Sinking POC and PIC fluxes measured with PIT sediment traps 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/555879
Version: 15 April 2015
Version Date: 2015-04-15

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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Dataset Description

Sinking POC and PIC fluxes measured with PIT sediment traps on the KN207-01 cruise.

Methods & Sampling

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

Vertically sinking particulate carbon fluxes were measured at 50, 150, and 300 meters using surface-tethered cylindrical sediment traps (0.0125 m2 cross-sectional area; materials and construction as described in McDonnell and Buesseler, 2012). A mooring consisting of four traps at each depth, a surface buoy, wave-action mitigation bungee cord, and several floats, was deployed at each process station and allowed to drift for 3-5 days. The quasi-Lagrangian behavior of the mooring during each deployment was confirmed by comparison of positional data obtained from an Argos satellite beacon mounted on the surface buoy with shipboard acoustic Doppler current profiler (ADCP) data from the R/V Knorr, which trailed the mooring at a range of 1-2 miles.

Traps were prepared, deployed, and recovered as described in McDonnell and Buesseler (2012). Traps were then sampled for particulate carbon in accordance with McDonnell and Buesseler (2012), except that the screened brine suspension (350 um pore size, to exclude macrozooplankton) was filtered onto a series of

precombusted, 47 mm GF/F filters (0.7 um nominal pore size). Field and analytical blanks were collected at each station. Filters were immediately frozen in liquid nitrogen and then stored at -80 degrees C.

Filters from three of the four traps at each depth were used for determination of total particulate and particulate inorganic carbon (TPC and PIC, respectively). After thawing, the filters (including blanks) were first dried at 70 degrees C in a drying oven; each filter was then weighed and cut in half with precombusted stainless steel scissors. Each half was then weighed separately. One half was reserved for PIC analysis and the other reserved for determination of TPC.

For TPC, sets of filter halves were transferred to 12 mm by 20 cm precombusted quartz tubes containing copper oxide (100 mg) and elemental silver wires. The tubes were then attached to a vacuum line, evacuated, flame-sealed, and combusted at 850 degrees C for 10 h. The evolved carbon dioxide was then isolated through a series of cold traps and quantified manometrically. PIC was determined from the other set of filter halves by coulometric analysis of acidified samples using a Model CM5014 UIC Coulometric Analyzer with Carbonate Acidification Module, as described in Honjo et al. (1995). Particulate organic carbon (POC) was determined for each trap by difference of the blank-corrected TPC and PIC measurements.

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.

McDonnell, A. M. P., and K. O. Buesseler (2012), A new method for the estimation of sinking particle fluxes from measurements of the particle size distribution, average sinking velocity, and carbon content, *Limnol Oceanogr-Meth*, *10*, 329-346, doi:10.4319/Lom.2012.10.329.

Honjo, S., J. Dymond, R. Collier, and S. J. Manganini (1995), Export production of particles to the interior of the equatorial Pacific Ocean during the 1992 EqPac experiment, *DSR*, *42*(2–3), 831-870, doi:10.1016/0967-0645(95)00034-N.

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.

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Data Files

File
KN207-01_flux.csv (Comma Separated Values (.csv), 1.32 KB) MD5:0cd12343ddf0b4e807724d5631ba1e27 Primary data file for dataset ID 555879

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Parameters

Parameter	Description	Units
lat	Latitude.	decimal degrees
lon	Longitude.	decimal degrees
ISO_DateTime_Start_UTC	Start date and time (UTC), formatted to ISO 8601 standard.	YYYY-mm-ddTHH:MM:SS.xxZ
ISO_DateTime_End_UTC	End date and time (UTC), formatted to ISO 8601 standard.	YYYY-mm-ddTHH:MM:SS.xxZ
ISO_DateTime_Start_Local	Start date and time (local time zone, UTC-4), formatted to ISO 8601 standard.	YYYY-mm-ddTHH:MM:SS.xxZ
ISO_DateTime_End_Local	End date and time (local time zone, UTC-4), formatted to ISO 8601 standard.	YYYY-mm-ddTHH:MM:SS.xxZ
deploy_duration	Deployment duration.	days
depth	Depth.	meters
PIC_flux	Particulate inorganic carbon (PIC) flux.	milligrams C per square meter per day (mg C m-2 d-1)
PIC_flux_stdev	Standard deviation of PIC.	milligrams C per square meter per day (mg C m-2 d-1)
POC_flux	Particulate organic carbon (POC) flux.	milligrams C per square meter per day (mg C m-2 d-1)
POC_flux_stdev	Standard deviation of POC flux.	milligrams C per square meter per day (mg C m-2 d-1)
POC_to_PIC_ratio	Rain ratio of POC to PIC.	dimensionless (ratio)

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Instruments

Dataset-specific Instrument Name	Model CM5014 UIC Coulometric Analyzer
Generic Instrument Name	CO2 Coulometer
Dataset-specific Description	PIC was determined from the other set of filter halves by coulometric analysis of acidified samples using a Model CM5014 UIC Coulometric Analyzer with Carbonate Acidification Module, as described in Honjo et al. (1995).
Generic Instrument Description	A CO2 coulometer semi-automatically controls the sample handling and extraction of CO2 from seawater samples. Samples are acidified and the CO2 gas is bubbled into a titration cell where CO2 is converted to hydroxyethylcarbonic acid which is then automatically titrated with a coulometrically-generated base to a colorimetric endpoint.

Dataset-specific Instrument Name	PIT sediment trap
Generic Instrument Name	Sediment Trap - Particle Interceptor
Dataset-specific Description	Vertically sinking particulate carbon fluxes were measured at 50, 150, and 300 meters using surface-tethered cylindrical sediment traps (0.0125 m2 cross-sectional area; materials and construction as described in McDonnell and Buesseler, 2012).
Generic Instrument Description	A Particle Interceptor Trap is a prototype sediment trap designed in the mid 1990s to segregate 'swimmers' from sinking particulate material sampled from the water column. The prototype trap used 'segregation plates' to deflect and segregate 'swimmers' while a series of funnels collected sinking particles in a chamber (see Dennis A. Hansell and Jan A. Newton. September 1994. Design and Evaluation of a "Swimmer"-Segregating Particle Interceptor Trap, Limnology and Oceanography, Vol. 39, No. 6, pp. 1487-1495).

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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.

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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.

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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.

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Funding

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

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