Porewater sulfate from samples collected by pushcore from Guaymas Basin hydrothermal sediments on R/V Atlantis cruise AT37-06 in the Guaymas Basin in December 2016

Website: https://www.bco-dmo.org/dataset/720669
Data Type: Cruise Results
Version: 1
Version Date: 2017-12-08

Project

» 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 sulfate from samples collected by pushcore from Guaymas Basin hydrothermal sediments on cruise AT37-06 in December 2016.

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Coverage

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

Dataset Description

Porewater sulfate from samples collected by pushcore from Guaymas Basin hydrothermal sediments on cruise AT37-06 in December 2016.

Publications associated with this project are as follows:
Schutte, C.A., A. Teske, B.J. MacGregor, V. Salman-Carvalho, G. Lavik, and D. de Beer**.** Filamentous giant *Beggiatoaceae* from Guaymas Basin are capable of both denitrification and dissimilatory nitrate reduction to ammonium (DNRA). For submission.

Acquisition Description

Sampling and Analytical Methodology: Freshly collected sediment cores were sliced on the ship into 3 cm layers; porewater was obtained by gently centrifuging freshly collected sediment in 50 ml conical Falcon tubes for ca. 5 to 10 minutes until the sediment had settled; one Falcon tube produced ca. 8 to 10 ml of porewater. For porewater sulfate measurements, 1 ml subsamples of the overlying porewater were drawn into syringes and injected through 0.45 µm filters into screw cap Eppendorf vials, each acidified with 50 µl of 6N HCl, and then gently bubbled with nitrogen for 4 min to remove sulfide; the samples were then stored at 4ºC before shipping and analysis.

Geochemical Analyses: SO4 was analyzed on a Dionex ICS-1000 using a RFIC IonPac AS22 4 X 250mm column and a RFIC IonPac AG22 Guard column 4 X 50 mm. The IC was calibrated using a 5 point std curve and a minimum r^2 value of 0.999. The MDL measured at 0.10 ppm SO4. A check standard from a 1000 ppm was made fom a Dionex 7 anion standard to a concentration of 15 ppm. An external Standard from HACH 100 ppm SO4 was used to make a 20 ppm QC standard. In general, QCs were analyzed for 10% of the samples.

Data Processing: The porewater data of Guaymas Basin sand Sonora Margin piston cores were tabulated in Excel sheets.

Quality Control: Note that Sample_IDs "D7A_10X_CKS" are internal quality control standards (15.5 mg/L) and Sample_IDs "DI_SPK" are external quality control standards (20.0 mg/L).

Processing Description

BCO-DMO Processing:

- modified parameter names (replaced spaces with underscores);
- replaced commas in Sample_ID column with semi-colons.

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Parameters

Parameter	Description	Units
Sample_ID	Sample identification number	unitless
Sulfate_Concentration	Sulfate concentration	millimoles per liter (mMol/L)

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Instruments

Dataset-specific Instrument Name	
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	Dionex ICS-1000
Generic Instrument Name	Ion Chromatograph
Dataset-specific Description	SO4 was analyzed on a Dionex ICS-1000 using a RFIC IonPac AS22 4 X 250mm column and a RFIC IonPac AG22 Guard column 4 X 50 mm.
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....)

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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

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Project Information

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. Publications associated with this project are as follows: Note: this is now a list of all publications that use samples collected from the NSF-funded Guaymas cruises AT15-40 and AT15-56. All these publications were funded from NSF award OCE-0647633, the grant that funded these two cruises. Those publications that were written and published after 2013 continue to use samples collected and analyzed on cruises AT15-40 and AT15-56 under NSF award OCE-0647633, but the effort in analyzing the data and writing the manuscript also relied

on funding by OCE-1357238. Since we will not have new samples until late in 2016, current work and publications on OCE-1357238 will continue to rely on samples collected during cruises AT15-40 and AT15-56. Holler, T. F. Widdel, K. Knittel, R. Amann, M. Y. Kellermann, K.-. Hinrichs, A. Teske, A. Boetius, and G. Wegener. 2011. Thermophilic anaerobic oxidation of methane by marine microbial consortia. The ISME Journal 5:1946-1956. doi:10.1038/ismej.2011.77 Biddle, J.F., Z. Cardman, H. Mendlovitz, D.B. Albert, K.G. Lloyd, A. Boetius, and A. Teske. 2012. Anaerobic oxidation of methane at different temperature regimes in Guaymas Basin hydrothermal sediments. The ISME Journal 6:1018-1031. doi:10.1038/ismej.2011.164 McKay, L.J., B.J. MacGregor, J.F. Biddle, H.P. Mendlovitz, D. Hoer, J.S. Lipp, K.G. Lloyd, and A.P. Teske. 2012. Spatial heterogeneity and underlying geochemistry of phylogenetically diverse orange and white Beggiatoa mats in Guaymas Basin hydrothermal sediments. Deep-Sea Research I, 67:21-31. doi:10.1016/j.dsr.2012.04.011 Bowles, M.W., L.M. Nigro, A.P. Teske, and S.B. Joye.. 2012. Denitrification and environmental factors influencing nitrate removal in Guaymas Basin hydrothermally-altered sediments. Frontiers in Microbiology 3:377. doi:10.3389/fmicb.2012.03377 MacGregor, B.J., J.F. Biddle, J.R. Siebert, E. Staunton, E. Hegg, A.G. Matthysse, and A. Teske. 2013. Why orange Guaymas Basin Beggiatoa spp. are orange: Single-filament genome-enabled identification of an abundant octaheme cytochrome with hydroxylamine oxidase, hydrazine oxidase and nitrite reductase activities. Applied and Environmental Microbiology 79:1183-1190. doi:10.1128/AEM.02538-12 MacGregor, B.J., J.F. Biddle, and A. Teske. 2013. Mobile elements in a single-filament orange Guaymas Basin Beggiatoa ("Candidatus Maribeggiatoa") sp. draft genome; evidence for genetic exchange with cyanobacteria. Applied and Environmental Microbiology 79:3974-3985. doi:10.1128/AEM.03821-12 Meyer, S., G. Wegener, K.G. Lloyd, A. Teske, A. Boetius, and A. Ramette. 2013. Microbial habitat connectivity across spatial scales and hydrothermal temperature gradients at Guaymas Basin. Frontiers in Microbiology 4:207. doi:10.3389/fmic.2013.00207 MacGregor, B.J., J.F. Biddle, C. Harbort, A.G. Matthysse, and A. Teske. 2013. Sulfide oxidation, nitrate respiration, carbon acquisition and electron transport pathways suggested by the draft genome of a single orange Guaymas Basin Beggiatoa (Cand. Maribeggiatoa) sp. filament. Marine Genomics 11:53-65. doi:10.1016/j.margen.2013.08.001 Ruff, E., J.F. Biddle, A. Teske, K. Knittel, A. Boetius, and A. Ramette. 2015. Global dispersion and local diversification of the methane seep microbiome. Proc. Natl. Acad. Sci. USA, 112:4015-4020. doi:10.1073/pnas.1421865112 McKay, L., V. Klokman, H. Mendlovitz, D. LaRowe, M. Zabel, D. Hoer, D. Albert, D. de Beer, J. Amend, A. Teske. Thermal and geochemical influences on microbial biogeography in the hydrothermal sediments of Guaymas Basin. Environmental Microbiology, in revision. Teske, A., D. de Beer, L. McKay, M.K. Tivey, J.F. Biddle, D. Hoer, K.G. Lloyd, M.A. Lever, H.Røy, D.B. Albert, H. Mendlovitz, B. J. MacGregor. 2016. The Guaymas Basin hiking guide to hydrothermal mounds, chimneys and microbial mats: complex seafloor expressions of subsurface hydrothermal circulation. Frontiers in Microbiology 7:75, doi:10.3389/fmicb.2016.00075. Dowell, F., Z. Cardman, S. Dasarathy, M.Y. Kellermann, L.J. McKay, B.J. MacGregor, S.E. Ruff, J.F. Biddle, K.G. Lloyd, J.S. Lipp, K-U.

Hinrichs, D.B. Albert, H. Mendlovitz, and A. Teske. 2016. Microbial communities in methane and short alkane-rich hydrothermal sediments of Guaymas Basin. Frontiers in Microbiology 7:17, doi:10.3389/fmicb.2016.00017. Conference abstracts (post 2013, only NSF-OCE 1357238): B.J. MacGregor. 2014. Receiver (REC) domains in the orange Guaymas "Maribeggiatoa" (BOGUAY) draft genome: an evolutionary network of sensor networks. The Human and Environmental Microbiome Symposium 2014. Duke Center for the Genomics of Microbial Systems, Durham, NC. B.J. MacGregot. 2015. Abundant intergenic repeats and a possible alternate RNA polymerase betra subunit in the orange Guaymas "Maribeggiatoa" genome. American Society for Microbiology 2015 General Meeting. New Orleans, LA. Z. Cardman, L.J. McKay, E. Dowell, S. Dasarathy, V. Klokman, J.F. Biddle, K.G. Lloyd, H. Mendlovitz, D. Albert, M. Kellermann, K.-U. Hinrichs, B.J. MacGregir and A.P. Teske. 2014. American Society for Microbiology 2014 General Meeting. Boston, MA.

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Funding Source	Award
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