Microbial cell counts derived from the formation fluids recovered from the CORKs installed at North Pond; collected on Maria S. Merian cruises MSM20-5 and MSM37 from 2012-2014 (North Pond Microbes project)

Website: https://www.bco-dmo.org/dataset/630288
Data Type: Cruise Results
Version: 1
Version Date: 2015-12-29

Project
» Collaborative Research: Characterization of Microbial Transformations in Basement Fluids, from Genes to Geochemical Cycling (North Pond Microbes)

Programs
» Center for Dark Energy Biosphere Investigations (C-DEBI)
» International Ocean Discovery Program (IODP)

Contributors	Affiliation	Role
Girguis, Peter	Harvard University	Principal Investigator
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Coverage

Spatial Extent: **N**:22.8 **E**:-46.03 **S**:22.47 **W**:-46.09
Temporal Extent: 2012-04-25 - 2014-04-05

Dataset Description

Microbial cell counts derived from the formation fluids recovered from the CORKs (Circulation Obviation Retrofit Kits) installed at the North Pond in 2012 and 2014 on MSM20-5 and MSM37. The North Pond is an isolated, northeast-trending, ~8 km × 15 km sediment pond located on the western flank of the Mid-Atlantic Ridge (MAR) at 22°45' N and 46°05' W.

Details of these CORKS and their positions, construction and depth can be found in the Proceedings of the IODP expedition 336. See: http://publications.iodp.org/scientific_prospectus/336/336sp_6.htm

Access Restriction: Data are restricted through 2016.

In addition to NSF OCE-1061934 (to Girguis), this dataset was funded by C-DEBI (OCE-0939564) sub-award number 41940192 granted to Beate Kraft.

Methods & Sampling

Whole formation fluids and bottom seawater were fixed with 3.7% formaldehyde for cell counts. Up to 19.8 ml of fixed fluids were filtered onto a 0.2 um GTBP polycarbonate filter (Millipore), stained with DAPI (4',6'-diamidino-2-phenylindole; Sigma), and counted via epiflourescent microscopy. For fluorescence in situ hybridization (FISH), cells were filtered onto 0.2 um GTTP polycarbonate filters (Millipore) and fixed with 2% paraformaldehyde, rinsed with milliQ H2O, air dried and stored at –20 degrees C until further use. Cells on filters were hybridized with HRP-labeled 16S rRNA targeted oligonucleotide probes EUB338, ARCH915 and NON338(Biomers GmbH, Ulm, Germany), and the signal was amplified as described elsewhere using Alexa 488® tyramides (Invitrogen). The permeabilization step of the protocol before probe hybridization was modified, such that the cells on the filters were first permeabilized with Proteinase K (0.005 U ul –1 in 0.05 M EDTA, 0.1 M Tris-HCl, at pH 8) for 30 minutes at 37 degrees C. Filters were then washed in 50 ml 1X PBS at room temperature, followed by a second permeabilization treatment with Lysozyme (10^6 U ml–1, in 0.05 M EDTA, 0.1 M Tris-HCl, at pH 8) for 30 minutes at 37 degrees C. After signal amplification, all cells were counterstained with DAPI and counted via epiflourescent microscopy.

Data Processing Description

BCO-DMO Processing:
- Modified parameter names to conform with BCO-DMO naming conventions;
- Replaced blanks (missing data) with 'nd' to indicate 'no data';
- Added cruise id numbers.

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Data Files

File	
fluids_cell_counts.csv	(Comma Separated Values (.csv), 1.35 KB) MD5:47ed8c2b7ad33a89f75e7042f32bb427
Primary data file for dataset ID 630288	

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Parameters

Parameter	Description	Units
cruise_id	Cruise identifier.	dimensionless
year	4-digit year of cruise.	YYYY
date	Year-month-day.	YYYYmmdd
sample	Sample identifier. The nomenclature refers to the IODP hole and formation horizon. For example, U1383C-shallow means the fluids came from IODP CORK drillhole 1383C in the shallowest accessible porewater horizon.	dimensionless
lat	Latitude of sample. Positive = North.	decimal degrees
lon	Longitude of sample. Negative = South.	decimal degrees
dive_num	Dive number.	dimensionless
cells_per_mL	Cell count.	cells per milliliter (cells/mL)
mean	Mean cell count for the sample.	cells per milliliter (cells/mL)

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Instruments

Dataset-specific Instrument Name	epiflourescent microscopy
Generic Instrument Name	Fluorescence Microscope
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of fluorescence and phosphorescence instead of, or in addition to, reflection and absorption of visible light. Includes conventional and inverted instruments.

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Deployments

MSM20-5

Website	https://www.bco-dmo.org/deployment/555399
Platform	R/V Maria S. Merian
Report	http://dmoserv3.whoi.edu/data_docs/Huber/Fahrtbericht_MSM20_5_02.pdf
Start Date	2012-04-11
End Date	2012-05-10

MSM37

Website	https://www.bco-dmo.org/deployment/555401
Platform	R/V Maria S. Merian
Report	https://datadocs.bco-dmo.org/d3/data_docs/North_Pond_Microbes/msm37_cruise_rpt_downld2018-02-12.pdf
Start Date	2014-03-22
End Date	2014-04-21
Description	Conducted operations on subseafloor observatories (CORKs) installed during IODP Leg 336 to examine hydrological-geochemical-microbiological interactions in North Pond. The remotely operated vehicle (ROV) Jason II of the Woods Hole Oceanographic Institution (Woods Hole, USA) was the main operational tool.

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Project Information

Collaborative Research: Characterization of Microbial Transformations in Basement Fluids, from Genes to Geochemical Cycling (North Pond Microbes)

Coverage: North Pond, mid-Atlantic Ridge

Description from NSF award abstract:
Current estimates suggest that the volume of ocean crust capable of sustaining life is comparable in magnitude to that of the oceans. To date, there is little understanding of the composition or functional capacity of microbial communities in the sub-seafloor, or their influence on the chemistry of the oceans and subsequent consequences for global biogeochemical cycles. This project focuses on understanding the relationship between microbial communities and fluid chemistry in young crustal fluids that are responsible for the transport of energy, nutrients, and organisms in the crust. Specifically, the PIs will couple microbial activity measurements, including autotrophic carbon, nitrogen and sulfur metabolisms as well as mineral oxide reduction, with quantitative assessments of functional gene expression and geochemical transformations in basement fluids. Through a comprehensive suite of in situ and shipboard analyses, this research will yield cross-disciplinary advances in our understanding of the microbial ecology and geochemistry of the sub-seafloor biosphere. The focus of the effort is at North Pond, an isolated sediment pond located on ridge flank oceanic crust 7-8 million years old on the western side of the Mid-Atlantic Ridge. North Pond is currently the target for drilling on IODP expedition 336, during which it will be instrumented with three sub-seafloor basement observatories.

The project will leverage this opportunity for targeted and distinct sampling at North Pond on two German-US research cruises to accomplish three main objectives:

1. to determine if different basement fluid horizons across North Pond host distinct microbial communities and chemical milieus and the degree to which they change over a two-year post-drilling period.

2. to quantify the extent of autotrophic metabolism via microbially-mediated transformations in carbon, nitrogen, and sulfur species in basement fluids at North Pond.

3. to determine the extent of suspended particulate mineral oxides in basement fluids at North Pond and to characterize their role as oxidants for fluid-hosted microbial communities.

Specific outcomes include quantitative assessments of microbial activity and gene expression as well as geochemical transformations. The program builds on the integrative research goals for North Pond and will provide important data for guiding the development of that and future deep biosphere research programs. Results will increase understanding of microbial life and chemistry in young oceanic crust as well as provide new insights into controls on the distribution and activity of marine microbial communities throughout the worlds oceans.

There are no data about microbial communities in ubiquitous cold, oceanic crust, the emphasis of the proposed work. This is an interdisciplinary project at the interface of microbial ecology, chemistry, and deep-sea oceanography with direct links to international and national research and educational organizations.

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Program Information

Center for Dark Energy Biosphere Investigations (C-DEBI)

Website: http://www.darkenergybiosphere.org

Coverage: Global

The mission of the Center for Dark Energy Biosphere Investigations (C-DEBI) is to explore life beneath the seafloor and make transformative discoveries that advance science, benefit society, and inspire people of all ages and origins.

C-DEBI provides a framework for a large, multi-disciplinary group of scientists to pursue fundamental questions about life deep in the sub-surface environment of Earth. The fundamental science questions of C-DEBI involve exploration and discovery, uncovering the processes that constrain the sub-surface biosphere below the oceans, and implications to the Earth system. What type of life exists in this deep biosphere, how much, and how is it distributed and dispersed? What are the physical-chemical conditions that promote or limit life? What are the important oxidation-reduction processes and are they unique or important to humankind? How does this biosphere influence global energy and material cycles, particularly the carbon cycle? Finally, can we discern how such life evolved in geological settings beneath the ocean floor, and how this might relate to ideas about the origin of life on our planet?

C-DEBI's scientific goals are pursued with a combination of approaches:
(1) coordinate, integrate, support, and extend the research associated with four major programs—Juan de Fuca Ridge flank (JdF), South Pacific Gyre (SPG), North Pond (NP), and Dorado Outcrop (DO)—and other field sites;
(2) make substantial investments of resources to support field, laboratory, analytical, and modeling studies of the deep subseafloor ecosystems;
(3) facilitate and encourage synthesis and thematic understanding of submarine microbiological processes, through funding of scientific and technical activities, coordination and hosting of meetings and workshops, and support of (mostly junior) researchers and graduate students; and
(4) entrain, educate, inspire, and mentor an interdisciplinary community of researchers and educators, with an emphasis on undergraduate and graduate students and early-career scientists.

Note: Katrina Edwards was a former PI of C-DEBI; James Cowen is a former co-PI.

Data Management:
C-DEBI is committed to ensuring all the data generated are publically available and deposited in a data repository for long-term storage as stated in their Data Management Plan (PDF) and in compliance with the NSF Ocean Sciences Sample and Data Policy. The data types and products resulting from C-DEBI-supported research include a wide variety of geophysical, geological, geochemical, and biological information, in addition to education and outreach materials, technical documents, and samples. All data and information generated by C-DEBI-supported research projects are required to be made publically available either following publication of

research results or within two (2) years of data generation.

To ensure preservation and dissemination of the diverse data-types generated, C-DEBI researchers are working with BCO-DMO Data Managers make data publicly available online. The partnership with BCO-DMO helps ensure that the C-DEBI data are discoverable and available for reuse. Some C-DEBI data is better served by specialized repositories (NCBI's GenBank for sequence data, for example) and, in those cases, BCO-DMO provides dataset documentation (metadata) that includes links to those external repositories.

International Ocean Discovery Program (IODP)

Website: http://www.iodp.org/index.php

Coverage: Global

The International Ocean Discovery Program (IODP) is an international marine research collaboration that explores Earth's history and dynamics using ocean-going research platforms to recover data recorded in seafloor sediments and rocks and to monitor subseafloor environments. IODP depends on facilities funded by three platform providers with financial contributions from five additional partner agencies. Together, these entities represent 26 nations whose scientists are selected to staff IODP research expeditions conducted throughout the world's oceans.

IODP expeditions are developed from hypothesis-driven science proposals aligned with the program's science plan *Illuminating Earth's Past, Present, and Future*. The science plan identifies 14 challenge questions in the four areas of climate change, deep life, planetary dynamics, and geohazards.

IODP's three platform providers include:

- The U.S. National Science Foundation (NSF)
- Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- The European Consortium for Ocean Research Drilling (ECORD)

More information on IODP, including the Science Plan and Policies/Procedures, can be found on their website at http://www.iodp.org/program-documents.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1061934
NSF Division of Ocean Sciences (NSF OCE)	OCE-0939564

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