Dissolved organic carbon and total dissolved nitrogen from the formation fluids recovered from the CORKs installed at the North Pond; collected on Maria S. Merian cruise MSM20-5 in 2012

Website: https://www.bco-dmo.org/dataset/630362
Data Type: Cruise Results
Version: 1
Version Date: 2015-12-30

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
Glazer, Brian	University of Hawai'i at Mānoa (SOEST)	Co-Principal Investigator
Huber, Julie	Marine Biological Laboratory (MBL)	Co-Principal Investigator
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Abstract
This dataset includes dissolved organic carbon and total dissolved nitrogen from the formation fluids recovered from the CORKs installed at the North Pond; collected on Maria S. Merian cruise MSM20-5 in 2012.

Table of Contents

Coverage

Spatial Extent: **Lat**:22.75 **Lon**:-46.08333
Temporal Extent: 2008-04-19 - 2008-04-30

Dataset Description

Dissolved organic carbon and total dissolved nitrogen from the formation fluids recovered from the CORKs installed at the North Pond in 2012 on MSM20-5. 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

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

Dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) were measured by high temperature (680 ºC) combustion using a Shimadzu TOC-L analyzer at the SOEST Laboratory for Analytical Biogeochemistry, University of Hawaii. Samples analyzed include those filtered in situ for crustal fluids as well as the CTD samples filtered on deck. Samples were acidified to pH <2 within the autosampler syringe and were purged with nitrogen to remove inorganic carbon. Five to six replicate analyses were performed using an injected sample volume of 150 µL. The detection limits of DOC and TDN were about 2 and 1.5 uM, respectively. Two consensus reference materials CRM, from University of Miami, deep seawater and low carbon water, were used extensively before, between, and after sample analysis to monitor analytical accuracy. The analytical reproducibility for DOC and TDN is better than 1.1 uM and 460 0.2 uM, respectively, by repeated analysis of four deep seawater CRM.

Data Processing Description

BCO-DMO Processing:
- Modified parameter names to conform with BCO-DMO naming conventions;
- Replaced commas with semi-colons;
- Replaced spaces with underscores;
- Added cruise id numbers.

[table of contents | back to top]

Data Files

File
DOC_TDN.csv (Comma Separated Values (.csv), 495 bytes) MD5:b1f2edb8d5cc6c9f2a679d1379b55b13 Primary data file for dataset ID 630362

[table of contents | back to top]

Parameters

Parameter	Description	Units
UH_Cowen_ID	UH_Cowen identification number.	dimensionless
cruise_id	Cruise identifier.	dimensionless
site	Sampling site name. 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
DOC	Dissolved organic carbon.	micromolar (uM)
TDN	Total dissolved nitrogen.	micromolar (uM)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Shimadzu TOC-L analyzer
Generic Instrument Name	Shimadzu TOC-L Analyzer
Dataset-specific Description	Dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) were measured by high temperature (680 degrees C) combustion using a Shimadzu TOC-L analyzer at the SOEST Laboratory for Analytical Biogeochemistry, University of Hawaii.
Generic Instrument Description	A Shimadzu TOC-L Analyzer measures DOC by high temperature combustion method. Developed by Shimadzu, the 680 degree C combustion catalytic oxidation method is now used worldwide. One of its most important features is the capacity to efficiently oxidize hard-to-decompose organic compounds, including insoluble and macromolecular organic compounds. The 680 degree C combustion catalytic oxidation method has been adopted for the TOC-L series. http://www.shimadzu.com/an/toc/lab/toc-l2.html

[table of contents | back to top]

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

[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

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.

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

[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]