Net oxygen consumption rates of the fluids recovered from the CORKs installed at North Pond; collected on Maria S. Merian cruise MSM37 in 2014

Website: https://www.bco-dmo.org/dataset/630314
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
» International Ocean Discovery Program (IODP)
» Center for Dark Energy Biosphere Investigations (C-DEBI)

Contributors	Affiliation	Role
Girguis, Peter	Harvard University	Principal Investigator
Glazer, Brian	University of Hawai'i at Mānoa (SOEST)	Co-Principal Investigator
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Abstract
This dataset includes net oxygen consumption rates of the fluids recovered from the CORKs installed at North Pond; collected on Maria S. Merian cruise MSM37 in 2014.

Table of Contents

Coverage

Spatial Extent: **N**:22.8 **E**:-46.03 **S**:22.47 **W**:-46.09
Temporal Extent: 2014-03-22 - 2014-04-21

Dataset Description

Net oxygen consumption rates of the fluids recovered from the CORKs (Circulation Obviation Retrofit Kits) installed at the North Pond in 2014 on MSM37.

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

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

To determine potential rates of oxygen consumption, 20 mL of freshly sampled fluids were incubated in sterile, combusted serum vials. For this, fluids were injected into the butyl stoppered serum vials using a 60 mL syringe and hypodermic needle using sterile technique. Overpressure was released by insertion of a second hypodermic needle. Oxygen was monitored optically via optical sensor spots (Presens) mounted to the inner wall of the vials. Fluids not containing particles >3 um diameter and sterile controls were set up as described above but with an additional filter (3 um and 0.2 um pore size respectively) inserted between the syringe outlet and the hypodermic needle. Tubes were incubated in the dark at 5 degrees C.

Data Processing Description

BCO-DMO Processing:
- Transposed original table so that parameter names are columns, rather than rows;
- Modified parameter names to conform with BCO-DMO naming conventions;
- Replaced blanks (missing data) with 'nd' to indicate 'no data';
- Added year and cruise id numbers;
- Corrected longitude value of bottom seawater sample from positive to negative.

[table of contents | back to top]

Data Files

File
O2_consumption.csv (Comma Separated Values (.csv), 330 bytes) MD5:598f0a9db2d3342dfd223e9740d6fd6b Primary data file for dataset ID 630314

[table of contents | back to top]

Parameters

Parameter	Description	Units
cruise_id	Cruise identifer.	dimensionless
year	4-digit year of cruise.	YYYY
site	Site 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
dive_num	Dive number.	dimensionless
date	Year-month-day.	YYYYmmdd
lat	Latitude of sample. Positive = North.	decimal degrees
lon	Longitude of sample. Negative = South.	decimal degrees
O2_consump_no_particles	Oxygen consumption; no particles (<3 um).	micromoles per liter per day (umol/l/d)
O2_consump_whole_fluids	Oxygen consumption; whole fluids.	micromoles per liter per day (umol/l/d)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Presens optical sensor spots
Generic Instrument Name	Optode
Dataset-specific Description	Oxygen was monitored optically via optical sensor spots (Presens) mounted to the inner wall of the vials.
Generic Instrument Description	An optode or optrode is an optical sensor device that optically measures a specific substance usually with the aid of a chemical transducer.

[table of contents | back to top]

Deployments

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.

[table of contents | back to top]

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.

[table of contents | back to top]

Program Information

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.

A summary table with links to IODP datasets currently hosted on Zenodo (https://zenodo.org/communities/iodp) can be accessed using the following link: https://iodp.tamu.edu/database/zenodo.html

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.

[table of contents | back to top]

Funding

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

[table of contents | back to top]