

EXPEDITION PROGRAMME PS142

Polarstern

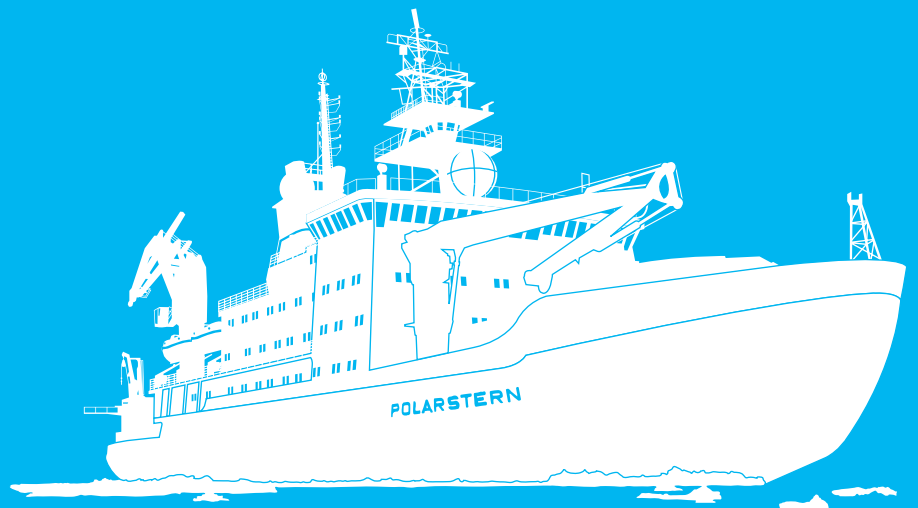
PS142

Walvis Bay - Bremerhaven

16 April 2024 - 14 May 2024

Coordinator: Ingo Schewe

Chief Scientist: Simon Dreutter



HELMHOLTZ

Bremerhaven, February 2024

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

Telefon: +49 471 4831-0
Telefax: +49 471 4831-1149
E-Mail: info@awi.de

Website: <http://www.awi.de>
Email Coordinator: ingo.schewe@awi.de
Email Chief Scientist: simon.dreutter@awi.de

The Expedition Programme *Polarstern* is issued by the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) in Bremerhaven, Germany.

The Programme provides information about the planned goals and scientific work programmes of expeditions of the German research vessel *Polarstern*.

The papers contained in the Expedition Programme *Polarstern* do not necessarily reflect the opinion of the AWI.

Editorial editing and layout
Susan Amir Sawadkuhi

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

www.awi.de
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1. ÜBERBLICK UND EXPEDITIONSVERLAUF

Simon Dreutter

DE.AWI

Der Fahrtabschnitt PS142 ist der letzte Abschnitt der antarktischen Forschungs-Saison 2023/24 und dient neben dem Forschungsprogramm dazu, *Polarstern* zurück nach Bremerhaven zu überführen. Die Reise startet am 16.04.2024 in Walvis Bay und endet am 13.05.2024 in Bremerhaven (Abb. 1.1).

Während PS142 sind folgende Messungen und Tätigkeiten geplant:

1. Bathymetrische Vermessung der Meeresbodentopographie mit den schiffseigenen hydroakustischen Systemen sowie regelmäßige Wasserschallkalibration der Echolotsysteme mittels CTD-Stationen.
2. Regelmäßige Probennahme der Reinseewasser-Pumpe sowie per CTD zur Untersuchung von Coccolithophoren.
3. Tägliche Wetterbeobachtungen und -vorhersagen durch den Deutschen Wetterdienst.
4. Technische Wartungsarbeiten an der Schiffs-IT.

SUMMARY AND ITINERARY

The expedition PS142 is the last leg of the Antarctic season 2023/24 and, next to the scientific programme, will return *Polarstern* to its home port Bremerhaven. The trip will start in Walvis Bay on 16 April 2024 and will end on 14 May 2024 in Bremerhaven (Fig. 1.1).

During PS142 the following measurements and activities will be carried out:

1. With the ship-mounted hydroacoustic systems, a swath of seabed topography will be bathymetrically surveyed along the ship's track. In summary, one day of station time will be spent on calibrating the echosounding systems by regular CTD casts.
2. Sampling via the sea water in-take or plankton nets for coccolithophores.
3. Daily weather observations and forecasts will be carried out by Germany's National Meteorological Service.
4. Technical Maintenance on the ship's IT.

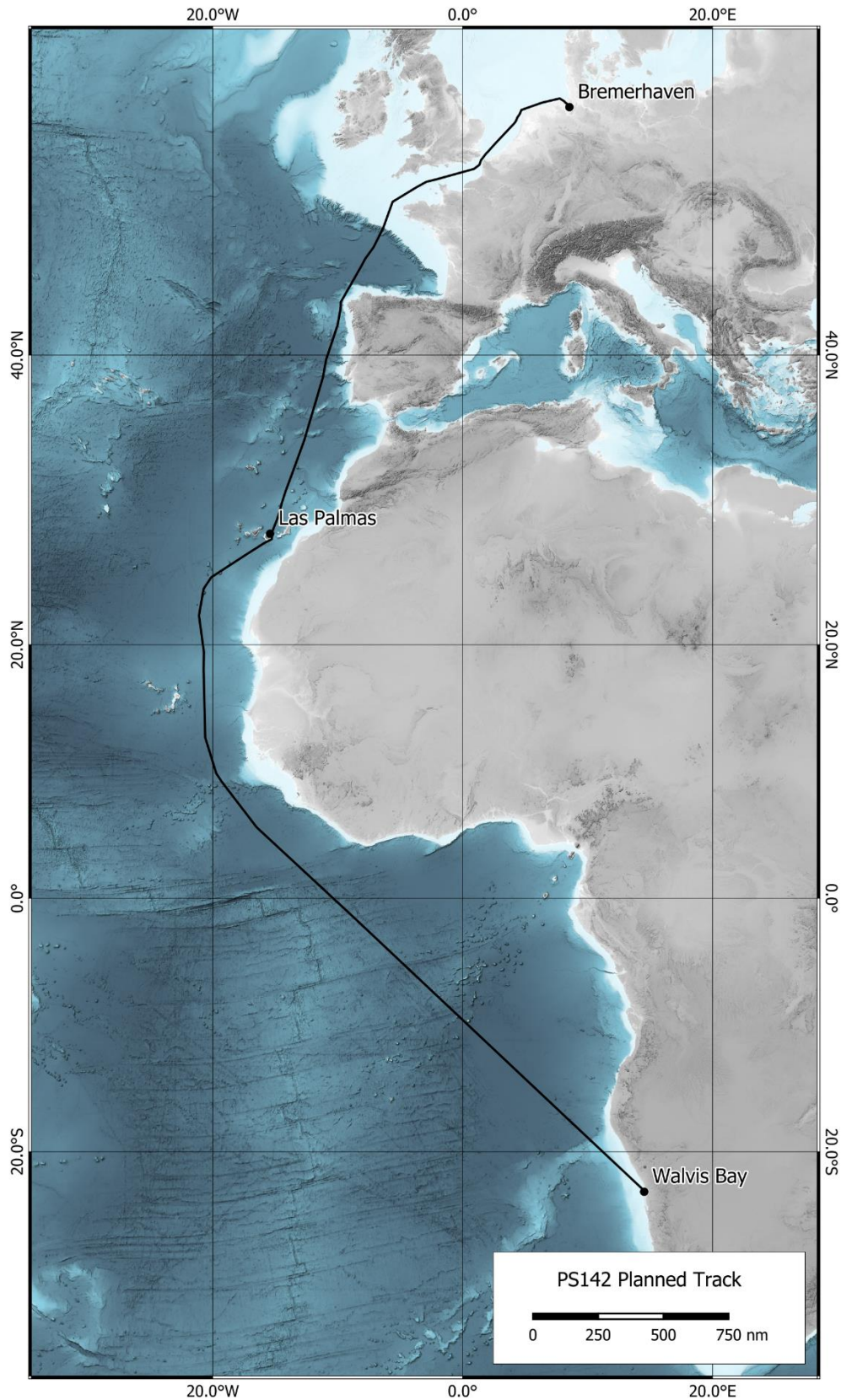


Abb. 1.1: Geplanter Fahrtverlauf der Polarstern Expedition PS142
Fig. 1.1: Planned cruise track of Polarstern expedition PS142

2. BATHYMETRIC UNDERWAY MEASUREMENTS

Simon Dreutter¹, Annie Lemire², Boris Dorschel¹

¹DE.AWI

²DE.UNI-BREMEN

Grant-No. AWI_PS142_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, hence geomorphology, is furthermore 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 10s of meters below the seabed provide information on the sediments at the seafloor and on the lateral extension of sediment successions.

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 resolution necessary 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 sufficient to resolve those features. The collection of underway data during PS142 will contribute to the bathymetry data archive at the AWI and therefore contribute to bathymetric world datasets like GEBCO (General Bathymetric Chart of the Ocean).

Work at sea

Bathymetric data will be recorded with the hull-mounted multibeam echosounder Teledyne Reson HYDROSWEEP DS3. The main task of the bathymetry group is to run hydroacoustic systems during transit. The raw bathymetric data will be corrected for sound velocity changes in the water column, and will be further processed and cleaned for erroneous soundings and artefacts.

Sound velocity profiles will be collected with a CTD (Conductivity Temperature Depth), an Underway CTD, or an SVP (Sound Velocity Probe) whenever possible.

Preliminary (expected) results

Expected results will consist of high-resolution seabed maps along the cruise track.

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.

This expedition is supported by the Helmholtz Research Programme “Changing Earth – Sustaining our Future” Topic 2, Subtopic 3 Sea Level Change.

In all publications based on this expedition, the **Grant No. AWI_ PS142_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. CAPTURING DIVERSITY OF COCCOLITHOPHORES THROUGH SINGLE CELL GENOMICS

Raphael Gollnisch¹

¹UK.OXF

Grant-No. AWI_PS142_02

Outline

Marine phytoplankton are responsible for producing half of our planet's organic matter and oxygen. Despite their significance, surprisingly little is known about their demographic history and the population genetic processes that underlie their evolution. This project aims to advance our understanding of evolutionary processes in extremely large plankton populations by building on recent plankton evolution research. The project will focus specifically on coccolithophores, which are fundamental components of the marine carbon cycle. It aims to investigate the demography and evolutionary history of coccolithophores based on genomic analysis of extant species. The large quantities of DNA required for sequencing are typically obtained through laboratory culture of monoclonal strains of unicellular algae. However, only a small fraction of coccolithophore species have been successfully grown in culture. Culturing strains of *Geophyrocapsa* species is well established, but the diversity of coccolithophores beyond these genera is currently underrepresented in culture collections. In this project, single-cell genomics will be employed to circumvent the existing culturing bias in coccolithophores.

Objectives

The objective of this project is to sample coccolithophores and to isolate single cells, aiming at uncultured species in particular. Samples will be collected to cover a wide geographic range in diversity of coccolithophores. The isolated single cells will then be used for whole genome amplification and single-cell genomic analysis of the demography and evolutionary history of uncultured coccolithophores.

Work at sea

Surface seawater samples will be collected using Niskin bottles (rosette water sampler) to characterize the phytoplankton assemblage and to isolate single cells of coccolithophores. The samples will be used for manual isolation of single coccolithophore cells (single-cell genome sequencing), filtration for metagenome sequencing, and filtration for SEM imaging.

Seawater samples for single cell isolation will be concentrated through tangential flow filtration. Single cells of coccolithophores will then be isolated from the concentrated samples by micropipetting and using a microscope. All isolated cells will be documented by microscopy images during isolation to later link individual genotypes to morphotypes. Single-cell isolates will be stored frozen for whole genome amplification and sequencing to produce single amplified genomes. Seawater samples for SEM imaging to document the species assemblage in the sample will be vacuum filtered onto PC membrane filters and dried. Seawater samples for metagenome sequencing will be vacuum filtered onto PC membrane filters and stored frozen for subsequent nucleic acid extraction and sequencing.

Preliminary (expected) results

The project will provide insights into the genetic diversity of coccolithophores through single amplified genomes and metagenomes, with a focus on uncultured species. This will allow to study their demography and evolutionary history. Evolutionary genetic inference of the demographic history of coccolithophores in combination with paleontological records will improve our paleoclimatic understanding of the biological drivers of global climatic change.

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.

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 expedition, the **Grant No. AWI_PS142_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>.

APPENDIX

A.1 TEILNEHMENDE INSTITUTE / PARTICIPATING INSTITUTES

A.2 FAHRTTEILNEHMER:INNEN / CRUISE PARTICIPANTS

A.3 SCHIFFSBESATZUNG / SHIP'S CREW

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.SYSTEMA	SYSTEMA Gesellschaft für angewandte Datentechnik mbH Haferwende 27 28357 Bremen Germany
DE.UNI-BREMEN	Universität Bremen Klagenfurter Strasse 2-4 28359 Bremen Germany
DE.WERUM	Werum Software & Systems AG Anna-Vogeley-Straße 20 21337 Lüneburg Germany
UK.OXF	University of Oxford Department of Earth Sciences 3 South Parks Road OX1 3AN Oxford United Kingdom

A.2 FAHRTTEILNEHMER:INNEN / CRUISE PARTICIPANTS

Name/ Last name	Vorname/ First name	Institut/ Institute	Beruf/ Profession	Fachrichtung/ Discipline
Betz	Maximilian	DE.AWI	Engineer	Logistics
Crenan	Brieuc	DE.LAEISZ	Engineer	Logistics
Dreutter	Simon	DE.AWI	Technician	Geophysics
Immoor	Sebastian	DE.AWI	Technician	Logistics
Janssen	Inna	DE.WERUM	Engineer	Logistics
Lemire	Annie	DE.UNI-BREMEN	Student	Geophysics
Lensch	Norbert	DE.AWI	Technician	Geology
Gollnisch	Raphael	UK.OXF	Scientist	Biology
Riess	Felix	DE.LAEISZ	Inspector	Logistics
Rohleder	Christian	DE.DWD	Technician	Meteorology
Seidenstücker	Andreas	DE.SYSTEMA	Engineer	Logistics
Wiese	Anne	DE.DWD	Scientist	Meteorology

A.3 SCHIFFSBESATZUNG / SHIP'S CREW

Name / Last Name	Vorname / First name	Position / Rank
Kentges	Felix	Master
Strauß	Erik	C/M
Eckenfels	Hannes	2/M Cargo
Ziemann	Olaf	C/E
Weiß	Daniel	2/M
Peine	Lutz	2/M
Dr. Guba	Klaus	Doc
Dr. Hofmann	Jörg	E/E Com.
Ehrke	Tom	2/E
Krinfeld	Oleksandr	2/E
Rusch	Torben	2/E
Pommerencke	Bernd	E/E SET
Frank	Gerhard	E/E Brücke
Schwedka	Thorsten	E/E Labor
Winter	Andreas	E/E Sys
Krüger	Lars	E/E Winde
Brück	Sebastian	Bosun
Keller	Jürgen	Carpenter
Möller	Falko	MPR
Buchholz	Joshua	MPR
Schade	Tom	MPR
Decker	Jens	MPR
Niebuhr	Tim	MPR
TBN		MPR
Mahlmann	Oliver	MPR
TBN		MPR
Probst	Lorenz	MPR
Clasen	Nils	MPR
TBN		MPR
TBN		MPR
Plehn	Marco	Fitter/E
Skrzipale	Mitja	Cook
Fehrenbach	Martina	2./Cook
TBN		2./Cook
Witusch	Petra	C/Stew.
Ilk	Romy	Stew./Nurse
Probst	Sabine	2./Stew.
Golla	Gerald	2./Stew.

Name / Last Name	Vorname / First name	Position / Rank
Stocker	Eileen	2./Stew.
Shi	Wubo	2./Stew.
Chen	Jirong	2./Stew.
Chen	Quanlun	2./Stew.
Spellerberg	Falk	Trainee

