d15N of size-fractionated particulate organic nitrogen (PON) from sediment traps in the Sargasso Sea

Website: https://www.bco-dmo.org/dataset/747014
Data Type: Cruise Results
Version: 1
Version Date: 2018-10-01

Project
» Understanding the nitrogen isotopes of planktonic foraminifera: A modern Sargasso Sea study (N Isotopes Foraminifera)

Contributors	Affiliation	Role
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Abstract
d15N of size-fractionated particulate organic nitrogen (PON) from sediment traps n the Sargasso Sea (off Bermuda) in the western subtropical North Atlantic. Sediment traps from 500 m, 1500 m, and 3200 m water depth (31°50'N, 64°10'W).

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Coverage

Spatial Extent: **N**:32.167 **E**:-64.167 **S**:31.667 **W**:-64.567
Temporal Extent: 2009-11 - 2010-11

Dataset Description

d15N of size-fractionated particulate organic nitrogen (PON) from sediment traps n the Sargasso Sea (off Bermuda) in the western subtropical North Atlantic. Sediment traps from 500 m, 1500 m, and 3200 m water depth (31°50'N, 64°10'W).

Data published in:
Smart, S.M., H. Ren, S.E. Fawcett, R. Schiebel, M. Conte, P.A. Rafter, K.K. Ellis, M.A. Weigand, S. Oleynik, G.H. Haug, D.M. Sigman (2018). Ground-truthing the planktic foraminifer-bound nitrogen isotope paleo-proxy in the Sargasso Sea, Geochimica et Cosmochimica Acta, doi: https://doi.org/10.1016/j.gca.2018.05.023

Acquisition Description

Bulk sinking PON was collected by sediment traps moored at 500 m, 1500 m, and 3200 m water depth (Conte et al., 2001; Conte and Weber, 2014) between November 2009 and November 2010, with each sample representing a two-week collection. Isotope measurements were made on the <125 um size fraction. See methods section of Smart et al. (2018) for more details of sample collection, isotope analysis and data quality.

The d15N of sinking PON was analyzed on the <125 um size fraction of sediment trap samples by mass spectrometry using either a Europa 20-20 or GV Isoprime mass spectrometer.

Processing Description

Data processing: After correcting for drift (when necessary) and non-linearity in the data, isotope ratio measurements were calibrated to N2 in air using international reference materials that were included in every run.

Missing data identifier = -999

BCO-DMO Processing:
- modified parameter names (replaced hyphens and spaces w/ underscores);
- converted date format from mm/dd/yyyy to yyyy-mm-dd.

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Related Publications

Conte, M. H., Ralph, N., & Ross, E. H. (2001). Seasonal and interannual variability in deep ocean particle fluxes at the Oceanic Flux Program (OFP)/Bermuda Atlantic Time Series (BATS) site in the western Sargasso Sea near Bermuda. Deep Sea Research Part II: Topical Studies in Oceanography, 48(8-9), 1471–1505. doi:10.1016/S0967-0645(00)00150-8

Conte, M., & Weber, J. (2014). Particle Flux in the Deep Sargasso Sea: The 35-Year Oceanic Flux Program Time Series. Oceanography, 27(1), 142–147. doi:10.5670/oceanog.2014.17

Smart, S. M., Ren, H., Fawcett, S. E., Schiebel, R., Conte, M., Rafter, P. A., … Sigman, D. M. (2018). Ground-truthing the planktic foraminifer-bound nitrogen isotope paleo-proxy in the Sargasso Sea. Geochimica et Cosmochimica Acta, 235, 463–482. doi:10.1016/j.gca.2018.05.023

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Parameters

Parameter	Description	Units
mid_collection_date	Collection date (yyyy-mm-dd)	unitless
bulk_d15N_500m	Bulk d15N (per mil vs. AIR) of the	per mil
bulk_d15N_1500m	Bulk d15N (per mil vs. AIR) of the	per mil
bulk_d15N_3200m	Bulk d15N (per mil vs. AIR) of the	per mil

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Instruments

Dataset-specific Instrument Name	Europa 20-20 or GV Isoprime
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	The d15N of sinking PON was analyzed on the
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	sediment traps
Generic Instrument Name	Sediment Trap
Dataset-specific Description	Bulk sinking PON was collected by sediment traps moored at 500 m, 1500 m, and 3200 m water depth.
Generic Instrument Description	Sediment traps are specially designed containers deployed in the water column for periods of time to collect particles from the water column falling toward the sea floor. In general a sediment trap has a jar at the bottom to collect the sample and a broad funnel-shaped opening at the top with baffles to keep out very large objects and help prevent the funnel from clogging. This designation is used when the specific type of sediment trap was not specified by the contributing investigator.

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Project Information

Understanding the nitrogen isotopes of planktonic foraminifera: A modern Sargasso

Sea study (N Isotopes Foraminifera)

Coverage: Sargasso Sea

NSF Award Abstract: Nitrogen (N) and phosphorus are the two nutrients required in large quantity by phytoplankton in the ocean, and together they limit productivity throughout most of the tropical, subtropical, and temperate ocean. Both the cycling of N and its input/output budget have been argued to control the fertility of the ocean and the ocean's role in setting atmospheric CO2. The CaCO3 tests of foraminifera can represent a substantial fraction of marine sediments and have been used extensively in paleoceanography; they are an obvious target for isotopic analysis of microfossil-bound organic matter. In recent years, researchers at Princeton have developed a protocol for the isotopic analysis of foraminiferal shell-bound N. The current protocol is at least 100 times more sensitive than typical on-line combustion, allowing for rapid progress with a N isotope archive that was previously not feasible to measure. Measurements on surface sediments and a downcore record from the Caribbean show the promise of foraminifera-bound del15N (fb-del15N) to provide both a robust N isotope archive for paleoceanography, and one with a unique potential of richness, given the existence of multiple foraminiferal species with different depth habitats and behaviors. Moreover, the finding from the Caribbean Sea record -- reduced N fixation in ice age Atlantic -- has changed the scientific conversation about the nature of the input/output budget of oceanic fixed N and its potential to change ocean fertility and atmospheric CO2. However, the controls on fb-del15N have not yet been adequately studied. In this project, as a first major step in developing a foundation for the paleoceanographic application of fb-del15N, the same Princeton University team will study its genesis in the water column, transport to the seafloor, and early diagenesis. They will undertake this study in the Sargasso Sea south of Bermuda. This is one of the best studied regions of the ocean, in general and with respect to foraminifera, and a region that has been has been a focus of the N isotope research of the PI for the last decade and others previously. Moreover, its significant seasonality -- in physical oceanography, biogeochemistry, and foraminiferal species abundance -- will facilitate the effort to understand the controls on fb-del15N at a mechanistic level. The research team will participate in six Bermuda Atlantic Time-series Study (BATS) cruises over two years, collecting foraminifera and other N forms likely to provide insight into the controls on fb-del15N. From the nearby Oceanic Flux Program (OFP) moored sediment traps and from shallow sediments collected in the region, they will pick foraminifera shells and again make relevant ancillary measurements. This work will establish the relationship of foraminiferal biomass to shell-bound del15N for different species, and comparison of the foraminiferal isotope data with the upper ocean N pools will yield empirical isotopic relationships and work toward a mechanistic insight of fb-del15N (e.g., the importance of different N pools to the diets of different foraminifera; the role of algal symbionts). The sediment trap and surface sediment data will support the plankton tow data by integrating over longer time scales and will also address questions regarding late stage (e.g., gametogenic)

calcification and the early diagenesis of fb-del15N and fb-N content. Broader Impacts: This study will yield an improved understanding of the nutrient dynamics of foraminifera, a class of organisms whose shells are a central tool in micropaleontology and paleoclimatology. The project will also build on the principal investigator's involvement in the Bermuda Institute of Ocean Sciences as an asset for integrating ocean-related education and research at both the undergraduate and graduate levels.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0960802
NSF Division of Ocean Sciences (NSF OCE)	OCE-1136345
NSF Division of Ocean Sciences (NSF OCE)	OCE-1060947

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