# Sediment geochemistry from push cores collected during HOV Alvin dives during the R/V Atlantis cruise AT37-06 in Guaymas Basin, Gulf of California in December 2016

**Website**: https://www.bco-dmo.org/dataset/814391
**Data Type**: Cruise Results
**Version**: 1
**Version Date**: 2020-07-21

**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**
Sediment geochemistry from push cores obtained using the human-occupied deep-diving vehicle (HOV) Alvin dives 4867-4872 during the R/V Atlantis cruise AT37-06 in Guaymas Basin, Gulf of California (27 00.00 N, -111 20.00 W) in December 2016. These data were published in (Zhuang et al., 2018).

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## Coverage

**Spatial Extent**: **N**:27.46667 **E**:-111.38417 **S**:27.00733 **W**:-111.47317
**Temporal Extent**: 2016-12-18 - 2016-12-26

### Methods & Sampling

Methodology:

Sediment samples were collected from hydrothermal areas of Guaymas Basin in the Gulf of California during cruise AT3706 of R/V Atlantis in December 2016. Push cores were obtained using the human-occupied deep diving vehicle Alvin during dives 4867 to 4872. Porewater was extracted from the sediment by centrifugation and then filtered through a 0.2 µm syringe filter. Samples for quantification of concentrations of dissolved inorganic carbon (DIC), dissolved organic carbon (DOC), volatile fatty acids and alcohols were immediately frozen and stored at −20 °C or −80 °C (i.e. alcohols) before analysis.

Instruments:

The in situ temperature in the sediment was measured with Alvin's external heatflow probe (McKay et al., 2012). DIC was measured with: Shimadzu Instruments GC-2014 Gas Chromatograph with FID Detector and Methanizer. The concentration of DOC was measured with a Shimadzu TOC-V equipped with a nondispersive infrared detector (Joye et al., 2004). The concentrations and stable carbon isotopic compositions of VFAs were analyzed by a liquid chromatography coupled to isotope ratio mass spectrometry (DELTA Plus XP IRMS) via a LC Isolink interface (ThermoFinnigan) (Heuer et al., 2006). Methanol and Ethanol were measured with: a purge and trap system connected to an SRI Instruments 8610C Gas Chromatograph with FID Detector.

Issues of note:

Due to the limited volume of porewaters, methanol and ethanol were not determined for most of the samples collected from Dives 4867 to Dive 4870.

Missing data identifiers:
* B.D.: Below detection limit.
* nd□Not determined. nd is the default missing data identifier in the BCO-DMO data system.

**Data Processing Description**

BCO-DMO Data Manager Processing Notes:
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions (spaces, +, and - changed to underscores). Units in parentheses removed and added to Parameter Description metadata section.
* Data submitted in Excel file "Data submission OCE.xlsx" sheet "Geochemistry" extracted to csv
* The defualt missing identifier in the original file N.D. for "not determined" is displayed as "nd" in the data. nd is the default missing data identifier in the BCO-DMO system.
* removed metadata notes at the bottom of the file and moved to parameter descriptions. E.g. "B.D.: Below detection limit."
* Date formats converted to ISO 8601 yyyy-mm-dd
* Lat/lon converted to decimal degrees from degrees decimal minutes

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## Data Files

| File |
|---|
| **geochem.csv** (Comma Separated Values (.csv), 5.67 KB) MD5:a7bc2c7844f0056f78cb56c80a13f133<br>Primary data file for dataset ID 814391 |

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## Related Publications

Bowles, M. W., Samarkin, V. A., & Joye, S. B. (2011). Improved measurement of microbial activity in deep-sea sediments at in situ pressure and methane concentration. Limnology and Oceanography: Methods, 9(10), 499–506. doi:10.4319/lom.2011.9.499
*Methods*

Guangchao Zhuang. (2018). *Volatile fatty acids and alcohols concentrations, stable carbon isotopic compositions, and metabolic rates in hydrothermally altered sediments data collected aboard R/V Atlantis cruise AT37-06 in the Guaymas Basin, the Gulf of California from 2016-12-18 to 2016-12-24*. Harte Research Institute. https://doi.org/10.7266/N7-334G-EH74 https://doi.org/10.7266/n7-334g-eh74
*Results*

Heuer, V. B., Pohlman, J. W., Torres, M. E., Elvert, M., & Hinrichs, K.-U. (2009). The stable carbon isotope biogeochemistry of acetate and other dissolved carbon species in deep subseafloor sediments at the northern Cascadia Margin. Geochimica et Cosmochimica Acta, 73(11), 3323–3336. doi:10.1016/j.gca.2009.03.001

*Methods*

Joye, S. B., Boetius, A., Orcutt, B. N., Montoya, J. P., Schulz, H. N., Erickson, M. J., & Lugo, S. K. (2004). The anaerobic oxidation of methane and sulfate reduction in sediments from Gulf of Mexico cold seeps. Chemical Geology, 205(3-4), 219–238. doi:10.1016/j.chemgeo.2003.12.019
*Methods*

McKay, L. J., MacGregor, B. J., Biddle, J. F., Albert, D. B., Mendlovitz, H. P., Hoer, D. R., … Teske, A. P. (2012). Spatial heterogeneity and underlying geochemistry of phylogenetically diverse orange and white Beggiatoa mats in Guaymas Basin hydrothermal sediments. Deep Sea Research Part I: Oceanographic Research Papers, 67, 21–31. doi:10.1016/j.dsr.2012.04.011
*Methods*

Zhuang, G.-C., Montgomery, A., & Joye, S. B. (2019). Heterotrophic metabolism of C1 and C2 low molecular weight compounds in northern Gulf of Mexico sediments: Controlling factors and implications for organic carbon degradation. Geochimica et Cosmochimica Acta, 247, 243–260. doi:10.1016/j.gca.2018.10.019
*Methods*

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## Related Datasets

### IsRelatedTo

Joye, S. B., Teske, A. P. (2020) **Acetate and methanol turnover rates from sediment push cores collected during HOV Alvin dives during the R/V Atlantis cruise AT37-06 in Guaymas Basin, Gulf of California in December 2016.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-06-04 doi:10.26008/1912/bco-dmo.814406.1 [view at BCO-DMO]
*Relationship Description: Related Datasets which used the same sediment core samples.*

Joye, S. B., Teske, A. P. (2020) **Results from inhibition experiments conducted using sediment samples from push cores obtained using HOV Alvin dive 4869 during the R/V Atlantis cruise AT37-06 in Guaymas Basin, Gulf of California in December 2016.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-06-04 doi:10.26008/1912/bco-dmo.814415.1 [view at BCO-DMO]
*Relationship Description: Related Datasets which used the same sediment core samples.*

Joye, S. B., Teske, A. P. (2020) **Sediment geochemistry summary from push cores collected during HOV Alvin dives during the R/V Atlantis cruise AT37-06 in the Guaymas Basin from December 2016.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-07-21 doi:10.26008/1912/bco-dmo.819127.1 [view at BCO-DMO]
*Relationship Description: Related Datasets which used the same sediment core samples.*

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| Dive_No | Dive number | unitless |
| Site | Site name | unitless |
| Sampling_date | Sample date (UTC) in ISO 8601 format yyyy-mm-dd | unitless |
| Latitude | Latitude | decimal degrees |
| Longitude | Longitude | decimal degrees |
| Depth1 | Sediment sampling depth | centimeters (cm) |
| DIC | Porewater concentrations of dissolved inorganic carbon | millimoles per liter (mmol/L) |
| DOC | Porewater concentrations of dissolved organic carbon | micromoles per liter (umol/L) |
| Formate | Porewater concentrations of formate | micromoles per liter (umol/L) |
| d13C_Formate | Stable carbon isotopic composition of formate | permil (0/00) |
| Acetate | Porewater concentrations of acetate | micromoles per liter (umol/L) |
| d13C_Acetate | Stable carbon isotopic composition of formate | permil (0/00) |
| Lactate | Porewater concentrations of lactate | micromoles per liter (umol/L) |
| d13C_Lactate | Stable carbon isotopic composition of lactate | permil (0/00) |
| Methanol | Porewater concentrations of methanol | micromoles per liter (umol/L) |
| Ethanol | Porewater concentrations of ethanol | micromoles per liter (umol/L) |
| Depth2 | Temperature Sampling depth | centimeters (cm) |
| Temperature | Sediment temperature | degrees Celsius |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | SRI Instruments 8610C |
| **Generic Instrument Name** | Gas Chromatograph |
| **Dataset-specific Description** | Methanol and Ethanol were measured with: a purge and trap system connected to an SRI Instruments 8610C Gas Chromatograph with FID Detector. |
| **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** | Shimadzu Instruments GC-2014 |
| **Generic Instrument Name** | Gas Chromatograph |
| **Dataset-specific Description** | DIC was measured with Shimadzu Instruments GC-2014 Gas Chromatograph with FID Detector and Methanizer. |
| **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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## 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. |

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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-1357360 |


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