Porewater nutrient, sulfide, and sulfate concentrations in Alvin pushcore samples collected from Guaymas Basin hydrothermal vents during R/V Atlantis cruise AT42-05 in November 2018 and analyzed at the Max Planck Institute for Marine Microbiology

Website: https://www.bco-dmo.org/dataset/816549
Data Type: Cruise Results
Version: 1
Version Date: 2020-08-21

Project
» Collaborative Research: Hydrothermal Fungi in the Guaymas Basin Hydrocarbon Ecosystem (HOTFUN)

Contributors	Affiliation	Role
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Abstract
Porewater nutrient, sulfide, and sulfate (NH4+, NO2-, NO3-, PO43-, SiO42-, Cl-, S2-, SO24-) concentrations in Alvin pushcore samples collected from Guaymas Basin hydrothermal vents during R/V Atlantis cruise AT42-05 in November 2018. This dataset was obtained at the Max-Planck-Institute for Marine Microbiology in Bremen, Germany.

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Coverage

Spatial Extent: **N**:27.0118 **E**:-111.4039 **S**:27.0069 **W**:-111.4071
Temporal Extent: 2018-11-17 - 2018-11-25

Dataset Description

Porewater nutrient, sulfide, and sulfate (NH4+, NO2-, NO3-, PO43-, SiO42-, Cl-, S2-, SO24-) concentrations in Alvin pushcore samples from Guaymas Basin hydrothermal vents, R/V Atlantis cruise AT42-05, Nov. 2018. These samples were analyzed at the Max Planck Institute for Marine Microbiology in Bremen, Germany.

Porewater samples from this cruise were also reported by Woods Hole Oceanographic Institution (NO3+NO2, NH4, PO4) and the University of North Carolina at Chapel Hill (sulfate and sulfide). See related datasets:
https://www.bco-dmo.org/dataset/773129 (WHOI)
https://www.bco-dmo.org/dataset/816852 (UNC)

Methods & Sampling

This porewater dataset was obtained at the Max-Planck-Institute for Marine Microbiology in Bremen, Germany. The sampling site names in the data are based on Teske et al. 2016.

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 dataset (depth_bsf).

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, nitrite, nitrate, phosphate, and silicate were determined from porewater using a continuous flow nutrient analyzer (QuAAtro39; Seal Analytical) as published previously (Grasshoff et al., 2009).

Problem report: Transport problems have caused sample losses among the porewater samples, which are evident in occasional gaps in porewater profiles.

Data Processing Description

BCO-DMO Processing:
- renamed fields;
- removed empty columns;
- changed date format from DD.MM.YYYY to YYYY-MM-DD;
- added Site, Sample_type, Lat, Lon, and Water_depth fields from information originally provided in Word;
- removed commas in Site and Sample_type columns;
- joined data columns from separate spreadsheets into one data by matching on key Dive+Core+depth_bsf.

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Data Files

File
MPI_porewater_nutrients.csv (Comma Separated Values (.csv), 12.50 KB) MD5:2999c7774478808cde3817406740ff2d Primary data file for dataset ID 816549

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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., 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

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Parameters

Parameter	Description	Units
Site	Site name	unitless
Sample_type	Description of sample	unitless
Lat	Site latitude; positive values = North	decimal degrees North
Lon	Site longitude; positive values = East	decimal degrees East
Water_depth	Depth of the water	meters
date	Date of sampling; format: YYYY-MM-DD	unitless
gear	Sampling gear	unitless
Dive	Dive ID number	unitless
Core	Core ID number	unitless
depth_bsf	Depth below sea floor	centimeters (cm)
Ammonia	Ammonia	micromoles per liter (umol/L)
Nitrite	Nitrite	micromoles per liter (umol/L)
Nitrite_Nitrate	Nitrite+Nitrate	micromoles per liter (umol/L)
Phosphate	Phosphate	micromoles per liter (umol/L)
Silicate	Silicate	micromoles per liter (umol/L)
Nitrate	Nitrate	micromoles per liter (umol/L)
Chloride	Chloride	millimolar (mM)
Sulfate	Sulfate	millimolar (mM)
Sulfide	Sulfide	millimolar (mM)

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Instruments

Dataset-specific Instrument Name	Alivn pushcore
Generic Instrument Name	Alvin tube core
Generic Instrument Description	A plastic tube, about 40 cm (16 inches) long, is pushed into the sediment by Alvin's manipulator arm to collect a sediment core.

Dataset-specific Instrument Name	ion chromatography
Generic Instrument Name	Ion Chromatograph
Dataset-specific Description	Sulfate concentrations were measured 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).
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	QuAAtro39; Seal Analytical continuous flow nutrient analyzer
Generic Instrument Name	Nutrient Autoanalyzer
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

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.

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Deployments

AT42-05

Website	https://www.bco-dmo.org/deployment/773347
Platform	R/V Atlantis
Start Date	2018-11-15
End Date	2018-11-29
Description	Alvin dives to hydrothermal vent area.

AT42-05_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/773374
Platform	Alvin
Start Date	2018-11-17
End Date	2018-11-25
Description	Alvin dives 4991-5001at Guaymas Basin

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Project Information

Collaborative Research: Hydrothermal Fungi in the Guaymas Basin Hydrocarbon Ecosystem (HOTFUN)

Coverage: Guaymas Basin, Gulf of CA, Mexico

NSF Award Abstract:
Fungi that can derive energy from chemicals, yet consume other organisms or organic material to obtain carbon have been reported from diverse marine subsurface samples, including from hundreds of meters below the seafloor. Evidence exists that Fungi are active in subsurface marine sediments globally, yet there is a dearth of knowledge on their role in the marine subsurface, and specifically on their role(s) in hydrocarbon degradation within deep-sea sediments. This team is isolating a broad collection of environmentally relevant filamentous Fungi and yeasts from hydrothermally-influenced and hydrocarbon-rich seep sediments of Guaymas Basin using high-throughput culture-based approaches. They aim to reveal the diversity of Fungi and Bacteria in these hydrothermal sediments, how temperature and hydrocarbon composition shape their distribution, and how Fungi cooperate to enhance the degradation of hydrocarbons by Bacteria. By hosting six undergraduates through the WHOI Summer Student Fellows program and the Woods Hole Partnership Education Program, the project contributes to increasing diversity in marine science by offering opportunities for promising undergraduates from disadvantaged populations. High school students are involved in summer projects and in intensive summer workshops. One postdoc, a graduate student, and two Research Associates are supported, and international collaborations are strengthened. The postdoc and graduate student are gaining valuable cruise-based experience. An e-lecture on Fungi and their role(s) in biodegradation of hydrocarbons will be made publicly available by the end of the project. Fungal isolates with accompanying information will be secured in a reference culture collection for long-term storage and are available to any interested researcher throughout the project.

The PIs are isolating a broad collection of environmentally relevant filamentous Fungi and yeasts from hydrothermally-influenced and hydrocarbon-rich seep sediments of Guaymas Basin using high-throughput culture-based approaches, with the aim to reveal their ability to degrade individual hydrocarbons under in situ pressures and temperatures. Culture independent methods marker gene analyses are used to characterize in situ fungal and bacterial diversity and to examine how temperature and hydrocarbon composition shape fungal community composition and distribution. Traditional and comprehensive two-dimensional gas chromatographic analyses are used to examine the complexities and subtle changes in inventories of hydrocarbons within sediment cores, and provide evidence for in situ microbial alteration of individual hydrocarbons. Incubation experiments are used to test the ability of fungal isolates to utilize different hydrocarbons as a sole or auxiliary carbon source under in situ pressures and temperatures and their ability to stimulate biodegradation of hydrocarbons by hydrocarbon-degrading bacteria. Expressed genes within these incubation studies tell us how Fungi and Bacteria couple metabolisms to increase overall specificity and extent of biodegradation of hydrocarbons.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829680

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