Cruise report

BYPASS 2019

06-06-2019 – 24-06-2019

Texel - Terceira

64PE453

The unknown role of Whittard Canyon – Pathway or sink for organic carbon?

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Acknowledgements: The shipboard scientific party would like to thank the captain and crew of the RV Pelagia and the NIOZ technicians and NIOZ logistics and administrative departments (NIOZ-NMF) for their help with cruise preparations and at sea. Ship time was funded by NIOZ. Furu Mienis and Sofia Ledin as well as additional costs were paid by NWO-VIDI, grant agreement 016.161.360.

Scientific background
During expedition 64PE453 the role of canyons in transport of carbon to the deep-sea was investigated to define if canyon systems form important pathways or sinks for organic carbon. Two main research questions were formulated at the start of the project: How do the submarine canyons affect global carbon fluxes and ultimately climate change and are these canyons 'conveyor belts' of nutrition for deep-sea organisms?

Carbon fluxes between surface waters and the deep ocean potentially have both positive and negative feedbacks on climate change and therefore it is crucially important to understand transport, sequestration and remineralisation processes (Inthorn et al., 2006). Lateral transport of material likely plays a dominant role in the transport of organic matter from the continental margins all the way to the deep ocean, withdrawing carbon from the system over longer time scales. It has been shown that a lot of this material is channelled through submarine canyons, which form effective connections between productive shelf waters and the nutrient poor deep-sea (Puig, et al. 2014). Besides forming conduits, the steep and irregular topography of canyons interacts with the hydrography, resulting in enhanced turbulence and mixing of material (Wilson, et al. 2015).
Worldwide roughly 6000 large canyons incise continental and island margins, which probably all play a major role in processing of OM (Harris and Whiteway 2011). Firstly, they create immense conduits for rapid transport of dissolved and particulate matter from shelf to deep-ocean (Puig, et al. 2014), due to for instance the interaction between the seafloor topography and internal tides. Similar to their terrestrial analogues, submarine canyons create a multitude of habitats (De Leo, et al. 2010), including vulnerable marine ecosystems composed of cold-water corals (Huvenne, et al. 2011; Orejas, et al. 2009), as well as rich detritivorous benthic communities (De Leo, et al. 2010). Van Oevelen et al (2009) showed that cold-water corals are hotspots of carbon remineralization and their occurrences hence indicate high fluxes of bioavailable carbon in these canyons. Secondly this implies significantly enhanced carbon processing. Thirdly studies have shown that sediments in canyons are enriched in carbon content compared to similar depths on the open slope. Enhanced organic carbon burial in the Nazaré Canyon implies that besides conduits, canyons also act as carbon sinks, a hitherto overlooked function (Masson, et al. 2010). Although the ecological importance of canyons is established, particle and OM fluxes remain poorly specified. The lack of appropriate temporal and spatial data of these canyons is the main reason that their role in transport, sequestration and remineralization of carbon has so far been neglected.

Study area
The Whittard canyon complex (Figure 1) is a dendritic canyon system (4 main canyon branches) that runs from the shallow 200 m deep shelf to the Celtic fan at 4000 m water depth (Amaro, et al. 2016). The canyon is situated in an area of high primary productivity in the Atlantic Ocean, Bay of Biscay and is not connected to any major river system. The canyon is described as inactive, however during previous expeditions pronounced nepheloid layers were observed in all canyon branches (Wilson et al., 2015).

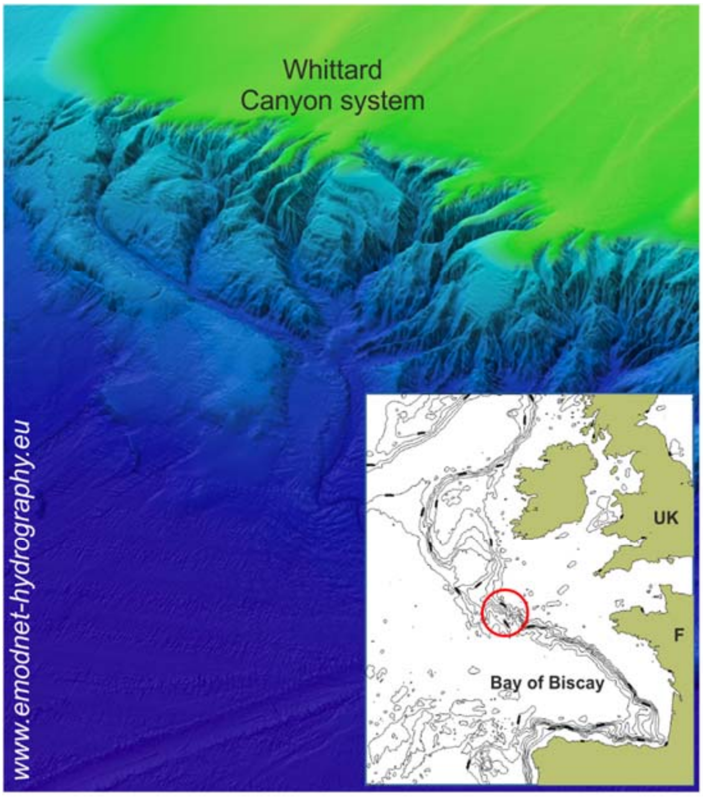


Figure 1. Study area in the Bay of Biscay

Cruise log

Cruise 64PE453 with the RV Pelagia departed from Texel on the 6th of June 2019. During this cruise samples and data were collected in the eastern most branch of the Whittard Canyon Complex. After 72 hours of steaming the research area was reached and a first CTD cast was made to calibrate the multibeam and USBL systems. Unfortunately, the multibeam system malfunctioned during the first days of the cruise, which is described in detail below. The USBL did not function at all and has not been used during the cruise. Sampling and data collection were carried out during day time. Data and samples were collected with a CTD/Rosette, box corer, piston corer, towed video system and benthic landers. During the cruise two moorings have been deployed that will be recovered in June 2020. During night time the multibeam map of the research area was extended or existing data were improved. Turbidity on the aquaflow system was not logged due to a broken sensor. We started our transit to Terceira on the evening of the 21st, where we arrived on the 26st. All cruise activities are listed in the Appendix.

Cruise participants

Below is the list of participants that joined RV Pelagia cruise 64PE453.

Name	Professional	Affiliation
Furu Mienis	Marine geology (chief-scientist)	NIOZ
Marc Lavaleye	Marine biology/taxonomy (co-chief)	NIOZ
Andrew Davies	Marine biology	University of Rhode Island
Marta Arjona	Marine geology (PhD)	CSIC
Sofia Ledin	Marine ecology (PhD)	NIOZ
Grace English	Student	Irish Observer
Aike Vonk	Student	Utrecht University
Reyhaneh Roohi	Student	University of Milan
Sander Asjes	Electronic engineering	NIOZ
Lorendz Boom	Mechanical engineering	NIOZ

Materials and methods

Multibeam

The Kongsberg EM 302 multibeam echosounder as presently installed on board the RV Pelagia is a 30 kHz echo sounder with a one degree opening angle for the transmitter and a 2° angle for the receiver. It uses 288 beams with 2-3 depth measurements per beam. The system is equipped with a dual swath, resulting in a maximum number of depth measurements of 864 per ping. The maximum swath opening angle is 150°. The transmit fan is split into at maximum 9 individual sectors that can be steered independently to compensate for ships roll, pitch and yaw to get a best fit of the ensonified line perpendicular to the ships track and thus a uniform coverage of the sea bed. The transducers are mounted in a gondola which is placed at the port site of the vessel at about one quarter to one third of the ships length from the bow. The motion of the vessel is registered by a Kongsberg MRU-5 motion reference unit. Ships position and heading is determined with two GPS antennas. The motion and position information is combined in a Seapath 380 ships attitude processing unit and send to the Transmit and Receiver Unit (TRU). The system is synchronized by means of a 1 pulse per second (1PPS) signal produced by the Seapath 380 which is send to the TRU. The data from the receiver transducer and the ships attitude are sent through an ethernet connection to the acquisition computer (Kongsberg HWS 10). Data acquisition is done using the Kongsberg SIS (Seafloor Information System) software. The sound velocity profile is calculated from salinity, pressure and temperature data recorded by a Seabird CTD system. During the cruise the Reson SVP 70 sound velocity probe that is normally mounted on the gondola containing the transducers and measures the sound velocity near the transducers was not available. The near-transducer sound velocity was taken from the calculated velocity profile. The processing PC is connected to a display on the bridge of the Pelagia through a KVM switch and an ethernet connection allowing operation of the system from the bridge if desired.

We collected a total of 179 lines of multibeam data, with an aim to fill gaps and extend earlier surveys that were conducted in 2017 and 2018 (Table 1). A sound velocity profile was made from a CTD cast at station 64PE453-02. Several major issues with the system were observed upon arrival at Whittard Canyon, largely due to a misconfiguration of the EM302 system, whereby communication between the SIS acquisition software and the EM302, plus the position unit (SeaPath), was inconsistent (Table 1). Issues were solved through communication with Henk de Haas, and the engineer from Kongsberg, which included 1) restarting SeaPath to return it to a working state (indicated by “Safe” data, and three green LEDs on the deck unit), and 2) Changing the Baud Rate of COM1 within SIS > Installation menu from 9600 to 19200, 3) Changing the Beam angle and beam width within SIS > Runtime to best match the seafloor.

Table 1. Multibeam lines, comments on data state and any errors that occurred during acquisition.

Date	Stn(s)	Lines	Comment
		\2019-Survey	
09-06-19	05	0000-0018	Good data
10-06-19	10/11	0019-0022	Some issues due to communication issues with MRU
		0023-0036	Issue with MRU causing erroneous data (Dropped from project)
11-06-19	19	0037-0057	Good data (MRU caused error at 23:20 ship time, 22:20 UTC, no obvious error in SeaPath log)
12-06-19	25	0058-0077	Good data
13-06-19	33	0078-0097	Good data (MRU caused error at 23:20 ship time, 22:20 UTC, no obvious error in SeaPath log)
14-06-19	39	0098-0116	Incorrect max depth setting in SIS caused some lines to capture erroneous data.

		\2019-Survey-b	
15-06-19	45	0000-0018	MRU error at 05:30 UTC 15-06-2019, no lines logged after this.
16-06-19	50	0019-0044	Good data
		\2019-Survey-d	
17-06-19	55	0000-0016	Good data

Data from 2017 and 2018 were added to the 2019 data within a Fledermaus PFM, and manually cleaned following the CUBE generation. Erroneous soundings were identified by utilizing the standard deviation view within Fledermaus and flagged as suspect. These soundings were then omitted from surface generation. Two surface resolutions were created, 1) 25 m grid cell resolution (Figure 2) and 2) 50 m grid cell resolution (Figure 3).

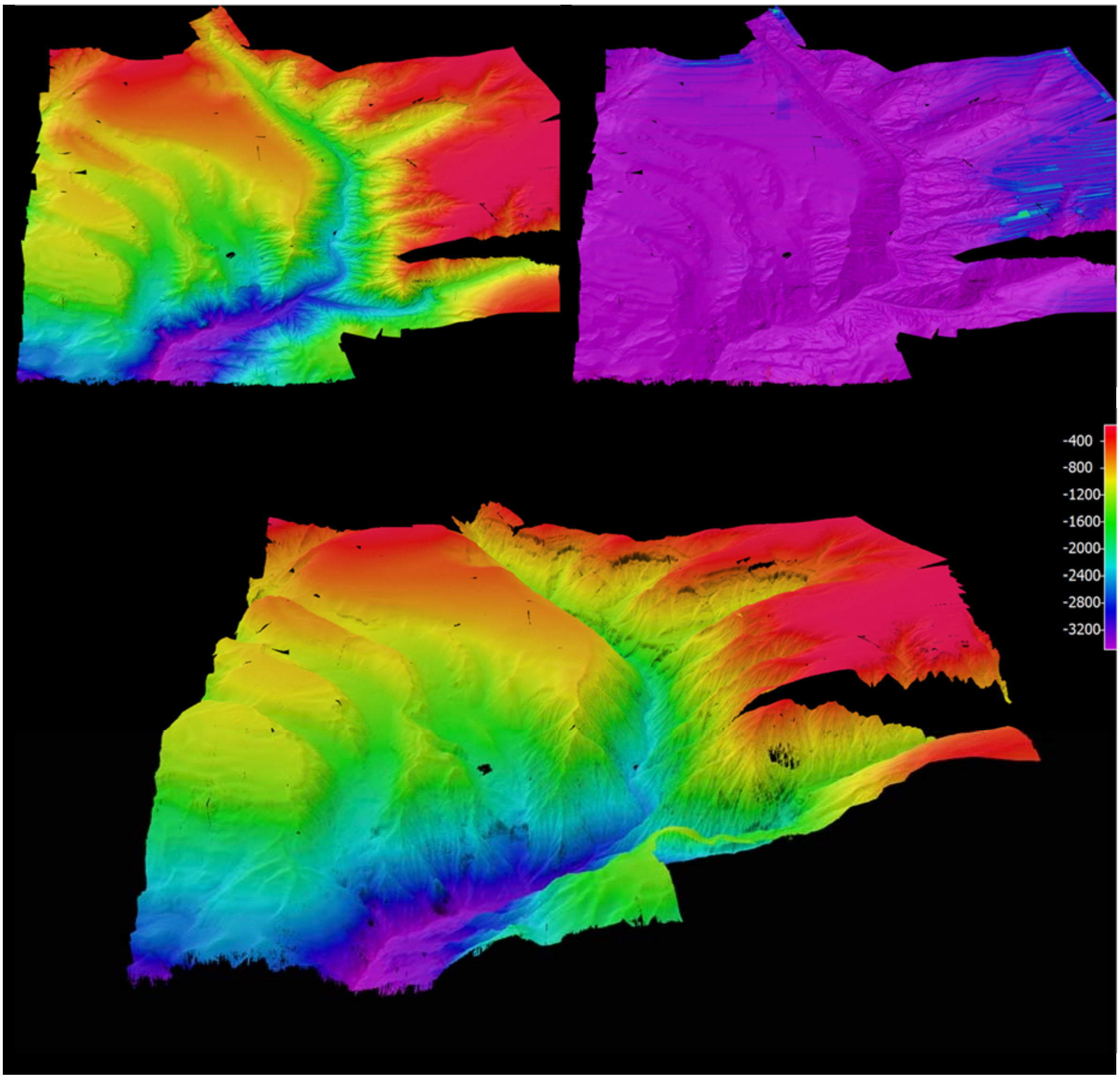


Figure 2. Multibeam depth (top left), sounding density (top right) and isometric 3D view (bottom) for the 25 m cell resolution data product.

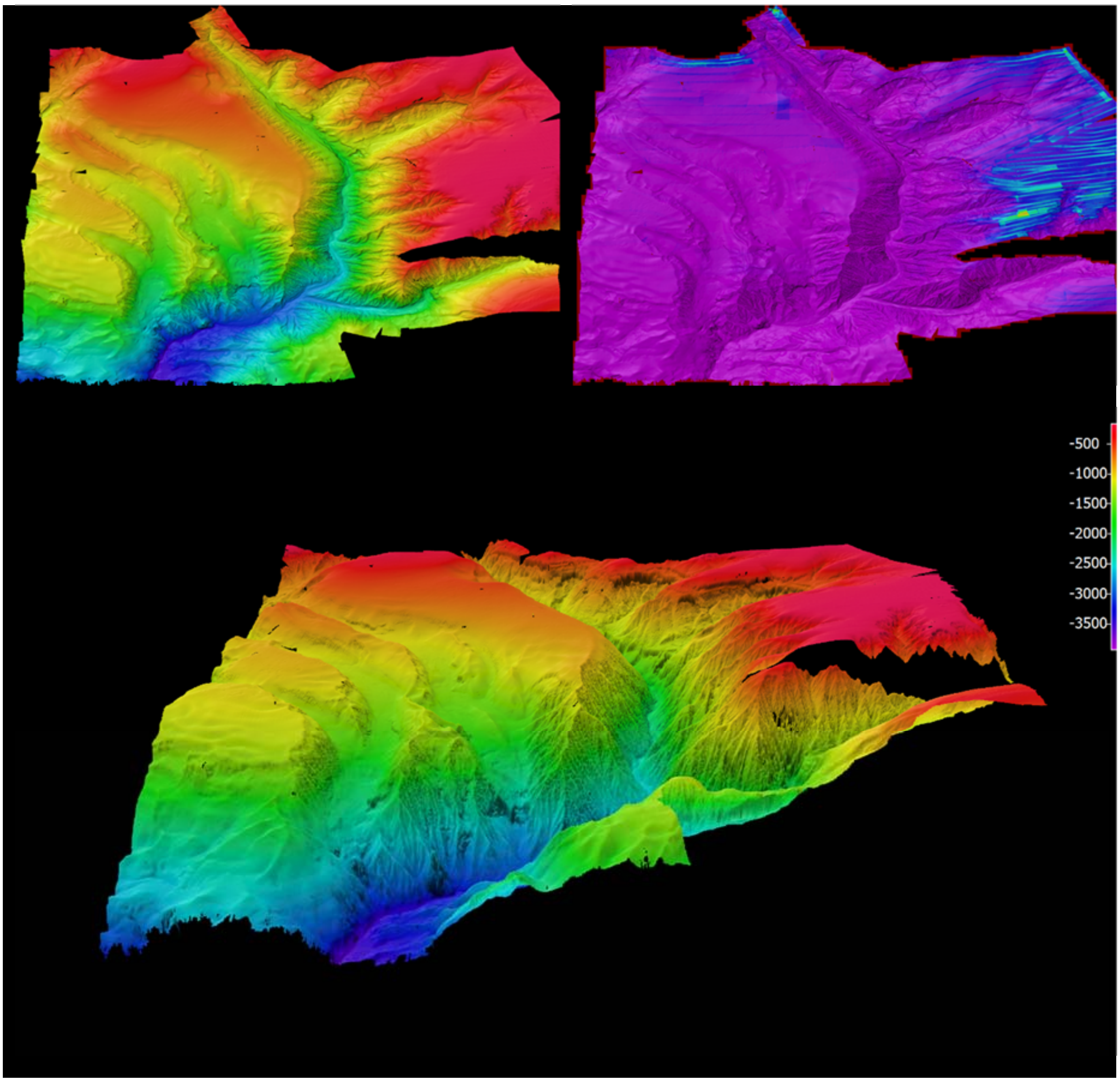


Figure 3. Multibeam depth (top left), sounding density (top right) and isometric 3D view (bottom) for the 50 m cell resolution data product.

Box corer
All bottom samples were taken with a NIOZ box corer equipped with a stainless-steel cylindrical core of 50 cm in diameter and 55 cm height. The box corer was equipped with a downward looking camera to select the sampling location. In total 7 box cores were collected for sediment and biodiversity samples (Figure 4). Box core stations were selected based on video transects, which allowed sampling of different habitats.

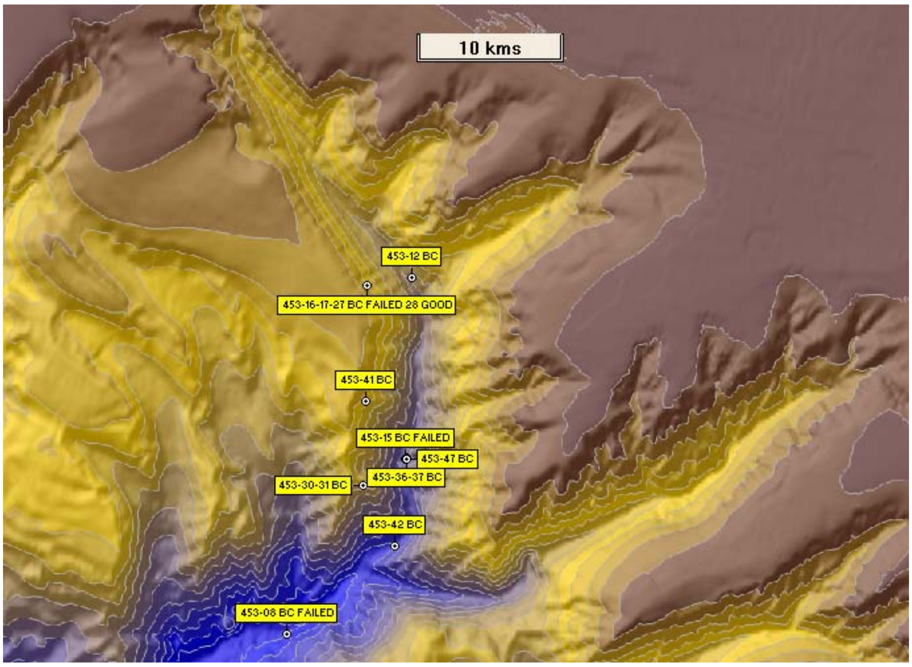


Figure 4. Map with box core locations

Box cores dedicated to sediment and biodiversity sampling were carefully opened and if present the overlying water was siphoned off. The surface of the core was photographed (Figure 5), and a description of the species composition and other characteristics was made (e.g. height of sediment, sediment characteristics, living/fossil species). Two sub cores were taken from each box core for sediment and plastic analysis (stored at 4 °C). In addition, three surface samples were taken for C, N and pigment analysis, three syringes were taken from the surface sediment for eDNA analysis (stored at -80 °C), one syringe was collected for organic carbon (stored at -20 °C), and three sub cores and a surface sample were collected for meiofauna analysis. A quarter of the box core was used for fauna analysis and was sieved over a 1 mm sieve. After removal of the core barrel a sedimentological down core description was made. Core 12 and 47 were used for pore water analysis. Pore water was subsampled for trace metals, DIC, inorganic nutrients and Si.
During this cruise 7 box core sampling attempts failed, which is unusual for the NIOZ box corer. Partly this was due to the very soft sediment at some stations, which caused the core to penetrate too deep in the sediment, disturbing the surface of the sample in such a way that the sample could not be used for surface sampling. However, the main reason for failure, was the fact that there were problems with the Kley-France winch (which holds the synthetic light weight Aramide cable with optic fibres), and forced us to use a steel cable for box core sampling. At the great depths at which we sampled, the weight of the steel cable weighs more than the box core itself, and therefore makes it more difficult to exactly notice when the core hits the seafloor. This resulted in paying out too much wire, causing the cable to get wrapped around part of the box corer, or paying out not enough cable with the effect that the box corer did not trip. This could not been noted during the procedure, as the camera could not be used with the steel cable.

Figure 5. Box core photographs.

Piston corer
Piston cores were taken using the NIOZ piston corer with a core head weight of 1500 kg and fitted with a 12 m long barrel with 11 cm diameter liners. On deck the liner was cut into pieces of 100 cm or shorter if necessary, capped, labelled and stored in the fridge at 4 ºC. A piston core of 9.8 m was retrieved from the depocenter in the canyon. A shorter core of 1.3 m was successfully sampled from the western slope of the canyon (Figure 6).

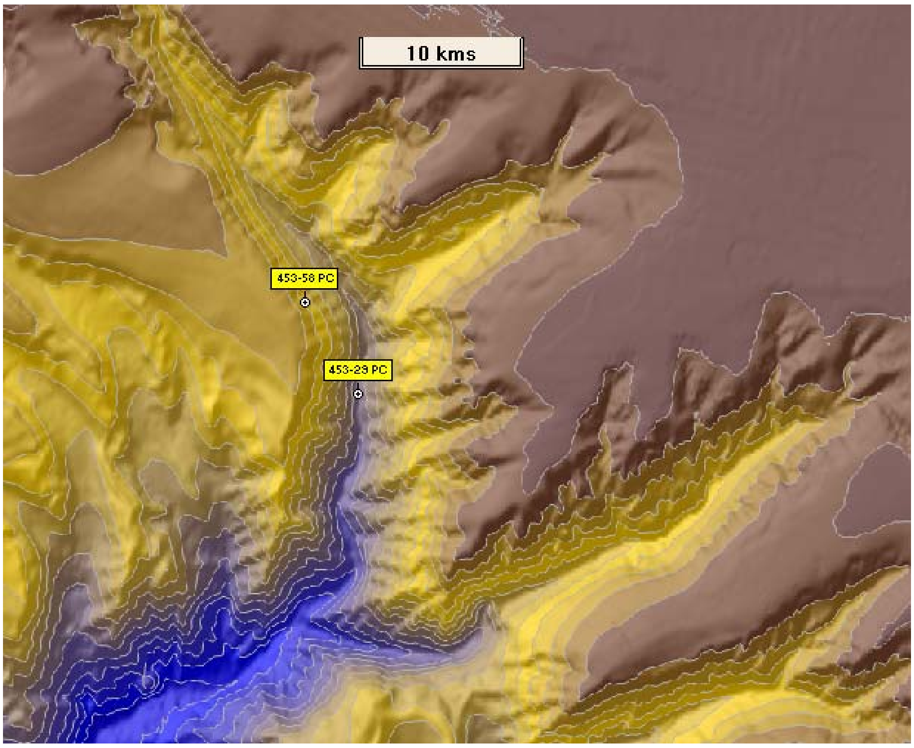


Figure 6. Map with piston core locations.

Benthic landers and moorings
Landers
During cruise 64PE453 6 short (24-48 hour) deployments were made with bottom landers (Figure 7). During the short deployments the ALBEX2 lander consisted of an alu tripod equipped with 12 glass Benthos™ floats, two Benthos™ acoustic releasers and a single 270 kg ballast weight necessary for deployment and recovery. An Iridium beacon, radio beacon, flash light and large orange flag were attached to the frame to locate it after surfacing. The ALBEX4 lander consisted of the same configuration. Furthermore, the ALBEX2 lander was equipped with an Aquadopp current meter and three benthic incubation chambers. During the 3 deployments of the ALBEX2 lander all programmed equipment functioned without errors. However, during the first deployment at station 18 the 3 incubation chambers did not penetrate the sediment, probably because of a rocky terrain, which made the incubations useless (Table 2).
The ALBEX4 lander was equipped with a combined Wetlabs FLNTU turbidity and fluorescence sensor, an Advantech ATUD turbidity sensor an Aquadopp profiler, a McLane particle pump (sample interval every 2 hours) and a NIOZ designed profile pump. The profile pump was programmed to take samples at 6 depth intervals above the seafloor all at exactly the same time, which allowed for the collection of bottom water along a gradient (10-320 cm). Samples were collected at the end of each short-term lander deployment. After retrieval subsamples were taken for inorganic nutrients, DIC, trace metals and suspended matter (GGF, 25 mm). The 3 deployments of the ALBEX4 were all successful, with a note that not all of the water sampling bags of the profile pump were filled properly, because of a problem with the connecting tubes. This resulted in water

collection at station 13 and 24 at 4 depths (10, 20, 80, 160 cm above bottom) and 5 depths at station 44 (10, 20, 40, 80, 160 cm above bottom).

Table 2. The results of the 3 incubation chambers of the 3 ALBEX2 deployments. The two station numbers in each row are the deployment and recovery actions of the cruise log (see Appendix). Volumes of water in the incubation chambers are either in ml, or when water or sediment were partly lost, in height in cm. Sediment samples consisted of a 50 ml syringe, a small surface sample, and 0.5 mm sieved residue.

Station	Incubation chamber	Volume of water	Sediment samples
18-26	8B	none	no
18-26	82	none	no
18-26	89	none	no
32-40	8B	1300 ml	yes
32-40	82	sediment lost	no
32-40	89	1600 ml	yes
48-56	8B	20 cm high	yes
48-56	82	1350 ml	yes
48-56	89	ca. 17 cm high	no

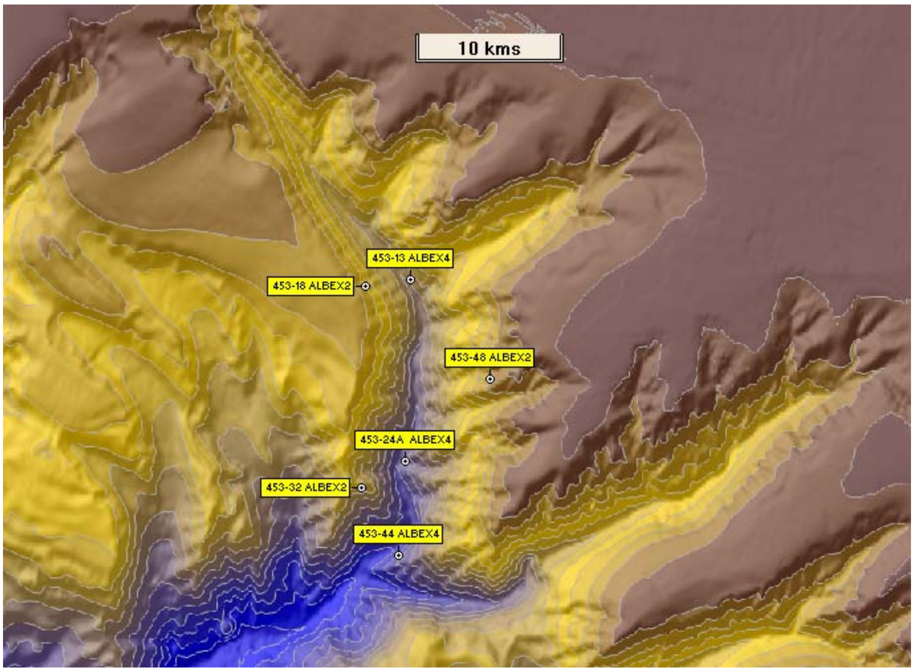


Figure 7. Map with lander locations.

Moorings

Two moorings, were deployed at 1600 and 2200 m water depth along the thalweg of Whittard Canyon (Figure 8). Both moorings consisted of a 700 kg bottom weight, a 1500/2000 m long line with a McLane traveller with Seabird CT and Wetlabs FLNTU attached and a upward looking 75 kHz ADCP. The moorings were in addition equipped with a sediment trap (start date 20 June 2019 06:00, interval 30 days) that was mounted at 6 m above the bottom (see Appendix). The Technicap PPS4/3 sediment trap with rotating carrousel of 12 bottles will rotate at a 30 days interval. At the top end of the mooring a large orange so called “smarty” buoy was attached, equipped with an iridium beacon.

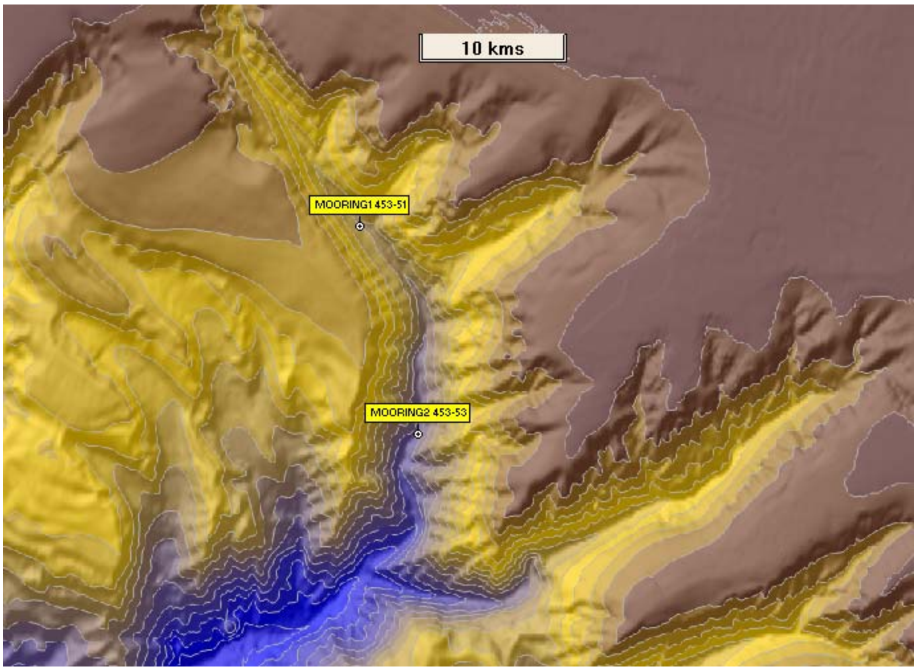


Figure 8. Map with mooring locations.

CTD/Rosette
During the cruise the CTD-rosette sampler was equipped with 24 Noex bottles of 12 litres, a Seabird™ 911 CTD with auxiliary sensors for oxygen, fluorescence (Chelsea Aqua 3). Data were acquired using the SeaBird SBEdata Processing –Win 32 software. CTDs were mainly carried out along the canyon axis. In addition, CTD casts were recorded at ALBEX4 lander sites to connect data collected with the profile pump with the upper water column. Based on the downcast profiles, depths were selected for water sampling during the up-cast.

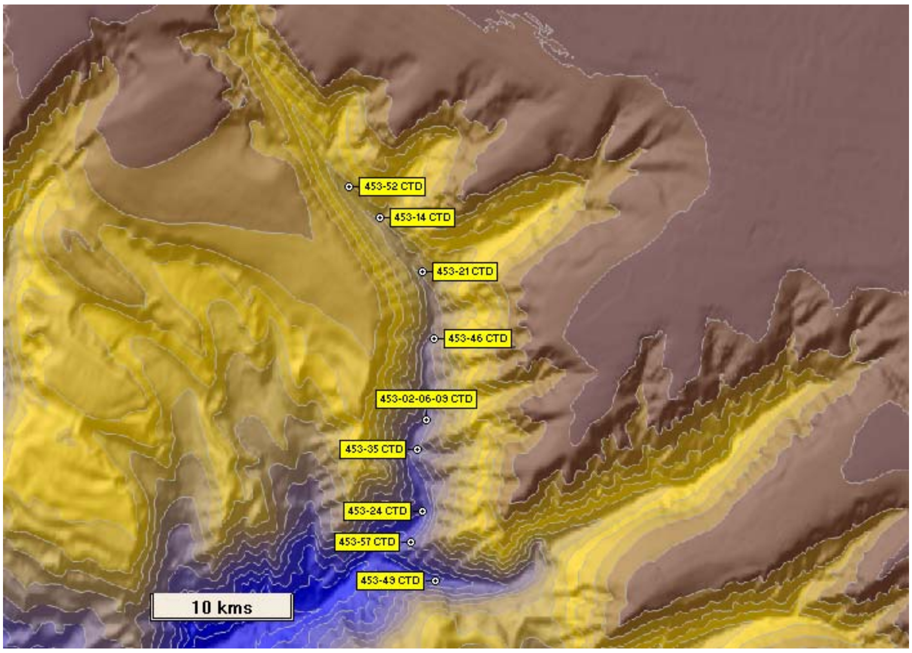


Figure 9. Map with CTD locations, station 1 and 4 are left out as no data were logged.

In total, 13 CTD casts were taken within Whittard Canyon (Figure 9). Difficulties were encountered with bottle closures of the clean CTD system with the pressure release system (Stations 1,2,4 and 6), Station 1 no data was logged and bottles failed to close, Station 4 was a test deployment to 200 m water depth, and no data were logged. This ultimately led to the decision to replace the frame with the spring release Niskin bottle system (Station 9 onwards), see Table 3 for more information.

The following data were collected for stations 9 onwards (Figure 12-22): 1) Salinity calibration, 2) SPM (for calibration of optical backscatter sensors), 3) SPOM, 4) eDNA, 5) water for incubations, 6) inorganic nutrients and silicate. A complete overview of all collected samples is presented in the Appendix. Station 2 and 9 were used for the calibration of oxygen sensors and turbidity sensors, respectively.

Table 3. Meta-data for CTD casts collected in Whittard Canyon.

Date	Latitude	Longitude	Stn	Sounder depth (m)
6/9/19 09:13	N 48° 29.457'	W 9° 56.08662'	1	2234.69
6/9/19 10:20	N 48° 29.46108'	W 9° 56.097'	2	2223.3
6/9/19 19:14	N 48° 23.48952'	W 9° 59.67108'	4	2863.3
6/10/19 07:04	N 48° 29.47278'	W 9° 56.0736'	6	2217.28
6/10/19 18:47	N 48° 29.47122'	W 9° 56.10312'	9	2269.06
6/11/19 10:28	N 48° 37.0251'	W 9° 58.7307'	14	1567.43
6/12/19 08:04	N 48° 34.9737'	W 9° 56.322'	21	1668.12
6/12/19 15:48	N 48° 26.03448'	W 9° 56.29362'	24	2599.31
6/14/19 08:20	N 48° 28.38978'	W 9° 56.67342'	35	2292.69
6/16/19 07:13	N 48° 32.5365'	W 9° 55.70532'	46	2047.17
6/16/19 14:56	N 48° 23.4816'	W 9° 55.62378'	49	2673.2
6/17/19 11:07	N 48° 38.19108'	W 10° 0.5217'	52	1431.85
6/18/19 08:41	N 48° 24.89868'	W 9° 57.05112'	57	2483.56

Mono corer
A mono corer was suspended 7 m beneath the CTD during all CTD casts (Figure 10 and 11). This device provided a core sample of the bottom at most of the locations also sampled with the ship's CTD. After retrieval cores were immediately sliced in cm slices. Half of the slice was stored for organic C and N as well as sedimentological analysis at -20 °C. The other half was preserved for plastic analysis and samples were stored at 4 °C.

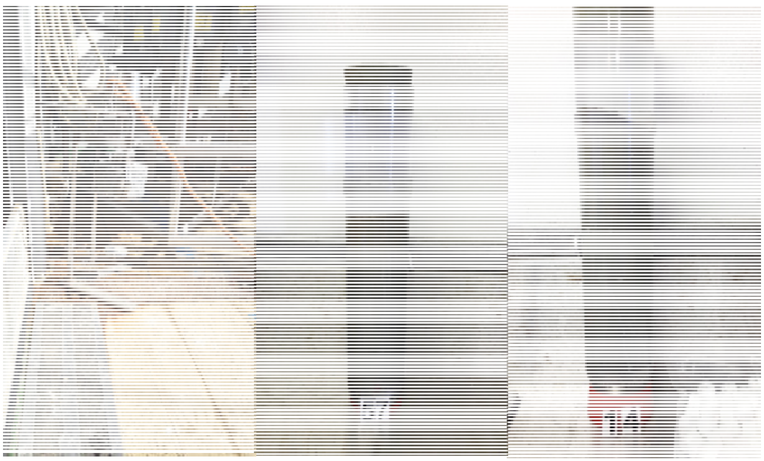


Figure 10. The mono corer and mono cores collected during CTD casts.

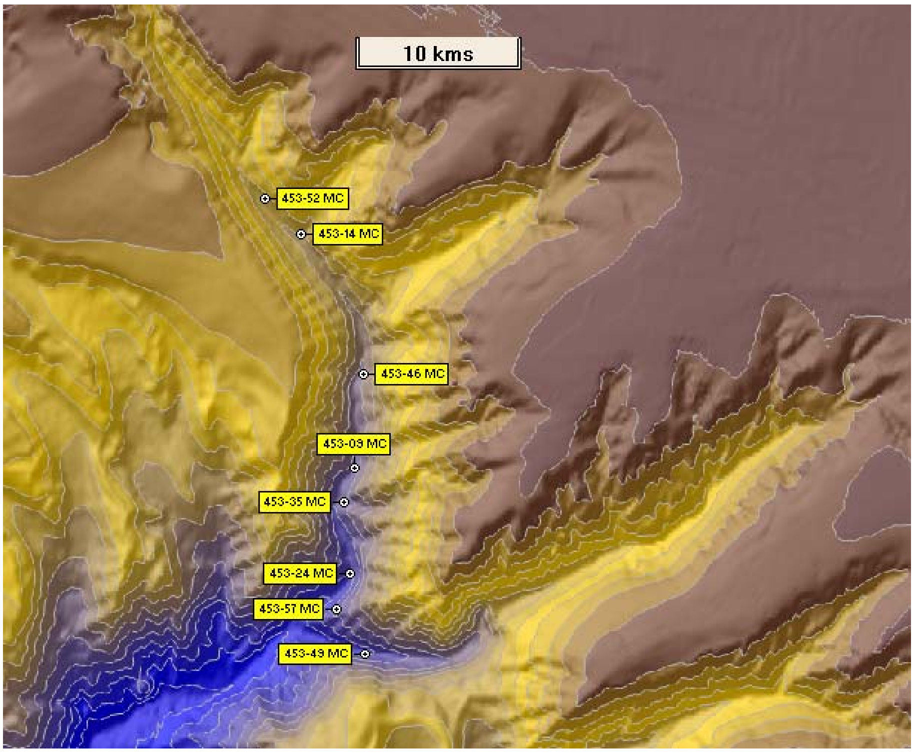


Figure 11. Map with mono core locations.

Figure 12. CTD data Stn 02

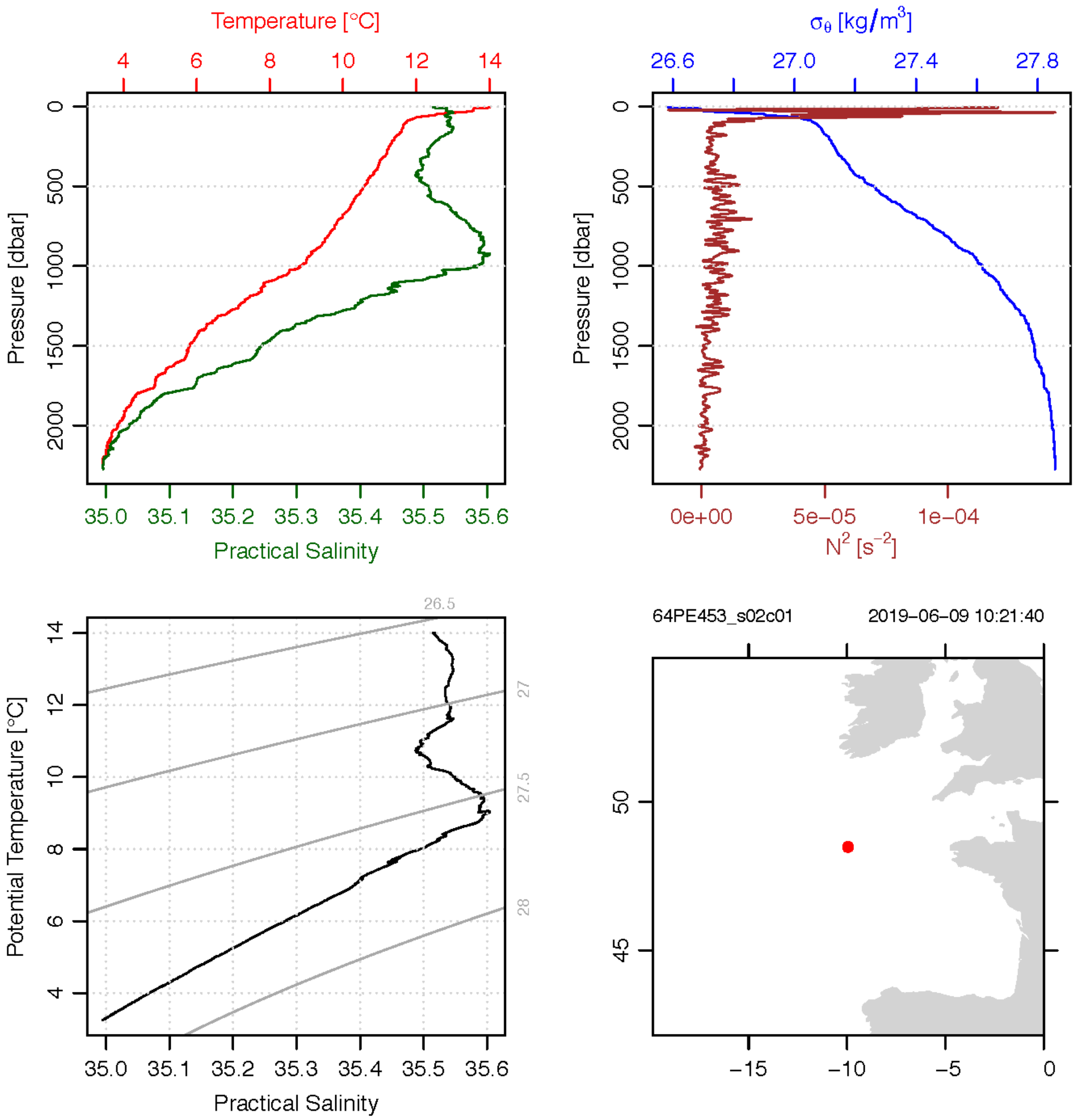


Figure 13. CTD data Stn 06

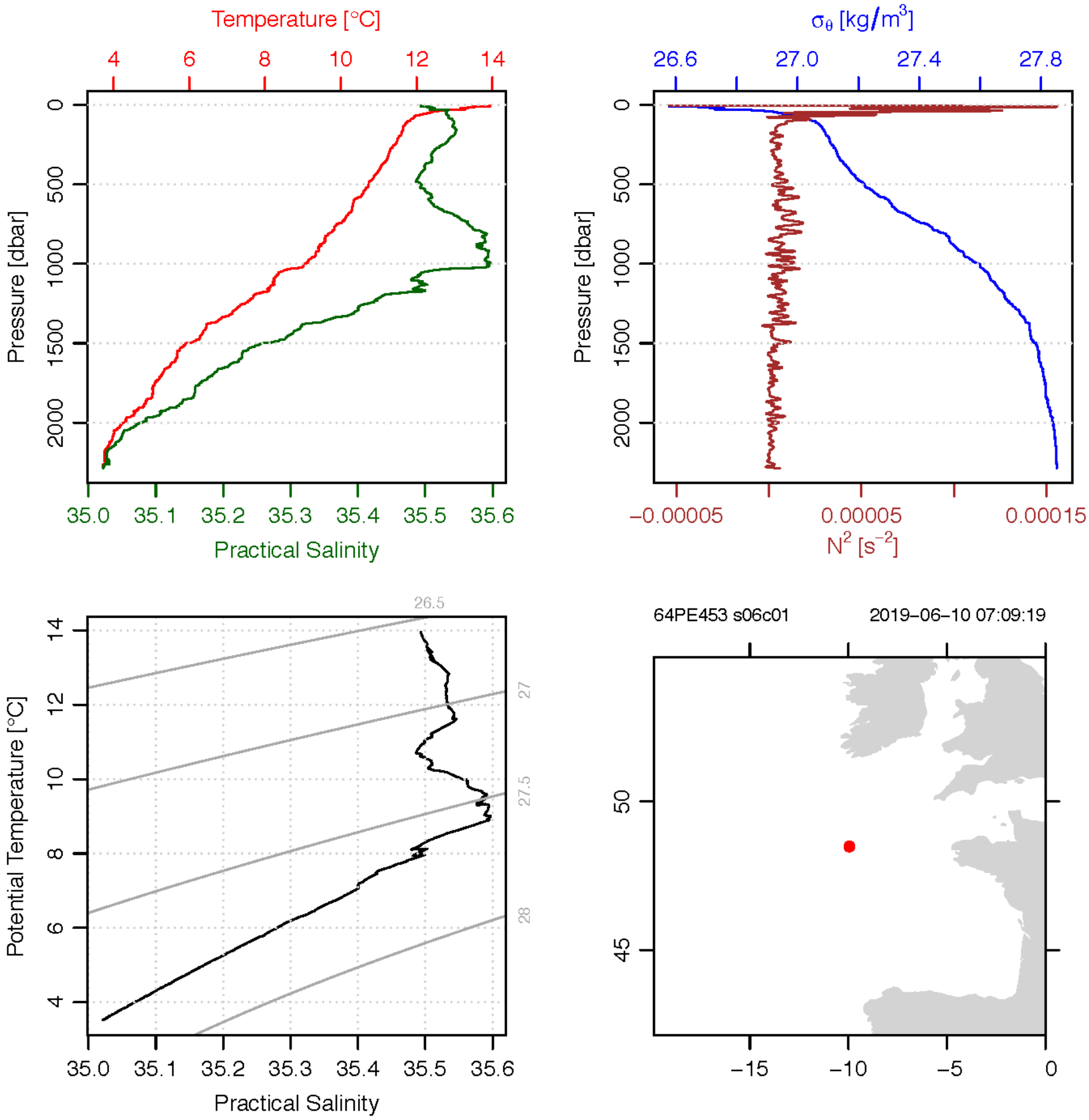


Figure 14. CTD data Stn 09

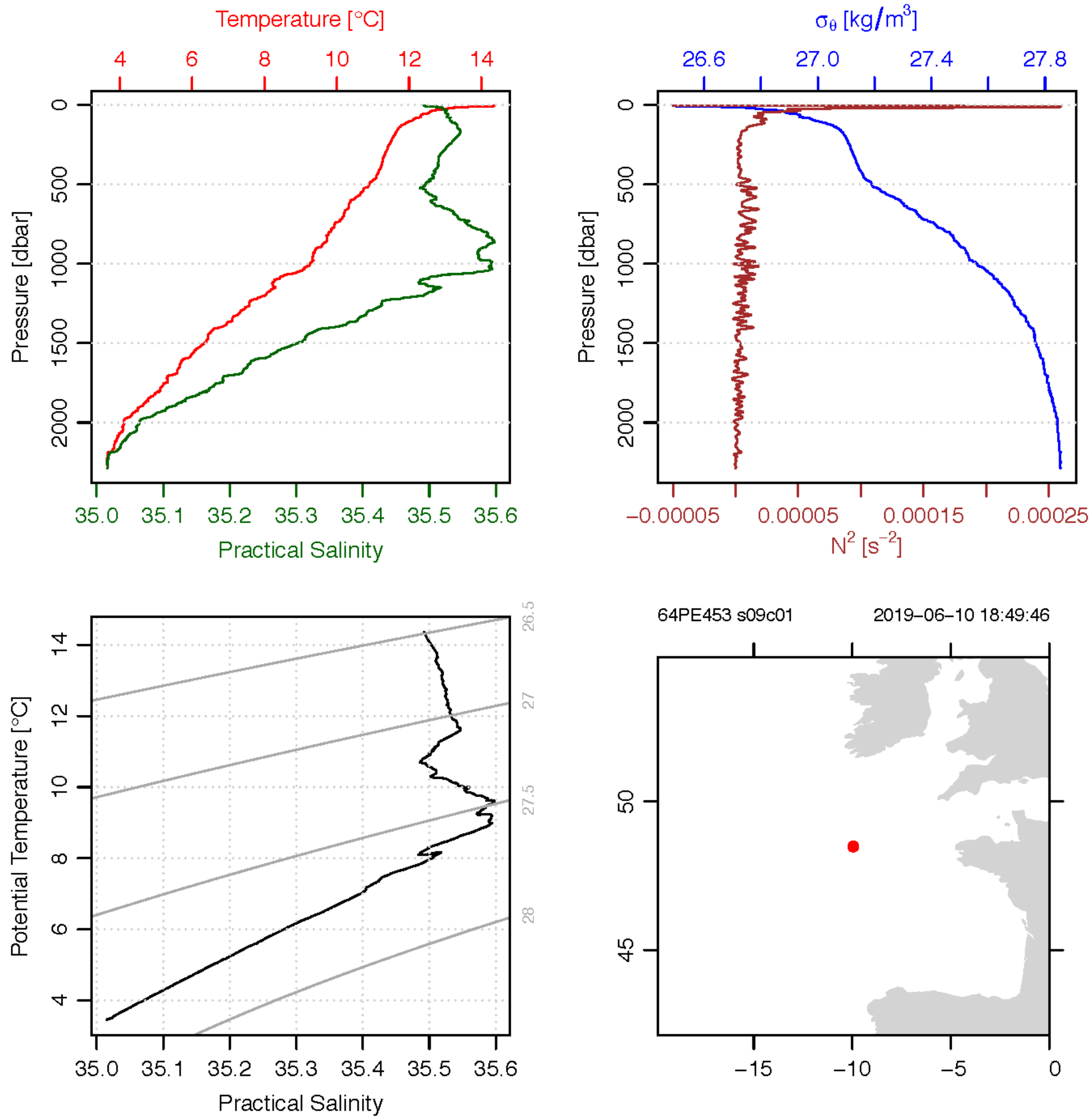


Figure 15. CTD data Stn 14

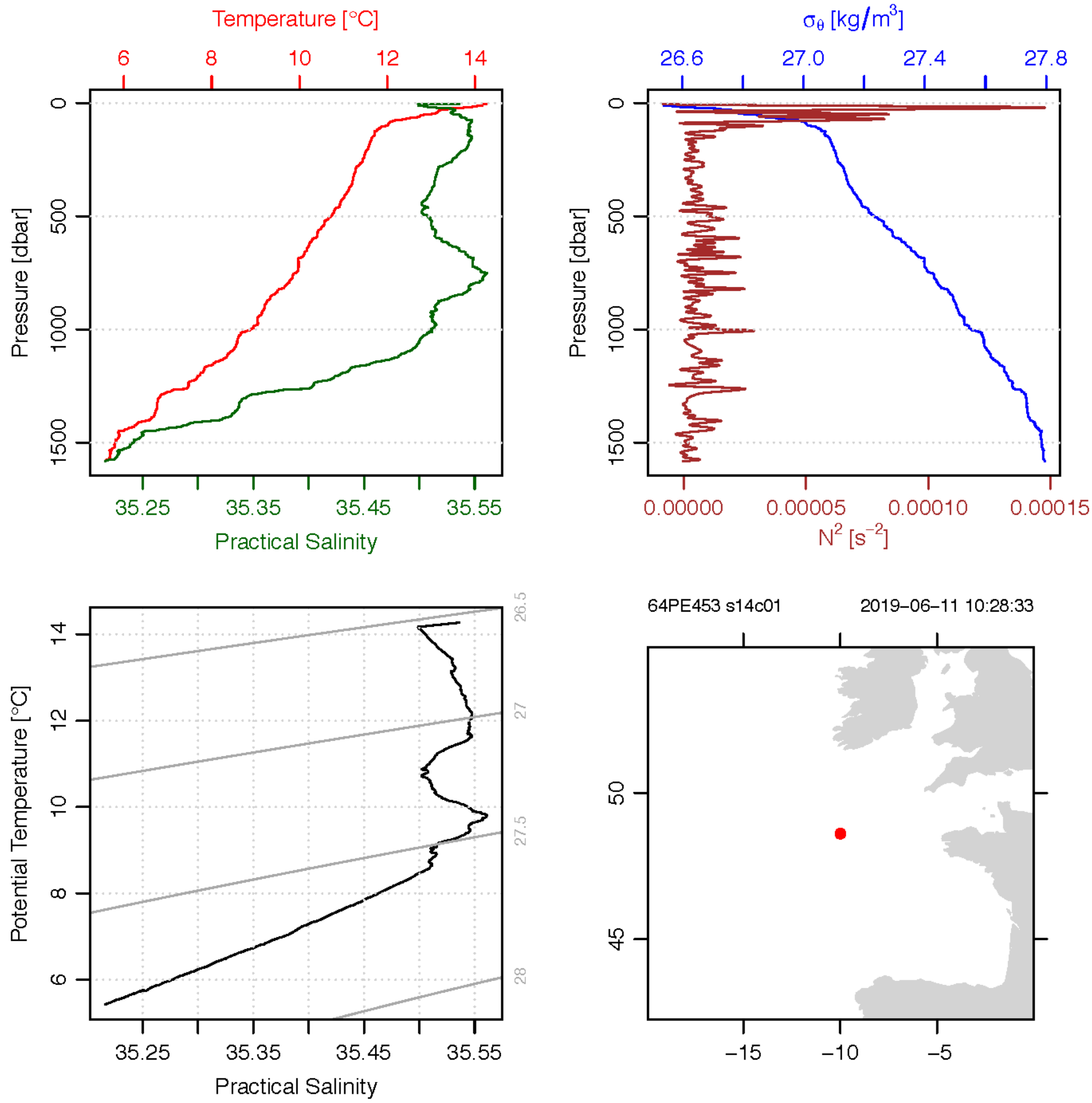


Figure 16. CTD data Stn 21

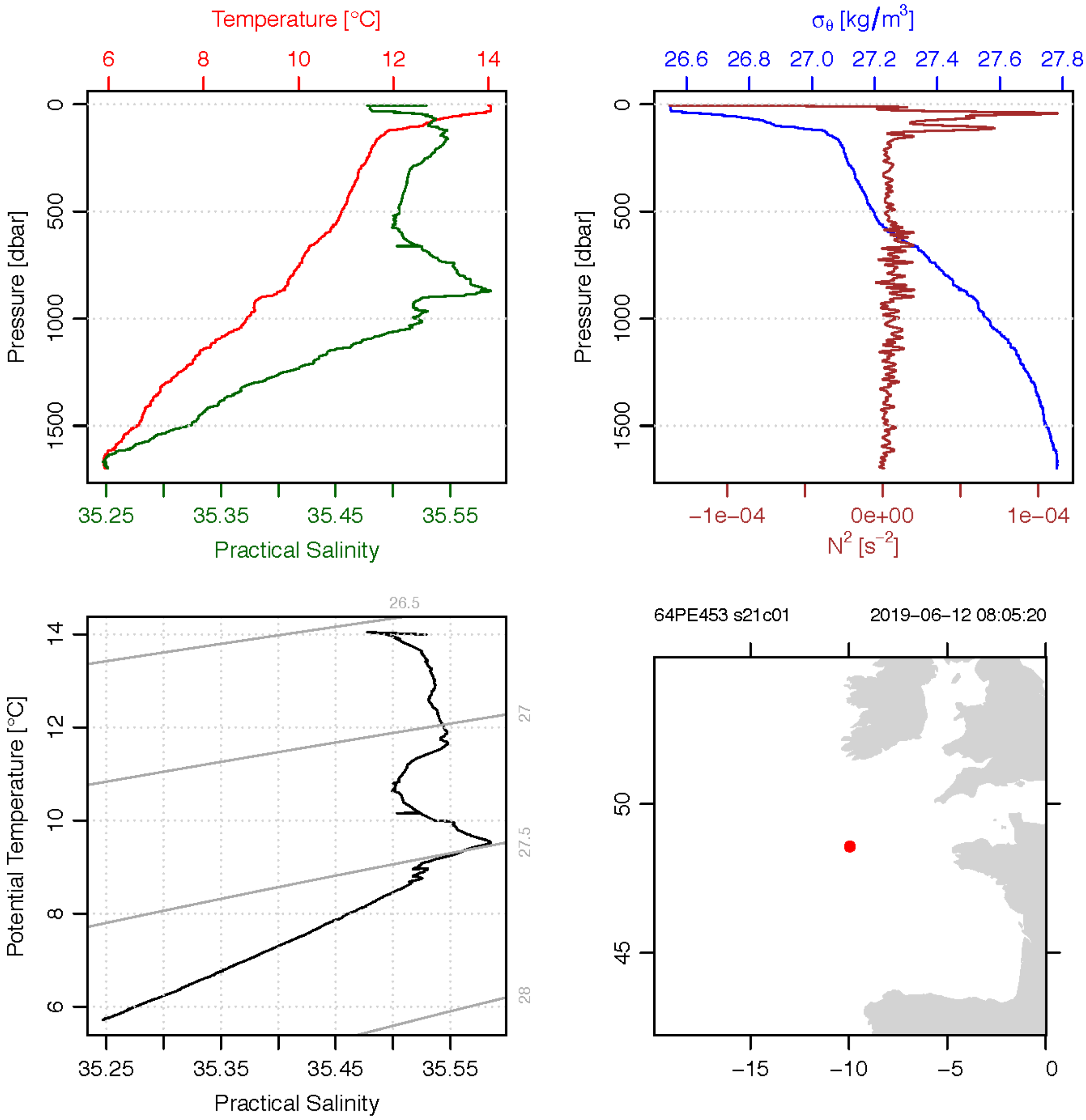


Figure 17. CTD data Stn 23

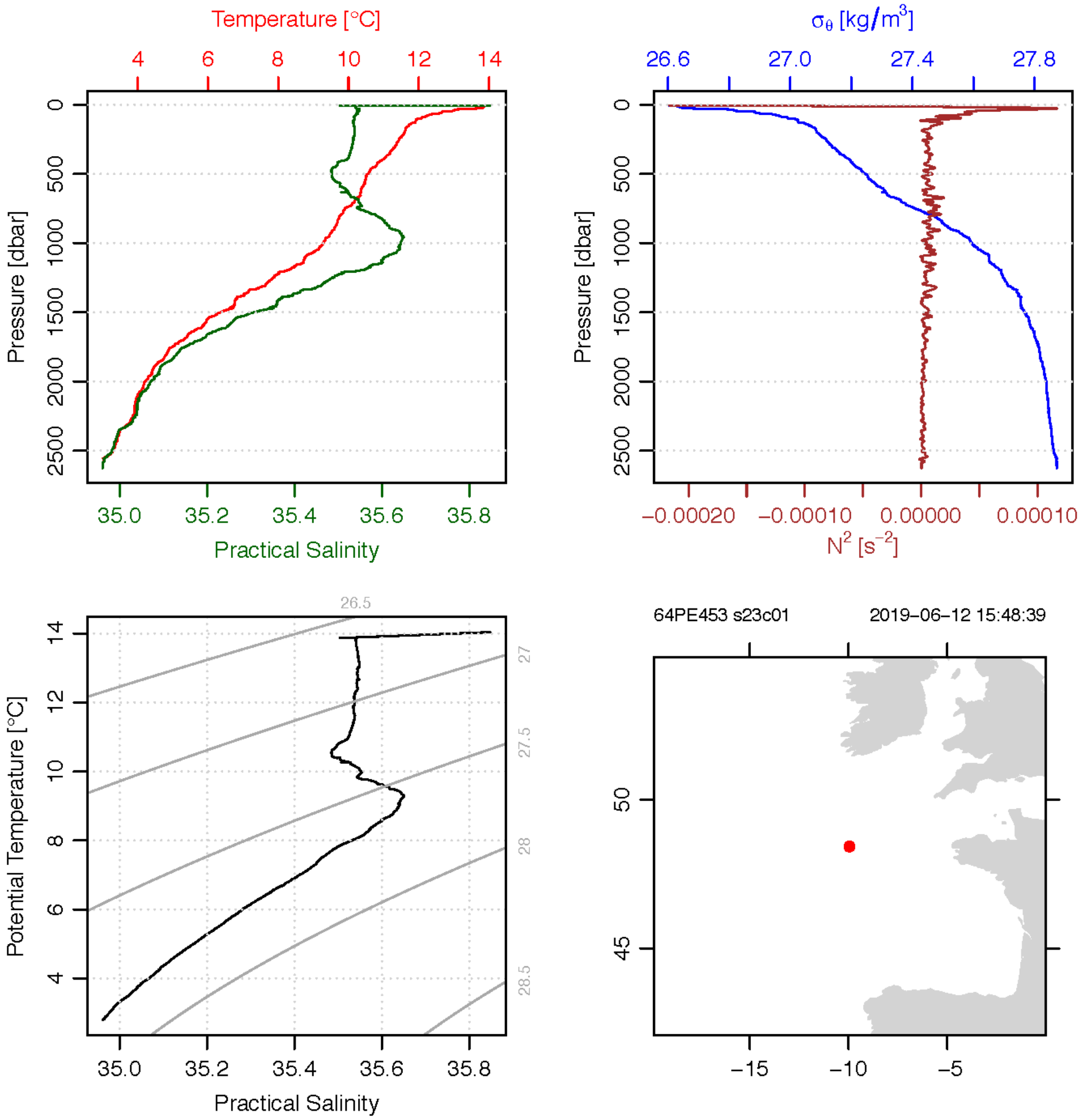


Figure 18. CTD data Stn 35

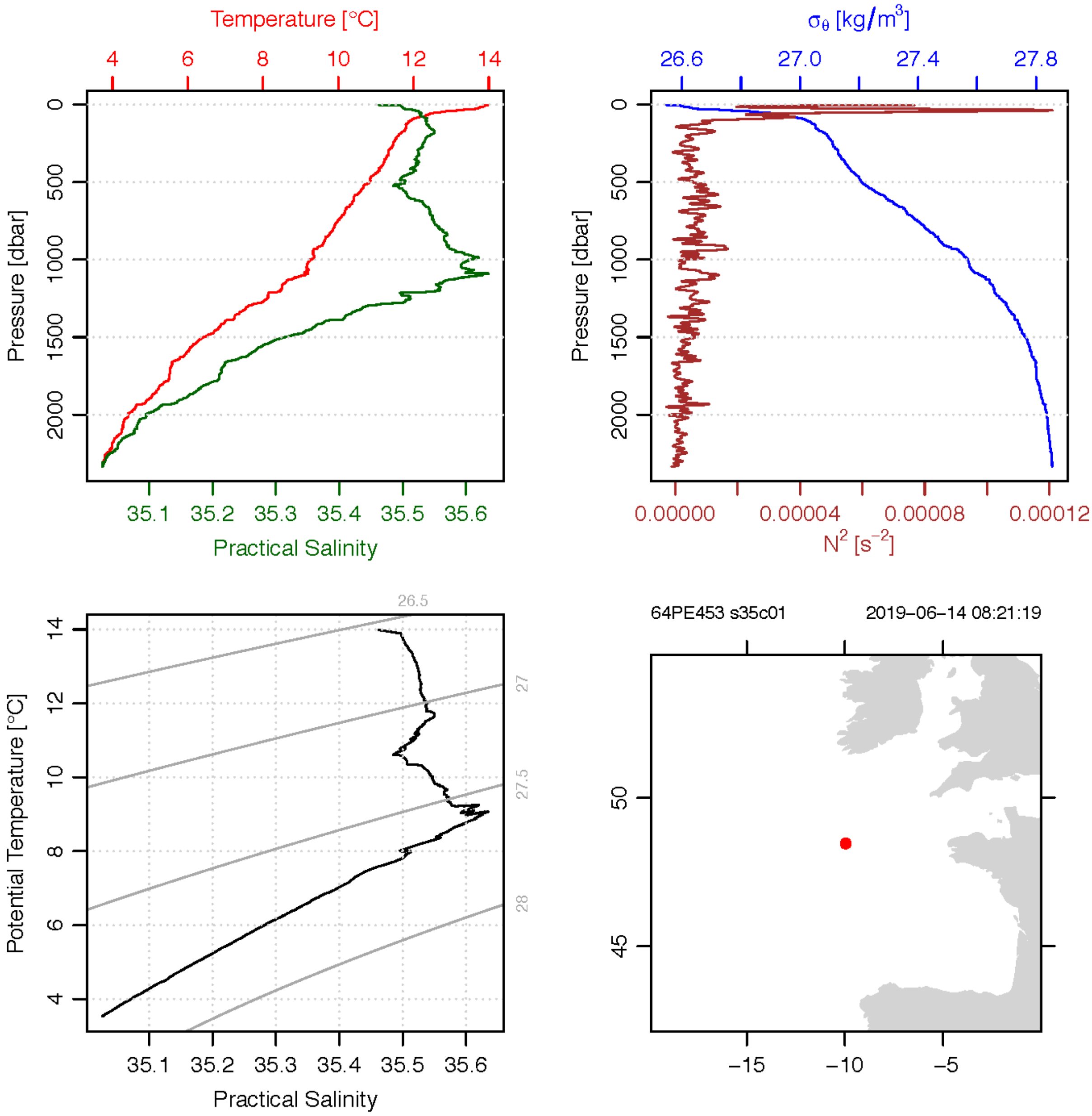


Figure 19. CTD data Stn 46

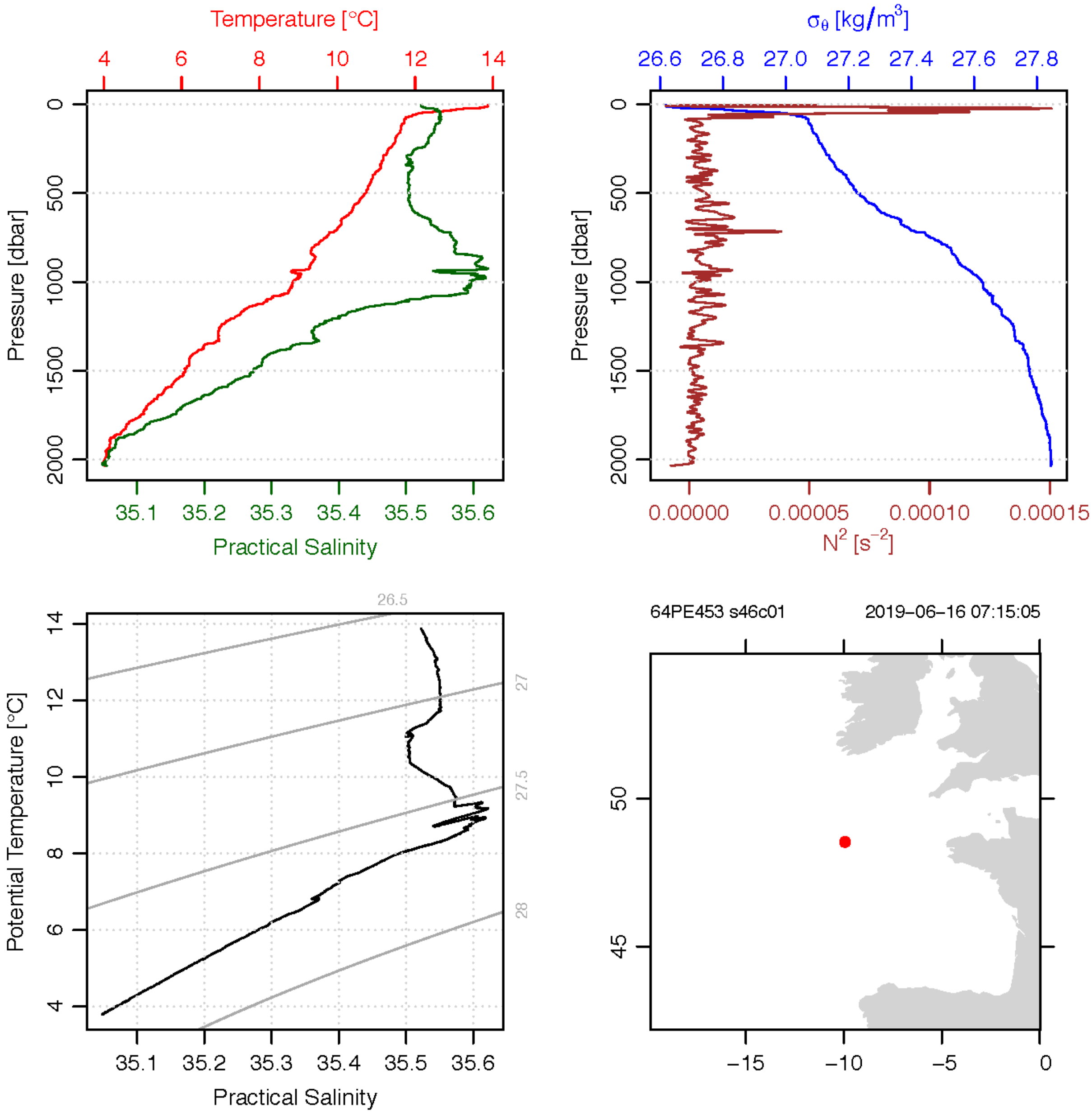


Figure 20. CTD data Stn 49

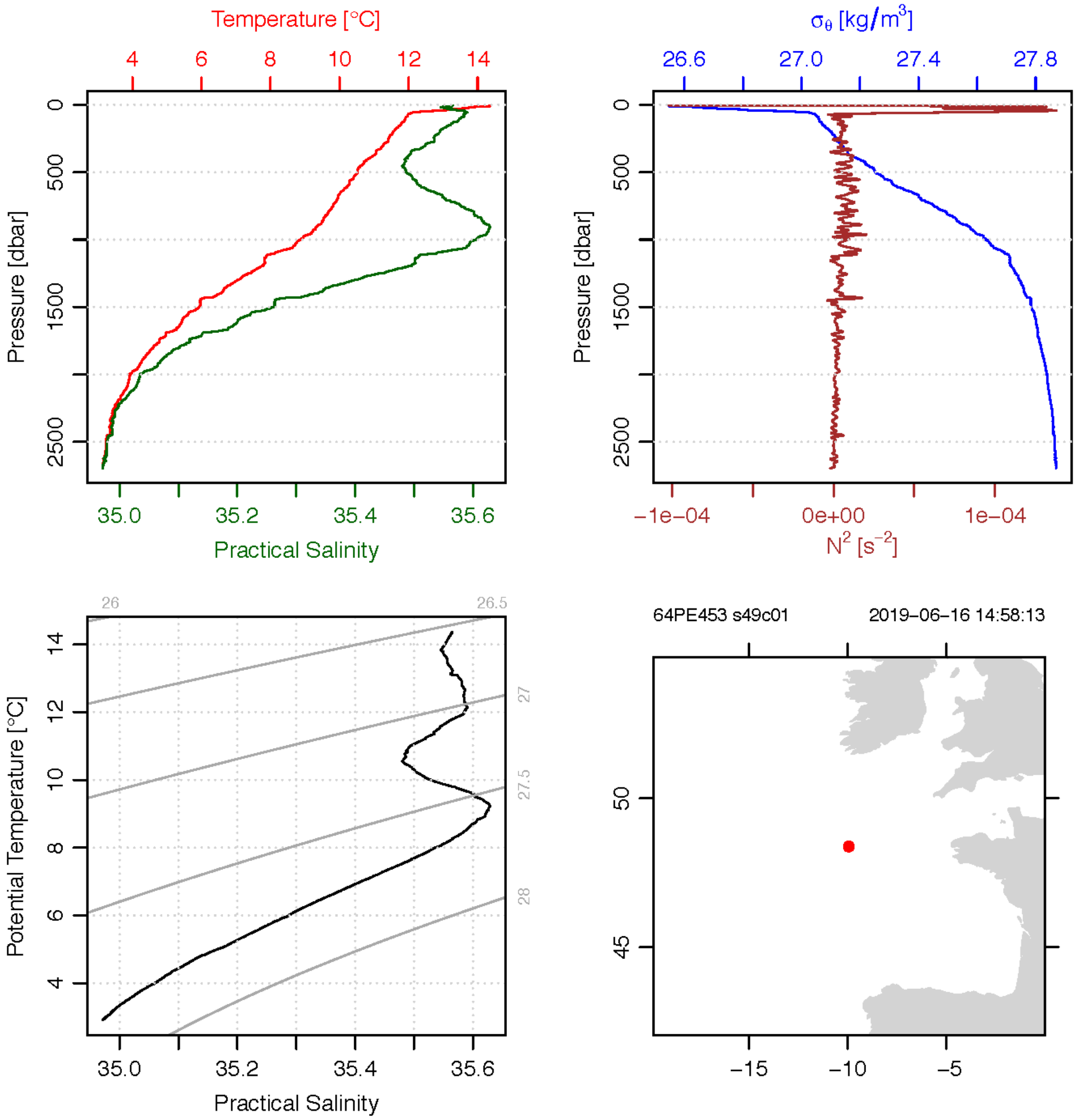


Figure 21. CTD data Stn 52

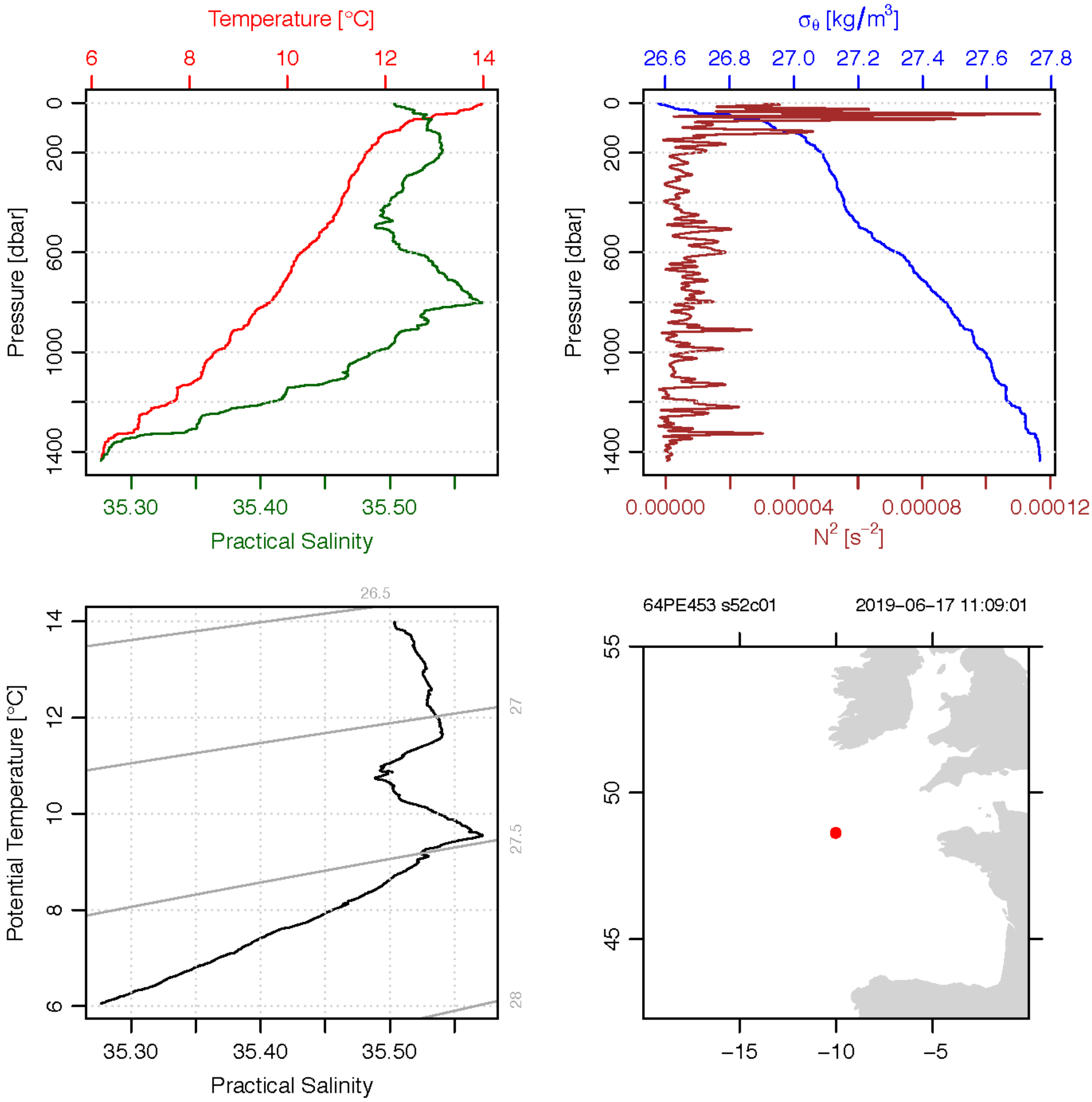
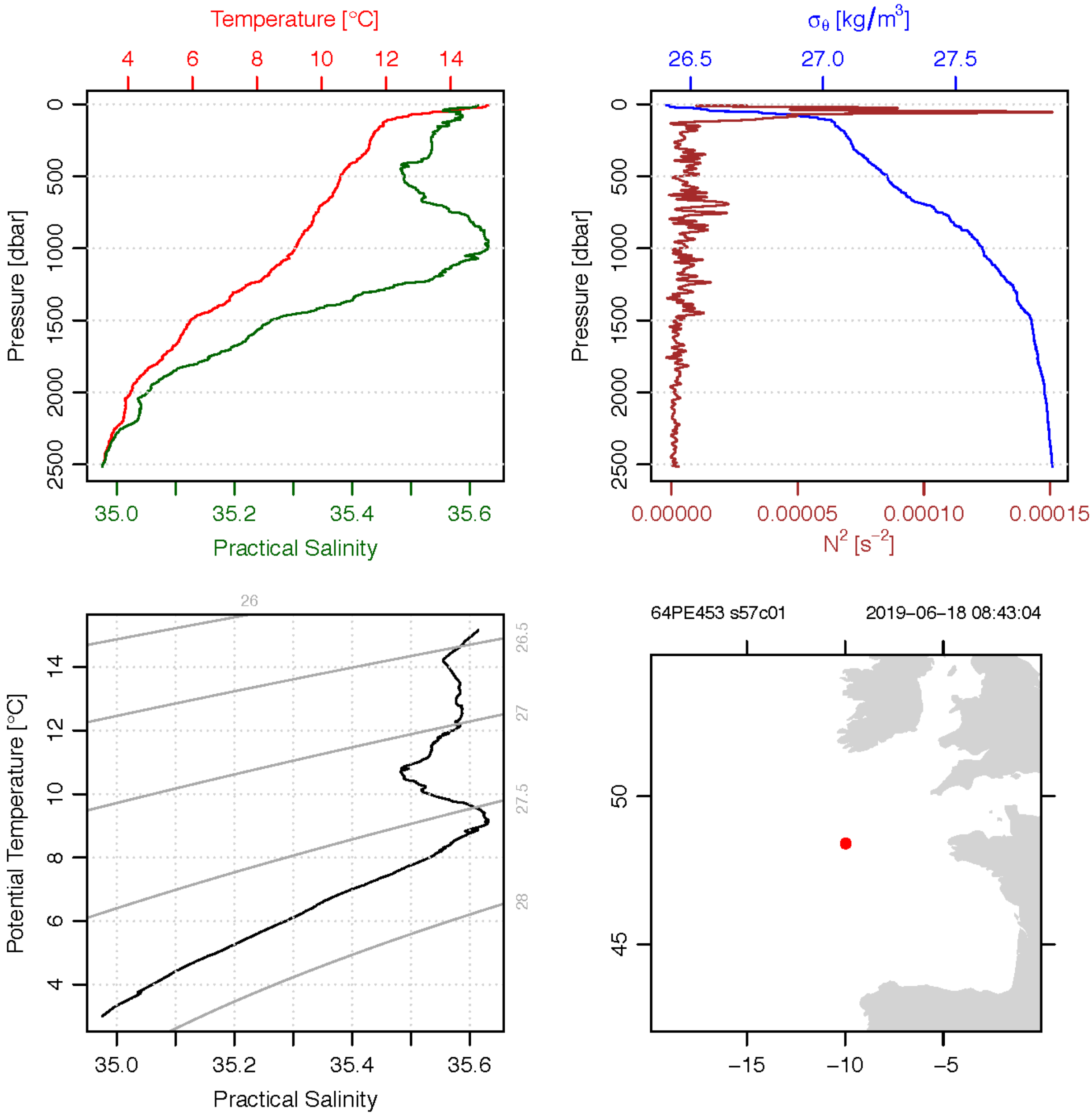


Figure 22. CTD data Stn 57



Towed video surveys

The hopper video is a 2x1.5x1 m, 700 kg tethered video frame, connected via a cable to the ship. The frame is equipped with two HD cameras, one forward facing to determine the oncoming landscape and potential obstacles and one downward facing camera aimed at the seafloor for habitat classification and faunal quantification. Two green lasers, 30 cm apart, are placed in the middle of the downward facing camera view for scale. A SeabirdSBE37 CT-ODO was attached to the frame, as well as a forward-facing sonar system (Kongsberg Mesotech, frequency of 675 kHz) to navigate the complex terrain of Whittard Canyon together with the forward-facing camera. The system is deployed from the side of the ship and down to station depth hoovering approximately 1-2 m above the seafloor, controlled by a winch, and towed after the ship downwards along a predetermined transect in the canyon branch.

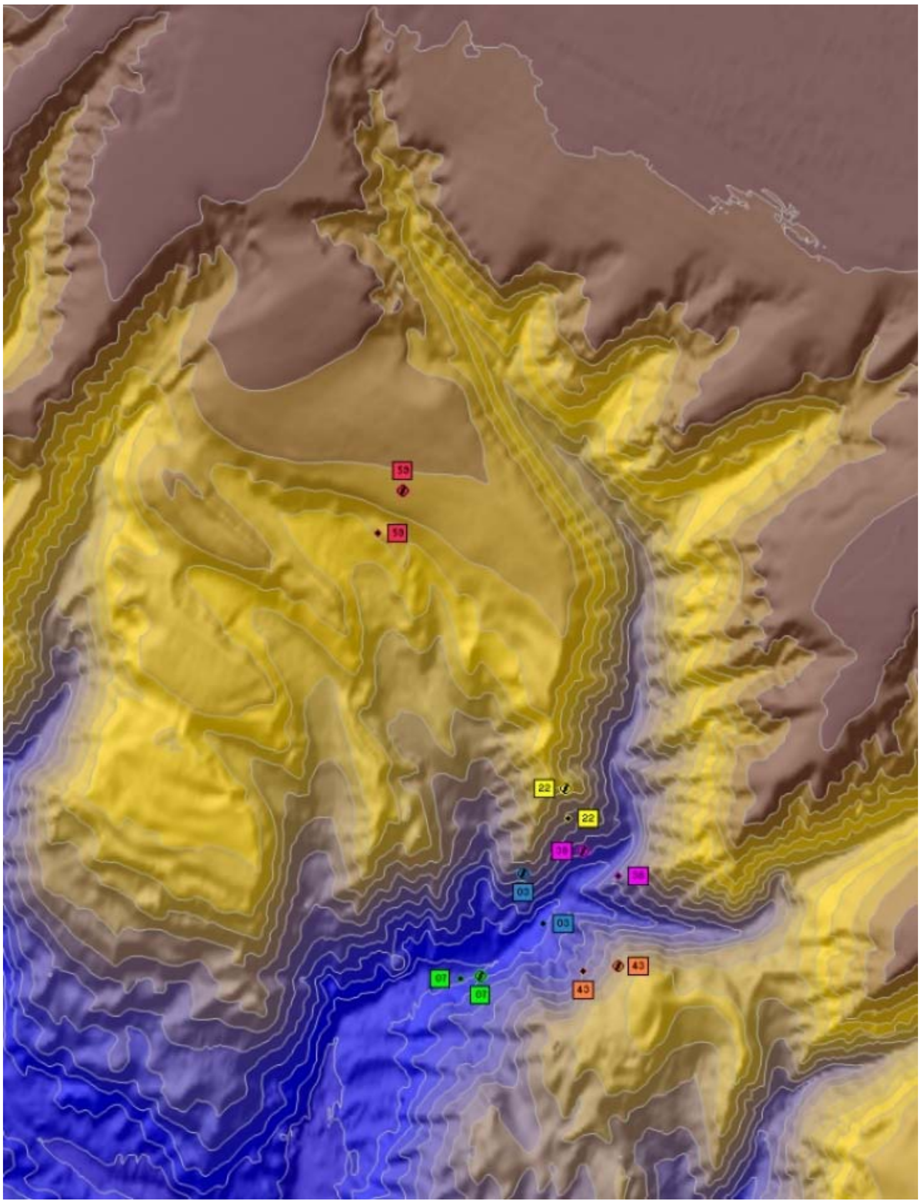


Figure 23. Video transects recorded with the towed camera.

Six video transects were conducted in the most eastern branch of Whittard canyon during the 64PE453 BYPASS cruise consisting of approximately 15 hours of recorded data (Table 4). Downwards and forwards video and still photos, taken every 10 seconds, were recorded and stored on an external hard drive during each dive. Stations visited were selected to complement previous data collected in the area to better understand how faunal zonation may correspond to respective particle load and physical oceanography along the canyon axis in between the canyon walls.

Table 4. Locations and time of video transects.

Station	Time start (UTC)	Start Latitude	Start Longitude	Start depth (m)	End depth (m)	Comments
3	09/06/2019 14:05	48.415750	-10.016000	3291	3100	West wall
7	10/06/2019 11:18	48.366667	-10.046167	3094	3241	East wall
22	12/06/2019 12:31	48.457250	-9.984500	1390	1900	West wall
38	14/06/2019 15:56	48.426517	-9.972667	2488	2600	Depocenter
43	15/06/2019 16:29	48.370617	-9.946533	641	935	East wall
59	18/06/2019 15:45	48.600333	-10.103192	1718	2293	West Sidebranch

Station 3 on the west wall was characterized by hard substrate (mostly carbonate) with thin layers of soft sediment including steep terrain (cliffs, boulders) where the sediment showed ripples and other erosion tracks. Stalked crinoids were the most observed taxa including the whipped coral *Viminella* and the soft coral *Anthomastus* (Figure 24).

Fauna observed at station 7 was dominated by ophiurids, holothurians and the soft coral *Anthomastus*, while the substrate was similar to station 3 dominated by hard substrate with layers of soft sediment. Station 7 showed a less steep overall morphology dominated by ripples in the sediment.

Station 22 showed a different community where soft sediment was observed inhabited by the sponges *Hyalonema* and *Pheronema* including two different varieties of the soft coral *Acanella*.

Station 38 substrate consisted of soft sediment and clay with coarse and rocky sections including some cliffs, here clear erosion lines were observed throughout the transect, including burrows and ripples in the sediment. Fish was abundant such as rattails and Moridae including sponges and *Anthomastus*.

The transect of station 43 was characterized by soft sediment covered cliffs with burrows and sections of ripples. Here the most abundant species was the Cutthroat eel and the whipped coral *Viminella*, including “sticks” most likely a species of Funiculidae.

Station 59 located in one of the side furrows on the west wall consisted of soft and sandy sediment with ripples and also sections of pebbles and boulders were observed. Asteroids and gastropods were mostly observed together with a variaty of anemones such as Cerianthids. Rattail fish and cutthroat eels were mostly observed. Fishing line and trash was observed along transects of station 3, 38 and 59, where a wellington boot was located (Figure 24).

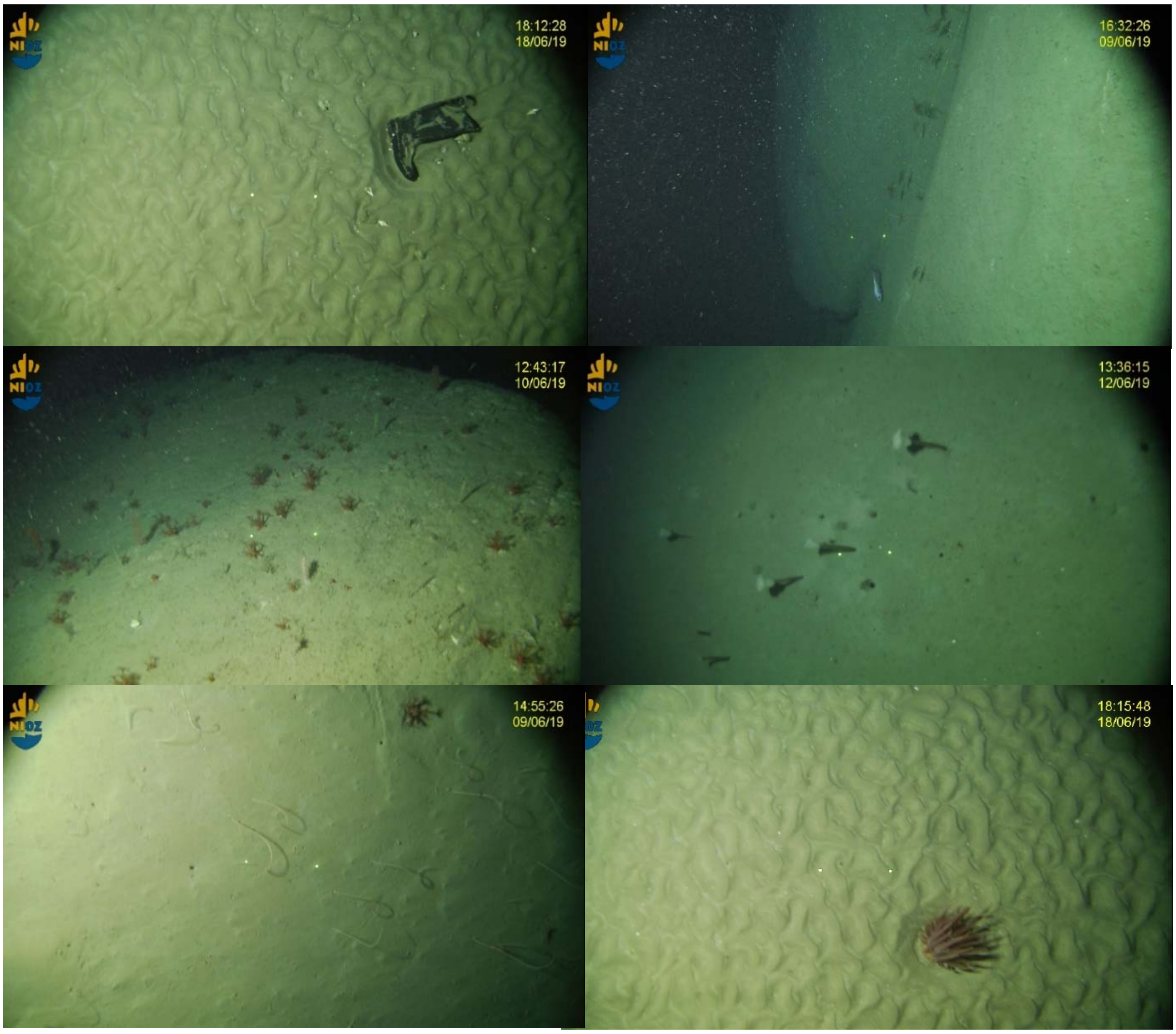


Figure 24. Boot found at 1000 m depth at the end of transect 59. Stalked Crinoids and rattail on cliff wall from transect 3. *Hyalonema* observed in transect 22 including burrows. Transect 7, field of *Anthomastus*, *Acanella* and likely the seapen Funiculidae. *Viminella* and *Anthomastus* on a steep cliff covered by soft sediment in transect 3. Large anemone in transect 59.

Bacteria

Nepheloid layers are characterized by high particle dispersal compared to clear waters (Dickson and McCave, 1986) a higher amount of organic matter would affect the local fauna in the area and a greater microbial activity can be expected, and a difference in microbial community in comparison to clear water zones. Our aim is to investigate the microbial community in the water and their activity through eDNA, bacterial counts, nutrient availability and respiration rates of water samples in nepheloid layers and clear water.

Incubations

To measure bacterial activity through respiration rates, PSt3 type optodes (small non-invasive oxygen sensors) were attached on the inside of 1.1 L glass bottles with silicon glue labeled with a unique number between 1-21. To read the optodes a fiber optic oxygen transmitter (Fibox3) with polymer optical fibers (POF) connected through a Fibox3 that in turn are coupled to a PC with the software program PreSens Measurement Studio 2 (PMS2) installed were utilized (Figure 25). The bottle numbers and calibration measurements of each specific optode were added to the PMS2 to store the data measured during the experiment under each station numbers measurement file.

Sample water for the analysis were collected with the CTD in Niskin bottles. From the Niskin bottle, 2l were taken for eDNA filtration, samples for nutrients and bacterial count. For the incubation experiment the water from the CTD was collected in a 10l plastic bottle and stored in the dark at a temperature of 10°C. Four liters of collected water were then filtered through pre-weighed GF/F and polycarbonate 0.4 µm filters to create a 5:2 mix of filtered and unfiltered seawater. Every 12 hours the oxygen (O_2 µmol/l) was measured, and time (HH:MM), date (D/M/Y), pressure (hPa) and temperature (°C) were recorded. The values were directly added in a pre-prepared excel sheet with blank graphs to easily interpret the respiration rate visually in each separate bottle from the nepheloid and clear water incubations. All incubations were done in dark containers (Box 1 or 2) each equipped with a thermometer (Traceable®Logger-Trac™). The bottles where only exposed to light during the manual measurements, and each incubation was run for 72 hours. At the end of the incubation each bottle was sampled for nutrients, bacterial count and the left-over water ca. 1.1 L were filtered over 0.2 µm polycarbonate filters for eDNA. Each bottle was then cleaned using 0.1M HCl and washed 3 times with MilliQ, dried and wrapped in aluminum foil. If not yet fully dried until the next experiment the bottles were rinsed with sample water or filtered sample water before use.

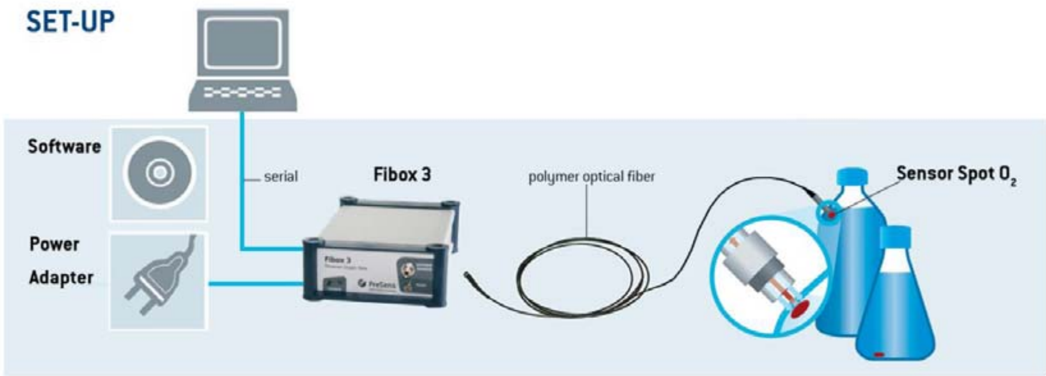


Figure 25. Set-up for measurement with PSt3 optodes (PreSens 2016)

From seven different CTD stations water was used for incubation measurements (9, 14, 21, 23, 46, 49 and 52). The collected water came from CTD bottles which sampled water in the nepheloid layer close to the seafloor or from clear water (CW) at a shallower depth (Table 5).

Table 5. Incubation metadata

Station	Depth (m)	Temperature (°C)	Incubation bottle nr
9	2235	3.6	1-3 nepheloid
			4 Filtered seawater
			5 MilliQ
14	1546/1199	5.6	6-8 Nepheloid
		7.6	9-11 CW
21	1660/1100	5.9	12-14 Nepheloid
		8.4	15-17 CW
23	2567/2000	3.0	18-20 Nepheloid
		4.2	1-3 CW
46	1988/1402	4	1-3 Nepheloid
		6.2	4-6 CW
49	2635/2000	3.2	7-9 Nepheloid
		3.9	10-12 CW
52	1399/1000	6.2	13-15 Nepheloid
		8.6	16-18 CW

In general respiration rate of water collected from the nepheloid layers was higher than water collected from the CW layer.

eDNA

Both sediment and water were used to collect eDNA samples. Water from the boxcore if available was collected in 3x2 L bottles and filtered over 0.2 µm polycarbonate filters for eDNA. Sediment was collected with 3 precut syringes from the boxcores, sealed, labeled and stored in the -80°C freezer. From the CTD 2 L of water was taken from 3 different niskin bottles at the same depth in the nepheloid layer as well as from clear water above the nepheloid layer.This was then filtered over a 0.2 µm polycarbonate filters for eDNA, the filters were put in pony vials, labeled and stored in the -80°C freezer. The same procedure was conducted on the water from the incubations after the experiment was ended.

Bacterial Counts

Water was collected from 3 different niskin bottles collected at the same depth in the nepheloid layer and in clearwater for bacterial counts. These are the same depths as where water was collected for eDNA. 1 ml of the water was then added to prelabeled cryovials with 20 µl glutaraldehyde, mixed gently and stored in the fridge for approximately 20 minutes before the samples were frozen in liquid nitrogen and stored in the -80°C freezer.

Marine mammal (cetaceans) observations

During the cruise daily sightings were made of whales and dolphins (Figure 26). The common dolphin was observed in large numbers, as well as pilot and fin whales. This was different compared to previous years when we visited Whittard Canyon in May.

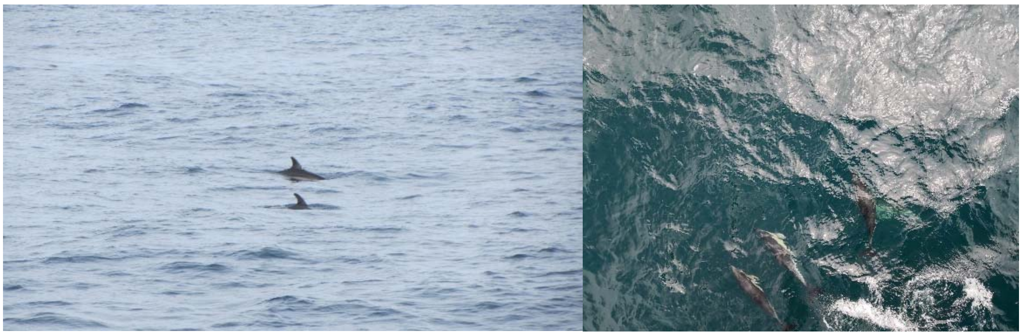


Figure 26. Large numbers of cetaceans were observed during cruise 64PE453.

Outreach

Several blogs were written during the cruise. In addition, high lights were tweeted and shared on Facebook.

References

Amaro, T., et al. (2016). The Whittard Canyon - A case study of submarine canyon processes. Progress in Oceanography 146:38-57.

De Leo, F.C., et al. (2010). Submarine canyons: hotspots of benthic biomass and productivity in the deep sea. Proceedings of the Royal Society B-Biological Sciences 277(1695):2783-2792.

Dickson, R.R. and McCave, I.N. (1986). Nepheloid layers on the continental slope west of Porcupine Bank. Deep Sea Research Part A. Oceanographic Research Papers 33:791-818.

Harris P.T. and Whiteway, T. (2011). Global distribution of large submarine canyons: Geomorphic differences between active and passive continental margins. Marine Geology 285:69-86.

Huvenne, V.A.I., et al. (2011). A Picture on the Wall: Innovative Mapping Reveals Cold-Water Coral Refuge in Submarine Canyon. Plos One 6(12).

Inthorn, M., Wagner, T., Scheeder, G., Zabel, M., 2006. Lateral transport controls distribution, quality, and burial of organic matter along continental slopes in high-productivity areas. Geology 34, 205-208.

Masson, D.G., et al. (2010). Efficient burial of carbon in a submarine canyon. Geology 38(9):831-834.

Orejas, C., et al. (2009). Cold-water corals in the Cap de Creus canyon, northwestern Mediterranean: spatial distribution, density and anthropogenic impact. Marine Ecology Progress Series 397:37-51.

Puig P., et al. (2014). Contemporary Sediment-Transport Processes in Submarine Canyons. Annual Review of Marine Science, Vol 6 6: 53-77.

Van Oevelen, D., et al. (2009). The cold-water coral community as a hot spot for carbon cycling on continental margins: A food-web analysis from Rockall Bank (northeast Atlantic). Limnology and Oceanography 54:1829-1844.

Wilson A.M., et al. (2015). Nepheloid layer distribution in the Whittard Canyon, NE Atlantic Margin. Marine Geology 367:130-142.

Appendices

- Cruise log
- Bacterial DNA (PC 47 mm, 0.2 um)
- SPM (PC 47 mm 0.4 um)
- SPOM (GFF, 47 mm)
- SPOM (GFF, 47 mm) McLane pump
- SPOM (GFF, 25 mm)
- Inorganic nutrient samples
- Inorganic nutrient samples lander incubations
- Si samples
- DIC samples
- Trace metal samples
- Salinity calibration samples
- Bacterial incubations from CTD water
- CTD sampling sheets
- Box core description and subsampling
- Samples for macrofauna
- Samples for meiofauna
- Mooring configuration
- Blogs

Appendix, Cruise log

Date/time	Latitude	Longitude	Device name	Action name	Station	Depth (m)	remarks
09/06/2019 09:13	N 48° 29.457'	W 9° 56.08662'	CTD with samples	Begin	1	2234	failed, program had to be restarted
09/06/2019 09:36	N 48° 29.4594'	W 9° 56.0877'	CTD with samples	Bottom	1	2256	failed, program had to be restarted
09/06/2019 09:54	N 48° 29.4528'	W 9° 56.09808'	CTD with samples	End	1	2257	failed, program had to be restarted
09/06/2019 10:20	N 48° 29.46108'	W 9° 56.097'	CTD with samples	Begin	2	2223	failed, bottles did not close
09/06/2019 11:03	N 48° 29.44902'	W 9° 56.1099'	CTD with samples	Bottom	2	2219	failed, bottles did not close
09/06/2019 12:34	N 48° 29.44542'	W 9° 56.10438'	CTD with samples	End	2	2228	failed, bottles did not close
09/06/2019 13:36	N 48° 25.0098'	W 10° 0.8967'	Video Frame	Begin	3	0	
09/06/2019 14:11	N 48° 24.94512'	W 10° 0.96102'	Video Frame	Start track	3	0	
09/06/2019 18:00	N 48° 23.47338'	W 10° 0.07638'	Video Frame	Stop track	3	2443	
09/06/2019 18:50	N 48° 23.46978'	W 9° 59.83428'	Video Frame	End	3	2755	
09/06/2019 19:14	N 48° 23.48952'	W 9° 59.67108'	CTD with samples	Begin	4	2863	test to 200m, bottle closing okay
09/06/2019 19:19	N 48° 23.51232'	W 9° 59.60532'	CTD with samples	Bottom	4	2846	test to 200m, bottle closing okay
09/06/2019 19:32	N 48° 23.56848'	W 9° 59.4561'	CTD with samples	End	4	2810	test to 200m, bottle closing okay
09/06/2019 21:11	N 48° 23.87292'	W 10° 6.04872'	Multibeam	Begin	5	2511	
09/06/2019 22:44	N 48° 23.59278'	W 10° 19.85778'	Multibeam	Course Change	5	1812	
09/06/2019 23:17	N 48° 25.33818'	W 10° 19.7415'	Multibeam	Course Change	5	1363	
10/06/2019 00:20	N 48° 26.0082'	W 10° 11.27778'	Multibeam	Course Change	5	1705	
10/06/2019 00:36	N 48° 26.5935'	W 10° 12.65892'	Multibeam	Course Change	5	1205	
10/06/2019 01:25	N 48° 26.37498'	W 10° 19.77768'	Multibeam	End	5	1236	
10/06/2019 01:26	N 48° 26.37252'	W 10° 19.84308'	Multibeam	Course Change	5	1246	
10/06/2019 01:46	N 48° 27.53448'	W 10° 19.8519'	Multibeam	Course Change	5	1144	
10/06/2019 02:25	N 48° 27.82992'	W 10° 14.56128'	Multibeam	Course Change	5	1060	
10/06/2019 03:20	N 48° 22.7616'	W 10° 10.6953'	Multibeam	Course Change	5	2304	
10/06/2019 05:29	N 48° 24.05928'	W 9° 54.8268'	Multibeam	Course Change	5	2114	
10/06/2019 05:56	N 48° 21.4035'	W 9° 55.21122'	Multibeam	End	5	1237	
10/06/2019 07:04	N 48° 29.47278'	W 9° 56.0736'	CTD with samples	Begin	6	2217	failed, bottles did not close
10/06/2019 07:53	N 48° 29.4555'	W 9° 56.09958'	CTD with samples	Bottom	6	2272	failed, bottles did not close
10/06/2019 08:53	N 48° 29.45712'	W 9° 56.1021'	CTD with samples	End	6	2271	failed, bottles did not close
10/06/2019 10:38	N 48° 22.0077'	W 10° 2.65332'	Video Frame	Begin	7	3064	
10/06/2019 11:40	N 48° 22.00752'	W 10° 2.77038'	Video Frame	Start track	7	3087	
10/06/2019 13:02	N 48° 21.91548'	W 10° 3.67608'	Video Frame	Stop track	7	3239	
10/06/2019 13:50	N 48° 21.6924'	W 10° 3.7125'	Video Frame	End	7	2583	
10/06/2019 16:30	N 48° 21.93588'	W 10° 3.26298'	Boxcore	Bottom	8	3231	not tripped
10/06/2019 18:47	N 48° 29.47122'	W 9° 56.10312'	CTD with samples	Begin	9	2269	CTD frame changed for old system
10/06/2019 19:29	N 48° 29.46108'	W 9° 56.11212'	CTD with samples	Bottom	9	2270	
10/06/2019 20:24	N 48° 29.45148'	W 9° 56.09628'	CTD with samples	End	9	2256	all bottles closed

10/06/2019 21:16	N 48° 32.8857'	W 9° 51.06'	Multibeam	Begin	10	410	
10/06/2019 22:08	N 48° 36.4209'	W 9° 55.51998'	Multibeam	Course Change	10	863	
10/06/2019 22:22	N 48° 36.57408'	W 9° 54.2007'	Multibeam	End	10	858	
10/06/2019 22:24	N 48° 36.41388'	W 9° 54.11508'	Multibeam	Begin	11	949	
10/06/2019 23:07	N 48° 33.12798'	W 9° 50.5365'	Multibeam	Course Change	11	409	
10/06/2019 23:35	N 48° 32.94228'	W 9° 51.06852'	Multibeam	Course Change	11	398	
11/06/2019 00:55	N 48° 33.0288'	W 9° 40.00848'	Multibeam	Course Change	11	397	
11/06/2019 01:03	N 48° 33.4152'	W 9° 40.0698'	Multibeam	Course Change	11	377	
11/06/2019 02:15	N 48° 32.52822'	W 9° 50.0805'	Multibeam	Course Change	11	746	
11/06/2019 02:24	N 48° 32.8548'	W 9° 50.10162'	Multibeam	Course Change	11	344	
11/06/2019 05:44	N 48° 33.8469'	W 9° 44.1384'	Multibeam	End	11	354	
11/06/2019 08:09	N 48° 34.9767'	W 9° 56.31792'	Boxcore	Bottom	12	1655	good
11/06/2019 09:55	N 48° 34.97838'	W 9° 56.3214'	Lander	Deployment	13	1650	ALBEX4-profile pump
11/06/2019 10:28	N 48° 37.0251'	W 9° 58.7307'	CTD with samples	Begin	14	1567	
11/06/2019 10:56	N 48° 37.0329'	W 9° 58.7214'	CTD with samples	Bottom	14	1569	
11/06/2019 11:38	N 48° 37.0395'	W 9° 58.68288'	CTD with samples	End	14	1571	
11/06/2019 14:04	N 48° 28.38648'	W 9° 56.72328'	Boxcore	Bottom	15	2379	failed, little sediment
11/06/2019 16:45	N 48° 34.74612'	W 9° 58.82208'	Boxcore	Bottom	16	997	failed, cable wrapped
11/06/2019 18:00	N 48° 34.7586'	W 9° 58.80702'	Boxcore	Bottom	17	1013	too full, geocore
11/06/2019 19:04	N 48° 34.76328'	W 9° 58.80972'	Lander	Deployment	18	1088	ALBEX2-incubation
11/06/2019 20:13	N 48° 36.77328'	W 9° 55.956'	Multibeam	Begin	19	973	
11/06/2019 22:30	N 48° 32.93478'	W 9° 40.02378'	Multibeam	Course Change	19	207	
11/06/2019 22:42	N 48° 33.30342'	W 9° 40.1595'	Multibeam	Course Change	19	187	
12/06/2019 01:15	N 48° 36.88758'	W 9° 55.51488'	Multibeam	Course Change	19	848	
12/06/2019 01:21	N 48° 36.94842'	W 9° 54.95808'	Multibeam	Course Change	19	688	
12/06/2019 03:38	N 48° 33.65268'	W 9° 40.0071'	Multibeam	Course Change	19	168	
12/06/2019 04:53	N 48° 33.28602'	W 9° 50.00268'	Multibeam	Course Change	19	318	
12/06/2019 05:45	N 48° 33.7932'	W 9° 44.49528'	Multibeam	End	19	175	
12/06/2019 07:37	N 48° 34.9476'	W 9° 56.42928'	Lander	Recovery	20	1688	ALBEX4-profile pump
12/06/2019 08:04	N 48° 34.9737'	W 9° 56.322'	CTD with samples	Begin	21	1668	
12/06/2019 08:39	N 48° 34.98168'	W 9° 56.32218'	CTD with samples	Bottom	21	1664	
12/06/2019 09:25	N 48° 34.9713'	W 9° 56.31048'	CTD with samples	End	21	1645	
12/06/2019 12:13	N 48° 27.41922'	W 9° 59.07072'	Video Frame	Begin	22	1366	
12/06/2019 12:38	N 48° 27.43512'	W 9° 59.07072'	Video Frame	Start track	22	1364	
12/06/2019 14:30	N 48° 26.54778'	W 9° 58.94868'	Video Frame	Stop track	22	2044	
12/06/2019 15:14	N 48° 26.50752'	W 9° 59.1486'	Video Frame	End	22	1949	
12/06/2019 15:48	N 48° 26.03448'	W 9° 56.29362'	CTD with samples	Begin	24	2599	
12/06/2019 16:35	N 48° 26.06262'	W 9° 56.316'	CTD with samples	Bottom	24	2590	
12/06/2019 17:34	N 48° 26.0649'	W 9° 56.3088'	CTD with samples	End	24	2590	
12/06/2019 18:46	N 48° 28.395'	W 9° 56.64168'	Lander	Deployment	24a	2322	ALBEX4-profile pump
12/06/2019 20:11	N 48° 33.40632'	W 9° 49.4676'	Multibeam	Begin	25	245	

12/06/2019 21:15	N 48° 34.3164'	W 9° 40.1634'	Multibeam	Course Change	25	162	
12/06/2019 21:27	N 48° 34.66032'	W 9° 40.25808'	Multibeam	Course Change	25	164	
12/06/2019 22:33	N 48° 33.675'	W 9° 49.3626'	Multibeam	Course Change	25	243	
12/06/2019 22:40	N 48° 34.03128'	W 9° 49.11528'	Multibeam	Course Change	25	239	
12/06/2019 23:45	N 48° 34.89042'	W 9° 39.78258'	Multibeam	Course Change	25	166	
12/06/2019 23:59	N 0° 0'	E 0° 0'	Multibeam	Course Change	25	167	
13/06/2019 00:59	N 48° 34.44078'	W 9° 48.336'	Multibeam	Course Change	25	227	
13/06/2019 01:11	N 48° 34.90152'	W 9° 47.73192'	Multibeam	Course Change	25	247	
13/06/2019 02:09	N 48° 35.53452'	W 9° 39.8013'	Multibeam	Course Change	25	167	
13/06/2019 02:17	N 48° 35.87898'	W 9° 39.98208'	Multibeam	Course Change	25	170	
13/06/2019 03:03	N 48° 35.45538'	W 9° 46.5474'	Multibeam	Course Change	25	240	
13/06/2019 03:59	N 48° 36.11538'	W 9° 39.95148'	Multibeam	Course Change	25	169	
13/06/2019 04:30	N 48° 36.1395'	W 9° 43.74408'	Multibeam	Course Change	25	210	
13/06/2019 05:05	N 48° 36.83592'	W 9° 39.96318'	Multibeam	Course Change	25	173	
13/06/2019 05:26	N 48° 36.77832'	W 9° 42.57432'	Multibeam	End	25	200	
13/06/2019 07:30	N 48° 34.64862'	W 9° 58.8015'	Lander	Recovery	26	1037	ALBEX2-incubation
13/06/2019 08:12	N 48° 34.75008'	W 9° 58.8063'	Boxcore	Bottom	27	1085	too full
13/06/2019 09:30	N 48° 34.75788'	W 9° 58.80828'	Boxcore	Bottom	28	1093	good
13/06/2019 12:16	N 48° 31.77168'	W 9° 56.12172'	Pistoncorer	Bottom	29	2061	
13/06/2019 14:59	N 48° 27.4164'	W 9° 59.05002'	Boxcore	Bottom	30	1386	macrofauna
13/06/2019 16:20	N 48° 27.414'	W 9° 59.067'	Boxcore	Bottom	31	1389	good
13/06/2019 17:40	N 48° 27.4425'	W 9° 59.0511'	Lander	Deployment	32	1363	ALBEX2-incubation
13/06/2019 18:44	N 48° 31.8783'	W 10° 0.61182'	Multibeam	Begin	33	902	
13/06/2019 19:16	N 48° 33.67668'	W 9° 57.10362'	Multibeam	Course Change	33	1374	
13/06/2019 19:44	N 48° 36.45'	W 9° 54.15348'	Multibeam	Course Change	33	933	
13/06/2019 21:10	N 48° 42.00138'	W 10° 1.99338'	Multibeam	Course Change	33	352	
13/06/2019 21:13	N 48° 42.0897'	W 10° 2.03418'	Multibeam	Course Change	33	340	
13/06/2019 21:59	N 48° 39.94302'	W 9° 56.1453'	Multibeam	Course Change	33	827	
13/06/2019 22:09	N 48° 39.30738'	W 9° 56.72292'	Multibeam	Course Change	33	965	
13/06/2019 22:58	N 48° 41.23788'	W 10° 2.08788'	Multibeam	Course Change	33	783	
13/06/2019 23:34	N 48° 38.03778'	W 10° 3.12018'	Multibeam	Course Change	33	635	
14/06/2019 00:14	N 48° 38.7033'	W 10° 7.32762'	Multibeam	Course Change	33	458	
14/06/2019 01:34	N 48° 39.3321'	W 10° 13.1373'	Multibeam	Course Change	33	367	
14/06/2019 03:01	N 48° 39.73632'	W 10° 2.58612'	Multibeam	Course Change	33	1282	
14/06/2019 03:53	N 48° 37.33098'	W 9° 55.64532'	Multibeam	Course Change	33	701	
14/06/2019 04:15	N 48° 37.04538'	W 9° 57.98928'	Multibeam	Course Change	33	1269	
14/06/2019 04:22	N 48° 37.10478'	W 9° 58.9266'	Multibeam	Course Change	33	1505	

14/06/2019 04:49	N 48° 38.745'	W 10° 1.8834'	Multibeam	Course Change	33	1350	
14/06/2019 04:56	N 48° 38.7333'	W 10° 2.99592'	Multibeam	Course Change	33	840	
14/06/2019 05:14	N 48° 36.6225'	W 10° 1.16178'	Multibeam	Course Change	33	805	
14/06/2019 05:30	N 48° 35.24298'	W 10° 0.63702'	Multibeam	End	33	677	
14/06/2019 07:54	N 48° 28.2783'	W 9° 56.99838'	Lander	Recovery	34	2399	ALBEX4-profile pump
14/06/2019 08:20	N 48° 28.38978'	W 9° 56.67342'	CTD with samples	Begin	35	2292	
14/06/2019 09:03	N 48° 28.3935'	W 9° 56.67738'	CTD with samples	Bottom	35	2338	
14/06/2019 10:08	N 48° 28.39842'	W 9° 56.673'	CTD with samples	End	35	2348	
14/06/2019 11:41	N 48° 28.3944'	W 9° 56.6739'	Boxcore	Bottom	36	2321	failed, cable wrapped
14/06/2019 13:35	N 48° 28.383'	W 9° 56.66808'	Boxcore	Bottom	37	2345	Failed, not tripped
14/06/2019 15:12	N 48° 25.64562'	W 9° 58.36698'	Video Frame	Begin	38	2446	
14/06/2019 16:01	N 48° 25.59138'	W 9° 58.3653'	Video Frame	Start track	38	2480	
14/06/2019 18:26	N 48° 24.83622'	W 9° 56.85702'	Video Frame	Stop track	38	2392	
14/06/2019 19:18	N 48° 24.74718'	W 9° 56.76228'	Video Frame	End	38	0	
14/06/2019 19:27	N 48° 24.64962'	W 9° 56.95968'	Multibeam	Begin	39	2291	
14/06/2019 20:06	N 48° 23.6157'	W 9° 59.54262'	Multibeam	Course Change	39	2917	
14/06/2019 20:44	N 48° 25.69398'	W 9° 55.97988'	Multibeam	Course Change	39	2670	
15/06/2019 00:04	N 48° 22.8654'	W 10° 12.10368'	Multibeam	Course Change	39	1794	
15/06/2019 00:55	N 48° 20.21658'	W 10° 12.73998'	Multibeam	Course Change	39	2203	
15/06/2019 02:07	N 48° 21.61368'	W 10° 20.19432'	Multibeam	Course Change	39	2385	
15/06/2019 03:08	N 48° 21.92502'	W 10° 12.63642'	Multibeam	Course Change	39	2011	
15/06/2019 04:08	N 48° 19.25712'	W 10° 20.21958'	Multibeam	Course Change	39	2783	
15/06/2019 05:40	N 48° 19.31358'	W 10° 6.10668'	Multibeam	End	39	3082	
15/06/2019 07:39	N 48° 27.36018'	W 9° 59.3106'	Lander	Recovery	40	1443	ALBEX2-incubation
15/06/2019 08:54	N 48° 30.4686'	W 9° 58.87008'	Boxcore	Bottom	41	1134	leaked a bit, not much sediment
15/06/2019 12:59	N 48° 25.176'	W 9° 57.2271'	Boxcore	Bottom	42	2796	3 cm sediment
15/06/2019 15:54	N 48° 22.2447'	W 9° 56.7828'	Video Frame	Begin	43	1594	
15/06/2019 16:29	N 48° 22.2372'	W 9° 56.79288'	Video Frame	Start track	43	1694	
15/06/2019 18:20	N 48° 22.1592'	W 9° 58.3668'	Video Frame	Stop track	43	2371	
15/06/2019 19:00	N 48° 22.21308'	W 9° 58.30038'	Video Frame	End	43	2320	
15/06/2019 20:20	N 48° 24.91158'	W 9° 57.0444'	Lander	Deployment	44	2785	ALBEX4-profile pump
15/06/2019 21:33	N 48° 26.65662'	W 9° 54.29988'	Multibeam	Begin	45	1437	
16/06/2019 01:05	N 48° 26.05218'	W 10° 10.9704'	Multibeam	Course Change	45	1769	
16/06/2019 03:25	N 48° 25.2399'	W 9° 55.38978'	Multibeam	Course Change	45	1761	
16/06/2019 03:47	N 48° 23.745'	W 9° 55.21872'	Multibeam	Course Change	45	2286	
16/06/2019 05:33	N 48° 27.85338'	W 10° 3.11988'	Multibeam	End	45	1859	
16/06/2019 07:13	N 48° 32.5365'	W 9° 55.70532'	CTD with samples	Begin	46	2047	
16/06/2019 07:50	N 48° 32.53038'	W 9° 55.69608'	CTD with samples	Bottom	46	2944	
16/06/2019 08:39	N 48° 32.53398'	W 9° 55.7148'	CTD with samples	End	46	2033	
16/06/2019 10:43	N 48° 28.39152'	W 9° 56.66808'	Boxcore	Bottom	47	2308	
16/06/2019 13:13	N 48° 31.41108'	W 9° 51.94698'	Lander	Deployment	48	594	ALBEX2-incubation

16/06/2019 14:56	N 48° 23.4816'	W 9° 55.62378'	CTD	Begin	49	2673	
16/06/2019 15:40	N 48° 23.49678'	W 9° 55.6584'	CTD	Bottom	49	2673	
16/06/2019 16:54	N 48° 23.4924'	W 9° 55.6587'	CTD	End	49	2673	
16/06/2019 17:31	N 48° 25.3674'	W 9° 55.61958'	Multibeam	Begin	50	1955	
16/06/2019 18:02	N 48° 27.86052'	W 9° 57.69858'	Multibeam	Course Change	50	2885	
16/06/2019 18:07	N 48° 28.40532'	W 9° 57.36252'	Multibeam	Course Change	50	2384	
16/06/2019 18:17	N 48° 29.44152'	W 9° 56.6208'	Multibeam	Course Change	50	2121	
16/06/2019 21:33	N 48° 40.92108'	W 10° 3.6762'	Multibeam	Course Change	50	1230	
16/06/2019 21:42	N 48° 40.66338'	W 10° 4.46442'	Multibeam	Course Change	50	794	
16/06/2019 22:19	N 48° 37.26012'	W 10° 4.81602'	Multibeam	Course Change	50	539	
16/06/2019 23:02	N 48° 40.50642'	W 10° 3.26718'	Multibeam	Course Change	50	1250	
17/06/2019 00:16	N 48° 45.04752'	W 10° 6.34542'	Multibeam	Course Change	50	717	
17/06/2019 01:06	N 48° 42.76398'	W 10° 3.50358'	Multibeam	Course Change	50	415	
17/06/2019 02:03	N 48° 45.4569'	W 10° 5.49948'	Multibeam	Course Change	50	433	
17/06/2019 03:04	N 48° 41.59812'	W 10° 7.01898'	Multibeam	Course Change	50	358	
17/06/2019 04:00	N 48° 41.70972'	W 10° 14.63958'	Multibeam	Course Change	50	554	
17/06/2019 04:06	N 48° 42.13842'	W 10° 14.60622'	Multibeam	Course Change	50	510	
17/06/2019 04:08	N 48° 42.04308'	W 10° 14.13372'	Multibeam	Course Change	50	482	
17/06/2019 05:04	N 48° 42.35232'	W 10° 5.793'	Multibeam	Course Change	50	847	
17/06/2019 05:13	N 48° 42.9504'	W 10° 6.0237'	Multibeam	Course Change	50	899	
17/06/2019 05:43	N 48° 41.8356'	W 10° 9.49638'	Multibeam	End	50	252	
17/06/2019 09:40	N 48° 36.9816'	W 9° 59.48148'	Mooring	Deployment	51	1616	Mooring 1
17/06/2019 11:07	N 48° 38.19108'	W 10° 0.5217'	CTD with samples	Begin	52	1431	
17/06/2019 11:35	N 48° 38.1981'	W 10° 0.50868'	CTD with samples	Bottom	52	1421	
17/06/2019 12:15	N 48° 38.205'	W 10° 0.53142'	CTD with samples	End	52	1419	
17/06/2019 15:46	N 48° 29.2347'	W 9° 56.41188'	Mooring	Deployment	53	2290	Mooring 2
17/06/2019 16:12	N 48° 28.96038'	W 9° 57.39228'	Mooring	Deployment	53	2141	
17/06/2019 16:33	N 48° 30.43032'	W 9° 56.1222'	Mooring	Deployment	53	2196	
17/06/2019 16:53	N 48° 28.9746'	W 9° 54.75102'	Mooring	Deployment	53	2046	
17/06/2019 18:38	N 48° 24.80298'	W 9° 57.17958'	Lander	Recovery	54	2339	ALBEX4-profile pump
17/06/2019 19:28	N 48° 23.8053'	W 9° 55.94628'	Multibeam	Begin	55	2470	
17/06/2019 21:40	N 48° 23.8368'	W 10° 12.64278'	Multibeam	Course Change	55	1436	
17/06/2019 22:10	N 48° 21.69078'	W 10° 12.68322'	Multibeam	Course Change	55	1950	
18/06/2019 00:30	N 48° 20.25762'	W 9° 56.3664'	Multibeam	Course Change	55	1360	
18/06/2019 03:06	N 48° 21.70218'	W 10° 8.02038'	Multibeam	Course Change	55	3013	
18/06/2019 03:55	N 48° 21.82278'	W 10° 0.22872'	Multibeam	Course Change	55	2636	
18/06/2019 04:29	N 48° 19.35522'	W 9° 55.80912'	Multibeam	Course Change	55	1444	
18/06/2019 05:22	N 48° 19.10322'	W 10° 5.78772'	Multibeam	End	55	3100	
18/06/2019 07:29	N 48° 31.33782'	W 9° 51.93'	Lander	Recovery	56	546	ALBEX2-incubation

18/06/2019 08:41	N 48° 24.89868'	W 9° 57.05112'	CTD with samples	Begin	57	2483	
18/06/2019 09:27	N 48° 24.9096'	W 9° 57.03678'	CTD with samples	Bottom	57	2452	
18/06/2019 10:34	N 48° 24.91032'	W 9° 57.0516'	CTD with samples	End	57	2451	
18/06/2019 13:42	N 48° 34.7724'	W 9° 58.79808'	Piston corer	Bottom	58	1097	130 cm
18/06/2019 15:32	N 48° 36.0156'	W 10° 6.22962'	Video Frame	Begin	59	641	
18/06/2019 15:45	N 48° 36.0222'	W 10° 6.19158'	Video Frame	Start track	59	641	
18/06/2019 18:25	N 48° 34.73538'	W 10° 7.3143'	Video Frame	Stop track	59	933	
18/06/2019 18:45	N 48° 34.6944'	W 10° 7.30392'	Video Frame	End	59	942	

Appendix II, bacterial DNA (PC 47 mm, 0.2 um)

Station	Date	Depth (m)	Niskin bottle	Amount filtered (L)	Remarks
9	10/06/2019	2235	4	2	AA - Nepheloid
9	10/06/2019	2235	5	2	BB - Nepheloid
9	10/06/2019	2235	6	2	CC - Nepheloid
9	10/06/2019	1500	13	2	DD - Clear water
9	10/06/2019	1500	14	2	EE - Clear water
9	10/06/2019	1500	15	2	FF - Clear water
14	11/06/2019	1546	4	2	AA - Nepheloid
14	11/06/2019	1546	5	2	BB - Nepheloid
14	11/06/2019	1546	6	2	CC - Nepheloid
14	11/06/2019	1199	11	2	DD - Clear water
14	11/06/2019	1199	12	2	EE - Clear water
14	11/06/2019	1199	13	2	FF - Clear water
21	12/06/2019	1660	4	2	AA - Nepheloid
21	12/06/2019	1660	5	2	BB - Nepheloid
21	12/06/2019	1660	6	2	CC - Nepheloid
21	12/06/2019	1100	13	2	DD - Clear water
21	12/06/2019	1100	14	2	EE - Clear water
21	12/06/2019	1100	15	2	FF - Clear water
23	12/06/2019	2567	4	2	AA - Nepheloid
23	12/06/2019	2567	5	2	BB - Nepheloid
23	12/06/2019	2567	6	2	CC - Nepheloid
23	12/06/2019	2000	14	2	DD - Clear water
23	12/06/2019	2000	15	2	EE - Clear water
23	12/06/2019	2000	16	2	FF - Clear water
35	14/06/2019	2280	4	2	AA - Nepheloid
35	14/06/2019	2280	5	2	BB - Nepheloid
35	14/06/2019	2280	6	2	CC - Nepheloid
35	14/06/2019	1502	13	2	DD - Clear water
35	14/06/2019	1502	14	2	EE - Clear water
35	14/06/2019	1502	15	2	FF - Clear water
12	12/06/2019	1655		1.8	Box Core
12	12/06/2019	1655		1.8	Box Core
12	12/06/2019	1655		1.8	Box Core
28	14/06/2019	1093		1.8	Box Core
28	14/06/2019	1093		1.8	Box Core
28	14/06/2019	1093		1.8	Box Core
30	14/06/2019	1386		1.8	Box Core
30	14/06/2019	1386		1.8	Box Core
30	14/06/2019	1386		1.8	Box Core
14 inc	14/06/2019	1546	B6	1.1	Nepheloid
14 inc	14/06/2019	1546	B7	1.1	Nepheloid
14 inc	14/06/2019	1546	B8	1.1	Nepheloid
14 inc	14/06/2019	1199	B9	1.1	Clear water
14 inc	14/06/2019	1199	B10	1.1	Clear water

14 inc	14/06/2019	1199	B11	1.1	Clear water
21	15/06/2019	1660	B12	1.1	Nepheloid
21	15/06/2019	1660	B13	1.1	Nepheloid
21	15/06/2019	1660	B14	1.1	Nepheloid
21	15/06/2019	1100	B15	1.1	Clear water
21	15/06/2019	1100	B16	1.1	Clear water
21	15/06/2019	1100	B17	1.1	Clear water
23	15/06/2019	2567	B18	1.1	Nepheloid
23	15/06/2019	2567	B19	1.1	Nepheloid
23	15/06/2019	2567	B20	1.1	Nepheloid
23	15/06/2019	2000	B1	1.1	Clear water
23	15/06/2019	2000	B2	1.1	Clear water
23	15/06/2019	2000	B3	1.1	Clear water
46	16/06/2019	1988	4	2	AA - Nepheloid
46	16/06/2019	1988	5	2	BB - Nepheloid
46	16/06/2019	1988	6	2	CC - Nepheloid
46	16/06/2019	1402	13	2	DD - Clear water
46	16/06/2019	1402	14	2	EE - Clear water
46	16/06/2019	1402	15	2	FF - Clear water
49	16/06/2019	2635	4	2	AA - Nepheloid
49	16/06/2019	2635	5	2	BB - Nepheloid
49	16/06/2019	2635	6	2	CC - Nepheloid
49	16/06/2019	2000	13	2	DD - Clear water
49	16/06/2019	2000	14	2	EE - Clear water
49	16/06/2019	2000	15	2	FF - Clear water
52	17/06/2019	1399	4	2	AA - Nepheloid
52	17/06/2019	1399	5	2	BB - Nepheloid
52	17/06/2019	1399	6	2	CC - Nepheloid
52	17/06/2019	1000	13	2	DD - Clear water
52	17/06/2019	1000	14	2	EE - Clear water
52	17/06/2019	1000	15	2	FF - Clear water
57	18/06/2019	2458	4	2	AA - Nepheloid
57	18/06/2019	2458	5	2	BB - Nepheloid
57	18/06/2019	2458	6	2	CC - Nepheloid
57	18/06/2019	2000	11	2	DD - Clear water
57	18/06/2019	2000	12	2	EE - Clear water
57	18/06/2019	2000	13	2	FF - Clear water
41	18/06/2019	1134		1.7	Box Core
41	18/06/2019	1134		1.7	Box Core
41	18/06/2019	1134		1.8	Box Core
47	18/06/2019	2308		1.5	Box Core
47	18/06/2019	2308		1.8	Box Core
47	18/06/2019	2308		1.8	Box Core
42	18/06/2019	2796		1.8	Box Core
42	18/06/2019	2796		1.8	Box Core
42	18/06/2019	2796		1.8	Box Core

Appendix, SPM (PC 47 mm 0.4 um)

Station/Cast	Bottle	Depth (m)	Bottle nr	Filter	Remarks
9	E	2235	3	PF1	5L filtered
9	G	2000	8	PF3	5L filtered
9	M	1500	12	PF4	5L filtered
9	Q	15	19	PF9	3.17 L filtered
9	F	2235	3	PF8	5L filtered
9	H	2000	8	PF7	5L filtered
9	N	1500	12	PF5	5L filtered
9	R	15	19	PF10	2.7L filtered
14	E	1549	3	PF11	5L filtered
14	F	1549	3	PF13	5L filtered
14	M	1199	10	PF14	5L filtered
14	N	1199	10	PF15	5L filtered
21	E	1600	3	PF31	5L filtered
21	F	1600	3	PF32	5L filtered
21	K	1100	12	PF33	5L filtered
21	L	1100	12	PF34	5L filtered
21	O	20	22	PF35	1.9L filtered
21	P	20	22	PF36	2L filtered
23	E	2567	3	PF37	5L filtered
23	F	2567	3	PF38	5L filtered
23	K	2000	13	PF39	5L filtered
23	L	2000	13	PF40	5L filtered
23	O	18.87	23	PF41	
23	P	18.87	23	PF42	
35	E	2280	3	PF43	5L filtered
35	F	2280	3	PF44	5L filtered
35	K	1502	12	PF45	5L filtered
35	L	1502	12	PF48	5L filtered
35	O	15	22	PF47	2.5L filtered
35	P	15	22	PF46	2.6L filtered
46	E	1988	3	PF49	5L filtered
46	F	1988	3	PF50	5L filtered
46	K	1402	12	PF51	5L filtered
46	L	1402	12	PF52	5L filtered
46	O	15	23	PF53	2.6L filtered
46	P	15	23	PF54	2.5L filtered
49	E	2635	3	PF55	5L filtered
49	F	2635	3	PF56	5L filtered
49	K	2000	12	PF57	5L filtered
49	L	2000	12	PF58	5L filtered
49	O	20	23	PF59	2.5L filtered
49	P	20	23	PF16	2.4L filtered
52	E	1399	3	PF17	5L filtered
52	F	1399	3	PF18	5L filtered

52	K	1000	12	PF19	5L filtered
52	L	1000	12	PF20	5L filtered
52	O	22	24	PF21	2.5L filtered
52	P	22	24	PF22	2.5L filtered
57	E	2458	3	PF23	5L filtered
57	F	2458	3	PF24	5L filtered
57	K	2000	10	PF25	5L filtered
57	L	2000	10	PF26	5L filtered
57	O	32	23	PF27	2.5L filtered
57	P	32	23	PF28	2.5L filtered

Appendix, SPOM (GFF, 47 mm)

Filter nr	Station nr	Depth (m)	Amount filtered (L)	Remarks
FA91	9	2235	10	A,B
FA93	9	2235	10	C,D
FA92	9	1500	10	I,J
FA94	9	1500	10	K,L
FA95	9	15	5	O
FA96	9	15	5	P
FA97	14	1546	10	A,B
FA98	14	1546	10	C,D
FA99	14	1199	10	G,H
FA100	14	1199	10	I,J
17FI166	21	1660	10	A,B
17FI167	21	1660	10	C,D
17FI168	21	1100	10	G,H
17FI169	21	1100	10	I,J
17FI170	21	20	5	M
17				blanc filter (nothing)
17FI171	21	20	5	N
17FI172	23	2567	10	A,B
17FI173	23	2567	10	C,D
17FI174	23	2000	10	G,H
17FI175	23	2000	10	I,J
17FI176	23	18.87	5	M
17FI177	23	18.87	5	N
17FI178	35	2280	10	A,B
17FI179	35	2280	10	C,D
17FI180	35	1502	10	G,H
AN76	35	1502	10	I,J
AN77	35	15	5	M
AN78	35	15	5	N
AN79	46	1988	10	A,B
AN80	46	1988	10	C,D
AN81	46	1402	10	G,H
AN82	46	1402	10	I,J
AN83	46	15	5	M
AN84	46	15	5	N
AN85	49	2635	10	A,B
AN86	49	2635	10	C,D
AN87	49	2000	10	G,H
AN88	49	2000	10	I,J
AN89	49	20	5	M
AN90	49	20	5	N

AN70	52	1399	10	A,B
AN71	52	1399	10	C,D
AN72	52	1000	10	G,H
AN73	52	1000	10	I,J
AN74	52	22	5	M
AN75	52	22	5	N
AN94	57	2458	10	A,B
AN95	57	2458	10	C,D
AN96	57	2000	10	G,H
AN97	57	2000	10	I,J
AN98	57	32	5	M
AN99	57	32	5	N

Appendix, SPOM (GFF, 47 mm) McLane pump

Station nr	Cup nr	Type	Filter nr	Amount filtered	Remarks
13	1	McLane	FA56	10 L	
13	2	McLane	FA57	10 L	
13	3	McLane	FA58	10 L	
13	4	McLane	FA59	10 L	
13	5	McLane	FA60	10 L	
13	6	McLane	FA76	10 L	
13	7	McLane	FA77	10 L	
13	8	McLane	FA78	10 L	
13	9	McLane	FA79	10 L	
13	10	McLane	FA80	10 L	
13	11	McLane	FA81	10 L	
13	12	McLane	FA82	10 L	
24	1	McLane	17FI81	10 L	
24	2	McLane	17FI82	10 L	
24	3	McLane	17FI83	10 L	
24	4	McLane	17FI84	10 L	
24	5	McLane	17FI85	10 L	
24	6	McLane	17FI86	10 L	
24	7	McLane	17FI87	10 L	
24	8	McLane	17FI88	10 L	
24	9	McLane	17FI89	10 L	
24	10	McLane	17FI90	10 L	
24	11	McLane	17FI91	10 L	
24	12	McLane	17FI92	10 L	
24	13	McLane	FA83	10 L	
24	14	McLane	FA84	10 L	
24	15	McLane	FA85	10 L	
24	16	McLane	FA86	10 L	
24	17	McLane	FA87	10 L	
24	18	McLane	FA88	10 L	
44	1	McLane	FA16	10 L	Filter incomplete
44	2	McLane	FA17	10 L	
44	3	McLane	FA18	10 L	
44	4	McLane	FA19	10 L	
44	5	McLane	FA20	10 L	
44	6	McLane	FA21	10 L	
44	7	McLane	FA22	10 L	Filter incomplete
44	8	McLane	FA23	10 L	
44	9	McLane	FA24	10 L	
44	10	McLane	FA25	10 L	
44	11	McLane	FA26	10 L	
44	12	McLane	FA27	10 L	
44	13	McLane	FA28	10 L	
44	14	McLane	FA29	10 L	

44	15	McLane	FA30	10 L	
44	16	McLane	AN91	10 L	
44	17	McLane	17F195	10 L	Filter incomplete
44	18	McLane	AN92	10 L	Filter incomplete
44	19	McLane	AN93	10 L	

Appendix, SPOM (GFF, 25 mm)

Filter nr	Station nr	Depth	Amount filtered (L)	Remarks
18A88	13	20 cm	3.15	PP
18A89	13	80 cm	4.3	PP
18A61	13	10 cm	4.5	PP
18A87	13	160 cm	4.65	PP
18A91	24	10 cm	5	PP
18A92	24	20 cm	2.67	PP
18A73	24	80 cm	3.1	PP
18A74	24	160 cm	3.55	PP
18A78	44	10 cm	4.6	PP
18A79	44	20 cm	4.3	PP
18A80	44	40 cm	4.8	PP
18A85	44	80 cm	3.2	PP
18A86	44	160 cm	4.7	PP

Appendix, inorganic nutrient samples

Cruise	Station nr	Instrument	Depth	Remarks
64PE453-	9	CTD	2235 m	
64PE453-	9	CTD	2235 m	
64PE453-	9	CTD	2000 m	
64PE453-	9	CTD	1500 m	
64PE453-	9	CTD	15 m	
64PE453-	12	BC	1.5 cm	core depth
64PE453-	12	BC	2.5 cm	core depth
64PE453-	12	BC	3.5 cm	core depth
64PE453-	12	BC	4.5 cm	core depth
64PE453-	12	BC	5.5 cm	core depth
64PE453-	12	BC	6.5 cm	core depth
64PE453-	12	BC	7.5 cm	core depth
64PE453-	12	BC	8.5 cm	core depth
64PE453-	12	BC	9.5 cm	core depth
64PE453-	12	BC	10.5 cm	core depth
64PE453-	12	BC	11.5 cm	core depth
64PE453-	12	BC	13.5 cm	core depth
64PE453-	13	PP	10 cm	above bottom
64PE453-	13	PP	10 cm	above bottom
64PE453-	13	PP	20 cm	above bottom
64PE453-	13	PP	20 cm	above bottom
64PE453-	13	PP	80 cm	above bottom
64PE453-	13	PP	80 cm	above bottom
64PE453-	13	PP	160 cm	above bottom
64PE453-	13	PP	160 cm	above bottom
64PE453-	14	CTD	1546 m	
64PE453-	14	CTD	1546 m	
64PE453-	14	CTD	1199 m	
64PE453-	14	CTD	16 m	
64PE453-	21	CTD	1660 m	
64PE453-	21	CTD	1660 m	
64PE453-	21	CTD	1200 m	
64PE453-	21	CTD	1100 m	
64PE453-	21	CTD	1100 m	
64PE453-	21	CTD	500 m	
64PE453-	21	CTD	150 m	
64PE453-	21	CTD	20 m	
64PE453-	24	PP	10 cm	above bottom
64PE453-	24	PP	10 cm	above bottom
64PE453-	24	PP	20 cm	above bottom
64PE453-	24	PP	20 cm	above bottom
64PE453-	24	PP	80 cm	above bottom
64PE453-	24	PP	80 cm	above bottom
64PE453-	24	PP	160 cm	above bottom

64PE453-	24	PP	160 cm	above bottom
64PE453-	35	CTD	2280 m	
64PE453-	35	CTD	2280 m	
64PE453-	35	CTD	1502 m	
64PE453-	35	CTD	1502 m	
64PE453-	35	CTD	896 m	
64PE453-	35	CTD	400 m	
64PE453-	35	CTD	15 m	
64PE453-	35	CTD	1988 m	
64PE453-	35	CTD	1988 m	
64PE453-	35	CTD	1650 m	
64PE453-	35	CTD	1402 m	
64PE453-	35	CTD	1402 m	
64PE453-	35	CTD	765 m	
64PE453-	35	CTD	400 m	
64PE453-	35	CTD	15 m	
64PE453-	44	PP	10 cm	above bottom
64PE453-	44	PP	10 cm	above bottom
64PE453-	44	PP	20 cm	above bottom
64PE453-	44	PP	20 cm	above bottom
64PE453-	44	PP	40 cm	above bottom
64PE453-	44	PP	40 cm	above bottom
64PE453-	44	PP	80 cm	above bottom
64PE453-	44	PP	80 cm	above bottom
64PE453-	44	PP	160 cm	above bottom
64PE453-	44	PP	160 cm	above bottom
64PE453-	47	BC	1.5 cm	core depth
64PE453-	47	BC	2.5 cm	core depth
64PE453-	47	BC	3.5 cm	core depth
64PE453-	47	BC	4.5 cm	core depth
64PE453-	47	BC	5.5 cm	core depth
64PE453-	47	BC	6.5 cm	core depth
64PE453-	47	BC	7.5 cm	core depth
64PE453-	47	BC	8.5 cm	core depth
64PE453-	47	BC	9.5 cm	core depth
64PE453-	47	BC	10.5 cm	core depth
64PE453-	47	BC	11.5 cm	core depth
64PE453-	47	BC	13.5 cm	core depth
64PE453-	47	BC	14.5 cm	core depth
64PE453-	47	BC	15.5 cm	core depth
64PE453-	47	BC	17.5 cm	core depth
64PE453-	47	BC	19.5 cm	core depth
64PE453-	47	BC	21.5 cm	core depth
64PE453-	49	CTD	2635 m	
64PE453-	49	CTD	2635 m	
64PE453-	49	CTD	2301 m	

64PE453-	49	CTD	2000 m	
64PE453-	49	CTD	2000 m	
64PE453-	49	CTD	1450 m	
64PE453-	49	CTD	930 m	
64PE453-	49	CTD	400 m	
64PE453-	49	CTD	20 m	
64PE453-	52	CTD	1399 m	
64PE453-	52	CTD	1399 m	
64PE453-	52	CTD	1141 m	
64PE453-	52	CTD	1000 m	
64PE453-	52	CTD	1000 m	
64PE453-	52	CTD	750 m	
64PE453-	52	CTD	398 m	
64PE453-	52	CTD	200 m	
64PE453-	52	CTD	22 m	
64PE453-	57	CTD	2458 m	
64PE453-	57	CTD	2458 m	
64PE453-	57	CTD	2000 m	
64PE453-	57	CTD	2000 m	
64PE453-	57	CTD	1500 m	
64PE453-	57	CTD	902 m	
64PE453-	57	CTD	500 m	
64PE453-	57	CTD	250 m	
64PE453-	57	CTD	32 m	

Appendix, inorganic nutrient samples lander incubations

Cruise	Station nr	Type	Box	Syringe
64PE453-	32	lander-inc	82	1A
64PE453-	32	lander-inc	82	1B
64PE453-	32	lander-inc	82	2A
64PE453-	32	lander-inc	82	2B
64PE453-	32	lander-inc	89	1A
64PE453-	32	lander-inc	89	1B
64PE453-	32	lander-inc	89	2A
64PE453-	32	lander-inc	89	2B
64PE453-	32	lander-inc	8B	1A
64PE453-	32	lander-inc	8B	1B
64PE453-	32	lander-inc	8B	2A
64PE453-	32	lander-inc	8B	2B
64PE453-	48	lander-inc	82	1A
64PE453-	48	lander-inc	82	1B
64PE453-	48	lander-inc	82	2A
64PE453-	48	lander-inc	82	2B
64PE453-	48	lander-inc	89	1A
64PE453-	48	lander-inc	89	1B
64PE453-	48	lander-inc	89	2A
64PE453-	48	lander-inc	89	2B
64PE453-	48	lander-inc	8B	1A
64PE453-	48	lander-inc	8B	1B
64PE453-	48	lander-inc	8B	2A
64PE453-	48	lander-inc	8B	2B

Appendix, Si samples

Cruise	Station nr	Instrument	Depth	Remarks
64PE453-	9	CTD	2235 m	
64PE453-	9	CTD	2235 m	
64PE453-	9	CTD	2000 m	
64PE453-	9	CTD	1500 m	
64PE453-	9	CTD	15 m	
64PE453-	12	BC	1.5 cm	Core depth
64PE453-	12	BC	2.5 cm	Core depth
64PE453-	12	BC	3.5 cm	Core depth
64PE453-	12	BC	4.5 cm	Core depth
64PE453-	12	BC	5.5 cm	Core depth
64PE453-	12	BC	6.5 cm	Core depth
64PE453-	12	BC	7.5 cm	Core depth
64PE453-	12	BC	8.5 cm	Core depth
64PE453-	12	BC	9.5 cm	Core depth
64PE453-	12	BC	10.5 cm	Core depth
64PE453-	12	BC	11.5 cm	Core depth
64PE453-	12	BC	13.5 cm	Core depth
64PE453-	13	PP	10 cm	above bottom
64PE453-	13	PP	10 cm	
64PE453-	13	PP	20 cm	
64PE453-	13	PP	20 cm	
64PE453-	13	PP	80 cm	
64PE453-	13	PP	80 cm	
64PE453-	13	PP	160 cm	
64PE453-	13	PP	160 cm	
64PE453-	14	CTD	1546 m	
64PE453-	14	CTD	1546 m	
64PE453-	14	CTD	1199 m	
64PE453-	14	CTD	15 m	
64PE453-	21	CTD	1660 m	
64PE453-	21	CTD	1660 m	
64PE453-	21	CTD	1200 m	
64PE453-	21	CTD	1100 m	
64PE453-	21	CTD	1100 m	
64PE453-	21	CTD	500 m	
64PE453-	21	CTD	150 m	
64PE453-	21	CTD	20 m	
64PE453-	24	PP	10 cm	
64PE453-	24	PP	10 cm	
64PE453-	24	PP	20 cm	
64PE453-	24	PP	20 cm	
64PE453-	24	PP	80 cm	
64PE453-	24	PP	80 cm	
64PE453-	24	PP	160 cm	

64PE453-	24	PP	160 cm	
64PE453-	35	CTD	2280 m	
64PE453-	35	CTD	2280 m	
64PE453-	35	CTD	1502 m	
64PE453-	35	CTD	1502 m	
64PE453-	35	CTD	896 m	
64PE453-	35	CTD	400 m	
64PE453-	35	CTD	15 m	
64PE453-	35	CTD	1988 m	
64PE453-	35	CTD	1988 m	
64PE453-	35	CTD	1650 m	
64PE453-	35	CTD	1402 m	
64PE453-	35	CTD	1402 m	
64PE453-	35	CTD	765 m	
64PE453-	35	CTD	400 m	
64PE453-	35	CTD	15 m	
64PE453-	44	PP	10 cm	above bottom
64PE453-	44	PP	10 cm	above bottom
64PE453-	44	PP	20 cm	above bottom
64PE453-	44	PP	20 cm	above bottom
64PE453-	44	PP	40 cm	above bottom
64PE453-	44	PP	40 cm	above bottom
64PE453-	44	PP	80 cm	above bottom
64PE453-	44	PP	80 cm	above bottom
64PE453-	44	PP	160 cm	above bottom
64PE453-	44	PP	160 cm	above bottom
64PE453-	47	BC	1.5 cm	Core depth
64PE453-	47	BC	2.5 cm	Core depth
64PE453-	47	BC	3.5 cm	Core depth
64PE453-	47	BC	4.5 cm	Core depth
64PE453-	47	BC	5.5 cm	Core depth
64PE453-	47	BC	6.5 cm	Core depth
64PE453-	47	BC	7.5 cm	Core depth
64PE453-	47	BC	8.5 cm	Core depth
64PE453-	47	BC	9.5 cm	Core depth
64PE453-	47	BC	10.5 cm	Core depth
64PE453-	47	BC	11.5 cm	Core depth
64PE453-	47	BC	13.5 cm	Core depth
64PE453-	47	BC	14.5 cm	Core depth
64PE453-	47	BC	15.5 cm	Core depth
64PE453-	47	BC	17.5 cm	Core depth
64PE453-	47	BC	19.5 cm	Core depth
64PE453-	47	BC	21.5 cm	Core depth
64PE453-	49	CTD	2635 m	
64PE453-	49	CTD	2635 m	
64PE453-	49	CTD	2301 m	

64PE453-	49	CTD	2000 m	
64PE453-	49	CTD	2000 m	
64PE453-	49	CTD	1450 m	
64PE453-	49	CTD	930 m	
64PE453-	49	CTD	400 m	
64PE453-	49	CTD	20 m	
64PE453-	52	CTD	1399 m	
64PE453-	52	CTD	1399 m	
64PE453-	52	CTD	1141 m	
64PE453-	52	CTD	1000 m	
64PE453-	52	CTD	1000 m	
64PE453-	52	CTD	750 m	
64PE453-	52	CTD	398 m	
64PE453-	52	CTD	200 m	
64PE453-	52	CTD	22 m	
64PE453-	57	CTD	2458 m	
64PE453-	57	CTD	2458 m	
64PE453-	57	CTD	2000 m	
64PE453-	57	CTD	2000 m	
64PE453-	57	CTD	1500 m	
64PE453-	57	CTD	902 m	
64PE453-	57	CTD	500 m	
64PE453-	57	CTD	250 m	
64PE453-	57	CTD	32 m	

Appendix, DIC samples

Cruise	Station nr	Instrument	Depth	Remarks
64PE453-	12	BC	1.5 cm	core depth
64PE453-	12	BC	2.5 cm	core depth
64PE453-	12	BC	3.5 cm	core depth
64PE453-	12	BC	4.5 cm	core depth
64PE453-	12	BC	5.5 cm	core depth
64PE453-	12	BC	6.5 cm	core depth
64PE453-	12	BC	7.5 cm	core depth
64PE453-	12	BC	8.5 cm	core depth
64PE453-	12	BC	9.5 cm	core depth
64PE453-	12	BC	10.5 cm	core depth
64PE453-	12	BC	11.5 cm	core depth
64PE453-	12	BC	13.5 cm	core depth
64PE453-	13	PP	10 cm	above bottom
64PE453-	13	PP	20 cm	above bottom
64PE453-	13	PP	80 cm	above bottom
64PE453-	13	PP	160 cm	above bottom
64PE453-	21	CTD	1660 m	
64PE453-	24	PP	10 cm	above bottom
64PE453-	24	PP	20 cm	above bottom
64PE453-	24	PP	80 cm	above bottom
64PE453-	24	PP	160 cm	above bottom
64PE453-	35	CTD	2280 m	
64PE453-	47	BC	1.5 cm	core depth
64PE453-	47	BC	2.5 cm	core depth
64PE453-	47	BC	3.5 cm	core depth
64PE453-	47	BC	4.5 cm	core depth
64PE453-	47	BC	5.5 cm	core depth
64PE453-	47	BC	6.5 cm	core depth
64PE453-	47	BC	7.5 cm	core depth
64PE453-	47	BC	8.5 cm	core depth
64PE453-	47	BC	9.5 cm	core depth
64PE453-	47	BC	10.5 cm	core depth
64PE453-	47	BC	11.5 cm	core depth
64PE453-	47	BC	13.5 cm	core depth
64PE453-	47	BC	14.5 cm	core depth
64PE453-	47	BC	15.5 cm	core depth
64PE453-	47	BC	17.5 cm	core depth
64PE453-	47	BC	19.5 cm	core depth
64PE453-	47	BC	21.5 cm	core depth
64PE453-	44	PP	10 cm	above bottom
64PE453-	44	PP	20 cm	above bottom
64PE453-	44	PP	40 cm	above bottom

64PE453-	44	PP	80 cm	above bottom
64PE453-	44	PP	160 cm	above bottom
64PE453-	57	CTD	2458 m	

Appendix, trace metal samples

Cruise	Station nr	Instrument	Depth	Remarks
64PE453-	12	BC	1.5 cm	core depth
64PE453-	12	BC	2.5 cm	core depth
64PE453-	12	BC	3.5 cm	core depth
64PE453-	12	BC	4.5 cm	core depth
64PE453-	12	BC	5.5 cm	core depth
64PE453-	12	BC	6.5 cm	core depth
64PE453-	12	BC	7.5 cm	core depth
64PE453-	12	BC	8.5 cm	core depth
64PE453-	12	BC	9.5 cm	core depth
64PE453-	12	BC	10.5 cm	core depth
64PE453-	12	BC	11.5 cm	core depth
64PE453-	12	BC	13.5 cm	core depth
64PE453-	13	PP	10 cm	above bottom
64PE453-	13	PP	20 cm	above bottom
64PE453-	13	PP	80 cm	above bottom
64PE453-	13	PP	160 cm	above bottom
64PE453-	21	CTD	1660 m	
64PE453-	24	PP	10 cm	above bottom
64PE453-	24	PP	20 cm	above bottom
64PE453-	24	PP	80 cm	above bottom
64PE453-	24	PP	160 cm	above bottom
64PE453-	35	CTD	2280 m	
64PE453-	47	BC	1.5 cm	core depth
64PE453-	47	BC	2.5 cm	core depth
64PE453-	47	BC	3.5 cm	core depth
64PE453-	47	BC	4.5 cm	core depth
64PE453-	47	BC	5.5 cm	core depth
64PE453-	47	BC	6.5 cm	core depth
64PE453-	47	BC	7.5 cm	core depth
64PE453-	47	BC	8.5 cm	core depth
64PE453-	47	BC	9.5 cm	core depth
64PE453-	47	BC	10.5 cm	core depth
64PE453-	47	BC	11.5 cm	core depth
64PE453-	47	BC	13.5 cm	core depth
64PE453-	47	BC	14.5 cm	core depth
64PE453-	47	BC	15.5 cm	core depth
64PE453-	47	BC	17.5 cm	core depth
64PE453-	47	BC	19.5 cm	core depth
64PE453-	47	BC	21.5 cm	core depth

Appendix, salinity calibration samples

Cruise	Station nr	Instrument	Depth	Remarks
64PE453-	9	CTD	2235 m	Bottle nr #49
64PE453-	9	CTD	2000 m	Bottle nr #50
64PE453-	9	CTD	1500 m	Bottle nr #51
64PE453-	9	CTD	300 m	Bottle nr #52
64PE453-	14	CTD	1546 m	Bottle nr #53
64PE453-	14	CTD	1199 m	Bottle nr #54
64PE453-	14	CTD	1000 m	Bottle nr #55
64PE453-	14	CTD	300 m	Bottle nr #56
64PE453-	21	CTD	1660 m	Bottle nr #57
64PE453-	21	CTD	1200 m	Bottle nr #58
64PE453-	21	CTD	1100 m	Bottle nr #59
64PE453-	21	CTD	500 m	Bottle nr #60
64PE453-	21	CTD	150 m	Bottle nr #61
64PE453-	23	CTD	2560 m	Bottle nr #62
64PE453-	23	CTD	2269 m	Bottle nr #63
64PE453-	23	CTD	2000 m	Bottle nr #64
64PE453-	23	CTD	500 m	Bottle nr #65
64PE453-	35	CTD	2280 m	Bottle nr #66
64PE453-	35	CTD	1701 m	Bottle nr #67
64PE453-	35	CTD	1502 m	Bottle nr #68
64PE453-	35	CTD	896 m	Bottle nr #69
64PE453-	35	CTD	400 m	Bottle nr #70
64PE453-	46	CTD	1988 m	Bottle nr #71
64PE453-	46	CTD	1650 m	Bottle nr #72
64PE453-	46	CTD	1402 m	Bottle nr #1
64PE453-	46	CTD	765 m	Bottle nr #2
64PE453-	46	CTD	400 m	Bottle nr #3
64PE453-	49	CTD	2635 m	Bottle nr #4
64PE453-	49	CTD	2301 m	Bottle nr #5
64PE453-	49	CTD	2000 m	Bottle nr #6
64PE453-	49	CTD	1450 m	Bottle nr #7
64PE453-	49	CTD	930 m	Bottle nr #8
64PE453-	49	CTD	400 m	Bottle nr #9
64PE453-	52	CTD	1399 m	Bottle nr #10
64PE453-	52	CTD	1141 m	Bottle nr #11
64PE453-	52	CTD	1000 m	Bottle nr #12
64PE453-	52	CTD	750 m	Bottle nr #13
64PE453-	52	CTD	398 m	Bottle nr #14
64PE453-	52	CTD	200 m	Bottle nr #15
64PE453-	57	CTD	2458 m	Bottle nr #16
64PE453-	57	CTD	2000 m	Bottle nr #17
64PE453-	57	CTD	1500 m	Bottle nr #18
64PE453-	57	CTD	902 m	Bottle nr #19
64PE453-	57	CTD	500 m	Bottle nr #20

64PE453-	57	CTD	250 m	Bottle nr #21

Appendix, Bacterial incubations from CTD water

Station	Niskin Neph	Niskin CW	Bacterial Incubation	eDNA	Bact. count	Nuts	Inc. eDNA	Inc. Bact. count	Inc. Nuts	GF/F	PC 0.4
64PE453-09	4		x	x	x	x	x	x	x	-	-
64PE453-09	5			x	x					-	-
64PE453-09	6			x	x					-	-
64PE453-09		13	x	x	x	x	x	x	x		
64PE453-09		14		x	x						
64PE453-09		15		x	x						
64PE453-14	4		x	x	x	x	x	x		FB95	98
64PE453-14	5			x	x						
64PE453-14	6			x	x						
64PE453-14		11	x	x	x	x	x	x	x	FB96	97
64PE453-14		12		x	x						
64PE453-14		13		x	x						
64PE453-21	4		x	x	x	x	x	x	x	FB97	85
64PE453-21	5			x	x						
64PE453-21	6			x	x						
64PE453-21		13	x	x	x	x	x	x	x	FB98	86
64PE453-21		14		x	x						
64PE453-21		15		x	x						
64PE453-23	4		x	x	x	x	x	x	x	FB99	87
64PE453-23	5			x	x						
64PE453-23	6			x	x						
64PE453-23		14	x	x	x	x	x	x	x	FB76	84
64PE453-23		15		x	x						
64PE453-23		16		x	x						
64PE453-35	4			x		x				-	-
64PE453-35	5			x							

64PE453-35	6			x							
64PE453-35	7				x	x					
64PE453-35		13		x	x	x					
64PE453-35		14		x							
64PE453-35		15		x							
64PE453-46	4		x	x	x	x	x	x	x	FB78	96
64PE453-46	5			x							
64PE453-46	6			x							
64PE453-46		13		x	x	x	x	x		FB77	88
64PE453-46		14		x	x						
64PE453-46		15		x	x						
64PE453-49	4			x	x	x	x	x	x	FB79	95
64PE453-49	5			x	x						
64PE453-49	6			x	x						
64PE453-49		13		x	x	x	x	x	x	FB80	94
64PE453-49		14		x	x						
64PE453-49		15		x	x						
64PE453-52	4			x	x	x	x	x	x	FB82	93
64PE453-52	5			x	x						
64PE453-52	6			x	x						
64PE453-52		13		x	x	x	x	x	x	FB81	92
64PE453-52		14		x	x						
64PE453-52		15		x	x						

Appendix, CTD sampling sheets

Station/Cast: 64PE453-09		Depth: 2236 m	EM302 depth: 2247 m
Date: 10-06-2019	UTC time start: 18:45	UTC time bottom: 19:25	UTC time deck:

Niskin Bottle	Depth (m)	NUTS/Si	SPOM	SPM	DIC	Bacterial DNA	Bact/virus ab	Bacterial inc.	Trace metals	Salinity calib.	Niskin Bottle	T (°C)	Remarks
1	2235	X	X								1	3.6	
2	2235		X								2	3.6	
3	2235			X							3	3.6	
4	2235	X				X	X	X			4	3.6	
5	2235					X	X				5	3.6	
6	2235					X	X				6	3.6	
7	2235									X	7	3.6	Salinity #49
8	2000			X							8	4.1	
9	2000	X								X	9	4.1	Salinity #50
10	1500		X								10	6	
11	1500		X								11	6	
12	1500			X							12	6	
13	1500	X				X	X	X			13	6	
14	1500					X	X				14	6	
15	1500					X	X				15	6	
16	1500									X	16	6	Salinity #51
17	300									X	17	11.4	Salinity #52 cable between bottle
18	15	X	X								18	12.9	
19	15			X							19		
20											20		
21											21		
22											22		
23											23		
24											24		

Station/Cast: 64PE453- 14		Depth: 1548 m	EM302 depth: 1571 m
Date: 11/06/2019	UTC time start: 10:30	UTC time bottom: 10:57	UTC time deck:

Niskin Bottle	Depth (m)	NUTS/Si	SPOM	SPM	DIC	Bacterial DNA	Bact/virus ab	Bacterial inc.	Trace metals	Salinity calib.	Niskin Bottle	T (°C)	Remarks
1	1546	X	X								1	5.6	
2	1546		X								2		
3	1546			X							3		
4	1546	X				X	X	X			4		Drips from the top
5	1546					X	X				5		
6	1546					X	X				6		
7	1546									X	7		Salinity 53
8	1199		X								8	7.6	
9	1199		X								9		
10	1199			X							10		
11	1199	X				X	X	X			11		
12	1199					X	X				12		
13	1199					X	X				13		
14	1199									X	14		Salinity 54
15	1000									X	15	8.7	Salinity 55
16	1000									X	16		
17	300									X	17	11.2	Salinity 56
18	300									X	18		Didn't close
19	16	X	X								19	13.8	Didn't close
20	16										20		In SPM column is a cross on the mark
21											21		
22											22		
23											23		
24											24		

Station/Cast: 64PE453- 21		Depth: 1660 m	EM302 depth: m
Date: 12/06/2019	UTC time start: 7:35	UTC time bottom: 08:37	UTC time deck: 9:25

Niskin Bottle	Depth (m)	NUTS/Si	SPOM	SPM	DIC	Bacterial DNA	Bact/virus ab	Bacterial inc.	Trace metals	Salinity calib.	Niskin Bottle	T (°C)	Remarks
1	1660	x	X								1	5.9	
2	1660		X								2		
3	1660			x							3		
4	1660	X				X	X	X			4		
5	1660					X	X				5		
6	1660					X	X				6		
7	1660									X	7		Salinity 57
8	1200	X								X	8	7.8	Salinity 58
9	1200									X	9		
10	1100	X	X								10	8.4	
11	1100		X								11		
12	1100			X							12		
13	1100	X				X	X	x			13		
14	1100					X	X				14		
15	1100					X	X				15		
16	1100									X	16		Salinity 59
17	500	X								X	17	10.4	Salinity 60
18	500									X	18		Did not contain water
19	150	X								X	19	11.7	
20	150									X	20		Salinity 61
21	20		x								21	14.1	
22	20			X							22		
23	20	X									23		Spare
24	20										24		Spare

Station/Cast: 64PE453-23		Depth: 2382 m	EM302 depth: 2599 m
Date: 12/6/19	UTC time start: 15:48	UTC time bottom: 16:34	UTC time deck:

Niskin Bottle	Depth (m)	NUTS/Si	SPOM	SPM	DIC	Bacterial DNA	Bact/virus ab	Bacterial inc.	Trace metals	Salinity calib.	Niskin Bottle	T (°C)	Remarks
1	2560	X	X								1	3	
2	2560		X								2	3	
3	2560			X							3	3	
4	2560	X				X	X	X			4	3	
5	2560					X	X				5	3	
6	2560					X	X				6	3	
7	2560									X	7	3	Sal 62
8	2269									X	8	3.7	Inside 2nd turbidity layer Sal 63
9	2269										9	3.7	Inside 2nd turbidity layer Sal 63
10	2269										10	3,7	Inside 2nd turbidity layer Sal 63
11	2000	X	X								11	4.2	
12	2000		X								12	4.2	
13	2000			X							13	4.2	
14	2000	X				X	X	X			14	4.2	
15	2000					X	X				15	4.2	
16	2000					X	X				16	4.2	
17	2000									X	17	4.2	Sal 64
18	1000									X	18	9.4	
19	1000									X	19	9.4	
20	500									X	20	10.6	Sal 65
21	500									X	21	10.6	
22	18.87		X								22	13.8	
23	18.87			X							23	13.8	
24	18.87		X								24	13.8	

Station/Cast: 64PE453-35		Depth: 2318 m	EM302 depth: 2377 m
Date: 14-06-2019	UTC time start: 08:25	UTC time bottom: 09:04	UTC time deck: 10:08

Niskin Bottle	Depth (m)	NUTS/Si	SPOM	SPM	DIC	Bacterial DNA	Bact/virus ab	Bacterial inc.	Trace metals	Salinity calib.	Niskin Bottle	T (°C)	Remarks
1	2280	X	X								1	3.7	
2	2280		X								2	3.7	
3	2280			X							3	3.7	
4	2280	X				X					4	3.7	
5	2280					X					5	3.7	
6	2280					X					6	3.7	
7	2280									X	7	3.7	Salinity #66
8	1701									X	8	5.5	Salinity #67
9	1701										9	5.5	
10	1502	X	X								10	6.1	
11	1502		X								11	6.1	
12	1502			X							12	6.1	
13	1502	X				X					13	6.1	
14	1502					X					14	6.1	
15	1502					X					15	6.1	
16	1502									X	16	6.1	Salinity #68
17	896	X								X	17	9.4	Salinity #69
18	896										18	9.4	
19	400	X								X	19	11.1	Salinity #70
20	400										20	11.1	
21	15		X								21	13.9	
22	15	X		X							22	13.9	
23	15										23	13.9	Spare
24	15										24	13.9	Spare

Station/Cast: 64PE453-46		Depth: 2008 m	EM302 depth: 2041 m
Date: 2019/06/16	UTC time start: 07:15	UTC time bottom: 07:45	UTC time deck: 8.39

Niskin Bottle	Depth (m)	NUTS/Si	SPOM	SPM	DIC	Bacterial DNA	Bact/virus ab	Bacterial inc.	Trace metals	Salinity calib.	Niskin Bottle	T (°C)	Remarks
1	1988	X	X								1	4	
2	1988		X								2		
3	1988			X							3		
4	1988	X				X	X	X			4		
5	1988					X	X				5		
6	1988					X	X				6		
7	1988									X	7		Salinity 71
8	1650	X									8	6.2	
9	1650									X	9		Salinity 72
10	1402	X	X								10	6.2	
11	1402		X								11		
12	1402			X							12		
13	1402	X				X	X	X			13		
14	1402					X	X				14		
15	1402					X	X				15		
16	1402									X	16		Salinity 1
17	765	X								X	17	9.7	Salinity 2
18	765										18		
19	400	X								X	19	11	Salinity 3
20	400										20		
21	15	X									21	13.8	
22	15		X								22		
23	15			X							23		Extra
24	15										24		Extra

Station/Cast: 64PE453- 49		Depth: 2655 m	EM302 depth: 2674 m
Date: 16/06/2019	UTC time start: 14:59	UTC time bottom: 15:43	UTC time deck: 16:53

Niskin Bottle	Depth (m)	NUTS/Si	SPOM	SPM	DIC	Bacterial DNA	Bact/virus ab	Bacterial inc.	Trace metals	Salinity calib.	Niskin Bottle	T (°C)	Remarks
1	2635	X	X								1	3.2	
2	2635		X								2		
3	2635			X							3		
4	2635	X				X	X	X			4		
5	2635					X	X				5		
6	2635					X	X				6		
7	2635									X	7		Salinity 5
8	2301	X									8	3.7	
9	2301									X	9		Salinity 4
10	2000	X	X								10	3.9	
11	2000		X								11		
12	2000			X							12		
13	2000	X				X	X	X			13		
14	2000					X	X				14		
15	2000					X	X				15		
16	2000									X	16		Salinity 6
17	1450	X									17	6.0	
18	1450									X	18		Salinity 7
19	930	X									19	9.2	
20	930									X	20		Salinity 8
21	400									X	21	10.9	Salinity 9
22	20		X								22	13.9	
23	20			X							23		
24	20	X									24		

Station/Cast: 64PE453-52		Depth: 1418 m	EM302 depth: 1432 m
Date: 17/06/2019	UTC time start: 11:08	UTC time bottom: 11:34	UTC time deck: 1213

Niskin Bottle	Depth (m)	NUTS/Si	SPOM	SPM	DIC	Bacterial DNA	Bact/virus ab	Bacterial inc.	Trace metals	Salinity calib.	Niskin Bottle	T (°C)	Remarks
1	1399	X	X								1	6.2	
2	1399		X								2		
3	1399			X							3		
4	1399	X				X	X	X			4		
5	1399					X	X				5		
6	1399					X	X				6		
7	1399									X	7		Salinity 10
8	1141	X									8	7.8	
9	1141									X	9		Salinity 11
10	1000	X	X								10	8.6	
11	1000		X								11		
12	1000			X							12		
13	1000	X				X	X	X			13		
14	1000					X	X				14		
15	1000					X	X				15		
16	1000									X	16		Salinity 12
17	750	X									17	9.7	
18	750									X	18		Salinity 13
19	398	X									19	11.1	
20	398									X	20		Salinity 14
21	200	X									21	11.6	
22	200									X	22		Salinity 15
23	22	X	X								23	13.9	
24	22			X							24		

Station/Cast: 64PE453-57		Depth: 2478 m	EM302 depth: 2438 m
Date: 18/06/2019	UTC time start: 08:44	UTC time bottom: 09:28	UTC time deck:

Niskin Bottle	Depth (m)	NUTS/Si	SPOM	SPM	DIC	Bacterial DNA	Bact/virus ab	Bacterial inc.	Trace metals	Salinity calib.	Niskin Bottle	T (°C)	Remarks
1	2458	X	X								1	3.2	
2	2458		X								2		
3	2458			X							3		
4	2458	X				X	X				4		
5	2458					X	X				5		
6	2458					X	X				6		
7	2458									X	7		Salinity 16
8	2000	X	X								8	4.1	
9	2000		X								9	3.8	
10	2000			X							10		
11	2000	X				X	X				11		
12	2000					X	X				12		
13	2000					X	X				13		
14	2000									X	14		Salinity 17
15	1500	X									15	6.1	
16	1500									X	16		Salinity 18
17	902	X									17	9.4	
18	902									X	18		Salinity 19
19	500	X									19	10.7	
20	500									X	20		Salinity 20
21	250	X								X	21	11.5	Salinity 21
22	32		X								22	14.0	
23	32			X							23		
24	32	X									24		

1740 m : stop for wire inspection

Appendix, box core description and subsampling

Station	**Depth**	**Type**	**Observation**	**Recovered** core depth	**DNA** BC water	**Geology** PVC core core depth	**Plastic** PVC core core depth	**Pore water** PVC core	**Slicing** Meio fauna 10cm	**DNA frozen** syringe 10cm	**Corg** syringe 10cm	**DNA ethanol** Meio fauna surface 1cm	**Corg** 4ml vial surface 1cm	**Fauna** 1/4 or whole core sieved
12	1655	large box core	greyish olive (5Y5/3) sandy silt, living fauna tube worms or small sponges?	38-44 cm	3	1	1	1	3	3	1	1	3	1/4
15	2379	large box core	failed, tripped in frame											
16	997	large box core	failed, cable around frame											
17	1013	large box core	failed, too much sediment	55 cm		1								whole core
27	1085	large box core	failed, too full											
28	1093	large box core	dark olive (5Y4/3 silty clay), living fauna: pheronema, amphissa,	34-42 cm	3	1	1		3	3	1	1	3	1/4

			soft coral, sabellidae											
30	1386	large box core	yellowish brown (2.5Y5/3) sandy clay, living fauna Acanella, tube worms, bristle worms, foraminifera (branched)	5-16 cm	3									whole core
31	1389	large box core	yellowish brown (2.5Y5/3) sandy clay, living fauna Acanella, scale worms, unisses, foraminifera (branched)	24-40 cm		1	1		3	3	1	1	3	1/4
36	2321	large box core	failed, cable entangled											
37	2345	large box core	failed, did not trip											
41	1134	large box core	yellowish brown (2.5Y5/3) silty clay, living fauna isopod	3-13 cm	3					3	1		3	whole core

42	2796	large box core	dark olive (5Y4/4) soupy sediment with a few pieces of bedrock, living fauna holothurians, ophiurid	3 cm	3									whole core
47	2308	large box core	grayish olive (5Y5/3) sandy clay, living fauna hydrozoa, polychaetes	25-50 cm	3	1	1	1	3	3	1	1	3	1/4

Appendix, Samples for macrofauna

Station nr	Gear	part	fraction	preservation	vial
12	large boxcore (Ø 50cm)	0.25, top 15 cm	> 0.5 mm	formaline	250 ml
28	large boxcore (Ø 50cm)	0.25, top 15 cm	> 0.5 mm	formaline	500 ml
30	large boxcore (Ø 50cm)	all	> 0.5 mm	formaline	2000 ml
31	large boxcore (Ø 50cm)	0.25, top 15 cm	> 0.5 mm	formaline	500 ml
41	large boxcore (Ø 50cm)	all	> 0.5 mm	formaline	250 ml
42	large boxcore (Ø 50cm)	all, but only 3cm	> 0.5 mm	formaline	250 ml
47	large boxcore (Ø 50cm)	0.25, top 15 cm	> 0.5 mm	formaline	250 ml
32	ALBEX 2, incubation chamber	chamber 89	> 0.5 mm	formaline	250 ml
32	ALBEX 2, incubation chamber	chamber 8B	> 0.5 mm	formaline	250 ml
48	ALBEX 2, incubation chamber	chamber 82	> 0.5 mm	formaline	250 ml
48	ALBEX 2, incubation chamber	chamber 8B	> 0.5 mm	formaline	250 ml

Appendix, Samples for meiofauna
Cruise number: 64PE453

Station number of Box core: 12
Surface subsample is preserved in in 96% ETOH
Subsamples: 12-1, 12-2, 12-3 Each subsample sliced each centimetre up to 10 cm core depth from the surface and preserved in 8% formaldehyde.

Station number of Box core: 28
Surface subsample is preserved in in 96% ETOH
Subsamples: 28-1, 28-2, 28-3 Each subsample sliced each centimetre up to 10 cm core depth from the surface and preserved in 8% formaldehyde.

Station number of Box core: 31
Surface subsample is preserved in in 96% ETOH
Subsamples: 31-1, 31-2, 31-3 Each subsample sliced each centimetre up to 10 cm core depth from the surface and preserved in 8% formaldehyde.

Station number of Box core: 47
Surface subsample is preserved in 96% ETOH
Subsamples: 47-1, 47-2, 47-3 Each subsample sliced each centimetre up to 10 cm core depth from the surface and preserved in 8% formaldehyde.

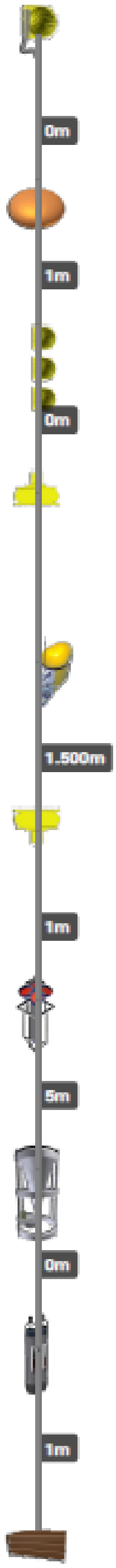
Appendix, mooring configuration

Mooring I

470m	**Buoyancy units** - floatation line with benthos buoy	↑	B: -24.58	kg: 49.86	h: 1058
478m	**Buoyancy units** - CRP 1500/500 Type C	↑	B: -488.09	kg: 528.07	h: 517
482m	**Buoyancy units** - Benthos Sphere 1pieces	↑	B: -20.38	kg: 26.71	h: 238
484m	**Instrument** - McLane Stopper boven	↓	B: 3.21	kg: 5.28	h: 44
700m	**Instrument** - McLane Profiler	↓	B: 0	kg: 60	h: 180
1.483m	**Instrument** - McLane Stopper onder	↓	B: 3.21	kg: 5.28	h: 40
1.485m	**Instrument** - ADCP-WHLR in Inline-Frame	↓	B: 83.69	kg: 139.91	h: 134
1.491m	**Sedimenttrap** - sedimenttrap PPS3/4	↓	B: 4.16	kg: 20.69	h: 42
1.493m	**Release** - Acoustic Release, IXSEA AR861 B2S	↓	B: 49.57	kg: 76.5	h: 112.09
1.500m	**Anker** - Anchor Weight (700 kg) ⚓ Remains on the seabed	↓	B: 710.22	kg: 814.56	h: 558

Mooring II

469m	**Buoyancy units** - floatation line with benthos buoy	↑ B: -24.58	kg: 49.86	h: 1058
477m	**Buoyancy units** - CRP 1500/500 Type C	↑ B: -488.09	kg: 528.07	h: 517
482m	**Buoyancy units** - Benthos Spheres, 4 pieces	↑ B: -94.89	kg: 93.83	h: 334
484m	**Instrument** - McLane Stopper boven	↓ B: 3.21	kg: 5.28	h: 44
1.800m	**Instrument** - McLane Profiler	↓ B: 0	kg: 60	h: 180
1.984m	**Instrument** - McLane Stopper onder	↓ B: 3.21	kg: 5.28	h: 40
1.986m	**Instrument** - ADCP-WHLR in Inline-Frame	↓ B: 83.69	kg: 139.91	h: 134
1.992m	**Sedimenttrap** - sedimenttrap PPS3/4	↓ B: 4.16	kg: 20.69	h: 42
1.993m	**Release** - Acoustic Release, IXSEA AR861 B2S	↓ B: 49.57	kg: 76.5	h: 112.09
2.000m	**Anker** - Anchor Weight (700 kg) ⚓ Remains on the seabed	↓ B: 710.22	kg: 814.56	h: 558



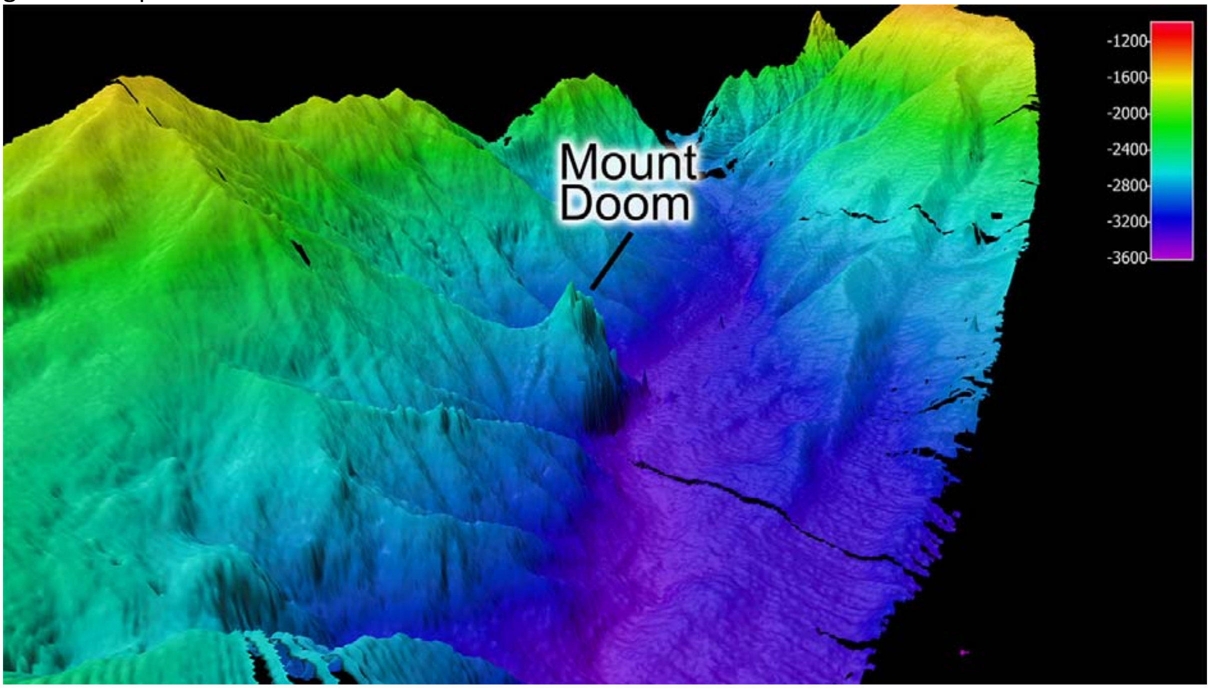
Appendix, blogs

The mysteries and secrets of Whittard Canyon

After three days of transit we have arrived at the Whittard Canyon complex in the Bay of Biscay. The Whittard Canyon complex has 4 major branches which run from 200 to over 4000 m water depth. The morphology of Whittard Canyon is comparable to canyon systems on land, like the Grand Canyon with the main difference that this canyon system lies completely underwater. Canyons form important transport channels for material from shallow to deep water, hereby connecting the productive shelf with the food limited deep-sea. We would like to understand how much and how often material is transported through the canyon and where this material is deposited. We are mainly interested in the transport of carbon since canyons might form important pathways for carbon transport to the deep-sea. If this carbon gets buried in the deep-sea it will be no longer part of the carbon cycle, which in the end might affect global climate. Transport of particles can be a constant process but can also be linked to episodes. Data collected in the canyon during previous cruises have shown that for instance storms hitting the shelf result in events whereby large amounts of material are transported. These events occur several times a year. In addition the carbon is also an important food source for deep-sea fauna, like cold-water corals, sponges, but also large numbers of fish. During this cruise we will study the distribution and density of fauna and we will see if we can link their occurrence to abiotic factors, like temperature, food supply and morphology of the canyon.

Exploring Mount Doom (written by Andy Davies, University of Rhode Island)

Submarine canyons are invisible from the ocean surface, but are very heterogenous habitats with highly variable terrain. They incise the relatively shallow continental shelf (approximately 200m water depth), to quickly reach the abyssal plain at depths between 3000 to 6000 m. To explore the topography of canyons we use multibeam echosounders, these complex systems take position data from satellites and motion sensors on the ship, and couple this with large transducers attached to the hull of the ship that send pings of sound to the seafloor and listens for the return signal. Computer algorithms then make sense of this complex and multi-faceted data, turning it into a gridded map of the seafloor.

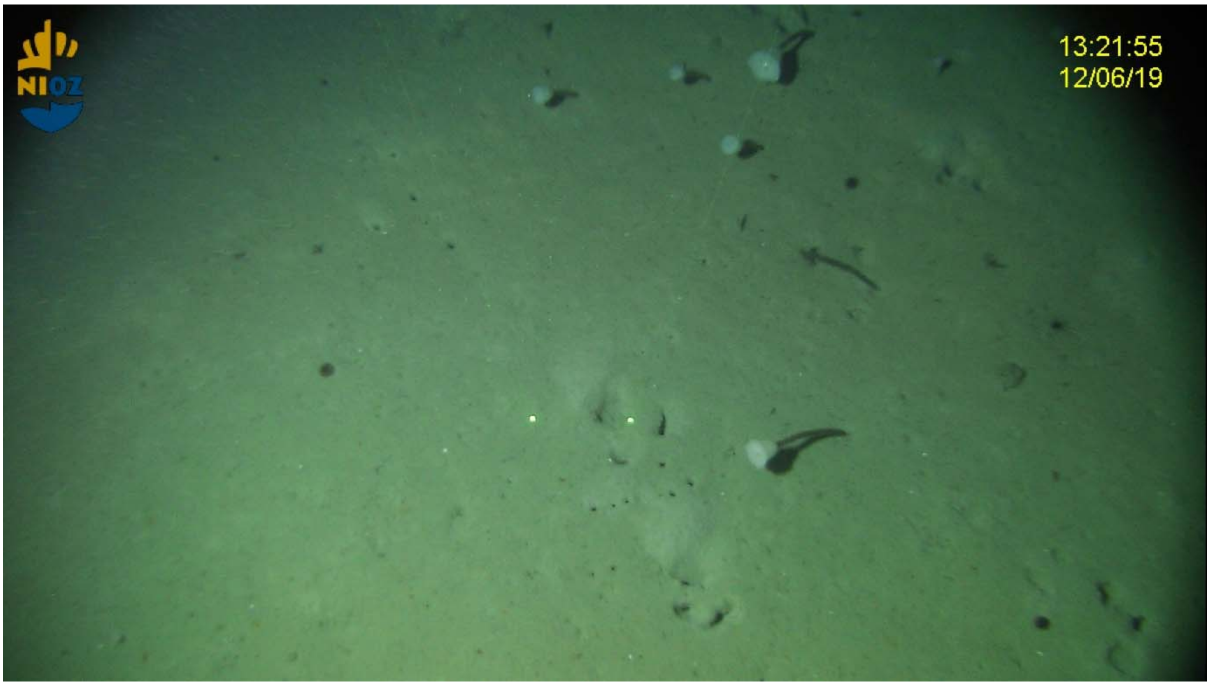


As part of BYPASS 2019, we are exploring the Whittard Canyon, a highly active canyon system south of Ireland. One of our activities is to complete a comprehensive multibeam map of the system, filling in areas that we collected on previous research cruises in 2017 and 2018. We've already made some interesting discoveries, foremost, a pinnacle at 2500 m water depth that we have informally named "Mount Doom", which is approximately 800 m high from the bottom of the Canyon. This outcrop is likely exposed rock, potentially an old volcano and may contain abundant marine life. This mystery will only be solved when we send down a camera.

Secrets of Whittard Canyon, the premiere (Aike Vonk, Master student at Utrecht University)

Not only in the evening we watch movies at the Pelagia, but also some of our daylight hours are spent behind the tv screen. We, researchers on the Pelagia, do not watch the newest Avengers movie, or the thrilling James Bond series, what we see is way more exciting... We discover the slopes of Whittard Canyon.

The research conducted at Whittard Canyon takes place in the deep sea, about 200-4000 meters under the sea surface. Because of the large depths in the Canyon, it is often unknown what the sea floor looks like. To find out, we use video images. A frame with two camera's is led down over the side of the ship until it is a few meters above the sea floor. One camera faces downwards and films the ocean floor; the other camera faces forward. On this camera we can see if steep flanks arise and whether or not the camera should be taken back up. Because we look at the deep parts of the Canyon, it can take over 40 minutes before the camera reaches the bottom of the ocean.
Once the ocean floor appears on screen, we feel like adventurers. Parts of our earth are exposed that no one else has ever seen before! If you think that the only images we see are boring sand flats, you could not be more wrong. When the ship moves through the ocean, the ocean floor changes from impressive mountain landscapes with large blocks of stone and steep slopes of tens of meters high, to flat sand bottoms inhabiting all kinds of animals, like sponges and corals. The video images are used to investigate fauna distribution and density, but also to look at the topography of the ocean floor. Based on the video footage it is determined which parts of the Whittard Canyon are suitable for sampling and which parts of the sea floor are too rough.



Sediment sampling with the box core (Grace English, Irish observer)

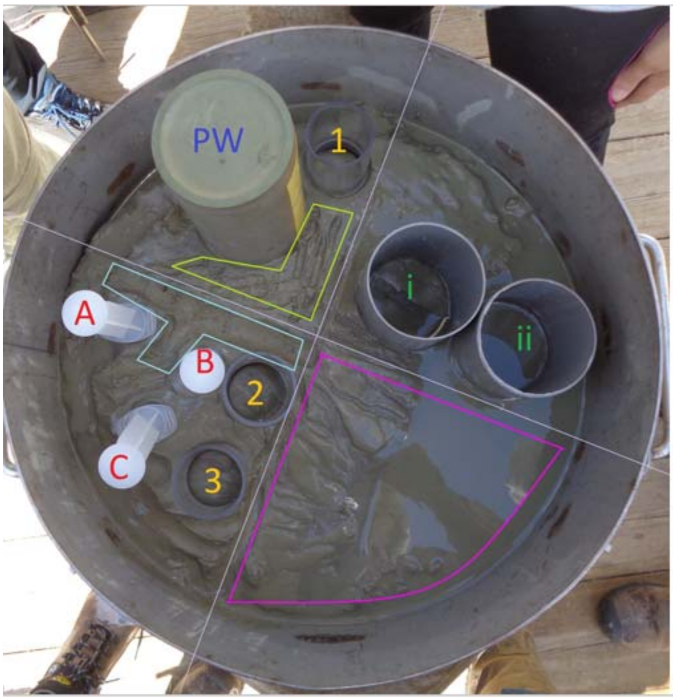
As this research survey is taking place on the Whittard Canyon, in Irish waters, there is a role available for an Irish Observer on board. Under the United Nations Convention on Laws of the Sea (UNCLOS), the observer acts as a representative of the state and prepares a summary cruise report. It is also an opportunity for young researchers to gain practical experience on board a research vessel and gain experience with new techniques.

As the Irish Observer with the Marine Institute, Ireland on board, I helped wherever I was needed during sampling. I found it amazing the variety and amount of different samples that can be taken from the same source. For example, the box core, a geological sampling tool which is deployed to get a soft sediment sample of the seafloor surface. From these box cores we get an image of the composition and inhabitants of the sea floor.

When the box core arrives back on deck, first the water needs to be siphoned off to reveal the sediment core. Some of this water is saved for filtering so that the suspended sediment can be tested for microbial and environmental DNA. Before all the water is removed, a tube with small holes at centimetre intervals along the side (taped tightly!) takes a saturated sample so that the pore water can be examined.

The water can then be removed, and a picture taken of the underlying sediment. This can be an exciting moment as the last of the water is siphoned off to potentially reveal a macrofauna species lying on the surface. Ophiuroids, soft corals and sponges have all been found this cruise!

The sediment type and colour are recorded and then the core is divided into four roughly equal parts so that one quarter can be reserved for sieving the macrofauna as a qualitative sample. The box core is then sampled for meiofauna, stable isotope analysis, plastics, and organic carbon. The remaining sediment is sieved through a 0.5mm sieve to gather the rest of the macrofauna living inside the sediment as a quantitative sample.



Sampling methods and their purpose:

PW = pore water sample tube

1,2,3 = meiofauna 10cm sample tubes

i,ii = Plastics, organic carbon

A,B,C = eDNA samples

Green outline = Surface sample for stable isotope analysis

Blue outline = meiofauna surface sample

Purple outline = macrofauna qualitative sample

Effect of trawling on particle transport in canyons (Marta Arjona, CSIC)

Hey deep sea-explorers!! I am Marta, a PhD student from the Institute of Marine Sciences (CSIC) in Barcelona (Spain), doing an internship at the NIOZ. My research mainly focuses on the study of sedimentary dynamics in Mediterranean submarine canyons associated with deep-sea trawling activities. Beside natural processes, the disturbance of the deep-sea in the Mediterranean by this fishing technique is considered to be notably higher than all other anthropogenic pressures combined, given its intensity, recurrence and wide geographical distribution. Although its impacts on coastal and shallower environments have been investigated in the past from a geological point of view, only very few studies have addressed the role of deep-sea trawling in submarine canyons, where background energy levels controlling natural sedimentary processes are normally low and where the associated faunal communities are less resilient and more vulnerable.
Therefore, my main goal is to understand the contemporary sedimentary processes that tend to occur in submarine canyons driven by this anthropogenic activity. To accomplish this, during my thesis project I have joined many cruises in which I have been recording time series of currents, suspended sediment concentrations and particle fluxes by several mooring deployments nearby heavily trawled sites. Since my work is related to submarine canyons, I'm here on the R/V Pelagia to improve my knowledge of sedimentary processes, and gain insight into other canyon systems in comparison to the Mediterranean submarine canyons. On this cruise I'm working with some amazing researchers and crew and I will be helping out with various types of sampling techniques and analyses, and with the knowledge I gain here I hope to improve my own research.

Cruise participants of RV Pelagia cruise 64PE453