

Selenium observations from the R/V Kilo Moana in the tropical Pacific Ocean from October 2011

Website: <https://www.bco-dmo.org/dataset/749397>

Data Type: Cruise Results

Version: 1

Version Date: 2018-11-09

Project

» [Collaborative Research: Interwoven biogeochemical cycles and biological transformations of mercury and selenium in the upper ocean](#) (Mercury and Selenium)

Contributors	Affiliation	Role
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Abstract

The data include measurements of total dissolved selenium and particulate selenium with depth for 9 stations occupied in the tropical Pacific Ocean in 2011, and total dissolved selenium in surface waters collected while the ship was underway between stations.

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Coverage

Spatial Extent: N:17.0273 E:-154.4 S:-15.0931 W:-174.378

Temporal Extent: 2011-10-01 - 2011-10-24

Dataset Description

The data include measurements of total dissolved selenium and particulate selenium with depth for 9 stations occupied in the tropical Pacific Ocean in 2011, and total dissolved selenium in surface waters collected while the ship was underway between stations.

Methods & Sampling

Water samples were collected using a trace metal clean rosette from eight stations occupied in the tropical North and South Pacific during the Metzyme cruise from Hawaii to Samoa (1 to 24 October 2011; 20°N to 15°S). Surface water samples were obtained using water collected at 5-10 m depth from the ship's underway sampling system. Particulate samples were collected using McLane in-situ pumps from six stations occupied during the cruise at depths up to 900 m, with ~1000 L filtered per deployment. Water was filtered on board (0.2 µm), acidified to 0.5% HCl (trace metal grade) and transported to the University of Connecticut for

analysis. All samples were stored refrigerated (4C) and under dark conditions prior to analysis. Dissolved Se speciation was determined within six months of collection following established methods (Cutter and Cutter, 2001; Cutter and Bruland, 1984). The method relies on hydride generation of hydrogen selenide using sodium borohydride. Total dissolved Se was determined by boiling samples in 4M HCl for 15 min to convert all forms to Se(IV), followed by hydride generation step using sodium borohydrate. A PS Analytical Millennium Excalibur instrument equipped with a specific high discharge Se lamp that relies on atomic fluorescence was used for detection. The particulate samples were quantified after microwave digestion (800 W microwave; 20 min at 10% power, then 20 min at 20% power to slowly increase temperature). Filters were placed in Teflon bombs with 5 mL of a 10:1 concentrated HNO₃:H₂SO₄ mixture (Zhao et al., 2010). The volume filtered was determined from the total volume filtered by the in situ pump and the fraction of the filter that was analyzed.

Data Processing Description

BCO-DMO Processing Notes:

- Combined two excel spreadsheets into one dataset with all observations organized by station and depth
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- added the station identifier "Underway" and depth "surface" for the underway observations.

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Data Files

File
selenium.csv (Comma Separated Values (.csv), 8.64 KB) MD5:d3a0eb8a4e5f003690a2d5e02bfd85ae Primary data file for dataset ID 749397

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Related Publications

Cutter, G. A., & Bruland, K. W. (1984). The marine biogeochemistry of selenium: A re-evaluation1. *Limnology and Oceanography*, 29(6), 1179–1192. doi:[10.4319/lo.1984.29.6.1179](https://doi.org/10.4319/lo.1984.29.6.1179)
Methods

Cutter, G. A., & Cutter, L. S. (2001). Sources and cycling of selenium in the western and equatorial Atlantic Ocean. *Deep Sea Research Part II: Topical Studies in Oceanography*, 48(13), 2917–2931. doi:10.1016/S0967-0645(01)00024-8 [https://doi.org/10.1016/S0967-0645\(01\)00024-8](https://doi.org/10.1016/S0967-0645(01)00024-8)
Methods

Gosnell, K. J., & Mason, R. P. (2015). Mercury and methylmercury incidence and bioaccumulation in plankton from the central Pacific Ocean. *Marine Chemistry*, 177, 772–780. doi:[10.1016/j.marchem.2015.07.005](https://doi.org/10.1016/j.marchem.2015.07.005)
General

Munson, K. M., Lamborg, C. H., Swarr, G. J., & Saito, M. A. (2015). Mercury species concentrations and fluxes in the Central Tropical Pacific Ocean. *Global Biogeochemical Cycles*, 29(5), 656–676. doi:10.1002/2015gb005120 <https://doi.org/10.1002/2015GB005120>
General

Soerensen, A. L., Mason, R. P., Balcom, P. H., Jacob, D. J., Zhang, Y., Kuss, J., & Sunderland, E. M. (2014). Elemental Mercury Concentrations and Fluxes in the Tropical Atmosphere and Ocean. *Environmental Science & Technology*, 48(19), 11312–11319. doi:[10.1021/es503109p](https://doi.org/10.1021/es503109p)
General

Zhao, Q.-X., Chen, Y.-W., Belzile, N., & Wang, M. (2010). Low volume microwave digestion and direct

determination of selenium in biological samples by hydride generation-atomic fluorescence spectrometry. Analytica Chimica Acta, 665(2), 123–128. doi:[10.1016/j.aca.2010.03.040](https://doi.org/10.1016/j.aca.2010.03.040)
Methods

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Parameters

Parameter	Description	Units
Station	identifier for the station	unitless
Latitude	latitude in degrees North	decimal degrees
Longitude	longitude in degrees East	decimal degrees
Depth	depth of observation	meters (m)
TDSe	total dissolved selenium	nano Mole (nM)
TDSe_Stdev	standard deviation of total dissolved selenium	nano Mole (nM)
Part_Se	Particulate selenium	pico Mole (pM)
Date	Date of observation in MM/DD/YY format	unitless
Arrival_Time	Time of observation in H:M AM/PM format	unitless

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Instruments

Dataset-specific Instrument Name	PS Analytical Millennium Excalibur
Generic Instrument Name	Spectrometer
Dataset-specific Description	PS Analytical Millennium Excalibur instrument equipped with a specific high discharge Se lamp that relies on atomic fluorescence for detection.
Generic Instrument Description	A spectrometer is an optical instrument used to measure properties of light over a specific portion of the electromagnetic spectrum.

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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

Collaborative Research: Interwoven biogeochemical cycles and biological transformations of mercury and selenium in the upper ocean (Mercury and Selenium)

Coverage: Tropical North and South Pacific and equatorial region; cruise track from Hawaii to Tahiti

NSF Award Abstract:

Researchers from the University of Connecticut, Woods Hole Oceanographic Institution, and Harvard University plan to address three questions related to the global biogeochemical mercury (Hg) and selenium (Se) cycles, namely (1) what are the abiotic and biotic mechanisms for formation of methylated Hg and Se compounds in the upper ocean?; (2) what is the role of photochemical reactions in air-sea exchange of Hg and Se?; and (3) how are the biogeochemical cycles of Hg and Se related? To attain their goal, the scientists will participate in a cruise of opportunity to the Tropical North Pacific, as well as carry out laboratory culture and controlled incubation experiments. Samples collected during the cruise will be used to determine the speciation of Hg and Se, as well as obtain measurements of photochemical status (i.e., UV, ozone, light levels, chemical (i.e., natural organic matter, redox metals), and biological (i.e., chlorophyll a, phytoplankton composition, proteomics, estimates of carbon mineralization) properties. The laboratory culture and controlled incubation experiments will be used to determine the specific pathways for Hg and Se compound formation and degradation, especially the role of photochemical transformations, as well as assess the importance of Se as a binding ligand for Hg in the marine environment. Lastly, the researchers will continue to develop the oceanic sub-model of the GEOS-Chem global biochemical Hg model to include the cycling of Se and will use the model to ascertain the importance of various processes of conversion and evasion in the global cycles of these two elements.

As regards broader impacts, this study has societal benefits because it would improve our understanding on how mercury enters seafood which impacts human health. Results from the research would be included in curriculum material. One graduate student from the University of Connecticut, one postdoc from Harvard University, and one graduate student from Woods Hole Oceanographic Institution would be supported and trained as part of the project.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1130711

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