Particulate trace element concentrations measured during four cruises in 2019 at locations around the Bermuda Atlantic Time-series Study (BATS) station

Website: https://www.bco-dmo.org/dataset/888772
Data Type: Cruise Results
Version: 1
Version Date: 2023-02-01

Project
» NSFGEO-NERC: Collaborative Research: Using Time-series Field Observations to Constrain an Ocean Iron Model (BAIT)

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

Contributors	Affiliation	Role
Twining, Benjamin	Bigelow Laboratory for Ocean Sciences	Principal Investigator
Ohnemus, Daniel C.	Skidaway Institute of Oceanography (SkIO)	Co-Principal Investigator
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Abstract
Particulate trace element concentrations were measured during 4 BATS cruises (March, May, August, November) in 2019 as part of the Bermuda Atlantic Iron Timeseries (BAIT) project. Three stations were sampled around the BATS station to 1800 meters (m) with a trace-metal clean rosette system. Collected water was passed through 0.45-micrometer (um) Supor membranes and subsequently subjected to both a weak acid leach and a total digest. Samples were analyzed via magnetic sector ICPMS for aluminum (Al), phosphorus (P), titanium (Ti), vanadium (V), manganese (Mn), iron (Fe), cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), cadmium (Cd), barium (Ba), lead (Pb), and thorium (Th). Data have been used to partition particulate Fe into lithogenic, biogenic, and authigenic fractions, and to understand controls on Fe cycling in the upper ocean over a seasonal cycle.

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Coverage

Spatial Extent: **N**:32.151 **E**:-63.5636 **S**:31.1769 **W**:-64.8234
Temporal Extent: 2019-03-11 - 2019-11-21

Methods & Sampling

Water column samples were collected by the Bermuda Atlantic Iron Timeseries (BAIT) sampling team from 12 trace metal clean modified 6-liter (L) Niskin-X samplers (General Oceanics Inc.) deployed on a clean CTD rosette system (Sedwick et al. 2005). Water was decanted from Niskin-X bottles in a trace metal van, transferred to trace metal bubble, and passed through 25-millimeter (mm) 0.45-micrometer (um) Supor (Pall Gelman) membranes via positive pressure from 0.2-um filtered air. Between 2.4-4.1L (mean = 3.6L) were passed through each filter membrane. Membranes were frozen at -20 degrees Celsius (C) until processing and analysis.

All digestion steps were performed in a Class-100 clean room using standard clean techniques. Filters were cut in half using a ceramic blade, using a cutting template and a light table to aid precision. One half was digested following the protocol of Berger et al. (2008) to obtain labile particulate concentrations; the other was digested using a 4M HCl, 4M HNO3, and 4M HF mixture as described in Ohnemus et al. (2014) to obtain total particulate element concentrations. Labile particulate filter halves were leached in a solution of 25% Optima-grade acetic acid and 0.02 M hydroxylamine hydrochloride following the protocol of Berger et al. (2008). One milliliter (mL) of this solution was added to the filter stored in a 1.7 mL polypropylene vial. Following the recommendation of Berger et al. (2008), the solution was heated to 95°C in a water bath for 10 minutes and then allowed to cool to room temperature. The filter was in contact with the acetic acid leach for a total of two hours, after which the filter was removed from the polypropylene vial and the acetic acid/hydroxylamine leachate was centrifuged at 14,000 rotations per minute (rpm) for 10 minutes to sediment all particles. Without disturbing particles on the bottom of the tube, approximately 0.8 mL of leachate was transferred into an acid-cleaned 7 mL PFA digestion vial. Optima-grade HNO3 was added (100 microliters (uL)) to the digestion vial, which was subsequently heated uncapped at 110ºC to near dryness. Vial contents were redissolved with 2% HNO3 (Optima grade).

Total particulate metals were determined by digestion of the second filter half. The filter was transferred to a rigorously cleaned 22-mL PFA vial, 2 mL of a solution containing 4M HCl, 4M HNO3, and 4M HF (all Optima grade) was added to completely cover the filter piece, and the vial was tightly capped and heated to 110°C for 4 hours. This procedure has been determined to be adequate for digestion of all particulate material, while allowing the Supor filter to remain intact (Ohnemus et al. 2014). Following heating, the acid solution in the bomb was poured into a second PFA vial, leaving the filter piece behind. To ensure complete transfer of acid, the bombs were thoroughly rinsed with 3 × 0.5 mL aliquots of ultrapure water which were poured into the secondary vial. The secondary vial was then heated to dryness and the contents redissolved with 2 mL of a 50% Optima-grade HNO3 + 15% Optima-grade H2O2 (v/v of concentrated reagents) solution. This solution was again dried down and the contents redissolved with 2% HNO3.

All digests were analyzed using a Thermo Element2 HR-ICP-MS at the University of Maine following the protocols outlined in Twining et al. (2011). The instrument is equipped with a cyclonic nebulizer, an autosampler contained under a HEPA filter, and nickel cones. Quantification was performed by external calibration, and In-115 was used as an internal standard to correct for variations in instrumental sensitivity during analyses.

Cs-133, spiked during the initial sample digestions, was used as a process recovery monitor, but no samples were discarded or corrected using the Cs recoveries, as typical Cs recoveries were 95-105%.

Data Processing Description

All ICP-MS elemental concentration data were normalized to an In-115 internal standard and quantified using external standard curves. After accounting for sample dilutions due to acid digestion steps, quantities of each element per filter (pmol/filter) were calculated for each analytical run. The contribution of the 'process blank' (measured as the elements contained in an acid-washed filter through which 0.2-um filtered water was passed during the cruise) was then subtracted. Separate process blanks were calculated for the labile (acetic acid/hydroxylamine) and total (HCl/HNO3/HF) digestions.

Following process blank correction, element concentrations (per volume of water filtered) were calculated by dividing the determined picomoles per filter (pmol/filter) by the volume of water passed through each filter (measured volumetrically on the ship following each filtration).

BCO-DMO Processing:
- replaced "999" with "nd" as the missing data / no data value;
- changed longitude values that were positive to negative to indicate the West direction.

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Data Files

File
bait_particles.csv(Comma Separated Values (.csv), 64.10 KB) MD5:c0cb1d8fa3ce262ce4920b8d890557d5 2019 BAIT Particulate Metals data file

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Related Publications

Berger, C. J. M., Lippiatt, S. M., Lawrence, M. G., & Bruland, K. W. (2008). Application of a chemical leach technique for estimating labile particulate aluminum, iron, and manganese in the Columbia River plume and coastal waters off Oregon and Washington. Journal of Geophysical Research, 113. doi:10.1029/2007jc004703 https://doi.org/10.1029/2007JC004703
Methods

Ohnemus, D. C., Auro, M. E., Sherrell, R. M., Lagerström, M., Morton, P. L., Twining, B. S., ... Lam, P. J. (2014). Laboratory intercomparison of marine particulate digestions including Piranha: a novel chemical method for dissolution of polyethersulfone filters. Limnology and Oceanography: Methods, 12(8), 530–547. doi:10.4319/lom.2014.12.530
Methods

Ohnemus, D. C., Rauschenberg, S., Cutter, G. A., Fitzsimmons, J. N., Sherrell, R. M., & Twining, B. S. (2017). Elevated trace metal content of prokaryotic communities associated with marine oxygen deficient zones. Limnology and Oceanography, 62(1), 3–25. Portico. https://doi.org/10.1002/lno.10363
Methods

Tagliabue, A., Buck, K. N., Sofen, L. E., Twining, B. S., Aumont, O., Boyd, P. W., Caprara, S., Homoky, W. B., Johnson, R., König, D., Ohnemus, D. C., Sohst, B., & Sedwick, P. (2023). Authigenic mineral phases as a driver of the upper-ocean iron cycle. Nature, 620(7972), 104–109. https://doi.org/10.1038/s41586-023-06210-5
General

Twining, B. S., Baines, S. B., Bozard, J. B., Vogt, S., Walker, E. A., & Nelson, D. M. (2011). Metal quotas of plankton in the equatorial Pacific Ocean. Deep Sea Research Part II: Topical Studies in Oceanography, 58(3-4), 325–341. doi:10.1016/j.dsr2.2010.08.018
Methods

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Parameters

Parameter	Description	Units
CRUISE	BAIT project cruise number: Cruise 1 = R/V Endeavor EN631 Cruise 2 = R/V Atlantic Explorer AE1909 Cruise 3 = R/V Atlantic Explorer AE1921 Cruise 4 = R/V Atlantic Explorer AE1930	unitless
STATION	Station location (BATS or numbered spatial station)	unitless
UNIQUE_CAST_ID	Cruise and cast number	unitless
SAMPLE_ID	Cruise, cast, and depth ID	unitless
TMP	Rosette cast (1-3 for each cruise)	unitless
DEPTH	Depth (m) of bottle	meters (m)
STATION_TYPE	Station position relative to BATS	unitless
DATE	Date of sample collection	unitless
LATITUDE	Latitude, degrees N	degrees North
LONGITUDE	Longitude, degrees E	degrees East

AL27_TPL_CONC_BOTTLE	Concentration of total particulate labile Al27 (nM)	nanomolar (nM)
AL27_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Al27 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
P31_TPL_CONC_BOTTLE	Concentration of total particulate labile P31 (nM)	nanomolar (nM)
P31_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of P31 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
TI47_TPL_CONC_BOTTLE	Concentration of total particulate labile Ti47 (nM)	nanomolar (nM)
TI47_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Ti47 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
V51_TPL_CONC_BOTTLE	Concentration of total particulate labile V51 (nM)	nanomolar (nM)
V51_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of V51 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
MN55_TPL_CONC_BOTTLE	Concentration of total particulate labile Mn55 (nM)	nanomolar (nM)
MN55_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Mn55 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
FE57_TPL_CONC_BOTTLE	Concentration of total particulate labile Fe57 (nM)	nanomolar (nM)
FE57_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Fe57 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
CO59_TPL_CONC_BOTTLE	Concentration of total particulate labile Co59 (nM)	nanomolar (nM)
CO59_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Co59 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
NI62_TPL_CONC_BOTTLE	Concentration of total particulate labile Ni62 (nM)	nanomolar (nM)
NI62_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Ni62 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
CU63_TPL_CONC_BOTTLE	Concentration of total particulate labile Cu63 (nM)	nanomolar (nM)
CU63_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Cu63 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
ZN68_TPL_CONC_BOTTLE	Concentration of total particulate labile Zn68 (nM)	nanomolar (nM)
ZN68_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Zn68 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
CD111_TPL_CONC_BOTTLE	Concentration of total particulate labile Cd111 (nM)	nanomolar (nM)
CD111_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Cd111 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
BA137_TPL_CONC_BOTTLE	Concentration of total particulate labile Ba137 (nM)	nanomolar (nM)
BA137_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Ba137 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
PB208_TPL_CONC_BOTTLE	Concentration of total particulate labile Pb208 (nM)	nanomolar (nM)

PB208_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Pb208 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
TH232_TPL_CONC_BOTTLE	Concentration of total particulate labile Th232 (nM)	nanomolar (nM)
TH232_TPL_FLAG_BOTTLE	Quality flag for total particulate measurement of Th232 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
AL27_TP_CONC_BOTTLE	Concentration of total particulate Al27 (nM)	nanomolar (nM)
AL27_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Al27 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
P31_TP_CONC_BOTTLE	Concentration of total particulate P31 (nM)	nanomolar (nM)
P31_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of P31 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
TI47_TP_CONC_BOTTLE	Concentration of total particulate Ti47 (nM)	nanomolar (nM)
TI47_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Ti47 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
V51_TP_CONC_BOTTLE	Concentration of total particulate V51 (nM)	nanomolar (nM)
V51_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of V51 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
MN55_TP_CONC_BOTTLE	Concentration of total particulate Mn55 (nM)	nanomolar (nM)
MN55_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Mn55 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
FE57_TP_CONC_BOTTLE	Concentration of total particulate Fe57 (nM)	nanomolar (nM)
FE57_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Fe57 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
CO59_TP_CONC_BOTTLE	Concentration of total particulate Co59 (nM)	nanomolar (nM)
CO59_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Co59 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
NI62_TP_CONC_BOTTLE	Concentration of total particulate Ni62 (nM)	nanomolar (nM)
NI62_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Ni62 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
CU63_TP_CONC_BOTTLE	Concentration of total particulate Cu63 (nM)	nanomolar (nM)
CU63_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Cu63 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
ZN68_TP_CONC_BOTTLE	Concentration of total particulate Zn68 (nM)	nanomolar (nM)
ZN68_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Zn68 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
CD111_TP_CONC_BOTTLE	Concentration of total particulate Cd111 (nM)	nanomolar (nM)
CD111_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Cd111 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless

BA137_TP_CONC_BOTTLE	Concentration of total particulate Ba137 (nM)	nanomolar (nM)
BA137_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Ba137 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
PB208_TP_CONC_BOTTLE	Concentration of total particulate Pb208 (nM)	nanomolar (nM)
PB208_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Pb208 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless
TH232_TP_CONC_BOTTLE	Concentration of total particulate Th232 (nM)	nanomolar (nM)
TH232_TP_FLAG_BOTTLE	Quality flag for total particulate measurement of Th232 (1 = good value, 6 = below detection limit, 6a = below blank, 9 = missing value)	unitless

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Instruments

Dataset-specific Instrument Name	SBE 19 plus
Generic Instrument Name	CTD Sea-Bird SBE SEACAT 19plus
Dataset-specific Description	The seawater samples and associated hydrographic data were collected using a trace-metal clean conductivity-temperature-depth sensor (SBE 19 plus, SeaBird Electronics) mounted on a custom-built trace-metal clean carousel (SeaBird Electronics) fitted with custom-modified 5-L Teflon-lined external-closure Niskin-X samplers (General Oceanics) and deployed on an Amsteel non-metallic line.
Generic Instrument Description	Self contained self powered CTD profiler. Measures conductivity, temperature and pressure in both profiling (samples at 4 scans/sec) and moored (sample rates of once every 5 seconds to once every 9 hours) mode. Available in plastic or titanium housing with depth ranges of 600m and 7000m respectively. Minature submersible pump provides water to conductivity cell.

Dataset-specific Instrument Name	Thermo Element2 HR-ICP-MS
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	All digests were analyzed using a Thermo Element2 HR-ICP-MS at the University of Maine.
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.

Dataset-specific Instrument Name	Niskin-X samplers
Generic Instrument Name	Niskin-1010X
Dataset-specific Description	The seawater samples and associated hydrographic data were collected using a trace-metal clean conductivity-temperature-depth sensor (SBE 19 plus, SeaBird Electronics) mounted on a custom-built trace-metal clean carousel (SeaBird Electronics) fitted with custom-modified 5-L Teflon-lined external-closure Niskin-X samplers (General Oceanics) and deployed on an Amsteel non-metallic line.
Generic Instrument Description	The Model 1010X NISKIN-X External Spring Niskin Water Sampler is a Niskin water sample bottle with the stainless steel closure springs mounted externally. The external closure mechanism is designed to support applications such as trace metal analysis where the inside of the sampler must be totally free of contaminants. The 1010X Niskin bottle, manufactured by General Oceanics Inc., is available in a variety of sizes (sample volume). It can be activated by the GO Devil Messenger (1000-MG) if individually or serially attached to a hydrocable or can be deployed as part of a Rosette multibottle array. The bottles can be teflon-lined and are available as GO-FLO bottles to further avoid sample contamination. (more from General Oceanics)

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Deployments

AE1909

Website	https://www.bco-dmo.org/deployment/869175
Platform	R/V Atlantic Explorer
Report	https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/atlanticexplorer_ae1909.pdf
Start Date	2019-05-11
End Date	2019-05-17
Description	See additional cruise information at the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/AE1909

AE1921

Website	https://www.bco-dmo.org/deployment/869176
Platform	R/V Atlantic Explorer
Report	https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/atlanticexplorer_ae1921.pdf
Start Date	2019-08-16
End Date	2019-08-22
Description	See additional cruise information at the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/AE1921

AE1930

Website	https://www.bco-dmo.org/deployment/869177
Platform	R/V Atlantic Explorer
Report	https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/atlanticexplorer_ae1930.pdf
Start Date	2019-11-15
End Date	2019-11-21
Description	See additional cruise information at the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/AE1930

EN631

Website	https://www.bco-dmo.org/deployment/869159
Platform	R/V Endeavor
Report	https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/endeavor_en631.pdf
Start Date	2019-03-10
End Date	2019-03-15
Description	See additional cruise information at the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/EN631

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Project Information

NSFGEO-NERC: Collaborative Research: Using Time-series Field Observations to Constrain an Ocean Iron Model (BAIT)

Coverage: Bermuda Atlantic Time-Series Study region, waters of the western Subtropical North Atlantic Gyre (ca. 30°N-33°N, 62°W-65°W)

NSF and NERC Award Abstract:
Iron is an essential nutrient for the growth of phytoplankton in the oceans. As such, iron plays key roles in regulating marine primary production and the cycling of carbon. It is thus important that models of ocean biology and chemistry consider iron, in order to explore past, present and future variations in marine productivity and the role of the ocean in the global carbon cycle. In this joint project involving researchers in the U.S. and the U.K., supported by both NSF and the Natural Environment Research Council (U.K.), field data from the Bermuda Atlantic Time-series Study (BATS) region will be combined with an established, state-of-the-art ocean biogeochemical model. By leveraging the known seasonal-scale physical, chemical and biological changes in the BATS region, the oceanographic context provided by the BATS core data, and an existing model of the regional physical circulation, the proposed study will yield process-related information that is of general applicability to the open ocean. In particular, the proposed research will focus on understanding the atmospheric input, biological uptake, regeneration and scavenging removal of dissolved iron in the oceanic water column, which have emerged as major uncertainties in the ocean iron cycle. The project will include significant educational and training contributions at the K-12, undergraduate, graduate and postdoctoral levels, as well as public outreach efforts that aim to explain the research and its importance.

The ability of ocean models to simulate iron remains crude, owing to an insufficient understanding of the mechanisms that drive variability in dissolved iron, particularly the involvement of iron-binding ligands, colloids and particles in the surface input, biological uptake, regeneration and scavenging of dissolved iron in the upper ocean. Basin-scale data produced by the GEOTRACES program provide an important resource for testing and improving models and, by extension, our mechanistic understanding of the ocean iron cycle. However such data provide only quasi-synoptic 'snapshots', which limits their utility in isolating and identifying the processes that control dissolved iron in the upper ocean. The proposed research aims to provide mechanistic insight into these governing processes by combining time-series data from the BATS region with numerical modeling experiments.

Specifically, seasonally resolved data on the vertical (upper 2,000 meters) and lateral (tens of kilometers) distributions of particulate, dissolved, colloidal, soluble and ligand-bound iron species will be obtained from the chemical analysis of water column samples collected during five cruises, spanning a full annual cycle, shared with the monthly BATS program cruises. These data, along with ancillary data from the BATS program, will be used to test and inform numerical modeling experiments, and thus derive an improved understanding of the mechanisms that control the distribution and dynamics of dissolved iron in the oceanic water column.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

This is a project jointly funded by the National Science Foundation’s Directorate for Geosciences (NSF/GEO) and the National Environment Research Council (NERC) of the United Kingdom (UK).

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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-1829819

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