CH4, H2, CO, and d13C concentrations from the Strytan Hydrothermal Field collected by SCUBA July 15-8 2012 (C-DEBI, Lost City-type hydrothermal system project)

Website: https://www.bco-dmo.org/dataset/685511
Version:
Version Date: 2017-03-22

Project
» A Lost City-type hydrothermal system in readily accessible, shallow water (Lost City-type hydrothermal system)

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

Contributors	Affiliation	Role
Price, Roy	Stony Brook University (SUNY Stony Brook)	Principal Investigator
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Abstract
The data include field geochemistry (pH, Temp, oxidation-reduction potential (ORP), and TDS), as well as H2S, DIC, major, minor and trace elements in vent fluids, and dissolved gas concentrations (H2, CH4) and isotopic composition d13C-CH4. Data were collected at the Strytan Hydrothermal Field (SHF) during a CDEBI-funded expedition July 15-18, 2012.

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Coverage

Spatial Extent: **N**:66.025228 **E**:-18.09397 **S**:65.824674 **W**:-18.400214

Dataset Description

These data have been submitted to BCO-DMO and are in the process of being served.

Methods & Sampling

Samples were collected from 3 sites: Big Strytan, Arnarnasstrytan, and Hrisey (see lat/lon below). SCUBA diving was utilized to collect vent fluids and hydrothermal precipitates. Vent fluids for geochemistry were sampled in sterile 60 ml syringes. The first 20 ml was discarded to decrease the amount of seawater contamination during sampling. Vent fluid sampling for dissolved gases consisted of 2 methods: 1) the “syringe-to- syringe” method (STS), and 2) the “syringe-to-bottle” method (STB). The STS method consisted of pulling 40 ml of vent fluid at the end of a dive, transporting it back to the lab, and equilibrating the fluid with 20

ml of purified N2. The gas was then injected into Cali-5-Bond gas sampling bags for transport prior to analysis by GC. The STB method consisted of pulling a known volume of vent fluid (typically 40 ml) into a syringe, and immediately injecting into a 60 ml N2-flushed, evacuated, serum bottle.

Temperatures were measured in situ using a temperature probe. The pH/ORP/Conductivity/TDS were measured on shore using a Myron-L field pH meter. Aliquots for H2S measurements were preserved in the field by precipitation of ZnS following the addition of 1 ml of a 50 mM zinc acetate solution to a 3 ml sample, placed on dry ice, and analyzed in the laboratory with a spectrophotometer at a wavelength of 670 nm. Samples for anion analysis (Br, Cl, and SO4) were filtered in the field (0.2 um), placed on dry ice, and kept frozen until measurement in the laboratory using ion chromatography. Samples for analysis of major cations and trace elements (Na, B, Mg, Si, K, Ca, Al, As, V, Cr, Cu, Zn, Sr, Mo, and W) were preserved in the field by filtering (0.2 um) and acidification with 0.1% ultrapure HNO3, and measured by inductively coupled plasma-mass spectrometry (ICP-MS). Dissolved gases (H2, CH4, and CO), as well as organic acids and DIC, were analyzed at NASA Ames in the lab of Tori Hoehler. D13C-CH4 was measured at Montana State University by Eric Boyd.

Data Processing Description

BCO-DMO Data Manager Processing Notes:
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions
* blank values replaced with no data value 'nd'
* location names, latitude, and longitude added

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	inductively coupled plasma-mass spectrometry (ICP-MS)
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	Myron-L field pH
Generic Instrument Name	pH Sensor
Dataset-specific Description	pH/ORP/Conductivity/TDS were measured on shore using a Myron-L field pH meter.
Generic Instrument Description	An instrument that measures the hydrogen ion activity in solutions. The overall concentration of hydrogen ions is inversely related to its pH. The pH scale ranges from 0 to 14 and indicates whether acidic (more H+) or basic (less H+).

Dataset-specific Instrument Name	
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	spectrophotometer at a wavelength of 670 nm
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

Dataset-specific Instrument Name	temperature probe
Generic Instrument Name	Water Temperature Sensor
Generic Instrument Description	General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).

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Deployments

Strytan_SCUBA_2012

Website	https://www.bco-dmo.org/deployment/685426
Platform	Iceland
Start Date	2012-07-15
End Date	2012-07-18
Description	Strytan Hydrothermal Field (SHF) sampling during a CDEBI-funded expedition July 15-18, 2012. Sampled locations: Big Strytan: 65.824674, -18.093970 Arnarnasstrytan: 65.879169, -18.221686 Hrisey: 66.025228, -18.400214

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Project Information

A Lost City-type hydrothermal system in readily accessible, shallow water (Lost City-type

hydrothermal system)

The Strytan Hydrothermal Field (SHF; Eyjafjord, northern Iceland) exhibits alkaline (pH ~ 10), hot (up to 78 degrees C), submarine hydrothermal venting, resulting in the formation of numerous saponite towers. We performed a detailed geochemical and microbiological characterization of hydrothermal fluids and precipitates from the site. End-member calculations revealed elevated concentrations of many major and trace elements (e.g., 2.4 mM Na, 3 to 27 uM K, 40 to 120 uM Ca, 10 to 25 uM B, and overall high concentrations of trace elements). We hypothesize that recharge of meteoric water occurs in the mountains south of Eyjafjord, and low temperature alteration of plagioclase, pyroxene and olivine in basalt, and precipitation of calcite, occurs in a closed system. This explains the observed high pH, variable Ca concentrations, and low DIC. CH4, H2, and CO concentrations were all elevated relative to normal seawater (up to 1.41, 5.19, and 0.13 uM, respectively), and a range of δ13C-CH4 was measured. Weathering of pyroxene may produce H2, which combines with CO2 to form abiotic CH4. The abiotic production of H2 and CH4 in a site such as the SHF broadens the range of potential origin of life environments significantly. Intact polar lipids indicate Bacteria dominated all samples except one. Up to 50% of the lipids at this site were archaeal. Bacterial clone sequences were dominated by betaproteobacteria (*Dechloromonas sp.*), followed by deltaproteobacteria (*Desulfovibrio sp.*) Archaeal results indicate a dominance of Crenarchaeota, particularly Thermoproteales, followed by *Desulfurococcales*. More detailed analysis of microbial communities is currently underway.

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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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0939564

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