Amino acid compound specific isotope values for particles from R/V Kilo Moana KM1407 and KM1418 in the Central North Pacific, Station ALOHA, Tropical Pacific, Feb and Sept. 2014

Website: https://www.bco-dmo.org/dataset/751313
Data Type: Cruise Results
Version: 1
Version Date: 2018-12-05

Project

» Collaborative Research: Isotopic insights to mercury in marine food webs and how it varies with ocean biogeochemistry (Hg_Biogeochemistry)

Contributors	Affiliation	Role
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Abstract

This dataset contains amino acid compound specific nitrogen isotope ratios in particles collected during R/V Kilo Moana cruises around Station ALOHA (KM1407 and KM1418). For more information about the ALOHA observatory see: http://aco-ssds.soest.hawaii.edu/. These data were published in Gloeckler et al (2018), Supporting Information file lno10762-sup-0002-suppinfo2.xlsx

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Coverage

Spatial Extent: **Lat**:22.75 **Lon**:-158
Temporal Extent: 2014-02-19 - 2014-09-11

Dataset Description

This dataset contains amino acid compound specific nitrogen isotope ratios in particles collected during R/V Kilo Moana cruises around Station ALOHA (KM1407 and KM1418).

For more information about the ALOHA observatory see: http://aco-ssds.soest.hawaii.edu/

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Methods & Sampling

Amino acid-specific stable N isotope composition was determined on samples that were hydrolyzed, derivatized, and analyzed according to Popp et al. (2007) and Hannides et al. (2009). Briefly, size-fractioned zooplankton material and target zooplankton taxa were hydrolyzed using trace metal-grade 6 M HCl and the resulting AAs purified using cation exchange chromatography. The samples were then esterified using 4:1 isopropanol:acetyl chloride and derivatized using 3:1 methylene chloride:trifluoroacetyl anhydride. The resulting trifluoroacetyl and isopropyl ester (TFA) derivatives were purified using chloroform extraction and stored at -20°C for up to 1 month before analysis. This method yielded information for the following AAs: alanine (Ala), glycine (Gly), isoleucine (Ile), leucine (Leu), lysine (Lys), methionine (Met), phenylalanine (Phe), proline (Pro), serine (Ser), threonine (Thr), tyrosine (Tyr), and valine (Val). During acid hydrolysis asparagine (Asn) is converted to aspartic acid (Asp) and glutamine (Gln) is converted to glutamic acid (Glu), thus we also report information on the combined pools, termed Asx (Asn+Asp) and Glx (Gln+Glu), respectively.

TFA derivatives of AAs were analyzed for stable N isotope composition (d15NAA values) following Hannides et al. (2013). AAs were analyzed using a Thermo Scientific Delta V Plus IRMS interfaced to a trace gas chromatograph (GC) fitted with a 60 m BPx5 capillary column through a GC-C III combustion furnace (980°C), reduction furnace (680°C) and liquid nitrogen cold trap. d15NAA values were measured on 3 – 5 replicate injections with norleucine and aminoadipic acid with known d15N values as internal reference materials co-injected on each run.

A composite source d15NAA value was calculated by a weighted averaging a suite of AAs (e.g., d15NSrc-AA = average of Gly, Lys, Phe, and Ser d15N values). Weighting was based the analytical uncertainty calculated from at least triplicate analysis of each sample.

Data Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- added comment column

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Data Files

File
particle_amino_acids.csv (Comma Separated Values (.csv), 696 bytes)   MD5:935de45939c79dd5dd1eb959c54838f5
Primary data file for dataset ID 751313

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Related Publications

Choy, C. A., Popp, B. N., Hannides, C. C. S., & Drazen, J. C. (2015). Trophic structure and food resources of epipelagic and mesopelagic fishes in the North Pacific Subtropical Gyre ecosystem inferred from nitrogen isotopic compositions. Limnology and Oceanography, 60(4), 1156–1171. doi:10.1002/lno.10085
Methods

Gloeckler, K., Choy, C. A., Hannides, C. C. S., Close, H. G., Goetze, E., Popp, B. N., & Drazen, J. C. (2017).

Stable isotope analysis of micronekton around Hawaii reveals suspended particles are an important nutritional source in the lower mesopelagic and upper bathypelagic zones. Limnology and Oceanography, 63(3), 1168–1180. doi:10.1002/lno.10762
Results

Hannides, C. C. S., Popp, B. N., Choy, C. A., & Drazen, J. C. (2013). Midwater zooplankton and suspended particle dynamics in the North Pacific Subtropical Gyre: A stable isotope perspective. Limnology and Oceanography, 58(6), 1931–1946. doi:10.4319/lo.2013.58.6.1931
Methods

Popp, B. N., Graham, B. S., Olson, R. J., Hannides, C. C. S., Lott, M. J., López-Ibarra, G. A., … Fry, B. (2007). Insight into the Trophic Ecology of Yellowfin Tuna, Thunnus albacares, from Compound-Specific Nitrogen Isotope Analysis of Proteinaceous Amino Acids. Terrestrial Ecology, 173–190. doi:10.1016/s1936-7961(07)01012-3
Methods

Parameters

Parameter	Description	Units
Particle_size	particle size	microns
Sample	sample identifier	unitless
Depth	sample depth	meters
delta15N	ratio of tissue 15N:14N isotopes	permil
delta15N_stdev	standard deviation of ratio of tissue 15N:14N isotopes	permil
comment	comments	unitless

Instruments

Dataset-specific Instrument Name	Thermo Scientific Delta V Plus IRMS
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Used to analyze amino acids.
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

Dataset-specific Instrument Name	
Generic Instrument Name	Ion Chromatograph
Dataset-specific Description	Amino acids were purified using cation exchange chromatography.
Generic Instrument Description	Ion chromatography is a form of liquid chromatography that measures concentrations of ionic species by separating them based on their interaction with a resin. Ionic species separate differently depending on species type and size. Ion chromatographs are able to measure concentrations of major anions, such as fluoride, chloride, nitrate, nitrite, and sulfate, as well as major cations such as lithium, sodium, ammonium, potassium, calcium, and magnesium in the parts-per-billion (ppb) range. (from http://serc.carleton.edu/microbelife/research_methods/biogeochemical/ic....)

Dataset-specific Instrument Name	
Generic Instrument Name	McLane Large Volume Pumping System WTS-LV
Dataset-specific Description	Particles were collected using in situ filtration.
Generic Instrument Description	The WTS-LV is a Water Transfer System (WTS) Large Volume (LV) pumping instrument designed and manufactured by McLane Research Labs (Falmouth, MA, USA). It is a large-volume, single-event sampler that collects suspended and dissolved particulate samples in situ. Ambient water is drawn through a modular filter holder onto a 142-millimeter (mm) membrane without passing through the pump. The standard two-tier filter holder provides prefiltering and size fractioning. Collection targets include chlorophyll maximum, particulate trace metals, and phytoplankton. It features different flow rates and filter porosity to support a range of specimen collection. Sampling can be programmed to start at a scheduled time or begin with a countdown delay. It also features a dynamic pump speed algorithm that adjusts flow to protect the sample as material accumulates on the filter. Several pump options range from 0.5 to 30 liters per minute, with a max volume of 2,500 to 36,000 liters depending on the pump and battery pack used. The standard model is depth rated to 5,500 meters, with a deeper 7,000-meter option available. The operating temperature is -4 to 35 degrees Celsius. The WTS-LV is available in four different configurations: Standard, Upright, Bore Hole, and Dual Filter Sampler. The high-capacity upright WTS-LV model provides three times the battery life of the standard model. The Bore-Hole WTS-LV is designed to fit through a narrow opening such as a 30-centimeter borehole. The dual filter WTS-LV features two vertical intake 142 mm filter holders to allow simultaneous filtering using two different porosities.

Deployments

KM1407

Website	https://www.bco-dmo.org/deployment/635932
Platform	R/V Kilo Moana
Start Date	2014-02-19
End Date	2014-02-28
Description	Original cruise data are available from the NSF R2R data catalog

KM1418

Website	https://www.bco-dmo.org/deployment/636002
Platform	R/V Kilo Moana
Start Date	2014-08-29
End Date	2014-09-11
Description	Original cruise data are available from the NSF R2R data catalog

Project Information

Collaborative Research: Isotopic insights to mercury in marine food webs and how it varies with ocean biogeochemistry (Hg_Biogeochemistry)

Coverage: Pacific Subtropical Gyre, Station ALOHA 22.75N 158W; equatorial Pacific (10N 155W, 5N 155W)

NSF award abstract:
Mercury is a pervasive trace element that exists in several states in the marine environment, including monomethylmercury (MMHg), a neurotoxin that bioaccumulates in marine organisms and poses a human health threat. Understanding the fate of mercury in the ocean and resulting impacts on ocean food webs requires understanding the mechanisms controlling the depths at which mercury chemical transformations occur. Preliminary mercury analyses on nine species of marine fish from the North Pacific Ocean indicated that intermediate waters are an important entry point for MMHg into open ocean food webs. To elucidate the process controlling this, researchers will examine mercury dynamics in regions with differing vertical dissolved oxygen profiles, which should influence depths of mercury transformation. Results of the study will aid in a better understanding of the pathways by which mercury enters the marine food chain and can ultimately impact humans. This project will provide training for graduate and undergraduate students, and spread awareness on oceanic mercury through public outreach and informal science programs.

Mercury isotopic variations can provide insight into a wide variety of environmental processes. Isotopic compositions of mercury display mass-dependent fractionation (MDF) during most biotic and abiotic chemical reactions and mass-independent fractionation (MIF) during photochemical radical pair reactions. The unusual combination of MDF and MIF can provide information on reaction pathways and the biogeochemical history of mercury. Results from preliminary research provide strong evidence that net MMHg formation occurred below the surface mixed layer in the pycnocline and suggested that MMHg in low oxygen intermediate waters is an important entry point for mercury into open ocean food webs. These findings highlight the critical need to understand how MMHg levels in marine biota will respond to changes in atmospheric mercury emissions, deposition of inorganic mercury to the surface ocean, and hypothesized future expansion of oxygen minimum zones. Using field collections across ecosystems with contrasting biogeochemistry and mercury isotope fractionation experiments researchers will fill key knowledge gaps in mercury biogeochemistry. Results of the proposed research will enable scientists to assess the biogeochemical controls on where in the water column mercury methylation and demethylation likely occur.

Related background publication with supplemental data section:
Joel D. Blum, Brian N. Popp, Jeffrey C. Drazen, C. Anela Choy & Marcus W. Johnson. 2013. Methylmercury production below the mixed layer in the North Pacific Ocean. Nature Geoscience 6, 879–884.

Funding

Funding Source	Award
[NSF Division of Ocean Sciences (NSF OCE)](#)	[OCE-1433846](#)