Nutrients measured in porewater from sediments collected at Guaymas Basin from R/V JOIDES Resolution IODP-385 cruise in the Guaymas Basin from September to June, 2019.

Website: https://www.bco-dmo.org/dataset/869414
Data Type: Other Field Results
Version: 1
Version Date: 2022-08-12

Project
» Collaborative Research: IODP-enabled Insights into Fungi and Their Metabolic Interactions with Other Microorganisms in Deep Subsurface Hydrothermal Sediments (IODP insights Fungi)

Contributors	Affiliation	Role
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Abstract
Nutrients measured in porewater from sediments collected at Guaymas Basin from R/V JOIDES Resolution IODP-385 cruise in the Guaymas Basin between September and November, 2019.

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Coverage

Spatial Extent: **N**:27.6374 **E**:-111.22 **S**:27.2064 **W**:-111.889
Temporal Extent: 2019-10-04 - 2019-11-10

Methods & Sampling

Sediments samples dedicated to nutrient analyses recovered from 8 drilling sites from up to 427 meter below seafloor. Two ~40ml samples of sediment were placed in 50 ml Falcon tubes and were centrifuged at 3000 rpm for 15 minutes to separate porewater from the sediment. The porewater was collected into vials for dissolved inorganic carbon (DIC), dissolved organic carbon (DOC), NOx, and total nitrogen (TN). Samples were stored at 4oC.

Data Processing Description

Colorimetric determinations of ammonium, nitrate, were performed using a OI Analytical Flow Solutions IV auto analyzer. Total nitrogen and carbon (weight %) are measured with a Costech 1040 CHNOS Elemental Combustion system. Filtered porewater samples were analyzed for dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) using a Shimadzu TOC/TN analyzer. Dissolved organic nitrogen (DON) was calculated

by subtracting TDN from the sum of the inorganic nitrogen species.

All nutrient analyses were performed at Wetland Biogeochemistry Analytical Services, LSU, LA.

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Data Files

File
porewaternutrients.csv (Comma Separated Values (.csv), 7.50 KB) MD5:bd1788d101385b0fcf2f64ed043ea852 Primary data file for dataset ID 869414

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Parameters

Parameter	Description	Units
Sample_ID	Sample ID	unitless
Depth	Sample depth	meters (m)
Latitude	Latitude of sampling location, south is negative	decimal degrees
Longitude	Longitude of sampling location, west is negative	decimal degrees
ISO_DateTime_UTC	Date and time of sampling in ISO format (UTC timezone)	unitless
Temperature	Temperature	degrees Celsius (°C)
Dissolved_Organic_Carbon	measurement of Dissolved Organic Carbon	mg/L
Dissolved_Inorganic_Carbon	measurement of Dissolved Inorganic Carbon	mg/L
Total_Nitrogen	measurement of Total Nitrogen	mg/L
NO2_NO_as_N_um	measurement of nitrate and nitrite a nitrogen	uM
NO2_NO_as_N	measurement of nitrate and nitrite a nitrogen	mg/L -N
Notes	description	units

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Instruments

Dataset-specific Instrument Name	Costech 1040 CHNOS Elemental Combustion system
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	Shimadzu TOC/TN analyzer
Generic Instrument Name	Total Nitrogen Analyzer
Generic Instrument Description	A unit that accurately determines the nitrogen concentrations of organic compounds typically by detecting and measuring its combustion product (NO). See description document at: http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/totalnit.pdf

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Deployments

IODP-385

Website	https://www.bco-dmo.org/deployment/869491
Platform	R/V JOIDES Resolution
Start Date	2019-09-16
End Date	2019-11-16
Description	Guaymas Basin Tectonics and Biosphere - International Ocean Discovery Program Expedition 385, General information: https://iodp.tamu.edu/scienceops/expeditions/guaymas_basin_tectonics_bio...

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Project Information

Collaborative Research: IODP-enabled Insights into Fungi and Their Metabolic Interactions with Other Microorganisms in Deep Subsurface Hydrothermal Sediments (IODP insights Fungi)

Website: https://www2.whoi.edu/site/edgcomblab/research/deep-marine-subsurface-eukaryotes/

Coverage: Guaymas Basin, Gulf of California, Mexico

NSF Award Abstract:
The marine subsurface is one of the least explored habitats on Earth. International Ocean Discovery Program (IODP) Expedition 385 drilled into the seafloor in Guaymas Basin, Mexico, and was the first to drill directly into subsurface sediments and sediment-hosted basalt sill intrusions of an active hydrothermal basin. This expedition provides a direct microbiological window into a deep hydrothermal biosphere across an active plate spreading center where complex hydrocarbons are generated by heating of buried organic matter under high temperature and pressure. Mounting evidence suggests that Fungi constitute an active and ecologically important fraction of the subsurface biosphere community. This is especially true in organic-rich continental margin sediments that are ideal for colonization by aerobic and anaerobic Fungi, where fungal activities may contribute significantly to nutrient cycling. Major knowledge gaps in our knowledge of subsurface microbiota preclude our ability to estimate their full impact: how active Fungi are distributed along temperature and depth gradients, the range of substrates utilized by active cells, and how Fungi may cooperate with bacteria in degradation of complex organic matter, including hydrocarbons. Fungi are known to participate in degradation of refractory organics and cycling of metals and to produce novel metabolites with interesting properties. This project informs us on origins of different lineages of microbial life on Earth, the extent of marine subsurface carbon cycling, limits of life, how life adapts to environmental change, and the potential for Fungi to accelerate the biodegradation of complex hydrocarbons. Given the extent of the potential subsurface biosphere, Fungi likely play an important role in global nutrient cycling. The culture collection of fungal isolates created by this

project will be available for exploration of their ecology and novel properties by other interested researchers, and may also yield insights into basal fungal lineages. These biogeochemical and potential evolutionary outcomes are of great interest to other research disciplines, educators, and students alike. The project's K-16 education program capitalizes on programs aimed at increasing involvement of under-represented undergraduate populations in research. High school students, undergraduates, a graduate student, and postdoc are involved in the research. An art-in-science project with a local high school is being displayed at the community library along with education materials on marine Fungi and their ecological roles.

This project examines how abundance, diversity and distribution of Fungi and co-inhabiting bacteria and archaea changes in subsurface sediment samples exhibiting a wide range of in situ temperatures and pressure, what the active fraction of cells is along these gradients, and whether/how Fungi impact carbon cycling in this biosphere by interacting metabolically with bacteria to break down hydrocarbon substrates. The project is assessing the activities of in situ microorganisms in this active hydrothermal subsurface biosphere using a cutting-edge combination of molecular approaches and culture-based studies of enrichments and microbial isolates applied to an extensive collection of samples from 8 sites in Guaymas Basin varying in temperature profile, presence of old, buried magmatic sills, and geochemical conditions. The investigators are examining 1) marker genes and metagenomes of sorted active cells using new bioorthogonal non-canonical amino acid tagging (BONCAT) approaches, 2) the distribution of bacterial, archaeal, and fungal cells and their marker genes along depth and geochemical gradients using microscopy, 'meta-omics' and lipid biomarker analyses, 3) substrate usage by fungal isolates, 4) metabolite pools, nutrients, and hydrocarbons with depth, and 5) fungal metabolism of complex organics (and syntrophies between Fungi and Bacteria) using time-course stable isotope probing of RNA from culture-based studies coupled with analyses of expressed genes and pools of metabolites.

Broader Impacts: The proposed project can transform our understanding of microbial life in the sedimented marine subsurface biosphere because active mycobiota would have implications for deep carbon budgets. Our culture collection is estimated to generate hundreds of new strains of fungi that will be available for exploration of their ecology and novel properties by interested researchers, and may also yield insights into basal fungal lineages. These biogeochemical and potential evolutionary outcomes are of great interest to other research disciplines, educators, and students alike. Our proposed K-16 education program capitalizes on programs aimed at increasing involvement of under-represented undergraduate populations in research. High school students, undergraduates (4 per year), a graduate student, and postdoc will be involved. The PI and an art teacher at a local high school will teach an art-in-science unit. The product (a large quilt of art inspired by fungal cultures) will be displayed at the community library along with education materials on marine fungi and their ecological roles. The project involves two international collaborators, and will partially support 4 principal investigators at three institutions, including two early career researchers, Roland Hatzenpichler and Paraskevi Mara.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2048489

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