Lead (Pb) isotopic ratios in lake water, river water, groundwater, and TSP samples collected in and around Lake Tahoe from 2006 to 2016

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Data Type: Cruise Results, Other Field Results
Version: 1
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Project
» Atmospheric Deposition Impacts on Marine Ecosystems (ADIMA)

Contributors	Affiliation	Role
Paytan, Adina	University of California-Santa Cruz (UC Santa Cruz)	Principal Investigator
Chien, Chia-Te	University of California-Santa Cruz (UC Santa Cruz)	Student
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset reports Lead (Pb) isotopic ratios in lake water, river water, groundwater, and TSP samples collected in and around Lake Tahoe from 2006 to 2016. Total suspended particle (TSP) samples were collected weekly using a Graseby Andersen TSP High Volume Sampler located near the lake at the UC Davis Field Station. Water depth profiles were collected seven times at different seasons between the Spring of 2013 and Summer 2016 using Van Dorn bottles.). Groundwater samples were obtained from two wells at the Lake Tahoe fire station and three wells at the Hatchery. River water samples were collected from Third Creek, Trout Creek, Upper Truckee River, Ward Creek, Incline Creek, Blackwood Creek and General Creek.

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Coverage

Spatial Extent: **Lat**:39.09231 **Lon**:-120.00275
Temporal Extent: 2006-01-03 - 2016-07-22

Acquisition Description

Total suspended particle (TSP) samples were collected between 2005 and 2010. Weekly integrated samples were collected on acid washed quartz fiber filters (10"x8", Whatman®) using a Graseby Andersen TSP High Volume Sampler. Between November 2005 and May 2007, the sampler was located near the lake at the UC Davis Field Station (Hatchery) away from any local source of disturbance. After May 2007, the

sampler was relocated about 300m south to reduce local impacts due to remodeling at the Hatchery. The TSP sampler was placed 3.2m above the ground and protected by trees from direct road dust inputs. TSP samples were collected at an airflow rate of 85m3 h−1. All filters were kept frozen until further analyses.

Water depth profile samples from Lake Tahoe were collected seven times at different seasons between the Spring of 2013 and Summer 2016. Van Dorn bottles (Wildco Beta Plus acrylic 2.2 L, with no metal parts that touch the sample) were used for water collection at depths of 50, 100, 150, 200, 250, 300, 350, 400, and 450m and a one-liter HDPE bottle attached to a 2.5m long plastic rod was used to collect surface water samples. Samples were collected at the Mid-lake Tahoe Profile (MLTP) station (39.09231° N; 120.00275° W). From each depth, one liter of water was dispensed into an acid-washed sample rinsed LDPE bottle for trace metals and Pb isotope analyses as described in Chien et al. (2017). Groundwater samples were obtained from two wells at the Lake Tahoe fire station and three wells at the Hatchery, and river water samples were collected from Third Creek, Trout Creek, Upper Truckee River, Ward Creek, Incline Creek, Blackwood Creek and General Creek. All water samples were filtered with acid washed 0.45 µm filters (SupaPore) before nutrient, trace metal and Pb isotope analyses. Samples for trace metal and Pb isotopes analyses were acidified to pH < 2 with concentrated double distilled nitric acid. MilliQ water blanks were also collected and analyzed similarly.

In order to separate Pb from the different sample matrices, 500 mL from each water sample and the digested TSP samples were dried down and re-dissolved in 100 µL of concentrated HBr (Optima grade, Fisher Scientific) three times. Pb was separated using AG1-X8 resin. Briefly, the matrix of the samples was eluted with 1 N HBr and the Pb fraction was eluted by 6 N double distilled HNO3, this eluent was then dried down and brought up with 2% HNO3 to ~2 ppb for analyses. Pb separation and trace metal pretreatments were done in the clean room in the Keck lab of UCSC. To determine Pb isotopic composition, analyses were carried out on a Thermo Element XR HR-ICP-MS in the Marine Analytical Laboratory at UC Santa Cruz following the method developed by (Zurbrick et al., 2013). 204Pb, 206Pb, 207Pb and 208Pb were analyzed and 200Hg and 202Hg were also monitored for isobaric interference correction on 204Pb. Pb isotopes in the samples were corrected by bracketing to NIST SRM-981 values; NIST SRM-981 was analyzed between every five samples. Typically, a 2 ppb Pb solution resulted in a signal of about 4x10^6 counts per second on 208Pb, external precision (2σ) for 206Pb/204Pb, 206Pb/207Pb and 208Pb/207Pb are 5.7‰, 3.7‰ and 2.2‰, respectively (based on 33 NIST SRM-981 analyses).

Processing Description

BCO-DMO Processing:
- changed date format to YYYY-MM-DD;
- renamed fields to comply with BCO-DMO naming conventions.

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Related Publications

Buck, C. S., Landing, W. M., Resing, J. A., & Lebon, G. T. (2006). Aerosol iron and aluminum solubility in the northwest Pacific Ocean: Results from the 2002 IOC cruise. Geochemistry, Geophysics, Geosystems, 7(4), n/a–n/a. doi:10.1029/2005gc000977 https://doi.org/10.1029/2005GC000977
General

Chien, C.-T., Allen, B., Dimova, N. T., Yang, J., Reuter, J., Schladow, G., & Paytan, A. (2019). Evaluation of atmospheric dry deposition as a source of nutrients and trace metals to Lake Tahoe. Chemical Geology, 511, 178–189. doi:10.1016/j.chemgeo.2019.02.005
Results

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
Methods

Zurbrick, C. M., Gallon, C., & Flegal, A. R. (2013). A new method for stable lead isotope extraction from seawater. Analytica Chimica Acta, 800, 29–35. doi:10.1016/j.aca.2013.09.002
Methods

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Parameters

Parameter	Description	Units
Type	sample type (TSP = Total Suspended Particle)	unitless
Date	date of collection; for TSP the date is the beginning date of collection; format: YYYY-MM-DD	unitless
Location	location	unitless
Depth	water depth	meters (m)
Pb206_Pb204	206Pb to 204Pb ratio	unitless
Pb206_Pb204_stdev	One standard deviation of 206Pb to 204Pb ratios	unitless
Pb206_Pb207	206Pb to 207Pb ratio	unitless
Pb206_Pb207_stdev	One standard deviation of 206Pb to 207Pb ratios	unitless
Pb208_Pb207	208Pb to 207Pb ratio	unitless
Pb208_Pb207_stdev	One standard deviation of 208Pb to 207Pb ratios	unitless

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Instruments

Dataset-specific Instrument Name	Thermo Element XR HR-ICP-MS
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	Thermo Element XR high-resolution inductively coupled plasma mass spectrometer (HR-ICP-MS)
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	Graseby Andersen TSP High Volume Sampler
Generic Instrument Name	Aerosol Sampler
Generic Instrument Description	A device that collects a sample of aerosol (dry particles or liquid droplets) from the atmosphere.

Dataset-specific Instrument Name	Van Dorn bottles
Generic Instrument Name	Van Dorn water sampler
Generic Instrument Description	A free-flushing water sample bottle comprising a cylinder (polycarbonate, acrylic or PVC) with a stopper at each end. The bottle is closed by means of a messenger from the surface releasing the tension on a latex band and thus pulling the two stoppers firmly into place. A thermometer can be mounted inside the bottle. One or more bottles can be lowered on a line to allow sampling at a single or multiple depth levels. Van Dorn samplers are suitable for for physical (temperature), chemical and biological sampling in shallow to very deep water. Bottles are typically lowered vertically through the water column although a horizontal version is available for sampling near the seabed or at thermoclines or chemoclines. Because of the lack of metal parts the bottles are suitable for trace metal sampling, although the blue polyurethane seal used in the Alpha version may leach mercury. The Beta version uses white ASA plastic seals that do not leach mercury but are less durable.

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Deployments

Lake_Tahoe_Paytan

Website	https://www.bco-dmo.org/deployment/856096
Platform	R/V John Le Conte
Description	Cruise identifiers: 442, 450, 453, 468, 471, 474, 481.

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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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