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The Expeditions PS145/1 and PS145/2 of the Research Vessel POLARSTERN to the Atlantic Ocean in 2024

Edited by

Claudia Hanfland and Natalie Cornish
with contributions of the participants

HELMHOLTZ

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Herausgeber
Dr. Horst Bornemann

Redaktionelle Bearbeitung und Layout
Susan Amir Sawadkuhi

Editor
Dr. Horst Bornemann

Editorial editing and layout
Susan Amir Sawadkuhi

Alfred-Wegener-Institut
Helmholtz-Zentrum für Polar- und Meeresforschung
Am Handelshafen 12
27570 Bremerhaven
Germany

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Alfred-Wegener-Institut
Helmholtz-Zentrum für Polar- und Meeresforschung
Am Handelshafen 12
27570 Bremerhaven
Germany

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Titel: Gruppenarbeit während des POLMAR Hydroakustik Kurses an Bord von Polarstern
(Foto: Tabea Altenbernd-Lang, AWI)

Cover: Group work during the POLMAR hydroacoustics course on Polarstern
(Photo: Tabea Altenbernd-Lang, AWI)

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PS145/1 and PS145/2

24 November 2024 – 21 December 2024

Bremerhaven – Walvis Bay

Chief scientists
Claudia Hanfland
(PS145/1 Bremerhaven – Las Palmas)

Natalie Cornish
(PS145/2 Las Palmas – Walvis Bay)

Coordinator
Ingo Schewe

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1. ÜBERBLICK UND EXPEDITIONSVERLAUF

Claudia Hanfland, Natalie Cornish DE.AWI

Der Fahrtabschnitt PS145 war der erste Fahrtabschnitt der antarktischen Forschungssaison 2024/25 und diente der Überführung des Schiffes nach Walvis Bay, Namibia. Die Expedition PS145 startete in Bremerhaven am 24.11.2024 und endete am 21.12.2024 in Walvis Bay (Abb. 1.1). Am 25.11.2024 abends erfolgte ein kurzer Zwischenstopp in Rotterdam zum Bunkern. Am 05.12.2024 erfolgte bei einem Zwischenstopp in Las Palmas, Spanien, ein Wechsel der Teams an Bord. Somit startete mit Auslaufen aus Las Palmas der Fahrtabschnitt PS145/2. Während des gesamten Expedition PS145 wurde eine bathymetrische Vermessung des Meeresbodens mit den schiffseigenen hydroakustischen Systemen durchgeführt. Ausgenommen hiervon waren designierte Regionen ohne gültige Forschungserlaubnis. Die Kalibration der hydroakustischen Systeme erfolgte durch den regelmäßigen Einsatz der schiffseigenen CTD.

Während des Abschnitts PS145/1 fanden folgende Tätigkeiten statt:

- Tägliche Wetterbeobachtungen und -vorhersagen durch den Deutschen Wetterdienst.
- Reparatur- und Prüfarbeiten durch die Schiffslogistik und die Reederei Laeisz.
- Trainingskurs POLMAR-TRAIN: Masterstudent:innen der Universitäten Bremen und Potsdam (jeweils Fachbereich Geowissenschaften) sowie Doktorand:innen des AWI wurden ausgebildet in geophysikalischen Methoden an den hydroakustischen Messsystemen. Neben den bathymetrischen Vermessungen mit dem Fächerecholot Hydrosweep studierte die Gruppe den Sedimentaufbau der oberen Schichten des Meeresbodens mit dem parametrischen Sedimentecholot Parasound.

Die Teilnehmer:innen aller genannten drei Gruppen gingen in Las Palmas von Bord. Dort stiegen Mitglieder des Neubauprojekts *Polarstern II* auf zum besseren Kennenlernen des Schiffes.

SUMMARY AND ITINERARY

Expedition PS145 was the first leg of the 2024/25 Antarctic research season and served primarily to transfer the ship to Walvis Bay, Namibia. The expedition began on 24 November 2024 in Bremerhaven and ended on 21 December 2024 in Walvis Bay (Fig. 1.1). A short layover to bunker fuel in Rotterdam took place on the evening of 25 November 2024. The layover in Las Palmas, Spain, on 5 December 2024 allowed for a change in personnel on board. As such, the second leg of the cruise (PS145/2) began as participants disembarked in Las Palmas. Bathymetric surveying was carried out *en route*, for the full duration of PS145, with the exception of regions where no research permit was granted. The data collected was acquired using *Polarstern*'s hydroacoustic equipment, which was calibrated by sound velocity profiles derived from regular deployments of the ship's CTD.

The following activities took place during PS145/1:

- Daily weather observations and predicitons provided by the German Weather Service.
- Repairs and inspections carried out by ship logistics and Laeisz shipping company employees.
- POLMAR-TRAIN: master's students from the University of Bremen and the University of Potsdam (Department of Geosciences, respectively), as well as AWI doctoral candidates were trained in hydroacoustic theory and hands-on data collection, using the hydroacoustic equipment on board. In addition to the bathymetric measurements acquired with the Hydrosweep multibeam echosounder, the group studied the sedimentology of the upper layers of the seabed, using the Parasound parametric sub-bottom profiler.

Participants of all three of the groups listed above disembarked in Las Palmas, while members of the *Polarstern II* ship building team embarked to familiarize themselves with the ship.

Abb. 1.1: Fahrtverlauf der Expeditionen PS145/1 und PS145/2. Siehe https://doi.pangaea.de/10.1594/PANGAEA.975212 und https://doi.pangaea.de/10.1594/PANGAEA.975265 für eine Darstellung des Master tracks in Verbindung mit der Stationsliste für PS145/1 und 145/2.

Fig. 1.1: Cruise track of expeditions PS145/1 und PS145/2. See https://doi.pangaea.de/10.1594/PANGAEA.975212 and https://doi.pangaea.de/10.1594/PANGAEA.975265 to display the master track in conjunction with the station list for PS145/1 and 145/2.

WEATHER CONDITIONS DURING PS145/1

Patrick Suter DE.DWD

Bremerhaven – Rotterdam

Polarstern started from Bremerhaven on the evening of 24 November 2024. On the morning of 26 November, the ship reached Rotterdam to refuel.

During the voyage through the southern North Sea, a cold front moved eastwards across the cruising area from a storm over Scotland on 25 November 2024. The strong current, initially from the south, later southwest to west, blew most of the time with 7 to 8 Bft, in gusts at times with gale force (9 Bft). Due to the proximity to the coast and the offshore wind, the waves only reached 2 to 2.5 m. The cold front brought nimbostratus clouds and rain in the morning. The clouds behind the front cleared by the evening. The low moved towards Norway and was followed by an intermediate high-pressure ridge from the nearby Atlantic. As a result, light winds and, apart from showers in the surrounding area, partly sunny conditions prevailled on 26 November in Rotterdam.

Rotterdam – Las Palmas

After refueling, *Polarstern* left Rotterdam for the English Channel on the morning of 27 November 2024. In doing so, it crossed the path of a low that was developing into a storm. Over the course of the day, this low moved from the south-west through the English Channel to the north-east. On the downstream area of the low, the wind blew from southerly directions and quickly increased to 8 to 9 Bft over the sea. The maximum measured 10-minute average wind speed was 42 kt (9 Bft), with gust peaks of up to 50.5 kt (10 Bft). The low was accompanied by a textbook-like warm- anwd cold frontal passage. With the cold front, the wind shifted to north-west by the afternoon and decreased rapidly again by the evening. The sea rose to 3 m by midday and receded significantly in the Strait of Dover in the evening.

From 28 November 2024, a high-pressure system moved from the British Isles to Central Europe and connected to another high-pressure zone over Spain and Morocco. At the same time, a large low-pressure zone persisted over the central North Atlantic. A current of mostly 5 to 6 Bft from southerly directions developed between the described pressure systems at the exit of the English Channel and in the Bay of Biscay. On reaching the Bay of Biscay, the swell, coming from the Atlantic, increased to around 3 m. In addition, two weakly active cold fronts on 29 November and again in the early evening of 30 November 2024 brought some showers and, with relatively high humidity, it was misty at times during this period.

On 1 December 2024, *Polarstern* was moving west of Portugal. Just south of this, a surface trough moved southwards. With low air pressure contrasts, the current decreased to 3 to 4 Bft and turned clockwise to north with the approach of a high-pressure system near the Azores. In the meantime, the swell had lost height and still reached around 1.5 m.

The Azores High then took over and by 3 December 2024 the surface trough had also dissipated. On the eastern flank of the high, the current blew from north-east on 2 and 3 December with 4 to 5 Bft. The air was slightly unstable in the lower layers and, in addition to fairly sunny conditions, weak showers repeatedly formed from the cumulus clouds in the vicinity of the ship. On 4 December 2024, the north-easterly to easterly flow gained slightly in strength before decreasing again on reaching Las Palmas on the morning of 5 December 2024. This marked the end of the PS145/1 section.

2. POLMAR-TRAIN

Tabea Altenbernd-Lang[1], Abril Amezcua Montiel[1], Bernhard Diekmann[1], Simon Dreutter[1], Alessandro Gagliardi[1], Janina Güntzel[1], Claudia Hanfland[1], Amelia Hine[1], Tea Isler[1], Timo Krause[1], Lingyan Luo[1], Fernanda Oliveira Matos[1], Kathrin Riemann-Campe[1], Diren Senger[1], Alexander Thorneloe[1], Estella Weigelt[1], Lara Eberlin[2], Lea Tabea Antonia Fuchs[2], Enowyeket Enow Provindence[2], Lasse Johannes Schopen[2], Rohith Thulaseedhar an Nair Seema Nair[2], Mai-Britt Berghöfer[3], Ludovica Martina Gatti[3], Sophia Künzig[3], Kilian Theo Lenz[3], Jakob Terschlüsen[3]

[1]DE.AWI
[2]DE.UNI-Bremen
[3]DE.UNI-Potsdam

Grant-No. AWI_PS145_01

Objectives

POLMAR-TRAIN is a training course which was jointly run by the AWI-based Helmholtz Graduate School for Polar and Marine Research (POLMAR) and the Department of Geosciences of the University of Bremen and the Faculty of Science of the University of Potsdam. It contributes to the programme “Master of Sciences Marine Geosciences” at the University of Bremen, to the International Master programme “Climate, Earth, Water, Sustainability” (CLEWS) at the University of Potsdam as well as to the scientific programme of the Helmholtz Graduate School POLMAR. All programmes involve (ship-based) field-work for students and doctoral candidates. Furthermore, this training represents a perfect opportunity to train future student assistants for forthcoming marine expeditions in hydro-acoustic operations.

The purpose of POLMAR-TRAIN 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 was to promote peer-learning by combining master students and doctoral candidates in this course. In addition, we provided knowledge and literature about the geological provinces, their near-surface marine geology and the ocean hydrography along the cruise track.

Thus, the objectives of the work at sea are threefold: participants were expected to

1. learn to operate the echosounding systems during 24/7 shifts,
2. store, process, retrieve 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 marine geology along the cruise track.

The geophysical training was complemented by

1. a primer to sedimentology, enabling students to identify typical marine sediments under the microscope
2. lectures and practicals on working with QGIS
3. lectures and practicals on finding, retrieving, preparing and submitting data from and to the World Data Center PANGAEA Data Publisher for Earth & Environmental Science

Work at sea

Participants of the training were first introduced to the principles of Parasound and Hydrosweep, followed by hands-on introduction to hardware and software of both systems. After this basic introduction, the participants were able to operate the systems independently in pairs of two during their watches. Further general lectures focussed on the marine geology along the route track from the English Channel to the Canary Islands.

In a next step, working-group topics were assigned, which had to be worked on in small groups during the course of the voyage. All groups prepared a geological overview of a selected region along the route, presented characteristic data and provided a short summary of the geology. The five regions are summarised below.

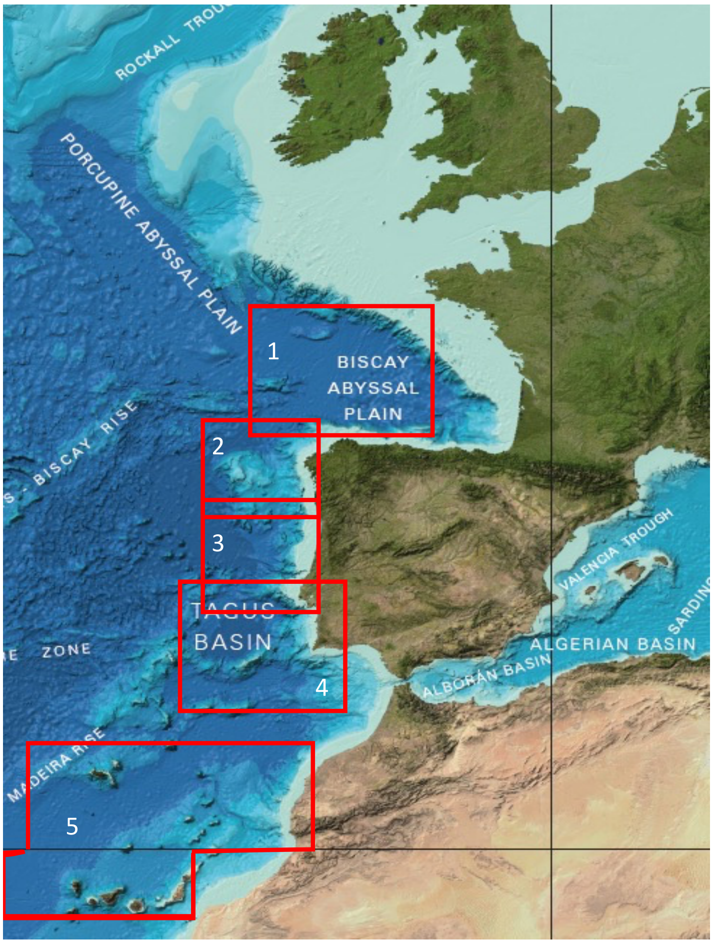

Fig. 2.1: Overview of the work regions along the the cruise track:
(1) European shelf-slope system and Bay of Biscay; (2): Galicia Bank; (3): Iberian Margin;
(4): Plate Boundary in the Cadiz Basin; (5): Agadir Canyon

From the shelf-slope area of Brittany into the Biskay Abyssal Plain of the Bay of Biscay

The continental slope area of Brittany marks the transition from the shallow continental shelf to the deep-sea. It has been heavily influenced by past glacial-interglacial cycles (e.g. Mojtahid et al. 2005) as well as tidal dynamics (Franzetti et al. 2013). Here, we report on some of the preliminary findings within the acquired data (high-resolution bathymetry and sediment structure) as well as their interpretation that the authors worked on during PS145/1 using the Hydrosweep MBES and Parasound sub-bottom profiler.

The sub-bottom profile at the end of the English Channel and on the continental shelf of Brittany is characterized by paleo meltwater channels of Quarternary age cutting into Cenozoic and Mesozoic strata (Paquet et al. 2023). Although it was not possible to date the traversed substratum precisely without taking a sediment core, many different sediment layers were detectable using the Parasound profiler (Fig. 2.2).

One of the main features observed from the western part of the English Channel to the very end of the continental shelf are large dunes and dune fields (Fig. 2.2). Submarine dunes are sandy bedforms formed by the interplay of tidal and wind forcing, that develop perpendicular to the main direction of the prevailing current (Franzetti et al. 2013). The dunes observed along the track have very different sizes, shapes, and degrees of symmetry, with partly regular and partly irregular distribution. Recurring bathymetric surveys would allow analysis of dune migration. Typical propagation speeds are expected to range from several meters up to 70 m per year in the direction of the residual current (Belleney et al. 2022). However, due to the shallow waters (~150 m) and assuming a swath angle of (2 x 60°), a strip of seafloor only ~500 m wide can be mapped along the track. An analysis of dune migration would therefore require recurring surveys along very similar cruise tracks, consequently reducing the area mapped by high-resolution bathymetry in the deeper sections to the south-west.

Moving on, the continental slope, as part of the Armorican Margin, is characterized by a network of spurs and canyons organized into submarine drainage basins (Mulder et al. 2012). Along our cruise track we observe slopes of 10%-15% (large-scale average over the ~30 km where sea floor depth changes from ~170 m to 4,000 m). Turbiditic activity along this slope has been influenced by sea-level fluctuations during the last climatic cycles, primarily through the seaward transfer of subglacial material from the Manche Paleoriver (Toucanne et al. 2008). These inputs are linked to the development of channel-levee systems, which extend to the abyssal plain at depths of 4,100 to 4,650 m (Zaragosi et al. 2001). Figure 2.3 shows an example of an observed channel-levee system. Subparallel, continuous sediment layers tilting onto the old channel floor indicate deposition from turbidity flows and currents, while the highest channel velocity has migrated southwards, eroding a moat at the outer bank. Repeated episodes of overbank flows may have supported the build-up of the levees, and the lateral stepping could have been enhanced due to overlying currents running downslope.

Following the track into the abyssal plain, the channel-levee systems are replaced by major lobes, marking a shift in sedimentary processes in the deep ocean (Zaragosi et al. 2001). Data from the sub-bottom profiler support this, showing an interplay of mass transport deposits, turbidity flows, and ocean floor sedimentation. Extensive continuous and parallel sediment layers, indicating pelagic or hemipelagic sedimentation possibly resulting from turbidity flows, are interrupted by well-mixed sediments from mass transport deposits. However, a single data track does not provide information about the extent of the features, and sediment cores would be needed to gather further information regarding sorting and timescales of sedimentation.

Overall, the data acquired during PS145/1 extends the data coverage in this area. Through systematic shifts in the cruise track during past Antarctic transits, a wide section (~75 km to ~90 km) of the continental slope and abyssal plain of Biscay is now mapped by high-resolution bathymetry data with a reasonably high degree of coverage.

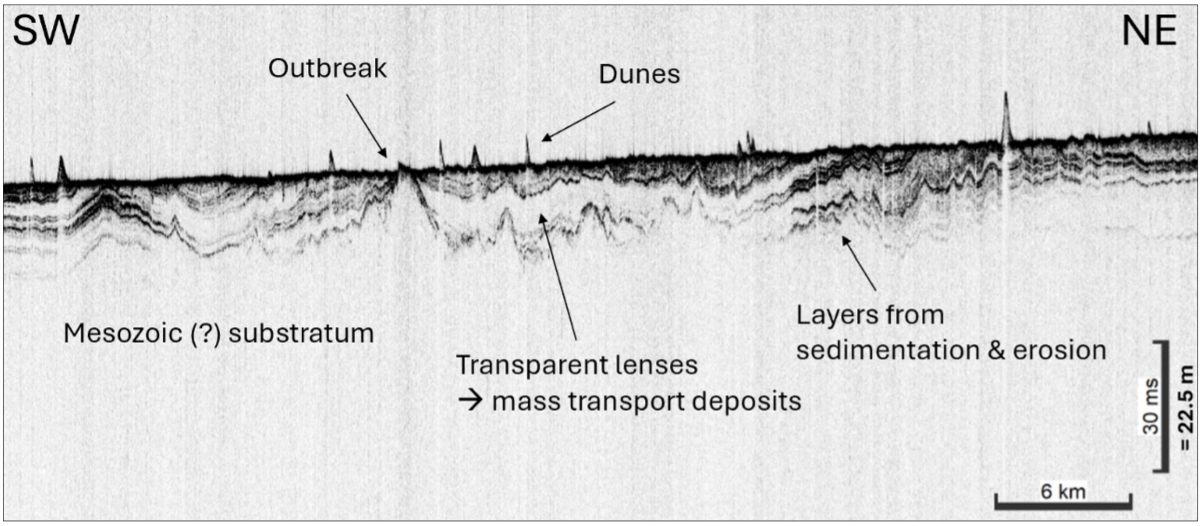

Fig. 2.2: Continental shelf of Brittany (depth ~100 m in the Northeast and ~110 m in the Southwest) with dunes and sub-bottom profile

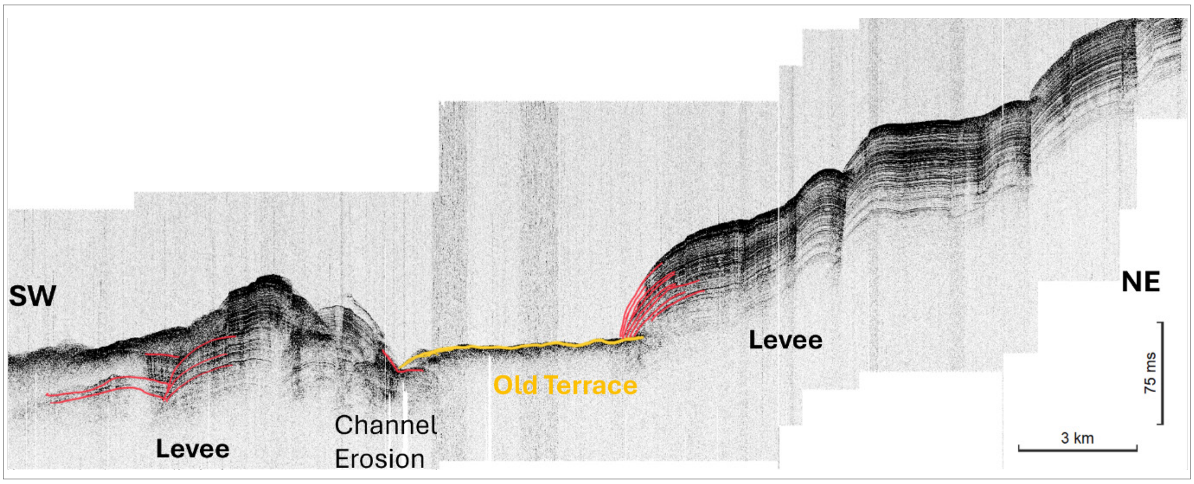

Fig. 2.3: Channel Levee System with channel floor at around 4,500 m depth

Galicia Bank: Contourites and Tectonic Features

The Galicia Bank is a NW-SE trending seamount located in the distal domain of the western Galician continental margin, approximately 200 km from the Iberian coast. It is bound by the Biscay and Iberian Abyssal Plains to the north and west (Fig. 2.4). This region is a non-volcanic passive margin and composed of multiple morphostructural provinces. The complex structure is the result of multi-phase rifting during the late Mesozoic followed by compression during the Cenozoic. (Ercilla et al. 2011).

Prior to the breakup of the Pangea supercontinent, the Galicia bank was part of the Iberian plate, forming the western edge of Eurasian Plate. Rifting between the North American plate and the Eurasian Plate led to significant crust thinning in the Galicia Bank region, resulting in the development of extensive half-graben, graben, and horst structures. Oceanic crust started forming in the early Cretaceous when the North American Plate and Iberian Plate were fully separated. Rifting stopped during the Mid-Cretaceous, and a compression stage driven by the northern convergence of the Iberian Plate and the southward subduction of the Bay of Biscay oceanic crust. During this time, many pre-existing faults were reactivated, leading to the formation of present-day morphology. (Ercilla et al. 2008)

The Galicia Bank region receives little terrigenous sediment input due to its distance from the coast. However, the presence of widespread seamounts of various sizes interferes with water mass dynamics, creating a unique sedimentation environment that favors the deposition of contourites. Contourites are fine-grained sediments re-deposited by the bottom contour currents parallel to seamounts. Therefore, contourites can be valuable indicators of paleo-oceanographic conditions.

During the Late Miocene, contourites and debrites were most extensively deposited around the Galicia Bank. The Pliocene-Quaternary sequences are dominated by a combination of turbidites, debrites, contourites and (hemi-)pelagites. The contourite sedimentary system at the Galicia Bank is mostly influenced by multiple water masses, the most important one being the Mediterranean Outflow Water (MOW) (Ercilla et. al. 2011).

The MOW, originating from the deep outflow of the Mediterranean Sea through the Strait of Gibraltar, flows at depths of 1,500 to 1,600 m with velocities of 5-10 cm/s, influenced by seafloor features. Near 42°N, the MOW splits into two branches: one west of the Galicia Bank and the other north along the Iberian continental slope. A little deeper than the MOW, the Labrador Sea Water (LSW) flows southward at depths of around 1,800 m through the Galicia Interior basin. Below LSW, the North Atlantic Deep Water (NADW) flows northward at depths of about 2,500-3,000 m. A Lower Deep Water flows northward near the bottom at about 4,000 m. Due to the complex distribution and influence of different water masses, the sedimentation trend and pattern vary significantly around the Galicia Bank, especially near topographic highs.

A total of seven sedimentary features were identified from our sub-bottom profiles across the Galicia Bank Region. Here we present two examples. To the north-east of the Savoye Seamount, a contourite drift is identified, characterized by northward migration of the depocenter in its lower section. This drift is subsequently modified by the development of a channel, as evidenced by the presence of an erosional surface and toplap reflections beneath (Fig. 2.5).

A U-shaped constructive furrow is observed downslope to the south of the Sancho Seamount, appearing as depressions roughly parallel to the bathymetric contours. Sedimentation patterns reveal two distinct channels, and their positions suggest possible migration of the depocenter over time (Fig. 2.6).

Other sedimentary features such as sediment waves and channel levee are also identified in our dataset of the Galicia Bank region. Figure 2.7 shows the location of all the identified features and our interpretation of the current flow directions. From the different depths at which the features are located, we infer that the sedimentation patterns are influenced by different water masses, and thus local trends of sediment transport were formed when the water masses meet the morphological obstacles.

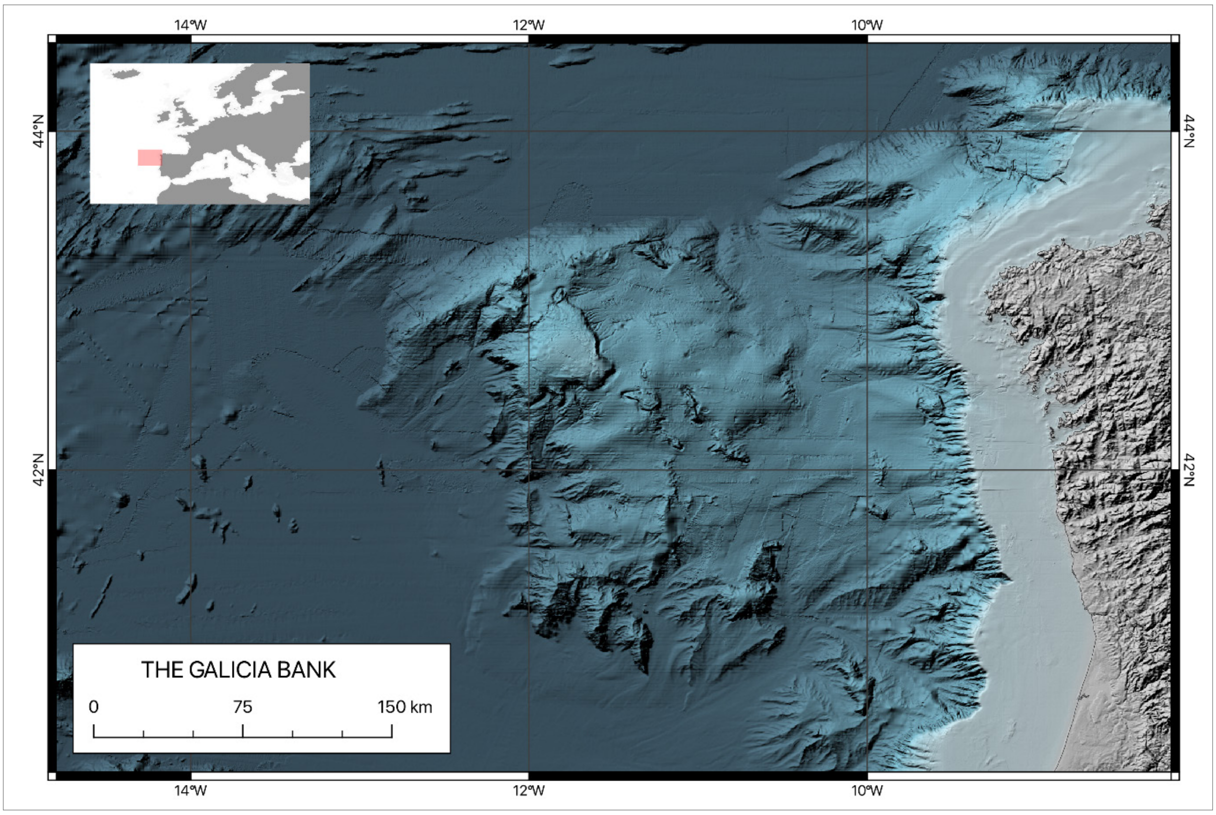

Fig. 2.4: Galicia Bank seamount location. Data represents bathymetry obtained from GEBCO Compilation Group (2024) GEBCO 2024 Grid, using a WGS84 coordinate system.

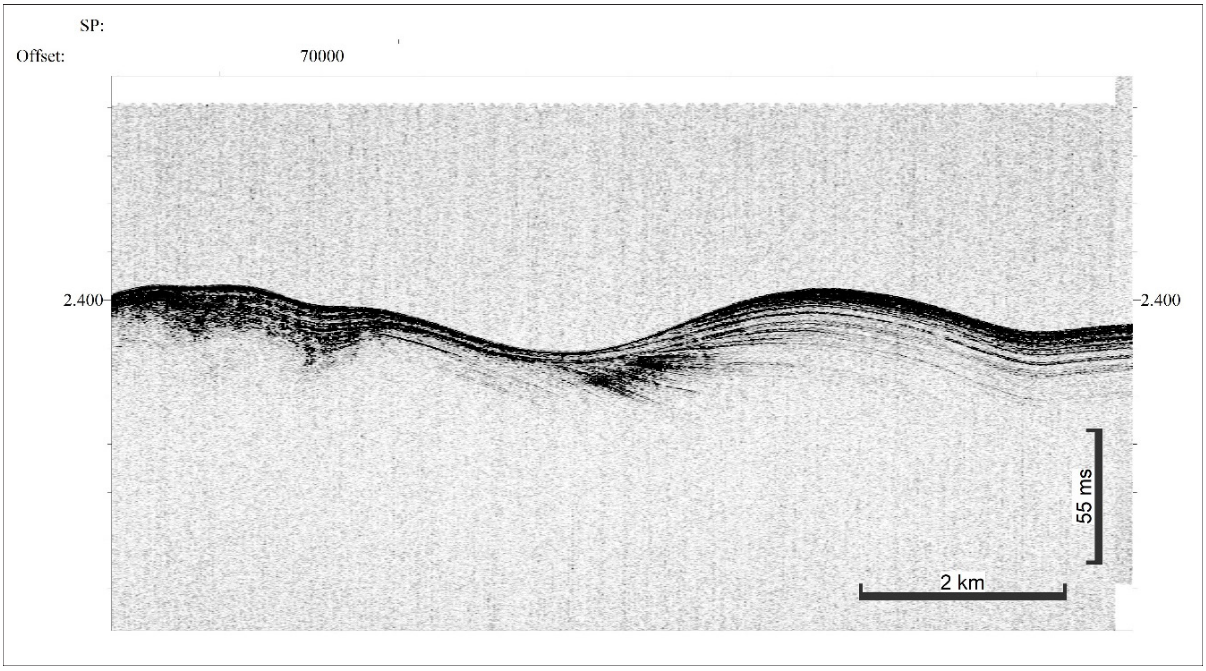

Fig. 2.5: Parasound profile from the Galicia Bank along a transect at 42.35 N, 10.99 W to 42.40 N, 10.97 W. Data acquired using the Parasound P70 system aboard Polarstern in November 2018. Horizontal and vertical scales are 2 km and 55 ms, respectively).

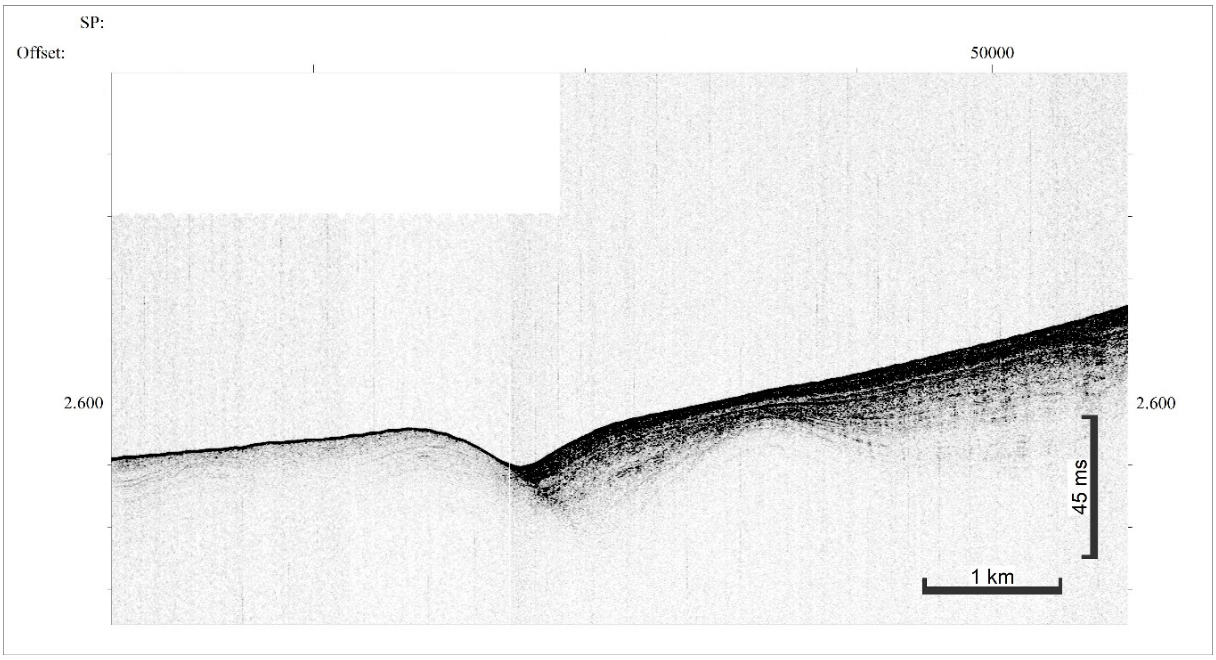

Fig 2.6: Parasound profile from the Galicia Bank along a transect at 42.23 N, 11.47 W to 42.28 N, 11.45 W. Data acquired using the Parasound P70 system aboard Polarstern in November 2021. Horizontal and vertical scales are 1 km and 45 ms, respectively.

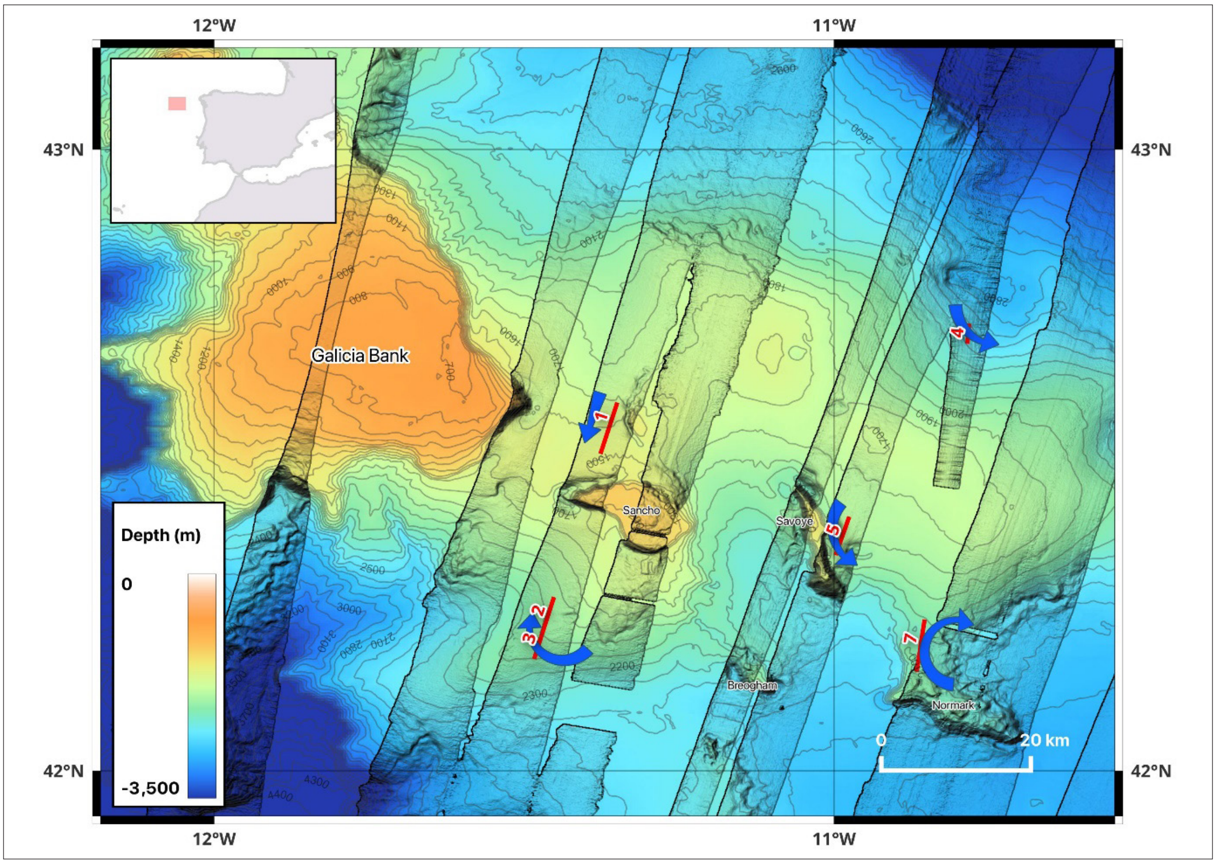

Fig. 2.7: Contour map of the Galicia Bank Region, showing selected Parasound profiles (red numbered lines) and our interpretation of current direction (blue arrows).

The Iberian Margin – Submarine Canyons, mass transport deposits and turbidites

Geography and Geology of the study area

The Western Iberian margin is a non-volcanic rifted continental margin that evolved during separation from North America and is heavily influenced by complex plate tectonic history, causing onshore and offshore strike-slip fault systems (Lastras et al. 2009). The North and Northwest Iberian Margin were shaped by the subduction of the Bay of Biscay's oceanic lithosphere following the early Cenozoic collision between the Eurasian and Iberian plates (Le Pichon et al. 1971). From the late Miocene to the present, the stress field in the Iberian Peninsula shifted from N-S to NW-SE (Andeweg et al. 1999; Yenes et al. 2019).

Shelf sediments are transported through canyons and form sediment gravity flows which terminate in the abyssal plains. Storm events can trigger near-bottom currents that lead to pulses of down canyon suspended sediment transport, creating turbidity currents which erode the seafloor and creating large-scale sediment waves (Lastras et al. 2009).

Figure 2.8 shows the Lisbon Margin with the Nazaré Canyon to its north and the Lisbon Canyon to its south. The canyons terminate in the Iberian abyssal plain and in the Tagus abyssal plain, respectively. Turbidite deposits are expected to be within these abyssal plains. The inset in the upper left of the map indicates the study area at a larger scale, including the flow direction of north Atlantic deep water (NADW) and Mediterranean outflow water (MOW).

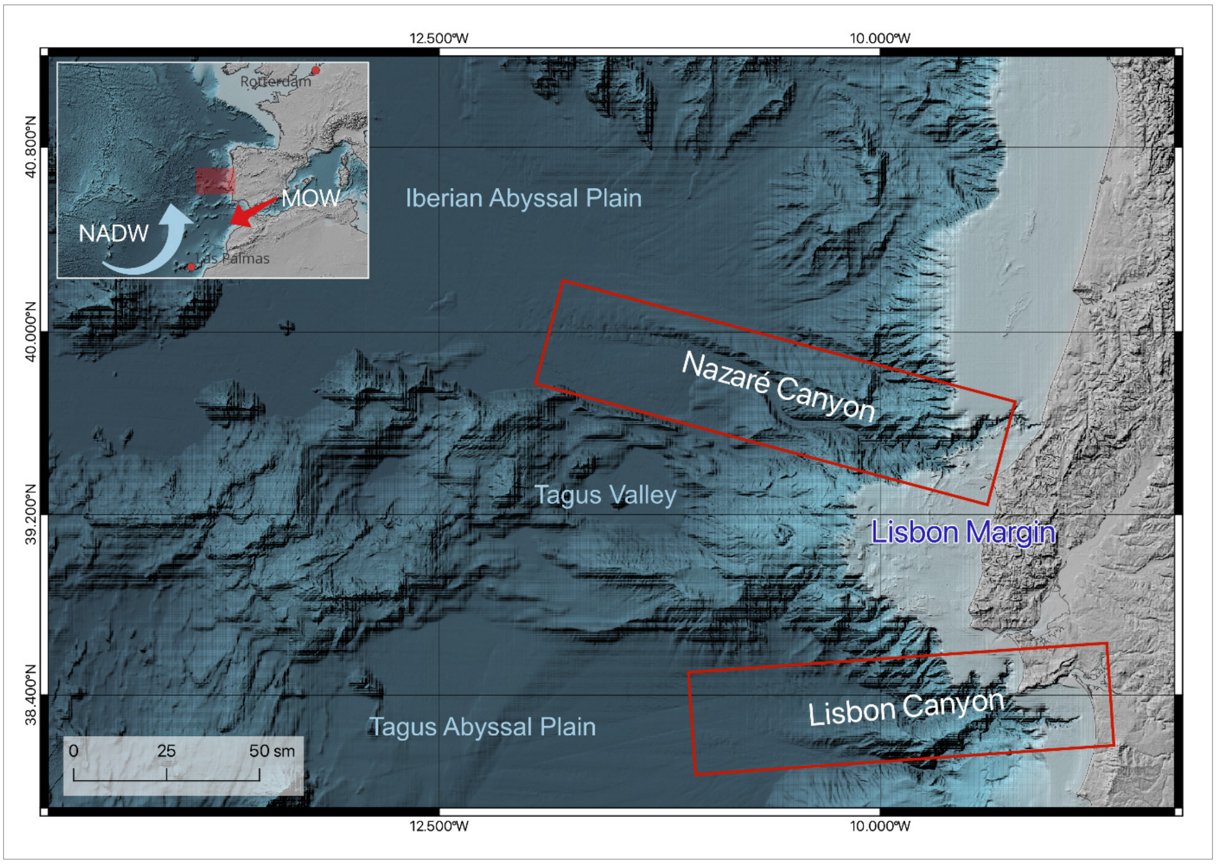

Fig. 2.8: Study area at the continental margin of Portugal. NADW = North Atlantic Deep Water; MOW = Mediterranean Outflow Water. Map is based on GEBCO (GEBCO, 2024).

Geomorphology / Sediments in the Region

Both canyons are characterized by steep side walls, incised into the Iberian continental shelf. For the Nazaré submarine canyon, it is likely that the alongshore current, going from NNE to SSW, transports terrestrial sediments from the Mondego River and feeds the canyon. The Lisbon Canyon is fed more directly with terrestrial material by the Tejo and the Sado Rivers. As both canyons evolve down the continental slope, they merge into the channel-lobe transition zone with a distinct thalweg within the Nazaré submarine canyon. Especially within the steeper regions of the canyon systems, it is likely to find mass transport deposits (MTD), resulting from slides or slumps. Further down in the thalweg, the channel-lobe transition zone or even within the abyssal plain, it is likely to have turbidite deposits. The abyssal plain is further influenced by hemipelagic sedimentation (Lastras et al. 2009). It is likely to observe similar MTDs and sediments in the PARASOUND and bathymetric data, obtained during the cruise.

Methods and data obtained during the cruise

The equipment used to obtain geophysical data were the multibeam echo sounder (MBES) system (Atlas Hydrosweep) and the sediment echograph (PARASOUND).

Figures 2.9 and 2.10 show the preliminary results obtained during the cruise. The bathymetry datasets from the previous cruise transits show a detailed topographic map of the seafloor. The submarine bedforms include submarine canyon systems, ridges, seamounts and abyssal plains with a slightly rugged seafloor structure. The water depths in the study area range from -2,880 to -5,220 mbsl. The inlet on the bathymetric map in Figure 2.9 shows the location of the respective PARASOUND line 2024_1201_193203. The movement of the ship during acquisition was from North to South. The line starts on the abyssal plain and reaches a submarine ridge with an elevation of approximately -3,660 mbsl towards the end of the line. The PARASOUND profile presents a prominent reflector at the boundary between the water column and the seafloor. The intensity then fades with depth. In the depression in the middle of the profile, alternating layers of different reflectance properties are revealed. The upper part shows stronger reflectors alternating with transparent, low-reflectivity layers. The layers show a medium level of stratification. After a second prominent reflector the amount of transparent reflectors increases.

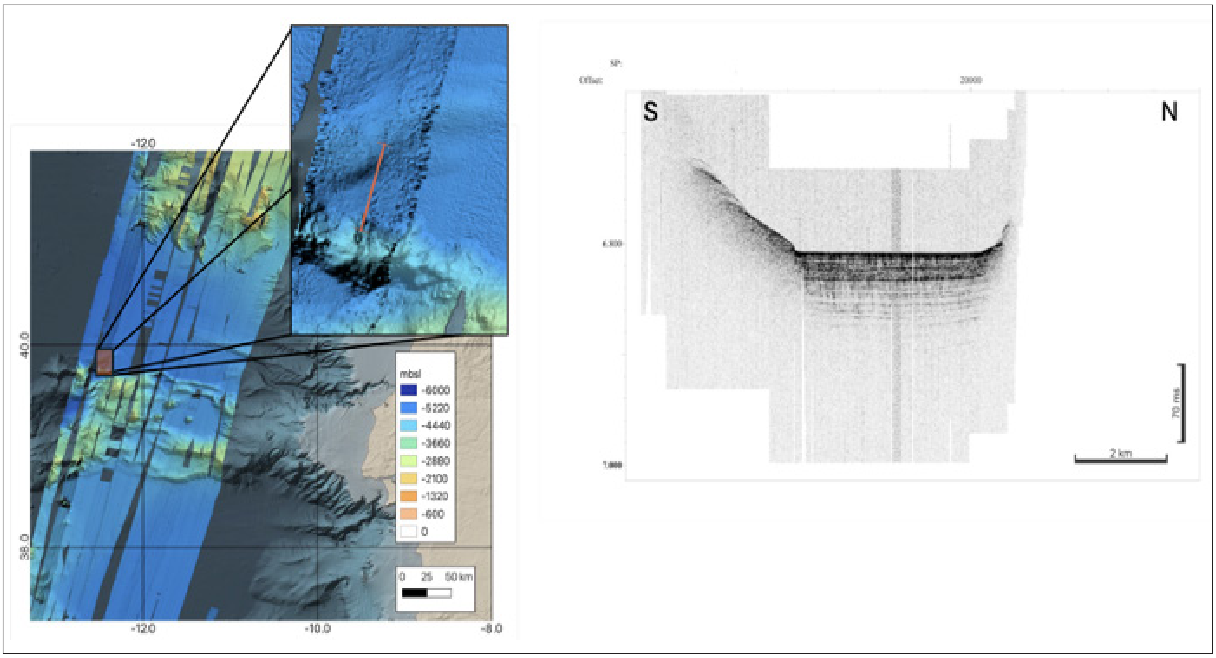

Fig. 2.9: MBES swath stripes from 2009 to 2024 off the Iberian Margin. The colour bar indicates the depth below sealevel (mbsl) and the subset shows the location of the PARASOUND profile 2024_1201_193203 (red line, left). The PARASOUND profile (right) reveals a sedimentary basin fill with different acoustic layers, located in front of a submarine ridge. Ship movement was from North to South (Basemap QGIS; GEBCO, 2024).

Interpretation of preliminary results:

The sediment echo-sounder (SES) data provides valuable information regarding the sedimentary dynamics of the Nazaré Canyon on the northwest Iberian Margin. The SES profile shows a sloping zone on the southern side with disrupted and chaotic reflectors, indicative of sediment slumping or mass wasting, which is initiated from the gravitational instability. The central region of the profile sections displays continuous, parallel reflectors, which represent sediment deposition towards the Iberian abyssal plane. These reflectors suggest interbedding of coarser, high-amplitude layers, likely from turbidity currents, with finer, low-amplitude hemipelagic deposits. The stratigraphic structure reflects a dynamic depositional environment where high-energy sediment gravity flows alternate with periods of slower sedimentation, forming a distinct sedimentary architecture.

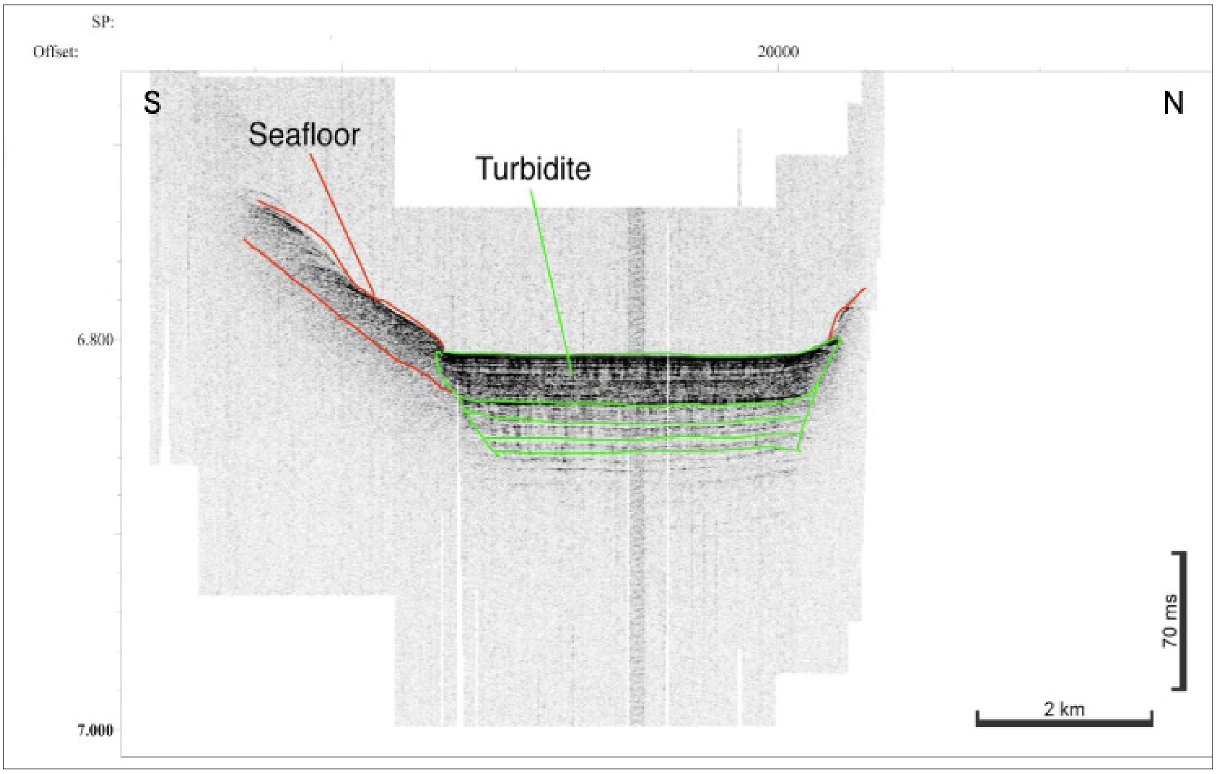

Fig. 2.10: PARASOUND Profile with preliminary interpretation. The layers marked in green have been classified as a turbidite sequence. The parts of the profile marked in red is the reflectance of the slope adjacent to the turbidite.

Crossing a plate boundary

The convergence of the Eurasian and African plates near the Tore-Madeira Rise is a geologically complex and seismically active region. The most well-known catastrophic event is the earthquake and tsunami that hit Lisbon in 1755 which originated in this area (Martínez-Loriente et al. 2022). Studies utilizing bathymetry, sub-bottom profilers, and seismic data (e.g., Somoza et al. 2021) have identified geomorphological structures associated with fault zones and mass transport deposits on the slopes, likely triggered by seismic activity. The region is predominantly characterized by strike-slip motion (Peirce & Barton 1991) and features a prominent alignment of seamounts along an NNE-SSW orientation forming the Tore-Madeira Rise, along with scattered seamounts throughout the area (Merle et al. 2018).

During the PS145/1 transit from Bremerhaven to Las Palmas we analyzed bathymetric and sub-bottom profiles at this plate boundary, identifying complex tectonic and geomorphological features. Additionally, to the data acquired during the regular transit, we also had the opportunity to conduct an eight-hour survey in international waters. We allocated this time to the collection of cross section sub bottom profiles of a basin confined by fault structures and to map some gaps in the existing bathymetric dataset (Fig. 2.11).

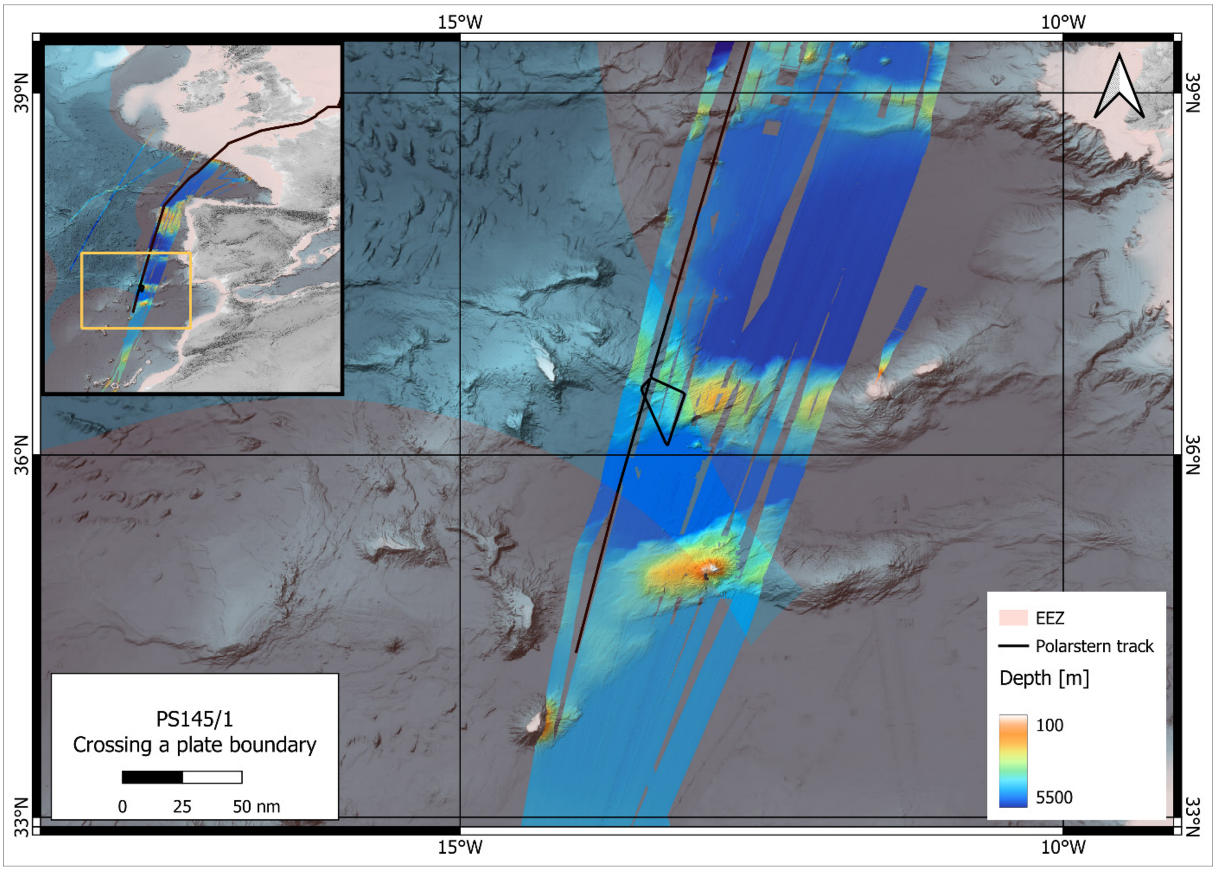

Fig. 2.11: Study area. AWI bathymetry archive at the African-Eurasian plate boundary. From the entire Bremerhaven – Las Palmas transit, only 95 nm were crossing international waters.

During the survey's second sub-bottom profiler crossline we imaged a sequence of three subsequent mass transport deposits (MTD) interlayered with parallel units deposited between mass deposition events on the lower slope in the transition to the Horseshoe Abyssal Plane from the northern ridge (Fig. 2.12). These MTDs are most likely a result of the normal faulting found upslope to the north (Fig. 2.13) indicating a slow slope collapse due to potentially uplift, a sign of the active tectonics in the region.

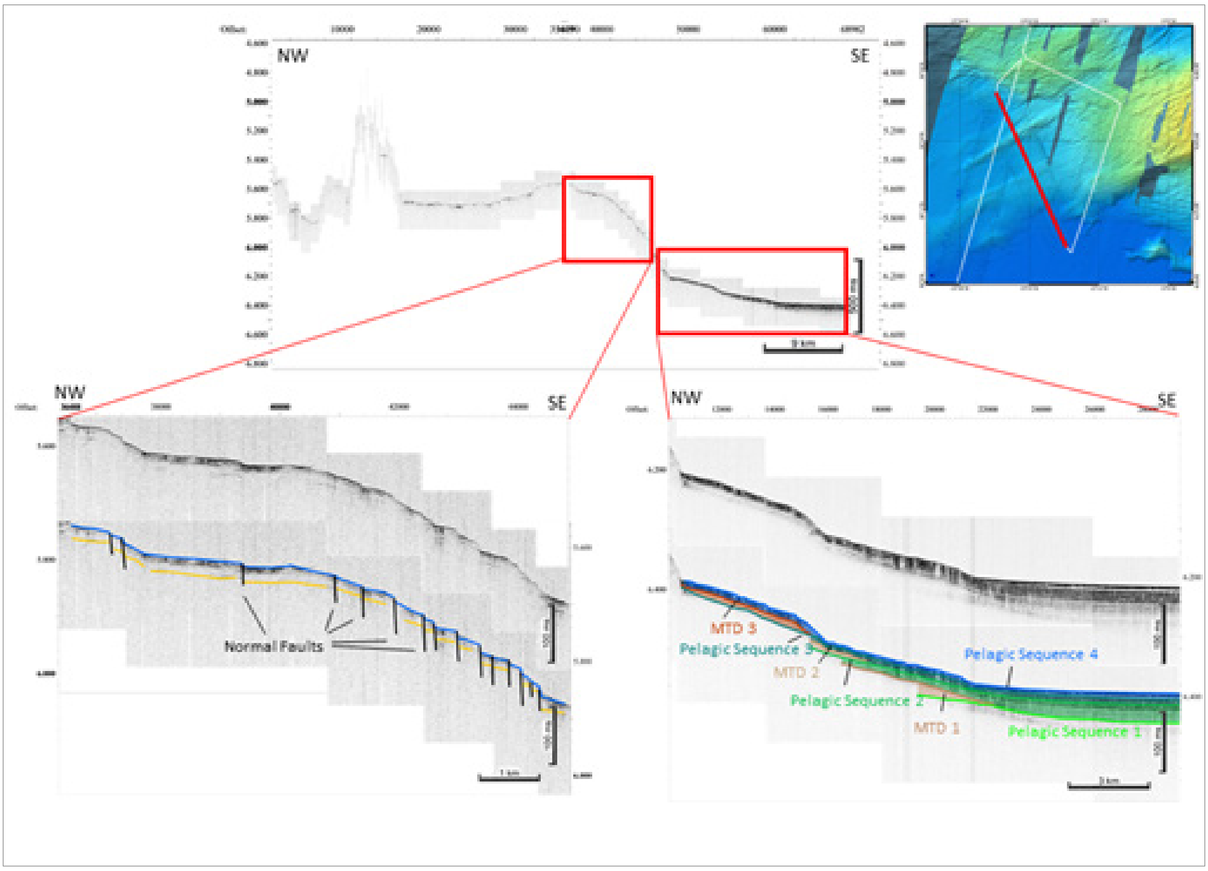

Fig. 2.12: Sub-bottom profiler cross-section along the survey crossline. Normal faults on slope and mass transport deposits (MTD) on transition to Horseshoe Abyssal Plane.

A cross section through the abyssal plane reveals outcropping paleo-seafloor sediments at the northern boundary (Fig. 2.13), as well as a submarine volcano cutting through the basin fill of the abyssal plane in the south of the plane and normal faulting on the southern plane boundary slope (Fig. 2.13).

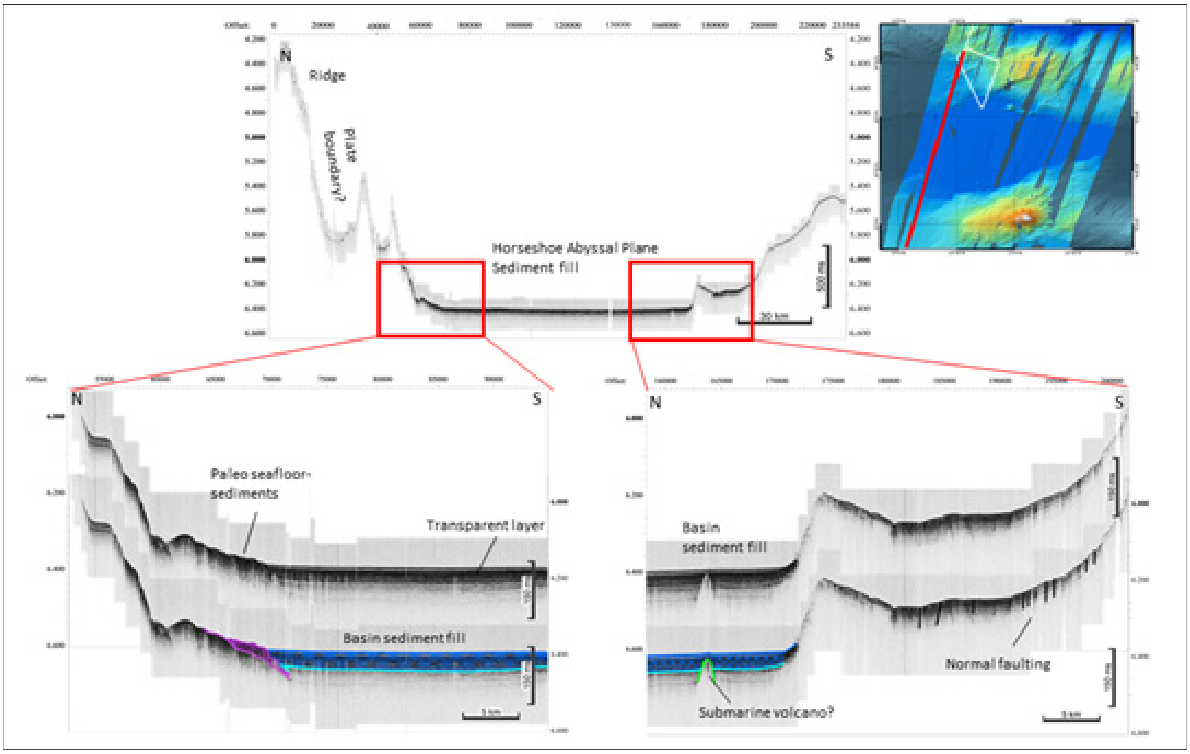

Fig. 2.13: Sub bottom profiler cross-section along the transit path through Horseshoe Abyssal Plane with outcropping paleo seafloor and northern edge, potential submarine volcanoes and faulting southern slope.

The Agadir Canyon

Background

This report examines the Agadir Canyon, a submarine feature, surveyed during the PS145/1 training cruise using multibeam bathymetric and sediment echosounder. Submarine canyons are large-scale incisions and dynamic environments found on the continental shelf and slope of all continental margins. The formation is mostly attributed to erosion of the slopes by mass wasting events and they are shaped by processes like tidal and turbidity currents. These formations serve as sediment transport pathways from continents to the deep sea, with two main types: shelf-incised canyons, directly linking continental shelves to marine environments and closely associated with fluvial environments, where sediments are rapidly supplied and slope canyons, confined to slopes and shaped by structural activities like faulting or folding, with depositional sediments generated by slope or wall failure within the canyon.

The Agadir Canyon

The Agadir Canyon, located along the Northwest African passive continental margin, is one of the largest submarine canyons in the world. It stretches approximately 450 km in length, reaches widths of up to 30 km, and descends to depths of about 1.5 km. The climate of the Agadir region is characterized by arid to semi-arid climate, which results in limited sediment input from rivers. The deposition within the canyon is primarily due to large sediment-gravity flows, which can lead to significant landslides. Consequently, the sediments found within the canyon are predominantly siliciclastic and volcaniclastic.

The Agadir Canyon is characterized by four main areas: The upper and lower canyons, the Agadir Slide, and the Agadir Basin, all connected with peripheral submarine and tributary canyons. The continental slope is directly connected to the lower Agadir Canyon with its headwall characterised by layers of sediments, which are more pronounced in the upper levels of the ocean floor (Krastel 2015). However, as the sediment flows run through the lower canyon channel, part of its debris are advected to the Agadir Slide and some tributary canyons. The sedimentation on the walls of the lower canyon is characterized by well stratified background sediments beneath thicker layers of debrites that extend through the channel (Krastel et al. 2016). As the debris is deposited, only the finer sediments are transported in the form of turbidites. As a result, the upper canyon is deeper (~ 210 m) than the lower canyon (~150 m) (Böttner *et al.* 2024). The remaining sediment is deposited in the Agadir Basin.

Results

During the sampling of the area during the PS145/1 expedition, only the Agadir Basin could be surveyed due to political restrictions as the Agadir Canyon is located at an economic zone. Unfortunately, since the basin was the last area covered before the end of the cruise, we were not able to post-process the data. Therefore, the results presented here are preliminary.

We could observe that the ocean floor is located at the depth between 4,200 – 4,400 m depth, with hemipelagic sedimentation in most areas during the watches (Fig. 2.14). However, during the last watch, turbidites could be seen between 31.69 and 31.66˚N (Fig. 2.15)

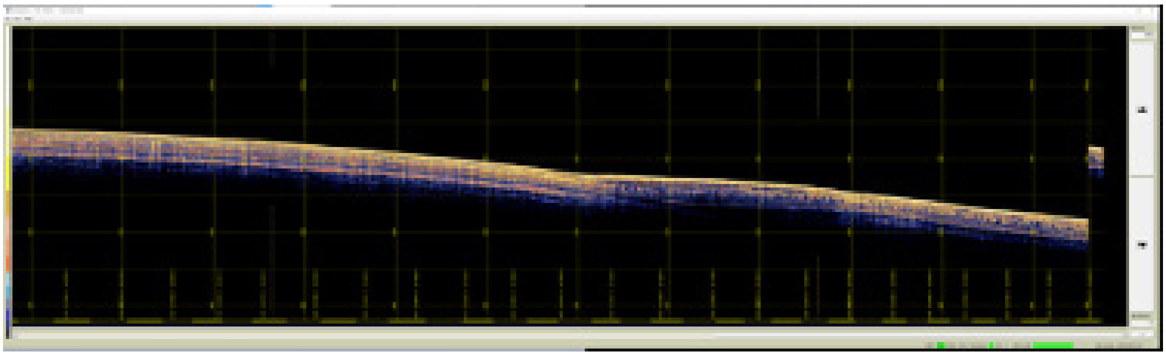

Fig. 2.14: Snapshot of the sampled area showing layered sediments with no major feature other than hemipelagic sedimentation

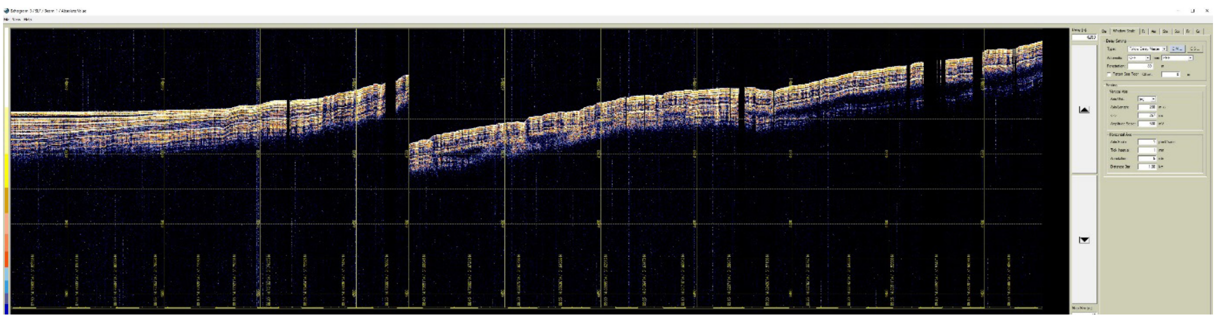

Fig. 2.15: Snapshot of the sampled area showing layered sediments with indication of turbidite sedimentation between 14.80˚W and 31.69 - 31.66˚N, below 4,300 m depth (red area)

Initial observations on meaning-making during echo sounding data collection

Participation in a cruise is a rare opportunity for social scientists, and scientific work on a cruise can almost be considered as a ‘black box’, as scientific outcomes of the cruise seem to be well known and communicated, although scientific work on a ship remains more or less unclear to persons who are not directly involved. In joining PS145/1 my aim was primarily to engage with the practices of echosounding as processes through which operators can explore the seabed; its form, structure, and materiality. Of particular interest were the technologies themselves including the data they produced, their processing, and in how far human sense and prior knowledge play a role concerning each step of the process and its ways. This research forms a complement to further fieldwork undertaken in relation to the seabed in museum collections, drilling expeditions, core repositories, and scientific labs.

The methods I employed over the duration of the cruise included: daily fieldnotes recording observations, events, and personal experiences over the event period; photo and video documentation of work practices (with written ethical consent from my shift mates); and audio recorded semi structured interviews with training instructors (also with ethical consent). This was in addition to my active participation in the echo sounding training, lectures, and shifts.

After passing through the English Channel and over the continental shelf to the abyssal plains, the seabed was sounded in general at a depth of 4,000 – 5,000 m below the surface. This raised questions regarding the use of technology as a mediator between the vertically remote seabed and the operator, and the selective view of the material world that was manifested. Usually parasound data would be used to inform core sampling locations, working in parallel with this next step. In our training, however, the collection of parasounding data was an end to itself, to be used by the participants to inform opinions on the character of the seabed. The physical nature of the signal itself became clear as we learnt to operate the equipment, with the active selection of different frequencies and increasing or decreasing amplitude dependent on the depth of the seabed. While the data we received effectively eliminated the water column, alongside all living matter, in its visualisations, the adjustments we made and indeed the CTD station data we received on the character of the water column did not allow us to completely remove it from our consciousness. These initial observations sit in conversation with Sammler and House-Peters’ discussions on how technologies engage with the material of the ocean, albeit in the context seabed mining: ‘the water column is articulated as a medium for seabed mapping assemblages, but is ignored as such for material extraction’ (2023, p.05).

Similarly, the individual operators’ sense of how to both manage the software to follow the trajectory of the seabed and to interpret the accuracy of the data produced is of interest. Our role was to keep an eye on the data being produced on screen and if conditions changed (such as increased depth or a whale sighting) or if something went wrong, we needed to respond (with assistance). This meant that a large portion of our shifts involved simply observing the population of data on screen and keeping our senses open for things that did not seem ‘right’. Hägele (2024) has written briefly on the central role of intuition for both echosounding data production and processing, noting in relation to data processing that ‘deciding on which pixels of the map to keep and which ones to remove represents a process based on “intuition,” “feeling,” and sensory knowledge’ (p.220-221). The intersection of experience and pattern recognition in identifying computer-generated ‘visual artifacts’ came out most clearly during the interviews I conducted, adding additional and possibly competing data for future consideration in relation to the study of scientists’ use of the sensory landscape. Further, the operator’s familiarity with and ability to anticipate the material formations of the seabed alongside their capacity to recognise computer generated anomalies seems to be one of the key reasons for having humans monitoring the data generation rather than wholly trusting the software to operate independently. At the same time, the level of input the operator had in the running of the hardware and software was minimal. Despite this, the motivations of particularly the more senior participants in the cruise was to engage directly with the collection of data to understand the conditions under which collection occurs. Many of these participants work with already collected data and forming an appreciation of the physical conditions of its collection was viewed as helpful in understanding its potential flaws caused by such things as weather conditions, technology complications, and the mental and physical experience of operators collecting and processing raw data in a confined space over time periods (Fig. 2.16) from several weeks to months. Regaining a connection with the physical space that the data they work with represents is seen as beneficial to their research and their careers. This challenges Lehman's assertion that 'remote and robotic sensing technologies tend to obscure the fact that any view of the world is a view from somewhere' (2018, p.64), and instead reinforces the engagement of scientists with the situatedness of scientific knowledge production.

It was informative to observe the analysis of the processed parasounding data in the final presentations given by the training participants, because it highlighted the uncertainty and limitations around interpreting geological formations and history from remote sensing imagery alone. Furthermore, it became evident that the geological knowledge to accurately interpret the data that we were collecting and to create meaning from it was an independent skillset. Similar to learning pattern recognition to identify artifacts through extended experience viewing and processing data, recognising seabed geological formations with confidence and accuracy seems to also rely on repeated exposure to stratigraphic imagery alongside the knowledge of what each formation should be interpreted as.

Fig. 2.16: Students on shift in the bathymetry lab

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 expedition at the latest. By default, the CC-BY license will be applied.

This expedition was supported by the Helmholtz Research Programme “Changing Earth – Sustaining our Future” Topic 2. Further support was generously provided by funding through the Nippon Foundation – GEBCO Seabed 203 Project.

In all publications based on this expedition, the **Grant No. AWI_PS145_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.

References

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

Andeweg B, De Vicente G, Cloetingh SAPL, Giner J, Martin AM (1999) Local stress fields and intraplate deformation of Iberia: variations in spatial and temporal interplay of regional stress sources. Tectonophysics 305(1-3):153-164.

Belleney D, Ehrhold A, Le Dantec N, Le Roy P, Jouet G (2022) Multi-temporal analysis of submarine sand dunes morphodynamics (Bay of Brest, Brittany, France): A marker of sediment pathways in a macrotidal environment open to sea swells. Estuarine, Coastal and Shelf Science 274:107911. https://doi.org/10.1016/j.ecss.2022.107911

Böttner C, Stevenson, CJ, Englert R, Schönke M, Pandolpho BT, Geersen J, Feldens P, Krastel S (2024) Extreme erosion and bulking in a giant submarine gravity flow. Sciences Advances 10(34):eadp2584. https://doi.org/10.1126/sciadv.adp2584

Ercilla G, García-Gil S, Estrada F, Gràcia E, Vizcaino A, Váquez JT, Díaz S, Vilas F, Casas D, Alonso B, Dañobeitia J, Farran M (2008) High-resolution seismic stratigraphy of the Galicia Bank Region and neighbouring abyssal plains (NW Iberian continental margin). Marine Geology 249(1–2):108–127. https://doi.org/10.1016/j.margeo.2007.09.009

Ercilla G, Casas D, Vázquez JT, Iglesias J, Somoza L, Juan C, Medialdea T, León R, Estrada F, García-Gil S, Farran M, Bohoyo F, García M, Maestro A (2011) Imaging the recent sediment dynamics of the Galicia Bank region (Atlantic, NW Iberian Peninsula). Marine Geophysical Research 32(1–2): 99–126. https://doi.org/10.1007/s11001-011-9129-x

Franzetti M, Le Roy P, Delacourt C, Garlan T, Cancouët R, Sukhovich A, Deschamps A (2013) Giant dune morphologies and dynamics in a deep continental shelf environment: Example of the banc du four (Western Brittany, France). Marine Geology 346:17-30. https://doi.org/10.1016/j.margeo.2013.07.014

GEBCO Bathymetric Compilation Group 2024 (2024) The GEBCO_2024 Grid - a continuous terrain model of the global oceans and land. NERC EDS British Oceanographic Data Centre NOC. https://doi.org/10.5285/1c44ce99-0a0d-5f4f-e063-7086abc0ea0f

Hägele R (2024) Following a Deep-Sea Channel: Sensory Landscape and Experiential Knowledge in Science-Making on a Research Vessel. Nature and Culture 19(2):209-235. https://doi.org/10.3167/nc.2024.190205

Krastel S (2015) Interaction of large landslides and canyons off NW-Africa. Submarine Canyon Dynamics. CIESM Workshop Monographs 47:60-69.

Krastel S, Wynn RB, Feldens P, Schürer A, Böttner C, Stevenson C, Cartigny MJB, Hühnerbach V, Unverricht D (2016) Flow behaviour of a giant landslide and debris flow entering the Agadir Canyon, NW Africa. In: Lamarche G, Mountjoy J, Bull S, Hubble T, Krastel S, Lane E, Micallef A, Moscardelli L, Mueller C, Pecher I, Woelz S (2016) Submarine Mass Movements and their Consequences. Advances in Natural and Technological Hazards Research 41:145-154. https://doi.org/10.1007/978-3-319-20979-1_14

Lastras G, Arzola RG, Masson DG, Wynn RB, Huvenne VAI, Hühnerbach V, Canals M (2009) Geomorphology and sedimentary features in the Central Portuguese submarine canyons, Western Iberian margin. Geomorphology 103:310–329. https://doi.org/10.1016/j.geomorph.2008.06.013

Lehman J (2018) From ships to robots: The social relations of sensing the world ocean. Social Studies of Science 48(1):57-79. https://doi.org/10.1177/0306312717743579

Le Pichon X, Fox PJ (1971) Marginal offsets, fracture zones, and the early opening of the North Atlantic. Journal of Geophysical Research 76(26):6294-6308.

Martínez-Loriente S, Sallarès V, Gràcia E (2022) The Horseshoe Abyssal Plain Thrust, the most plausible source of the 1755 Lisbon earthquake and tsunami. Resúmenes de la IV Reunión Ibérica sobre Fallas Activas y Paleosismología, Teruel, España: 145-147. http://hdl.handle.net/10261/333463

Merle R, Jourdan F, Girardeau J (2018) Geochronology of the Tore-Madeira Rise seamounts and surrounding areas: a review. Australian Journal of Earth Sciences 65(5):591–605. https://doi.org/10.1080/08120099.2018.1471005

Mojtahid M, Eynaud F, Zaragosi S, Scourse J, Bourillet J-F, Garlan T (2005) Palaeoclimatology and Palaeohydrography of the Glacial Stages on Celtic and Armorican Margins over the Last 360000 Yrs. Marine Geology 224(1–4):57–82. https://doi.org/10.1016/j.margeo.2005.07.007

Mulder T, Zaragosi S, Garlan T, Mavel J, Cremer M, Sottolichio A, Sénéchal N, Schmidt S (2012) Present deep-submarine canyons activity in the Bay of Biscay (NE Atlantic). Marine Geology 295–298:113–127. https://doi.org/10.1016/j.margeo.2011.12.005

Paquet F, Thinon I, Dugué O, Tessier B, Benabdellouahed M, Lasseur E, Briais J, Couëffé R, Guennoc P, Gaullier V (2023) The Central English Channel troughs: major source-to-sink remnants or giant tidal scours? Marine and Petroleum Geology 153:106303. https://doi.org/10.1016/j.marpetgeo.2023.106303

Peirce C, Barton PJ (1991) Crustal structure of the Madeira-Tore Rise, eastern North Atlantic—results of a DOBS wide-angle and normal incidence seismic experiment in the Josephine Seamount region. Geophysical Journal International 106(2):357–378. https://doi.org/10.1111/j.1365-246X.1991.tb03898.x

Sammler KG, House-Peters L (2023) Unblackboxing mediation in the digital mine. Geoforum 141: 103745. https://doi.org/10.1016/j.geoforum.2023.103745

Somoza L, Medialdea T, Terrinha P, Ramos A, Vázquez J-T (2021) Submarine Active Faults and Morpho-Tectonics Around the Iberian Margins: Seismic and Tsunamis Hazards. Frontiers in Earth Science 9:653639. https://doi.org/10.3389/feart.2021.653639

Toucanne S, Zaragosi S, Bourillet JF, Naughton F, Cremer M, Eynaud F, Dennielou B (2008) Activity of the turbidite levees of the Celtic–Armorican margin (Bay of Biscay) during the last 30,000 years: Imprints of the last European deglaciation and Heinrich events. Marine Geology 247(1-2):84-103. http://dx.doi.org/10.1016/j.margeo.2007.08.006

Yenes M, Casas D, Nespereira J, Monterrubio S, Ercilla G, López-González N, (2019) Galicia Bank sediment transport activity in response to continuous sedimentary instability dynamics: a geotechnical perspective. International Journal of Earth Sciences 108(8):2545–2560. https://digital.csic.es/handle/10261/195398

Zaragosi S, Le Suavé R, Bourillet JF, Auffret GA, Faugères J-C, Pujol C, Garlan T (2001) The deep-sea Armorican depositional system (Bay of Biscay), a multiple source, ramp model. Geo-Marine Letters 20:219–232. https://doi.org/10.1007/s003670100061

3. BATHYMETRIC UNDERWAY MEASUREMENTS

Natalie Cornish, Simon Dreutter, Tea Isler DE.AWI
not on board: Boris Dorschel

Grant-No. AWI_PS145_02

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 PS145 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 cruise PS145, 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 Control Module (CM) 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 CM 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 entire cruise track between Bremerhaven and Walvis Bay. The MBES was operated with Sonar UI and for online data visualization, Teledyne PDS was used. The collected bathymetry was stored in 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 WOA18 (World Ocean Atlas 2018) data to create full ocean depth SV profiles.

Stations

The Hydrosweep and CTD stations are listed in Table 3.1 (PS145/1) and Table 3.2 (PS145/2).

Tab. 3.1: List of bathymetry related stations during PS145/1

Station Number	Description	Device	Time	Lat	Lon
PS145/1_0_ Underway-7	Multibeam underway survey	Multibeam echosounder	Start: 25-11-24 07:48 End: 05-12-24 07:39	Start: 53.76138 End: 28.25697	Start: 5.92348 End: -15.34058
PS145/1_1-1	SVP	CTD/Rosette	29-11-24 15:54	47.11063	-7.72008
PS145/1_2-1	SVP	MIDAS SVP	30-11-24 15:18	43.95101	-10.97721
PS145/1_3-1	SVP	CTD/Rosette	01-12-24 10:47	41.53951	-11.95611
PS145/1_4-1	SVP	CTD/Rosette	02-12-24 14:12	37.16639	-13.26831
PS145/1_5-1	SVP	CTD/Rosette	03-12-24 14:04	34.70094	-13.95104
PS145/1_6-1	SVP	CTD/Rosette	04-12-24 13:38	30.98798	-14.97062

Tab. 3.2: List of bathymetry related stations during PS145/2

Station Number	Description	Device	Time	Lat	Lon
PS145/2_0_ Underway-2	Multibeam underway survey	Multibeam echosounder	Start: 06-12-24 17:41 End: 20-12-24 05:21	Start: 24.94150 End: -20.10700	Start: -20.28400 End: 11.18410
PS145/2_1-1	SVP	MIDAS SVP	07-12-24 13:00	21.23942	-21.07986
PS145/2_2-1	SVP	CTD/Rosette	08-12-24 13:58	16.94311	-21.13356
PS145/2_3-1	SVP	CTD/Rosette	09-12-24 13:49	12.53043	-21.11569
PS145/2_4-1	SVP	CTD/Rosette	10-12-24 13:55	8.60245	-19.11635
PS145/2_5-1	SVP	CTD/Rosette	11-12-24 13:52	5.29778	-16.18911
PS145/2_6-1	SVP	CTD/Rosette	12-12-24 13:56	2.46465	-13.13193
PS145/2_7-1	SVP	CTD/Rosette	13-12-24 12:50	-0.27427	-10.19648
PS145/2_8-1	SVP	CTD/Rosette	15-12-24 12:54	-6.34044	-3.75963
PS145/2_9-1	SVP	CTD/Rosette	16-12-24 12:49	-9.19894	-0.71925

Preliminary results

During 28 days (PS145/1: 11 days, PS145/2: 17 days), bathymetric data was surveyed along the cruise track by the swath bathymetry system. Figure 3.1 shows the generated bathymetry grid over the Atlantic.

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 expedition 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. This expedition was supported by the Helmholtz Research Programme “Changing Earth – Sustaining our Future” Topic 2, Subtopic 3. The data was obtained as part of the project BATHY-LTO.

In all publications based on this expedition, the **Grant No. AWI_PS145_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.

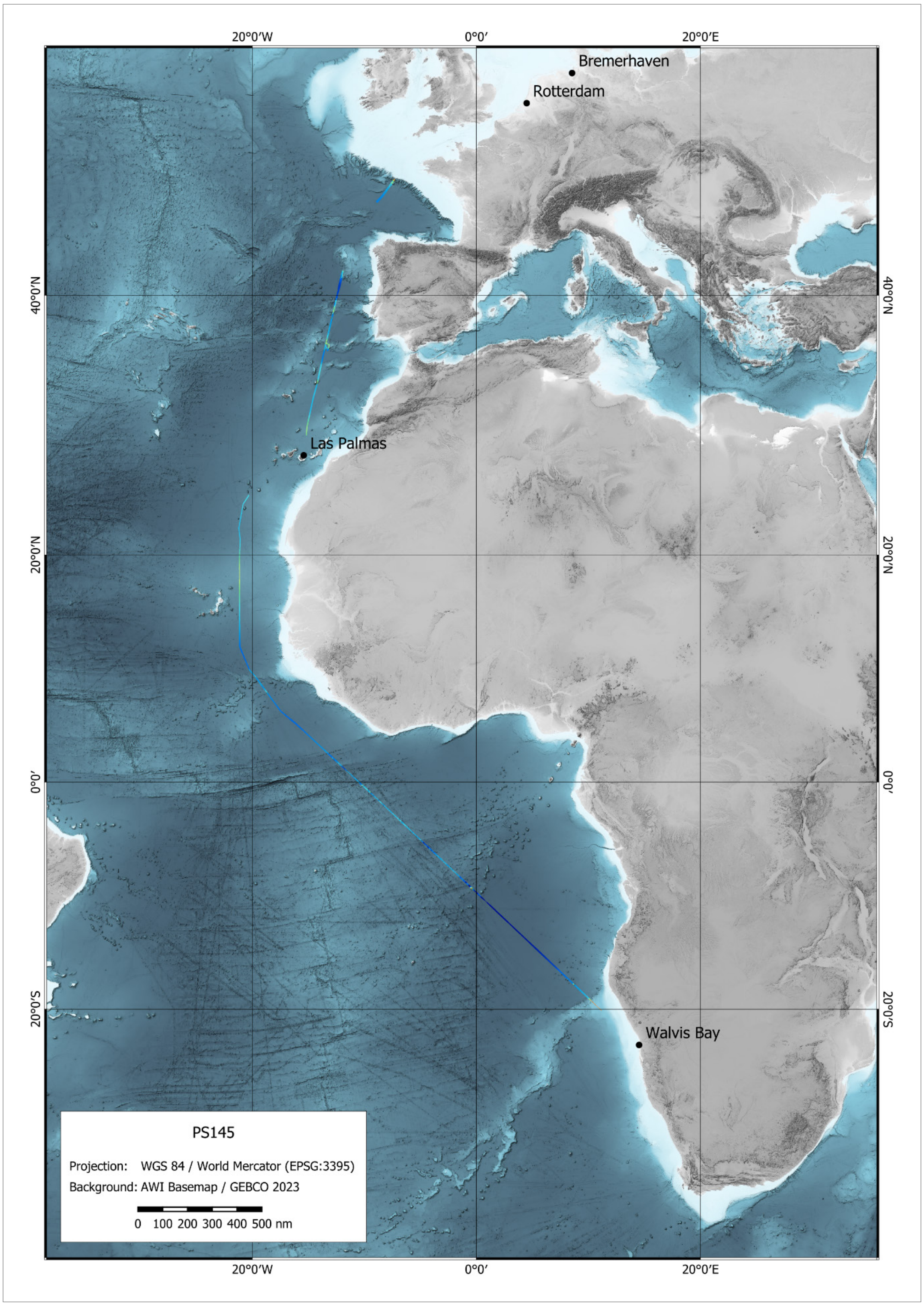

Fig. 3.1: Overview of bathymetric data acquired during PS145

4. TEST OF SEISMIC LMF AIR COMPRESSOR

Andreas Pluder[1], Uwe Hahnel[2]

[1]DE.LAEISZ
[2]DE.MWB

Grant-No. AWI_PS145_00

Objectives

Renewing of Siemens Controller from Seismic LMF Air Compressor. To confirm successful installation, the compressor must be tested at sea with board energy.

Work at sea

Test and troubleshooting. No special ship time was required.

Preliminary (expected) results

Work is in progress but the system is not fully operational due to a problem with a safety valve and the fisher valve. As there is no need for the compressor during this season, final service will be executed during next ship yard in April 2025.

5. SEA TRIALS NEW 4H-JENA FERRYBOX

Brieuc Crenan[1]
not on board: Peter Gerchow[2], Florian Koch[2], Philipp Fischer[2], Ralf Krocker[2]

[1]DE.LAEISZ
[2]DE.AWI

Grant-No. AWI_PS145_00

Objectives

4H-Jena Ferrybox, owned by institute HEREON (formerly Helmholtz Zentrum Geesthacht – HZG) was installed 15 years ago and now removed due to own requirements. The Ferrybox was replaced by a new one with new sensors, as water analysis is mandatory for nearly all cruises. During ship yard, initial tests with fresh water took place. During the cruise, sea trials and tests with sea water were executed.

Work at sea

Tests were limited due to an issue with an external pump from the vessel. Due to works in machine room, this pump could be changed only at the middle of the cruise. Finally, all planned tests could be executed.

Preliminary (expected) results

From electrical and hydraulic point of view, the system is fully operational. On sensor side, it seems there is a wrong value on the CO_2 sensor, which is under investigation. All other sensors are technically fully functional.

On the software side, some issues were found such as intern-email system and the creation of the “All Sensor” files. The company -4H-Jena is handling the case and is reactive.

6. TEST WINCH EL31

Brieuc Crenan[1], Andreas Pluder[1]
not on board: Ralf Krocker[2]

[1]DE.LAEISZ
[2]DE.AWI

Grant-No. AWI_PS145_00

Objectives

The CTD Winch "EL31" was in complete overhaul in summer 2024. After that, sea trials and tests are necessary to confirm proper functionality under real conditions.

Work at sea

Test of the winch without and with a CTD, inspection, check-up, including twisting out off the wire.

Preliminary (expected) results

The winch is fully functional beside a missing roller. Clarification is currently running with the contracted company who was in charge of the overhaul.

7. RE-ORGANISATION OF THE WORK OF DELETED POSITION "WFT"

Holger Deckelmann[1], Holger Schmithüsen[1], Patrick Suter[2], Frank Otte[2], Brieuc Crenan[3]

[1]DE.AWI
[2]DE.DWD
[3]DE.LAEISZ

Grant-No. AWI_PS145_00

Objectives

The position of the Weather Radio Technician ("Wetterfunktechniker" – WFT) on board *Polarstern* is discontinued from the end of 2024. The previous tasks of the WFT are central to the operation of the Meteorological Observatory *Polarstern*. For this reason, tasks were redistributed on scientists and crew members, so that the operation of the observatory can continue.

Work at sea

AWI scientists assisted WFT at all his usual work and checked, if all task are completely determined for reorganisation. New applications were installed and adjustments in operation were arranged. Responsible operators were trained to do these tasks.

Preliminary (expected) results

Synoptic observations: So far, the WFTs on board have produced synoptic weather reports that are used globally in all weather forecasting models. Over the decades since 1982 this has accumulated to a very valuable long-term time series. In addition to automatic measurements such as pressure, temperature, humidity and wind, these observations also include manually observed parameters such as clouds, weather phenomena and waves. In future, the observations will be carried out by the nautical officers on duty. With this, *Polarstern* will be part of the WMO-coordinated "Voluntary Observing Ship Scheme" (VOS). The VOS-standard software for reporting, namely TurboWin+, was installed on the bridge and the nautical officers were instructed in its use. Various software problems arose and were solved in order to get TurboWin+ ready for operational use. One major issue was the *Polarstern* mail server (WERUM): The server only supports unencrypted access for delivering outgoing mail. However, TurboWin+ cannot be configured to transmit outgoing messages unencrypted to a mail server. Unfortunately, the AWI mail server also caused communication problems that could not be solved. As a workaround, an email address from a commercial email provider was configured to send the weather reports from *Polarstern*.

Radiosoundings: The WFT used to launch daily radiosondes for 12 UTC, and additionally around 6 UTC during times of potential helicopter operations. The radiosondes in both polar regions are an integral part of the Meteorological Observatory *Polarstern*. The concept for future operation is to find alternating scientists for each cruise to carry out the soundings. Procedures on board were registered and documented to be carried out by varying staff. The workflow for ordering sounding material, including helium, needs some adjustments. From our point of view it would be best to order material by the AWI group “Meteorological Observatories” in analogy to the ordering process for *Neumayer Station III*. Whether this is feasible will be assessed.

Data management

All data of the Meteorological Observatory *Polarstern* used to be compiled by the WFT by the end of each cruise leg and sent to the AWI group “Meteorological Observatories” in Bremerhaven. This process shall be automated, coordination with *Polarstern* system administration and AWI IT department for this “ingest process” is ongoing.

Documentation: A broader staff pool on board *Polarstern* for duties of the Meteorological Observatory requires more flexible and accessible documentation of procedures. The “*Polarstern*-Wiki” which is available locally on board is not suitable for this, since the content is overwritten twice per year by its land version. Hence, any changes made on board will be lost. It has been agreed with IT department to use a wiki on land on spaces.awi.de. Consequently, this fortifies the dependency on a permanent and reliable fast internet connection.

8. OBSERVATION OF ROUTINE *POLARSTERN* SHIP OPERATIONS BY THE *PSII* TEAM

Tobias Boebel DE.AWI

Grant-No. AWI_PS145_00

Objectives

Part of the team handling the acquisition and build of *Polarstern II* participated in PS145/2. This group consisted of marine engineers, scientists and *Polarstern II* administration officials, who observed both the technical and scientific operations, as well as everyday ship operations. The goal was to validate the design plans for the new ship and to transfer 42 years of valuable experience and know-how in operating the *Polarstern*, to the procurement procedure and build of *Polarstern II*.

Work at sea

The team observed everyday ship operations and engaged with the crew. A close inspection of all regions of the ship was conducted, focusing on laboratories, working spaces, technical infrastructure and storage spaces. Special themes, including inventory, spare parts, the hull, superstructure, the interior design, nautical and communications equipment, scientific equipment and infrastructure, as well as the management of data flows, were inspected.

Preliminary results

The team observed very efficient work flows in routine scientific and everyday ship operations. Part of these observations will be used to further optimize the detailed design for *Polarstern II*.

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
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.LAEISZ	Reederei F. Laeisz GmbH Bartelstraße 1 27570 Bremerhaven Germany
DE.MWB	MWB Elektrotechnik Service GmbH Rudloffstr. 49 27568 Bremerhaven Germany
DE.SHIPDESIGN	SDC Ship Design & Consult GmbH Bramfelder Str. 164 22305 Hamburg Germany
DE.UNI-Bremen	Universität Bremen Klagenfurter Straße 2-4 28359 Bremen Germany
DE.UNI-Potsdam	Universität Potsdam Am Neuen Palais 10 14469 Potsdam Germany

A.2 FAHRTTEILNEHMER:INNEN / CRUISE PARTICIPANTS

PS145/1 Bremerhaven – Las Palmas				
Name/ Last name	**Vorname/ First name**	**Institut/ Institute**	**Beruf/ Profession**	**Fachrichtung/ Discipline**
Altenbernd-Lang	Tabea	DE.AWI	Scientist	Geophysics
Amezcua Montiel	Abril	DE.AWI	PhD student	Geology
Berghöfer	Mai-Britt	DE.UNI-Potsdam	Student (Master)	Geosciences
Cornish	Natalie Roslyn	DE.AWI	Scientist	Geophysics
Crenan	Brieuc	DE.LAEISZ	Engineer	Shipping Company
Deckelmann	Holger	DE.AWI	Engineer	Physics
Diekmann	Bernhard	DE.AWI	Scientist	Geology
Dreutter	Simon	DE.AWI	Technician	Geophysics
Eberlin	Lara	DE.UNI-Bremen	Student (Master)	Geosciences
Fuchs	Lea Tabea Antonia	DE.UNI-Bremen	Student (Master)	Geosciences
Gagliardi	Alessandro	DE.AWI	PhD student	Physics
Güntzel	Janina	DE.AWI	PhD student	Geology
Gatti	Ludovica Martina	DE.UNI-Potsdam	Student (Master)	Geosciences
Hähnel	Uwe	DE.MWB	Engineer	Shipping Company
Hanfland	Claudia	DE.AWI	Scientist	Geology
Hine	Amelia	DE.AWI	Postdoc	Geosciences
Isler	Tea	DE.AWI	PhD student	Geophysics
Krause	Timo	DE.AWI	PhD student	Geophysics
Künzig	Sophia	DE.UNI-Potsdam	PhD Student	Geosciences
Lenz	Kilian Theo	DE.UNI-Potsdam	Student (Master)	Geophysics
Luo	Lingyan	DE.AWI	PhD student	Geophysics
Oliveira Matos	Fernanda	DE.AWI	PhD student	Oceanography
Otte	Frank	DE.DWD	Scientist	Meteorology
Pluder	Andreas	DE.LAEISZ	Engineer	Shipping Company
Providence	Enowyeket Enow	DE.UNI-Bremen	Student (Master)	Geophysics
Riemann-Campe	Kathrin	DE.AWI	Scientist	Data Sciences
Schmithüsen	Holger	DE.AWI	Scientist	Meteorology
Schopen	Lasse Johannes	DE.UNI-Bremen	Student (Master)	Geophysics
Senger	Diren	DE.AWI	Postdoc	Data Sciences

PS145/1 Bremerhaven – Las Palmas				
Name/ Last name	**Vorname/ First name**	**Institut/ Institute**	**Beruf/ Profession**	**Fachrichtung/ Discipline**
Suter	Patrick	DE.DWD	Scientist	Meteorology
Terschlüsen	Jakob	DE.UNI-Potsdam	Student (Master)	Geosciences
Thorneloe	Alexander	DE.AWI	PhD student	Physics
Thulaseedharan Nair Seema Nair	Rohith	DE.UNI-Bremen	Student (Master)	Geosciences
Weigelt	Estella	DE.AWI	Scientist	Geophysics

PS145/2 Las Palmas – Walvis Bay				
Name/ Last name	**Vorname/ First name**	**Institut/ Institute**	**Beruf/ Profession**	**Fachrichtung/ Discipline**
Boebel	Tobias	DE.AWI	Scientist	Logistics
Cornish	Natalie	DE.AWI	Scientist	Geophysics
Dreier	Stefanie	DE.AWI	Technician	Logistics
Haeusler	Sandra	DE.AWI	Technician	Logistics
Isler	Tea	DE.AWI	PhD student	Geophysics
Koch	Florian	DE.AWI	Scientist	Biology
Marienfeld	Thomas	DE.LAEISZ	Engineer	Shipping Company
Schartow	Matthias	DE.AWI	Technician	Logistics
Trautmann	Michael	DE.AWI	Engineer	Logistics
Utech	Sabine	DE.LAEISZ	Inspector	Shipping Company
Weil	Jörg	DE.SHIPDESIGN	Observer	Logistics

PS145/1 and PS145/2 not on board				
Name/ Last name	**Vorname/ First name**	**Institut/ Institute**	**Beruf/ Profession**	**Fachrichtung/ Discipline**
Dorschel	Boris	DE.AWI	Scientist	Geophysics
Fischer	Philipp	DE.AWI	Scientist	Biology
Gerchow	Peter	DE.AWI	Scientist	Logistics
Krocker	Ralf	DE.AWI	Scientist	Logistics

A.3 SCHIFFSBESATZUNG / SHIP‘S CREW PS145/1

No	Name / Last Name	Vorname / First name	Position / Rank
1	Kentges	Felix	Master (P)
2	Langhinrichs	Jacob	Chief Mate (P)
3	Janik	Michael	Chief Mate Cargo (P)
4	Hering	Igor	2nd Mate (P)
5	Rathke	Wulf	2nd Mate (P)
6	Goessmann - Lange	Petra	Doctor
7	Grafe	Jens	Chief Engineer (P)
8	Baehler	Stefanie	2nd Engineer (P)
9	Brose	Thomas	2nd Engineer (P)
10	Farysch	Tim	2nd Engineer (P)
11	Hofmann	Joerg	Electrical Engineer – Communication (P)
12	Huettebraeucker	Olaf	Electrical Engineer (P)
13	Jaeger	Vladimir	Electrical Engineer (P)
14	Pliet	Johannes	Electrical Engineer (P)
15	Redmer	Jens	Electrical Engineer (P)
15	Sedlak	Andreas	Bosun
17	Ackenhausen	Hendrik	FA/D
18	Burzan	Gerd-Ekkehard	FA/D
19	Deutschbein	Felix Maximilian	FA/D
20	Fischer	Sascha	FA/D
21	Klaehn	Anton	FA/D
22	Klee	Philipp	FA/D
23	Kryszkiewicz	Maciej	FA/D
24	Roeth	Benedikt	FA/D
25	Haenert	Ove	FA/M
26	Juszczyk	Michal	FA/M
27	Klinger	Dana	FA/M

No	Name / Last Name	Vorname / First name	Position / Rank
28	Muenzenberger	Boerge	FA/M
29	Schroeder	Paul	FA/M
30	Neisner	Winfried	Carp.
31	Preussner	Joerg	Fitter/E
32	Hofmann	Werner	Cook
33	Dietrich	Emilia	2./Cook
34	Hammelmann	Louisa	2./Cook
35	Pieper	Daniel	C/Stew.
36	Schwantes	Andrea	Stew. / Nurse
37	Arendt	Rene	2./Stew.
38	Braendli	Monika	2./Stew.
39	Chen	Dansheng	2./Stew.
40	Cheng	Qi	2./Stew.
41	Dibenau	Torsten	2./Stew.
42	Tiesler	Anja	2./Stew.

A.3 SCHIFFSBESATZUNG / SHIP‘S CREW PS145/2

No	Name / Last Name	Vorname / First name	Position / Rank
1	Kentges	Felix	Master (P)
2	Langhinrichs	Jacob	Chief Mate (P)
3	Janik	Michael	Chief Mate Cargo (P)
4	Hering	Igor	2nd Mate (P)
5	Rathke	Wulf	2nd Mate (P)
6	Goessmann - Lange	Petra	Doctor
7	Grafe	Jens	Chief Engineer (P)
8	Baehler	Stefanie	2nd Engineer (P)
9	Brose	Thomas	2nd Engineer (P)
10	Farysch	Tim	2nd Engineer (P)
11	Loske	Sven	2nd Engineer (P)
12	Hofmann	Joerg	Electrical Engineer – Communication (P)
13	Ejury	Rene	Electrical Engineer (P)
14	Huettebraeucker	Olaf	Electrical Engineer (P)
15	Jaeger	Vladimir	Electrical Engineer (P)
15	Pliet	Johannes	Electrical Engineer (P)
17	Redmer	Jens	Electrical Engineer (P)
18	Sedlak	Andreas	Bosun
19	Ackenhausen	Hendrik	FA/D
20	Burzan	Gerd-Ekkehard	FA/D
21	Deutschbein	Felix Maximilian	FA/D
22	Fischer	Sascha	FA/D
23	Klaehn	Anton	FA/D
24	Klee	Philipp	FA/D
25	Kryszkiewicz	Maciej	FA/D
26	Roeth	Benedikt	FA/D
27	Haenert	Ove	FA/M

No	Name / Last Name	Vorname / First name	Position / Rank
28	Juszczyk	Michal	FA/M
29	Klinger	Dana	FA/M
30	Muenzenberger	Boerge	FA/M
31	Schroeder	Paul	FA/M
32	Neisner	Winfried	Carp.
33	Preussner	Joerg	Fitter/E
34	Hofmann	Werner	Cook
35	Dietrich	Emilia	2./Cook
36	Hammelmann	Louisa	2./Cook
37	Pieper	Daniel	C/Stew.
38	Schwantes	Andrea	Stew. / Nurse
39	Arendt	René	2./Stew.
40	Braendli	Monika	2./Stew.
41	Chen	Dansheng	2./Stew.
42	Cheng	Qi	2./Stew.
43	Dibenau	Torsten	2./Stew.
44	Tiesler	Anja	2./Stew.

A.4 STATIONSLISTE / STATION LIST PS145/1 AND PS145/2

Station list of expedition PS145/1 from Bremerhaven – Las Palmas; the list details the action log for all stations along the cruise track.

See https://www.pangaea.de/expeditions/events/PS145/1 to display the station (event) list for expedition PS145/1.
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
PS145/1-track		2024-11-24T00:00:00	53.56750	8.55480		CT	Station start	Bremerhaven – Las Palmas
PS145/1-track		2024-12-05T00:00:00	28.14410	-15.40220		CT	Station end	Bremerhaven – Las Palmas
PS145/1_0_Underway-1		2024-11-28T19:40:24	49.45099	-4.32500	80	AUTOFIM	Station start	no start given (here same as Underway-2)
PS145/1_0_Underway-1		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	AUTOFIM	Station end	no start given (here same as Underway-2)
PS145/1_0_Underway-2		2024-11-28T19:40:24	49.45099	-4.32500	80	MYON	Station start	
PS145/1_0_Underway-2		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	MYON	Station end	
PS145/1_0_Underway-3		2024-11-30T14:46:29	44.01384	-10.92240	4948.4	FBOX	Station start	
PS145/1_0_Underway-3		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	FBOX	Station end	
PS145/1_0_Underway-4		2024-11-28T19:40:24	49.45099	-4.32500	80	ICERAD	Station start	no start given (here same as Underway-2)

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment
PS145/1_0_Underway-4		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	ICERAD	Station end	no start given (here same as Underway-2)
PS145/1_0_Underway-5		2024-11-28T19:37:51	49.45476	-4.31504	79.9	MAG	Station start	
PS145/1_0_Underway-5		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	MAG	Station end	
PS145/1_0_Underway-6		2024-11-28T19:37:21	49.45546	-4.31315	80.7	GRAV	Station start	
PS145/1_0_Underway-6		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	GRAV	Station end	
PS145/1_0_Underway-7		2024-11-25T07:48:00	53.76138	5.92348	15.1	MBES	Station start	
PS145/1_0_Underway-7		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	MBES	Station end	
PS145/1_0_Underway-8		2024-11-28T19:39:56	49.45170	-4.32312	80.1	NEUMON	Station start	
PS145/1_0_Underway-8		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	NEUMON	Station end	
PS145/1_0_Underway-9		2024-11-28T19:40:24	49.45099	-4.32500	80	CAME	Station start	no start given (here same as Underway-2)
PS145/1_0_Underway-9		2024-12-05T07:38:39	28.25850	-15.34004	2061.5	CAME	Station end	no start given (here same as Underway-2)
PS145/1_0_Underway-10		2024-11-30T14:47:17	44.01187	-10.92420	4949.5	pCO2	Station start	
PS145/1_0_Underway-10		2024-12-05T07:38:39	28.25850	-15.34004	2061.5	pCO2	Station end	
PS145/1_0_Underway-11		2024-11-28T19:40:24	49.45099	-4.32500	80	pCO2	Station start	no start given (here same as Underway-2)

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment
PS145/1_0_Underway-11		2024-12-05T07:38:39	28.25850	-15.34004	2061.5	pCO2	Station end	no start given (here same as Underway-2)
PS145/1_0_Underway-12		2024-11-28T19:40:24	49.45099	-4.32500	80	RAMSES	Station start	no start given (here same as Underway-2)
PS145/1_0_Underway-12		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	RAMSES	Station end	no start given (here same as Underway-2)
PS145/1_0_Underway-13		2024-11-28T18:34:26	49.55306	-4.07060	73	PS	Station start	
PS145/1_0_Underway-13		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	PS	Station end	
PS145/1_0_Underway-14		2024-11-28T19:40:24	49.45099	-4.32500	80	SEISREFL	Station start	no start given (here same as Underway-2)
PS145/1_0_Underway-14		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	SEISREFL	Station end	no start given (here same as Underway-2)
PS145/1_0_Underway-15		2024-11-25T07:48:00	53.76138	5.92348	15.1	SNDVELPR	Station start	
PS145/1_0_Underway-15		2024-12-05T07:38:39	28.25850	-15.34004	2061.5	SNDVELPR	Station end	
PS145/1_0_Underway-16		2024-11-28T19:38:34	49.45372	-4.31784	80.8	TSG	Station start	
PS145/1_0_Underway-16		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	TSG	Station end	
PS145/1_0_Underway-17		2024-11-28T19:38:53	49.45325	-4.31906	80	TSG	Station start	
PS145/1_0_Underway-17		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	TSG	Station end	

Event label	Optional label	Date/Time	Latitude	Longitude	Depth [m]	Gear	Action	Comment
PS145/1_0_Underway-18		2024-11-28T19:40:24	49.45099	-4.32500	80	W-RADAR	Station start	no start given (here same as Underway-2)
PS145/1_0_Underway-18		2024-12-05T07:38:39	28.25850	-15.34004	2061.5	W-RADAR	Station end	no start given (here same as Underway-2)
PS145/1_0_Underway-19		2024-11-24T08:00:00	53.56393	8.55894		SWEAS	Station start	
PS145/1_0_Underway-19		2024-12-05T07:39:12	28.25697	-15.34058	2057.1	SWEAS	Station end	
PS145/1_0_Underway-20		2024-11-28T20:02:45	49.41854	-4.41119	81.1	ADCP	Station start	
PS145/1_0_Underway-20		2024-12-05T07:38:39	28.25850	-15.34004	2061.5	ADCP	Station end	
PS145/1_1-1		2024-11-29T15:54:27	47.11063	-7.72008	4243.6	CTD-RO	max depth	
PS145/1_2-1		2024-11-30T15:18:09	43.95101	-10.97721	4950.5	SVP	Station start	
PS145/1_2-1		2024-11-30T19:02:20	43.95300	-10.97490	4961	SVP	Station end	
PS145/1_3-1		2024-12-01T10:47:29	41.53951	-11.95611	4462.6	CTD-RO	max depth	
PS145/1_4-1		2024-12-02T14:12:45	37.16639	-13.26831	4167.5	CTD-RO	max depth	
PS145/1_5-1		2024-12-03T14:04:18	34.70094	-13.95104	4071.8	CTD-RO	max depth	
PS145/1_6-1		2024-12-04T13:38:09	30.98798	-14.97062	3854.2	CTD-RO	max depth	

** Comments are limited to 130 characters. See https://www.pangaea.de/expeditions/events/PS145/1 to show full comments in conjunction with the station (event) list for expedition PS145/1.*

Abbreviation	Method/Device
ADCP	Acoustic Doppler Current Profiler
AUTOFIM	Automated Filtration for Marine Microbes
CAME	Camera
CT	Underway cruise track measurements
CTD-RO	CTD/Rosette
FBOX	FerryBox
GRAV	Gravimetry
ICERAD	Ice radar
MAG	Magnetometer
MBES	Multibeam echosounder
MYON	DESY Myon Detector
NEUMON	Neutron monitor
PS	ParaSound
RAMSES	RAMSES hyperspectral radiometer
SEISREFL	Seismic reflection profile
SNDVELPR	Sound velocity probe
SVP	Sound velocity profiler
SWEAS	Ship Weather Station
TSG	Thermosalinograph
W-RADAR	Wave Radar System
pCO2	pCO2 sensor

Station list of expedition PS145/2 from Las Palmas – Walvis Bay;
the list details the action log for all stations along the cruise track.

See https://www.pangaea.de/expeditions/events/PS145/2 to display the station (event) list for expedition PS145/2.
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	Elevation	Gear	Action	Comment [cut]
PS145/2-track		2024-12-05T00:00:00	28.14410	-15.40220		CT	Station start	Las Palmas – Walvis Bay
PS145/2-track		2024-12-21T00:00:00	-22.94100	14.50300		CT	Station end	Las Palmas – Walvis Bay
PS145/2_0_Underway-1		2024-12-05T17:12:56	27.66193	-15.35796	1900.7	ADCP	Station start	
PS145/2_0_Underway-1		2024-12-20T09:14:21	-20.58614	11.72232	1067.3	ADCP	Station end	
PS145/2_0_Underway-2		2024-12-06T17:41:46	24.94150	-20.28400	1925.3	MBES	Station start	
PS145/2_0_Underway-2		2024-12-20T05:21:47	-20.10700	11.18410	1067.3	MBES	Station end	
PS145/2_0_Underway-4		2024-12-05T17:11:41	27.66550	-15.35530	1925.3	MYON	Station start	
PS145/2_0_Underway-4		2024-12-20T09:14:53	-20.58733	11.72364	1067.4	MYON	Station end	
PS145/2_0_Underway-5		2024-12-05T17:11:41	27.66550	-15.35530	1925.3	FBOX	Station start	
PS145/2_0_Underway-5		2024-12-20T09:14:53	-20.58733	11.72364	1067.4	FBOX	Station end	
PS145/2_0_Underway-7		2024-12-05T17:11:41	27.66550	-15.35530	1925.3	MAG	Station start	
PS145/2_0_Underway-7		2024-12-20T09:14:53	-20.58733	11.72364	1067.4	MAG	Station end	
PS145/2_0_Underway-8		2024-12-05T17:11:41	27.66550	-15.35530	1925.3	GRAV	Station start	
PS145/2_0_Underway-8		2024-12-20T09:14:53	-20.58733	11.72364	1067.4	GRAV	Station end	
PS145/2_0_Underway-9		2024-12-05T17:11:41	27.66550	-15.35530	1925.3	NEUMON	Station start	
PS145/2_0_Underway-9		2024-12-20T09:14:53	-20.58733	11.72364	1067.4	NEUMON	Station end	
PS145/2_0_Underway-11		2024-12-05T17:12:56	27.66193	-15.35796	1900.7	pCO2	Station start	

Event label	Optional label	Date/Time	Latitude	Longitude	Elevation	Gear	Action	Comment [cut]
PS145/2_0_Underway-11		2024-12-20T09:14:21	-20.58614	11.72232	1067.3	pCO2	Station end	
PS145/2_0_Underway-16		2024-12-05T17:12:56	27.66193	-15.35796	1900.7	SNDVELPR	Station start	
PS145/2_0_Underway-16		2024-12-20T09:14:21	-20.58614	11.72232	1067.3	SNDVELPR	Station end	
PS145/2_0_Underway-17		2024-12-05T17:11:41	27.66550	-15.35530	1925.3	TSG	Station start	
PS145/2_0_Underway-17		2024-12-20T09:14:53	-20.58733	11.72364	1067.4	TSG	Station end	
PS145/2_0_Underway-18		2024-12-05T17:11:41	27.66550	-15.35530	1925.3	TSG	Station start	
PS145/2_0_Underway-18		2024-12-20T09:14:53	-20.58733	11.72364	1067.4	TSG	Station end	
PS145/2_0_Underway-20		2024-12-05T17:11:41	27.66550	-15.35530	1925.3	SWEAS	Station start	Event shows start/end point (date/time & coordinates) of first/last data record using Atlas Hydrographic Hydrosweep DS 3 multibeam…
PS145/2_0_Underway-20		2024-12-20T09:14:53	-20.58733	11.72364	1067.4	SWEAS	Station end	Event shows start/end point (date/time & coordinates) of first/last data record using Atlas Hydrographic Hydrosweep DS 3 multibeam…
PS145/2_1-1		2024-12-07T13:00:09	21.23942	-21.07986	4242.6	SVP	Station start	
PS145/2_1-1		2024-12-07T15:03:27	21.24191	-21.07888	4241.3	SVP	Station end	
PS145/2_2-1		2024-12-08T13:58:45	16.94311	-21.13356	3580.6	CTD-RO	max depth	

Event label	Optional label	Date/Time	Latitude	Longitude	Elevation	Gear	Action	Comment [cut]
PS145/2_3-1		2024-12-09T13:49:45	12.53043	-21.11569		CTD-RO	max depth	
PS145/2_4-1		2024-12-10T13:55:09	8.60245	-19.11635		CTD-RO	max depth	
PS145/2_5-1		2024-12-11T13:52:54	5.29778	-16.18911		CTD-RO	max depth	
PS145/2_6-1		2024-12-12T13:56:45	2.46465	-13.13193	4906.8	CTD-RO	max depth	
PS145/2_7-1		2024-12-13T12:50:36	-0.27427	-10.19648		CTD-RO	max depth	
PS145/2_8-1		2024-12-15T12:54:27	-6.34044	-3.75963	4934.1	CTD-RO	max depth	
PS145/2_9-1		2024-12-16T12:49:36	-9.19894	-0.71925		CTD-RO	max depth	

** Comments are limited to 130 characters. See https://www.pangaea.de/expeditions/events/PS145/2 to show full comments in conjunction with the station (event) list for expedition PS145/2*

Abbreviation	Method/Device
ADCP	Acoustic Doppler Current Profiler
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
SVP	Sound velocity profiler
SWEAS	Ship Weather Station
TSG	Thermosalinograph
pCO2	pCO2 sensor

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HELMHOLTZ-ZENTRUM FÜR POLAR-
UND MEERESFORSCHUNG

BREMERHAVEN

Am Handelshafen 12
27570 Bremerhaven
Telefon 0471 4831-0
Telefax 0471 4831-1149
www.awi.de

HELMHOLTZ