Microbial cell abundance and carbon, nitrogen, and sulfur content from venting fluids and microbial mats at Axial Seamount; from R/V Atlantis cruise AT18-08 in the Axial Seamount, Juan de Fuca Ridge in 2011

Website: https://www.bco-dmo.org/dataset/636098
Data Type: Cruise Results
Version: 21 Jan 2016
Version Date: 2016-01-21

Project
» Function, activity, and adaptation of microbial communities in geochemically diverse subseafloor habitats (AXIAL)

Contributors	Affiliation	Role
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Dataset Description

Microbial cell abundance and carbon, nitrogen, and sulfur content from venting fluids and microbial mats at Axial Seamount, 2011. Samples collected on cruise AT18-08.

Methods & Sampling

Diffuse fluids were collected from newly discovered snowblower vents at Axial Seamount in late July 2011 with the ROV Jason II using the hydrothermal fluid and particle sampler (Butterfield et al., 2004). White and orange flocculent materials were collected on the subsequent University of Washington Visions' 11 cruise, in support of the Regional Scale Nodes component of the Ocean Observatories Initiative in August 2011. White flocculent material was collected from the orifice of the Subway snowblower vent on dives R1467 (White Floc 1) and R1472 (White Floc 2) and orange flocculent material was collected on the seafloor distal to Marker 33 during dive R1472 where it coated freshly deposited basalt. All of the fluid and floc samples analyzed in this study are from a small area in the south rift zone at the southeastern edge of Axial Caldera, with the exception of background seawater which was collected outside of the caldera.

Subsamples of flocculent material were viewed under phase contrast, fixed and stained with DAPI for cell counting via epiflourescent microscopy, or fixed for scanning electron microscopy (SEM) with elemental detection system (EDS) on a Zeiss Supra 40VP. White and orange flocs were fixed with 2.5% glutaldehyde for both cell counts and SEM. Preserved whole fluids were also stained with DAPI for cell counts.

Bulk carbon and nitrogen were measured using a Thermo Scientific CN Analyzer (Model Flash 2000) from subsamples of flocculent material dried at 50–60 degrees C for 2 days. A standard curve for bulk carbon and nitrogen was made using aspartic acid as a standard and acetanilide and apple leaf as standard curve checks.

Bulk sulfur was measured using a LECO S632 Sulfur Analyzer from subsamples of flocculent material dried in a dessicator for 4 days and supplemented with sterile sea sand (Fisher) to meet minimum volume requirements. A standard curve for bulk sulfur was made using coal with known sulfur content provided by LECO.

Related references:
Meyer, J.L., Akerman, N.H., Proskurowski, G. and J.A. Huber. 2013. Microbiological characterization of post-eruption "snowblower" vents at Axial Seamount, Juan de Fuca Ridge. Frontiers in Microbiology. 4:153. doi:10.3389/fmicb.2013.00153

Data Processing Description

Two subsamples were analyzed for each floc sample and replicate readings were averaged for all bulk C, N, and S measurements. ± 95% confidence levels for total cell counts are reported.

BCO-DMO Processing:
- modified parameter names to conform with BCO-DMO naming conventions;
- replaced "no data" with "nd";
- removed "m" (meters) in depth column;
- changed format of date to YYYYmmdd;
- replaced commas with semi-colons;
- Added cruise_id field.

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Data Files

File	
Snowblower_CellCounts.csv	(Comma Separated Values (.csv), 1.26 KB) MD5:68c98feff81b0f4a2cecd3ec49e03550
Primary data file for dataset ID 636098	

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Parameters

Parameter	Description	Units
cruise_id	Crusie identifier.	dimensionless
geo_loc_name	Geographic location name.	dimensionless
env_feature	Environmental feature.	dimensionless
env_biome	Biome.	dimensionless
organism	Organism.	dimensionless
sample_name	Sample name.	dimensionless
lat	Latitude of sample collection.	decimal degrees
lon	Longitude of sample collection.	decimal degrees
collection_date	Year, month, and day of sample collection.	YYYYmmdd
depth	Depth of sample collection.	meters (m)
vent_name	Vent name.	dimensionless
sample_title	Sample title.	dimensionless
env_material	Material.	dimensionless
cell_count	Cell count: Cells per gram of wet floc or cells per milliliter of fluid.	cells/g or cells/mL
conf_level_95pcnt	95% confidence level for cell_count.	cells/g or cells/mL
pcnt_C	Percent Carbon.	percentage (%)
pcnt_N	Percent Nitrogen.	percentage (%)
pcnt_S	Percent Sulfur.	percentage (%)

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Instruments

Dataset-specific Instrument Name	Zeiss Supra 40VP
Generic Instrument Name	Electron Microscope
Dataset-specific Description	Subsamples of flocculent material were viewed under phase contrast, fixed and stained with DAPI for cell counting via epiflourescent microscopy, or fixed for scanning electron microscopy (SEM) with elemental detection system (EDS) on a Zeiss Supra 40VP.
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of electrons behaving as waves.

Dataset-specific Instrument Name	Thermo Scientific CN Analyzer
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	Bulk carbon and nitrogen were measured using a Thermo Scientific CN Analyzer (Model Flash 2000).
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	LECO S632 Sulfur Analyzer
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	Bulk sulfur was measured using a LECO S632 Sulfur Analyzer.
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	ROV Jason II
Generic Instrument Name	ROV Jason
Generic Instrument Description	The Remotely Operated Vehicle (ROV) Jason is operated by the Deep Submergence Laboratory (DSL) at Woods Hole Oceanographic Institution (WHOI). WHOI engineers and scientists designed and built the ROV Jason to give scientists access to the seafloor that didn't require them leaving the deck of the ship. Jason is a two-body ROV system. A 10-kilometer (6-mile) fiber-optic cable delivers electrical power and commands from the ship through Medea and down to Jason, which then returns data and live video imagery. Medea serves as a shock absorber, buffering Jason from the movements of the ship, while providing lighting and a bird's eye view of the ROV during seafloor operations. During each dive (deployment of the ROV), Jason pilots and scientists work from a control room on the ship to monitor Jason's instruments and video while maneuvering the vehicle and optionally performing a variety of sampling activities. Jason is equipped with sonar imagers, water samplers, video and still cameras, and lighting gear. Jason's manipulator arms collect samples of rock, sediment, or marine life and place them in the vehicle's basket or on "elevator" platforms that float heavier loads to the surface. More information is available from the operator site at URL.

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Deployments

AT18-08

Website	https://www.bco-dmo.org/deployment/568087
Platform	R/V Atlantis
Report	http://dmoserv3.whoi.edu/data_docs/C-DEBI/cruise_reports/AT18-08_nemo11-cruise-report.pdf
Start Date	2011-07-19
End Date	2011-08-01
Description	Data expected from C-DEBI investigator, Julie Huber. Additional cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Function, activity, and adaptation of microbial communities in geochemically diverse subseafloor habitats (AXIAL)

Website: http://www.pmel.noaa.gov/vents/index.html

Coverage: NE Pacific Ocean, Juan de Fuca Ridge, Axial Seamount

Collaborative Research: Function, activity, and adaptation of microbial communities in geochemically diverse subseafloor habitats

The integration of both laboratory and field-based chemical and microbiological measurements into a

quantitative predictive framework is crucial to understanding the microbial ecology of marine systems. This project work will provide a quantitative assessment of the functional diversity, activity, and physiological adaptation of microbial communities in geochemically diverse subseafloor habitats. Results will guide development of models for linking biogeochemical processes with particular microbial communities at deep-sea hydrothermal vents, with implications for other marine habitats as well. The focus of the effort is at Axial Seamount, a well-studied, active, deep-sea hydrothermal seamount in the NE Pacific Ocean. Samples already collected from Axial, along with a field program in Year 2, will serve as the foundation for the three objectives, which are to:

1. Determine and quantify the functional diversity and activity (expression) of key subseafloor microbial lineages at Axial Seamount.

2. Determine physiological adaptations to the subseafloor habitat by quantifying the growth response of Axial Seamount isolates to in-situ geochemical parameters.

3. Develop a quantitative predictive framework for linking particular types of geochemical vent conditions with specific microbial functional groups and activities at Axial Seamount.

Specific outcomes of this project include the creation of a comprehensive quantitative microbiological and chemical dataset on diffuse and adjacent high-temperature vents within Axial Seamount. This database will include chemical measurements (gases, nutrients, metals, isotopes, and calculated Gibbs free energies) relevant to microbial metabolic processes that can be compared to microbiological data (abundance and activity of microbial lineages and functional genes, growth rates of subseafloor isolates at relevant environmental conditions) using statistical analysis to identify how specific microbial activity is linked to the geochemical environment. This project builds on previous studies of microbial population structure and geochemical measurements at Axial Seamount and addresses critical gaps in current knowledge and understanding that are impeding progress of modeling hydrothermal systems. Results will increase understanding of deep-sea hydrothermal ecosystems as well as provide new insights into controls on the distribution and activity of marine microbial communities throughout the world's oceans.

NeMO10 TN253 Cruise Report

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0929167

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