2022-12-13	22:16:51	-125.86960	14.11175	4546.77	Retrieving PUCs back into 16 Core Rack
2022-12-13	22:18:32	-125.86962	14.11177	4546.79	PUC73 retrieved
2022-12-13	22:20:14	-125.86965	14.11177	4546.77	PUC11 retrieved
2022-12-13	22:21:38	-125.86967	14.11175	4546.78	PUCD6 retrieved
2022-12-13	22:22:02	-125.86967	14.11175	4546.77	PUCD3 retrieved
2022-12-13	22:23:08	-125.86964	14.11175	4546.76	PUCD7 retrieved
2022-12-13	22:24:40	-125.86966	14.11177	4546.77	PUC69 retrieved
2022-12-13	22:25:39	-125.86966	14.11178	4546.75	PUCD0 retrieved
2022-12-13	22:26:31	-125.86964	14.11180	4546.76	PUCC4 retrieved
2022-12-13	22:27:17	-125.86962	14.11179	4546.76	 PUC site C post coring 20221213_222717_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	22:32:55	-125.86973	14.11174	4545.75	Moving to MICP-DEEP1 deployed earlier during the dive
2022-12-13	22:33:24	-125.86974	14.11175	4545.66	 MICP-DEEP1 prior to recovery 20221213_223324_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	22:40:11	-125.86980	14.11182	4545.61	MICP-DEEP 1 picked up from the seafloor
2022-12-13	22:40:43	-125.86980	14.11186	4545.64	Carrying MICP-DEEP1 to Elevator 1
2022-12-13	22:45:25	-125.86985	14.11202	4545.97	MICP-DEEP 1 placed on Elevator 1
2022-12-13	22:50:11	-125.86981	14.11202	4546.08	MICP-DEEP 1 secured with elastic straps
2022-12-13	22:51:34	-125.86982	14.11197	4546.05	Moves 40m to MICP1 deployed earlier during the dive
2022-12-13	22:54:54	-125.86978	14.11179	4545.54	 MICP1 prior to recovery 20221213_225454_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-13	22:57:14	-125.86970	14.11168	4545.59	MICP1 picked up from the seafloor
2022-12-13	22:58:25	-125.86970	14.11172	4545.32	Transporting MICP1 to Elevator 1
2022-12-13	23:03:53	-125.86974	14.11193	4545.34	Jellyfish (?)
2022-12-13	23:05:42	-125.86976	14.11194	4545.32	MICP1 placed on Elevator 1
2022-12-13	23:13:23	-125.86980	14.11193	4545.51	MICP 1 secured with elastic straps
2022-12-13	23:17:17	-125.86975	14.11195	4544.39	Moving to MICP-DEEP2 deployed earlier during the dive
2022-12-13	23:19:40	-125.86969	14.11202	4545.18	Shrimp ('Lobster' in original notes)
2022-12-13	23:22:11	-125.86955	14.11201	4545.46	MICP-DEEP2 picked up from the seafloor

2022-12-13	23:23:01	-125.86957	14.11201	4544.84	Transporting MICP-DEEP2 to Elevator 1
2022-12-13	23:27:48	-125.86978	14.11202	4544.83	MICP-DEEP2 placed on Elevator 1
2022-12-13	23:32:35	-125.86972	14.11193	4545.37	MICP-DEEP2 secured with elastic straps
2022-12-13	23:34:02	-125.86973	14.11191	4543.77	Next action: getting the ROV operated shackle from the Elevator Recovery System ('Bergefuchs')
2022-12-13	23:53:43	-125.86978	14.11191	4529.99	Elevator Recovery System located
2022-12-14	00:11:27	-125.86958	14.11161	4534.53	Grabbing the ROV operated shackle
2022-12-14	00:12:37	-125.86961	14.11170	4534.71	Pulling the ROV operated shackle while moving to Elevator 1
2022-12-14	00:17:33	-125.86979	14.11189	4543.66	Attaching the ROV operated shackle to Elevator 1
2022-12-14	00:17:44	-125.86980	14.11187	4543.79	ROV operated shackle attached to Elevator 1
2022-12-14	00:18:37	-125.86983	14.11188	4544.06	ROV operated shackle attached to Elevator 1 (photo not displayed) 20221214_001837_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-14	00:18:40	-125.86984	14.11188	4544.06	 ROV operated shackle attached to Elevator 1 20221214_001840_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-14	00:19:05	-125.86986	14.11190	4544.11	Confirming that connection is OK
2022-12-14	00:19:30	-125.86985	14.11191	4544.15	 Elevator 1 ready to be pulled up by the ship 20221214_001930_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-14	00:21:14	-125.86982	14.11202	4544.2	Elevator 1 ready to be pulled up by the ship (photo not displayed) 20221214_002114_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-14	00:21:39	-125.86982	14.11203	4544.2	 Elevator leaving the seafloor 20221214_002139_Sonne_SO295_197ROV23_Logo_thumb.jpg
2022-12-14	00:21:39	-125.86982	14.11203	4544.2	Elevator 1 is being recovered from the seafloor
2022-12-14	00:23:59	-125.87034	14.11209	4533.33	End of scientific mission
2022-12-14	00:24:16	-125.87038	14.11209	4524.33	OFF THE BOTTOM
2022-12-14	02:07:24	None	None	None	ON DECK

Kiel 6000 Dive 24   (SO295_202-1_ROV-24)

Date: 14.Dec.2022

Principal Investigators: Felix Janssen, Sabine Gollner, Lilian Böhringer

Observers: Duygu Sevilgen, Ricarda Meineke, Carsten Rühlemann, Lilian Böhringer

Protocol: Felix Janssen

ROV positions (at the bottom)
Start of dive: 14°7.096' N   125°52.598' W
End of dive: 14°7.105' N   125°52.601' W

Dive duration:

ROV in the water:	14.Dec.2022	15:09:20
ROV at the bottom:	14.Dec.2022	17:01:41
ROV off the bottom:	15.Dec.2022	00:00:04
ROV on deck:	15.Dec.2022	01:49:00

Explored sites: BEL control site northwest of collector area

Aims of the Dive:

- Deployment of Elevator 1
- Deployment of Fiberoptical Microsensor Profilers (MICP-DEEP 1&2)
- Deployment of Electrochemical Microsensor Profler (MICP2)
- Photo transect
- Megafauna sampling
- Push Core (PUC) sampling
- Retrieval of MICP2, MICP-DEEP 1&2
- Recovery of Elevator 1

Handled ROV Tools (including scientific payload):

- Magnet Stick
- 16 PUCs in 16 Core Racks
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- ICBM Biobox extra large

Relevant Elevator payload

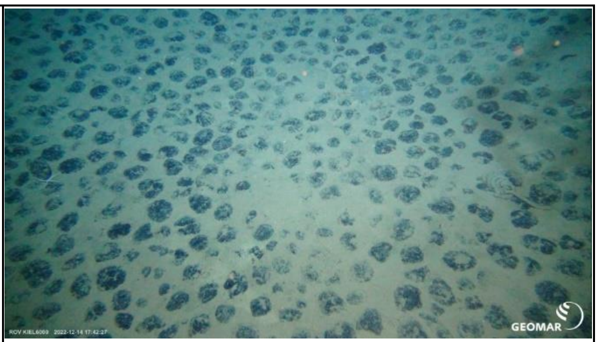
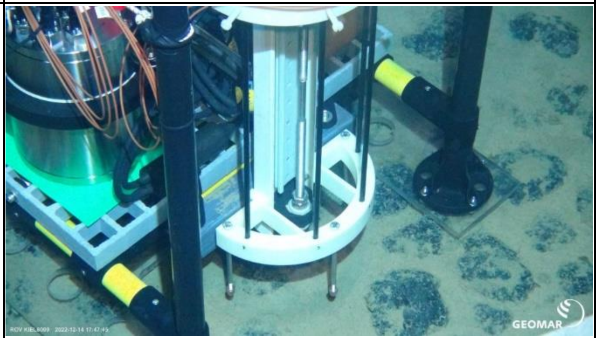
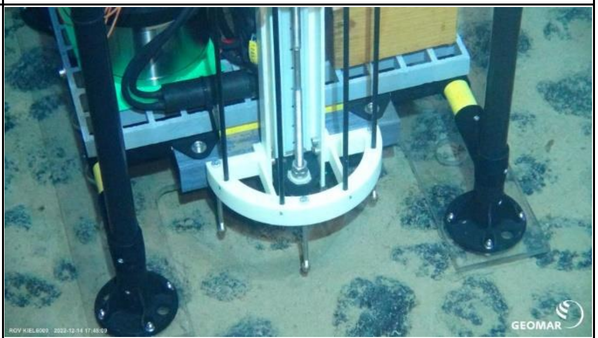
Elevator 1

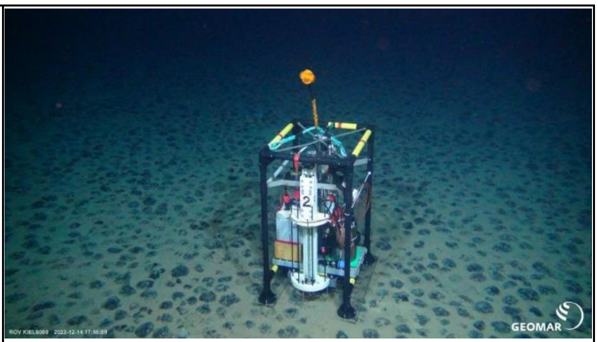
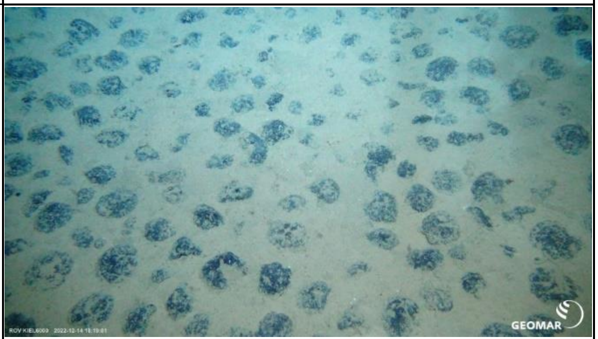
- MICP2
- MICP-DEEP1 & 2
- 2 Amphipod traps (AMPHITRAP1, 2)

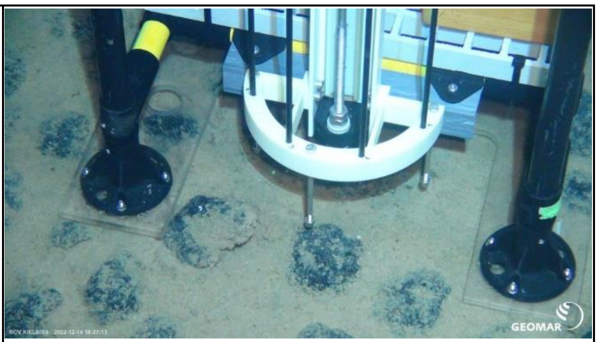
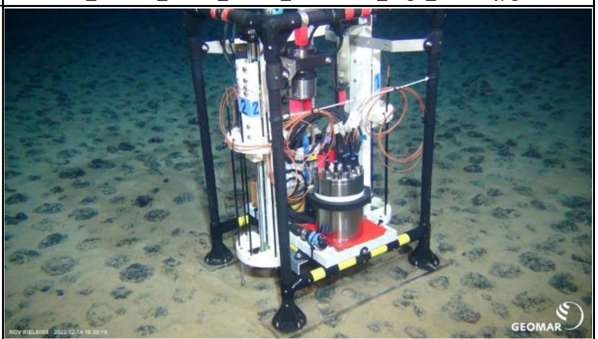
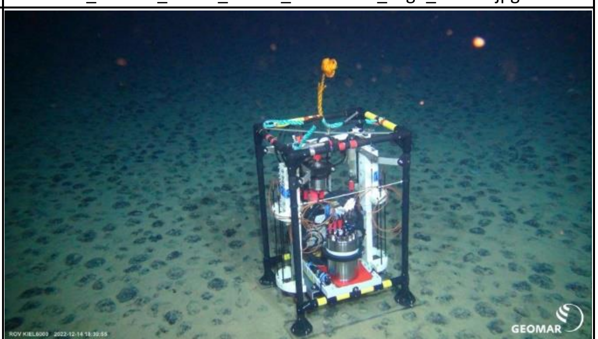
Dive summary

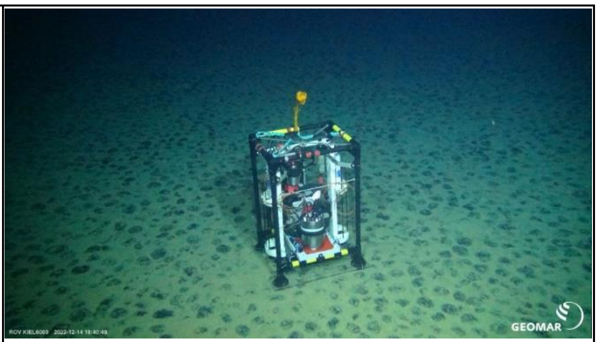
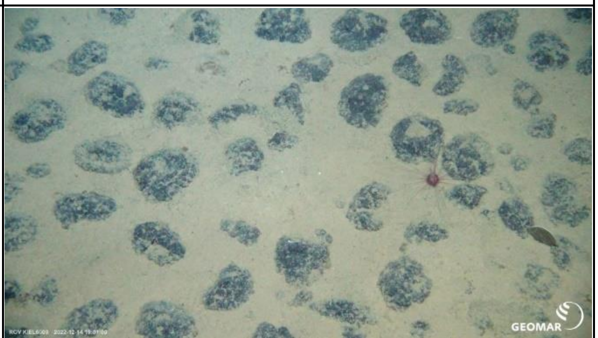
Elevator 1 hosting three microprofilers (MICP-DEEP1, MICP-DEEP2, and MICP2) and 2 amphipod traps was lowered while the ROV is descending. After arrival at the seafloor, Elevator 1 was released from the cable by the ROV. MICP-DEEP1, MICP-DEEP2, and MICP2 were taken from the elevator one after the other and deployed. Subsequently, a video transect was carried out following a section of the path of OFOS deployment 10. On the way towards sites selected for PUC sampling, some megafauna specimen were collected. PUC sampling took place at three sites (‘A’, ‘B’, ‘C’). After push-coring, the collection of megafauna specimen continued before finally picking up the 3 microprofilers and taking them one by one back to Elevator 1. The Elevator Recovery System was connected to Elevator 1 for retrieval before the ROV started to ascend.

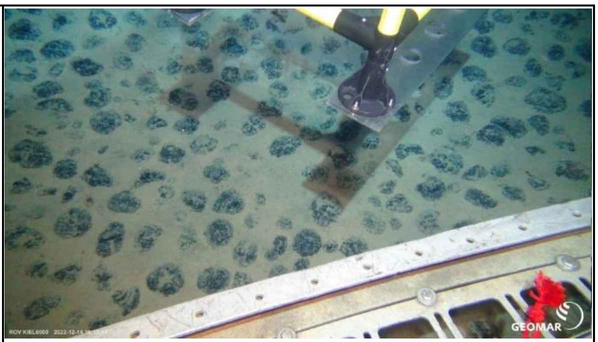
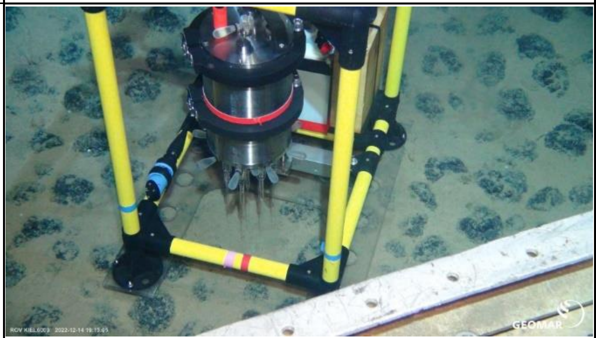
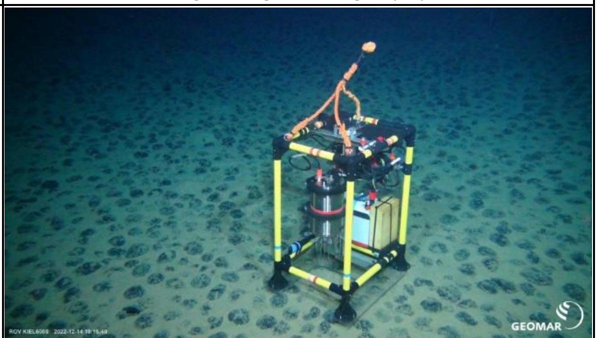
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-14	15:09:20	None	None	None	IN THE WATER
2022-12-14	17:01:41	-125.87663	14.11826	4532.96	AT THE BOTTOM
2022-12-14	17:08:12	-125.87632	14.11827	4521.45	Looking for Elevator 1 in water column
2022-12-14	17:08:20	-125.87631	14.11827	4521.51	Elevator 1 in view
2022-12-14	17:12:25	-125.87625	14.11829	4535.72	Elevator 1 close to the seafloor (photo not displayed) 20221214_171225_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:12:33	-125.87626	14.11829	4535.72	 Elevator 1 landing at the seafloor 20221214_171233_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:12:48	-125.87626	14.11830	4535.71	Elevator 1 deployed at the seafloor
2022-12-14	17:17:35	-125.87622	14.11825	4536.25	ROV operated shackle released
2022-12-14	17:24:30	-125.87626	14.11828	4536.11	Red shrimp
2022-12-14	17:31:20	-125.87616	14.11832	4537.14	Picking up MICP-DEEP1 from Elevator
2022-12-14	17:33:28	-125.87624	14.11831	4536.59	Flying with MICP-DEEP1 westwards towards deployment site
2022-12-14	17:36:49	-125.87636	14.11835	4537.31	 Snail 20221214_173649_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:37:14	-125.87638	14.11834	4537.3	Sea cucumber

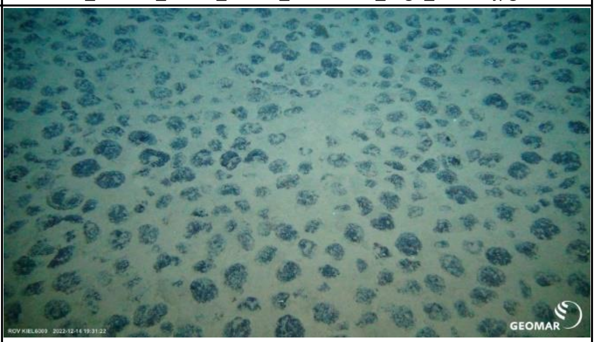
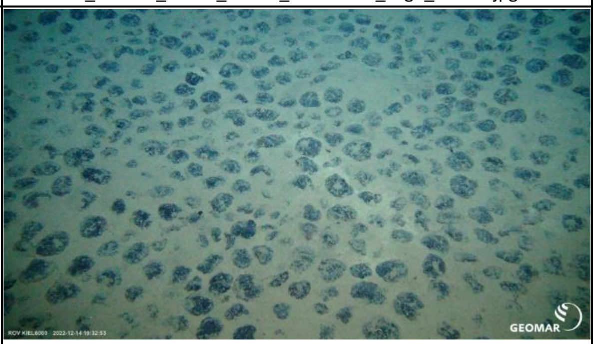
2022-12-14	17:42:27	-125.87647	14.11838	4537.31	 Deployment site MICP-DEEP1 20221214_174227_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:47:02	-125.87645	14.11834	4537.71	MICP-DEEP1 deployed at the seafloor
2022-12-14	17:47:45	-125.87644	14.11835	4537.7	 MICP-DEEP1 stage 1 20221214_174745_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:48:09	-125.87642	14.11835	4537.66	 MICP-DEEP1 stage 1 20221214_174809_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:48:57	-125.87640	14.11834	4537.56	Flying around to check positioning of Stage 2
2022-12-14	17:50:10	-125.87642	14.11830	4537.56	MICP-DEEP1 stage 2 (photo not displayed) 20221214_175010_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:50:18	-125.87642	14.11830	4537.55	MICP-DEEP1 stage 2 (photo not displayed) 20221214_175018_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:52:08	-125.87641	14.11831	4537.56	 MICP-DEEP1 stage 2: sensors 7&8 located right above a nodule 20221214_175208_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:54:20	-125.87641	14.11834	4537.37	MICP-DEEP1 started with magnet, stages turning: deployment MICP-DEEP1-1

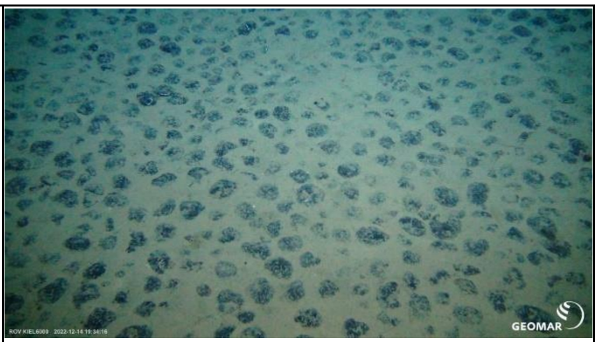
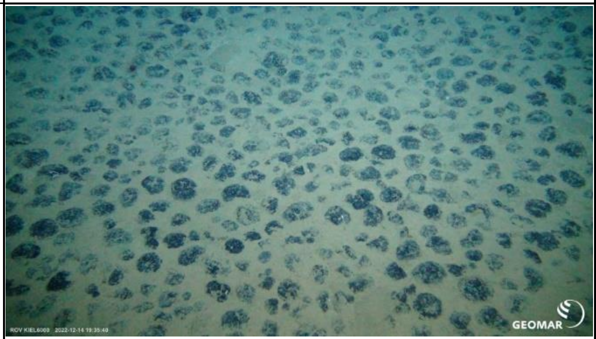
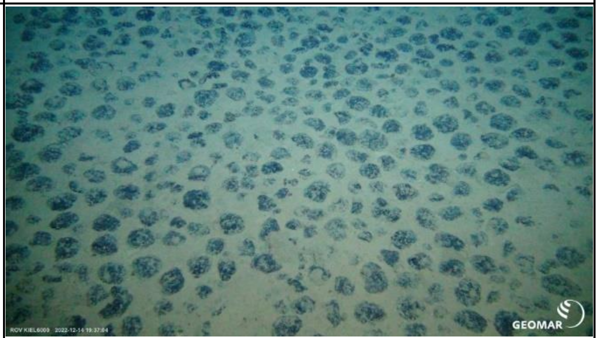
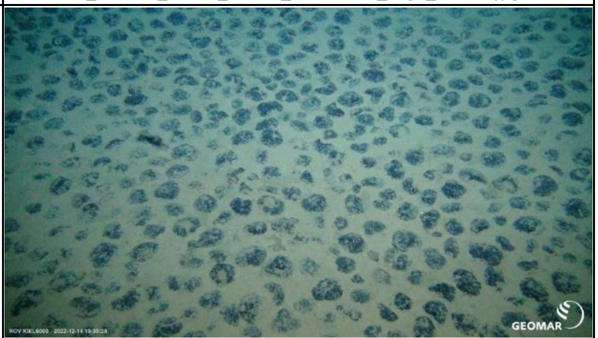
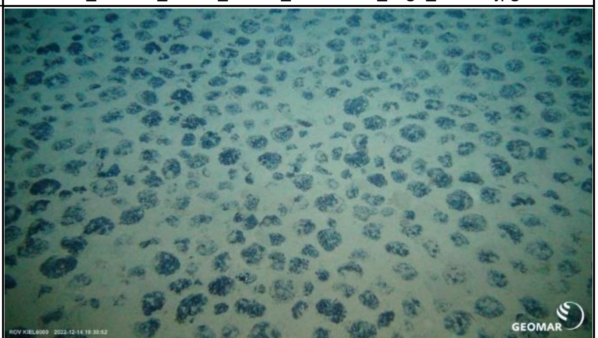
2022-12-14	17:56:09	-125.87639	14.11832	4537.17	 MICP-DEEP1 at seafloor 20221214_175609_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	17:56:27	-125.87639	14.11830	4536.8	Flying back to Elevator 1 to pick up next profiler
2022-12-14	18:00:58	-125.87619	14.11830	4536.83	Picking up MICP-DEEP2 from Elevator1
2022-12-14	18:01:33	-125.87617	14.11830	4536.73	Fauna
2022-12-14	18:01:35	-125.87617	14.11830	4536.73	Fish
2022-12-14	18:03:29	-125.87607	14.11831	4536.17	Flying towards south west to find deployment site of MICP-DEEP2
2022-12-14	18:06:32	-125.87626	14.11818	4537.06	Anemone or sponge
2022-12-14	18:19:01	-125.87595	14.11820	4537.81	 MICP-DEEP2 deployment site 20221214_181901_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:25:38	-125.87636	14.11813	4537.87	MICP-DEEP2 deployed
2022-12-14	18:25:46	-125.87636	14.11812	4537.88	 Fish near MICP-DEEP2 deployment site 20221214_182546_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:25:51	-125.87636	14.11813	4537.89	 20221214_182551_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:25:57	-125.87637	14.11813	4537.89	Fish near MICP-DEEP2 deployment site (photo not displayed) 20221214_182557_Sonne_SO295_202ROV24_Logo_thumb.jpg

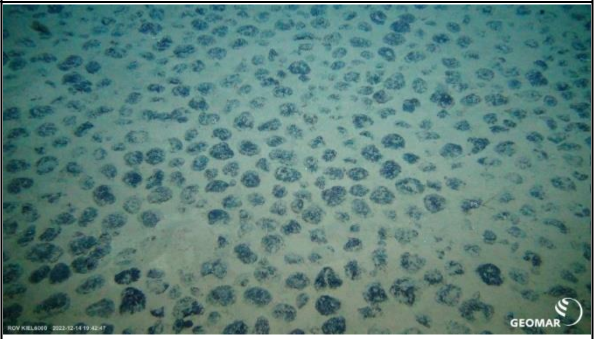
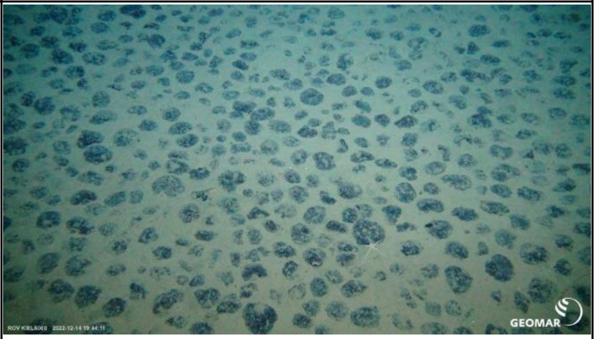
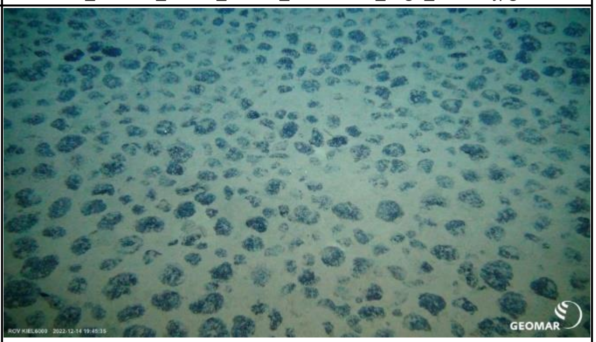
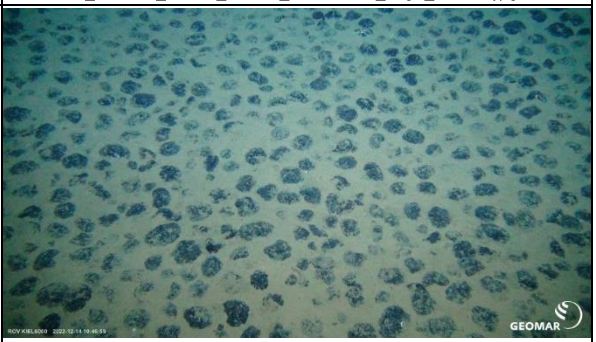
2022-12-14	18:27:13	-125.87634	14.11814	4537.9	 MICP-DEEP2 stage 1 20221214_182713_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:27:31	-125.87635	14.11815	4537.91	Flying around MICP-DEEP2 to check other stage
2022-12-14	18:31:54	-125.87641	14.11816	4537.8	Landing ROV on sediment to slightly adjust the positioning of MICP-DEEP2 to prevent sensors from hitting nodules
2022-12-14	18:34:29	-125.87644	14.11815	4538.27	Polychaete
2022-12-14	18:35:24	-125.87643	14.11814	4538.27	 MICP-DEEP2 stage 2 20221214_183524_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:37:25	-125.87638	14.11818	4538.29	MICP-DEEP2 started with magnet, stages turning: deployment MICP-DEEP2-1
2022-12-14	18:37:47	-125.87638	14.11818	4538.29	Fish
2022-12-14	18:39:03	-125.87639	14.11816	4538.21	MICP-DEEP2 at seafloor (photo not displayed) 20221214_183903_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:39:10	-125.87640	14.11816	4538.17	 MICP-DEEP2 at seafloor 20221214_183910_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:39:55	-125.87641	14.11815	4537.77	 MICP-DEEP2 at seafloor 20221214_183955_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:40:45	-125.87641	14.11818	4537.11	MICP-DEEP2 at seafloor (photo not displayed) 20221214_184045_Sonne_SO295_202ROV24_Logo_thumb.jpg

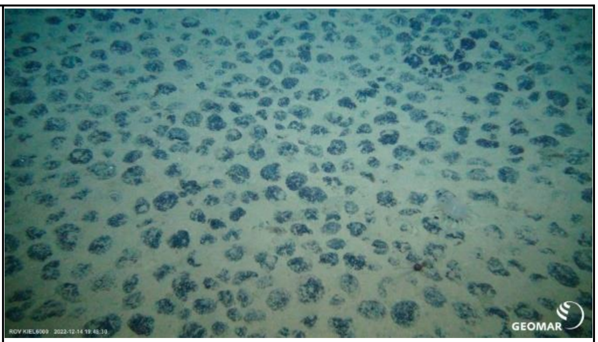
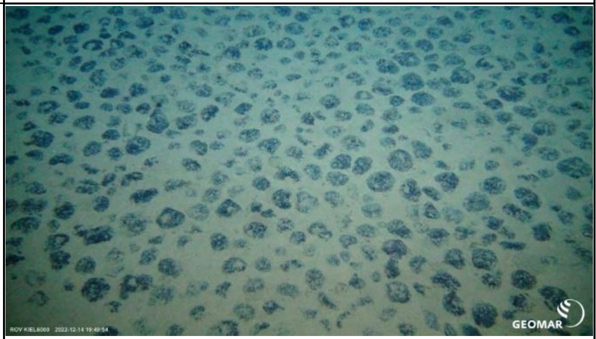
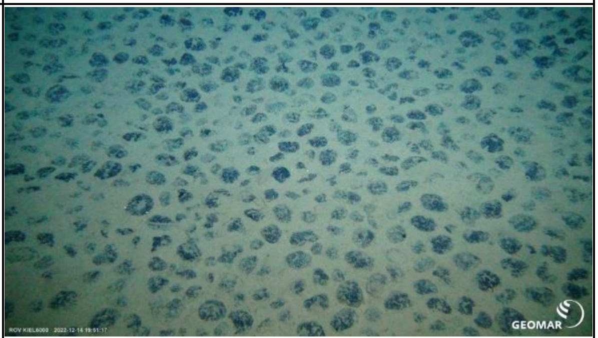
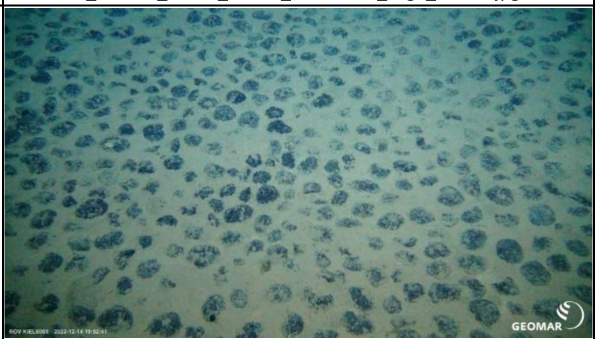
2022-12-14	18:40:49	-125.87641	14.11818	4537.03	 MICP-DEEP2 at seafloor 20221214_184049_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:40:49	-125.87641	14.11818	4537.03	Flying back to Elevator 1 to pick up MICP2
2022-12-14	18:45:27	-125.87614	14.11829	4537.26	 big red shrimp 20221214_184527_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:48:50	-125.87613	14.11837	4536.78	Picking up MICP2 from Elevator
2022-12-14	18:49:57	-125.87612	14.11827	4536.32	Flying towards south southeast to find MICP2 deployment site
2022-12-14	18:52:14	-125.87608	14.11815	4537.67	Sea cucumber
2022-12-14	18:52:18	-125.87608	14.11814	4537.7	Sea urchin
2022-12-14	18:54:10	-125.87607	14.11810	4537.83	 sea urchin 20221214_185410_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	18:54:18	-125.87607	14.11810	4537.83	Sea urchin
2022-12-14	19:01:00	-125.87602	14.11808	4538.02	 Sea urchin 20221214_190100_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:05:00	-125.87599	14.11808	4538.06	First trial to deploy MICP2 failed as sediment plume was created when positioning and moving instrument, looking for a new spot
2022-12-14	19:10:31	-125.87598	14.11807	4538.07	Photo Taken

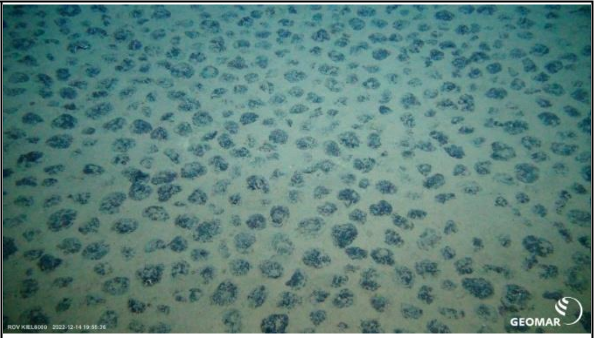
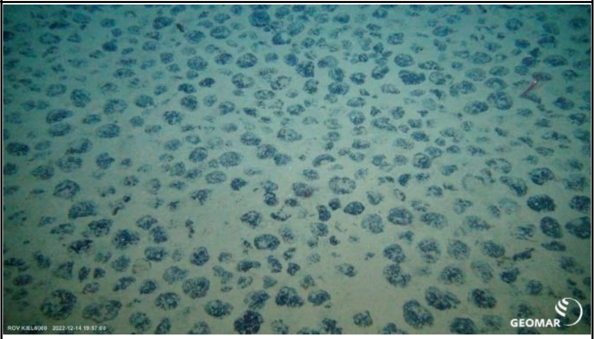
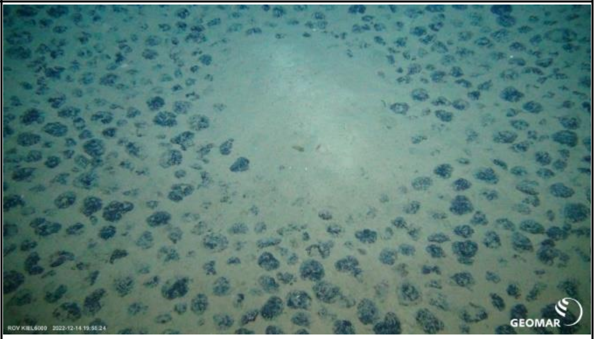
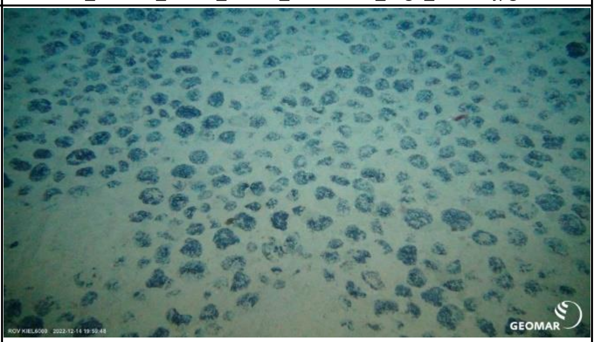
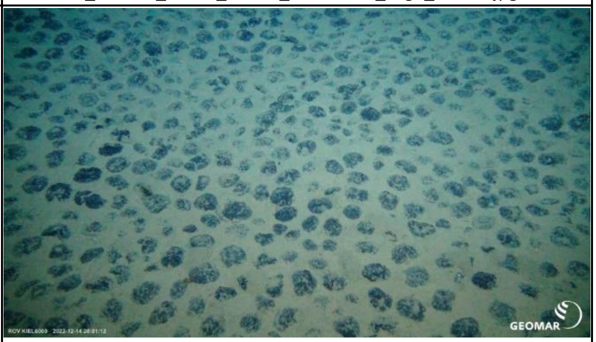
2022-12-14	19:10:34	-125.87598	14.11807	4538.07	 Second MICP2 deployment site 20221214_191034_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:12:37	-125.87598	14.11805	4538.09	MICP2 deployed at seafloor
2022-12-14	19:12:57	-125.87598	14.11805	4538.08	MICP2 at seafloor (photo not displayed) 20221214_191257_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:13:05	-125.87599	14.11807	4538.08	 MICP2 at seafloor (detail) 20221214_191305_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:14:48	-125.87601	14.11809	4538.04	MICP2 started with magnet, stage is turning: deployment MICP2-1
2022-12-14	19:15:40	-125.87603	14.11806	4538.05	 MICP2 at seafloor 20221214_191540_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:24:22	-125.87627	14.11815	4537.51	Flying west to the starting point of the ROV video transect (waypoint 'OFOS 10 end'
2022-12-14	19:25:49	-125.87640	14.11819	4537.29	Starting the transect (only every 10th image displayed in protocol)
2022-12-14	19:25:53	-125.87640	14.11819	4537.29	 20221214_192553_Sonne_SO295_202ROV24_Logo_thumb.jpg

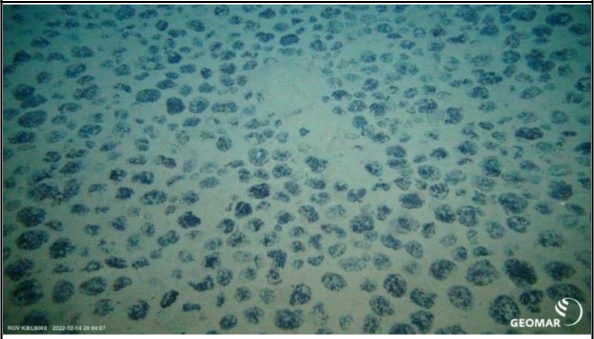
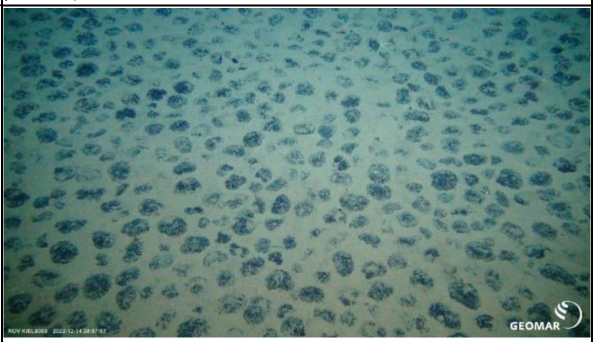
2022-12-14	19:27:03	-125.87640	14.11824	4537.16	 20221214_192703_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:28:34	-125.87649	14.11826	4537	 20221214_192834_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:29:58	-125.87659	14.11849	4536.86	 20221214_192958_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:31:22	-125.87667	14.11844	4536.78	 20221214_193122_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:32:53	-125.87672	14.11849	4536.71	 20221214_193253_Sonne_SO295_202ROV24_Logo_thumb.jpg

2022-12-14	19:34:16	-125.87681	14.11858	4536.68	 20221214_193416_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:35:40	-125.87684	14.11861	4536.62	 20221214_193540_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:37:04	-125.87692	14.11873	4536.59	 20221214_193704_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:38:28	-125.87698	14.11874	4536.56	 20221214_193828_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:39:52	-125.87703	14.11877	4536.53	 20221214_193952_Sonne_SO295_202ROV24_Logo_thumb.jpg

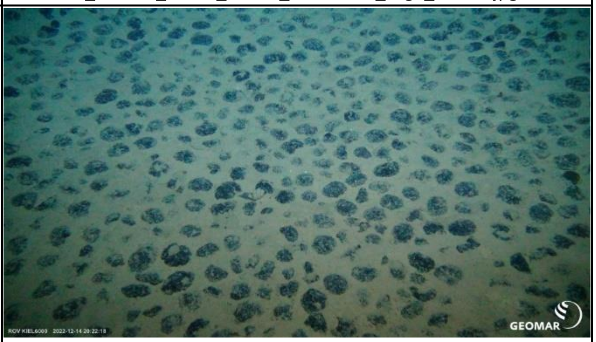
2022-12-14	19:41:23	-125.87709	14.11883	4536.5	 20221214_194123_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:42:47	-125.87711	14.11888	4536.44	 20221214_194247_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:44:11	-125.87717	14.11888	4536.4	 20221214_194411_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:45:35	-125.87720	14.11900	4536.36	 20221214_194535_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:46:59	-125.87726	14.11914	4536.33	 20221214_194659_Sonne_SO295_202ROV24_Logo_thumb.jpg

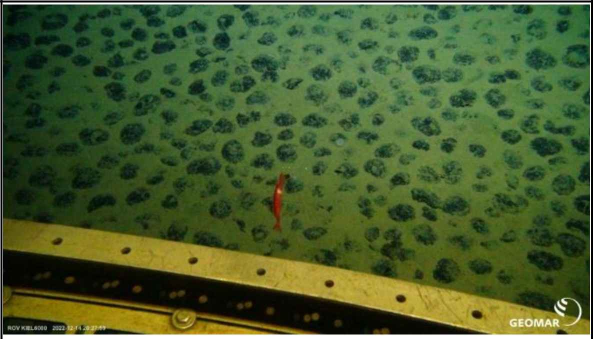
2022-12-14	19:48:30	-125.87727	14.11911	4536.3	 20221214_194830_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:49:54	-125.87730	14.11909	4536.24	 20221214_194954_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:51:17	-125.87737	14.11910	4536.19	 20221214_195117_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:52:41	-125.87745	14.11919	4536.13	 20221214_195241_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:54:05	-125.87750	14.11930	4536.08	 20221214_195405_Sonne_SO295_202ROV24_Logo_thumb.jpg

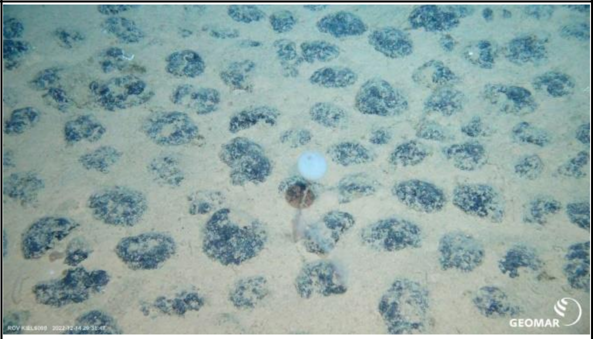
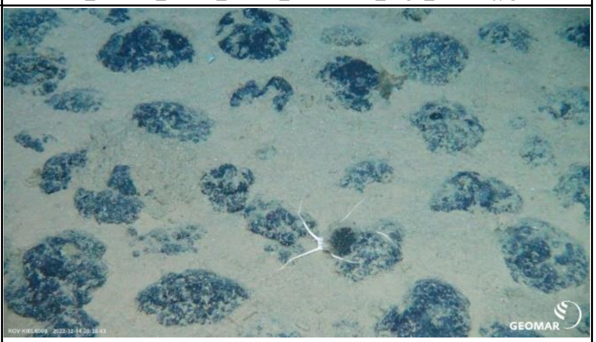
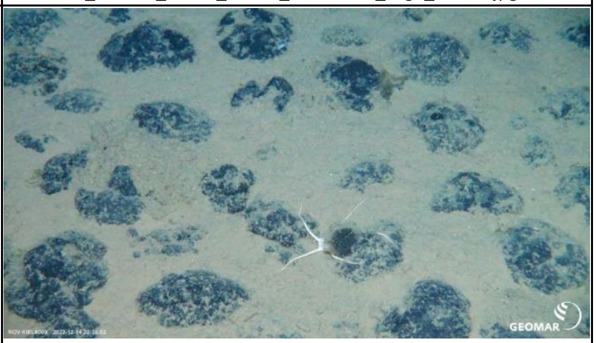
2022-12-14	19:55:36	-125.87756	14.11937	4536.02	 20221214_195536_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:57:00	-125.87761	14.11941	4535.98	 20221214_195700_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:58:24	-125.87769	14.11946	4535.92	 20221214_195824_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	19:59:48	-125.87774	14.11954	4535.89	 20221214_195948_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:01:12	-125.87772	14.11949	4535.87	 20221214_200112_Sonne_SO295_202ROV24_Logo_thumb.jpg

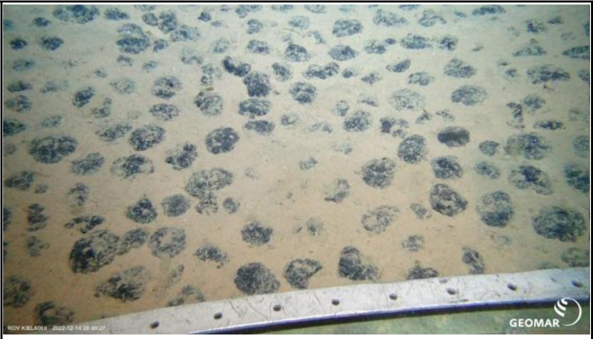
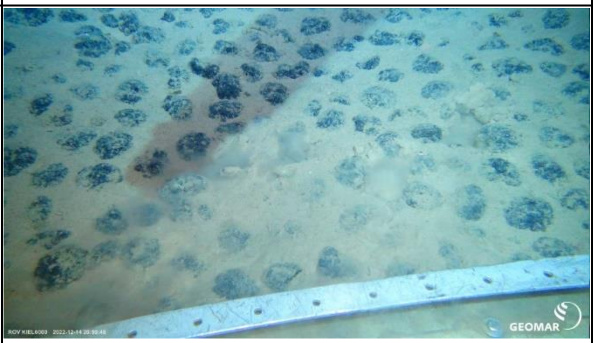
2022-12-14	20:02:43	-125.87769	14.11945	4535.9	 20221214_200243_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:04:07	-125.87773	14.11956	4535.92	 20221214_200407_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:05:31	-125.87777	14.11960	4535.99	 20221214_200531_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:06:55	-125.87792	14.11961	4536.01	 20221214_200655_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:07:10	-125.87792	14.11960	4536.01	going back the same track in a grid (only every 10th image displayed in protocol)
2022-12-14	20:07:57	-125.87793	14.11955	4535.98	 20221214_200757_Sonne_SO295_202ROV24_Logo_thumb.jpg

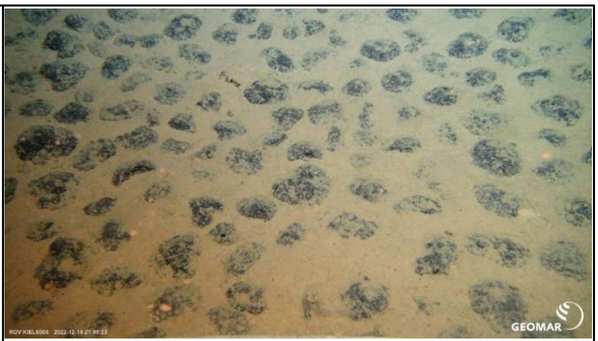
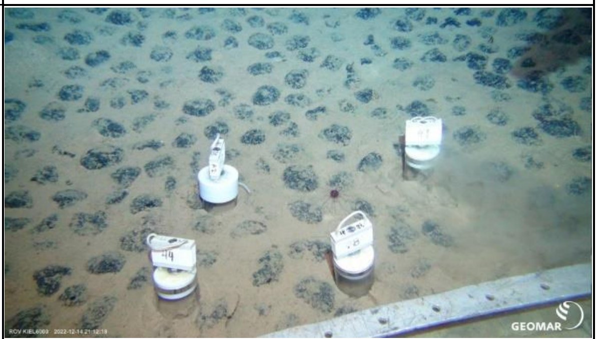
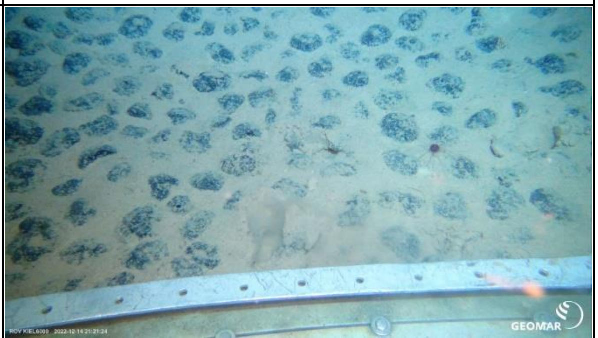
2022-12-14	20:09:21	-125.87793	14.11950	4535.89	 20221214_200921_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:10:45	-125.87796	14.11946	4535.8	 20221214_201045_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:12:16	-125.87797	14.11939	4535.74	 20221214_201216_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:13:40	-125.87793	14.11939	4535.73	 20221214_201340_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:15:04	-125.87782	14.11937	4535.69	 20221214_201504_Sonne_SO295_202ROV24_Logo_thumb.jpg

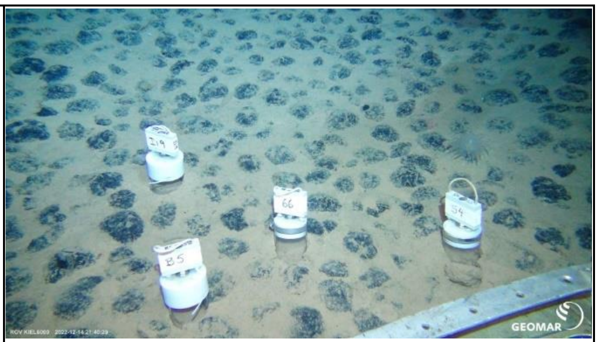
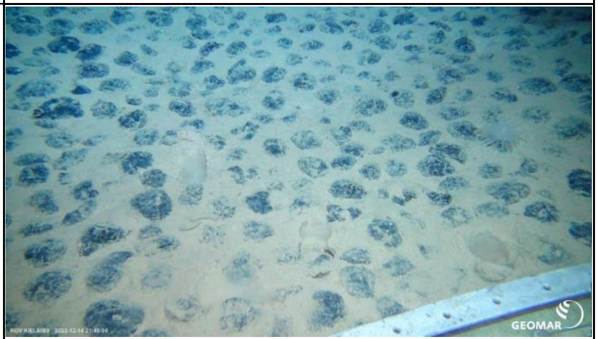
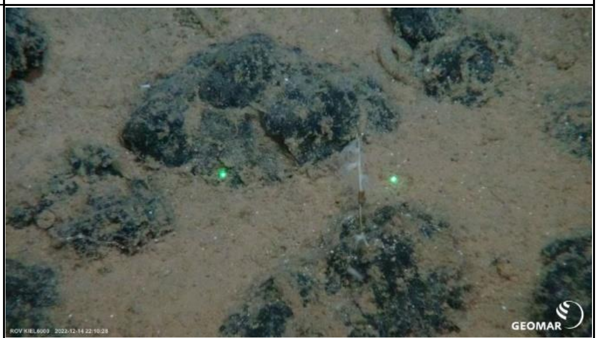
2022-12-14	20:16:28	-125.87773	14.11929	4535.7	 20221214_201628_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:17:59	-125.87757	14.11918	4535.72	 20221214_201759_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:19:23	-125.87752	14.11918	4535.81	 20221214_201923_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:20:47	-125.87745	14.11921	4535.92	 20221214_202047_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:22:18	-125.87740	14.11918	4536.05	 20221214_202218_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:23:48	-125.87738	14.11919	4536.11	Ending with video transect

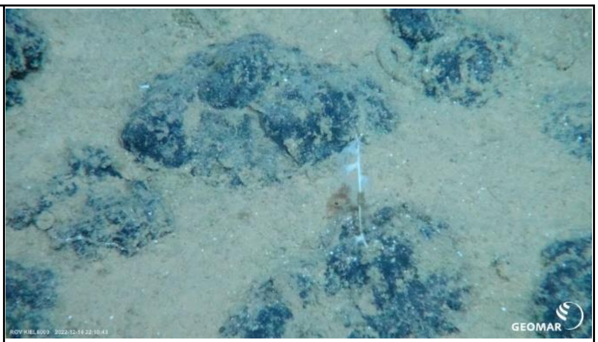
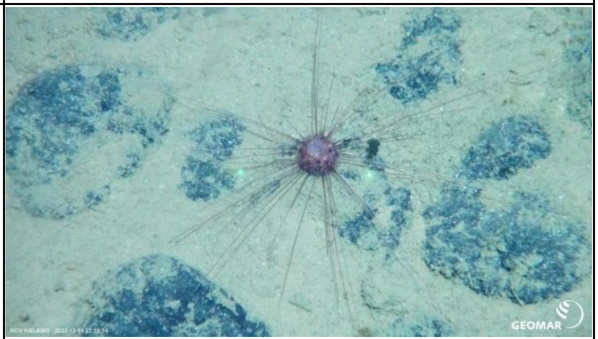
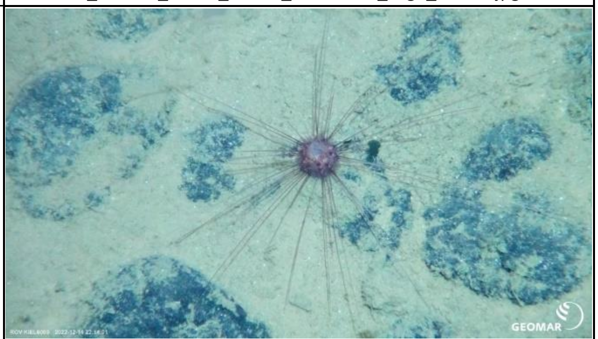
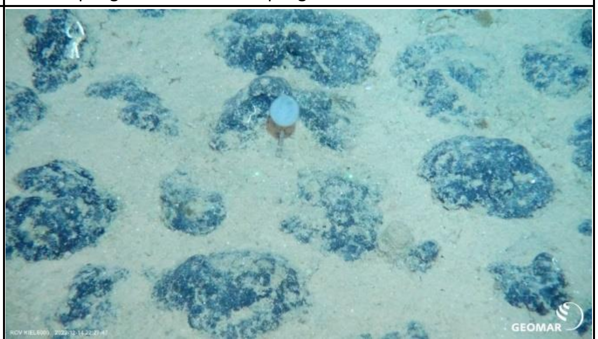
2022-12-14	20:27:01	-125.87735	14.11901	4535.97	Flying back towards the Elevator 1 to start PUC sampling north west of the elevator
2022-12-14	20:27:45	-125.87735	14.11894	4535.99	 Shrimp 20221214_202745_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:27:59	-125.87735	14.11894	4536	 Shrimp 20221214_202759_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:30:24	-125.87722	14.11885	4536.83	ROV landed for fauna sampling
2022-12-14	20:30:35	-125.87722	14.11887	4536.92	Brittle star (photo not displayed) 20221214_203035_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:30:45	-125.87722	14.11887	4536.98	 Brittle star 20221214_203045_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:32:06	-125.87721	14.11887	4537.08	ICBM Biobox extra large opened for collection of brittle star
2022-12-14	20:32:59	-125.87722	14.11882	4537.06	Brittle star collected in right biobox compartment: sample MEGA112
2022-12-14	20:34:25	-125.87722	14.11882	4536.71	ROV moving on towards a sponge
2022-12-14	20:37:18	-125.87705	14.11872	4536.92	ROV landed near stalked sponge and brittle star
2022-12-14	20:37:48	-125.87705	14.11873	4537.11	Stalked sponge (photo not displayed) 20221214_203748_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:38:01	-125.87706	14.11873	4537.14	Stalked sponge (photo not displayed) 20221214_203801_Sonne_SO295_202ROV24_Logo_thumb.jpg

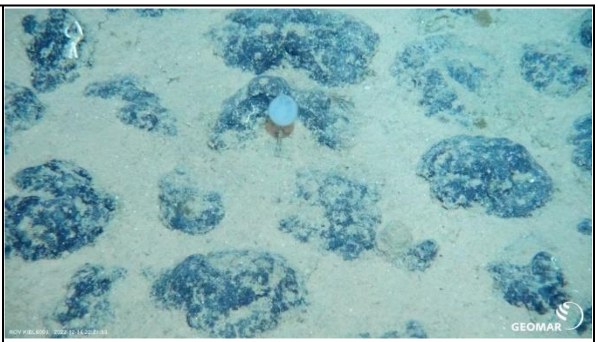
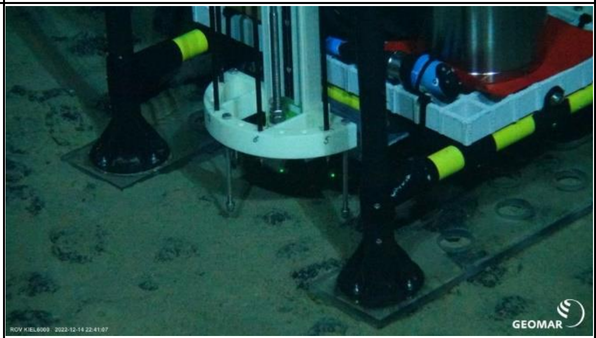
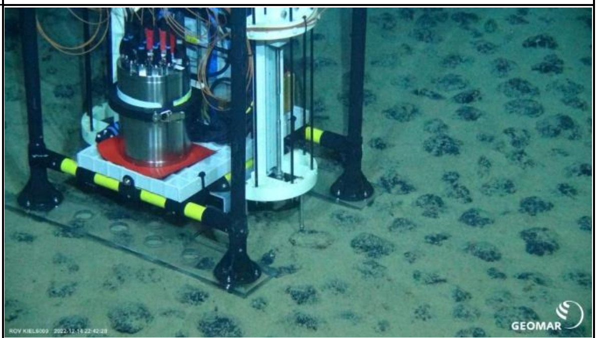
2022-12-14	20:38:28	-125.87707	14.11874	4537.16	 Stalked sponge 20221214_203828_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:38:37	-125.87707	14.11875	4537.16	Stalked sponge (photo not displayed) 20221214_203837_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:38:47	-125.87707	14.11875	4537.16	 Stalked sponge 20221214_203847_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:39:43	-125.87707	14.11876	4537.14	 Brittle star 20221214_203943_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:39:52	-125.87707	14.11876	4537.14	 Brittle star 20221214_203952_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:40:40	-125.87707	14.11876	4537.12	Opening ICBM Biobox extra large for megafauna collection
2022-12-14	20:42:33	-125.87705	14.11876	4537.11	Brittle star collected in left compartment: sample MEGA114
2022-12-14	20:44:49	-125.87708	14.11879	4537.09	Sponge collected in left compartment: sample MEGA113
2022-12-14	20:46:43	-125.87707	14.11876	4536.64	Continuing to fly direction east south east (120 degrees)
2022-12-14	20:47:33	-125.87705	14.11874	4536.6	Looking for a suitable site for PUC sampling
2022-12-14	20:48:52	-125.87706	14.11871	4536.92	ROV landed at selected PUC site

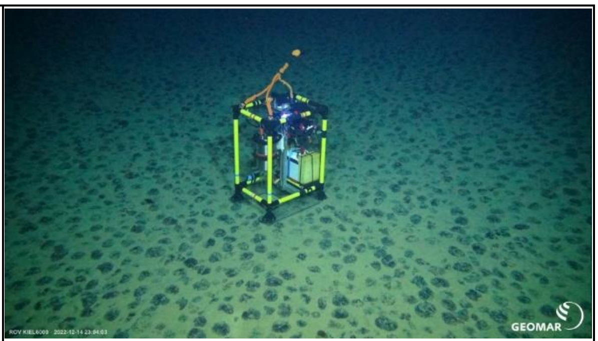
2022-12-14	20:49:27	-125.87705	14.11871	4537.11	 PUC site A prior to coring 20221214_204927_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:50:23	-125.87703	14.11874	4537.14	PUC sampling start at site A with PUCs from 16 Core Rack
2022-12-14	20:50:43	-125.87703	14.11874	4537.14	PUC74 deployed
2022-12-14	20:52:33	-125.87708	14.11873	4537.12	PUC9 deployed
2022-12-14	20:53:41	-125.87701	14.11880	4537.11	PUC22 deployed
2022-12-14	20:55:15	-125.87704	14.11881	4537.09	PUC75 deployed
2022-12-14	20:55:19	-125.87704	14.11881	4537.09	 PUC site A with deployed cores 20221214_205519_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:55:58	-125.87704	14.11881	4537.09	Retrieving PUCs back into 16 Core Rack
2022-12-14	20:56:46	-125.87704	14.11882	4537.06	PUC75 retrieved
2022-12-14	20:57:51	-125.87706	14.11878	4537.04	PUC22 retrieved
2022-12-14	20:58:50	-125.87707	14.11878	4537.03	PUC9 retrieved
2022-12-14	20:59:24	-125.87707	14.11879	4537.03	PUC74 retrieved
2022-12-14	20:59:46	-125.87706	14.11879	4537.02	 PUC site A post coring 20221214_205946_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	20:59:58	-125.87705	14.11879	4536.99	Selecting PUC site B

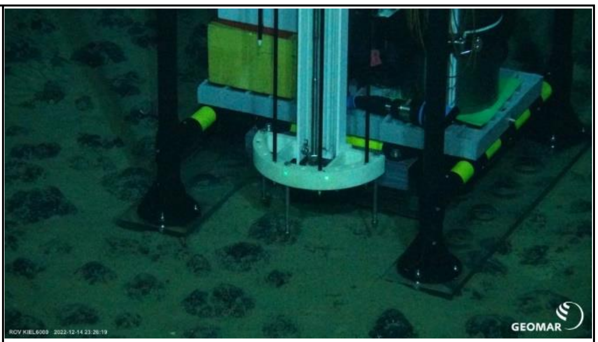
2022-12-14	21:05:33	-125.87687	14.11861	4536.88	 PUC site B prior to coring 20221214_210533_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	21:06:10	-125.87688	14.11860	4537.09	PUC sampling start at site B with PUCs from 16 Core Rack
2022-12-14	21:07:17	-125.87692	14.11862	4537.09	PUCA2 deployed
2022-12-14	21:08:58	-125.87694	14.11864	4537.08	PUC44 deployed
2022-12-14	21:10:58	-125.87689	14.11866	4537.07	PUC78 deployed
2022-12-14	21:12:17	-125.87691	14.11866	4537.06	PUC41 deployed
2022-12-14	21:12:18	-125.87691	14.11866	4537.06	 PUC site B with deployed cores 20221214_211218_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	21:12:50	-125.87690	14.11866	4537.06	Retrieving PUCs back into 16 Core Rack
2022-12-14	21:15:50	-125.87689	14.11858	4537.03	PUC41 retrieved
2022-12-14	21:17:14	-125.87688	14.11859	4537.01	PUC78 retrieved
2022-12-14	21:18:33	-125.87690	14.11857	4537.02	PUCA2 retrieved
2022-12-14	21:20:17	-125.87689	14.11861	4537.01	PUC44 retrieved
2022-12-14	21:21:24	-125.87686	14.11861	4536.85	 PUC site B post coring 20221214_212124_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	21:24:32	-125.87675	14.11843	4535.85	ROV moves direction south east towards PUC site C
2022-12-14	21:31:08	-125.87666	14.11849	4537.35	PUC sampling start at site C with PUCs from 16 Core Rack PUCD9 deployed
2022-12-14	21:33:18	-125.87670	14.11846	4537.33	PUC66 deployed
2022-12-14	21:35:27	-125.87670	14.11847	4537.32	PUCB5 deployed
2022-12-14	21:38:18	-125.87663	14.11847	4537.32	PUC54 deployed

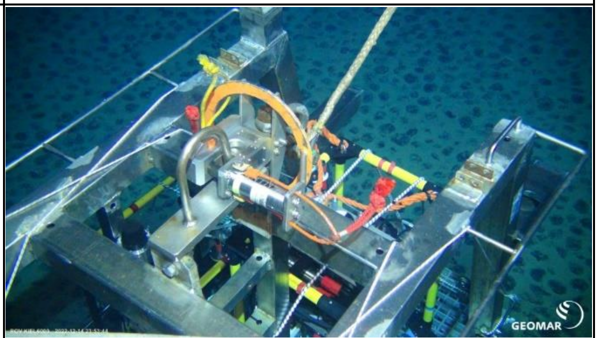
2022-12-14	21:40:29	-125.87659	14.11847	4537.32	 PUC site C with deployed cores 20221214_214029_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	21:41:08	-125.87660	14.11847	4537.32	Retrieving PUCs back into 16 Core Rack
2022-12-14	21:42:05	-125.87664	14.11845	4537.32	PUC54 rectrieved
2022-12-14	21:44:38	-125.87659	14.11842	4537.32	PUC66 retrieved
2022-12-14	21:46:15	-125.87662	14.11839	4537.3	PUCD9 retrieved
2022-12-14	21:48:17	-125.87656	14.11845	4537.31	PUCB5 retrieved
2022-12-14	21:49:06	-125.87661	14.11845	4537.25	 PUC site C post coring 20221214_214906_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	21:50:43	-125.87661	14.11835	4536.15	ROV continues moving to continue with megafauna sampling
2022-12-14	22:03:00	-125.87646	14.11808	4536.31	Searching for megafauna
2022-12-14	22:07:16	-125.87645	14.11795	4536.21	Coral selected for sampling
2022-12-14	22:10:28	-125.87650	14.11794	4537.31	 Coral 20221214_221028_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	22:10:37	-125.87650	14.11794	4537.31	Coral (photo not displayed) 20221214_221037_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	22:10:38	-125.87650	14.11794	4537.31	Photo Taken

2022-12-14	22:10:43	-125.87650	14.11794	4537.31	 Coral 20221214_221043_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	22:12:57	-125.87651	14.11793	4537.3	Coral collected into left compartment of ICBM Biobox extra large: sample MEGA115
2022-12-14	22:13:54	-125.87649	14.11796	4537.29	 Sea urchin 20221214_221354_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	22:14:01	-125.87650	14.11796	4537.29	 Sea urchin 20221214_221401_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	22:20:47	-125.87670	14.11801	4535.58	Seafloor photo taken by accident (photo not displayed) 20221214_222047_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	22:26:53	-125.87669	14.11816	4536.6	Stalked sponge selected for sampling
2022-12-14	22:27:47	-125.87668	14.11816	4536.73	 Stalked sponge 20221214_222747_Sonne_SO295_202ROV24_Logo_thumb.jpg

2022-12-14	22:27:53	-125.87668	14.11816	4536.73	 Stalked sponge 20221214_222753_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	22:33:25	-125.87670	14.11822	4536.75	Stalked sponge collected into left-hand compartment of biobox: sample MEGA116, then moving towards MICP-DEEP2-1 deployment site
2022-12-14	22:41:07	-125.87640	14.11824	4536.67	 MICP-DEEP2 stage 2 pre retrieval 20221214_224107_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	22:42:20	-125.87636	14.11818	4536.69	 MICP-DEEP2 stage 1 pre retrieval 20221214_224220_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	22:46:03	-125.87635	14.11823	4536.54	MICP-DEEP2 picked up by ROV
2022-12-14	22:46:55	-125.87634	14.11821	4536.33	ROV flying towards Elevator 1
2022-12-14	22:49:31	-125.87617	14.11839	4536.37	ROV arrived at Elevator 1
2022-12-14	22:52:58	-125.87616	14.11845	4536.39	Grenadier fish behind Elevator 1
2022-12-14	22:54:11	-125.87614	14.11843	4536.44	MICP-DEEP 2 placed on Elevator 1
2022-12-14	22:58:43	-125.87615	14.11844	4536.87	MICP DEEP2 secured with rubber band both on right and left side
2022-12-14	23:00:20	-125.87617	14.11839	4536.65	ROV flying towards MICP2-1 deployment site
2022-12-14	23:01:40	-125.87614	14.11831	4536.65	Fish close to the elevator, not a grenadier but too far to verify
2022-12-14	23:02:26	-125.87607	14.11815	4536.71	Picking up MICP2
2022-12-14	23:02:39	-125.87607	14.11815	4536.72	Grenadier fish

2022-12-14	23:04:03	-125.87599	14.11808	4536.7	 MICP2 pre retrieval 20221214_230403_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:04:40	-125.87599	14.11807	4536.72	 MICP2 pre retrieval 20221214_230440_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:04:49	-125.87599	14.11805	4536.73	 MICP2 pre retrieval 20221214_230449_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:05:05	-125.87598	14.11802	4536.72	MICP2 pre retrieval (photo not displayed) 20221214_230505_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:07:39	-125.87593	14.11808	4536.65	MICP2 picked up
2022-12-14	23:08:01	-125.87594	14.11808	4536.64	Swimming shrimp
2022-12-14	23:09:01	-125.87596	14.11808	4536.63	Flying towards Elevator 1 with MICP2 in gripper of right manipulator (‘Orion’)
2022-12-14	23:09:37	-125.87600	14.11811	4536.63	Elevator 1 in view
2022-12-14	23:10:35	-125.87607	14.11829	4536.52	Many fish around Elevator 1 probably because of amphipod trap
2022-12-14	23:12:40	-125.87612	14.11828	4536.48	MICP2 placed onto Elevator 1 on top platform and gently pushed in
2022-12-14	23:18:22	-125.87621	14.11857	4536.55	MICP2 secured on Elevator 1 with elastic band
2022-12-14	23:20:35	-125.87617	14.11855	4536.6	Swimming sea cucumber
2022-12-14	23:24:37	-125.87616	14.11840	4535.55	ROV flying towards location of deployment MICP-DEEP1-1 to pick it up
2022-12-14	23:25:17	-125.87627	14.11842	4535.35	Arriving at MICP-DEEP1. Instruments is blinking : program is finished

2022-12-14	23:26:19	-125.87633	14.11845	4536.08	 MICP-DEEP1 stage 2 20221214_232619_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:26:33	-125.87634	14.11845	4536.2	MICP-DEEP1 stage 2 (photo not displayed) 20221214_232633_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:28:46	-125.87633	14.11845	4535.87	MICP-DEEP1 picked up
2022-12-14	23:29:07	-125.87632	14.11844	4535.38	Moving with MICP-DEEP1 in gripper of right manipulator (‘Orion’) towards Elevator 1
2022-12-14	23:30:00	-125.87627	14.11843	4535.07	Elevator 1 in view
2022-12-14	23:32:53	-125.87606	14.11841	4536.64	MICP-DEEP1 placed onto Elevator 1 on the lower platform
2022-12-14	23:35:02	-125.87608	14.11841	4537.12	MICP-DEEP1 secured with elastic bands
2022-12-14	23:35:17	-125.87608	14.11840	4537.09	Fish are going wild next to the elevator
2022-12-14	23:36:00	-125.87609	14.11843	4536.5	Scientific program finished
2022-12-14	23:36:05	-125.87609	14.11843	4536.38	Waiting for the Elevator Recovery System ('Bergefuchs’) at some distance of Elevator 1
2022-12-14	23:41:04	-125.87610	14.11834	4526.7	Lights of Elevator Recovery System in sight
2022-12-14	23:44:09	-125.87606	14.11827	4526.76	Moving towards Elevator Recovery System
2022-12-14	23:45:01	-125.87592	14.11826	4527.75	 Elevator Recovery System 20221214_234501_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:45:12	-125.87582	14.11829	4528.23	 Elevator Recovery System 20221214_234512_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:47:06	-125.87579	14.11827	4531.21	ROV grabbed onto ROV operated shackle of Elevator Recovery System
2022-12-14	23:48:17	-125.87581	14.11826	4531.43	Moving with ROV operated shackle on ROV porch back towards Elevator 1

2022-12-14	23:48:45	-125.87584	14.11825	4531.53	 Moving with ROV operated shackle towards Elevator 1 20221214_234845_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:50:11	-125.87614	14.11820	4533.25	Elevator 1 in view
2022-12-14	23:51:51	-125.87608	14.11831	4535.45	ROV operated shackle connected to Elevator 1
2022-12-14	23:53:44	-125.87607	14.11831	4535.46	 ROV operated shackle connected to Elevator 1 20221214_235344_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:53:53	-125.87607	14.11830	4535.46	ROV operated shackle connected to Elevator 1 (photo not displayed) 20221214_235353_Sonne_SO295_202ROV24_Logo_thumb.jpg
2022-12-14	23:57:19	-125.87620	14.11828	4535.19	Elevator is being pulled up
2022-12-14	23:57:39	-125.87620	14.11829	4535.18	Elevator off the bottom
2022-12-14	23:58:22	-125.87622	14.11828	4535.08	Anemone
2022-12-14	23:59:22	-125.87644	14.11831	4534.52	swimming sea cucumber
2022-12-15	00:00:04	-125.87668	14.11841	4529.85	OFF THE BOTTOM
2022-12-15	01:49:00	None	None	None	ON DECK

Kiel 6000 Dive 25 (SO295_209-1_ROV-25)

Date: 15.Dec.2022

Principal Investigators: Duygu Sevilgen, Sabine Gollner, Lilian Böhringer

Observers: Felix Janssen, Devin Vlach, Carsten Rühlemann, Lilian Böhringer

Protocol: Felix Janssen

ROV positions (at the bottom)
Start of dive: 14°6.744' N 125°52.369' W
End of dive: 14°6.767' N 125°52.343' W

Dive duration:
ROV in the water: 15.Dec.2022 15:54:35
ROV at the bottom: 15.Dec.2022 17:46:52
ROV off the bottom: 16.Dec.2022 00:27:03
ROV on deck: 16.Dec.2022 02:12:47

Explored sites: BEL plume impact (thick cover)

Aims of the Dive:

- Deploy Elevator 1
- Deploy Fiberoptical Microsensor Profilers (MICP-DEEP 1 & 2)
- Deploy Electrochemical Microsensor Profiler (MICP1)
- Photo transect
- Megafauna sampling
- Push Core (PUC) sampling
- Retrieval of MICP-DEEP1 & 2, MICP1
- Recovery of Elevator 1

Handled ROV Tools (including scientific payload):

- 16 Core PUC Rack
- Magnet Stick
- Megafauna sampling tools:
  Handnets, Scoop, Shovel, Suction Pump
- ICBM Biobox extra large

Relevant Elevator payload:

Elevator 1

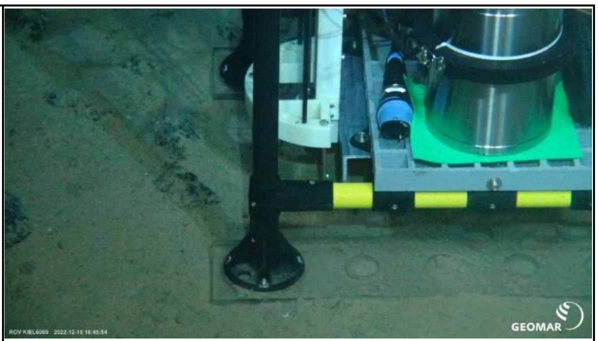
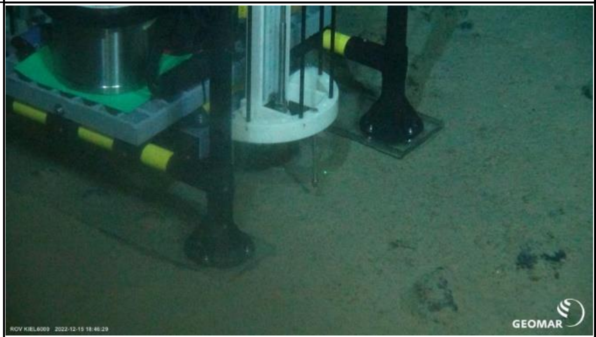
- Electrochemical Microsensor Profiler (MICP1)
- 2 Fiberoptical Microsensor Profilers (MICP-DEEP1, MICP-DEEP2)

Dive summary

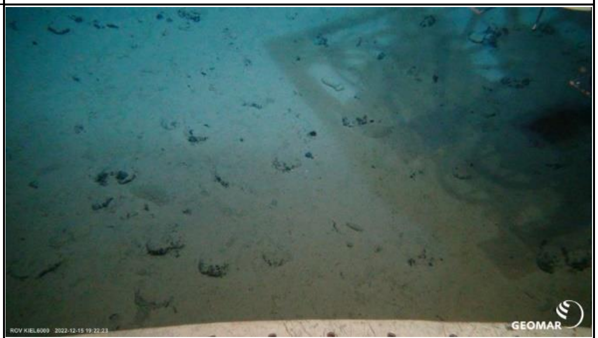
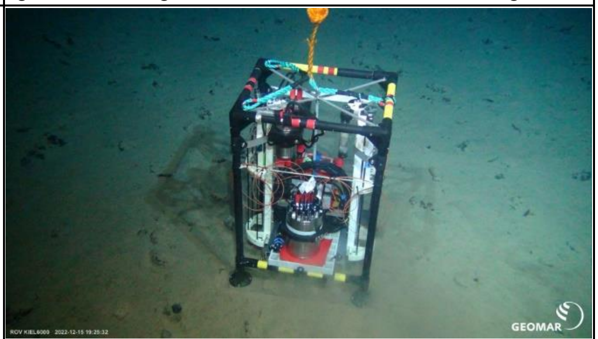
Elevator 1, hosting three microprofilers (MICP-DEEP1, MICP-DEEP2, and MICP1) was lowered while the ROV was descending. After arrival at the seafloor, Elevator 1 was released from the ship's cable by the ROV. MICP-DEEP1, MICP-DEEP2, and MICP1 were taken from the elevator one after the other and deployed in the area with thick-covered nodules. Subsequently, a photo transect was carried out following a section of the path of OFOS deployment 11. Extensive sampling of megafauna specimen took place afterwards, interrupted by PUC sampling of sediments within thick-covered nodules. After PUC sampling, the collection of megafauna specimen continued. Finally, the three microprofilers were picked up and taken one by one back to Elevator 1. The Elevator Recovery System was connected to Elevator 1 for retrieval before the ROV started to ascend for the last time during this expedition.

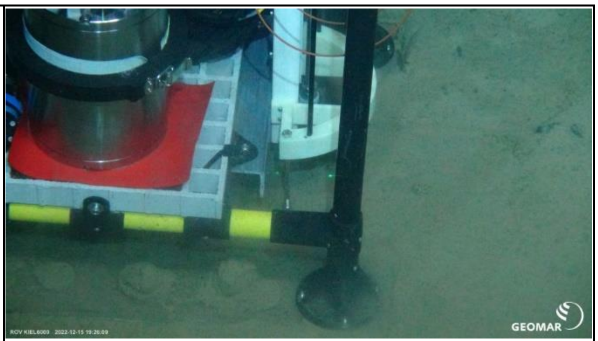
Date	UTC Time	SUB1_Lon	SUB1_Lat	SUB1_Depth	Observations/Comments / Image
2022-12-15	15:54:35	None	None	None	IN THE WATER
2022-12-15	17:12:25	-125.87280	14.11255	2997.05	ROV manipulator gripper (photo not displayed) 20221215_171225_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	17:12:34	-125.87280	14.11255	3004.48	ROV manipulator gripper (photo not displayed) 20221215_171234_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	17:34:15	-125.87279	14.11259	4008.68	ROV manipulator gripper (photo not displayed) 20221215_173415_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	17:46:52	-125.87282	14.11240	4529.55	AT THE BOTTOM
2022-12-15	17:55:01	-125.87274	14.11289	4524.76	Posidonia positioning jumpy
2022-12-15	17:55:33	-125.87272	14.11292	4524.74	Waiting for Elevator 1 to come into view / arrive at target position
2022-12-15	17:56:10	-125.87270	14.11292	4524.72	Homer beacon indicates 100m distance, approaching elevator position
2022-12-15	17:56:52	-125.87268	14.11299	4524.79	Elevator 1 is being lowered step by step
2022-12-15	18:05:41	-125.87264	14.11291	4526.34	Elevator 1 in view right in front
2022-12-15	18:08:16	-125.87273	14.11315	4528.18	Elevator 1 can be clearly seen with instruments blinking
2022-12-15	18:11:04	-125.87227	14.11268	4534.93	Elevator 1 arriving at seafloor
2022-12-15	18:12:58	-125.87228	14.11258	4535.21	Elevator 1 deployment created sediment cloud. Limited visibility around the elevator
2022-12-15	18:14:02	-125.87225	14.11272	4535.14	Bottom water currents seem to be rather slow today - sediment cloud is hardly moving
2022-12-15	18:16:06	-125.87215	14.11261	4535.62	ROV porch (photo not displayed) 20221215_181606_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:16:42	-125.87215	14.11261	4535.82	Approaching Elevator to release ROV operated shackle
2022-12-15	18:20:19	-125.87223	14.11272	4537.51	ROV operated shackle released and kept in manipulator claw while heading backwards away from the elevator
2022-12-15	18:20:57	-125.87222	14.11273	4537.51	Cable with ROV operated shackle is being hieved
2022-12-15	18:21:32	-125.87221	14.11268	4537.47	Rope from elevator entangled with ROV, free shortly after
2022-12-15	18:22:47	-125.87219	14.11253	4537.4	Ship moving 100m towards south east to give room for ROV work near the elevator
2022-12-15	18:22:58	-125.87219	14.11252	4537.4	 Christmas egg / season's greetings from the ROV team 20221215_182258_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:25:06	-125.87218	14.11238	4537.86	Waiting for the ship to move away
2022-12-15	18:26:08	-125.87217	14.11254	4538.17	MICP-DEEP
2022-12-15	18:26:18	-125.87217	14.11254	4538.23	Approaching Elevator 1 to pick up MICP-DEEP1
2022-12-15	18:27:27	-125.87218	14.11251	4538.85	Visibility at the elevator is back now
2022-12-15	18:27:51	-125.87219	14.11252	4539	Removing elastic ropes holding MICP-DEEP in place
2022-12-15	18:30:00	-125.87212	14.11258	4538.17	MICP-DEEP1 taken from Elevator 1

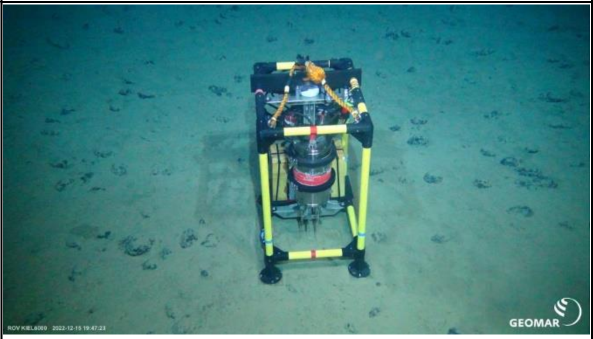
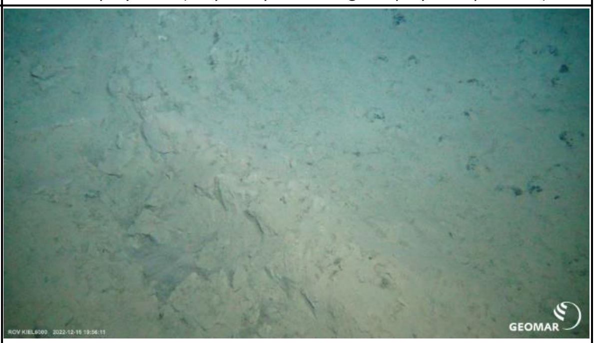
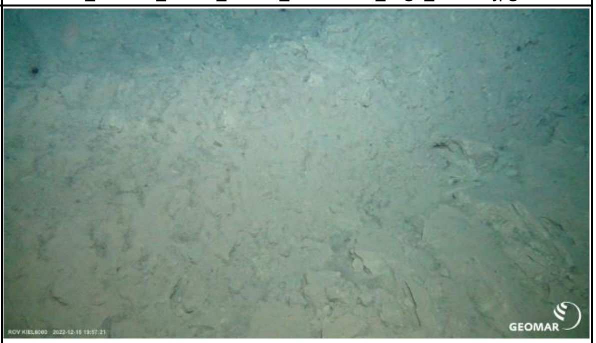
2022-12-15	18:30:14	-125.87207	14.11259	4537.92	cabel ties needed a bit of pull to break
2022-12-15	18:30:37	-125.87202	14.11261	4537.52	heading north east with MICP-DEEP 1 in manipulator gripper
2022-12-15	18:32:09	-125.87204	14.11262	4537.5	Nodules are thickly covered - only few dark spots visible
2022-12-15	18:32:52	-125.87209	14.11268	4537.96	Posidonia positioning jumpy
2022-12-15	18:35:27	-125.87228	14.11286	4537.83	One of the experimental Corrals used for food web experiments and lost from elevator during SONNE SO268/2 spotted at the seafloor
2022-12-15	18:35:47	-125.87230	14.11289	4537.94	Experimental Corral (photo not displayed) 20221215_183547_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:36:02	-125.87230	14.11289	4538.11	 Experimental Corral used for food web experiments on SO268 20221215_183602_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:36:55	-125.87231	14.11290	4539.11	Looking for a spot to deploy MICP-DEEP1
2022-12-15	18:37:48	-125.87231	14.11289	4539.7	 MICP-DEEP1 deployment site 20221215_183748_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:37:58	-125.87231	14.11289	4539.71	Photo Taken
2022-12-15	18:38:12	-125.87232	14.11289	4539.72	Patch without visible nodules selected for deployment of MICP-DEEP1
2022-12-15	18:41:04	-125.87232	14.11292	4539.73	MICP-DEEP
2022-12-15	18:41:10	-125.87232	14.11292	4539.73	Starting MICP-DEEP1 with Magnet stick on the porch
2022-12-15	18:41:47	-125.87232	14.11292	4539.76	Gear wheels turning: program started
2022-12-15	18:44:35	-125.87230	14.11296	4539.95	MICP-DEEP deployed at the seafloor: deployment MICP-DEEP1-1 with the visible sensor close to a nodule (hoping that there is a gap next to the nodule large enough for the sensors)
2022-12-15	18:45:17	-125.87230	14.11297	4540.01	 MICP-DEEP1 stage 2 20221215_184517_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:45:51	-125.87230	14.11297	4540.04	Stage 2 sensors close to nodule - hopefully there are no further nodules in the immediate vicinity

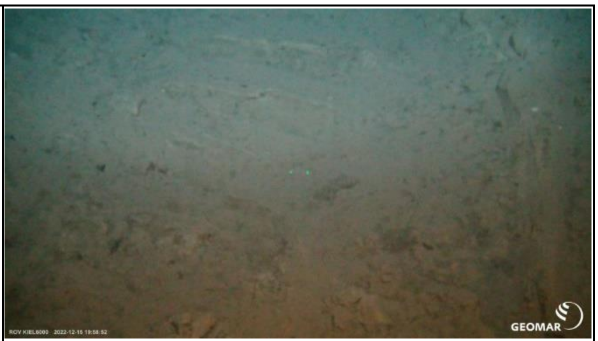
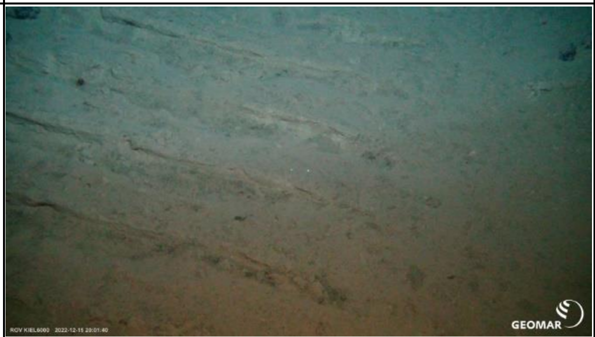
2022-12-15	18:45:54	-125.87230	14.11298	4540.04	 MICP-DEEP1 stage 2 20221215_184554_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:46:02	-125.87231	14.11299	4540.05	MICP-DEEP1 stage 1 (photo not displayed) 20221215_184602_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:46:21	-125.87230	14.11298	4540.08	No visible nodules under stage 1
2022-12-15	18:46:29	-125.87229	14.11297	4540.09	 MICP-DEEP1 stage 1 20221215_184629_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:46:44	-125.87227	14.11295	4540.12	MICP-DEEP1 stage 1 (photo not displayed) 20221215_184644_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:46:46	-125.87227	14.11295	4540.12	Photo Taken
2022-12-15	18:47:02	-125.87226	14.11293	4540.13	 Fish within experimental corral from SO268 20221215_184702_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:47:40	-125.87226	14.11293	4540.13	Fish within Corral
2022-12-15	18:47:53	-125.87226	14.11293	4540.13	 MICP-DEEP1 20221215_184753_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:49:21	-125.87229	14.11291	4540.15	Hardly any nodules visible at the surface - they seem to all be deeply buried – only from very short distance some indications of bumpy structure of the sediment surface (indicative of nodules under the sediment) becomes visible

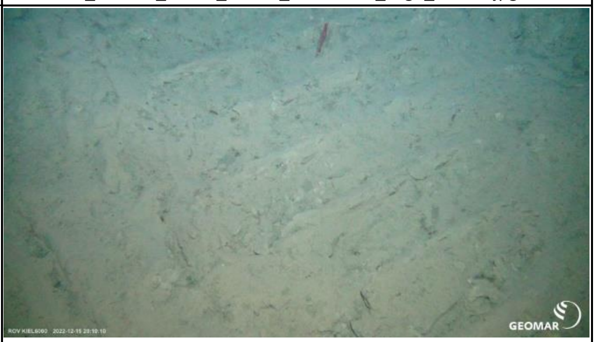
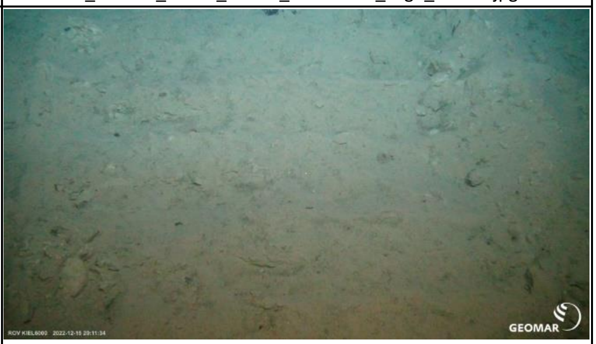
2022-12-15	18:49:27	-125.87229	14.11291	4540.14	 Big nodule or sediment lump with isopod on top 20221215_184927_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:49:41	-125.87229	14.11290	4540.14	Big nodule or sediment lump with isopod on top (not displayed) 20221215_184941_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:49:53	-125.87229	14.11290	4540.13	of big nodule or sediment lump with isopode on top
2022-12-15	18:50:38	-125.87226	14.11290	4540.15	another isopod
2022-12-15	18:51:49	-125.87225	14.11293	4540.23	 Big nodule or sediment lump with isopod on top 20221215_185149_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:52:33	-125.87225	14.11292	4540.05	Still it is not 100% clear whether this is an area with few nodules only or if they are just covered by a very thick sediment layer
2022-12-15	18:53:33	-125.87225	14.11280	4539.44	Heading back to Elevator 1 to pick up MICP-DEEP2
2022-12-15	18:55:13	-125.87224	14.11262	4538.63	Nodules below the surface become clearly visible as bumps on the way back to Elevator 1 but only few dark spots are visible
2022-12-15	18:55:28	-125.87223	14.11260	4538.6	Sea cucumber
2022-12-15	18:55:34	-125.87223	14.11260	4538.6	 Sea cucumber 20221215_185534_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	18:56:37	-125.87221	14.11256	4538.61	Empty eggshell on the seafloor - maybe from a previous dive around Easter…
2022-12-15	18:56:49	-125.87221	14.11256	4538.57	Arriving at the Elevator 1
2022-12-15	19:00:25	-125.87188	14.11231	4539.18	Removing elastic ropes
2022-12-15	19:02:07	-125.87215	14.11253	4539.06	Picking up MICP-DEEP2 from Elevator 1
2022-12-15	19:05:34	-125.87210	14.11256	4539.35	Heading north east towards SO295 MUC35 deployment position
2022-12-15	19:07:03	-125.87190	14.11263	4541.01	Nodule coverage seems to get a bit thinner (or nodules are bigger here so more stick out)
2022-12-15	19:07:15	-125.87187	14.11264	4541.13	50 m away from elevator

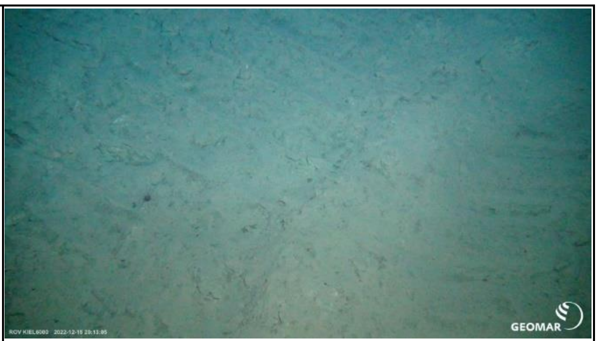
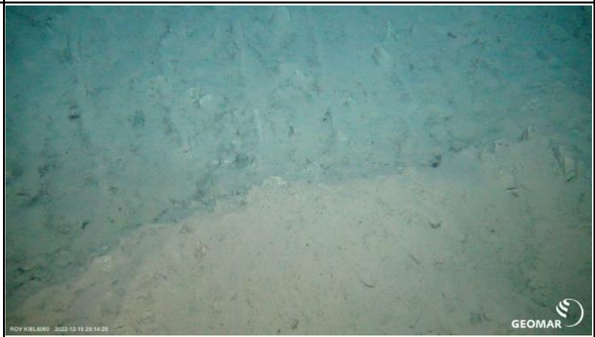
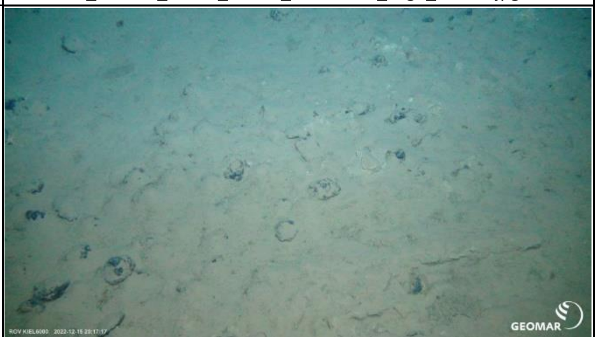
2022-12-15	19:09:12	-125.87186	14.11266	4541.38	 Site selected for first attempt to deploy MICP-DEEP2 with few nodules visible at the surface 20221215_190912_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	19:14:02	-125.87183	14.11269	4541.68	MICP-DEEP 2 started with Magnet Stick on porch
2022-12-15	19:14:23	-125.87184	14.11267	4541.69	Gear wheels turning: program started
2022-12-15	19:17:31	-125.87184	14.11265	4541.81	First attempt to deploy MICP-DEEP2 at the seafloor
2022-12-15	19:18:31	-125.87184	14.11264	4541.8	Instrument touchdown was a bit rough. Taking MICP-DEEP2 up again for a second try.
2022-12-15	19:20:17	-125.87183	14.11271	4541.78	ROV moving a little more forward
2022-12-15	19:22:23	-125.87180	14.11269	4541.95	 MICP-DEEP2 deployment site selected for second try 20221215_192223_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	19:23:14	-125.87181	14.11270	4541.94	This time a nodule is selected to go directly below the threaded rod of stage 2 so the sensors form a half circle around it
2022-12-15	19:25:00	-125.87181	14.11270	4542	Again a bit of a rough touchdown with sediment cloud evolving
2022-12-15	19:25:32	-125.87183	14.11272	4542.02	 MICP-DEEP2 20221215_192532_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	19:25:39	-125.87182	14.11273	4542.03	MICP-DEEP2 positioned at seafloor: deployment MICP-DEEP2-1
2022-12-15	19:25:50	-125.87183	14.11274	4542.03	 MICP-DEEP2 stage 2 20221215_192550_Sonne_SO295_209ROV25_Logo_thumb.jpg

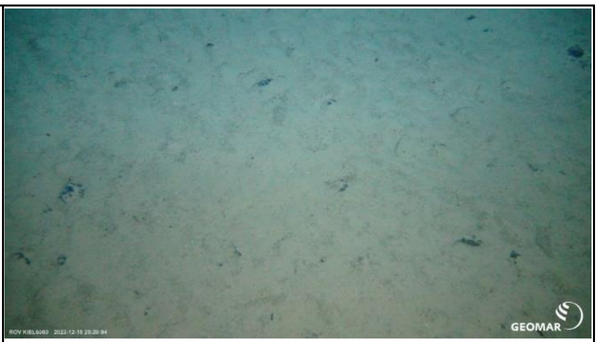
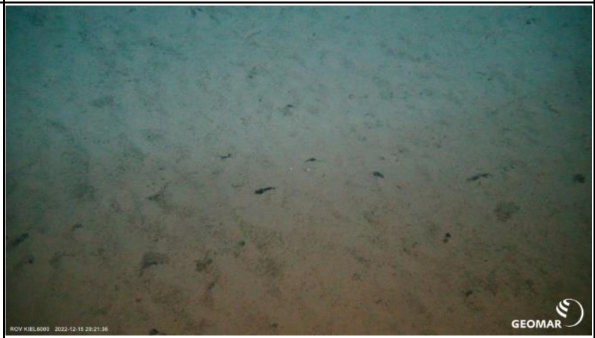
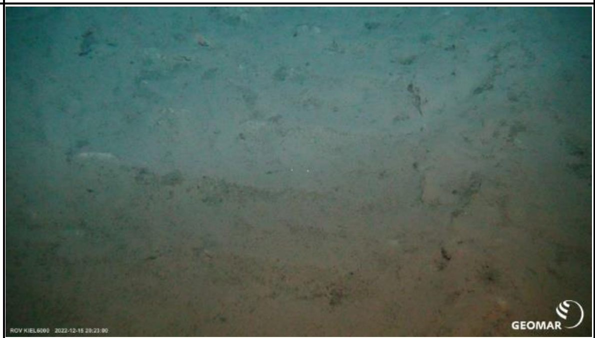
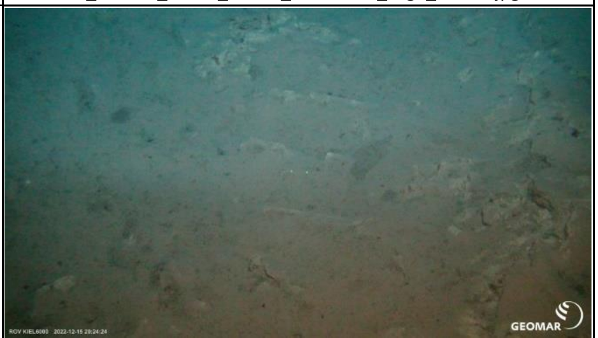
2022-12-15	19:26:09	-125.87182	14.11275	4542.03	 MICP-DEEP2 stage 1 20221215_192609_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	19:28:01	-125.87179	14.11276	4541.44	Starting to fly back direction south west past Elevator 1 in search for the start of the PATAINA II tracks to check whether the transition is clearly visible – and to rule out that MICP-DEEP1 & 2 have been deployed on sediment-covered collector tracks
2022-12-15	19:29:12	-125.87187	14.11262	4540.62	Viewed in this direction the cover seems again thicker
2022-12-15	19:29:29	-125.87189	14.11263	4540.29	Tracks become clearly visible on sonar
2022-12-15	19:30:28	-125.87204	14.11256	4539.11	Passing Elevator 1
2022-12-15	19:30:58	-125.87205	14.11256	4538.81	Arriving at first track. Transition clearly visible hence it must be that the cover at the MICP-DEEP deployment sites is really thick enough so most of the nodules are hardly visible
2022-12-15	19:31:05	-125.87206	14.11256	4538.78	 First PATANIA II track viewed from north east 20221215_193105_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	19:31:50	-125.87209	14.11256	4538.77	Returning to Elevator 1 to pick up MICP1
2022-12-15	19:32:06	-125.87211	14.11257	4538.79	Arriving at Elevator 1
2022-12-15	19:34:54	-125.87205	14.11255	4538.82	Removing elastic ropes
2022-12-15	19:37:04	-125.87207	14.11258	4538.69	Taking MICP1 off Elevator 1
2022-12-15	19:38:35	-125.87206	14.11255	4538.81	Moving direction east to select MICP1 deployment position
2022-12-15	19:39:09	-125.87195	14.11249	4538.89	Again nodules seem less covered viewed from this direction
2022-12-15	19:39:51	-125.87190	14.11249	4539.2	Getting close to tracks as direction was not precise, turning a bit towards east
2022-12-15	19:40:43	-125.87187	14.11250	4540.11	Selecting a spot
2022-12-15	19:41:22	-125.87185	14.11251	4540.4	 MICP1 deployment site 20221215_194122_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	19:43:02	-125.87184	14.11250	4540.48	MICP1 started with magnet on porch
2022-12-15	19:43:20	-125.87184	14.11249	4540.48	Gear wheels turning - program started
2022-12-15	19:46:13	-125.87182	14.11246	4540.53	MICP1 set down on seafloor: deployment MICP1-1

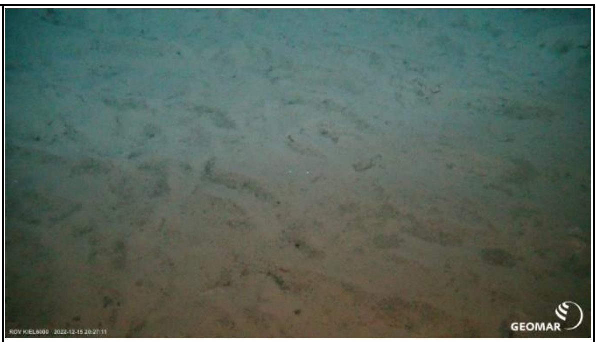
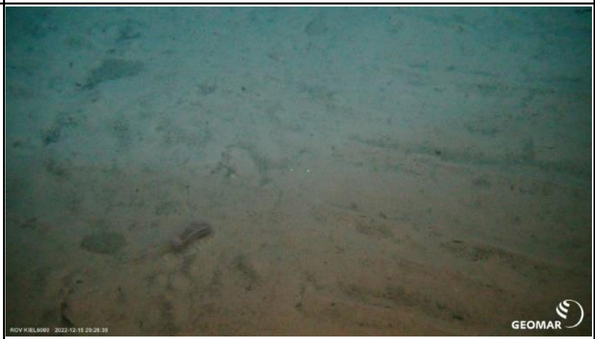
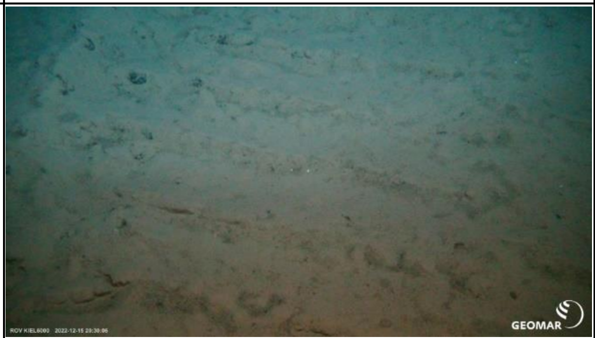
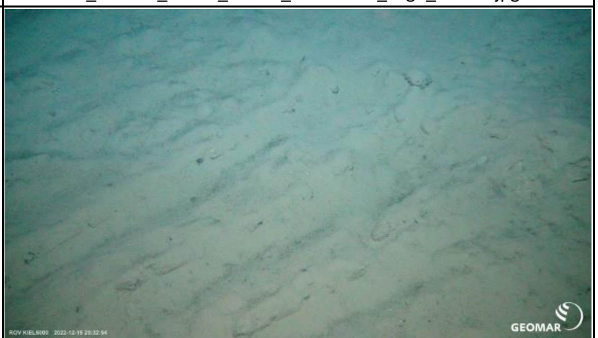
2022-12-15	19:47:01	-125.87181	14.11246	4540.51	 MICP1 at seafloor (detail sensor area) 20221215_194701_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	19:47:23	-125.87181	14.11245	4540.5	 MICP1 at seafloor 20221215_194723_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	19:53:08	-125.87183	14.11237	4539.68	ROV moving towards way point 12 from OFOS 11 deployment as starting point for video transect
2022-12-15	19:56:04	-125.87191	14.11225	4538.81	Starting video transect. Heading is 285 degrees following track from OFOS 11 deployment (only every 10th image displayed in protocol)
2022-12-15	19:56:11	-125.87191	14.11225	4538.8	 20221215_195611_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	19:57:21	-125.87191	14.11226	4538.6	 20221215_195721_Sonne_SO295_209ROV25_Logo_thumb.jpg

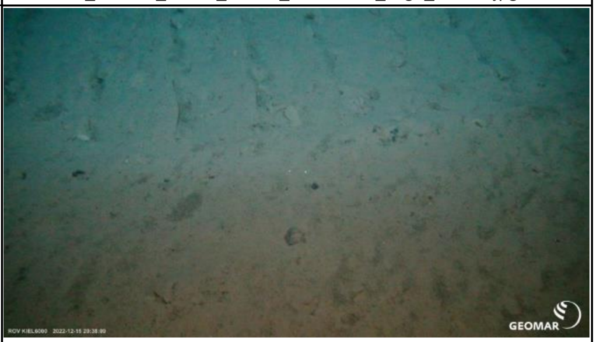
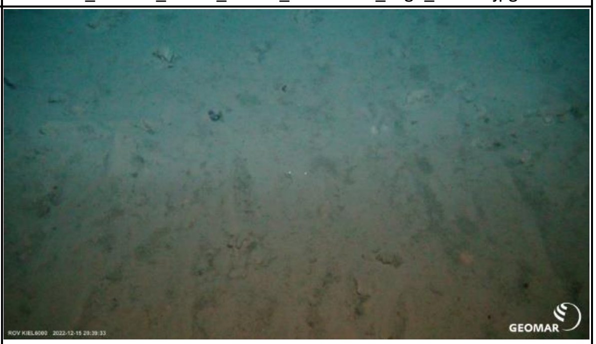
2022-12-15	19:58:52	-125.87202	14.11226	4538.26	 20221215_195852_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:00:16	-125.87204	14.11227	4537.87	 20221215_200016_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:01:40	-125.87207	14.11229	4537.51	 20221215_200140_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:03:04	-125.87222	14.11246	4537.2	 20221215_200304_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:04:34	-125.87228	14.11229	4536.85	 20221215_200434_Sonne_SO295_209ROV25_Logo_thumb.jpg

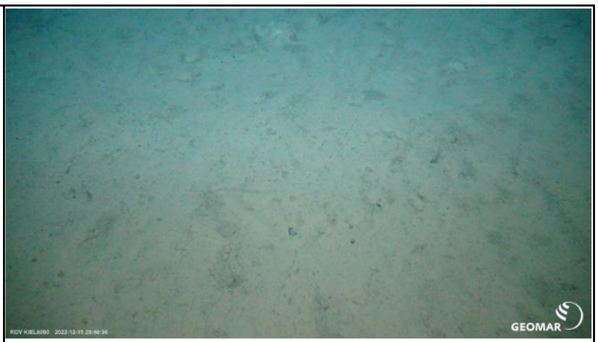
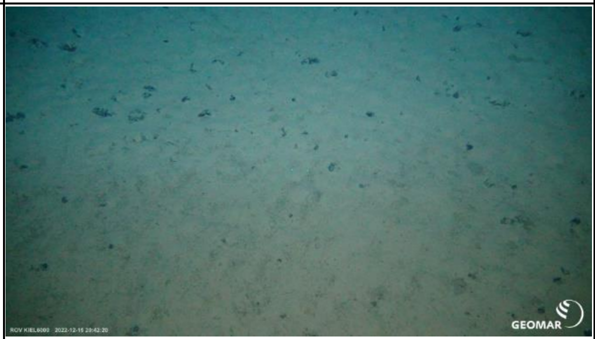
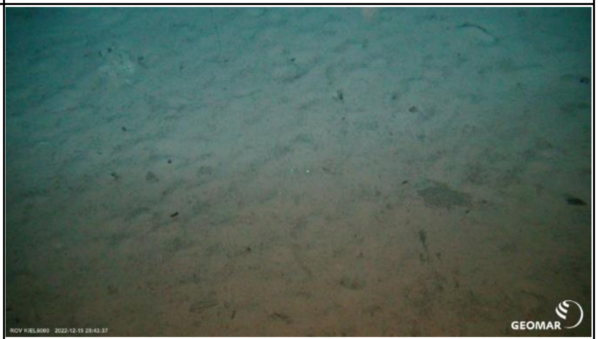
2022-12-15	20:05:58	-125.87237	14.11240	4536.54	 20221215_200558_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:07:22	-125.87241	14.11248	4536.21	 20221215_200722_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:08:46	-125.87254	14.11249	4535.78	 20221215_200846_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:10:10	-125.87257	14.11254	4535.31	 20221215_201010_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:11:34	-125.87264	14.11260	4534.59	 20221215_201134_Sonne_SO295_209ROV25_Logo_thumb.jpg

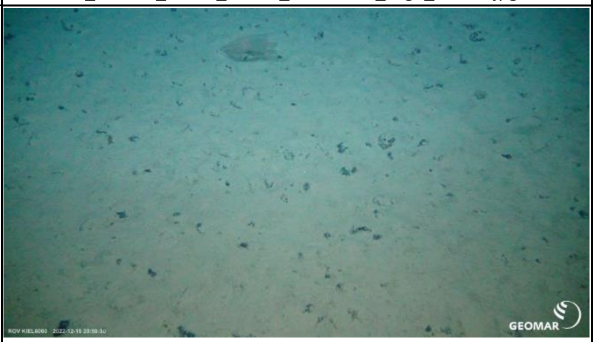
2022-12-15	20:13:05	-125.87272	14.11260	4533.54	 20221215_201305_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:14:29	-125.87278	14.11261	4533.68	 20221215_201429_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:15:53	-125.87283	14.11262	4533.4	 20221215_201553_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:17:17	-125.87302	14.11262	4533.05	 20221215_201717_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:18:41	-125.87300	14.11269	4532.68	 20221215_201841_Sonne_SO295_209ROV25_Logo_thumb.jpg

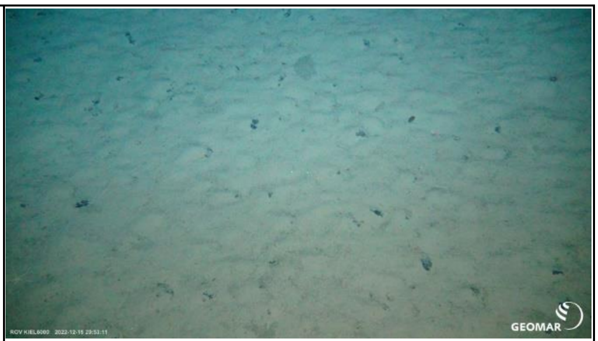
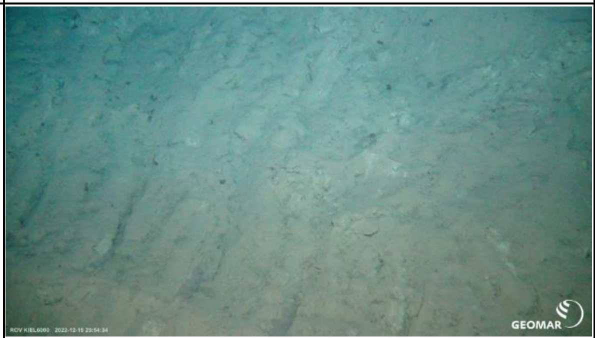
2022-12-15	20:20:04	-125.87308	14.11271	4532.3	 20221215_202004_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:21:36	-125.87315	14.11273	4531.87	 20221215_202136_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:23:00	-125.87330	14.11288	4531.56	 20221215_202300_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:24:24	-125.87331	14.11287	4531.36	 20221215_202424_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:25:47	-125.87359	14.11274	4531.17	 20221215_202547_Sonne_SO295_209ROV25_Logo_thumb.jpg

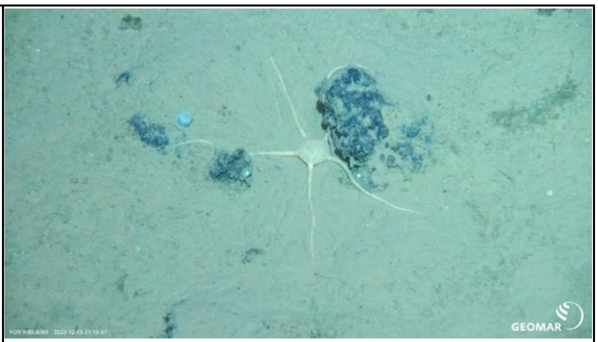
2022-12-15	20:27:11	-125.87356	14.11290	4530.89	 20221215_202711_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:28:35	-125.87359	14.11297	4530.71	 20221215_202835_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:30:06	-125.87362	14.11295	4530.59	 20221215_203006_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:31:30	-125.87373	14.11288	4530.52	 20221215_203130_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:32:54	-125.87373	14.11287	4530.46	 20221215_203254_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:33:07	-125.87371	14.11287	4530.44	Continuing transect in opposite direction (only every 10th image displayed in protocol)

2022-12-15	20:33:50	-125.87371	14.11285	4530.4	 20221215_203350_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:35:21	-125.87373	14.11277	4530.37	 20221215_203521_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:36:45	-125.87364	14.11274	4530.37	 20221215_203645_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:38:09	-125.87362	14.11276	4530.5	 20221215_203809_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:39:33	-125.87350	14.11280	4530.68	 20221215_203933_Sonne_SO295_209ROV25_Logo_thumb.jpg

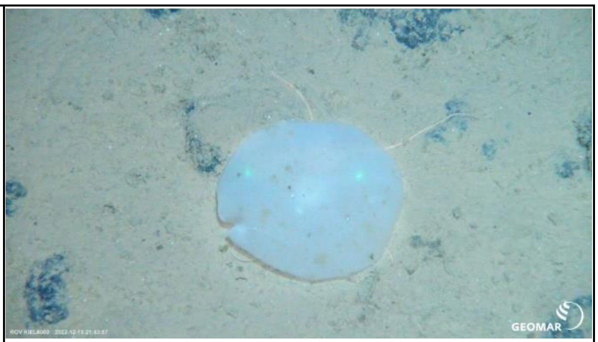
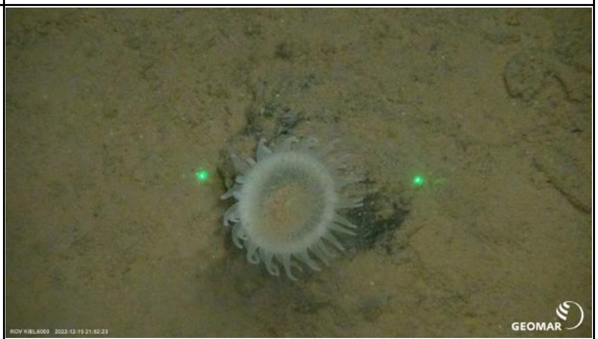
2022-12-15	20:40:56	-125.87345	14.11285	4530.87	 20221215_204056_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:42:20	-125.87338	14.11287	4531.06	 20221215_204220_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:42:48	-125.87336	14.11288	4531.1	Turning 150 degrees and continuing transect (only every 10th image displayed in protocol)
2022-12-15	20:43:37	-125.87334	14.11286	4531.1	 20221215_204337_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:45:08	-125.87330	14.11275	4531.13	 20221215_204508_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:46:10	-125.87327	14.11272	4531.11	Turning 40 degrees and continuing transect (only every 10th image displayed in protocol)

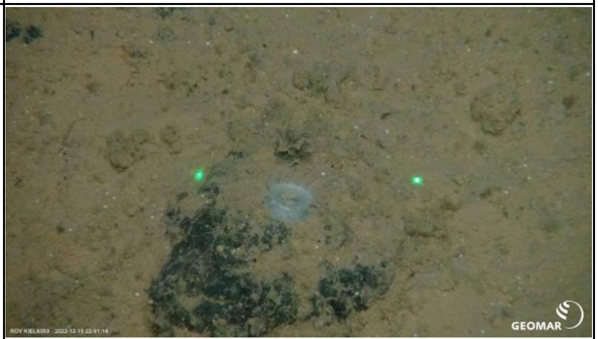
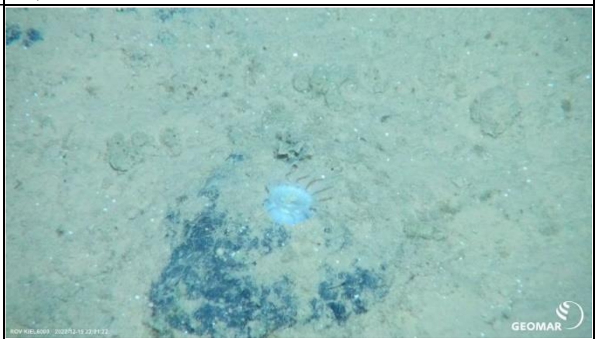
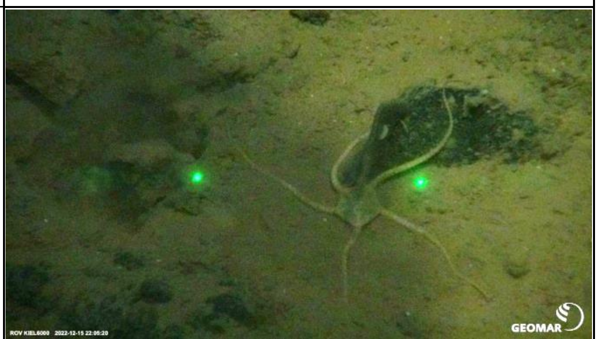
2022-12-15	20:46:11	-125.87327	14.11272	4531.11	 20221215_204611_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:47:42	-125.87324	14.11271	4531.36	 20221215_204742_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:49:06	-125.87321	14.11276	4531.54	 20221215_204906_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:50:30	-125.87314	14.11281	4531.78	 20221215_205030_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:51:08	-125.87312	14.11281	4531.82	Turning 150 degrees and continuing transect (only every 10th image displayed in protocol)
2022-12-15	20:51:47	-125.87307	14.11284	4531.86	 20221215_205147_Sonne_SO295_209ROV25_Logo_thumb.jpg

2022-12-15	20:53:11	-125.87307	14.11284	4531.93	 20221215_205311_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:54:34	-125.87321	14.11277	4531.99	 20221215_205434_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	20:55:58	-125.87314	14.11269	4531.92	 20221215_205558_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:02:07	-125.87319	14.11271	4532.13	Coral(?; photo not displayed) 20221215_210207_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:02:11	-125.87319	14.11270	4532.15	Starting megafauna sampling after finishing transect
2022-12-15	21:02:14	-125.87319	14.11270	4532.16	 Coral(?) 20221215_210214_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:04:59	-125.87307	14.11259	4532.97	Nodules almost completely covered by sediment at this site
2022-12-15	21:07:03	-125.87309	14.11261	4532.99	Specimen moves filtering organs in form of waves (or is being moved by currents)
2022-12-15	21:09:40	-125.87305	14.11260	4532.98	Specimen is sitting on a completely buried nodule
2022-12-15	21:12:32	-125.87309	14.11263	4533.01	Specimen picked up and collected in left compartment of ICBM Biobox extra large: sample MEGA117Coral

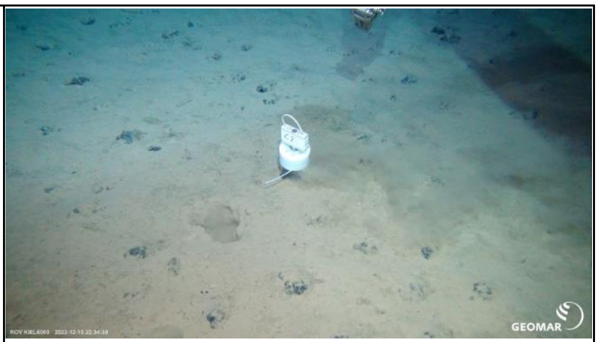
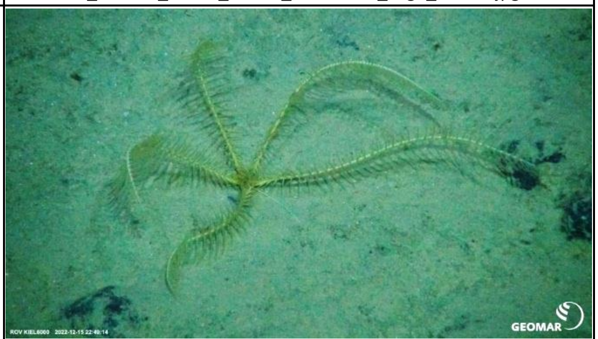
2022-12-15	21:19:57	-125.87292	14.11273	4533.63	 Brittle star 20221215_211957_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:20:02	-125.87291	14.11273	4533.69	 Brittle star 20221215_212002_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:20:24	-125.87290	14.11276	4533.84	 Small anemone next to brittle star 20221215_212024_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:20:30	-125.87290	14.11276	4533.86	 Small anemone next to brittle star 20221215_212030_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:23:38	-125.87288	14.11276	4533.9	Brittle star collected in left compartment of ICBM Biobox extra large: MEGA118Brittlestar
2022-12-15	21:27:06	-125.87292	14.11278	4533.83	Anemone probably collected in left compartment of ICBM Biobox extra large (difficult to see because specimen is very small): MEGA119Anemone

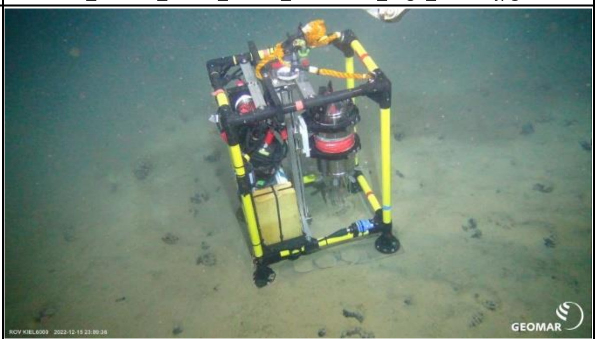
2022-12-15	21:31:15	-125.87278	14.11285	4534.81	 2 Anemones in close proximity 20221215_213115_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:31:21	-125.87278	14.11285	4534.84	 2 Anemones in close proximity 20221215_213121_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:34:41	-125.87273	14.11286	4534.93	Small anemone collected in left compartment of ICBM Biobox extra large: MEGA120Anemone
2022-12-15	21:36:00	-125.87273	14.11286	4534.95	Big anemone collected in left compartment of ICBM Biobox extra large: MEGA121Anemone
2022-12-15	21:36:08	-125.87272	14.11285	4534.95	Grenadier fish ahead
2022-12-15	21:37:47	-125.87273	14.11283	4534.93	Brittle star selected for sampling (photo not displayed) 20221215_213747_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:38:00	-125.87273	14.11283	4534.93	 Brittle star 20221215_213800_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:38:06	-125.87273	14.11283	4534.93	 Brittle star 20221215_213806_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:40:38	-125.87276	14.11285	4534.96	Brittle star collected in right compartment of ICBM Biobox extra large: MEGA112Brittlestar
2022-12-15	21:43:56	-125.87270	14.11289	4535.25	Sponge with brittle star underneath selected for collection

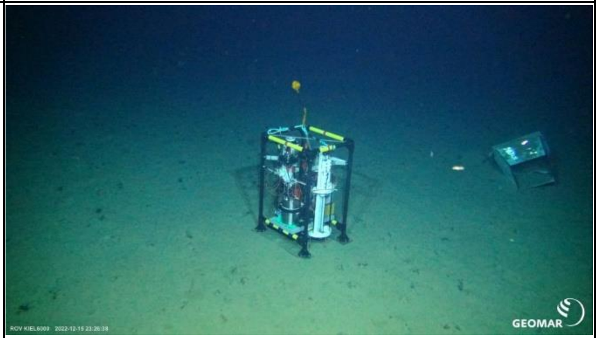
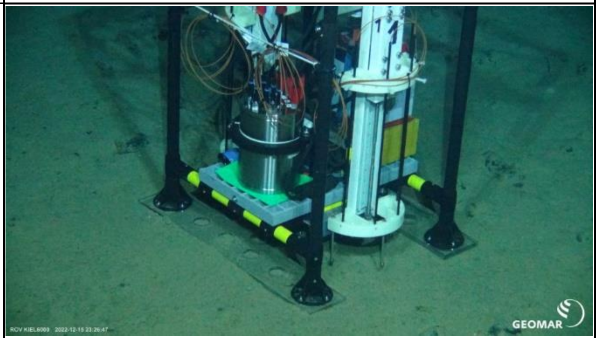
2022-12-15	21:43:57	-125.87270	14.11289	4535.26	 Sponge with brittle star underneath 20221215_214357_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:44:05	-125.87270	14.11289	4535.31	 Sponge with brittle star underneath 20221215_214405_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:44:08	-125.87270	14.11289	4535.32	Sponge with brittle star underneath (photo not displayed) 20221215_214408_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:47:51	-125.87272	14.11290	4535.28	Sponge (MEGA123Sponge) and brittle star (MEGA124Brittlestar) collected together with nodule and stored in right compartment of ICBM Biobox extra large
2022-12-15	21:52:14	-125.87272	14.11290	4535.19	Anemone selected for collection
2022-12-15	21:52:23	-125.87273	14.11291	4535.18	 Anemone 20221215_215223_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:52:30	-125.87274	14.11291	4535.18	Anemone (photo not displayed) 20221215_215230_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:52:44	-125.87274	14.11290	4535.18	Anemone (photo not displayed) 20221215_215244_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:52:51	-125.87275	14.11290	4535.19	Anemone (photo not displayed) 20221215_215251_Sonne_SO295_209ROV25_Logo_thumb.jpg

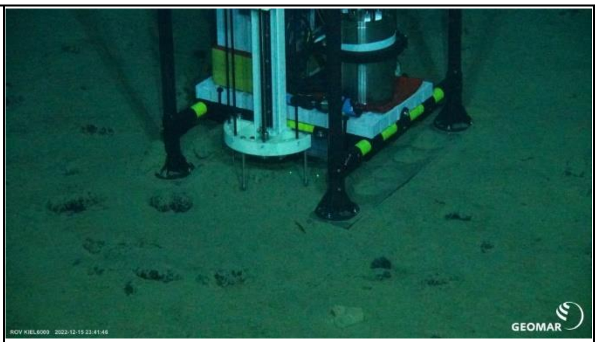
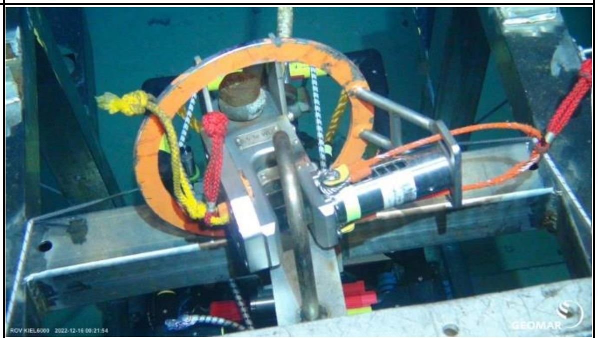
2022-12-15	21:52:55	-125.87275	14.11291	4535.19	 Anemone 20221215_215255_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	21:54:41	-125.87268	14.11282	4535.15	Sediment was stirred up by ROV before taking the photos, part of the plume settled on anemone
2022-12-15	21:55:04	-125.87268	14.11283	4535.17	Anemone collected in right compartment of ICBM Biobox extra large: MEGA125Anemone
2022-12-15	22:01:14	-125.87274	14.11282	4535.25	 Small anemone 20221215_220114_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:01:18	-125.87274	14.11282	4535.26	Very small anemone selected for collection
2022-12-15	22:01:22	-125.87274	14.11282	4535.26	 Small anemone 20221215_220122_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:01:26	-125.87274	14.11282	4535.27	Small anemone (photo not displayed) 20221215_220126_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:03:45	-125.87276	14.11283	4535.27	Small anemone collected in right compartment of ICBM Biobox extra large: MEGA126Anemone
2022-12-15	22:04:17	-125.87276	14.11283	4535.29	Brittle star selected for collection
2022-12-15	22:05:20	-125.87278	14.11281	4535.29	 Brittle star, blurred by plume 20221215_220520_Sonne_SO295_209ROV25_Logo_thumb.jpg

2022-12-15	22:05:25	-125.87278	14.11281	4535.29	 Brittle star, blurred by plume 20221215_220525_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:06:47	-125.87277	14.11283	4535.3	Brittle star collected in right compartment of ICBM Biobox extra large
2022-12-15	22:10:06	-125.87270	14.11278	4534.97	PATANIA II track ahead
2022-12-15	22:17:18	-125.87231	14.11272	4539.57	Arrival and landing at PUC site A PUC sampling start with PUCs from 16 Core Rack Nodules at site A are almost completely covered with sediment
2022-12-15	22:17:23	-125.87231	14.11272	4539.57	PUCA8 deployed
2022-12-15	22:19:43	-125.87233	14.11278	4539.57	PUC2 deployed
2022-12-15	22:20:00	-125.87233	14.11279	4539.56	PUC35 deployed
2022-12-15	22:22:16	-125.87230	14.11276	4539.59	PUC49 deployed
2022-12-15	22:23:50	-125.87228	14.11277	4539.59	PUCB0 deployed
2022-12-15	22:24:15	-125.87229	14.11277	4539.6	 PUC site A with deployed cores 20221215_222415_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:24:29	-125.87228	14.11276	4539.6	 PUC site A with deployed cores 20221215_222429_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:24:45	-125.87228	14.11275	4539.6	Retrieving PUCs back into 16 Core Rack
2022-12-15	22:26:28	-125.87231	14.11272	4539.6	PUCB0 retrieved
2022-12-15	22:27:55	-125.87230	14.11277	4539.61	PUC2 retrieved
2022-12-15	22:29:16	-125.87228	14.11276	4539.6	PUCA8 retrieved
2022-12-15	22:30:52	-125.87229	14.11277	4539.59	PUC49 retrieved, PUC is only filled to a small extent
2022-12-15	22:32:15	-125.87228	14.11272	4539.58	PUC35 retrieved

2022-12-15	22:34:30	-125.87228	14.11266	4539.59	 PUC site A with deployed core C2 20221215_223430_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:34:42	-125.87228	14.11266	4539.59	PUCC2 deployed still at PUC site A
2022-12-15	22:35:56	-125.87228	14.11268	4539.59	PUCC2 retrieved
2022-12-15	22:39:06	-125.87221	14.11256	4537.96	Elevator in sight
2022-12-15	22:39:47	-125.87215	14.11253	4537.99	 Christmas egg / season's greetings from the ROV team 20221215_223947_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:48:57	-125.87170	14.11229	4540.22	 Strange brittle star 20221215_224857_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:49:04	-125.87169	14.11229	4540.23	Strange brittle star (photo not displayed) 20221215_224904_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:49:14	-125.87170	14.11229	4540.23	 Strange brittle star 20221215_224914_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:53:38	-125.87200	14.11253	4540.59	Sponge and brittle star (photo not displayed) 20221215_225338_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:53:44	-125.87200	14.11253	4540.61	Sponge and brittle star (photo not displayed) 20221215_225344_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:53:44	-125.87200	14.11253	4540.61	Sponge and brittle star selected for collection

2022-12-15	22:54:58	-125.87195	14.11256	4541.51	 Sponge and brittle star 20221215_225458_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:55:04	-125.87195	14.11256	4541.57	 Sponge and brittle star 20221215_225504_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	22:58:39	-125.87189	14.11256	4541.7	Sponge (MEGA128Sponge) and brittle star (MEGA129Brittlestar) collected together in left compartment of ICBM Biobox extra large
2022-12-15	23:03:53	-125.87189	14.11251	4540.38	Swimming sea cucumber
2022-12-15	23:07:56	-125.87190	14.11248	4539.53	Arriving at MICP1for retrieval
2022-12-15	23:09:12	-125.87190	14.11248	4540.05	MICP1 is not blinking (i.e., program not yet finished) but will still be picked up as sensors are out of the sediment already
2022-12-15	23:09:22	-125.87190	14.11248	4540.14	 MICP1 before retrieval (detail) 20221215_230922_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	23:09:36	-125.87190	14.11249	4540.2	 MICP1 before retrieval 20221215_230936_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	23:10:32	-125.87194	14.11258	4539.21	MICP1 is picked up
2022-12-15	23:11:17	-125.87195	14.11258	4538.11	flying with MICP1 in manipulator gripper towards Elevator 1
2022-12-15	23:11:43	-125.87195	14.11258	4537.72	Elevator 1 in view
2022-12-15	23:15:12	-125.87215	14.11271	4537.55	MICP1 placed onto top platform of Elevator 1

2022-12-15	23:19:40	-125.87208	14.11260	4538.78	MICP1 secured with elastic straps
2022-12-15	23:23:01	-125.87205	14.11257	4537.5	Flying towards deployment position MICP-DEEP1-1 for retrieval
2022-12-15	23:23:39	-125.87206	14.11258	4536.44	Sea cucumber next to Elevator 1
2022-12-15	23:24:28	-125.87208	14.11261	4536.2	Swimming sea cucumber
2022-12-15	23:25:37	-125.87218	14.11279	4537.04	MICP-DEEP1 in view
2022-12-15	23:26:36	-125.87221	14.11292	4538.78	MICP-DEEP1 is blinking: program has finished
2022-12-15	23:26:38	-125.87221	14.11292	4538.82	 MICP-DEEP1 before retrieval 20221215_232638_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	23:26:47	-125.87221	14.11293	4538.99	 MICP-DEEP1 stage 1 before retrieval 20221215_232647_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	23:28:08	-125.87221	14.11295	4539.18	Experimental corral in view behind MICP-DEEP1
2022-12-15	23:28:59	-125.87220	14.11295	4538.6	MICP-DEEP1 picked up
2022-12-15	23:30:07	-125.87216	14.11279	4537.87	Flying back towards Elevator 1 with MICP-DEEP1 in manipulator gripper
2022-12-15	23:30:32	-125.87215	14.11271	4537.76	Elevator 1 in view
2022-12-15	23:32:48	-125.87206	14.11255	4537.84	MICP-DEEP1 placed onto top elevator platform
2022-12-15	23:36:47	-125.87210	14.11261	4538.57	MICP-DEEP1 secured with elastic bands
2022-12-15	23:38:55	-125.87206	14.11257	4537.56	Flying towards MICP-DEEP2 for retrieval
2022-12-15	23:40:39	-125.87189	14.11267	4539.45	MICP-DEEP2 in view. Instrument is blinking: program has finished
2022-12-15	23:41:36	-125.87177	14.11270	4540.64	 MICP-DEEP2 before retrieval 20221215_234136_Sonne_SO295_209ROV25_Logo_thumb.jpg

2022-12-15	23:41:46	-125.87176	14.11270	4540.79	 MICP-DEEP2 stage 2 before retrieval 20221215_234146_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-15	23:43:15	-125.87176	14.11272	4540.65	MICP-DEEP2 picked up
2022-12-15	23:44:06	-125.87178	14.11273	4539.66	Sea cucumber
2022-12-15	23:44:33	-125.87178	14.11273	4539.23	Moving towards elevator with MICP-DEEP2 in manipulator gripper
2022-12-15	23:45:04	-125.87191	14.11269	4538.69	Elevator 1 in view
2022-12-15	23:47:31	-125.87209	14.11261	4538.08	MICP-DEEP2 placed onto elevator on the lower platform
2022-12-15	23:50:05	-125.87207	14.11260	4538.92	MICP-DEEP2 secured with elastic bands
2022-12-15	23:52:16	-125.87211	14.11257	4538.47	Scientific work done – next is Elevator 1 recovery
2022-12-16	00:21:54	-125.87207	14.11265	4537.01	 ROV operated shackle from Elevator Recovery System ('Bergefuchs') attached to Elevator 1 20221216_002154_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-16	00:25:35	-125.87220	14.11274	4536.84	 Elevator 1 lift off 20221216_002535_Sonne_SO295_209ROV25_Logo_thumb.jpg
2022-12-16	00:27:03	-125.872383	14.1127828	4532.75	OFF THE BOTTOM
2022-12-16	02:12:47	None	None	None	ON DECK