Geochemical measurements of CTD and Alvin Niskin samples collected in the Gulf of California during R/V Falkor cruise FK190211 in 2019

Website: https://www.bco-dmo.org/dataset/821645
Data Type: Cruise Results
Version: 1
Version Date: 2023-01-20

Project
» Collaborative Research: Microbial Carbon cycling and its interactions with Sulfur and Nitrogen transformations in Guaymas Basin hydrothermal sediments (Guaymas Basin Interactions)

Contributors	Affiliation	Role
Joye, Samantha B.	University of Georgia (UGA)	Principal Investigator
Teske, Andreas	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Co-Principal Investigator
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Geochemical measurements of CTD and Alvin Niskin samples collected in the Gulf of California during R/V Falkor cruise FK190211 in 2019.

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Coverage

Spatial Extent: **N**:27.59087 **E**:-108.86287 **S**:23.95688 **W**:-111.4752
Temporal Extent: 2019-02-27 - 2019-03-13

Dataset Description

Geochemical measurements of CTD and Alvin Niskin samples collected in the Gulf of California during R/V Falkor cruise FK190211 in 2019.

Methods & Sampling

Locations:

Gulf of California
Guaymas Basin, 27 00.00 N, -111 24.00 W
Sonora Margin, 27 35.00 N, -111 28.00 W
Pescadero Basin, 24 00.00 N, -108 51.00 W

Sampling and analytical procedures:

1) Nutrients (DOC, TDN, NOx, NO2, NH4, PO4, TDP): Water sample was filtered through a pre-rinsed 0.2 um regenerated cellulose Target2 syringe filter (Thermo Scientific, Prod. No. F25047), collected into an HDPE bottle and stored frozen at -20°C until analysis. Individual analytes were analyzed as follows:
DOC was determined using high temperature catalytic combustion and an NDIR detector following the method described in Sugimura and Suzuki, 1988.
TDN was determined using high temperature combustion and a chemiluminescence detector following the method described in Watanabe et. al, 2007.
NOx was determined using chemical reduction and a nitric oxide detector following the method described by Garside, 1982.
NO2 was determined using the colorimetric method described by Bendschneider and Robinson, 1952 (A new spectrophotometric method for the determination of nitrite in sea water. J. Mar. Res., 11: 87) as reproduced by Parsons, Marta, and Lalli, 1984.
NH4 was determined using the colorimetric method described by Solorzano, 1969.
PO4 was determined using the colorimetric method described by Strickland and Parsons, 1972.
TDP was determined using the colorimetric method described by Solorzano and Sharp, 1980.

2) Alkalinity - Water sample was filtered through a pre-rinsed 0.2 µm regenerated cellulose Target2 syringe filter (Thermo Scientific, Prod. No. F25047) into a 15 mL centrifuge tube and stored at 5°C until analysis. Alkalinity was determined using the spectrophotometric method described by Sarazin et al., 1999.

3) H2S: 5 mL water sample was collected into a 15 mL centrifuge tube containing 200 uL of 20% zinc acetate and stored at 5°C until analysis. H2S was determined using the colorimetric method described by Cline, 1969.

4) SO4: Water sample was filtered through a pre-rinsed 0.2 µm regenerated cellulose Target2 syringe filter (Thermo Scientific, Prod. No. F25047) into a 7 mL scintillation vial. Samples were acidified with 10 µL of concentrated HNO3 per 1 mL sample, sealed with a PTFE lined cap, and stored at room temperature until analysis. Sample analysis was performed using KOH eluent supplied by a Dionex EGC III KOH Eluent Generator Cartridge (Prod. No. 074532), Dionex CR-ATC Continuously Regenerated Trap Column (Prod. No. 060477), Dionex AERS 500 Electronically Regenerated Suppressor (Prod. No. 082541), Dionex IonPac AG19 Guard Column (Prod. No. 062888), Dionex IonPac AS19 Analytical Column (Prod. No. 062886) and Dionex CRD 200 RFIC Carbonate Removal Device (Prod. No. 062986). Reference - Weston et al. 2006, Biogeochemistry 77: 375-408.

5) Cl - Water sample was filtered through a pre-rinsed 0.2 µm regenerated cellulose Target2 syringe filter (Thermo Scientific, Prod. No. F25047) into a 7 mL scintillation vial. Samples were acidified with 10 µL of concentrated HNO3 per 1 mL sample, sealed with a PTFE lined cap, and stored at room temperature until analysis. Sample analysis was performed using KOH eluent supplied by a Dionex EGC III KOH Eluent Generator Cartridge (Prod. No. 074532), Dionex CR-ATC Continuously Regenerated Trap Column (Prod. No. 060477), Dionex AERS 500 Electronically Regenerated Suppressor (Prod. No. 082541), Dionex IonPac AG19 Guard Column (Prod. No. 062888), Dionex IonPac AS19 Analytical Column (Prod. No. 062886) and Dionex CRD 200 RFIC Carbonate Removal Device (Prod. No. 062986). Reference - Weston et al. 2006, Biogeochemistry 77: 375-408.

6) Dissolved oxygen: - DO was measured with a Thermo Orion DO probe (Prod. No. 083005MD) while sample was constantly stirred.

7) Salinity: Salinity was determined with a refractometer.

8) pH - pH was measured using a Ross electrode (Thermo Fisher, Prod. No. 8103BNUWP) calibrated with standard pH buffers of pH 4, 7, and 10.

9) CH4: - Gas samples were collected by overflowing a 1 L PETG bottle and closing headspace-free with a Teflon septum cap. A modified 1 L glass media bottle was evacuated to a pressure of 0.2 Torr or below. A 0.7 L aliquot of sample from the PETG was pulled into the evacuated bottle. The 0.7 L sample was shaken and sonicated 3x before the pressure was equilibrated by the addition of brine purged with UHP nitrogen. Extracted gases were collected from the top of the modified media bottle using a syringe and stored in 20 mL serum vials filled with brine. Methane concentrations were determined by injecting gas samples from the brine vials onto an SRI 8610 GC-FID and SRI Hayesep D 6'x1/8" column (Prod. No. 8600-PKDB). See Schmitt, 1991 and Lammers, 1994.

10) Calculated Values (NO3, DIN, DON, DOP): These values were calculated as follows:
NO3 = NOx - NO2

DIN = NOx + NH4
DON = TDN - DIN
DOP= TDP - PO4

Data Processing Description

BCO-DMO Data Manager Processing Notes:
* Extracted data submitted in Excel file FK190211 Water Column Summary - with MOx.xlsx to csv
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions: only A-Za-z0-9 and underscore allowed. Can not start with a number. (spaces, +, and - changed to underscores).
* blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system.
* longitude and latitude converted from degrees decimal mintues to decimal degrees, rounded to five decimal places
* Date converted to ISO 8601 format YYYY-MM-DD
* comment lines explaining what BD and ND mean were removed and added to the parameter descriptions
* The second occurance of column named "NH4" was removed from the dataset at the request of the submitter.

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Data Files

File
fk190211-water-geochem.csv (Comma Separated Values (.csv), 23.45 KB) MD5:e6ea8e6b018787496334986007 3f88e5 Primary data file for dataset ID 821645

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Parameters

Parameter	Description	Units
Operation_No	Unique deployment ID	unitless
Site	Site name	unitless
Date	Sample collection date in ISO 8601 format YYYY-MM-DD	unitless
Collection_Type	CTD/ROV Niskin	unitless
Latitude	Latitude	degrees, decimal min
Longitude	Longitude	degrees, decimal min

Depth	Sample collection depth	meters (m)
pH	pH	pH scale
Salinity	Salinity	Practical Saliinty Units (PSU)
DO	dissolved oxygen	milligrams per liter (mg/L)
NH4	Ammonium, shipboard measurement. Method detection limit = 0.1	micromolar (umol/L)
NO2	Nitrite. Method detection limit = 0.1	micromolar (umol/L)
NOx	Nitrate + Nitrite. Method detection limit = 0.1	micromolar (umol/L)
NO3	Nitrate. Method detection limit = 0.1	micromolar (umol/L)
DIN	Dissolved Inorganic Nitrogen. Method detection limit = 0.1	micromolar (umol/L)
TDN	Total Dissolved Nitrogen. Method detection limit = 1	micromolar (umol/L)
DON	Dissolved Organic Nitrogen. Method detection limit = 1	micromolar (umol/L)
PO4	Phosphate. Method detection limit = 0.1	micromolar (umol/L)
TDP	Total Dissolved Phosphate. Method detection limit = 0.1	micromolar (umol/L)
DOP	Dissolved Organic Phosphate. Method detection limit = 0.1	micromolar (umol/L)
DIN_to_DIP	Dissolved Inorganic N:P ratio. molar ratio. Method detection limit = 0.1	dimensionless
DON_to_DOP	Dissolved Organic N:P ratio. molar ratio. Method detection limit = 1	dimensionless
DOC	Dissolved Organic Carbon. Method detection limit = 1	micromolar (umol/L)
Alkalinity	Alkalinity. Method detection limit = 0.1	millimolar (mm/L)

CH4	Dissolved Methane. Method detection limit = 1	nanomolar (nm/L)
H2S	Hydrogen Sulfide. Method detection limit = 1	micromolar (umol/L)
SO4	Sulfate. Method detection limit = 0.1	millimolar (mm/L)
Cl	Chloride. Method detection limit = 1	millimolar (mm/L)

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Instruments

Dataset-specific Instrument Name	Antek Instruments 7050 Nitric Oxide Detector
Generic Instrument Name	Chemiluminescence NOx Analyzer
Dataset-specific Description	Antek Instruments 7050 Nitric Oxide Detector with 745 Nitrate/Nitrite Reduction Assembly
Generic Instrument Description	The chemiluminescence method for gas analysis of oxides of nitrogen relies on the measurement of light produced by the gas-phase titration of nitric oxide and ozone. A chemiluminescence analyzer can measure the concentration of NO/NO2/NOX. One example is the Teledyne Model T200: https://www.teledyne-api.com/products/nitrogen-compound-instruments/t200

Dataset-specific Instrument Name	Shimadzu Instruments GC-2014 Gas Chromatograph with FID Detector and Methanizer
Generic Instrument Name	Gas Chromatograph
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	SRI Instruments 8610C Gas Chromatograph with FID Detector
Generic Instrument Name	Gas Chromatograph
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	DIONEX Corporation ICS-2000 Ion Chromatography System
Generic Instrument Name	Ion Chromatograph
Generic Instrument Description	Ion chromatography is a form of liquid chromatography that measures concentrations of ionic species by separating them based on their interaction with a resin. Ionic species separate differently depending on species type and size. Ion chromatographs are able to measure concentrations of major anions, such as fluoride, chloride, nitrate, nitrite, and sulfate, as well as major cations such as lithium, sodium, ammonium, potassium, calcium, and magnesium in the parts-per-billion (ppb) range. From: http://serc.carleton.edu/microbelife/research_methods/biogeochemical/ic....

Dataset-specific Instrument Name	ASI-V Autosampler
Generic Instrument Name	Laboratory Autosampler
Dataset-specific Description	Shimadzu Instruments TOC-Vcph Total Organic Carbon Analyzer with ASI-V Autosampler and TNM Total Nitrogen Analyzer
Generic Instrument Description	Laboratory apparatus that automatically introduces one or more samples with a predetermined volume or mass into an analytical instrument.

Dataset-specific Instrument Name	
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Ross pH electrode
Generic Instrument Name	pH Sensor
Generic Instrument Description	An instrument that measures the hydrogen ion activity in solutions. The overall concentration of hydrogen ions is inversely related to its pH. The pH scale ranges from 0 to 14 and indicates whether acidic (more H+) or basic (less H+).

Dataset-specific Instrument Name	Fisher refractometer
Generic Instrument Name	Refractometer
Generic Instrument Description	A refractometer is a laboratory or field device for the measurement of an index of refraction (refractometry). The index of refraction is calculated from Snell's law and can be calculated from the composition of the material using the Gladstone-Dale relation. In optics the refractive index (or index of refraction) n of a substance (optical medium) is a dimensionless number that describes how light, or any other radiation, propagates through that medium.

Dataset-specific Instrument Name	Hach Company DR 2800 Spectrophotometer
Generic Instrument Name	Spectrophotometer
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

Dataset-specific Instrument Name	Shimadzu Instruments UV1601 Spectrophotometer
Generic Instrument Name	Spectrophotometer
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

Dataset-specific Instrument Name	TNM Total Nitrogen Analyzer
Generic Instrument Name	Total Nitrogen Analyzer
Dataset-specific Description	Shimadzu Instruments TOC-Vcph Total Organic Carbon Analyzer with ASI-V Autosampler and TNM Total Nitrogen Analyzer
Generic Instrument Description	A unit that accurately determines the nitrogen concentrations of organic compounds typically by detecting and measuring its combustion product (NO). See description document at: http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/totalnit.pdf

Dataset-specific Instrument Name	Shimadzu Instruments TOC-Vcph Total Organic Carbon Analyzer
Generic Instrument Name	Total Organic Carbon Analyzer
Dataset-specific Description	Shimadzu Instruments TOC-Vcph Total Organic Carbon Analyzer with ASI-V Autosampler and TNM Total Nitrogen Analyzer
Generic Instrument Description	A unit that accurately determines the carbon concentrations of organic compounds typically by detecting and measuring its combustion product (CO2). See description document at: http://bcodata.whoi.edu/LaurentianGreatLakes_Chemistry/bs116.pdf

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Deployments

FK190211

Website	https://www.bco-dmo.org/deployment/820900
Platform	R/V Falkor
Start Date	2019-02-11
End Date	2019-03-14
Description	Start and end port: Manzanillo, Mexico

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Project Information

Collaborative Research: Microbial Carbon cycling and its interactions with Sulfur and Nitrogen transformations in Guaymas Basin hydrothermal sediments (Guaymas Basin Interactions)

Coverage: Guaymas Basin, Gulf of California, 27.00 N, 111.00W

Description from NSF award abstract:
Hydrothermally active sediments in the Guaymas Basin are dominated by novel microbial communities that catalyze important biogeochemical processes in these seafloor ecosystems. This project will investigate genomic potential, physiological capabilities and biogeochemical roles of key uncultured organisms from Guaymas sediments, especially the high-temperature anaerobic methane oxidizers that occur specifically in hydrothermally active sediments (ANME-1Guaymas). The study will focus on their role in carbon transformations, but also explore their potential involvement in sulfur and nitrogen transformations. First-order research topics include quantifying anaerobic methane oxidation under high temperature,in situ concentrations of phosphorus and methane , and with alternate electron acceptors; sulfate and sulfur-dependent microbial pathways and isotopic signatures under these conditions; and nitrogen transformations in methane-oxidizing microbial communities, hydrothermal mats and sediments.

This integrated biogeochemical and microbiological research will explore the pathways of and environmental controls on the consumption and production of methane, other alkanes, inorganic carbon, organic acids and organic matter that fuel the Guaymas sedimentary microbial ecosystem. The hydrothermal sediments of Guaymas Basin provide a spatially compact, high-activity location for investigating novel modes of methane cycling and carbon assimilation into microbial biomass. In the case of anaerobic methane oxidation, the high temperature and pressure tolerance of Guaymas Basin methane-oxidizing microbial communities, and their

potential to uncouple from the dominant electron acceptor sulfate, vastly increase the predicted subsurface habitat space and biogeochemical role for anaerobic microbial methanotrophy in global deep subsurface diagenesis. Further, microbial methane production and oxidation interlocks with syulfur and nitrogen transformations, which will be explored at the organism and process level in hydrothermal sediment microbial communities and mats of Guaymas Basin. In general, first-order research tasks (rate measurements, radiotracer incorporation studies, genomes, in situ microgradients) define the key microbial capabilities, pathways and processes that mediate chemical exchange between the subsurface hydrothermal/seeps and deep ocean waters.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357360

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