Porewater methane concentrations and d13C-CH4 values in Alvin pushcore samples from Guaymas Basin hydrothermal sediments collected on R/V Atlantis cruise AT37-06 in December 2016

Website: https://www.bco-dmo.org/dataset/842974
Data Type: Cruise Results
Version: 1
Version Date: 2021-03-11

Project
» Collaborative Research: Microbial Carbon cycling and its interactions with Sulfur and Nitrogen transformations in Guaymas Basin hydrothermal sediments (Guaymas Basin Interactions)

Contributors	Affiliation	Role
Teske, Andreas	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Principal Investigator
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Abstract
Porewater methane concentrations and d13C-CH4 values in Alvin pushcore samples from Guaymas Basin hydrothermal sediments collected on R/V Atlantis cruise AT37-06 in December 2016.

Table of Contents

Coverage

Spatial Extent: **Lat**:27 **Lon**:-111
Temporal Extent: 2016-12 - 2016-12

Methods & Sampling

Methodology: Porewater Methane concentrations were determined by headspace Gas Chromatography - flame ionization detection, and d13C signatures of methane were determined by Gas Chromatography coupled to Mass Spectrometry, using a Finnigan MAT Delta S isotope ratio Mass Spectrometer inlet system.

Sampling and Analytical Procedures: For combined concentration and δ13C analysis of methane, 2 ml sediment subsamples were added to 30 ml serum vials containing 2 ml of 1 M sodium hydroxide solution, sealed with thick butyl rubber stoppers, crimped with aluminum seals and stored at 4°C. Due to shipping problems and a resulting shortage of serum vials, only selected sediment cores were sampled for methane. Since cores were retrieved unpressurized, outgassing may have impacted in particular the measurements of methane concentrations near and above saturation, 1.5 mM. After the cruise, the methane samples were analyzed by headspace gas chromatography-flame ionization detection (GC-FID) at Florida State University

(Magen et al., 2014). Gas samples were analyzed for δ13C by injecting 0.1 to 0.5 ml of sample into a gas chromatograph interfaced to a Finnigan MAT Delta S isotope ratio Mass Spectrometer inlet system as previously described (Chanton and Liptay 2000). Values are reported in the per mil (‰) notation relative to Vienna Pee Dee Belemnite (VPDB). Sampling site names are based on Teske et al. 2016 and Teske et al. 2021.

Known Problems/Issues: Problems with Mexican customs and the agent used by WHOI at the time have resulted in limited availability of sampling gear and sampling vials on the ship. Transport problems during the return trip have caused sample losses among the porewater samples, which are evident in occasional gaps in porewater profiles or short profiles.

Data Processing Description

BCO-DMO Processing:
- added Site_Name column;
- renamed columns to comply with BCO-DMO naming conventions;
- added columns for Lat, Lon, and Depth_Dive from separate file provided by data submitter.

[table of contents | back to top]

Data Files

File
porewater_methane.csv (Comma Separated Values (.csv), 6.18 KB) MD5:50c30fc1fe470f9a29e38d2e4ff9ab8f Primary data file for dataset ID 842974

[table of contents | back to top]

Related Publications

Chanton, J., & Liptay, K. (2000). Seasonal variation in methane oxidation in a landfill cover soil as determined by an in situ stable isotope technique. Global Biogeochemical Cycles, 14(1), 51–60. doi:10.1029/1999gb900087 https://doi.org/10.1029/1999GB900087
Methods

Magen, C., Lapham, L. L., Pohlman, J. W., Marshall, K., Bosman, S., Casso, M., & Chanton, J. P. (2014). A simple headspace equilibration method for measuring dissolved methane. Limnology and Oceanography: Methods, 12(9), 637–650. doi:10.4319/lom.2014.12.637
Methods

Teske, A., Wegener, G., Chanton, J. P., White, D., MacGregor, B., Hoer, D., … Ruff, S. E. (2021). Microbial Communities Under Distinct Thermal and Geochemical Regimes in Axial and Off-Axis Sediments of Guaymas Basin. Frontiers in Microbiology, 12. doi:10.3389/fmicb.2021.633649
Results

Teske, A., de Beer, D., McKay, L. J., Tivey, M. K., Biddle, J. F., Hoer, D., Lloyd, K.G., Lever, M.A., Roy, H., Mendlovitz, H., & MacGregor, B. J. (2016). The Guaymas Basin Hiking Guide to Hydrothermal Mounds, Chimneys, and Microbial Mats: Complex Seafloor Expressions of Subsurface Hydrothermal Circulation. Frontiers in Microbiology, 7. doi:10.3389/fmicb.2016.00075
Related Research

[table of contents | back to top]

Parameters

Parameter	Description	Units
Site_Name	Site/location name	unitless
Site	Site number	unitless
Depth_Dive	Depth of sample collection	meters (m)
Lat	Latitude of sampling location	decimal degrees North
Lon	Longitude of sampling location	decimal degrees East
Depth	Core depth	centimeters (cm)
del_CH4	delCH4	per mil
del_CH4_Std_Dev	Standard deviation of del_CH4	per mil
Conc_CH4_pcnt	CH4 concentration, percent	percent (%)
Conc_CH4_ppm	CH4 concentration, parts per million	parts per million (ppm)
Conc_CH4_mM	CH4 concentration, millimolar	millimolar (mM)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Flame Ionization Detector
Dataset-specific Description	Methane samples were analyzed by headspace gas chromatography-flame ionization detection (GC-FID).
Generic Instrument Description	A flame ionization detector (FID) is a scientific instrument that measures the concentration of organic species in a gas stream. It is frequently used as a detector in gas chromatography. Standalone FIDs can also be used in applications such as landfill gas monitoring, fugitive emissions monitoring and internal combustion engine emissions measurement in stationary or portable instruments.

Dataset-specific Instrument Name	
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Methane samples were analyzed by headspace gas chromatography-flame ionization detection (GC-FID).
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	Finnigan MAT Delta S isotope ratio Mass Spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Alvin pushcore
Generic Instrument Name	Push Corer
Generic Instrument Description	Capable of being performed in numerous environments, push coring is just as it sounds. Push coring is simply pushing the core barrel (often an aluminum or polycarbonate tube) into the sediment by hand. A push core is useful in that it causes very little disturbance to the more delicate upper layers of a sub-aqueous sediment. Description obtained from: http://web.whoi.edu/coastal-group/about/how-we-work/field-methods/coring/

[table of contents | back to top]

Deployments

AT37-06

Website	https://www.bco-dmo.org/deployment/720354
Platform	R/V Atlantis
Report	https://datadocs.bco-dmo.org/d3/data_docs/GuaymasBasin_Interactions/AT37-06_CruiseReport.pdf
Start Date	2016-12-09
End Date	2016-12-27

AT37-06_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/782870
Platform	Alvin
Report	https://datadocs.bco-dmo.org/d3/data_docs/GuaymasBasin_Interactions/AT37-06_CruiseReport.pdf
Start Date	2016-12-09
End Date	2016-12-27
Description	Alvin dives conducted at Guyamas Basin on R/V Atlantis cruise AT37-06.

[table of contents | back to top]

Project Information

Collaborative Research: Microbial Carbon cycling and its interactions with Sulfur and Nitrogen transformations in Guaymas Basin hydrothermal sediments (Guaymas Basin Interactions)

Coverage: Guaymas Basin, Gulf of California, 27.00 N, 111.00W

Description from NSF award abstract:
Hydrothermally active sediments in the Guaymas Basin are dominated by novel microbial communities that catalyze important biogeochemical processes in these seafloor ecosystems. This project will investigate genomic potential, physiological capabilities and biogeochemical roles of key uncultured organisms from Guaymas sediments, especially the high-temperature anaerobic methane oxidizers that occur specifically in hydrothermally active sediments (ANME-1Guaymas). The study will focus on their role in carbon transformations, but also explore their potential involvement in sulfur and nitrogen transformations. First-order research topics include quantifying anaerobic methane oxidation under high temperature,in situ concentrations of phosphorus and methane , and with alternate electron acceptors; sulfate and sulfur-dependent microbial pathways and isotopic signatures under these conditions; and nitrogen transformations in methane-oxidizing microbial communities, hydrothermal mats and sediments.

This integrated biogeochemical and microbiological research will explore the pathways of and environmental controls on the consumption and production of methane, other alkanes, inorganic carbon, organic acids and organic matter that fuel the Guaymas sedimentary microbial ecosystem. The hydrothermal sediments of Guaymas Basin provide a spatially compact, high-activity location for investigating novel modes of methane cycling and carbon assimilation into microbial biomass. In the case of anaerobic methane oxidation, the high temperature and pressure tolerance of Guaymas Basin methane-oxidizing microbial communities, and their potential to uncouple from the dominant electron acceptor sulfate, vastly increase the predicted subsurface habitat space and biogeochemical role for anaerobic microbial methanotrophy in global deep subsurface diagenesis. Further, microbial methane production and oxidation interlocks with syulfur and nitrogen transformations, which will be explored at the organism and process level in hydrothermal sediment microbial communities and mats of Guaymas Basin. In general, first-order research tasks (rate measurements, radiotracer incorporation studies, genomes, in situ microgradients) define the key microbial capabilities, pathways and processes that mediate chemical exchange between the subsurface hydrothermal/seeps and deep ocean waters.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357238
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357360

[table of contents | back to top]