CTD data at Stations K and D

Website: https://www.bco-dmo.org/dataset/915301
Data Type: Cruise Results
Version: 1
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Project
» Collaborative Research: Peptide Deamination as a Source of Refractory Dissolved Organic Matter in Marine Sediments (Peptide Deamination)

Contributors	Affiliation	Role
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Abstract
CTD data (Conductivity, temperature, depth, Chl-a, and dissolved oxygen) at Station (K; Latitude: 35.375524, Longitude: -121.501211) and at Station D (Latitude: 36.112556, Longitude: -122.186097) collected on Dec 4th, 2020 and Dec 8th, 2020, respectively, onboard Oceanus R/V Sikuliaq using SeaBird SBE-911+. It showed the depth profile of different physiochemical properties of the water column at the Stations K and D sampling locations.

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Methods & Sampling

The Conductivity-Temperature-Depth (CTD) instrument (SeaBird SBE-911+) equipped with the following sensors (Temperature, Conductivity, Pressure, Fluorometer, Dissolved Oxygen, Transmissometer, Photosynthetically Active Radiation (PAR) was initially tested and calibrated. The CTD rosette was mounted on a winch cable and underwent a brief "soak" at the surface for sensor equilibration. The CTD-rosette was then lowered into the water at a typical descent rate of ~ 0.5 meters per second, all the while logged data in real-time to the onboard computer. At ~1m above the sediment depths, the descent was paused. Then, the rosette-CTD system was ascended, and additional measurements were collected. The collected data was then post-processed to correct for sensor drift, followed by a thorough deployment documentation, including any anomalies or issues encountered.

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	CTD SeaBird SBE-911+
Generic Instrument Name	Sea-Bird SBE 911plus CTD
Dataset-specific Description	The Conductivity-Temperature-Depth (CTD) instrument (SeaBird SBE-911+) equipped with the following sensors (Temperature, Conductivity, Pressure, Fluorometer, Dissolved Oxygen, Transmissometer, Photosynthetically Active Radiation (PAR) was initially tested and calibrated. The CTD rosette was mounted on a winch cable and underwent a brief "soak" at the surface for sensor equilibration. The CTD-rosette was then lowered into the water at a typical descent rate of ~ 0.5 meters per second.
Generic Instrument Description	[tethered, real-time] The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

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Deployments

SKQ202016S

Website	https://www.bco-dmo.org/deployment/915307
Platform	R/V Sikuliaq
Start Date	2020-12-01
End Date	2020-12-12
Description	See more information at R2R: https://www.rvdata.us/search/cruise/SKQ202016S

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Project Information

Collaborative Research: Peptide Deamination as a Source of Refractory Dissolved Organic Matter in Marine Sediments (Peptide Deamination)

Coverage: California Borderland

NSF Award Abstract:
Dissolved organic matter (DOM) in the ocean is one of the largest carbon reservoirs on Earth. Much of this DOM is highly resistant to degradation (refractory) and aged, but the nature and reasons behind the accumulation of refractory DOM in the ocean is one of the unresolved mysteries of the marine carbon cycle. While marine sediments have been shown to be a globally important source of DOM to the ocean, the connection between sediment DOM dynamics and the oceanic DOM cycle remains elusive, because information is lacking on the molecular composition and reactivity of pore water DOM. To fill this knowledge gap, this

project will address the question of how refractory DOM is produced in sediments and the fate of benthic DOM in the water column. The research will focus on the relationship between protein/peptide dynamics and sediment DOM cycling, examining peptide deamination as an important pathway for the production of refractory and 14C-depleted DOM in continental margin sediments. These objectives will be met through a combination of geochemical profiling of sediment cores collected across a range of redox conditions, and long-term sediment incubation studies conducted under controlled laboratory conditions. At the heart of this proposed work is structural elucidation and quantification of intact and deaminated peptides in pore-water DOM using state-of-the-art analytical techniques. The study will help better understand how the present-day carbon cycle operates, as well as how it may respond in the future. The proposed work will integrate research and education using several approaches. All PIs routinely integrate their research into their classes, which range from introductory-undergraduate to advanced-graduate courses and will continue to do so here. All three PIs are also committed to engaging women and underrepresented minority students.

Marine sediments are a globally important source of dissolved organic matter (DOM) to the ocean. However, the connection between sediment DOM dynamics and the oceanic DOM cycle remains elusive because information about the molecular composition and reactivity of pore water DOM is lacking. To help fill this knowledge gap, this project will address the question of how refractory DOM is produced in sediments and the fate of the benthic DOM flux in the water column. The proposed study explores a novel and potentially transformative idea that deamination of peptides in sediments is a source of refractory and 14C-depleted DOM in seawater. This idea is consistent not only with the fact that the majority of seawater dissolved organic nitrogen occurs in amide form, but also with recent reports about the widespread occurrence of nitrogen-bearing formulas in deep-sea refractory DOM. The central hypothesis will be tested through a unique blend of bottom-up (molecular level DOM analyses) and top-down (bulk-level elemental and isotopic analyses, and numerical modeling) approaches. This work will involve a combination of geochemical profiling of sediment cores collected across a range of redox conditions, and long-term sediment incubation studies conducted under controlled laboratory conditions. At the heart of the proposed work is structural elucidation and quantification of intact and deaminated peptides in pore-water DOM using a state-of-the-art liquid chromatography-mass spectrometry system (ultra-high performance liquid chromatography coupled to an Orbitrap Fusion Tribrid Mass Spectrometer), which is expected to provide an unprecedented wealth of molecular-level information about pore water DOM. The proposed work will lead to an improved mechanistic understanding of organic matter decomposition and benthic DOM cycling and shed light on the connections between the modern-day oceanic and sedimentary carbon and nitrogen cycles as they relate to the formation of refractory DOM.

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-1756672

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