Water column (community) respiration rates from changes in DO in incubations from samples collected on R/V Knorr cruise KN207-01 along the southern tip of Nova Scotia to Bermuda in 2012 (SargassoSeaLipids project)

Website: https://www.bco-dmo.org/dataset/555915
Version: 16 April 2015
Version Date: 2015-04-16

Project
» Biogeochemical Impact and Fate of Non-phosphorus Membrane Lipids in the Sargasso Sea (SargassoSeaLipids)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Table of Contents

Dataset Description

Water column (community) respiration rates from changes in DO in incubations.

Methods & Sampling

Refer to Collins et al., *Global Biogeochem. Cycles* (2015), in review. Excerpted from methods section:

Estimates of aerobic respiration by the water column microbial community (WCR) were calculated by linear regression of measurements of dissolved oxygen concentration in a series of 300 mL shipboard bottle incubations. Determination of dissolved oxygen was made at 3- to 9-hour intervals in at least five replicates using optode spot minisensors (PreSens PSt3; Precision Sensing GmbH, Regensburg, Germany) that were glued to the inside surfaces of the bottles using food-quality silicone cement (M Warkentin et al., 2007). The use of these optode spots eliminated the need for drawing of aliquots from the sample bottles. Incubations were conducted in the dark at in situ temperature as described in Edwards et al. (2011). We validated the rates from these incubations using a series of Winkler titrations; methods are described in the Auxiliary Material to Collins et al. (2015). We used the standard error of the slope parameter from these regressions as the uncertainty in our estimates of WCR.

References:

Collins, J. R., B. R. Edwards, K. Thamatrakoln, J. E. Ossolinksi, G. R. DiTullio, K. D. Bidle, S. C. Doney, and B. A. S. Van Mooy (2015), The multiple fates of sinking particles in the North Atlantic Ocean, *Global Biogeochem. Cycles,* in review.

Edwards, B. R., C. M. Reddy, R. Camilli, C. A. Carmichael, K. Longnecker, and B. A. S. Van Mooy (2011), Rapid microbial respiration of oil from the Deepwater Horizon spill in offshore surface waters of the Gulf of Mexico, *Environmental Research Letters*, *6*(3), doi:10.1088/1748-9326/6/3/035301.

Warkentin, M., H. M. Freese, U. Karsten, and R. Schumann (2007), New and fast method to quantify respiration rates of bacterial and plankton communities in freshwater ecosystems by using optical oxygen sensor spots, *Appl. Environ. Microbiol.*, *73*(21), 6722-6729, doi:10.1128/Aem.00405-07.

Data Processing Description

BCO-DMO processing notes:
- Modified parameter names to conform with BCO-DMO naming conventions.
- Modified format of date/time to fit ISO8601 format.
- Replaced blanks (missing data) with 'nd'.

[table of contents | back to top]

Data Files

File
KN207-01_resp.csv (Comma Separated Values (.csv), 334 bytes) MD5:bc4028bbce87fed9069112923befc5be Primary data file for dataset ID 555915

[table of contents | back to top]

Parameters

Parameter	Description	Units
station_ctd	CTD station number.	dimensionless
depth	Sample depth.	meters
incub_temp	Incubation temperature.	degrees Celsius (C)
lat_CTD	Latitude of CTD station.	decimal degrees
lon_CTD	Longitude of CTD station.	decimal degrees
delta_O2	Delta O2.	millimoles O2 per cubic meter per day (mmol O2 m-3 d-1)
delta_O2_stdev	Standard deviation of delta O2.	millimoles O2 per cubic meter per day (mmol O2 m-3 d-1)
mean_R2	Mean r-squared value of regressions DO on time.	dimensionless
ISO_DateTime_UTC	Date and time, UTC, (from CTD timestamp) formatted to ISO 8601 standard. T represents the start of the time string and Z indicates UTC.	YYYY-mm-ddTHH:MM:SS.xxZ
ISO_DateTime_Local	Date and time, local time zone (UTC-4), (from CTD timestamp) formatted to ISO 8601 standard. T represents the start of the time string and Z indicates UTC.	YYYY-mm-ddTHH:MM:SS.xx

[table of contents | back to top]

Deployments

KN207-01

Website	https://www.bco-dmo.org/deployment/58787
Platform	R/V Knorr
Start Date	2012-04-21
End Date	2012-05-04
Description	Projected Science Plan: The plan is to conduct two, 5-day quasi-lagrangian time-series stations at 65W, one north of the Gulf Stream and one south of the Gulf Stream. The daily cruise track will be centered around following free-floating sediment net traps arrays. The traps will be retrieved and re-deployed on 24 hour intervals (generally beginning at day break). CTD casts, primarily in the upper 250 meters, will be done in the afternoons, with McLane pumps deployed overnight. This cruise is funded by NSF OCE-1031143. More information about this cruise is available from the vessel operator (WHOI cruise synopsis). Cruise information and original data are available from the NSF R2R data catalog.

[table of contents | back to top]

Project Information

Biogeochemical Impact and Fate of Non-phosphorus Membrane Lipids in the Sargasso Sea (SargassoSeaLipids)

Coverage: Sargasso Sea

Intact polar diacyglycerols (IP-DAGs) are the fatty-acid bearing lipid molecules that compose bacterial and eukaryotic cell membranes. As such, they are one of the most abundant classes of lipid molecules in plankton, and play a major role in the marine carbon cycle. However, until very recently, the molecular diversity of IP-DAGs was poorly understood; the structural identity and characteristics of IP-DAGs were inferred almost exclusively from their constituent fatty acids. These non-phosphorus containing IP-DAGs were largely unknown to chemical oceanography. In contrast, phospholipids, which have been the focus of considerable research, compose a disproportionally small fraction of total IP-DAGs. But we still lack even a cursory understanding of biochemical functions and geochemical fates of non-phosphorus IP-DAGs. Given that these molecules are among the most abundant lipid molecules on the planet, this represents a profound and unexpected gap in our understanding the marine carbon and phosphorus cycles.

In this project, researchers at the Woods Hole Oceanographic Institution will launch a pioneering study of these poorly understood compounds. Their approach will be guided by four questions: (1) How do non-phosphorus lipids contribute to variations in the C:N:P of particulate organic matter in the Sargasso Sea? (2) What are the relative degradation rates of phospholipids and non-phosphorus lipids in surface waters? (3) Which groups of microbes utilize the carbon and phosphorus from different IP-DAGs? (4) What are the relative contributions of different IP-DAGs to particulate organic matter export to the deep-sea?

These questions will be answered by using sophisticated HPLC/MS analyses and novel isotope tracing approaches in conjunction with long-standing methods for measuring the C:N:P of plankton and determining the degradation rates of organic molecules. The research team will establish whether these newly-recognized sulfolipids and betaine lipids molecules are a quantitatively important biochemical option for phytoplankton to affect flexible C:N:P stoichiometry in the face of nutrient stress. They will also elucidate the degradation rate, microbial fate, and export potential of the carbon and phosphorus from IP-DAGs. This will shed new light on the broader roles of these molecules in the cycling of these elements by the planktonic community.

This project contains components that are specifically designed to meet the NSF criteria for "advancing

discovery and understanding while promoting teaching, training and learning." The project will support the training of a graduate student and postdoctoral fellow. In addition, the research team will work with the non-profit Zephyr Foundation in Woods Hole to design educational 'units' based on the team's research that will be tailored to student in grades 6 - 12. The Foundation will present these units as part of their hands-on marine science field trip series that is delivered to over 200 students and their teachers per year.

[table of contents | back to top]

Program Information

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1031143

[table of contents | back to top]