

# Chemistry from discrete samples of hydrothermal springs sampled by the HOV Alvin during R/V Atlantis cruise AT26-24 at Dorado Outcrop in December of 2014

**Website:** <https://www.bco-dmo.org/dataset/664454>

**Data Type:** Cruise Results

**Version:**

**Version Date:** 2016-11-10

## Project

» [Discovery, sampling, and quantification of flows from cool yet massive ridge-flank hydrothermal springs on Dorado Outcrop, eastern Pacific Ocean](#) (Dorado Outcrop)

## Program

» [Center for Dark Energy Biosphere Investigations](#) (C-DEBI)

Contributors	Affiliation	Role
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## Table of Contents

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

## Dataset Description

This dataset contains chemistry from discrete hydrothermal water samples collected by syringe. Dissolved inorganic carbon (DIC), stable carbon isotope ratio (d13C), stable carbon isotope ratio of dissolved inorganic carbon (13C/12C ratio in DIC), alkalinity, chlorinity, the concentration of nitrate plus nitrite, and pH are included in the data. Concentrations of the following elements and compounds are also included; Mo, V, Rb, Cs, U, PO4, silicic acid, Sr, Li, S, Na, Ca, Mg, K, B, Mn, Fe. Latitude, longitude, and date of the Alvin dives that collected these data are also included. Collection occurred during the R/V Atlantis cruise AT26-24.

## Methods & Sampling

Syringe samples of hydrothermal water were collected during Alvin dives.

The Alvin dives were conducted off the west coast of Costa Rica in the Pacific Ocean at Dorado Outcrop during

the R/V Atlantis cruise AT26-24. For more information about operations of this cruise see the cruise pages which contain links to cruise reports ([AT26-24](#))

## Chemical Measurements:

All fluids were measured using established standard protocols. At sea, alkalinity was determined potentiometrically via titration with 0.1N hydrochloric acid; a pH measurement is conducted as part of this procedure. An Inductively Coupled Plasma Optical Emission Spectrophotometer (ICPOES) was used to measure Na, K, Sr, Li, Mg, Ca, and S with a 1:200 dilution and Sr, Li, Fe, Mn, and B with a 1:25 dilution in 1% nitric acid. An inductively coupled plasma mass spectrometry (ICP-MS) was used to analyze Rb, Cs, Ba, Mo, V and U with a 1:75 dilution in 3% nitric acid. Nutrients (silicate, phosphate, total nitrogen and nitrate) were measured at Oregon State University using standard colorimetric, automated, segmented flow procedures. Chlorinity was determined potentiometrically via titration with silver nitrate. Carbon analyses were conducted at Oregon State University

## Data Processing Description

The data have not been processed further.

BCO-DMO Processing Notes:

- \* added a conventional header with dataset name, PI name, version date
- \* modified parameter names to conform with BCO-DMO naming conventions
- \* added lat, lon, and date of Alvin dives as listed in the [Alvin Dive Log](#)

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

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## Data Files

File
<b>HydroThermDiscrete.csv</b> (Comma Separated Values (.csv), 5.31 KB) MD5:eb549e081f7971627a19fec446361dda Primary data file for dataset ID 664454

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

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## Parameters

Parameter	Description	Units
dive_id	Alvin submersible dive identifier	unitless
dive_date	Alvin submersible dive date in format yyyy-mm-dd	unitless
dive_lat	Alvin submersible dive latitude; north is positive	decimal degrees
dive_lon	Alvin submersible dive longitude; east is positive	decimal degrees
sample_id	Sample identifier	unitless
DIC	Dissolved inorganic carbon using Pee Dee Belemnite (PDB) standard	permil (0/00)
DIC_stdev	Standard deviation of dissolved inorganic carbon using the Pee Dee Belemnite (PDB) standard	permil (0/00)
DIC_d13C	Stable carbon isotope ratio of dissolved inorganic carbon (13C:12C ratio in DIC) using the Pee Dee Belemnite (PDB) standard	permil (0/00)
DIC_d13C_stdev	Standard deviation of stable carbon isotope ratio of dissolved inorganic carbon (13C:12C ratio in DIC) using the Pee Dee Belemnite (PDB) standard	permil (0/00)

Mo	Molybdenum concentration	nanomoles per kilogram (nmol/Kg)
V	Vanadium concentration	nanomoles per kilogram (nmol/Kg)
pH	pH	pH scale
alkalinity	Alkalinity	millimoles per kilogram (umol/Kg)
chlorinity	Chlorinity	millimoles per kilogram (umol/Kg)
Rb	Rubidium concentration	nanomoles per kilogram (nmol/Kg)
Cs	Cesium concentration	nanomoles per kilogram (nmol/Kg)
U	Uranium concentration	nanomoles per kilogram (nmol/Kg)
PO4	Phosphate concentration	micromolar (uM)
N_plus_N	Nitrate plus Nitrite concentration	micromolar (uM)
silicic_acid	Silicic acid concentration	micromolar (uM)
Sr	Strontium concentration	micromoles per kilogram (umol/Kg)
Li	Lithium concentration	micromoles per kilogram (umol/Kg)
S	Sulfur concentration	millimoles per kilogram (umol/Kg)
Na	Sodium concentration	millimoles per kilogram (umol/Kg)
Ca	Cadmium concentration	millimoles per kilogram (umol/Kg)
Mg	Magnesium concentration	millimoles per kilogram (umol/Kg)
K	Potassium concentration	millimoles per kilogram (umol/Kg)
B	Boron concentration	micromoles per kilogram (umol/Kg)
Mn	Manganese concentration	micromoles per kilogram (umol/Kg)

Fe	Iron concentration	micromoles per kilogram (umol/Kg)
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[ [table of contents](#) | [back to top](#) ]

## Instruments

<b>Dataset-specific Instrument Name</b>	syringe sample taken by Alvin
<b>Generic Instrument Name</b>	Discrete water sampler
<b>Generic Instrument Description</b>	A device that collects an in-situ discrete water sample from any depth and returns it to the surface without contamination by the waters through which it passes, such as a water bottle.

<b>Dataset-specific Instrument Name</b>	inductively coupled plasma mass spectrometry (ICP-MS)
<b>Generic Instrument Name</b>	Inductively Coupled Plasma Mass Spectrometer
<b>Generic Instrument Description</b>	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.

<b>Dataset-specific Instrument Name</b>	Inductively Coupled Plasma Optical Emission Spectrophotometer (ICPOES)
<b>Generic Instrument Name</b>	Inductively Coupled Plasma Optical Emission Spectrometer
<b>Generic Instrument Description</b>	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.

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

## Deployments

AT26-24

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/627856">https://www.bco-dmo.org/deployment/627856</a>
<b>Platform</b>	R/V Atlantis
<b>Report</b>	<a href="http://dmoserv3.who.edu/data_docs/C-DEBI/cruise_reports/AT26-24_Dorado_Outcrop_2014_Cruise_Report_reduced.pdf">http://dmoserv3.who.edu/data_docs/C-DEBI/cruise_reports/AT26-24_Dorado_Outcrop_2014_Cruise_Report_reduced.pdf</a>
<b>Start Date</b>	2014-11-30
<b>End Date</b>	2014-12-12
<b>Description</b>	Research was conducted on this cruise as part of the C-DEBI project titled "Discovery, sampling, and quantification of flows from cool yet massive ridge-flank hydrothermal springs on Dorado Outcrop, eastern Pacific Ocean" (see: <a href="http://www.bco-dmo.org/project/627844">http://www.bco-dmo.org/project/627844</a> ).

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

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## Project Information

### Discovery, sampling, and quantification of flows from cool yet massive ridge-flank hydrothermal springs on Dorado Outcrop, eastern Pacific Ocean (Dorado Outcrop)

**Website:** <http://www.darkenergybiosphere.org/research/dorado.html>

**Coverage:** Dorado Outcrop near Cocos Ridge (9N, 87W)

#### *Description from NSF award abstract:*

Pristine fluids from a typical ridge-flank hydrothermal system have never been sampled, mainly because it has not been possible to locate a site of focused discharge where representative samples could be collected. The PIs have located a small basement feature, Dorado outcrop, on 23 m.y.-old seafloor on the eastern flank of the East Pacific Rise that they plan to sample to determine the fluid composition, and to assess the rate of discharge from the outcrop, so that they can quantify the chemical impact of this hydrothermal system. They plan an 18-day expedition that combines the surveying capabilities of the AUV Sentry (bathymetric, sub-bottom sonar, photo mosaics, water column anomalies) and an ocean-class vessel capable of collecting high-quality multi-beam data and CTD samples, and supporting the survey and sampling capabilities of the ROV Jason II for collection of spring and plume fluids, heat flow data, sediment push cores, and still and video photography. These data and samples will be combined hopefully to generate the first well-constrained estimates of hydrothermal flows from Dorado outcrop. This expedition will result in the collection of samples and data from a "fire hose" of ridge-flank, hydrothermal system, challenging the commonly held view that discharge from ridge flank hydrothermal systems occurs primarily from diffuse seeps.

[ [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 seafloor 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](#) ]

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## **Funding**

<b>Funding Source</b>	<b>Award</b>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1130146</a>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1131210</a>

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