

# Particulate organic carbon from the formation fluids recovered from the CORKs installed at North Pond; collected on Maria S. Merian cruise MSM20-5 in 2012

**Website:** <https://www.bco-dmo.org/dataset/630335>

**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
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## Abstract

This dataset includes particulate organic carbon from the formation fluids recovered from the CORKs installed at North Pond; collected on Maria S. Merian cruise MSM20-5 in 2012.

## Table of Contents

- [Coverage](#)
- [Dataset Description](#)
  - [Acquisition Description](#)
  - [Processing Description](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)
- [Project Information](#)
- [Program Information](#)
- [Funding](#)

## Coverage

**Spatial Extent:** Lat:22.75 Lon:-46.08333

**Temporal Extent:** 2012-04-11 - 2012-05-10

## Dataset Description

Particulate organic carbon (POC) 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](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.

## Acquisition Description

Carbon and nitrogen concentrations of particulate organic matter were measured by the Biogeochemical Stable Isotope Facility at School of Ocean and Earth Science and Technology, University of Hawaii. A few drops of sulfurous acid (6-9 % of H<sub>2</sub>SO<sub>3</sub>) were added to wet the filter and to remove inorganic carbon from the filter. The acidified filters were transferred to a 60 degree C oven for 24 hours. The dried filters were then transferred into a tin capsule before placing within a high temperature combustion CN elemental analyzer (Costech, ECS 4010) connected in-line with a Mass Spectrometer (ThermoFinnigan Delta XP interfaced with a ConFloIV) for analysis of their organic carbon and nitrogen isotopic compositions. The detection limit for carbon and nitrogen content is 10 ug-C and 0.3 ug-N, respectively. The limit for reliable carbon and nitrogen isotopic determination is 10 ug-C and 10 ug-N, respectively.

## Processing Description

BCO-DMO Processing:

- Modified parameter names to conform with BCO-DMO naming conventions;
- Replaced "n.a." with "nd" to indicate "no data";
- Replaced "u.d." with "bel\_det" to indicate "below detection";
- Replaced commas with semi-colons;
- Replaced spaces with underscores;
- Added cruise id numbers.

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

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## Parameters

Parameter	Description	Units
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
cruise_id	Cruise identifier.	dimensionless
dive_num	Dive number.	dimensionless
method	Sampling method.	dimensionless
PN_ug	Particulate nitrogen.	micrograms (ug)
del15N	delta 15N	per mille vs air (‰)
OC	Organic Carbon (?)	micrograms (ug)
del13C	delta 13C	per mille (‰) vs VPDB
vol_filt	Volume filtered.	milliliters (mL)
POC	Particulate organic carbon.	micromoles per Liter (umol/L)
PN_umolL	Particulate nitrogen.	micromoles per Liter (umol/L)
C_to_N	Molar ratio of carbon to nitrogen.	Molar ratio C/N
fraction_C	1/C	1/micrograms (1/ug)

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

## Instruments

<b>Dataset-specific Instrument Name</b>	ThermoFinnigan Delta XP
<b>Generic Instrument Name</b>	Mass Spectrometer
<b>Dataset-specific Description</b>	The dried filters were then transferred into a tin capsule before placing within a high temperature combustion CN elemental analyzer (Costech, ECS 4010) connected in-line with a Mass Spectrometer (ThermoFinnigan Delta XP interfaced with a ConFloIV) for analysis of their organic carbon and nitrogen isotopic compositions.
<b>Generic Instrument Description</b>	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

<b>Dataset-specific Instrument Name</b>	Costech, ECS 4010
<b>Generic Instrument Name</b>	Elemental Analyzer
<b>Dataset-specific Description</b>	The dried filters were then transferred into a tin capsule before placing within a high temperature combustion CN elemental analyzer (Costech, ECS 4010) connected in-line with a Mass Spectrometer (ThermoFinnigan Delta XP interfaced with a ConFloIV) for analysis of their organic carbon and nitrogen isotopic compositions.
<b>Generic Instrument Description</b>	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

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

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## Deployments

### MSM20-5

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

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

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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 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](#) ]

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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 seafloor 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](#) ]

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1061934</a>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-0939564</a>

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