

Combined bottle data for nutrients and hydrographic parameters collected on the US GEOTRACES GP17-ANT cruise in the Amundsen Sea on RVIB Nathaniel B. Palmer (NBP2401) from November 2023 to January 2024

Website: <https://www.bco-dmo.org/dataset/1009991>

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Project

» [US GEOTRACES GP17 Section: Amundsen Sea Sector of the Antarctic Continental Margin \(GP17-ANT\)](#) (GP17-ANT)

Program

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

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Abstract

This dataset comprises the processed bottle data for nutrients and hydrographic parameters collected from the Amundsen Sea and adjacent Southern Ocean during US GEOTRACES cruise GP17-ANT (RVIB Nathaniel B. Palmer cruise NBP24-01) in December 2023 and January 2024. The data are from discrete samples and associated sensor measurements collected during deployments of the trace-metal clean CTD rosette ("GTC rosette") and the conventional CTD rosette ("ODF rosette"), as well as from Niskin samplers deployed during McLane pump casts and multicorer deployments, and seawater collected from an underway towfish pump system or from pump systems used for collecting seawater for analysis of beryllium-7 and radium isotopes. The data include measurements of macronutrients (nitrate, nitrite, phosphate, silicate), salinity and dissolved oxygen in Niskin or GoFlo bottle samples, or pumped seawater samples, and corresponding CTD sensor measurements of depth (estimated from pressure), temperature, salinity, dissolved oxygen, beam transmittance, turbidity and chlorophyll fluorescence. Processing of the CTD sensor data and the discrete sample measurements were performed by personnel of the Scripps Institution of Oceanography Oceanographic Data Facility (SIO-ODF).

Table of Contents

- [Coverage](#)
- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
 - [BCO-DMO Curation Notes](#)
 - [Problem Description](#)
- [Related Publications](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)
- [Project Information](#)
- [Program Information](#)
- [Funding](#)

Coverage

Location: Amundsen Sea sector of Southern Ocean

Spatial Extent: N:-65.234 E:-78.854 S:-74.389 W:-133.038

Temporal Extent: 2023-12-05 - 2024-01-13

Methods & Sampling

Water column samples were collected using seven different sampling systems, each of which is detailed below. Wherever feasible, methods adhered to protocols described in the GEOTRACES Cookbook (Aguilar-Islas et al., 2024)

(1) Conventional CTD rosette ("ODF rosette") system deployments. The ODF rosette casts were performed with a package consisting of a 36-bottle rosette frame, a 36-place carousel and 36 x 10.6 liter (L) Bullister-style Niskin sampler bottles. The carousel was provided by the NOAA PMEL, with primary underwater electronic components consisting of a SeaBird Electronics housing unit with a pressure sensor, temperature sensors, conductivity sensors, and a membrane oxygen sensor, as well as a transmissometer, chlorophyll-a fluorometer, altimeter, and turbidity sensor. The package was deployed on a conducting steel hydrowire using the winch in the Baltic Room of RVIB *Nathaniel B. Palmer*. Further details are provided in the Instruments section and the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

(2) Trace-metal clean CTD rosette ("GTC rosette") system deployments. The GTC rosette casts were performed using the U.S. GEOTRACES trace-element rosette sampling system with a SeaBird custom-built frame and carousel (newly purchased) and 24 x 12 L GoFlo sampler bottles. The system included a SeaBird Electronics CTD unit with a pressure sensor, temperature sensors, conductivity sensors, and a membrane oxygen sensor, as well as a transmissometer, chlorophyll-a fluorometer, altimeter, and turbidity sensor. The package was deployed on sheathed conducting cable with Vectran strength member using a Dynacon winch mounted on the 02 deck of RVIB *Nathaniel B. Palmer*. Further details are provided in the Instruments section and the GP17-ANT cruise report (Sedwick et al., 2024).

(3) McLane in-situ pump deployments. During deep casts of the McLane in-situ pumps, which were deployed on Hytrel-coated, non-conducting Vectran line using a MASH4k winch mounted on the 02 deck of RVIB *Nathaniel B. Palmer*, 30 L Niskin samplers were attached to the Vectran line ~1-2 meters above each McLane pump, and were closed using Teflon-coated messengers. Sample depths are estimated using data collected by a SeaBird Electronics 19-plus v2 Seacat self-recording CTD that was shackled to the end of the Vectran wire for each pump cast. Further details are provided in the GP17-ANT cruise report (Sedwick et al., 2024).

(4) Multicorer deployments. During sediment collections using a Bowers and Connelly Mega Corer ("multicorer"), an external-closure Niskin-type sampler modified and cleaned for trace metal use was attached to the multicorer frame in a position ~1 meter above the seafloor, and was closed by means of a cable released upon initial descent of the multicorer tubes and associated weights. Sample depths are estimated from seafloor depths as indicated by the shipboard multibeam sonar system. The Niskin sampler closed successfully and returned samples for 8 of the 9 multicorer deployments, at Stations 7, 10, 14, 15, 17, 21, 25, and 27. Further details are provided in the GP17-ANT cruise report (Sedwick et al., 2024).

(5) Towfish deployments. Near-surface (~2 meters depth) seawater was collected while underway on approach to or departure from each station using an overboard towed-fish ("towfish") sampling system deployed outside of the ship's wake. Using a deckboard pneumatic Teflon diaphragm pump, seawater from the towfish was pumped into a shipboard clean-air laboratory van. Further details are provided in the GP17-ANT cruise report (Sedwick et al., 2024).

(6) Radium surface pump deployments. Near-surface (~3 meters depth) seawater samples for analysis of radium isotopes were collected using a surface pump deployed by hand over the starboard quarter of RVIB *Nathaniel B. Palmer*.

(7) Beryllium-7 pump deployments. Upper water-column (<200 meters depth) seawater samples for analysis of beryllium-7 were collected using a deckboard pump system and overboard weighted inlet tube. Sample depths are estimated from an in-situ logging pressure sensor.

Dissolved nutrients (nitrate+nitrite, nitrite, phosphate and silicate) were determined shipboard in unfiltered seawater samples using a Seal Analytical continuous-flow AutoAnalyzer 3 following methods described in the nutrient section of the updated GO-SHIP repeat hydrography manual (Becker et al., 2019; 2020). Accuracy and precision were assessed from the analysis of Reference Materials for Nutrients in Seawater (RMNS) batch CM at every station, which yielded concentrations $\pm$ one standard deviation of 33.12 ± 0.18 micromoles per kilogram ($\mu\text{mol/kg}$) nitrate, 2.39 ± 0.02 $\mu\text{mol/kg}$ phosphate, 100.8 ± 1.0 $\mu\text{mol/kg}$ silicate, and 0.025 ± 0.005 $\mu\text{mol/kg}$ nitrite, versus RMNS assigned concentrations of 33.2 $\mu\text{mol/kg}$, 2.28 $\mu\text{mol/kg}$, 100.5 $\mu\text{mol/kg}$ and 0.02 $\mu\text{mol/kg}$, respectively. Further methodological details are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

Salinity was measured in discrete samples using the Guildline 8410A "Portasal" salinometer aboard RVIB *Nathaniel B. Palmer*. The salinometer was standardized for each group of samples analyzed (normally 2 to 6 casts, up to ~95 samples) using two bottles of standard seawater: one at the beginning and one at the end of each set of

measurements. IAPSO Standard Seawater Batch P-167 was used for all calibrations: K15 = 0.99988, salinity 34.994, expiration 2026-02-21. PSS-78 salinity was calculated for each sample from the measured conductivity ratios. The offset between the initial standard seawater value and its reference value was applied to each sample. Then the difference (if any) between the initial and final vials of standard seawater was applied to each sample as a function of elapsed run time. Further methodological details are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

Dissolved oxygen was measured in discrete samples using an SIO/ODF-designed automated oxygen titrator using photometric end-point detection based on the absorption of 365-nanometer (nm) wavelength ultraviolet light using a whole-bottle modified-Winkler titration following the technique of Carpenter (1965) with modifications by Culbertson (1991), but with higher concentrations of potassium iodate standard (~0.012 N), and thiosulfate solution (~55 grams per liter (g/L)). Further methodological details are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

Instrumentation Details:

ODF CTD rosette system and sensors: ODF rosette casts were performed with a package consisting of a 36-bottle rosette frame and carousel, and 36 (plus spares) x 10.6 L Bullister-style Niskin bottles. Underwater electronic components primarily consisted of an SBE-9plus housing unit with Digiquartz pressure sensor with dual plumbed lines where each line has a pump, SBE-3plus temperature sensor, SBE-4C conductivity sensor, and exhaust line. An SBE-43 membrane oxygen sensor was mounted on the "primary" line. An SBE-35 reference thermometer, JFE-Advantech RINKO oxygen optode, WetLabs C-Star transmissometer and ECO-FL-RTD chlorophyll-a fluorometer, Valeport VA500 altimeter, and SeaPoint turbidity sensor were also mounted on the rosette. The CTD pressure, temperature, conductivity, and oxygen sensors were calibrated prior to the cruise, whereas the transmissometer was calibrated before the start and after the end of science operations. The CTD data acquisition system consisted of an SBE-11plus (V1) deck unit and a networked generic PC workstation running Windows 10. SBE SeaSave7 v.7.26.7.121 software was used for data acquisition and to close bottles on the rosette. Further details are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

GTC CTD rosette system and sensors: GTC rosette casts were performed with a package consisting of the 24-bottle U.S. GEOTRACES SBE trace-element rosette frame and carousel, and 24 (plus spares) x 12 L GoFlo sampler bottles. Underwater electronic components primarily consisted of an SBE 9plus housing unit with a Digiquartz pressure sensor, dual SeaBird SBE-3 temperature sensors and SBE-4C conductivity sensors, an SBE-43 membrane dissolved oxygen sensor, and a WetLabs C-Star transmissometer and ECO-FL-RTD chlorophyll-a fluorometer. Sensors were calibrated during summer 2023, immediately prior to the GP17-ANT cruise, and the transmissometer was calibrated before the start and after the end of science operations. The GTC rosette also included a Benthos altimeter, which ceased functioning during the latter part of the cruise and was replaced with a Valeport altimeter borrowed from the shipboard USAP equipment, and a Seapoint turbidity sensor. The CTD data acquisition system consisted of an SBE-11plus deck unit and a networked generic PC workstation running Windows 10. SBE SeaSave7 v.7.26.7.121 software was used for data acquisition and to close bottles on the rosette. Further details are provided in the GP17-ANT cruise report (Sedwick et al., 2024).

CTD used with McLane in-situ pump deployments: Niskin sampling depths were estimated from data recorded by an SBE 19-plus v2 Seacat self-recording CTD. Further details are provided in the GP17-ANT cruise report (Sedwick et al., 2024).

Dissolved nutrient analysis: Seal Analytical continuous-flow AutoAnalyzer 3. Further details are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

Salinity measurements: Guildline 8410A Portasal salinometer. Further details are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

Dissolved oxygen analyses: SIO-ODF-designed automated oxygen titrator using photometric end-point detection based on the absorption of 365 nm wavelength ultra-violet light. Sample titration and data logging were controlled by PC LabView software. Thiosulfate was dispensed by a Dosimat 665 buret driver fitted with a 1.0 ml burette. Further details are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

Data Processing Description

CTD data from ODF and GTC rosettes: Shipboard CTD data processing was performed after deployment using SIO/ODF CTD processing software ctdcal v. 0.1.4b. CTD acquisition data were copied onto a Macintosh OS X system, and then processed. CTD data at bottle trips were extracted, and a 2-decibar downcast pressure series created. The pressure series data set was submitted for CTD data distribution after corrections were applied. CTD data were examined at the completion of each deployment for clean corrected sensor response and any calibration

shifts. As bottle salinity and oxygen results became available, they were used to refine conductivity and oxygen sensor calibrations. Temperature, salinity, and dissolved oxygen comparisons were made between down and upcasts, as well as between groups of adjacent deployments. Further details are provided in the ODF cruise report (Scripps Institution of Oceanography Ocean Data Facility team, 2024).

Nutrient analyses: Data collection and processing were done with the software provided with the instrument from Seal Analytical (AACE). After each run, the charts were reviewed for any problems during the run, any blank was subtracted, and final concentrations (in micromoles per liter ($\mu\text{mol/L}$)) were calculated, based on a linear curve fit. Once the run was reviewed and concentrations calculated, a text file was created. That text file was reviewed then converted to another text file with only sample identifiers and nutrient concentrations, then merged with other bottle data.

Salinity measurements: Communications with the Portasal were established using a Windows 10 workstation running Salinometer Data Logger v1.2 by Ocean Scientific International. PSS-78 salinity was calculated for each sample from the measured conductivity ratios. The offset between the initial standard seawater value and its reference value was applied to each sample, then the difference (if any) between initial and final analyses of standard seawater was applied to each sample as a function of elapsed run time. The corrected salinity data were then incorporated into the cruise database.

Dissolved oxygen analyses: Sample draw temperatures, measured with an electronic resistance temperature detector embedded in the draw tube, were used to calculate concentrations in $\mu\text{mol/kg}$, and as a diagnostic check of bottle integrity. Samples were analyzed within 2-24 hours of collection, and the data incorporated into the cruise database. Thiosulfate normalities were calculated for each standardization and corrected to 20 degrees Celsius ($^{\circ}\text{C}$). The 20°C thiosulfate normalities and blanks were plotted versus time and reviewed for possible problems, and subsequently determined to be stable enough that no smoothing was required.

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

- Imported original file "Sedwick_GP17-ANT_Bottle_Data_BCO-DMO_07-30-26.xlsx" (sheet 1) into the BCO-DMO data processing system.
- Treated row 12 as header, skipped row 13 (units row).
- Treated "ND" as a missing data value, meaning it was removed. (Missing data are empty/blank in the final CSV file published by BCO-DMO).
- Deleted "Column title" column (empty).
- Renamed columns to comply with BCO-DMO naming conventions.
- Converted Start_Date_UTC (%d/%m/%Y) and Start_Time_UTC (%H:%M:%S) into a combined Start_ISO_DateTime_UTC datetime column (UTC, output format %Y-%m-%dT%H:%M:%SZ).
- Converted End_Date_UTC and End_Time_UTC into a combined End_ISO_DateTime_UTC datetime column (UTC, output format %Y-%m-%dT%H:%M:%SZ).
- Reordered columns.
- Converted Start_Date_UTC and End_Date_UTC into format %Y-%m-%d.
- Saved the final file as "1009991_v1_gp17-ant_bottle_data.csv".

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

- N/A

Problem Description

A number of issues directly impacted CTD data analysis, including bottle closures and mis-trips, as well as issues with the temperature, conductivity, and oxygen sensors. Further details are provided in the ODF cruise report

(Scripps Institution of Oceanography Ocean Data Facility team, 2024) and GP17-ANT cruise report (Sedwick et al., 2024). Problematic bottle samples and data are indicated with Gear ID (bottle quality) flags and data quality flags.

Gear ID (bottle quality) flags:

- 1: Bottle information unavailable.
- 2: No problems noted.
- 3: Leaking.
- 4: Did not trip correctly.
- 5: Not reported.
- 9: Samples not drawn from this bottle.

Data quality flags for all other parameters (except those with prefix CTD; see below):

- 1: Sample for this measurement was drawn from bottle but analysis not received.
- 2: Acceptable measurement.
- 3: Questionable measurement.
- 4: Bad measurement.
- 5: Not reported.
- 6: Mean of replicate measurements.
- 9: Sample not drawn for this measurement from this bottle.

Data quality flags for parameters with prefix CTD (e.g., CTDTMP):

- 1: Not calibrated.
- 2: Acceptable measurement.
- 3: Questionable measurement.
- 4: Bad measurement.
- 5: Not reported.
- 6: Interpolated over a pressure interval larger than 2 dbar.
- 7: Despiked.
- 9: Not sampled.

[[table of contents](#) | [back to top](#)]

Related Publications

Aguilar-Islas, A., Bridgestock, L., Bundy, R., Conway, T., Hayes, C., Heimbürger, L., Planquette, H., & Shaked, Y. (2024). Sampling and Sample-handling Protocols for GEOTRACES Cruises (Cookbook). Version 4.0, August 2024. <https://www.geotraces.org/wp-content/uploads/2024/10/GEOTRACES-cookbook-v4-2024.pdf>
Methods

Becker, S., Aoyama, M., Woodward, E. M. S., Bakker, K., Coverly, S., Mahaffey, C., & Tanhua, T. (2019). GO-SHIP Repeat Hydrography Nutrient Manual: The precise and accurate determination of dissolved inorganic nutrients in

seawater, using Continuous Flow Analysis methods. GO-SHIP Program and SCOR. <https://doi.org/10.25607/OBP-555>

Methods

Becker, S., Aoyama, M., Woodward, E. M. S., Bakker, K., Coverly, S., Mahaffey, C., & Tanhua, T. (2019/2020). GO-SHIP Repeat Hydrography Nutrient Manual: The Precise and Accurate Determination of Dissolved Inorganic Nutrients in Seawater, Using Continuous Flow Analysis Methods. *Frontiers in Marine Science*, 7. <https://doi.org/10.3389/fmars.2020.581790>

Methods

CARPENTER, J. H. (1965). THE CHESAPEAKE BAY INSTITUTE TECHNIQUE FOR THE WINKLER DISSOLVED OXYGEN METHOD. *Limnology and Oceanography*, 10(1), 141-143. doi:[10.4319/lb.1965.10.1.0141](https://doi.org/10.4319/lb.1965.10.1.0141)

Methods

Culbertson, C. H., Knapp, G., Stalcup, M. C., Williams, R. T., & Zemlyak, F. (1991). A Comparison of methods for the determination of dissolved oxygen in seawater. Report WHPO 91-2, WOCE Hydrographic Programme Office. <https://doi.org/10.1575/1912/243>

Methods

[[table of contents](#) | [back to top](#)]

Parameters

Parameter	Description	Units
Station_ID	cruise station identifier	unitless
Event_ID	unique identifier for each sampling operation	unitless
Gear_ID	sampling device identifier: GF-# = GoFlo bottle #; GSNIS-# = Niskin bottle #; MCLANE-NIS-# = pump cast Niskin bottle #; FISH = towfish underway sampling; BE-PUMP = Beryllium-7 pump sampling; RA-PUMP = Radium pump sampling; MULTICORER = Niskin bottle on multicorer	unitless
Gear_ID_flag	sample quality flag (see Problems/Issues for quality flag definitions)	unitless
Start_ISO_DateTime_UTC	start date and time (UTC) of sampling operation in ISO 8601 format; Note: For all McLane pump casts, the reported start and end times/dates designate start/end times/dates for actual pumping, not start/end for the entire cast.	unitless
Start_Date_UTC	start date of sampling operation (UTC)	unitless
Start_Time_UTC	start time of sampling operation (UTC)	unitless

End_ISO_DateTime_UTC	end date and time (UTC) of sampling operation in ISO 8601 format; Note: For all McLane pump casts, the reported start and end times/dates designate start/end times/dates for actual pumping, not start/end for the entire cast.	unitless
End_Date_UTC	end date of sampling operation (UTC)	unitless
End_Time_UTC	end time of sampling operation (UTC)	unitless
Start_Latitude	start latitude of sampling operation (negative value = South)	decimal degrees N
Start_Longitude	start longitude of sampling operation (negative value = West)	decimal degrees E
End_Latitude	end latitude of sampling operation (negative value = South)	decimal degrees N
End_Longitude	end longitude of sampling operation (negative value = West)	decimal degrees E
Sample_ID	GEOTRACES sample number = unique identifier for each water-column sample	unitless
Sample_Depth	water depth of sample (below sea surface)	meters
CTDPRS_UP_T_VALUE_SENSOR_ydynbi	sensor pressure from upcast (the 6 trailing letters are GEOTRACES barcode)	decibar
SD1_CTDPRS_UP_T_VALUE_SENSOR_ydynbi	standard deviation on sensor pressure from upcast (the 6 trailing letters are GEOTRACES barcode)	decibar
Flag_CTDPRS_UP_T_VALUE_SENSOR_ydynbi	data quality flag (see Problems/Issues for quality flag definitions) for CTDPRS_UP_T_VALUE_SENSOR (the 6 trailing letters are GEOTRACES barcode)	unitless
NITRATE_D_CONC_BOTTLE_owiemd	nitrate concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_NITRATE_D_CONC_BOTTLE_owiemd	standard deviation on nitrate concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram

Flag_NITRATE_D_CONC_BOTTLE_owiemd	data quality flag (see Problems/Issues for quality flag definitions) for NITRATE_D_CONC_BOTTLE (the 6 trailing letters are GEOTRACES barcode)	unitless
NITRATE_D_CONC_FISH_pt2a4c	nitrate concentration of towfish sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_NITRATE_D_CONC_FISH_pt2a4c	standard deviation on nitrate concentration of towfish sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_NITRATE_D_CONC_FISH_pt2a4c	data quality flag (see Problems/Issues for quality flag definitions) for NITRATE_D_CONC_FISH (the 6 trailing letters are GEOTRACES barcode)	unitless
NITRATE_D_CONC_PUMP_pepwzi	nitrate concentration of pumped sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_NITRATE_D_CONC_PUMP_pepwzi	standard deviation on nitrate concentration of pumped sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_NITRATE_D_CONC_PUMP_pepwzi	data quality flag (see Problems/Issues for quality flag definitions) for NITRATE_D_CONC_PUMP (the 6 trailing letters are GEOTRACES barcode)	none
NITRITE_D_CONC_BOTTLE_xdrz0y	nitrite concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_NITRITE_D_CONC_BOTTLE_xdrz0y	standard deviation on nitrite concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_NITRITE_D_CONC_BOTTLE_xdrz0y	data quality flag (see Problems/Issues for quality flag definitions) for NITRITE_D_CONC_BOTTLE (the 6 trailing letters are GEOTRACES barcode)	unitless
NITRITE_D_CONC_FISH_pu8yik	nitrite concentration of towfish sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_NITRITE_D_CONC_FISH_pu8yik	standard deviation on nitrite concentration of towfish sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram

Flag_NITRITE_D_CONC_FISH_pu8yik	data quality flag (see Problems/Issues for quality flag definitions) for NITRITE_D_CONC_FISH (the 6 trailing letters are GEOTRACES barcode)	unitless
NITRITE_D_CONC_PUMP_zt8gpj	nitrite concentration of pumped sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_NITRITE_D_CONC_PUMP_zt8gpj	standard deviation on nitrite concentration of pumped sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_NITRITE_D_CONC_PUMP_zt8gpj	data quality flag (see Problems/Issues for quality flag definitions) for NITRITE_D_CONC_PUMP (the 6 trailing letters are GEOTRACES barcode)	unitless
PHOSPHATE_D_CONC_BOTTLE_9fzv dv	phosphate concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_PHOSPHATE_D_CONC_BOTTLE_9fzv dv	standard deviation on phosphate concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_PHOSPHATE_D_CONC_BOTTLE_9fzv dv	data quality flag (see Problems/Issues for quality flag definitions) for PHOSPHATE_D_CONC_BOTTLE (the 6 trailing letters are GEOTRACES barcode)	unitless
PHOSPHATE_D_CONC_FISH_y8qlge	phosphate concentration of towfish sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_PHOSPHATE_D_CONC_FISH_y8qlge	standard deviation on phosphate concentration of towfish sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_PHOSPHATE_D_CONC_FISH_y8qlge	data quality flag (see Problems/Issues for quality flag definitions) for PHOSPHATE_D_CONC_FISH (the 6 trailing letters are GEOTRACES barcode)	unitless
PHOSPHATE_D_CONC_PUMP_4yxu4v	phosphate concentration of pumped sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_PHOSPHATE_D_CONC_PUMP_4yxu4v	standard deviation on phosphate concentration of pumped sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram

Flag_PHOSPHATE_D_CONC_PUMP_4yxu4v	data quality flag (see Problems/Issues for quality flag definitions) for PHOSPHATE_D_CONC_PUMP (the 6 trailing letters are GEOTRACES barcode)	unitless
SILICATE_D_CONC_BOTTLE_cqslad	silicate concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_SILICATE_D_CONC_BOTTLE_cqslad	standard deviation on silicate concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_SILICATE_D_CONC_BOTTLE_cqslad	data quality flag (see Problems/Issues for quality flag definitions) for SILICATE_D_CONC_BOTTLE (the 6 trailing letters are GEOTRACES barcode)	unitless
SILICATE_D_CONC_FISH_7bxhe0	silicate concentration of towfish sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_SILICATE_D_CONC_FISH_7bxhe0	standard deviation on silicate concentration of towfish sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_SILICATE_D_CONC_FISH_7bxhe0	data quality flag (see Problems/Issues for quality flag definitions) for SILICATE_D_CONC_FISH (the 6 trailing letters are GEOTRACES barcode)	unitless
SILICATE_D_CONC_PUMP_llsgvx	silicate concentration of pumped sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_SILICATE_D_CONC_PUMP_llsgvx	standard deviation on silicate concentration of pumped sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_SILICATE_D_CONC_PUMP_llsgvx	data quality flag (see Problems/Issues for quality flag definitions) for SILICATE_D_CONC_PUMP (the 6 trailing letters are GEOTRACES barcode)	unitless
CTDTMP_UP_T_VALUE_SENSOR_wbop31	sensor temperature from upcast (the 6 trailing letters are GEOTRACES barcode)	degrees Celsius
SD1_CTDTMP_UP_T_VALUE_SENSOR_wbop31	standard deviation on sensor temperature from upcast (the 6 trailing letters are GEOTRACES barcode)	degrees Celsius

Flag_CTDTMP_UP_T_VALUE_SENSOR_wbop31	data quality flag (see Problems/Issues for quality flag definitions) for CTDTMP_UP_T_VALUE_SENSOR (the 6 trailing letters are GEOTRACES barcode)	unitless
CTDSAL_UP_D_CONC_SENSOR_qsismz	sensor salinity from upcast (the 6 trailing letters are GEOTRACES barcode)	unitless
SD1_CTDAL_UP_D_CONC_SENSOR_qsismz	standard deviation on sensor salinity from upcast (the 6 trailing letters are GEOTRACES barcode)	unitless
Flag_CTDSAL_UP_D_CONC_SENSOR_qsismz	data quality flag (see Problems/Issues for quality flag definitions) for CTDSAL_UP_D_CONC_SENSOR (the 6 trailing letters are GEOTRACES barcode)	unitless
SALINITY_D_CONC_BOTTLE_7pchb6	salinity of bottle sample (the 6 trailing letters are GEOTRACES barcode)	unitless
SD1_SALINITY_D_CONC_BOTTLE_7pchb6	standard deviation on salinity of bottle sample (the 6 trailing letters are GEOTRACES barcode)	unitless
Flag_SALINITY_D_CONC_BOTTLE_7pchb6	data quality flag (see Problems/Issues for quality flag definitions) for SALINITY_D_CONC_BOTTLE (the 6 trailing letters are GEOTRACES barcode)	unitless
SALINITY_D_CONC_FISH_4vkmjo	salinity of towfish sample (the 6 trailing letters are GEOTRACES barcode)	unitless
SD1_SALINITY_D_CONC_FISH_4vkmjo	standard deviation on salinity of towfish sample (the 6 trailing letters are GEOTRACES barcode)	unitless
Flag_SALINITY_D_CONC_FISH_4vkmjo	data quality flag (see Problems/Issues for quality flag definitions) for SALINITY_D_CONC_FISH (the 6 trailing letters are GEOTRACES barcode)	unitless
SALINITY_D_CONC_PUMP_pjrgvj	salinity of pumped sample (the 6 trailing letters are GEOTRACES barcode)	unitless
SD1_SALINITY_D_CONC_PUMP_pjrgvj	standard deviation on salinity of pumped sample (the 6 trailing letters are GEOTRACES barcode)	unitless

Flag_SALINITY_D_CONC_PUMP_pjrgvj	data quality flag (see Problems/Issues for quality flag definitions) for SALINITY_D_CONC_PUMP (the 6 trailing letters are GEOTRACES barcode)	unitless
CTDOXY_UP_D_CONC_SENSOR_2spkfk	sensor dissolved oxygen concentration from upcast (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_CTDOXY_UP_D_CONC_SENSOR_2spkfk	standard deviation on sensor dissolved oxygen concentration from upcast (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_CTDOXY_UP_D_CONC_SENSOR_2spkfk	data quality flag (see Problems/Issues for quality flag definitions) for CTDOXY_UP_D_VALUE_SENSOR (the 6 trailing letters are GEOTRACES barcode)	unitless
OXYGEN_D_CONC_BOTTLE_luceph	dissolved oxygen concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
SD1_OXYGEN_D_CONC_BOTTLE_luceph	standard deviation on dissolved oxygen concentration of bottle sample (the 6 trailing letters are GEOTRACES barcode)	micromoles per kilogram
Flag_OXYGEN_D_CONC_BOTTLE_luceph	data quality flag (see Problems/Issues for quality flag definitions) for OXYGEN_D_CONC_BOTTLE (the 6 trailing letters are GEOTRACES barcode)	unitless
CTDTURB_UP_RAW_T_VALUE_SENSOR_if7loo	sensor turbidity (raw uncalibrated data) from upcast (the 6 trailing letters are GEOTRACES barcode)	volts
SD1_CTDTURB_UP_RAW_T_VALUE_SENSOR_if7loo	standard deviation on sensor turbidity (raw uncalibrated data) from upcast (the 6 trailing letters are GEOTRACES barcode)	volts
Flag_CTDTURB_UP_RAW_T_VALUE_SENSOR_if7loo	data quality flag (see Problems/Issues for quality flag definitions) for CTDTURB_UP_RAW_T_VALUE_SENSOR (the 6 trailing letters are GEOTRACES barcode)	unitless
CTDXMISS_UP_RAW_T_VALUE_SENSOR_uolrwg	sensor beam transmission (raw uncalibrated data) from upcast (the 6 trailing letters are GEOTRACES barcode)	volts

SD1_CTDXMISS_UP_RAW_T_VALUE_SENSOR_uolrwg	standard deviation on sensor beam transmission (raw uncalibrated data) from upcast (the 6 trailing letters are GEOTRACES barcode)	volts
Flag_CTDXMISS_UP_RAW_T_VALUE_SENSOR_uolrwg	data quality flag (see Problems/Issues for quality flag definitions) for CTDXMISS_UP_RAW_T_VALUE_SENSOR (the 6 trailing letters are GEOTRACES barcode)	unitless
CTDFLUOR_UP_RAW_T_VALUE_SENSOR_1bhbv8	sensor chlorophyll-a fluorescence (raw uncalibrated data) from upcast (the 6 trailing letters are GEOTRACES barcode)	volts
SD1_CTDFLUOR_UP_RAW_T_VALUE_SENSOR_1bhbv8	standard deviation on sensor chlorophyll-a fluorescence (raw uncalibrated data) from upcast (the 6 trailing letters are GEOTRACES barcode)	volts
Flag_CTDFLUOR_UP_RAW_T_VALUE_SENSOR_1bhbv8	data quality flag (see Problems/Issues for quality flag definitions) for CTDFLUOR_UP_RAW_T_VALUE_SENSOR (the 6 trailing letters are GEOTRACES barcode)	unitless

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	Seal Analytical continuous-flow AutoAnalyzer 3
Generic Instrument Name	Bran+Luebbe / SEAL Analytical AutoAnalyzer 3 (AA3) continuous-flow analyzer
Dataset-specific Description	Dissolved nutrients (nitrate+nitrite, nitrite, phosphate and silicate) were determined shipboard in unfiltered seawater samples using a Seal Analytical continuous-flow AutoAnalyzer 3. See "Methods & Sampling" and the cruise reports for complete descriptions of this instrument.
Generic Instrument Description	The AutoAnalyzer 3 (AA3) is a segmented continuous-flow analyzer (continuous flow analyzer, CFA) used for automated colorimetric analysis of dissolved nutrients and other analytes in environmental, seawater, freshwater, wastewater, soil, and agricultural samples. The AA3 was originally manufactured by Bran+Luebbe and, following acquisition of the product line in 2006, has continued to be manufactured and supported by SEAL Analytical. The AA3 is the third-generation instrument in the Technicon AutoAnalyzer family and is widely used for determination of nitrate, nitrite, ammonium, phosphate, silicate, and other dissolved nutrients. See the description from the manufacturer.

Dataset-specific Instrument Name	Towfish
Generic Instrument Name	GeoFish-type Near-surface Towfish Sampler
Dataset-specific Description	Near-surface (~2 meters depth) seawater was collected while underway on approach to or departure from each station using an overboard towed-fish ("towfish") sampling system deployed outside of the ship's wake. The towfish system employed was loaned by Jessica Fitzsimmons (Texas A&M), and was a scaled-up version of a previous design employed by Co-Chief Sherrell, modified in minor ways from that used on GP17-OCE to better fit the specifics of deployment using the ship's starboard A-frame. See "Methods & Sampling" and the cruise reports for complete descriptions of this instrument.
Generic Instrument Description	This term describes a family of custom-designed, trace-metal-clean, near-surface seawater sampling systems based on the 'GeoFish' design developed by Geoffrey Smith and Ken Bruland at the University of California, Santa Cruz (UCSC). The systems consist of a weighted towed body or torpedo, clean intake tubing, a shipboard pneumatic pump, and a sampling manifold. They are deployed alongside a moving vessel, outside the ship's wake, with the intake typically positioned approximately 1 to 3 meters below the sea surface. Seawater is continuously pumped through the clean tubing to the ship for filtered and unfiltered sampling and, in some applications, direct connection to analytical instruments. This term includes the original GeoFish sampler, Super-GeoFISH variants, and subsequent modified towfish systems used on U.S. GEOTRACES cruises. These systems share the same basic sampling principle but may differ in body construction, depressor or stabilization design, deployment hardware, tubing, pump configuration, flow rate, and sampling manifold. The systems have been used for trace-metal, nutrient, biological, and other chemical measurements in both GEOTRACES and non-GEOTRACES studies, including Bruland et al. (2005).

Dataset-specific Instrument Name	GoFlo sampler bottles
Generic Instrument Name	GO-FLO Bottle
Dataset-specific Description	The GTC rosette casts were performed using the U.S. GEOTRACES trace-element rosette sampling system with a SeaBird custom-built frame and carousel (newly purchased) and 24 x 12 L GoFlo sampler bottles.
Generic Instrument Description	GO-FLO bottle cast used to collect water samples for pigment, nutrient, plankton, etc. The GO-FLO sampling bottle is specially designed to avoid sample contamination at the surface, internal spring contamination, loss of sample on deck (internal seals), and exchange of water from different depths.

Dataset-specific Instrument Name	Guildline 8410A "Portasal" salinometer
Generic Instrument Name	Guildline Portasal 8410 series salinometer
Dataset-specific Description	Salinity was measured in discrete samples using the Guildline 8410A "Portasal" salinometer aboard RVIB Nathaniel B. Palmer. See "Methods & Sampling" and the cruise reports for complete descriptions of this instrument.
Generic Instrument Description	The Guildline Portasal 8410 series salinometer is a portable instrument for laboratory or field use that determines salinity of a water sample by comparison of its electrical conductivity with a standard solution. The system employs a continuous flow system, where the sample is drawn into the unit under low air pressure. A high stability temperature control bath and heat exchanger maintain the sample at a precisely defined, user selected temperature during analysis. The instrument can operate over a conductivity range of 0.004 to 76 mS/cm with a resolution of 0.0003 mS/cm (15 deg C and 35 PSU) or 0.0003 Equivalent PSU, and an accuracy of ± 0.003 Equivalent PSU (same set point temperature as standardization and within -2 deg C and +4 deg C of ambient). The series consists of 2 known models: 8410 and 8410A. The models have the same specifications although the 8410A has an RS232 interface. The reference number 8410N refers to an operational manual update only.

Dataset-specific Instrument Name	McLane in-situ pumps
Generic Instrument Name	McLane Large Volume Pumping System WTS-LV
Dataset-specific Description	The WHOI UNOLS pump pool provided 8 dual-flow, battery-operated McLane pumps (5 WTS-LVDF, 3 modified WTS-LV-upright). Daniel Ohnemus provided 4 additional WTS-LVDF pumps. See "Methods & Sampling" and the cruise reports for complete descriptions of these instruments and associated sensors.
Generic Instrument Description	The WTS-LV is a Water Transfer System (WTS) Large Volume (LV) pumping instrument designed and manufactured by McLane Research Labs (Falmouth, MA, USA). It is a large-volume, single-event sampler that collects suspended and dissolved particulate samples in situ. Ambient water is drawn through a modular filter holder onto a 142-millimeter (mm) membrane without passing through the pump. The standard two-tier filter holder provides prefiltering and size fractioning. Collection targets include chlorophyll maximum, particulate trace metals, and phytoplankton. It features different flow rates and filter porosity to support a range of specimen collection. Sampling can be programmed to start at a scheduled time or begin with a countdown delay. It also features a dynamic pump speed algorithm that adjusts flow to protect the sample as material accumulates on the filter. Several pump options range from 0.5 to 30 liters per minute, with a max volume of 2,500 to 36,000 liters depending on the pump and battery pack used. The standard model is depth rated to 5,500 meters, with a deeper 7,000-meter option available. The operating temperature is -4 to 35 degrees Celsius. The WTS-LV is available in four different configurations: Standard, Upright, Bore Hole, and Dual Filter Sampler. The high-capacity upright WTS-LV model provides three times the battery life of the standard model. The Bore-Hole WTS-LV is designed to fit through a narrow opening such as a 30-centimeter borehole. The dual filter WTS-LV features two vertical intake 142 mm filter holders to allow simultaneous filtering using two different porosities.

Dataset-specific Instrument Name	Multicorer
Generic Instrument Name	Multi Corer
Dataset-specific Description	To supplement investigation of water-column TEIs near the seafloor, a plan was developed for mounting a trace metal-clean external-closure Niskin (Niskin-X) bottle to the stainless steel frame of the multicorer. See "Methods & Sampling" and the cruise reports for complete descriptions of this instrument.
Generic Instrument Description	The Multi Corer is a benthic coring device used to collect multiple, simultaneous, undisturbed sediment/water samples from the seafloor. Multiple coring tubes with varying sampling capacity depending on tube dimensions are mounted in a frame designed to sample the deep ocean seafloor. For more information, see Barnett et al. (1984) in <i>Oceanologica Acta</i> , 7, pp. 399-408.

Dataset-specific Instrument Name	Niskin sampler bottles
Generic Instrument Name	Niskin bottle
Dataset-specific Description	The ODF rosette casts were performed with a package consisting of a 36-bottle rosette frame, a 36-place carousel and 36 x 10.6 L Bullister-style Niskin sampler bottles.
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Radium surface pump
Generic Instrument Name	Pump surface
Dataset-specific Description	Near-surface (~3 meters depth) seawater samples for analysis of radium isotopes were collected using a surface pump deployed by hand over the starboard quarter of RVIB Nathaniel B. Palmer. See "Methods & Sampling" and the cruise reports for complete descriptions of this instrument.
Generic Instrument Description	A source of uncontaminated near-surface seawater pumped onto the deck of the research vessel that can be sampled and analyzed. This pumped seawater supply is from an over-the-side pumping system, and is therefore different from the vessel underway seawater system.

Dataset-specific Instrument Name	Beryllium-7 pump
Generic Instrument Name	Pump surface
Dataset-specific Description	Upper water-column (
Generic Instrument Description	A source of uncontaminated near-surface seawater pumped onto the deck of the research vessel that can be sampled and analyzed. This pumped seawater supply is from an over-the-side pumping system, and is therefore different from the vessel underway seawater system.

Dataset-specific Instrument Name	SIO/ODF-designed automated oxygen titrator
Generic Instrument Name	Scripps Institution of Oceanography (SIO) ODF automated oxygen titrator
Dataset-specific Description	Dissolved oxygen was measured in discrete samples using an SIO/ODF-designed automated oxygen titrator. See "Methods & Sampling" and the cruise reports for complete descriptions of this system.
Generic Instrument Description	A bench-top, oxygen titrator system designed by the Ocean Data Facility (ODF) at the Scripps Institution of Oceanography that is based on the Winkler titration method. It measures dissolved oxygen using photometric end-point detection based on the absorption of 365nm wavelength ultra-violet light. Thiosulphate is typically dispensed from a Dosimat burette. The titration and data logging are controlled by ODF PC software compiled in LabView.

Dataset-specific Instrument Name	Trace-Metal Clean (GTC) CTD Rosette and Conventional ODF Rosette
Generic Instrument Name	Sea-Bird SBE 911plus CTD
Dataset-specific Description	See "Methods & Sampling" and the cruise reports for complete descriptions of these instruments and associated sensors.
Generic Instrument Description	[tethered, real-time] The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

[[table of contents](#) | [back to top](#)]

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.

[[table of contents](#) | [back to top](#)]

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.

[[table of contents](#) | [back to top](#)]

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.

[[table of contents](#) | [back to top](#)]

Funding

Funding Source	Award
NSF Antarctic Sciences (NSF ANT)	ANT-2023214
NSF Antarctic Sciences (NSF ANT)	ANT-2023230
NSF Antarctic Sciences (NSF ANT)	ANT-2023363

[[table of contents](#) | [back to top](#)]