Particulate organic phosphorus data from TriCoLim incubation experiments done aboard R/V Atlantis AT39-05 in the Tropical Atlantic

Website: https://www.bco-dmo.org/dataset/855661
Data Type: Cruise Results
Version: 1
Version Date: 2021-07-13

Project
» Collaborative Research: Iron and phosphorus balanced limitation of nitrogen fixation in the oligotrophic ocean (TriCoLim)

Contributors	Affiliation	Role
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Abstract
Particulate organic phosphorus data from TriCoLim incubation experiments done aboard R/V Atlantis AT39-05 in the Tropical Atlantic

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Coverage

Spatial Extent: **N**:13.6776 **E**:-21.998 **S**:-7.99893 **W**:-55.8122

Methods & Sampling

Shipboard incubation experiments were carried out at 15 stations in the tropical Atlantic with trace metal clean-collected bulk seawater to examine iron (Fe) and phosphorus (P) co-limitation of dinitrogen (N2) fixation (see TriCoLim Station coordinates metadata). Treatments were: Co-limited control (no additions, “Colimit”), + 2nM Fe (“Fe”), + 50 nM P (“P”) and Replete (+Fe+P, “Rep”). All incubations were carried out at ambient (“Lo”) temperature and ambient temperature +3C (“Hi”) for 2-4 days on deck before measuring 15N2 and 13CO2 fixation rates and particulate organic carbon (POC), nitrogen (PON) and phosphorus (POP). See related datasets.

POP measurements were conducted as follows: ~500 ml of bulk water were filtered onto pre-combusted GFF filters and rinsed two times with 2 ml each of 0.17M sodium sulfate (Na2SO4). Filters were placed in pre-combusted borosilicate vials capped a combusted aluminum foil cap and soaked in 2 ml of 0.017M magnesium sulfate (MgSO4) and left to dry in an oven at 60 deg C for 2-3 days.

Data Processing Description

Samples were processed colorimetrically following previously established methods (Fu et al., 2005).

BCO-DMO Processing Notes:

- names

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Related Publications

Fu, F.-X., Zhang, Y., Bell, P. R. F., & Hutchins, D. A. (2005). PHOSPHATE UPTAKE AND GROWTH KINETICS OFTRICHODESMIUM(CYANOBACTERIA) ISOLATES FROM THE NORTH ATLANTIC OCEAN AND THE GREAT BARRIER REEF, AUSTRALIA. Journal of Phycology, 41(1), 62–73. doi:10.1111/j.1529-8817.2005.04063.x
Results

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Related Datasets

IsRelatedTo

Hutchins, D. A., Fu, F. (2021) **Physiology data from Crocosphaera iron and phosphorus colimitation culture experiment.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-07-20 http://lod.bco-dmo.org/id/dataset/856201 [view at BCO-DMO]
Relationship Description: Part of same experiment.

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Parameters

Parameter	Description	Units
Station	Station identifier	unitless
Experiment_ID	Experiment identifier	unitless
Latitude	Latitude of sampling station	decimal degrees
Longitude	Longitude of sampling station	decimal degrees
Sample_ID	Sample identifier	unitless
Treatment	Treatment description	unitless
POP	Particulate organic phosphorus	Micromol/liter (umol/l)

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Deployments

AT39-05

Website	https://www.bco-dmo.org/deployment/765978
Platform	R/V Atlantis
Start Date	2018-02-11
End Date	2018-03-14
Description	For study of iron and phosphorus balanced limitation of nitrogen fixation in the oligotrophic ocean.

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Project Information

Collaborative Research: Iron and phosphorus balanced limitation of nitrogen fixation in the oligotrophic ocean (TriCoLim)

Coverage: Tropical Atlantic

NSF abstract:

Marine cyanobacteria are able to use or "fix" atmospheric nitrogen gas, and so supply much of the essential nutrient nitrogen that supports open ocean food chains. Oceanographers have usually thought that the growth of these nitrogen-fixing cyanobacteria is limited at any particular time and place by the supply of either iron, or of phosphorus. Preliminary experiments have shown, though, that these nitrogen fixers instead grow best when both iron and phosphorus are scarce at the same time. In this project, the researchers will use cellular indicators that are specific for iron and phosphorus limitation to determine how important this type of "balanced limitation" of nitrogen-fixing cyanobacteria is in controlling the productivity of ocean food chains in the tropical Atlantic Ocean. Two graduate students will be trained at the University of Southern California (USC) and Woods Hole Oceanographic Institution, as well as a postdoctoral researcher at USC. Educational outreach efforts will take place at a Los Angeles inner city high school with a student body that is over 98% Hispanic and African-American, and with underrepresented undergraduates in the USC Global Environmental Microbiology course. In addition, two Research Experiences for Undergraduates students will be supervised for summer research projects to help them learn about science career options.

The researchers will investigate the biological and biogeochemical consequences of this unique balanced iron/phosphorus-limited phenotype, using both laboratory and fieldwork approaches. During the first year of this project, the nitrogen-fixing cyanobacteria will be cultured under iron and/or phosphorus limitation, followed by application of proteomics and transcriptomics to identify genes that are potential diagnostic biomarkers for iron/phosphorus balanced limitation. Preliminary work has already identified one promising candidate biomarker in one cyanobacterium, an EzrA protein domain that appears to be associated with the cell size decreases seen specifically under balanced limitation, and the researchers have identified numerous other potential candidates for similar biomarkers. During the second year, these new co-limitation biomarkers and others previously validated for iron limitation (IsiB) and phosphorus limitation (SphX) will be used to investigate balanced limitation during a research cruise transecting from relatively high-iron, low-phosphorus North Atlantic waters, to the relatively high-phosphorus, low-iron South Atlantic. This fieldwork component will survey nitrogen fixing cyanobacteria populations across this natural iron/phosphorus gradient for genetic, proteomic, and physiological indicators of balanced limitation, as well as testing their responses to iron and phosphorus manipulations in shipboard incubation experiments. The third year will be devoted to sample analysis, and publications exploring the responses of oceanic nitrogen fixers to simultaneous limitation by both iron and phosphorus.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1657757

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