

Sediment and porewater

Website: <https://www.bco-dmo.org/dataset/1002503>

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Project

» [Collaborative Research: Investigating the source and flux of dissolved organic carbon released from methane seeps to the deep-ocean](#) (seepDOM)

Contributors	Affiliation	Role
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Coverage

Spatial Extent: Lat:0 Lon:0

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Collaborative Research: Investigating the source and flux of dissolved organic carbon released from methane seeps to the deep-ocean (seepDOM)

Website: <https://sites.google.com/umces.edu/thelaphamlab/home/projects/seepdoc>

Coverage: Astoria Canyon and Hydrate Ridge

NSF Award Abstract:

Dissolved organic carbon (DOC) is a key component of the ocean's food web and carbon cycle, and carbon exchanged between oceanic DOC and the atmosphere has influenced atmospheric CO₂ levels on timescales ranging from recent decades to the geologic past. Production by marine algae in the surface ocean is the largest source of DOC and its effects on the ocean carbon cycle are widely appreciated. However, the contribution of DOC from additional sources such as rivers, hydrothermal vents, and methane seeps and their impact on ocean ecology and chemistry are not well understood. Each source differs in terms of its biological

utilization and age, which affects the storage and distribution of DOC among the ocean basins. Methane seeps located along continental margins are particularly significant because they may transfer globally significant quantities of carbon stored below the seafloor as natural gas and gas hydrate to the oceans. This project will investigate the production, flux, composition and potential for biological utilization of DOC at Hydrate Ridge, located offshore Oregon. Hydrate Ridge is a prominent methane seep with massive accumulations of gas hydrate and a node of the Ocean Observatories Initiative telecommunications cabled array on the Juan De Fuca tectonic plate, which provides a continuous stream of real-time regional oceanographic data. We will sample and chemically characterize methane, DOC, and other materials to provide information about where the materials originated (deep vs shallow), how they have been chemically altered, to what extent they may feed deep ocean organisms, or contribute to the long term storage of DOC in the ocean. Experiments and analysis will be conducted using sediment cores and bottom water samples collected using either the remotely operated vehicle Jason or the human occupied vehicle Alvin during a 7-day ocean expedition. Additionally, this project will place osmotically-driven pumps on the seafloor to continuously sample fluids for approximately one year, thereby allowing us to monitor the movement of methane and DOC expelled from the seafloor to the ocean and constrain processes that regulate the release of carbon to the oceans at methane seeps. This project will support one graduate student and several undergraduates from a community college in Maryland and a college located in a lower-income urban center in southeastern Massachusetts. We will disseminate project findings to the public with a series of videos for public TV.

This study will investigate the production, flux and reactivity of methane-derived dissolved organic carbon (DOC) from methane (CH₄) seeps at Hydrate Ridge, Offshore Oregon. The study will address four fundamental questions to determine the significance of CH₄-derived DOC within the ocean carbon cycle: (1) How much CH₄-derived fossil DOC do seeps contribute to the oceans? (2) To what extent is CH₄-derived C incorporated into DOC during anaerobic oxidation of CH₄? (3) Is seep DOC bioavailable or recalcitrant when released into the deep ocean? (4) How does the flux of DOC to the water column vary over time? We will employ an interdisciplinary strategy that includes in situ sampling, laboratory incubations, and a comprehensive analytical geochemistry program. Data from the Ocean Observatories Initiative Regional Cabled Array at Southern Hydrate Ridge will be used to provide context for field and experimental data. The composition and abundance of organic and inorganic chemical species along with the stable and radiocarbon isotope composition of pore water, bulk sediment, and water column C pools will be used to identify DOC sources and quantify fluxes from cold seeps characterized by a range of advection rates. The centerpiece of the investigation will be a 7-day research cruise to Hydrate Ridge to collect sediments, pore fluids, and water column samples, and deploy OsmoSamplers for continuous time series fluid sampling. The results will form the foundation for estimating the contribution of CH₄-derived DOC to the oceanic DOC pool.

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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2049517

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