

Water isotope, d18O and 3H, distributions collected on the US GEOTRACES GP17- ANT expedition aboard R/V Nathaniel B. Palmer (cruise NBP24-01) in the Southern Ocean across the Amundsen Sea from December 2023 to January 2024

Website: <https://www.bco-dmo.org/dataset/1009629>

Data Type: Cruise Results

Version: 1

Version Date: 2026-10-12

Project

» [US GEOTRACES GP17 Section: Amundsen Sea Sector of the Antarctic Continental Margin \(GP17-ANT\)](#) (GP17-ANT)
» [Collaborative Research: US GEOTRACES GP17-OCE and GP17-ANT: Properties and processes impacting other trace element and isotope cycles using noble gas and stable isotope tracers](#) (GP17-OCE and GP17-ANT noble gas and stable isotope tracers)

Program

» [U.S. GEOTRACES](#) (U.S. GEOTRACES)

Contributors	Affiliation	Role
Loose, Brice	University of Rhode Island (URI)	Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

These oxygen isotope samples were collected during the US GEOTRACES GP17-ANT expedition aboard R/V Nathaniel B. Palmer (cruise NBP24-01) in the Southern Ocean across the Amundsen Sea from December 2023 to January 2024. The water samples were measured at the British Geological Survey (BGS) by Isotope Ratio Mass Spectrometry. The measurements cover the central Amundsen Sea from the continental shelf break to the Dotson and Getz ice shelves, including the area of the Amundsen Sea Polynya. The measurements can be used with CTD salinity to estimate the relative amount (relative concentration) of sea ice melt and meteoric water - both sources of freshwater to the ocean, and were collected by Dr. Brice Loose of the University of Rhode Island.

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Coverage

Location: Central Amundsen Sea from the shelf break to the Dotson and Getz ice shelves

Methods & Sampling

Seawater samples for oxygen-18 were collected from the Seabird SBE 9 CTD rosette, from snow samples, and from sea ice cores in 30-milliliter (mL) Fisherbrand amber Boston Round glass vials with conical cap. Caps were sealed with electrical tape to secure them in place and to reduce the risk of evaporation.

Seawater samples for tritium were collected in argon-filled 1-liter (L) amber glass bottles. Snow samples were collected in 3L multilayer foil bags and evacuated of air before purging with pure nitrogen; snow samples were allowed to melt and transferred to Boston Round glass vials. Sea ice cores were allowed to melt in sample

containers covered by Parafilm before being measured for salinity and transferred to the 1L argon-filled bottles.

Data Processing Description

No measured water samples were excluded from this data set. Replicate oxygen isotope samples are measured at the BGS every 6 to 10 samples to determine an analytical uncertainty. The average of these replicates was 0.02 permil and is used as the data set uncertainty for oxygen-18.

A percentage of tritium samples collected for measurement are lost during degassing and storage. The remainder are included in this dataset. The analytical precision was determined as 0.007 permil based on a replicate in the dataset.

BCO-DMO Curation Notes

This section documents curation actions performed prior to publication review with the submitter, and additional information relevant to understanding and reusing this dataset. It distinguishes changes made to the submitted (meta)data from unresolved issues and/or enhancements that improve future reuse and interoperability.

CURATION ACTIONS PERFORMED ON DATA

- This dataset was accepted by BCO-DMO on 2026-10-09 and is currently being processed.

CURATION ACTIONS PERFORMED ON METADATA

- BCO-DMO's standard metadata entry and text formatting steps were performed. See: <https://www.bco-dmo.org/how-to/standard-curation-edits>

ISSUES POTENTIALLY IMPACTING REUSE

- TBD

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Parameters

Parameters for this dataset have not yet been identified

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Deployments

NBP2401

Website	https://www.bco-dmo.org/deployment/969543
Platform	RVIB Nathaniel B. Palmer
Report	https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/nathanielbpalmer_nbp2401.pdf
Start Date	2023-11-29
End Date	2024-01-28
Description	See more information at: R2R https://www.rvdata.us/search/cruise/NBP2401 BODC https://www.bodc.ac.uk/resources/inventories/cruise_inventory/report/18091/ US GEOTRACES https://usgeotraces.ideo.columbia.edu/content/gp17-ant Description: The U.S. GEOTRACES GP17-ANT expedition departed Punta Arenas, Chile on November 29th, 2023 and arrived in Lyttelton, New Zealand on January 28th, 2024. The cruise took place in the Amundsen Sea aboard the R/V Nathaniel B. Palmer with a team of 35 scientists led by Peter Sedwick (Old Dominion University), Phoebe Lam (University of California, Santa Cruz), and Robert Sherrell (Rutgers University). GP17 was planned as a two-leg expedition, with its first leg (GP17-OCE) as a southward extension of the 2018 GP15 Alaska-Tahiti expedition and this second leg (GP17-ANT) into coastal and shelf waters of Antarctica's Amundsen Sea.

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Project Information

US GEOTRACES GP17 Section: Amundsen Sea Sector of the Antarctic Continental Margin (GP17-ANT)

Website: <https://www.geotraces.org/>

Coverage: Amundsen Sea Sector of the Antarctic Continental Margin

U.S. GEOTRACES extended its meridional transect, initiated on the 2018 GP15 Alaska-Tahiti expedition, south to the Antarctic ice edge and then east to Chile with GP17-OCE (December 2022 - January 2023). Because of the potentially important trace elements and isotopes (TEIs) inputs and transformations occurring in Antarctic waters and shelves, GP17 also had a second leg, GP17-ANT (November 29, 2023 - January 30, 2024) into coastal and shelf waters of Antarctica's Amundsen Sea. Further information is available on the [US GEOTRACES website](#).

NSF Project Title: Collaborative Research: Management and Implementation of US GEOTRACES GP17 Section: Amundsen Sea Sector of the Antarctic Continental Margin (GP17-ANT)

NSF Award Abstract:

This project will support the management and implementation of a 60-day research cruise to the Amundsen Sea sector of the Antarctic continental margin to collect samples for measurements of a broad suite of trace elements and isotopes ('TEIs'), as part of the U.S. GEOTRACES program. GEOTRACES is a global effort in the field of Chemical Oceanography, the goal of which is to understand the distributions of trace elements and their isotopes in the ocean. Determining the distributions of these elements and isotopes will increase the understanding of processes that shape their distributions and also the processes that depend on these elements. Key TEIs include essential micronutrients such as iron and zinc; 'tracers' such as aluminum, manganese, and isotopes of nitrogen, thorium and neodymium that can be used to investigate modern and ancient ocean processes; and elements such as lead that are indicative of human activities. In the Southern Ocean, the Antarctic continental margins are important as sources of micronutrient trace elements such as iron, which is required to support biological production and carbon export over the Antarctic shelf and in offshore waters of the Antarctic Circumpolar Current. Moreover, these regions are experiencing rapid environmental changes that are expected to impact oceanic circulation and biogeochemical cycles, for which TEIs provide crucial data needed to test and refine numerical models of the Earth system. The Amundsen Sea sector holds particular interest because of the pronounced, decadal-scale increases in the melting rates of glacial ice shelves that border the region, driven by intrusions of warm Circumpolar Deep Water onto the continental shelf. This melting has potentially major impacts on global sea level, on the formation of Antarctic Bottom Water in the Ross Sea, and on the regional ecosystem.

The cruise will comprise essential sampling operations (collection and shipboard processing) and ancillary measurements (hydrography, nutrients, algal pigments) in support of multiple, individual science projects, following the successful model of previous U.S. GEOTRACES cruises in the Atlantic, Pacific and Arctic ocean basins. The

cruise will sample the ocean region between 100°W and 135°W, with stations ranging from 67°S in the Antarctic Circumpolar Current southward to the Amundsen Sea continental shelf, including stations adjacent to several rapidly melting ice shelves and in highly-productive shelf polynyas. Water column samples will be collected using conventional and trace-metal clean CTD-rosette systems, in-situ high-volume pumps, and a towed fish sampler or small boat, using established methods. Sampling time will also be provided for collection of sea ice, floating glacial ice, and seafloor sediments. To facilitate coordination with a complementary open-ocean cruise and ensure access to the study region to document the impact of biological processes, the cruise is planned for late austral summer (late January-late March). Beyond the disciplinary contributions, the proposed research will contribute knowledge concerning the cryosphere and its impacts on global sea level and ocean circulation, regional ecosystems and biological processes, ocean-atmosphere interactions, and past and future environmental change. The project will contribute to STEM education and outreach through the participation of an NSF-funded PolarTREC education professional, and a K-12 STEM program for students from underserved and underrepresented schools run by Rutgers University education specialists. To foster public engagement, the investigators will partner with the UCSC Science Communication Program to engage freelance science journalists to profile research in this spectacular and harsh Antarctic environment.

Collaborative Research: US GEOTRACES GP17-OCE and GP17-ANT: Properties and processes impacting other trace element and isotope cycles using noble gas and stable isotope tracers (GP17-OCE and GP17-ANT noble gas and stable isotope tracers)

NSF Award Abstract:

The goal of the international GEOTRACES program is to understand the distributions of trace chemical elements and their isotopes in the oceans. This project will undertake measurements of noble gas concentrations, helium and oxygen isotope abundances, and tritium on two upcoming U.S. GEOTRACES expeditions to the South Pacific, Southern Ocean, and Amundsen Sea. The noble gas and isotope tracers will be used to determine the contributions of hydrothermal venting, glacial meltwater, and sea ice formation to the water masses of the region. Glacial melt and sea ice production are considered important drivers of trace element cycling on the Antarctic continental shelf. These processes also help establish the properties of Southern Ocean-sourced deep water. Upwelling of deep-sourced hydrothermal water could deliver limiting micronutrients such as iron to the surface waters of the Southern Ocean, driving enhanced primary productivity. Deeper-lying hydrothermal plumes may export fluxes of hydrothermal trace elements and isotopes (TEIs) through the Drake Passage. The project will support a graduate student, teacher professional development, and public outreach.

During the GEOTRACES GP17-OCE expedition, the team will measure helium-3, helium concentration, and neon concentration. On the GP17-ANT expedition, they will measure the concentrations of all five noble gases, helium-3, the stable isotope composition of water, and tritium. Specific aims include (1) to study pathways for hydrothermal inputs throughout the South Pacific, (2) to quantify other hydrothermally-sourced TEI fluxes and scavenging rates, (3) to quantify the inputs of snow and sea ice melt in relation to iron and other TEIs in the Amundsen Sea, (4) trace the ice shelf pump mechanism in the Amundsen Sea, and examine the spread of northward spread of meltwater and TEIs from the ice-covered marginal seas to the open Southern Ocean. In addition, since there is evidence that not all the hydrothermal inputs to the Southern Ocean have been discovered, the expeditions have the potential to expand knowledge of where additional hydrothermal systems, important to the biogeochemistry of the water column, are located.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Program Information

U.S. GEOTRACES (U.S. GEOTRACES)

Website: <http://www.geotraces.org/>

Coverage: Global

GEOTRACES is a [SCOR](#) sponsored program; and funding for program infrastructure development is provided by the [U.S. National Science Foundation](#).

GEOTRACES gained momentum following a special symposium, S02: Biogeochemical cycling of trace elements and isotopes in the ocean and applications to constrain contemporary marine processes (GEOSECS II), at a 2003 Goldschmidt meeting convened in Japan. The GEOSECS II acronym referred to the Geochemical Ocean Section Studies To determine full water column distributions of selected trace elements and isotopes, including their concentration, chemical speciation, and physical form, along a sufficient number of sections in each ocean basin to establish the principal relationships between these distributions and with more traditional hydrographic parameters;

- * To evaluate the sources, sinks, and internal cycling of these species and thereby characterize more completely the physical, chemical and biological processes regulating their distributions, and the sensitivity of these processes to global change; and

- * To understand the processes that control the concentrations of geochemical species used for proxies of the past environment, both in the water column and in the substrates that reflect the water column.

GEOTRACES will be global in scope, consisting of ocean sections complemented by regional process studies. Sections and process studies will combine fieldwork, laboratory experiments and modelling. Beyond realizing the scientific objectives identified above, a natural outcome of this work will be to build a community of marine scientists who understand the processes regulating trace element cycles sufficiently well to exploit this knowledge reliably in future interdisciplinary studies.

Expand "Projects" below for information about and data resulting from individual US GEOTRACES research projects.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2148473

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