# Pore water chemical concentration data and location from push cores collected by the ROV Jason II on dive J2-773 from cruise MSM37 on R/V Maria S. Merian from March to April 2014

**Website**: https://www.bco-dmo.org/dataset/764875
**Data Type**: Cruise Results
**Version**: 1
**Version Date**: 2019-04-11

**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 |
|---|---|---|
| Wheat, C. Geoffrey | Monterey Bay Aquarium Research Institute (MBARI) | Principal Investigator |
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**Abstract**
Pore water chemical concentration data and location from push cores collected by the ROV Jason II on dive J2-773 from cruise MSM37 on R/V Maria S. Merian on 11-April-2014.

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## Coverage

**Spatial Extent**: **N**:22.82078 **E**:-46.11082 **S**:22.8204 **W**:-46.11083
**Temporal Extent**: 2014-04-11

### Methods & Sampling

Push cores were collected by the ROV Jason II on dive J2-773 on 11-April-2014.

Pore waters were extracted in a cold room at 4C using acid-rinsed, washed and dried rhizomes. The first 2 ml of fluid was discarded, then the remaining fluid was filtered through a 0.45 micron membrane and stored in hot acid (60C) washed high-density polyethylene bottles. Fluids were analyzed by electrode (pH), titration (chlorinate, calcium, and alkalinity), colorimetric (nitrate), inductively coupled optical emission spectroscopy (ICPOES), and inductively coupled mass spectroscopy (ICPMS). Precision was generally 0.2% for chlorinate and calcium titrations, 2% for alkalinity titrations, 0.01  for pH, 5% for nitrate determinations, 2% for ICPOES measurements and 5% for ICPMS measurements. All measurements were above detection limits with the exception of Mn (0.1 umol/kg) and Fe (0.01 mol/kg).

Careful consideration of these data should examine the potential of sampling artifacts for many of the solutes. We believe, for example, the Ca difference from bottom seawater values is an artifact of sample handling, resulting from the movement of sediment with carbonate present to the ship where the sediment was handled. Other solutes are likewise probably affected.

**Data Processing Description**

BCO-DMO Processing:
- copied core ID number from header row to all corresponding data rows;
- moved notes into new "notes" column for all corresponding data rows;
- deleted empty rows;
- created lat/lon columns using info from the notes column;
- replaced "---" and blank cells with "nd" for "no data".

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## Data Files

| File |
|---|
| **pore_water_2014.csv** (Comma Separated Values (.csv), 8.80 KB)<br>MD5:2d152c09d8a2862d17be5de7ab727a76<br>Primary data file for dataset ID 764875 |

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| Core | Core identification number | unitless |
| Depth | Depth below seafloor, in centimeters | centimeters (cm) |
| pH | pH; measured by electrode | unitless (pH scale) |
| alkalinity | Alkalinity; measured by titration | millimoles per kilogram (mmol/kg) |
| Nitrate | Nitrate concentration; measured colorimetrically | micromoles per kilogram (umol/kg) |
| Chlorinity | Chlorinity; measured by titration | millimoles per kilogram (mmol/kg) |
| Ca | Calcium (Ca) concentration; measured by titration | millimoles per kilogram (mmol/kg) |
| B | Boron (B) concentration; measured by ICP-OES | micromoles per kilogram (umol/kg) |

| | | |
|---|---|---|
| Mn | Manganese (Mn) concentration; measured by ICP-OES | micromoles per kilogram (umol/kg) |
| Fe | Iron (Fe) concentration; measured by ICP-OES | micromoles per kilogram (umol/kg) |
| Si | Silicon (Si) concentration; measured by ICP-OES | micromoles per kilogram (umol/kg) |
| Sr | Strontium (Sr) concentration; measured by ICP-OES | micromoles per kilogram (umol/kg) |
| Li | Lithium (Li) concentration; measured by ICP-OES | micromoles per kilogram (umol/kg) |
| S | Sulfur (S) concentration; measured by ICP-OES | millimoles per kilogram (mmol/kg) |
| Na | Sodium (Na) concentration; measured by ICP-OES | millimoles per kilogram (mmol/kg) |
| Mg | Magnesium (Mg) concentration; measured by ICP-OES | millimoles per kilogram (mmol/kg) |
| K | Potassium (K) concentration; measured by ICP-OES | millimoles per kilogram (mmol/kg) |
| V | Vanadium (V) concentration; measured by ICPMS | nanomoles per kilogram (nmol/kg) |
| Rb | Rubidium (Rb) concentration; measured by ICPMS | micromoles per kilogram (umol/kg) |
| Mo | Molybenum (Mo) concentration; measured by ICPMS | nanomoles per kilogram (nmol/kg) |
| Cs | Cesium (Cs) concentration; measured by ICPMS | nanomoles per kilogram (nmol/kg) |
| Ba | Barium (Ba) concentration; measured by ICPMS | nanomoles per kilogram (nmol/kg) |
| U | Uranium (U) concentration; measured by ICPMS | nanomoles per kilogram (nmol/kg) |
| Lat | Latitude in decimal degrees; calculated from position described in Notes column | degrees North |
| Lon | Longitude in decimal degrees; calculated from position described in Notes column; Negative values = West | degrees East |
| Notes | Notes and comments pertaining to the core | unitless |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | ICPMS |
| **Generic Instrument Name** | Inductively Coupled Plasma Mass Spectrometer |
| **Generic Instrument Description** | An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | ICPOES |
| **Generic Instrument Name** | Inductively Coupled Plasma Optical Emission Spectrometer |
| **Generic Instrument Description** | Also referred to as an Inductively coupled plasma atomic emission spectroscope (ICP-AES). These instruments pass nebulised samples into an inductively-coupled gas plasma (8-10000 K) where they are atomised and excited. The de-excitation optical emissions at characteristic wavelengths are spectroscopically analysed. It is often used in the detection of trace metals. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | ROV Jason Push Core |
| **Generic Instrument Name** | Push Corer |
| **Generic Instrument Description** | Capable of being performed in numerous environments, push coring is just as it sounds. Push coring is simply pushing the core barrel (often an aluminum or polycarbonate tube) into the sediment by hand. A push core is useful in that it causes very little disturbance to the more delicate upper layers of a sub-aqueous sediment. Description obtained from: http://web.whoi.edu/coastal-group/about/how-we-work/field-methods/coring/ |

| | |
|---|---|
| **Dataset-specific Instrument Name** | ROV Jason II |
| **Generic Instrument Name** | ROV Jason |
| **Generic Instrument Description** | The Remotely Operated Vehicle (ROV) Jason is operated by the Deep Submergence Laboratory (DSL) at Woods Hole Oceanographic Institution (WHOI). WHOI engineers and scientists designed and built the ROV Jason to give scientists access to the seafloor that didn't require them leaving the deck of the ship. Jason is a two-body ROV system. A 10-kilometer (6-mile) fiber-optic cable delivers electrical power and commands from the ship through Medea and down to Jason, which then returns data and live video imagery. Medea serves as a shock absorber, buffering Jason from the movements of the ship, while providing lighting and a bird's eye view of the ROV during seafloor operations. During each dive (deployment of the ROV), Jason pilots and scientists work from a control room on the ship to monitor Jason's instruments and video while maneuvering the vehicle and optionally performing a variety of sampling activities. Jason is equipped with sonar imagers, water samplers, video and still cameras, and lighting gear. Jason's manipulator arms collect samples of rock, sediment, or marine life and place them in the vehicle's basket or on "elevator" platforms that float heavier loads to the surface. More information is available from the operator site at URL. |

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## 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. |

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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 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.

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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 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.

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## Funding

| Funding Source | Award |
| --- | --- |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1061934 |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1061827 |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1062006 |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-0939564 |


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