

Dissolved Fe, Mn, Cd, Cu and Zn concentrations from bottle samples during the R/V Thomas G. Thompson TN303 GEOTRACES EPZT cruise in the Eastern Tropical Pacific from November to December 2013 (U.S. GEOTRACES EPZT)

Website: <https://www.bco-dmo.org/dataset/671150>

Data Type: Cruise Results

Version:

Version Date: 2017-03-21

Project

- » [U.S. GEOTRACES East Pacific Zonal Transect \(GP16\)](#) (U.S. GEOTRACES EPZT)
- » [Geotraces Pacific section: Dissolved Fe, Mn, Zn, Cu, and Cd and colloidal Fe \(FeMnCdCuZn\)](#)

Program

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

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Coverage

Spatial Extent: N:-10.50017 E:-109.1895 S:-15.00033 W:-152.00033

Temporal Extent: 2013-11-18 - 2013-12-17

Dataset Description

This dataset contains dissolved concentrations of trace metals including iron (Fe), manganese (Mn), cadmium (Cd), copper (Cu), and zinc (Zn) from bottle samples. The samples were collected during the U.S. GEOTRACES EPZT cruise TN303 aboard the R/V Thomas G. Thompson between November and December of 2013. Also included in this dataset are latitude, longitude, depth, event number, station number, cast number, and bottle number.

Methods & Sampling

Samples were collected by the U.S. GEOTRACES sampling team from 24 modified 12-L Teflon-coated GO-FLO samplers mounted on the GEOTRACES clean CTD rosette system (Cutter and Bruland 2012). The U.S. GEOTRACES sampling team filtered the samples through 0.2 um Supor Acropak filter cartridges (Pall) inside the U.S. GEOTRACES clean-air laboratory van. Filtered samples were stored in LDPE 0.5-L bottles. After transportation to the land-based lab, samples were acidified using trace metal grade nitric acid (HNO₃). Samples were stored at room temperature for more than two months prior to analysis.

Dissolved trace metal analysis:

Acidified samples were determined for dissolved Fe, Mn, Cd, Cu, and Zn using Mg(OH)₂ co-precipitation method coupled to isotope dilution and by means of a multiple-collector inductively coupled plasma mass spectrometer. The method is a modified version of Wu and Boyle (1997 and 1998).

Data Processing Description

Data processing was carried out using Thermo Scientific software and also Microsoft Excel.

BCO-DMO Data Manager Processing Notes:

- * added a conventional header with dataset name, PI name, version date
- * modified parameter names to conform with BCO-DMO naming conventions
- * blank values replaced with no data value 'nd'
- * removed data column "Cruise" containing value "USGT_EPZT" for all cells
- * added SECT_ID "EPZT" and cruise_id "TN303"
- * changed parameter names with _std to _SD to be consistent with other GEOTRACES datasets
- * joined dataset as described below to add :
CASTNO,GEOTRC_EVENTNO,BTL_ISO_DATETIME_UTC,BTLNBR,BTLNBR_FLAG_W,ISO_DATETIME_UTC_START_EVENT,EVENT_LAT,EVENT_LON,STNNBR,CTDDEPTH,CTDPRS
- * changed depth variable to PI_depth to distinguish between the master epzt depth and the rounded depth originally in the dataset.
- * new data version posted (2017-03-21) which replaces version 2016-12-28. The only change is 5 replacements of "nd " to "nd" with space removed.

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.

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Data Files

File
Fe_etc_joined.csv (Comma Separated Values (.csv), 69.64 KB) MD5:2f1f43b65d4e23afca867548fc50c097
Primary data file for dataset ID 671150

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Related Publications

Cutter, G. A., & Bruland, K. W. (2012). Rapid and noncontaminating sampling system for trace elements in global ocean surveys. *Limnology and Oceanography: Methods*, 10(6), 425–436. doi:[10.4319/lom.2012.10.425](https://doi.org/10.4319/lom.2012.10.425)
Methods

Wu, J., & Boyle, E. A. (1997). Low Blank Preconcentration Technique for the Determination of Lead, Copper, and Cadmium in Small-Volume Seawater Samples by Isotope Dilution ICPMS. *Analytical Chemistry*, 69(13), 2464–2470. doi:[10.1021/ac961204u](https://doi.org/10.1021/ac961204u)
Methods

Wu, J., & Boyle, E. A. (1998). Determination of iron in seawater by high-resolution isotope dilution inductively coupled plasma mass spectrometry after Mg(OH)₂ coprecipitation. *Analitica Chimica Acta*, 367(1–3), 183–191. [https://doi.org/10.1016/S0003-2670\(98\)00145-7](https://doi.org/10.1016/S0003-2670(98)00145-7) [https://doi.org/10.1016/S0003-2670\(98\)00145-7](https://doi.org/10.1016/S0003-2670(98)00145-7)
Methods

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Parameters

Parameter	Description	Units
GEOTRC_SAMPNO	Unique GEOTRACES sample number based on USGT EPZT documentation	unitless
year	year of sampling	unitless
STNNBR	station number from USGT EPZT cruise documentation	unitless
PI_depth	depth of sample	meters
Fe_D_CONC_BOTTLE	dissolved concentration (	nanomolar(nM)
Fe_D_CONC_BOTTLE_SD	standard deviation of dissolved concentration (	nanomolar(nM)
Mn_D_CONC_BOTTLE	dissolved concentration (	nanomolar(nM)
Mn_D_CONC_BOTTLE_SD	standard deviation of dissolved concentration (	nanomolar(nM)
Cd_D_CONC_BOTTLE	dissolved concentration (	picomolar(pM)
Cd_D_CONC_BOTTLE_SD	standard deviation of dissolved concentration (	picomolar(pM)
Cu_D_CONC_BOTTLE	dissolved concentration (	nanomolar(nM)
Cu_D_CONC_BOTTLE_SD	standard deviation of dissolved concentration (	nanomolar(nM)
Zn_D_CONC_BOTTLE	dissolved concentration (	nanomolar(nM)
Zn_D_CONC_BOTTLE_SD	standard deviation of dissolved concentration (	nanomolar(nM)
ISO_DATETIME_UTC_START_EVENT	ISO timestamp for start of sampling event in format YYYY-mm-ddTHH:MM:SS[.xx]Z (UTC time)	unitless
BTLNBR	Identifier for GEOTRACES bottle sample	unitless
CASTNO	Identifier for CTD cast	unitless
GEOTRC_EVENTNO	Identifier for GEOTRACES event	unitless
BTL_ISO_DATETIME_UTC	ISO timestamp for bottle sample in format YYYY-mm-ddTHH:MM:SS[.xx]Z (UTC time)	unitless
EVENT_LAT	latitude of GEOTRACES event; north is positive	decimal degrees
EVENT_LON	longitude of GEOTRACES event; east is positive	decimal degrees
CTDDEPTH	CTD bottle firing depth	meters
CTDPRS	Pressure from CTD	decibars

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Instruments

Dataset-specific Instrument Name	GEOTRACES clean CTD rosette system
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	Teflon-coated GO-FLO
Generic Instrument Name	GO-FLO Teflon Trace Metal Bottle
Generic Instrument Description	GO-FLO Teflon-lined Trace Metal free sampling bottles are used for collecting water samples for trace metal, nutrient and pigment analysis. The GO-FLO sampling bottle is designed specifically 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	multiple-collector inductively coupled plasma mass spectrometer
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	Acidified samples were determined for dissolved Fe, Mn, Cd, Cu, and Zn using Mg(OH) ₂ co-precipitation method coupled to isotope dilution and by means of a multiple-collector inductively coupled plasma mass spectrometer. The method is a modified version of Wu and Boyle (1997 and 1998).
Generic Instrument Description	An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer.

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Deployments

TN303

Website	https://www.bco-dmo.org/deployment/499719
Platform	R/V Thomas G. Thompson
Report	http://dmosev3.whoj.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)

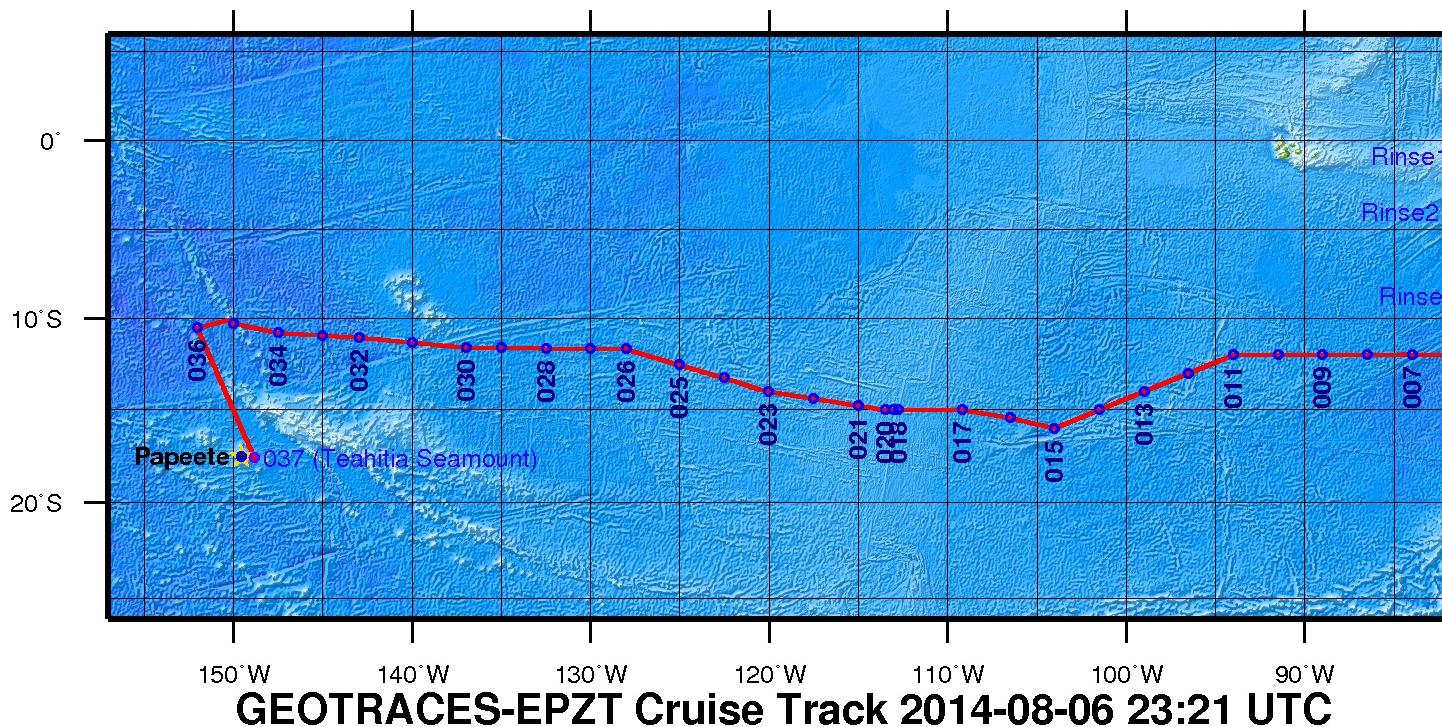
From the NSF Award Abstract

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 Intercalibration 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 Pacific section: Dissolved Fe, Mn, Zn, Cu, and Cd and colloidal Fe (FeMnCdCuZn)

Coverage: Eastern Tropical Pacific

A scientist from the University of Miami Rosenstiel School of Marine and Atmospheric Science plans to participate in the 2013 GEOTRACES Eastern Pacific Zonal transect cruise to determine the vertical distribution of dissolved (<math><0.2 \mu\text{m}</math>) iron, manganese, zinc, copper, and cadmium in samples obtained between the East Pacific Rise and Tahiti. In addition, measurements of soluble (<math><10</math> kilo Daltons) and colloidal iron will be made on all samples collected during the cruise track from Peru to Tahiti. Results from this study will be used to determine the influence of hydrothermal vents on the source and sink of the above mentioned elements and to understand the role of colloid iron in the transport of hydrothermal iron, as well as the cycling of iron in the oligotrophic South Pacific and low oxygen waters near the continental margin off Peru.

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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-1233155

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