Most probable number of various thermophiles, and total CH4 produced in microcosms from hydrothermal sampling sites from 5 cruises to the Axial Seamount, Juan de Fuca Ridge from 2012 to 2015 (NeMO2015 project)

Website: https://www.bco-dmo.org/dataset/664280
Data Type: experimental
Version:
Version Date: 2016-11-08

Project
» Event response to an eruption at Axial Seamount (NeMO2015)

Program
» Ocean Observatories Initiative (OOI)

Contributors	Affiliation	Role
Holden, James	University of Massachusetts Amherst	Principal Investigator
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Table of Contents

Dataset Description

This dataset includes Most-Probable Number (MPN, L-1) estimates of heterotrophs, H2-producing heterotrophs, methanogens, and non-methanogenic hydrogenotrophs that grow at 55 C and 80 C.

Relevant Reference: Topcuoglu, BD, Stewart LC, Morrison HG, Butterfield DA, Huber JA and Holden JF (2016) Hydrogen Limitation and Syntrophic Growth among Natural Assemblages of Thermophilic Methanogens at Deep-sea Hydrothermal Vents. Front. Microbiol. 7:1240. doi: 10.3389/fmicb.2016.01240

Related Datasets:
Axial Seamount hydrothermal sampling sites
Thermophile growth

Methods & Sampling

In August 2012, September and October 2013, August 2014, and August 2015, 7-40°C diffuse hydrothermal fluids were collected from 10 vent sites at 1515-1716 m depths from Axial Seamount on the Juan de Fuca

Ridge. The fluid samples were drawn into 650 ml Tedlar plastic bags with polyethylene valves within rigid housings using the NOAA Hydrothermal Fluid and Particle Sampler. The sampler pumped vent fluid through a titanium nozzle and recorded the temperature of the fluid within the intake nozzle once every second during pumping. Samples were collected using the research submarines Jason II and ROPOS. Background seawater was collected by shipboard hydrocasts at 1500 m depth directly over the caldera (25 m above the bottom) and 3 km west of the summit with 10 L Niskin bottles. The hydrothermal fluid and background seawater samples were divided for cultivation-dependent Most Probable Number (MPN) concentration estimates of thermophiles and hyperthermophiles (100 ml), microcosm incubations (400 ml), and total cell counts (40 ml). All operations at sea occurred on the research vessels Marcus G. Langseth, Thomas G. Thompson, Falkor, and Ronald H. Brown.

Most Probable Number (MPN) Cell Estimates: Three-tube MPN analyses were used by adding 3.3, 0.33, and 0.03 ml of the hydrothermal fluid samples in triplicate to the methanogen, autotrophic sulfur reducer, and heterotroph media. After inoculation, the tubes were incubated at 80°C and 55°C for up to 7 days. Growth in the tubes was confirmed using phase-contrast light microscopy. Growth of methanogens and H2-producing heterotrophs was verified by analyzing all of the tubes for CH4 and H2, respectively, in the headspace using gas chromatography. Total and H2-producing heterotroph cell concentration estimates were scored and reported separately based on tubes that had cells versus those with H2. In order to estimate the concentration of non-methanogenic autotrophs in the autotrophic sulfur medium, the estimated number of methanogens in the autotrophic sulfur medium MPN tubes was subtracted from the estimated concentration of total cells.

Full methodology

Data Processing Description

BCO-DMO Processing notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- replaced 'ND' with 'not_detected'
- replaced '-' with nd (no data)
- replaced blank cells with NA (not applicable)
- removed special characters '(' and ')' from site names
- reformatted table into a flat file
- added latitudes and longitudes

[table of contents | back to top]

Data Files

File
thermophile_abund.csv (Comma Separated Values (.csv), 30.68 KB) MD5:010402fef2b95468b557cddd56c47796 Primary data file for dataset ID 664280

[table of contents | back to top]

Parameters

Parameter	Description	Units
temp	experimental incubation temperature	degrees Celsius
year	sampling year	year
site	location where sample was collected	unitless
organism	type of organism in sample	unitless
MPN_L	Most-probable number of microbes in sample after incubation	cells/liter
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	phase-contrast light microscope
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Used to confirm growth of cultures
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

[table of contents | back to top]

Deployments

TN327

Website	https://www.bco-dmo.org/deployment/664100
Platform	R/V Thomas G. Thompson
Start Date	2015-08-14
End Date	2015-08-29
Description	NOAA New Millennium Observatory (NeMO) 2015/Rapid Response to an Eruption

TN300

Website	https://www.bco-dmo.org/deployment/665996
Platform	R/V Thomas G. Thompson
Start Date	2013-09-03
End Date	2013-09-19

FK010

Website	https://www.bco-dmo.org/deployment/666111
Platform	R/V Falkor
Report	https://datadocs.bco-dmo.org/d3/data_docs/Subseafloor_Life/FK010_CruiseReport_Huber_Final.pdf
Start Date	2013-09-22
End Date	2013-10-05

MGL1216

Website	https://www.bco-dmo.org/deployment/665937
Platform	R/V Marcus G. Langseth
Start Date	2012-08-16
End Date	2012-08-26

RB1403

Website	https://www.bco-dmo.org/deployment/665908
Platform	NOAA Ship Ronald H. Brown
Start Date	2014-08-07
End Date	2014-08-19

[table of contents | back to top]

Project Information

Event response to an eruption at Axial Seamount (NeMO2015)

Website: http://axial2015.blogspot.com

Coverage: Axial Seamount, Juan de Fuca Ridge, northeastern Pacific Ocean (46.06°N 130.00°W)

On 24 April 2015, the NSF-funded Ocean Observatories Initiative's (OOI) Cabled Array detected the onset of a probable eruption at Axial Seamount, heralded by a swarm of >8000 small earthquakes and a rapid subsidence of the seafloor by >2.4 meters at the center of the caldera. Evidence that lava was erupted in or near the summit caldera includes a dramatic temperature rise recorded by instruments on the OOI Cabled Array-- up to 0.6-0.7°C above ambient sustained for weeks after the event. This eruption is likely to have significantly perturbed the hydrothermal and biological systems in and around the summit caldera, and provides the rare opportunity to address time-critical scientific questions that can only be investigated with the near-term seafloor investigations. A currently scheduled NSF and NOAA funded cruise to Axial Seamount on R/V Thompson with ROV Jason and AUV Sentry in August 2015 provides an excellent opportunity for such a response. This study adds 3 days onto this cruise to facilitate time-critical event response science.

Detailed seafloor mapping with shipboard multi-beam sonar and near-bottom Sentry surveys will cover areas of the caldera and adjacent rift zones that are expected eruption site(s). Fresh rock, if located, will be sampled and dated using the 210Po-210Pb technique. Hydrothermal plumes will be discerned with CTD casts and sensor tows. A mooring will be deployed with Miniature Autonomous Plume Recorders to measure temperature, light attenuation, and redox potential. The at-sea team plans to make samples and data available to the broader science community for targeted research on seafloor processes.

[table of contents | back to top]

Program Information

Ocean Observatories Initiative (OOI)

Website: http://oceanobservatories.org/

The Ocean Observatories Initiative (OOI) is a science-driven ocean observing network that delivers real-time data to address critical science questions regarding the world's oceans. Funded by the National Science Foundation to encourage scientific investigation, OOI data are freely available online to anyone with an Internet connection. OOI was designed as a long-term project to collect ocean data for up to 30 years. This longevity makes it possible to measure and directly observe both short-lived episodic events and longer-term changes occurring in the ocean. Such data make it possible to better understand ocean processes and how the ocean is changing.

The OOI has five active research arrays that comprise the three major observatory elements linked together by instrument, infrastructure, and information management systems. Global Ocean Arrays consist of moored arrays and autonomous vehicles that provide time-series observations and mesoscale spatial sampling at sparsely sampled, high-latitude regions critical to our understanding of climate, the carbon cycle, and ocean circulation. The Regional Cabled Array consists of fiber-optic cables off the Oregon coast that provide unprecedented power, bandwidth, and communication to seafloor instrumentation and profiler moorings, enabling monitoring of volcanic and hydrothermal activity, methane seeps, earthquakes, and myriad ocean processes in coastal and blue water environments. Coastal Arrays consist of cross-shelf moored arrays and autonomous vehicles that observe the dynamic coastal environment, enabling examination of upwelling, shelf break fronts, and cross-shelf exchanges.

These marine arrays are outfitted with more than 900 instruments — of 45 different types — measuring more than 200 different parameters. These instruments gather physical, chemical, geological, and biological data – from the air-sea interface to the seafloor. The data collected are transmitted through a cyberinfrastructure, an information management system that allows users to access real- to near real-time data from suites of sensors. The OOI provides annotations and automated quality control for data streams and is working to meet the IOOS Quality Assurance of Real Time Ocean Data (QARTOD) standards.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1547004

[table of contents | back to top]