Samples collected and their associated temperatures on an expedition to the Lost City hydrothermal field on R/V Atlantis cruise AT42-01 in September 2018

Website: https://www.bco-dmo.org/dataset/782197
Data Type: Cruise Results
Version: 1
Version Date: 2020-03-25

Project
» Collaborative Research: Investigating the Lost City as an ultramafic urban center of the subseafloor, fueled by energy and carbon from the mantle (Lost City Limits to Life)

Contributors	Affiliation	Role
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Abstract
Summary of samples collected by the Hydrothermal Organic Geochemistry (HOG) sampler on AT-4201 with ROV Jason, on dives J2_1107 through J2_1111, during R/V Atlantic cruise AT42-01, September 9 - October 1, 2018.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Parameters
- Instruments
- Deployments
- Project Information
- Funding

Coverage

Spatial Extent: **N**:30.1299858 **E**:-42.1187256 **S**:30.1237075 **W**:-42.1222159
Temporal Extent: 2018-09-16 - 2018-09-21

Dataset Description

Summary of samples collected by the Hydrothermal Organic Geochemistry (HOG) sampler on AT-4201 with ROV Jason, on dives J2_1107 through J2_1111, during R/V Atlantic cruise AT42-01, September 9 - October 1, 2018.

Methods & Sampling

Fluid samples were collected into either 2 L or 11 L kynar bags that were acid washed (10% HCl soak overnight, followed by through rinsing, overnight Milli-Q soak, and further rinsing). Sample for geochemistry were collected unammended. Samples for microbiology were pre-spiked with 13C-labeled formate, bicarbonate, or methane, or with preservative. Additional samples were collected by filtering fluids in situ through sterivex filters.

Average T refers to the average of the fluid temperature measured while the sample was being collected. Temperatures were measured with NKE Instrumentation Temperature sensors (P/N S2T6000-Ti-DH; P/N 60-07-326-002). "N.D." is no data.

Data Processing Description

BCO-DMO Processing:
- created Sample_Descrip column;
- re-formatted date to yyyy-mm-dd;
- added start and end date/time columns in ISO 8601 format;
- replaced commas with semi-colons in the Comment column.

[table of contents | back to top]

Data Files

File
AT42-01_Collected_Fluids.csv (Comma Separated Values (.csv), 18.89 KB) MD5:259bbef045451f87ae2f713c6338b520 Primary data file for dataset ID 782197

[table of contents | back to top]

Parameters

Parameter	Description	Units
Sample_Descrip	Sample description	unitless
Sample_ID	Sample identifier	unitless
Sample_Type	Sample type	unitless
Site	Site name	unitless
Date_GMT	Date (GMT); format: yyyy-mm-dd	unitless
Start_Time_GMT	Start time (GMT); format: HH:MM	unitless
End_Time_GMT	End time (GMT); format: HH:MM	unitless
Average_T	Average temperature	degrees Celsius
Highest_T	Highest temperature	degrees Celsius
Comment	Comment/notes	unitless
ISO_DateTime_Start_GMT	Date and time at start (GMT) formatted ISO 8601 standard; format: yyyy-mm-ddTHH:MM:SSZ	unitless
ISO_DateTime_End_GMT	Date and time at end (GMT) formatted ISO 8601 standard; format: yyyy-mm-ddTHH:MM:SSZ	unitless
Latitude	Latitude	decimal degrees North
Longitude	Longitude (negative values = West)	decimal degrees East

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	ROV Jason
Dataset-specific Description	The Hydrothermal Organic Geochemistry (HOG) sampler was designed to collect hydrothermal fluids for biogeochemical and microbiological analyses. It consists of seven 2-liter and two 11-liter sample chambers for natural abundance geochemistry connected to a titanium intake nozzle with an in situ temperature probe. A second titanium intake nozzle with an in situ temperature probe is connected to seven 2-liter sample chambers devoted to incubation experiments, and five Sterivex filters for trapping microbial cell-sized particles. The HOG Sampler was deployed on all but one dive and is described in more detail in the methods section of the cruise report. Temperatures were measured with NKE Instrumentation Temperature sensors (P/N S2T6000-Ti-DH; P/N 60-07-326-002).
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.

[table of contents | back to top]

Deployments

AT42-01

Website	https://www.bco-dmo.org/deployment/782074
Platform	R/V Atlantis
Report	https://datadocs.bco-dmo.org/docs/Lost_City_Limits_to_Life/data_docs/AT42-01_Cruise%20Report_reduced.pdf
Start Date	2018-09-08
End Date	2018-10-01

[table of contents | back to top]

Project Information

Collaborative Research: Investigating the Lost City as an ultramafic urban center of the subseafloor, fueled by energy and carbon from the mantle (Lost City Limits to Life)

Coverage: Lost City Hydrothermal Field

NSF Award Abstract:
The vast majority of deep seafloor sediments are inhabited by microbial communities that survive under extreme energy limitation, with apparent generation times of centuries to millennia. Hydrothermal systems are a stark contrast to these energy-starved environments and may represent important, high-activity, 'population centers' in the oceanic subsurface. When rocks from the Earth's mantle are uplifted and exposed to water, the resulting reactions lead to acidic fluids with high concentrations of hydrogen. Under certain circumstances, small organic molecules such as methane can also form in the absence of biology. These compounds can provide energy to subseafloor microbial communities and, given the ubiquity of mantle rocks, such reactions may fuel a significant proportion of the active subsurface biosphere. The current project will characterize the microbial communities inhabiting an iconic example of this type of system, the Lost City Hydrothermal Field, using a remotely operated vehicle. The ghostly spires of Lost City are highly telegenic and have been featured in professional documentaries. The high definition underwater video footage collected during the expedition will provide the raw material for an 8 week educational training program in digital media focused on kindergarten through 12th grade high school students and undergraduate students. The resulting short documentaries will be published on YouTube and the Utah Education Network.

Mantle rocks comprise significant portions of the seafloor, and microbial communities hosted within them may be important mediators of carbon and energy exchange between the deep Earth and the surface biosphere. Upon tectonic uplift and exposure to water, the serpentinization of these materials releases potential energy in the form of hydrogen, methane, and heat, and further reaction of these products can sustain the abiogenic synthesis of small organic molecules. Recent studies have highlighted, however, the lack of alkalithermophiles that are capable of survival at the high pH (9-11) and elevated temperatures found in these systems. The almost complete lack of carbon dioxide (CO2) represents a second, and possibly more significant, limitation to growth. To better understand the extent of the serpentinite subsurface, this project will address the question: What limits biological activity in the serpentinite subsurface? Specifically, the proposed work will test the hypotheses: (1) microbial diversity spans a wider range of temperature-pH conditions than currently recognized and (2) the scarcity of CO2 is a key biological limitation to serpentinization-driven ecosystems that can be overcome by the metabolic activity of one or a few foundation species. These hypotheses will be tested during a 20 day (10 days on site) expedition to the Lost City Hydrothermal Field, focusing on fluids as windows to the subsurface biosphere. The sampling approach will capitalize on the differences in temperature, carbon availability, and microbial activity across the field. The analytical approach will integrate multidisciplinary techniques performed on replicate subsamples and feature the application of next-generation sequencing technologies to these marine serpentinizing fluids for the first time. This study will generate extensive sequence data from environmental DNA, environmental mRNA, and single-cell genomes, allowing us to identify the in situ expression of metabolic pathways and the genomics of active single cells. These efforts will be closely linked with a thorough characterization of carbon in these fluids that will focus on identifying available substrates (e.g. methane, CO2, organic acids) and on characterizing biomarkers that reflect specific metabolic pathways (e.g. lipids, amino acids).

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536702
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536405
NSF Division of Ocean Sciences (NSF OCE)	OCE-1535962

[table of contents | back to top]