

Concentrations of total dissolved trace metals (Fe, Mn, Zn, Ni, Cd) obtained using seaFAST preconcentration and ICP-MS from the R/V Kilo Moana cruise KM1128 in the Central Pacific Ocean in October 2011

Website: <https://www.bco-dmo.org/dataset/836347>

Data Type: Cruise Results

Version: 1

Version Date: 2021-01-15

Project

» [Connecting Trace Elements and Metalloenzymes Across Marine Biogeochemical Gradients](#) (MetZyme)

Program

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

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Abstract

Concentrations of total dissolved trace metals (Fe, Mn, Zn, Ni, Cd) obtained using seaFAST preconcentration and ICP-MS from the R/V Kilo Moana cruise KM1128.

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Coverage

Spatial Extent: N:17 E:-154.4 S:-15 W:-174.5

Temporal Extent: 2011-10-03 - 2011-10-24

Acquisition Description

Seawater sampling occurred during October 1-25 2011 onboard the R/V Kilo Moana during the METZYME expedition (Saito et al., 2014). Seawater samples for trace metal analyses were collected using a trace metal clean rosette consisting of X-Niskins on a trace metal clean (Amsteel) winch line. Following seawater collection, X-Niskins were brought into a fabricated shipboard class-100 clean room and pressurized with filtered high purity nitrogen gas. Seawater was filtered through 47mm 0.2 µm Supor membranes to

remove the particulate fraction.

METZYME seawater was acidified to pH 1.8 using hydrochloric acid (Optima grade, Fisher Chemical). Seawater preconcentration was performed using an automated solid phase extraction system, seaFAST pico, run in offline concentration mode. Following offline seaFAST preconcentration, the multi-element quantitative analysis was performed using an iCAP Q inductively coupled plasma-mass spectrometer (ICP-MS) (Thermo Scientific). Concentrations of Fe, Mn, Zn Ni and Cd were determined using a six-point external standard curve with a multi-element standard (SPEX CertiPrep), diluted to range from 1-10 ppb in 5% nitric acid. Indium standards (SPEX CertiPrep) were similarly added to these standard stocks, diluted to 1, 2, 3, 4 and 10ppb. Instrument injection blanks consisted of 5% nitric acid in Milli-Q. Standard curve R² values were ≥0.98 for the metals monitored.

Processing Description

Quality flags follow the SeaDataNet schem as per the GEOTRACES recommendations:
<https://www.geotraces.org/geotraces-quality-flag-policy/>

Flag definitions:

- 1 = good quality;
- 2 = probably good;
- 3 = probably bad;
- 4 = bad;
- 6 = below detection;
- 9 = missing data.

BCO-DMO Processing:

- renamed fields;
- added date/time fields in ISO8601 format;
- formatted flag columns as integers;
- replaced values of 0.00 with 'nd' for sample 1226558 because it was not run (quality flag of 9).

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Related Publications

Saito, M. A., McIlvin, M. R., Moran, D. M., Goepfert, T. J., DiTullio, G. R., Post, A. F., & Lamborg, C. H. (2014). Multiple nutrient stresses at intersecting Pacific Ocean biomes detected by protein biomarkers. *Science*, 345(6201), 1173–1177. <https://doi.org/10.1126/science.1256450>
Methods

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Parameters

Parameter	Description	Units
Station_ID	Station identifier	unitless
Start_Date_UTC	Date at start of sample collection; format: MM/DD/YYYY	unitless
Start_Time_UTC	Time (UTC) at start of sample collection; format: hh:mm	unitless

Start_ISO_DateTime.UTC	Date and time (UTC) at start of sample collection formatted to ISO8601 standard: YYYY-MM-DDThh:mmZ	unitless
End_Date.UTC	Date at end of sample collection; format: MM/DD/YYYY	unitless
End_Time.UTC	Time (UTC) at end of sample collection; format: hh:mm	unitless
End_ISO_DateTime.UTC	Date and time (UTC) at end of sample collection formatted to ISO8601 standard: YYYY-MM-DDThh:mmZ	unitless
Start_Latitude	Latitude at start of sampling event	degrees North
Start_Longitude	Longitude at start of sampling event	degrees East
End_Latitude	Latitude at end of sampling event	degrees North
End_Longitude	Longitude at end of sampling event	degrees East
Event_ID	Event number	unitless
Sample_ID	Sample number	unitless
Sample_Depth	Sample depth	meters (m)
Mn_D_CONC_BOTTLE_czyiap	Total dissolved Mn concentration	nanomoles per kilogram (nmol/kg)
SD1_Mn_D_CONC_BOTTLE_czyiap	One standard deviation of Mn_D_CONC_BOTTLE_czyiap	nanomoles per kilogram (nmol/kg)
Flag_Mn_D_CONC_BOTTLE_czyiap	Quality flag for Mn_D_CONC_BOTTLE_czyiap	unitless
Ni_D_CONC_BOTTLE_6xcczg	Total dissolved Ni concentration	nanomoles per kilogram (nmol/kg)
SD1_Ni_D_CONC_BOTTLE_6xcczg	One standard deviation of Ni_D_CONC_BOTTLE_6xcczg	nanomoles per kilogram (nmol/kg)
Flag_Ni_D_CONC_BOTTLE_6xcczg	Quality flag for Ni_D_CONC_BOTTLE_6xcczg	unitless
Zn_D_CONC_BOTTLE_6qkiaq	Total dissolved Zn concentration	nanomoles per kilogram (nmol/kg)
SD1_Zn_D_CONC_BOTTLE_6qkiaq	One standard deviation of Zn_D_CONC_BOTTLE_6qkiaq	nanomoles per kilogram (nmol/kg)
Flag_Zn_D_CONC_BOTTLE_6qkiaq	Quality flag for Zn_D_CONC_BOTTLE_6qkiaq	unitless
Cd_D_CONC_BOTTLE_zlf6jp	Total dissolved Cd concentration	nanomoles per kilogram (nmol/kg)
SD1_Cd_D_CONC_BOTTLE_zlf6jp	One standard deviation of Cd_D_CONC_BOTTLE_zlf6jp	nanomoles per kilogram (nmol/kg)
Flag_Cd_D_CONC_BOTTLE_zlf6jp	Quality flag for Cd_D_CONC_BOTTLE_zlf6jp	unitless

Fe_D_CONC_BOTTLE_hphsej	Total dissolved Fe concentration	nanomoles per kilogram (nmol/kg)
SD1_Fe_D_CONC_BOTTLE_hphsej	One standard deviation of Fe_D_CONC_BOTTLE_hphsej	nanomoles per kilogram (nmol/kg)
Flag_Fe_D_CONC_BOTTLE_hphsej	Quality flag for Fe_D_CONC_BOTTLE_hphsej	unitless

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Instruments

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Dissolved trace metal samples were collected by an internally programmed standard SBE Rosette (Seabird Electronics Inc.) user-modified to serve as a trace metal clean system with 24 8 L X-Niskin bottles (Ocean Test Equipment).
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Thermo iCAP Q ICP-MS
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
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	CTD Sea-Bird SBE SEACAT 19plus
Generic Instrument Name	CTD Sea-Bird SBE SEACAT 19plus
Dataset-specific Description	Temperature, oxygen and conductivity sensor data were collected using a SBE19plusV2 system (Seabird Electronics Inc.) attached to a CTD extension stand on the Trace Metal Rosette
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	seaFAST Pico
Generic Instrument Name	SeaFAST Automated Preconcentration System
Dataset-specific Description	Seawater preconcentration was performed using an automated solid phase extraction system, seaFAST pico, run in offline concentration mode.
Generic Instrument Description	The seaFAST is an automated sample introduction system for analysis of seawater and other high matrix samples for analyses by ICPMS (Inductively Coupled Plasma Mass Spectrometry).

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Deployments

KM1128

Website	https://www.bco-dmo.org/deployment/59053
Platform	R/V Kilo Moana
Start Date	2011-10-01
End Date	2011-10-25
Description	This is a MetZyme project cruise. The original cruise data are available from the NSF R2R data catalog.

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Project Information

Connecting Trace Elements and Metalloenzymes Across Marine Biogeochemical Gradients (MetZyme)

Coverage: Tropical North Pacific along 150 degrees West from 18 degrees North to the equator

MetZyme project researchers will determine the role of enzymatic activity in the cycling of trace metals. Specifically the research will address the following questions: (1) degradation of sinking particulate organic material in the Tropical North Pacific can be influenced by the ability of microbes to synthesize zinc proteases, which in turn is controlled by the abundance or availability of zinc, and (2) methylation of mercury is controlled, in part, by the activity of cobalt-containing enzymes, and therefore the supply of labile cobalt to the corrinoid-containing enzymes or co-factors responsible for methylation. To attain their goal, they will collect dissolved and particulate samples for trace metals and metalloenzymes from three stations along a biogeochemical gradient in the Tropical North Pacific (along 150 degrees West from 18 degrees North to the equator). Sinking particles from metal clean sediment traps will also be obtained. The samples will also be used to carry out shipboard incubation experiments using amendments of metals, metal-chelators, B12, and proteases to examine the sensitivity and metal limitation of heterotrophic, enzymatic degradation of organic matter within the oceanic "Twilight Zone" (100-500 m). This study will result in a novel metaproteomic/metalloenzyme datasets that should provide insights into the biogeochemical cycling of metals, as well as co-limitation of primary productivity and controls on the export of carbon from the photic zone. In addition to the final data being contributed to BCO-DMO, an online metaproteomic data server will be created so the community has access to the raw data files generated by this research.

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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-1031271

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