Hydrocarbon compounds identified and measured in sediments and porewaters using gas chromatography from R/V JOIDES Resolution IODP-385 cruise in the Guaymas Basin between September and November, 2019.

Website: https://www.bco-dmo.org/dataset/869407
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
Edgcomb, Virginia P.	Woods Hole Oceanographic Institution (WHOI)	Principal Investigator
Teske, Andreas	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Contact
Soenen, Karen	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Hydrocarbon compounds identified and measured in sediments and porewaters using gas chromatography from R/V JOIDES Resolution IODP-385 cruise in the Guaymas Basin between September and November, 2019

Table of Contents

- Coverage
- Dataset Description
  - Acquisition Description
  - Processing Description
- Parameters
- Instruments
- Deployments
- Project Information
- Funding

Coverage

Spatial Extent: **N**:27.6372 **E**:-111.22 **S**:27.2064 **W**:-111.889
Temporal Extent: 2019-10-01 - 2019-11-10

Acquisition Description

Sediments samples dedicated to hydrocarbon analyses recovered from 8 drilling sites from up to 427 meter below seafloor. The samples (~40ml of sample) were aliquoted into two 50 ml Falcon tubes and was centrifuged at 3000 rpm for 15 minutes to separate porewater from the sediment.

After centrifuge the porewater was filtered through sterile syringe cellulose 0.45µm filters. 20 ml the porewater was collected into 20 ml serum vials for saturated hydrocarbons, polycyclic aromatic hydrocarbons (PAH) and alkane analysis and stored at 4oC.

The sediment cake from each horizon was kept and stored at 4oC for hydrocarbons, polycyclic aromatic hydrocarbons (PAH) and alkane analysis.

Processing Description

All analysis were performed by Alpha Analytical using ion monitoring (SIM) Gas Chromatography/Mass Spectometry (GC/MS-SIM).

[table of contents | back to top]

Parameters

Parameter	Description	Units
SAMPLE_ID	Sample ID	unitless
Sample_Type	Sample type: porewater nutrients or sediment cake	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)
Compound_Solids_Total	identified compound	percentage (%)
Compound_cis_trans_Decalin	identified compound	micrograms per kilogram (ug/kg)
Compound_C1_Decalins	identified compound	micrograms per kilogram (ug/kg)
C2_Decalins	identified compound	micrograms per kilogram (ug/kg)
Compound_C3_Decalins	identified compound	micrograms per kilogram (ug/kg)
Compound_C4_Decalins	identified compound	micrograms per kilogram (ug/kg)
Compound_Naphthalene	identified compound	micrograms per kilogram (ug/kg)
Compound_C1_Naphthalenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C2_Naphthalenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C3_Naphthalenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C4_Naphthalenes	identified compound	micrograms per kilogram (ug/kg)
Compound_2_Methylnaphthalene	identified compound	micrograms per kilogram (ug/kg)
Compound_1_Methylnaphthalene	identified compound	micrograms per kilogram (ug/kg)
Compound_Benzothiophene	identified compound	micrograms per kilogram (ug/kg)

Compound_C1_Benzo_b_thiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C2_Benzo_b_thiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C3_Benzo_b_thiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C4_Benzo_b_thiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_Biphenyl	identified compound	micrograms per kilogram (ug/kg)
Compound_2_6_Dimethylnaphthalene	identified compound	micrograms per kilogram (ug/kg)
Compound_Dibenzofuran	identified compound	micrograms per kilogram (ug/kg)
Compound_Acenaphthylene	identified compound	micrograms per kilogram (ug/kg)
Compound_Acenaphthene	identified compound	micrograms per kilogram (ug/kg)
Compound_2_3_5_Trimethylnaphthalene	identified compound	micrograms per kilogram (ug/kg)
Compound_Fluorene	identified compound	micrograms per kilogram (ug/kg)
Compound_C1_Fluorenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C2_Fluorenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C3_Fluorenes	identified compound	micrograms per kilogram (ug/kg)
Compound_Dibenzothiophene	identified compound	micrograms per kilogram (ug/kg)
Compound_4_Methyldibenzothiophene_4MDT	identified compound	micrograms per kilogram (ug/kg)
Compound_2_3_Methyldibenzothiophene_2MDT	identified compound	micrograms per kilogram (ug/kg)
Compound_1_Methyldibenzothiophene_1MDT	identified compound	micrograms per kilogram (ug/kg)
Compound_C1_Dibenzothiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C2_Dibenzothiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C3_Dibenzothiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C4_Dibenzothiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_Phenanthrene	identified compound	micrograms per kilogram (ug/kg)
Compound_3_Methylphenanthrene_3MP	identified compound	micrograms per kilogram (ug/kg)
Compound_2_Methylphenanthrene_2MP	identified compound	micrograms per kilogram (ug/kg)

Compound_2_Methylanthracene_2MA	identified compound	micrograms per kilogram (ug/kg)
Compound_9_4_Methylphenanthrene_9MP	identified compound	micrograms per kilogram (ug/kg)
Compound_1_Methylphenanthrene_1MP	identified compound	micrograms per kilogram (ug/kg)
Compound_C1_Phenanthrenes_Anthracenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C2_Phenanthrenes_Anthracenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C3_Phenanthrenes_Anthracenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C4_Phenanthrenes_Anthracenes	identified compound	micrograms per kilogram (ug/kg)
Compound_Retene	identified compound	micrograms per kilogram (ug/kg)
Compound_Anthracene	identified compound	micrograms per kilogram (ug/kg)
Compound_Carbazole	identified compound	micrograms per kilogram (ug/kg)
Compound_Fluoranthene	identified compound	micrograms per kilogram (ug/kg)
Compound_Benzo_b_fluorene	identified compound	micrograms per kilogram (ug/kg)
Compound_Pyrene	identified compound	micrograms per kilogram (ug/kg)
Compound_C1_Fluoranthenes_Pyrenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C2_Fluoranthenes_Pyrenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C3_Fluoranthenes_Pyrenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C4_Fluoranthenes_Pyrenes	identified compound	micrograms per kilogram (ug/kg)
Compound_Naphthobenzothiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C1_Naphthobenzothiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C2_Naphthobenzothiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C3_Naphthobenzothiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C4_Naphthobenzothiophenes	identified compound	micrograms per kilogram (ug/kg)
Compound_Benz_a_anthracene	identified compound	micrograms per kilogram (ug/kg)
Compound_Chrysene_Triphenylene	identified compound	micrograms per kilogram (ug/kg)

Compound_C1_Chrysenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C2_Chrysenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C3_Chrysenes	identified compound	micrograms per kilogram (ug/kg)
Compound_C4_Chrysenes	identified compound	micrograms per kilogram (ug/kg)
Compound_Benzo_b_fluoranthene	identified compound	micrograms per kilogram (ug/kg)
Compound_Benzo_j__k_fluoranthene	identified compound	micrograms per kilogram (ug/kg)
Compound_Benzo_a_fluoranthene	identified compound	micrograms per kilogram (ug/kg)
Compound_Benzo_e_pyrene	identified compound	micrograms per kilogram (ug/kg)
Compound_Benzo_a_pyrene	identified compound	micrograms per kilogram (ug/kg)
Compound_Perylene	identified compound	micrograms per kilogram (ug/kg)
Compound_Indeno_1_2_3_cd_pyrene	identified compound	micrograms per kilogram (ug/kg)
Compound_Dibenz_a_h_a_c_anthracene	identified compound	micrograms per kilogram (ug/kg)
Compound_Benzo_g_h_i_perylene	identified compound	micrograms per kilogram (ug/kg)
Compound_8015D_M	identified compound	micrograms per kilogram (ug/kg)
Compound_Total_Petroleum_Hydrocarbons_C9_C44	identified compound	milligram per kilogram (mg/kg)
Compound_n_Nonane_C9	identified compound	milligram per kilogram (mg/kg)
Compound_n_Decane_C10	identified compound	milligram per kilogram (mg/kg)
Compound_n_Undecane_C11	identified compound	milligram per kilogram (mg/kg)
Compound_n_Dodecane_C12	identified compound	milligram per kilogram (mg/kg)
Compound_n_Tridecane_C13	identified compound	milligram per kilogram (mg/kg)
Compound_2_6_10_Trimethyldodecane_1380	identified compound	milligram per kilogram (mg/kg)
Compound_n_Tetradecane_C14	identified compound	milligram per kilogram (mg/kg)
Compound_2_6_10_Trimethyltridecane_1470	identified compound	milligram per kilogram (mg/kg)
Compound_n_Pentadecane_C15	identified compound	milligram per kilogram (mg/kg)

Compound_n_Hexadecane_C16	identified compound	milligram per kilogram (mg/kg)
Compound_Norpristane_1650	identified compound	milligram per kilogram (mg/kg)
Compound_n_Heptadecane_C17	identified compound	milligram per kilogram (mg/kg)
Compound_Pristane	identified compound	milligram per kilogram (mg/kg)
Compound_n_Octadecane_C18	identified compound	milligram per kilogram (mg/kg)
Compound_Phytane	identified compound	milligram per kilogram (mg/kg)
Compound_n_Nonadecane_C19	identified compound	milligram per kilogram (mg/kg)
Compound_n_Eicosane_C20	identified compound	milligram per kilogram (mg/kg)
Compound_n_Heneicosane_C21	identified compound	milligram per kilogram (mg/kg)
Compound_n_Docosane_C22	identified compound	milligram per kilogram (mg/kg)
Compound_n_Tricosane_C23	identified compound	milligram per kilogram (mg/kg)
Compound_n_Tetracosane_C24	identified compound	milligram per kilogram (mg/kg)
Compound_n_Pentacosane_C25	identified compound	milligram per kilogram (mg/kg)
Compound_n_Hexacosane_C26	identified compound	milligram per kilogram (mg/kg)
Compound_n_Heptacosane_C27	identified compound	milligram per kilogram (mg/kg)
Compound_n_Octacosane_C28	identified compound	milligram per kilogram (mg/kg)
Compound_n_Nonacosane_C29	identified compound	milligram per kilogram (mg/kg)
Compound_n_Triacontane_C30	identified compound	milligram per kilogram (mg/kg)
Compound_n_Hentriacontane_C31	identified compound	milligram per kilogram (mg/kg)
Compound_n_Dotriacontane_C32	identified compound	milligram per kilogram (mg/kg)
Compound_n_Tritriacontane_C33	identified compound	milligram per kilogram (mg/kg)
Compound_n_Tetratriacontane_C34	identified compound	milligram per kilogram (mg/kg)
Compound_n_Pentatriacontane_C35	identified compound	milligram per kilogram (mg/kg)
Compound_n_Hexatriacontane_C36	identified compound	milligram per kilogram (mg/kg)

Compound_n_Heptatriacontane_C37	identified compound	milligram per kilogram (mg/kg)
Compound_n_Octatriacontane_C38	identified compound	milligram per kilogram (mg/kg)
Compound_n_Nonatriacontane_C39	identified compound	milligram per kilogram (mg/kg)
Compound_n_Tetracontane_C40	identified compound	milligram per kilogram (mg/kg)
Compound_Total_Saturated_Hydrocarbons	identified compound	milligram per kilogram (mg/kg)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Gas Chromatography
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	All hydrocarbon analyses were performed with Gas Chromatography at Alpha Analytical Labs, Mansfiled MA.
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)

[table of contents | back to top]

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...

[table of contents | back to top]

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.

[table of contents | back to top]

Funding

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

[table of contents | back to top]