Inventory of fluid and filter samples collected for carbon composition and isotope analysis from R/V Atlantis cruise AT39-01 at the North Pond CORK Sites U1382A and U1383C during October 2017

Website: https://www.bco-dmo.org/dataset/723493
Data Type: Cruise Results
Version: 1
Version Date: 2018-01-12

Project
» Collaborative Research: A multidimensional approach to understanding microbial carbon cycling beneath the seafloor during cool hydrothermal circulation (Subseafloor Microbial Carbon Cycling)

Program
» Center for Dark Energy Biosphere Investigations (C-DEBI)

Contributors	Affiliation	Role
Girguis, Peter	Harvard University	Principal Investigator
Shah Walter, Sunita R.	Harvard University	Co-Principal Investigator
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Abstract
This dataset is an inventory of fluid and filter samples collected for carbon composition and isotope analysis from R/V Atlantis cruise AT39-01 at the North Pond CORK Sites U1382A and U1383C during October 2017.

Table of Contents

Coverage

Spatial Extent: **N**:22.812723 **E**:-46.05277 **S**:22.755885 **W**:-46.081518
Temporal Extent: 2017-10-11 - 2017-10-15

Dataset Description

Inventory of fluid and filter samples collected for carbon composition and isotope analysis during R/V Atlantis cruise AT39-01 at North Pond IODP CORK observatories U1382A and U1383C.

Acquisition Description

Detailed methodology for fluid recovery described in (Meyer et al., 2016).

All fluids transferred from sampling bags by peristaltic pump through Masterflex Bio-Pharm silicone tubing and PFA or PVDF fittings. All tubing and fittings precleaned with in 10% HCl and rinsed with MilliQ water.

Whole water samples transferred to pre-combusted amber glass bottles and sealed with PFTE-line lids and stored frozen at -80°C.

Samples meant for DIC and alkalinity measurements sampled according to NOSAMS protocol (http://www.whoi.edu/fileserver.do?id=75006&pt=2&p=75096). Poisoned samples stored at room temperature in the dark.

Samples meant for DOC analysis were filtered through pre-combusted 47 mm Sterlitech GF75 filters into pre-combusted amber glass bottles sealed with PFTE-lined lids. Sampled stored at -40°C until analysis.

Filters collected at the seafloor by the Mobile Pumping System (MPS) described in (Cowen et al., 2012).

Fluids filtered sequentially through 5 µm nylon woven mesh (Spectrum Labs), Whatman GF/F and Sterlitech GF75 and stored frozen at -80°C wrapped in pre-combusted aluminum foil.

Processing Description

BCO-DMO Processing:
- replaced spaces with underscores in parameter names;
- converted latitude and longitude to decimal degrees;
- replaced spaces with underscores in Location_Description.

[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
Methods

Meyer, J. L., Jaekel, U., Tully, B. J., Glazer, B. T., Wheat, C. G., Lin, H.-T., … Huber, J. A. (2016). A distinct and active bacterial community in cold oxygenated fluids circulating beneath the western flank of the Mid-Atlantic ridge. Scientific Reports, 6(1). doi:10.1038/srep22541
Methods

Shah Walter, S. R., Jaekel, U., Osterholz, H., Fisher, A. T., Huber, J. A., Pearson, A., … Girguis, P. R. (2018). Microbial decomposition of marine dissolved organic matter in cool oceanic crust. Nature Geoscience, 11(5), 334–339. doi:10.1038/s41561-018-0109-5
Results

Trembath-Reichert, E., Shah Walter, S. R., Ortiz, M. A. F., Carter, P. D., Girguis, P. R., & Huber, J. A. (2021). Multiple carbon incorporation strategies support microbial survival in cold subseafloor crustal fluids. Science Advances, 7(18), eabg0153. doi:10.1126/sciadv.abg0153
Results

[table of contents | back to top]

Parameters

Parameter	Description	Units
Location_Description	Location description/name	unitless
Latitude	Latitude; positive values = North	decimal degrees
Longitude	Longitude; negative values = West	decimal degrees
Depth	Depth	m or mbsf
m_or_mbsf	Indicates whether depth is water depth (m) or meters below seafloor (mbsf)	unitless
Date_Sampled	Date of sampling formatted as mm/dd/yyyy	unitless
CTD_cast_or_Jason_Dive_Number	"CTD" if CTD cast or Jason dive number	unitless
Fluid_Volume_Sampled	Fluid volume sampled	milliliters (mL)
Type_of_Sample_or_Treatment	Type of sample/treatment	unitless
storage_conditions	Description of storage conditions	unitless
notes	Notes/comments	unitless

[table of contents | back to top]

Deployments

AT39-01

Website	https://www.bco-dmo.org/deployment/723337
Platform	R/V Atlantis
Report	http://datadocs.bco-dmo.org/docs/Subseafloor_Microbial_Carbon_Cycling/data_docs/North_Pond_2017_Expedition%20Report_FINAL.pdf
Start Date	2017-10-02
End Date	2017-11-02

[table of contents | back to top]

Project Information

Collaborative Research: A multidimensional approach to understanding microbial carbon cycling beneath the seafloor during cool hydrothermal circulation (Subseafloor Microbial Carbon Cycling)

Coverage: The "North Pond" sedimented site in the Mid-Atlantic ridge. This is an IODP study site. The coordinates are 22 ° and 23°N by 44°30 ' to 46°20'W

NSF abstract:

The global ocean comprises Earth's largest microbiome, with at least half of the ocean's microbial biomass occurring beneath the ocean floor. In particular, oceanic crust encompasses the largest aquifer on Earth, with a liquid volume equal to approximately 2% of the ocean's volume. It also harbors a substantial reservoir of microbial life that may influence global-scale biogeochemical cycles. This project investigates this largest actively flowing aquifer system on Earth- the fluids circulating through oceanic crust underlying the oceans and sediments. Despite advancing knowledge about life in the deep ocean, the understanding of microorganisms in the rocky oceanic crust and the fluids flowing through it remains rudimentary. This project is focused on understanding the linkages between microbial activity and the cycling of carbon in the cool, subseafloor biosphere. The balance between organic carbon-consuming and organic carbon-producing metabolisms within the crustal biosphere will be determined using seafloor observatories put in place by the International Ocean Discovery Program (IODP) on the flanks of the Mid-Atlantic Ridge, likely representative of the majority of global hydrothermal fluid circulation. The rates of microbial transformations of carbon will be determined using both geochemical and biological approaches. Results will help establish the extent to which microbially-mediated processes in the subseafloor influence carbon cycling in the ocean. This work will represent the first comprehensive description of carbon cycling in the cold oxic crustal aquifer. Two female postdocs will be supported on the grant, and both high school and community college students will also be involved through collaborations with Cape Cod Community College and Cambridge-Rindge and Latin School. The goal is to promote science, technology, engineering and math literacy among high-school and community college students through hand-on research experiences, peer-to-peer mentoring, and professional development opportunities.

The goal of the project is to answer the question "is the cool crustal subseafloor biosphere net autotrophic or net heterotrophic?" 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. The two objectives of the project are to:

1. Characterize suspended particles in subseafloor fluids with respect to their inorganic and organic carbon content, and natural ^{14}C and ^{13}C isotopic ratios, to determine microbially-mediated fluxes and processes.

2. Characterize the net influence of particle-associated and free-living microbial communities on subseafloor fluid primary production and remineralization, as well as the taxon-specific contributions to these same processes.

The integration of isotope geochemical and molecular biological approaches represents a significant cross-disciplinary advance in the understanding of the microbial ecology and geochemistry of the subseafloor biosphere in young oceanic crust and their role in maintaining global deep-sea redox balance. Expected outcomes include identifying signatures of autotrophic and heterotrophic metabolism in particle-associated and free-living subseafloor microbial communities as well as quantification of autotrophic and heterotrophic metabolism and associated taxon-abundances to provide insights into the net and specific microbial processes in crustal fluids on carbon fluxes.

[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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1635365

[table of contents | back to top]