Temperature profiles of hydrothermal sediments measured by HOV Alvin's heat flow probe in Guaymas Basin hydrothermal vents, RV/Atlantis cruise AT42-05, Nov. 2018

Website: https://www.bco-dmo.org/dataset/878936
Data Type: Cruise Results
Version: 1
Version Date: 2022-08-25

Project
» Collaborative Research: Hydrothermal Fungi in the Guaymas Basin Hydrocarbon Ecosystem (HOTFUN)

Contributors	Affiliation	Role
Teske, Andreas	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Principal Investigator
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Abstract
Temperature profiles of hydrothermal sediments measured by HOV Alvin's heat flow probe in Guaymas Basin hydrothermal vents, RV/Atlantis cruise AT42-05, Nov. 2018.

Table of Contents

Coverage

Spatial Extent: **N**:27 **E**:-111 **S**:24 **W**:-111
Temporal Extent: 2018-11-17 - 2018-11-26

Dataset Description

Data are published in Ramírez et al., 2021 (Table 2), see related publications.

Methods & Sampling

Thermal profiles were measured in surficial sediments using Alvin's 50 cm heat flow probe in Guaymas Basin, Gulf of California (111W 27N) in November 2018. Alvin dive numbers 4991-5001.

A Heatflow probe manufactured by the Woods Hole Oceanographic Institution (WHOI) was used to measure temperature profiles. This is a 0.6 m titanium tube containing a linear heater and five thermistors (type 44032, Omega Engineering, Inc.) at 10 cm intervals along the length of the tube (personal communication with Lane J. Abrams, WHOI). The thermistors have a tolerance of +/- 0.2 up to 40C, and +/- 1 C up to 200C.

The probe has thermal sensors every 10 cm, starting 5 cm under the attached plastic disk (the “puck”) that limits probe penetration and rests on the seafloor once the probe is inserted. After approx. 3 to 5 minutes, temperature readings stabilize and are recorded. The heat flow probe shorted at the beginning of Alvin dive 5000; instead, the thermosensor within the tip of the suction intake was inserted into the sediment at approx. 5 cm, 10 cm and 20 cm depth, and the temperature was recorded immediately.

The probe is considered fully inserted when a disk at the base reaches the sediment surface, and takes temperature readings at 0, 10, 20, 30 and 40 cmbsf. For additional resolution, 5 cm depth resolution was achieved by first inserting the probe 5 cm less than complete insertion and recording one profile, and then inserting the probe the rest of the way and recording a second profile, 5 cm offset from the first. Temperatures were recorded after the readings had stabilized for each of the five depths, usually after 3 to 5 minutes.

Data Processing Description

BCO-DMO Processing Notes;
* Adjusted naming of parameters to comply with database requirements
* Converted date to ISO format
* Split up longitude and latitude in their own column

[table of contents | back to top]

Data Files

File
temperature.csv (Comma Separated Values (.csv), 44.00 KB) MD5:a03877a08a6a15288c9b5d56cd7a941b Primary data file for dataset ID 878936

[table of contents | back to top]

Related Publications

Ramírez, G. A., Mara, P., Sehein, T., Wegener, G., Chambers, C. R., Joye, S. B., Peterson, R. N., Philippe, A., Burgaud, G., Edgcomb, V. P., & Teske, A. P. (2021). Environmental factors shaping bacterial, archaeal and fungal community structure in hydrothermal sediments of Guaymas Basin, Gulf of California. PLOS ONE, 16(9), e0256321. https://doi.org/10.1371/journal.pone.0256321
Results

[table of contents | back to top]

Parameters

Parameter	Description	Units
Date	Date of sampling in ISO format, UTC timezone	unitless
Site	Sampling site	unitless
Latitude	Latitude of sampling location, south is negative	decimal degrees
Longitude	Longitude of sampling location, west is negative	decimal degrees
Dive_Number	HOV Alvin dive number	unitless
Core_Number	sediment push core number	unitless
Mats	the color of the microbial mat found on the sediment	unitless
Sediment_Depth	the sediment depth from which temperature was measured	centimeter (cm)
T	temperature	Degrees Celsius (°C)
T1	temperature	Degrees Celsius (°C)
T2	temperature	Degrees Celsius (°C)
T3	temperature	Degrees Celsius (°C)
T4	temperature	Degrees Celsius (°C)
T5	temperature	Degrees Celsius (°C)
T6	temperature	Degrees Celsius (°C)
T7	temperature	Degrees Celsius (°C)
T8	temperature	Degrees Celsius (°C)
T9	temperature	Degrees Celsius (°C)
T10	temperature	Degrees Celsius (°C)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Heatflow probe
Generic Instrument Name	Alvin Heatflow Probe 0.66m
Dataset-specific Description	A Heatflow probe manufactured by the Woods Hole Oceanographic Institution (WHOI) was used to measure temperature profiles. This is a 0.6 m titanium tube containing a linear heater and five thermistors (type 44032, Omega Engineering, Inc.) at 10 cm intervals along the length of the tube (personal communication with Lane J. Abrams, WHOI). The thermistors have a tolerance of +/- 0.2 up to 40C, and +/- 1 C up to 200C. https://ndsf.whoi.edu/alvin/using-alvin/sampling-equipment/
Generic Instrument Description	The Heatflow probe is a temperature measuring device on the submersible Alvin. It is a 0.6 m titanium tube containing a linear heater and 5 thermistors. The Heatflow probe is designed to measure temperature gradients when inserted into soft sediments.

[table of contents | back to top]

Deployments

AT42-05

Website	https://www.bco-dmo.org/deployment/773347
Platform	R/V Atlantis
Start Date	2018-11-15
End Date	2018-11-29
Description	Alvin dives to hydrothermal vent area.

[table of contents | back to top]

Project Information

Collaborative Research: Hydrothermal Fungi in the Guaymas Basin Hydrocarbon Ecosystem (HOTFUN)

Coverage: Guaymas Basin, Gulf of CA, Mexico

NSF Award Abstract:
Fungi that can derive energy from chemicals, yet consume other organisms or organic material to obtain carbon have been reported from diverse marine subsurface samples, including from hundreds of meters below the seafloor. Evidence exists that Fungi are active in subsurface marine sediments globally, yet there is a dearth of knowledge on their role in the marine subsurface, and specifically on their role(s) in hydrocarbon degradation within deep-sea sediments. This team is isolating a broad collection of environmentally relevant filamentous Fungi and yeasts from hydrothermally-influenced and hydrocarbon-rich seep sediments of Guaymas Basin using high-throughput culture-based approaches. They aim to reveal the diversity of Fungi and Bacteria in these hydrothermal sediments, how temperature and hydrocarbon composition shape their distribution, and how Fungi cooperate to enhance the degradation of hydrocarbons by Bacteria. By hosting six undergraduates through the WHOI Summer Student Fellows program and the Woods Hole Partnership Education Program, the project contributes to increasing diversity in marine science by offering opportunities for promising undergraduates from disadvantaged populations. High school students are involved in summer projects and in intensive summer workshops. One postdoc, a graduate student, and two Research Associates are supported, and international collaborations are strengthened. The postdoc and graduate student are gaining valuable cruise-based experience. An e-lecture on Fungi and their role(s) in biodegradation of hydrocarbons will be made publicly available by the end of the project. Fungal isolates with accompanying information will be secured in a reference culture collection for long-term storage and are available to any interested researcher throughout the project.

The PIs are isolating a broad collection of environmentally relevant filamentous Fungi and yeasts from hydrothermally-influenced and hydrocarbon-rich seep sediments of Guaymas Basin using high-throughput culture-based approaches, with the aim to reveal their ability to degrade individual hydrocarbons under in situ pressures and temperatures. Culture independent methods marker gene analyses are used to characterize in situ fungal and bacterial diversity and to examine how temperature and hydrocarbon composition shape fungal community composition and distribution. Traditional and comprehensive two-dimensional gas chromatographic analyses are used to examine the complexities and subtle changes in inventories of hydrocarbons within sediment cores, and provide evidence for in situ microbial alteration of individual hydrocarbons. Incubation experiments are used to test the ability of fungal isolates to utilize different hydrocarbons as a sole or auxiliary carbon source under in situ pressures and temperatures and their ability to stimulate biodegradation of hydrocarbons by hydrocarbon-degrading bacteria. Expressed genes within these incubation studies tell us how Fungi and Bacteria couple metabolisms to increase overall specificity and extent of biodegradation of hydrocarbons.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829680

[table of contents | back to top]