MeHg concentrations and stable isotope ratios for individual samples from mercury reduction experiments conducted on marine phytoplankton from 2012-2013

Website: https://www.bco-dmo.org/dataset/826724
Data Type: experimental
Version: 1
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Project
» Collaborative Research: Transformations and mercury isotopic fractionation of methylmercury by marine phytoplankton (Phytoplankton MeHg)

Contributors	Affiliation	Role
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Abstract
MeHg concentrations and stable isotope ratios for individual samples from mercury reduction experiments conducted on marine phytoplankton from 2012-2013.

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Coverage

Temporal Extent: 2012-12-12 - 2013-08-27

Methods & Sampling

For detailed methods, see Kritee, et al. (2017).

Rates and Hg stable isotope signatures of photomicrobial transformations of Hg(II) and MeHg in marine phytoplankton exposed to visible light and varying levels of UV radiation were examined in experiments with (1) sterile-filtered spent growth media containing extracellular exudates from cultures of *Isochrysis galbana*, a eukaryotic marine microalga of the globally important Prymnesiophyceae class; (2) actively growing monospecific cultures of *I. galbana*; and (3) cysteine or ocean water washed (nongrowing) *I. galbana* cells.

These data were published in Supplementary Table 4 of Kritee, et al. (2017).

Data Processing Description

BCO-DMO Processing:
- renamed fields;
- removed commas from treatment column.

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Data Files

File	
ISOMeHg_samples.csv	(Comma Separated Values (.csv), 3.51 KB) MD5:72cd20d641d62e3459f29f8b313a248d
Primary data file for dataset ID 826724	

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Related Publications

Kritee, K., Motta, L. C., Blum, J. D., Tsui, M. T.-K., & Reinfelder, J. R. (2017). Photomicrobial Visible Light-Induced Magnetic Mass Independent Fractionation of Mercury in a Marine Microalga. ACS Earth and Space Chemistry, 2(5), 432–440. doi:10.1021/acsearthspacechem.7b00056
Results

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Parameters

Parameter	Description	Units
Treatment	Experimental conditions	unitless
Time	Experimental sampling time	hours
Hg_conc	Hg(II) concentration at sample time	micrograms per liter (ppb)
Frac_remain	Fraction of Hg(II) remaining in solution	percent (%)
delta_202	d202Hg value	per mil (‰)
delta_204	d204Hg value	per mil (‰)
delta_201	d201Hg value	per mil (‰)
delta_200	d200Hg value	per mil (‰)
delta_199	d199Hg value	per mil (‰)
D_199	D199Hg value	per mil (‰)
D_201	D201Hg value	per mil (‰)
D_204	D204Hg value	per mil (‰)
D_200	D200Hg value	per mil (‰)

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Project Information

Collaborative Research: Transformations and mercury isotopic fractionation of methylmercury by marine phytoplankton (Phytoplankton MeHg)

Coverage: Antarctic Peninsula

NSF Award Abstract:
The accumulation of mercury (Hg) in seafood is a public health concern. The presence of Hg in seafood depends to a large degree on the air-sea exchange of Hg, with atmospheric deposition leading to accumulation of Hg in the ocean. The pathways to seafood start with the uptake of Hg by phytoplankton from seawater where is has always been assumed to accumulate to be eaten by grazers and passed on to larger organisms. This project challenges this assumption with preliminary data that suggests certain phytoplankton species can transform Hg to volatile forms (mercury vapor & dimethylmercury) that are lost to the atmosphere, a

processes that removes Hg from the ocean rather than simply concentrating it into the ecosystem and seafood. This process, which has not been studied before, could dramatically alter our view of the Hg cycle in the ocean. The researchers funded by this project will look for the specific phytoplankton species that are capable of volatilizing Hg and quantify the rates at which they do so. They will also examine the suspected role of associated sulfur and selenium compounds in the process, as well as quantifying the changes in the Hg isotopic values for potential use as chemical tracers of the source of Hg in the ecosystem and food supply. These results should allow oceanographers to better quantify and refine our knowledge of Hg cycling in the ocean. The project will support participation of graduate students, a postdoctoral scientist, and incorporation of new information directly into courses taught by the researchers. Funding will also support continuing activities by the participants in activities that disseminate information on mercury and its effect on public and environmental health.

Biogeochemical cycling of mercury (Hg) in the ocean may be more complex than previously assumed. New evidence has challenged the idea that methylmercury (MeHg) merely accumulates in phytoplankton and undergoes little to no transformation before being passed into the food web. This project aims to more fully elucidate the mechanisms behind the intracellular transformation of MeHg to volatile Hg and dimethylmercury (Me2Hg) that can be lost to the atmosphere, as well as to evaluate the range of algal taxa that can perform this transformation using directed culture work. Additionally, the PIs will investigate evidence that thiols, organic selenium (Se) compounds, and sulfides are required to facilitate these reactions within the phytoplankton, and specific pathways will be investigated and quantified through this research. Stable Hg isotopic data has been used to track Hg sources and pathways in marine systems and its fractionation during these MeHg transformations will also be quantified for future field study of marine Hg. The investigators hypothesize that coccolithophorids and other haptophytes capable of these intracellular reactions may account for a significant portion of the production of volatile Hg in the ocean. If this turns out to be the case, understanding and quantifying these volatilization processes may significantly alter our current understanding of the overall biogeochemical cycling of Hg in the ocean.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1634154

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