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The Expeditions PS130/1 and PS130/2 of the Research Vessel POLARSTERN to the Atlantic Ocean in 2022

Edited by

Simon Dreutter and Claudia Hanfland
with contributions of the participants

HELMHOLTZ

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Titel: Gemeine Delphine, Biskaya, Nordatlantik
(Foto: Gabriel Erni Cassola e Barata, Universität Basel)

Cover: Common Dolphins, Bay of Biscay, North Atlantic
(Photo: Gabriel Erni Cassola e Barata, University of Basel)

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PS130/1
PS130/2

28 April 2022 – 29 May 2022

Punta Arenas – Las Palmas – Bremerhaven

Chief scientists

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Coordinator
Ingo Schewe

Contents

1. ÜBERBLICK UND FAHRTVERLAUF

Simon Dreutter[1], Claudia Hanfland[1] [1]DE.AWI

Der Fahrtabschnitt PS130 war der letzte Abschnitt der antarktischen Forschungssaison 2021/22 und diente der Überführung des Schiffes in seinen Heimathafen Bremerhaven. Die Expedition PS130 startete in Punta Arenas am 28.04.2022 (Auslaufen am 30.04.2022) und endete am 29.05.2022 in Bremerhaven (Abb. 1.1). Am 22.05.2022 wurde ein Zwischenstopp in Las Palmas eingelegt, der die Fahrt in die Abschnitte PS130/1 und PS130/2 gliederte. Auf der gesamten Reise (Abschnitte 1 und 2) wurden folgende *en route* Messungen und Tätigkeiten durchgeführt:

- Mit den schiffsinternen hydroakustischen Systemen wurde auf der gesamten Strecke ein Streifen Meeresbodentopographie bathymetrisch vermessen. Die Gesamt-Fahrtzeit von vier Wochen umfasste einige Stunden Stationszeit für die Kalibration der Echolotsysteme mittels Wasserschallsonde sowie Durchführung von CTD-Stationen.
- Über die Seewasserpumpe wurden kontinuierlich Wasserproben zur Bestimmung der Mikroplastikkonzentrationen an der Wasseroberfläche genommen.
- Weiterhin wurden auf vorangegangenen Expeditionen gewonnene Planktonproben an das Alfred-Wegener-Institut Helmholtz Zentrum für Polar- und Meeresforschung nach Bremerhaven transportiert.

Während des Zwischenstopps in Las Palmas wurde Treibstoff gebunkert. Zudem sind folgende Arbeitsgruppen für den Fahrtabschnitt PS130/2 an Bord gegangen:

- Mitarbeitende der Logistik für Arbeiten am IT-Netz an Bord
- Mitarbeitende des *Polarstern II*-Teams zum besseren Kennenlernen des Schiffs
- POLMAR-TRAIN: Masterstudent:innen der Universität Bremen, Fachbereich Geowissenschaften sowie Doktorand:innen des AWI und der International Research Training Group ArcTrain zur Ausbildung in geophysikalischen Methoden an den hydroakustischen Messsystemen. Neben den bathymetrischen Vermessungen mit dem Fächerecholot Hydrosweep hat die Gruppe den Sedimentaufbau der oberen Schichten des Meeresbodens mit dem parametrischen Sedimentecholot Parasound vermessen.

SUMMARY AND ITINERARY

The expedition PS130 was the final leg of the Antarctic season 2021/22 and brought the ship back to its port of registry, Bremerhaven. The leg PS130 started in Punta Arenas on 28 April 2022 (leaving the harbour on 30 April 2022) and ended on 29 May 2022 in Bremerhaven (Fig. 1.1). One stopover took place in Las Palmas on 22 May, thereby splitting the cruise in two legs, PS130/1 and PS130/2, respectively. The following underway measurements were carried out throughout the entire journey (legs 1 and 2):

- With the ship-mounted hydroacoustic systems, a swath of seabed topography was bathymetrically surveyed along the ship's track. A few hours of station time has been spent on calibrating the echosounding systems by sound velocity profiler and CTD casts.
- Continuous water samples from the ship's seawater supply have been continuously analysed for microplastics concentration in surface waters.
- Living organisms like plankton caught during the previous Antarctic season were cared for and transported to the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research in Bremerhaven.

While bunkering fuel in Las Palmas, additional working groups joined the cruise:

- Staff of AWI Logistics Department for maintenance of the IT network on board
- Staff of AWI *Polarstern II* team for familiarisation with the ship
- POLMAR-TRAIN: master students from University of Bremen, department of geosciences as well as doctoral candidates from AWI and from the International Research Training Group ArcTrain for a hands-on training in geophysical methods on the ship-mounted hydroacoustic systems. Next to bathymetric surveys of the seafloor with the multibeam echosounder Hydrosweep, the group also investigated the upper part of the sedimentary layer with the parametric sediment echosounder Parasound.

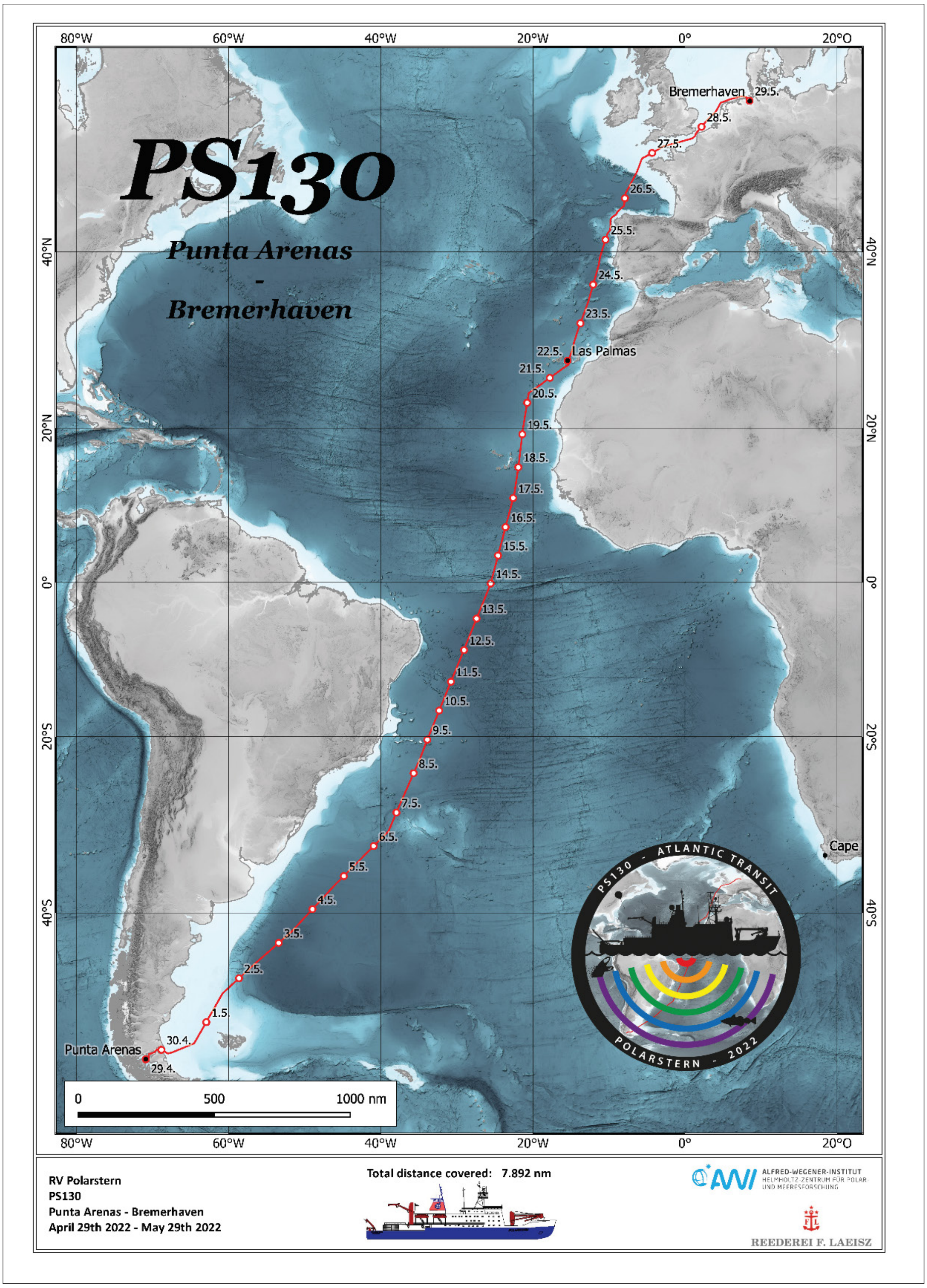

Abb. 1.1: Fahrtverlauf der Expedition PS130 von Punta Arenas nach Bremerhaven: siehe https://doi.pangaea.de/10.1594/PANGAEA.947344 und https://doi.pangaea.de/10.1594/PANGAEA.947590 für eine Darstellung des master tracks in Verbindung mit der Stationsliste für PS130/1 (Punta Arenas – Las Palmas) und PS130/2 (Las Palmas – Bremerhaven).

Fig. 1.1: Cruise track of expedition PS130 from Bremerhaven to Cape Town; see https://doi.pangaea.de/10.1594/PANGAEA.947344 and https://doi.pangaea.de/10.1594/PANGAEA.947590 to display the master track in conjunction with the station list for PS130/1 (Punta Arenas – Las Palmas) und PS130/2 (Las Palmas – Bremerhaven).

WEATHER CONDITIONS DURING PS130/1 AND PS130/2

Julia Wenzel DE.DWD

PS130/1 – from Punta Arenas to Las Palmas

The expedition started in the morning of 30 April 2022 in calm high-pressure weather and *Polarstern* sailed from Punta Arenas through the eastern Strait of Magellan into the South Atlantic. Heading northeast, the research vessel followed the back of a strengthening high-pressure system, which also moved northeastwards. Thereby, the northwesterly wind temporarily increased to 8 Bft during the night from 3 to 4 May and the sea state rose to 3 m.

From 5 to 6 May, a low-pressure system moving eastwards from the southern part of Brazil crossed the route and caused reduced visibility due to drizzle and rain showers, as well as a temporary increase of the wind to 7 Bft with gusts of 8 Bft and the swell to up to 4 m.

In the outer area of a subtropical high, calm weather subsequently prevailed, characterised by isolated rain showers. On 10 and 11 May, one of the lowest sea states during this voyage was reached with a significant wave height of just below 1 m (mainly swell from the east).

From 12 to 16 May, *Polarstern* crossed the inner-tropical convergence zone, which extended across the Atlantic Ocean between about 10° southern and 10° northern latitude. This area was characterised by high air and water temperatures, as well as some heavy rain showers. After crossing the equator on 14 May, a swell from northeast replaced the swell from southeast on 15 May.

Due to the proximity to the West African continent, in the period from 16 to 18 May a slight reduction in visibility occurred because of Saharan dust.

Heading north, *Polarstern* slowly left the area of weak winds of the doldrums and, from 18 May (Cape Verde), was caught in a rapidly increasing trade wind on the south-eastern flank of an extended subtropical high over the North Atlantic. The trade wind continued until reaching the Canary Islands, with a mean wind speed of mostly 5 to 6 Bft and a temporary increase in significant wave height to 2.5 m. Due to the jet effect between the Canary Islands, the wind temporarily increased to 8 Bft in the night to 22 May and shortly decreased to 4 Bft in the lee of the islands (wind shadow effect). On the morning of 22 May, *Polarstern* reached the port of Las Palmas accompanied by a wind from North of 4 Bft.

PS130/2 – from Las Palmas to Bremerhaven

Leaving Las Palmas, *Polarstern* was still accompanied by a fresh to strong northeast trade wind. Until 24 May, the high shifted moved above the Azores and afterwards moved northeast almost simultaneously and parallel to *Polarstern*'s route, so that the north to northeast wind persisted until 26 May. When passing Cape Finisterre in the night to 26 May, the wind parallel to the coast temporarily increased to 7 Bft due to local coastal effects (coastal guidance and cape effect). While *Polarstern* was crossing the Bay of Biscay on 26 May, the high-pressure system was centered just west of the Bay of Biscay, so that *Polarstern* reached its eastern flank on 26 May, the wind decreased to 3 Bft and turned to the northwest in the night to 27 May. A swell of 2 m from the northwest could already be observed from 25 May on. Afterwards, the high-pressure system moved northwards over Ireland (night to 28 May) towards Iceland (29 May). The passage through the English Channel on 27 May thus took place with moderate winds from northwesterly directions and a wave height decreasing to below 1 m.

Between a ridge extending from this high pressure system until France and a low pressure system over the south of Finland (as well as a secondary low on the Norwegian coast caused by this low pressure system), a strong northerly wind over the North Sea caused a temporary increase in the significant wave height to 3 m on 28 and 29 May. *Polarstern* arrived in its home port Bremerhaven in the afternoon of 29 May.

2. BATHYMETRIC UNDERWAY MEASUREMENTS

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not on board: Boris Dorschel[1]

[1]DE.AWI

Grant-No. AWI_PS130_01

Objectives

Accurate knowledge of the seafloor topography, hence high-resolution bathymetry data, is key basic information necessary to understand many marine processes. It is of particular importance for the interpretation of scientific data in a spatial context. Bathymetry, or geomorphology, is a basic parameter for the understanding of the general geological setting of an area and geological processes such as erosion, sediment transport and deposition. Even information on tectonic processes can be inferred from bathymetry. Supplementing the bathymetric data, high-resolution sub-bottom profiler data of the top 10 s of meters below the seabed provide information of the sediment architecture and the lateral extension of sediment successions. This can be used to study depositional environments on larger scales in terms of space and time, of which the uppermost sediments may be sampled.

While world bathymetric maps give the impression of a detailed knowledge of worldwide seafloor topography, most of the world's ocean floor remains unmapped by hydroacoustic systems. In these areas, bathymetry is modelled from satellite altimetry with a corresponding low resolution. Satellite-altimetry derived bathymetry therefore lack the necessary resolution to resolve small- to meso-scale geomorphological features (e.g. sediment waves, glaciogenic features and small seamounts). Ship-borne multibeam data provide bathymetry information in a resolution that is sufficient to resolve those features.

Therefore, the main tasks of the bathymetry/geophysics group on board *Polarstern* during PS130 were:

- collection of bathymetric data, including calibration and correction of the data for environmental circumstances (sound velocity, systematic errors in bottom detection, etc.)
- post processing and cleaning of the data
- data management for on-site map creation
- collection of sound velocity data

Work at sea

Technical description

During the PS130 cruise, the bathymetric surveys were conducted with the hull-mounted multibeam echosounder (MBES) Teledyne Reson HYDROSWEEP DS3. The HYDROSWEEP is a deep water system for continuous mapping with the full swath potential. It operates on a frequency of ~14 kHz. On *Polarstern*, the MBES transducer arrays are arranged in a

Mills cross configuration of 3 m (transmit unit) by 3 m (receive unit). The combined motion, position (Trimble GNSS), and time data comes from an iXBlue Hydrins system and the signal is directly transferred into the Processing Unit (PU) of the MBES to carry out real-time motion compensation in Pitch, Roll and Yaw. With a combination of phase and amplitude detection algorithms the PU computes the water depth from the returning backscatter signal. The system can cover a sector of up to 140° with 70° per side. In the deep sea, an angle of ~50° to both sides could be achieved.

Data acquisition and processing

Data acquisition was carried out along the cruise track between Punta Arenas and the British Channel with the exception of Spanish waters due to a missing permit.

The MBES was operated with Hydromap Control and for online data visualisation, Teledyne PDS was used. The collected bathymetry was stored in ASD and S7K raw files. Subsequent data processing was performed using Caris HIPS and SIPS. For generating maps, the data were exported to Quantum GIS in the GeoTIFF raster format.

Sound velocity profiles

For best survey results with correct depths, frequent CTD (Conductivity Temperature Depth) casts were performed by the Bathymetry group, and were used to measure the water sound velocity in different depths. This is essential, as the acoustic signal travels down the water column from the transducer to the seafloor and back to the surface through several different layers of water masses with each a different sound velocity. The sound velocity (SV) is influenced by density and compressibility, both depending on pressure, temperature and salinity. Wrong or outdated sound velocity profiles lead to refraction errors and reduced data quality.

The CTD measures conductivity, temperature, and depth in the water column while the ship is on station. From these parameters, the sound velocity is calculated.

The sound velocity profiles obtained by the CTD were immediately processed and applied within the MBES for correct beamforming during the survey.

Additionally, these profiles were combined/extended with WOA13 (World Ocean Atlas 2013) data to create full ocean depth SV profiles.

Stations

The Hydrosweep, CTD and SVP stations are listed in Table 2.1 (PS130/1) and Table 2.2 (PS130/2).

Tab. 2.1: List of bathymetry related stations during PS130/1

Station Number	Description	Device	Time	LAT	LON
PS130/1_0_ Underway-29	Multibeam survey	Multibeam echosounder	Start: 2022-05-02 02:39 End: 2022-05-20 21:09	Start: -47.62048 End: 24.40349	Start: -60.76516 End: -20.373
PS130/1_5-1	SVP	SV profiler	2022-05-03 16:33	-42.34042	-52.42884
PS130/1_12-1	SVP	CTD/Rosette	2022-05-06 16:12	-32.43061	-40.35972

Station Number	Description	Device	Time	LAT	LON
PS130/1_20-1	SVP	CTD/Rosette	2022-05-09 16:02	-19.77123	-33.6052
PS130/1_26-1	SVP	CTD/Rosette	2022-05-12 15:08	-8.50562	-28.89447
PS130/1_31-1	SVP	CTD/Rosette	2022-05-15 14:03	3.79222	-24.50046
PS130/1_32-1	SVP	CTD/Rosette	2022-05-17 09:57	10.82132	-22.67325
PS130/1_33-1	SVP	CTD/Rosette	2022-05-19 16:13	19.84251	-21.30902
PS130/1_34-1	SVP	CTD/Rosette	2022-05-20 16:27	23.70008	-20.65658

Tab. 2.2: List of bathymetry related stations during PS130/2

Station Number	Description	Device	Time	Lat	Lon
PS130/2_0_ Underway-13	Multibeam survey	Multibeam echosounder	Start: 2022-05-23 05:42 End: 2022-05-25 14:58	Start: 31.05962 End: 41.78465	Start: -14.28336 End: -10.19767
PS130/2_0_ Underway-31	Multibeam survey	Multibeam echosounder	Start: 2022-05-26 17:34 End: 2022-05-27 18:51	Start: 46.0609 End: 50.024	Start: -7.49681 End: -1.75095
PS130/2_35-1	SVP	CTD/Rosette	2022-05-24 00:49	34.74989	-12.70549

Preliminary results

During 25 days (PS130/1: 19 days, PS130/2: 6 days), bathymetric data was surveyed along the cruise track by the swath bathymetry system. Figure 2.1 shows the generated bathymetry grid over the Atlantic.

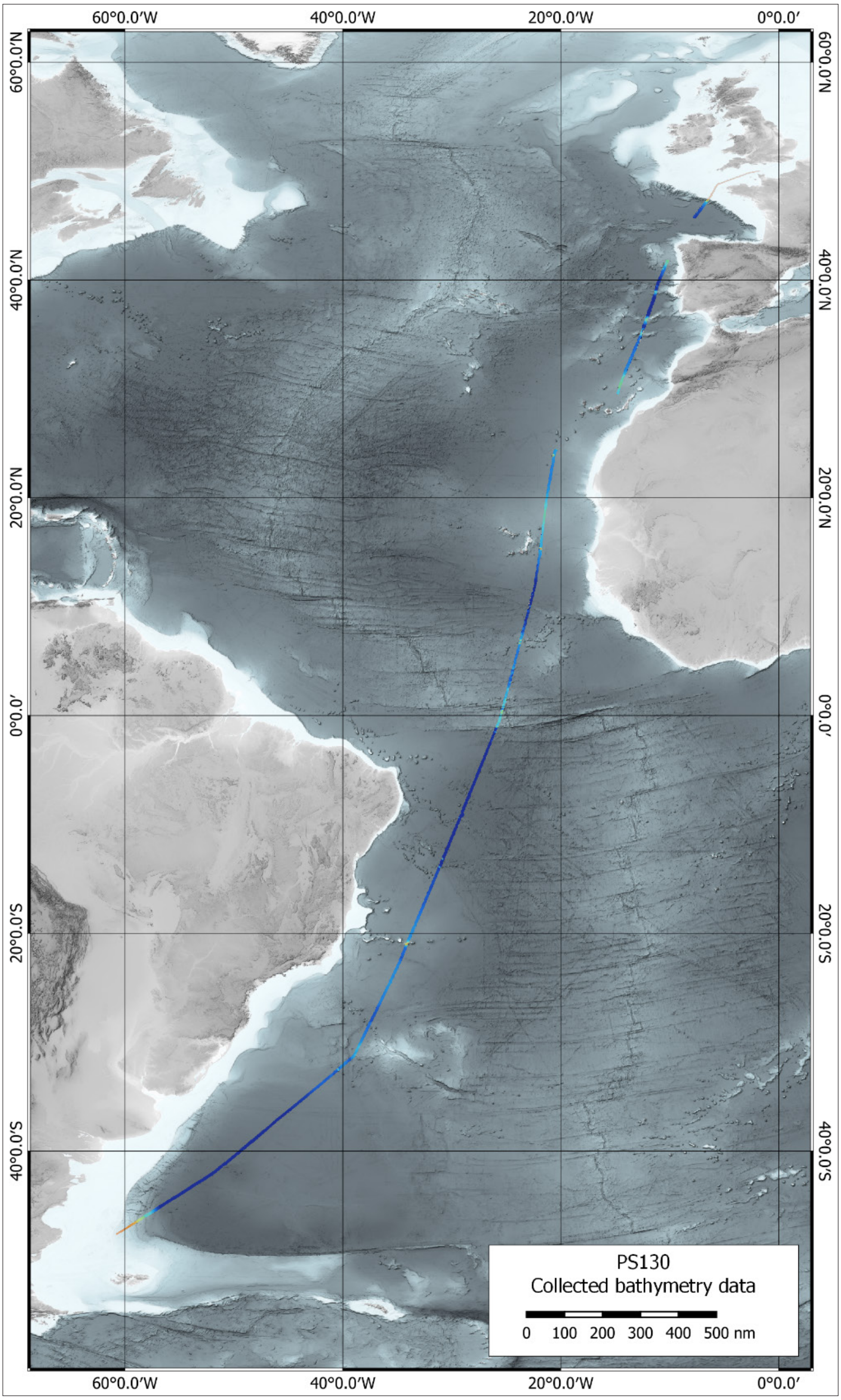

Fig. 2.1: Overview on the bathymetric data acquired during PS130

Data management

Geophysical and oceanographic data will be archived, published and disseminated according to international standards by the World Data Center PANGAEA Data Publisher for Earth & Environmental Science (https://www.pangaea.de) within two years after the end of the cruise at the latest. By default, the CC-BY license will be applied. Furthermore, bathymetric data will be provided to the Nippon Foundation – GEBCO Seabed 2030 Project.

In all publications based on this expedition, the **Grant No. AWI_PS130_01** will be quoted and the following publication will be cited:

Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (2017) Polar Research and Supply Vessel *POLARSTERN* Operated by the Alfred-Wegener-Institute. Journal of large-scale research facilities, 3, A119. http://dx.doi.org/10.17815/jlsrf-3-163.

3. MICROBIAL COLONIZATION OF MICROPLASTICS IN THE SOUTH AND NORTH ATLANTIC

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[1]CH.UNIBASEL

Grant-No. AWI_PS130/1_02

Objectives

The objective is to improve our understanding of plastic colonization by microbes in off shore waters of the South and North Atlantic by studying microbial biofilm formation on polyethylene films along the cruise transect.

Work at sea

To study microbial colonization of plastics in the Atlantic, an experimental set-up was designed to mimic plastics floating in sea surface water. Polyethylene (PE) was used as substrate, as it is among the most commonly found plastic polymers in the environment (Erni-Cassola et al., 2019) researchers have struggled to detect expected increases of marine plastic debris in sea surfaces, sparking discussions about "missing plastics" and final sinks, which are hypothesised to be coastal and deep-sea sediments. While it holds true that the highest concentrations of plastic particles are found in these locations (103–104 particles m^{-3} in sediments vs. 0.1 – 1 particles m^{-3} in the water column), thereby employing "pristine" and surface oxidised PE, as well as glass as an inert control substrate–analogous to previous experiments in coastal waters (Erni-Cassola et al. 2020) often referred to as the "Plastisphere." Given that common plastics are derived from fossil fuels, one would expect that Plastispheres should be enriched with obligate hydrocarbon-degrading bacteria (OHCB). The incubations were performed in two glass aquaria (60 L each); one aquarium was installed on the back of the working deck (port side), while the second aquarium was maintained in Wetlab 1 and provided with a source of light to promote growth of photosynthetic organisms (10 W 500 mm, SolarStinger LED sunstrip; wrapped in a cotton bag to provide some shading). Both aquaria were continuously supplied with water from the ships sea water intake through the stainless-steel system and previously thoroughly rinsed polypropylene hoses at a flow rate of ca. 6 L / min. Seawater was obtained via the ship's stainless steel continuous supply system from ca. 11.2 m depth. The set-up on the working deck was intended as the most realistic scenario being exposed to environmental conditions, while the aquarium kep in Wetlab1 served as back-up and comparison for experiments conducted during the PS129 cruise.

Incubation experiments were started as soon as international waters had been reached (or stopped accordingly). PE and glass slides (2.5 x 7.5 cm) were attached to stainless-steel frames, which were inserted in the aquaria. In total, four repeat incubation experiments of different durations were conducted throughout the transit with samples (n = 4 per substrate) being recovered after 2, 7, 14 and 18 days. For DNA analyses, samples were sonicated in filter sterilised sea water, biofilm material pelleted *via* centrifugation and resuspended in lysis buffer (MBL, Qiagen). Samples for microscopy, and biofilm thickness measurements were fixed in

4 % formaldehyde solution (ROTI Histofix 4%, Roth). All samples were stored at –20 °C. As reference for the planktonic microbial community, occasional water samples (sampling V = 2 L) from the aquaria, as well as from CTD casts (surface water at depth of ships water intake, *i.e.* ca. 11.5 m and chlorophyll maximum) was vacuum filtered (0.2 µm PC membrane); filters were immediately stored in lysis buffer and stored at –20 °C. A list of all samples taken is in Table 3.1.

Preliminary (expected) results

In total 215 biofilm DNA samples, 47 fixed samples and 28 water samples were collected. Biofilm growth was visually and preliminarily assessed to be limited.

Tab. 3.1: List of all samples taken. Experiments (Exp.) were started in the southern Atlantic (SA_x) or northern Atlantic (NA_x)

Sample_ID	Material	Time Point	Exp.	LAT	LON	Date	Water Source	Incubation Place
inc_109	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_110	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_111	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_112	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_113	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_114	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_115	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_116	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_117	glass	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_118	glass	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_119	glass	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_120	glass	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
inc_121	glass	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_122	glass	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_123	glass	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_124	glass	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_125	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_126	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_127	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_128	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_129	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_130	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_131	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
inc_132	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
fix37	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
fix38	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
fix39	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
fix40	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
fix41	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
fix42	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	wetLab1
fix43	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
fix44	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
fix45	PE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck

Sample_ID	Material	Time Point	Exp.	LAT	LON	Date	Water Source	Incubation Place
fix46	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
fix47	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
fix48	wPE	day2	SA_1	39° 37.667’ S	48° 58.439’ W	4.5.2022	KlausUnion	workingDeck
water5	water	NA	NA	36° 10.59’ S	44° 51.18’W	5.5.2022	KlausUnion	wetLab1
inc_133	wPE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_134	wPE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_135	wPE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_136	wPE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_137	PE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_138	PE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_139	PE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_140	PE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_141	glass	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_142	glass	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_143	glass	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_144	glass	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_145	PE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_146	PE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_147	PE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_148	PE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_149	glass	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_150	glass	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_151	glass	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_152	glass	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_153	wPE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_154	wPE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_155	wPE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_156	wPE	day7	SA_1	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_157	PE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_158	PE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_159	PE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_160	PE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_161	glass	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_162	glass	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_163	glass	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_164	glass	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_165	wPE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_166	wPE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_167	wPE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_168	wPE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
inc_169	wPE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_170	wPE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_171	wPE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_172	wPE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_173	glass	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_174	glass	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1

Sample_ID	Material	Time Point	Exp.	LAT	LON	Date	Water Source	Incubation Place
inc_175	glass	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_176	glass	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_177	PE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_178	PE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_179	PE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
inc_180	PE	day2	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
fix49	wPE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
fix50	wPE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
fix51	wPE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
fix52	PE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
fix53	PE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
fix54	PE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	wetLab1
fix55	wPE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
fix56	wPE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
fix57	wPE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
fix58	PE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
fix59	PE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
fix60	PE	day7	SA_2	20° 31.257’ S	33° 55.977’ W	9.5.2022	KlausUnion	workingDeck
water6	water	NA	NA	13° 01.923’ S	30° 45.717’ W	11.5.2022	KlausUnion	wetLab1
water8	water	NA	NA	04° 47.617’ S	27° 23.553’ W	13.5.2022	KlausUnion	workingDeck
water9	water	NA	NA	NA	NA	13.5.2022	milliq	NA
water10	water	NA	NA	04° 47.617’ S	27° 23.553’ W	13.5.2022	KlausUnion	wetLab1
water11	water	NA	NA	03° 47.349’ N	24° 30.091’ W	15.5.2022	CTD_70m	NA
water12	water	NA	NA	03° 47.349’ N	24° 30.091’ W	15.5.2022	milliq	NA
water13	water	NA	NA	03° 47.349’ N	24° 30.091’ W	15.5.2022	CTD_12m	NA
inc_181	glass	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_182	glass	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_183	glass	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_184	glass	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_185	wPE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_186	wPE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_187	wPE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_188	wPE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_189	PE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_190	PE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_191	PE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_192	PE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	workingDeck
inc_193	glass	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	wetLab1
inc_194	glass	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	wetLab1
inc_195	glass	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	wetLab1
inc_196	glass	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	wetLab1
inc_197	wPE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	wetLab1
inc_198	wPE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	wetLab1
inc_199	wPE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	wetLab1
inc_200	wPE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	wetLab1
inc_201	PE	day8	SA_2	04° 42.03’ N	24° 16.0’ W	15.5.2022	KlausUnion	wetLab1

Sample_ID	Material	Time Point	Exp.	LAT	LON	Date	Water Source	Incubation Place
inc_202	PE	day8	SA_2	04° 42.03' N	24° 16.0' W	15.5.2022	KlausUnion	wetLab1
inc_203	PE	day8	SA_2	04° 42.03' N	24° 16.0' W	15.5.2022	KlausUnion	wetLab1
inc_204	PE	day8	SA_2	04° 42.03' N	24° 16.0' W	15.5.2022	KlausUnion	wetLab1
inc_217	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_218	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_219	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_220	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_221	glass	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_222	glass	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_223	glass	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_224	glass	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_225	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_226	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_227	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_228	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
inc_229	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_230	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_231	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_232	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_233	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_234	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_235	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_236	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_237	glass	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_238	glass	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_239	glass	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
inc_240	glass	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
fix61	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
fix62	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
fix63	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
fix64	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
fix65	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
fix66	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	workingDeck
fix67	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
fix68	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
fix69	wPE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
fix70	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
fix71	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
fix72	PE	day14	SA_1	07° 39.748' N	23° 29.320' W	16.5.2022	KlausUnion	wetLab1
water14	water	NA	NA	10° 49.240' N	22° 40.342' W	17.5.2022	CTD_11m	NA
water15	water	NA	NA	10° 49.240' N	22° 40.342' W	17.5.2022	CTD_41m	NA
water16	water	NA	NA	10° 49.240' N	22° 40.342' W	17.5.2022	KlausUnion	wetLab1
water17	water	NA	NA	10° 49.240' N	22° 40.342' W	17.5.2022	KlausUnion	workingDeck
inc_241	PE	day2	NA_1	14° 40.275' N	21° 58.280' W	18.5.2022	KlausUnion	workingDeck
inc_242	PE	day2	NA_1	14° 40.275' N	21° 58.280' W	18.5.2022	KlausUnion	workingDeck
inc_243	PE	day2	NA_1	14° 40.275' N	21° 58.280' W	18.5.2022	KlausUnion	workingDeck

Sample_ID	Material	Time Point	Exp.	LAT	LON	Date	Water Source	Incubation Place
inc_244	PE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	workingDeck
inc_245	wPE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	workingDeck
inc_246	wPE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	workingDeck
inc_247	wPE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	workingDeck
inc_248	wPE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	workingDeck
inc_249	glass	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	workingDeck
inc_250	glass	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	workingDeck
inc_251	glass	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	workingDeck
inc_252	glass	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	workingDeck
inc_253	wPE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_254	wPE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_255	wPE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_256	wPE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_257	glass	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_258	glass	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_259	glass	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_260	glass	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_261	PE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_262	PE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_263	PE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_264	PE	day2	NA_1	14° 40.275’ N	21° 58.280’ W	18.5.2022	KlausUnion	wetLab1
inc_265	wPE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_266	wPE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_267	wPE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_268	wPE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_269	PE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_270	PE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_271	PE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_272	PE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_273	glass	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_274	glass	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_275	glass	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_276	glass	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	workingDeck
inc_277	glass	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_278	glass	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_279	glass	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_280	glass	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_281	wPE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_282	wPE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_283	wPE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_284	wPE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_285	PE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_286	PE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_287	PE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
inc_288	PE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1
fix73	wPE	day18	SA_1	23° 07.363’ N	20° 44.372’ W	20.5.2022	KlausUnion	wetLab1

Sample_ID	Material	Time Point	Exp.	LAT	LON	Date	Water Source	Incubation Place
fix74	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
fix75	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
fix76	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
fix77	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
fix78	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
fix79	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
fix80	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
fix81	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
fix82	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
fix83	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
fix84	wPE	day18	SA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_289	glass	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_290	glass	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_291	glass	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_292	glass	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_293	PE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_294	PE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_295	PE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_296	PE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_297	wPE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_298	wPE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_299	wPE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_300	wPE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
inc_301	PE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_302	PE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_303	PE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_304	PE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_305	glass	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_306	glass	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_307	glass	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_308	glass	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_309	wPE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_310	wPE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_311	wPE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
inc_312	wPE	day5	NA_1	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
water18	water	NA	NA	23° 07.363' N	20° 44.372' W	20.5.2022	CTD_11.5m	NA
water19	water	NA	NA	23° 07.363' N	20° 44.372' W	20.5.2022	CTD_90m	NA
water20	water	NA	NA	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	wetLab1
water21	water	NA	NA	23° 07.363' N	20° 44.372' W	20.5.2022	KlausUnion	workingDeck
water22	water	NA	NA	34° 44.998' N	12° 42.347' W	24.5.2022	CTD_11.4m	NA
water23	water	NA	NA	34° 44.998' N	12° 42.347' W	24.5.2022	CTD_80m	NA
water24	water	NA	NA	34° 44.998' N	12° 42.347' W	24.5.2022	KlausUnion	wetLab1
water25	water	NA	NA	34° 44.998' N	12° 42.347' W	24.5.2022	KlausUnion	workingDeck
inc_313	PE	day2	NA_2	41° 24.758' N	10° 21.265' W	25.5.2022	KlausUnion	workingDeck
inc_314	PE	day2	NA_2	41° 24.758' N	10° 21.265' W	25.5.2022	KlausUnion	workingDeck
inc_315	PE	day2	NA_2	41° 24.758' N	10° 21.265' W	25.5.2022	KlausUnion	workingDeck

Sample_ID	Material	Time Point	Exp.	LAT	LON	Date	Water Source	Incubation Place
inc_316	PE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	workingDeck
inc_317	glass	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	workingDeck
inc_318	glass	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	workingDeck
inc_319	glass	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	workingDeck
inc_320	glass	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	workingDeck
inc_321	wPE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	workingDeck
inc_322	wPE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	workingDeck
inc_323	wPE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	workingDeck
inc_324	wPE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	workingDeck
inc_325	PE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_326	PE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_327	PE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_328	PE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_329	glass	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_330	glass	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_331	glass	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_332	glass	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_333	wPE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_334	wPE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_335	wPE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
inc_336	wPE	day2	NA_2	41° 24.758’ N	10° 21.265’ W	25.5.2022	KlausUnion	wetLab1
water26	water	NA	NA	NA	NA	25.5.2022	milliq	NA
water27	water	NA	NA	NA	NA	25.5.2022	milliq	NA
water28	water	NA	NA	NA	NA	25.5.2022	milliq	NA

Data management

Environmental data will be archived, published and disseminated according to international standards by the World Data Center PANGAEA Data Publisher for Earth & Environmental Science (https://www.pangaea.de) within two years after the end of the cruise at the latest. By default, the CC-BY license will be applied.

Molecular data (DNA and RNA data) will be archived, published and disseminated within one of the repositories of the International Nucleotide Sequence Data Collaboration (INSDC, www.insdc.org) comprising of EMBL-EBI/ENA, GenBank and DDBJ).

In all publications based on this expedition, the **Grant No. AWI_PS130/1_02** will be quoted and the following publication will be cited:

Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (2017) Polar Research and Supply Vessel *POLARSTERN* Operated by the Alfred-Wegener-Institute. Journal of large-scale research facilities, 3, A119. http://dx.doi.org/10.17815/jlsrf-3-163.

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Erni-Cassola G, Zadjelovic V, Gibson MI, Christie-Oleza JA (2019) Distribution of plastic polymer types in the marine environment; A meta-analysis. J Hazard Mater 369:691–698. https://doi.org/10.1016/j.jhazmat.2019.02.067

4. IDENTIFYING THE CARBON THAT MATTERS: CHEMICAL CONTROLS ON ORGANIC MATTER AGGREGATION (COMA)

Jan Tebben[1]
Not on board: Mario Hoppema[1], Kai-Uwe Ludwichowski[1], Martin Graeve[1], M. González-Dávila[3], M. Santana-Casiano[3], Boris Koch[1,2], Alessandro Tagliabue[4], Stephane Pesant[5]

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Grant-No. AWI_PS129_07

Outline

The biological pump and its transport of particulate organic matter (POM) from the photic zone to the ocean floor and the formation and downwelling of CO_2 and recalcitrant dissolved organic matter (DOM) in the Southern Ocean are key regulators of the transfer of atmospheric CO_2 to long-term storage of carbon. The composition and distribution of organic matter is controlled by primary production and microbial activity, water mass mixing, physico-chemical degradation, and aggregation processes (Koch et al., 2014). DOM undergoes aggregation and binds to particles (e.g., cells, fecal pellets and detritus), which contributes to deposition and sequestration of carbon and creates a major sink in the global carbon cycle. Despite the significant role of aggregation, very little is known about the accumulation rates and binding of low molecular organic matter and colloidal matter on macromolecules and particles.

Objectives

This project can address some of the central questions of the global carbon cycle, namely to derive a mechanistic understanding whether certain chemical classes within the DOM pool predominantly drive aggregation in the Southern Ocean and therefore impact the sequestration of atmospheric CO_2. The central objectives of this project therefore are to sample, isolate and structurally identify bacterially produced molecules that 1) act as coagulants and drive particle aggregation and 2) sample, isolate and structurally identify bacterially produced ligands that complex trace metals such as iron. A consequential objective is then to correlate the genetic diversity of bacteria and phytoplankton (e.g., Bucklin et al., 2016) with aggregation rates and environmental parameters (iron stress, salinity and temperature). The main work of this project was conducted during the Antarctic PS129 HAFOS/COMA expedition. The samples obtained from PS130/1 will serve as a comparative dataset that includes sampling of warmer water masses and strong dissolved iron gradients around the equator.

Work at sea

The filtration and concentration of large amounts of particulate and dissolved OM is a prerequisite for the chromatographic isolation and identification of OM components as well as the exploration of the genetic diversity (DNA barcoding). Both phytoplankton species as well as clonal lines of bacterial strains will be isolated from single cells on board to be used in co-inoculation experiments in the home laboratories. All materials were washed with 10 %

hydrochloric acid followed by pure water unless stated otherwise. Water was sampled from the ship's moon pool at 11 m water depth using a "snorkel" equipped with a Teflon head protruding ~0.5 m below the ships edge, a 40 m x 1 inch suction hose with polyethylene tubing inlay (suction side), and a Teflon pneumatic pump equipped with pulsation dampening (Tapflo). The water flow was divided with a T-valve (pressure side post-pump) to a half inch polyethylene tubing and 4 mm PTFE tubing piped in under a laminar flow cabinet inside a clean room container (Table 4.1).

Large volume samples (LVS) were prefiltered using polypropylene filter socks in a 10-inch polypropylene filter housing (Fuhr, 1 µm pore size). LVS were collected in 1 m³ intermediate bulk containers (IBC). The IBC was washed with ~ 100 L at each station and the wash-water discarded. 950 L were then collected over ~30 min equivalent to a distance of approximately 5 nautical miles and acidified to pH 3 using concentrated hydrochloric acid (12 M, Carl Roth). The water was pumped at 20 L h^{-1} through a pre-combusted (500° C, 5 h) glass fiber filter (Whatman, GFF, 142 mm) in a polycarbonate filter-holder and a manually packed and precleaned (methanol, LichroSolv followed by ultrapure water pH 2) solid phase extraction (SPE) cartridge containing a 17 g of bulk solid phase adsorber material (BondElut ENV, Agilent, or PPL, Agilent, respectively). While the LVS bulk container was filled, the divided sample flow was simultaneously sampled in a clean room lab container for Fe^{3+} (0.5 L, 0.2 µm filtered over Sartobran 300), Fe^{2+} (0.25 L), ligands (0.5 L), live bacterial cultures (15 mL), nutrients (20 mL), dissolved organic carbon (DOC, 20 mL), dissolved inorganic carbon (DIC, 0.5 L), fluorescence (FL, 20 mL) analysis, particulate organic carbon (POC, 2 L), eDNA (20 L) and small volume (0.5 L) solid phase extractions for the molecular characterisation of dissolved organic matter (DOM). The acidified and pre-filtered water in each IBC was additionally sampled for DOC (1 L).

Tab. 4.1: Sample types derived from underway sampling (snorkel)

Parameter	Treatment	Sample Volume	Storage container	Storage condition
LVS DOM, POM	Prefiltered 1 µm	950 L	1 m³ IBC container	Frozen -20°C (Chromatographic resin and GF/F filter)
Fe2+	Unfiltered, sampling under laminar flow in Clean Room container	500 mL	HDPE bottle	Frozen -20°C
Ligands	Unfiltered, sampling under laminar flow in Clean Room container	500 mL	HDPE bottle	Frozen -20°C
Fe3+	0.8/0.2 µm filtration (Sartobran 300) under laminar flow in Clean Room container	250 mL	HDPE bottle	Acidified, 4°C
DOC	GF/F filtered, sampling under laminar flow in Clean Room container	20 mL	HDPE bottle	Frozen -20°C
SPE-DOM	GF/F filtered, acidified	500 mL	ppl resin/PP cartridge	Frozen -20°C
Fluorescence	GF/F filtered	20 mL	HDPE bottle	Frozen -20°C
Nutrients	Unfiltered, sampling under laminar flow in Clean Room container	20 mL	HDPE bottle	Direct analysis

Parameter	Treatment	Sample Volume	Storage container	Storage condition
Inorganic carbon	Unfiltered	0.5 mL	Glass bottle	Direct analysis
Bacterial culture	Unfiltered	15 mL	Sterile falcon tube	Agar plating
eDNA	Unfiltered, 3 µm, 0.2 µm filtration. $FeCl_3$ precipitate (12 h) filtered onto 0.8 µm	20 L	5 mL cryotube	Snap frozen in liquid N_2, then -80°C

The Niskin water bottles from the water rosette were sampled using acid-washed glass bottles (1 or 2 L, Schott, Duran) that were thoroughly rinsed with sample water. The surface depths (chlorophyll maximum and surface) were sampled using acid-washed PE sample bottles (2 L) to avoid iron contamination and additional samples for bacteria were taken in sterile 50 mL centrifuge vials.

For all DOC and FL samples, at least 1 L of water was filtered using pre-combusted (450° C, 5 h) glass fiber filters (Whatman, GFF, 42 mm diameter) and a glass filtration unit. Samples were filled into pre-cleaned and thoroughly rinsed high density polyethylene HDPE bottles (50 mL). For POC samples, 2 L of water was filtered using the same method and filters were wrapped in aluminum foil. All samples were stored at –20°C until further analysis. Inorganic nutrient samples were measured unfiltered directly onboard (see HAFOS – Nutrients). Small volume extraction was performed using 0.5 L of the filtrate of the DOC samples and precleaned SPE cartridges (PPL, Agilent, 200 mg).

Tab 4.2: Sample types taken from the CTD rosette

Parameter	Treatment	Sample Volume	Storage container	Storage condition
DOC	GF/F filtered, sampling under laminar flow in Clean Room container	20 mL	HDPE bottle	Frozen -20°C
SPE-DOM	GF/F filtered, acidified	500 mL	ppl resin/PP cartridge	Frozen -20°C
Fluorescence	GF/F filtered	20 mL	HDPE bottle	Frozen -20°C
Nutrients	Unfiltered, sampling under laminar flow in Clean Room container	20 mL	HDPE bottle	Direct analysis
Bacterial culture	Unfiltered	15 mL	Sterile falcon tube	Agar plating
eDNA	Unfiltered, 3 µm, 0.2 µm filtration. $FeCl_3$ precipitate (12 h) filtered onto 0.8 µm	20 L	5 mL cryotube	Snap frozen in liquid N_2, then -80°C

Blanks

- Ultrapure water pH2
- SPE process blank
- GFF Filtration blank

Preliminary (expected) results

All analyses for the COMA project will be carried out after the cruise. Here, we provide an overview on the types, number and volumes of samples taken.

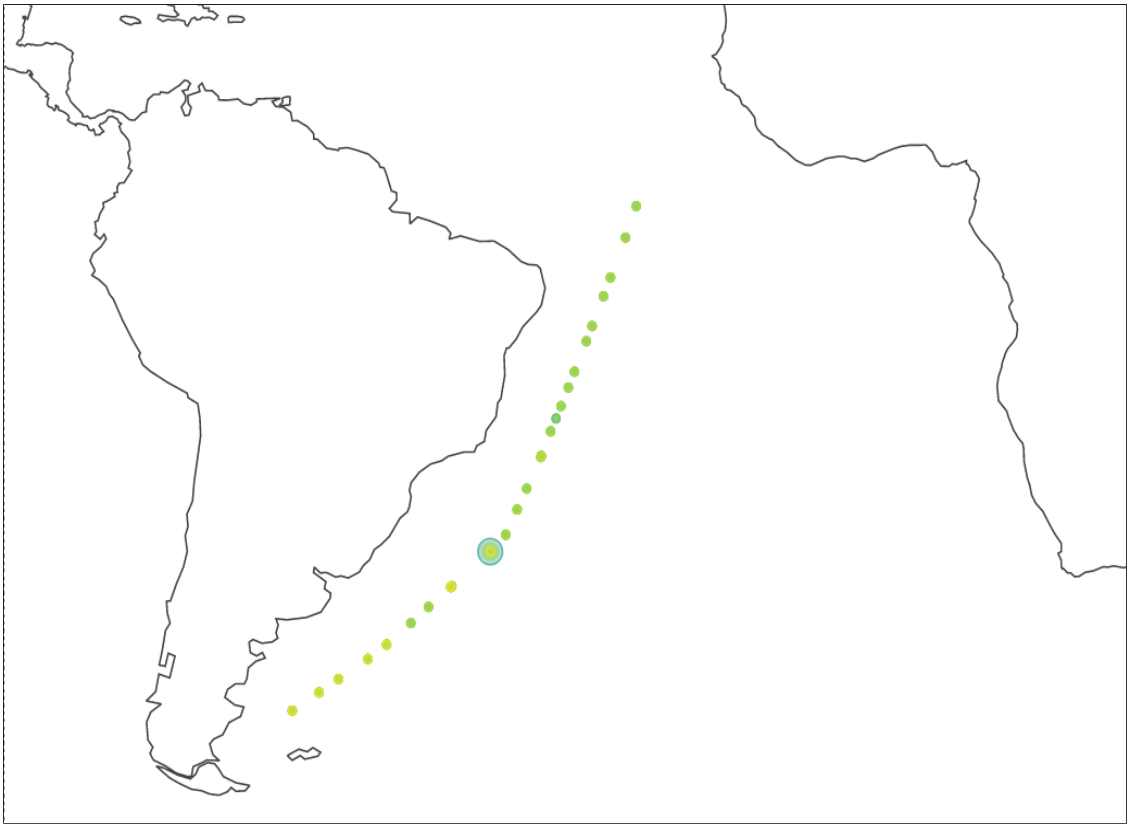

Fig. 4.1: Location of surface water samples taken within the COMA project; big dot represents a CTD station with 5 sampling depths.

Tab. 4.3: Overview on samples collected during PS130/1

Parameter	Number of samples	Total volume (L)
DOC	30	15
POC	30	30
SPE_XL	24	22800
POC_big	24	22800
POC_sock	10	11400
FE2plus	10	5
FE3plus	10	5
Ligands	10	5
SPE	30	15

Parameter	Number of samples	Total volume (L)
nut	30	0.2
bacteria	30	0
Fluor	30	0.2
TARA	10	200
Total	**278**	**23060**

Data management

Environmental data will be archived, published and disseminated according to international standards by the World Data Center PANGAEA Data Publisher for Earth & Environmental Science (https://www.pangaea.de) within two years after the end of the cruise at the latest. By default, the CC-BY license will be applied. Molecular data (DNA and RNA data) will be archived, published and disseminated within one of the repositories of the International Nucleotide Sequence Data Collaboration (INSDC, www.insdc.org) comprising of EMBL-EBI/ENA, GenBank and DDBJ).

Any other data will be submitted to an appropriate long-term archive that provides unique and stable identifiers for the datasets and allows open online access to the data. In all publications, based on this cruise, the **Grant No. AWI_PS129_07** will be quoted and the following *Polarstern* article will be cited: Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (2017) Polar Research and Supply Vessel *POLARSTERN* Operated by the Alfred-Wegener-Institute. Journal of large-scale research facilities, 3, A119. http://dx.doi.org/10.17815/jlsrf-3-163. This expedition was supported by the Helmholtz Research Programme "Changing Earth – Sustaining our Future" Topic 6, Subtopic 1, 6.2 and 6.3.

Third party funding for the following projects supporting this expedition is provided by the Priority Programme 1158 Antarctic Research with Comparable Investigations in Arctic Sea Ice Areas: "Recognition, signalling and response of the diatom Fragilariopsis to epibiotic bacterial colonization" Harder T and Tebben J; "Siderophore mediated iron acquisition of psychrophilic Antarctic marine bacteria" Tebben J, Harder T and Völker C; Identifying the carbon that matters: Chemical controls on organic matter aggregation (COMA) Hoppema M, Koch B, Tebben J.

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Egbers PH, Harder T, Koch BP, Tebben J (2020) Siderophore purification with titanium dioxide nanoparticle solid phase extraction. Analyst 145(22):7303-7311.

Koch BP, Kattner G, Witt M, Passow U (2014) Molecular insights into the microbial formation of marine dissolved organic matter: recalcitrant or labile? Biogeosciences 11:4173-4190.

5. *POLARSTERN* O2A DATA LOGISTICS SUPPORT

Maximilian Betz[1], Sebastian Immoor[1]
not on board: Roland Koppe[1]

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Grant-No. AWI_PS130_00

Objectives

The Data Logistics Support (DLS) team from the Computing Department works on the O2A (Observation to Archive) data flow and coordinates the IT infrastructure on board of *Polarstern*. Maximilian Betz and Sebastian Immoor attended the campaign PS130/2 in order to finalise and fine-tune running as well as setup new IT projects regarding raw data flows and internet communication on the vessel.

Work at Sea

The Mass Data Management (MDM) system was put in operation on *Polarstern* in November 2021. This system is an extension of the DShip data acquisition system and allows storing raw data files in a well-organised manor (DShip itself only supports storage of raw data values/ telegrams). The MDM enables best-practice raw data flows from the instruments on board to the institute's FAIR data infrastructures.

After six months of operation it was necessary to collect feedback during operation, fine-tune the system and connect more scientific data sources on board.

The satellite communication system "Kepler Space" is a store-and-forward communication system allowing users to exchange files with a much higher volume as current satellite providers such as Iridium offer (due to transmission speed or cost).

On PS130/2 a new self-service portal called "*Polarstern* Data Exchange Service" developed by M. Betz, R. Koppe and S. Immoor was deployed on board (and at shore) enabling scientists, crew and their colleagues on land to use the Kepler system on their own without the need of administrative personal to be involved in the communication process. Development was and will be continued in order to provide an easy to use and stable product.

Further IT and data flow related tasks were inspected and solved in close coordination with the IT/WTB personnel on board.

Preliminary results

Not applicable

Data management

Not applicable

6. ECHOSOUNDING TRAINING POLMAR-TRAIN

Claudia Hanfland[1], Simon Dreutter[1], Frank Niessen[1], Gerhard Kuhn[1], Michal Siccha[2], Ellen Werner[1]

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Grant-No. AWI_PS130_04

Objectives

POLMAR-TRAIN 2022 is a student-training course that was jointly run by the AWI-based Helmholtz Graduate School for Polar and Marine Research (POLMAR) and the University of Bremen as well as ArcTrain. The purpose is to provide master students and doctoral candidates from the field of geosciences but also from other disciplines with a hands-on training in operating the hull-mounted echosounding systems of *Polarstern* (Teledyne multibeam echosounder HYDROSWEEP DS3 and sediment echosounder PARASOUND P70). Parallel to the practical training, the aim is to promote peer-learning by combining master students (beginners and advanced stage) and doctoral candidates in this course. In addition, we provide knowledge and literature about the near-surface marine geology and oceanography along the south western and north western continental margin of Europe and Africa, respectively. Thus, the objectives of the work at sea are threefold:

1. learn to operate the systems during shifts,
2. store, process and interpret the sub-bottom and bathymetric data, and,
3. put the hydro-acoustic results into a broader regional perspective based on published literature, in order to understand the geology along the cruise track.

The geophysical training was complemented by a primer to practical physical oceanography. This aspect comprised a series of five lectures and one CTD station for a hands- on introduction to sensors and datae acquisition.

POLMAR-TRAIN is part of the programme “Master of Sciences Marine Geosciences” at the University of Bremen as well as of the scientific programme of POLMAR and ArcTrain. All three programmes involve ship-based field-work for students and doctoral candidates. In addition, we take the opportunity to train participants of forthcoming marine expeditions in hydro-acoustic operation. The training is carried out by six lecturers affiliated with AWI or the University of Bremen.

Work at sea

Educational Aspects

Nine students from the University of Bremen (of which one is a member of the ArcTrain group), four doctoral candidates (POLMAR) and one data engineer from AWI Bremerhaven, and five Students (three PhD and two MSc) from Canada (ArcTrain), participated in the training. Research topics of the participants’ Master or PhD projects include geology, geophysics, bathymetry and modelling (paleoclimate, sea ice, ice sheets, ocean).

The echosounding course started with a general introduction into the geology along the continental margins from the Canary Islands to the English Channel, followed by three theoretical introductions (i) into the physics and techniques of echosounding, (ii) the use and handling of the parametric echosounder PARASOUND on *Polarstern*, and (iii) how to work with PARASOUND data. After introduction into the operations of the PARASOUND and HYDROSWEEP systems in the hydro-acoustic centre of the ship, students started going on watches (generally 4 hours) for 24-hour operation in pairs of two each for both systems HYDROSWEEP and PARASOUND. For teaching the students how to interpret the hydroacoustic data, three about one-hour evening sessions were carried out to discuss and understand typical "key" structures in PARASOUND profiles from the region.

In addition, in groups of three to four, participants took over responsibilities for, in total, five regional areas of specific geological/geophysical characteristics along the cruise track from Las Palmas to the Armorican Shelf. These include:

- The area of the Canary Islands including adjacent seamounts and the Agadir submarine canyon complex
- The area of the boundary between the African and Eurasian plates (area of and north of the Horseshoe abyssal plain)
- The area west of major submarine canyons off Portugal (Iberian margin)
- The area of the Galicia Bank to the Spanish shelf of around Cape Finisterre
- The western Armorican continental slope and the Bay of Biscay

The participants learned to interpret submarine geomorphological structures from bathymetric images, sediment echographs combined with information from the literature including seismic-profiles. With regard to multibeam-bathymetric data, participants were introduced to data acquisition, data processing, and visualisation with different kind of profiling and GIS mapping software. For processing and replying of PARASOUND data, the Teledyne software PARASTORE was used. In addition to data acquired during PS116, participants had access to both HYDROSWEEP and PARASOUND data from the following previous cruises:

- PS88.1
- PS97
- PS105
- PS116.1

Where possible, the track line of cruise PS130/2 was placed to the east of previous cruises so that a slightly larger coverage of the sea floor is achieved for mapping in addition to previous course tracks. Exact repetition of sub-bottom results is avoided whenever possible. Due to the lack of a research permit for the EEZ-areas of Spain, hydroacoustic data were only acquired within the EEZ of Portugal (including Madeira) and France and outside of EEZ boundaries. For the geological areas listed above, which include Spanish EEZ territories, the students were using hydroacoustic data from previous cruises as listed above.

A single CTD-cast to 4,420 m water depth was conducted for training purposes. The ship-owned SBE911 CTD was equipped with a fluorescence [WET Labs ECO-AFL/FL, S/N 1670], transmissivity [WET Labs C-Star S/N 814] and oxygen sensor [SBE 43, S/N 880] next to its standard configuration of pressure [S/N 0485] and redundant temperature [S/N 2417, 2460] and conductivity [S/N 2054, 2055] sensors. No water samples were taken.

Technical Aspects

On the way from Las Palmas to Bremerhaven PARASOUND and HYDROSWEEP recording started with entering the EEZ of Portugal (Madeira) and was switched off within the EEZ of mainland Spain (no valid research permission). Data acquisition of PARASOUND is summarised in Table 6.1. No system crashes occurred. The operational settings of PARASOUND transmissions are summarised in Table 6.2. Along the continental slope from the abyssal plain of the Bay of Biscay to the Armorican Shelf, the operational mode of pulsing was changed from Quasi-Equidistant (QED) to Single Pulse (SP) operation in depth shallower than 1,000 m.

Using Software PARASTORE PHF and SLF profiles were visualised online. PHF and SLF data were stored in ASD and PS3 (frequency carrier/lat.long.) formats (Tab. 6.2). In addition, auxiliary data (navigation and PARASOUND settings) were stored in one-minute intervals. "Printing" of PHF and SLF data was performed using a PDF-creator of the operator PC via PNG output formats stored on disc (Online Prints).

Tab. 6.1: PARASOUND data acquisition and storage during cruise PS130/2

Date	Time UTC	EEZ	Sounding	PHF ASD	SLF ASD	PHF PS3	SLF PS3
22.05.22	22:22	Spain /Portugal Madeira	on	x	x	x	x
23.05.22	23:12	international	standby				
24.05.22	2:38	international	on	x	x	x	x
25.05.22	15:06	Portugal / Spain	off				
26.05.22	14:33	Spain / France	standby				
26.05.22	15:35	France	on	x	x	x	x
28.01.00	06:05	France	off				

Preliminary results

Educational Results

The concept of combining undergraduates and postgraduates in this training proved to be a successful approach. Next to guidance and discussion with the team of lecturers, peer-learning was an important factor for the success of this training concept. In particular, this turned out to be successful by grouping students together with higher, to some, to no scientific background in geology (watches and areal working groups).

The combination of theoretical background, practical work on the hydroacoustic systems (including troubleshooting), discussion of acquired and published as well as student presentations was the right combination for a thorough and comprehensive training in echosounding techniques. However, the time available during PS130/2 was extremely short for logistic reasons. *Polarstern* left Las Palmas on 22 May in the afternoon and reached the

Armorican Shelf off the coast of France only 4.5 days later. Accordingly, the ship speed was relatively high during our transect, so that Bremerhaven was already reached after seven days, whereas earlier training cruises had eight to ten days available for education for this part of the transit. Moreover, it is harder to run the echosounding systems at ship speeds well above 10 kn (average about 13 kn during PS130/2) compared to a normal average transit speed of 10.5 kn.

At the end of the cruise, the groups responsible for the five regions along the cruise track (as listed above) gave a 20-minute presentation each, in which they presented PARASOUND and HYDROSWEEP results obtained during PS130/2 (and/or during previous cruises PS116, PS105 PS97 and PS88 along parallel cruise tracks) in the context of the regional geology published elsewhere (provided to the students on board). In this way, a very good overview was compiled about the characteristics of the geology of the continental margins. This includes understanding how the results documented by *Polarstern* hydroacoustic data support or extend the state-of-the-art knowledge. This combination turned out to be very effective for both motivating the students to acquire hydroacoustic data and developing interpretation skills. By using data from previous cruises, the different groups were able to work simultaneously without waiting for their area to be surveyed and/or where no new survey data were acquired during PS130/2 (Tab.6.2).

Tab. 6.2: Settings of ATLAS HYDROMAP CONTROL for operating PARASOUND during cruise PS130/2

Used Settings	Selected Options	Selected Ranges
Mode of Operation	P-SBP/SBES, shallow and deep-sea settings	PHF, SLF
Frequency	PHF	20 kHz
	SLF	4 kHz
Pulse Length	No. of Periods	2 (Continuous Wave)
	Length	0.5 ms (Continuous Wave)
Transmission Source	Transmission Power	100 %
	Transmission Voltage	159 V
	Beam Width	Automatic (4.5°)
Beam Steering	none	
Mode of Transmisson	Single Pulse (SP)	Auto according to water depth
	Quasi-Equidistant (QED)	Interval 400 ms
Pulse Types	Continuous Wave	
Pulse Shape	Rectangular	
Receiver	Output Sample Rate (OSR)	12.2 kHz
	Band Width	4.069 kHz
	Pulse Resolution	0.369 m
	Amplification	TVG Automatic, Shift: 20 dB
Reception Shading	none	
System Depth Source		ATLAS PARASOUND PHF
	Min./Max Depth similar to	ATLAS HYDROSWEEP SLF
	PARASTORE echogram window	(for very short periods only = vsp)
Water Velocity	C-Mean	Manual 1500 ms^{-1}

Used Settings	Selected Options	Selected Ranges
Data Recording	C-Keel	System C-keel (vsp at beginning)
	PHF	100 m above Sediment
	SLF	200 m Penetration

Technical Results

The PARASOUND online operation was very stable with good data quality in most places. Screenshots of the SLF echogram window were captured in regular intervals and with small lateral overlap in order to have images available for immediate interpretation. All data were acquired in more than sufficient quality to allow optimal use for the requirements of the Echosounding Training Course.

For software PARASTORE, the automatic mode remained mostly on "off", because the automated mode provided window shifts too often, thereby making screenshot images nearly unreadable. Thus, constant watch keeping of the system and manual window shifts were maintained until the shallow shelf was reached at the western end of the English Channel.

There were three points, which turned out to be critical during operation, and should be further tested or analysed:

- One observation has already been made, when the system was turned on and put into operation. The desired PARASOUND SLF was set to 4 kHz. Despite the fact, that the PHF frequency was set to 20 kHz, the currently active PHF was indicated as 18 kHz under "Applied Data". The only higher than 18-kHz-PHF turned out to be 22 kHz, which was acknowledged by the system under "Applied Data". According to Table 6.2, we run the system with PHF adjusted to 20 kHz, acknowledged by the system as 18 kHz. However, during the entire simultaneous operation with both PARASOUND (PS) and HYDROSWEEP (HS), the well-known mutual disturbances due to the narrow PHF difference between 15 and 18 kHz (HS, PS, respectively) were not observed. From earlier experience during PS116.2 with strong mutual disturbances of PS and HS (Niessen et al., 2019) running PS PHF with 18 kHz, we suspect that during PS130/2, the PS-PHF transmitted with 20 kHz pulses and this was incorrectly indicated as 18 kHz under PARASTORE "Applied Data". This should be checked.
- At the beginning of the cruise, the PARASOUND template "P-SBP-SBES_DeepSea" was loaded, modified and stored as "P-SBP-SBES_DeepSea_PS130_2". During testing it was noted that the sea floor and reflectors underneath were affected by artefacts of depth (see indication by arrows in Fig. 6.1). These problems were overcome by changing the template default setting of C-Mean (HYDROMAP CONTROL, Sounder Environment) "System C-Profile" to "Manual", 1500 ms-1. It remained obscure which System C-Profile was applied before this modification. Also, we were not able to identify, why the artefacts were irregular in occurrence (Fig. 6.1). For these reasons, we prefer to have set the Manual C-Mean as default in the Deep-Sea Template provided for PARASOUND by the manufacturer Teledyne Reson.
- Within two time-windows during the cruise (23.05.22 and 25.05.22, Fig. 6.2), the number of pulses of PARASOUND QED transmission dropped from 4 to 1 for no obvious reasons (no change of settings) and did not recover for about 45 minutes each (also for no obvious reasons). As a result, the lateral resolution of the data dropped significantly within these time windows (Fig. 6.2).

We did not observe any error or incompleteness in motion compensation in the PARASOUND data during PS130/2. However, with moderate winds only and minimal swell, untypical for the cruise area west of the English Channel, we were unable to test any compensation problems.

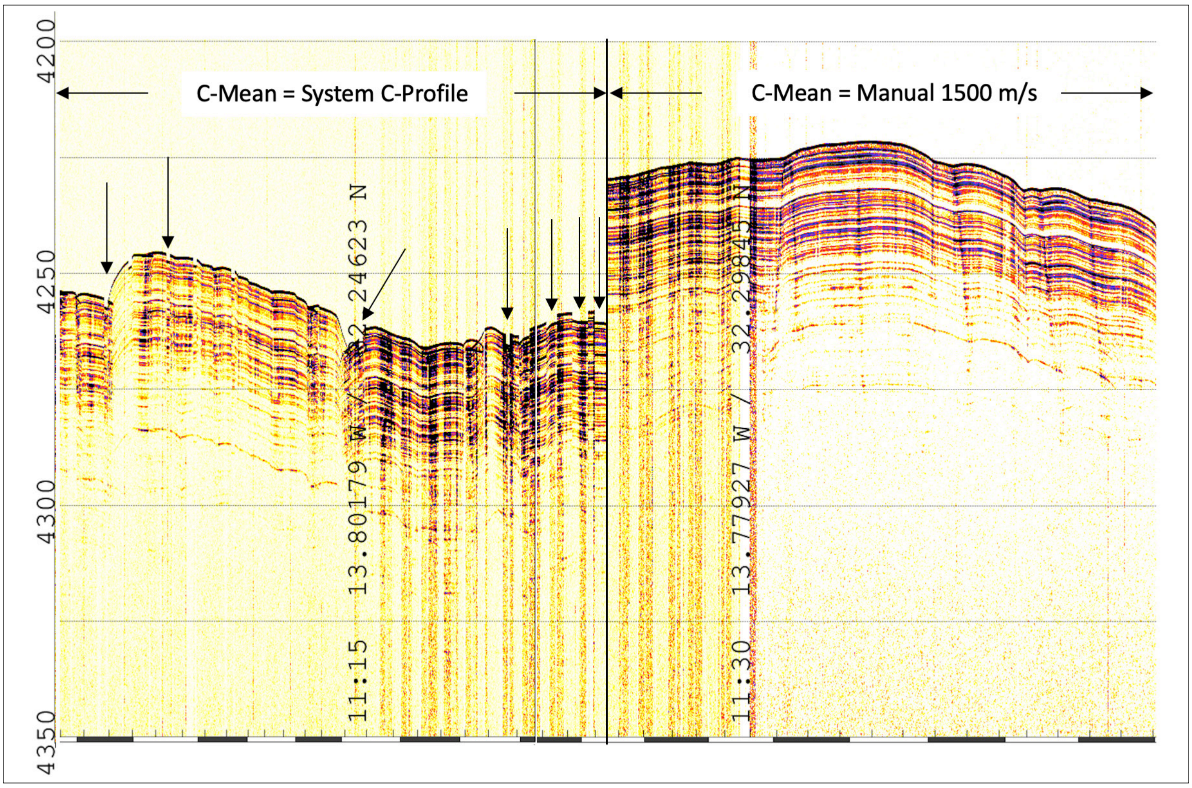

Fig. 6.1: PARASOUND profile recorded on 23.05.2022 with depth artefacts (arrows, C-Mean = System C-Profile) left.
Traces were unclipped before and clipped after 11:30 UTC, respectively.Depth scale in (m). Black and white horizontal bars are 1 km each.

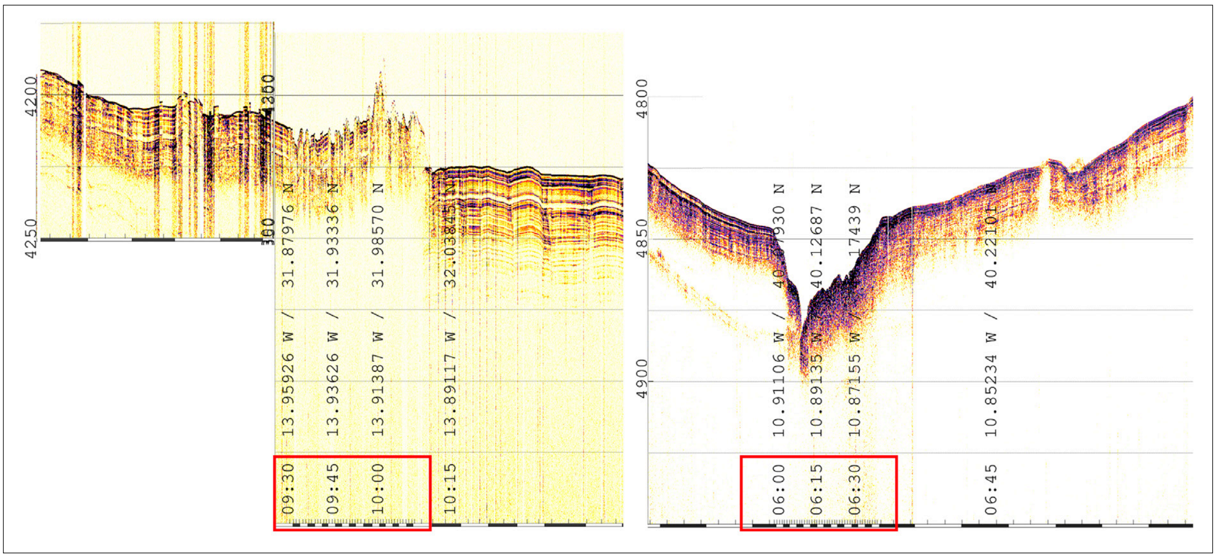

Fig. 6.2: PARASOUND profile recorded on 23 May 2022 (left) and 25 May 2022 (right) with drop of pulses (4 to 1, red boxes with time and km-scales). Time is UTC, black and white horizontal bars are 1 km each and depth scale is in (m).

Data management

Hydroacoustic data (multibeam and sediment echosounder) collected during the expedition (Tab. 6.1) have been copied to the *Polarstern* data base. From there the data will be transferred to the data mass storage at AWI Bremerhaven. Finally, the data will be stored and linked to the PANGAEA data repository at AWI. Furthermore, the data will be provided to international mapping projects and included in regional data compilations such as the Nippon Foundation-GEBCO (General Bathymetric Chart of the Oceans) Seabed 2030 Project.

Reference

Niessen F et al. (2019) Echosounding Training Course (POLMAR-TRAIN). In: Hanfland C and König B (Eds) The Expedition PS116 of the Research Vessel *POLARSTERN* to the Atlantic Ocean in 2018, Berichte zur Polar- und Meeresforschung = Reports on polar and marine research, Bremerhaven, Alfred Wegener Institute for Polar and Marine Research 731:9-14.

APPENDIX

A.1 TEILNEHMENDE INSTITUTE / PARTICIPATING INSTITUTES

A.2 FAHRTTEILNEHMER:INNEN / CRUISE PARTICIPANTS

A.3 SCHIFFSBESATZUNG / SHIP'S CREW

A.4. STATIONSLISTE / STATION LIST

A.1 TEILNEHMENDE INSTITUTE / PARTICIPATING INSTITUTES

Affiliation	Address
CA.MCGILL	McGill University 805 Sherbrooke Street West H3A0B9 Montréal Canada
CA.UALBERTA	University of Alberta 1-26 Earth Sciences Building T6G 2E3 Edmonton Canada
CA.UQAM	Université du Québec à Montréal 201, Avenue du Président-Kennedy Local PK-6150 H2X 3Y7 Montréal Canada
CH.UNIBASEL	Universität Basel Petersplatz 1, P. O. Box 4001 Basel Switzerland
DE.AWI	Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung Postfach 120161 27515 Bremerhaven Germany
DE.DWD	Deutscher Wetterdienst Seewetteramt Bernhard-Nocht-Str. 76 20359 Hamburg Germany
DE.KLARTEXT	KlarText Beratung und Training Herzog-Otto-Straße 43 67105 Schifferstadt Germany
DE.LAEISZ	Reederei F. Laeisz GmbH Bartelstraße 1 27570 Bremerhaven Germany
DE.MARUM	MARUM - Zentrum für Marine Umweltwissenschaften der Universität Bremen Leobener Str. 6 28359 Bremen Germany
DE.UNIBREMEN	Universität Bremen Klagenfurter Straße 2-4 28359 Bremen Germany

A.2 FAHRTTEILNEHMER:INNEN / CRUISE PARTICIPANTS

PS130/1: Punta Arenas – Bremerhaven				
Name/ Last name	**Vorname/ First name**	**Institut/ Institute**	**Beruf/ Profession**	**Fachrichtung/ Discipline**
Dreutter	Simon	DE.AWI	Technician	Bathymetry
Elsaesser	Antje	DE.DWD	Scientist	Meteorology
Erni Cassola e Barata	Gabriel	CH.UNIBASEL	Scientist	Biology
Otte	Frank	DE.DWD	Scientist	Meteorology
Tebben (*)	Jan	DE.AWI	Scientist	Ecological Chemistry
Wenzel	Anna Julia	DE.DWD	Scientist	Meteorology
Werner	Ellen	DE.AWI	Student	Bathymetry

(*) disembarkation in Las Palmas / Spain

PS130/2: Las Palmas – Bremerhaven				
Name/ Last name	**Vorname/ First name**	**Institut/ Institute**	**Beruf/ Profession**	**Fachrichtung/ Discipline**
Betz	Maximilian	DE.AWI	Engineer	Computing and Data Centre
Brand	Caroline	DE.UNI-Bremen	Student	Geosciences
Bukar	Shettima	DE.UNI-Bremen	PhD Student	Geophysics
Chnelewski	Frank-Peter	DE.AWI	Observer	Logistics and Research Platforms
Doshi	Smit Chetan	DE.AWI	PhD Student	Climate Dynamics
Dreutter	Simon	DE.AWI	Technician	Bathymetry
Eggensberger	Lea Anna	DE.UNI-Bremen	Student	Geosciences
Elsaesser	Antje	DE.DWD	Scientist	Meteorology
Erni Cassola e Barata	Gabriel	CH.UNIBASEL	Scientist	Biology
Gille-Petzoldt	Johanna Veronika	DE.AWI	PhD Student	Geophysics
Hanfland	Claudia	DE.AWI	Scientist	Scientific Education
Harrie-Salzmann	Kerstin	DE.AWI	Observer	Logistics and Research Platforms
Immoor	Sebastian	DE.AWI	Technician	Logistics and Research Platforms
Kamb	Guenter	DE.KLARTEXT	Other	Scientific Education
Kordes	Thomas	DE.AWI	Engineer	Logistics and Research Platforms
Kühl	Johannes	DE.AWI	Engineer	Logistics and Research Platforms
Kuhn	Gerhard	DE.AWI	Scientist	Geosciences
Leusch	Maja	DE.UNI-Bremen	Student	Geosciences
Marquis	Oreste	CA.MCGILL	Student	Glaciology

PS130/2: Las Palmas – Bremerhaven				
Name/ Last name	**Vorname/ First name**	**Institut/ Institute**	**Beruf/ Profession**	**Fachrichtung/ Discipline**
Möller	Wilma Apollonia	DE.UNI-Bremen	Student	Other Geosciences
Najjarifarizhendi	Banafsheh	DE.AWI	PhD Student	Geophysics
Niessen	Frank	DE.AWI	Scientist	Geosciences
Otte	Frank	DE.DWD	Scientist	Meteorology
Rahf	Johanna	DE.UNI-Bremen	Student	Geosciences
Rogenhagen	Johannes	DE.LAEISZ	Inspector	Reederei Laeisz
Savard	Antoine	CA.MCGILL	PhD Student	Glaciology
Schmidt	Jan-Niklas	DE.UNI-Bremen	Student	Geophysics
Schwarzbach	Patrick	DE.AWI	Technician	Bathymetry
Siccha Rojas	Michael Georg	DE.MARUM	Scientist	Marine Geology and Palaeontology
Sinnen	Vivian Marissa	DE.AWI	PhD Student	Marine Geology and Palaeontology
Stavrakoudis	Sophia	DE.UNI-Bremen	Student	Marine Geology and Palaeontology
Weiss-Gibbons	Tahya	CA.UALBERTA	Student	Physical Oceanography of Polar Seas
Wenzel	Anna Julia	DE.DWD	Scientist	Meteorology
Werner	Ellen	DE.AWI	Student	Bathymetry
Zarrinderakht	Maryam	CA.UBC	PhD Student	Geophysics
Zumaque	Jena	CA.UQAM	PhD Student	Geosciences

A.3 SCHIFFSBESATZUNG / SHIP'S CREW

PS130/1: Punta Arenas – Bremerhaven	
Name	**Position**
Wunderlich, Thomas Wolf	Master
Kentges, Felix	Chiefmate
Langhinrichs, Jacob	Chiefmate Cargo
Grafe, Jens	Chief
Lange, Felix	2nd Mate
Müller, Andreas	ELO
Goessmann-Lange, Petra	Shops Doc
Brose, Thomas Christian Gerhard	2nd. Eng
Fielder, Alexander	2nd. Eng
Haack, Michael Detlev	2nd. Eng
Redmer, Jens Dirk	ELO
Hüttebräucker, Olaf	ELO
Nasis, Ilias	ELO
Jäger, Vladimir	ELO
Sedlak, Andreas Enrico	Bosun
Neisner,Winfried	Carpen.
Heinstein, Patricia	MP Rat.
Denzer, Florian	MP Rat.
Hoche, Jan	MP Rat.
Meier, Jan	MP Rat.
Mohr, Tassilo Peter	MP Rat.
Wende, Uwe	AB
Baecker, Andreas	AB
Burzan, Gerd-Ekkehard	AB
Preußner, Jörg	Storek.
Schwarz, Uwe	MP Rat.
Hänert, Ove	MP Rat.
Rhau, Lars-Peter	MP Rat.
Klinger, Dana	MP Rat.

PS130/1: Punta Arenas – Bremerhaven	
Name	**Position**
Claasen, Thies	MP Rat.
Marquardt, Geron	Cook
Silinski, Frank	Cooksm.
Martens, Michael	Cooksm.
Pieper, Daniel	Chief Stew.
Silinski, Carmen Viola	2nd Stew.
Krause, Tomasz	2nd Stew.
Dibenau, Torsten	2nd Stew.
Arendt, René	2nd Stew.
Chen, Dansheng	2nd Stew.
Sun,Yongsheng	Laundym.

PS130/2: Las Palmas – Bremerhaven	
Name	**Position**
Wunderlich, Thomas Wolf	Master
Kentges, Felix	Chiefmate
Langhinrichs, Jacob	Chiefmate Cargo
Grafe, Jens	Chief
Lange, Felix	2nd Mate
Müller, Andreas	ELO
Goessmann-Lange, Petra	Shops Doc
Brose, Thomas Christian Gerhard	2nd. Eng
Fielder, Alexander	2nd. Eng
Haack, Michael Detlev	2nd. Eng
Redmer, Jens Dirk	ELO
Frank, Gerhard	ELO
Hüttebräucker, Olaf	ELO
Nasis, Ilias	ELO
Jäger, Vladimir	ELO
Sedlak, Andreas Enrico	Bosun
Neisner, Winfried	Carpen.
Heinstein, Patricia	MP Rat.

PS130/2: Las Palmas – Bremerhaven	
Name	**Position**
Denzer, Florian	MP Rat.
Hoche, Jan	MP Rat.
Meier, Jan	MP Rat.
Mohr, Tassilo Peter	MP Rat.
Wende, Uwe	AB
Baecker, Andreas	AB
Burzan, Gerd-Ekkehard	AB
Preußner, Jörg	Storek.
Schwarz, Uwe	MP Rat.
Hänert, Ove	MP Rat.
Rhau, Lars-Peter	MP Rat.
Klinger, Dana	MP Rat.
Claasen, Thies	MP Rat.
Marquardt, Geron	Cook
Silinski, Frank	Cooksm.
Martens, Michael	Cooksm.
Pieper, Daniel	Chief Stew.
Golla, Gerald	2nd Stew.
Silinski, Carmen Viola	2nd Stew.
Krause, Tomasz	2nd Stew.
Dibenau, Torsten	2nd Stew.
Arendt, René	2nd Stew.
Chen, Dansheng	2nd Stew.
Sun,Yongsheng	Laundym.

A.4 STATIONSLISTEN / STATION LISTS PS130/1 AND PS130/2

Station list of expedition PS130/1 from Punta Arenas – Las Palmas; the list details the action log for all stations along the cruise track.

See https://www.pangaea.de/expeditions/events/PS130/1 and https://www.pangaea.de/expeditions/events/PS130/2 to display the station (event) list for expedition PS130/1 und PS130/2.
This version contains Uniform Resource Identifiers for all sensors listed under https://sensor.awi.de. See https://www.awi.de/en/about-us/service/computing-centre/data-flow-framework.html for further information about AWI's data flow framework from sensor observations to archives (O2A).

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment [cut]
PS130/1-track		2022-04-30T00:00:00	-53.14470	-70.90910		CT	Station start	Punta Arenas – Las Palmas
PS130/1-track		2022-04-30T00:00:00	28.14410	-15.40220		CT	Station end	Punta Arenas – Las Palmas
PS130/1_0_Underway-29		2022-05-02T02:39:34	-47.62048	-60.76516	374.6	MBES	Station start	
PS130/1_0_Underway-29		2022-05-02T02:39:34	24.40349	-20.37300	4004.7	MBES	Station end	
PS130/1_0_Underway-28		2022-05-02T02:50:30	-47.59516	-60.72392	388.0	SWEAS	Station start	
PS130/1_0_Underway-28		2022-05-02T02:50:30	25.59906	-18.55489		SWEAS	Station end	
PS130/1_0_Underway-22		2022-05-02T02:51:06	-47.59372	-60.72162	387.3	SNDVELPR	Station start	
PS130/1_0_Underway-22		2022-05-02T02:51:06	24.40216	-20.37498	4007.0	SNDVELPR	Station end	
PS130/1_0_Underway-14		2022-05-02T02:53:05	-47.58915	-60.71417	401.6	NEUMON	Station start	
PS130/1_0_Underway-14		2022-05-02T02:53:05	24.40073	-20.37732	4007.5	NEUMON	Station end	
PS130/1_0_Underway-12		2022-05-02T02:53:34	-47.58807	-60.71240	401.0	GRAV	Station start	
PS130/1_0_Underway-12		2022-05-02T02:53:34	24.39995	-20.37860	4008	GRAV	Station end	
PS130/1_0_Underway-11		2022-05-02T02:53:55	-47.58723	-60.71102	406.8	MAG	Station start	
PS130/1_0_Underway-11		2022-05-02T02:53:55	24.39944	-20.37942	4005.6	MAG	Station end	
PS130/1_0_Underway-6		2022-05-02T02:55:03	-47.58463	-60.70687	401.5	MYON	Station start	
PS130/1_0_Underway-6		2022-05-02T02:55:03	24.39919	-20.37981	4005.2	MYON	Station end	

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment [cut]
PS130/1_0_Underway-26		2022-05-02T02:57:35	-47.57883	-60.69725	401.3	UWS	Station start	
PS130/1_0_Underway-26		2022-05-02T02:57:35	24.39836	-20.38104	4003.8	UWS	Station end	
PS130/1_0_Underway-25		2022-05-02T02:57:48	-47.57833	-60.69643	402.9	UAS	Station start	
PS130/1_0_Underway-25		2022-05-02T02:57:48	24.39813	-20.38136	4003.8	UAS	Station end	
PS130/1_1-1		2022-05-02T03:04:09	-47.56371	-60.67264	418.3	UWS	Station start	
PS130/1_1-1		2022-05-02T03:04:09	-47.36564	-60.35085	559.3	UWS	Station end	
PS130/1_0_Underway-24		2022-05-02T11:46:06	-46.32587	-58.68222	2344.8	TSG	Station start	
PS130/1_0_Underway-24		2022-05-02T11:46:06	24.39753	-20.38220	4004.1	TSG	Station end	
PS130/1_0_Underway-23		2022-05-02T11:46:26	-46.32515	-58.68100	2345.1	TSG	Station start	
PS130/1_0_Underway-23		2022-05-02T11:46:26	24.39695	-20.38306	4004.8	TSG	Station end	
PS130/1_0_Underway-18		2022-05-02T11:46:49	-46.32424	-58.67947	2344.9	pCO2	Station start	
PS130/1_0_Underway-18		2022-05-02T11:46:49	24.39619	-20.38419	4004.9	pCO2	Station end	
PS130/1_0_Underway-7		2022-05-02T11:47:15	-46.32326	-58.67782	2344.6	FBOX	Station start	
PS130/1_0_Underway-7		2022-05-02T11:47:15	24.39557	-20.38516	4002.8	FBOX	Station end	
PS130/1_0_Underway-2		2022-05-02T11:47:41	-46.32225	-58.67619	2345.8	AFIM	Station start	
PS130/1_0_Underway-2		2022-05-02T11:47:41	24.39458	-20.38669	4001.5	AFIM	Station end	
PS130/1_0_Underway-1		2022-05-02T11:48:00	-46.32152	-58.67502	2347.3	ADCP	Station start	
PS130/1_0_Underway-1		2022-05-02T11:48:00	24.39375	-20.38792	4000.3	ADCP	Station end	
PS130/1_2-1		2022-05-02T15:10:05	-45.84943	-57.92820	3299.3	UWS	Station start	
PS130/1_2-1		2022-05-02T15:10:05	-45.76215	-57.79084	3385.2	UWS	Station end	
PS130/1_3-1		2022-05-03T00:26:17	-44.56806	-55.92087	5309.2	UWS	Station start	
PS130/1_3-1		2022-05-03T00:26:17	-44.48862	-55.79384	5362.2	UWS	Station end	
PS130/1_4-1		2022-05-03T14:14:26	-42.65551	-52.91196	5671.7	UWS	Station start	
PS130/1_4-1		2022-05-03T14:14:26	-42.54764	-52.74501	5656.6	UWS	Station end	
PS130/1_5-1		2022-05-03T16:33:55	-42.34042	-52.42884	5761.0	SNDVELPR	Station start	
PS130/1_5-1		2022-05-03T16:33:55	-42.33787	-52.42168	5653.5	SNDVELPR	Station end	
PS130/1_6-1		2022-05-04T00:58:16	-41.29033	-50.99357	5492.2	UWS	Station start	

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment [cut]
PS130/1_6-1		2022-05-04T00:58:16	-41.16331	-50.83727	5513.0	UWS	Station end	
PS130/1_7-1		2022-05-04T14:31:57	-39.23647	-48.50584	5345.1	UWS	Station start	
PS130/1_7-1		2022-05-04T14:31:57	-39.13953	-48.39026	5324.9	UWS	Station end	
PS130/1_8-1		2022-05-05T01:26:30	-37.70235	-46.69546	5152.3	UWS	Station start	
PS130/1_8-1		2022-05-05T01:26:30	-37.60331	-46.57990	5130.1	UWS	Station end	
PS130/1_9-1		2022-05-05T14:27:25	-35.81537	-44.41084	4864.7	UWS	Station start	
PS130/1_9-1		2022-05-05T14:27:25	-35.73255	-44.30974	4878.6	UWS	Station end	
PS130/1_10-1		2022-05-05T15:01:09	-35.73144	-44.30835	4878.5	UWS	Station start	
PS130/1_10-1		2022-05-05T15:01:09	-35.65991	-44.22114	4885.6	UWS	Station end	
PS130/1_11-1		2022-05-06T02:21:34	-34.18930	-42.44400	4590.7	UWS	Station start	
PS130/1_11-1		2022-05-06T02:21:34	-34.07146	-42.30296	4573.6	UWS	Station end	
PS130/1_12-1		2022-05-06T16:12:19	-32.43061	-40.35972	4257.1	CTD-RO	max depth	
PS130/1_13-1		2022-05-06T17:11:16	-32.40573	-40.33016	4385.1	UWS	Station start	
PS130/1_13-1		2022-05-06T17:11:16	-32.31551	-40.22437	4320.3	UWS	Station end	
PS130/1_14-1		2022-05-07T03:17:41	-30.82424	-38.76376	3933.4	UWS	Station start	
PS130/1_14-1		2022-05-07T03:17:41	-30.70026	-38.70300	3860.8	UWS	Station end	
PS130/1_15-1		2022-05-07T15:34:05	-28.43211	-37.60204	4452.5	UWS	Station start	
PS130/1_15-1		2022-05-07T15:34:05	-28.34172	-37.55701	4530.3	UWS	Station end	
PS130/1_0_Underway-17		2022-05-07T16:27:26	-28.26147	-37.51710	4333.6	pCO2	Station start	
PS130/1_0_Underway-17		2022-05-07T16:27:26	24.39259	-20.38946	4004.2	pCO2	Station end	
PS130/1_16-1		2022-05-08T01:50:14	-26.44217	-36.61964	4349.8	UWS	Station start	
PS130/1_16-1		2022-05-08T01:50:14	-26.31066	-36.55527	4288.3	UWS	Station end	
PS130/1_17-1		2022-05-08T17:27:50	-23.43279	-35.16558	4199.6	UWS	Station start	
PS130/1_17-1		2022-05-08T17:27:50	-23.34292	-35.12267	4209.7	UWS	Station end	
PS130/1_18-1		2022-05-08T17:59:54	-23.34164	-35.12203	4211.3	UWS	Station start	
PS130/1_18-1		2022-05-08T17:59:54	-23.22923	-35.06848	4231.1	UWS	Station end	
PS130/1_19-1		2022-05-09T07:29:23	-20.98439	-34.16281	1991.0	UWS	Station start	

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment [cut]
PS130/1_19-1		2022-05-09T07:29:23	-21.01780	-34.19032	294.4	UWS	Station end	
PS130/1_20-1		2022-05-09T16:02:36	-19.77123	-33.60520	4182.2	CTD-RO	max depth	
PS130/1_21-1		2022-05-09T23:18:24	-18.58160	-33.09977	4332.6	UWS	Station start	
PS130/1_21-1		2022-05-09T23:18:24	-18.45862	-33.04713	4364.1	UWS	Station end	
PS130/1_22-1		2022-05-10T09:16:22	-16.80545	-32.34464	4621.5	UWS	Station start	
PS130/1_22-1		2022-05-10T09:16:22	-16.72467	-32.30789	4613.1	UWS	Station end	
PS130/1_23-1		2022-05-10T22:40:48	-15.31749	-31.71737	4713.2	UWS	Station start	
PS130/1_23-1		2022-05-10T22:40:48	-15.20803	-31.67136	4719.6	UWS	Station end	
PS130/1_24-1		2022-05-11T15:34:30	-12.40234	-30.50050	5402.5	UWS	Station start	
PS130/1_24-1		2022-05-11T15:34:30	-12.28631	-30.45230	5387.3	UWS	Station end	
PS130/1_25-1		2022-05-11T23:21:27	-10.96747	-29.90685	5398.5	UWS	Station start	
PS130/1_25-1		2022-05-11T23:21:27	-10.86327	-29.86384	5400.3	UWS	Station end	
PS130/1_26-1		2022-05-12T15:08:48	-8.50562	-28.89447	5506.7	CTD-RO	max depth	
PS130/1_27-1		2022-05-12T18:02:41	-8.12309	-28.74234	5540.8	UWS	Station start	
PS130/1_27-1		2022-05-12T18:02:41	-8.00248	-28.69326	5551.2	UWS	Station end	
PS130/1_28-1		2022-05-13T03:41:11	-6.34189	-28.01907	5637.0	UWS	Station start	
PS130/1_28-1		2022-05-13T03:41:11	-6.23987	-27.97774	5646.8	UWS	Station end	
PS130/1_29-1		2022-05-13T23:43:32	-2.53654	-26.48159	5518.1	UWS	Station start	
PS130/1_29-1		2022-05-13T23:43:32	-2.45525	-26.44879	5402.1	UWS	Station end	
PS130/1_30-1		2022-05-14T17:50:21	0.46552	-25.37369	2523.5	UWS	Station start	
PS130/1_30-1		2022-05-14T17:50:21	0.56791	-25.34701	4280.3	UWS	Station end	
PS130/1_31-1		2022-05-15T14:03:55	3.79222	-24.50046	4099.6	CTD-RO	max depth	
PS130/1_32-1		2022-05-17T09:57:34	10.82132	-22.67325	5154.0	CTD-RO	max depth	
PS130/1_33-1		2022-05-19T16:13:02	19.84251	-21.30902	3702.3	CTD-RO	max depth	
PS130/1_34-1		2022-05-20T16:27:36	23.70008	-20.65658	4149.6	CTD-RO	max depth	

** Comments are limited to 130 characters. See https://www.pangaea.de/expeditions/events/PS130/1 to show full comments in conjunction with the station (event) list for expedition PS130/1*

Abbreviation	Method/Device
ADCP	Acoustic Doppler Current Profiler
AFIM	AutoFim
CT	Underway cruise track measurements
CTD-RO	CTD/Rosette
FBOX	FerryBox
GRAV	Gravimetry
MAG	Magnetometer
MBES	Multibeam echosounder
MYON	DESY Myon Detector
NEUMON	Neutron monitor
SNDVELPR	Sound velocity probe
SWEAS	Ship Weather Station
TSG	Thermosalinograph
UAS	Underway air sampling
UWS	Underway water sampling
pCO2	pCO2 sensor

Station list of expedition PS130/2 from Las Palmas – Bremerhaven; the list details the action log for all stations along the cruise track.

See https://www.pangaea.de/expeditions/events/PS130/2 to display the station (event) list for expedition PS130/2.
This version contains Uniform Resource Identifiers for all sensors listed under https://sensor.awi.de. See https://www.awi.de/en/about-us/service/computing-centre/data-flow-framework.html for further information about AWI's data flow framework from sensor observations to archives (O2A).

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment [cut]
PS130/2-track		2022-05-22T00:00:00	28.1441	-15.4022		CT	Station start	Las Palmas – Bremerhaven
PS130/2-track		2022-05-22T00:00:00	53.5675	8.5548		CT	Station end	Las Palmas – Bremerhaven
PS130/2_0_Underway-28		2022-05-23T00:38:14	29.97212	-14.64466		SWEAS	Station start	
PS130/2_0_Underway-28		2022-05-23T00:38:14	51.20839	1.80646	29.7	SWEAS	Station end	
PS130/2_0_Underway-20		2022-05-23T05:41:16	31.05593	-14.28467		PS	Station start	
PS130/2_0_Underway-20		2022-05-23T05:41:16	41.78544	-10.19733	3002.2	PS	Station end	
PS130/2_0_Underway-13		2022-05-23T05:42:15	31.05962	-14.28336		MBES	Station start	
PS130/2_0_Underway-13		2022-05-23T05:42:15	41.78465	-10.19767	3001.4	MBES	Station end	
PS130/2_0_Underway-22		2022-05-23T05:43:45	31.06511	-14.28133	3183.8	SNDVELPR	Station start	
PS130/2_0_Underway-22		2022-05-23T05:43:45	41.78371	-10.19808	3002.0	SNDVELPR	Station end	
PS130/2_0_Underway-12		2022-05-23T05:45:03	31.06986	-14.2796	3187	GRAV	Station start	
PS130/2_0_Underway-12		2022-05-23T05:45:03	41.78214	-10.19876	3000.6	GRAV	Station end	
PS130/2_0_Underway-11		2022-05-23T05:45:30	31.0715	-14.279	3185.4	MAG	Station start	
PS130/2_0_Underway-11		2022-05-23T05:45:30	41.78131	-10.19913	3005.6	MAG	Station end	
PS130/2_0_Underway-24		2022-05-23T07:44:14	31.50387	-14.11281	3924.3	TSG	Station start	
PS130/2_0_Underway-24		2022-05-23T07:44:14	41.78069	-10.1994	3006.4	TSG	Station end	
PS130/2_0_Underway-23		2022-05-23T07:44:37	31.50531	-14.11222	3925.9	TSG	Station start	

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment [cut]
PS130/2_0_Underway-23		2022-05-23T07:44:37	41.7793	-10.20004	3006.7	TSG	Station end	
PS130/2_0_Underway-18		2022-05-23T07:45:17	31.50764	-14.11126	3921.2	pCO2	Station start	
PS130/2_0_Underway-18		2022-05-23T07:45:17	41.77847	-10.2004	3008.6	pCO2	Station end	
PS130/2_0_Underway-17		2022-05-23T07:45:36	31.50878	-14.1108	3922.2	pCO2	Station start	
PS130/2_0_Underway-17		2022-05-23T07:45:36	41.77675	-10.20111	3009	pCO2	Station end	
PS130/2_0_Underway-7		2022-05-23T07:47:36	31.51604	-14.10787	3938.7	FBOX	Station start	
PS130/2_0_Underway-7		2022-05-23T07:47:36	41.77565	-10.20155	3011.9	FBOX	Station end	
PS130/2_0_Underway-2		2022-05-23T07:48:00	31.51743	-14.10735	3939.6	AFIM	Station start	
PS130/2_0_Underway-2		2022-05-23T07:48:00	41.77404	-10.20221	3012.3	AFIM	Station end	
PS130/2_0_Underway-1		2022-05-23T07:48:20	31.51863	-14.1069	3940.4	ADCP	Station start	
PS130/2_0_Underway-1		2022-05-23T07:48:20	41.773	-10.20262	3013.9	ADCP	Station end	
PS130/2_0_Underway-6		2022-05-23T10:01:49	31.99194	-13.91116	4211.1	MYON	Station start	
PS130/2_0_Underway-6		2022-05-23T10:01:49	41.77191	-10.20306	3014.7	MYON	Station end	
PS130/2_35-1		2022-05-24T00:49:11	34.74989	-12.70549	4446.2	CTD-RO	max depth	
PS130/2_0_Underway-29		2022-05-26T17:32:43	46.05525	-7.50103	4799.9	ADCP	Station start	
PS130/2_0_Underway-29		2022-05-26T17:32:43	51.20839	1.80646	29.7	ADCP	Station end	
PS130/2_0_Underway-30		2022-05-26T17:33:37	46.05794	-7.49912	4797.6	FBOX	Station start	
PS130/2_0_Underway-30		2022-05-26T17:33:37	51.20749	1.80508	29.9	FBOX	Station end	
PS130/2_0_Underway-31		2022-05-26T17:34:38	46.06093	-7.49681	4798.6	MBES	Station start	
PS130/2_0_Underway-31		2022-05-26T17:34:38	50.024	-1.75095	75.5	MBES	Station end	
PS130/2_0_Underway-32		2022-05-26T17:35:17	46.06287	-7.49522	4797.1	PS	Station start	
PS130/2_0_Underway-32		2022-05-26T17:35:17	51.12855	1.70311		PS	Station end	
PS130/2_0_Underway-33		2022-05-26T17:35:51	46.06448	-7.49392	4791.7	pCO2	Station start	
PS130/2_0_Underway-33		2022-05-26T17:35:51	51.20656	1.80362	30.0	pCO2	Station end	
PS130/2_0_Underway-34		2022-05-26T17:36:27	46.06625	-7.49255	4795.8	GRAV	Station start	
PS130/2_0_Underway-34		2022-05-26T17:36:27	51.20561	1.80207	29.6	GRAV	Station end	
PS130/2_0_Underway-35		2022-05-26T17:36:58	46.06784	-7.49137	4795.1	MAG	Station start	

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment [cut]
PS130/2_0_Underway-35		2022-05-26T17:36:58	51.2047	1.80058	29.4	MAG	Station end	
PS130/2_0_Underway-36		2022-05-26T17:37:24	46.06914	-7.49042	4793.6	SNDVELPR	Station start	
PS130/2_0_Underway-36		2022-05-26T17:37:24	51.20355	1.79871	29.4	SNDVELPR	Station end	
PS130/2_0_Underway-37		2022-05-26T17:38:39	46.07284	-7.48764	4791.6	TSG	Station start	
PS130/2_0_Underway-37		2022-05-26T17:38:39	51.20289	1.79762	29.5	TSG	Station end	
PS130/2_0_Underway-38		2022-05-26T17:39:12	46.07439	-7.48636	4793.4	TSG	Station start	
PS130/2_0_Underway-38		2022-05-26T17:39:12	51.20177	1.79585	29.6	TSG	Station end	
PS130/2_0_Underway-39		2022-05-26T17:39:53	46.07636	-7.48475	4791.5	pCO2	Station start	
PS130/2_0_Underway-39		2022-05-26T17:39:53	51.20092	1.79457	29.6	pCO2	Station end	
PS130/2_0_Underway-40		2022-05-26T17:40:32	46.07826	-7.48328	4792.3	MYON	Station start	
PS130/2_0_Underway-40		2022-05-26T17:40:32	51.20002	1.79326	29	MYON	Station end	

** Comments are limited to 130 characters. See https://www.pangaea.de/expeditions/events/PS130/2 to show full comments in conjunction with the station (event) list for expedition PS130/2*

Abbreviation	Method/Device
ADCP	Acoustic Doppler Current Profiler
AFIM	AutoFim
CT	Underway cruise track measurements
CTD-RO	CTD/Rosette
FBOX	FerryBox
GRAV	Gravimetry
MAG	Magnetometer
MBES	Multibeam echosounder
MYON	DESY Myon Detector
PS	ParaSound
SNDVELPR	Sound velocity probe
SWEAS	Ship Weather Station
TSG	Thermosalinograph
pCO2	pCO2 sensor

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