Porewater geochemistry data for sediment samples included in global seep survey from R/V Atlantis cruise AT15-40 and Alvin dives in the Guaymas Basin in 2008 (Guaymas Basin interactions project)

Website: https://www.bco-dmo.org/dataset/559738
Data Type: Cruise Results
Version: 1
Version Date: 2015-06-02

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
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Abstract
Porewater geochemistry data for sediment samples included in global seep survey from R/V Atlantis cruise AT15-40 and Alvin dives in the Guaymas Basin in 2008.

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Coverage

Spatial Extent: **N**:27.0085 **E**:-111.4087 **S**:27.0065 **W**:-111.4096
Temporal Extent: 2008-12-06 - 2008-12-13

Dataset Description

Porewater geochemistry data for sediment samples that were included in global seep survey.

Methods & Sampling

Geochemical Analyses:
Sulfate concentration measurements were completed shipboard; after centrifuging sediment-filled 15 ml tubes, the overlying porewater was filtered through 0.45 um filters, acidified with 50 ul of 50% HCl and bubbled with nitrogen for 4 minutes to remove sulfide. Sulfate concentrations were then measured shipboard using a 2010i Dionex Ion Chromatograph (Sunnyvale, CA, USA) through Ag+ exchange columns (Dionex) so as to remove Cl- (Martens et al., 1999).

For sulfide, 1 ml porewater samples were combined with 0.1M zinc acetate and concentrations were analyzed spectrophotometrically on the ship (Cline 1969).

For methane, sediment subsamples were added to serum bottles containing a 0.1 M sodium hydroxide solution. Headspace methane concentrations were determined onboard using standard gas chromatography using a flame ionization detector. Stable isotopic compositions of methane was measured via gas chromatography/combustion/isotope ratio mass spectrometry (GC/C/IRMS) on a Finnigan MAT 252 Isotope Ratio Mass Spectrometer.

To measure DIC, 2 ml of unamended porewater from each sediment horizon were injected into evacuated serum vials (30 ml) and stored upside down at -20 degrees C. At UNC, the samples were thawed, and DIC was volatilized by adding 1 ml 30% phosphoric acid to each serum vial and shaking vigorously before GC analysis (Kelley et al., 1990). Stable isotopic values and concentrations of DIC were analyzed via coupled GC (Hewlett Packard 5890) and Isotope Ratio Mass Spectrometer (Finnigan MAT 252).

Data Processing Description

The porewater data of Guaymas Basin sediment have been tabulated in Excel sheets and were in part used to characterize Guaymas Basin samples that were included in a global census of seep microbiota (Ruff et al. 2015).

BCO-DMO processing:
- Extracted table from Word document.
- Modified format of date.
- Removed trailing N and W from lat/lon values. Changed lat values to negative (to indicate West).
- Created separate columns for depth_min and depth_max.
- Separated columns for CH4, SO4, HS-.

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Data Files

File	
porewater_geochem_Ruff.csv	(Comma Separated Values (.csv), 589 bytes) MD5:87fe6e9da56b1beb8cd35ff2b2734760
Primary data file for dataset ID 559738	

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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

Kelley, C. A., Martens, C. S., & Chanton, J. P. (1990). Variations in sedimentary carbon remineralization rates in the White Oak River estuary, North Carolina. Limnology and Oceanography, 35(2), 372–383. doi:10.4319/lo.1990.35.2.0372
Methods

Martens, C. S. (1999). Stable isotope tracing of anaerobic methane oxidation in the gassy sediments of Eckernfoerde Bay, German Baltic Sea. American Journal of Science, 299(7-9), 589–610. doi:10.2475/ajs.299.7-9.589
Methods

Ruff, S. E., Biddle, J. F., Teske, A. P., Knittel, K., Boetius, A., & Ramette, A. (2015). Global dispersion and local diversification of the methane seep microbiome. Proceedings of the National Academy of Sciences, 112(13), 4015–4020. doi:10.1073/pnas.1421865112
Results

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Parameters

Parameter	Description	Units
sample	Sample identification number.	alphanumeric
cruise_id	Cruise identification number.	alphanumeric
date	Month, day, and year of sampling.	mm/dd/YYYY
month	2-digit month of sampling.	mm (01 to 12)
day	2-digit day of sampling.	dd (01 to 31)
year	4-digit year of sampling.	YYYY
lat	Latitude in decimal degrees North.	decimal degrees
lon	Longitude in decimal degrees East (negative = West).	decimal degrees
depth_range	Range of depth of the sediment sample.	centimeters
depth_min	Minimum depth of the sediment sample.	centimeters
depth_max	Maxium depth of the sediment sample.	centimeters
temp_approx	Approximate temperature.	degrees Celsius
CH4	Methane(CH4) concentration determined in closest geochemistry core.	milli-Molar (mM)
SO4	Sulfate (SO4) concentration determined in closest geochemistry core.	milli-Molar (mM)
HS	Sulfide (HS-) concentration determined in closest geochemistry core.	milli-Molar (mM)
closest_geochemistry_core	Identification number of the closest geochemistry core.	alphanumeric

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Instruments

Dataset-specific Instrument Name	Hewlett Packard 5890
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Stable isotopic values and concentrations of DIC were analyzed via coupled GC (Hewlett Packard 5890) and Isotope Ratio Mass Spectrometer (Finnigan MAT 252).
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	2010i Dionex Ion Chromatograph
Generic Instrument Name	Ion Chromatograph
Dataset-specific Description	Sulfate concentrations were measured shipboard using a 2010i Dionex Ion Chromatograph (Sunnyvale, CA, USA) through Ag+ exchange columns (Dionex).
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	Finnigan MAT 252 Isotope Ratio Mass Spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Stable isotopic compositions of methane was measured via gas chromatography/ combustion/isotope ratio mass spectrometry (GC/C/IRMS) on a Finnigan MAT 252 Isotope Ratio Mass Spectrometer. Stable isotopic values and concentrations of DIC were analyzed via coupled GC (Hewlett Packard 5890) and Isotope Ratio Mass Spectrometer (Finnigan MAT 252).
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).

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Deployments

AT15-40

Website	https://www.bco-dmo.org/deployment/58831
Platform	R/V Atlantis
Report	http://www.marine.whoi.edu/at_synop.nsf/9452cb38d8d28f30852568cd004b8077/13f181c7f933dbac052574e4006399a9?OpenDocument
Start Date	2008-12-05
End Date	2008-12-18
Description	R/V Atlantis cruise in Guaymas Basin where 12 Alvin dives were made. Cruise information and original data are available from the NSF R2R data catalog.

AT15-40_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/58837
Platform	HOV Alvin
Start Date	2008-12-06
End Date	2008-12-17
Description	The Alvin dives of cruise AT15-40 (dive numbers 4483 through 4493) are listed below, with dive targets and shipfix and subfix position. Alvin dive 4483 December 6, 2008 Pilot: Sean Kelley Observers: Andreas Teske, Karen G. Lloyd Dive target: Marker 4; 2004 m depth Ship fix: 27°N00.388, 111°W24.560; Subfix: none Alvin Dive 4484 December 7, 2008 Pilot: Bruce Strickrott Observers: Frank Wenzhoefer, Stephanie Gruenke Dive target: Marker 4; 2004 m depth Ship fix: 27°N00.388, 111°W24.560; Subfix: none Alvin Dive 4485 December 8, 2008 Pilot: Mark Spear Observers: Howard Mendlovitz, Jennifer Biddle Dive target: Marker 1; 2010 m depth Ship fix: 27°N00.464, 111°W24.512; Subfix: 27°N00.459, 111°W24.526 Alvin Dive 4486 December 9, 2008 Pilot: Sean Kelley Observers: Bo B. Jørgensen, Antje Vossmeyer Dive target: Marker 1; 2010 m depth Ship fix: 27°N00.464, 111°W24.512; Subfix: 27°N00.459, 111°W24.526 Alvin Dive 4487 December 10, 2008 Pilot: Bruce Strickrott, Pilot-in-Training: Mike Skowronski Observer: Javier Caraveo Dive target: Marker 1; 2010 m depth Ship fix: 27°N00.464, 111°W24.512; Subfix: 27°N00.459, 111°W24.526 Alvin Dive 4488 December 12, 2008 Pilot: Mark Spear Observers: Julius Lipp, Barbara MacGregor Dive target: Marker 1; 2010 m depth Ship fix: 27°N00.464, 111°W24.512; Subfix: 27°N00.459, 111°W24.526 Alvin Dive 4489 December 13, 2008 Pilot: Sean Kelley Observers: Daniel B. Albert, Luke McKay Dive target: Marker 1; 2010 m depth Ship fix: 27°N00.464, 111°W24.512; Subfix: 27°N00.459, 111°W24.526 Alvin Dive 4490 December 14, 2008 Pilot: Bruce Strickrott Observers: Andreas Teske, Frank Wenzhoefer Dive target: Marker 1; 2010 m depth Ship fix: 27°N00.464, 111°W24.512; Subfix: 27°N00.459, 111°W24.526 Alvin Dive 4491 December 15, 2008 Pilot: Mark Spear Observers: Howard Mendlovitz, Julia Rezende Dive target: Marker 6; 2005 m depth Ship fix: 27°N00.423, 111°W24.477; Subfix: 27°N00.423, 111°W24.492 Alvin Dive 4492 December 16, 2008 Pilot: Sean Kelley, Pilot-in-Training: Mike Skowronski Observer: Alban Ramette Dive target: Marker 1; 2010 m depth Ship fix: 27°N00.464, 111°W24.512; Subfix: 27°N00.459, 111°W24.526 Alvin Dive 4493 December 17, 2008 Pilot: Bruce Strickrott Observers: Daniel Santillano, Matthias Kellermann Dive target: Marker 1; 2010 m depth Ship fix: 27°N00.464, 111°W24.512; Subfix: 27°N00.459, 111°W24.526

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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.

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Funding

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

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