

Invertebrate stable isotopes from samples collected at methane seeps off Southern California with the HOV Alvin from July 16-28, 2023 during R/V Atlantis cruise AT50-12

Website: <https://www.bco-dmo.org/dataset/945708>

Data Type: Cruise Results, Other Field Results

Version: 1

Version Date: 2024-12-10

Project

» [Collaborative Research: Redefining the footprint of deep ocean methane seepage for benthic ecosystems](#)
(Methanosphere)

Contributors	Affiliation	Role
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Abstract

This dataset provides C and N stable isotope data for invertebrates collected by HOV Alvin from July 16-28, 2023 at methane seeps in Southern California during R/V Atlantis cruise AT50-12. There are also POC data for one surface and one near bottom water sample collected by CTD. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ measurements were made on 0.2-4 mg dry-weight samples combusted using an elemental analyzer interfaced to a continuous flow isotope ratio mass spectrometer at the Stable Isotope Facility at the University of California, Davis (SIF-UCD).

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Coverage

Location: Methane seeps off Southern California at depths ~300-1040 m

Spatial Extent: N:33.7997358 E:-117.405733333333 S:32.6326 W:-118.647282

Temporal Extent: 2023-07-16 - 2023-07-27

Methods & Sampling

Puschore, rocks, biotubes, and slurp samples were collected with HOV Alvin using the manipulator. Rocks were placed into individual compartments in a biobox on the Alvin basket. Before preserving, samples were kept cold and animals were handpicked to sample tissue for stable isotope analyses (see other data files for isotopic data). The tissue (aprox. 0.5-2.5 mg) was placed in pre weighted tin boats or combusted vials (500C overnight) and frozen at -70C. In addition to natural abundance analyses, some animals were placed into mylar bags and exposed to labeled C and N for incubation experiments. These were carried out for 3-8 days, and animals were then processed following the same method as for natural abundance samples. Surface and bottom seawater was collected using a CTD/Rosette system and filtered through microglass fiber filters. Filters were frozen for further processing in the laboratory.

Data Processing Description

In the laboratory, tissue samples were oven dried (60C) overnight, weighed and acidified with 12.5-25 ul 1N H₃PO₄ to remove inorganic C. Stable isotopes measurements (d¹³C and d¹⁵N) were carried out using an isotope ratio mass spectrometer at the Stable Isotope Facility at University of California, Davis. Microglass fiber filters were oven dried (60C) overnight, and the material on the filters was scrapped off and place int pre-weighed tin boats. Samples were then processed following the same method as for tissue samples.

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	CTD/Rosette system
Generic Instrument Name	CTD Sea-Bird 911
Dataset-specific Description	Surface and bottom seawater was collected using a CTD/Rosette system and filtered through microglass fiber filters.
Generic Instrument Description	The Sea-Bird SBE 911 is a type of CTD instrument package. The SBE 911 includes the SBE 9 Underwater Unit and the SBE 11 Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	oven
Generic Instrument Name	Drying Oven
Dataset-specific Description	In the laboratory, tissue samples were oven dried (60C) overnight, weighed and acidified with 12.5-25 ul 1N H ₃ PO ₄ to remove inorganic C.
Generic Instrument Description	a heated chamber for drying

Dataset-specific Instrument Name	HOV Alvin
Generic Instrument Name	HOV Alvin
Dataset-specific Description	Puschore, rocks, biotubes, and slurp samples were collected with HOV Alvin using the manipulator.
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	isotope ratio mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Stable isotopes measurements (d13C and d15N) were carried out using an isotope ratio mass spectrometer at the Stable Isotope Facility at University of California, Davis.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

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Deployments

AT50-12

Website	https://www.bco-dmo.org/deployment/946261
Platform	R/V Atlantis
Start Date	2023-07-16
End Date	2023-07-29

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Project Information

Collaborative Research: Redefining the footprint of deep ocean methane seepage for benthic ecosystems (Methanosphere)

Coverage: Gulf of Alaska and Southern California Bight

NSF Award Abstract:

This research examines the role of deep-sea organisms in determining the fate and footprint of methane, a potent greenhouse gas, on Pacific continental margins. The investigators are evaluating the deep ocean methanosphere defined by the microbial communities that consume methane and the animals that directly feed on or form symbioses with methane-consuming microbes. They are also investigating animal communities that gain energy indirectly from methane, as well as those that take advantage of carbonate rocks, the physical manifestation of methane consumption in seafloor sediments. The study of methane seeps in the deep waters of both Alaska (4400-5500 meters) and Southern California (450-1040 meters) is enabling comparisons of the methanosphere under different food-limitation and oxygen regimes. By applying diverse chemical, isotopic, microscopy, and genetic-based analyses to seep microbes and fauna, this study is advancing understanding of the contribution of methane to deep-sea biodiversity and ecosystem function, information that can inform management and conservation actions in US waters. In addition to training for graduate and undergraduate students at their home institutions, the investigators are collaborating with the Alaska Native Science and Engineering Program (ANSEP). They are recruiting Alaskan undergraduates to participate in the research, contributing to ANSEP's online resources that promote interaction between scientists and middle and high school students, and participating in ANSEP's annual residential Career Exploration in Marine Science programs to engage middle school students in learning about deep-sea ecosystems and the variety of career pathways available in marine related fields.

Microbial production and consumption of methane is dynamic and widespread along continental margins, and some animals within deep-sea methane seeps rely on the oxidation and sequestration of methane for nutrition. At the same time, understanding of methane-dependent processes and symbioses in the deep-sea environment is still rudimentary. The goals of this study are to 1) examine the diversity of animals involved in methane-based symbioses and heterotrophic consumption of methane-oxidizing microbes and how these symbioses extend the periphery of seeps, contributing to non-seep, continental slope food webs; and 2) determine whether carbonates on the seep periphery sustain active methanotrophic microbial assemblages, providing a localized food source or chemical fuel for thiotrophic symbioses, via anaerobic oxidation of methane, or free-living, sulfide-oxidizing bacteria consumed by animals. The investigators are addressing these goals by surveying, sampling, and characterizing microbes, water, sediments, carbonates and animals at a deep seep site on the Aleutian Margin and a shallow site off Southern California. Shipboard experiments and laboratory analyses are using molecular, isotopic, geochemical, and radiotracer tools to understand transfer of methane-sourced carbon from aerobic methanotrophs under multiple oxygen levels, pressures, and photosynthetic food inputs. This approach offers a wide lens by which to examine the methane seep footprint, allow reinterpretation of past observations, and identify new scientific areas for future study. Improved characterization of the deep continental margin methanosphere informs climate science, biodiversity conservation, and resource management.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2048720

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