CTD data from sediment coring events taken on board of the R/V Ira C. in September 2018

Website: https://www.bco-dmo.org/dataset/874187
Data Type: Cruise Results
Version: 1
Version Date: 2022-05-11

Project
» Collaborative Research: Predicting controls of partitioning between dissimilatory nitrate reduction to ammonium (DNRA) and dinitrogen production in marine sediments (Thin_Disc_Project)

Contributors	Affiliation	Role
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Abstract
Water column profile parameters above the sediment sampling sites taken on board of the R/V Ira C. in September 2018.

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Coverage

Temporal Extent: 2018-09-04

Methods & Sampling

CTD data from sediment coring events taken at Miller Island, Damariscotta River Estuary and Pemaquid, Gulf of Maine.

Instrument was held at 1 meter depth for 3 minutes prior to profiling in order for all sensor modules to stabilize.

Data Processing Description

SBE Data Processing 7.26.8

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Parameters

Parameter	Description	Units
Cast	Cast ID	unitless
Latitude	Latitude of sampling location, south is negative	decimal degrees
Longitude	Longitude of sampling location, west is negative	decimal degrees
ISO_DateTime_UTC	Sampling start date and time (UTC) in ISO8601 format: YYYY-MM-DDThh:mm:ssz	unitless
depSM	Depth	meters (m)
sigma00	Density	Kg/m^3
flECO_AFL	Fluorescence	mg/m^3
sbeox0Mg_L	Oxygen	mg/l
sbeox0PS	Oxygen, saturation	percentage (%)
sal00	Salinity, Practical	PSU
t090C	Temperature, ITS-90	degrees Celsius (°C)
turbWETntu0	Turbidity, WET Labs ECO	NTU
specc	Specific Conductance	micro siemens per centimer (uS/cm)
par	PAR/Irradiance	unitless
CStarAt0	Beam Attenuation	1/m
CStarTr0	Beam Transmission	percentage (%)
flag	0.00E+00	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	LI-COR Biospherical PAR Sensor
Generic Instrument Description	The LI-COR Biospherical PAR Sensor is used to measure Photosynthetically Available Radiation (PAR) in the water column. This instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	
Generic Instrument Name	Wet Labs ECO-AFL/FL Fluorometer
Generic Instrument Description	The Environmental Characterization Optics (ECO) series of single channel fluorometers delivers both high resolution and wide ranges across the entire line of parameters using 14 bit digital processing. The ECO series excels in biological monitoring and dye trace studies. The potted optics block results in long term stability of the instrument and the optional anti-biofouling technology delivers truly long term field measurements. more information from Wet Labs

Dataset-specific Instrument Name	
Generic Instrument Name	WET Labs {Sea-Bird WETLabs} C-Star transmissometer
Generic Instrument Description	The C-Star transmissometer has a novel monolithic housing with a highly intgrated opto-electronic design to provide a low cost, compact solution for underwater measurements of beam transmittance. The C-Star is capable of free space measurements or flow-through sampling when used with a pump and optical flow tubes. The sensor can be used in profiling, moored, or underway applications. Available with a 6000 m depth rating. More information on Sea-Bird website: https://www.seabird.com/c-star-transmissometer/product?id=60762467717

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Project Information

Collaborative Research: Predicting controls of partitioning between dissimilatory nitrate reduction to ammonium (DNRA) and dinitrogen production in marine sediments (Thin_Disc_Project)

Coverage: Coastal Maine

Microbial processes in marine sediments play a major role in the global nitrogen cycle. Because the presence of nitrogen compounds dissolved in seawater largely controls biological growth, understanding how the sedimentary nitrogen budget changes with altered circulation, acidity, and biological productivity is of critical importance to predict oceanic function in future climate scenarios. Surprisingly, we do not know definitively if nitrogen exchange between sediments and the water column is in balance, and if not, how it varies over time and space. We do know that two bacterially mediated chemical reactions are primarily responsible for removing nitrogen from marine ecosystems by converting biologically usable forms of dissolved nitrogen back to nitrogen gas (N2) that is not generally available for biological production. These reactions are called denitrification and anaerobic ammonium oxidation (anammox); the latter operating only where oxygen is zero. This project will investigate a third reaction, called dissimilatory nitrate reduction (DNRA), which competes directly with anammox to limit N2 production and the consequent "loss" of nitrogen, thus retaining nitrogen for use in marine ecosystems. The role of DNRA has not been fully explored and quantifying this reaction could help evaluate the overall nitrogen balance in ocean systems. The researchers here will use novel experimental reactors that contain collected marine sediments and, by varying environmental conditions (pH, temperature, oxygen, organic carbon), will discover and quantify what controls rates of DNRA, denitrification, and anammox in sediments. This will provide a direct test and further development of theoretical sedimentary nitrogen models that can be used to predict possible changes in the global nitrogen cycle resulting with various future climate scenarios. Two graduate students will participate in the research and collaborations with the Maine Coastal Observing Alliance (MCOA) and the Gulf of Maine Institute (GOMI), as well as the Institute for Broadening

Participation (IBP) will generate minority student involvement and enhanced outreach activity.

This project uses thermodynamic calculations and empirical evidence as a basis to evaluate the ratio of available organic carbon (C) to nitrate (NO3-) as a key controlling factor of nitrogen redox partitioning; with higher ratios believed to favor dissimilatory nitrate reduction (DNRA) over N2 production. The investigator's theoretical model predicts rapid and reversible transitions between DNRA and N2 production over relatively small changes in C/NO3-. This suggests that partitioning could be sensitive to seasonal and possibly inter-annual differences in organic C deposition as well as processes that control nitrate flux to the sediments such as water column stratification. Quantitative relationships between sedimentary C/NO3- and nitrogen partitioning remain poorly defined, and a number of other factors including T, H2S, and Fe(II), are known to influence N partitioning. This study will investigate the hypothesis that relationships between nitrogen redox partitioning and C/NO3-, and by extension H2S/NO3-, are predicted by the proposed theoretical sedimentary nitrogen model. Experiments will varying NO3 fluxes while providing hydrogen sulfide (H2S) and 13C-labelled detritus as electron donors, and measure transformation rates of 15NO3- to 15NH4+ and 29/30N2 in thin disc reactors to determine rates and pathways of DNRA and N2 production. The proposed integration of these experiments with a theoretically-based biogeochemical model will develop a quantifiable and testable understanding of the marine nitrogen cycle. This study should provide a major advance that could be broadly applied to quantitatively predict the sedimentary balance between nitrogen retention and loss across marine ecosystems.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1635461
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