H2S from microsensor profiles of ex situ sediment cores collected in the Chesapeake Bay and measured during 2017-2018

Website: https://www.bco-dmo.org/dataset/847949
Data Type: Other Field Results
Version: 1
Version Date: 2021-04-07

Project
» Collaborative Research: Probing the Metabolic and Electrical Interactions of Cable Bacteria in Anoxic Sediments (Anoxic Sediment Bacteria Interactions)

Contributors	Affiliation	Role
Malkin, Sairah	University of Maryland Center for Environmental Science (UMCES/HPL)	Principal Investigator
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Abstract
This dataset includes H2S from microsensor profiles of ex situ sediment cores collected in the Chesapeake Bay and measured during 2017-2018.

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Coverage

Spatial Extent: **N**:38.55728 **E**:-76.42794 **S**:38.55505 **W**:-76.49402
Temporal Extent: 2017-03-28 - 2018-08-24

Methods & Sampling

Methodology:
High-resolution microsensor profiling of O_2, pH, and H_2S was performed on replicate sediment cores retrieved from the sampling sites, with 1 or 2 replicate profiles made per sediment core per analyte, using commercial microsensors operated with a motorized micromanipulator (Unisense A.S., Denmark). Sulfide (SumH2S) was calibrated with 5-point calibration using NaS2 (0-300 micromolar), and corrected with pH at the corresponding depth. Detailed methodology is given in Malkin et al., 2014.

Sampling and Analytical Procedures:
Replicate sediment cores were collected using a gravity corer (Uwitec; clear PVC liners, Ø = 8.6 cm), capped, kept in the dark at bottom water temperature in a water bath, and transported back to the laboratory, where they were held in a climate-controlled room. Microsensor profiling was conducted within 1 day of core retrieval.

Instruments:

Unisense A.S. microsensors (Denmark) and motorized micromanipulator system were used for data collection. The 4 channel microsensor multimeter was used, with the following microsensors: Ox-50, pH-200, and H2S-100. Each sensor was used consecutively and so resultant data is provided separately as individual datasets. SensorTrace Suite software was used for data collection.

Data Processing Description

BCO-DMO Processing:
- changed date format to YYYY-MM-DD;
- converted longitude from positive degrees West to negative degrees East.

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Data Files

File
H2S.csv (Comma Separated Values (.csv), 522.98 KB) MD5:77d68127b16995a036b3c7b292e642fd Primary data file for dataset ID 847949

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Related Publications

Malkin, S. Y., Rao, A. M., Seitaj, D., Vasquez-Cardenas, D., Zetsche, E.-M., Hidalgo-Martinez, S., … Meysman, F. J. (2014). Natural occurrence of microbial sulphur oxidation by long-range electron transport in the seafloor. The ISME Journal, 8(9), 1843–1854. doi:10.1038/ismej.2014.41
Methods

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Related Datasets

IsRelatedTo

Malkin, S. (2021) **O2 saturation from microsensor profiles of ex situ sediment cores collected in the Chesapeake Bay and measured during 2017-2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-04-06 doi:10.26008/1912/bco-dmo.847846.1 [view at BCO-DMO]

Malkin, S. (2021) **pH from microsensor profiles of ex situ sediment cores collected in the Chesapeake Bay and measured during 2017-2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-04-07 doi:10.26008/1912/bco-dmo.847923.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
date_local	date of field sampling (local time zone; EST); format: YYYY-MM-DD	unitless
Year	year of field sampling	unitless
Month	month of field sampling	unitless
Day	day of month of field sampling	unitless
site	site of sediment collection	site
lat	latitude	degrees North
lon	longitude	degrees East
site_depth	depth of sampling site	meters (m)
CoreRep	core replicate (A or B)	unitless
ProfileRep	replicate profiles within a core (A or B)	unitless
sensor_depth_mm	depth of microsensor	millimeters (mm)
value_SumH2S	calibrated value of H2S microsensor	micromol per L
Flag	indication of measurement problem or caution	unitless

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Instruments

Dataset-specific Instrument Name	gravity corer (Uwitec)
Generic Instrument Name	Gravity Corer
Generic Instrument Description	The gravity corer allows researchers to sample sediment layers at the bottom of lakes or oceans. The coring device is deployed from the ship and gravity carries it to the seafloor. (http://www.whoi.edu/instruments/viewInstrument.do?id=1079).

Dataset-specific Instrument Name	Unisense A.S. microsensors (Denmark)
Generic Instrument Name	Unisense H2S microsensor
Dataset-specific Description	Unisense A.S. microsensors (Denmark) and motorized micromanipulator system were used for data collection. The 4 channel microsensor multimeter was used, with the following microsensors: Ox-50, pH-200, and H2S-100. Each sensor was used consecutively.
Generic Instrument Description	The Unisense H2S microsensor is a tool for studying H2S production and oxidation in a wide range of applications. The H2S microsensor is a miniaturized amperometric sensor with internal reference and a sensing anode. The anode is polarized against an internal reference. Driven by the external partial pressure, H2S from the environment penetrates through the sensor tip membrane into the electrolyte where the H2S is ultimately oxidized by the anode. This generates a current in the pA range which is measured by a picoammeter. See more on the manufacturer's website: https://www.unisense.com/H2S/

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Project Information

Collaborative Research: Probing the Metabolic and Electrical Interactions of Cable Bacteria in Anoxic Sediments (Anoxic Sediment Bacteria Interactions)

Coverage: Chesapeake Bay sediments; Mid-Atlantic Coastal sediments

NSF Award Abstract:
Marine sediments represent the world's largest repository of stored organic carbon, and understanding how microorganisms break down this carbon is an imperative for understanding global carbon cycling. Yet long-standing questions remain regarding how networks of microorganisms work together to accomplish the complete breakdown of organic carbon in marine sediments. Sediment microbes interact in a myriad of ways that couple their metabolism to the break down of organic carbon, including by sharing products of metabolism. Accumulating evidence further suggests that some microorganisms can interact by transferring electrons directly to other unrelated microorganisms. This ability occurs across diverse microorganisms and appears to be widespread in the biosphere, particularly in anaerobic environments such as marine sediments. This project addresses emerging questions about the identity and metabolic linkages between microorganisms that work together in natural anaerobic marine and estuarine sediments to break down organic carbon. The investigators approach these questions by focusing on the influence of a keystone bacterium on its surrounding microbial community. "Cable bacteria" are a recently discovered group of long filamentous bacteria that act as electrical conductors in aquatic sediments providing a conduit for electrons to commute from deeper sulfidic sediments up to the surface oxygen layer by the process of centimeter-scale electron transport. Since their discovery about 6 years ago, these bacteria have been observed in a wide range of depositional sedimentary environments, often at extremely high cell densities. Where these bacteria are abundant, such as in coastal marine muds, they drive intense localized changes in pH and strongly influence the mineral cycling. This research explores the direct and indirect influence of cable bacteria on the metabolic activity of associated microorganisms. This project also advance the education and training of two early-career investigators, two PhD students, and undergraduate students. The skills and expertise gained from these PhD research projects will enable the students to be competitive in academic pursuits and in bioinformatics and technology applications relevant to private industry. The scientific discoveries emerging from this work is being incorporated into undergraduate and graduate level courses in marine microbial ecology. The research team will reach out to the broader community by hosting public lectures promoting a better understanding of environmental microbial ecology.

The proposed work is to investigate the role of cable bacteria in structuring sediment microbial communities. Due to their growth strategy and morphology, cable bacteria are particularly amenable to experimental manipulation, providing an outstanding opportunity to better understand community interactions among microorganisms in a natural and complex anaerobic environment. The investigators will explore the interactions and relationships between cable bacteria and their associated microbial community by manipulating the growth and activity of cable bacteria and quantifying the resultant microbial community response. Specifically, this project aims to (1) identify microorganisms whose growth is enhanced by cable bacteria, (2) identify metabolic processes linked with cable bacteria activity using metatranscriptomics, (3) test specific metabolic links between sediment microorganisms and cable bacteria activity using a DNA-stable isotope probing (SIP) approach, and (4) visually confirm the identity and quantify key microorganisms associated with cable bacteria using microscopy. As more is learned about the identity and the mechanisms by which microorganisms are metabolically linked in anoxic sediments, we will be better able to understand and make predictions about how microorganisms function in their environment and how they can be utilized in bioengineered systems.

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-1756877
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756851

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