Bottle data from CTD profiles from the GTC rosette deployed on the US GEOTRACES GP17-OCE cruise on R/V Roger Revelle (RR2214) from December 2022 to January 2023

Website: https://www.bco-dmo.org/dataset/927640
Data Type: Cruise Results
Version: 1
Version Date: 2025-06-04

Project
» US GEOTRACES GP17 Section: South Pacific and Southern Ocean (GP17-OCE) (GP17-OCE)

Program
» U.S. GEOTRACES (U.S. GEOTRACES)

Contributors	Affiliation	Role
Twining, Benjamin	Bigelow Laboratory for Ocean Sciences	Principal Investigator
Cutter, Gregory A.	Old Dominion University (ODU)	Co-Principal Investigator
Fitzsimmons, Jessica N.	Texas A&M University (TAMU)	Co-Principal Investigator
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Abstract
This dataset includes the processed bottle data from CTD profiles of the GTC rosette deployed on the US GEOTRACES GP17-OCE cruise on R/V Roger Revelle (RR2214) from December 2022 to January 2023. Data were processed by the Oceanographic Data Facility (ODF) at Scripps Institution of Oceanography. The data include bottle salinity, in addition to CTD measurements (oxygen, salinity, temperature, pressure).

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Coverage

Location: South Pacific and Southern Ocean
Spatial Extent: **N**:-19.99987 **E**:-75.0972 **S**:-66.99988 **W**:-152.00021
Temporal Extent: 2022-12-04 - 2023-01-24

Methods & Sampling

Excerpts from the GP17-OCE Cruise Report:
The Cutter group (ODU) and the East Coast van and winch pools provided the GEOTRACES Trace Element

Carousel sampling system (GTC), including the A-frame, Dynacon winch with 7300 m of Vectran cable with conductors, clean lab van, and Seabird 9/11+ carousel/CTD with 24 x 12L Go-Flo bottles (+spares).

The GTC sensor array was re-calibrated immediately prior to the GP17-OCE cruise. The sensor array consisted of dual SBE-9 temperature and salinity sensors (calibration date: 23 June 2022), an SBE-43 dissolved oxygen sensor (calibration date: 9 Aug 2022), a Seapoint fluorometer, a Benthos altimeter, and a WetLabs C-Star transmissometer (calibration date: 12 July 2022). The "Salinity-2" sensor on the CTD physically broke after Station 36 and was replaced with a spare calibrated from the same set (and calibration values updated accordingly). The Bishop (UC Berkeley), Lam (UC Santa Cruz), and Ohnemus (UGA Skidaway) groups also installed on the GTC a birefringence sensor that detects particulate inorganic carbon (PIC) at all stations/depths (observed as "Voltage 7" in the GTC CTD data). The Fitzsimmons lab (TAMU) also installed a logging, non-conducting MAPR (Miniature Autonomous Plume Recorder) sensor suite on the rosette frame at deep casts of Stations 18 and 20 in order to collect turbidity and oxidationreductional potential data near the hydrothermal plumes.

In total, 58 GTC hydrocasts were conducted on GP17-OCE. At all stations except the super stations, 2 Go-Flo bottles were triggered per depth. At super stations, 3 Go-Flo bottles were triggered per depth in the shallow casts to accommodate larger sample volume requests; at the first super station (station 1), intermediate and deep casts had 3 Go-Flo bottles triggered per depth.

Once samples were brought into the clean van, unfiltered samples were collected immediately before connecting the Go-Flo bottles to the air pressure system (which was maintained at 12 psi). Acropak filtration was completed using Acropak-500 0.8/0.2 µm capsule filters; this is the same filter material but a larger capsule than the Acropak-200 capsules used on prior U.S. GEOTRACES cruises (which were not available for GP17-OCE due to COVID manufacturing delays). Membrane filtration was completed using 25mm 0.45 µm Supor membranes in a Swinnex filter holder, which at select euphotic zone samples was preceded by filtration through a second Swinnex filter holder containing a 25mm 5 µm polycarbonate filter.

Go-Flos from the same depth have unique GEOTRACES sample numbers.

Full cruise report is available from:
https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/rogerrevelle_rr2214.pdf

Data Processing Description

WOCE CTD Quality Code descriptions can be found at https://exchange-format.readthedocs.io/en/latest/quality.html#ctd-quality-codes, and are replicated below:

WOCE CTD Quality Codes:
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.
(8): Not used for CTD data.
9: Not sampled.

WOCE Bottle Quality Codes:
1: Bottle information unavailable.
2: No problems noted.
3: Leaking.
4: Did not trip correctly.
5: Not reported.
(6): (Significant discrepancy in measured values between Gerard and Niskin bottles.)
(7): (Unknown problem.)
(8): (Pair did not trip correctly. Note that the Niskin bottle can trip at an unplanned depth while the Gerard trips correctly and vice versa.)
9: Samples not drawn from this bottle.

WOCE Water Sample Quality Codes:

1: Sample for this measurement was drawn from water bottle but analysis not received.
2: Acceptable measurement.
3: Questionable measurement.
4: Bad measurement.
5: Not reported.
6: Mean of replicate measurements (Number of replicates should be specified in the .DOC file and the replicate data tabulated there).
7: Manual chromatographic peak measurement.
8: Irregular digital chromatographic peak integration.
9: Sample not drawn for this measurement from this bottle.

BCO-DMO Processing Description

- Imported original file "data_from_33RR20221201_GTC_hy1.txt" into the BCO-DMO system.
- Renamed fields to comply with BCO-DMO naming conventions.
- Converted date/time field to ISO 8601 format.
- Converted longitude values from a 0-360 scale to -180 to 180 (negative values = West).
- Re-ordered columns (put in same order as GP15 bottle data).
- Removed redundant and unnecessary columns: Station, Comments, Cruise_Report, Source_File_Name.
- Joined the bottle dataset to the nutrients dataset (dataset ID 933861) based on STNNBR, CASTNO, and SAMPNO; added the following fields: EVENT_NUMBER, GEOTRC_SAMPNO, BTLNBR.
- Renamed fields and removed fields as requested by data submitter to better align with the GP15 bottle file format.
- Saved final file as "927640_v1_gp17-oce_gtc_bottle.csv".

Problem Description

Excerpts from the GP17-OCE Cruise Report:

The system overall performed very well despite rough seas. However, we did damage several Go-Flo bottles and required several cable re-terminations:

On demi Station 5 (shallow Cast 2) in rough seas, we lost communication with the CTD and had to recover the GTC (no bottles fired).

At full Station 10 (deep Cast 7), one bottle was irreparably damaged during a fall on deck, as the PVC neck to the spigot was sheared.

At super Station 14 (shallow Cast 2) in rough seas, we lost communication with the CTD after firing bottles at 4 of 8 total depths. Upon recovery, troubleshooting by Calderwood (ODF) pointed to an issue with a CTD cable, which was swapped out. Thus, we redeployed at Cast 6, and while communications were OK on deck, once the GTC hit the water, communications were lost once again (no bottles fired). Upon recovery, Calderwood did a complete electrical re-termination, and the aborted cast 6 was replaced with Cast 8.

Station 18 (Cast 3) suffered noisy transmissometer data because of a cable that came loose part way through the cast.

Station 22 (Cast 2) was aborted when communications were lost in rough seas.

After Station 32 (Cast 3), two Go-Flo bottles were recovered with broken connections between the Go-Flo bottle body and the small PVC tee that supports the spigot. It is not clear what those bottles hit, as the rosette was not further bent, nor did anyone on deck notice a collision. No re-termination was required, and the Go-Flo bottles were replaced with spares.

At Station 34 (Cast 2), the rosette hit the ship’s hull during recovery. A vertical post on the rosette was bent, and blue paint from the ship was visible on the rosette’s powder coating. No Go-Flo bottles were damaged, and no re-termination was required.

At Station 35, the GTC rosette again hit the ship’s hull during recovery. This time, the bottom of the rosette

was still in the water, likely slowing the velocity of the package, and fortunately the rosette and Go-Flo bottles were not damaged.

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Data Files

File
927640_v1_gp17-oce_gtc_bottle.csv (Comma Separated Values (.csv), 216.20 KB) MD5:29021495e3b79b0f3a1a213a5d25fb75 Primary data file for dataset ID 927640, version 1

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Supplemental Files

File
GTC CTD scanned log sheets filename: GTC scanned log sheets-20250602T215617Z-1-001.zip (ZIP Archive (ZIP), 152.53 MB) MD5:23f9739b03b567f47e8ab636029a11dc Supplemental file for GP17-OCE datasets; this folder contains PDFs of the original GTC CTD console and sample logs. Files are named starting with 3 digits representing station number followed by 2 digits representing cast number (e.g. 00302 = station 3, cast 2).

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Related Datasets

IsRelatedTo

CCHDO Hydrographic Data Office (2024). Hydrographic data from cruise 33RR20221201. Version 2024-05-11. In CCHDO Hydrographic Data Archive. UC San Diego Library Digital Collections. https://cchdo.ucsd.edu/cruise/33RR20221201

Hawco, N. J. (2025) **Concentration of labile dissolved zinc (dZn) from trace metal clean samples collected on the GEOTRACES GP17 expedition across the South Pacific and Southern Oceans in December 2022 to January 2023 on the R/V Revelle (RR2214).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-07-30 http://lod.bco-dmo.org/id/dataset/969915 [view at BCO-DMO]

Twining, B., Cutter, G. A., Fitzsimmons, J. N. (2025) **Bottle data from CTD profiles from the ODF rosette deployed on the US GEOTRACES GP17-OCE cruise on R/V Roger Revelle (RR2214) from December 2022 to January 2023.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 2) Version Date 2025-07-25 doi:10.26008/1912/bco-dmo.955717.2 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Cruise	Cruise ID	unitless
EXPOCODE	Cruise EXPOCODE	unitless

SECT_ID	GEOTRACES cruise section	unitless
STNNBR	Station number	unitless
Type	Data type; B = Bottle	unitless
CASTNO	Cast number	unitless
SAMPNO	Sample number	unitless
BTLNBR	Bottle number	unitless
EVENT_NUMBER	Event number	unitless
GEOTRC_SAMPNO	GEOTRACES sample number	unitless
ISO_DateTime_UTC	Date and time (UTC) in ISO 8601 format	unitless
Longitude	Longitude in degrees East (-180 to 180); negative values = West direction	decimal degrees
Latitude	Latitude in degrees North; negative values = South direction	decimal degrees
Bot_Depth	Bottom depth	meters (m)
CTDPRS	The corrected pressure as measured by the CTD	decibars (db)
QV_WOCECTD_CTDPRS	WOCE quality flag for CTD data	unitless
CTDTMP	The corrected temperature as measured by the CTD [ITS-90]	degrees Celsius
QV_WOCECTD_CTDTMP	WOCE quality flag for CTD data	unitless
CTDSAL	The corrected practical salinity as measured (calculated) by the CTD [PSS-78]	PSU
QV_WOCECTD_CTDSAL	WOCE quality flag for CTD data	unitless

CTDOXY	The corrected oxygen measured by the CTD	micromoles per kilogram (umol/kg)
QV_WOCECTD_CTDOXY	WOCE quality flag for CTD data	unitless
SALINITY_D_CONC_BOTTLE	Bottle salinity	PSU
QV_WOCEBOTTLE_SALNTY	WOCE quality flag for bottle data	unitless

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Instruments

Dataset-specific Instrument Name	Seabird 9/11+ carousel/CTD
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Generic Instrument Description	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

Dataset-specific Instrument Name	12L Go-Flo bottles
Generic Instrument Name	GO-FLO Bottle
Dataset-specific Description	Seabird 9/11+ carousel/CTD with 24 x 12L Go-Flo bottles (+spares).
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.

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Deployments

RR2214

Website	https://www.bco-dmo.org/deployment/905754
Platform	R/V Roger Revelle
Report	https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/rogerrevelle_rr2214.pdf
Start Date	2022-12-01
End Date	2023-01-25
Description	The U.S. GEOTRACES GP17-OCE expedition departed Papeete, Tahiti (French Polynesia) on December 1st, 2022 and arrived in Punta Arenas, Chile on January 25th, 2023. The cruise took place in the South Pacific and Southern Oceans aboard the R/V Roger Revelle with a team of 34 scientists led by Ben Twining (Chief Scientist), Jessica Fitzsimmons, and Greg Cutter (Co-Chief Scientists). 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 a second leg (GP17-ANT; December 2023-January 2024) into coastal and shelf waters of Antarctica's Amundsen Sea. The GP17-OCE section encompassed three major transects: (1) a southbound pseudo-meridional section (~152-135 degrees West) from 20 degrees South to 67 degrees South; (2) an eastbound zonal transect from 135 degrees West to 100 degrees West; (3) and a northbound section returning to Chile (100-75 degrees West). Additional cruise information is available from the following sources: R2R: https://www.rvdata.us/search/cruise/RR2214 CCHDO: https://cchdo.ucsd.edu/cruise/33RR20221201 More information can also be found at: https://usgeotraces.ldeo.columbia.edu/content/gp17-oce

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Project Information

US GEOTRACES GP17 Section: South Pacific and Southern Ocean (GP17-OCE) (GP17-OCE)

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

Coverage: Papeete, Tahiti to Punta Arenas, Chile

The U.S. GEOTRACES GP17-OCE expedition departed Papeete, Tahiti (French Polynesia) on December 1st, 2022 and arrived in Punta Arenas, Chile on January 25th, 2023. The cruise took place in the South Pacific and Southern Oceans aboard the R/V Roger Revelle (cruise ID RR2214) with a team of 34 scientists lead by Ben Twining (Chief Scientist), Jessica Fitzsimmons and Greg Cutter (Co-Chief Scientists). 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 a second leg (GP17-ANT; December 2023-January 2024) into coastal and shelf waters of Antarctica's Amundsen Sea.

The South Pacific and Southern Oceans sampled by GP17-OCE play critical roles in global water mass circulation and associated global transfer of heat, carbon, and nutrients. Specific oceanographic regions of interest for GP17-OCE included: the most oligotrophic gyre in the global ocean, the Antarctic Circumpolar Current (ACC) frontal region, the previously unexplored Pacific- Antarctic Ridge, the Pacific Deep Water (PDW) flow along the continental slope of South America, and the continental margin inputs potentially emanating from South America.

Further information is available on the US GEOTRACES website and in the cruise report (PDF).

NSF Project Title: Collaborative Research: Management and Implementation of US GEOTRACES GP17 Section: South Pacific and Southern Ocean (GP17-OCE)

NSF Award Abstract:
This award will support the management and implementation of a research expedition from Tahiti to Chile that will enable sampling for a broad suite of trace elements and isotopes (TEI) across oceanographic regions of importance to global nutrient and carbon cycling 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 understanding of processes that shape their distributions, such as ocean currents and material fluxes, and also the processes that depend on these elements, such as the growth of phytoplankton and the support of ocean ecosystems. The proposed cruise will cross the South Pacific Gyre, the Antarctic Circumpolar Current, iron-limited Antarctic waters, and the Chilean margin. In combination with a proposed companion GEOTRACES expedition on a research icebreaker (GP17-ANT) that will be joined by two overlapping stations, the team of investigators will create an ocean section from the ocean's most nutrient-poor waters to its highly-productive Antarctic polar region - a region that plays an outsized role in modulating the global carbon cycle. The expedition will support and provide management infrastructure for additional participating science projects focused on measuring specific external fluxes and internal cycling of TEIs along this section.

The South Pacific Gyre and Pacific sector of the Southern Ocean play critical roles in global water mass circulation and associated global transfer of heat, carbon, and nutrients, but they are chronically understudied for TEIs due to their remote locale. These are regions of strong, dynamic fronts where sub-surface water masses upwell and subduct, and biological and chemical processes in these zones determine nutrient stoichiometries and tracer concentrations in waters exported to lower latitudes. The Pacific sector represents an end member of extremely low external TEI surface fluxes and thus an important region to constrain inputs from the rapidly-changing Antarctic continent. Compared to other ocean basins, TEI cycling in these regions is thought to be dominated by internal cycling processes such as biological uptake, regeneration, and scavenging, and these are poorly represented in global ocean models. The cruise will enable funded investigators to address research questions such as: 1) what are relative rates of external TEI fluxes to this region, including dust, sediment, hydrothermal, and cryospheric fluxes? 2) What are the (micro) nutrient regimes that support productivity, and what impacts do biomass accumulation, export, and regeneration have on TEI cycling and stoichiometries of exported material? 3) What are TEI and nutrient stoichiometries of subducting water masses, and how do scavenging and regeneration impact these during transport northward? This management project has several objectives: 1) plan and coordinate a 55-day research cruise in 2021-2022; 2) use both conventional and trace-metal 'clean' sampling systems to obtain TEI samples, as well as facilitate sampling for atmospheric aerosols and large volume particles and radionuclides; 3) acquire hydrographic data and samples for salinity, dissolved oxygen, algal pigments, and macro-nutrients; and deliver these data to relevant repositories; 4) ensure that proper QA/QC protocols, as well as GEOTRACES intercalibration protocols, are followed and reported; 5) prepare the final cruise report to be posted with data; 6) coordinate between all funded cruise investigators, as well as with leaders of proposed GP17-ANT cruise; and 7) conduct broader impact efforts that will engage the public in oceanographic research using immersive technology. The motivations for and at-sea challenges of this work will be communicated to the general public through creation of immersive 360/Virtual Reality experiences, via a collaboration with the Texas A&M University Visualization LIVE Lab. Through Virtual Reality, users will experience firsthand what life and TEI data collection at sea entail. Virtual reality/digital games and 360° experiences will be distributed through GEOTRACES outreach websites, through PI engagement with local schools, libraries, STEM summer camps, and adult service organizations, and through a collaboration with the National Academy of Sciences.

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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-2023315
NSF Division of Ocean Sciences (NSF OCE)	OCE-2023206
NSF Division of Ocean Sciences (NSF OCE)	OCE-2023237

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