Chlorophyll and phaeopigment concentrations from incubation experiments performed with amended Southern Drake Passage on RVIB Nathaniel B. Palmer cruise NBP 16-08 from September to October 2016

Website: https://www.bco-dmo.org/dataset/742206
Data Type: Cruise Results
Version: 1
Version Date: 2018-07-25

Project
» Collaborative Research: Investigating Iron-binding Ligands in Southern Ocean Diatom Communities: The Role of Diatom-Bacteria Associations (Diatom_Bacteria_Ligands)

Contributors	Affiliation	Role
Chappell, Phoebe Dreux	Old Dominion University (ODU)	Principal Investigator
Buck, Kristen	University of South Florida (USF)	Co-Principal Investigator
Jenkins, Bethany D.	University of Rhode Island (URI-GSO)	Co-Principal Investigator
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Abstract
This dataset includes chlorophyll and phaeopigment concentrations from incubation experiments performed with amended Southern Drake Passage on RVIB Nathaniel B. Palmer cruise NBP 16-08 from September to October 2016.

Table of Contents

Coverage

Spatial Extent: **N**:-62.332 **E**:-59.565 **S**:-62.46 **W**:-64.6485
Temporal Extent: 2016-09-12 - 2016-10-09

Dataset Description

Chlorophyll and phaeopigment concentrations from incubation experiments performed with amended Southern Drake Passage waters on cruise NBP 16-08.

Methods & Sampling

Incubation 1: Chlorophyll and phaeopigment samples were collected from an incubation experiment set up

with near-surface waters (35 - 25 meters depth) collected using the TMC CTD at -62.332N, -64.6485E over three casts with each cast homogenized in 50 L carboys. Incubation setup occurred in a TMC van and treatments were incubated in 4L polycarbonate bottles in a temperature controlled (2 °C) lighted incubator van with 24hr light. Sampling occurred in a TMC bubble.Treatment identifiers are as follows:

Cast = Homogenized carboy sample at T0 for individual casts.
A = control
B = +1 nM 57FeCl3
C = +4 nM Fe 57FeCl3
D = +10 nM Fe 57FeCl3
E = +600 pM Vitamin B12
F = +4 nM 57FeCl3/+600 pM Vitamin B12
G = Dark control
H = Dark +1 nM 57FeCl3
I = Dark +4 nM Fe 57FeCl3
J = Dark +10 nM Fe 57FeCl3
K = Dark +600 pM Vitamin B12
L = Dark +4 nM 57FeCl3/+600 pM Vitamin B12

Incubation 2: Chlorophyll and phaeopigment samples were collected from an incubation experiment set up with near-surface waters (35 - 25 meters depth) collected using the TMC CTD at -62.46N, -59.565E over two casts with each cast homogenized in 50 L carboys. Incubation setup occurred in a TMC van, treatments were incubated in 4L polycarbonate bottles in a temperature controlled (2 °C) lighted incubator van with 24hr light. Sampling occurred in a TMC bubble. Treatment identifiers are as follows:

Cast = Homogenized carboy sample at T0 for individual casts.
M = control
N = +4 nM Fe 57FeCl3
O = +600 pM Vitamin B12
S = Dark control
T = Dark +4 nM Fe 57FeCl3
U = Dark +600 pM Vitamin B12

Incubation 3: Chlorophyll and phaeopigment samples were collected from an incubation experiment set up with near-surface waters (35 - 25 meters depth) collected using the TMC CTD at -62.332N, -64.6485E over a single cast where waters were homogenized in 50 L carboys. The only amendment included adding 50% of 0.2 um filtered near surface (35 – 25 meters depth) waters collected at -62.46N, -59.565E. Incubation setup occurred in a TMC van and treatments were incubated in 4L polycarbonate bottles in a temperature controlled (2 °C) lighted incubator van with 24hr light. Sampling occurred in a TMC bubble. Treatment identifiers are as follows:

Cast = Homogenized carboy sample at T0 for individual casts.
Q = control (unfiltered water from -62.332N, -64.6485E)
R = 50% unfiltered water from -62.332,N -64.6485E with 50% 0.2 um filtered waters from -62.46N, -59.565E

For each sampling timepoint, samples of 50-100 mL were filtered onto 25 mm GFF filters and extracted using the protocol of:
Jespersen, A.M. and Christoffersen, K. (1987) Measurements of Chlorophyll-a from phytoplankton using ethanol as extraction solvent. Arch. Hydrobiol. 109 (3) 445-454, as updated in:
Morison, F. and Menden-Deuer, S. (2015) Early spring phytoplankton dynamics in the sub polar North Atlantic: The influence of protistan herbivory. Limnol. Oceanogr. 60(4) 1298-1313.

Analyses were performed by Ms. Zuzanna Abdala (ODU) and Ms. Alexa Sterling (URI).

At the start of the cruise, Turner 10-AU Fluorometer was calibrated using Chla Standard Stock Solution (SSS) from Anacystis nidulans algae (#C-5753) following the protocol by Kirk Ireson & Karen Baker (PDF).

Calibration was performed by Dr. Randelle Bundy (UW) and Dr. Bethany Jenkins (URI).

Data Processing Description

BCO-DMO Processing:

- changed date format from m/dd/yyyy to yyyy-mm-dd;
- combined 3 separate files into one dataset.

[table of contents | back to top]

Data Files

File
NBP1608_INC_PIGMENTS.csv (Comma Separated Values (.csv), 17.78 KB) MD5:89ba38bdf8690fad6194258eb3150727 Primary data file for dataset ID 742206

[table of contents | back to top]

Supplemental Files

File
Turner Digital 10-AU Fluorometer Calibration filename: chl_calib_howto.pdf (Portable Document Format (.pdf), 82.86 KB) MD5:5a5c6068ef6111e4e663aacad187f427 Turner Digital 10-AU Fluorometer Calibration information. Written by Kirk Ireson & Karen Baker - 09 Oct 2000 ; Updated by Tristan Wohlford - 20 Mar 2006.

[table of contents | back to top]

Related Publications

Jespersen AM, Christoffersen K. 1987. Measurements of Chlorophyll a from phytoplankton using ethanol as a solvent. Archiv Fur Hydrobiologie 109:445–454.
Methods

Morison, F., & Menden-Deuer, S. (2015). Early spring phytoplankton dynamics in the subpolar North Atlantic: The influence of protistan herbivory. Limnology and Oceanography, 60(4), 1298–1313. doi:10.1002/lno.10099
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
INCUBATION	Incubation identifier	unitless
DATE	GMT date when incubation sampling was started, in format yyyy-mm-dd	unitless
DAY	Number of days since start of incubation that sampling was started	unitless
ID	Sample identifier that includes information on treatment and bottle ID	unitless
TREATMENT	Treatment identifier	unitless
BTLNBR	Incubation bottle ID number	unitless
CHLA_FLUOR_TP_CONC_BOTTLE	Concentration of Chlorophyll a via fluorometric method using ethanol extraction without size fractionation of particles	micrograms per liter (ug/l)
CHLA_FLUOR_TP_CONC_BOTTLE_STDEV	Standard deviation of Chlorophyll a data from duplicate or triplicate analyses. Missing data identifier: NDA indicates no replicate samples were analyzed.	micrograms per liter (ug/l)
CHLA_FLUOR_TP_CONC_BOTTLE_N	Number of replicates used in calculations of Chlorophyll a data	unitless
PHAEO_FLUOR_TP_CONC_BOTTLE	Concentration of phaeopigments via fluorometric method using ethanol extraction without size fractionation of particles	micrograms per liter (ug/l)
PHAEO_FLUOR_TP_CONC_BOTTLE_STDEV	Standard deviation of phaeopigment data from duplicate or triplicate analyses. Missing data identifier: NDA indicates no replicate samples were analyzed.	micrograms per liter (ug/l)
PHAEO_FLUOR_TP_CONC_BOTTLE_N	Number of replicates used in calculations of phaeopigment data.	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Turner Designs Fluorometer
Generic Instrument Name	Turner Designs Fluorometer 10-AU
Dataset-specific Description	Turner Designs Fluorometer (s/n 5651)
Generic Instrument Description	The Turner Designs 10-AU Field Fluorometer is used to measure Chlorophyll fluorescence. The 10AU Fluorometer can be set up for continuous-flow monitoring or discrete sample analyses. A variety of compounds can be measured using application-specific optical filters available from the manufacturer. (read more from Turner Designs, turnerdesigns.com, Sunnyvale, CA, USA)

[table of contents | back to top]

Deployments

NBP1608

Website	https://www.bco-dmo.org/deployment/742174
Platform	RVIB Nathaniel B. Palmer
Start Date	2016-09-07
End Date	2016-10-14

[table of contents | back to top]

Project Information

Collaborative Research: Investigating Iron-binding Ligands in Southern Ocean Diatom Communities: The Role of Diatom-Bacteria Associations (Diatom_Bacteria_Ligands)

Coverage: Southern Ocean, Western Antarctic Peninsula 60-65 S, 63 W

This project focuses on an important group of photosynthetic algae in the Southern Ocean (SO), diatoms, and the roles associated bacterial communities play in modulating their growth. Diatom growth fuels the SO food web and balances atmospheric carbon dioxide by sequestering the carbon used for growth to the deep ocean on long time scales as cells sink below the surface. The diatom growth is limited by the available iron in the seawater, most of which is not freely available to the diatoms but instead is tightly bound to other compounds. The nature of these compounds and how phytoplankton acquire iron from them is critical to understanding productivity in this region and globally. The investigators will conduct experiments to characterize the relationship between diatoms, their associated bacteria, and iron in open ocean and inshore waters. Experiments will involve supplying nutrients at varying nutrient ratios to natural phytoplankton assemblages to determine how diatoms and their associated bacteria respond to different conditions. This will provide valuable data that can be used by climate and food web modelers and it will help us better understand the relationship between iron, a key nutrient in the ocean, and the organisms at the base of the food web that use iron for photosynthetic growth and carbon uptake. The project will also further the NSF goals of training new generations of scientists and of making scientific discoveries available to the general public. The project supports early career senior investigators and the training of graduate and undergraduate students as well as outreach activities with middle school Girl Scouts in Rhode Island, inner city middle and high school age girls in Virginia, and middle school girls in Florida.

The project combines trace metal biogeochemistry, phytoplankton cultivation, and molecular biology to address

questions regarding the production of iron-binding compounds and the role of diatom-bacterial interactions in this iron-limited region. Iron is an essential micronutrient for marine phytoplankton. Phytoplankton growth in the SO is limited by a lack of sufficient iron, with important consequences for carbon cycling and climate in this high latitude regime. Some of the major outstanding questions in iron biogeochemistry relate to the organic compounds that bind >99.9% of dissolved iron in surface oceans. The investigators' prior research in this region suggests that production of strong iron-binding compounds in the SO is linked to diatom blooms in waters with high nitrate to iron ratios. The sources of these compounds are unknown but the investigators hypothesize that they may be from bacteria, which are known to produce such compounds for their own use. The project will test three hypotheses concerning the production of these iron-binding compounds, limitations on the biological availability of iron even if present in high concentrations, and the roles of diatom-associated bacteria in these processes. Results from this project will provide fundamental information about the biogeochemical trigger, and biological sources and function, of natural strong iron-binding compound production in the SO, where iron plays a critical role in phytoplankton productivity, carbon cycling, and climate regulation.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443483
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443474
NSF Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-1443646

[table of contents | back to top]