Vent fluid chemistry from R/V Atlantis AT26-10 and AT26-23 in the East Pacific Rise, Pacific Ocean from 2013-2014 (Microbial Communities at Deep-Sea Vents project)

Website: https://www.bco-dmo.org/dataset/674781
Data Type: Cruise Results
Version: 1
Version Date: 2017-01-13

Project
» An Integrated Study of Energy Metabolism, Carbon Fixation, and Colonization Mechanisms in Chemosynthetic Microbial Communities at Deep-Sea Vents (Microbial Communities at Deep-Sea Vents)

Programs
» Dimensions of Biodiversity (Dimensions of Biodiversity)
» Center for Dark Energy Biosphere Investigations (C-DEBI)

Contributors	Affiliation	Role
Seewald, Jeffrey S.	Woods Hole Oceanographic Institution (WHOI)	Principal Investigator
Sievert, Stefan M.	Woods Hole Oceanographic Institution (WHOI)	Co-Principal Investigator
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Abstract
This dataset is the chemical composition of hydrothermal fluids collected during research cruises AT26-10 and AT26-23 at the 9ºN deep-sea hydrothermal vent field on the East Pacific Rise, Pacific Ocean.

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Coverage

Spatial Extent: **Lat**:9.8387 **Lon**:-104.2912

Methods & Sampling

- All fluids were collected using isobaric gas-tight fluid samplers (Seewald et al., 2002).
- Temperature was measured during sample collection using a type-J thermocouple attached to the inlet snorkel. Reported values are maximums observed during sample collection.

Analytical methods:
pH: Ag/AgCl combination reference electrode
Na+, K+, Ca2+, Mg2+, Cl-, Br-, SO42- : ion chromatography with suppressed conductivity detectionCH4: gas chromatography with flame ionization detection

H2: gas chromatography with thermal conductivity detection

Data Processing Description

BCO-DMO Processing:
- Added conventional header with dataset name, PI name, version date
- Modified parameter names to conform with BCO-DMO naming conventions
- Replaced blanks (missing data) and 'nd' to indicate 'no data'
- Added cruise_id column

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Data Files

File
vent_fluid_chemistry.csv (Comma Separated Values (.csv), 3.50 KB) MD5:8ffa300d3051a6d117d063ba875d3f9d Primary data file for dataset ID 674781

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Related Publications

Seewald, J. S., Doherty, K. W., Hammar, T. R., & Liberatore, S. P. (2002). A new gas-tight isobaric sampler for hydrothermal fluids. Deep Sea Research Part I: Oceanographic Research Papers, 49(1), 189–196. doi:10.1016/s0967-0637(01)00046-2 https://doi.org/10.1016/S0967-0637(01)00046-2
Methods

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Related Datasets

IsSupplementedBy

Reysenbach, A., Seewald, J. S. (2021) **Sampling overview from R/V Roger Revelle cruise RR1507 in the Eastern Lau Spreading Center in 2015 (Functional microbial dynamics of vent deposits project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2015-09-21 doi:10.26008/1912/bco-dmo.566965.1 [view at BCO-DMO]

Sievert, S. M., Seewald, J. S., Taylor, C. (2021) **Sample log from Jason-II dives for Sievert collected from the R/V Atlantis (AT26-10) in the East Pacific Rise, Pacific Ocean (Microbial Communities at Deep-Sea Vents project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2015-05-26 doi:10.26008/1912/bco-dmo.559780.1 [view at BCO-DMO]

IsRelatedTo

Seewald, J. S. (2017) **Chemical composition of hydrothermal fluids collected on RV/Roger Revelle RR1507 in the Eastern Lau Spreading Center and Valu Fa Ridge, April-May 2015 (Functional microbial dynamics of vent deposits project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2017-01-13 http://lod.bco-dmo.org/id/dataset/674750 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
cruise_id	Cruise identifier	unitless
lat	Latitude; north is positive	degrees
lon	Longitude; east is positive	degrees
sample	Sample identifier	unitless
vent_site	Vent site name	unitless
temp	Temperature	degrees Celsius
pH_25C	pH at 25 degrees C	unitless
Na_mmol_kg	Sodium concentration	millimoles/kilogram (mmol/kg)
K_mmol_kg	Potassium concentration	millimoles/kilogram (mmol/kg)
Mg_mmol_kg	Magnesium concentration	millimoles/kilogram (mmol/kg)
Ca_mmol_kg	Calcium concentration	millimoles/kilogram (mmol/kg)
Cl_mmol_kg	Chloride concentration	millimoles/kilogram (mmol/kg)
SO4_mmol_kg	Sulfate concentration	millimoles/kilogram (mmol/kg)
Br_mmol_kg	Bromide concentration	millimoles/kilogram (mmol/kg)
H2S_mmol_L	Hydrogen sulfide concentration	millimoles/kilogram (mmol/kg)
H2_umol_L	Hydrogen gas concentration	micromoles/kilogram (umol/kg)
CH4_umol_L	Methane concentration	micromoles/kilogram (umol/kg)

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Isobaric Gas-Tight Sampler
Dataset-specific Description	Used for sample collection
Generic Instrument Description	Isobaric Gas Tight (IGT) samplers, designed and built by scientists and engineers at WHOI, are titanium instruments designed to be used with deep submergence vehicles to sample corrosive hydrothermal vent fluids at high temperature and high pressure. The IGT prevents the sampled fluid from degassing as pressure decreases during the vehicle's ascent to the surface.

Dataset-specific Instrument Name	
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. https://ndsf.whoi.edu/jason/

Dataset-specific Instrument Name	type-J thermocouple attached to the inlet snorkel
Generic Instrument Name	Water Temperature Sensor
Dataset-specific Description	Used to measure in-situ temperature.
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

AT26-10

Website	https://www.bco-dmo.org/deployment/529031
Platform	R/V Atlantis
Report	http://dmoserv3.bco-dmo.org/data_docs/Microbe_Vent_Communities/AT26-10_Cruise_Report_v2_2015-07-09.pdf
Start Date	2013-12-29
End Date	2014-01-27
Description	Samples were collected by ROV Jason II at the 9N deep-sea hydrothermal vent field on the East Pacific Rise, Pacific Ocean

AT26-23_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/550445
Platform	HOV Alvin
Start Date	2014-11-02
End Date	2014-11-21
	[DMO NOTE-This deployment was added for Costa Vetriani's 'chemosynthetic biofilm diversity' dataset but then he asked to have it removed. I'm leaving it here in case he submits data for these dives in the future. - njc, 2015-02-10] The Alvin dives of cruise AT26-23 (dive numbers 4761 through 4774) are listed below, with dive members and synopses. All took place in the East Pacific Rise hydrothermal vent area. Alvin Dive Pilot Observers Synopsis Dive: 4761 Pilot: Bob Waters Observers: Stefan Sievert, Jesse McNichol Synopsis: Dive started a Pvent, where pieces of fresh chimney were collected. Temperature was measured at 325ºC. We proceeded to check on the larval colonization site of Lauren Mullineaux close to Pvent (bucket lid marker O). Took photos and video. Proceeded north to Crab Spa area. We deployed two colonizers at Riftia colony below Crab Spa, one in diffuse 30ºC flow, one away from venting. Collected water samples with sippers in Riftia colony and collected Riftia of various sizes. We then took four IGT samples at Crab Spa, and fired Niskin off axis before ascending. Dive: 4762 Pilot: Bruce Strickrott Observers: Katie Scott, Jefferson Grau Synopsis: We were tasked with collecting a black smoker from Bio9, Riftia, and 4 IGT samples at Crab Spa. On the way down, the starbourd thruster developed a ground fault. Based on diminished maneuverability we decided to punt on the black smoker collection and move on to the water sample and Riftia collections. We cruised to Crab Spa, where we took four IGT samplers at 18-32C from the shimmering water emerging from the top of the feature. From there, we went to the base of the feature where there is a large Riftia clump. We temperature-probed the clump, collected four water samples using the Wheat squeezer samplers, and collected many small Riftia from the clump. Bruce trained Jefferson how to collect Riftia without damaging them, and Jefferson did a great job with this. We still had a little time, so we cruised toward Bio9 to perhaps collect a smoker, but ran out of time before we found a suitable smoker to collect. It was a very successful dive. Dive: 4763 Pilot: Phil Forte Observers: Craig Taylor, Jeremy Rich Synopsis: The first item of business was the deployment of the Vent-SID, that was deployed to the bottom within ~50 m of the sampling site via hydro-wire the night before. The instrument was brought to a site (x-4575 y-78160) that had a crack in the sea floor that was emanating vent fluids at about 40 C. The instrument umbilicus wand was inserted into the crack and the instrument initiated for automated sampling and tracer incubations (19:02 GMT). IGT #6 and #4 were fired at the Vent-SID sampling sight to obtain chemistry and gas samples (17:56, 18:07 GMT for IGT 6 & 4, respectively). Alvin motored to Crab Spa to obtain fluid samples, IGT #'s 2 and 5 (x-4598 y-78148, temp 23-24C. 19:32 & 19:44 GMT, IGT 2, 5 respectively. About 30 mussels were collected at Crab Spa and stored in BioBox (x-4600 y-78150, temperature at sampling site ranged between 4.5-6.0C. 20:00 - 20:05 GMT. Bacterial colonizers (#CV-84 & 85) were placed in a well developed bed of Riftia (x-4595 y-78163), temperatures above the colonizers fluctuated substantially and ranged between 8-12C. 20:16 - 20:20 GMT. Alvin motored to Bio 9 black smokers to collect 2 chimney samples that were deposited in separate small bioboxes. Chimney material with low numbers of Alvanella worms was collected (x4617 y-77996), highest temperature of the fluids exiting the chimney was 361C. 20:48 GMT. A second chimney sample, densely populated with Alvanella was collected (x-4619 y-77984), max temp of emanating fluids, 271C. 21:06 GMT. A niskin bottle was tripped

Description	off axis, x-4642 y-77976. 21:18 GMT. Dive: 4764 Pilot: Bob Waters Observers: Jeff Seewald, Fengping Wang Synopsis: After arriving at the bottom on the western side of the ASC we transited to the Riftia patch near Tica to release the VENT-SID. This was followed by a transit to Bio9. Once at Bio9 we measured temperature with the Alvin T-probe and then collected chimney material. High temperature fluid was collected in a tedlar bag using the SIP for 30 minutes. This was followed by collection of two high temperature fluid samples using isobaric gas-tight samplers. Transited back to the riftia patch while taking a few detours to survey the area. Collected riftia at the riftia patch. Moved to the Crab Spa area where we collected basalt substrate that was bathed in diffuse fluid from a structure located few meters way from the Crab Spa vent. Another quick survey of the Tica area before returning to Crab Spa to collect the final two isobaric gas-tight fluid samples. Transited back to Bio9 to collect more fluid in the tedlar bag using the SIP. Moved off axis before tripping the Niskin bottle. Dive: 4765 Pilot: Bruce Strickrott Observers: Horst Felbeck, Donato Giovanelli Synopsis: We landed a short distance away from Bio9. Deployed two CV colonizers at two different places. Deployment was difficult because of weight problems with the colonizers. Temperatures were measured before and after deployment. Moved to the Vent-SID deployment site and inserted a third colonizer into the crack were the VENT-SID wand was used. Temperature was taken. Small Riftia were collected close by in a large Riftia clump. A few larger Riftia were collected afterwards. Transited to Crab Spa. Because of problems inserting the IGT wand, a loose rock with animal growth was removed from the entry of the outflow and collected. 4 IGT samples were taken. We proceeded south to look for colonizing plates that had been left in January 2014 but did not find any. Proceeded to P-vent and surveyed. Went a short distance off axis and collected two basalt samples. Triggered Niskin bottle and dropped weights. Dive: 4766 Pilot: Phil Forte Observers: Jefferson Grau, Sean Sylva Synopsis: We landed to the West of the ASC and transited to Bio9. Once there we collected a high temperature fluid into a Tedlar bag with the SIP sampler for 30 minutes. Next we moved over to P-Vent and collected a chimney sample. Moved over to Vent SID site and collected a chimney with Alvinella on the back side of Riftia Patch. This was followed by collection of two high temperature fluids with isobaric gas-tight samplers. Collected Riftia at the Vent SID/chimney site. Moved to Crab Spa and collected two fluids with isobaric gas-tight samplers. Continued our search for small to medium Riftia at Tica and other patches we came across. Transited off-axis and collected bottom seawater in the Go-Flo bottle. Dive: 4767 Pilot: Bob Waters Observers: Stefan Sievert, Sayaka Mino Synopsis: We started the dive by finding the Vent-SID, which had been wired down the night before. We quickly found the instrument and then moved to the deployment site about 30 m away. The Vent-SID was quickly positioned by pilot Bob Waters, and we then looked for a suitable location to insert the wand in a crack emanating hydrothermal fluids. Finding the right spot was greatly aided by having real-time temperature data from the tip of the wand by using an ICL. We found a spot that was around 40ºC warm and proceeded to start the instrument. We then moved to the L-O bucket lid marker site close to Pvent to recover and deploy larval colonization panels, also known as 'sandwiches', for Lauren Mullineaux. Temperature at base of sandwiches was measured before recovery and after deployment of new ones. Afterwards, we collected a piece of black smoker chimney at Pvent and fired 2 IGTs. We then proceeded to Crab Spa where two IGT samples were taken. We also sampled pieces of basalt covered with biofilm and animals. We then moved off-axis and fired a Niskin before ascending. Dive: 4768 Pilot: Bruce Strickrott Observers: Jeff Seewald, Jessica Panzarino Synopsis: After arriving at the bottom on the western side of the ASC we transited to the Riftia patch near Tica to release the VENT-SID. Two fluid samples were collected from Riftia crack where the VENT-SID had been deployed. Riftia were then collected in the general vicinity of the Riftia patch/Tica along with fluids samples in Wheat-style syringe samplers. Transited to Crab Spa where two fluid samplers were collected in isobaric gas-tight samplers. Moved to the summit of Tica to image previously deployed microbial colonizers. Headed south to Bio9 where a high temperature chimney sulfide was collected along with a piece of sulfide that was not in contact with active fluid flow. Moved off axis before tripping the Niskin bottle. Dive: 4769 Pilot: Phil Forte Observers: Stefan Sievert, Camila Signori Synopsis: We landed off-axis to the west of the axial trough. We proceeded to LVP landing site, picked up LVP, and positioned it next to Crab Spa. We then moved south to Bio9 to pick up two CV colonizers (CV 86, 87). After picking up both colonizers, we moved back to Crab Spa area, took an IGT sample in the Riftia crack (45ºC), and picked a number of Riftias at a low activity site nearby (temperature was just a little bit over ambient). We then proceeded to recover CV 88 in Riftia crack. Moving on to Crab Spa we took 3 IGTs (~25ºC), positioned the wand of the LVP at Crab Spa, and took a SIP sample (pumping for 50 min). We ended the dive by taking a Niskin off-axis. Dive: 4770 Pilot: Bob Waters Observers: Chris Lathan, Sean Sylva Synopsis: We landed on bottom and

	transited to Crap Spa. Once there we released the Large Volume Pump. Next we moved over to Tica to recover CV84 located in a clump of Rifta. We then transited to Flea Vent. Once at Flea Vent we collected two fluids with isobaric gas-tight-samplers. We transited back to Crap spa where we collected two more fluid samples with isobaric gas-tight samplers. Next we collected a low temperature fluid, at Crab Spa, into a Tedlar bad with the SIP sampler. We moved off-axis and collected bottom seawater with the Go-flo bottle. Dive: 4771 Pilot: Bruce Strickrott Observers: Scott White, Avery Lee Synopsis: Dive Synopsis Alvin 4771 11/16/14 There was a problem with FrameGrabber, so there are no pictures and no data for this dive's Framegrabber. Off-axis exploration of the a string of small volcanic mounds overlying a melt lens detected seismically (http://dx.doi.org/10.1016/j.epsl.2013.12.040) followed a ~3 km track from east to west toward the spreading axis of the East Pacific Rise, about 5 km away. Alvin landed on seafloor of large pillow outcrops amid pockets of sediment, and took one rock and one sediment core (core barrel 6). Proceeding upslope and north, the sediment grew thicker so another sediment core was taken (core barrel 5). Alvin then proceeded to the top of a low ridge, having ascended 20 m over 300 m, we turned west. Farther along by 200 m, pillows turned into lobate lava and another rock sample was taken. Alvin continued west returning into pillow lava and back into lobate lava where another rock sample was taken. The track turned to the north, skirting the base of a 60 m high volcanic mound, stopping 500 m farther along for a sample of sheet lava and sediment core (barrel 9). Alvin turn south, upslope, to the mound summit stopping at mid-way for another pillow lava sample. At the summit, 3 rock samples and 3 sediment cores (barrels 2, 3, 10) were taken. Alvin proceeded southwest, toward the spreading axis, finding lava collapses and a ropy sheet flow, the latter sampled, before ending the dive back amid pillows where a final rock sample and sediment core (barrel 11) were taken. Dive: 4772 Pilot: Phil Forte Observers: Stefan Sievert, Jennifer Barone Synopsis: We landed on the bottom and proceeded to the Vent-SID. We picked up the Vent-SID and transited to Crab Spa. We positioned the Vent-SID next to the vent and placed the wand in the vent opening. We collected 4 fluid samples from Crab Spa with the IGTs (isobaric gas-tight samplers). We then checked the positioning of the Vent-SID wand and triggered the start of Vent-SID sampling. Next we transited to the Large Volume Pump (LVP) and released it to the surface. Then we located the Mineral Colonizers and loaded them onto the basket. We collected several Riftia nearby and triggered the Niskin bottle. We briefly visited Bio9 (no samples collected) before our ascent. Dive: 4773 Pilot: Bob Waters Observers: Katie Scott, Nuria Gonzalez Synopsis: Dive began at about 9 am. Minor issues with navs when we arrived at the bottom, but we found Crab Spa at around 11:35. We stowed the umbilicus of the device, moved it off of Crab Spa, and released the dive weights after a bit of manipulation with the temperature probe. We then took four IGT's in 20-25C water at crab spa. At 1 pm, we transited to Tica to retrieve the CV 85 colonizer. Once this was stowed, we collected 2-3 doz Riftia of assorted sizes. We then transited to Bio 9 to collect beehive formations. In the process of collecting these we nicked a hydraulic line and left the bottom at 2:45. Dive: 4774 Pilot: Bruce Strickrott Observers: Scott White, Florian Gotz Synopsis: started south east of axis about 6 kilometers at 2790m travelled north to east to side of topographical high, moved west up the slope then north before turning west toward ridge axis. Observed multiple lavea types (pillow, lobates, sheet flow, and varied jumbled forms of lava). Heavy sediment through much of the dive although observed one are of lessened sediment before returning to area of heavier sediment. No hydro thermal activity observed.

AT26-23

Website	https://www.bco-dmo.org/deployment/550442
Platform	R/V Atlantis
Start Date	2014-11-02
End Date	2014-11-21
Description	Study of in situ metabolism of microorganisms carrying out CO2-fixation at deep-sea hydrothermal vents.

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Project Information

An Integrated Study of Energy Metabolism, Carbon Fixation, and Colonization Mechanisms in Chemosynthetic Microbial Communities at Deep-Sea Vents (Microbial Communities at Deep-Sea Vents)

Deep-sea hydrothermal vents, first discovered in 1977, are poster child ecosystems where microbial chemosynthesis rather than photosynthesis is the primary source of organic carbon. Significant gaps remain in our understanding of the underlying microbiology and biogeochemistry of these fascinating ecosystems. Missing are the identification of specific microorganisms mediating critical reactions in various geothermal systems, metabolic pathways used by the microbes, rates of the catalyzed reactions, amounts of organic carbon being produced, and the larger role of these ecosystems in global biogeochemical cycles. To fill these gaps, the investigators will conduct a 3-year interdisciplinary, international hypothesis-driven research program to understand microbial processes and their quantitative importance at deep-sea vents. Specifically, the investigators will address the following objectives: 1. Determine key relationships between the taxonomic, genetic and functional diversity, as well as the mechanisms of energy and carbon transfer, in deep-sea hydrothermal vent microbial communities. 2. Identify the predominant metabolic pathways and thus the main energy sources driving chemoautotrophic production in high and low temperature diffuse flow vents. 3. Determine energy conservation efficiency and rates of aerobic and anaerobic chemosynthetic primary productivity in high and low temperature diffuse flow vents. 4. Determine gene expression patterns in diffuse-flow vent microbial communities during attachment to substrates and the development of biofilms.

Integration: To address these objectives and to characterize the complexity of microbially-catalyzed processes at deep-sea vents at a qualitatively new level, we will pursue an integrated approach that couples an assessment of taxonomic diversity using cultivation-dependent and -independent approaches with methodologies that address genetic diversity, including a) metagenomics (genetic potential and diversity of community), b) single cell genomics (genetic potential and diversity of uncultured single cells), c) meta-transcriptomics and -proteomics (identification and function of active community members, realized potential of the community). To assess function and response to the environment, these approaches will be combined with 1) measurement of in situ rates of chemoautotrophic production, 2) geochemical characterization of microbial habitats, and 3) shipboard incubations under simulated in situ conditions (hypothesis testing under controlled physicochemical conditions). Network approaches and mathematical simulation will be used to reconstruct the metabolic network of the natural communities. A 3-day long project meeting towards the end of the second year will take place in Woods Hole. This Data Integration and Synthesis meeting will allow for progress reports and presentations from each PI, postdoc, and/or student, with the aim of synthesizing data generated to facilitate the preparation of manuscripts.

Intellectual Merit. Combining the community expression profile with diversity and metagenomic analyses as well as process and habitat characterization will be unique to hydrothermal vent microbiology. The approach will provide new insights into the functioning of deep-sea vent microbial communities and the constraints regulating the interactions between the microbes and their abiotic and biotic environment, ultimately enabling us to put these systems into a quantitative framework and thus a larger global context.

Broader Impacts. This is an interdisciplinary and collaborative effort between 4 US and 4 foreign institutions, creating unique opportunities for networking and fostering international collaborations. This will also benefit the involved students (2 graduate, several undergraduate) and 2 postdoctoral associates. This project will directly contribute to many educational and public outreach activities of the involved PIs, including the WHOI Dive & Discover program; single cell genomics workshops and Cafe Scientifique (Bigelow); REU (WHOI, Bigelow, CIW); COSEE and RIOS (Rutgers), and others. The proposed research fits with the focus of a number of multidisciplinary and international initiatives, in which PIs are active members (SCOR working group on Hydrothermal energy and the ocean carbon cycle, http://www.scorint. org/Working_Groups/wg135.htm; Deep Carbon Observatory at CIW, https://dco.gl.ciw.edu/; Global Biogeochemical Flux (GBF) component of the Ocean Observatories Initiative (OOI), http://www.whoi.edu/GBF-OOI/page.do?pid=41475)

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Program Information

Dimensions of Biodiversity (Dimensions of Biodiversity)

Website: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503446

Coverage: global

(adapted from the NSF Synopsis of Program)
Dimensions of Biodiversity is a program solicitation from the NSF Directorate for Biological Sciences. FY 2010 was year one of the program. [MORE from NSF]

The NSF Dimensions of Biodiversity program seeks to characterize biodiversity on Earth by using integrative, innovative approaches to fill rapidly the most substantial gaps in our understanding. The program will take a broad view of biodiversity, and in its initial phase will focus on the integration of genetic, taxonomic, and functional dimensions of biodiversity. Project investigators are encouraged to integrate these three dimensions to understand the interactions and feedbacks among them. While this focus complements several core NSF programs, it differs by requiring that multiple dimensions of biodiversity be addressed simultaneously, to understand the roles of biodiversity in critical ecological and evolutionary processes.

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-1136727

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