Dissolved nitrate plus nitrite, nitrite and phosphate from water column of the East Pacific Rise in April 2019 aboard the R/V Atlantis cruise AT42-09

Website: https://www.bco-dmo.org/dataset/948718
Data Type: Cruise Results
Version: 1
Version Date: 2025-02-04

Project
» Collaborative Research: From hot to cold in the dark - shifts in seafloor massive sulfide microbial communities as physical and geochemical conditions change after venting ceases (Hot2cold Vents)

Contributors	Affiliation	Role
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Abstract
These are dissolved inorganic nutrient concentrations from the eastern tropical north pacific ocean from the water column overlying the east pacific rise at 9°50'N 104°18.14'W including samples in hypoxic water. The measured nutrients are nitrate plus nitrite, nitrite, and phosphate. Samples were collected through two casts, one each on April 9 2019 and April 13 2019 by Dr. Benjamin Tully aboard the RV Atlantis cruise AT 42-09. Samples were run by Chesapeake Bay Laboratory's Analytical services facility following EPA method 353.2 with analysis overseen by Jerry Frank. While the cruise primarily focused on the hydrothermal vent field below, our team focused on measurements of suspended particles in the water column and their microbial communities. These nutrient data supported this analysis. These data support a paper in review titled "Quantitative microbial taxonomy across particle size, depth, and oxygen concentration" lead by Paulina Huanca.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
  - BCO-DMO Processing Description
  - Problem Description
- Data Files
- Related Publications
- Related Datasets
- Parameters
- Instruments
- Deployments
- Project Information
- Funding

Coverage

Location: Water column of the Eastern Tropical North Pacific Ocean overlying the East Pacific Rise hydrothermal vent field.9°50'N 104°18.14'W Full depth profile to 2500 m
Spatial Extent: **Lat**:9.8333 **Lon**:-104.3023
Temporal Extent: 2019-04-09 - 2022-09-15

Dataset Description

These data were supported by NSF award OCE-1756339 and Horn Point Laboratory startup funds.

Results publication in review:
Fuchsman, C.A. and Cram, J.A. (n.d.) Size fractionated suspended organic carbon and nitrogen from the offshore Eastern Tropical North Pacific Oxygen Deficient Zone suggest contributions of picocyanobacteria and vertically migrating metazoans to organic matter. Global Biogeochemical Cycles. In review.
*preprint available at ESS Open Archive (Fuchsman & Cram 2024, doi:10.22541/essoar.173046855.50289201/v1)

Huanca, P., C.A. Fuchsman, B.J. Tully, J.B. Sylvan, J.A. Cram (n.d.) Quantitative microbial taxonomy across particle size, depth, and oxygen concentration. Frontiers in Microbiology. In review.

Methods & Sampling

[See "Related Publications" section for full references and links to methods and standards cited here.]

Water was collected from the CTD rosette and prefiltered through a 0.2 µm Sterivex filter into a triplle rinsed 50 ml falcon tube. Samples were stored at -80 °C, shipped to University of Southern California on dry ice, stored for one year, and then shipped on to UMCES. At UMCES prefiltered (0.2 µm) dissolved nitrate, nitrite, and phosphate from the water samples were analyzed at the Nutrient Analytical Services Laboratory at the Chesapeake Biological Laboratory (CBL). The ELAP Certification Number for all samples is 12066 Methods for each nutrient follow:

Nitrite plus nitrate:

Measured by using the Method EPA 353.2 - CADMIUM (in the case of samples AT4209-007-Surf, and AT2309-007-Chla-Top) and method ASTDM D-7781-14 for all other samples.

Method detection limit was 0.0004 for method EPA 353.2 - CADMIUM and 0.0057 for method ASTM D-7781-14. Reporting limit was 0.0056 for method EPA 353.2 - CADMIUM and 0.028 for method ASTM D-7781-14.

Nitrate with the method EPA 353.2
Method detection limit was 0.0009 and reporting limit was 0.0032

Phosphate by using method EPA 365.1
Method detection limit was 0.0034 and reporting limit was 0.0102

Data Processing Description

Data were processed by Chesapeake Bay Laboratory Analytical Services using their standard pipeline. Final data files for upload to BCO DMO were curated by hand by Jacob Cram.

BCO-DMO Processing Description

Data Version 1:
* data within the submitted file "EPR_Nutrients_for_BCODMO_W.csv", was imported into the BCO-DMO data system for this dataset. Several revisions of this file were uploaded, but the version that corresponds to public version 1 of this dataset "EPR_Nutrients_for_BCODMO_W.csv" was uploaded 2025-02-17.

* Column names adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]

* Dates converted to ISO 8601 format

* ISO DateTime with timezone (UTC) column added in ISO 8601 format.

* latitude and longitude columns added from values provided in submission metadata.

Problem Description

All samples were stored from spring 2019 though fall 2022 longer than 28 days from collection to sample processing recommended by the sequencing center.

[table of contents | back to top]

Data Files

File
948718_v1_epr_2019_nutrients.csv (Comma Separated Values (.csv), 1.26 KB) MD5:930a4d06384ec4f9b8d5122605527bd7 Primary data file for dataset ID 948718, version 1

[table of contents | back to top]

Related Publications

American Society for Testing and Materials. (2014). Standard test methods for nitrite-nitrate in water (D7781-14), Book of Standards ASTM Volume 11.02: Water (II), ICS Code: 13.060.50. doi: 10.1520/D7781-14 https://doi.org/10.1520/D7781-23
Methods

Fuchsman, C. A., & Cram, J. A. (2024). Size fractionated suspended organic carbon and nitrogen from the offshore Eastern Tropical North Pacific Oxygen Deficient Zone suggest contributions of picocyanobacteria and vertically migrating metazoans to organic matter. https://doi.org/10.22541/essoar.173046855.50289201/v1
Results

Huanca, P., C.A. Fuchsman, B.J. Tully, J.B. Sylvan, J.A. Cram (n.d.) Quantitative microbial taxonomy across particle size, depth, and oxygen concentration. Frontiers in Microbiology. In review.
Results

U.S. EPA. (1993) In: Method 353.2, Revision 2.0 (August 1993): Determination of Nitrate-Nitrite Nitrogen by Automated Colorimetry. US EPA. Retrieved from https://www.epa.gov/sites/default/files/2015-08/documents/method_353-2_1993.pdf
Methods

U.S. EPA. (1993). Method 365.1. Revision 2.0 (August 1993), Determination of Phosphorus by Semi-Automated Colorimetry. U.S. Environmental Protection Agency, Cincinnati, OH. Retrieved from https://www.epa.gov/sites/default/files/2015-08/documents/method_365-1_1993.pdf
Methods

[table of contents | back to top]

Related Datasets

IsRelatedTo

University of Maryland Center for Environmental Science. EPR_Size_Fractionated_Microbiota. 2024/11. In: NCBI:BioProject: PRJNA1191024.[Internet]. Bethesda, MD: National Library of Medicine (US), National Center for Biotechnology Information; Available from: http://www.ncbi.nlm.nih.gov/bioproject/PRJNA1191024.

[table of contents | back to top]

Parameters

Parameter	Description	Units
Sample_ID	Sample identifier provided by client, usually indicate on COC and/or sample vessel	unitless
Depth	Depth of sample colection	meters (m)
latitude	location sampled (latitude)	decimal degrees
longitude	location sampled (longitude)	decimal degrees
Sample_Date	Date sample was taken or produced, usually indicated on COC and/or sample vessel. ISO 8601 format	unitless
Sample_Time	Time the sample was collected (recorded in UTC time zone). ISO 8601 format.	unitless
Sample_ISO_DateTime_UTC	Datetime with timezone (UTC) sample was taken or produced, usually indicated on COC and/or sample vessel. ISO 8601 format	unitless
Received_Date	Date sample arrived at NASL/CBL and entered the analysis queue	unitless
NO2	Nitrite (NO2) concentration	milligrams per liter (mg N/L)
NO23	Nitrite (NO2) plus Nitrate (NO3) concentration	milligrams per liter (mg N/L)
PO4	Phosphate (PO4) concentration	milligrams per liter (mg P/L)
NO2_Flag	Flag for nitrite "NO2" column. Flag indicating if samples is below the method detection limit or reporting limit. An "L" denotes the sample concentration is less than the stated Method Detection Limit (MDL), BR denotes the concentration is less than the stated reporting limit. MDL is reported if the value is "L".	unitless

NO23_Flag	Flag for nitrite plus nitrate column "NO23" indicating if samples is below the method detection limit or reporting limit. An "L" denotes the sample concentration is less than the stated Method Detection Limit (MDL), BR denotes the concentration is less than the stated reporting limit. MDL is reported if the value is "L".	unitless
PO4_Flag	Flag for phosphate column 'PO4' indicating if samples is below the method detection limit or reporting limit. An "L" denotes the sample concentration is less than the stated Method Detection Limit (MDL), BR denotes the concentration is less than the stated reported limit. MDL is reported if the value is "L".	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	PMC Industries Flat Bed Linear recorder
Generic Instrument Name	flatbed linear recorder
Dataset-specific Description	Technicon Bran & Luebbe AutoAnalyzer II (now owned by Seal Analytical) sampler, proportioning pump, manifold and colorimeter capable of analyzing for TDP as orthophosphate were used to measure phosphate concentration. A PMC Industries Flat Bed Linear recorder was used to record electronic output from the colorimeter.
Generic Instrument Description	flatbed linear recorder (chart recorder) Example: PMC Industries Flat Bed Linear recorder which can be used to record electronic output from instruments.

Dataset-specific Instrument Name	Seal AA500 System and AS2 sampler
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	To analyze colorimetry for nitrite an nitrite samples a Seal AA500 System and AS2 sampler, which includes proportioning pump, manifold and colorimeter capable of analyzing for nitrate plus nitrite was used.
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

Dataset-specific Instrument Name	Technicon Bran & Luebbe AutoAnalyzer II
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Technicon Bran & Luebbe AutoAnalyzer II (now owned by Seal Analytical) sampler, proportioning pump, manifold and colorimeter capable of analyzing for TDP as orthophosphate were used to measure phosphate concentration. A PMC Industries Flat Bed Linear recorder was used to record electronic output from the colorimeter.
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

[table of contents | back to top]

Deployments

AT42-09

Website	https://www.bco-dmo.org/deployment/937024
Platform	R/V Atlantis
Start Date	2019-03-25
End Date	2019-04-23

[table of contents | back to top]

Project Information

Collaborative Research: From hot to cold in the dark - shifts in seafloor massive sulfide microbial communities as physical and geochemical conditions change after venting ceases (Hot2cold Vents)

Coverage: East Pacific Rise

NSF Award Abstract:
Hydrothermal vents, which deposit seafloor massive sulfides (SMS), occur along the 89,000 km of mid-ocean ridges, submarine volcanoes, and backarc basins that occur at tectonic plate boundaries in the ocean. Active hydrothermal vent sulfide chimneys are hotspots of biodiversity and productivity in the deep ocean, as well as potential resources for metals. While significant effort has focused on understanding the diversity of biological communities and geochemistry associated with actively venting SMS, relatively little is known about the biological communities associated with SMS once venting ceases. Furthermore, little is known about the microbiological and geochemical changes that occur during the transition period from active to inactive, during which an important succession occurs in the microbial community and geochemistry of fluids within the chimney. This interdisciplinary project will create and sample this transition period by collecting multiple active SMS samples from individual vents at 9 degrees N East Pacific Rise and allowing them to transition to inactive on the seafloor, mimicking the end of venting while allowing for the exact time when venting ceased to be known, something not possible when sampling naturally formed inactive SMS. Microbial community diversity and metabolism will be analyzed in parallel with bulk and fine-scale geological measurements for active, transitioning, and inactive sulfides. This seafloor experimental and analytical approach will provide knowledge of how microbial communities, rates of biogeochemical transformations, and geological conditions change as SMS transition from hot and actively venting to cold and inactive. Students in grades 6-8 will be entrained into the project through research cruise "ship-to-shore" interactions and communications, post-cruise workshops for

educators working with students typically underrepresented in STEM fields, and a collaboration with the Science, Engineering, Art and Design Gallery (SEAD), a community and economic development project in Bryan, TX.

Hydrothermal vents are quantitatively important to the biology and chemistry of the deep ocean, but the vast majority of current knowledge focuses on actively venting deposits. However, after venting ceases, sulfides can persist on the seafloor for tens of thousands of years, making them long-lived, globally-abundant microbial substrates. In recent years, studies of inactive SMS found drastically different microbial communities than those on active deposits, indicating a succession of the microbial community, and thus a potentially different impact on deep ocean biodiversity and biogeochemistry than actively venting deposits. However, ages of the inactive structures are often not known, so it is impossible to estimate how quickly these changes occur, and how quickly co-occurring changes in sulfide mineralogy and microbiological communities occur. This project will provide the first insight into what happens at the microbial and mineralogical level as SMS initially transition from active to inactive. Active SMS will be sampled and analyzed for microbial community composition, functional capacity, gene expression and metabolic rates. Co-located subsamples will be analyzed for porosity and bulk and fine-scale mineralogy. Subsamples of those active SMS samples will be left on the seafloor to incubate and be collected weeks and a year or more later, with the same analyses conducted upon collection. This will allow for determination of microbiological and mineralogical changes that occur during that initial transition and for comparison with older inactive SMS from the same vent fields. Together, the data collected will be integrated to generate a conceptual model of succession of biology, mineralogy, porosity and pore distribution as vent deposits transition from active to inactive. This project will fill a knowledge gap about hydrothermal ecosystems and has the potential to transform the current understanding of diversity and rates of change in these important seafloor biomes.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756339

[table of contents | back to top]