

# 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
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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.

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## Coverage

**Spatial Extent:** Lat:27 Lon:-111

**Temporal Extent:** 2016-12 - 2016-12

## Acquisition Description

**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  $\delta^{13}\text{C}$  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  $\delta^{13}\text{C}$  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.

## 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.

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## 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](https://doi.org/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](https://doi.org/10.3389/fmicb.2021.633649)

*Results*

Teske, A., de Beer, D., McKay, L. J., Tivey, M. K., Biddle, J. F., Hoer, D., ... 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](https://doi.org/10.3389/fmicb.2016.00075)

*Related Research*

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## 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_pcmt	CH4 concentration, percent	percent (%)
Conc_CH4_ppm	CH4 concentration, parts per million	parts per million (ppm)
Conc_CH4_mM	CH4 concentration, millimolar	millimolar (mM)

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## Instruments

<b>Dataset-specific Instrument Name</b>	Finnigan MAT Delta S isotope ratio Mass Spectrometer
<b>Generic Instrument Name</b>	Isotope-ratio Mass Spectrometer
<b>Generic Instrument Description</b>	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).

<b>Dataset-specific Instrument Name</b>	
<b>Generic Instrument Name</b>	Gas Chromatograph
<b>Dataset-specific Description</b>	Methane samples were analyzed by headspace gas chromatography-flame ionization detection (GC-FID).
<b>Generic Instrument Description</b>	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)

<b>Dataset-specific Instrument Name</b>	Alvin pushcore
<b>Generic Instrument Name</b>	Push Corer
<b>Generic Instrument Description</b>	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: <a href="http://web.whoi.edu/coastal-group/about/how-we-work/field-methods/coring/">http://web.whoi.edu/coastal-group/about/how-we-work/field-methods/coring/</a>

<b>Dataset-specific Instrument Name</b>	
<b>Generic Instrument Name</b>	Flame Ionization Detector
<b>Dataset-specific Description</b>	Methane samples were analyzed by headspace gas chromatography-flame ionization detection (GC-FID).
<b>Generic Instrument Description</b>	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.

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## Deployments

### AT37-06

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

### AT37-06\_Alvin\_Dives

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/782870">https://www.bco-dmo.org/deployment/782870</a>
<b>Platform</b>	Alvin
<b>Report</b>	<a href="https://datadocs.bco-dmo.org/d3/data_docs/GuaymasBasin_Interactions/AT37-06_CruiseReport.pdf">https://datadocs.bco-dmo.org/d3/data_docs/GuaymasBasin_Interactions/AT37-06_CruiseReport.pdf</a>
<b>Start Date</b>	2016-12-09
<b>End Date</b>	2016-12-27
<b>Description</b>	Alvin dives conducted at Guaymas 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 sulfur 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
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1357238</a>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1357360</a>

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