Inventory of push cores taken on Alvin dives on RV/Atlantis cruise AT37-13 and AT42-03 at methane seeps off the Pacific coast of Costa Rica (Costa Rica Seeps project)

Website: https://www.bco-dmo.org/dataset/715706
Data Type: Cruise Results
Version: 3
Version Date: 2021-06-10

Project
» Collaborative research: Quantifying the biological, chemical, and physical linkages between chemosynthetic communities and the surrounding deep sea (Costa Rica Seeps)

Contributors	Affiliation	Role
Orphan, Victoria J.	California Institute of Technology (Caltech)	Principal Investigator
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Abstract
This dataset is an inventory of push corer samples collected by HOV/Alvin on the RV/Atlantis cruises AT/37-13 and AT42-03 to the Costa Rica Margin (Mound 12, Quepos landslide, Jaco Scar) during May/June 2017 and Oct./Nov 2018. It includes a description of the sampling locations and information on the types of analyses that were to be performed on the samples.

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Coverage

Spatial Extent: **N**:9.1181 **E**:-84.1281 **S**:8.8525 **W**:-84.8413
Temporal Extent: 2017-05-21 - 2018-11-04

Dataset Description

This dataset is an inventory of push corer samples collected by HOV/Alvin on the RV/Atlantis cruises AT/37-13 and AT42-03 to the Costa Rica Margin (Mound 12, Quepos landslide, Jaco Scar) during May/June 2017 and Oct./Nov 2018. It includes a description of the sampling locations and information on the types of analyses that were to be performed on the samples.

Methods & Sampling

Seafloor sediment push cores were collected using the manned submersible Alvin. Sediment cores were stored at 4ºC upon recovery and extruded from push core liners in 1 or 3 cm increments onboard immediately after

collection. Subsamples of each depth horizon were preserved for later microscopy and molecular analysis or processed immediately for pore water geochemistry (See Dekas et al., 2013 Environmental Microbiology) for details.

Data Processing Description

version 1 BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- blank values were replaced with no data value 'nd'
- reformatted Date from dd-Mon-yy to yyyy-mm-dd

version 2 (2017-09-25) **BCO-DMO Processing Notes:**
- added conventional header with dataset name, PI name, version date
- occurrences of 'n.a.' and 'n.m.' were replaced with no data value 'nd'
- reformatted Date from m/d/yyyy to yyyy-mm-dd
- added column for cruise_id
- reformatted lat and lon from degrees and minutes to decimal degrees for cruise_id AT42-03
- corrected date 2018-05-25 to 2018-10-25 for cruise_id AT42-03

version 3 (2021-06-10) BCO-DMO Processing Notes:
* data file converted to UTF-8. A comment in version 2 read with a "bad" character in a comment "bacterial mat near 6▒ water, actively bubbling active", After converting to UTF-8 the comment reads "bacterial mat near 6° water, actively bubbling active"

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Data Files

File
pushcore_log.csv (Comma Separated Values (.csv), 198.88 KB) MD5:d4a96fd3a7285980cf8b5245ed08d515 Primary data file for dataset ID 715706

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Related Publications

Dekas, A. E., Chadwick, G. L., Bowles, M. W., Joye, S. B., & Orphan, V. J. (2014). Spatial distribution of nitrogen fixation in methane seep sediment and the role of the ANME archaea. Environmental Microbiology, 16(10), 3012–3029. doi:10.1111/1462-2920.12247
Methods

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Parameters

Parameter	Description	Units
Date	sampling date	unitess
Dive	Alvin dive number	unitess
Push_Core	Push core number	unitess
Region	sampled region	unitess
Characteristic	description of physical site and biome	unitess
Activity	hydrothermal activity: inactive; transition; active	unitess
Depth_m	sample depth	meters
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
Serial_Number	lab serial number for sample	unitess
Horizon_cm	the push core sediment depth sampled	centimeters
methane	methane sample taken flag; x=yes	unitess
FISH	Fluorescent In Situ Hybridization sample taken flag; x=yes	unitess
DNA	DNA sample taken flag; x=yes	unitess
RNA	RNA sample taken flag; x=yes	unitess
Squeeze_Cakes	Squeeze Cakes sample taken flag; x=yes	unitess
carbonate_nodules	carbonate nodules sample taken flag; x=yes	unitess
sulfide	sulfide sample taken flag; x=yes	unitess
bromobimane	bromobimane sample taken flag; x=yes	unitess
sulfate	sulfate sample taken flag; x=yes	unitess
DIC	DIC sample taken flag; x=yes	unitess
IC	IC sample taken flag; x=yes	unitess
Fe	Fe sample taken flag; x=yes	unitess
pH	pH measure of acidity/alkalinity	unitess
Live_Mud	RNA sample taken flag; x=yes	unitess
cruise_id	cruise identifier	unitless
Site	site name with the sampling region	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Push Corer
Dataset-specific Description	Used to collect sediment samples from HOV/Alvin.
Generic Instrument Description	Capable of being performed in numerous environments, push coring is just as it sounds. Push coring is simply pushing the core barrel (often an aluminum or polycarbonate tube) into the sediment by hand. A push core is useful in that it causes very little disturbance to the more delicate upper layers of a sub-aqueous sediment. Description obtained from: http://web.whoi.edu/coastal-group/about/how-we-work/field-methods/coring/

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Deployments

AT37-13

Website	https://www.bco-dmo.org/deployment/714567
Platform	R/V Atlantis
Start Date	2017-05-20
End Date	2017-06-11
Description	More cruise information is available from Rolling Deck to Repository (R2R): * https://www.rvdata.us/search/cruise/AT37-13 * https://doi.org/10.7284/907684

AT37-13_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/715760
Platform	Alvin
Start Date	2017-05-21
End Date	2017-06-08
Description	Collections of seep organisms in sediments and on rocks.

AT42-03

Website	https://www.bco-dmo.org/deployment/777903
Platform	R/V Atlantis
Start Date	2018-10-17
End Date	2018-11-06
Description	More cruise information is available from Rolling Deck to Repository (R2R): * https://www.rvdata.us/search/cruise/AT42-03 * https://doi.org/10.7284/908473

AT42-03_Alvin_Dives

Website	https://www.bco-dmo.org/deployment/777904
Platform	Alvin
Start Date	2018-10-17
End Date	2018-11-04

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Project Information

Collaborative research: Quantifying the biological, chemical, and physical linkages between chemosynthetic communities and the surrounding deep sea (Costa Rica Seeps)

Coverage: Costa Rica Pacific Margin

NSF abstract:
If life were to disappear from the deep sea, would we notice? We only have a cursory understanding of this vast region and the connectivity among its communities and the rest of the oceans, and yet the ecosystems of the deep sea have been implicated in the larger function of the global marine ecosystems. We now rely on the deep ocean for food, energy, novel drugs and materials, and for its role in the global cycling of carbon, as well as for supporting services such as habitat creation, nutrient replenishment for shallow waters, and the maintenance of biodiversity. Cold seeps, active areas of the seafloor where methane and other chemicals are released, are key features along the continental margins worldwide. To characterize how methane seep communities interact with the surrounding ecosystems and vice versa, we will study methane seeps off the Pacific coast of Costa Rica in 2017 and 2018. It is the sphere of influence around the seep, both along the seafloor and up into the water column, that we seek to better understand. We will map the structure and the chemistry surrounding these habitats using a novel 3-dimensional framework, combining typical transects with vertical characterizations of the water column just above the seafloor. This will include measurements of methane flux into the water column and changes in the overlying carbonate chemistry and oxygen levels that are critical to our understanding of the effect of warming, oxygen loss and ocean acidification in this region. Within this framework, we will collect seep organisms in sediments and on rocks (including all sizes from microbes to large animals), and transplant some of these from within the area of seep influence to the background deep sea, and vice-versa. Together, these studies will help us to measure the size of the seep sphere of influence, and also demonstrate the role of these seeps within the deep sea and the greater, global, marine ecosystem. We will share this information with a group of teachers during a series of workshops in the San Diego area, at an exhibit at the Birch Aquarium, and through the work of an artist who has worked extensively with marine organisms in extreme environments.

Chemosynthetic ecosystems are inextricably linked to the broader world-ocean biome and global biogeochemical cycles in ways that we are just beginning to understand. This research will identify the form, extent, and nature of the physical, chemical, and biological linkages between methane seeps and the surrounding deep-sea ecosystem. The proposed research builds critical understanding of the structural and functional processes that underpin the ecosystem services provided by chemosynthetic ecosystems. We target a critical continental margin, Costa Rica, where methane fates and dynamics loom large and play out in an setting that reflects many oceanographic stressors. We will use quantitative sampling and manipulative studies within a 3-dimensional oceanographic framework. We will ask what are the shapes of the diversity and density functions for organisms of different size classes and trophic position over the transition from the seep habitat through the ecotone to the background deep sea? Further, we will ask how do depth, dissolved oxygen concentrations, pH and carbonate ion availability, relative rates of fluid flux, and substrate (biogenic, authigenic carbonate, sediments) alter these linkages and interactions with the surrounding deep sea? Evidence for distinct transitional communities and biotic patterns in density and alpha and beta diversity will be quantified and placed in a global biogeographic context. All of these investigations will occur across biological size spectra: for microorganisms (archaea, bacteria, microeukaryotes), the macrofauna, and the megafauna that form biogenic habitats. Our research results will be interpreted in the context of potential effects of global ocean change in the equatorial Pacific to determine how the linkages with the surrounding deep sea will be altered as anthropogenic impacts proceed in the future.

Related publications:

Levin, L.A., V.J. Orphan, G.W. Rouse, W. Ussler, A. E. Rathburn, G. S. Cook, S. Goffredi, E. Perez, A. Waren, B. Grupe, G. Chadwick, B. Strickrott. (2012). A hydrothermal seep on the Costa Rica margin: Middle ground in a continuum of reducing ecosystems. *Proc. Royal Soc. B.* 279: 2580-88 doi: 10.1098/rspb.2012.0205

Sahling, H., Masson, D. G., Ranero, C. R., Hühnerbach, V., Weinrebe, W., Klaucke, I., & Suess, E. (2008). Fluid seepage at the continental margin offshore Costa Rica and southern Nicaragua. *Geochemistry, Geophysics, Geosystems* 9: doi: 10.1029/2008GC001978

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1634002

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