

Scanning Transmission X-Ray Microscopy raw images and spectra for aXis 2000 analysis software packages from the Maria S. Merian from 2012-2014 (North Pond Microbes project)

Website: <https://www.bco-dmo.org/dataset/565388>

Data Type: Cruise Results

Version: 2015-09-02

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
Glazer, Brian	University of Hawaii at Manoa (SOEST)	Principal Investigator
Girguis, Peter	Harvard University	Co-Principal Investigator
Huber, Julie	Marine Biological Laboratory (MBL)	Co-Principal Investigator
Toner, Brandy Marie	University of Minnesota Twin Cities (UMTC)	Co-Principal Investigator
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

This dataset includes Scanning Transmission X-Ray Microscopy raw images and spectra for aXis 2000 analysis software packages. Samples from the North Pond CORK Observatories were filtered during RV/Maria S. Merian cruises MSM20-5 and MSM37 during 2012 and 2014 expeditions. Contact PI for lab notebook notes to describe images and spectra. Archive files are grouped by date of trips to Berkeley's Advanced Light Source: 2013_01, 2013_10, 2014_09. They are in .zip compressed files.

Table of Contents

- [Coverage](#)
- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
- [Data Files](#)
- [Related Publications](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)
- [Project Information](#)
- [Program Information](#)
- [Funding](#)

Coverage

Spatial Extent: N:22.802068 E:-46.05277 S:22.755883 W:-46.081517

Temporal Extent: 2013-01 - 2014-09

Dataset Description

Download data files:

2013_01 - http://dmoserv3.bco-dmo.org/data/glazer/North_Pond_Microbes/STXM/ALS_STX...

2013_10 - http://dmoserv3.bco-dmo.org/data/glazer/North_Pond_Microbes/STXM/ALS_STX...

Methods & Sampling

Standard Scanning transmission X-ray microscopy (STXM) analyses on particulates collected from subsamples from fluid sampling activities at IODP CORK Observatories.

Details for ROV sampling instrumentation are provided in Cowen, et al. (2012).

Data Processing Description

BCO-DMO Processing:

- Added conventional header with dataset name, PI name, version date
- Created links to download the .zip files from the data object

[[table of contents](#) | [back to top](#)]

Data Files

File
STXM.csv (Comma Separated Values (.csv), 417 bytes) MD5:dce4d091d882243bc681d8d02ffbad Primary data file for dataset ID 565388

[[table of contents](#) | [back to top](#)]

Related Publications

Cowen, J. P., Copson, D. A., Jolly, J., Hsieh, C.-C., Lin, H.-T., Glazer, B. T., & Wheat, C. G. (2012). Advanced instrument system for real-time and time-series microbial geochemical sampling of the deep (basaltic) crustal biosphere. *Deep Sea Research Part I: Oceanographic Research Papers*, 61, 43-56.

doi:[10.1016/j.dsr.2011.11.004](https://doi.org/10.1016/j.dsr.2011.11.004)

Methods

Wheat, C. G., Becker, K., Villinger, H., Orcutt, B. N., Fournier, T., Hartwell, A., & Paul, C. (2020). Subseafloor Cross-Hole Tracer Experiment Reveals Hydrologic Properties, Heterogeneities, and Reactions in Slow-Spreading Oceanic Crust. *Geochemistry, Geophysics, Geosystems*, 21(1). doi:10.1029/2019gc008804

<https://doi.org/10.1029/2019GC008804>

Results

[[table of contents](#) | [back to top](#)]

Parameters

Parameter	Description	Units
date_run	Year and month of analysis.	yyyy-mm
download	Link to downloadable .zip file.	unitless

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	GeoMICROBE
Generic Instrument Name	GeoMICROBE
Dataset-specific Description	Autonomous sled with sensors and fluid sampling system.
Generic Instrument Description	Integrated Ocean Drilling Program borehole CORK (Circulation Obviation Retrofit Kit) observatories provide long-term access to hydrothermal fluids circulating within the basaltic crust (basement), providing invaluable opportunities to study the deep biosphere. We describe the design and application parameters of the GeoMICROBE instrumented sled, an autonomous sensor and fluid sampling system. The GeoMICROBE system couples with CORK fluid delivery lines to draw large volumes of fluids from crustal aquifers to the seafloor. These fluids pass a series of in-line sensors and an in situ filtration and collection system. GeoMICROBE's major components include a primary valve manifold system, a positive displacement primary pump, sensors (e.g., fluid flow rate, temperature, dissolved O ₂ , electrochemistry-voltammetry analyzer), a 48-port in situ filtration and fluid collection system, computerized controller, seven 24 V-40 A batteries and wet-mateable (ODI) communications with submersibles. This constantly evolving system has been successfully connected to IODP Hole 1301A on the eastern flank of the Juan de Fuca Ridge. Reference: Cowen, J.P., Copson, D., Jolly, J., Hsieh, C.-C., Matsumoto, R., Glazer, B.T. et al. (2012) Advanced instrument system for real-time and time-series microbial geochemical sampling of the deep (basaltic) crustal biosphere., Deep-Sea Research I, 61: 43-56 doi:10.1016/j.dsr.2011.11.004

Dataset-specific Instrument Name	Scanning Transmission X-Ray Microscope
Generic Instrument Name	X-Ray Microscope
Dataset-specific Description	Used for particle analysis
Generic Instrument Description	An X-ray microscope uses electromagnetic radiation in the soft X-ray band to produce images of very small objects. The resolution of X-ray microscopy lies between that of the optical microscope and the electron microscope.

[[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

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 world's 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>.

[[table of contents](#) | [back to top](#)]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1061827

[[table of contents](#) | [back to top](#)]