Megafauna counts by taxon in images collected during three surveys (December 25, 2019, April 7 and 9, 2021) with deep-submergence vehicles at inactive sulfide mounds on the East Pacific Rise.

Website: https://www.bco-dmo.org/dataset/932975
Data Type: Other Field Results
Version: 1
Version Date: 2024-07-05

Project
» Collaborative Research: Life after Death: Do Inactive Sulfides Fuel a Unique Ecosystem at the Deep Seafloor? (Inactive Sulfides)

Contributors	Affiliation	Role
Mullineaux, Lauren	Woods Hole Oceanographic Institution (WHOI)	Principal Investigator
Beaulieu, Stace	Woods Hole Oceanographic Institution (WHOI)	Co-Principal Investigator, Contact, Data Manager
Dykman, Lauren	Woods Hole Oceanographic Institution (WHOI)	Scientist
Wu, Jyun-nai	University of California-San Diego (UCSD-SIO)	Scientist
Best, Ayinde	Wheaton College	Student
Meneses, Michael	Woods Hole Oceanographic Institution (WHOI)	Student
Mills, Susan	Woods Hole Oceanographic Institution (WHOI)	Technician
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes counts by taxon for megafauna in images collected during surveys with deep-submergence vehicles at inactive sulfide mounds near the 9 50’ N hydrothermal vent field on the East Pacific Rise. Images were collected with a down-looking digital still camera. We provide image areas for estimating megafauna density (counts per area of seafloor). Here we provide data from three surveys: one during HOV Alvin Dive 5044 at Lucky’s Mound on 25 December 2019 on cruise AT42-21 and two during ROV Jason II Dives 1309 and 1311, on the oceanic rise (between Lucky’s Mound and Sentry Spire) on 7 April 2021 and at Sentry Spire on 9 April 2021, respectively, on cruise RR2102. Megafauna were manually annotated to morphotype using ImageJ software. Morphotypes were identified to the lowest taxonomic level and assigned to a feeding mode. This dataset is provided in two formats: long-format comma-separated variable (csv) file and wide-format Excel (xlsx) file. This dataset is analyzed in a manuscript by Meneses et al. (2024).

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
  - BCO-DMO Processing Description
- Data Files
- Supplemental Files
- Related Publications
- Related Datasets
- Parameters
- Instruments

- Deployments
- Project Information
- Funding

Coverage

Location: East Pacific Rise 9 N 104 W depth 2500m
Spatial Extent: **N**:9.790445 **E**:-104.2857049 **S**:9.772427 **W**:-104.2873457
Temporal Extent: 2019-12-25 - 2021-04-09

Methods & Sampling

Images collected during surveys with deep-submergence vehicles

Three imaging surveys near the 9 50′ N hydrothermal vent field on the East Pacific Rise, two on inactive sulfide mounds and one on the nearby flat oceanic rise, were conducted during research expeditions on the RV Atlantis (AT42-21) and RV Roger Revelle (RR2102). Images of the seafloor were collected with a downward-facing Ocean Imaging Systems (OIS) Model D3300 24,000 Digital Still Camera (Nikon D7100 SLR) with image size 6000 x 4000 pixels (24 megapixel). The camera was mounted on the human occupied vehicle Alvin on Dive 5044 at Lucky's Mound on 25 December 2019 and the remotely-operated vehicle Jason II on Dive 1309 on the oceanic rise (between Lucky's Mound and Sentry Spire) on 7 April 2021 and Dive 1311 at Sentry Spire on 9 April 2021. The camera captured images every 5 or 10 seconds in sync with 300 Watt/s high intensity strobe lights. We thank Dr. Daniel Fornari and the WHOI-SSSG/MISO Facility for access to the MISO Imagery © Woods Hole Oceanographic Institution (WHOI).

Each survey was designed to cover a comparable area (within ~60 m x 60 m bounding box) and, for the inactive sulfides, to also cover vertical habitat variation. For the oceanic rise survey, the vehicle traveled at ~0.5 km hr-1 at an altitude of ~5 m above the seafloor; there was more variability in speed and altitude on the inactive features due to challenging topography. In particular, the altitude of Sentry Spire images was often greater than 5 m. Spatiotemporal data to associate with each image were collected by the vehicles and processed on-ship after each dive (i.e., re-navigated position, depth, and altitude per UTC timestamp) and are available from the U.S. National Deep Submergence Facility (NDSF). The camera had an internal clock for UTC timestamp which was synced with the vehicle clock with the exception of *Alvin* Dive 5044, for which the MISO timestamp is 13 minutes and 20 seconds ahead of the actual UTC timestamp.

Images that were poorly illuminated or out of focus were removed from the study. Overlapping images were removed to prevent duplicate sampling. For each of the three surveys, the remaining images were randomly subsampled to a set of 49 (Lucky's Mound), 50 (Oceanic Rise), and 44 (Sentry Spire) images. Images from Lucky's Mound and Sentry Spire were categorized to approximate vertical position: Spire, Apron, or Base. Two image filenames are marked with an asterisk. One (RR2102_J1311_OID_20210409T160036) is an incorrect filename; the image annotated in the ImageJ Stack did not match the original with this filename. One (RR2102_J1311_OID_20210409T154531) has one incorrect count likely due to association to the incorrect filename within the annotated set of Sentry Spire images.

Counts by morphotype per image per survey

Organisms visible in the total of 143 survey images were manually annotated to a numbered morphotype using ImageJ public domain software. Organisms could be resolved to at least 3 cm (as described in next section). Morphotype numbers were assigned in ascending order per site. Images were annotated per survey in "stacks" of 5 - 10; we concatenated the per-stack output tables of counts per numbered morphotype using an R script.

Co-author M. Meneses annotated megafauna for images from Lucky's Mound and Oceanic Rise. For Sentry Spire co-author A. Best initially annotated, and then for consistency across sites M. Meneses validated and added to the annotations. Combining all ImageJ annotations resulted in 2413 annotations; however 91 annotations were determined to be abiotic, and 9 appeared biotic but could not be assigned to morphotype, resulting in the total of 2313 counts.

Area per image per survey

- Estimating from vehicle altitude and camera field of view

Since the down-looking images did not have paired lasers for scale, camera altitude (m above seafloor) and field of view were used for trigonometric estimate of the total area of each image. For the ROV Jason II dives at Sentry Spire and Oceanic Rise, the camera was mounted near and at the same vertical position as the vehicle altimeter, thus camera altitude was approximately the same as vehicle altitude. However, for the HOV Alvin dive at Lucky's Mound, the camera was mounted forward of and 1.03 m lower than the vehicle altimeter, thus we subtracted 1.03 m from vehicle altitude for an initial estimate of camera altitude.

The camera was fitted with a Nikkor 20mm f2.8 lens behind a domed optical port that produced a 38.6° x 55.7° field of view. Initial image area was calculated by multiplying the resulting values from the following 2 functions in an EXCEL spreadsheet, in which H is camera altitude:

=TAN(19.3*PI()/180)*H*2
=TAN(27.85*PI()/180)*H*2

We thank Dr. Daniel Fornari for angle calculations for the camera's field of view from inside the pressure housing; we selected the angle calculation for 3.2 m altitude (the higher of two altitudes with angle calculations). We thank Karl Roberts for diagramming the trigonometric calculation.

Using other down-looking images from cruises AT42-21 and RR2102, we confirmed when the vehicles were descending to the seafloor that images were in focus when the camera altitude was less than 8 m. Note this results in maximum area per image 47.37 m2, with minimum resolution of 7.1 pixels per cm.

- Trimming portions out of focus for a subset of images

For a subset of images from Lucky's Mound and Sentry Spire where topographic variation within an image caused portions to be out of focus, only the portions in focus were used for megafauna counts and area estimates. Image "trimming" was carried out using the ImageJ tool "Freehand selection" to select the useable portions of an image while excluding portions out of focus. The ImageJ "Measure" function was then used to count pixels within this selection. The Useable_Proportion_of_Image is the fraction of pixels selected out of 24 megapixel, which reduced the final area reported for only 1 image from Lucky's Mound (which was also the only image with initial estimate of camera altitude > 8 m) and 9 from Sentry Spire (including the 4 with initial estimate of camera altitude > 8 m).

- Scaling to correct area for a subset of images

For a subset of images from Lucky's Mound and Sentry Spire with complex topography, the initial estimate of camera altitude appeared inadequate for an accurate image scale. In particular for the imaging survey with Alvin at Lucky's Mound, we needed to better estimate the camera altitude when *Alvin* was transiting up-slope because the camera was situated forward of the altimeter, thus, closer to the seafloor. We categorized each image as occurring during transit over relatively flat seafloor (Flat), or moving up-slope (Up) or down-slope (Down).

We were able to calibrate the scale by using known sizes of megafaunal taxa from other imagery. Images of galatheid squat lobsters (Munidopsis), unstalked crinoids (Antedonidae), and shrimp (Nematocarcinidae) were selected from close-up, high-resolution (4K) videos of the study sites acquired with Alvin on a later cruise (AT50-06, December 2022). Beams from parallel lasers mounted 10 cm apart were visible in each screenshot and allowed for accurate measurement of those individuals using ImageJ. After measuring multiple (>5) individuals of each morphotype, an "actual measured" size range was calculated for use in assessing, and adjusting if necessary, the scale for survey images containing these morphotypes. For survey images containing these three morphotypes, we measured 1 (or 2, if possible) individuals to obtain an initial size estimate. When the measured value (initial size estimate) exceeded expectations from the actual measured range, an Adjustment_Value was calculated in EXCEL as Expected / Measured, in which Expected was the actual measured maximum. In general we did not apply scaling to transit Flat because we found there was no need for scaling to bring morphotypes into actual measured range [median Adjustment_Value 1]. We also confirmed this by measuring shrimp in the survey at Oceanic Rise, and all but one were within range (and that one was only 0.1 cm out of range). For the 12 Sentry Spire images transiting Up or Down but without any calibrated morphotypes in view, the scale was linearly interpolated from the previous and subsequent, reliably scaled, images in the time series using an R script.

Ultimately, scaling was applied for 15 images from Lucky's Mound and 18 from Sentry Spire in the column Corrected_Area_m2. The total Corrected_Area_m2 for the 143 survey images was 2654 m2.

Taxon and feeding mode assignment per morphotype

To harmonize morphotypes across sites we created a photo atlas and "CreatureDex" table to match the per-site morphotype numbers. We used the CreatureDex to give each morphotype an initial, unique label (verbatimIdentification). Morphotypes were assigned to the lowest possible taxonomic level by referencing scientific literature, online databases, and expert opinions. When morphotypes with similar appearance could not be distinguished reliably, they were grouped together into a higher taxonomic level (e.g., various brittle stars grouped into Ophiurida). The total number of harmonized morphotypes was 51, and we provide the cropped images for the 51 morphotypes in the file "cropped_images_CreatureDex-2024-07-05.zip". We standardized our morphotype labels to scientific names and corresponding AphiaIDs in the World Register of Marine Species as part of the minimal requirement for inclusion of these data in the Ocean Biodiversity Information System (OBIS).

Each morphotype was categorized into 1 of 7 feeding modes for which we slightly modified definitions from the "Characteristic feeding method" in the Biological Traits Information Catalogue (BIOTIC; MarLIN 2006): Suspension Feeder Passive ("Suspension feeder: Passive" in BIOTIC), Suspension Feeder Active ("Suspension feeder: Active"), Deposit Feeder ("Deposit feeder"), Scavenger ("Scavenger"), Predator ("Predator"), Grazer ("Grazer (surface / substratum)"), and Unknown ("Insufficient information"). Feeding mode assignment was inferred from studies of closely related taxa as reported in textbooks and peer-reviewed literature.

Unique taxa in this dataset (WoRMS_scientificName, WoRMS_scientificNameID):
* Note that there are fewer unique taxa than unique morphotypes due to standardized classification at high taxonomic level.

Actiniaria, urn:lsid:marinespecies.org:taxname:1360
Animalia, urn:lsid:marinespecies.org:taxname:2
Antedonidae, urn:lsid:marinespecies.org:taxname:123148
Anthomastus, urn:lsid:marinespecies.org:taxname:125285
Anthozoa, urn:lsid:marinespecies.org:taxname:1292
Aphroditidae, urn:lsid:marinespecies.org:taxname:938
Asteroidea, urn:lsid:marinespecies.org:taxname:123080
Asterozoa, urn:lsid:marinespecies.org:taxname:148743
Bathycrinidae, urn:lsid:marinespecies.org:taxname:123144
Brisingida, urn:lsid:marinespecies.org:taxname:123085
Bryozoa, urn:lsid:marinespecies.org:taxname:146142
Bythograeidae, urn:lsid:marinespecies.org:taxname:106746
Cladorhizidae, urn:lsid:marinespecies.org:taxname:131644
Elasipodida, urn:lsid:marinespecies.org:taxname:123112
Gastropoda, urn:lsid:marinespecies.org:taxname:101
Halosauridae, urn:lsid:marinespecies.org:taxname:125500
Hexactinellida, urn:lsid:marinespecies.org:taxname:22612
Holothuroidea, urn:lsid:marinespecies.org:taxname:123083
Hydrozoa, urn:lsid:marinespecies.org:taxname:1337
Munidopsis, urn:lsid:marinespecies.org:taxname:106836
Munnopsidae, urn:lsid:marinespecies.org:taxname:118264
Nematocarcinidae, urn:lsid:marinespecies.org:taxname:106784
Octocorallia, urn:lsid:marinespecies.org:taxname:1341
Ophidiiformes, urn:lsid:marinespecies.org:taxname:10314
Ophiurida, urn:lsid:marinespecies.org:taxname:123117
Paguroidea, urn:lsid:marinespecies.org:taxname:106687
Pantopoda, urn:lsid:marinespecies.org:taxname:1358
Polychaeta, urn:lsid:marinespecies.org:taxname:883
Polyplacophora, urn:lsid:marinespecies.org:taxname:55
Porifera, urn:lsid:marinespecies.org:taxname:558
Primnoidae, urn:lsid:marinespecies.org:taxname:125278
Rossellidae, urn:lsid:marinespecies.org:taxname:131694
Tentaculata, urn:lsid:marinespecies.org:taxname:1249
Vulcanoctopus, urn:lsid:marinespecies.org:taxname:341470
Xenophyophoroidea, urn:lsid:marinespecies.org:taxname:736980

Data Processing Description

Dataset compilation

This dataset was built from three sources described above: counts by morphotype per image per survey from annotations in ImageJ; area per image per survey including an adjustment to scaling when needed; and an assignment per morphotype to a standardized taxon and 1 modality of a feeding mode functional trait. To compile the dataset we used a script in R version 4.2.3 with packages including tidyverse, gtools, openxlsx, and readxl.

This dataset is provided in two formats: long-format comma-separated variable (csv) file and wide-format Excel (xlsx) file. The long-format csv file includes taxonomic standardization and spatiotemporal metadata to align with a Darwin Core occurrence table. To complete the minimal requirement for OBIS: add columns for occurrenceID (e.g., concatenate File_Name with verbatimIdentification), basisOfRecord (MachineObservation), occurrenceStatus (present if individualCount > 0), maximumDepthInMeters and minimumDepthInMeters (Depth_m + Vehicle_Altitude_m plus or minus 5 m); note leave countryCode blank for international waters. Right-most columns in the long-format csv file may be extracted into a Darwin Core event table with the File_Name corresponding to eventID.

BCO-DMO Processing Description

* Data from source file megafauna_counts_per_image_long_BCODMO_2024-07-08.csv were imported into the BCO-DMO data system as the primary data table for the dataset.

* An additional column was added to supplemental file: cropped_image_per_morphotype_CreatureDex.csv to provide the unique path for each image (relative path within zip file).

[table of contents | back to top]

Data Files

File
Megafauna counts (long-format) filename: 932975_v1_megafauna-counts.csv (Comma Separated Values (.csv), 1.56 MB) MD5:a2c17394073880ed880bf634ec70bc2d Primary data file for dataset ID 932975, version 1. This format of the dataset is a long-format table for megafauna counts per image including taxonomic standardization and spatiotemporal metadata. The long-format includes a verbatimIdentification column (e.g. "Xenophyophoroidea, cluster shaped") and an individualCount column. See "Supplemental Files" section for a wide-format version of these data that have separate count columns per verbatimIdentification category.

[table of contents | back to top]

Supplemental Files

File
Cropped images for the 51 morphotypes filename: cropped_images_CreatureDex-2024-07-05.zip (ZIP Archive (ZIP), 12.16 MB) MD5:e63bc8bf12e693e50b4106eaa1c7d801 zip file containing cropped images for the 51 morphotypes and a csv file to associate cropped image filenames to Final_Morphotype_ID (corresponding to verbatimIdentification in long-format table). Here, we provide the cropped images for the 51 morphotypes, many of which include the superimposed ImageJ annotation. Images were annotated using ImageJ software, with morphotypes numbered within each site. Sites were annotated separately, each starting with morphotype number zero. To harmonize these morphotype numbers across sites to the ultimate Final_Morphotype_ID, we used these cropped images as a photo atlas in our “CreatureDex” table to help distinguish the 51 morphotypes. Because some of the cropped image filenames are the same, please use the file “cropped_image_per_morphotype_CreatureDex.csv” within this zip file to associate cropped image filenames to Final_Morphotype_ID. Although we know which site each cropped image is from, the provenance to trace back to the original image was not retained in the filename or file properties. See README_cropped_images_CreatureDex.txt within this zip file for more information.
Megafauna counts (wide-format) filename: Morphotype_Counts-BCODMO_2024-07-05.xlsx (Microsoft Excel, 35.82 KB) MD5:fc5c2f95d4cf59170630a058796af7f7 Wide-format table for megafauna counts per image. The wide format includes a count column per Final_Morphotype_ID (verbatimIdentification category, e.g. "Xenophyophoroidea, cluster shaped"). See "Data Files" for the long-format version of the same data.

[table of contents | back to top]

Related Publications

MarLIN (2006). BIOTIC - Biological Traits Information Catalogue. Marine Life Information Network. Plymouth: Marine Biological Association of the United Kingdom. Available from <http://www.marlin.ac.uk/biotic>.
References

Meneses, M. J., Beaulieu, S. E., Best, A. C., Dykman, L. N., Mills, S. W., Wu, J.-N., & Mullineaux, L. S. (2024). Vertical distributions of megafauna on inactive vent sulfide features correspond to their feeding modes. Marine Environmental Research, 200, 106649. https://doi.org/10.1016/j.marenvres.2024.106649
Results

R Core Team (2023). R: A language and environment for statistical computing. R v4.2.3. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org
Software

Schneider, C. A., Rasband, W. S., ... (n.d.). ImageJ. US National Institutes of Health, Bethesda, MD, USA. Available from https://imagej.nih.gov/ij/
Software

[table of contents | back to top]

Related Datasets

IsRelatedTo

National Deep Submergence Facility. (2024). NDSF: National Deep Submergence Facility; Data. Available from https://ndsf.whoi.edu/data/

[table of contents | back to top]

Parameters

Parameter	Description	Units

File_Name	image file name (date and time in UTC are written into the File_Name, but for Alvin Dive 5044 need to subtract by 13 minutes and 20 seconds for the actual UTC timestamp).	unitless
Site	study site surveyed (Lucky’s Mound, Oceanic Rise, or Sentry Spire)	unitless
Habitat	approximate vertical position categorized on inactive sulfide mound (Spire, Apron, or Base) or on flat basalt (Rise)	unitless
Corrected_Area_m2	area per image with initial estimate corrected for a subset of images from Lucky’s Mound and Sentry Spire	meters squared
verbatimIdentification	original identification/determination of morphotype (corresponding to Final_Morphotype_ID in supplemental files.)	unitless
Feeding_Mode	modality of feeding mode functional trait (modified from BIOTIC database)	unitless
individualCount	number of individuals per morphotype annotated in the image	integer count
WoRMS_scientificName	scientific name in lowest level taxonomic rank matched to the World Register of Marine Species (pair with WoRMS_scientificNameID)	unitless
WoRMS_scientificNameID	identifier for the scientific name in lowest level taxonomic rank matched to the World Register of Marine Species (pair with WoRMS_scientificName). This is a Life Science Identifier (LSID).	unitless
eventDate	date of survey (UTC). ISO 8601 format.	unitless
decimalLatitude	geographic latitude from vehicle re-navigated position at the time the image was taken	decimal degrees
decimalLongitude	geographic longitude from vehicle re-navigated position at the time the image was taken	decimal degrees
Depth_m	depth below sea level recorded by the vehicle at the time the image was taken	meters
Vehicle_Altitude_m	altitude above the seafloor recorded by the vehicle at the time the image was taken (note for Alvin Dive 5044 at Lucky’s Mound, the camera was mounted forward of and 1.03 m lower than the vehicle altimeter)	meters

AngleCategory	each image was categorized as occurring during transit over relatively flat seafloor (Flat), or moving up-slope (Up) or down-slope (Down)	unitless
Adjustment_Value	one-dimensional scaling factor to correct area for subset of images from Lucky's Mound and Sentry Spire (1 means no scaling). NaN = not applicable to images from Oceanic Rise	unitless
Useable_Proportion_of_Image	fraction of pixels in focus per image (1 means no trimming)	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	HOV Alvin
Generic Instrument Description	Human Occupied Vehicle (HOV) Alvin is part of the National Deep Submergence Facility (NDSF). Alvin enables in-situ data collection and observation by two scientists to depths reaching 6,500 meters, during dives lasting up to ten hours. Commissioned in 1964 as one of the world's first deep-ocean submersibles, Alvin has remained state-of-the-art as a result of numerous overhauls and upgrades made over its lifetime. The most recent upgrades, begun in 2011 and completed in 2021, saw the installation of a new, larger personnel sphere with a more ergonomic interior; improved visibility and overlapping fields of view; longer bottoms times; new lighting and high-definition imaging systems; improved sensors, data acquisition and download speed. It also doubled the science basket payload, and improved the command-and-control system allowing greater speed, range and maneuverability. With seven reversible thrusters, it can hover in the water, maneuver over rugged topography, or rest on the sea floor. It can collect data throughout the water column, produce a variety of maps and perform photographic surveys. Alvin also has two robotic arms that can manipulate instruments, obtain samples, and its basket can be reconfigured daily based on the needs of the upcoming dive. Alvin's depth rating of 6,500m gives researchers in-person access to 99% of the ocean floor. Alvin is a proven and reliable platform capable of diving for up to 30 days in a row before requiring a single scheduled maintenance day. Recent collaborations with autonomous vehicles such as Sentry have proven extremely beneficial, allowing PIs to visit promising sites to collect samples and data in person within hours of their being discovered, and UNOLs driven technological advances have improved the ability for scientific outreach and collaboration via telepresence Alvin is named for Allyn Vine, a WHOI engineer and geophysicist who helped pioneer deep submergence research and technology. (from https://www.whoi.edu/what-we-do/explore/underwater-vehicles/hov-alvin/, accessed 2022-09-09)

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.

Dataset-specific Instrument Name	Ocean Imaging Systems (OIS) Model D3300 24,000 Digital Still Camera (Nikon D7100 SLR)
Generic Instrument Name	Underwater Camera
Generic Instrument Description	All types of photographic equipment that may be deployed underwater including stills, video, film and digital systems.

[table of contents | back to top]

Deployments

AT42-21

Website	https://www.bco-dmo.org/deployment/879912
Platform	R/V Atlantis
Start Date	2019-12-17
End Date	2020-01-07

AT42-21_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/933987
Platform	Alvin
Start Date	2019-12-17
End Date	2020-01-07
Description	Alvin dives conducted at the East Pacific Rise (EPR) on R/V Atlantis cruise AT42-21.

RR2102

Website	https://www.bco-dmo.org/deployment/879915
Platform	R/V Roger Revelle
Start Date	2021-03-24
End Date	2021-04-25

AT50-06

Website	https://www.bco-dmo.org/deployment/933990
Platform	R/V Atlantis
Start Date	2022-12-03
End Date	2023-01-01
Description	Project: RUI: Collaborative: The Predictive Nature of Microbial Biofilms for Cuing Larval Settlement at Deep-Sea Hydrothermal Vents START/END PORT: Puntarenas, Costa Rica

[table of contents | back to top]

Project Information

Collaborative Research: Life after Death: Do Inactive Sulfides Fuel a Unique Ecosystem at the Deep Seafloor? (Inactive Sulfides)

Coverage: East Pacific Rise near 10 N

NSF Award Abstract:
This project is investigating a newly discovered community of animals and microbes near deep-sea hydrothermal vents that appears to inhabit only cool, inactive sulfide features. The main objectives are to determine what species live on these features, whether they are new to science, and how they function in the community. The discovery of this novel community, which may be fueled by production of resident microbes, is likely to change the way we think about inactive vents and their contribution to deep-sea biodiversity and productivity. This project has broad impact in four different areas: 1) Informing policy for sustainable use (mining) of inactive sulfides; 2) Contributing to global data systems and the NSF-funded repository at BCO-DMO to make our data available for research use at other temporal, spatial, and taxonomic scales; 3) Increasing public scientific literacy by enhancing K-12 education in the sciences at Memorial Junior High in Eagle Pass TX with about 98% Hispanic and 2% Native American students and a high number of English Language Learners and migrants; and 4) Developing a diverse workforce by engaging students from under-represented and marginalized groups into undergraduate intern programs.

Hydrothermal venting of heated, reduced fluids from the seafloor occurs globally at plate tectonic boundaries and mid-plate hotspots and has been the subject of vigorous geological, chemical and biological research. However, this venting is ultimately transient, leaving behind only the sulfide mineral-rich deposits after the fluid flow stops. This project investigates the organisms living on these lesser studied inactive sulfide features in order to understand their ecology and associations with the mineral substratum. Recent discoveries indicate that some microbial and animal species inhabiting inactive sulfides are not found elsewhere in the marine environment, suggesting the sulfides serve as a unique habitat, distinct from other seafloor topographic features. The main project objectives are to characterize the species and functional diversity of the inactive sulfide ecosystem across all three domains of life (eukaryotic, bacterial, and archaeal), determine which animal species are endemic or predominantly associated with inactive sulfides, and explore the biological and geological characteristics governing those associations. The investigators are conducting field studies between 9-10 degrees N on the East Pacific Rise at sites within the axial summit trough as well as at recently discovered off-axis sites away from modern day venting features. The discovery of this novel community of organisms inhabiting inactive sulfide features at hydrothermal vent fields, fueled by resident chemolithotrophic microorganisms, is likely to change the way we think about the role of these ecosystems in deep-sea biodiversity and productivity.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2152453

[table of contents | back to top]