Alkaline phosphatase activities for in situ and incubation samples from RV/Atlantic Explorer cruise AE1812 cruise transect from Bermuda to Rhode Island in May 2018.

Website: https://www.bco-dmo.org/dataset/739973
Data Type: experimental
Version: 1
Version Date: 2018-07-16

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

Contributors	Affiliation	Role
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Abstract
This dataset reports alkaline phosphatase activities (APA) for 3 incubation runs and 33 in situ samples collected on RV/Atlantic Explorer cruise AE1812 in May 2018. The samples were collected between Bermuda and Rhode Island.

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Coverage

Spatial Extent: **N**:40.42 **E**:-56.56 **S**:31.42 **W**:-70.58
Temporal Extent: 2018-05-02 - 2018-05-15

Dataset Description

This dataset reports alkaline phosphatase activities (APA) for 3 incubation runs and 33 in situ samples collected on RV/Atlantic Explorer cruise AE1812 in May 2018. The samples were collected between Bermuda and Rhode Island.

Acquisition Description

For APA analysis, triplicate biological samples (250 mL) from in situ and incubation samples were filtered onto 47-mm polycarbonate membranes (0.2 µm). Stored at −20°C until analysis.

APA was assayed after Dyhrman and Ruttenberg (2006) using the fluorogenic phosphatase substrate 6,8-difluoro-4-methylumbelliferyl phosphate. Values were normalized to both volume and chl a.
Reagents/Abs/Em used:

D-6567 6,8-difluoro-4-methylumbelliferyl phosphate (DiFMUP):
- Storage upon receipt: ≤ 20°C; Desiccate
- Abs/Em = 358/455
- Molecular Formula: C10H7F2O6P
- Molecular Weight: 292.1
- CAS Name/Number: 2H-1-Benzopyran-2-one, 6,8-difluoro-4-methyl-7-(phosphonooxy)-/ 214491-43-7

D-6566 6,8-difluoro-7-Hydroxy-4-Methylcoumarin (DiFMU) - Reference Standard:
- Storage upon receipt: Room temp.; protect from light
- Molecular Formula: C10H6F2O3
- Molecular Weight: 212.15
- CAS Name/Number: 2H-1-Benzopyran-2-one, 6,8-difluoro-7-hydroxy-4-methyl-/ 215868-23-8

Incubation key:
Control = no addition of nutrients or deep water
DSW = deep seawater addition (added 20% deep seawater (700 m))
+P = Added phosphate only (0.5 µM final for incubations 1 and 2, 1 µM final for incubation 3)
+N = Added nitrate only (6 µM final for incubations 1 and 2, 12 µM final for incubation 3)
phi_P = All but P added (N, Si, Fe, B12)
phi_N = All but N added (P, Si, Fe, B12)
-1, -2, -3 = biological replicates

In situ key:
IS = in situ
-1, -2, -3 = biological replicates

Lost = sample was lost

Processing Description

BCO-DMO Processing:
-combined 3 incubations and in situ data into one dataset.
-decreased number of decimal places for APA from various to 3.
-changed date format from m/d/yyyy to yyyy-mm-dd
-changed sample name phi symbol to text

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Related Publications

Dyhrman, S. T., & Ruttenberg, K. C. (2006). Presence and regulation of alkaline phosphatase activity in eukaryotic phytoplankton from the coastal ocean: Implications for dissolved organic phosphorus remineralization. Limnology and Oceanography, 51(3), 1381–1390. doi:10.4319/lo.2006.51.3.1381
Methods

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Parameters

Parameter	Description	Units
incubation	Incubation replicate or in situ sampling	unitless
sample	Sample identifier	unitless
station	Station identification number	unitless
cast	Cast number on cruise	unitless
date_harvest	Day on which samples were filtered and stored; formatted as yyyy-mm-dd	unitless
APA_nmolP_hr_liter	Alkaline phosphatase activity; volume normalized	nanomol Phosphate/hour/liter [nmol P/h/L]
APA_nmolP_hr_ug_chla	Alkaline phosphatase activity; chl a normalized	nanomol Phosphate/hour/microgram chlorophyll-a [nmol P/h/µg Chl a]
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees

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Instruments

Dataset-specific Instrument Name	Biotek Synergy fluorescent plate reader
Generic Instrument Name	plate reader
Dataset-specific Description	Samples were run on a Biotek Synergy fluorescent plate reader using black plates
Generic Instrument Description	Plate readers (also known as microplate readers) are laboratory instruments designed to detect biological, chemical or physical events of samples in microtiter plates. They are widely used in research, drug discovery, bioassay validation, quality control and manufacturing processes in the pharmaceutical and biotechnological industry and academic organizations. Sample reactions can be assayed in 6-1536 well format microtiter plates. The most common microplate format used in academic research laboratories or clinical diagnostic laboratories is 96-well (8 by 12 matrix) with a typical reaction volume between 100 and 200 uL per well. Higher density microplates (384- or 1536-well microplates) are typically used for screening applications, when throughput (number of samples per day processed) and assay cost per sample become critical parameters, with a typical assay volume between 5 and 50 µL per well. Common detection modes for microplate assays are absorbance, fluorescence intensity, luminescence, time-resolved fluorescence, and fluorescence polarization. From: http://en.wikipedia.org/wiki/Plate_reader, 2014-09-0-23.

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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.

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Funding

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

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