

Water column phosphate data from RV/Atlantic Explorer AE1812, May 2018

Website: <https://www.bco-dmo.org/dataset/762824>

Data Type: Cruise Results

Version: 1

Version Date: 2019-03-20

Project

- » [Collaborative Research: Defining the biogeochemical drivers of diatom physiological ecology in the North Atlantic](#) (North Atlantic Diatoms)
- » [Redox Cycling of Phosphorus in the Western North Atlantic Ocean](#) (Phosphorus Redox Cycling)

Contributors	Affiliation	Role
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Abstract

This dataset includes water column phosphate data from RV/Atlantic Explorer AE1812, May 2018.

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Coverage

Spatial Extent: N:41.19 E:-63.48 S:31.67 W:-70.97

Temporal Extent: 2018-05-02 - 2018-05-15

Dataset Description

This dataset includes water column phosphate data from RV/Atlantic Explorer AE1812, May 2018.

Methods & Sampling

MAGIC Soluble reactive phosphorus (SRP) concentrations. SRP (i.e. phosphate) was determined in seawater samples (done in triplicate) and incubations using MAGnesium Induced Coprecipitation (MAGIC) as described by Karl and Tien (1992).

Total particulate phosphorus (TPP) concentrations. TPP was determined in seawater samples using a wet chemical oxidation method using potassium persulfate as described in Suzumura (2008). Briefly, 1 to 2 liters of seawater were filtered onto 47 mm 0.2 µm pore size polyvinylidene fluoride membranes (Millipore) and frozen

(-80°C) until analysis. One fourth of these filters were cut with clean stainless-steel scissors and placed in 8 mL glass vials for oxidation. 2 mL of 5% (0.19 M) persulfate was added to each vial and the samples were then autoclaved for 30 minutes at 120°C. To remove any residual material, the samples were filtered through 0.45 µm syringe filters (Millipore Millex-HV). The persulfate was shown to inhibit color development when greater than 2%, therefore, the samples were diluted to 0.5% (0.019 M). As with the SRP samples, the TPP samples were analyzed via the molybdenum blue method using a spectrophotometer (Thermo).

Data Processing Description

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- re-formatted date from m/d/yyyy to yyyy-mm-dd

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Data Files

File
AE1812_water_column_P.csv (Comma Separated Values (.csv), 13.33 KB) MD5:4e0a6b68648eaf3cdfc92d3df036a3ce
Primary data file for dataset ID 762824

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Related Publications

Karl, D. M., & Tien, G. (1992). MAGIC: A sensitive and precise method for measuring dissolved phosphorus in aquatic environments. *Limnology and Oceanography*, 37(1), 105–116. doi:[10.4319/lo.1992.37.1.0105](https://doi.org/10.4319/lo.1992.37.1.0105)
Methods

Suzumura, M. (2008). Persulfate chemical wet oxidation method for the determination of particulate phosphorus in comparison with a high-temperature dry combustion method. *Limnology and Oceanography: Methods*, 6(11), 619–629. doi:[10.4319/lom.2008.6.619](https://doi.org/10.4319/lom.2008.6.619)
Methods

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Parameters

Parameter	Description	Units
Date	UTC Sampling date formatted as yyyy-mm-dd.	unitless
Depth	Depth at which the samples were collected.	meters
Station	Numeric identifier for the station where the data was collected.	unitless
CTD_Cast	Numeric identifier for the CTD cast where the data was collected.	unitless
Lat	Latitude of sampling. Positiv evalues indicate North.	decimal degrees
Long	Longitude of sampling. Negative values indicate West.	decimal degrees
MAGIC_SRP	Soluble reactive phosphorus measured by magnesium induced co-precipitation.	nmol per liter
TPP	Total particulate phosphorus.	nmol per liter

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Centrifuge
Dataset-specific Description	Used to collect precipitate for soluble reactive phosphorus (SRP) measurements.
Generic Instrument Description	A machine with a rapidly rotating container that applies centrifugal force to its contents, typically to separate fluids of different densities (e.g., cream from milk) or liquids from solids.

Dataset-specific Instrument Name	
Generic Instrument Name	CTD - profiler
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934 .

Dataset-specific Instrument Name	
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	free-floating NetTrap
Generic Instrument Name	Sediment Trap - Particle Interceptor
Dataset-specific Description	"Based on the design of a closing plankton net capable of collecting large amounts (~1 g) of very fresh sinking particulate material in short time periods (24-36 h) to facilitate microbial decomposition experiment." (Peterson et al, 2005)
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).

Dataset-specific Instrument Name	
Generic Instrument Name	Shipboard Incubator
Generic Instrument Description	A device mounted on a ship that holds water samples under conditions of controlled temperature or controlled temperature and illumination.

Dataset-specific Instrument Name	spectrophotometer (Thermo)
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	Used to measure total particulate phosphate concentrations
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

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Deployments

AE1812

Website	https://www.bco-dmo.org/deployment/739972
Platform	R/V Atlantic Explorer
Start Date	2018-05-01
End Date	2018-05-16

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Project Information

Collaborative Research: Defining the biogeochemical drivers of diatom physiological ecology in the North Atlantic (North Atlantic Diatoms)

Coverage: North Atlantic

NSF abstract:

About half of photosynthesis on earth is generated by marine phytoplankton, single celled organisms that drift with tides and currents. Within the phytoplankton, the diatoms conduct nearly half of this photosynthesis, exerting profound control over global carbon cycling. Despite their importance, there are surprisingly fundamental gaps in understanding how diatoms function in their natural environment, in part because methods to assess in situ physiology are lacking. This project focuses on the application of a powerful new approach, called Quantitative Metabolic Fingerprinting (QMF), to address this knowledge gap and examine species-specific physiology in the field. The project will provide transformative insights into how ocean geochemistry controls the distribution of diatoms, the metabolic responses of individual diatom species, and how metabolic potential is partitioned between diatom species, thus providing new insights into the structure and function of marine systems. The overarching goal is to examine how diatom species respond to changes in biogeochemistry across marine provinces, from the coast to the open ocean, by following shifts in diatom physiology using QMF. This research is critical to understand future changes in oceanic phytoplankton in response to climate and environmental change. Furthermore, activities on this project will include supporting a graduate student and postdoctoral fellow and delivering the Artistic Oceanographer Program (AOP) to diverse middle school age children and teachers in the NYC metropolitan area and to middle-school girls in the Girl Scouts of RI, reaching an anticipated 60 children and 30 teachers annually. The programs will foster multidisciplinary hands-on learning and will directly impact STEM education at a critical point in the pipeline by targeting diverse middle-school aged groups in both NY and RI.

In laboratory studies with cultured isolates, there are profound differences among diatom species' responses to nutrient limitation. Thus, it is likely that different species contribute differently to nutrient uptake, carbon flux and burial. However, marine ecosystem models often rely on physiological attributes drawn from just one species and apply those attributes globally (e.g. coastal species used to model open ocean dynamics) or choose a single average value to represent all species across the world's oceans. In part, this is due to a relatively poor understanding of diatom physiological ecology and a limited tool set for assessing in situ diatom physiological ecology. This research project will address this specific challenge by explicitly tracking metabolic pathways, measuring their regulation and determining their taxonomic distribution in a suite of environmentally significant diatoms using a state of the art, species-specific approach. A research expedition is set in the North Atlantic, a system that plays a major role in carbon cycling. Starting with a New England coastal shelf site, samples will be collected from the coast where diatoms thrive, to the open ocean and a site of a long term ocean time series station (the Bermuda Atlantic Time Series) where diatom growth is muted by nutrient limitation. This research takes advantage of new ocean observatories initiative (OOI) and time series information. Through the research expedition and downstream laboratory experiments, the molecular pathways of nutrient metabolism and related gene expression in a suite of environmentally significant diatoms will be identified. Data will be combined to predict major limiting factors and potentially important substrates for diatoms across marine provinces. Importantly, this integrated approach takes advantage of new advances in molecular and bioinformatics tools to examine in situ physiological ecology at the species-specific level, a key knowledge gap in the field.

Redox Cycling of Phosphorus in the Western North Atlantic Ocean (Phosphorus Redox Cycling)

Coverage: western north Atlantic

NSF Award Abstract:

Redox Cycling of Phosphorus in the Western North Atlantic Ocean
Benjamin Van Mooy
ID: 1536346

Understanding controls on the growth of plankton in the upper ocean, which plays an essential role in the sequestration of carbon dioxide, is an important endeavor for chemical oceanography. Phosphorus is an essential element for marine plankton, and has been a research focus of chemical oceanography for nearly a century. Yet, phosphorus redox cycling rates are almost completely unknown throughout the ocean, and the specific molecular identities of the phosphonates, a form of phosphate, in seawater have defied elucidation.

This project will explore and refine entirely new pathways for the biological cycling of phosphorus. This project will support teaching and learning by funding the PhD research of a graduate student, and through the continuation of conducting K-12 classroom laboratory modules and hosting 6-8th grade science fair participants in the investigator's lab.

Phosphorus has never been viewed by oceanographers as an element that actively undergoes chemical redox reactions in the water column, and it was believed to occur only in the +5 valence state, in compounds such as phosphate. However, over the last 17 years, numerous lines of geochemical and genomic information have emerged to show that phosphorus in the +3 valence state (P(+3)), particularly dissolved phosphonate compounds, may play a very important role within open ocean planktonic communities. This is particularly true in oligotrophic gyres such as the Sargasso Sea, where growth of phytoplankton can be limited by the scarcity of phosphate. To better understand these new data, the investigators will design and execute a research program that spans at-sea chemical oceanographic experimentation, state-of-the-art chromatography and mass spectrometry, and novel organic synthesis of ^{33}P -labeled P(+3) compounds. Specifically, they will answer questions about rates of production and consumption of low molecular weight P(+3) compounds, the impact of phosphate availability on the production and consumption of P(+3) compounds, and the groups of phytoplankton that utilize low molecular weight P(+3) compounds. Results of this project have the potential to contribute to the transformation of our understanding of the marine phosphorus cycle.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1558490
NSF Division of Ocean Sciences (NSF OCE)	OCE-1558506
NSF Division of Ocean Sciences (NSF OCE)	OCE-1536346

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