

Methane seep hard substrate species collected on RV/Atlantis AT15-44, AT15-59, AT15-68, AT18-10 in the Pacific, off Costa Rica and USA from 2009-2011 (Seep Carbonate Ecology CROCKS II project)

Website: <https://www.bco-dmo.org/dataset/3757>

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Project

» [Short-term colonization processes at Costa Rica methane seeps](#) (Seep Carbonate Ecology CROCKS II)

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Dataset Description

Methane seep hard substrate species collected on 4 RV/Atlantis cruises and lodged at the SIO Benthic Invertebrate Collection.

Samples were taken at methane seeps on the Costa Rica Margin (80° 55.8' N 84° 18.7' W) and at Hydrate Ridge, Oregon Margin (44° 34' N, 125° 9' W).

Field investigations (collections and experiments) were made using the submersible ALVIN on the RV Atlantis at methane seeps on the Costa Rica margin during 2009 (AT 15-44) and 2010 (AT 15-59 funded by OCE 0939557). To compliment the studies of carbonate ecosystems off Costa Rica, but in a lower-oxygen realm, we examined parallel ecosystems and conducted parallel colonization experiments at Hydrate Ridge methane seeps. AT 15-68 was conducted with ALVIN at the northern, southern and southeast summits of Hydrate Ridge from July 30-Aug. 9, 2010, and AT 18-10 was conducted with ROV Jason, to recover experiments placed at Hydrate Ridge in 2010.

Collections from the two Costa Rica cruises yielded 909 lots cataloged into the Scripps Institution of Oceanography Benthic Invertebrate Collection (SIO-BIC), with 1874 whole specimens and 342 tissue samples. DNA has been extracted from 294 specimens and minimally sequenced for Cytochrome oxidase I (some for 16S and 18S as well). Collections from the Oregon Hydrate Ridge cruises in 2010 and 2011 resulted in 488 lots cataloged into SIO-BIC with 682 specimens and 295 tissue samples. DNA has been extracted from about 200 specimens and some sequenced (mainly CO1, but some for 16S and 1S).

The Costa Rica methane seeps hosted about 25 species of gastropods that are likely to be endemic to seeps, this is exceptionally high diversity, twice the normal 8-12 species found at seeps. Among them was the first species of Neomphalidae from a seep, this group was previously known from vents only, and two species of Lepetodrilidae, almost only known from vents.

The diversity of carbonate macrofauna is higher at Costa Rica seeps than at Hydrate Ridge seeps, in both

active and inactive settings. Faunal diversity is higher on active carbonates at Costa Rica and Hydrate Ridge than on inactive carbonates or within active seep (microbial mat-covered) sediments.

Methods & Sampling

Station locations:

Costa Rica Margin Lat Long
CR Quepos Landslide 8 50.0 N 84 13.0 W
CR Jaco Summit 9 10.4 N 84 47.9 W
CR Mound 12 8 55.8 N 84 18.7 W
CR Mound 11 8 55.3 N 84 18.2 W
CR Mound Quepos 9 1.9 N 84 37.2 W
CR Jaco Wall 9 7.2 N 84 50.5 W

Oregon:

Hydrate Ridge North 44 34 N 125 9 W
Hydrate Ridge South 44 40 N 125 6 W

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Data Files

File
seep_specimens.csv (Comma Separated Values (.csv), 8.22 KB) MD5:252d5b1e74ddbc6262a461fe749c28aa Primary data file for dataset ID 3757

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Parameters

Parameter	Description	Units
phylum	taxonomic phylum	text
subphylum_class	taxonomic subphylum or class	text
family	taxonomic family	text
name	taxonomic name at most specific level possible	text
region	geographic region where sample was collected: HR = Hydrate Ridge, Orgeon; CR = Costa Rica Margin	text
station	station name	text
depth_range	depth range of collection	meters
number	number of samples sequenced	integer

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Instruments

Dataset-specific Instrument Name	Alvin tube core
Generic Instrument Name	Alvin tube core
Generic Instrument Description	A plastic tube, about 40 cm (16 inches) long, is pushed into the sediment by Alvin's manipulator arm to collect a sediment core.

Dataset-specific Instrument Name	Multi Corer
Generic Instrument Name	Multi Corer
Dataset-specific Description	Ocean Instruments MultiCorer
Generic Instrument Description	The Multi Corer is a benthic coring device used to collect multiple, simultaneous, undisturbed sediment/water samples from the seafloor. Multiple coring tubes with varying sampling capacity depending on tube dimensions are mounted in a frame designed to sample the deep ocean seafloor. For more information, see Barnett et al. (1984) in Oceanologica Acta, 7, pp. 399-408.

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Deployments

AT15-44

Website	https://www.bco-dmo.org/deployment/58869
Platform	R/V Atlantis
Start Date	2009-02-21
End Date	2009-03-08
Description	Cruise Objective: We will conduct research in exposed carbonate ecosystems on the Costa Rica margin (700-1,400 m), to test hypotheses about the influence of active seepage on carbonate rock animal communities and their successional phases, on microbial activity including anaerobic methane oxidation and sulfide oxidation, on carbon isotopic composition of shelled organisms, and on phylogenetic affinities of animals. To test hypotheses we will sample existing authigenic carbonates from 3 levels of seepage activity: highly active, weak and inactive. Activity level will be defined by presence of /or proximity to bubbles/shimmering water, microbial mat development and megafauna, as well as previous fluid flow and composition measurements made at the Costa Rica study sites. We will sample 5 to 8 locations with each activity level in each study region, controlling for rock size and carbonate configuration when possible. ALVIN: During 3 dives at each of 4 study sites we will conduct bottom surveys and video transects, measure S, T, O ₂ , select 4 to 8 highly active, weakly active and inactive sites, photograph organisms and classify rocks in situ, collect rocks of varying sizes with organisms, and sample nearby sediments and biotic substrata (mussels, tube worms) for taxonomic comparisons. The remaining 2 dives at Costa Rica seeps will be used to conduct follow-up survey and sampling of the most promising locations, based on shipboard sample observations. Nighttime operations will consist of CTD casts (a minimum of one each at Mound 11, Mound 13, Jaco Scarp and Mound Quepos), multicoring (adjacent to mounds and at 400 m and 600 m sites in the OMZ), and pre-dive seabeam surveys. Cruise information and original data are available from the NSF R2R data catalog.

AT15-59

Website	https://www.bco-dmo.org/deployment/58765
Platform	R/V Atlantis
Start Date	2010-01-06
End Date	2010-01-13
Description	Costa Rica seafloor methane seeps 8 deg 55 N 84 depth 990m. Included Alvin dives 4586-4591. The primary goal of the cruise was to recover biological experiments deployed at active and inactive seep areas during Feb./March 2009. We successfully recovered 23/24 experimental units deployed on Mound 12, Costa Rica. One was simply missing on the sea floor. By using a gear elevator each day to maximize sample collection (and reserve ALVIN basket space for experiments) we were able to recover our experiments rapidly. This left us time for exploration of unusual biological communities at Jaco Scar. Cruise information and original data are available from the NSF R2R data catalog. Cruise dates changed Feb 2015 to match WHOI ship schedule and R2R.

AT15-68

Website	https://www.bco-dmo.org/deployment/58870
Platform	R/V Atlantis
Start Date	2010-07-31
End Date	2010-08-12
Description	Cruise information and original data are available from the NSF R2R data catalog.

AT18-10

Website	https://www.bco-dmo.org/deployment/58871
Platform	R/V Atlantis
Start Date	2011-08-31
End Date	2011-09-08
Description	Cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Short-term colonization processes at Costa Rica methane seeps (Seep Carbonate Ecology CROCKS II)

Coverage: Costa Rica seafloor methane seeps 8 deg 55 N 84 deg 18 W depth 990m

This RAPID project will conduct 5 submersible or ROV dives to collect a series of colonization experiments deployed in March 2009 on Mound 12 off Costa Rica (997 m). These experiments were deployed opportunistically, and to optimize the information that could be obtained, the PIs needed to recover them within a 12 month time frame. Early colonization of rock, wood, shell and tube substrates will be studied. The microbes, foraminiferans and metazoans present after 6-12 mo will be compared to those colonizing similar experiments to be deployed at Hydrate Ridge, where seeps occur within an oxygen minimum zone. The overall project goal is to integrate physical, geological, chemical and biological data to develop a holistic view of the influence of seep-generated carbonate hard-ground ecosystems on margins.

The objectives of the research are to (a) Compare colonizers at seeps off Costa Rica and Hydrate Ridge to

assess the importance of different oxygen regimes in the development of anaerobic methane oxidation, sulfide oxidizers and other microbial metabolisms on hard substrates, and to evaluate their roles in driving protozoan and metazoan succession at methane seeps. (b) Deploy a suite of biotic and abiotic substrates to distinguish the specific roles of carbonate substrate from those of other hard substrates (wood, clam and mussel shells, worm tubes) available. (c) Explore the similarity of vent and seep colonization processes by comparing colonization at the Costa Rica seeps, where vent species are common, to the Hydrate Ridge seeps, where they are not. (d) Determine whether there are diagnosable biogeographic isotope or other biomarker signatures from newly recruited Costa Rica microbial, foraminiferal and animal populations at active vs. inactive seeps, and whether these differ from those at Hydrate Ridge.

This research will involve international participation from Costa Rican scientists at the Univ. of Costa Rica.

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Funding

Funding Source	Award
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