

Biogeochemical and sediment characteristics of the Cinder Cones Methane seep site in the Ross Sea from November 2016

Website: <https://www.bco-dmo.org/dataset/770638>

Data Type: Other Field Results

Version: 1

Version Date: 2019-06-21

Project

» [EAGER: Elucidating the Antarctic Methane Cycle at the Cinder Cones Reducing Habitat](#) (Cinder Cone Seep)

Contributors	Affiliation	Role
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Abstract

These data are samples of pore water collected from a methane seep on Ross Island. This seep had been active for 5 years at the time of sampling and were collected from 10m water depth.

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Coverage

Spatial Extent: Lat:-77.8 Lon:-166.666

Temporal Extent: 2016-11-07 - 2016-11-15

Dataset Description

Biogeochemical and sediment characteristics of the Cinder Cones Methane seep site

Methods & Sampling

Sediment samples: Sediment cores were collected from the Cinder Cones site including a methane seep habitat and vertically sectioned into identified intervals at either 3cm or 1cm intervals depending on the analysis. To quantify methane from sediment plugs, subcores were taken vertically via a syringe with the end cut off to sample 3 cm³ of sediment. The subcores were preserved in 2ml of 5M NaOH in a serum bottle and capped with a butyl stopper for later analysis. It was stored and shipped upside down. Large grain size led to rapid dewatering of the cores making the concentrations likely conservative estimates of the methane (i.e. the is a chance some of the porewater was lost during sampling). For 0-1 cm sediment plugs, a core was vertically sectioned and frozen at -80oC until later analysis.

Porewater samples: Pore water was sampled in situ by placing a vertical barrier in the sediment, excavating one side and inserting a Rhyzon filter (0.2 um) into the intact sediment on the opposite side of the excavation. 1 ml of porewater was discarded as a rinse and then 5ml of pore water was extracted. These were taken at 2

cm intervals starting at 1 cm below the sediment surface to 5cm. 3ml were preserved in serum bottles with 2ml of 5M NaOH for later methane analysis. 1 ml was filtered to remove particles >0.2 um and frozen for ion analysis and 1ml was preserved with 0.25ml of 0.05 M Zinc acetate for hydrogen sulfide concentration for Spectrophotometric analysis following Cline (1969).

Sampling and analytical procedures:

Methane: Samples were kept stored cold and inverted for both porewater and sediment plug sampling approaches for methane. Headspace from each of the serum vials was injected into a Gas Chromatograph with Flame Ionization Detector (GC-FID) after a standard curve was generated based on known standards increasing from 10 to 1000 ppm and the same injection volume (between 50 and 100 ul) as the headspace of the samples. Adjusted r2 of the calibration curve was 1.0. Response area was measured using "Peak Simple" software.

Methane Flux: Methane flux was measured in 2016 through the deployment of benthic flux chambers. Chambers were 10cm i.d. cores with a cap containing a septa sealed hole for sampling and an o-ring seal around the cap. The chambers were sealed with the caps after the cores were inserted into the sediment to ensure minimal disturbance to the system. Chambers were not continually stirred but were stirred by using magnetic propeller system that allowed gentle agitation prior to each sample collection. Samples were taken on 12-hour intervals to quantify that release of methane through syringe sampling through the septa; at no point were the chambers opened

Data Processing Description

Data processing was limited to using standard curves from and converting to water volume and surface area.

BCO-DMO Processing Notes:

- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- converted "Collection_Date" from Excel date integer to ISO yyyy-mm-dd representation and inserted into "Date" column.

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Data Files

File
ions.csv (Comma Separated Values (.csv), 8.40 KB) MD5:0c38d85494dab4d1d5d94d08f4b12314
Primary data file for dataset ID 770638

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Related Publications

Cline, J. D. (1969). Spectrophotometric Determination of Hydrogen Sulfide in Natural Waters. *Limnology and Oceanography*, 14(3), 454-458. doi:[10.4319/lo.1969.14.3.0454](https://doi.org/10.4319/lo.1969.14.3.0454)
Methods

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Parameters

Parameter	Description	Units

Site_name	Name of dive location on Ross Island Antarctica	unitless
Habitat	Whether the sample was from an area of active methane seepage or sampled adjacent to this habitat.	unitless
Collection_Date	Date sample was collected as Excel integer representation	unitless
Date	Collection Date represented as yyyy-mm-dd	unitless
geo_loc_lat	Latitude of the sample in degrees	decimal degrees
geo_loc_long	Longitude of the sample in degrees	decimal degrees
Water_depth	Depth in meter that the sample was collected from	meters (m)
Replicate	Individual identifier for the core (all letters indicate samples from a single core or sampling cluster). Pore water was taken adjacent to the core however within 10cm of the core and thus from the same geochemical environment.	unitless
Sediment_Depth	depth or depth range from which the same was taken	centimeters (cm)
sampling_approach	sampling approach used for the observations (porewater; sediment; or flux chamber)	unitless
Fluoride	Fluoride	millimole (mmol)
Acetate	Acetate	millimole (mmol)
Formate	Formate	millimole (mmol)
Chloride	Chloride	millimole (mmol)
Nitrite	Nitrite	millimole (mmol)
Bromide	Bromide	millimole (mmol)
Sulfate	Sulfate	millimole (mmol)
Thiosulfate	Thiosulfate	millimole (mmol)
Lithium	Lithium	millimole (mmol)
Sodium	Sodium	millimole (mmol)
Ammonium	Ammonium	millimole (mmol)
Potassium	Potassium	millimole (mmol)
Magnesium	Magnesium	millimole (mmol)
Calcium	Calcium	millimole (mmol)
Sulfide	Sulfide	millimole (mmol)
Methane_porewater	Methane in porewater	nanomole per milliliter of porewater (nmol ml ⁻¹ porewater)
Methane_sediment	Methane in sediment	nanomole per cubic centimeter of sediment (nmol cm ⁻³ sediment)
d2HVSMOW	stable isotopic composition of hydrogen in comparison to the reference "Vienna-Standard Mean Ocean Water"	per mil
d13CVPDB	stable isotopic composition of carbon in comparison to the reference "Vienna PeeDee Belemnite"	per mil
Methane_Flux	Methane_Flux	millimole per meter squared per day (mmol m ⁻² d ⁻¹)

Instruments

Dataset-specific Instrument Name	HP 5890 Gas Chromatograph
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	Methane concentration was measured with a HP 5890 Gas Chromatograph with an AllTech Porapak N8/100 column and a Flame ionization detector.
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

Dataset-specific Instrument Name	Thermo Delta V Plus isotope ratio mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	The $\delta^{13}\text{C}$ and $\delta^2\text{H}$ of methane were analyzed at the University of California, Davis on a Thermo Scientific GasBench-Precon interfaced to a Thermo Delta V Plus isotope ratio mass spectrometer.
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).

Project Information

EAGER: Elucidating the Antarctic Methane Cycle at the Cinder Cones Reducing Habitat (Cinder Cone Seep)

Coverage: Ross Sea, Antarctica (78 S, 166 E)

NSF abstract:

Methane is a potent greenhouse gas that is naturally emitted into the oceans by geologic seeps and microbial production. Based on studies of persistent deep-sea seeps at mid- and northern latitudes, researchers have learned that bacteria and archaea can create a "sediment filter" that oxidizes methane prior to its release. Antarctica is thought to contain large reservoirs of organic carbon buried beneath its ice which could a quantity of methane equivalent to all of the permafrost in the Arctic and yet we know almost nothing about the methane oxidizing microbes in this region. How these microbial communities develop and potentially respond to fluctuations in methane levels is an under-explored avenue of research. A bacterial mat was recently discovered at 78 degrees south, suggesting the possible presence of a methane seep, and associated microbial communities. This project will explore this environment in detail to assess the levels and origin of methane, and the nature of the microbial ecosystem present.

An expansive bacterial mat appeared and/or was discovered at 78 degrees south in 2011. This site, near

McMurdo Station Antarctica, has been visited since the mid-1960s, but this mat was not observed until 2011. The finding of this site provides an unusual opportunity to study an Antarctic marine benthic habitat with active methane cycling and to examine the dynamics of recruitment and community succession of seep fauna including bacteria, archaea, protists and metazoans. This project will collect the necessary baseline data to facilitate further studies of Antarctic methane cycling. The concentration and source of methane will be determined at this site and at potentially analogous sites in McMurdo Sound. In addition to biogeochemical characterization of the sites, molecular analysis of the microbial community will quantify the time scales on which bacteria and archaea respond to methane input and provide information on rates of community development and succession in the Southern Ocean. Project activities will facilitate the training of at least one graduate student and results will be shared at both local and international levels. A female graduate student will be mentored as part of this project and data collected will form part of her dissertation. Lectures will be given in K-12 classrooms in Oregon to excite students about polar science. National and international audiences will be reached through blogs and presentations at a scientific conference. The PI's previous blogs have been used by K-12 classrooms as part of their lesson plans and followed in over 65 countries.

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Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1642570

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