Log of Jason Dives from cruise RR1413 at the Mariana arc in December 2014

Website: https://www.bco-dmo.org/dataset/659790
Data Type: Cruise Results
Version: 27 Sept 2016
Version Date: 2016-09-27

Project
» Ecology of microbial mats at seamount associated Fe-rich hydrothermal vent systems (Ecology of Vent Mats)

Contributors	Affiliation	Role
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Dataset Description

This dataset provides metadata for all significant sample collections on the deployment, RR1413. More information is available from the virtual van website at http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-rr1413/index.html (use is currently restricted, but it will be accessible in future; see WHOI guidlines)

Data Processing Description

BCO-DMO added dates from the dive logs in the cruise report (starting on page 121; section 5.7-1).

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Data Files

File
RR1413_Dive_Log.csv (Comma Separated Values (.csv), 40.59 KB) MD5:4719b6d41343aabfc9a085191cf4a020 Primary data file for dataset ID 659790

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Parameters

Parameter	Description	Units
sample	Sample identifier	unitless
sample_type	Type of sample	unitless
site	Name of sampling site	unitless
ISO_DateTime_UTC	Date and time of collection, formatted to the ISO 8601 standard (YYYY-mm-ddTHH:MM:SS.xxZ where T indicates the start of the time string). BCO-DMO generated values in this columns using the time columns in the original data file and the dates from the dive logs in the cruise report.	unitless
lat	Latitude; BCO-DMO converted from degrees and decimal minutes to decimal degrees.	decimal degrees
lon	Longitude; BCO-DMO converted from degrees and decimal minutes to decimal degrees.	decimal degrees
depth	Sample depth	meters (m)
gyro	Gyro	degrees
van_num	Identification number for WHOI virtual van website http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-rr1413/index.html	unitless
comments	Comments	unitless

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Instruments

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/

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Deployments

RR1413

Website	https://www.bco-dmo.org/deployment/562242
Platform	R/V Roger Revelle
Report	http://dmoserv3.whoi.edu/data_docs/Moyer/SRoF-Ironman-2014-CruiseReport-withdivelogs.pdf
Start Date	2014-11-29
End Date	2014-12-21
Description	The "Submarine Ring of Fire 2014 – Ironman" Expedition was a cooperative venture with two science parties with overlapping interests and goals. Craig Moyer from Western Washington University led a group funded by the National Science Foundation to conduct research on iron-oxidizing bacteria at hydrothermal vents. Bill Chadwick led a NOAA/PMEL group funded by the NOAA Ocean Exploration and Research Program and focused on the chemical and biological impacts of hydrothermal vent emissions from active submarine volcanoes in the Mariana arc. Additional cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Ecology of microbial mats at seamount associated Fe-rich hydrothermal vent systems (Ecology of Vent Mats)

Website: http://oceanexplorer.noaa.gov/explorations/14fire/welcome.html

Coverage: Loihi Seamount, Hawaii; and Mariana Arc and Backarc Hydrothermal Systems

Description from NSF award abstract:
A grand challenge in microbial ecology is to understand what drives the structure of microbial communities. A recently discovered novel class of Proteobacteria, the Zetaproteobacteria, are associated with microbial mats at iron rich hydrothermal vents at submarine volcanoes deep in the ocean. These bacteria only grow using iron as an energy source and fix carbon dioxide. Within iron rich microbial mats, Zetaproteobacteria are the dominant bacterial population; however they are rare in most other deep-sea or marine habitats, suggesting they may be restricted to specific niches characterized by gradients of oxygen and iron. Recent discoveries have expanded their range to fluids collected from deep ocean crust boreholes, iron deposits in coastal saltmarshes, and with steel associated bio-corrosion, demonstrating that marine Zetaproteobacteria are cosmopolitan. A unique property of these marine iron oxidizing bacteria is that they produce morphologically distinct iron oxide structures in the form of filamentous sheaths or stalk-like structures. These structures are easily recognized by light microscopy, and electron microscopy is beginning to reveal subtle differences among them that may be diagnostic of different populations of iron oxidizing bacteria. Another unusual aspect of iron oxidizing bacteria is that they produce large quantities of oxides with relatively little bacterial biomass. As a result, the oxides form a matrix that influences water and nutrient flow in the microbial mats where they grow, and in turn, may influence the growth of other groups of bacteria and archaea that live in the mats. In an ecological context, the PIs believe this makes them a keystone species that form the predominant structural matrix of the mat, and engineer an environment conducive for growth of specific bacterial populations within the mat ecosystem. The PIs propose to use high resolution mat sampling techniques to investigate the architecture of mat ecosystems and couple these with modern molecular methods (i.e., single-cell metagenomics) and geochemical measurements of the vent fluid to couple morphological and functional diversity to phylogenetic and physiological diversity. Because the Zetaproteobacteria are ancient, have unique metabolic and morphological attributes, and appear to be restricted to a well-defined habitat, they offer an interesting model for understanding fundamental ecological concepts that drive microbial diversity and evolution.

A better understanding of iron oxidizing bacteria that include Zetaproteobacteria is of fundamental interest to scientists interested in areas of earth science and oceanography because they illustrate how microbes can fundamentally influence geochemical cycling and mineral deposition. Furthermore, morphological structures similar to those produced by Zetaproteobacteria can still be identified hundreds of millions (and possibly billions) of years back in the geological record, making them of paleontological, and potentially of exobiological, interest. As knowledge of extant populations grow, it is possible they will also help to inform us of environmental change in past Earth history. A wealth of educational and outreach opportunities will be made possible by this work, including graduate and postdoctoral education, research experiences for undergraduates, and teacher training. In addition the participating scientists are involved in a number of programs to make the general public aware of the process of how scientific research is conducted, and how discoveries of a fundamental nature can ultimately benefit humankind.

Additional information/resources:
TN293 (Loihi 2013)
Loihi Summit Map (PDF)
Cruise blog: https://zetahunters.wordpress.com/
Jason Virtual Control Van: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-tn293/index.html

Related Publications:
Fullerton, H., K. W. Hager, S. M. McAllister, and C. L. Moyer. 2017. Hidden diversity revealed by genome-resolved metagenomics of iron-oxidizing microbial mats from Lō'ihi Seamount, Hawai'i. ISMEJ 11:1900–1914. doi:10.1038/ismej.2017.40
Emerson, D., J. J. Scott, A. Leavitt, E. Fleming, and C. L. Moyer. 2016. In situ estimates of iron-oxidation and accretion rates for iron-oxidizing bacterial mats at Loihi Seamount. bioRxiv 095414. doi:10.1101/095414
Scott, J. J., B. T. Glazer, and D. Emerson. 2017. Bringing microbial diversity into focus: high-resolution analysis of iron mats from the Lō'ihi Seamount. Environmental Microbiology 19:301–316. doi:10.1111/1462-2920.13607
Chan, C.S., S.M. McAllister, A.H. Leavitt, B.T. Glazer, S.T. Krepski, and D. Emerson. 2016. The architecture of iron microbial mats reflects the adaptation of chemolithotrophic iron oxidation in freshwater and marine environments. Frontiers in Microbiology 7:796. doi:10.3389/fmicb.2016.00796
Fullerton, H., K. W. Hager, and C. L. Moyer. 2015. Draft genome sequence of Mariprofundus ferrooxydans strain JV-1, isolated from Loihi Seamount, Hawaii. Genome announcements 3:e01118-15. doi:10.1128/genomeA.01118-15
Field, E.K., A. Sczyrba, A.E. Lyman, C.C. Harris, T. Woyke, R. Stepanauskas, and D. Emerson. 2015. Genomic insights into the uncultivated marine Zetaproteobacteria at Loihi Seamount. ISMEJ 9:857–870. doi:10.1038/ismej.2014.183
Jesser, KJ, Fullerton H, Hager KW, Moyer CL. 2015. Quantitative PCR analysis of functional genes in iron-rich

microbial mats at an active hydrothermal vent system (Lō'ihi Seamount, Hawai'i). Appl Environ Microbiol 81:2976–2984. doi:10.1128/AEM.03608-14. (PDF)

RR1413 (Mariana 2014)
RR1413 Cruise Report (5.2 MB PDF)
Urushima to Rota Map (PDF)
Jason Virtual Control Van website: http://4dgeo.whoi.edu/webdata/virtualvan/html/VV-rr1413/index.html

Related Publications:
Hager, K. W., H. Fullerton, D. A. Butterfield, and C. L. Moyer. 2017. Community structure of lithotrophically-driven hydrothermal microbial mats from the Mariana Arc and Back-Arc. Frontiers in Microbiology 8:1578. doi:10.3389/fmicb.2017.01578

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1155756
NSF Division of Ocean Sciences (NSF OCE)	OCE-1155754
NSF Division of Ocean Sciences (NSF OCE)	OCE-1155290

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