Porewater sulfate, sulfide, ammonia, phosphate, and silicate concentrations 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/843000
Data Type: Cruise Results
Version: 1
Version Date: 2021-03-12

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
Joye, Samantha B.	University of Georgia (UGA)	Co-Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Porewater sulfate, sulfide, ammonia, phosphate, and silicate concentrations 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 sulfide concentrations were determined photometrically, and sulfate concentrations were determined by ion chromatography.

Sampling and Analytical Procedures: This porewater sulfate and sulfide dataset consists of results obtained at the Max-Planck-Institute for Marine Microbiology in Bremen, Germany. The experimental procedures are listed here separately by institution. The sampling site names in the data table are based on Teske et al. 2016 and Teske et al. 2021.

For analyses at the Max-Planck Institute for Marine Microbiology (Gunter Wegener), intact sediment cores were sampled using the Rhizons (Rhizosphere Research Products, Wageningen, NL) as described previously (Seeberg-Elversfeldt et al., 2005). The overlying water was removed from the cores and holes were drilled into designated sediment sampling depths. Pretreated Rhizons were injected and suction was applied with syringes for approx. 30 min. The rhizome depths are given in the sample tables. For sulfide analysis, 1 ml porewater subsamples were fixed with 0.1 ml of 0.1 M zinc acetate solution to preserve the sulfide as zinc sulfide until analysis by the methylene blue method (Cline 1969). The same fixed porewater sample was used for measuring sulfate concentrations using ion chromatography (Metrohm 930 Compact IC flex oven, Metrosep A PCC HC/4.0 preconcentration column, and Metrosep A Supp 5 Guard/4.0 chromatography column). The concentrations of ammonia, phosphate, and silicate were determined from porewater using a continuous flow nutrient analyzer (QuAAtro39; Seal Analytical) as published previously (Grasshoff et al., 2009).

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.

Note that the Alvin frame grabber was not turned on during dive 4862; therefore positions and depth are approximations.

Data Processing Description

BCO-DMO Processing:
- 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_nutrients.csv (Comma Separated Values (.csv), 5.88 KB) MD5:0060fce7dc9f47f80c46a4b499db35eb Primary data file for dataset ID 843000

[table of contents | back to top]

Related Publications

Cline, J. D. (1969). Spectrophotometric Determination of Hydrogen Sulfide in Natural Waters. Limnology and Oceanography, 14(3), 454–458. doi:10.4319/lo.1969.14.3.0454
Methods

Grasshoff, K., Kremling, K., & Ehrhardt, M. (Eds.). (2009). Methods of seawater analysis. John Wiley & Sons. https://isbnsearch.org/isbn/978-3-527-61399-1
Methods

Seeberg-Elverfeldt, J., Schlüter, M., Feseker, T., & Kölling, M. (2005). Rhizon sampling of porewaters near the sediment-water interface of aquatic systems. Limnology and Oceanography: Methods, 3(8), 361–371. doi:10.4319/lom.2005.3.361
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
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Alvin_Dive_Number	Alvin dive 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
Core_Number	Core number	unitless
Depth	Core depth	centimeters (cm)
Ammonia	Ammonia	micromoles per liter (umol/L)
Nitrite	Nitrite	micromoles per liter (umol/L)
Nitrate_Nitrite	Nitrate+Nitrite	micromoles per liter (umol/L)
Nitrate	Nitrate	micromoles per liter (umol/L)
Phosphate	Phosphate	micromoles per liter (umol/L)
Silicate	Silicate	micromoles per liter (umol/L)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	QuAAtro39; Seal Analytical
Generic Instrument Name	Continuous Flow Analyzer
Generic Instrument Description	A sample is injected into a flowing carrier solution passing rapidly through small-bore tubing.

Dataset-specific Instrument Name	
Generic Instrument Name	Ion Chromatograph
Dataset-specific Description	Metrohm 930 Compact IC flex oven, Metrosep A PCC HC/4.0 preconcentration column, and Metrosep A Supp 5 Guard/4.0 chromatography column
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	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/

Dataset-specific Instrument Name	Rhizons
Generic Instrument Name	Sediment Porewater Sampler
Generic Instrument Description	A device that collects samples of pore water from various horizons below the seabed.

[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]