

Particulate Acid-Volatile Sulfide (pAVS) and elemental selenium (pSe) concentrations from a McLane pump collected during the R/V Thomas G. Thompson cruise TN303 from Peru to Tahiti in 2013 (U.S. GEOTRACES EPZT project)

Website: <https://www.bco-dmo.org/dataset/646143>

Data Type: Cruise Results

Version: 1

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Project

- » [U.S. GEOTRACES East Pacific Zonal Transect](#) (U.S. GEOTRACES EPZT)
- » [US GEOTRACES Pacific section: Characterizing the redox environment of the eastern tropical Pacific Ocean](#) (EPZT_Redox_Elements)

Program

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

Contributors	Affiliation	Role
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Abstract

Particulate Acid-Volatile Sulfide (pAVS) and elemental selenium (pSe) concentrations from a McLane pump collected during the R/V Thomas G. Thompson cruise TN303 from Peru to Tahiti in 2013.

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Coverage

Spatial Extent: N:-11.99933 E:-77.376 S:-16.00058 W:-120.00217

Temporal Extent: 2013-10-29 - 2013-11-29

Dataset Description

Data for the concentrations of Particulate Acid-Volatile Sulfide (pAVS) (0.8 μm) in depth profiles from in situ McLane pumps at GEOTRACES EPZT Stations 1-5, 7, 9, 11, 13, 17, 18, 20, 21, and 23.

DMO notes:

- changed -9999 values in SAMPNO to nd
- added zeros to pad EVENT_LAT and EVENT_LON where decimal places were not 5 places like most of the dataset.
- original name pAVS and pSe(0) changed to conform to GEOTRACES conventions

Acquisition Description

Samples analyzed for acid-volatile sulfides (AVS) were collected on McLane pumps suspended from a trace metal wire (Hytrek-jacketed Vectran). Pumps filtered for four hours, flowing first over a 51- μm polyester pre-filter, then over paired 0.8- μm pore-size, 142-mm Supor polyethersulfone filters. A small portion of the top Supor filter, representing ~2% of the filter area (0.8-51 μm size-fraction material), was sub-sectioned into polyethylene vials and frozen at -85°C until shipboard AVS analysis, described below. Filter blanks were held within identical filter housings and submerged on one of the deeper pumps on each cast, but were not actively filtered through. Blanks were handled identically to samples during processing, which was conducted in a HEPA-filtered environment using trace metal procedures.

Particulate elemental samples were collected using McLane in situ pumps (P. Lam, UCSC) with splits (section) from a 0.8 μm Supor filter processed immediately in a N₂-purged glove bag after collection and pump recovery; filter splits were placed and sealed in Tedlar bags and stored at -80°C until analysis. Particulate elemental selenium concentrations were determined using a sulfite leach following Velinsky and Cutter (1990) and analyzed like selenite+selenate following Cutter (1978). Precision was ca. 10% RSD (n=3).

Processing Description

Samples analyzed in triplicate and means computed. Standard additions of selenite were used for daily calibration on a representative sample and its slope applied to subsequent samples.

Determinations of acid-volatile sulfide (AVS) were made on-board ship and used the method of Cutter and Oatts (Cutter and Oatts, 1987) that includes acidification, gas stripping and cryogenic trapping/preconcentration of the generated hydrogen sulfide. In this case, the filter slice was placed in a glass stripping vessel, 10 mL of deionized water added, and the stripper purged with He. The cryogenic trap was then immersed in liquid nitrogen, 10mL of 1M HCl added through a septum in the stripping vessel and the evolved and trapped hydrogen sulfide was then quantified using the gas chromatography/flame photometric detection method of Radford-Knoery and Cutter (Radford-Knoery and Cutter, 1993). The system was calibrated with hydrogen sulfide from a permeation tube (calibrated diffusion rate) and assuming a filtration volume of at least 5L (median sample volume: 7.9L), the detection limit was 0.2 pmol/L. It should be noted that AVS determined by this method includes monosulfides of iron, zinc, and nickel, but not those with copper or mercury, or mixed oxidation state sulfides such as greigite or pyrite (Cutter and Oatts, 1987; Radford-Knoery and Cutter, 1993).

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Related Publications

Cutter, G. A. (1978). Species determination of selenium in natural waters. *Analytica Chimica Acta*, 98(1), 59–66. doi:10.1016/s0003-2670(01)83238-4 [https://doi.org/10.1016/S0003-2670\(01\)83238-4](https://doi.org/10.1016/S0003-2670(01)83238-4) [details]

Cutter, G. A., & Oatts, T. J. (1987). Determination of dissolved sulfide and sedimentary sulfur speciation using gas chromatography-photoionization detection. *Analytical Chemistry*, 59(5), 717–721. doi:[10.1021/ac00132a008](https://doi.org/10.1021/ac00132a008) [details]

Radford-Knoery, J., & Cutter, G. A. (1993). Determination of carbonyl sulfide and hydrogen sulfide species in natural waters using specialized collection procedures and gas chromatography with flame photometric detection. *Analytical Chemistry*, 65(8), 976–982. doi:[10.1021/ac00056a005](https://doi.org/10.1021/ac00056a005) [details]

Velinsky, D. J., & Cutter, G. A. (1990). Determination of elemental selenium and pyrite-selenium in sediments. *Analytica Chimica Acta*, 235, 419–425. doi:10.1016/s0003-2670(00)82102-9 [https://doi.org/10.1016/S0003-2670\(00\)82102-9](https://doi.org/10.1016/S0003-2670(00)82102-9) [details]

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Parameters

Parameter	Description	Units
cruise_id	Cruise identifier. TN = R/V Thomas G. Thompson.	unitless
GEOTRC_EVENTNO	GEOTRACES event number.	unitless
CASTNO	Cast number.	unitless
DATE_START_EVENT	Date at the start of the event, according to the event log.	YYYYmmdd
ISO_DATETIME_UTC_START_EVENT	Date and time (UTC) at start of the event, formatted to ISO 8601 standard, according to the event log. Format is YYYY-mm-ddTHH:MM:SS.xxZ.	unitless
EVENT_LAT	Latitude at the start of the event, according to the event log.	decimal degrees
GEOTRC_SAMPNO	GEOTRACES sample number.	unitless
SAMPNO	Bottle sample number, according to PI.	unitless
STNNBR	Station number.	unitless
EXPOCODE	Used as a unique identifier for a cruise. Usual generation formula is ICES 4 character platform code then the cruise departure date in YYYYMDD format	unitless
SECT_ID	GEOTRACES cruise name.	unitless
TIME_START_EVENT	Time at the start of the event according to the event log	unitless
DEPTH_MIN	event depth minimum	meters
DEPTH_MAX	event depth maximum	meters
depth_n	nominal depth	meters
AVS_TP_CONC_PUMP	particulate acid volatile sulfide	picomoles per liter
Se_0_TP_CONC_PUMP	particulate elemental selenium	nanomoles per liter
EVENT_LON	Longitude according to the event log; West is negative	decimal degrees
GEOTRC_INSTR	Instrument	unitless

Instruments

Dataset-specific Instrument Name	McLane pumps
Generic Instrument Name	McLane Pump
Dataset-specific Description	In the data, McLane pumps are called "McL-Prof."
Generic Instrument Description	McLane pumps sample large volumes of seawater at depth. They are attached to a wire and lowered to different depths in the ocean. As the water is pumped through the filter, particles suspended in the ocean are collected on the filters. The pumps are then retrieved and the contents of the filters are analyzed in a lab.

Dataset-specific Instrument Name	Gas chromatograph
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Gas chromatograph/flame photometric ionizer
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

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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] Original data are available from the NSF R2R data catalog

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Project Information

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

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

Coverage: Eastern Tropical Pacific - Transect from Peru to Tahiti

From the NSF Award Abstract The mission of the International GEOTRACES Program (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 μM 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]

US GEOTRACES Pacific section: Characterizing the redox environment of the eastern tropical Pacific Ocean (EPZT_Redox_Elements)

Coverage: Eastern Pacific

Extracted from the NSF award abstract: The 2013 GEOTRACES Eastern Pacific Zonal Transect from Peru to Tahiti will cross an extensive oxygen deficient zone typically described as "suboxic"; however, measurements of sulfate reduction in this region suggest it may have some anoxic characteristics due to the presence of free sulfide. Redox conditions influence the solubility/stability of many trace elements which in turn affects their vertical and horizontal transport. A scientist from Old Dominion University plans to analyze water samples collected during the cruise for dissolved iodate/iodide, arsenic [As(III)/As(V)], selenium [Se(IV, VI), particulate Se(0)], and nano- to picomolar hydrogen sulfide speciation (total, free/uncomplexed). These measurements, along with nitrate/nitrite, nitrous oxide, and iron species determined by other participants during the cruise, will be used to constrain the range of redox conditions within the oxygen deficient zone, assess the importance of in-situ reduction versus horizontal advection of the redox species, and the changing redox conditions within the hydrothermal plume of the East Pacific Rise. Availability of this data will also enable other researchers to determine the behavior of other redox sensitive trace elements in the ocean.

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-1235328