Dissolved lead (Pb) along the US GEOTRACES East Pacific Zonal Transect from the R/V Thomas G. Thompson TN303 cruise in the Eastern Tropical Pacific, Peru to Tahiti during 2013

Website: https://www.bco-dmo.org/dataset/646842
Data Type: Cruise Results
Version: 1
Version Date: 2016-06-03

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

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

Contributors	Affiliation	Role
Flegal, Arthur Russell	University of California-Santa Cruz (UCSC)	Principal Investigator
Till, Ralph	University of California-Santa Cruz (UCSC)	Contact
Kinkade, Danie	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Dissolved lead (Pb) along the US GEOTRACES East Pacific Zonal Transect from the R/V Thomas G. Thompson TN303 cruise in the Eastern Tropical Pacific, Peru to Tahiti during 2013.

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Coverage

Spatial Extent: **N**:-10.21911 **E**:-77.37617 **S**:-16.00033 **W**:-152.11975
Temporal Extent: 2013-10-29 - 2013-12-17

Dataset Description

Dissolved lead concentrations of the transect in samples taken from the GEOTRACES GO-FLO rosette surface casts and filtered through a 0.2um Acropak capsule filter.

Methods & Sampling

Sampling:
Sample bottles were LDPE and cleaned in accordance with the GEOTRACES cookbook (http://www.geotraces.org/images/stories/documents/intercalibration/Cookbook.pdf). Sample bottles were stored in weak (~0.1 N) HNO_3, and were emptied before shipping.

Samples were collected using the U.S. GEOTRACES sampling system of 24 Teflon-coated GO-FLO bottles (Cutter and Bruland, 2012). At each station, the bottles were deployed open and tripped on ascent at 3 m/min. GO-FLOs were sampled in the GEOTRACES trace metal clean sampling van that contained HEPA-filtered air.

During sampling, the GO-FLO bottles were pressurized to ~0.4 atm with HEPA-filtered air, and their spigots were fitted with an acid-cleaned piece of Bev-a-Line tubing that fed into an Acropak-200 Supor capsule filter (0.2 µm pore size made of polyethersulfone). Before use, this filter had been filled with filtered surface seawater that had been acidifed to pH 2 with trace metal clean HCl and left overnight to rinse. Before collecting any subsamples, at least 500mL of seawater was passed through the filter (while eliminating air bubbles in the capsule reservoir). Sample bottles were rinsed three times with 10% sample volume before filling. Acropak filters were used for at most 3 casts before a new filter was used, and they were stored empty in a refrigerator while not in use. GEOFish surface samples were taken using an all-plastic "towed fish" pumping system as described in Bruland et al. 2005 at approximately 3 m depth and were similarly filtered and sampled.

Samples were acidified at sea with the equivalent of 4mL quartz-distilled 6M HCl per liter of seawater (resulting in pH 1.7-1.8). Samples were sitting acidified for several months before analysis back in the laboratory.

Analysis:
Samples were analyzed using the method of Ndung'u et. al. (2003) with adaptations from Zurbrick, et. al. (2013). Aliquots of samples are poured in to 15mL LDPE bottles for analysis. Samples, blanks, reference materials and standards are all treated equally. They are buffered with trace metal clean ammonium acetate (pH 9) in line and sent across a Toyopearl AF-Chelate 650 M resin column. The column is rinsed with diluted ammonium acetate, and eluted in 1.5N quartz distilled nitric acid (with added bismuth as an internal standard) into the injector of the HR-ICP-MS. Counts of lead are measured throughout the elution, yielding a curve which is then integrated to give our raw values.

Standards are made by spiking lead into low concentration seawater. Blanks are 24mL HCl in Milli-Q. Reference materials used were SAFe S1, SAFe D2, and GEOTRACES reference samples GS and GD. Standard curves are run at the beginning and the end of runs and reference materials and blanks are run throughout (every 10 or less samples).

Data Processing Description

Flegal Lab Processing:
For every sample, standard, blank and reference, we integrate an elution peak. We used a seawater standard calibration curve for lead. We subtracted a process blank from every sample. We checked that reference samples analyzed and processed in the same way resulted in reasonable values. **NOTE:** concentration values are in parts per billion units.

BCO-DMO Processing:
- added conventional header with dataset name, PI name, version date
- renamed parameter names to GEOTRACES standard naming conventions
- edited Pb conc. values from 14 decimal precision to 2 decimal precision.
- split GeoFish samples into a separate column from GO-FLO bottle samples.
- sample values were place in station order for all sample numbers.
- nominal depth for GeoFish samples was edited from 'surface' to 3.5 meters
- removed one duplicate sample (8346) entered as both a bottle and GeoFish sample (master event and GeoFish cast logs confirmed the sample to be from GeoFish, therefore the bottle entry was deleted).
- added columns by joining the submitted data with an Events Master file (see Additional GEOTRACES Processing).

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, EXPOCODE,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.

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Data Files

File
Pb_diss_flegal_joined.csv (Comma Separated Values (.csv), 61.54 KB) MD5:0bb905e0c4c63617e73973bb854e7988 Primary data file for dataset ID 646842

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Related Publications

Bruland, K. W., Rue, E. L., Smith, G. J., & DiTullio, G. R. (2005). Iron, macronutrients and diatom blooms in the Peru upwelling regime: brown and blue waters of Peru. Marine Chemistry, 93(2-4), 81–103. doi:10.1016/j.marchem.2004.06.011
Methods

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
Methods

Ndung'u, K., Franks, R. P., Bruland, K. W., & Flegal, A. R. (2003). Organic complexation and total dissolved trace metal analysis in estuarine waters: comparison of solvent-extraction graphite furnace atomic absorption spectrometric and chelating resin flow injection inductively coupled plasma-mass spectrometric analysis. Analytica Chimica Acta, 481(1), 127–138. doi:10.1016/s0003-2670(03)00063-1 https://doi.org/10.1016/S0003-2670(03)00063-1
Methods

Zurbrick, C. M., Gallon, C., & Flegal, A. R. (2013). A new method for stable lead isotope extraction from seawater. Analytica Chimica Acta, 800, 29–35. doi:10.1016/j.aca.2013.09.002
Methods

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Parameters

Parameter	Description	Units
cruise_id	Cruise identifier.	dimensionless
EXPOCODE	Unique cruise identifier.	dimensionless
STNNBR	Station Number	unitless
GEOTRC_EVENTNO	GEOTRACES Event Number. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	unitless
EVENT_LAT	latitude in decimal degrees at the start of the event (according to the EPZT event log)	decimal degrees
EVENT_LON	longitude in decimal degrees at the start of the event (according to the EPZT event log)	decimal degrees
GEOTRC_SAMPNO	GEOTRACES sample number	unitless
depth_PI	Sample depth as reported by PI.	meters
Pb_D_CONC_FISH	Dissolved lead concentration as measured from the GeoFish sampler	ppb: parts per billion
Pb_D_CONC_BOTTLE	Dissolved lead concentration as measured from GO-FLO bottles	ppb: parts per billion
CASTNO	Cast Number. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	unitless
BTLNBR	Bottle number. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	unitless
BTLNBR_FLAG_W	Bottle quality flag: 2 = good; 3 = questionable; 4 = bad; 9 = missing data. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	unitless
ISO_DATETIME_UTC_START_EVENT	ISO 8601:2004 standard date and time at start of event. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	year, month, day, hour, minute, seconds
CTDDEPTH	CTD bottle firing depth. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	meters
CTDPRS	CTD pressure. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	meters
ODF_CTDPRS	ODF CTD pressure. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	meters
SMDEPTH	Saunders-Mantyla depth (integrated, uses dynamic height). Values were added from the intermediate US GEOTRACES master file (see Processing Description).	meters
FMDEPTH	Fofonoff-Millard depth (non-integrated). Values were added from the intermediate US GEOTRACES master file (see Processing Description).	meters
BTMDEPTH	Bottom depth. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	meters
DATE_START_EVENT	date of event start	unitless
TIME_START_EVENT	time of event start	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	GeoFish Towed near-Surface Sampler
Generic Instrument Description	The GeoFish towed sampler is a custom designed near surface (

Dataset-specific Instrument Name	
Generic Instrument Name	GO-FLO Bottle
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

TN303

Website	https://www.bco-dmo.org/deployment/499719
Platform	R/V Thomas G. Thompson
Report	http://dmoserv3.whoi.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/

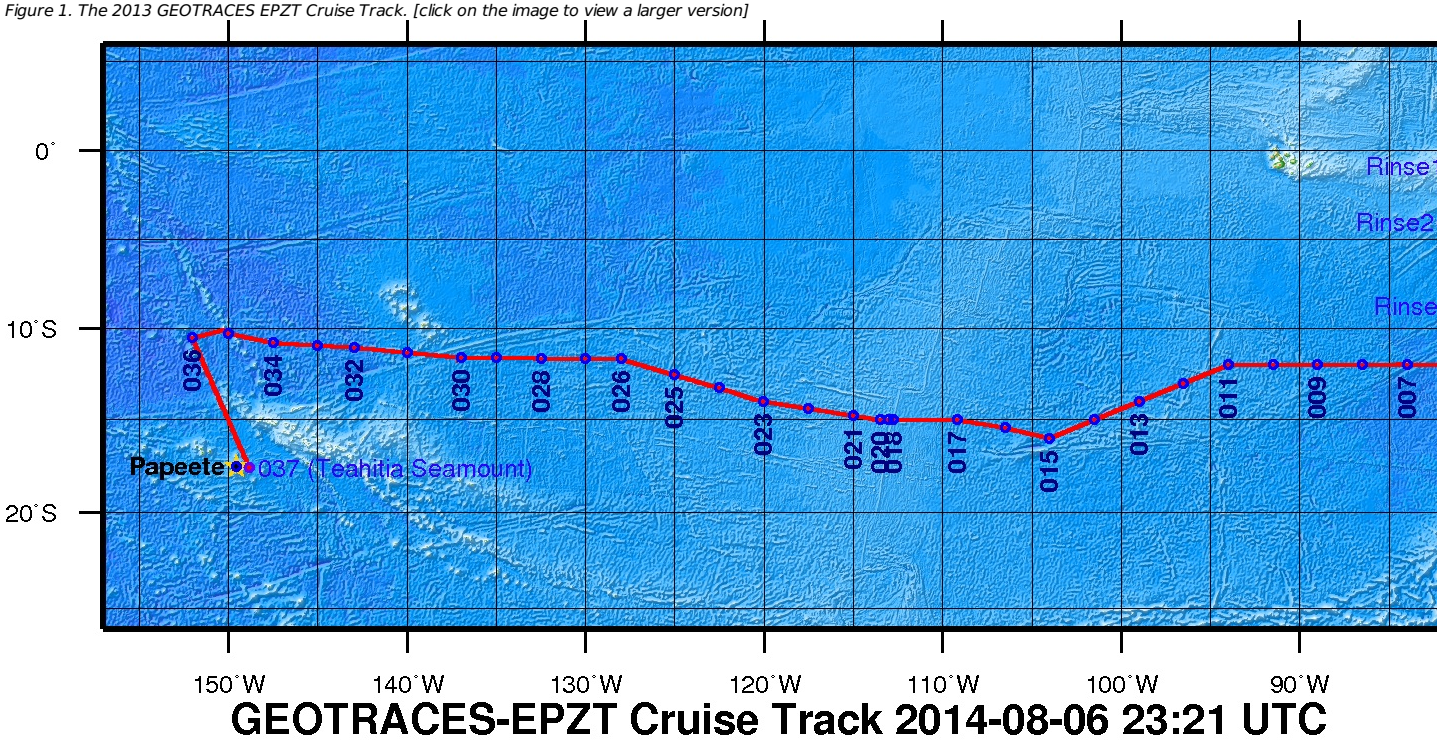
Coverage: Eastern Tropical Pacific - Transect from Peru to Tahiti (GP16)

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]



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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-1234213

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