

Beryllium-7 aerosol concentration from GEOTRACES Peru-Tahiti section on R/V Thomas G. Thompson cruise TN303 from October to December 2013

Website: <https://www.bco-dmo.org/dataset/671814>

Data Type: Cruise Results

Version: 29 December 2016

Version Date: 2016-12-29

Project

- » [U.S. GEOTRACES East Pacific Zonal Transect \(GP16\)](#) (U.S. GEOTRACES EPZT)
- » [GEOTRACES Peru-Tahiti section: Measurement of ⁷Be as a Tracer of Upper Ocean Processes](#) (EPZT Be-7)

Program

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

Contributors	Affiliation	Role
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Dataset Description

Beryllium-7 aerosol concentration from GEOTRACES Peru-Tahiti section, R/V Thompson cruise TN303.

Methods & Sampling

Aerosol samples were collected between Nov 7, 2011 and Dec 9, 2013 during the U.S. GEOTRACES EPZT cruise, R/V Thomas G. Thompson (TGT303), which took place from 25 October 2013 - 20 December 2013, Manta, Ecuador - Papeete, Tahiti, French Polynesia. Aerosol samples were obtained with a Tisch TE-5170V-BL high volume aerosol sampler, modified to collect 12 replicate samples on acid-washed (Wallace et al, 1977; Baker et al., 2006) 47 mm diameter Whatman-41 (W-41) filters, using procedures of the US GEOTRACES aerosol program (Morton et al., 2013). In order to minimize the filter blanks for our experiment, the W-41 filters were pre-cleaned before deployment using three cycles of leaching with 0.5M HCl (Optima) then rinsing with ultra-high purity water (UHP water) according to trace element protocols in a HEPA-filtered laminar flow hood (Morton et al., 2013; similar to Baker et al., 2006).

For ⁷Be, three of the 47 mm aerosol samples were stacked in a plastic Petri dish and counted by gamma spectroscopy. Be-7 has a readily identifiable gamma peak at 478 keV. The counting system was calibrated for all samples by preparing a commercial standard in geometry identical to the samples.

Related references:

Baker, A.R., French, M., and K.L. Linde (2006), Trends in aerosol nutrient solubility along a west-east transect of the Saharan dust plume. *Geophysical Research Letters*, 33, L07805, doi:[10.1029/2005GL024764](https://doi.org/10.1029/2005GL024764).

Morton, P.L., Landing, W.M., Milne, A., et al. INTERCAL: Results from the 2008 GEOTRACES aerosol intercalibration study. *Limnology and Oceanography: Methods* 11, 2013, 62-78.

Wallace G.T., J.R. Fletcher and R.A. Duce (1977) Filter washing, a simple means of reducing blank values and variability in trace metal environmental samples. *Journal Environmental Science and Health*, A12, 493-506.

Kadko, D. and D. Olson (1996) Be-7 as a tracer of surface water subduction and mixed layer history. *Deep Sea Res.* 43, 89-116.

Data Processing Description

For data processing, please refer to:

Kadko, D. and D. Olson (1996) Be-7 as a tracer of surface water subduction and mixed layer history. *Deep Sea Res.* 43, 89-116.

BCO-DMO Processing:

- modified parameter names to conform with BCO-DMO and GEOTRACES naming conventions;
- shortened Be-7 values to 5 decimal places per communication with dataset contact;
- joined to BCO-DMO EPZT master data file;
- created ISO date/time for start and end.

Additional GEOTRACES Processing:

As was done for the GEOTRACES-NAT data, BCO-DMO added standard US GEOTRACES information, such as the US GEOTRACES event number, to each submitted dataset lacking this information. To accomplish this, BCO-DMO compiled a 'master' dataset composed of the following parameters:

cruise_id, EXPCODE,SECT_ID, STNNBR, CASTNO, GEOTRC_EVENTNO, GEOTRC_SAMPNO, GEOTRC_INSTR, SAMPNO, GF_NO, BTLNBR, BTLNBR_FLAG, W, DATE_START_EVENT, TIME_START_EVENT, ISO_DATETIME_UTC, START_EVENT, EVENT_LAT, EVENT_LON, DEPTH_MIN, DEPTH_MAX, BTL_DATE, BTL_TIME, BTL_ISO_DATETIME_UTC, BTL_LAT, BTL_LON, ODF_CTDPRS, SMDEPTH, FMDEPTH, BTMDEPTH, CTDPRS, CTDDEPTH.

This added information will facilitate subsequent analysis and inter comparison of the datasets.

Bottle parameters in the master file were taken from the GT-C_Bottle and ODF_Bottle datasets. Non-bottle parameters, including those from GeoFish tows, Aerosol sampling, and McLane Pumps, were taken from the TN303 Event Log (version 30 Oct 2014). Where applicable, pump information was taken from the PUMP_Nuts_Sals dataset.

A standardized BCO-DMO method (called "join") was then used to merge the missing parameters to each US GEOTRACES dataset, most often by matching on sample_GEOTRC or on some unique combination of other parameters.

If the master parameters were included in the original data file and the values did not differ from the master file, the original data columns were retained and the names of the parameters were changed from the PI-submitted names to the standardized master names. If there were differences between the PI-supplied parameter values and those in the master file, both columns were retained. If the original data submission included all of the master parameters, no additional columns were added, but parameter names were modified to match the naming conventions of the master file.

See the dataset parameters documentation for a description of which parameters were supplied by the PI and which were added via the join method.

Data Files

File
Be7_Aerosol_joined.csv (Comma Separated Values (.csv), 3.08 KB) MD5:dd870040443f0e15c6fc975eff4db10d
Primary data file for dataset ID 671814

Parameters

Parameter	Description	Units
cruise_id	Cruise identification	unitless
SECT_ID	Cruise section identifier; EPZT = GEOTRACES East Pacific Zonal Transect. Added from BCO-DMO GEOTRACES EPZT master data file.	unitless
GEOTRC_SAMPNO	Unique GEOTRACES sample number	unitless
STNNBR	Station number; added from BCO-DMO GEOTRACES EPZT master data file.	unitless
GEOTRC_EVENTNO	GEOTRACES event number; added from BCO-DMO GEOTRACES EPZT master data file.	unitless
julian_day	Julian day at start of sampling event.	unitless
day_start	2-digit day of month at start of sampling event.	unitless
month_start	2-digit month of year at start of sampling event.	unitless
year_start	4-digit year at start of sampling event.	unitless
time_start_utc	Time (UTC) at start of sampling event. 24-hour clock; formatted as HHMM.	unitless
ISO_DateTime.UTC_start	Date and time (UTC) formatted to ISO 8601 standard. Calculated from start date and time provided. Format: YYYY-MM-DDTHH:MM:SS[.xx][+/-TZ]	unitless
lat_start	Latitude at start of sampling event. North = Positive.	decimal degrees
lon_start	Longitude at start of sampling event. West = Negative.	decimal degrees
day_end	2-digit day of month at end of sampling event.	unitless
month_end	2-digit month of year at end of sampling event.	unitless
year_end	4-digit year at end of sampling event.	unitless
time_end_utc	Time (UTC) at end of sampling event. 24-hour clock; formatted as HHMM.	unitless
ISO_DateTime.UTC_end	Date and time (UTC) formatted to ISO 8601 standard. Calculated from end date and time provided. Format: YYYY-MM-DDTHH:MM:SS[.xx][+/-TZ]	unitless
lat_end	Latitude at end of sampling event. North = Positive.	decimal degrees
lon_end	Longitude at end of sampling event. West = Negative.	decimal degrees
air_vol	Air volume sampled	cubic meter (m ³)
Be_7_AER_CONC_TISCH	Beryllium-7 (Be-7) aerosol concentration	becquerels per cubic meter (bq/m ³)
Be_7_AER_CONC_TISCH_ERR	Error (+/-) associated with Be-7 measurement	becquerels per cubic meter (bq/m ³)

Instruments

Dataset-specific Instrument Name	Tisch TE-5170V-BL high volume aerosol sampler
Generic Instrument Name	Aerosol Sampler
Dataset-specific Description	Aerosol samples were obtained with a Tisch TE-5170V-BL high volume aerosol sampler, modified to collect 12 replicate samples on acid-washed 47 mm diameter Whatman-41 (W-41) filters, using procedures of the US GEOTRACES aerosol program.
Generic Instrument Description	A device that collects a sample of aerosol (dry particles or liquid droplets) from the atmosphere.

Dataset-specific Instrument Name	gamma spectroscopy
Generic Instrument Name	Spectrometer
Dataset-specific Description	For 7Be, three of the 47 mm aerosol samples were stacked in a plastic Petri dish and counted by gamma spectroscopy.
Generic Instrument Description	A spectrometer is an optical instrument used to measure properties of light over a specific portion of the electromagnetic spectrum.

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Deployments

TN303

Website	https://www.bco-dmo.org/deployment/499719
Platform	R/V Thomas G. Thompson
Report	http://dmoserv3.who.edu/data_docs/GEOTRACES/EPZT/GT13_EPZT_ODFReport_All.pdf
Start Date	2013-10-25
End Date	2013-12-20
Description	A zonal transect in the eastern tropical South Pacific (ETSP) from Peru to Tahiti as the second cruise of the U.S.GEOTRACES Program. This Pacific section includes a large area characterized by high rates of primary production and particle export in the eastern boundary associated with the Peru Upwelling, a large oxygen minimum zone that is a major global sink for fixed nitrogen, and a large hydrothermal plume arising from the East Pacific Rise. This particular section was selected as a result of open planning workshops in 2007 and 2008, with a final recommendation made by the U.S.GEOTRACES Steering Committee in 2009. It is the first part of a two-stage plan that will include a meridional section of the Pacific from Tahiti to Alaska as a subsequent expedition. Figure 1. The 2013 GEOTRACES EPZT Cruise Track. [click on the image to view a larger version] Additional cruise information is available from the Rolling Deck to Repository (R2R): http://www.rvdata.us/catalog/TN303

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Project Information

U.S. GEOTRACES East Pacific Zonal Transect (GP16) (U.S. GEOTRACES EPZT)

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

Coverage: Eastern Tropical Pacific - Transect from Peru to Tahiti (GP16)

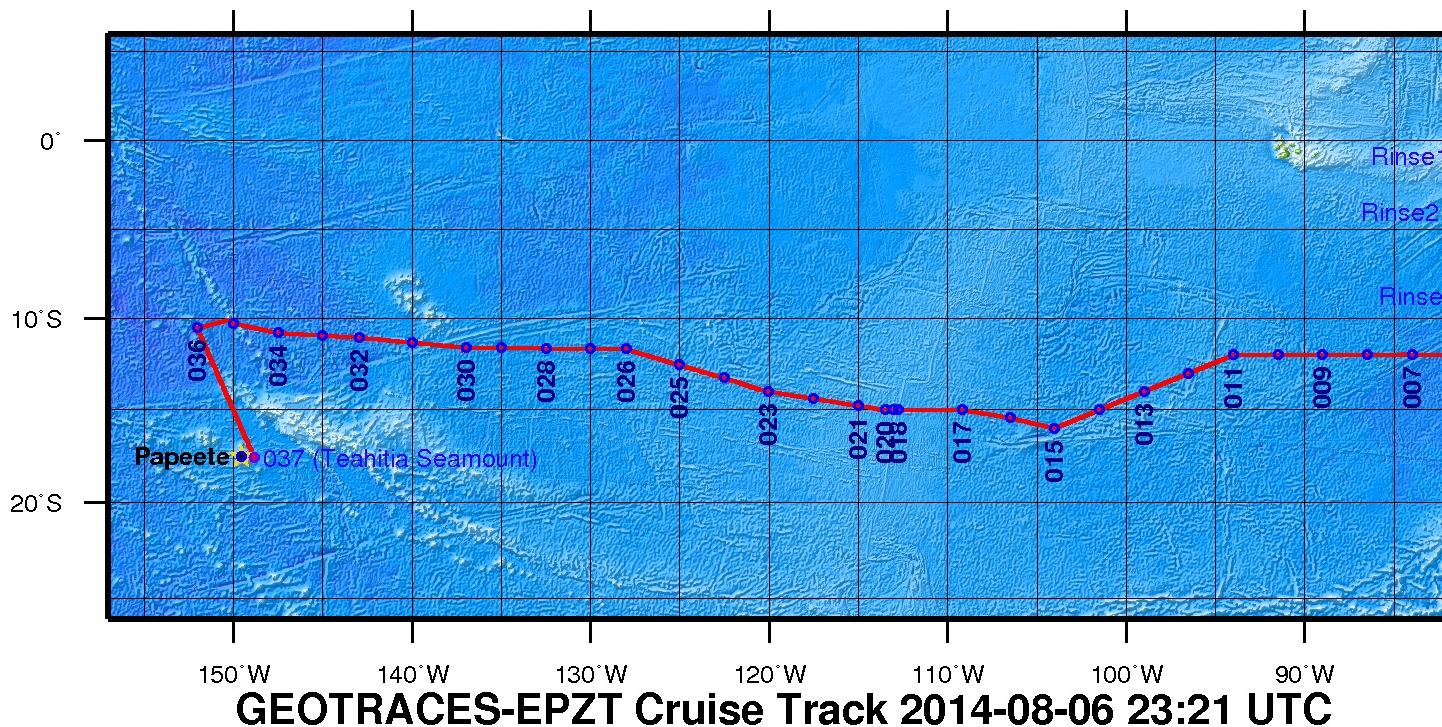
From the NSF Award Abstract

The mission of the International GEOTRACES Program (<https://www.geotraces.org/>), of which the U.S. chemical oceanography research community is a founding member, is "to identify processes and quantify fluxes that control the distributions of key trace elements and isotopes in the ocean, and to establish the sensitivity of these distributions to changing environmental conditions" (GEOTRACES Science Plan, 2006). In the United States, ocean chemists are currently in the process of organizing a zonal transect in the eastern tropical South Pacific (ETSP) from Peru to Tahiti as the second cruise of the U.S.GEOTRACES Program. This Pacific section includes a large area characterized by high rates of primary production and particle export in the eastern boundary associated with the Peru Upwelling, a large oxygen minimum zone that is a major global sink for fixed nitrogen, and a large hydrothermal plume arising from the East Pacific Rise. This particular section was selected as a result of open planning workshops in 2007 and 2008, with a final recommendation made by the U.S.GEOTRACES Steering Committee in 2009. It is the first part of a two-stage plan that will include a meridional section of the Pacific from Tahiti to Alaska as a subsequent expedition.

This award provides funding for management of the U.S.GEOTRACES Pacific campaign to a team of scientists from the University of Southern California, Old Dominion University, and the Woods Hole Oceanographic Institution. The three co-leaders will provide mission leadership, essential support services, and management structure for acquiring the trace elements and isotopes samples listed as core parameters in the International GEOTRACES Science Plan, plus hydrographic and nutrient data needed by participating investigators. With this support from NSF, the management team will (1) plan and coordinate the 52-day Pacific research cruise described above; (2) obtain representative samples for a wide variety of trace metals of interest using conventional CTD/rosette and GEOTRACES Sampling Systems; (3) acquire conventional JGOFS/WOCE-quality hydrographic data (CTD, transmissometer, fluorometer, oxygen sensor, etc) along with discrete samples for salinity, dissolved oxygen (to 1 uM detection limits), plant pigments, redox tracers such as ammonium and nitrite, and dissolved nutrients at micro- and nanomolar levels; (4) ensure that proper QA/QC protocols are followed and reported, as well as fulfilling all GEOTRACES Inter-calibration protocols; (5) prepare and deliver all hydrographic-type data to the GEOTRACES Data Center (and US data centers); and (6) coordinate cruise communications between all participating investigators, including preparation of a hydrographic report/publication.

Broader Impacts: The project is part of an international collaborative program that has forged strong partnerships in the intercalibration and implementation phases that are unprecedented in chemical oceanography. The science product of these collective missions will enhance our ability to understand how to interpret the chemical composition of the ocean, and interpret how climate change will affect ocean chemistry. Partnerships include contributions to the infrastructure of developing nations with overlapping interests in the study area, in this case Peru. There is a strong educational component to the program, with many Ph.D. students carrying out thesis research within the program.

Figure 1. The 2013 GEOTRACES EPZT Cruise Track. [click on the image to view a larger version]



GEOTRACES Peru-Tahiti section: Measurement of ^7Be as a Tracer of Upper Ocean Processes (EPZT Be-7)

Coverage: Eastern Tropical Pacific

Description from NSF award abstract:

In the ocean, trace elements function variously as nutrients, as contaminants from human activity, and even as convenient tracers of current and past oceanographic processes. Their biogeochemical cycling has major impacts on the ocean carbon cycle and ecosystem dynamics as well as on global climate change. Many processes influencing the distribution and behavior of trace elements in the ocean cannot be directly observed, so consequently a variety of geochemical tracers are used to provide important constraints on their rates and pathways. Beryllium-7 (^7Be) is a cosmogenic (i.e., produced in the upper atmosphere) radionuclide that, because of its half-life (53.3d), can be used in the study of environmental processes occurring over seasonal timescales. This timescale is important to studies of biological production, nutrient regeneration, and atmospheric deposition, to name a few.

In this project, a research team from the University of Miami will make measurements of water column ^7Be along the U.S. GEOTRACES transect from Peru to Tahiti in 2013. The mission of the International GEOTRACES Program (of which the US program is a component) is "to identify processes and quantify fluxes that control the distributions of key trace elements and isotopes in the ocean, and to establish the sensitivity of these distributions to changing environmental conditions."

As part of the multi-institutional U.S. GEOTRACES Pacific campaign, the Miami team will address key tasks formulated within the GEOTRACES Science Plan. Specifically, they will: (1) provide realistic estimates of the underlying transport processes influencing measured trace elements of interest (TEI) distributions; they will use water column measurements of ^7Be as a tracer of physical processes, such as mixing and upwelling, which redistribute biologically active species; and (2) develop and apply new ^7Be methods for quantifying the atmospheric deposition of TEIs measured by other research teams participating in the campaign. Measurements of ^7Be in the surface waters and in the lower atmosphere along the cruise track will provide estimates of the atmospheric input of relevant TEIs. The atmospheric input into the global ocean is an important budgetary component of numerous chemical species, yet is very difficult to constrain. The data generated in this work will be available to allow ground-truthing of aerosol deposition models and the atmospheric input of trace elements.

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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.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1451120
NSF Division of Ocean Sciences (NSF OCE)	OCE-1232794