Seawater lead (Pb) concentrations and isotopic compositions in the Western Philippine Sea (WPS) in March 2014

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Project
» Atmospheric Deposition Impacts on Marine Ecosystems (ADIMA)

Contributors	Affiliation	Role
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Abstract
This dataset reports seawater lead (Pb) concentrations and isotopic compositions in the Western Philippine Sea (WPS) from samples collected on R/V Ocean Researcher V, cruise OR5-0035, in March 2014.

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Coverage

Spatial Extent: **N**:23.5 **E**:128 **S**:23.5 **W**:121.74
Temporal Extent: 2014-03 - 2014-03

Acquisition Description

Seawater samples were collected using Teflon-lined GO-FLO bottles (General Oceanics) on a trace metal clean sampling rosette. The GO-FLO bottles were moved into a trace metal clean van after seawater collection and each sample was filtered through an acid cleaned 0.2 µm capsule filter (PolycapTC, Whatman) into an acid washed, sample rinsed, 1 L low density polyethylene (LDPE) bottle and acidified with 4 mL of 6 M ultrapure HCl (final concentration 0.024 M).

After collection, samples were shipped to University of California at Santa Cruz (UCSC) and stored at room temperature until they were analyzed. Typically 500 to 1000 g of each seawater sample was extracted by Nobias Chelate-PA1 resin (HITACH, Japan) for seawater matrix removal and Pb pre-concentration (Biller and Bruland, 2012; Sohrin et al., 2008). The Pb in the seawater was then recovered by eluting the column with 3 mL 1 M HNO3 and measured using a Thermo Element XR high-resolution inductively coupled plasma mass spectrometer (HR-ICP-MS) at UCSC for concentration determination. To estimate recovery

yield, Pb free seawater (pretreated with the Nobias Chelate-PA1 resin) was spiked with varying amounts of a Pb standard and processed with every sample batch. The Pb concentrations of these standard spiked seawater samples were compared to standards of similar concentration prepared in 2% HNO3. The Pb blank for the full procedure was 0.33±0.16 pmol kg−1. Method accuracy and precision were assessed relative to GEOTRACES SAFe, S, and D1 reference seawater samples. After Pb concentration measurements were made, samples were dried on a hot plate in preparation for Pb isotope ratio determination. All work was performed in a class 1000 clean lab inside class 100 laminar flow hoods.

Lead isotope ratios in seawater samples were measured using a Thermo Neptune Plus multi-collector ICP-MS the University of California, Davis. Detailed information about measurement conditions and instrument settings are described by (Erhardt, 2013). Samples were dried down and then brought up in 2% HNO3 to a concentration of at least 3 ppb, NBS SRM 997 Tl solution was added to obtain a Tl/Pb ratio of 0.2 to correct for the mass fractionation using an exponential law correction. The diluted samples were self-aspirated using a 50 µL min−1 PFA nebulizer. An ESI APEX-IR desolvating system was used to increase sensitivity with the Neptune Plus configured with a jet sample cone and X-style skimmer cone. Samples (in sets of 5) were bracketed with a 5 ppb solution of the NBS SRM981 Pb standard. The bracketing standard was used to correct for instrumental mass bias and the mass bias correction was applied to the measured samples. A 2% HNO3 blank was analyzed after each sample with the analyzed blank subtracted from each sample to ensure no sample crossover contamination.

Processing Description

BCO-DMO Processing:
- created columns for Station, Latitude, and Longitude;
- renamed fields to comply with BCO-DMO naming conventions;
- removed asterisks from the Depth column and added Comment column instead to indicate values that are from duplicate samples.

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Related Publications

Biller, D. V., & Bruland, K. W. (2012). Analysis of Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb in seawater using the Nobias-chelate PA1 resin and magnetic sector inductively coupled plasma mass spectrometry (ICP-MS). Marine Chemistry, 130-131, 12–20. doi:10.1016/j.marchem.2011.12.001
Methods

Chien, C.-T., Ho, T.-Y., Sanborn, M. E., Yin, Q.-Z., & Paytan, A. (2017). Lead concentrations and isotopic compositions in the Western Philippine Sea. Marine Chemistry, 189, 10–16. doi:10.1016/j.marchem.2016.12.007
Results

Erhardt, A. M., Pälike, H., & Paytan, A. (2013). High-resolution record of export production in the eastern equatorial Pacific across the Eocene-Oligocene transition and relationships to global climatic records. Paleoceanography, 28(1), 130–142. doi:10.1029/2012pa002347 https://doi.org/10.1029/2012PA002347
Methods

Sohrin, Y., Urushihara, S., Nakatsuka, S., Kono, T., Higo, E., Minami, T., … Umetani, S. (2008). Multielemental Determination of GEOTRACES Key Trace Metals in Seawater by ICPMS after Preconcentration Using an Ethylenediaminetriacetic Acid Chelating Resin. Analytical Chemistry, 80(16), 6267–6273. doi:10.1021/ac800500f
Methods

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Parameters

Parameter	Description	Units
Station	Station number	unitless
Latitude	Latitude	decimal degrees North
Longitude	Longitude	decimal degrees East
Depth	Depth of water sample	meters (m)
Pb_Concentration	Seawater Lead (Pb) concentration	picomoles per kilogram (pmol kg-1)
Pb206_Pb207	206Pb to 207Pb ratio	unitless
Pb206_Pb207_2SD	Standard deviation of 206Pb to 207Pb ratios times 2; see Comment field description	unitless
Pb208_Pb207	208Pb to 207Pb ratio	unitless
Pb208_Pb207_2SD	Standard deviation of 208Pb to 207Pb ratios times 2; see Comment field descripton	unitless
Pb206_Pb204	206Pb to 204Pb ratio	unitless
Pb206_Pb204_2SD	Standard deviation of 206Pb to 204Pb ratios times 2; see Comment field description	unitless
Comment	This column denotes values that are mean and standard error of isotope results from duplicate samples (occurring at STN6 only); because these are from duplicate samples, the values in the 2SD columns are 2SE (standard error)	unitless

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Instruments

Dataset-specific Instrument Name	Teflon-lined GO-FLO bottles (General Oceanics)
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.

Dataset-specific Instrument Name	Thermo Element XR high-resolution inductively coupled plasma mass spectrometer (HR-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	Thermo Neptune Plus multi-collector ICP-MS (MC-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.

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Deployments

OR5-0035

Website	https://www.bco-dmo.org/deployment/856296
Platform	R/V Ocean Researcher V

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Project Information

Atmospheric Deposition Impacts on Marine Ecosystems (ADIMA)

Website: http://pmc.ucsc.edu/~apaytan/page_projects.html

Coverage: Gulf of Aqaba, Atlantic Ocean (Bermuda Time Series Station), Monterey Bay

Chemical components delivered to the surface ocean through atmospheric deposition influence ocean productivity and ecosystem structure thus are tightly related to the global carbon cycle and climate. Accordingly, the major aim of this project is to quantitatively estimate the variable impact of aerosols on marine phytoplankton and to determine the specific effects on various taxa. Such data could in the future be used to better understand the global impact of aerosols on the oceanic ecosystem. To accomplish this goal the PI will monitor aerosol dry deposition fluxes, determine aerosol sources, obtain the chemical composition and solubility of aerosols, and evaluate the contribution of aerosols to nutrient and trace metal budgets of seawater at two oceanographically different sites (Bermuda and Monterey Bay) representing open ocean and coastal setting. The effects of the different aerosol "types" (defined by source

and chemical characteristics) on specific phytoplankton taxa will also be evaluated using pure culture and natural samples bioassays. This project is particularly important in light of the role atmospheric deposition can resume in oligotrophic and coastal settings and the predicted future global conditions of increased aridity and urbanization and associated changes in dust fluxes and composition.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0850467

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