Halomethane concentrations in San Pedro Ocean Time series (SPOT) from March to December 2017

Website: https://www.bco-dmo.org/dataset/772335
Data Type: Other Field Results
Version: 1
Version Date: 2019-07-02

Project
» The role of organic and metal cofactors on the biogenic synthesis of halogenated volatile hydrocarbons (Volatile_Hydrocarbons)

Contributors	Affiliation	Role
Sanudo-Wilhelmy, Sergio A.	University of Southern California (USC)	Principal Investigator
Cutter, Lynda	University of Southern California (USC)	Contact
Biddle, Mathew	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset contains halomethane concentrations at the San Pedro Ocean Time series from March to December 2017.

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Coverage

Spatial Extent: **Lat**:33.55 **Lon**:-118.4
Temporal Extent: 2017-03-01 - 2017-12-01

Dataset Description

Concentrations of bromomethane (CH3Br), iodomethane (CH3I), dibromo methane (CH2Br2), and bromoform tribromomethane (CHBr3) seawater.

Methods & Sampling

Samples were collected at 7 depths using Niskin sampling bottles deployed on a rosette for deep samples from 0 meters to 250 meters. Samples were transferred from Niskins into acid cleaned 250 ml borosilicate serum bottles without entraining air, acidifed with 1mL 1 molar hydrochloric acid and stored in the refrigerator for up to two weeks prior to analysis. Duplicate samples were taken.

Samples were analyzed for dissolved halocarbon concentrations using a gas chromatography (GC) method adapted from Schall and Heumann (1993) and quantified relative to an internal standard. Purge-and-trap

capillary column gas chromatography with electron capture detection(GC-ECD) (EPA, 1986; Schall and Heumann 1993). 5-50 mL seawater samples were purged with ultra-high purity He for 45min at a flow rate of 60mL min-1 through an in-line K2CO3 drying tube and onto a liquid nitrogen trap. The purge vessel is then rinsed with methanol and the drying trap replaced with 0.75g fresh K2CO3 between individual analyses.

Cryo-concentrated samples were introduced into an Agilent 7890A GC by means of a splitless injection with sweep pressure at 50psi for 3.5min returning to analytical column pressure of 18psi after injection. Inlet temperature was set to 60°C to facilitate cryo-focusing on the column. Initial oven temperature was 40°C for 10min increasing to 120°C by 4°C min-1 and held there for another 2min. Temperature was then ramped to a final 240°C at a rate of 5°C min-1 and held for 20min

Calibration was carried out using 20µL of 0.5µg/L of tribromochloromethane as an internal standard (Gonzalez-Gago et al. 2007)

Data Processing Description

Data was processed using Peak Simple model 302 Integration using Peak 393 software.

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 latitde and longitude columns with coordinates from metadata form.
- added ISO_Date column with date formatted according to ISO-8601 convention.

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Data Files

File
halomethanes_prof.csv (Comma Separated Values (.csv), 7.35 KB) MD5:124c1e8eeba99944bddfa31ba6b0a89e Primary data file for dataset ID 772335

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Related Publications

González-Gago, A., Marchante-Gayón, J. M., & García Alonso, J. I. (2007). Determination of trihalomethanes in drinking water by GC-ICP-MS using compound independent calibration with internal standard. Journal of Analytical Atomic Spectrometry, 22(9), 1138. doi:10.1039/b705035f
Methods

Schall, C., & Heumann, K. G. (1993). GC determination of volatile organoiodine and organobromine compounds in Arctic seawater and air samples. Fresenius' Journal of Analytical Chemistry, 346(6-9), 717–722. doi:10.1007/bf00321279 https://doi.org/10.1007/BF00321279
Methods

U.S. EPA (1986). Method 8260, Determination of Volatile Organic Compounds by Gas Chromatography. U.S. Environmental Protection Agency https://19january2017snapshot.epa.gov/sites/production/files/2015-12/documents/8260b.pdf
Methods

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Parameters

Parameter	Description	Units
Date	observation year and month	unitless
Depth	water depth	meters (m)
note	comments	unitless
CH3Br_Average	bromomethane average	pico mole per liter (pmol/L)
CH3Br_SD	bromomethane standard deviation	pico mole per liter (pmol/L)
CH3I_avg	CH3I average	pico mole per liter (pmol/L)
CH3I_SD	CH3I standard deviation	pico mole per liter (pmol/L)
CH2Br2_avg	dibromo methane average	pico mole per liter (pmol/L)
CH2Br2_SD	dibromo methane standard deviation	pico mole per liter (pmol/L)
CHBr3_avg	bromoform; tribromomethane average	pico mole per liter (pmol/L)
CHBr3_SD	bromoform; tribromomethane standard deviation	pico mole per liter (pmol/L)
ISO_Date	Date in ISO-8601 format	unitless
lat	latitude with positive values indicating North	decimal degrees
lon	longitude with negative values indicating West	decimal degrees

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Instruments

Dataset-specific Instrument Name	Agilent 7890A Gas Chromatograph
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Agilent 7890A Gas Chromatograph with electron capture detector. Column- Restek Rtx-502.2 (60m, 0.32mm ID, 1.8µm)
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)

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Project Information

The role of organic and metal cofactors on the biogenic synthesis of halogenated volatile hydrocarbons (Volatile_Hydrocarbons)

NSF Award Abstract:
Volatile halogenated hydrocarbon gases, in this case halomethanes, are produced naturally by organisms in the ocean; which then serves as a source of these biogenic gases to the atmosphere. Their chemical reactions in the atmosphere are very similar to those of anthropogenic chlorofluorocarbons (CFCs). While CFCs are well-studied because they consume the ozone in the upper atmosphere that shields the earth from harmful ultraviolet radiation, halomethanes have been largely neglected, even though they currently account for 25% of the ozone depletion. As anthropogenic CFC levels steadily decline, however, halomethanes are predicted to account for 50% of ozone depletion by 2050. Based on limited study thus far, marine halomethane production has been ascribed mainly to phytoplankton and macro algae. This project will build on new and compelling data that suggests marine heterotrophic bacteria could also be major producers of halomethanes. The data produced here will provide the critical evaluation required to address discrepancies in global halomethane budgets which currently are out of balance due to an unknown source to the atmosphere, evaluating the hypothesis that marine heterotrophic bacteria can supply this missing source. Concerns over the stability of the earth's stratospheric ozone layer make this valuable and necessary research with added value of providing support for engaged undergraduate, graduate, and postdoctoral education at the University of Southern California.

Past research on the production of marine halomethanes has focused on phytoplankton and macro algae, while potential bacterial contributions to the processe have been neglected. This research proposes to study the role of marine heterotrophic bacteria on the production of halomethanes. It has been noted in past studies that there are discrepancies in the global atmospheric halomethane budget, and it is possible this is due to a large missing bacterial source. Additionally, this research will evaluate the potential importance of vitamin B12, methionine, and vanadium cofactors on the synthesis of halomethanes in bacteria. A large portion of marine bacteria cannot synthesize methylation co-enzymes, and therefore, would require available B12, methionine, and vanadium from external sources to complete the methylation step. This study will also measure concentrations of halomethanes, B12, methionine, and vanadium in upwelling regions as well as at a long-term time series site in order to put constraints on the variability of halomethanes concentrations for use in global linked air-sea models.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1559276

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